



Contents lists available at [ScienceDirect](#)

## Sleep Medicine

journal homepage: [www.elsevier.com/locate/sleep](http://www.elsevier.com/locate/sleep)



### Editorial

## Welcome address

*Dear Colleagues and Friends,*

On behalf of the World Association of Sleep Medicine (WASM) and the Spanish Sleep Society (SES), we are delighted to welcome you to our joint congress: the 5th International World Association of Sleep Medicine Congress and the 22nd Annual Congress of the Spanish Sleep Society in Valencia, Spain, from September 28th to October 2nd, 2013. The congress provides an international discussion forum of sleep professionals from the entire world. It focuses particularly on the interdisciplinary character of our field. Sleep clinicians, technologists, trainees, educators and scientists from around the world will meet here to advance knowledge on sleep science; sleep in public health; sleep health; and the sleep-wake disorders, diagnosis, and treatments. We seek to maximize learning both from formal presentations by the leading experts in their fields and from informal discussion groups emphasizing opportunities for your participation. The social events and the Mediterranean magic of Valencia also support productive professional and personal interactions. The global character and reach of WASM in collaboration with the knowledge of the local Spanish Sleep Society brings the best of sleep medicine to Valencia.

Your involvement in this congress will be greatly valued. You may learn and also share knowledge and skills that will advance sleep health around the world.

We hope that you'll enjoy the science, learning, collegiality, and social events at our world sleep conference in this lively city with great history, architecture, art, and music. Sunny weather matching the warm Spanish hospitality is nearly guaranteed. Welcome to Valencia!

Warm Greetings,

Claudia Trenkwalder  
*World Association of Sleep Medicine, Spain*

Diego Garcia-Borreguero  
*Spanish Sleep Society, Spain*



## 5th World Congress on Sleep Medicine, 28 September to 2 October 2013, Valencia, Spain – Symposium Information

### S1: New Diagnostic Technologies for Sleep Disordered Breathing

**Chair:**

Thomas Penzel (Germany)

**Speakers:**

Thomas Penzel (Germany), Robert Thomas (USA), Robert Poirrier (Belgium), Ludger Grote (Sweden), Pierre Escourrou (France), Chen Lin (USA0029)

**Learning Objectives:**

New methods for portable diagnosis of sleep apnea – possibilities and limitations

Modern diagnostic methods give new chances to investigate pathophysiology in sleep apnea and cardiovascular consequences in order to improve predictors for outcome

Therapy compliance monitoring does become a part of diagnostic follow up studies

**Target Audience:**

Sleep physicians who want to learn about new options in diagnostic tools. Sleep physicians who want to see the state of the art in technological developments supporting the diagnosis of sleep disordered breathing. Sleep technologist who want to learn about upcoming developments for the sleep laboratory environment.

**Summary:**

The symposium educates about new technical developments for the diagnosis of sleep disorders. This includes education on sleep disordered breathing with consequences for cardiovascular disorders and for sleep fragmentation.

One talk is addressing the issues of new technologies in the follow up of compliance with therapy again in patients with sleep disordered breathing. New telemedicine techniques allow a rapid check of patient adherence to therapy with CPAP and other ventilation techniques. In addition to these pathophysiological and technical issues, the management of sleep centers is addressed. Do we need full sleep centers which cope with all sleep disorders? Do we need specialized sleep centers which focus on respiratory or neurological problems alone? Do we need centers which only perform portable sleep studies?

**Introduction**

Thomas Penzel (Germany)

**Cardiopulmonary coupling in the diagnosis of instable sleep and sleep disordered breathing**

Robert Thomas (USA)

**Sagittal movement recording for the detection of sleep disordered breathing and sleep stages**

Robert Poirrier (Belgium)

**Autonomic state indicator for the assessment of cardiovascular risk in patients with sleep disorder**

Ludger Grote (Sweden)

**Telemedicine approach to assess CPAP compliance**

Pierre Escourrou (France)

**Different activation of autonomic nervous system with flow limitation**

Chen Lin (USA)

**Management of sleep disordered breathing inside and outside the sleep laboratory**

Thomas Penzel (Germany)

### S2: Cognitive Behavioral Therapy for Insomnia (CBT-I): Knowledge Transfer and Treatment Dissemination

**Co-chairs:**

Charles M. Morin (Canada), Yun Kwok Wing (China)

**Speakers:**

Charles M. Morin (Canada), Yun Kwok Wing (China), Josee Savard (Canada), Rachel Manber (USA), Colin Espie (United Kingdom)

**Learning Objectives:**

Describe innovative methods to deliver treatment and transfer knowledge

Summarize recent findings on the impact of these treatment delivery models and web-based technologies to disseminate interventions for insomnia/sleep disturbances

**Target Audience:**

This symposium is likely to be of significant interest for both sleep clinicians providing insomnia treatment and investigators conducting clinical trials on insomnia therapies.

**Summary:**

There is solid evidence that cognitive-behavioral therapy for insomnia (CBT-I) is effective, produces sustained benefits over time, and is well accepted by patients. An important challenge that remains, however, is to translate this evidence into practical applications and to disseminate it to potential users, i.e., individuals with insomnia and health-care practitioners who work with sleep patients in diverse settings. The main objectives of this symposium are to describe innovative methods and technologies to disseminate CBT-I and optimize knowledge transfer. Five speakers from different part of the world will present evidence from recent clinical trials documenting the impact of self-help therapies using the Internet and web-based applications, training workshops, and sleep education programs as implemented in community, hospital, and school settings.

**Introduction**

Charles M. Morin (Canada)

**Knowledge transfer through sleep education among school-aged children**

Yun Kwok Wing (China)

**Efficacy of a video-based CBT for insomnia in cancer patients**

Josee Savard (Canada), H. Ivers, M-H. Savard, J. Villa, C.M. Morin

**Training dissemination of CBT-I in veterans administration health care system**

Rachel Manber (USA)

**A web-based intervention for insomnia**

Colin Espie (United Kingdom)

**Internet-delivered CBT for insomnia**

Charles Morin, L. Ritterband, F. Thorndike, L. Gonder-Frederick, K. Ingersoll

**Question and answer**

Charles M. Morin (Canada)

**S3: Converging Understanding of the Biology of Restless Legs Syndrome****Chair:**

Richard P. Allen (USA)

**Speakers:**

Richard P. Allen (USA), James R. Connor (USA), Christopher J. Earley (USA), Juliane Winkelmann (USA), Yong-Won Cho (South Korea)

**Learning Objectives:**

Biological significance of RLS genetics for brain development and iron regulation

Role of hypoxic and related pathways in expression of RLS symptoms

Differing pathways and neurochemical systems for spinal and cortical excitability in RLS

Brain connectivity differences supporting development of RLS symptoms

Possibilities of biologically based developments of new approaches to diagnosis, evaluation and treatment of RLS

**Target Audience:**

Intermediate to advanced clinical and scientific interest in RLS and new diagnostic and treatment considerations developing from understanding the biology of RLS.

**Summary:**

A wide range in disparate biological features of RLS have each been advanced as the biological basis for RLS, e.g.: peripheral nervous system, spinal mechanisms, dopaminergic systems (A11, nigro-striatal), thalamo-pathways, cortical arousal, pain/sensory systems, glutamatergic activation, hypoxic pathways, iron regulation, genetics. There is now the beginning of understanding how these various biological features of RLS converge to reveal both underlying biological diatheses for RLS and pathways for expression of the disease. This symposium will present some of the initial findings that begin to reveal this complicated biological network for RLS. First, new advances in understanding the biological significance of RLS genetics reveal pathways for producing both basic iron regulation problems, particularly at the blood-brain-barrier and also basic alterations in development of major brain systems, particularly the nigro-striatal system. Second, alternate pathways leading to expression of the disease have been found involving

activation of hypoxic and related pathways in peripheral and central tissue that also may relate to RLS genetics and peripheral as well as brain features of RLS. Finally brain connectivity imaging, spectroscopy and recent neurophysiological studies provide an interesting picture of divergent paths for expression of the disease. These involve altered thalamo-connectivity and possibly spinal systems with putative somewhat separate pathways and neurochemistry expressing the hyperarousal versus periodic leg movements of RLS. The insights provided by these studies on the biology of RLS impact developments for better diagnosis, evaluation and treatment of RLS.

**Introduction**

Richard P. Allen (USA)

**MEIS1, iron and RLS: Genetic effects on iron regulation and blood brain barrier in RLS**

James R. Connor (USA)

**RLS biological pathways: hypoxic and related pathways in brain and peripheral systems**

Christopher J. Earley (USA)

**Genetics and developmental issues in RLS biology**

Juliane Winkelmann (USA)

**RLS Cortical/spinal excitability, PLM vs hyperarousal: Iron, dopamine and glutamate**

Richard P. Allen (USA)

**Brain imaging: MRI connectivity, iron and dopamine**

Yong-Won Cho (South Korea)

**Question and answer**

Richard P. Allen (USA)

**S4: The Autonomic Nervous System and Sleep in Human****Narcolepsy: Do Patients Have an Increased Cardiovascular Risk?****Chair:**

Pietro Cortelli (Italy)

**Speakers:**

Pietro Cortelli (Italy), Daniela Grimaldi (USA-Italy), Stine Knudsen (Denmark), Yves Dauvilliers (France), Rolf Fronczek (The Netherlands)

**Learning Objectives:**

Gain insight in what is known about how the autonomic nervous system is affected in hypocretin-deficient human narcolepsy

Learn the results of several recent sleep studies with autonomic measurements in human narcolepsy

Understand the broader impact of hypocretin deficiency in human narcolepsy in relation to possible cardiovascular risk and obesity

**Target Audience:**

Advanced topic for clinical sleep specialists and basic researchers with a special interest in the autonomic nervous system effects of hypocretin deficiency in human narcolepsy.

**Summary:**

Almost all narcolepsy with cataplexy patients lack the neuropeptide hypocretin (orexin). The hypocretin system plays a key role in the complex interaction between sleep and the autonomic nervous system. It is hypothesized that hypocretin deficiency thus affects cardiovascular risk factors in narcolepsy. In this symposium results of several recent studies will be presented, with a focus on

the autonomic nervous system in relation to sleep in human narcolepsy. This includes blood pressure rhythms and spectral analysis of heart rate variability as a reflection of sympathovagal balance during sleep, which reveals an abnormal sleep-cardiovascular system interaction. Furthermore, recent data indicate a reduced heart rate response to arousals and leg movements during sleep in narcolepsy patients that lack hypocretin. In another study, a higher percentage of 'non-dipping' blood pressure profiles (defined as <10% drop in blood pressure during sleep) was found in drug-free patients with narcolepsy-cataplexy compared to controls without evidence for endothelial dysfunction. Thermoregulation is also controlled by the autonomic nervous system and is altered around sleep onset and during sleep in human narcolepsy. To conclude, the broader impact of these recent insights will be summarized in relation to a possible increased cardiovascular risk in human narcolepsy and to the obesity that is characteristic for narcolepsy.

#### **Introduction**

Pietro Cortelli (Italy)

#### **Abnormal sleep-cardiovascular system interaction in narcolepsy with cataplexy: effects of hypocretin**

Daniela Grimaldi (USA-Italy)

#### **Attenuated autonomic response to nighttime arousal and leg movements in human narcolepsy**

Stine Knudsen (Denmark)

#### **Non-dipping blood pressure profile in narcolepsy with cataplexy**

Yves Dauvilliers (France)

#### **Regulation of heart rate, body temperature, metabolism and sleep in human narcolepsy**

Rolf Fronczek (The Netherlands)

#### **Question and answer**

Pietro Cortelli (Italy)

### **S5: The Role of Sleep in Emotional Memory Processing and Development or Prevention of PTSD**

#### **Chair:**

Gina R. Poe (USA)

#### **Speakers:**

Gina R. Poe (USA), Anne Germain (USA), Maria Corsi-Cabrera (Mexico), Subimal Datta (USA), William Vanderheyden (USA)

#### **Learning Objectives:**

Understand the traits of sleep important to processing memories

Learn which sleep traits change after PTSD induction

Observe how sleep normally changes after fear learning and extinction training

Build a comprehensive model of abnormal processing of fearful memories after PTSD

Gain insight as to how the more successful PTSD treatments may work and how reestablishing normal sleep function for memory processing could recover normal function after PTSD

#### **Target Audience:**

The content is appropriate for a broad audience familiar with sleep. Presentations will be basic as well as clinical and include conceptual models that tie the results together.

#### **Summary:**

Attendees should be able to identify traits of sleep that change after traumatic events that induce PTSD, and further understand how such traits are altered during fear conditioning and extinction

in those with and without PTSD. Human and basic animal studies will be presented. Mechanistic models and areas of coherence as well as disagreement will be directly addressed. The symposium will concentrate on the physiological characteristics of sleep that are influenced by and influence the adaptive vs. maladaptive sleep processing of traumatic memories.

#### **Introduction**

Gina R. Poe (USA)

#### **Role of sleep traits in the induction of PTSD, fear conditioning, and fear extinction**

Gina R. Poe (USA)

#### **Brain imaging findings in combat-exposed Veterans with and without PTSD**

Anne Germain (USA)

#### **Emotion regulation after sleep deprivation in humans**

Maria Corsi-Cabrera (Mexico)

#### **Role of REM sleep P-wave activity in fear extinction memory**

Subimal Datta (USA)

#### **Modeling PTSD in the rat: sleep and learning phenotypes**

William Vanderheyden (USA)

#### **Question and answer**

Gina R. Poe (USA)

### **S6: Sleep Disorders and Cancer**

#### **Co-chairs:**

Miguel Ángel Martínez-García (Spain), Javier Nieto (USA)

#### **Speakers:**

Miguel Ángel Martínez-García (Spain), Javier Nieto (USA), Sonia Ancoli-Israel (USA), Ramon Farré (Spain), Francisco Campos-Rodríguez (Spain)

#### **Learning Objectives:**

Relationship between sleep metabolism, circadian rhythm and cancer risk

Sleep disturbances and cancer risk (especially sleep duration)

Role of Melatonin and hypnotic treatments in cancer

New discoveries. Intermittent hypoxia and cancer in animal models

New discoveries. Sleep apnea and risk of cancer. Incidence and mortality

The future. New studies needed and the role sleep disorders treatment in cancer

#### **Target Audience:**

Everyone with interest in sleep disorders.

#### **Summary:**

The relationship between different aspects of non-apneic sleep disorders, particularly sleep duration and some drugs intake, and cancer has been studied by various authors. Some studies have shown an association between short sleep duration, long sleep duration or prolonged naps and an increased incidence of cancer, particularly breast cancer. Several mechanisms have been postulated as explanations for this association, most notably the increased production of pro-inflammatory cytokines and the suppression of melatonin secretion, which has been shown to inhibit cancer development and growth. Moreover, recently three large observational studies from Wisconsin (Nieto J, et al, 1500 patients, follow up 22 years, population-based study. *Am Respir J Critr Care Med* 2012) and Spain (Campos-Rodríguez F, et al and Martínez-García

MA, et al. Clinical cohort of more than 5,000 patients with suspected OSA with a follow-up 5 years. Am Respir J Crit Care Med 2013 and ATS Congress 2012) have shown a relationship between severe sleep apnea (measured by an hypoxemia index) and an increased incidence and mortality from cancer. All these studies have been presented in USA and Europe with great interest of the Scientific Community and Press (New York Times, Lancet, Sky news and others). The pathophysiological mechanism proposed to link sleep apnea and cancer is intermittent hypoxia as has been previously observed by Farré et al in an animal model. Some editorials have been recently written about it (Redline S in Am Respir J Crit Care Med, Martínez-García MA et al. European Respiratory Journal). Some studies will begin in 2013 on this topic specially from the Spanish Sleep and Breathing group.

### Introduction

Miguel Ángel Martínez-García (Spain)

### Introduction

Javier Nieto (USA)

### Non-apneic sleep disorders and cancer

Sonia Ancoli-Israel (USA)

### Intermittent hypoxia and cancer. Pathophysiology and studies in animal models

Ramon Farré (Spain)

### Sleep apnea and risk of cancer incidence and mortality

Francisco Campos-Rodríguez (Spain)

### Question and answer

Miguel Ángel Martínez-García (Spain) and Javier Nieto (USA)

## S7: Brain Imaging Studies in Sleep Disorders and Sleep Deprivation

### Chair:

Seung Bong Hong (South Korea)

### Speakers:

Seung Bong Hong (South Korea), Luigi Ferini-Strambi (Italy), Eus JW Van Someren (The Netherlands), Michael Chee (Singapore), In-young Yoon (South Korea)

### Learning Objectives:

Does OSA cause structural abnormalities in brain and is there a correlation between brain changes and cognitive dysfunction in OSA patients?

Is brain metabolism and EEG changes reversible by nasal CPAP treatment in OSA patients?

Heterogeneity of insomnia may have impeded progress in our understanding of underlying causes and depending on the phenotype, remarkably different cerebral mechanisms can underlie seemingly similar subjective sleep complaints

Are there structural changes in brain of narcolepsy patients and the relationship between brain changes and narcolepsy symptoms?

What is the consequence of sleep deprivation in cognitive function and how does fMRI elucidate the effect of sleep deprivation on brain function?

### Target Audience:

Sleep physicians, professors, clinical and basic researchers, students.

### Summary:

The changes of brain function or structures are suspected in various sleep disorders such as OSA, narcolepsy, insomnia and others.

Recently both functional and structural abnormalities have been reported in sleep disorders. Neuroimaging such as brain MRI, fMRI, PET, SPECT is a useful research tool for studying brain pathology or dysfunction related to sleep disorders and sleep deprivation in live human. This symposium will present the results of brain imaging studies in OSA, insomnia, narcolepsy and sleep deprivation. In OSA, two (#1, 5) speakers will present structural brain abnormalities and their relationship with cognitive dysfunction, and changes of brain glucose metabolism and quantitative EEG after CPAP treatment respectively. The 2nd speaker will talk about the relationship between brain imaging and different phenotypes of insomnia such as primary insomnia, insomnia with major depression and insomnia with anxiety disorder, and implications for our understanding of insomnia; depending on the phenotype, remarkably different cerebral mechanisms can underlie seemingly similar subjective sleep complaints. Despite evidence of disturbances of the hypothalamic hypocretin system in idiopathic narcolepsy patients, a gross inspection of brain MRI is usually normal and computer-aided studies of brain MRI revealed conflicting results and there is limited data on possible structural brain changes that might be associated with idiopathic narcolepsy. So the 3rd speaker will review neuroimaging studies using brain MRI including gray and white matter changes and cortical thickness and discuss their relation to the pathogenesis of narcolepsy. The brain dysfunctions have been reported in people with sleep deprivation. The 4th speaker will present the techniques and results of brain dysfunctions related to sleep deprivation studied by functional MRI (fMRI).

### Introduction

Seung Bong Hong (South Korea)

### Brain gray/white matter abnormality and cortical thickness changes in narcolepsy

Seung Bong Hong (South Korea)

### Structural brain changes and cognitive dysfunction in OSA patients

Luigi Ferini-Strambi (Italy)

### Brain imaging elucidates different insomnia endophenotypes

Eus JW Van Someren (The Netherlands)

### fMRI study on cognitive dysfunction in people with sleep deprivation

Michael Chee (Singapore)

### Brain metabolism and QEEG changes after CPAP treatment in OSA patients

In-young Yoon (South Korea)

### Question and answer

Seung Bong Hong (South Korea)

## S8: Obstructive Sleep Apnea, Motor Vehicles Accidents and Driving

### License Regulations

*This symposium is supported by an unrestricted educational grant from General Directorate for traffic (Dirección de Tráfico).*

### Chair:

Daniel Rodenstein (Belgium), Jean Krieger (France)

### Speakers:

Daniel Rodenstein (Belgium), Joaquin Teran-Santos (Spain), Maria Seguí (Spain), Julia Kremer (Belgium)

**Learning Objectives:**

After a general introduction of the subject under the perspective of the literature available up 2013, the symposium will examine how different countries are implementing solutions for this issue.

**Target Audience:**

Although not strictly speaking a medical matter, the issue is even more important since most physicians have little knowledge of the driving license regulations and to their role as physicians in the process of authorizing or limiting or preventing someone to access to a driving capacity.

**Summary:**

Every sleep specialist dealing with patients will be confronted to the question of motor vehicles driving obligations and rights. This applies specially to obstructive sleep apnea, probably the medical disorder carrying the higher risk for motor vehicle accidents.

**Introduction**

Daniel Rodenstein (Belgium)

**Obstructive sleep apnea and motor vehicle accidents: the evidence**

Joaquin Teran-Santos (Spain)

**Obstructive sleep apnea and road policy. The Spanish experience**

Maria Segui (Spain)

**Obstructive sleep apnea as a risk factor for road safety. In search for recognition**

Daniel Rodenstein (Belgium)

**Obstructive sleep apnea and road safety. The EU approach.**

Julia Kremer (Belgium)

**Conclusion**

Joaquin Teran-Santos (Spain)

**Question and answer**

Daniel Rodenstein (Belgium)

**S9: Neurocognition and Behavior, Sleep Disturbance and Sleep Disordered Breathing****Chair:**

Christian Guilleminault (USA)

**Speakers:**

Christian Guilleminault (USA), Sarah Biggs (Australia), Yu-shu Huang (Taiwan), Louise O'Brien (USA), Karen Spruyt (USA)

**Learning Objectives:**

There is very little knowledge on what happen following T&A perform for SDB on neurocognition. The symposium will present new information on the impact of SDB and snoring in different age groups of children including pre-school and school age children. It will also explore the impact of treatment on neurocognition, and the risks associated with currently untreated mild sleep-disordered breathing on neurocognition and behavior.

**Target Audience:**

Clinician involved in pediatric sleep, researchers involved in sleep disordered research, in psychological and cognitive outcome and in assessment of cognitive risks and schooling impact.

**Summary:**

Neurocognition can be impaired in association with sleep disordered breathing. This impairment may impact learning and beha-

avior in children and may lead to behavioral changes. The symposium will present the results of 4-year longitudinal data of behavioral and neurocognitive outcomes in children with sleep disordered breathing, comparing those treated to those untreated in a cohort of Australian children; the results of a study looking at neurocognitive changes within 6 months post adenotonsillectomy and follow-up of neurocognitive development of children during the following 36 months and the results of longitudinal neurocognitive changes pre and post adenotonsillectomy in a cohort of US school-age children and similar neurocognitive evaluation in pre-school and school-age children with cleft palate, finally presentation of the impact on behavior and neurocognition on pre-school children in New-Zealand.

**Introduction**

Christian Guilleminault (USA)

**Sleep-disordered breathing and neurocognitive development: Effect of treating or not treating SDB-in**

Sarah Biggs (Australia)

**A long term (36 months) follow-up study of children post-T&A: neurocognitive changes: effect of age**

Yu-shu Huang (Taiwan)

**Follow-up cohorts of children with OSA and Cleft-palate and SDB: neurocognitive outcome**

Louise O'Brien (USA)

**Obesity sleep disordered breathing and cognition in children**

Karen Spruyt (USA)

**Question and answer**

Christian Guilleminault (USA)

**S10: Identification of the Neuronal Network Regulating the Sleep-waking Cycle: A Never Ending Story?****Chair:**

Pierre Herve Luppi (France)

**Speakers:**

Pierre Herve Luppi (France), Antoine Adamantidis (Belgium), John Peever (Canada), Luis de Lecea (USA), Christelle Peyron (France)

**Learning Objectives:**

This symposium will provide up to date information on the mechanisms and the neuronal network generating the sleep-waking cycle.

**Target Audience:**

The expected audience is a mix of basic and clinical researcher interested to obtain latest hypotheses on the mechanisms controlling sleep.

**Summary:**

The purpose of this symposium is to provide latest update on the mechanisms at the origin of the sleep-waking cycle.

Combination of classical methods with latest advances in genetic manipulation of neurons (optogenetic, pharmacogenetic, transgenic models) have been used to progress in the identification of the neuronal network responsible for all sleep-wake stages. In particular, the role in sleep control of the posterior hypothalamus and of the nucleus accumbens will be adressed. Brainstem network controlling REM sleep atonia will also be clarified.

**Introduction**

Pierre Herve Luppi (France)

**Optogenetic dissection of hypothalamic sleep-wake circuits**

Antoine Adamantidis (Belgium)

**The identification of the REM sleep circuit**

John Peever (Canada)

**Different flavors of optogenetic awakenings**

Luis de Lecea (USA)

**The role of the hypothalamus in REM sleep control**

Christelle Peyron (France)

**Question and answer**

Pierre Herve Luppi (France)

**S11: Innovations in Sleep Apnea Management****Chair:**

Meir Kryger (USA)

**Speakers:**

Meir Kryger (USA), David White (USA), Klar Yaggi (USA), Winfried Randerath (Germany)

**Learning Objectives:**

When CPAP therapy is not acceptable that there are alternative treatments to consider in selected patients

End expiratory airway pressure (EPAP), and oral pressure therapy (OPT) can be useful in selected OSA patients

Hypoglossal nerve stimulation is a potentially promising therapy in OSA

Treatment of OSA may prevent strokes

**Target Audience:**

Clinicians and scientists managing OSA.

**Summary:**

This symposium will review management innovations in the treatment of OSA. The topics to be discussed include new therapeutic modalities including EPAP, OPT and hypoglossal N stimulation, and whether CPAP can prevent strokes.

**Introduction**

Meir Kryger (USA)

**EPAP therapy in OSA**

Meir Kryger (USA)

**OPT (Oral Pressure Therapy) in OSA**

David White (USA)

**Can CPAP prevent strokes?**

Klar Yaggi (USA)

**Hypoglossal Nerve Stimulation in OSA**

Winfried Randerath (Germany)

**Question and answer**

Meir Kryger (USA)

**S12: Sleep and Circadian Rhythm Abnormalities in Mood Disorders****Chair:**

Ruth Benca (USA)

**Speakers:**

Ruth Benca (USA), Kathleen Ries Merikangas (USA), Ian Hickie (Australia), Tiina Paunio (Finland)

**Learning Objectives:**

To gain understanding of the current status of research on activity patterns, sleep and circadian rhythms in relation to mood disorders.

To appreciate the role of genetic and epigenetic mechanisms linking sleep and emotions.

To learn about changes in sleep-related brain plasticity in mood disorders.

To recognize the importance of varied research approaches to identify sleep and circadian targets for treatment interventions in mood disorders.

**Target Audience:**

This presentation is intended for both clinicians and scientists who are interested in the role of sleep and circadian rhythm disturbances in mood disorders, including those with backgrounds in sleep and/or psychiatry. The presentations should be accessible to those with more basic knowledge in the area, but will be of greater interest to the more advanced attendees.

**Summary:**

Abnormalities in the sleep-wake cycle, patterns of physical activity and circadian rhythms are core features of mood disorders. Moreover, sleep and circadian rhythm disruptions are predictive of the onset of mood disorders and likely contribute to their progression. This symposium will provide an overview of recent advances in our understanding of the relationships between sleep and circadian rhythm abnormalities and mood disorders. Dr. Merikangas will discuss findings from an epidemiologic family study enriched for people with mood disorders, including the relationship between patterns of sleep and activity and mood disorder subtypes as well as ordinal associations between daily mood fluctuations and sleep/activity patterns. Dr. Hickie will review work demonstrating that disrupted circadian function is characteristic of young people with emerging mood disorders and is likely to be a key pathophysiological aspect of these conditions. Dr. Paunio will describe the identification of DNA variants that affect both regulation of sleep and mood, showing that at least some of the genetic variability in regulation of sleep and mood is shared. Finally, Dr. Benca will discuss data from high density EEG studies of sleep and waking brain activity in depressed subjects that suggest alterations in brain plasticity mechanisms. Taken together, these findings suggest that an increased focus on objective measures of activity, sleep and circadian rhythms may provide key biomarkers for the onset, course and response to treatment of mood disorders, as well as targets for clinical interventions.

**Introduction**

Ruth Benca (USA)

**Daily rhythms of activity, sleep and mood in a family study of affective spectrum disorders**

Kathleen Ries Merikangas (USA)

**Sleep and circadian rhythm disruption in young people with emerging mood disorders**

Ian Hickie (Australia)

**Genetic regulation of sleep and emotions**

Tiina Paunio (Finland)

**High-density EEG analysis of sleep in depression**

Ruth Benca (USA)

**Question and answer**

Ruth Benca (USA)

**S13: Sleep, Circadian Rhythms and Brain Health in Aging****Co-chairs:**

Aleksandar Videnovic (USA), Nadia Gosselin (Canada)

**Speakers:**

Symposium Chairs (USA/Canada), Sonia Ancoli-Israel (USA), Nadia Gosselin (Canada), Aleksandar Videnovic (USA), Alex Iranzo (Spain), Alpar S. Lazar (United Kingdom)

**Learning Objectives:**

Discuss sleep and circadian dysfunction in Alzheimer's disease.

Understand the impact of sleep disordered breathing on cognition.

Discuss how circadian dysregulation and impaired sleep-wake cycle impact Parkinson's disease.

Understand the interface of RBD and neurogeneration.

Identify sleep and circadian rhythms disturbances in Huntington's disease.

**Target Audience:**

Practitioners, academicians, residents, postdoctoral fellows.

**Summary:**

Sleep dysfunction in neurological diseases remains frequently under-recognized by physicians and under-reported by patients. Some of the clearest evidence of the bidirectional relationship between sleep and circadian rhythms and expression of disease is seen in neurodegenerative disorders. This program emphasizes the role of impaired sleep, alertness and circadian rhythmicity in three major neurodegenerative disorders, AD, PD and HD. REM sleep behavior disorder and its associations with neurodegenerative disorders will be discussed. The program encompasses fields of neurodegeneration, sleep, and circadian biology, integrating basic science with clinical practice of neurology and sleep medicine. Greater understanding of the underlying mechanisms of circadian and sleep disturbances has transformative potential for neurodegenerative disorders and provides new dimension in neurology and sleep medicine.

**Introduction**

Symposium Chairs (USA/Canada)

**Sleep and circadian disorders and their management in Alzheimer's disease**

Sonia Ancoli-Israel (USA)

**Consequences of obstructive sleep disordered breathing on cognition and brain health in the elderly**

Nadia Gosselin (Canada)

**Sleep and Circadian Rhythm Dysfunction - Implications for Parkinson's Disease**

Aleksandar Videnovic (USA)

**REM sleep behavior disorder and neurodegenerative diseases**

Alex Iranzo (Spain)

**Disruption of Sleep and Circadian Timing in Huntington's Disease**

Alpar S. Lazar (United Kingdom)

**Question and answer**

Symposium Chairs (USA/Canada)

**S14: Explaining Differences in Epidemiology of Sleep Disorders****Across the World: The Case of SDB and RLS****Chair:**

Diego Garcia Borreguero (Spain)

**Speakers:**

Diego Garcia Borreguero (Spain), Manuel Sanchez de la Torre (Spain), Klaus Berger (Germany), Yuichi Inoue (Japan), Juliane Winkelman (USA), Christian Guilleminault (USA)

**Learning Objectives:**

Relationship between sleep metabolism, circadian rhythm and cancer risk

Sleep disturbances and cancer risk (especially sleep duration)

Role of Melatonin and hypnotic treatments in cancer

New discoveries. Intermittent hypoxia and cancer in animal models

New discoveries. Sleep apnea and risk of cancer. Incidence and mortality

The future. New studies needed and the role sleep disorders treatment in cancer

**Target Audience:**

Everyone with interest in sleep disorders.

**Summary:**

There are differences in the rate of sleep disorders throughout the world, and genetics behind these disorders may explain these differences, genetic and epidemiology are very much linked when considering our understanding of the clinical findings. Two major sleep disorders are considered in the symposium: OSA and RLS. The current understanding of the genetics behind OSA will be presented, and the racial differences in OSA noted in a multi-racial population (Australia) will be outlined. Similarly, prevalence of RLS has been consistently high in western countries; however studies performed in non-Caucasians have been lower. Our understanding of the genetics behind these disorders may explain some of the discrepancies noted depending of the racial presentation.

**Introduction**

Diego Garcia Borreguero (Spain)

**Genetics of Sleep Apnea**

Manuel Sanchez de la Torre (Spain)

**Racial differences in sleep-disordered breathing specific population**

Christian Guilleminault (USA)

**RLS prevalence around the world – numbers, methods, and interpretations**

Klaus Berger (Germany)

**RLS epidemiology in Asia: The Japanese perspective**

Yuichi Inoue (Japan)

**Difference in ethno-genetics predisposition to RLS across the world**

Juliane Winkelman (USA)

**Question and answer**

Diego Garcia Borreguero (Spain)

**S15: Pregnancy and Sleep****Chair:**

Leigh Signal (New Zealand)

**Speakers:**

Louise O'Brien (USA), Mauro Manconi (Switzerland), Maria Sarberg (Sweden), Leigh Signal (New Zealand)

**Learning Objectives:**

Understand how sleep changes during pregnancy and how these changes impact health, particularly the need for medical intervention at birth and maternal mental health.

Educate Sleep clinicians and researchers on the need to consider pregnant women with sleep disorders differently than the general population.

Suggest new field of research on sleep and woman.

**Summary:**

Pregnancy is a period when sleep change and some of the changes may have negative outcome for women and offspring. An understanding of these changes and to recognize them to prevent as much as possible negative outcome is an important goal. Mother may present significant and dangerous depression that may impact well been of both mother and child. Sleep in late pregnancy will have a clear impact in general on the immediate postpartum period. And presence or development of well-known sleep disorders such as abnormal breathing during sleep and Restless Leg will impact both mother and child. The understanding on how fetal development may be affected, and also how mother health can be greatly disturb will be presented in this symposium

**Introduction**

Leigh Signal (New Zealand)

**Snoring in pregnancy: Effects on the offspring**

Louise O'Brien (USA)

**Restless legs and pregnancy - when, how and why?**

Mauro Manconi (Switzerland)

**Sleeping problems and post-partum depression**

Maria Sarberg (Sweden)

**Sleep in late pregnancy and the relationship to maternal health**

Leigh Signal (New Zealand)

**S16: Interpreting and Evaluating Parasomnias: New Perspectives****Chair:**

Federica Provini (Italy)

**Speakers:**

Federica Provini (Italy), Lino Nobili (Italy), Isabelle Arnulf (France), Thanh Dang-Vu (Canada)

**Learning Objectives:**

To understand that sleep is not simply a quiescent state, but can involve behaviours of varying complexity. To understand that during arousal disorders EEG features of sleep and wakefulness might be simultaneously present in different cerebral regions suggesting that sleep depth is not evenly distributed within the brain. To understand that dreamlike mentation may occasionally exist during arousal disorders, suggesting that a complex mental activity also takes place during SWS. To understand how neuroimaging methods might be a useful approach to assess the structural and functional correlates of sleep impairments enhancing our understanding of the pathophysiological mechanisms of sleep disorders, including parasomnias. To understand that wake and sleep behaviour and body homeostasis are controlled by a neuronal network running from the brainstem to the cerebral cortex and working in a unitary fashion according to a caudorostral organization.

**Target Audience:**

Neurologists, Paediatricians, Psychiatrists, Psychologists Level of symposium: advanced.

**Summary:**

Parasomnias are very common, especially among children, but there are many misconceptions about them and neuropathological abnormalities have not been identified for most of the common parasomnias. The study of parasomnias provides unique opportunities to understand the mechanisms that regulate sleep and wakefulness. In this symposium we will present recent data obtained using intracerebral electroencephalographic recordings suggesting that arousal disorders are not a global cerebral phenomenon, but the coexistence of different local states of being. We will present the latest data on the complex mental activity taking place during REM and NREM parasomnias and the specific changes in brain structure or regional activity obtained with functional neuroimaging techniques. Lastly, we will present data on Agrypnia Excitata (AE), a syndrome characterized by loss of sleep and permanent motor and autonomic hyperactivation, making some general reflections on the composition and function of the cerebral neuronal network generating wake and sleep behaviour and regulating body homeostasis.

**Introduction**

Federica Provini (Italy)

**Local activations in Parasomnias: data from intracerebral recordings**

Lino Nobili (Italy)

**Sleep mentation during NREM and REM parasomnias**

Isabelle Arnulf (France)

**Neuroimaging of REM and NREM parasomnias**

Thanh Dang-Vu (Canada)

**Oneiric stupor and agrypnia excitata**

Federica Provini (Italy)

**Question and answer**

Federica Provini (Italy)

**S17: Novel Insights into Cardiometabolic Mechanisms of OSA****Co-chairs:**

Jan Hedner (Sweden), Brian Kent (Ireland)

**Speakers:**

Jan Hedner (Sweden), Brian Kent (Ireland), Richard Schulz (Germany), Jan Hedner (Sweden), Nikolas Büchner (Germany), Ludger Grote (Sweden)

**Learning Objectives:**

To expand on the epidemiological association between OSA and cardiometabolic disease. To review hypoxic pathways that potentially link OSA with cardiometabolic disease. To understand and apply appropriate measures of cardiovascular dysfunction in OSA.

**Target Audience:**

Physicians and researchers with an interest in sleep disordered breathing and its links to cardiometabolic disease. Level: Advanced

**Summary:**

This session aims to describe novel insights into the association between sleep disordered breathing and cardiometabolic disorders. Speakers will address information from large scale epidemiological data bases. Novel mechanisms linking OSA and cardiovascular and metabolic disease will be presented. Additional topics include new methods and targets to characterize cardiovascular disease in OSA.

**Introduction**

Jan Hedner (Sweden)

**Cardiometabolic disorders in European sleep apnea patients**

Brian Kent (Ireland)

**Oxidative stress and cardiometabolic disease in OSA**

Richard Schulz (Germany)

**Acid-base balance and carbonic anhydrase activity in OSA and its complications**

Jan Hedner (Sweden)

**Vascular hemodynamics in OSA – What is appropriate to monitor?**

Nikolas Büchner (Germany)

**Assessment of vascular function by continuous monitoring in OSA**

Ludger Grote (Sweden)

**Question and answer**

Jan Hedner (Sweden)

**S18: Those Comorbidities that Invade the Night: Treating Sleep Problems in Patients with Psychiatric Disorders****Chair:**

Jack D. Edinger (USA)

**Speakers:**

Jack D. Edinger (USA), Colleen E. Carney (Canada), Anne Germain (USA), Daniel Freeman (United Kingdom)

**Learning Objectives:**

Discuss and demonstrate helpful intervention strategies for managing patients with comorbid depression or nocturnal panic attacks

Demonstrate how to implement Imagery Rehearsal Therapy for Chronic nightmares

Demonstrate the implementation of graded exposure therapy for CPAP-related anxiety and claustrophobic reactions

**Target Audience:**

Clinicians who wish to learn how to implement a number of useful behavioral sleep medicine interventions with patients that have complicating comorbidities associated with their sleep problems. Sleep researchers interested in the nature and impact of mood and anxiety disorders on comorbid sleep problems.

**Summary:**

Patients who present with sleep complaints in association with comorbid anxiety and mood disorders represent significant challenges to providers charged with their management. Although various behavioral sleep medicine strategies have been developed for managing the anxiety and mood problems that commonly occur in association with various sleep disorders, many sleep professionals do not have training or skills in implementing these techniques. This symposium will review the evidence for and methods of managing common mood related and anxiety problems presented by sleep disorders patients. Specific techniques for managing obstacles to adherence with CBT related to depression and nocturnal panic attacks will be presented. Methods for dealing with CPAP-related claustrophobia and the recurrent nightmares common in patients with PTSD will be discussed and demonstrated via video vignettes.

**Introduction**

Jack D. Edinger (USA)

**Graded Exposure Therapy for Claustrophobic Reactions to CPAP Therapy**

Jack D. Edinger (USA)

**Management of sleep disturbances due to nocturnal panic attacks**

Colleen E. Carney (Canada)

**Imagery rehearsal therapy for anxiety-provoking dreams and nightmares**

Anne Germain (USA)

**Targeted CBT for Insomnia Symptoms in Schizophrenia**

Daniel Freeman (United Kingdom)

**Question and answer**

Jack D. Edinger (USA)

**S19: Pain, Opioids and Sleep Breathing Disorder – An Interaction to Manage****Co-chairs:**

Gilles Lavigne (Canada), Raphael Heinzer (Switzerland), Michael T. Smith (USA)

**Speakers:**

Gilles Lavigne (Canada), Giancarlo Vanini (USA), Michael T. Smith (USA), Raphael Heinzer (Switzerland), Christian Guilleminault (USA)

**Learning Objectives:**

Understand the interaction between pain conditions and sleep breathing.

Understand the perception of pain in presence of sleep breathing disorders.

Understand and estimate the risk of pain management on sleep breathing disorders.

Explore alternative avenues to manage concomitant pain and breathing disorders.

**Target Audience:**

Physicians, dentists, psychologists, nurses and investigators in sleep and pain management and in research.

**Summary:**

Chronic pain is concomitant in many patients with sleep disorders. Pain perception can be modified by the changes in breathing. Use of opioids, e.g., codeine or morphine, can aggravate breathing disorders. The pain specialist needs to better understand such risk, from basic science up to clinical consequences. Alternative in pain management needs to be discussed. Sleep specialist should be able to guide pain colleagues facing sleep disorders breathing cases.

**Introduction to the interaction between pain and respiration**

Gilles Lavigne (Canada)

**Neurochemical control of pain, sleep and breathing**

Giancarlo Vanini (USA)

**Sleep disorders and pain perception**

Michael T. Smith (USA)

**Opioids and nocturnal breathing disorders**

Raphael Heinzer (Switzerland)

**Take home message on safety and efficient pain relief**

Christian Guilleminault (USA)

**S20: Sleep and Glucose Metabolism****Chair:**

Karine Spiegel (France)

**Speakers:**

Karine Spiegel (France), Luiz Menna-Barreto (Brazil), Rachel Leproult (Belgium), Mark Barone (Brazil)

**Learning Objectives:**

Understand how sleep loss affects metabolism, leading to type 2 diabetes mellitus;

Understand the association between poor glycemic control and sleep impairments;

Understand rhythmicity as an important component to health.

**Target Audience:**

Researchers who work in the field of sleep restriction, sleep disorders and diabetes; Clinicians, and Health Care Professionals in general. Although the topic is very specific, the present Symposium will be comprehensible by the Congress audience.

**Summary:**

In this Symposium, the association of diabetes mellitus and sleep impairment will be explored. Some of the most recent findings concerning how sleep loss favors the development of diabetes and impact glycemic control, and, conversely, how glycemic impairment may affect sleep, will be discussed. The effects of circadian misalignment on glucose metabolism will also be discussed.

**Introduction with some consideration about the topic**

Karine Spiegel (France)

**Insulin Resistance and Sleep/Wake Cycle, how the impairment of these rhythms lead to diseases**

Luiz Menna-Barreto (Brazil)

**Impact of sleep loss and circadian misalignment on diabetes risk**

Rachel Leproult (Belgium)

**Sleep and type 1 diabetes, what is the association?**

Mark Barone (Brazil)

**Question and answer**

Karine Spiegel (France)

**S21: Sleep Apnea and The Adipocyte: Trends and Treatments****Chair:**

Gary S. Richardson (USA)

**Speakers:**

Gary S. Richardson (USA), Joseph M. Ojile (USA), David M. Rapoport (USA)

**Learning Objectives:**

The participant will become familiar with the physiology of the adipocyte, including central mechanisms controlling appetite and metabolism

The participant will appreciate the multidirectional relationships among sleep, sleep apnea and obesity—both the mechanisms linking obesity to sleep pathology and those linking sleep disturbance to obesity

The participant will review and evaluate data regarding CPAP as a therapy that effectively addresses the underlying obesity factor

The participant will examine and evaluate the current data as a compelling factor in potential changes in treatment for Sleep Apnea

**Target Audience:**

Physicians in sleep medicine, endocrinology and internal medicine in academic, research and clinical settings. Research and clinical scientists and clinical technologists and medical providers (Advanced Practice Nurses, Physicians Assistants) at an advanced level.

**Summary:**

The symposium will provide an accessible overview of the multidirectional relationships among sleep, sleep apnea and obesity. Recent advances have substantially enhanced our understanding of the basic physiology of the adipocyte, and of the role of adipose inflammation in the pathogenesis of obesity and insulin resistance. As these mechanisms are elucidated, it also becomes clear that obstructive sleep apnea (OSA), with attendant hypoxia and sympathetic nervous system (SNS) activation, represents a singular challenge to the adipocyte, and potentially accelerates the indigenous inflammatory response. These data also provide a basic foundation for the observed relationships among OSA and insulin resistance and the metabolic syndrome, and highlight a second path connecting obesity, inflammation, cytokines and persistent sleepiness in OSA patients after CPAP therapy. Recent work suggests that adipose remodeling in response to OSA may not be reversible with treatment of the hypoxia and sleep disruption. These results provide a perspective for consideration of the growing body of clinical data examining the effects of CPAP therapy on obesity measures. Several recent controlled and open trials of CPAP in OSA have produced a mixed picture of the impact of current OSA therapy on obesity and its consequences. Last, the faculty will consider whether these data should dictate the consideration of alternate treatment strategies that more directly address the adipose tissue pathology.

**Introduction**

Gary S. Richardson (USA)

**The physiology of sleep, sleep disorders and the adipocyte**

Gary S. Richardson (USA)

**Does CPAP therapy effectively address the underlying obesity factor?**

Joseph M. Ojile (USA)

**Does available data on the bi-directionality of sleep apnea and obesity support changes in treatment?**

David M. Rapoport (USA)

**Question and answer**

Gary S. Richardson (USA)

**S24: The Challenges for Defining Normative Data for Sleep****Disordered Breathing Across Lifespan****Chair:**

Hartmut Schneider (USA)

**Speakers:**

Hartmut Schneider (USA), Brian McGinley (USA), Joseph M. Monserrat (Spain), Ludger Grote (Sweden), Olli Polo (Finland), Thomas Penzel (Germany)

**Learning Objectives:**

Demonstrate how novel approaches to improve standards for detection and definition of sleep disordered breathing in clinical and research populations.

Define the challenges of assessing normative data.

Advance sleep field by showing how various age group affect sleep disorders breathing indices

**Target Audience:**

Epidemiologists in Sleep, Physiologists, Pediatricians and adult sleep doctors.

**Summary:**

The standards that have been established for defining sleep disordered breathing have been advanced without a body of data defining the range of normal breathing in sleep. New studies have revealed a wide range of normality in sleep and breathing that varies with age and gender. The problem becomes defining the significant respiratory features and the range that defines abnormality and the clinical significance of this range. This has been complicated by the failure to appreciate the major differences related to age and gender in human sleep.

**Introduction**

Hartmut Schneider (USA)

**Physiologic changes of respiratory components across the lifespan: Impact on sleep disordered breath**

Hartmut Schneider (USA)

**Pediatric: advances in criteria for defining sleep disordered breathing**

Brian McGinley (USA)

**Elderly: Problems of defining normality in the older population**

Joseph M. Monserrat (Spain)

**Defining sleep disordered breathing in adults, lessons from ESADA.**

Ludger Grote (Sweden)

**Gender differences of sleep disordered breathing**

Olli Polo (Finland)

**Question and answer**

Thomas Penzel (Germany)

**S25: Hypocretin/orexin as a Therapeutic Target for Sleep Disorders****Chair:**

Luis de Lecea (USA)

**Speakers:**

Luis de Lecea (USA), Jyrki Kukkonen (Finland), Takeshi Sakurai (Japan), W. Joseph Herring (USA)

**Learning Objectives:**

Learn about the basic neuroanatomy and pharmacology of the hypocretin/orexin system

Basic connectivity of orexin neurons with monoaminergic systems

Learn about the differential functions of orexin receptors

Learn about optogenetic methods applied to sleep research

Learn about suvorexant and other therapeutic tools targeting orexin receptors

**Target Audience:**

Specialists in sleep medicine, scientists with an interest in the neurobiology underlying sleep/wake transitions. Intermediate-advanced level.

**Summary:**

This symposium will gather the most current knowledge on the hypocretin/orexin system and the application of orexin receptor-antagonists in the treatment of insomnia and other disorders.

**Introduction**

Luis de Lecea (USA)

**Hypocretins/orexins as masters regulators of sleep/wake cycle and beyond**

Luis de Lecea (USA)

**Orexin receptors and signaling**

Jyrki Kukkonen (Finland)

**Orexin system**

Takeshi Sakurai (Japan)

**Survorexant: An orexin receptor antagonist for the treatment of insomnia**

W. Joseph Herring (USA)

**Question and answer**

Luis de Lecea (USA)

**S26: Spinal Mechanisms in RLS****Co-chairs:**

Walter Paulus (Germany), Stefan Clemens (USA)

**Speakers:**

Walter Paulus (Germany), Federica Provini (Italy), Cornelius Bachmann (Germany), Stefan Clemens (USA), Imad Ghorayeb (France)

**Learning Objectives:**

Role of dopamine and opioid receptors in the spinal cord

Accessibility of spinal cord function in RLS patients

Augmentation liability in RLS due to spinal specifics

Treatment option by transcutaneously-applied direct current stimulation

How to decide on pharmacotherapy of RLS on the background of spinal specifics

**Target Audience:**

Physicians involved in diagnosis and treatment of the Restless Legs Syndrome.

**Summary:**

Restless Legs Syndrome is a network disorder involving the brain as well as the spinal cord. In this symposium we will address both the pathophysiology of the spinal cord as well as treatment oriented aspects. Obviously rodent data differ from primate data, since the former involve dopaminergic neurotransmission, while the latter address L-dopaergic A11 neurones. Differences will be outlined. Aspects such as small fibre neuropathy induced spinal neuron denervation and lack of spinal dopamine transporter will be discussed on the background of reflex studies and therapeutic consequences, in particular with regard to dopaminergic augmentation. Recent data on a beneficial effect of spinal direct current stimulation will complete the overview on spinal mechanisms in RLS.

**Introduction**

Stefan Clemens (USA)

**Concepts of Spinal pathophysiology in RLS**

Walter Paulus (Germany)

**Spinal mechanisms of PLM in RLS patients**

Federica Provini (Italy)

**Spinal direct current stimulation in RLS**

Cornelius Bachmann (Germany)

**Rodent models of spinal pathophysiology**

Stefan Clemens (USA)

**Primate models of spinal pathophysiology**

Imad Ghorayeb (France)

**Question and answer**

Walter Paulus (Germany)

**S27: Idiopathic Hypersomnia: Past, Present and Future****Co-Chairs:**

Michel Billiard (France), Sona Nevsimalova (Czech Republic)

**Speakers:**

Michel Billiard (France), Karel Sonka (Czech Republic), Seiji Nishino (USA), Sona Nevsimalova (Czech Republic), Timothy Morgenthaler (USA)

**Learning Objectives:**

To trace the evolution of the concept of idiopathic hypersomnia since its origin

To suggest new limits between the different forms of narcolepsy and idiopathic hypersomnia, based on cluster analysis

To make an update on the role of monoamines, histamine and hypocretin in the pathophysiology of idiopathic hypersomnia and to suggest new orientations for research

To bring light on the genetics and on the circadian rhythms in idiopathic hypersomnia with and without long sleep time

To propose, based on the largest one-center retrospective review ever published, the most active and the least liable to side-effects drugs for idiopathic hypersomnia

**Target Audience:**

Mostly clinicians and researchers interested in hypersomnias of central origin, idiopathic hypersomnia and narcolepsy.

**Summary:**

In comparison with narcolepsy and even Kleine-Levin syndrome, idiopathic hypersomnia stands as the least studied among hypersomnias of central origin.

**The concept of idiopathic hypersomnia since its origin**

Michel Billiard (France)

**Spectra of narcolepsy and idiopathic hypersomnia**

Karel Sonka (Czech Republic)

**Neurochemistry of idiopathic hypersomnia**

Seiji Nishino (USA)

**Genetic aspects of idiopathic hypersomnia**

Sona Nevsimalova (Czech Republic)

**Treatment of idiopathic hypersomnia: trials and tribulation**

Timothy Morgenthaler (USA)

**S28: Dental Management of OSA in Adults and Children****Co-chairs:**

Félix de Carlos Villafranca (Spain), Emilio Macías Escalada (Spain)

**Speakers:**

Félix de Carlos Villafranca (Spain), Christian Guilleminault (USA), Michèle Hervy-Auboiron (France), Bernard Fleury (France)

**Learning Objectives:**

Benefits of Dental Devices and dentofacial orthopedics in the sleep-related breathing disorders

**Target Audience:**

Physicians, Dentists, Pediatricians, Orthodontists interested in treating the syndrome of obstructive sleep apnea in both children and adults.

**Summary:**

The use of intra-oral appliances for the treatment of obstructive problems in the upper airways is not a new concept. Back in 1902, Pierre Robin recommended the use of an appliance of these characteristics (monoblock) in order to achieve functional mandibular advancement, moving the mandible to a more advanced position. By doing so, he was able to add traction to the tongue and prevent it from falling backwards. Passive manipulation of the lower jaw by means of intra-oral mandibular advancement devices (MAD) involves changes in the morphology and volume of the upper airways. This movement stabilizes and fixes the mandible and the hyoid bone, preventing posterior rotation of these structures and avoiding occupation of the airway when recumbent.

MAD facilitate an increase in volume and permeability of the upper airways. This increase in the upper airways has been documented in a large number of studies using different scanning systems and imaging techniques. MAD represent a useful alternative in patients with chronic snoring and/or obstructive sleep apnoea. They comprise a reasonable alternative with respect to other existing therapies, as they do not involve a permanent change in the individual (as occurs with surgery) and their use can be discontinued at any time. However, a suitable risk-benefit assessment of the patient must be carried out on an individual level in order to determine the best therapy in each particular case. Benefits perceived by the patient are confirmed in polysomnographic records as: a reduction in the frequency and intensity of snoring, improved oxygen saturation, a reduction in the number of apneas and arousals, decreased blood pressure readings and, ultimately, a significant improvement in sleep structure. Obstructive sleep apnoea is a common breathing problem with a complex and poorly understood physiopathology which involves changes in neural control and in the reflexes of the upper airways. In fact, the coordinate neural regulation of the upper airway muscles is basic to control airway size and resistance. Knowledge of the mechanism of action of these devices and of the facial structures that support them represents a different approach to the treatment of obstructive diseases of the upper airway. There still remains an important outstanding issue, however, namely that of intervention at an early age. This should be taken into consideration to establish a hypothetical prophylaxis of obstructive sleep disease. The possibility of manipulating maxillomandibular growth by orthopaedic and orthodontic means in children in order to stimulate or inhibit the growth of these structures is of major interest. By doing so, we induce changes in the airways, thus achieving a conformation that is less susceptible to collapse.

**Introduction**

Félix de Carlos Villafranca (Spain)

**Oro-facial growth and pediatric sleep disordered breathing**

Christian Guilleminault (USA)

**Orthopedics and orthodontics treatment of OSA in children and prevention**

Michèle Hervy-Auboiron (France)

**Optimization of oral appliance therapy for sleep-related breathing disorders**

Félix de Carlos Villafranca (Spain)

### **Cardiovascular impact in SAOS patients treated with advancement mandibular devices**

Bernard Fleury (France)

#### **Question and answer**

Félix de Carlos Villafranca (Spain)

## **S29: Narcolepsy Update**

### **Part I: Recent Big Data Analysis of Morbidity, Mortality and Societal Burden of Narcolepsy**

#### **Part II: Nordic H1N1 Vaccine and Narcolepsy experience: Recent Unexpected Findings**

##### **Part I Speakers:**

Maurice Ohayon (USA), Poul Jennum (Denmark), Jed Black (USA)

##### **Part I Learning Objectives:**

Describe the higher rates of medical comorbidity in patients with narcolepsy relative to the general population of non-narcolepsy patients treated within the Danish and US healthcare systems.

Quantify the higher rates of healthcare utilization, and associated costs in narcolepsy patients compared with those without narcolepsy.

Understand the relationship between narcolepsy and mortality risk.

##### **Part I Summary:**

Part I Summary: While it has long been recognized that narcolepsy can have detrimental impacts on various psychological, medical, and functional facets of life, the broad impact of the disease on both individuals and society has not been, until recently, well quantified using large, population-based samples. The three speakers will present original, population-based research addressing the burden of illness relating to narcolepsy. Dr. Ohayon will present findings relating to medical comorbidity and mortality risk associated with narcolepsy in a large cohort of 322 well-documented narcolepsy patients within the US population. This cohort is matched with a representative US sample of 15,928 individuals.

Dr. Jennum will review his results of an evaluation of 816 narcolepsy patients from the 5.5 million-patient Danish National patient registry. These data confirm a significant burden of illness and medical comorbidity presence in patients with narcolepsy compared with a sample of four-fold, well-matched controls within the registry.

Dr. Black will describe a recent analysis of claims data on 9,312 narcolepsy patients and 46,559 highly-matched controls in the US, which revealed significantly higher rates of comorbid diseases, healthcare service and drug utilization rates, and associated medical costs in narcolepsy subjects versus controls. Narcolepsy was also associated with significantly higher rates of short-term disability related outcomes, including costs.

Combined, these data substantiate the tremendous impact of narcolepsy globally and highlight the importance of ongoing efforts to facilitate earlier diagnosis and timely implementation of effective therapy in patients suffering from the disorder.

##### **Part II Speakers:**

Markku Partinen (Finland)

##### **Part II Learning Objectives:**

Summarize the association of H1N1 vaccination and narcolepsy in Nordic countries and understand the role that public policy or practices may play in introducing bias in medical practice or scientific discovery.

##### **Part II Summary:**

Dr. Partinen will provide a general update on the overall pattern of association of H1N1 vaccination and narcolepsy in Nordic countries and review current findings on narcolepsy symptom evolution in children with recent-onset narcolepsy. Of particular importance, Dr. Partinen will provide a focused review of the Finnish experience with H1N1 vaccination and the presentation of narcolepsy in over 100 Finnish pediatric and adult cases, highlighting the possibility that Finnish disability compensation policies may impart a potential source of bias.

## **S35: Young Investigator Symposium: Sleep and Neurodegeneration**

##### **Co-chairs:**

Carlos H. Schenck (USA), Claudia Trenkwalder (Germany)

##### **Speakers:**

Carlos H. Schenck (USA), Yo-El Ju (USA), Jason Valerio (Canada), Alia Mansour (Egypt), Preeti Devnani (India), Lena Tholfson (Norway), Nicholas-Tiberio Economou (Greece), Claudio Liguori (Italy)

##### **Learning Objectives:**

To learn about sleep problems associated with neurodegenerative disorders

To learn how idiopathic RBD (iRBD) is a strong risk factor for future parkinsonism

To learn about PET data on cholinergic and striatal dopaminergic dysfunction in iRBD in the context of increased risk for future neurodegeneration

To become acquainted with an evidence based review of the treatment of RBD

To learn about the correlates of sleep and orexin with cognitive decline in Alzheimer disease (AD).

To become acquainted with how polysomnographic findings can have correlates with mild cognitive impairment and AD

##### **Target Audience:**

A broad target audience, including clinicians and basic scientists of all levels of training and experience.

##### **Summary:**

This symposium is dedicated to the recent excellent work of young investigators and those who are new to the area of sleep and neurodegeneration. It covers areas of abnormal sleep in neurodegenerative disorders, focusing on RBD and excessive sleepiness in PD, and their clinical, polysomnographic, and brain imaging correlates. Underlying mechanisms are explored by PET cholinergic and striatal dopaminergic imaging of idiopathic RBD patients, searching for risk factors of future neurodegeneration. An evidence based review of RBD treatment is presented. In the Introduction, the broad scope of current knowledge on RBD is summarized, and future directions of RBD research are indicated. Research on Alzheimer disease (AD) is presented in regards to the correlates of sleep and orexin with cognitive decline. Also, correlates of polysomnographic findings are applied across the spectrum of normal elderly cognition, mild cognitive impairment, and AD.

### **Introduction: RBD: Current Knowledge and Future Directions**

Carlos H. Schenck (USA)

### **Functional brain networks in REM sleep behavior disorder**

Yo-El Ju (USA)

**Cholinergic and striatal dopaminergic dysfunction using PET as a risk marker for developing a neurodegenerative disease in patients with idiopathic Rapid Eye Movement sleep behaviour disorder**

Jason Valerio (Canada)

**Clinical and Polysomnographic study of RBD in Parkinson's disease from Egypt**

Alia Mansour (Egypt)

**Treatment of REM Behaviour Disorder- An Evidence Based Review**

Preeti Devnani (India)

**Excessive daytime sleepiness in early Parkinson's disease: A five year follow-up**

Lena Tholfsen (Norway)

**From normal elderly through Mild Cognitive Impairment (MCI) to Alzheimer's Disease. A progression based on sleep polysomnographic findings**

Nicholas-Tiberio Economou (Greece)

**Alzheimer disease: sleep, orexin and cognitive decline**

Claudio Liguori (Italy)

**Question and answer**

Carlos H. Schenck (USA)

**Joint Symposium of WASM with the European Chapter of the International Federation of Clinical Neurophysiology**

**S34: REM Sleep: Normal and Abnormal Neurophysiology**

**Co-chairs:**

Luis Garcia-Larrea (France), Walter Paulus (Germany)

**Speakers:**

Luis Garcia-Larrea (France), Walter Paulus (Germany), H el ene Bastuji (France), Poul Jennum (Denmark), Marcello Massimini (Italy), Teresa Paiva (Portugal)

**Learning Objectives:**

To understand physiological mechanisms of brain connectivity during sleep with a focus on REM sleep in humans, integrating animal and human data

To identify REM sleep using an electronic algorithm for detecting RBD

To analyse brain connectivity during sleep using neurophysiological and imaging techniques

To describe the mechanisms and phenotypes of dreaming in neurological patients

**Target Audience:**

Target audience sleep clinicians, basic researchers and PhD students.

**Summary:**

The Symposium will deal with thalamo-cortical interactions during human sleep with special focus on REM (paradoxical) sleep. It will discuss (a) intracranial data from humans on sensory integration and thalamo-cortical coupling/decoupling during sleep (H Bastuji, Lyon); (b) the automatic detection of REM sleep in patients with idiopathic REM behaviour disorder (P Jennum, Glostrup) (c) the changes in effective connectivity during human REM sleep (M Massimini, Milan) and the particularities of REM sleep and dreaming in patients with neurological disorders (T Paiva, Lisbon).

**Introduction**

Luis Garcia-Larrea (France), Walter Paulus (Germany)

**Sensory integration and thalamo-cortical coupling/decoupling during sleep**

H el ene Bastuji (France)

**Automatic REM sleep detection associated with idiopathic REM sleep behavior disorder**

Poul Jennum (Denmark)

**Cortical reactivity and effective connectivity during REM sleep in humans as revealed by fMRI and EEG**

Marcello Massimini (Italy)

**Dreaming in neurological disorders**

Teresa Paiva (Portugal)

**Questions and answer**

Luis Garcia-Larrea (France), Walter Paulus (Germany)

**S30: Using the Dim Light Melatonin Onset (DLMO) to Evaluate**

**Circadian Timing in Clinical Populations**

**Chair:**

Jeanne Duffy (USA)

**Speakers:**

Jeanne Duffy (USA), Shadab Rahman (USA/Canada), Marcel G. Smits (The Netherlands),

Aurelija Jucaite (Lithuania/Sweden), Jung-Hie Lee (Korea)

**Learning Objectives:**

Sleep regulation by interaction of circadian and sleep-wake homeostatic processes

The dim light melatonin onset (DLMO) as a marker of circadian timing

In-home and laboratory methods for assessing DLMO

Evidence from clinical populations where the DLMO was used to assess circadian timing

**Target Audience:**

Clinicians who treat patients with insomnia and circadian rhythm sleep disorders; circadian rhythm researchers; sleep researchers who want to understand more about circadian rhythms.

**Summary:**

Circadian Rhythm Sleep Disorders (CRSD) are typically evaluated on the basis of sleep timing, with the assumption that the cause of the abnormal sleep timing is an abnormality in the circadian timing system. However, there is evidence that this assumption is not true for all CRSD patients. CRSD individuals sleeping at abnormal clock times may be sleeping at normal circadian times, which would suggest their behavioral choices of sleep and light-dark exposure are contributing to their sleep timing problems and should be the focus of treatment. Similarly, individuals sleeping at conventional clock times may be sleeping at abnormal circadian times, which could lead to problems with sleep initiation or sleep maintenance; treating such individuals should involve shifting the underlying circadian timing without changing sleep timing. Thus, circadian timing information may contribute to addressing several types of sleeping problems beyond the circadian rhythm disorders, and may guide better treatment choices. In research settings, the dim light melatonin onset (DLMO) is a widely-used tool for determining the timing of circadian rhythms. In clinical settings, serial saliva samples are collected in dim light conditions for several hours to be assayed for melatonin levels, and the time of the evening rise in melatonin (the DLMO) is determined and used as a marker of circadian phase. When the phase is compared

with habitual sleep timing, a phase angle can also be determined. While the phase provides information about the clock time of circadian rhythms, the phase angle provides information about the circadian time of sleep, and can provide insight into whether the individual's sleep is at a typical or abnormal circadian phase. In this symposium we will describe protocols for assessing DLMO in patient populations and present findings from several clinical populations where circadian timing information was used to guide treatment.

**Introduction to symposium: Rationale for direct assessment of circadian rhythms in sleep disorders patients**

Jeanne Duffy (USA)

**DSPS: Birds of the same feather? Utility of the DLMO test in diagnosing DSPS in a clinical population in Canada**

Shadab Rahman (USA/Canada)

**Using salivary melatonin measurements in patients with insomnia and possible sleep timing disorders: Experience with 1,800 patients in the Netherlands**

Marcel G. Smits (The Netherlands)

**Diurnal melatonin patterns in children: Ready to apply in clinical practice?**

Aurelija Jucaite (Lithuania/Sweden)

**Integrating DLMO assessments into clinical practice in Korea: Practical considerations**

Jung-Hie Lee (Republic of Korea)

**Question and answer**

Jeanne Duffy (USA)

**S31: Sleep Microstructure, Arousals and Autonomic Functions: New Insights and Clinical Implications**

**Co-Chairs:**

Liborio Parrino (Italy), Pietro Cortelli (Italy)

**Speakers:**

Liborio Parrino (Italy), Pietro Cortelli (Italy), Eduardo Benarroch (USA), Jussi Toppila (Finland), Andrea Grassi (Italy), Federica Provini (Italy)

**Learning Objectives:**

To update the relationship between sleep and autonomic regulation.

To evaluate the time relation between arousal events occurring during sleep and autonomic variations

To identify autonomic markers that correlate with sleep microstructure.

To understand the pathophysiological hemodynamic mechanisms associated with unstable sleep

To disclose the harmful impact of high amounts of CAP in sleep disorders, such as Nocturnal Epilepsy, which are commonly neglected in terms of autonomic risk.

**Target Audience:**

Sleep physicians, Neurologists, Neurophysiologists, Pulmonologists, Cardiologists, Sleep technologists

**Summary:**

There is an intimate relationship between the autonomic nervous system and sleep from an anatomical, physiological, and neurochemical point of view. Recording autonomic parameters during sleep can shed light on the biological price and potential harmful consequences of sleep disorders. A pivotal role is played by the arousal system which modulates ventilation, cardiovascular con-

trol and networks involved in the regulation of motor activities. During non-REM sleep, EEG arousal-related phasic events are organized in periodic sequences which are associated with oscillatory swings of the autonomic functions. These sequences are recognized as the cyclic alternating pattern (CAP), which represents the EEG marker of sleep instability. Conditions of reduced sleep quality are characterized by increased amounts of CAP and by a shift in the sympathetic/parasympathetic balance towards a sympathetic predominance. CAP-related autonomic alterations have been investigated by means of pulse wave amplitude and heart rate variability in patients with Nocturnal Frontal Lobe Epilepsy, characterized by an impressive increase of CAP. A novel non-invasive optical method for monitoring cortical and scalp hemodynamic changes is offered by near-infrared spectroscopy (NIRS), which has been recorded during CAP in healthy subjects and during apnea-related arousals in patients with obstructive sleep apnea syndrome.

The proposed symposium will allow presentation of these results and outline perspectives for further research.

**Introduction**

Liborio Parrino (Italy)

**Introduction**

Pietro Cortelli (Italy)

**Anatomo-functional integration between sleep and autonomic nervous system**

Eduardo Benarroch (USA)

**CAP-related cerebral hemodynamic variation measured with near-infrared spectroscopy (NIRS)**

Jussi Toppila (Finland)

**Autonomic nervous system activity during sleep in Nocturnal Frontal Lobe Epilepsy**

Andrea Grassi (Italy)

**Autonomic arousal and motor behaviours during sleep**

Federica Provini (Italy)

**Question and answer**

Liborio Parrino (Italy)

**S32: Obesity and Sleep Apnea in Children**

**Co-chairs:**

Indra Narang (Canada), David Gozal (USA)

**Speakers:**

David Gozal (USA), Stijn Verhulst (Belgium), Leila Kheirandish-Gozal (USA), Evan Propst (Canada),

Indra Narang (Canada)

**Learning Objectives:**

To understand the current prevalence and anatomical factors associated with obstructive sleep apnea in obese children.

To evaluate the role of the polysomnogram in the diagnosis of paediatric obesity related obstructive sleep apnea.

Outline the current medical options and their pitfalls in the management of obstructive sleep apnea in obese children.

Recognise the adverse consequences of obstructive sleep apnea in obese children and the impact of timely diagnosis and management of this disorder.

Debate whether tonsillectomy should be a treatment for obstructive sleep apnea in older children.

Discuss advanced surgical techniques for the management of obstructive sleep apnea in obese children.

**Target Audience:**

The proposed scientific symposium is designed to establish a comprehensive and complete review of the most recent evidence based practice of sleep medicine in children with obstructive sleep apnea and obesity. The prevalence and severity of obesity in children referred to sleep clinics has alarmingly increased in the past 2 decade and is indicative of a dramatic increase in the occurrence of obesity-associated morbidities, and more specifically has increased the prevalence of obstructive sleep apnea. Since both obesity and OSA are two inflammatory disorders, it is not surprising that inflammatory cascades might be involved in mediating such processes, whether at the pathophysiology of the disease themselves or their consequences. Therefore, discussion of novel targeted diagnostic and therapeutic modalities that may benefit such high-risk pediatric populations

**Summary:**

This symposium is aimed to review the most recent evidence on obesity, its association with obstructive sleep apnea and cardiovascular consequences during childhood. The proposed symposium will begin with review and discussion about pathophysiology and risk of OSA in obese children. The next lecture will link pediatric obstructive sleep apnea to inflammatory-pathways and present the evidence of systemic inflammation in OSA and obesity, with emphasis on similar and unique signatures. The symposium continues with discussion about changes in endothelial function in children with OSA and obesity. Autonomic dysfunction and hypertension will be presented during the 4th lecture and finally treatment of obese children with OSA will be discussed.

**Introduction**

David Gozal (USA)

**Prevalence, anatomical correlates and diagnosis of paediatric obesity**

Stijn Verhulst (Belgium)

**Systemic inflammation in OSA and obesity**

David Gozal (USA)

**Endothelial function in children with OSA and obesity**

Leila Kheirandish-Gozal (USA)

**Advanced surgical techniques for the management of obesity related OSA in children**

Evan Propst (Canada)

**Questions and answer**

Indra Narang (Canada)

**S33: Joint Symposia of WASM and Sociedad Española de Neumología y Cirugía Torácica (SEPAR)**

**Co-chairs:**

Christian Guilleminault (USA), Ferrán Barbé (Spain)

**Speakers:**

Ferrán Barbé (Spain), Manuel Sanchez de la Torre (Spain), Miguel Angel Martinez Garcia (Spain),

Alberto Alonso (Spain), Joaquin Duran (Spain), Christian Guilleminault (USA)

**Learning Objectives:**

To evaluate the role of the different pathogenic pathways in the development of atherosclerosis and cardiovascular disease in OSA patients

To understand the clinical relevance to identify and treat OSA in subjects with hypertension

To explore the relationship between OSA and pulmonary embolism

To highlight the importance to develop international collaborative clinical trials enrolling thousands of patients

**Target Audience:**

Advanced topic for clinical sleep specialists and basic researchers with a special interest in cardiovascular consequences of OSA

**Summary:**

The intermittent collapse of the upper airway during sleep activates different pathways such as oxidative stress, sympathetic activation, inflammation, hypercoagulability, endothelial dysfunction, and metabolic dysregulation that predispose patients with OSA to hypertension and atherosclerosis. OSA is a common cause of systemic hypertension and should be suspected in hypertensive individuals, especially those with resistant hypertension. Recent data suggest that OSA could be related to an increase in the incidence of pulmonary hypertension and this association could be based on the existence of hypercoagulability in OSAS patients. In order to modify clinical guidelines and to highlight the importance of OSA in the development cardiovascular diseases it is necessary to perform international clinical trials.

**Introduction**

Ferrán Barbé (Spain)

**Pathogenic bases of cardiovascular consequences in OSA patients**

Manuel Sanchez de la Torre (Spain)

**Resistant hypertension and OSA**

Miguel Angel Martinez Garcia (Spain)

**Pulmonary embolism and OSA**

Alberto Alonso (Spain)

**The need of international clinical trials collaboration**

Joaquin Duran (Spain)

**Closing remarks**

Christian Guilleminault (USA)



## Abstracts for the 5th World Congress on Sleep Medicine, 28 September to 2 October 2013, Valencia, Spain

### Clinical and polysomnographic study of RBD in Parkinson's disease from Egypt

A. Mansour<sup>1</sup>, T. Kamel<sup>1</sup>, T. Asaad<sup>2</sup>, Y. Metwally<sup>1</sup>, H. Aref<sup>1</sup>, N. Salah<sup>1</sup>

<sup>1</sup> Department of Neurology, Faculty of Medicine, Ain Shams University, Egypt

<sup>2</sup> Department of Psychiatry, Faculty of Medicine, Ain Shams University, Egypt

**Introduction:** Patients with Parkinson's disease (PD) are prone to sleep disturbances and disorders with a prevalence of 78–98% (Norlinah et al., 2009). The prevalence of RBD in idiopathic Parkinson's disease varies from 15% to 58% (Iranzo et al., 2009). The importance of RBD is that it is now considered as an early marker of developing Parkinson's disease (Arnulf, 2012). **Objective:** study the clinical and polysomnographic characteristics of PD patients with versus without RBD.

**Materials and methods:** Thirty-six PD patients were enrolled from the Involuntary Movement outpatient clinic in Ain Shams University hospital and submitted to clinical assessment by UPDRS-III, Hamilton depression scale, structured sheet for sleep questionnaire, Mayo clinic sleep questionnaire to diagnose RBD, Pittsburgh sleep scale for sleep quality, Epworth sleepiness scale to assess excessive day time sleepiness. In addition, REM sleep without atonia was assessed, in a one night video-polysomnography (PSG).

**Results:** Thirteen patients (36%) were found to have RBD clinically and confirmed by PSG. RBD patients were of older age ( $p = 0.086$ ), higher disease severity ( $p = 0.52$ ), shorter disease duration ( $p = 0.108$ ), there is no difference between the RBD+ve group and RBD–ve group as regard to tremors or rigidity as a predominant presentation. PSG analysis showed longer REM latency ( $p = 0.934$ ), higher periodic leg movement index (PLMI) and respiratory disturbance index (RDI),  $p = 0.553$ ,  $0.198$  respectively.

**Conclusion:** Our findings support the association between RBD and PD as well as the clinical relevance of sleep disturbances in PD. Association with shorter disease duration may support that it is an early marker of the disease.

<http://dx.doi.org/10.1016/j.sleep.2013.11.007>

### Alzheimer disease: sleep, orexin and cognitive decline

C. Liguori, A. Romigi, M. Albanese, S. Zannino, M. Marciari, F. Placidi  
Neuroscience Department, University Hospital of Rome Tor Vergata, Italy

**Introduction:** In Alzheimer's disease (AD) several networks including regions regulating the sleep-wake rhythm are altered. Orexin-A

is an hypothalamic neuropeptide contributing to the regulation of the sleep-wake cycle. The aim of our study was to investigate the possible involvement of the orexinergic system in the AD neurodegenerative processes and its relationship with sleep impairment.

**Materials and methods:** We included 48 consecutive untreated AD patients and 29 healthy controls. Based on MMSE, AD patients were divided in 2 groups: mild AD (MMSE  $\geq 21$ ; 21 subjects) and moderate-severe AD (MMSE  $< 21$ ; 27 subjects). We quantified orexin CSF levels in AD patients and controls, and examined potential links to the established AD markers CSF levels, as tau, phospho-tau (ptau), and beta-amyloid1–42 ( $A\beta 1-42$ ). Moreover, AD patients underwent a full nocturnal polysomnography (PSG). Finally, CSF results were correlated with sleep structure parameters and MMSE.

**Results:** Regarding CSF data, control subjects showed orexin CSF levels not significantly different with AD patients as well as with mild AD subjects. However, moderate-severe AD patients showed increased orexin CSF levels in respect to both mild AD patients and controls. Regarding PSG parameters, moderate-severe AD patients, compared to mild AD subjects, showed a significant reduction in sleep efficiency (SE) and a significant increase in wakefulness after sleep onset (WASO) and in REM latency. Moreover, in AD patients the orexin CSF levels were negatively correlated with REM sleep, slow wave sleep (SWS) and SE, whereas were positively correlated with WASO and sleep latency. Furthermore, it appeared to exist a positive correlation between the increase of orexin and tau CSF levels in AD patients.  $A\beta 1-42$  CSF levels were negatively correlated with WASO whereas were positively correlated with REM sleep. Tau CSF levels were negatively correlated with SWS. The decrease of MMSE correlated with the impairment of SE and REM sleep and the increase of WASO.

**Conclusion:** Our study shows that in AD cognitive decline is linked to a parallel sleep deterioration, which appears to be related to an increase of the CSF orexin levels. In conclusion, our results demonstrate that the orexinergic system is not impaired in AD, but its output and function appears to be overexpressed along the progression of neurodegenerative processes, possibly due to an unbalance of the neurotransmitters networks regulating the wake-sleep cycle towards the systems promoting wakefulness.

**Acknowledgements:** We are grateful to Ms. Alessandra Nitti for technical support, Dr. Francesca IZZI for acquisition of data, Prof. Nicola Biagio Mercuri for study supervision and Prof. Giuseppe Sancesario and Dr. Alessandro Martorana for acquisition of data and study supervision.

<http://dx.doi.org/10.1016/j.sleep.2013.11.008>

### Cholinergic and striatal dopaminergic dysfunction using pet as a risk marker for developing a neurodegenerative disease in patients with idiopathic rapid eye movement sleep behaviour disorder

J. Valerio<sup>a</sup>, V. Sossi<sup>b</sup>, K. Dinelle<sup>b</sup>, J. Mckenzie<sup>b</sup>, S. McCormick<sup>b</sup>, J. Stoessel<sup>b</sup>

<sup>a</sup>Department of Medicine (Neurology), Canada

<sup>b</sup>Pacific Parkinson's Research Centre, Canada

**Introduction:** Rapid eye movement (REM) sleep behaviour disorder (RBD) is characterized by dream enactment behaviours during REM sleep, due to loss of normal motor atonia. Previous studies have shown dopaminergic dysfunction in idiopathic RBD (iRBD) is predictive of developing a synucleinopathy, such as Parkinson's disease (PD), multiple system atrophy (MSA) or dementia with Lewy bodies (DLB). IRBD needs to be distinguished from secondary RBD which can be seen in narcolepsy, obstructive Sleep apnea (OSA) and in patients taking exogenous serotonin-elevating medications, such as selective serotonin reuptake inhibitors (SSRI's). We postulate that subjects with iRBD will tend to have a higher level of dopaminergic and cholinergic dysfunction reflective of their higher risk for developing a synucleinopathy compared to healthy controls and patients with secondary RBD.

**Materials and methods:** In a prospective study, 10 patients with RBD (mean age  $60.8 \pm 11.1$ ), were assessed and recruited by the movement disorders clinic (University of British Columbia), from 2005 to 2012. Patients were followed serially for 12 to 84 months to monitor for the development of a neurodegenerative disease. Baseline PET imaging was performed on all 10 subjects, using radiotracers [11C] PMP (acetylcholinesterase) and [11C] dihydrotetrabenazine (DTBZ) for vesicular monoamine transporter type 2 (VMAT2). PMP k3 was determined based on either striatal input or shape analysis and was judged to be reduced when values were below 2 SD of the corresponding values in healthy controls.

**Results:** Ten patients were diagnosed with RBD in a sleep lab prior to PET scanning. Three had OSA requiring CPAP and of those, two are on SSRI's for depression. One additional patient has narcolepsy. PMP and DTBZ binding were normal in these four subjects. Of the remaining 6 (presumed iRBD) subjects, four had reduced occipital cortical cholinergic innervation and two of these subjects also had reduced striatal DBTZ uptake, compared to control data. Two patients have developed parkinsonism and another mild cognitive impairment, 2 to 4 years after scanning, and all showed significantly reduced occipital PMP compared to controls ( $0.0212 \pm 0.0010$  vs.  $0.0250 \pm 0.0011$ ,  $t = 4.86$ ,  $p = 0.0028$ ). IRBD patients also had reduced thalamic cholinergic function compared to secondary RBD ( $0.0674 \pm 0.0107$  vs.  $0.0776 \pm 0.0037$ ,  $p = 0.0193$ ).

**Conclusion:** Decline in DBTZ and PMP in cortical and subcortical structures of patients with iRBD likely reflects dopaminergic and cholinergic dysfunction during the premotor stages of neurodegenerative disease. Previous studies have shown reduced cholinergic innervation in PD patients with RBD compared to those without. To our knowledge, this is the first time in vivo cholinergic dysfunction has been shown in iRBD. Disrupted occipital cholinergic function may predict patients at greater risk of progressing to a synucleinopathy. Monitoring cholinergic dysfunction in an iRBD population may provide further insight into the pathophysiology of RBD and subsequent neurodegeneration.

**Acknowledgements:** CIHR, TRIUMF.

<http://dx.doi.org/10.1016/j.sleep.2013.11.009>

### Excessive daytime sleepiness in early Parkinson's disease: a 5 year follow-up

L. Tholfsen<sup>a</sup>, J. Larsen<sup>a</sup>, O. Tysnes<sup>b</sup>, M. Gjerstad<sup>a</sup>

<sup>a</sup>The Norwegian Centre for Movement Disorders, Stavanger University Hospital, Norway

<sup>b</sup>Department of Neurology, Haukeland University Hospital, Norway

**Introduction:** Excessive daytime sleepiness (EDS) is reported as a possible risk factor for the development of PD and is a frequent non-motor symptom diagnosed in advanced Parkinson's disease (PD). The prevalence and significance of EDS in early PD remains uncertain. This study assesses the prevalence and clinical correlates of EDS in an incident cohort of drug-naïve patients with PD and after one and 5 years of treatment.

**Materials and methods:** 200 drug-naïve patients with early PD derived from a population-based incident cohort and 173 controls subjects were assessed for excessive daytime sleepiness (EDS) before initiated dopaminergic treatment, and re-evaluated after one and 5 years on treatment. Participants were diagnosed with EDS if the Epworth Sleepiness Score was 11 or above.

**Results:** Complete data of 127 patients and 139 control subjects were available at all three time points. The prevalence of EDS was higher in patients at all times ( $p < .005$ ) and increased from 17 (13.4%) to 32 (25.2%) in patients with PD from baseline to 5 year follow up and from 7 (5%) to 12 (8.6%) in control subjects. EDS was more often persistent in patients with PD ( $p < .05$ ). There were no major differences in motor or cognitive function or the type of dopaminergic treatment given in patients with or without EDS at baseline and after 1 year of treatment, where as patients with EDS had more severe motor impairment after 5 years ( $p < .05$ ).

**Conclusion:** EDS in patients with early PD is common and increases as the disease develops. More severe motor impairment is found in patients with EDS compared to those without after 5 years with dopaminergic treatment indicating an advanced disease progression in these patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.010>

### From normal elderly through mild cognitive impairment (MCI) to Alzheimer's disease. A progression based on sleep polysomnographic findings

N. Economou<sup>a</sup>, S. Papageorgiou<sup>b</sup>, A. Boanakis<sup>b</sup>, M. Maestri<sup>c</sup>, G. Tognoni<sup>c</sup>, E. Bonanni<sup>c</sup>

<sup>a</sup>Sleep Study Unit, Eginition Hospital, University of Athens Medical School, Greece

<sup>b</sup>Department of Neurology, ATTIKON University General Hospital, University of Athens Medical School, Greece

<sup>c</sup>Department of Neurosciences, University of Pisa, Italy

**Introduction:** MCI is the transitional stage between normal aging and dementia and it is either amnesic (aMCI) or non-amnesic (naMCI). aMCI presents only memory impairment; its clinical evolution, when present, is Alzheimer's disease – AD. Sleep in AD has been already assessed and it seems that sleep and cognitive deterioration are linearly correlated. Sleep in MCI has not been systematically assessed. This study aims to determine whether sleep patterns of MCI differ respect to those of AD and healthy elderly. Then, to verify possible correlations between neuropsychological tests and PSG parameters and eventually to provide further evidence on the linear link theory between sleep and cognitive impairment.

**Materials and methods:** 30 aMCI patients (19 M/11 F, m.a.  $72.9 \pm 6.6$  ys) vs. 18 mild-moderate-AD patients (9 M/9 F, m.a.

70 ± 10.6) vs. 24 healthy elderly-HE (14 M/10 F, m.a. 72.7 ± 12.7) are compared. Statistical analysis comprised independent-sample *t*-tests to compare mean values, parametric/non-parametric tests for the correlation in between the variables, 1-way ANOVA test for the comparison of the variables and *post hoc* analysis (Bonferroni correction) was done on the multiple comparisons (*p* was <.05).

**Results:** Several parameters were shown to be significant different mostly in AD vs. HE (less in AD vs. MCI and in MCI vs. HE). Hence, N1% was more prominent in AD compared to both MCI and HE (*p* = .000, ANOVA between groups *p* = .000). N2% was significantly lower in AD vs. HE (*p* = .001); a strong trend was between MCI and HE (*p* = 0.085, Anova between groups *p* = .001). Significance was in NREM/REM cycles between HE and MCI patients (*p* = 0.005), and a strong trend between AD and HE (*p* = .067) (ANOVA between groups *p* = .006). Number of awakenings and Apnea Hypopnea Index were found to be more pronounced in AD vs. HE (*p* = .09, ANOVA between groups *p* = .067) and *p* = .005, ANOVA between groups *p* = .007 respectively). Total Sleep Time correlated positively with the Mini-Mental score – MMSE, while N1% correlated negatively with the MMSE and positively with the Clinical Dementia Rating – CDR. Arousal Index correlated positively with CDR, while number of awakenings correlated positively with the Geriatric Depression Scale – GDS. Finally, N3% correlated negatively with CDR and with the Neuropsychiatric Inventory – NPI.

**Conclusion:** In line with recent clinical/epidemiological non-PSG evidence, we observed that accordingly to cognitive decline (from HE through MCI to mild-moderate AD) sleep appears to be linearly impaired.

<http://dx.doi.org/10.1016/j.sleep.2013.11.011>

### Functional brain networks in REM sleep behavior disorder

Y. Ju<sup>a</sup>, T. Nolan<sup>b</sup>, S. Duntley<sup>a</sup>, L. Larson-Prior<sup>b</sup>

<sup>a</sup>Washington University School of Medicine, Department of Neurology, United States

<sup>b</sup>Washington University School of Medicine, Department of Radiology, United States

**Introduction:** REM sleep behavior disorder (RBD) has a strong association with synucleinopathies. Prior studies of psychometrics have demonstrated subtle abnormalities of task-switching and visuo-spatial tasks in iRBD, similar to deficits in synucleinopathies. In this study, we used resting state functional connectivity MRI to assess the strength of brain networks and regions involved in attention, executive control, visual, auditory, and motor function.

**Materials and methods:** Ten individuals (6 male, 4 female) with polysomnogram-confirmed iRBD were compared to ten age- and sex-matched controls. All underwent brain MRI including two blood-oxygen level dependent (BOLD) sequences acquired resting awake with eyes closed. Following standard pre-processing and regression of noise signals, BOLD time series were extracted from pre-defined regions of interest (ROI). The correlation coefficient between BOLD time series of each pair of ROIs was Fisher-*z* transformed to obtain normally-distributed data, prior to constructing cross-correlation matrices. Correlation coefficients for ROI-pairs were averaged to assess the connectivity strength of each network. Paired *t*-tests were used to compare iRBD cases and controls.

**Results:** There were no significant differences between iRBD cases and controls in the strength of the executive control, attention, or default mode networks. However, there was a significant decrease in connectivity between visual cortex and attention network (iRBD 0.06 vs. Control 0.14, *p* = 0.02). Additionally, the iRBD group had almost no correlation between the visual and primary motor regions,

significantly lower than the robust correlation in controls (iRBD 0.08 vs. Control 0.33, *p* = 0.008).

**Conclusion:** Resting state functional connectivity MRI analysis demonstrates significantly reduced strength of connections between the visual regions and the attention network, and between the visual and motor regions. The strength of canonical cognitive networks—including the default mode, attention, and executive networks—and connectivity of other sensory and motor regions, was not different between iRBD cases and controls. These findings suggest that the decline in visuo-spatial performance in iRBD reflects a specific disconnection of the visual regions from their usual functional networks, rather than a generalized brain dysfunction. This has implications for understanding how and where synucleinopathies affect the brain at the earliest stages of disease.

**Acknowledgement:** American Sleep Medicine Foundation Physician Scientist Training Award.

<http://dx.doi.org/10.1016/j.sleep.2013.11.012>

### Treatment of REM behaviour disorder – An evidence based review

P. Devnani

Jaslok Hospital and Research Center, India

**Introduction:** REM sleep behavior disorder (RBD) is characterized by dream enactment behavior resulting from a loss of REM skeletal muscle atonia. The neurobiology of REM sleep and characteristic features of REM atonia have an important basis for understanding the aggravating etiologies and the proposed pharmacological interventions in its management and their effect on PSG phenomena.

**Materials and methods:** Pubmed database were reviewed up to May 2013 in peer reviewed scientific literature regarding the pathophysiology and management of RBD in adults. The key words for the searches were the following: (RBD OR REM Sleep behavior disorder) and treatment, behavioural modification, medication, drug therapy including key pharmacological names. As well as associations with neurological disorders such as Parkinson's, synucleinopathies, narcolepsy, Multisystem atrophy. Non motor manifestations such as cognition, autonomic, cardiac, sleep apnea were also investigated. The search was limited to articles published in English. In reviewing the literature in management of RBD evidence was graded according to the Oxford Centre of Evidence-Based Medicine Levels. Grade 1: High quality randomized clinical trials, Grade 2: Low quality randomized clinical trials or high quality cohort studies, Grade 3: Case-control studies and Grade 4: Case Series/case reports The level of recommendation were as follows: Level A – Recommended-Evidence level 1. Level B – Suggested-Evidence level 1–4 fewer studies or expert consensus. Level C – Considered-Evidence level 3–4.

**Results:** Neurobiology of REM Sleep: Cholinergic systems activate reticular formation neurons in a positive feedback interaction to produce the onset of REM. REM is terminated by the inhibitory activity of REM off aminergic neurons which become active at the end of a REM period due to the recruitment by REM on activity. Cessation of discharge of aminergic neurons during NREM–REM sleep transitions lead to disinhibition of LDT/PPR neurons<sup>1</sup> The Polysomnographic EEG characteristics of REM sleep observed are a manifestation of the ascending cholinergic activation that promotes EEG desynchrony. The descending cholinergic projections produced muscle atonia via activation of neurons in the pontine reticular formation (PRF) and ventral medial medulla that, in turn, project to spinal cord<sup>1</sup>. Glycine is the prominent inhibitory neurotransmitter that inhibits the spinal motor neuron and thus produces the muscle atonia that is characteristic of REM sleep. RBD and Falls: Patients

with RBD are at risk for sleep-related injury (SRI), injuring themselves or their spouses with aggressive behaviors during sleep, often during attempted dream enactment. Studies show about 33% and 65% of RBD patients have been reported to have had sleep related injury to self or bed partner. 30% to 81% was the reported sleep clinic prevalence of SRI in diagnosed RBD patients 6–9. In a series of 92 patients, 64% of the bed partners (53/83) sustained punches, kicks, attempted strangulation, and assault with objects 6. In comparison, a community sample of 1034 elderly surveyed in Hong Kong, 0.8% reported SRI 10. Falls prevention: Role of behavioral intervention. Despite apparent unconsciousness, the brain is readily responsive to the environment during REM sleep. Complex auditory sound processing, similar to wakefulness, occurs during REM sleep, and there is a lower threshold for reversibility to wakefulness with auditory stimuli compared to NREM 11. Further, it has been demonstrated that dream mentation can be altered by verbal stimulation. Anecdotal expert consensus exists on intervention measures to prevent falls in RBD including placing a mattress on the floor, padding corners of furniture, window protection, and removing potentially dangerous objects from the bedroom. A customized bed alarm pacifying patients with a calming phrase prevented falls in 4 medically refractory RBD patients during vigorous Dream Enactment Behaviour. Pre-treatment: 5 serious events, 80 minor events, and 193 near events were noted over 66 patient-months (4.21 events/pt-mo). Post-treatment improvement was noted after a follow up period of 63 pt-months with a marked reduction in events (0.05 event/pt-mo) 12. Falls prevention: Role of pharmacological intervention. 62/71 subjects in a case series from Hong Kong, the rate of SRI after treatment with clonazepam fell from 80.8% pre-treatment to 5.6% post-treatment 9. In a survey based study ( $N = 45$ ) 25 patients received melatonin, 18 were administered clonazepam, and two received both as initial treatment. Before treatment, 27 patients (60%) reported an RBD associated injury. Median dosages were 6 mg for melatonin and 0.5 mg for clonazepam. RBD visual analog scale (VAS) ratings were significantly improved following both treatments. Melatonin-treated patients reported less frequent adverse effects than those treated with clonazepam 13. Falls Prevention Safety: Level of Evidence A Pharmacotherapy of Rem Behaviour Disorder Clonazepam Meta-analysis of 22 studies includes 16 case series 6, 8, 10, 14–26, 6 case reports 27–32 and 1 community 10 sample with a total of 339 subjects, of whom 306 were noted to have complete (249) or partial (57) treatment response to clonazepam. The clinical efficacy noted was 80% at Minnesota Regional Sleep Disorders Center 33. The dosage ranged 0.25–4.0 mg administered 30 min prior to bedtime 34. Women tended to require higher dosage than men 35. Sustained clonazepam efficacy in 89.5% of 57 treated patients. No dose escalation was reported noted 8. Clonazepam also decreased the occurrence of sleep-related injury caused by RBD. Clonazepam: video-polysomnographic study PSG variables on patients that were drug-free RBD patients and on clonazepam treatment  $N = 57$  patients with 42 untreated iRBD patients, 15 iRBD patients on clonazepam (0.5–1 mg) at bedtime. iRBD + Clo patients showed a lower rate of stage shifts, improved sleep efficiency, lower percentage of wakefulness after sleep onset observed. The CGI scale improved after treatment. No evident common trend was observed for RBDSS or Atonia Index. Side effects of clonazepam included: sedation, impotence, morning motor incoordination, confusion, memory dysfunction, no reported instance of drug abuse, risk of confusion or falls. Pharmacological intervention with Clonazepam: Level of evidence B Melatonin: The mechanism of melatonin is unclear, it is suggested that it restores RBD-related desynchronization of the circadian rhythms. 1 case report 36, 2 open-label prospective case series 37–38, 2 retrospective case series 39 ( $N = 38$ ). Dose: 336–1239 mg at bedtime. PSG showed statistically significant decrease in number of R epochs without atonia 37, 38 and in movement time in R37. Successfully treated patients included those with synucleinopathies including

DLB, PD and MSA memory problems and sleep-disordered breathing 37, 39. Side effects include: morning headache, sleepiness, delusions/hallucinations. Pharmacological intervention with Melatonin: Level of evidence B Pramipexole: Pramipexole has been studied in the management of RBD in 3 case series, 2 retrospective cohorts with PSG variables including 113, 40, 41, 42, 43, 44 subjects with and without synucleinopathies. In a study of 8 patients with idiopathic REM sleep behavior disorder. 5 patients reported a sustained reduction in the frequency or intensity of sleep motor behaviors, which was confirmed by video recording, although no change was observed for the percentage of phasic EMG activity during REM sleep 40. In another study, 10 consecutive patients, 89% of patients experienced either a moderate reduction or complete resolution in the frequency of RBD symptoms throughout the duration of the study. Moreover, 67% reported at least a moderate reduction in the severity of remaining symptoms 41. In another study, 11 subjects with untreated RBD on levodopa monotherapy improved Parkinsonism but did not modify RBD related symptoms and objective video-polysomnographic abnormalities 42. In 98 patients with RBD (Pramipexole or Clonazepam), Pramipexole was efficacious in 61.7% (50/81). The ratio of RWA/REM was associated with Pramipexole effectiveness. The cut-off rate of RWA/REM for predicting Pramipexole effectiveness was estimated as 16.8%. Pramipexole + CNZP (higher RWA/REM and frequency of vocalization). Concluding that Pramipexole may play a role for mild iRBD cases with a lower rate of RWA 43. 14 patients with RBD (80.0%) achieved symptomatic improvement of RBD with pramipexole treatment, which reduced REM density and PLM index during non-REM sleep despite the unchanged amount of RWA. The rate of change in RBD symptoms correlated positively with the rate of REM density reduction. Significant reduction of the PLM index was observed in non-REM sleep but not in REM sleep. Pramipexole can improve RBD symptoms, possibly because of changes in dream contents or its amount manifested as the reduction of REM density 44. Pharmacological intervention with Pramipexole: Level of evidence C L-DOPA Limited and Conflicting level 4. Data PSG showed a statistically significant increase in tonic and phasic chin EMG activity in the group as a whole. The data overall suggest a limited role for L-DOPA in the treatment of RBD at this time 5. Acetylcholinesterase inhibitors RBD may be due to a disruption in R related cholinergic systems 45 associated with sleep disruption, vivid dreams and sleep-related disruptive behaviors 46, 47. Reviewed 2 papers, 6 cases, 4 were associated with neurodegenerative disorders. Result: 4 patients responded at doses between 10 and 15 mg 46, 48 and 2 patients failed to respond to donepezil. Pharmacological intervention with acetylcholinesterase inhibitors: Level of evidence C Rivastigmine A Double-blind, crossover pilot trial was conducted on 12 patients with Parkinson's disease. Dose of 4.6 mg/24 h for 3 weeks was administered. Side effects: peripheral cholinergic action 49. Other medications The following medications were considered for treatment of RBD with limited evidence: zopiclone, benzodiazepines other than clonazepam, Yi-Gan San, desipramine, clozapine, carbamazepine, and sodium oxybate 5. Pharmacological intervention with other medications: Level of evidence C/D. REM-related cardiorespiratory activation is altered in subjects with RBD. Normally observed NREM-to-REM-sleep cardiac excitatory response and parasympathetic withdrawal are absent in patients with idiopathic RBD and symptoms of clinical dysautonomia were more frequent in subjects with idiopathic RBD, as compared with age-matched controls. Reduced cardiac uptake of 123I-MIBG (a noradrenaline analog) in subjects with idiopathic RBD was observed 50. Relationship of RBD, OSA and medication. RBD might protect against obstructive sleep apnea. Loss of atonia in skeletal muscle in RBD patients could lead to lower severity of OSA with shorter apneas and hypopneas. Serotonergic enhancers such as paroxetine, mirtazapine and glycinergic antagonists could alleviate the severity of OSA via increasing EMG activity Cognitive function in REM sleep behavior disorder

Significant worsening in visuo-spatial learning over time in RBD compared to controls ( $p = 0.0001$ ). Cognitive decline may coincide or precede the onset of RBD. Cognitive decline occurred in 94% of a sample of patients with RBD. The risk for dementia is limited to those who develop abnormal neurological findings or includes all patients presenting with cryptogenic RBD. Role of intervention in this regard is unclear 51. Modulation of EEG with Long-term use of clonazepam With 46 participants: 15 with iRBD, 13 with narcolepsy/RBD 18 normal controls. RBD severity scale (RBDSS) was obtained. Atonia index was computed. NREM sleep instability was evaluated using an automatic quantitative analysis. Patients with iRBD were re-evaluated after  $2.75 \pm 1.62$  years. Clonazepam modifies NREM sleep in iRBD participants with a decrease in its instability. Wakefulness after sleep onset was decreased together with an increase in both slow-wave sleep (SWS) and sleep stage 2, chin tone was not modified by clonazepam. REM atonia index reduced in iRBD and reduced in Narcolepsy/RBD 52. Medications aggravating RBD A recent study ( $N = 48$ ) 53 showed an increased risk ratio of being on antidepressants for patients with early-onset RBD effect of SSRI medications on motor tone in R54 demonstrated that SSRI medications can induce RSWA.  $\alpha$ -Blockers have also been noted to cause RBD 55. RBD may be seen in association with R rebound states such as alcohol and barbiturate withdrawal 56.

**Conclusion:** Rapid eye movement sleep behavior is characterized by dysfunction of systems that produce the normal REM atonia of sleep. RBD allows a unprecedented opportunity for early and preclinical symptomatic evaluation of patients as a majority may transition into clinically neurodegenerative disease. This review outlines the evidence for behavioural and pharmaco-therapeutic measures along with evidence based guidelines for their implementation, while highlighting the non-motor, autonomic and cognitive impact of this entity. RBD provides a unique platform with its high risk of disease conversion and long latency for early intervention both to prevent disabling consequences such as falls and provide a bases for intervention with pharmacological and neuroprotective measures.

**Acknowledgements:** Racheal Fernandes, BSc and Dr. Claudia Trenkwalder for her encouragement.

<http://dx.doi.org/10.1016/j.sleep.2013.11.013>

### Hypodopaminergic mice have a sleep phenotype that resembles human Parkinson's disease

E. Soleimannejad<sup>1</sup>, C. Burgess<sup>1</sup>, A. Salahpour<sup>2</sup>, J. Peever<sup>2</sup>

<sup>1</sup>Department of Cell and Systems Biology, University of Toronto

<sup>2</sup>Department of Pharmacology and Toxicology, University of Toronto

**Introduction:** Patients with Parkinson's Disease (PD) have markedly disturbed sleep. For example, they have difficulty falling and staying asleep, and they commonly experience motor disturbances during both NREM and REM sleep (e.g., RBD). PD patients also suffer from excessive daytime sleepiness and in some cases experience sleep attacks. Although multiple animal models have been used to understand how abnormal dopamine transmission contributes to the cognitive and motor abnormalities in PD, none of them have determined if sleep is impacted in these models. Our current goal was to determine if an established mouse model of PD exhibits a sleep phenotype that resembles PD in human patients. The present study was designed to determine if hypodopaminergic (i.e., reduced brain levels of dopamine) mice have abnormal sleep and waking activity patterns that recapitulate sleep-wake activity in human PD patients.

**Materials and methods:** We used both wild-type mice (WT,  $n = 4$ ) and transgenic mice overexpressing the dopamine transporter

(DAT-tg,  $n = 4$ ). DAT-tg mice experience a 40% reduction in striatal dopamine levels and are an established model of PD. For example, they have significantly reduced brain levels of dopamine similar to that in human PD. DAT-Tg and WT mice were implanted with standard EEG and EMG electrodes for recording wakefulness, NREM and REM sleep. To determine if DAT-tg experience sleep-wake disturbs EEG and EMG activity was recorded for 24 h. Both WT and DAT-tg were habituated to recording instrumentation for 1 day before experimental testing began.

**results:** DAT-tg mice exhibit a PD phenotype. They suffer from sleepiness, disturbed sleep patterns and most notably experience sleep attacks. Compared to WT, which never experienced sleep attacks, we found that DAT-tg mice rapidly transitioned directly from active (not quiet) wakefulness into full-blown NREM sleep. Sleep attacks could result from their persistent sleepiness. DAT-tg mice experienced a 110% increase overall levels of NREM sleep compared to WT mice. REM sleep amounts were similar in both groups of mice. DAT-tg mice also suffered from sleep fragmentation. Compared to WT mice, they experienced a 184% increase in the total number of NREM sleep episodes.

**Conclusion:** As hypothesized, DAT-tg mice exhibit a PD phenotype. They suffer from persistent sleepiness, have disturbed sleep patterns and experience sleep attacks. These mice are therefore a suitable model for dissecting the mechanisms associated with sleep disturbs in human PD.

**Acknowledgements:** The present work was supported by CIHR grant.

<http://dx.doi.org/10.1016/j.sleep.2013.11.014>

### Characterization of sleep disorders on patients with parkinson's disease in Chile

M. Elso Tinoco<sup>1</sup>, F. Zenteno Araos<sup>2</sup>, D. Zenteno Araos<sup>2</sup>, R. Avello<sup>1</sup>, V. Mery Canales<sup>3</sup>

<sup>1</sup>Servicio de Neurología, Hospital Guillermo Grant Benavente, Universidad de Concepcion, Concepcion, Chile

<sup>2</sup>Facultad de Medicina, Universidad de Concepcion, Chile

<sup>3</sup>Facultad de medicina Universidad del Desarrollo, Clinica Alemana, Chile

**Introduction:** Patients with Parkinson's Disease (PD) experience many non-motor symptoms (NMS) which have a negative impact in quality of life (QoL). Sleep disorders (SDis) are among them, including insomnia; excessive daytime sleepiness (EDS); obstructive sleep apnea (OSA); Restless Leg syndrome (RLS); and REM Sleep Behaviour disorder (TCR). Our aim was to characterize the distribution of SDis in a Chilean group of patients with PD.

**Materials and methods:** Ambulatory patients with primary PD recruited consecutively from a movement disorder clinic at a tertiary hospital in Concepcion, Chile were screened for SDis using a Spanish translated version of the Mayo-Clinic Questionnaire informant and Epworth Sleepiness Scale (ESS). Sleep quality was assessed using the Parkinson's Disease Sleep questionnaire (PDSS). All subjects underwent a clinical evaluation by a sleep specialist. PD severity was assessed using the Movement Disorder Society Unified Parkinson's Disease Rating Scale (MDS-UPDRS).

**Results:** We studied 90 PD patients (43.4% male), of mean age 66.4, standard deviation (SD) 12.0, motor MDS-UPDRS 28.0, SD 12.9, time from diagnosis 6.5, SD 6.2 years. Mean PDSS was 102.2, SD 26.8. Eighty patients had a SDis based on published questionnaire cutoff values and confirmed after clinical evaluation. 55 (61.1%) subjects presented insomnia, 51 (56.6%) reported snoring, 36 (40%) had RLS, 34 (37.7%) had TCR, 24 (26.6%) had EDS, and 19 (21.1%) reported

witnessed apneas. PDSS score was significantly lower among PD patients with insomnia compared with no insomnia patients (PDSS 95.7, SD 24.2 vs 112.4, SD 28.1;  $p = 0.003$ ), and significantly lower among PD patients with TCR vs no TCR (PDSS 93.4, SD 27.3, vs 107.5, SD 25.5;  $p = 0.001$ ). There was no difference in terms of age, motor MDS-UPDRS or time from PD diagnosis for these groups. We did not find significant differences for PDSS among patients with RLS, EDS or snoring.

**Conclusion:** Sleep disorders are varied and frequent among patients with PD. PDSS reflected insomnia and TCR impaired QoL, but not snoring, EDS or RLS impact on QoL. PDSS could be used as a screening tool for insomnia and TCR. Clinical assessment by a sleep specialist is strongly recommended in patients with PD given the high proportion of subjects with sleep complain.

**Acknowledgements:** To all the health professionals that works in the Servicio de Neurologia, Hopistal Guillermo Grant Benavente, that helps in the attention and care for the patients with parkinson disease.

<http://dx.doi.org/10.1016/j.sleep.2013.11.015>

### Factors associated with treatment responses in patients with REM sleep behavior disorder

S. Li, S. Lam, J. Zhang, M. Yu, Y. Wing

Department of Psychiatry, Faculty of Medicine, The Chinese University of Hong Kong, China

**Introduction:** We aimed to examine the changes in dream- and behavioral-related features of RBD after treatment and factors associated with treatment response in RBD patients.

**Materials and methods:** Consecutive patients with polysomnographic-confirmed RBD were recruited from a university hospital-based sleep assessment unit. All the patients underwent clinical examinations and completed a self-administered questionnaire (modified RBDQ-HK) before (baseline) and after (follow-up) pharmacological treatment. A comprehensive battery of tests was conducted at baseline in idiopathic RBD patients to examine neurocognitive performance, motor function, color vision and olfaction.

**Results:** Forty-eight RBD patients [Male: 75.0%, Age at diagnosis: 68.4 (7.8) years, idiopathic RBD: 87.5%] were recruited and reassessed with a follow-up duration of 27.8 (13.9) months. Clonazepam and melatonin were prescribed after baseline assessments in 95.8% and 4.2% of the overall study subjects, respectively. Treatment response as defined by either 50% or more reduction in baseline RBDQ total score or complete elimination of SRI in the past 3 months was found in 26.2% and 66.7% of the patients with idiopathic RBD, respectively. Treatment response was not associated with gender, age at diagnosis, presence of a diagnosed psychiatric disorder, PSG parameters and severity of clinical RBD symptoms at baseline. While frequent episodes of violent and distressing dreams as well as more vigorous motor or verbal activities were reduced after treatment, reports of frequent dreams and sleep talking were comparable. As compared to those with residual SRI, patients who no longer reported any SRI at follow-up had an older age onset of RBD [59.4 (6.8) vs. 65.2 (7.9) years,  $p < .05$ ], scored significantly lower on MMSE at baseline [29.3 (.97) vs. 27.6 (2.4),  $p < .05$ ], and had a worse performance on baseline motor function test [speed in seconds: 81.6 (8.6) vs. 107.1 (34.0),  $p < .05$ ].

**Conclusion:** Although pharmacological treatment of RBD was found to reduce prominent RBD features, such as vigorous verbal or motor activities, residual symptoms were commonly reported in RBD patients. There is a need of searching more effective alternative treatment of RBD and further RCT study to evaluate the impact of

additional behavioral strategies in clinical management of RBD (e.g. environmental manipulation). Neurocognitive factors associated with treatment response in RBD may warrant further investigation.

**Acknowledgements:** This study was part of the project funded by Health and Health Services Research Fund (HHSRF) Grant (reference number 07080011) from the Food and Health Bureau of Hong Kong SAR, China. All the authors report no conflicts of interest. The funding body has no role in the conception, design, conduction, interpretation and analysis of the study or in the approval of the publication.

<http://dx.doi.org/10.1016/j.sleep.2013.11.016>

### Sleep complaints and cardio-cerebrovascular diseases in the elderly: a 6-year prospective study

I. Jaussent<sup>1</sup>, J. Empana<sup>2</sup>, M. Ancelin<sup>1</sup>, K. Ritchie<sup>1</sup>, J. Bouyer<sup>3</sup>, Y. Dauvilliers<sup>4</sup>

<sup>1</sup>Inserm, U1061, France

<sup>2</sup>Inserm, U970, France

<sup>3</sup>Inserm, U1018, France

<sup>4</sup>CHU, Service de Neurologie, Unité des Troubles du Sommeil, France

**Introduction:** While sleep disturbances may contribute to the development of cardio-cerebrovascular diseases (CVD), few studies have examined the association of sleep complaints (insomnia complaints and excessive daytime sleepiness (EDS)) with history of CVD and incident CVD in persons over 65.

**Materials and methods:** CVD was assessed at baseline and at the two, four, and six-year follow-ups in 5494 non-demented subjects. Self-reported insomnia complaints (poor sleep quality, difficulty in initiating sleep, difficulty in maintaining sleep, and early morning awakening), EDS and sleep medication use were evaluated at baseline. Logistic regression models and Cox proportional hazard models, with delayed entry and age of participants as the time scale, were adjusted for socio-demographic, lifestyle and clinical variables.

**Results:** At baseline, 748 participants had a past-history of CVD which was associated with EDS (OR = 1.28 95% CI = [1.05–1.57]) and the number of insomnia complaints (OR = 1.26 95% CI = [1.03–1.55] for 1–2 insomnia complaints; OR = 1.32 95% CI = [1.03–1.71] for >2 complaints). In longitudinal analyses, neither the four components of insomnia nor the number of insomnia complaints were significantly associated with first or recurrent CVD events ( $n = 391$  events). EDS was independently associated with future CVD events even after adjusting for prescribed sleep medication and past-history of CVD (HR = 1.35 95% CI = [1.06–1.71]).

**Conclusion:** Our results suggest a complex relationship between sleep complaints and CVD. Insomnia complaints are more likely to be a consequence of CVD, whereas EDS appears to be a determinant of CVD independently of past-history of CVD. EDS screening may thus constitute a means of detecting persons at high risk of CVD.

**Acknowledgements:** The 3C Study is conducted under a partnership agreement between Inserm, the Bordeaux II University and Sanofi-Synthelabo and was supported by the FRM, the CNMTS, DGS, MGEN, Institut de la Longevité, AFSSPS, the Regional Governments of Aquitaine, Bourgogne and Languedoc-Roussillon and, the Fondation de France, the Ministry of Research-Inserm Programme Cohorts and collection of biological material). The Lille received a grant from Eisai. Part of this project is financed by two grants from the ANR

<http://dx.doi.org/10.1016/j.sleep.2013.11.017>

## Two hours of evening light produces significant circadian phase delay shifts in older adults

J. Duffy<sup>1</sup>, K. Scheuermaier<sup>2</sup>, M. Münch<sup>3</sup>, J. Ronda<sup>1</sup>

<sup>1</sup>Brigham & Women's Hospital, Harvard Medical School, Department of Medicine, Division of Sleep Medicine, USA

<sup>2</sup>University of the Witwatersrand, Wits Sleep Laboratory, Brain Function Research Group, School of Physiology, Faculty of Health Sciences, USA

<sup>3</sup>Ecole Polytechnique Fédérale de Lausanne, Solar Energy and Building Physics Laboratory, School of Architecture, Civil and Environmental Engineering, USA

**Introduction:** Older adults have earlier sleep timing and altered timing of their circadian rhythms relative to their sleep timing compared with young adults. These differences are hypothesized to contribute to age-related sleep disruption, and therefore treatments that modify the timing of circadian rhythms have been proposed. Because light is the most powerful environmental signal that impacts the circadian system, we tested whether a short moderate intensity light exposure in the evening could alter the timing of circadian rhythms, thereby improving sleep quality.

**Materials and methods:** Ten healthy participants (6 women; mean age 63.3) who complained of early and/or frequent awakenings were studied in a 12-night study. They maintained an 8-h sleep episode at their preferred times for two weeks before the study, and those times were used to schedule their 8-h study sleep episodes. After 3 baseline days, circadian phase was assessed on days 4–5 using the dim light melatonin onset (DLMO). On the next 4 days, participants received a 2-h evening light exposure. The light exposure began 3 h before bedtime, and was delivered using a fixture on a desk in front of the seated participant. Half of the participants received standard polychromatic white light (4100 K) and half received blue-enriched polychromatic white light, with the same target photon density. Circadian phase was reassessed on days 9–10. On all but the circadian phase assessment days, the participants were allowed to go outside in the middle of each day. Sleep was recorded each night and waking EEG was recorded throughout each light exposure.

**Results:** The two light groups were not significantly different in sex composition, age, sleep times, or baseline DLMO times. During the light exposures, both groups showed similar increases in subjective and objective alertness. Following the 4 light exposures, both groups showed significant phase delays in DLMO timing and latency to REM sleep, and a significant shortening in the interval between DLMO and bedtime. However, there was no significant change in sleep efficiency or the duration of any sleep stage between baseline nights and the nights following the light exposures.

**Conclusion:** In this semi-ambulatory study, we found that 2 h evening light exposures of moderate intensity on four consecutive evenings could produce significant increases in evening alertness and significant phase delay shifts in circadian rhythm timing, but the light treatment was ineffective at changing nighttime sleep quality.

**Acknowledgements:** We thank SP Dunne, AM Guzik, J Row, EJ Silva, R Zhang, and the DSM Chronobiology Core for help collecting and analyzing the data. The study was funded by US NIH grant R01 AG06072, and was conducted in the Brigham & Women's Hospital General Clinical Research Center, supported by NIH grant M01 RR02635; MM was supported by fellowships from the La-Roche and Novartis Foundations (Switzerland) and Jazz Pharmaceuticals (USA); KS was supported by NIH fellowships T32 HL07901 and F32 AG031690. The polychromatic white and blue enriched lamps were provided by Philips Lighting B.V. for use in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.018>

## Age-related changes in sleep pattern and sleep structure and the association to cognitive performance: the metropolit 1953 danish male birth cohort

L. Waller<sup>1</sup>, P. Jennum<sup>2</sup>

<sup>1</sup>Danish Center for Sleep Medicine, Department of Clinical Neurophysiology Glostrup Hospital, Copenhagen, Denmark

<sup>2</sup>Danish Centre for Sleep Medicine, Department of Clinical Neurophysiology, Denmark

**Introduction:** Advancing age is accompanied by well-described changes in sleep pattern and increased prevalence of both sleep disturbances and cognitive impairment. Previous longitudinal studies exploring sleep and cognitive changes are scarce. Since disrupted sleep is linked to cognitive dysfunction, it remains an open question whether impaired sleep may be considered as an early sign of cognitive deterioration. The aim of this study was to examine whether objective sleep measurements are associated with subtle cognitive changes and cognitive performance.

**Materials and methods:** Overnight polysomnographic recordings were collected from 189 middle-aged males, recruited from the Project Metropolit 1953, as a part of a larger community-based prospective cohort study investigating predictors of minimal cognitive impairment. Based on earlier cognitive assessments, subjects entered the study as cognitively unimpaired ( $N = 97$ ) or cognitively impaired ( $N = 92$ ). A neuropsychological tests battery, including six paper-pencil tests, and Cambridge Neuropsychological Test Automated Battery (CANTAB) was applied.

**Results:** Cognitively impaired males showed lower sleep efficiency ( $78.54 \pm 12.82$  vs.  $83.14 \pm 10.56$   $p = 0,02$ ) and increased nocturnal wakefulness ( $17.23 \pm 6.97$  vs.  $12.76 \pm 9.25$ ,  $p = 0,02$ ) compared to cognitively unimpaired males. However, none of these measures showed significant group differences after Bonferroni correction. No correlation between sleep measures and cognitive scores was found.

**Conclusion:** These studies suggest that subtle cognitive changes seems to have, if any, relatively little influence on sleep per se. Future research is needed to study the heterogeneity of cognitive aging and potential predictors of cognitive decline.

**Acknowledgements:** Danish Centre for Sleep Medicine.

<http://dx.doi.org/10.1016/j.sleep.2013.11.019>

## Mean stress ratings across 6 weeks are related to increased levels of Stage 1 and waso during 4 (home) recorded sleep periods

T. Akerstedt<sup>1</sup>, G. Kecklund<sup>1</sup>, J. Axelsson<sup>2</sup>

<sup>1</sup>Stockholm University, Sweden

<sup>2</sup>Karolinska Institutet, Sweden

**Introduction:** Despite the common notion that stress impairs sleep there is little published data showing on home sleep polysomnography (PSG) in relation to naturally occurring stress. The purpose of the present study was to relate mean PSG across 4 home recordings to the average levels of daily stress ratings during the same weeks. No similar data are available.

**Materials and methods:** 33 normal subjects had 4 sleeps recorded with PSG at home across 6 weeks and kept a sleep/wake diary each day, including 3-hourly ratings of stress (scale 1–9). The stress ratings and the conventional PSG parameters were averaged across time. A stepwise multiple regression analysis was used to analyze the data.

**Results:** The results showed that the best predictors of stress were Stage 1 sleep ( $\beta = -.49$ ), latency to Stage 1 sleep (.47) (adjusted for anxiety and age). Other sleep continuity variables (WASO) had

significant correlations with stress but did not enter the stepwise multiple regression analysis. The correlation between stress before the start of the study and PSG data was not significant, but the correlation to the mean stress ratings during the 6 weeks was significant ( $r = .50$ ).

**Conclusion:** It was concluded that moderately increased stress over a longer period of time is related to moderate signs of disturbed sleep during that period but that habitual stress ratings are not.

**Acknowledgements:** This study was supported by the Swedish Science Council and Stockholm Stress Center.

<http://dx.doi.org/10.1016/j.sleep.2013.11.020>

### Sleep quality and arterial stiffness in middle-aged and older women

Y. Choi, N. Akazawa, A. Miyaki, S. Ra, T. Matsubara, S. Maeda  
University of Tsukuba, Japan

**Introduction:** Arterial stiffness is an independent risk factor of cardiovascular disease. Self-reported sleep duration is associated with arterial stiffness. However, there is no study on association between sleep quality and arterial stiffness. We examined whether sleep quality affects arterial stiffness in middle-aged and older women.

**Materials and methods:** Thirty-one sedentary middle-aged and older women (age 50–74 years) divided into good ( $n = 21$ , mean age 60.1 years) and poor ( $n = 10$ , 61.2 years) sleepers, based on the Pittsburgh Sleep Quality Index (PSQI) score (cut-off point of 5.5). Sleep parameters (total sleep time, sleep latency, wake time after sleep onset, and sleep efficiency) were assessed by in-home waist actigraphy across 1 week. The daily sleep duration was also assessed by self-report. All subjects underwent measurements of central (carotid-femoral) pulse wave velocity (PWV) and peripheral (femoral-ankle) PWV as an index of arterial stiffness.

**Results:** Objective total sleep time estimated by actigraphy did not differ in both groups, whereas subjective sleep duration obtained by reports was significantly longer in poor sleeper than in good sleeper. In poor sleeper, sleep latency and wake time after sleep onset were significantly higher than good sleeper. Also, sleep efficiency was significantly lower in poor sleeper than good sleeper. Central PWV and peripheral PWV were significantly higher in poor sleeper than in good sleeper.

**Conclusion:** Poor sleeper increased sleep latency and wake time after sleep onset, and decreased sleep efficiency. Arterial stiffness increased in poor sleeper. These results suggest that decreased sleep quality increases arterial stiffness in middle-aged and older women.

**Acknowledgements:** This work was supported by Grants-in-Aid for Scientific Research 2503006 from Japan Society for the Promotion of Science.

<http://dx.doi.org/10.1016/j.sleep.2013.11.021>

### To nap or not to nap: evidence on daytime napping and increased 13-year mortality in a British population

Y. Leng<sup>1</sup>, N. Wainwright<sup>1</sup>, F. Cappuccio<sup>2</sup>, P. Surtees<sup>1</sup>, K. Khaw<sup>1</sup>, C. Brayne<sup>1</sup>

<sup>1</sup>University of Cambridge, UK

<sup>2</sup>University of Warwick, UK

**Introduction:** The prevalence of napping increases with age. Epidemiological studies have reported conflicting results on the relation between daytime napping and mortality. Most studies have been

conducted in the Mediterranean area, while the association is under-reported among the British population. In this analysis, we aimed to explore the independent associations between daytime napping and cause-specific mortality among participants in EPIC-Norfolk, a British population based study.

**Materials and methods:** Between 1998 and 2000, 16374 participants (7161 men and 9213 women) aged 40–82 years, answered questions on napping habits (No/Yes, <1 h/Yes, ≥1 h) as well as other factors. They were followed for mortality until Dec 2012.

**Results:** At baseline, the prevalence of day time napping was 29.8%, of whom 90% reported napping for less than 1 h/day. A total of 3251 deaths (1034 from CVD, 1213 from cancer, 286 from respiratory diseases and 718 from all other causes) was observed. The unadjusted HRs (95% CI) of napping for all-cause mortality were 2.19 (2.04–2.36) (napping < 1 h) and 2.67 (2.28–3.13) (≥1 h). After adjustment for age, sex, social class, education and marital status, there was a dose-response association between napping and increased mortality from all causes (HR 1.23 [95% C.I. 1.14–1.33] for napping <1 h and 1.59 [1.35–1.87] for ≥1 h), CVD, cancer, respiratory diseases and all other causes. The associations between napping and CVD or cancer mortality were attenuated after further adjustment for body mass index, physical activity, smoking, alcohol, hypnotic use, depression, time spent in bed at night, self-reported general health and obstructive sleep apnea (OSA). However, a strong association remained between napping and all-cause mortality (HR 1.28 [1.03–1.61] for ≥1 h) and between napping and respiratory mortality (HR 2.33 [1.21–4.10] for ≥1 h) after full adjustment. The association between napping and all-cause mortality remained after exclusion of individuals with pre-existing CVD, cancer, respiratory diseases and OSA, and did not attenuate with increasing length of follow up.

**Conclusion:** Daytime napping is independently associated with increased all-cause mortality and respiratory mortality in a middle aged and older British population. Future studies are needed to confirm our finding and help understand potential mechanisms.

**Acknowledgements:** EPIC-Norfolk study was supported by programme grants from the Medical Research Council UK (G9502233, G0300128) and Cancer Research UK (C865/A2883).

<http://dx.doi.org/10.1016/j.sleep.2013.11.022>

### Survival and adherence to cpap in the elderly

D. López-Padilla, R. Alonso-Moralejo, S. De La Torre Carazo, T. Díaz Cambriles, J. Muñoz Méndez, M. Díaz De Azañón  
Hospital Universitario 12 de Octubre, Sleep Unit, Spain

**Introduction:** The prevalence of Obstructive Sleep Apnea (OSA) increases with age, as well as life expectancy in years has extended in the past decades. Regarding OSA and elderly population, scientific publications tend to consider an elder person the one who is 65 or more years old. Whereas OSA has been related to cardiovascular and recently to cancer mortality, Continuous Positive Airway Pressure (CPAP) treatment has demonstrated reducing it in specific groups of population. The aim of our study was to analyze the survival in patients older than 80 years who adhered to CPAP treatment.

**Materials and methods:** A cohort of patients older than 80 years diagnosed of OSA during the period 2000–2010 at our Sleep Unit was followed. An Apnea Hypopnea Index (AHI) ≥15 was considered diagnostic of OSA and ≥30 of severe OSA. The use of at least 3.5 h/night was considered adherence to CPAP treatment. Log-rank and Kaplan Meier were used for statistical analysis.

**Results:** 122 patients older than 80 years were diagnosed of OSA during the mentioned period, of which 62 were men. With a mean

age of  $85.6 \pm 2.6$  years, an AHI  $48.3 \pm 21.6$ , a total of 53 deaths were documented. Unadjusted all-cause mortality was significantly increased in the group of patients which did not adhere to CPAP (a mean survival of 90 months, CI95% 67–113 in the no-adherence group vs. 127, CI95% 110–144 in the adherence group). This finding persisted when the subgroup with an AHI  $\geq 30$  was analyzed ( $n = 94$ ), where a significant difference was found (76 months, CI95% 44–108 in the no-adherence group vs. 127, CI95% 110–144 in the adherence group).

**Conclusion:** It seems adherence to CPAP is related to an increased survival in patients older than 80 years old diagnosed of OSA, not only in the entire group but also in the subgroup with severe OSA.

**Acknowledgements:** No conflict of interests took place during the follow up of the presented cohort.

<http://dx.doi.org/10.1016/j.sleep.2013.11.023>

### **Asthma predicts 8-year incidence of obstructive sleep apnea in the Wisconsin sleep cohort**

E. Hagen<sup>1</sup>, P. Peppard<sup>1</sup>, J. Barnet<sup>1</sup>, T. Young<sup>1</sup>, L. Finn<sup>1</sup>, M. Teodorescu<sup>2</sup>

<sup>1</sup>University of Wisconsin, Department of Population Health Sciences, Madison, United States

<sup>2</sup>University of Wisconsin, Department of Medicine, Madison, United States

**Introduction:** Cross-sectionally, obstructive sleep apnea (OSA) is more common among asthmatics, but whether asthma promotes development of OSA in adulthood remains unknown. We investigated whether the presence or development of asthma is associated with risk of new-onset OSA in Wisconsin Sleep Cohort Study (WCS) participants.

**Materials and methods:** At four-year intervals, WCS participants (ages 30–60 years in 1988) completed in-laboratory polysomnography, clinical assessments, and health history questionnaires. We used logistic regression to model the association of presence of asthma and odds of incident 8-year OSA (apnea–hypopnea index (AHI)  $\geq 5$  or OSA treatment initiation) among participants free of OSA (apnea–hypopnea index  $< 5$  events/h and not treated) at baseline. First, asthma was assessed regardless of age of onset (“asthma at any age”); then, categorized by the age of onset as childhood (age  $< 18$  years) or adult (age  $\geq 18$  years). The first set of analyses adjusted for baseline variables (age, sex, BMI, smoking, alcoholic drinks/week, and nasal congestion); the second set of models also included new asthma cases and change in BMI.

**Results:** Of 1545 WCS participants with baseline studies, 773 had no OSA at baseline and an 8-year follow-up study. Of these 773 participants, 201 had asthma (61 childhood-onset, 140 adult-onset). Relative to those without asthma, those with asthma at any age had 1.70 times (95% CI = 1.15–2.51) greater odds of new-onset OSA. Each increment in asthma duration of 5 years was associated with 10% higher odds (1.01–1.19) of new-onset OSA at 8-year follow-up. Relative to no asthma, childhood-onset asthma was associated with 2.34 times (1.25–4.37) and adult-onset asthma with 1.48 times (0.92–2.36) greater odds of new-onset OSA. There were 45 subjects who developed asthma during follow-up. New-onset asthma was unassociated with new-onset OSA, both in the model that included asthma with onset at any age (which remained significantly associated 1.67 times (1.12–2.50) and when stratified by age of onset (childhood- onset 2.28 [1.24–4.20] and adult-onset asthma 1.44 [0.88–2.35]).

**Conclusion:** In adults, presence of asthma, particularly childhood-onset asthma, predicted 8-year risk of developing OSA. Incremental

asthma duration by 5 years was associated with 10% higher odds for OSA 8 years later. Whether and how intrinsic disease characteristics or associated features starting early in life affect upper airway patency during sleep remains unknown.

**Acknowledgements:** This work was supported by the National Heart, Lung, and Blood Institute (R01HL62252) and the National Center for Research Resources (1UL1RR025011) at the National Institutes of Health.

<http://dx.doi.org/10.1016/j.sleep.2013.11.024>

### **The expression of the Per2 clock gene is up-regulated in non-treated osas patients and normalizes its mRNA levels upon positive pressure treatment**

S. Moreira<sup>1</sup>, R. Rodrigues<sup>2</sup>, N. Pejanovic<sup>2</sup>, J. V. Rodrigues<sup>1</sup>, C. Barbara<sup>1</sup>, L. Ferreira Moita<sup>2</sup>

<sup>1</sup>Hospital de Santa Maria, Departamento de Pneumologia, Portugal

<sup>2</sup>Instituto de Medicina Molecular, Cell Biology of the Immune System Unit, Portugal

**Introduction:** The obstructive sleep apnea syndrome (OSAS) is a frequent sleep disorder that constitutes an independent risk factor for the development of metabolic syndrome and cardiovascular diseases. Nuclear receptors (NRs) are critical integrators of key cycles and metabolic pathways of human physiology. Most exhibit circadian variation at the mRNA and protein levels that can be controlled or influenced by master clock genes, which in turn are modulated by sleep/vigilance cycles. Our goal was to investigate if the expression level of mRNA coding for clock genes is altered in non-treated OSAS patients and if it can be corrected by standard positive pressure treatment.

**Materials and methods:** Peripheral blood was collected from male patients diagnosed with severe OSAS (AHI  $\geq 30$ /h) before treatment initiation. Collections were always performed between 8 and 10am. Blood was then used to perform routine biochemical analyses and to isolate peripheral blood mononuclear cells (PBMCs). RNA was isolated and qPCR used to measure mRNA levels of genes associated with the central circadian pacemaker including Clock, Bmal1 and three period genes (Per1, 2, 3). The selected patients were then followed up at 1, 3 and 6 months after therapy initiation with positive pressure and the mRNA level of relevant genes tested at these points. Patients with addiction habits, cancer, hematological disorders, and shift work were excluded from analysis.

**Results:** After testing the mRNA expression levels of clock genes in non-treated OSAS patients, we found Per2 to be reproducibly over-expressed in 6 out of 8 patients (75%), from 1.5 to 2.5-fold over a reference control. Strikingly, in all 6 patients found to have Per2 increased levels we observed positive pressure treatment-induced decrease of expression of this gene beginning at 1–3 months post-treatment initiation and normal expression values at 6 months.

**Conclusion:** We have identified the Per2 clock gene as possible marker of OSAS because it is over-expressed in non-treated patients and its expression levels normalize upon positive pressure treatment. This finding is likely the first molecular marker of the disease and can possibly be used to monitor therapy efficacy. It remains to be determined if Per2 is directly associated with the increased susceptibility of OSAS patients to the development of metabolic syndrome and cardiovascular disease.

**Acknowledgements:** This work was supported by Fundacao para a Ciencia e a Tecnologia (FCT): PIC/IC/82991/2007.

<http://dx.doi.org/10.1016/j.sleep.2013.11.025>

### The association of sleep-disordered breathing with objectively-assessed risk of falls

P. Peppard<sup>1</sup>, J. Barnet<sup>1</sup>, E. Hagen<sup>1</sup>, T. Young<sup>1</sup>, K. Hla<sup>1</sup>, M. Teodorescu<sup>2</sup>

<sup>1</sup>University of Wisconsin, Department of Population Health Sciences, Madison, United States

<sup>2</sup>University of Wisconsin, Department of Medicine, Madison, United States

**Introduction:** Sleep-disordered breathing (SDB) is associated with decrements in cognitive function. Recent data show that impairments in cognition impact the risk of falls. We sought to determine if the presence of SDB affects the risk of falling as assessed by gait tasks in Wisconsin Sleep Cohort Study participants.

**Materials and methods:** Adult subjects ( $n = 476$ ), selected from an employed-population sample of adults in 1988, were polysomnographically-assessed for SDB-characterized by the apnea-hypopnea index (AHI, events/h) – and also had gait evaluations. Gait was assessed with: (1) the Timed Up & Go task, and; 2) the Timed Up & Go task while counting backwards by 3's (Timed Up & Go-CB). To test whether SDB was associated with prolonged times of gait tasks indicating an increased risk of falling, linear models regressed gait task times on AHI with adjustments for age, gender, and body mass index (BMI).

**Results:** 476 subjects had an opportunity to complete the Balance and Gait Tasks; 2 subjects who were physically unable to complete the tasks and 16 subjects who used an assistive device during the tasks were excluded from the analysis. The 458 remaining subjects (46% female) were an average 65 (range: 45–82) years old at the time of testing. Both Timed Up & Go (mean  $11 \pm 2$  s) and Timed Up & Go-CB (mean  $13 \pm 6$  s) demonstrated prolongations of times to completion with age, BMI and AHI. After adjusting for the number of correct subtractions and errors committed, age, gender and BMI, there was a statistically significant relationship between increasing AHI and increased Timed Up & Go-CB time to completion; for every 10 point increase in AHI there was a 2.2 s increase in completion time ( $p < 0.001$ ). In addition, the difference in seconds between the time to complete Timed Up & Go-CB and Timed Up & Go (mean  $1.9 \pm 5.0$  s) was significantly associated with the increased AHI (1.9 s increase per 10 event/h increase in AHI) after multivariable adjustments ( $p < 0.001$ ); i.e., the additional cognitive burden of counting backwards while performing the gait task was associated with significantly greater reductions in Timed Up & Go performance in subjects with more severe SDB.

**Conclusion:** More severe SDB is associated with decrements in gait tasks performance, particularly the dual-task Timed Up and Go Counting Backwards. SDB-related lower cognitive reserve may lead to worse gait performance and, therefore, possibly a higher risk for injurious falls.

**Acknowledgements:** Funding support from NIH grants R01HL62252, 1R01AG036838–01A1, and 1UL1RR025011.

<http://dx.doi.org/10.1016/j.sleep.2013.11.026>

### Acute effects of obstructive sleep apnea on autonomic nervous system, arterial stiffness and heart rate in newly diagnosed untreated patients

R. Huang<sup>1</sup>, S. Lee<sup>2</sup>, C. Lai<sup>3</sup>, Y. Hsiao<sup>4</sup>, H. Ting<sup>5</sup>

<sup>1</sup>Chung Shan Medical University, Department of Medical Image and Radiological Sciences, China

<sup>2</sup>China Medical University, Department of Physical Therapy, Graduate Institute of Rehabilitation Science, China

<sup>3</sup>Chung Shan Medical University, Department of Applied Information Sciences, China

<sup>4</sup>Chung Shan Medical University, Medical Image and Radiological Sciences, China

<sup>5</sup>Chung Shan Medical University Hospital, Sleep Medicine Center, China

**Introduction:** In order to realize the acute effects of obstructive sleep apnea, we investigated newly diagnosed untreated patients with whole night PSG test. The ECG (ElectroCardioGraphy), EEG (ElectroEncephaloGraphy), and Plethysmography were analyzed to generate estimation of variables by methods which include HRV (Heart Rate Variability), DFA (Detrend Fluctuation Analysis), EEG Power Spectrum, QT corrected (QTc) intervals, PTT (Pulse Transit Time), PWV (Pulse Wave Velocity), and CoHrR (Coherence of Heart rate/Respiration).

**Materials and methods:** We investigated 226 newly diagnosed untreated patients on the sleep structures and apnea/hypopnea events. For HRV analysis, 5-min good ECG was needed to generate stable biomarkers because there are only 13 subjects with 5-min good EKG data during SWS (Slow Wave Sleep) with apnea or hypopnea. Therefore, we focused the analysis only on sleep stage 2 (S2) and REM (Rapid Eye Movement). In order to compare the states with/without apnea or hypopnea, we only chose the first good 5-min ECG epoch from begin of S2 and REM period with or without apnea/hypopnea respectively. Then we performed a pair-to-pair *T*-test by subject self-comparison of with/without sleep apnea for each estimation of variables.

**Results:** For S2 with apnea/hypopnea, we found that HR, VLF, LF, LFnU, HF, SDNN, RMSDD, NN50, pNN50, DFA alpha, QTc SD, EEG beta, EEG gamma, PWV and PTT SD are increased with statistical significance. And that CoHrR, QTvi, PTT, and EEG theta are decreased with statistical significance. We inferred that the acute effects of sleep apnea on S2 increased the tension of ANS (Autonomic Nervous System) and arterial stiffness and decreased the coherence of heart rate/respiration. For REM with apnea/hypopnea, we found that HR, VLF, SDNN, NN50, DFA alpha, QTc SD, EEG beta percentage, and PWV are increased with statistical significance. And that CoHrR, QTvi, and PTT are decreased with statistical significance. We inferred that the acute effects of sleep apnea on REM contribute to increase on heart rate and arterial stiffness.

**Conclusion:** The most different results of apnea effects on REM to S2 were REM affects HR while S2 affects ANS. And the common effects are increased on arterial stiffness, DFA alpha and decreased on coherence of heart rate/respiration.

<http://dx.doi.org/10.1016/j.sleep.2013.11.027>

### Obstructive sleep apnea in risk for first cardiovascular event and all-cause mortality: a competing risks approach

T. Kendzerska<sup>1</sup>, R. Leung<sup>2</sup>, A. Gershon<sup>3</sup>, G. Hawker<sup>4</sup>, G. Tomlinson<sup>5</sup>

<sup>1</sup>University of Toronto, Institute of Health Policy, Management and Evaluation

<sup>2</sup>University of Toronto, Sleep Laboratory, Canada

<sup>3</sup>University of Toronto, Canada

<sup>4</sup>University of Toronto, Medicine & Rheumatology Department of Medicine, Canada

<sup>5</sup>University of Toronto, Dalla Lana School of Public Health, Canada

**Introduction:** We previously found a relationship between obstructive sleep apnea (OSA)-related variables and a composite outcome of all-cause death, congestive heart failure (CHF), acute myocardial infarction (AMI), stroke, coronary artery bypass grafting or percutaneous coronary intervention. There is limited evidence on associations between OSA and separate cardiovascular (CV) events

or the impact of competing risks on non-fatal outcomes. We investigated relationships with the main components of our composite, with and without adjusting for competing risk of death.

**Materials and methods:** All adults referred with suspected OSA who underwent a first diagnostic sleep study at St Michael's Hospital (Toronto, Canada) between 1994 and 2010 were included. Patient data was linked to health administrative data. Our statistical model for a composite outcome controls for traditional CV risk factors and includes total sleep time (TST) with O<sub>2</sub> saturation <90%, TST, number of awakenings, periodic leg movements, heart rate in TST and daytime sleepiness (DS). The model was refitted to components of the composite. Subjects were followed from their first diagnostic sleep study to March 2011, the occurrence of the event of interest (CHF, AMI, stroke), or death, whichever occurred first. The Fine and Gray competing-risk model and Cox model were used.

**Results:** A total of 10,149 participants (62% males, mean age 50 years) were followed over a median of 68 months. There were 762 deaths, potentially competing events, and the following numbers of first CV events: 414 hospitalized CHFs (542 died without CHF); 145 hospitalized AMIs (712 died without an AMI); 100 hospitalized strokes (732 died without stroke). The Kaplan–Meier method overestimated the cumulative incidence of CV events by 3% at 100 months. In the Cox model all predictors except DS were significantly associated with all-cause death and CHF, but only TST and awakenings with stroke. In a competing risk model, the effect of awakenings became non-significant for both CHF and stroke, remaining significant only for all-cause mortality. OSA-related variables were not associated with incident AMI in either model.

**Conclusion:** All-cause mortality, stroke and CHF are significantly associated with some OSA-related variables. The findings for OSA variables were mostly unchanged in competing risk models. Nonetheless, we recommend competing risks analyses as a complementary approach to traditional Cox models, especially in frail populations.

**Acknowledgements:** The first author, Tetyana Kendzerska, is supported by the Canadian Institutes of Health Research (CIHR) Doctoral Research Award – Priority Announcement: Patient-Oriented Research – Clinical Epidemiology and Biostatistics; the project is supported by the ResMed research foundation. The ResMed research foundation had no role in the study design and analysis and no impact on the results reported.

<http://dx.doi.org/10.1016/j.sleep.2013.11.028>

### Assessing the delayed sleep phase disorder by ambulatory circadian monitoring

B. Rodriguez-Morilla<sup>1</sup>, J. Paniagua Soto<sup>2</sup>, E. Estivill-Sancho<sup>3</sup>, J. Albares Tendero<sup>3</sup>, C. Estivill-Domènech<sup>3</sup>, M. Rol De Lama<sup>4</sup>

<sup>1</sup>Chronolab, Department of Physiology, University of Murcia, Spain

<sup>2</sup>Sleep Unit, Clinical Neurophysiology Department, Virgen de las Nieves Hospital of Granada, Spain

<sup>3</sup>USP Institut Universitari Dexeus, Clinica del Son Estivill, Spain

<sup>4</sup>Laboratorio de Cronobiología, Departamento de Fisiología, Facultad de Biología, Universidad de Murcia, Spain

**Introduction:** The circadian system is responsible for the generation of biological rhythms synchronized to environmental 24 h cycle. The delayed sleep phase disorder (DSPD) refers to a delay between the sleep-wake rhythm and the desired bed and rise times and patients suffer chronic difficulty to fall asleep, rising and impaired performance during day. The aim of this work is to test an innovative ambulatory circadian monitoring (ACM) system based on wrist temperature (T), motor activity (A), body position (P), light exposure (L)

and environmental temperature (ET) rhythms, to evaluate patients affected by this syndrome.

**Materials and methods:** Fourteen patients between 10 and 86 yr old from the Sleep Unit of the Virgen de las Nieves Hospital and the Estivill Sleep Clinic, and 14 healthy volunteers (from 10 to 80 yr old) were included in the study. Their T, A, P, L and ET rhythms were registered by the ACM device Kronowise® (Cronolab, University of Murcia, Spain) during a week. Sleep-wake states were inferred using the integrated variable TAP using Circadianware® software (Chronolab, Univ. Murcia).

**Results:** Reliable circadian phase markers can be calculated from all variables, being the timing of five consecutive hours of maximum values for T and sleep (TM5) and of five consecutive hours of minimum values for A, P, TAP and L (TL5), the most accurate ones. Most DSPD subjects showed a similar phase-delay with respect control subjects in the TM5 or TL5 in all ACM variables (02:30–04:30 h for control subjects vs. 06:00 to 09:40 h for DSPD). However, a 21% of DSPD patients exhibited internal desynchronization between T and A, P or sleep phases. DSPD subjects showed higher fragmentation, lower regularity in all variables, together with lower light exposures than the standard scores specially during the morning.

**Conclusion:** Our results showed that ACM provides objective markers to detect DSPD and chronodisruption. Besides differences in circadian phase, DSPS subjects showed more irregular, fragmented and less robust rhythms, worse sleep quality and less diurnal activation than controls, probably caused to the duty of sleep within a social schedule that differs from their endogenous biological propensity. Insufficient light exposure during early morning contribute to maintain their circadian phase delay.

**Acknowledgements:** Study supported by RETICEF (RD12/0043/0011), MINECO (BFU2010–21945-C02–01), TIN2009–14372-C03–01 to MC and INNPACTO (IPT-2011–0833-900000) to JAM.

<http://dx.doi.org/10.1016/j.sleep.2013.11.029>

### Evaluation of circadian gene expression changes in human peripheral blood cells as biomarkers of circadian disruption in shift workers: application to studies of breast and prostate cancer chemoprevention

H. Zarbl<sup>1</sup>, H. Kipen<sup>1</sup>, M. Fang<sup>1</sup>, P. Ohman-Strickland<sup>2</sup>, K. Black<sup>3</sup>, J. Lew<sup>4</sup>

<sup>1</sup>Rutgers, The State University of New Jersey, Robert Wood Johnson Medical School, United States

<sup>2</sup>School of Public Health, Room 414A, 170 Frelinghuysen Road, United States

<sup>3</sup>Rutgers, the State University of New Jersey, Clinical Research and Occupational Medicine Division, United States

<sup>4</sup>Children's National Medical Center, Sheikh Zayed Campus for Advanced Children's Medicine, United States

**Introduction:** Epidemiological studies indicate that disruption of circadian rhythm by shift work is associated with increased risk of breast and prostate cancers. Rat studies demonstrated that carcinogens also disrupt the rhythmic expression of circadian and circadian controlled genes (CCG). More importantly, chemopreventive methylselenocysteine (MSC) resets the expression levels and phases of circadian and CCG genes, including estrogen receptor  $\beta$  (ER $\beta$ ) (Fang, Zhang & Zarbl Cancer Prev. Res. 3: 640–652, 2010). Unpublished findings indicate that MSC resets rhythmic oscillations in histone and Bmal1 acetylation on the Per2 gene promoter, suggesting a mechanism for MSC-mediated resetting of circadian rhythm. The goal of the present study was to determine if changes in circadian and CCG expression in white blood cells can serve as biomarkers

of circadian disruption in shift workers, and to assess the ability of MSC to reset the circadian rhythm in peripheral cells.

**Materials and methods:** Phase I: Fifteen hospital interns and residents (age 21–34) were recruited to a cross-over biomarker study. Blood samples were drawn at 8 AM, noon and 8 PM after completing at least one week on the day shift, and at 8 AM and 8 PM, after completing one week of service on the night shift. Serum melatonin and expression of circadian genes (Per2, NR1D1) and CCG (ER $\beta$ ) were measured in peripheral blood samples. Descriptive statistics and mixed linear models evaluated changes in gene expression. Phase II: Results of this study were used to design a blinded randomized placebo-controlled intervention trial to explore the ability of a dietary supplement of MSC to reset normal circadian and circadian controlled gene expression. One hundred healthy volunteers, who work predominantly at night, were randomized to a placebo or MSC interventions groups (50 subjects per group). Blood samples were collected prior to the intervention to determine baseline levels of biomarkers. Subjects were asked to take a daily supplement containing MSC (3 ppm Se) or a placebo for a period of 30 days, while keeping a sleep log. Biomarkers are reassessed after termination of the intervention.

**Results:** Results showed that when working the day-shift, the average Per2 mRNA levels were lower at night vs morning; however, when working the night-shift, per2 mRNA was significantly higher at night vs morning ( $p = 0.01$ ), indicating a change in Per2 mRNA expression with a change from day-to night-shift. We also observed a significant increase in Per2 mRNA expression ( $p = 0.034$ ) during night- vs day-shift based on the samples collected in the evening. However, NR1D1 and ER $\beta$  mRNA expression, very low at these time points, were not significantly affected by schedule changes. These findings formed the basis for a MSC interventional trial in 100 shift workers. The interventional study has been completed and the circadian biomarker analysis is in progress.

**Conclusion:** These results indicate that night- vs day-shift has a significant impact on Per2 gene expression, suggesting that it can be used as a biomarker to indicate disrupted circadian rhythm in shift workers. Per2 expression shows promise as a useful in longitudinal studies of MSC chemoprevention of cancer in shift workers.

**Acknowledgements:** These studies are supported by a Translational Research Grant from the V Foundation for Cancer Research, and NIH grants U19ES011387 (H. Zarbl, P.I.) and P30ES005022 (H. Zarbl, P.I.) from the National Institute for Environmental Health Sciences. We thank Kathy Kelly McNeil, Michelle Robertson, Susan Goodin and Benjamin Crabtree for contributions to this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.030>

### Circadian activity rhythm disturbances predict mortality

L. Zuurbier<sup>1</sup>, A. Luik<sup>1</sup>, E. Van Someren<sup>2,3,4</sup>, H. Tiemeier<sup>1</sup>

<sup>1</sup>Erasmus University Medical Center, Department of Epidemiology, Erasmus University Medical Center, Rotterdam, the Netherlands

<sup>2</sup>Netherlands Institute for Neuroscience, VU University and Medical Center, Department of Sleep and Cognition, Amsterdam, The Netherlands

<sup>3</sup>Department of Integrative Neurophysiology, VU University and Medical Center, Amsterdam, The Netherlands

<sup>4</sup>Department Medical Psychology, VU University and Medical Center, Amsterdam, The Netherlands

**Introduction:** Sleep and circadian rhythm changes occur during aging, and have been associated with adverse health consequences and mortality. Previous studies investigating sleep and mortality focused mainly on sleep duration and suggest that the relation between sleep duration and mortality is U-shaped. It is still unclear

if other sleep characteristics and if stability and fragmentation of the circadian rhythm predict mortality.

**Materials and methods:** Actigraphy and a sleep diary were used to measure the circadian activity rhythm and sleep in 1734 middle-aged and elderly participants of the Rotterdam Study. Circadian rhythm was measured with actigraphy to calculate the interdaily stability and intradaily variability (i.e. fragmentation) of the activity rhythm. Sleep was assessed objectively with actigraphy, and subjectively with a sleep diary to estimate sleep duration, sleep onset latency and wake after sleep onset. Sleep quality was measured with the Pittsburgh Sleep Quality Index. All-cause mortality was assessed by death certificates and records of general practitioners and hospitals. The association between circadian rhythm, sleep and mortality was estimated with cox proportional hazard models.

**Results:** The mean follow-up time was 5.9 years, in total, 137 deaths (7.9%) occurred. Higher stability of the circadian activity rhythm was associated with a lower mortality risk (HR = 0.82, 95% CI = 0.71–0.96) and more fragmentation to a higher mortality risk (HR = 1.25, 95% CI = 1.07–1.45) after adjustment for confounders. Whether assessed objectively or subjectively, sleep was not related to mortality in our study.

**Conclusion:** Lower stability and higher fragmentation of the circadian activity rhythm is related to higher all-cause mortality in a middle-aged and elderly population. Loss of circadian rhythm might be a disease indicator or a parameter for aging. Future research must show if stabilizing the circadian rhythm can improve quality of life and survival.

**Acknowledgements:** L.A. Zuurbier and A.I. Luik were supported by a Netherlands Organization for Scientific Research grant (NWO-VIDI: 017.106.370) awarded to H. Tiemeier.

<http://dx.doi.org/10.1016/j.sleep.2013.11.031>

### Sleep disturbances and their relationship with excessive exposure to light at night: the Korean genome and epidemiology study

Y. Koo, J. Choi, K. Jung

Korea University Medical Center, Korea University College of Medicine, Republic of Korea

**Introduction:** Although excessive artificial light at night is known to cause circadian disruption or nocturnal melatonin suppression, there was no systemic study which examined the association of light at night (LAN) and sleep disturbance. The aim of this study was performed to investigate how exposure to LAN can affect sleep in a population level.

**Materials and methods:** We carried out a cross-sectional study using the data from the Korean Genome and Epidemiology Study, which began in 2001 as an ongoing population-based study of Korean adults aged 39–70 years in Ansan and Ansong, South Korea. Using NOAA (national oceanic and atmospheric administration) satellite images, levels of LAN (0–63 W/cm<sup>2</sup> steradian) were dichotomized (high vs. low intensity) in both regions. The relationships between LAN exposure and sleep disturbances such as insomnia, excessive daytime sleepiness (EDS), insufficiency of sleep, snoring, irregularity of sleep, restless legs syndrome (RLS), and nap were investigated using multiple logistic regression. We estimated odds ratio (OR) and 95% confidence interval (CI) of LAN exposure parameter in each sleep disturbance using multiple logistic regression models adjusting for various clinical variables.

**Results:** The sample consisted of 8531 participants (4015 men and 4516 women) with mean age of 52.9  $\pm$  9.0 years. The participants complained of insomnia (9.6%), EDS (13.7%), insufficiency of sleep

(34.2%), snoring (62.7%), irregularity of sleep (26.3%), RLS (12.5%), and nap (37.8%). High LAN exposure was positively associated with insomnia (OR = 1.73, 95% CI [1.40, 2.14]) and snoring (OR = 1.20, 95% CI [1.06, 1.37]), but was negatively associated with EDS (OR = 0.73, 95% CI [0.61, 0.88]) and irregularity of sleep (OR = 0.65, 95% CI [0.57, 0.75]). On the other hand, LAN exposure was not associated with RLS, nap, or insufficiency of sleep.

**Conclusion:** We concluded that high LAN exposure contributed to sleep disturbance such as insomnia and snoring.

**Acknowledgements:** This study was supported by the KEITI of the Ministry of Environment of Korea (RQ201205099). This study was provided with biospecimens and data from the Korean Genome Analysis Project (4845–301), the Korean Genome and Epidemiology Study (4851–302), and Korea Biobank Project (4851–307, KBP-2013–05) that were supported by the Korea Center for Disease Control, Republic of Korea. The light at night data was provided by the National Oceanic and Atmospheric Administration.

<http://dx.doi.org/10.1016/j.sleep.2013.11.032>

### Cognitive impairments in individuals with insomnia: clinical significance and correlates

E. Fortier-Brochu, C. Morin  
Université Laval, Canada

**Introduction:** Although a considerable proportion of individuals with insomnia report altered cognitive performance, little is still known regarding the nature, significance and mechanisms of cognitive impairments underlying these cognitive complaints. The aims of this study were to further document the nature and clinical significance of cognitive impairment in individuals with insomnia and to investigate their correlates.

**Materials and methods:** Participants were 25 adults with primary insomnia (INS) and 16 matched controls (CTL) who underwent 3 consecutive nights of polysomnography (PSG). On the morning following night 3, participants completed a battery of questionnaires and neuropsychological tests, including the Continuous Performance Test-II (CPT-II) and the California Verbal Learning Test-II (CVLT-II). Groups were compared using MANOVAs for each of 4 cognitive domains (attention, working memory, episodic memory, executive functions). Clinically-significant deficits were defined as a performance at least one standard deviation below the normative mean. For each variable, frequencies of clinically-significant deficits in both groups were compared using Chi-square tests. Correlates of cognitive impairments were investigated using stepdown linear regressions. Potential correlates included: insomnia severity, depressive symptoms, anxiety, fatigue, sleepiness, arousal, beliefs about sleep, sleep continuity (from sleep diaries and PSG), sleep architecture and sleep microstructure variables (from power spectral analysis of the NREM sleep EEG).

**Results:** There were significant group differences for the attention ( $p = 0.04$ ) and episodic memory domains ( $p = 0.01$ ). Compared to CTL, INS had a poorer detectability ( $p = 0.01$ ) and more perseverative errors ( $p = 0.03$ ) on the CPT-II, and more intrusion errors ( $p = 0.03$ ) on the CVLT-II. Clinically-significant deficits were more frequent in INS for CPT-II perseveration errors ( $p = 0.02$ ) and CVLT-II intrusion errors ( $p = 0.03$ ). All performance variables were significantly associated with either subjective or objective sleep continuity, and some were also independently related to sleep microstructure (i.e., relative power for 0–1 Hz and 8–12 Hz frequencies) or selected psychological variables (i.e., beliefs or arousal).

**Conclusion:** These findings suggest clinically-significant alterations in attention and episodic memory in individuals with

insomnia. These deficits appear associated with sleep continuity, and may also be related to sleep EEG microstructure and psychological functioning.

**Acknowledgements:** Supported by the Canadian Institutes of Health Research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.033>

### Electroencephalographic correlates of on-the-road driving fatigue in untreated insomniac patients

J. Perrier<sup>1</sup>, T. Leufkens<sup>2</sup>, J. Ramaekers<sup>1</sup>, M. Bocca<sup>3</sup>, E. Vuurman<sup>1</sup>, A. Vermeeren<sup>1</sup>

<sup>1</sup>Department of Neuropsychology and Psychopharmacology, Faculty of Psychology and Neuroscience, The Netherlands

<sup>2</sup>Philips Research, The Netherlands

<sup>3</sup>INSERM, U 1075 COMETE, University of Caen, France

**Introduction:** Insomnia patients consistently self-reported daytime fatigue and cognitive impairments which could contribute to traffic crashes. However, the model of hyperarousal was proposed to explain the lack of objective evidence of cognitive dysfunction in patients with primary insomnia because of the contribution of psychological and physiological arousal to daytime functioning. In this case it is not clear that insomnia patients could suffer from sleepiness which could contribute to traffic crashes. Electroencephalography recordings during driving were previously used to assess sleepiness and fatigue during a driving task. It appeared that an increase in the theta, alpha and beta band is linked to a higher fatigue. We expected that insomnia patients will not have a decrement in their driving performance associated with EEG correlates of less fatigue. The purpose of the present study was thus to compare the electroencephalographic correlates of sleepiness and fatigue during a driving task in insomniac patients and in good sleepers.

**Materials and methods:** Nineteen older insomniacs and nineteen older good sleepers were included in the study (aged between 55–75 years). After a sleep recording night in the sleep unit, the participants performed an on-the-road highway driving task in the morning. The vehicle's speed and lateral position were continuously recorded. Electroencephalography was also recorded during the driving task. The main driving parameter was the standard deviation of the lateral position (SDLP), which is an index of weaving; the standard deviation of speed (SDS) was also quantified. The fatigue EEG correlates were assessed by quantification of the absolute power spectra in the theta, alpha and beta bands.

**Results:** Results for the SDLP and the SDS reveal that driving performance was not impaired in the insomnia group in comparison to the good sleepers group. Preliminary analysis of EEG recordings reveal that good sleepers had a higher power spectrum in the theta, alpha and beta bands.

**Conclusion:** It is concluded that older chronic insomnia patients appear to be able to successfully perform a one hour highway driving task in real traffic. EEG results suggested that insomniacs were less fatigued than good sleepers which could explain the lack of difference in the driving performance. This could be in line with the hyperarousal model proposed to explain to lack of cognitive dysfunction in insomnia patients.

**Acknowledgements:** We want to thanks Anita Van Oers for the driving data analyses, Henk Brauers and Jo Gorissen as driving instructors and student assistants for the help in the data collection.

<http://dx.doi.org/10.1016/j.sleep.2013.11.034>

### Spectral analysis in untreated primary insomniacs: evidence for cortical hyperarousal and prefrontal hypometabolism during sleep

J. Perrier<sup>1</sup>, F. Bertran<sup>2</sup>, C. Couque<sup>2</sup>, P. Clochon<sup>3</sup>, P. Denise<sup>4</sup>, M. Bocca<sup>4</sup>

<sup>1</sup>U1075 COMETE, UMR INSERM/UCBN, France

<sup>2</sup>Department of Clinical Physiology, France

<sup>3</sup>INSERM, U1077, France

<sup>4</sup>INSERM U1075, UMR INSERM/UCBN, France

**Introduction:** Primary insomnia is characterized by complaints of non-restorative and/or insufficient sleep during at least one month in the absence of other pathologies according to the DSM-IV. However, the pathophysiology of insomnia is not well understood. According to a number of studies, primary insomniacs display cortical hyperarousal during wake and sleep/wake transition which could explain both the lack of objective evidence of cognitive dysfunction and the difficulty to initiate or maintain a good sleep in insomnia. In support of the hyperarousal hypothesis, sleep spectral analysis in insomniacs consistently reveal an increase in beta power during NREM sleep in comparison to good sleepers. Recent studies investigated the activity and the metabolism in the prefrontal cortex during wake in insomnia and proposed that insomniacs have a hypometabolism and a hypoactivation of the prefrontal cortex during wake. Previous spectral analyzes in insomnia have been performed only in central electrodes (Krystal et al., 2002; Spiegelhalder et al., 2012). The aim of the present study was to assess delta, sigma, alpha and beta power spectra in prefrontal, occipital, temporal and central cortical areas and to compare activity in prefrontal regions to other scalp regions.

**Materials and methods:** Overall, 14 insomniacs and 10 good sleepers participated in the study. They completed one night of polysomnography in the sleep lab. Power spectra were calculated using the Fast Fourier Transformation during stage 2 and stages 3 + 4 of sleep and during REM at prefrontal, occipital, temporal and central electrode positions.

**Results:** Our results showed that insomniacs exhibited a higher beta power spectrum centrally, temporally and occipitally during stage 3 + 4 in comparison with good sleepers. However, power spectra did not differ between groups at prefrontal electrodes. During the REM stage, beta1 power spectrum significantly decreased at prefrontal electrodes in insomniacs in comparison with good sleepers. Finally, we also found an increase in the delta mean frequency during NREM sleep in insomniacs in comparison with good sleepers.

**Conclusion:** Main results are in line with the literature and the concept of hyperarousal. Interestingly, our data suggests hyperarousal in large parts of the brain of insomniacs except for the prefrontal cortex. The latter may be related to selective hypometabolism in this region as previously reported in insomniacs during wake (Altena et al., 2008; Notzfinger et al., 2004).

**Acknowledgements:** We want to thanks the participants for their implication in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.035>

### Insomnia symptoms and subsequent cardiovascular medication: a register-linked follow-up study among middle-aged employees

P. Haaramo<sup>1</sup>, O. Rahkonen<sup>1</sup>, C. Hublin<sup>2</sup>, T. Laatikainen<sup>3,4,5</sup>, E. Lahelma<sup>1</sup>, T. Lallukka<sup>2</sup>

<sup>1</sup>Hjelt Institute, Department of Public Health, University of Helsinki, Finland

<sup>2</sup>Finnish Institute of Occupational Health, Hjelt Institute, Department of Public Health, University of Helsinki, Finland

<sup>3</sup>Department of Chronic Disease Prevention, National Institute for Health and Welfare, Helsinki, Finland

<sup>4</sup>Institute of Public Health and Clinical Nutrition, Faculty of Health Sciences, University of Eastern Finland, Joensuu, Finland

<sup>5</sup>Hospital District of North Karelia, Joens, Finland

**Introduction:** Sleep disturbances have been associated with increased risk of cardiovascular disease outcomes. The associations of insomnia with hypertension and dyslipidemia, the main modifiable cardiovascular disease risk factors, are less studied. We aimed to examine associations of insomnia symptoms with subsequent prescribed medication for hypertension and dyslipidemia.

**Materials and methods:** Baseline questionnaire surveys among 40–60-year-old employees of the City of Helsinki, Finland, were conducted in 2000–2002 ( $N = 6,477$ , response rate 67%, 78% women) and linked to a national register on prescribed reimbursed medication 5–7 years prior to and 5 years after baseline. The associations between the frequency of insomnia symptoms (difficulties in initiating and maintaining sleep, non-restorative sleep) and hypertension and dyslipidemia medication during the follow-up were analysed using logistic regression analysis (odds ratios (OR) with 95% confidence intervals (CI)). Analyses were adjusted for pre-baseline medication, sociodemographic and work-related factors, health, and health behaviours.

**Results:** Frequent insomnia symptoms were reported by 20%. During the 5-year follow-up 32% had hypertension medication and 15% dyslipidemia medication. Adjusting for age, gender, and pre-baseline medication, frequent insomnia symptoms were associated with hypertension medication (OR 1.57, 95% CI 1.23–2.00) and dyslipidemia medication (OR 1.59, 95% CI 1.19–2.12). Occasional insomnia symptoms were also associated with cardiovascular medication, though less strongly. Further adjustments had negligible effects.

**Conclusion:** Insomnia should be taken into account in the prevention and management of cardiovascular disease and related risk factors.

**Acknowledgements:** The authors have no conflicts of interests to report. This study has been funded with grants from Academy of Finland, Finnish Work Environment Fund, Juho Vainio Foundation, Emil Aaltonen Foundation, and Doctoral Programs in Public Health.

<http://dx.doi.org/10.1016/j.sleep.2013.11.036>

### REM sleep behavior disorder is associated to increased risk of impulse control symptoms in patients with Parkinson's disease

M. Fantini<sup>1</sup>, M. Laura<sup>2</sup>, Z. Maurizio<sup>3</sup>, C. Alessandro<sup>3</sup>, L. Leonardo<sup>3</sup>, D. Franck<sup>4</sup>

<sup>1</sup>EA7980 Faculté de Medecine, Université d'Auvergne, France

<sup>2</sup>CMRR-CHU Clermont-Ferrand, France

<sup>3</sup>Department of Neurosciences, University of Turin, France

<sup>4</sup>Neurology Department, CHU Clermont Ferrand, France

**Introduction:** REM sleep behavior disorder (RBD) affects about 50% of patients with Parkinson's disease (PD) and is often associated to more severe both motor and non-motor impairment. However, it is unknown whether PD-RBD patients have an increased risk to develop impulse control disorders (ICDs) compared to PD-noRBD. We aimed to assess the frequency of ICD and related behaviors symptoms in PD with and without probable RBD.

**Materials and methods:** Two hundred and twenty consecutive patients with idiopathic PD (132 M, mean age:  $66.6 \pm 11.0$  yrs.; mean duration of PD:  $7.3 \pm 4.7$  yrs.; mean Hoehn and Yahr score:  $1.9 \pm 0.7$ , mean Levo-dopa Equivalent Daily Dose:  $731.8 \pm 448.6$  mg) filled

out the RBD-Single question, the RBD Screening Questionnaire (RBDSQ) and the Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease's (QUIP).

**Results:** Probable RBD was found in 99/220 (45%, 59 M) patients. One or more ICDs or related behaviors were found in 60/99 (60.6%) patients with PD-pRBD and in 46/121 (38.0%) PD-noRBD ( $p = 0.001$ ). PD-pRBD showed a higher QUIP score ( $1.5 \pm 1.7$  vs.  $0.8 \pm 1.3$ ;  $p = 0.009$ ) and a higher number of ICD and related behaviors symptoms ( $1.5 \pm 1.7$  vs.  $0.9 \pm 1.3$ ;  $p = 0.001$ ) compared to PD-noRBD. Furthermore, a significant positive correlation between RBDSQ and QUIP scores was observed in the whole group ( $R = 0.269$ ;  $p < 0.001$ ). The frequencies of ICD symptoms in patients with PD-pRBD compared to PD-noRBD were as follows: compulsive gambling (9.1% vs. 3.3%;  $p = 0.07$ ), compulsive sexual behaviors (11.1% vs. 6.6%;  $p = 0.23$ ) compulsive shopping (14.4% vs. 4.1%,  $p = 0.008$ ) compulsive eating (18.2% vs. 14.0%,  $p = 0.39$ ), hobbyism (24.2% vs. 13.2,  $p = 0.03$ ), punding (19.2% vs. 10.7%,  $p = 0.09$ ), walk-about (6.1% vs. 7.4%,  $p = 0.67$ ), dopamine dysregulation syndrome (18.2% vs. 5.0%,  $p = 0.002$ ). A logistic regression model accounting for Center (Clermont-Ferrand/Turin), sex, age, PD duration, PD severity (H&Y score) and Levo-Dopa Equivalent Daily Dose, indicated that PD-pRBD have a twofold risk to develop any ICDs (RR: 2.1 (C.I. 1.31–3.60);  $p = 0.003$ ) and a threefold risk to develop compulsive shopping (RR: 3.15 (1.11–8.9);  $p = 0.03$ ) and Dopamine Dysregulation syndrome (RR: 3.15 (1.23–8.079);  $p = 0.017$ ) compared to PD patients without RBD.

**Conclusion:** This study showed for the first time that RBD is associated to an increased risk to develop ICD symptoms in PD, even after controlling for age, severity, duration of PD and dopaminergic treatment. Further studies are warranted to clarify the mechanism underlying this association.

**Acknowledgements:** Authors are in debt with neuropsychologist Dr. Tiphaine Vidal and neurologists Drs. Ana-Raquel Marques, Béran-gère Debilly, Philippe Derost, Miguel Ulla and Nicolas Vitello for their contribution in collecting clinical data and with biostatistician Bruno Pereira for helping in statistical analysis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.037>

### How should we deal with the possible development into lewy body diseases from idiopathic REM sleep behavior disorder in the real world clinical practice?

N. Tachibana, K. Taniguchi, T. Oguri, H. Sugiyama, T. Hamano  
Department of Neurology and Center for Sleep-related Disorders, Kansai Electric Power Hospital, Japan

**Introduction:** It has been well established that apparent idiopathic REM sleep behavior disorder (iRBD) evolves mostly into Lewy body diseases (LBD) (Parkinson's disease (PD) and dementia with Lewy bodies). Therefore, in clinical practice we have to keep a watch on its early signs and symptoms as well as to treat REM sleep related behaviors. This study describes our experience in following up iRBD patients in the daily clinical setting, some of whom actually developed additional neurological and psychiatric signs and symptoms.

**Materials and methods:** We retrospectively reviewed the sleep clinic records of consecutive 30 polysomnographically confirmed iRBD patients who made the first consultation in the four year time period from December 2005. Four patients who were lost within one year after the first consultation were excluded. 26 patients (21 men and 5 women, 67.3} 5.9 years of age at the first clinic visit) were analyzed whose follow-up duration was 4.6}1.6 years (range 1–7.5 years).

**Results:** We found out that we had informed the possibility of future development in other neurodegenerative diseases in 24 patients (92.3%) after they completed diagnostic polysomnography and other investigations to rule out comorbid neurological diseases when they were discharged from hospital. However, the way of transmission was modified for each patient and mostly about PD, which later caused some confusion in the patients who developed psychiatric rather than motor symptoms. Two patients were not informed about this possibility because they were full of anxiety at that time. 16 out of 26 patients (61.5%) always came to the clinic alone and their RBD severity under treatment did not differ from that of the remaining 10 patients who were accompanied by their family members. Solo visit generally did not interfere with our comprehension of the actual state of RBD by the use of questionnaire for RBD severity index, nor with the assessment of motor function, but gradual intermittent intrusion of visual hallucination was difficult to be perceived until family members came up. 18 out of 26 patients (69.2%) continued to pay a regular visit (once per 1–3 months) up to the present (June 2013), and what symptoms and signs appeared to them chronologically will be presented in the other paper of our group.

**Conclusion:** In respect of development into LBD from iRBD, what we should focus on includes close communication with the patients as well as family members. It should be warranted to seek for good predictors for the future LBD in tandem with developing educational materials addressing this issue.

**Acknowledgements:** We thank Kei-Ichi Marumoto and Yoko Uozumi for their technical support for performing PSG.

<http://dx.doi.org/10.1016/j.sleep.2013.11.038>

### sleep deprivation correlations with risk behaviors in adolescents: results from a portuguese national survey

T. Paiva<sup>1</sup>, T. Gaspar<sup>2</sup>, M. Gaspar Matos<sup>3</sup>

<sup>1</sup> CENC, Sleep Medicine Center, Medical Faculty of Lisbon, Portugal

<sup>2</sup> Instituto de Psicologia e Ciências da Educação, Universidade Lusíada, Portugal

<sup>3</sup> Faculdade de Motricidade Humana, Portugal

**Introduction:** Adolescents sleep shows marked variation in duration and variability (Carskadon, 1982, Dahl e Lewin, 2002, Fredriksen et al., 2004); this is caused by the specific maturation period of adolescence and by external factors, among which the increasing school demands, high tech gadgets, the need of social interactions and health related factors must be accounted for. Furthermore, due to specific maturation characteristics the adolescent brain remains more vulnerable to impulsive behaviors in sex, food and sleep habits (Arain et al. 2013). Objectives To evaluate the impact of sleep deprivation (SD) upon current risk behaviors of adolescents, namely those involving reduced impulsive control.

**Materials and methods:** The Portuguese survey reported in this study is a component of the Health Behaviour in School-Aged Children (HBSC) study (Currie, Roberts, & Morgan, 2004; Matos et al., 2006). This survey is based on a self-completed questionnaire to be administered in schools by teachers. The Portuguese HBSC survey included pupils in the 8th and 10th grades (high school); the mean age was 14.91 years (SD = 1.255, min 12.5, max 19.0). The National sample consisted of 3476 students from randomly chosen Portuguese schools, representing those school grades in the entire country, as geographically stratified by Education Regional Divisions. The school response rate was 89.9%. The gender and grade distribution were as follows: 53.8% ( $n = 1869$ ) were girls; in terms of school grade they were distributed as follows: 45.9% ( $n = 1594$ ) attending

the 8th grade, 54.1% ( $n = 1882$ ) the 10th grade. This study used a Health Behaviour in School-Aged Children (HBSC 2010) questionnaire and inquired about: (1) gender and age; (2) socio demographics and self-reported BMI; (3) Family environment (social level, instruction level and employment of father and mother); (4) Sleep duration during the week and weekends, sleep deprivation; (5) Overnight dating in friends; (6) Risk behaviours: bullying, use of weapons, non-suicidal self harm, alcohol and drugs.

**Results:** In what concerns risk behaviours it is clear from table 6 that their prevalence is relatively high in what concerns chronic use of alcoholic beverages (13.6%) and getting drunk (8.0%), use of soft drugs (11.4%) and drugs themselves (7.3%). All these behaviours are more prevalent in the sleep deprived adolescents with high significance levels ( $\chi^2 = 60.047$ ;  $p = .000$ ;  $\chi^2 = 62.116$ ;  $p = .000$ ;  $\chi^2 = 42.053$ ;  $p = .000$ ;  $\chi^2 = 25.878$ ;  $p = .000$ ; respectively). In what concerns social behaviors dating with friends, which implies returning home during the morning at 6 or 8 am., is also quite frequent routinely done by students during every weekend or even more (25.3%). The prevalence significantly increases in SD adolescents ( $\chi^2 = 43.363$ ;  $p = .000$ ). Aggressive behaviors such as carrying weapons to school (6.7%) or being involved in fights (19.6) are also relatively frequent and the prevalence increases in SD adolescents ( $\chi^2 = 14.484$ ;  $p = .006$  and  $\chi^2 = 14.331$ ;  $p = .006$ , respectively) Auto aggression, namely self cutting, had a prevalence of 15.5%, and is also significantly associated with SD ( $\chi^2 = 11.055$ ;  $p = .026$ ). Suffering (9.8%) or being involved in provocations or bullying (12.2%) are not so frequent and are also not related with SD.

**Conclusion:** Most risk behaviors are strongly correlated with SD, namely consumption of alcohol and drugs, aggressive and violent behaviors and self cutting. No correlation was found with bullying and provocative behaviour. The impact of SD upon emotional and impulsive control in adolescents and young adults requires proper and detailed evaluation.

**Acknowledgements:** Aventura Social team regarding data collection and Ministry of health (grant).

<http://dx.doi.org/10.1016/j.sleep.2013.11.039>

### Increased TV viewing time is associated with less sleep and more sleep difficulties in a large population-based cohort

Y. Leng, N. Wainwright, R. Luben, P. Surtees, K. Khaw, C. Brayne  
University of Cambridge, UK

**Introduction:** TV watching before bedtime is often discouraged in sleep recommendations. However, there has been limited epidemiological evidence on how TV viewing time might influence different aspects of sleep, especially among the older population. We aim to explore the cross-sectional relation between TV viewing time and sleep in an ageing British population.

**Materials and methods:** Data were drawn from the European Prospective Investigation into Cancer and Nutrition (EPIC-Norfolk) study. During 2006–2007, 5475 men and women reported daily TV viewing time and at least one of the sleep measures: time spent in bed, sleep duration, difficulty getting to sleep at night, waking up during night or in early morning and trouble getting back to sleep. Sleep efficiency was defined as the ratio of sleep duration and time in bed. Participants were categorized into four physical activity levels based on a physical activity questionnaire during the same period.

**Results:** On average, participants spent 8.63 h (standard deviation [SD] = 0.85) in bed and slept for 6.93 h (SD = 1.10) per night. 47% of the participants reported difficulty getting to sleep, and more than 65% reported the other two difficulties. Those in the highest quartile

(4–9 h/d) compared to the lowest quartile of TV watching time (0–2 h/d) spent longer time in bed at night ( $\beta = 0.22$  [95%CI 0.17, 0.27]), slept for shorter hours ( $\beta = -0.18$  [-0.24, -0.12]), and had lower sleep efficiency (OR = 0.54 [0.48, 0.61]). They also reported higher prevalence of difficulty in getting to sleep (OR = 2.05 [1.83, 2.30]), waking up during the night (OR = 1.54 [1.36, 1.73]) or in early morning (OR = 1.61 [1.43, 1.81]) and trouble getting back to sleep. These associations remained after further adjustment for age, sex, social class, education, smoking, alcohol intake, hypnotic drug use, depression, Body Mass Index and physical activity ( $p < 0.001$ ). The adjusted ORs associated with long TV viewing time for higher sleep efficiency ( $\geq 80\%$ ) and difficulty falling asleep were 0.70 (0.59–0.84) and 1.78 (1.50–2.11), respectively. The above associations seemed stronger among those who were most physically active, though the interaction was not significant. Physical activity was not associated with the sleep measures.

**Conclusion:** TV viewing is associated with impaired sleep quality. Further longitudinal study is needed to examine the direction of the relationship.

**Acknowledgements:** EPIC-Norfolk study was supported by the Medical Research Council, UK (G9502233, G0300128) and Cancer Research, UK (C865/A2883).

<http://dx.doi.org/10.1016/j.sleep.2013.11.040>

### The effect of obstructive sleep apnea on declarative memory consolidation

M. Guo<sup>1</sup>, M. Igue<sup>1</sup>, A. Malhotra<sup>2</sup>, R. Stickgold<sup>3</sup>, I. Djonlagic<sup>1</sup>

<sup>1</sup> Brigham and Women's Hospital, Harvard Medical School, United States

<sup>2</sup> Division of Pulmonary and Critical Care Medicine, University of California San Diego, United States

<sup>3</sup> Beth Israel Deaconess Medical Center, Harvard medical School, United States

**Introduction:** Growing evidence supports the theory that memory decline in neurodegenerative disorders may be related to problems with slow wave sleep and spindle functioning, both of which have also been shown to play a role in declarative memory consolidation. Patients with sleep disordered breathing exhibit poor sleep quality along with various levels of cognitive deficits. The aim of this study was to test the hypothesis that patients with obstructive sleep apnea exhibit only practice-related learning on a declarative memory task and lack the normal learning benefit that occurs during sleep.

**Materials and methods:** A total of 50 participants (mean age 39.1 years) were included, 28 of which were healthy controls and 22 were newly diagnosed with obstructive sleep apnea. All subjects underwent a baseline screening PSG evaluation, which also served as adaptation night. They subsequently underwent an overnight testing session, which included computer sessions of the Psychomotor Vigilance Task (PVT) and the Verbal paired- associates task (VPA) in the evening followed by a full night PSG and repeat PVT and VPA sessions in the morning.

**Results:** Both group showed similar learning of the VPA in the evening. However the healthy control group showed significantly higher morning scores (83.3% vs. 73.9%,  $p = 0.001$ ) along with more overnight improvement on the VPA task compared to the OSA patients (13.6% vs. 5.9%,  $p = 0.002$ ) There was a significant difference in time spent in N3 sleep between the two groups during the test night (11.9% vs. 4.4%,  $p = 0.001$ ), which was not observed during the adaptation night. Morning retention on the VPA correlated with the amount of slow wave sleep ( $p = 0.04$ ). PVT baseline average reaction time at night and the average

reaction time in the morning showed no significant difference between the two groups.

**Conclusion:** Our results demonstrate that while subjects with sleep-disordered breathing show similar initial learning (encoding) on a declarative memory task compared to healthy controls, they perform significantly worse after a night of sleep. The higher amount of slow wave sleep in the control group seen only during the test night suggest that the lack of sleep-dependent consolidation in the OSA group may be due to the inability to generate a post-training increase in slow wave sleep, which is associated with more efficient memory consolidation.

**Acknowledgements:** This work was supported by K23 HL103850-01, American Board of Sleep Medicine Junior Faculty Research Award # 54-JF-1-10.

<http://dx.doi.org/10.1016/j.sleep.2013.11.041>

### **Prevalence of nightmares among the general Finnish adult population and veterans of the second world war**

N. Sandman<sup>1</sup>, K. Valli<sup>2</sup>, E. Kronholm<sup>3</sup>, H. Ollila<sup>3</sup>, T. Laatikainen<sup>3</sup>, T. Paunio<sup>3</sup>

<sup>1</sup>University of Turku, National Institute of Health and Welfare, Finland

<sup>2</sup>University of Turku, Finland

<sup>3</sup>National Institute of Health and Welfare, Finland

**Introduction:** Nightmares are emotionally negative intense dreams and a relatively common phenomenon. Most people experience occasional idiopathic nightmares which are completely benign, but frequent nightmares are associated with mental health problems and increased suicide risk and can be a serious mental health issue. The current research investigates the prevalence of nightmares among the Finnish general adult population as well as veterans of the Second World War. Specifically, we were interested how sex, age and war experiences affect the nightmare prevalence and how the prevalence has changed during the 35 year study period. We also investigated the associations between nightmares and various factors including other sleep problems, mental and physical health and lifestyle.

**Materials and methods:** The current research is based on the National FINRISK Study which includes health surveys conducted every 5 years from 1972 to 2012. The surveys consist of independent random population samples of Finnish adults aged 25–74 ( $N = 75,647$ ). The question about nightmares is self-assessment of frequency during the last 30 days. The surveys also contain questions about various topics related to mental and physical health. The statistical methods used include Pearson and Mantel–Haenszel  $\chi^2$ , Cramer's V and Logistic regression.

**Results:** In the whole sample, 3.5% of men and 4.8% of women report frequent nightmares, but the prevalence and the sex difference is significantly affected by the age of participants. Occasional nightmares have increased in Finland from 1972 to 2007 and the effect of the Second World War can be seen in nightmare prevalence still decades after the war in the surveys of 1972–1987. Among war veterans the prevalence of nightmares is significantly higher at 7.0% than among their peers without war experience. Significant correlates of nightmares include depression, insomnia and stress.

**Conclusion:** Nightmares are not uncommon among Finnish adults and their prevalence is affected by sex, age, historical time and war experiences. They are also associated with other sleep problems and poor mental health. Our research leads to better understanding of the interindividual variation in nightmare frequency.

**Acknowledgements:** This work has received financial support from Jenny and Antti Wihuri Foundation, Sigrid Juselius foundation and Turku Institute of Advanced Studies (TIAS).

<http://dx.doi.org/10.1016/j.sleep.2013.11.042>

### **"I cannot sleep if i don't eat" A dysfunctional beliefs could sustain nocturnal eating**

P. Vinai

Studi Cognitivi, Milano, Italy

**Introduction:** Nocturnal eating is an unusual behavior shared by patients affected by Night Eating Syndrome and Sleep Related Eating Disorder, the differential diagnosis between the two pathologies is frequently not easy. A pathognomonic symptom of NES is the presence of the believe that one must eat in order to fall asleep. The presence of this conviction was included among the diagnostic criteria for NES published in 2010. In this study we evaluated if this conviction is significantly more present among obese patients suffering from insomnia and nocturnal eating, than among obese patients with insomnia who do not eat at night.

**Materials and methods:** Ninety-eight obese subjects afflicted by insomnia were included in the study. Eight were affected by NES, 33 by Binge Eating Disorder (BED), and thirteen by both BED and NES. Subject's insomnia and sleep disturbances were assessed using the Insomnia Severity Index and the Sleep Disturbance Questionnaire. The presence of the belief that one must eat at night was evaluated with the question: "Do you need to eat in order to get back to sleep when you wake up at night?"

**Results:** Patients affected by NES and by both BED and NES were convinced that nocturnal food intake is necessary in order to fall back asleep after a night time awakening.

**Conclusion:** The presence of this belief seems to be a valid factor in identifying the presence of the Night Eating Syndrome among obese subjects suffering from insomnia.

**Acknowledgement:** A sincere thanks to all the colleagues who supported us during this research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.043>

### **Sleep enactment behaviors in Parkinson's disease and multiple system atrophy: Beyond rem behavior disorder**

P. Ratti<sup>1</sup>, M. Sierra-Peña<sup>2</sup>, J. Bastin<sup>3</sup>, R. Manni<sup>4</sup>,

M. Simonetta-Moreau<sup>5</sup>, O. David<sup>3</sup>

<sup>1</sup>Toulouse University Hospital, INSERM UMR 825, Department of Clinical Pharmacology, France

<sup>2</sup>Toulouse University Hospital, INSERM UMR 825, Clinical Investigation Center CIC 9302, France

<sup>3</sup>Grenoble Institute of Neurosciences, Brain Function & Neuromodulation, France

<sup>4</sup>IRCCS Casimiro Mondino Institute of Neurology Foundation, Sleep and Epilepsy Unit, France

<sup>5</sup>Toulouse University Hospital, INSERM UMR 825, Department of Physiology, France

**Introduction:** Arousal-related "Sleep Enactment Behaviors" (SEBs) in Parkinson's Disease (PD) and Multiple System Atrophy (MSA) consist of heterogeneous behaviors arising from NREM or REM sleep. Their semeiological and electrophysiological aspects have not been

elucidated so far. We describe the clinical features and EEG correlates of arousal-related NREM SEBs in PD and MSA.

**Materials and methods:** Twenty-four PD and 12 MSA patients underwent a video-polysomnography (VPSG) for dream enactment behavior. The recordings of 3 PD and 3 MSA patients ( $67.0 \pm 6.9$  years old, 4 men) in which a NREM/REM sleep pattern was recognizable were visually scanned to identify SEBs emerging from NREM sleep arousals. From all the NREM arousals, we distinguished “SEB arousals” and “No-SEB arousals” according to their semiological features at video, for each recording. For each patient, we extracted a 3-min EEG segment around each arousal. We computed EEG power in the time–frequency plan using a Morlet’s wavelet transform for SEB and No-SEB arousals. This wavelet transform was z-scored according to a baseline. This analysis was done for SEB and No-SEB arousals at F3, C3, O1, F4, C4, O2, Fz, Cz, Pz derivations referred to A1 + A2. A comparison of the normalized EEG power between SEB and No-SEB events was performed with a two-sample t-test, based on a fixed-effect analysis among patients.

**Results:** At video analysis, 25 NREM arousal-related SEBs were identified. Two independent scorers classified the NREM SEB arousals as (a) “simple” (15 episodes), (b) “pseudo-REM Behavior Disorder (RBD)” (3 episodes) and (c) “confusional”-type SEBs (7 episodes). The relative power spectrum analysis showed a power reduction at 5–6 Hz at frontal, central and occipital derivations bilaterally, starting around 100 s before SEB arousals ( $p < 0.05$ ) and a power reduction at 13–14 Hz also starting 100 s before SEB arousals at Fz ( $p < 0.05$ ).

**Conclusion:** NREM arousal-associated SEBs in PD and MSA may show different semiological pattern at video-PSG analysis. Moreover, their peculiar pattern of power spectrum EEG changes seems to suggest different underlying mechanisms compared to sleepwalking or confusional arousals.

**Acknowledgement:** We thank Mr. Jean Michel Duplantier for his logistic support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.044>

### REM sleep behavior disorder following cerebrovascular stroke: a polysomnographic study in an egyptian sample

T. Asaad<sup>1</sup>, A. Azza<sup>2</sup>

<sup>1</sup>Ain Shams University, Psychiatry, Egypt

<sup>2</sup>Ain Shams University, Neurology, Egypt

**Introduction:** REM sleep behavior disorder (RBD) is a parasomnia characterized by dream enacting behavior and vivid action-filled or unpleasant dreams, and presents a risk for self injury or harm to others. It is frequently seen in patients with neurodegenerative disorders, like Parkinsonism, dementia with Lewy bodies, and multiple system atrophy. The aim of the present study is to evaluate the presence of this parasomnia in patients with cerebrovascular strokes, applying the polysomnographic criteria of diagnosis.

**Materials and methods:** 30 patients with history of cerebrovascular stroke, within the 3 months prior to assessment, are selected from those attending the outpatient neurology clinic in Ain Shams University Specialized Hospital, Cairo, Egypt. Assessment should be, at least, two weeks after the onset of stroke, to avoid the acute period of hemodynamic instability. A control group of 30 age and sex matched healthy subjects has been considered. All subjects were assessed using REM sleep behavior disorder (RBD) screening questionnaire, as well as all-night polysomnography, in addition to the routine investigations, commonly done for stroke patients.

**Results:** 16.66% of the stroke patients fulfilled the PSG criteria of RBD, compared to none of the control group. According to the diagnostic criteria, the behavior could not be explained by any other associated sleep disorder or epilepsy. The male to female ratio was 4:1, and all the strokes associated with RBD were ischemic, mostly involving subcortical or brainstem structures.

**Conclusion:** REM sleep behavior disorder (RBD) is not uncommon, after ischemic cerebrovascular strokes, especially those involving brainstem or subcortical areas. Large scale studies are needed for proper estimation of the problem and evaluation of the associated risk factors.

**Acknowledgements:** The authors would like to acknowledge all residents of the Stroke Unit in Ain Shams University Specialized Hospital, as well as Dr. Adel Marie, the sleep specialist in the Institute of Psychiatry, Ain Shams University.

<http://dx.doi.org/10.1016/j.sleep.2013.11.045>

### Screening for sleep dysfunction after traumatic brain injury

T. Mollayeva<sup>1</sup>, A. Colantonio<sup>2</sup>, S. Mollayeva<sup>3</sup>, C. Shapiro<sup>4</sup>

<sup>1</sup>University of Toronto, Graduate department of Rehabilitation Science, Collaborative Program in Neuroscience, Canada

<sup>2</sup>University of Toronto, Toronto Rehabilitation Institute, Canada

<sup>3</sup>University of Toronto, ABI Research Lab, Canada

<sup>4</sup>University of Toronto, Toronto Western Hospital, Canada

**Introduction:** Numerous studies have been conducted in the past few decades on the high prevalence of sleep disorders in individuals with traumatic brain injury (TBI). These disorders can accentuate other consequences of TBI, negatively impacting mood, exacerbating pain, heightening irritability, and diminishing cognitive abilities and the potential for recovery. Nevertheless, sleep is not routinely assessed in this population. The purpose of this review was first to review the criteria for selective screening and examine the scientific evidence regarding screening for sleep disorders post-TBI; second, to identify gaps in our knowledge that are in need of resolution.

**Materials and methods:** Papers written in English before June 2012 pertinent to the discussion on sleep after TBI, found through PubMed search.

**Results:** (1) Sleep dysfunction is highly burdensome after TBI; (2) treatment interventions for some sleep disorders result in favorable outcomes; (3) sensitive and specific tests to detect sleep disorders are available; (4) the cost-effectiveness and sustainability of screening have been determined from other populations.

**Conclusion:** The current evidence supports screening for post-TBI sleep dysfunction. This approach has the potential to improve the outcomes and reduce the risks of post-TBI adverse health and non-health effects (e.g., secondary injuries). A joint sleep and brain injury collaboration focusing on outcomes is needed to improve our knowledge.

**Acknowledgements:** The first author was supported by 2011/2012 Toronto Rehabilitation Institute Scholarship and the University of Toronto Open Award. We recognize the support of the Toronto Rehabilitation Institute Foundation and a grant to the Ministry of Health and Long Term Care to the Toronto Rehabilitation Institute. Support was also provided through the Ontario Work Study Program.

<http://dx.doi.org/10.1016/j.sleep.2013.11.046>

## Neuropsychiatric consequences in sleep breathing disorders

A. Buettner-Teleaga

*Antje Buettner-Teleaga, Institute of Tumorbiology/Albert Ludwigs University, Germany*

**Introduction:** Sleep Breathing Disorders (SBD), especially Obstructive Sleep Apnea Syndromes (OSAS) lead to a lot of physical problems like hypertension and arrhythmias and even to neuropsychiatric consequences like Brain atrophy, Depression, Anxiety and Insomnia. Apart from a multitude of physical complaints, OSAS patients suffer from Excessive Daytime Sleepiness (EDS), reduced sustained attention, limited memory processes and cognitive functions and reduced Quality of Life (QoL). The apnea related neuropsychiatric diseases could be associated with conditions interfering with the mechanisms of mental and sensory-motor plasticity.

**Materials and methods:** In our study we used neuropsychological and neuropsychiatric methods in different patient groups in a sleep laboratory. Over the past five years we have tested more than 2000 patients. During admission to the clinic, all patients were selected according to their clinical diagnosis (ICD-10) and all patients were examined neurologically, neuro-psychologically and psychiatrically. All test persons must not suffer from any severe psychiatric disorders. The study was carried out involving all groups of randomly selected patients with OSAS on a number of neuropsychiatric parameters. In this context we analyzed e.g. (1) excessive daytime sleepiness by Epworth Sleepiness Scale (ESS) and Reading Test (2) attention deficits by vigilance test Carda and Clock Test and by sustained attention test Carsim, (3) memory dysfunction by Number Connection Test (ZVT) and Benton Test, (4) psychiatric consequences (e.g. depression by BDI, anxiety by HADS) and (5) quality of life by different questionnaires (SWLS, MLDL, FOSQ, SAQLI).

**Results:** Testing of neuropsychiatric diseases, memory processes and quality of life revealed a highly significant difference between healthy persons and OSAS patients ( $p < 0.05$ ). Examination of specific domains of neuropsychiatric diseases, memory processes and quality of life showed significant differences in patients with OSAS. In all dimensions of neuropsychiatric diseases, memory processes and quality of life, untreated OSAS patients had inferior scores to those who had undergone therapy. After more than 6 weeks of nCPAP therapy, the neuropsychiatric diseases of the OSAS patients, memory processes and quality of life improved to a significant degree ( $p < 0.05$ ). Analysis of the degree of severity showed for OSAS that on the whole, there is a significant difference concerning neuropsychiatric diseases, memory processes and quality of life.

**Conclusion:** The study revealed that patients with OSAS show neuropsychiatric problems and deficits concerning their vigilance achievements, their memory processes and their quality of life. The improvement of vigilance achievements and memory processes show a lower driving fitness (traffic safety) in untreated patients and increasing traffic safety in treated patients. In summary, based on our results, it is to be said that although a continuous nCPAP therapy improves the OSAS symptoms; neuropsychiatric consequences, memory processes and the quality of life require longer-term recovery.

<http://dx.doi.org/10.1016/j.sleep.2013.11.047>

## Patients with severe/moderate asthma crisis show abnormal stanford sleepiness scale score

C. Fransolin<sup>1</sup>, K. Carlos<sup>1</sup>, D. Martins<sup>1</sup>, A. Prado<sup>2</sup>, L. Prado<sup>1</sup>, G. Prado<sup>1</sup>

<sup>1</sup>Neuro-Sono Unifesp, Brazil

<sup>2</sup>Universidade de São Paulo, Brazil

**Introduction:** Asthmatic patients have difficulty maintaining sleep due to breathing difficulty or nocturnal cough. The emergency

physician usually does not evaluate the degree of sleepiness in these patients, and there are no studies evaluating this population when they seek care in the asthmatic acute phase.

**Materials and methods:** We applied the Stanford Sleepiness Scale in 42 patients treated at the Emergency Room of the São Paulo Hospital, Escola Paulista de Medicina, Universidade Federal de São Paulo. Patients had moderate or severe asthma and SSS was applied one hour after the initial measures recommended by the Global Initiative for Asthma. We guided patients to return to the clinic for reassessment of SSS and respiratory functions. SSS was applied to patients seen in the emergency room during the morning and afternoon. We did not include patients seen at night. The SSS scores range from 1 to 8 (fully alert to sleeping). Data were analyzed through the Mann-Whitney test.

**Results:** Median SSS in 42 patients in admission was 3, and 7 had a score of 6. Thirty patients returned 7 days later for reevaluation and presented a median SSS of 1, and only 3 had scores 6. There was statistically significant reduction in SSS ( $p = 0.015$ ).

**Conclusion:** Patients with moderate/severe asthma had high scores on the SSS during their stay in the emergency room. The SSS score decreased one week after treatment of the acute phase and treatment reorientation. In this preliminary work we did not investigate the reasons for these findings, but it is possible that the patient had poor sleep at night (or nights) before the visit to the emergency room, or inflammatory mechanisms of asthma itself, or association with obstructive sleep apnea, were responsible for drowsiness. It should be noted that the evaluations were performed one hour after the initial measures (GIA), and that patients had received drugs with potential stimulating effect (beta agonist and corticosteroid).

**Acknowledgements:** Supported by FAPESP 2009/16758–4, 2010/02633–2, #2010/06188–3.

<http://dx.doi.org/10.1016/j.sleep.2013.11.048>

## Allergy as a risk factor for sleep disordered breathing

L. Oliveira<sup>1</sup>, C. Gomes<sup>2</sup>, R. Ferreira<sup>2</sup>

<sup>1</sup>Department of Pediatrics, Santa Maria Hospital-CHLN, Academic Medical Center of Lisbon, Portugal

<sup>2</sup>Pneumology Unit, Department of Pediatrics, Santa Maria Hospital-CHLN, Academic Medical Center of Li, Portugal

**Introduction:** Allergy is strongly associated with poor sleep quality, being sleep disruption and sleep disordered breathing (SDB) the most common alterations, both in asthma and allergic rhinitis (AR). Nasal obstruction and congestion are a risk factor for SDB and for its persistence after adenotonsillectomy (AT). This study aims to describe and characterize the population with respiratory allergic disease (rhinitis and asthma) referred to specialized sleep clinic for snoring and/or breathing pauses and its follow-up.

**Materials and methods:** Retrospective descriptive study, reviewing the clinical files of patients referred to our sleep clinic for SDB who had a history of asthma and/or AR from January 2008 to December 2012. Allergy was considered present if reported by the parents in child past medical history. Allergic patients represent 15.8% ( $n = 58$ ) out of the total of the children referred for SDB. Descriptive and comparative (non-parametric tests) statistics were done.

**Results:** All the 68 children files were reviewed. Male gender predominates (42; 72.4%) and the median age at first observation was 9 (3; 16) years. Most children had a regular growth (56; 96.6%). Regarding respiratory allergic disease, 15 (25.9%) children had rhinitis, 27 (46.6%) had asthma, 16 (27.6%) had both. Fourteen (24.1%) had been previously submitted to TA. Family history of atopy was frequent (24; 41.4%), as well as family history of snoring (28; 48.3%).

Most children were under allergy medication (47; 80.0%) on first observation. Of the 50 (86.2%) children who underwent polysomnography, 17 (29.3%) had a fragmented sleep, with multiple arousals; the median apnea-hypopnea index (AHI) was 0.42/h (0.00; 3.00), and the median desaturation index (DSI) was 1.42/h (0.00; 7.80). Forty (69.0%) children were referred to Ear, Nose and Throat clinic, being 18 (45.0%) of them submitted to TA. In half of these (9; 50.0%) snoring had persisted, with no difference between children with asthma or rhinitis ( $p$ -value = 0.143). Five (7.4%) children were referred to an orthodontics specialist and 1 needed CPAP.

**Conclusion:** Our review shows that allergic disease is frequent in children with SDB, even if it is not severe. In these children, snoring persists after TA in a large number of patients, being necessary to consider other therapeutic options and prolonged follow-up. Allergy should be accessed as a risk-factor in the management of sleep-disordered breathing in children.

<http://dx.doi.org/10.1016/j.sleep.2013.11.049>

### **A dentist in a sleep medicine specialist team: first results for the treatment of obstructive sleep apnea patients with oral appliances**

F. Sacchi, A. Oldani, S. Marelli, A. Galbiati, L. Ferini Strambi, M. Zucconi

San Raffaele Scientific Institute, Dept of Clinical Neurosciences, Sleep Disorders Center, Italy

**Introduction:** The effectiveness of Oral Appliances (OA) in the treatment of Obstructive Sleep Apnea (OSA) has been widely recognized during the last decades. However, the presence of dentists in sleep medicine teams is still uncommon. We aim to describe the first results of such a collaboration in an Italian Sleep Medicine Centre.

**Materials and methods:** Fifty-three patients (45 F and 8 M, age  $52 \pm 10$  ys, BMI  $26 \pm 3$ ), referred from different specialists to the Sleep Center for a suspected OSA, started a treatment for sleep disordered breathing with an OA. Patients were classified according to the Apnea-Hypopnea Index (AHI): simple snorers (AHI < 5) 15%; mild OSA ( $5 < \text{AHI} < 15$ ) 30%; moderate OSA ( $15 < \text{AHI} < 30$ ) 36%, and severe OSA (AHI > 30) 19%. Every patient was monitored by means of both objective (cardiorespiratory monitoring) and subjective parameters (Thornton Snoring Scale (TSS), Epworth Sleepiness Scale (ESS)), before starting the treatment and at the end of OA titration. We adopted a combined method for titration of OA: initial protrusion was set to 50–75% of the maximum comfortable protrusion, according to the OSA severity and temporomandibular joint condition; further titration was adjusted based on both subjective results (patient's satisfaction and possible side effects) and objective respiratory parameters. Basal and post-treatment data were compared by Wilcoxon  $t$ -test.

**Results:** In simple snorers ( $n = 8$ ), the patient's self-evaluation and his/her partner's evaluation of snoring were considered satisfactory. In OSA patients, at the end of the titration, 97.8% of patients had an AHI < 15; 90.9% had an AHI < 10, and 73.3% had an AHI < 5. The differences of mean AHI before and post-treatment were highly significant ( $23.5 \pm 18$  vs  $4.3 \pm 5$ ;  $p < 0.001$ ). Subjective parameters were also significantly improved after the treatment (TSS:  $5.3 \pm 3$  vs  $1.9 \pm 2$ ; ESS:  $9.0 \pm 5$  vs  $8.3 \pm 4$ ;  $p < 0.001$ ). Optimal results (AHI < 5) were achieved in 100% of patients with mild OSA and 89.5% with moderate OSA. Patients with severe OSA obtained less favorable results, as expected, but anyway 9/10 of them got a final AHI < 15.

**Conclusion:** In comparison with other data reported in the current literature for similar treatments, our results seem very good.

Possible reasons might be: an accurate selection of patients by the sleep team; a considerable mandibular advancement at the end of titration (mean value: 10.3 mm), carefully monitored in order to avoid side-effects; an accurate choice of the device for every individual patient or situation.

**Acknowledgements:** We thanks: P. Pozzi, MD; A.C. Ogliari, MD; S. Barbera, MD; I. Tovaglieri, MD; E. Romagnoli, DDS; L. Gigante, DDS; S. Mattiello, PhD, for sending the patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.050>

### **Safety and efficacy of upper airway stimulation in treatment of obstructive sleep apnea**

P. Strollo<sup>1</sup>, R. Soose<sup>1</sup>, K. Strohl<sup>2</sup>

<sup>1</sup>University of Pittsburgh, United States

<sup>2</sup>Case Western University, United States

**Introduction:** Moderate to severe obstructive sleep apnea (OSA) is associated with significant health risks. Continuous positive airway pressure (CPAP) can mitigate these risks, although effectiveness is frequently compromised by inadequate adherence to treatment. We hypothesized that electrical stimulation of the hypoglossal nerve would restore upper airway patency and provide an alternative treatment option for OSA. The primary aim of this study was to determine the safety and efficacy of upper airway stimulation for treatment of OSA.

**Materials and methods:** The design was a prospective, multicenter trial with randomized therapy withdrawal arm. The study enrolled participants with moderate to severe OSA who had failed or had not tolerated CPAP. All qualified participants underwent a screening polysomnographic (PSG) study, surgical consultation and drug-induced sleep endoscopy (DISE). Participants without complete concentric collapse at the retropalatal airway received an implanted neurostimulator (Upper Airway Stimulation system, Inspire Medical Systems, Minnesota). All implanted participants were followed for 12 months to collect adverse events. Therapy efficacy was evaluated by PSG and quality of life measures Epworth Sleepiness Scale (ESS) and Functional Outcomes of Sleep Questionnaire (FOSQ) at 12 months compared with baseline. The therapy withdrawal effect was evaluated by randomizing half of consecutive therapy responders at 12 months to one week of therapy suspension versus therapy maintenance followed by a PSG.

**Results:** 126 participants (21 females) received an implanted system. Average age was  $54.5 \pm 10.2$  yrs and BMI was  $28.4 \pm 2.6$  kg/m<sup>2</sup>. At 12 months, there was a significant reduction in the Apnea Hypopnea Index (AHI) from a median of 29.3 (IQR of 14.9) at baseline to 9.0 (IQR of 18.2) and the Oxygen Desaturation Index from a median of 25.4 (IQR of 17.1) to 7.4 (IQR of 17.0). The ESS and FOSQ also showed significant improvement from pre-implant to 12 months. The therapeutic effect of stimulation was also confirmed at 12 months with a significant increase in AHI in the therapy withdrawal arm vs. no change in the therapy maintenance arm.

**Conclusion:** Upper airway stimulation is effective for the treatment of moderate to severe OSA with clinically and statistically significant improvement in objective and subjective measurements of OSA severity.

**Acknowledgements:** Funding source: Inspire Medical Systems, Minnesota; ClinicalTrials.gov number, NCT01161420.

<http://dx.doi.org/10.1016/j.sleep.2013.11.051>

### Circulating FABP4 and subclinical atherosclerosis in obstructive sleep apnea syndrome

R. Català<sup>1</sup>, A. Cabré<sup>2</sup>, R. Ferré<sup>2</sup>, S. Sangenis<sup>1</sup>, S. Hernández Flix<sup>1</sup>, L. Masana<sup>2</sup>

<sup>1</sup>Sleep Disorders Unit, Respiratory Department, "Sant Joan" University Hospital, Universitat Rovira i Virgili, IISPV, Reus, Spain

<sup>2</sup>Research Unit on Lipids and Atherosclerosis, Vascular Medicine and Metabolism Unit, Spanish Biomedical Research Centre in Diabetes and Associated Metabolic Disorders (CIBERDEM), "Sant Joan" University Hospital, Universitat Rovira i Virgili, IISPV, Reus, Spain

**Introduction:** Obstructive sleep apnea (OSA) is associated with high cardiovascular risk. Carotid intima-media thickness (cIMT) is a surrogate marker of subclinical atherosclerosis. Circulating adipocyte fatty acid-binding protein (FABP4) levels have been associated with metabolic alterations and increased cardiovascular morbidity. Our aim was to evaluate circulating FABP4 concentrations and cIMT in OSA patients.

**Materials and methods:** We included 125 participants, aged 18–75, referred by suspected OSA to our Sleep Disorders Unit. OSA was assessed by overnight polysomnography (PSG). Circulating FABP4 levels were determined by ELISA and cIMT was measured by ultrasonography.

**Results:** Circulating FABP4 levels were higher in the presence of OSA ( $25.8 \pm 9.7$  vs.  $19.1 \pm 7.9$   $\mu\text{g/l}$ ,  $p = 0.003$ ) and according to OSA severity (overall  $p = 0.017$ ). The presence of atheromatous carotid plaque as well as cIMT mean values were both higher in OSA compared to non OSA participants (48% vs. 2%,  $p = 0.004$  and  $665.4 \pm 120.1$  vs.  $581.3 \pm 78.1$   $\mu\text{m}$ ,  $p = 0.005$ , respectively). cIMT did not differ between OSA severity groups. Moreover, FABP4 levels were positively correlated with cIMT ( $r = 0.341$ ,  $p < 0.001$ ).

**Conclusion:** FABP4 is associated to OSA presence and severity. FABP4 is a biomarker of metabolic comorbidities in OSA patients. The carotid ultrasonography in these patients can reliably report of the precociousness of arteriosclerotic phenomenon. However, more studies are needed before this technique is widespread in our sleep units.

**Acknowledgements:** SOCAP, SEPAR and CIBERDEM.

<http://dx.doi.org/10.1016/j.sleep.2013.11.052>

### Cognitive training improves sleep quality and cognitive function among older adults with insomnia

I. Haimov, E. Shatil

Yezreel Academic College, Department of Psychology and the Center for Psychobiological Research, Israel

**Introduction:** Background: Insomnia is a sleep disorder frequently observed in older persons. Along with the changes in sleep structure accompanying the ageing process, ageing is also associated with cognitive impairment. In view of the findings showing that sleep during the night is critical in the consolidation of previously acquired memory traces, we hypothesized that intensive new learning experience provided by systematic cognitive training will act as a catalyst to change sleep architecture and by doing so will improve sleep quality among older adults with insomnia. Furthermore, we posited that if that learning specifically targets cognitive function, older people with insomnia will also exhibit improved cognitive performance. Thus, the present study examined the impact of cognitive training on sleep quality and cognitive performance among older adults with insomnia.

**Materials and methods:** Fifty-one older adults with insomnia (22M/29F; mean age:  $72.13 \pm 5.1$ ) were randomized into two groups: a cognitive training group ( $n = 34$ ) and an active control group ( $n = 17$ ). The participants in the cognitive training group completed an eight-week, home-based, personalized, computerized cognitive training program, while the participants in the active control group completed an eight-week, home-based program involving computerized tasks that do not engage high-level cognitive functioning. Before and after training, all participants' sleep was monitored for one week by an actigraph and their cognitive performance was evaluated.

**Results:** Mixed models for repeated measures analysis showed between-group improvements for the cognitive training group on both sleep quality (sleep onset latency and sleep efficiency:  $F_{1,51} = 5.49$ ,  $P < 0.05$ ;  $F_{1,51} = 6.86$ ,  $P < 0.05$ , respectively) and cognitive performance (avoiding distractions, working memory, visual memory, general memory and naming:  $F_{1,36} = 5.18$ ,  $P < 0.05$ ;  $F_{1,35} = 13.92$ ,  $P < 0.001$ ;  $F_{1,35} = 14.03$ ,  $P < 0.001$ ,  $F_{1,35} = 15.65$ ,  $P < 0.001$ ;  $F_{1,35} = 9.65$ ,  $P < 0.01$  respectively). Moreover, hierarchical linear regressions analysis indicated correlation between the improvement in cognitive function and those in sleep quality.

**Conclusion:** Cognitive training may be beneficial in the initiation and maintenance of sleep among older adult insomniacs. Cognitive training may be used as a novel non-pharmacological alternative to improve the sleep quality of older adults suffering from insomnia. The present study constitutes pioneering work in this field among older adults with insomnia.

**Acknowledgements:** The authors thank Paula S. Herer for assisting in the statistical analysis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.053>

### Is insomnia treatment superior to depression treatment for patients with both diagnoses? – Results of a randomized controlled trial

K. Blom, S. Jernelöv, M. Kraepelien, N. Lindefors, V. Kaldo  
Karolinska Institute, Department of Clinical Neuroscience,  
Division of Psychiatry, Sweden

**Introduction:** Patients with comorbid insomnia and depression are primarily treated for depression. Recent research indicates that this is not sufficient to cure insomnia and that untreated insomnia hinders full recovery from depression and increases risk for relapse. This trial compares treatment effects when patients with both diagnoses receive treatment for either insomnia or depression.

**Materials and methods:** Participants ( $n = 43$ ) were recruited via media, and randomized to guided Internet-delivered cognitive behavior therapy (ICBT) for either insomnia or depression. Primary outcome measures were symptom self-rating scales (Insomnia Severity Index, ISI, and the Montgomery Åsberg Depression Rating Scale, MADRS-S), assessed before and after treatment with follow-up after 6 and 12 months. The participants' self-rated need for further treatment after completion of ICBT was also investigated.

**Results:** The insomnia treatment was significantly more effective than the depression treatment in reducing insomnia severity ( $p < .05$ ), and equally effective in reducing depression severity. The largest between group effect (Cohen's  $d$ ) was found at 6 months with 0.72 for ISI. Post treatment, participants receiving treatment for insomnia had significantly less self-rated need for further insomnia treatment ( $p < .001$ ) than participants receiving treatment for depression. The need for further depression treatment was similar in both groups.

**Conclusion:** This study indicates that for patients with both diagnoses, treatment with cognitive behavior therapy (CBT) for insomnia may overall be more effective than CBT for depression. Ideally, efforts to treat both conditions should be made.

**Acknowledgements:** This project was funded by the regional agreement on medical training and clinical research (ALF) between Stockholm County Council and Karolinska Institutet, Söderström-Königskas Foundation, KI funds and AFA Sickness Insurance Research Fund.

<http://dx.doi.org/10.1016/j.sleep.2013.11.054>

### Impact of comorbidity on insomnia treatment response following cognitive-behavior therapy, behavior therapy, and cognitive therapy

L. Bélanger<sup>1</sup>, A. Harvey<sup>2</sup>, É. Fortier-Brochu<sup>1</sup>, S. Beaulieu-Bonneau<sup>1</sup>, P. Eidelman<sup>2</sup>, L. Talbot<sup>2</sup>

<sup>1</sup> Université Laval, Centre Hospitalier Universitaire de Québec, Canada

<sup>2</sup> University of California at Berkeley, University of California at Berkeley, United States

**Introduction:** There is a strong evidence-base on the efficacy of cognitive behavior therapy (CBT) for insomnia. Despite high comorbidity rates between insomnia and some anxiety and mood disorders, much less is known about impact of comorbidity on insomnia treatment response. The aim of the present study was to examine whether comorbid anxiety or mood disorders modulate response to insomnia treatment. As the data were derived from a larger study evaluating the unique contribution of behavior therapy (BT) and cognitive therapy (CT) relative to full CBT, we also examined modulating effects of comorbidity within each single treatment condition.

**Materials and methods:** Participants were 188 adults (117 women; M age = 47.4 years, SD = 12.6) meeting DSM-IV-TR diagnostic criteria for chronic insomnia (M duration: 14.5 years, SD: 12.8). Forty-five participants (23.9%) also met criteria for an anxiety or mood disorder (major depression, dysthymia, GAD, Panic Disorder). Participants were randomized to one of three treatment groups, BT ( $n = 63$ ), CT ( $n = 65$ ), CBT ( $n = 60$ ), stratified according to gender and presence of comorbidity. Treatment consisted of eight, weekly, individual sessions delivered by registered psychologists. Outcome measures were insomnia severity, measured by the Insomnia Severity Index (ISI) and usual sleep parameters derived from daily sleep diaries, and proportion of treatment responders (decrease of ISI score  $\geq 8$ ) and remissions (ISI score  $< 8$ ). The BDI-II and STAI were also used to monitor depression and anxiety levels.

**Results:** In the CBT condition, proportions of treatment responders or remissions were not significantly different between subgroups of individuals with and without comorbidity, and there were very few significant group differences on sleep parameters. Proportion of treatment responders was significantly lower in the comorbidity groups in both BT (81.6% vs 34.4%;  $p = 0.007$ ) and CT (57.6% vs 23.6%;  $p = 0.02$ ) conditions, but remission rates were not significantly different, nor were mean pre-post ISI change scores. The comorbidity group's pre- post change scores on the STAI ( $-9.2$  vs  $-2.5$ ;  $p = .01$ ) and BDI ( $-10.6$  vs  $-3.9$ ;  $p < 0.001$ ) were significantly greater relative to insomnia group without comorbidity group in the CBT condition but not in the other conditions.

**Conclusion:** There is a widespread assumption that psychiatric disorders comorbid to insomnia need to be addressed in order for sleep to improve. The present data suggest otherwise with respect to full CBT, as the presence of comorbid anxiety or unipolar depressive disorders do not appear to negatively impact treatment response. These

results may have important clinical implications as they suggest that comorbidity does not represent a contraindication to insomnia treatment. These results need to be replicated with larger comorbidity samples.

**Acknowledgements:** This project was supported by National Institute of Mental Health Grant RO1MH079188.

<http://dx.doi.org/10.1016/j.sleep.2013.11.055>

### Insomnia treatment in the third trimester of pregnancy prevents postpartum depression: a randomized clinical trial

M. Tahmasian<sup>1</sup>, H. Khazaie<sup>2</sup>, M. Ghadami<sup>2</sup>, D. Knight<sup>3</sup>, F. Emamian<sup>2</sup>

<sup>1</sup> Sleep Research Center, Department of Psychiatry, Kermanshah University of Medical Sciences(KUMS), Iran

<sup>2</sup> Sleep Research Center, Department of Psychiatry, Farabi Hospital, Kermanshah University of Medical Sciences(KUMS), Iran

<sup>3</sup> Department of Psychology, University of Alabama at Birmingham, Birmingham, United Kingdom

**Introduction:** Mental health is an important medical issue in perinatal care, and there is increasing evidence that insomnia during pregnancy is associated with postpartum depression (PPD). Therefore, the present study evaluated the effect of insomnia treatment during the third trimester of pregnancy on PPD symptoms.

**Materials and methods:** Fifty-three pregnant women with insomnia were randomly assigned to trazodone, diphenhydramine, or placebo treatment. Sleep quality was measured by actigraphy at baseline, and after 2 and 6 weeks of treatment. In addition, depression was assessed 2 and 6 weeks after delivery.

**Results:** Trazodone and diphenhydramine improved sleep quality compared to placebo after 6 weeks of treatment. Further, depressive symptoms were reduced 2 and 6 weeks after delivery in trazodone and diphenhydramine groups compared to placebo. No differences in depressive symptoms were observed between the trazodone and diphenhydramine groups.

**Conclusion:** These findings indicate that insomnia treatment with trazodone or diphenhydramine during the third trimester of pregnancy may prevent PPD.

**Acknowledgements:** This study was supported by a grant from Department of Research, Kermanshah University of Medical Sciences (Research No. 86014). We want to thank Ambulatory Monitoring, Inc. (Ardsley, New York) for their technical assistance and lending us actigraphy equipment.

<http://dx.doi.org/10.1016/j.sleep.2013.11.056>

### Peripheral hypoxia in patients with restless legs syndrome

A. Salminen<sup>1</sup>, O. Polo<sup>2</sup>

<sup>1</sup> University of Tampere, School of Medicine, University of Tampere, Finland

<sup>2</sup> Tampere University Hospital, Department of Respiratory Medicine, Finland

**Introduction:** Previous studies suggest that restless legs syndrome (RLS) may be associated with hypoxia in the skeletal muscles: biopsies have shown VEGF upregulation (Wählin-Larsson 2009) and structural analysis of the muscle revealed high capillary tortuosity (Larsson 2007). In this study we measured oxygen and carbon dioxide partial pressure (pO<sub>2</sub> and pCO<sub>2</sub>) in the legs of RLS patients and controls in order to evaluate the peripheral hypoxia suggested by these studies more directly.

**Materials and methods:** A total of 18 subjects (9 patients and 9 age and sex-matched controls) were included in the study. The tissue pO<sub>2</sub> and pCO<sub>2</sub> were estimated by transcutaneous measurements on the instep of the foot and on the chest. The measurements were performed in the evening, during two repeated suggested immobilization tests (SIT), two and four hours before bedtime. RLS patients went through the measurements once without medication and a second time with dopaminergic therapy. At the same time, arterial oxygen saturation (SaO<sub>2</sub>) was measured from the toe.

**Results:** The mean tissue pO<sub>2</sub> during SIT was lower in the legs of RLS patients than controls (5.1 kPa vs. 7.4 kPa,  $p < 0.05$ ). The oxygen gradient from chest to foot ( $=pO_2(\text{chest})-pO_2(\text{foot})$ ) was higher in RLS compared to controls (3.5 kPa vs. 1.5 kPa,  $p < 0.05$ ). The oxygen gradient showed a strong positive correlation with IRLSSG severity score (Pearson's  $r = 0.570$ ). Dopaminergic therapy resolved the hypoxia, raising the pO<sub>2</sub> of the legs almost to the level of the control patients (pO<sub>2</sub> = 6.4 kPa,  $p < 0.05$ ). There was no significant difference in SaO<sub>2</sub> or pCO<sub>2</sub> measures.

**Conclusion:** Our results confirm that there is a significant peripheral hypoxia in the legs of RLS patients during the symptomatic period. Control subjects showed normal oxygen levels. The strong positive correlation with RLS severity suggests that the leg hypoxia could be a major factor in RLS pathophysiology. The finding that dopaminergic therapy abolishes both the symptoms and the hypoxia may suggest that the site of action of dopamine in RLS is in the periphery.

**Acknowledgement:** The study was supported by Tuberculosis Foundation of Tampere, Finland.

<http://dx.doi.org/10.1016/j.sleep.2013.11.057>

### PTPRD expression regulates sleep consolidation in *Drosophila*

A. Freeman<sup>1</sup>, D. Rye<sup>1</sup>, S. Sanyal<sup>2</sup>

<sup>1</sup>Emory University, Department of Neurology, United States

<sup>2</sup>Biogen Idec, United States

**Introduction:** Restless legs syndrome/Willis-Ekbom Disease (RLS/WED) is a common sleep disorder, yet its underlying pathophysiology is poorly understood. Genome-wide association studies (GWAS) point to allelic variants in multiple genes that confer susceptibility to RLS/WED. They offer potential insights into molecular pathways that govern expressivity of symptoms and signs. We used *Drosophila melanogaster* to explore sleep related physiology of two genes harboring at-risk alleles for RLS which also have highly conserved fly homologs, BTBD9 and PTPRD. Here, we complement our recent report of RLS phenotypes in BTBD9 mutants by exploring whether similar phenotypes exist in PTPRD mutants and probe whether sleep phenotypes are mimicked by dual mutants (i.e., suggesting a common molecular pathway) or are more severely disrupted (i.e., consistent with parallel pathways).

**Materials and methods:** Sleep phenotypes resulting from mutations in the fly homolog of PTPRD (dLar) were assayed with the *Drosophila* Activity Monitor. Flies transgenic for either mutated or wild-type dLar protein allowed for cell-specific manipulation of expression levels. The impact of combined dLar and BTBD9 mutations on sleep architecture was also assessed.

**Results:** Disruption of dLar/PTPRD expression in flies yielded viable, hyperlocomotive animals. dLar mutants exhibit sleep fragmentation and increased wake after sleep onset similar to that observed in BTBD9 mutant flies, the latter of which bears close resemblance to human RLS. The magnitude of fragmentation, as measured by sleep bout number and average sleep bout length, was not further increased by introduction of BTBD9 mutations into

the dLar mutant background. Neuron specific expression of dLar constructs, using the GAL4-UAS system, yielded disrupted sleep consolidation similar to whole animal dLar mutants.

**Conclusion:** These results further validate GWAS as a hypothesis independent means to delineate the molecular pathophysiology underlying RLS/WED. While the role of PTPRD in neuronal development and plasticity has been studied previously in flies, this is the first exploration of its function in the context of sleep and, more specifically, RLS/WED. Our results suggest neuronal PTPRD expression regulates sleep architecture and most likely operates in a molecular pathway that also includes BTBD9. Ongoing efforts to delineate the mechanistic basis of sleep regulation by PTPRD and BTBD9 are underway.

**Acknowledgements:** Supported by RLS Foundation, Sleep Research Society, and Emory Neuroscience Initiative grants to S.S.

<http://dx.doi.org/10.1016/j.sleep.2013.11.058>

### Activity and sleep in a mouse model of Parkinson disease

I. Zavalko<sup>1</sup>, Y. Ukraintseva<sup>2</sup>, A. Manolov<sup>3</sup>, V. Dolgikh<sup>4</sup>, V. Dorokhov<sup>3</sup>, V. Kovalzon<sup>4</sup>

<sup>1</sup>Institute for Bio-Medical Problems, RAS, Russia

<sup>2</sup>Institute of Higher Nervous Activity/Neurophysiology, RAS, Russia

<sup>3</sup>Higher Nervous Activity/Neurophysiology, RAS, Russia

<sup>4</sup>Severtsov Institute Ecology/Evolution, RAS, Russia

**Introduction:** The search for early markers of Parkinson's disease (PD) is one of the most important problems in the struggle against neurodegenerative illnesses. It is well known that large set of sleep-wake disorders occur with PD, including RBD, daytime sleepiness, night sleep disturbance etc. The nature of these is generally unknown. Not infrequently such disorders appear several years (up to 20 years) before motor symptoms of PD. Recently, a new murine model of early stages of PD has been developed [Ugrumov et al., Neuroscience 181 (2011) 175–188]. In this model, two successive subcutaneous injections in C57 black mice (with 2-h interval) of 12 mg/kg MPTP (specific neurotoxin of dopamine neurons) serve to imitate two weeks later pre-clinical PD, and four injections early clinical forms of PD.

**Materials and methods:** A group of mice with preliminary implanted (under general anesthesia) electrodes for cortical EEG and nuchal EMG after a period of postoperative rest and adaptation to recording conditions was subjected to continuous 24-h video and digital polysomnographic recording in individual experimental chambers with 12/12 light/dark schedule, constant temperature (24–26°C) and food and water ad lib. After the baseline recording of video-tracking activity and sleep-wake EEG, mice were injected with 24 or 48 mg/kg b.w. of MPTP. Control group was injected with a saline. The recordings were continued for 2 more weeks.

**Results:** A significant increase in activity and decrease in slow wave sleep (SWS) percentage during the dark period (–25%) as compared to baseline and control recording (100%) was found. The effect was seen just at the 7th day following MPTP administration and became significant by the 14th day. The effect was more pronounced after 48 mg/kg injection than after 24. There was no change in paradoxical sleep (PS). Also, there were no changes either in SWS or PS during the light period. The reason for this increasing activity and diminished SWS level during the dark period in MPTP-treated mice is under study now.

**Conclusion:** The reason for this increasing activity and diminished SWS level during the dark period in MPTP-treated mice is under study now.

*Acknowledgements:* The study was supported by the RFFI/RFBR Grant No. 13–04–00327.

<http://dx.doi.org/10.1016/j.sleep.2013.11.059>

### **Hyperactivity and alterations in iron homeostasis in mu opioid receptor knockout mice: possible implications for restless legs syndrome/Willis-Ekbom disease**

M. De Andrade<sup>1</sup>, E. Unger<sup>2</sup>, L. Zhang<sup>3</sup>, F. Yokoi<sup>1</sup>, A. Walters<sup>4</sup>, Y. Li<sup>1</sup>

<sup>1</sup> University of Florida, United States

<sup>2</sup> Pennsylvania State University, United States

<sup>3</sup> University of Alabama at Birmingham, United States

<sup>4</sup> Vanderbilt University, United States

*Introduction:* Restless legs syndrome (RLS), also known as Willis-Ekbom disease, is a neurological disorder that is manifested generally at rest by an urge to move and is often accompanied by unpleasant sensations in the legs. Studies have demonstrated that the degree of opioid receptor binding is inversely proportional to the severity of RLS symptoms and there is a decrease in thalamic beta-endorphin and met-enkephalin, which are endogenous opioid peptides, in RLS patients. Furthermore,  $\mu$ -opioid receptor agonists have been used to treat RLS patients. In this study we examined the relevance of the mu opioid receptor to RLS.

*Materials and methods:* To test the hypothesis that the  $\mu$ -opioid receptor plays a role in RLS pathophysiology we have taken advantage of a previously generated  $\mu$ -opioid receptor knockout (KO) mouse. We analyzed the KO mice for RLS-like phenotypes, including spontaneous activity levels, voluntary wheel running levels during the day and night, and sleep structure. Additionally, we measured the levels of neurotransmitters and their metabolites in the striatum using high performance liquid chromatography. Lastly, we examined the KO mice and mice treated with a potent irreversible antagonist for the  $\mu$ -opioid receptor for alterations in iron homeostasis in the brain, liver, spleen, and serum using atomic absorption spectroscopy, colorimetric assays, and Western blot analysis.

*Results:* We have found that mice deficient for the  $\mu$ -opioid receptor have increased wheel running activity during the rest phase, parallel to human RLS. Furthermore, we have found that loss of the  $\mu$ -opioid receptor or pharmacological blockade of the mu opioid receptor using an antagonist leads to alterations in iron homeostasis in the periphery, in particular in the serum and spleen. However, we did not observe any alterations in the dopaminergic, serotonergic, or iron systems in the striatum of the  $\mu$ -opioid receptor KO mice.

*Conclusion:* Taken together, while the  $\mu$ -opioid receptor knockout mice do not match human RLS perfectly, they do have sleep period hyperactivity as expected of an animal model of RLS. Furthermore, the data suggest an interesting role of the mu opioid receptor in iron homeostasis that will need to be investigated in detail in future studies.

*Acknowledgements:* We thank Chad C. Cheetham, Atbin Doroodchi, Miki Jinno, Ning Peng, and J. Michael Wyss for their technical assistance and stimulating discussions. This work was supported by the National Institutes of Health (grants NS37409, NS47466, NS47692, NS54246, NS57098, NS65273, NS72872 and NS74423) and startup funds from the Departments of Neurology at UAB and UF.

<http://dx.doi.org/10.1016/j.sleep.2013.11.060>

### **Sleep onset delay and night awakenings in preschool children: the Generation XXI birth cohort**

A. Costa, H. Barros, A. Santos

Department of Clinical Epidemiology, Predictive Medicine and Public Health, University of Porto Medical School, Porto, Portugal

Institute of Public Health, University of Porto (ISPUP), Porto, Portugal

*Introduction:* Previous studies have shown that sleep onset delay and night awakenings are frequent in childhood and are associated with negative effects on children's development. However, associations between maternal and children's characteristics and these sleeping problems in young children remain unclear. Thus, we aimed to estimate the prevalence of sleep onset delay and night awakenings in preschool ages and their main associated factors.

*Materials and methods:* This study based in a Portuguese population-based birth cohort, Generation XXI, included 5631 singleton children, with 4/5 years of age. Data on demographic and socioeconomic characteristics, children's health, daytime activities and sleeping habits were collected using structured questionnaires. Sleep onset delay was defined when children experienced difficulty in falling asleep in 20 min and night awakenings were considered when occurred at least once every night. Odds ratios and respective 95% confidence intervals (CI) were estimated using multivariate unconditional logistic regression.

*Results:* Sleep onset delay and night awakenings were identified in 28.8% (95%CI: 27.6–30.0) and 15.1% (95%CI: 14.2–16.1) of the children, respectively. Both sleeping problems were more frequent in younger ages but no differences were observed regarding sex. Sleep onset delay was inversely associated with maternal age and educational level and presence of siblings in the household. It was more frequent in children with rhinitis and allergy diagnosis, with longer screen-based media use, in children that took naps in the afternoon, who slept in the parents' bedroom and who needed a relative's presence at bedtime and reading stories before fall asleep. Night awakenings were associated with unemployed mothers, rhinitis diagnosis, overweight and obesity, napping in the afternoon, a relative's presence at bedtime and were less frequent in children with single, divorced or widow mothers and with higher family income. Longer maternal sleep duration was inversely associated with both sleep problems.

*Conclusion:* Sleep onset delay and night awakenings are common conditions in preschool children. This study showed that sleeping problems in this age strata are linked to a multi-factorial set of maternal and children's characteristics. Due to the modifiable characteristic of most of these associated features, early interventions can promote adequate sleeping patterns, with gains in children's development.

*Acknowledgements:* This work was supported by the Portuguese Foundation for Science and Technology (F- COMP-01–0124-FEDER-01108; PTDC/SAU- ESA/105033/2008). We want to thank all members of the research team and staff of Generation XXI for their essential daily work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.061>

### **SLEEP patterns at 6 months and at 4/5 years of age in a portuguese birth cohort**

M. Gonçalves<sup>1</sup>, A. Rute<sup>1</sup>, A. Costa<sup>1</sup>, M. Severo<sup>2</sup>, C. Guilleminault<sup>3</sup>, H. Barros<sup>1</sup>

<sup>1</sup> Department of Clinical Epidemiology, Predictive Medicine and Public Health, University of Porto Medical School, Porto, Portugal

<sup>2</sup> Institute of Public Health, University of Porto (ISPUP), Porto, Portugal

<sup>3</sup> Stanford University Sleep Disorders Clinic, Stanford, USA

**Introduction:** Sleep/wake patterns are recognized to be established early in life, namely during the first year of life. In this study we were specifically interested in identifying infant sleep patterns at 6 months and 4/5 years of age, and their association.

**Materials and methods:** This study included 1092 singleton children of the Portuguese population-based birth cohort Generation XXI, evaluated at 6 months and at 4/5 years of age by face-to-face interview, with data on sleep habits. Sleep patterns were constructed through latent class analyses and included data at both ages on afternoon naps, waking hour, bedtime hour, and locale of night-time sleep and night awakenings. The number of latent classes was identified by the Bayesian information criteria (BIC).

**Results:** Globally, at 6 months of age, 39.7% napped more than 2.0 h in the afternoon, 45.0% go to bed from 10.0 pm and 42.8% wake up between 7.0 and 8.0 am. Also, at 6 months of age only 18.7% of the children sleep in their own bedroom at night (alone or with siblings) and 27.7% wake up more than 2 times per night 3 or more times per week. At 4/5 years of age, 39.3% of the children did not nap during the afternoon, 57.8% go to bed between 9.0 and 10.0 pm and 54.7% wake up between 7.0 and 8.0 am. At these ages, 73.3% of the children sleep in their bedroom (alone or with siblings) and 15.2% wake up at least once by night. Further, the BIC supports a subdivision in two classes (BIC = 21856.291). The first class ( $n = 574$ , 52.6%) is mainly characterized by earlier bedtime and waking hours and sleeping in the child's bedroom (alone or with siblings) at 6 months and at 4/5 years of age. On the contrary, the second class ( $n = 518$ , 47.4%) presented at both ages, later bedtime and waking hours, and the lowest prevalence of sleeping in their own room.

**Conclusion:** In childhood, sleep patterns are mainly determined by bedtime hour, wake-up hour and the place where night-time sleep occurs. This pattern is influenced by sleep patterns noted during the first months of age which highlights the importance of parental behaviors particularly those related to bedtime interactions and soothing routines for infant sleep.

**Acknowledgements:** We would like to thank to all members of the research team and staff of Generation XXI for their essential daily work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.062>

### **CHILD SLEEP – The Finnish birth cohort study: the effect of maternal sleep during pregnancy on a newborn wellbeing and a mother's labor experience**

O. Saarenpää-Heikkilä<sup>1</sup>, U. Lehto<sup>2</sup>, A. Kylliäinen<sup>3</sup>, T. Stenberg<sup>4</sup>, T. Paunio<sup>5</sup>, J. Paavonen<sup>6</sup>

<sup>1</sup> Pediatric Clinics, Tampere University Hospital, Finland

<sup>2</sup> National Institute for Health and Welfare, Finland

<sup>3</sup> University of Tampere, Finland

<sup>4</sup> University of Helsinki, Finland

<sup>5</sup> National Institute for Health and Welfare, University of Helsinki, Finland

<sup>6</sup> National Institute for Health and Welfare, Helsinki University Hospital, Finland

**Introduction:** Maternal sleep disturbances and mood disorders during the pregnancy are significant stress factors that might be related to newborn wellbeing. Our aim was to study whether maternal sleep or mood disturbances during pregnancy have an impact on

(1) child wellbeing after the delivery or (2) on mother's subjective experience of labor.

**Materials and methods:** The study is based on the CHILD SLEEP - cohort that was set up during 2011–2012 in Tampere, Finland. It consists of 1678 families (1678 mothers, 1645 fathers). The parents filled during the third trimester several standardized questionnaires on sleep quality and symptoms of depression and anxiety (i.e. BNSQ, CESD, STAI and PSS). After the delivery, the course of the labor (incl. Apgar scores, birth weight, height, duration of labor), as well as maternal labor experiences were evaluated using a 7-point VAS-scale in an interview. Multivariate logistic regression models were performed to describe prenatal factors related to negative birth outcomes and labor experience.

**Results:** Difficulties to fall asleep during pregnancy were reported by 14.2% of the mothers, too early awakenings by 10.8%, and poor sleep quality by 27.4%. Nocturnal awakenings were very common (94.9%), and awakenings three or more times per night were reported by 37.1%. Snoring every night was reported by 8.9%. A quarter of the women (25.6%) reported sleeping much worse during pregnancy than before. Low Apgar scores ( $\leq 8$ ) at five minutes after the delivery were found in 9.8% of the babies. Mothers' depressiveness with insomnia was related to low Apgar scores when birth weight, anxiety and prenatal stress were controlled (AOR 5.1, 95% CI 1.3–20.0;  $p = 0.021$ ). Maternal depressiveness during pregnancy was directly related to negative labor experience (AOR 1.8, 95% CI 1.1–3.0;  $p = 0.020$ ) and symptoms of depression with insomnia to inadequate pain relief during the labor (AOR 4.2, 95% CI 1.2–15.4;  $p = 0.029$ ).

**Conclusion:** Mother's depressiveness and poor sleep quality during pregnancy were associated with low Apgar scores of the baby at the age of five minutes and negative labor experience.

**Acknowledgements:** We are grateful to Dr. Hannu Turunen for his help in establishing the data base.

<http://dx.doi.org/10.1016/j.sleep.2013.11.063>

### **SLEEP cyclic alternating pattern (CAP) changes from school-age to adolescence in healthy subjects**

R. Chamorro<sup>1</sup>, R. Ferri<sup>2</sup>, C. Algarín<sup>1</sup>, B. Lozoff<sup>3</sup>, P. Peirano<sup>1</sup>

<sup>1</sup> Sleep laboratory, INTA, University of Chile, Chile

<sup>2</sup> Sleep Research Center, Dept. of Neurology IC, OASI Institute, Italy

<sup>3</sup> Center for Human Growth & Development, University of Michigan, United States

**Introduction:** Cyclic Alternating Pattern (CAP) is a well recognized process underlying sleep instability. CAP organization has been reported in several age-groups, but follow-up data in healthy children or adolescents is scarce. Objective: To assess sequential changes in CAP characteristics from school-age to adolescence in the same group of healthy subjects.

**Materials and methods:** We studied a sample of 45 healthy school-age children. All were participants in an ongoing cohort follow-up study since infancy. PSG recordings were performed at 10 years and repeated in adolescence. CAP was visually identified in non-REM sleep stages S1, S2 and SWS, according to international rules.

**Results:** The age of the subjects was  $10.3 \pm 0.2$  and  $15.6 \pm 0.5$  years at the time of the two assessments. CAP number, CAP rate, CAP duration but not CAP time were positively correlated between 10 and 15 years (all  $p < 0.05$ ). Between-age differences were as follows: an increase in CAP time ( $145.8 \pm 44.0$  vs.  $183.6 \pm 53.7$  min.,  $p < 0.0001$ ), CAP rate ( $41.9 \pm 11.6$  vs.  $47.5 \pm 12.0\%$ ,  $p < 0.01$ ), A3 percentage ( $18.3 \pm 9.8$  vs.  $27.4 \pm 10.7$ ,  $p < 0.0001$ ), A3 index ( $9.0 \pm 5.1$  vs.  $16.9 \pm 8.1$ ,  $p < 0.0001$ ), and a

decrease in A1 percentage ( $68.2 \pm 13.3$  vs.  $59.7 \pm 12.1$ ,  $p < 0.002$ ). We also found a lengthening of CAP cycles with a shortening of the B phase (both  $p < 0.03$ ). According to sleep stages, an increase in CAP rate and A1 index was apparent in SWS, whereas A1 index was decreased in S1 and S2 (all  $p < 0.004$ ). Finally, A3 index resulted higher in all non-REM sleep stages (all  $p < 0.004$ ).

**Conclusion:** These preliminary data show several changes in CAP parameters between 10 and 15 years. Given that the main modifications with advancing age were an increase in A3 and a reduction in A1 CAP subtypes, they provide support for a reduction in sleep stability towards adolescence in healthy subjects.

**Acknowledgements:** Financial support: Fondecyt 1110513 and NIH HD33487 grants. (\*) CONICYT PhD program fellowship.

<http://dx.doi.org/10.1016/j.sleep.2013.11.064>

### THE diagnosis and management of clinically significant central sleep apnea in infants with prader-willi syndrome

M. Cohen, J. Hamilton, I. Narang

Hospital for Sick Children, The University of Toronto, Canada

**Introduction:** Sleep related disordered breathing (SRDB) is common in pediatric Prader-Willi syndrome (PWS), however little is known regarding SRDB and their management in infants with PWS. SRDB has been suggested as a risk factor for sudden death in PWS patients treated with growth hormone (GH) and sleep surveillance is recommended prior to GH treatment. We aimed to describe the patterns of SRDB in infants with PWS and the management of central sleep apnea in this population. Furthermore, we sought to compare the nature of sleep disorders between infants and children with PWS.

**Materials and methods:** Overnight polysomnogram (PSG) studies performed in GH naïve infants and children between the years 2005–2013 were reviewed. Age, sex, body-mass-index z-score, sleep latency and efficiency, sleep stage percentages, apnea-hypopnea and central apnea indexes, oxygen saturation and carbon dioxide tension were determined. Results were analyzed separately and then compared between infants 0–2 years of age and children  $\geq 2$  years of age. Occurrence of 5 or more central sleep apneas per hour was considered clinically significant and an indication for nocturnal supplemental oxygen. The utility of this treatment was evaluated.

**Results:** Data from 44 patients were assessed, 23 infants and 21 children. Median age 1.9 years (0.3–15.6), mean BMIz-score  $1.3 \pm 2.1$ . Overall SRDB were common occurring in 74% of patients, including sleep apnea and hypoxia. Infants demonstrated a distinct pattern of sleep disorders compared with older children ( $p = 0.008$ ); they were more likely to have central sleep apnea (48% vs. 14%;  $p = 0.017$ ) and less likely to experience obstructive sleep apnea (9% vs. 43%;  $p = 0.009$ ). Nine infants were treated with nocturnal supplemental oxygen. With oxygen therapy, there was a significant decrease in the central apnea index from a median of 14 (5,68) to 1 (0,6;  $p = 0.008$ ) and a trend towards improvement in the oxygen saturation nadir from 70% (52, 92) to 81% (64,95;  $p = 0.080$ ). There was no corresponding hypercapnic response.

**Conclusion:** Infants with PWS have unique patterns of SRDB when compared with older children. CSA predominated in infants while OSA was predominant in childhood. Supplemental oxygen proved to be a successful treatment for infants with clinically significant CSA; it not only reduced the nocturnal hypoxia but was also associated with a reduction or resolution of CSA. We recommend: (i) Sleep surveillance in all children with PWS (ii) Supplemental oxygen treatment for infants with PWS who have significant CSA.

<http://dx.doi.org/10.1016/j.sleep.2013.11.065>

### Lipopolysaccharide-binding protein (LBP) serum levels in children with OSA and obesity

L. Kheirandish-Gozal, E. Peris, S. Harshan Vardhan, Y. Wang, A. Carreras, D. Gozal

The University of Chicago, Pediatrics, United States

**Introduction:** Obstructive sleep apnea (OSA) has been linked to obesity and the metabolic syndrome (MetS). All these conditions are further tightly linked to inflammation, the origin of the latter still being under debate. In recent years, the gut microbiota and/or gut permeability have emerged as important factors in the vicious cycle of obesity, MetS and inflammation. The gut microbiota, which serves as reservoir for bacterial lipopolysaccharides (LPS), could be altered by OSA and trigger inflammation. Lipopolysaccharide-binding protein (LBP) is a 65-kDa acute-phase protein derived from the liver which has been viewed as a surrogate marker of underlying low level endotoxemia brought about by LPS from the gut. We hypothesized that systemic LBP levels would be higher in obese children and in those with OSA.

**Materials and methods:** Consecutive snoring and non-snoring children (mean age:  $6.8 \pm 1.3$  years) were included after they underwent overnight polysomnographic evaluation and a fasting blood sample was drawn the morning after the sleep study. Children were subdivided into 4 sub-groups based on the presence of obesity (BMI z score  $> 1.65$ ) or OSA (obstructive AHI  $> 2$ /hrTST). Plasma LBP levels were assayed using commercial ELISA kits.

**Results:** Of the children studied to date ( $n = 56$ ), non-obese controls had lowest levels of LBP, and the presence of obesity without OSA was associated with significant increases in LBP levels ( $p < 0.03$ ). Non-obese children with OSA exhibited LBP levels that were similar to those of obese children without OSA ( $p < 0.01$  vs. non-obese without OSA), with obese children with OSA demonstrating the highest LBP levels of all 4 groups ( $p < 0.02$  vs. all 3 other groups).

**Conclusion:** Systemic low level endotoxemia and resultant systemic inflammation is present in children who are either obese or suffer from OSA, and is particularly prominent when both conditions are present. We postulate that altered sleep and other factors facilitating obesity such as high fat diet may disrupt the gut microbiome, and lead to increased systemic LPS leaks with resultant inflammation.

**Acknowledgements:** NIH HL65270.

<http://dx.doi.org/10.1016/j.sleep.2013.11.066>

### Snoring, sleepiness, inattention, and hyperactivity in preschool and kindergarten children with a repaired cleft palate

M. Moraleda-Cibrian<sup>1</sup>, S. Edwards<sup>2</sup>, S. Buchman<sup>3</sup>, S. Kasten<sup>3</sup>, S. Warschausky<sup>4</sup>, L. O'Brien<sup>1</sup>

<sup>1</sup>University of Michigan, Sleep Disorders Center, Department of Neurology, United States

<sup>2</sup>University of Michigan, Pediatrics Oral and Maxillofacial Surgery, United States

<sup>3</sup>University of Michigan, Plastic Surgery, Surgery, United States

<sup>4</sup>University of Michigan, Physical Medicine & Rehabilitation, United States

**Introduction:** School-age children with repaired cleft palate appear to be at high risk for symptoms of sleep-disordered breathing (SDB). In addition, they are also at risk of neurobehavioral morbidity. In typ-

ically developing school-age children, SDB symptoms such as snoring are robustly associated with behavioral problems. However, it is currently unknown whether underlying SDB may play a role in neurobehavioral morbidity in young children with a repaired cleft palate. Therefore, the main goal of this study was to investigate the association between cleft palate repair, SDB symptoms, and behavioral problems in children attending preschool and kindergarten.

**Materials and methods:** Children aged 2–6 years old with non-syndromic repaired cleft palate were recruited from a Craniofacial Anomalies Clinic. All parents completed the sleep-related breathing disturbance subscale (SRBD) from the Pediatric Sleep Questionnaire, a validated scale for SDB risk. A score on this scale of  $\geq 0.33$  indicates high risk for SDB. The 4-item snoring and sleepiness scale scores were also calculated. In addition, parents completed the Early Conners – Childhood Assessment which addresses adaptive behavior, development, and cognitive function in children below 6 years of age. A T-score on the Conners questionnaire of 65 ( $\geq 1.5$  SD above the mean) was considered elevated.

**Results:** Of 36 children thus far, mean age was  $4.9 \pm 1.3$  years and 53% were boys. Overall, 14% of children screened positive for SDB. Positive responses to the snoring and sleepiness subscales were reported in 17% and 8% of children respectively. Inattention/hyperactivity was identified in 25% of children, Defiant/Aggressive Behaviors in 17% and Poor Social Functioning in 11%. There were no correlations between the SRBD scale nor the snoring subscale scores and any behavioral domain. However, the sleepiness score was positively correlated with inattention/hyperactivity ( $r = 0.33$ ,  $p = 0.05$ ). Children with an elevated T-score for inattention/hyperactivity, compared to those without, had a higher SRBD score (0.26 vs. 0.13;  $p = 0.036$ ) and a higher sleepiness score (0.31 vs. 0.05;  $p = 0.004$ ). There were no differences in snoring scores (0.28 vs. 0.19;  $p = 0.50$ ).

**Conclusion:** Inattentive/hyperactive behaviors are common in preschool and kindergarten children with a repaired cleft palate. Although children with poor daytime behavior were more likely to screen positive for SDB, the relationship with behavior was driven by daytime sleepiness rather than snoring.

**Acknowledgements:** Dr. Moraleda-Cibrian is supported in part by Fundacio Universitaria Agusti Pedro i Pons.

<http://dx.doi.org/10.1016/j.sleep.2013.11.067>

### SLEEP-disordered breathing in children with laryngomalacia

R. Peralta Lepe, G. Castaño De Las Pozas, M. Alonso Álvarez, J. Cordero Guevara, E. Ordax Carbajo, J. Terán Santos  
Hospital Universitario de Burgos, Sleep Unit, Respiratory Department, Spain

**Introduction:** Laryngomalacia (LM) is one of the most frequent causes of the upper airway obstruction in children, and it is frequently associated with sleep-disordered breathing (SDB). Our main objective was to determine the presence of SDB in these patients and the need for ventilatory support.

**Materials and methods:** A review of 18 children with clinical suspected of LM. The diagnosis of LM was confirmed and classified by flexible laryngoscopy in all children. All of them went under sleep study: polysomnography (PSG) or respiratory polygraphy (RP) was performed at diagnosis and control.

**Results:** 18 children were studied; 5 of them by PSG and 13 by RP in the first study, 16 by PSG and 2 by RP in control. 11 (61.1%) were females, 4 (22.2%) of them were premature; with mean age  $3.38 (\pm 3.01)$  months and weight  $4674 (\pm 1418)$  grams. LM type 1 was present in 7 (38.9%), type 2 in 6 (33.3%) and type 3 in 5 (27.8%). Stridor was the most frequent symptom in 15 (83.3%) followed by the presence of feeding difficulties in 8 (44.4%) and apneas in 7

(38.8%). Gastroesophageal reflux disease was observed in 10 (55.5%). In the first sleep study, the mean values were: sleep efficiency 83% ( $\pm 5.85$ ), apnea-hypopnea index (AHI) 13.74 ( $\pm 10.90$ ), the cumulative percentage of time spent at saturation  $< 90\%$  (CT90) 2.09% ( $\pm 4.72$ ), mean oxygen saturation 96% ( $\pm 1.94$ ) and heart rate 126 ( $\pm 14.24$ ) bpm. 16 children (88.8%) were diagnosed of SDB: 11 (61.1%) required ventilatory support with a mean time of 9.45 ( $\pm 5.26$ ) months. In the study control the mean values were: sleep efficiency 71% ( $\pm 20.95$ ), AHI 3.67 ( $\pm 5.13$ ), CT90 0.43% ( $\pm 1.64$ ), mean oxygen saturation 96% ( $\pm 1.38$ ) and heart rate 111 ( $\pm 15.01$ ) bpm. Compared the first sleep study to control, we observed differences in AHI ( $p < 0.001$ ), CT90 ( $p = 0.05$ ) and mean heart rate ( $p = 0.005$ ). 4 children continued with SDB at study control, 2 of them continued with ventilatory support.

**Conclusion:** SDB are frequent in children with LM. We believe children with LM should be evaluated with sleep study in order to establish severity and the need of ventilatory support.

**Acknowledgements:** The authors would like to thank Dra. Navazo Eguía and the Sleep Unit staff at the University Hospital of Burgos for their help.

<http://dx.doi.org/10.1016/j.sleep.2013.11.068>

### Clinical characteristics of hospitalized heart failure patients with daytime cheyne-stokes respiration

Y. Tomita<sup>1</sup>, T. Kasai<sup>2</sup>, Y. Kimura<sup>3</sup>, S. Ishiwata<sup>1</sup>, M. Ohno<sup>1</sup>, K. Narui<sup>3</sup>  
<sup>1</sup>Toranomon Hospital, Department of Cardiology, Cardiovascular Center, Japan

<sup>2</sup>Juntendo University, Department of Cardiology, Japan

<sup>3</sup>Toranomon Hospital, Sleep Center, Japan

**Introduction:** Cheyne–Stokes respiration (CSR) frequently occurs in patients with heart failure (HF). CSR in HF patients is important because it may independently predict morbidity and mortality due to HF. In previous analyses of HF patients, CSR was observed not only in the nighttime but also in the daytime. Moreover, daytime CSR may also predict worse prognosis in HF patients. Most of these studies have evaluated HF patients only on chronic phase. Daytime CSR in patients with HF on sub-acute phase (during hospitalization) remains unknown. We therefore investigated prevalence and clinical characteristics of daytime CSR in hospitalized patients with worsening of HF.

**Materials and methods:** In consecutive patients who were hospitalized due to worsening of HF, breathing pattern was monitored with a portable respiratory polygraph continuously over 24 h after their condition was stabilized. The monitor comprised sensors for airflow and for respiratory effort and a pulse oximeter finger sensor. Body weight and blood test data were collected simultaneously.

**Results:** 28 HF patients were enrolled (age,  $71.1 \pm 11.4$  years; 9 women; LVEF,  $51.8 \pm 15.1$  %). Daytime CSR was highly prevalent ( $N = 22$ , 78.6%). In the nighttime, frequency of apneas and hypopneas per hour of recording expressed as nighttime apnea-hypopnea index (nAHI) was  $19.0 \pm 10.5$  whereas AHI in the daytime (dAHI) was  $8.8 \pm 5.7$ . The patients were divided into two groups according to median value of the dAHI: higher dAHI group (dAHI  $\geq 8.4$ ) and lower dAHI group (dAHI  $< 8.4$ ). We found no significant differences between two groups in baseline characteristics including age, sex, body mass index, plasma brain natriuretic peptide level, LVEF, New York Heart Association class, PaCO<sub>2</sub> and the presence of atrial fibrillation or ischemic heart disease (IHD). We only found significant difference in lung-to-finger circulation time (LFCT) between two groups ( $38.0$  vs  $24.0$  s;  $p < 0.001$ ) despite no difference in other cardiac parameters. In addition, LFCT was correlated with dAHI ( $r = 0.71$ ,  $p < 0.0001$ ). LFCT was longer in

men (men vs women, 33.8 vs 24.9 s,  $p < 0.05$ ) and patients with IHD (36.5 vs 26.5 s,  $p < 0.01$ ).

**Conclusion:** Daytime CSR is frequent in hospitalized patients with HF and is correlated with prolonged LFCT. Prolonged LFCT, which indicates impaired cardiac output, has an adverse effect on survival. Therefore, significant daytime CSR in hospitalized patients with HF might be a predictor of increased morbidity and mortality.

**Acknowledgements:** We express gratitude to all those who participated in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.069>

### Heart rate variability and autonomic modulation in children with obstructive sleep apnea syndrome

Z. Xu, L. Zhang, K. Shen

Beijing Children's Hospital, Capital Medical University, China

**Introduction:** To investigate whether obstructive sleep apnea syndrome (OSAS) is associated with impaired heart rate variability (HRV) indices, indicating impairment of cardiac autonomic modulation in children.

**Materials and methods:** Children with snoring and 5 years of age or elder who came to the Sleep center of Beijing Children's Hospital were enrolled. All subjects underwent polysomnography and 24-h Holter monitoring with continuous time dependent and spectral analysis of heart rate variability. HRV analysis included time and frequency domain indices.

**Results:** Ninety-three subjects were recruited into the study. Forty-seven met the criteria for OSAS, 46 were non-OSAS. There were no difference between the two groups with respect to age and gender. The OSAS group had significantly higher apnea hypopnea index (AHI), obstructive apnea index (OAI) and oxygen desaturation index (ODI) than the non-OSAS group. The HRV analysis showed that OSAS children had decreased N-N interval, SDNN (the standard deviation of NN intervals) and SDANN (the standard deviation of the average NN intervals calculated over 5 min) with P value of 0.007, 0.003, and 0.01 respectively. SDNN was significantly different and declined with the degree of severity of OSAS ( $P$  value  $< 0.01$ ). In children with OSAS, the nocturnal PNN50 was decreased while low frequency/high frequency (LF/HF) was elevated compared to the non-OSAS controls ( $p$  value 0.025 and 0.026 respectively). Multiple regression analysis showed that SDNN was related to AHI and age ( $p$  value 0.03 and 0.006).

**Conclusion:** OSAS in children is significantly associated with impaired cardiac autonomic modulation, i.e., sympathetic overflow and weaker parasympathetic modulation.

**Acknowledgements:** Thanks to Ms. Yunxiao WU and Bei Li for their helping with ECG monitoring.

<http://dx.doi.org/10.1016/j.sleep.2013.11.070>

### What is idiopathic hypersomnia without long sleep? rethinking the definitions by sleep wake diary data

A. Rodenbeck<sup>1</sup>, G. Mayer<sup>2</sup>, H. Benes<sup>3</sup>, P. Young<sup>4</sup>

<sup>1</sup>Studienzentrum Wilhelmshoehe GmbH, Germany

<sup>2</sup>Hephata Klinik, Germany

<sup>3</sup>Somnbene GmbH, Germany

<sup>4</sup>Universitätsklinikum Münster, Klinik für Schlafmedizin und Neuro-muskuläre Erkrankungen, Germany

**Introduction:** Excessive daytime sleepiness (EDS) almost daily persisting for more than three month is the essential symptom of the idiopathic hypersomnia without long sleep time (IH) classified by the ICSD2. DSM 5 meanwhile introduced the new term, major somnolence disorder'. Nocturnal sleep by IH definition should be between 6–10 h documented by interview, actigraphy, or sleep logs in the first diagnostic step. In a study on the effect of modafinil in IH patients we had the chance to investigate this concept by assessment of daily sleep wake diaries.

**Materials and methods:** We investigated 28 patients (35.3 ± 12.7 ys., 16 m, 12 f) suffering from IH according to ICSD2 established by clinical interview by sleep experts, PSG and MSLT. A standardized sleep-wake diary was filled out over one week by each patient, the intake of stimulants (8 subjects) was stopped at least one day before starting the diary. Results were given as the mean over the week or as number of days/nights per week.

**Results:** Daytime naps at least 3 times a week were seen in 17 patients, 9 of them showed difficulties in initiating and/or maintaining sleep. Mean sleep latency over all patients was 14 ± 11.7 min, in 8 patients more than 15 min. In average we found 6.6 nocturnal awakenings per patient and week, only 10 patients showed less than 3 nights without being awake. Mean wake time was 71.5 ± 93.5 min per week, meaning that 14 patients reported awakenings in at least 3 nights the week with a duration of more than 5 min each. 3 patients slept less than 6 h on average, 2 more than 10. The time lag between morning wake up and rising up was more than 20 min in 9 subjects.

**Conclusion:** The results indicated that beside the EDS there exist also features of an insomniac disorders in more than the half of the investigated patients. Difficulties in initiating and/or maintaining sleep were independent of taking daytime naps more or less than 3 times a week. Since all patients were diagnosed by experienced sleep experts by clinical interviews, it could be suggested that IH patients without long sleep time overestimate their sleep supporting the concept of the Shapiro group, who published the concept of "a positive sleep stage misperception" in 2007. This concept was not proven in IH until now. Another explanation is that this group of patients may have an insomniac disorder but without the typical hyperarousal resulting in somnolence instead of tiredness.

**Acknowledgements:** supported by Cephalon Germany GmbH.

<http://dx.doi.org/10.1016/j.sleep.2013.11.071>

### EIF3G is associated to narcolepsy

A. Holm<sup>1</sup>, S. Mostafavi<sup>2</sup>, S. Gammeltoft<sup>3</sup>, P. Jennum<sup>4</sup>, B. Kornum<sup>3</sup>, E. Mignot<sup>5</sup>

<sup>1</sup>Molecular Sleep Laboratory, Danish Center for Sleep Medicine, Department of Diagnostics, Denmark

<sup>2</sup>Computer Science Department, USA

<sup>3</sup>Molecular Sleep Laboratory, Department of Diagnostics, USA

<sup>4</sup>Danish Center for Sleep Medicine, University of Copenhagen, Denmark

<sup>5</sup>The Stanford Center for Sleep Sciences and Medicine, Stanford School of Medicine, USA

**Introduction:** A previous GWA study found an association between narcolepsy and SNPs in P2RY11. Later a missense mutation in DNMT1 was discovered to cause a rare familial form of narcolepsy in association with ataxia, deafness and dementia. Since P2RY11 and DNMT1 are located in close proximity we speculated if rs2305795 located in P2RY11 could be in linkage disequilibrium (LD) with a SNP located in DNMT1. Here we investigated SNPs in the P2RY11- DNMT1 region in several narcolepsy cohorts and

examined if different genotypes were correlated with a changed gene expression in the same locus.

**Materials and methods:** GWAS: Caucasian cohort: 807 cases and 1074 controls, Chinese cohort: 1078 cases and 1903 controls, African American cohort: 249 cases and 1048 controls. Fine mapping was performed using Taqman SNP genotyping assays for rs1551750, rs12460842, rs2305795, and rs3826784. RNA sequencing on blood cells combined with a GWA dataset from patients with depression and healthy controls ( $n = 1000$ ) were used to analyze gene expression. As disease status did not influence expression levels, we analyzed the combined cohort.

**Results:** Based on the LOD plots of GWA datasets we found that the narcolepsy association signal drops sharply between P2RY11 and DNMT1. Interestingly, however, we identified a novel SNP rs3826784 in EIF3G which was associated with narcolepsy and in high LD with rs2305795 in Caucasian and Chinese, but lower LD in African Americans. Genotyping showed that surprisingly rs3826784 but not rs2305795 was associated with narcolepsy in African Americans. We further found that EIF3G gene expression correlated with PPAN and P2RY11, but not DNMT1.

**Conclusion:** We found a novel association between SNP rs3826784 in EIF3G and narcolepsy. rs3826784 and the previously reported rs2305795 are in high LD in Caucasian and Chinese, but lower in African Americans. Since rs3826784 but not rs2305795 is associated with narcolepsy in African Americans, rs3826784 is a better marker for the genetic association and could be the functional variant involved. The strong correlation between the different genes in the locus suggests a shared regulatory mechanism that might be affected by the polymorphism. At the genetic level, however, the P2RY11/EIF3G association to narcolepsy does not extend into the DNMT1 gene region.

**Acknowledgements:** The Stanford Center for Sleep Sciences and Medicine, especially Ling Lin and Juliette Faraco. The Computer Science Department, especially Alexis Battle and Xiaowei Zhu. The Lundbeck Foundation for financial support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.072>

### The effects of sodium oxybate treatment on vigilance impairment in narcolepsy – A comparison between in-field and in-laboratory measurements

M. Van Schie<sup>1</sup>, E. Werth<sup>2</sup>, G. Lammers<sup>1</sup>, S. Overeem<sup>3</sup>, C. Baumann<sup>1</sup>, R. Fronczek<sup>1</sup>

<sup>1</sup> Leiden University Medical Centre, The Netherlands

<sup>2</sup> University Hospital Zurich, Switzerland

<sup>3</sup> Sleep Medicine Centre Kempenhaeghe, The Netherlands

**Introduction:** This study was designed to investigate the effect of Sodium Oxybate (SXB) treatment on vigilance in narcoleptics, by in-laboratory measurements as well as measurements in daily life with portable task equipment.

**Materials and methods:** This two-centre observational study comprised a nine-day protocol, in which two days of in-laboratory vigilance measurements were followed by seven days of portable digital assistant (PDA) task battery administrations. Narcoleptic patients followed this procedure before and three months after stable treatment with the normal therapeutic dose of SXB (4.5–9.0 g/day). In-laboratory measurements included the Maintenance of Wakefulness Test (MWT) and the Oxford Sleep Resistance (OSLER) test, a behavioural MWT. The MWT and OSLER test consisted both of four 40-min sessions in a quiet and dimly lit room. During the OSLER test, subjects were instructed to keep their finger in contact with a button which was placed in their lap, and to remove the finger for 1 s when

a red light-emitting diode (LED) flashed four feet away at eye level in the frontal visual field. The OSLER test was terminated when sleep-onset occurred or after 40 min of being awake. Outcome measures of the OSLER were average sleep latency, the total omission error count (number of times the finger was not removed upon a flash) and the omission error count per minute duration of the test (OSLEROMIS/MIN). In-field testing comprised a 15-minute task battery consisting of a session of the Sustained Attention to Response Task (SART) and a session of the Psychomotor Vigilance Test (PVT) in random order, as well as the administration of the Stanford Sleepiness Scale. The task battery was administered on a pocket-size personal digital assistant (PDA) computer and had to be performed three times per day during 1-hour-intervals around 10:00 h, 14:00 h and 20:00 h for seven days. The SART error count and PVT reciprocal average reaction time (1/RT) were considered the main outcome measures. Since the PVT and OSLER test had not yet been described in narcoleptics, and the use of a portable device in this study population was also new, a control group was included to compare baseline measurements of vigilance and sleep resistance with, in order to assess feasibility and validity of these measures. Data were analyzed by means of linear mixed effect models (LMMs) adjusted for age, time of day and centre.

**Results:** In total, data from 26 narcoleptics (14 had post-treatment data available) and 16 controls were available for analysis. Data are presented as geometrical means with P values originating from the LMM analyses described above. Narcoleptics had a higher SART error count compared to controls (17.5 versus 10.4 errors), lower PVT 1/RT (0.32 versus 0.38 ms<sup>-1</sup>), higher OSLEROMIS/MIN (4.9 versus 0.7 errors/minute), lower OSLER sleep latency (9.4 versus 36.4 min), and lower MWT sleep latency (6.1 versus 33.4 min), all  $P < 0.01$ . Treatment with SXB was associated with a longer MWT sleep latency (9.2 versus 6.1 min,  $P < 0.01$ ), lower OSLEROMIS/MIN (4.2 versus 4.9 errors/minute,  $P = 0.01$ ), and a slightly lower SART error count (17.1 versus 17.5 errors,  $P = 0.02$ ) in narcoleptics, but not with absolute changes in OSLER sleep latency or PVT reciprocal reaction time. Performance tended to decrease during the day for SART error count and OSLEROMIS/MIN after SXB treatment.

**Conclusion:** PDA vigilance measurements are feasible and consistent with in-laboratory OSLER and MWT measurements in narcoleptics and controls. Sodium Oxybate was associated with a better resistance to sleep, measured by the OSLER and the MWT, and with a slight but significant improved vigilance, measured by the SART. This was mainly manifested in the morning.

**Acknowledgements:** We thank our subjects for participating in this study; the sleep technologists from the University Hospital Zurich and the Leiden University Medical Centre for their help in data acquisition; and UCB for the financial support of this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.073>

### Optogenetic activation of specific neurons to ameliorate symptoms of narcolepsy in mice

P. Shiromani<sup>1</sup>, R. Konadhod<sup>2</sup>, D. Pelluru<sup>2</sup>, C. Blanco-Centurion<sup>2</sup>, M. Liu<sup>2</sup>, P. Mulholland<sup>2</sup>

<sup>1</sup> Ralph H. Johnson VA, Medical University of South Carolina, United States

<sup>2</sup> Medical University of South Carolina, United States

**Introduction:** Narcolepsy is now considered a neurodegenerative sleep disorder characterized by a massive loss of neurons containing the neuropeptide, orexin, also known as hypocretin. Since the orexin neurons have degenerated it is necessary to identify surrogate neurons that can release orexin and thereby ameliorate symptoms of narcolepsy. Can these surrogate orexin neurons be activated to

reduce narcolepsy symptoms? The neurons containing melanin concentrating hormone are particularly interesting as these neurons are silent during waking, which is when cataplexy is triggered. These neurons also project to the same targets as the orexin neurons. Can they be stimulated and does it change sleep-wake time?

**Materials and methods:** To answer this question the gene for the light-sensitive cation channel, channelrhodopsin-2, was delivered into the brains of wild-type or the mice models of human narcolepsy. Three weeks after recombinant adeno-associated virus (rAAV)-mediated gene transfer sleep-wake behavior was assessed. Mice were tethered to light-weight swivels and allowed 10 days to acclimate to the EEG cables. Sleep-wake behavior was recorded by polysomnogram and video.

**Results:** In-vitro slice electrophysiology studies confirmed that the ChR2 containing neurons were responsive to blue light. In-vivo studies consisted of recording sleep-wake behavior in freely-behaving WT mice ( $n = 14$ ) for 48 h. It was found that 10 and 30 Hz optogenetic stimulation of the MCH neurons induced sleep. The effects were seen at night but not the day. At night and day MCH stimulation reduced the length of wake bouts. In the next experiment, the arousal peptide, orexin, was inserted into MCH neurons and light stimulation was used to release it during waking. Research will be presented to show the effects of optogenetic stimulation of this pathway in controlling cataplexy.

**Conclusion:** These studies identify novel ways of using emerging new methods to treat sleep disorders. Narcolepsy is especially useful as animal models exist and specific pathways can be selectively manipulated.

**Acknowledgements:** Supported by the NIH and the Veterans Administration. We thank Dr. Anthony van den Pol for the MCH promoter.

<http://dx.doi.org/10.1016/j.sleep.2013.11.074>

### CSF hypocretin level in patients with Kleine-Levin syndrome

Q. Li<sup>1</sup>, J. Wang<sup>2</sup>, X. Dong<sup>1</sup>, J. Li<sup>1</sup>, X. Zhang<sup>1</sup>, F. Han<sup>1</sup>

<sup>1</sup>Department of Pulmonary Medicine, Peking University People's Hospital, China

<sup>2</sup>Department of Pulmonary Medicine, Bin Zhou Medical University, China

**Introduction:** Kleine-Levin syndrome (KLS) is a rare disease with symptoms that include episodic hypersomnia, cognitive and behavioral disturbances. Its pathogenesis is now unknown. Hypocretin levels were studied in KLS patients to determine the role of hypocretin in KLS.

**Materials and methods:** CSF samples were collected at 10:00–13:00 from 42 patients diagnosed with KLS in Peking university People's hospital from 2002 to 2012. 53 control CSF samples were collected in Peking university people's hospital. 21 CSF samples were collected from KLS patients during remissions and 25 CSF samples during episodes. Hypocretin was tested with 125I radioimmunoassay kit. Independent t test and paired t test were used to assess hypocretin levels between KLS patients and controls.

**Results:** No significant difference was found between non-episodic KLS patients and controls ( $303.45 \pm 18.48$  versus  $320.58 \pm 12.04$  pg/ml,  $p = 0.448$ ). Hypocretin levels, however, were lower in KLS patients during episodes, as compared with controls ( $185.46 \pm 13.58$  versus  $320.58 \pm 12.04$  pg/ml,  $p = 0.000$ ). Significant difference was also found in KLS patients between episodes and remissions ( $197.42 \pm 16.40$  versus  $303.91 \pm 22.34$  pg/ml,  $n = 16$ ,  $p = 0.000$ ).

**Conclusion:** KLS patients have lower hypocretin levels during episodes than controls and hypocretin levels are increased when they

recovery. Therefore, we hypothesis that hypocretin may play a role in KLS pathogenesis.

**Acknowledgements:** Fang Han Han Yan, Yanan Liu, Jingyu Wan, Xiaozhe Zhang, Wei Zhou, Yan Hu, Xiaosong Dong, Jing Li, Pei An, Long Zhao.

<http://dx.doi.org/10.1016/j.sleep.2013.11.075>

### Dissociated sleep states in fibromyalgia: prevalence and correlations

L. Ferreira<sup>1</sup>, S. Rebocho<sup>2</sup>, T. Oliveira<sup>3</sup>, J. Sanches<sup>4</sup>, T. Paiva<sup>5</sup>

<sup>1</sup>CHLN-EPE - HSM, CENC - Sleep Medicine Center, Italy

<sup>2</sup>CENC - Sleep Medicine Center, Portugal

<sup>3</sup>ISPA, IMM-FMUL, Portugal

<sup>4</sup>ISR, IST - UL, Portugal

<sup>5</sup>CENC - Sleep Medicine Center, IMM-FMUL, Portugal

**Introduction:** One of the prominent features in fibromyalgia patients (FMP) is the discrepancy between subjective and objective data. Pain index are more intense than in Rheumatoid Arthritis patients but supportive objective data are lacking. Sleep is among the most prevalent complaints and the intrusion of alpha activity, although common, is not specific. It may be considered that, somehow, the peripheral dysfunctions or complaints are magnified centrally. Therefore the objectives are: 1) To compare sleep and sleep questionnaires in FMP and healthy controls (HC); 2) To identify dissociated states (DS) in sleep microstructure, i.e., occurrence of alpha delta, NREM microevents in REM, presence of REMs and myoclonia in NREM.

**Materials and methods:** 20 FMP, mean age 44.00, and 14 HC, mean age 43.21, all females were evaluated with the following instruments: Type 1 PSG with 19 EEG electrodes, PSQI and Epworth Sleepiness scale (ESS). PSG were visually staged by experienced technicians and dissociated states were scored by a single technician. The percentage of DS (taking as reference the total number of sleep epochs per subject) was computed together with current sleep parameters. Student T test was used to evaluate differences between groups and Pearson correlation analysis was done to evaluate correlations between individual measures.

**Results:** Significant differences between groups are: Body Mass Index (FMP = 25.68; HC = 22.58); PSQI (FMP = 11.8; HC = 5.23); %N1 (FMP = 13.0; HC = 6.3); Microarousals (FMP = 37.8; HC = 40.4); Periodic Limb Movements of Sleep (PLMS) (FMP = 2.8; HC = 7.3); Alpha delta (AD) (FMP = 21.0; HC = 7.9); NREM myoclonia (FMP = 0.2; HC = 0.0); absence of DS (FMP = 76.8; HC = 90.6). Correlation analysis provided the following results: A- Sleep parameters: Total Sleep Time (TST) correlated with Time in bed (TIB), Sleep efficiency (SE), %N2, and negatively with %N3. SE correlates negatively with Sleep Latency (SL), REM latency (RL), %N1, Awakenings SL correlates with TIB, RL, %N1 RL correlates with TIB, Awakenings, PLMS, PSQI and negatively with %R %N1 correlates with Awakenings, PLMS, PSQI and negatively with %N3, %R %N2 correlates negatively with %N3, %R, ESS %N3 correlates with Awakenings, PSQI, ESS %R correlates negatively with Awakenings Apnea-Hypopnea Index (AHI) correlates with age PLMS correlates with PSQI ESS correlates with %N3 and negatively with %N2 B- DS parameters: AD correlates with Awakenings, %N2, Alpha REM (AR), REMs in NREM, REM without atonia and negatively with %R, ESS, absence of DS AR correlates with K-complex in REM and negatively with absence of DS Spindles in REM correlates with RL, Microarousals and NREM myoclonia REMs in NREM correlates with %N1, Awakenings, REM without atonia and negatively with ESS, absence of DS Microarousals correlates with NREM myoclonia NREM myoclonia correlates with Microarousals, PSQI, ESS

REM without atonia correlates with RL, % N2, AD and negatively with %R, absence of DS. Absence of DS correlates with %R, ESS and negatively with awakenings 1421.

**Conclusion:** Concerning our objectives it must be stated that the differences between groups are not overwhelming; the existent in term of polysomnography are mostly related with sleep microstructure. In fact FMP have decreased Microarousals, higher PLMS index and percentage of DS comparing with HC. FMP have also higher percentage of alpha delta sleep and NREM Myoclonia. In spite of this, and in line with the dissociation hypothesis, the subjective complaints evaluated by the PSQI are higher in FMP. The presence of dissociated states in sleep EEG is a further proof in favor of this hypothesis. The correlations found are in line with the general postulates of sleep organization.

**Acknowledgements:** Funded by: FCT project "Detection of Brain Microstates in Fibromyalgia" (PTDC/SAU-BEB/104948/2008) Work supported by the technicians Joana Belo and Patrícia Correia.

<http://dx.doi.org/10.1016/j.sleep.2013.11.076>

### Comparative meta-analysis of prazosin and imagery rehearsal therapy for nightmares, sleep disturbance and post-traumatic stress

M. Sanchez Ortuno<sup>1</sup>, G. Seda<sup>2</sup>, C. Welsh<sup>3</sup>, A. Halbower<sup>4</sup>, J. Edinger<sup>5</sup>

<sup>1</sup> University of Murcia, School of Nursing, Spain

<sup>2</sup> Division of Sleep Medicine, University of Colorado and National Jewish Health, United States

<sup>3</sup> Denver Veterans Affairs Medical Center, Department of Medicine, Division of Pulmonary Sciences, United States

<sup>4</sup> Department of Pulmonary Medicine, Children's Hospital of Colorado, University of Colorado, United States

<sup>5</sup> National Jewish Health and Duke University Medical Center, Durham, NC, United States

**Introduction:** The medication, Prazosin, and the psychological treatment known as imagery rehearsal therapy (IRT) have both proven effective for the treatment for post-traumatic stress disorder-associated nightmares. Whereas one recent meta-analysis compares their efficacy for reducing nightmares, their effects on other relevant outcomes, such as sleep quality and post-traumatic stress disorder symptoms (PSS) have not been compared. In this meta-analysis, we compared the short-term efficacy of prazosin and IRT on nightmares, sleep quality and PSS.

**Materials and methods:** Reference databases (PubMed, PsycInfo, Google Scholar, Cochrane Library and Web of Knowledge) were searched for studies using IRT or prazosin for nightmares, general sleep disturbance, and/or symptoms of post-traumatic stress. Inclusion criteria were (1) use of a randomized controlled trial design and (2) reporting of treatment outcomes in sufficient detail to calculate effect sizes. Effect sizes (Cohen's *d*) were calculated by subtracting the mean post-test score (defined as the first assessment following treatment) in the control group from the mean post-test score in the treatment group, and dividing the result by the pooled standard deviation of both groups. Mixed effects models were performed to evaluate the effect of treatment characteristics on treatment efficacy.

**Results:** Fourteen studies with a total of 850 subjects were included. Among these, 3 studies used prazosin, 10 used IRT and 1 included a group of subjects receiving prazosin and a group of subjects receiving IRT. Statistically significant improvements for all IRT comparisons combined ( $n = 12$ ), and for all prazosin studies combined ( $n = 4$ ) were found for nightmare frequency ( $d = 0.55$ ;  $p < 0.01$  and  $d = 0.43$ ;  $p < 0.05$ , respectively), sleep quality

( $d = 0.54$ ;  $p < 0.01$  and  $d = 0.70$ ;  $p < 0.01$ , respectively), and PSS ( $d = 0.51$ ;  $p < 0.01$  and  $d = 0.69$ ;  $p < 0.01$ ). The difference between the average effect sizes of the IRT studies and those of the prazosin studies was not statistically significant across all three treatment outcomes. However, interventions combining IRT and cognitive-behavioral therapy for insomnia (CBT-I) ( $n = 3$ ) resulted in greater improvements in sleep quality and PSS than interventions including IRT alone ( $n = 5$ ) ( $p < 0.05$  for sleep quality and  $p < 0.05$  for PSS) or IRT combined with other psychological interventions (e.g. lucid dreaming;  $n = 4$ ;  $p < 0.01$  for sleep quality and  $p < 0.05$  for PSS).

**Conclusion:** Overall, IRT and prazosin have documented and comparable acute effects for the treatment of nightmares, sleep disturbance and PSS. Furthermore, CBT-I seems to be a useful addition to IRT to enhance treatment outcomes. More randomized clinical trials that compare the short- and longer term effects of IRT, prazosin and their combination are warranted.

**Acknowledgements:** Fundación Séneca. Murcia, Spain.

<http://dx.doi.org/10.1016/j.sleep.2013.11.077>

### Can nocturnal sleep disturbances predict non-remission and relapse in patients with major depressive disorder? V A 5-year naturalistic longitudinal study

S. Li, J. Chan, J. Lam, M. Yu, Y. Wing

Department of Psychiatry, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong

**Introduction:** Sleep disruption often constitutes one of the core presenting symptoms entangled in the clinical course of major depressive disorder (MDD). The aim of the current study was to prospectively investigate nocturnal sleep disturbances in relation to non-remission and relapse in a cohort of psychiatric outpatients with MDD.

**Materials and methods:** A consecutive cohort of depressed patients were recruited from a university-affiliated psychiatric outpatient clinic at baseline ( $n = 419$ ) and invited for follow-up assessments at 4th year ( $n = 371$ ) and 5th year ( $n = 273$ ), which consisted of a standardized diagnostic psychiatric interview and a packet of self-reported questionnaires, including a general sleep questionnaire and Hospital Anxiety and Depression Scale (HADS).

**Results:** Of the overall study subjects in our analysis [ $n = 342$ , female: 81.6%, age: mean (s.d.) = 48.8 (10.5) years], 41.2% were classified as remitted at 4th year of follow-up. Prevalence rates of non-remission at 4th year of follow-up were 78%, 64.7%, 55.0% and 41.9% in the groups of subjects with comorbid frequent nightmares and insomnia, frequent insomnia only, frequent nightmares only, and no sleep disturbance at baseline, respectively ( $p < .001$ , linear-by-linear). Comorbid frequent nightmares and insomnia at baseline significantly predicted non-remission at 4th year of follow-up after adjusting for potential confounding factors (OR = 3.11, 95% C.I. 1.45–6.67). In addition, remitted subjects reporting residual insomnia at 4th year were more likely to relapse at 5th year of follow-up (OR = 4.86, 95% C.I. 1.16–20.32).

**Conclusion:** Despite optimized antidepressant treatments, nocturnal sleep disturbances can be linked to a clinically prognostic significance in predicting non-remission and relapse in depressed patients. Effective clinical management of sleep symptoms is warranted to achieving a sustained resolution of depressive symptomatology.

<http://dx.doi.org/10.1016/j.sleep.2013.11.078>

### Sleep profile in hypomania: a polysomnographic evaluation in an Egyptian sample

T. Asaad, H. El Rasas

Ain Shams University, Psychiatry, Egypt

**Introduction:** Patients with major depression have been previously described to show a unique sleep profile, especially regarding REM sleep latency and density; however, the specificity of such changes is still a matter of debate. Studies concerning bipolar disorder are rather scarce and it is not well known whether it shares the same polysomnographic changes with major depression or not. The aim of the present study was to assess the polysomnographic features of patients with hypomania, compared to patients with unipolar depression.

**Materials and methods:** The study included 20 patients fulfilling the DSM-IV criteria of hypomania, compared to 20 patients, diagnosed by the same criteria as major depression. Patients were selected from those attending the outpatient clinic of the Institute of Psychiatry, Ain Shams University, Cairo, Egypt, with the age range between 18 and 45 years. The selected patients should be free from any psychotropic medication at least one week before the assessment and should not have any other psychiatric or major physical disorder. A control group of 20 healthy age and sex matched volunteers has been considered. All the study subjects were evaluated through complete physical and mental examination, Standardized Sleep Questionnaire (in Arabic), SCID-I for psychiatric diagnosis, based on DSM-IV criteria (for all patients), YMRS (for hypomanic patients), HAM-D (for major depression patients), and all-night polysomnography (for all subjects).

**Results:** Both hypomanic and depressed patients showed significant differences from controls, regarding decreased sleep efficiency, increased stages I and II, with decreased SWS. Short REML, with increased REMD have been also found in both groups of patients. Patients with hypomania differed significantly from those with depression in having more sleep efficiency, more SWS and less REM percentage. The changes in REML and REMD were more robust in depressed patients than in hypomania.

**Conclusion:** Sleep EEG findings in hypomania show some similarities to major depression, especially regarding the REM parameters, denoting common biological factors in both conditions. The quantitative difference in sleep efficiency and SWS, being higher in hypomania, might explain the rather "refreshing" nature of sleep in hypomanic patients, compared to depression.

**Acknowledgements:** The authors would like to acknowledge Dr. Adel Marey, the sleep specialist in the Institute of Psychiatry, Ain Shams University, Cairo, Egypt, for his great support in sleep analysis of the studied sample.

<http://dx.doi.org/10.1016/j.sleep.2013.11.079>

### The natural history of restless legs syndrome: retrospective data on a clinical sample

M. Zucconi<sup>1</sup>, S. Marelli<sup>1</sup>, L. Ferini Strambi<sup>1</sup>, A. Oldani<sup>1</sup>, A. Galbiati<sup>1</sup>, R. Ferri<sup>2</sup>

<sup>1</sup>San Raffaele Scientific Institute, Dept of Clinical Neurosciences, Sleep Disorders Center, Italy

<sup>2</sup>Oasi Institute for Research on Mental Retardation and Brain Aging, Sleep Research Centre, Department of Neurology I.C. san, Italy

**Introduction:** To evaluate the "natural history" of idiopathic restless legs syndrome (iRLS) by means of a structured questionnaire with 17 questions.

**Materials and methods:** One hundred and fifty (150) patients with iRLS attending the Sleep Disorders Center of the San Raffaele hospital of Milan were consecutively enrolled. Eighty-four (56%) women, 66 (44%) men, age:  $60.3 \pm 14.38$ , age at onset  $44.5 \pm 17.66$ , IRLS  $23.9 \pm 6.42$ , PLMI  $41.0 \pm 48.21$ , ESS  $6.7 \pm 4.66$ , ferritin level  $98.5 \pm 121.14$ . Secondary forms of RLS were excluded on the basis of clinical history data and neurologic examination.

**Results:** Twenty-one % of patients reported RLS age onset between 46–55 years, 19% between 36–45 years and 15% between 26–35 years. No family history for RLS in 45% of this sample was recorded, while 42% of patients reported a parent with RLS. Twenty-three % of RLS patients had never had any problems with sleep, while 21% had had sleep problems in the past 10 years. Among patients who had had sleep disturbances before the onset of RLS (57%), 85% suffered from insomnia. Thirty-seven % of subjects reported symptoms of RLS to be "sporadic" at onset, 30% "fluctuating", and 15% "intermittent". At onset, 46% of subjects reported the severity of RLS symptoms to be "mild". The frequency of symptoms at onset was reported to be  $\leq 1$ /week in 65% of patients, 2–3/week in 23%, and more than 3 times/week in 12% of patients. In 73% of patients symptoms tended to worsen over time and only in 19% they were stable. In 29% of patients, approximately 3–5 years occurred between RLS onset and diagnosis/treatment. In 73% of subjects therapy remained stable. Thirty-five % of subjects took only 1 drug for RLS treatment, 29% 2 drugs,  $\geq 3$  drugs were used by 22% of patients. At the time of this study, 69% of subjects reported RLS symptoms more than 3 times/week. The intensity of the symptoms was "moderate" in 55% and "severe" in 28%. Forty % of women had no pregnancies, 27% had one pregnancy and 29% had two pregnancies; 66% of women reported no variations on RLS symptoms during pregnancy, 10% a "mild" worsening, another 10% a "moderate" worsening while 6% complained a "severe" worsening.

**Conclusion:** Despite the availability of drugs believed to be effective in RLS and their regular use in the majority of patients the RLS symptoms tend to persist. This points to the need of the development of new and more effective therapeutic strategies.

**Acknowledgements:** We thanks RLS patients for their availability in detailing their sleep and ill history.

<http://dx.doi.org/10.1016/j.sleep.2013.11.080>

### Patients with periodic limb movements disorder do not differ from patients with another sleep disorders in terms of nocturnal blood pressure

M. Sieminski<sup>1</sup>, M. Partinen<sup>2</sup>

<sup>1</sup>Medical University of Gdansk, Department of Adults' Neurology, Poland

<sup>2</sup>VitalMed Helsinki Sleep Clinic, Finland

**Introduction:** Restless legs syndrome (RLS) was found to be related with hypertension and the most probable link between RLS and increase of the blood pressure is sympathetic activation related to periodic limb movements (PLMs). The aim of the study was to analyze whether patients with periodic limb movements disorder (PLMD), without daily symptoms of RLS have higher values of nocturnal blood pressure than subjects with another sleep disorders.

**Materials and methods:** We have analyzed medical and polysomnographical data of 18 patients diagnosed with PLMD in a tertiary sleep clinic who underwent an all-night polysomnography with blood pressure monitoring and compared the data with 18 sex- and age-matched patients with other than sleep disorders (excluding sleep disordered breathing and restless legs syndrome) who underwent the same procedure of all-night recordings.

**Results:** There were 11 men and 7 women in both groups. Mean age in PLMD groups was 50.00 and in control group it was 49.89 years ( $p = 0.492$ ). PLMD patients had significantly higher BMI (27.69 vs. 23.84;  $p = 0.0047$ ). There was no difference between the groups in values in mean systolic blood pressure during the night (123.5 mmHg vs 121.66 mmHg,  $p = 0.369$ ) and during sleep (122.0 vs. 121.11,  $p = 0.433$ ). No difference was found in mean values of diastolic blood pressure during the night (77.66 vs. 75.15,  $p = 0.242$ ) and during the sleep (77.16 vs. 74.61,  $p = 0.239$ ).

**Conclusion:** We have found that periodic limb movement disorder does not influence significantly values of nocturnal blood pressure compared with another sleep disorders.

<http://dx.doi.org/10.1016/j.sleep.2013.11.081>

### Restless leg syndrome in young children with orofacial cleft

M. Moraleda-Cibrián<sup>1</sup>, S. Edwards<sup>2</sup>, S. Buchman<sup>3</sup>, S. Kasten<sup>3</sup>, S. Warschausky<sup>4</sup>, L. O'Brien<sup>1</sup>

<sup>1</sup> University of Michigan, Sleep Disorders Center, United States

<sup>2</sup> University of Michigan, Oral & Maxillofacial Surgery, United States

<sup>3</sup> University of Michigan, Department of Surgery, United States

<sup>4</sup> University of Michigan, Department of Physical Medicine and Rehabilitation, United States

**Introduction:** Periodic limb movements (PLMs) and Restless Leg Syndrome (RLS) are related conditions which are increasingly being recognized in children. The prevalence of PLMs is believed to be approximately 8–12% in childhood although it occurs in up to 25% of children with attention-deficit/hyperactivity disorder. Children with orofacial clefts are at increased risk of behavioral difficulties, including inattention and hyperactivity. However, no study has investigated the prevalence of PLMs or RLS in these children and the association with behavioral morbidity. The goal of the current study, therefore, was to investigate the frequency of PLMs and RLS in young children with orofacial cleft and to determine the relationship to inattentive and hyperactive behaviors.

**Materials and methods:** Families of children aged 2–6 years with orofacial clefts were invited to participate. All families completed the Pediatric Sleep Questionnaire (PSQ) which included the following subscales: PLMS (6-items), snoring and sleepiness (4 items each). A total score  $\geq 0.33$  on any subscale indicated a positive screen. Items about RLS and growing pains were also analyzed separately. In addition, families completed the Conners Early Childhood Assessment questionnaire which included several behavioral domains including hyperactivity/inattention.

**Results:** Thus far 36 children have been enrolled. Mean age was  $5.0 \pm 1.3$  years, 53% were boys and 61% Caucasian. Overall 19% of children screened positive for PLMs and a positive response to the RLS and growing pains items was reported in 15% and 12% of children respectively. Children with PLMs had a higher sleepiness score than those without (0.32 vs. 0.06;  $p = 0.008$ ). Those with RLS, compared to children without, tended towards a higher sleepiness score (0.25 vs. 0.09;  $p = 0.18$ ), as did those with growing pains (0.25 vs. 0.07;  $p = 0.12$ ). There were no associations between PLMs or RLS with snoring scores (0.25 vs. 0.21;  $p = 0.75$  and 0.20 vs. 0.21;  $p = 0.97$  respectively). Children with PLMs had higher inattention/hyperactivity scores than those without ( $66.7 \pm 17.0$  vs.  $53.9 \pm 13.5$ ;  $p = 0.039$ ), as did children with RLS ( $70.4 \pm 19.1$  vs.  $54.1 \pm 13.6$ ;  $p = 0.026$ ).

**Conclusion:** Daytime sleepiness and inattentive/behavioral problems are associated with symptoms of PLMs and RLS in young

children with orofacial cleft. Screening for such sleep problems may be important in this pediatric population.

**Acknowledgements:** Dr. Moraleda-Cibrián is supported in part by Fundacio Universitaria Agusti Pedro i Pons.

<http://dx.doi.org/10.1016/j.sleep.2013.11.082>

### Disease burden in patients with restless legs syndrome compared with an apnea and a control cohort

K. Morin<sup>1</sup>, L. Makaroff<sup>2</sup>, K. Moran<sup>3</sup>, S. Thieffry<sup>1</sup>

<sup>1</sup> UCB Inc., United Kingdom

<sup>2</sup> UCB Pharma, United Kingdom

<sup>3</sup> UCB, United Kingdom

**Introduction:** The objective of this study was to characterize demographics and disease burden for patients with restless legs syndrome (RLS) compared with an apnea and a control cohort.

**Materials and methods:** This retrospective, longitudinal, observational cohort study compared patient demographics, comorbidities, and prescription drug use in a prevalent cohort of RLS patients compared with an apnea and a control cohort. The study examined data from 1 year prior to index date (first ICD-9 diagnosis for RLS during time period 1/1/10 to 7/31/11) through 1 year post-index date in a US claims database. Prevalent RLS patients were identified by at least 2 RLS diagnoses with 2nd diagnosis any time pre- or 1 year post-index date. In a subset of incident RLS patients (no RLS diagnosis in pre-index period) prior sleep disorders and use of sleep aids was also determined.

**Results:** 7,773 prevalent RLS patients were matched 1:1 to apnea and control patients. Mean age of RLS patients was 61.4 years and 73% were female. There were 2,857 incident RLS cases. Due to matching, there was no significant difference in age or sex between cohorts. In the post-index period the prevalence of the most common comorbidities for RLS vs apnea patients was as follows: hypertension (46.9 vs 49.9%), pain (39.8 vs 29.0%), fatigue (17.7 vs 16.7%), anxiety (17.1 vs 8.1%), thyroid disease (16.8 vs 16.5%), depression (14.1 vs 7.4%), anemia (11.0 vs 7.2%), and peripheral neuropathy (10.7 vs 3.2%). Rates of pain, fatigue, anxiety, depression, anemia and peripheral neuropathy were higher ( $P < 0.001$ ) in RLS patients, while hypertension was higher ( $P < 0.0001$ ) in apnea patients. All comorbidities were more common ( $P < 0.0001$ ) in the RLS cohort than the control cohort. Unspecified insomnia in the incident population affected RLS patients (9.4%) more often ( $P < 0.0001$ ) than apnea (4.6%) or control (1.9%) patients. More incident RLS patients required a hypnotic agent during the pre-index period than apnea or control patients ( $P < 0.0001$ , RLS vs either). RLS patients used more opioid analgesics, dopamine precursors, benzodiazepines, dopamine agonists, anti-inflammatory agents, anticonvulsants, antidepressants, and anxiolytics than apnea patients or controls.

**Conclusion:** RLS was associated with hypertension, pain, anxiety, depression, anemia, and peripheral neuropathy, and was correlated with the utilization of several medications to control these conditions. This observational study suggests that unspecified insomnia may be an early symptom of RLS.

**Acknowledgements:** This study was supported by UCB Pharma.

<http://dx.doi.org/10.1016/j.sleep.2013.11.083>

### Orofacial myofunctional evaluation with scores in subjects with obstructive sleep apnea

G. Aparecida Folha, F. Cardoso Pereira Valera, L. Dantas Giglio, L. Vitaliano Voi Trawizki, C. Maria De Felício  
Faculty of Medicine of Ribeirão Preto, University of São Paulo, Brazil

**Introduction:** Orofacial myofunctional disorders (OMD) are common in patients with Obstructive Sleep Apnea (OSA), thus, it is necessary a detailed and precise clinical instrument for assessment of the OMD in this population, since the orofacial exercise has been recommended with positive results in patients with OSA. The Expanded Protocol of Orofacial Myofunctional Evaluation with Scores (OMES-E) is a validity instrument for the clinical evaluation of the orofacial myofunctional condition, that permit the examiner to express numerically the perception of the characteristics and behaviors observed in children. Thus, the aim of this study was to verify if the OMES-E protocol can discriminate the myofunctional orofacial characteristics in healthy adults and with OSA.

**Materials and methods:** Participated 133 subjects (19–60 years old), both genders (99 with untreated OSA, diagnosed by polysomnography - group OSA) and 34 healthy subjects, without OSA signs or symptoms (group C). Exclusion criteria were neurological or cognitive deficit, tumors or traumas in the head and neck, and use of analgesic, anti-inflammatory and psychiatric drugs. One speech therapist with experience in orofacial myofunctional evaluation performed the examination. The subjects were evaluated individually with the OMES-E protocol, according to the previously described methodology. To verify if the OMES-E protocol would be able to discriminate the myofunctional orofacial characteristics in the subjects with and without OSA, the analysis of covariance adjusted for the mean, with two variation factors (Group and Gender) was performed for the protocol Categories (Appearance/Posture, Mobility, Respiration, Deglutition and Mastication). Multiple Regression Analysis was calculated to verify the possible association between the variables Age and Body Mass Index (BMI) with the protocol Categories. Statistica software was used, significance level at 0.05.

**Results:** There was a higher percentage of OMD in group OSA compared to C ( $p < 0.001$ ). There were no differences regarding Gender to Categories of the protocol or interaction effect between Gender and Categories, but between Group and Categories. There was association between BMI with the Categories Appearance/Posture, Respiration ( $p < 0.01$ ) and Mobility ( $p < 0.05$ ), and between Age with Mobility ( $p < 0.05$ ).

**Conclusion:** Thus, the OMES-E protocol is able to discriminate the orofacial myofunctional characteristics in health adults and in patients with OSA.

**Acknowledgements:** This work received support from CAPES, the Brazilian Federal Agency for Support and Evaluation of Postgraduate Education.

<http://dx.doi.org/10.1016/j.sleep.2013.11.084>

### Sleep structure and cardiometabolic disorders in the general population

J. Haba-Rubio<sup>1</sup>, P. Marques-Vidal<sup>2</sup>, D. Andries<sup>1</sup>, N. Tobback<sup>1</sup>, M. Tafti<sup>1</sup>, R. Heinzer<sup>1</sup>

<sup>1</sup>Center for investigation and research in sleep (CIRS), University Hospital (CHUV), Switzerland

<sup>2</sup>Institute of social and preventive medicine (IUMSP), University Hospital (CHUV), Switzerland

**Introduction:** Recent research has identified relationships between sleep duration and quality and increased risk of cardiometabolic

disorders. Most previous studies used self-reported sleep duration or quality, but little is known about the objective sleep parameters underlying these associations. The aim of this study was to explore the association between sleep structure measured by polysomnography (PSG) and cardiometabolic disorders in a large unselected middle-aged general population sample.

**Materials and methods:** 2019 subjects (49.9% males,  $57.6 \pm 11.1$  years old, BMI  $25.4 \pm 4.4$  kg/m<sup>2</sup>) participating in an ongoing population-based sleep cohort (HypnoLaus, Lausanne, Switzerland) underwent full PSG recordings at home. All subjects had an extensive clinical workup including medical history, fasting glucose, morning systolic (SBP) and diastolic (DBP) blood pressure measurements. PSG were scored according to AASM 2007 scoring criteria.

**Results:** For the whole group there was, after adjustment for age, statistically significant correlations between cardiometabolic disorders and sleep parameters. The highest correlation coefficient values were obtained for % of slow wave sleep (SWS) and SBP ( $r^2 = -0.18$ ,  $p < 0.001$ ), DBP ( $r^2 = -0.13$ ,  $p < 0.01$ ), glycemia ( $r^2 = -0.18$ ,  $p < 0.001$ ) and BMI ( $r^2 = -0.17$ ,  $p < 0.001$ ); and for total arousal index (AI) and SBP ( $r^2 = 0.16$ ,  $p < 0.001$ ), DBP ( $r^2 = 0.13$ ,  $p < 0.01$ ), glycemia ( $r^2 = 0.19$ ,  $p < 0.001$ ) and BMI ( $r^2 = 0.19$ ,  $p < 0.001$ ). After excluding subjects with sleep disordered breathing and periodic limb movements (those with an apnea/hypopnea index -AHI-  $> 15$ /h and a periodic leg movement index -PLMSI-  $> 15$ /h) significant correlations remained between: SWS and SBP ( $r^2 = -0.17$ ,  $p < 0.05$ ), glycemia ( $r^2 = -0.22$ ,  $p < 0.01$ ) and BMI ( $r^2 = -0.25$ ,  $p < 0.01$ ). Significant associations (age-adjusted) were found between: SWS and BMI categories ( $p < 0.001$ ), diabetes ( $p = 0.01$ ), hypertension ( $p = 0.004$ ) and metabolic syndrome (MetSynd,  $p = 0.002$ ); and between AI and BMI categories ( $p < 0.001$ ), diabetes ( $p < 0.001$ ), hypertension ( $p < 0.001$ ) and MetSynd ( $p < 0.001$ ). After excluding subjects with abnormal AHI/PLMI significant associations remained between: SWS and BMI categories ( $p < 0.001$ ) and hypertension ( $p = 0.01$ ); and between AI and BMI categories ( $p = 0.003$ ), diabetes ( $p < 0.001$ ) and MetSynd ( $p = 0.02$ ).

**Conclusion:** Objectively measured sleep fragmentation and reduced SWS are associated with cardiometabolic disturbances in the general population.

**Acknowledgements:** Funding: Fondation Leenaards, FNS, GSK, Ligue Pulmonnaire Vaudoise and CIRS.

<http://dx.doi.org/10.1016/j.sleep.2013.11.085>

### Morbidity and mortality in children with obstructive sleep apnea: a controlled national study

P. Jennum

Danish Center for Sleep Medicine, Department of Clinical Neurophysiology, Denmark

**Introduction:** As there is little information regarding consequences of obstructive sleep apnea (OSA) in children, the aim of this study was to evaluate morbidity and mortality in childhood OSA.

**Materials and methods:** A total of 2998 patients with a diagnose of OSA were identified from the Danish National Patient Registry aged 0–19-years. For each patient, we randomly selected four citizens matched for age, sex and socioeconomic status, thus providing 11974 controls.

**Results:** The five-year mortality was 0.993 (0.989–0.996) versus 0.999 (0.998–0.999) in controls. The hazard ratio was 0.15 ( $p < 0.001$ ). Patients with OSA had greater morbidity at least three years before their diagnosis. The most common contacts with the health system (odds ratio, OR; confidence interval, CI): infections (OR:1.19; CI:1.01–1.40), endocrine, nutritional and metabolic

diseases (1.30; 0.94–1.80); nervous (2.12; CI: 1.65–2.73), eye (1.43; 1.07–1.90), ear-nose-throat (1.61; 1.33–1.94), respiratory system diseases (1.78; 1.60–1.98), gastrointestinal diseases (1.34; 1.09–1.66), skin (1.32; 1.02–1.71), congenital malformations (1.56; 1.31–1.85), abnormal clinical or laboratory findings (1.21; 1.06–1.39), and other factors that influence health status (1.29; 1.16–1.43). After its diagnosis, OSA was associated with incidences of endocrine, nutritional and metabolic diseases (1.78; 1.29–2.45), nervous (3.16; 2.58–3.89), ear-nose-throat (1.45; 1.14–1.84); respiratory system (1.94; 1.70–2.22), skin (1.42; 1.06–1.89), musculoskeletal (1.29; 1.01–1.64) diseases, congenital malformations (1.83; 1.51–2.22), abnormal clinical or laboratory findings (1.16; 1.06–1.27), and other factors influencing health status (1.35; 1.20–1.51).

**Conclusion:** Children with OSA show significant morbidities several years before and after a diagnosis. OSA should be considered in children with obesity and craniopharyngeal, upper airway/respiratory and neurological diseases.

**Acknowledgements:** Center for Healthy Aging, Faculty of Health Sciences, University of Copenhagen.

<http://dx.doi.org/10.1016/j.sleep.2013.11.086>

### Severity of sleep apnea syndrome is associated with arterial stiffness in elderly population

T. Kim, C. Lee, I. Yoon

Seoul National University, Seoul National University Bundang Hospital, South Korea

**Introduction:** Obstructive sleep apnea (OSA) increases cardiovascular morbidity and mortality, and higher arterial stiffness is one of the biological markers for increased cardiovascular risk in OSA. However, with aging, several cardiovascular comorbidities and treatments may confound the relationship between OSA and arterial stiffness. Therefore, we sought to investigate the association between OSA and arterial stiffness in otherwise healthy elderly population.

**Materials and methods:** We performed a cross-sectional study of 476 elderly patients ( $\geq 60$  yr) recruited from community and the sleep clinic in a university hospital between November 2010 and January 2013. Clinical data were collected using a standardized protocol, including questions about current medical condition and its medication. OSA was diagnosed using laboratory polysomnography. Subjects were stratified into two groups according to the presence of comorbid medical conditions or its treatment, such as, hypertension, diabetes, and dyslipidemia. Each group was subdivided into three groups based on apnea-hypopnea index (AHI), consisting of normal ( $\text{AHI} < 15$ ), mild-to-moderate OSA ( $15 \leq \text{AHI} \leq 30$ ), and severe OSA ( $\text{AHI} > 30$ ). Arterial stiffness was assessed by brachial-ankle pulse wave velocity (baPWV) and cardio-ankle vascular index (CAVI).

**Results:** Among 476 participants, 101 subjects were without any comorbid medical condition or medication use. The baPWV, CAVI, CRP were significantly higher in patients with severe OSA group after adjustment for gender, body mass index and smoking status ( $P = 0.003$ ,  $0.001$ , and  $0.025$  by ANCOVA, respectively) in healthy elderly group, but not in comorbid group. Multiple regression analysis showed baPWV, CAVI, and C-reactive protein had linear association with AHI ( $\beta = 0.326$ ,  $P = 0.002$ ;  $\beta = 0.326$ ,  $P = 0.002$ ;  $\beta = 3.253$ ,  $P = 0.002$ , respectively) in healthy group.

**Conclusion:** The severity of OSA is associated with arterial stiffness in otherwise healthy elderly individuals with OSA, but not in comorbid OSA individuals. In exploring the association between OSA and cardiovascular complications in the elderly, comorbidities need to be controlled, and we have found that OSA still increases cardiovascular risk in the elderly.

**Acknowledgements:** This study was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (Grant No. 2010-0008886).

<http://dx.doi.org/10.1016/j.sleep.2013.11.087>

### Gastrointestinal motility and sleep patterns assessed by ambulatory tracking of telemetric capsules combined with polysomnography

A. Haase<sup>1</sup>, S. Fallet<sup>2</sup>, M. Otto<sup>3</sup>, V. Schlageter<sup>4</sup>, K. Krogh<sup>1</sup>

<sup>1</sup>Aarhus University Hospital, Department of Gastroenterology and Hepatology, Denmark

<sup>2</sup>Swiss Federal Institute of Technology (EPFL), Swiss Federal Institute of Technology (EPFL), Switzerland

<sup>3</sup>Aarhus University Hospital, Department of Clinical Neurophysiology, Denmark

<sup>4</sup>Motilis Medica SA, Switzerland

**Introduction:** Due to the inaccessibility of the gastrointestinal (GI) tract and lack of proper measurement techniques clinical studies describing gastrointestinal function during sleep are sparse. In the present pilot study we aimed at introducing a novel ambulatory telemetric capsule system (3D-Transit) in conjunction with polysomnography (PSG).

**Materials and methods:** 3D-Transit (Motilis Medica SA) consists of ingestible electronic capsules, an extracorporeal portable detector containing 4 magnetic field sensors, and visualization software. The electromagnetic field emitted by each capsule is converted into space-time coordinates defining the distance and angular orientation of each capsule in relation to the detector. Changes in position and orientation of the capsules reflect GI contractile activity and progression. Nine healthy subjects (5 females, age 24–52) ingested a capsule in the morning at 08:00 a.m and another in the evening at 06:30 p.m. Polysomnography was carried out as an unattended portable sleep study with the electrodes placed just before bedtime. Standard placement of electrodes was used (EEG scalp sites: F3/F4, C3/C4, O1/O2, References M1/M2, EOG: E1/E2, EMG: Chin, ECG). The hypnograms were scored using 30-seconds epochs and were synchronized with 3D-Transit recordings. During sleep the first capsule was located in the colon and the second was initially in the stomach but moved to the small intestine (SI) within approximately 4 h (range 2–5.5 h). Propagating movements (PM) were defined as  $\geq 3$  cm anterograde displacement of the capsule with a velocity of either  $\geq 15$  cm/min (fast movements) or  $\geq 1.5$  cm/min (slow movement). Basic colonic activity was defined as the mean standard deviation of the position of capsules during displacement of  $< 3$  cm.

**Results:** Median sleep time was 6.6 h (range 5.1–7.5 h) with a median arousal index of 7.6 per hour sleep (range 4.9–16.9) and a median WASO of 26 min (range 7–84). From a total of 140 PM observed (85% in the SI and 15% in the colon), 12 (9%) occurred within 30 s after an arousal, 10 (7%) during wake periods and (84%) during stable sleep. There was no association between the sleep stages and the occurrence of PM (REM median 0.5 PM/h (range 0–6.9), N1 0 PM/h (0–2.7), N2 1.2 PM/h (0.3–5.7) and N3 2.2 PM/h (0–7.0)). The speed of progression through the SI did not change with depth of sleep or between REM and NREM sleep. Basic colonic activity was significantly lower during N3 ( $p = 0.02$ ) than during N2 and also lower during NREM sleep than during REM sleep ( $p = 0.02$ ). There was no difference between basic colonic activity during REM sleep and wake periods ( $p = 0.87$ ).

**Conclusion:** The novel ambulatory capsule technique (3D-Transit) in combination with PSG allows easy, minor invasive and completely

ambulatory investigation of associations between sleep patterns and gastrointestinal motility. This pilot study supports previous findings of deep sleep having an inhibitory effect on colonic activity.

<http://dx.doi.org/10.1016/j.sleep.2013.11.088>

### Fully automated sleep deprivation in rats using air puffs

B. Gross, W. Vanderheyden, A. Sergeeva, K. Prabhu, J. Priestly, G. Poe  
Department of Anesthesiology, University of Michigan, United States

**Introduction:** Full sleep deprivation via gentle handling is time-consuming and can result in increased personnel costs. The objective of this project was to develop an automated air puff sleep deprivation system using real-time state detection based on our previously published off-line software for automated state scoring.

**Materials and methods:** Data were acquired from male Sprague–Dawley rats online in real-time in 2 s epochs which are scored using nuchal EMG and a cortical EEG signals. Core blood was collected from sleep deprived and control rats after 6 h of air puff sleep deprivation during the light cycle or subjected to the same 6 h sequence of air puffs during the dark cycle to account for circadian fluctuations in corticosterone levels. Serum from each blood sample was isolated using a centrifuge and corticosterone concentration was measured using a radio immunoassay according to established methods.

**Results:** Analysis of corticosterone levels in serum showed no difference between the rats exposed to air puffs and their respective controls, suggesting that the air puffs are not stressful to the rats. Corticosterone levels in the dark cycle were higher than in the light cycle in accordance with published studies. Manual state scoring using the EMG and cortical EEG in 10 s epochs confirmed that the system completely deprived cortical sleep. Further investigation using a male Long Evans rat implanted with multi-tetrode microdrive in the hippocampus and cortical EEG screw electrodes also showed full sleep deprivation according cortical leads, consistent with the Sprague–Dawley rats. However, deep hippocampal EEG showed that local non-REM sleep occurred in the hippocampus approximately 10% of the sleep deprivation period. When not sleep deprived, no significant difference in the amount of non-REM sleep occurred between cortically and hippocampally scored EEG (Student's *t*-test;  $p = 0.92$ ).

**Conclusion:** The results show that the automated air puff sleep deprivation system completely prevents sleep when based on cortical EEG and is no more stressful to the rat than being housed in a recording chamber. This system can thus be used as an automated alternative to gentle handling in experiments that require full deprivation of sleep. Local sleep in the hippocampus, despite full sleep deprivation in the cortex, may have implications for compensatory mechanisms of memory consolidation during sleep deprivation and will be investigated in future cognitive studies.

**Acknowledgements:** Research funded by: The Dept. of Anesthesiology, University of Michigan Medical School and the National Institutes of Health (NIMH 1 R01 MH60670–11).

<http://dx.doi.org/10.1016/j.sleep.2013.11.089>

### Caffeine withdrawal: cost or benefit?

L. Lack, K. Johannson  
Flinders University of South Australia, School of Psychology, Australia

**Introduction:** Caffeine ingestion has been shown to enhance alertness and performance. However, caffeine ingestion before bed has

also been shown to lower the quality and quantity of sleep. For several reasons, including improved sleep hygiene to prevent or treat insomnia, caffeine withdrawal may be suggested. Many studies have shown negative effects during the first few days of caffeine withdrawal including headaches, lethargy, and irritability. Very few studies have continued observations beyond these immediate negative effects to determine the longer term effects. In other words, are individuals benefited or impaired given a longer period free of caffeine compared to the normal caffeine consumption period? The present study investigated a period of several weeks following caffeine withdrawal.

**Materials and methods:** Participants were 23 healthy young adult caffeine consumers. In addition to a caffeine consumption diary they recorded subjective evaluations of their day at 6 pm each day on a web based survey. The evaluations included headache symptoms, alertness, fatigue, moods, sleep, and overall quality of daily functioning. Measures were collected daily for a baseline week of normal caffeine consumption, a week of gradual withdrawal, and four additional weeks of caffeine abstinence.

**Results:** Repeated measures statistical analyses compared means for the baseline week, withdrawal week and the fourth week free of caffeine. During the week of withdrawal reported headaches and sleep length increased while alertness and overall day quality decreased compared to baseline caffeine consumption. However, by the last week all of these measures had returned to be comparable with the baseline week and in most cases were marginally but not significantly better than baseline week.

**Conclusion:** From this initial pilot study of the longer term subjective effects of caffeine withdrawal it appears that individuals rate their moods, sleep, and daytime functioning at least as favorably as during the baseline period of their normal caffeine consumption. Further studies including randomized placebo control trials using objective measures of sleep and performance are required to confirm these initial pilot findings.

**Acknowledgements:** Kristen Johannson who carried out this study as part of her Psychology Honours degree.

<http://dx.doi.org/10.1016/j.sleep.2013.11.090>

### Endocannabinoids and sleep

O. Prospéro-García<sup>1</sup>, M. Pérez Morales<sup>1</sup>, M. Méndez-Díaz<sup>1</sup>, A. Ruiz Contreras<sup>2</sup>

<sup>1</sup>UNAM, Facultad de Medicina, Mexico

<sup>2</sup>UNAM, Facultad de Psicología, Mexico

**Introduction:** Anecdotal information indicates that marijuana is anxiolytic and sleep inducer. We isolated an endocannabinoid, endogenous agonist of the CB1, from sleep-deprived cats; hence we believe endocannabinoids are sleep modulators. The objective of this series of studies is to describe the role of endocannabinoids in the modulation of sleep.

**Materials and methods:** Adult male Wistar rats were used in this study. Some of these rats were subjected to maternal care deprivation for 3 h from postnatal day (PND) 2 to PND16. Then utilized when adults. All rats were implanted with a set of electrode for standard sleep recording. Some were additionally implanted with a couple of cannulae aiming at the lateral ventricle. These cannulae were used to administer S1820, PAR1 agonist, 2 arachidonoylglycerol (2-AG) CB1 agonists and AM251 antagonists and tetrahydrolipstatine (THL) DGL Inhibitor.

**Results:** The activation of the PAR1 receptor increases sleep, in particular REM sleep. CB1 antagonist AM251 and THL prevent this effect. The administration of 2-AG into the lateral hypothalamus

increases the activation of MCH neurons and increases REM sleep. Oleamide restores NREM and REM sleep in maternal care deprived rats.

**Conclusion:** Our results suggest the endocannabinoid system is playing a crucial role in modulating sleep, in particular REM sleep.

**Acknowledgements:** Supported by Grants IN220712 from DGAPA-UNAM, 129103 from CONACyT and Fundación Miguel Alemán to OPG.

<http://dx.doi.org/10.1016/j.sleep.2013.11.091>

### Autoantibodies against distinct neuronal populations in narcoleptic patients – A possible link to vaccine induced autoimmunity?

P. Bergman<sup>1</sup>, C. Adori<sup>2</sup>, Y. Kai-Larsen<sup>3</sup>, A. Huuttoniemi<sup>4</sup>, M. Partinen<sup>4</sup>, T. Hökfelt<sup>2</sup>

<sup>1</sup>Karolinska Institutet, Dept. of Laboratory Medicine, Sweden

<sup>2</sup>Karolinska Institutet, Dept. of Neuroscience, Sweden

<sup>3</sup>Karolinska Institutet, Dept. of Neuroscience and Dept of Medical Biochemistry and Biophysics, Sweden

<sup>4</sup>University of Helsinki, Helsinki Sleep Clinic, Vitalmed Research Centre, and Haartman Institute, Finland

**Introduction:** Narcolepsy is a neurological sleep disorder that is characterized by excessive daytime sleepiness and cataplexy. The aetiology is unknown but genetic analyses have revealed a strong link to the HLA DQB1\*06:02 and T-cell receptor alpha loci. Thus, narcolepsy is proposed to be an autoimmune disease. During 2009–2010, a link between vaccination with the adjuvanted H1N1 influenza vaccine Pandemrix and onset of narcolepsy was observed in Finland and Sweden. We hypothesized that vaccination triggered generation of autoantibodies against orexinergic neurons in the lateral hypothalamus (LH) of affected patients. We searched for autoantibodies using immunohistochemistry using a rat brain 'neuroanatomical array'.

**Materials and methods:** Sera from 45 narcoleptic patients, 20 patients with other sleep related disorders (OSRD) and 20 healthy controls were included in the study, all of Finnish origin. All patients were HLA DQB1\*06:02 positive. Clinical information was collected. Sections of formalin-fixed rat brains were processed for immunohistochemistry using patient sera as primary antibody, followed by FITC-conjugated antibodies. Double-labelling with antisera to various relevant markers was carried out: Orexin, melanocyte-concentrating hormone (MCH),  $\beta$ -endorphin (marker for pro-opiomelanocortin (POMC) neurons), glutamic acid decarboxylase and more.

**Results:** Three distinct groups of immunoreactivity were recorded: group A (4/45) encompassed the MCH, but not the orexin neurons in the LH and the POMC neurons in the hypothalamic arcuate nucleus; group B (5/45) GABAergic interneurons in the cortex, many of them being calretinin or calbindin immunoreactive; and group C (4/45) neurons in the globus pallidus. In total 13/45 (29%) of narcoleptic sera stained some of the groups A, B or C. In the OSRD-group one positive serum was found (group B), whereas none of the sera in the healthy controls showed any staining. There was no clear link between the staining patterns and a previous history of Pandemrix-vaccination.

**Conclusion:** Almost one third of narcoleptic sera of Finnish patients contains autoantibodies against neuronal subpopulations, at least one of which has been associated with sleep-regulation.

**Acknowledgements:** The study was funded by the Swedish Medical Product Agency, the Swedish Research Council (VR) and Academy of Finland (26063) is a part of the NARPA- NORD consortium between Finland and Sweden.

<http://dx.doi.org/10.1016/j.sleep.2013.11.092>

### Sleep extension improves fasting insulin levels in adults who are habitually sleep restricted

R. Leproult, P. Peigneux

Université Libre de Bruxelles (ULB), Belgium

**Introduction:** Laboratory and epidemiological studies have evidenced an association between behavioral sleep restriction and an increased risk for the development of diabetes. The present study investigates the effects of bedtime extensions on fasting glucose and insulin levels in adults who are chronically sleep restricted during weekdays.

**Materials and methods:** Participants were sleep restricted as part of their lifestyle choices (self-reported sleep <7 h per weekday with increased bedtimes during WE). Wrist activity monitoring was obtained for 8 weeks, first for 2 weeks while following their regular bedtimes, then for 6 weeks while trying to increase their bedtimes by one hour per day and to adhere to prescribed sleep hygiene guidelines. At the end of the 2 weeks of habitual bedtimes, the participants completed a questionnaire on caloric intake for one day before the fasting blood sample. At the end of the 6 weeks of sleep extension, they were requested to follow exactly the same diet one day before the second fasting blood sample. Glucose and insulin were assayed before and after the sleep intervention.

**Results:** Eleven subjects completed the entire study (9 women/2 men, 28.5  $\pm$  6.5 years old, 21.2  $\pm$  2.8 kg/m<sup>2</sup>). On average, sleep time successfully increased by about 44 min per weekday ( $p = 0.001$ ) without any significant change in the sleep amount obtained during WE. There was a large inter-individual variability in the increase in sleep time (range 9–95 min) without any change in sleep efficiency. Fasting insulin levels decreased significantly after sleep extension ( $p = 0.036$ ) without any significant change in fasting glucose levels, indicating a lower diabetes risk with sleep extension. Noteworthy, this decrease in insulin levels correlated with weight changes (Kendall  $\hat{\rho} = -0.50$ ,  $p < 0.05$ ) and with increases in sleep time (Kendall  $\hat{\rho} = 0.48$ ,  $p < 0.05$ ).

**Conclusion:** Our findings demonstrate that sleep extension is feasible in adults who are chronically sleep restricted and beneficial in reducing fasting insulin levels, but is highly individual-dependent. Further investigation on sleep extension in pre-diabetics and diabetics who are chronically sleep restricted is needed to explore the possibilities of improving the severity of diabetes by sleep extension protocols.

**Acknowledgements:** The study was funded by a "Brains Back to Brussels", from INNOVIRIS, the Institut Bruxellois pour la Recherche et l'Innovation – Région Bruxelles-Capitale.

<http://dx.doi.org/10.1016/j.sleep.2013.11.093>

### Sleep bruxism and masseter muscle activity during rem sleep of rem sleep behavior disorder patients: a case control study

S. Abe<sup>1</sup>, J. Gagnon<sup>2</sup>, J. Montplaisir<sup>3</sup>, P. Rompré<sup>4</sup>, F. Kawano<sup>5</sup>, G. Lavigne<sup>4</sup>

<sup>1</sup>Tokushima University Hospital, Department of Oral care and Clinical Education, Japan

<sup>2</sup>Université du Québec à Montréal, Department of Psychology, Canada

<sup>3</sup>Université de Montréal, Département de Psychiatrie, Canada

<sup>4</sup>Université de Montréal, Faculté de Médecine Dentaire, Canada

<sup>5</sup>University of Tokushima, Department of Comprehensive Dentistry, Institute of Health biosciences Graduate School, Japan

**Introduction:** Rapid eye movement (REM) sleep behavior disorder (RBD) is characterized by abnormal and excessive motor activity in electromyographic (EMG) during REM sleep. Presence of sleep bruxism (SB)/tooth grinding and oromandibular myoclonus (OMM) were investigated in RBD patients not taking medications in comparison to age matched control subjects (CTRL).

**Materials and methods:** Polygraphy sleep and oromotor activity data from 9 RBD patients ( $68.22 \pm 3.63$  y.o.) and 9 healthy CTRL ( $65.11 \pm 3.95$  y.o.) were analyzed. RBD patients were diagnosed by a neurologist and confirmed by sleep laboratory recording. Rhythmic masticatory muscle activity (RMMA), a marker of sleep bruxism, and oromandibular myoclonus were scored from jaw electromyographic recordings during sleep using published criteria (Lavigne 1996; Kato 1999).

**Results:** RBD patients had significantly higher index of RMMA/SB than CTRL during sleep ( $p < 0.01$ ). During REM sleep, RBD patients had significantly higher index of RMMA/SB episodes and bursts than CTRL subjects ( $p < 0.001$ ). During non-REM sleep, no significant difference between RBD and CTRL was observed ( $p = 0.12$ ). Compared to controls, the OMM episode and burst indexes were significantly higher in RBD patients ( $p = 0.04$  and  $0.03$ , respectively).

**Conclusion:** RBD patient's not taking medication had significantly higher RMMA activity, a proxy of sleep bruxism diagnosis, than CTRL subjects over night and during REM sleep. The higher index of RMMA/SB during REM sleep of RBD patients suggest that activity in jaw closing muscles can be scored during sleep of suspected RBD patients. Furthermore, sleep bruxism occurring during REM may be a concomitant finding influencing the diagnosis and management of both SB and RBD.

**Acknowledgements:** (Supported by the Canadian Institutes of Health Research. grant from CIHR).

<http://dx.doi.org/10.1016/j.sleep.2013.11.094>

### Sleep, symptom-ratings and serum ferritin levels in children with ADHD

M. Abou-Khadra, O. Amin, O. Shaker, T. Rabah

**Introduction:** The present study was conducted to describe sleep problems in a sample of Egyptian children with ADHD and to examine the effect of low serum ferritin levels on their sleep and symptom-ratings.

**Materials and methods:** The parents of 41 ADHD children, aged 6–12 years, filled out the Children's Sleep Habits Questionnaire (CSHQ) and Conners' Parent Rating Scale-Revised: long version (CPRS-R:L) in Arabic. Serum ferritin levels of the children were determined with the enzyme-linked immunosorbent assay method. The parents of 62 normal control children filled out the CSHQ.

**Results:** The ADHD group had significantly higher scores on bedtime resistance, sleep anxiety, parasomnias, sleep-disordered breathing, daytime sleepiness and global sleep disturbance (CSHQ total score) than in the control group. Children with serum ferritin levels  $< 30$  ng/mL had more disturbed sleep than children with serum ferritin levels  $\geq 30$  ng/mL. There were significant negative correlations between sleep duration subscale, total score of CSHQ, and serum ferritin levels ( $p < 0.05$ ). There were no significant differences in ADHD symptoms in regard to ferritin levels ( $p > 0.05$ ).

**Conclusion:** Sleep problems are common among this sample of children with ADHD. This study suggests an association between low serum ferritin levels and sleep disturbances among Egyptian children with ADHD.

**Acknowledgements:** We would like to thank the parents and the children for participation in this study. Also, we would like to thank

Janssen-Cilag pharmaceutical company that paid the cost of the CPRS-R:L questionnaire.

<http://dx.doi.org/10.1016/j.sleep.2013.11.095>

### Sleep patterns and problems among egyptian children with ADHD: The impact of symptoms severity and subtypes

O. Amin, M. Abou-Khadra

**Introduction:** Sleep problems are common among children with attention deficit hyperactivity disorder (ADHD). The present study was conducted to describe sleep patterns and problems in a sample of Egyptian children with ADHD and to examine the impact of symptoms severity and subtypes on their sleep.

**Materials and methods:** The parents of 100 ADHD children, aged 6–12 years, filled out the Children's Sleep Habits Questionnaire (CSHQ) and Conners' Parent Rating Scale-Revised: long version (CPRS-R:L) in Arabic. The parents of 100 normal control children filled out the CSHQ.

**Results:** The ADHD group had significantly higher scores on bedtime resistance, sleep duration, sleep anxiety, parasomnias, daytime sleepiness and global sleep disturbance (CSHQ total score) than in the control group. There were significant positive correlations between oppositional, hyperactivity, cognitive problems/inattention, and ADHD index subscales raw score and CSHQ scale scores. Children with Combined subtype had significantly higher scores than controls in bedtime resistance ( $p < 0.001$ ), sleep anxiety ( $p < 0.001$ ), parasomnias ( $p = 0.001$ ), daytime sleepiness ( $p = 0.014$ ), and total score ( $p < 0.001$ ). There were no significant difference between ADHD subtypes in regard to CSHQ scale scores ( $p > 0.05$ ).

**Conclusion:** Sleep problems are common among this sample of children with ADHD. This study suggests that sleep disturbances are related to symptoms severity and ADHD subtype.

**Acknowledgements:** We would like to thank the parents and the children for participation in this study. Also, we would like to thank Janssen-Cilag pharmaceutical company that paid the cost of the CPRS-R:L questionnaire.

<http://dx.doi.org/10.1016/j.sleep.2013.11.096>

### Metabolomic fingerprinting approach to sleep apnea disorder in human plasma

M. Troncoso Acevedo<sup>1</sup>, T. Gómez García<sup>1</sup>, A. Ferrarini<sup>2</sup>, F. Ruperez<sup>2</sup>, A. Garcia<sup>2</sup>, N. Gonzalez Mangado<sup>1</sup>

<sup>1</sup> Servicio de Neumología, IIS-Fundación Jiménez Díaz, Brazil

<sup>2</sup> CEMBIO, Facultad de Farmacia, Universidad CEU San Pablo, Spain

**Introduction:** Obstructive sleep apnea/hypopnea syndrome (OSAHS) is becoming a major cause of morbidity and it is the most common medical cause of daytime sleepiness. Metabolomics fingerprinting is able to achieve through the identification of novel biomarkers the comprehensive characterization of the entire metabolome of a disease, with the final aim to predict response to different therapies and outcomes and increase the knowledge regarding the pathological bases underlying sleep disorders.

**Materials and methods:** A non-targeted metabolomic study of plasma from 42 OSAHS patients and 16 healthy subjects was performed. The individual analytical fingerprints obtained by gas chromatography coupled to mass spectrometry (GC-Q-MS) were deconvoluted using AMDIS software and identified by the

information compiled in Fiehn's and NIST libraries. The same set of samples were analysed by liquid chromatography coupled with quadrupole time-of-flight mass spectrometer (LC-QTOF-MS). Profiles were aligned and filtered using Mass Profiler Professional. Univariate and multivariate statistical analysis were applied for screening potential biomarkers.

**Results:** OPLS-DA plots obtained using SIMCA-P+, based on GC-MS and LC-MS data, show clear separation between control and severe patient. Changes in the metabolic profiles of amino acids were found between both groups, showing an increase trend, including some branched-chain amino acid (BCAAs). Different metabolic pathways could be altered under conditions related to insulin resistance, such as metabolic syndrome and obesity causing alterations in branched-chain keto acid dehydrogenase that could be reflected in the increased level of BCAAs. Phosphocholine and compounds related to the glycine and glutamate metabolism were putatively assigned. Glutamate receptors have recently been found present in the lung (NMDA receptors) causing a wide range of damage (lipid peroxidation, DNA bridges broken, activation of the system caspases, loss of energy and cell death).

**Conclusion:** These findings reflect considerable differences in individual metabolite fingerprints of OSAHS patients and open the possibility of identifying novel biomarkers associated to sleep disorders, that can help to uncover the complexity underlying the metabolic alterations occurring in OSAHS.

**Acknowledgements:** The research leading to these results has received funding from the [European Union] Seventh Framework Programme [FP7/2007- 2013] under grant agreement n°264864”.

<http://dx.doi.org/10.1016/j.sleep.2013.11.097>

### Sleep disorders in chronic renal failure patients

M. Eltawdy<sup>1</sup>, A. Rabah<sup>1</sup>, M. Nada<sup>2</sup>, R. Refaat<sup>1</sup>, L. Afifi<sup>2</sup>

<sup>1</sup>Neurology Dept, Cairo University, Egypt

<sup>2</sup>Clinical Neurophysiology, Cairo University, Egypt

**Introduction:** This work aims to assess the prevalence and quality (type) of sleep disorders in chronic renal failure patients.

**Materials and methods:** A study was conducted on 40 patients with chronic renal failure (CRF) who were subdivided into two groups; patients not on hemodialysis (HD) (group I) ( $n = 20$ ), and patients on regular HD (group II) ( $n = 20$ ), and 20 sex and age matched control subjects. All subjects were subjected to thorough neurological examination, sleep complaints history and polysomnography.

**Results:** All CRF patients had sleep complaints in the form of difficulty falling asleep (45%), fragmented sleep (55%), early morning awakening (45%) excess daytime sleepiness (25%) and jerking leg movements (15%). Patients group had significantly lower total sleep time, sleep efficiency, slow wave sleep percentage, oxygen desaturation and higher apnea hypopnea index and number of awakenings compared to control group. Sleep efficiency was significantly lower in group I compared to group II while periodic limb movement disorder was more in group II.

**Conclusion:** There is a high prevalence of sleep disorders in chronic renal failure CRF patients whether they are on regular HD or not and, proper management of these disorders will improve the morbidity and quality of life of those patient.

<http://dx.doi.org/10.1016/j.sleep.2013.11.098>

### Repeated sleepiness ratings throughout the day – A normative field study in 800 individuals across one working week

T. Akerstedt, G. Kecklund, D. Hallvig

Stockholm University, Sweden

**Introduction:** Sleepiness ratings are frequently used in field and laboratory studies in relation to altered sleep/wake patterns. In field studies sleepiness ratings are often the only reasonable way for measuring sleepiness. Most studies have been small, however, and focused on a particular occupational group. There is a need for normative values of sleepiness at different times of day in relation to factors that might affect sleepiness, for example, work/leisure, stress, gender, age, night sleep, and health. No similar studies have been carried out before and to obtain such data was the purpose of the present study.

**Materials and methods:** The participants rated their sleepiness on the Karolinska Sleepiness Scale (KSS) at 07, 10, 13, 16, 19, and 22 h each day for one week (scale 1–9) and filled out daily sleep diaries on sleep, stress (same time as KSS), workload, work/nonwork, subjective health and others.

**Results:** The results showed a very pronounced diurnal pattern with high levels at 07 h (4.6) and 22 h (6.6) with 3.5 around noon. Having a day off reduced the level by 0.4 units, being male reduced the levels by 0.4 units and higher age (60 years) reduced levels by 0.3 units (compared to 30 year olds) (all  $p$ -values  $< .001$ ). In a multiple regression analysis was observed that sleepiness was considerably higher in individuals high on stress (workday mean) or higher in individuals low on subjective health ( $p < .001$ ). Subjective sleep quality predicted lower sleepiness, but sleep duration did not.

**Conclusion:** It was concluded that subjective sleepiness has a pronounced circadian pattern which differs depending on age and gender, and is affected by prior sleep, although stress and the state of health play important roles. The results emphasize the importance of accounting for the modifying factors when using self-rated sleepiness.

**Acknowledgements:** This study was supported by The Swedish Research council and Stockholm Stress Center.

<http://dx.doi.org/10.1016/j.sleep.2013.11.099>

### CPAP can reduce blood pressure in symptomatic patients with OSAS

D. Al-Abri

Sultan Qaboos University Hospital, Oman

**Introduction:** obstructive sleep apnea syndrome (OSAS) is associated with raised arterial blood pressure (BP). There are controversial evidences about the effect of continuous positive airway pressure (CPAP) in lowering nocturnal and daytime BP in patients with OSAS and therefore, the aim was to examine the real effect of CPAP in blood pressure in these patients.

**Materials and methods:** We conducted a randomized sham-controlled cross-over study of the effects of 6 weeks of continuous positive airway pressure (CPAP) or Sham CPAP on 24-h blood pressure in 39 sleepy patients (37 males, 2 females) with mean age of  $50 \pm 8$ , mean apnea-hypopnea index [AHI],  $47 \pm 29$  and mean ESS  $16 \pm 3$ . Five patients were receiving anti-hypertension medications and 7 patients who had nocturnal dipping. Ambulatory blood pressure was recorded for the last 48 h at baseline and after each treatment. Epworth Sleepiness Score (ESS) was also recorded.

**Results:** There was a small decrease in nighttime diastolic blood pressure (DBP) (Sham CPAP,  $75.5 \pm 10.5$  mmHg; CPAP,  $71.9 \pm 10.5$  mmHg;  $p = 0.03$ ). There was also reduction but not significant in daytime DBP ( $p = 0.06$ ). The mean DBP for 24 h was also reduced by CPAP ( $p = 0.03$ ). There was no significant difference in systolic blood pressure (SBP) between sham-CPAP and CPAP treatment the average CPAP use was  $>$  or  $=$  4 h per night.

**Conclusion:** Thus, CPAP can reduce daytime and nighttime diastolic blood pressure in symptomatic patients with OSAS.

**Acknowledgements:** Dr. Renata Riha, Dr. Tom Mackay and Prof Neil Douglas, Department of Sleep Medicine, Royal Infirmary of Edinburgh and University of Edinburgh, UK.

<http://dx.doi.org/10.1016/j.sleep.2013.11.100>

### The oxford sleep resistance test (OSLER) is sensitive in showing modifications in vigilance with CPAP therapy in sleep apnea patients

A. Alakuijala<sup>1</sup>, P. Maasilta<sup>2</sup>, A. Bachour<sup>3</sup>

<sup>1</sup>Helsinki University Hospital, Department of Clinical Neurophysiology, Finland

<sup>2</sup>Helsinki University Hospital, Pulmonary Department, Finland

<sup>3</sup>Helsinki University Hospital, Sleep Unit, Finland

**Introduction:** Patients with obstructive sleep apnea (OSA) usually demonstrate cognitive dysfunction both subjectively and objectively. The Oxford Sleep Resistance Test (OSLER) is a behavioral test measuring the ability to maintain wakefulness. The subject is seated in a dark and quiet room and is instructed to remain awake and to respond by hitting a button on a portable device each time a dim light flashes at 3-s interval. The test consists of 3 to 4 sessions of 40 min each. When the subject fails to respond for 21 s (i.e., 7 consecutive illuminations), the test is ended and it is assumed that the subject has fallen asleep. Analyzing the error profile (including 1–6 consecutive missed hits) is considered as a sensitive mean of detecting fluctuations in vigilance. Here, we report the results of the OSLER test before and under CPAP therapy in professional drivers referred for OSA.

**Materials and methods:** 29 professional drivers (27 men and 2 women with a mean age of 50 yrs) referred for a suspicion of sleep apnea underwent an OSLER test at baseline and after two months from CPAP initiation. We started the first session at 9:00 AM followed by two sessions at 2-h interval. We also calculated the total number of missed hits (errors) and divided that by the duration of the test to obtain the number of errors per hour (OSLER error index).

**Results:** With CPAP therapy the mean AHI dropped significantly ( $p < 0.05$ ) from 50/h to 10/h, ODI4 from 44/h to 11/h, time with SpO<sub>2</sub> below 90% from 35% to 2%, and the Epworth sleepiness scale score from 9.5 to 7.4. Furthermore, the mean OSLER sleep latency time improved significantly ( $p < 0.05$ ) with CPAP from 33 min 2 s to 36 min 48 s, and the OSLER error index decreased from 51 errors/h to 20/h.

**Conclusion:** The OSLER test is a practical tool for measuring improvement in vigilance due to CPAP therapy in professional drivers suffering from sleep apnea.

<http://dx.doi.org/10.1016/j.sleep.2013.11.101>

### CSF beta-amyloid levels are altered in narcolepsy: a link with the inflammatory hypothesis?

M. Albanese, C. Liguori, F. Placidi, F. Izzi, M. Marciari, A. Romigi  
University Hospital of Rome 'Tor Vergata', Department of Neuroscience, Sleep Medicine Center, Italy

**Introduction:** Autoimmune and inflammatory mechanisms are suggested as a possible cause of the hypocretin cell loss in human narcolepsy. Interestingly, decreased CSF levels of beta-amyloid1–42 (Abeta–42) are described related to brain inflammation. In fact the Abeta–42 metabolism is strongly regulated by inflammatory mechanisms and the inflammatory pathways of the immune system represent targets for modulating  $\beta$ -amyloid generation and accumulation. The aim of our study was to evaluate the CSF levels of Abeta–42, total-tau (t-tau) and phosphorylated-tau (ptau) in narcoleptic patients, compared with matched healthy controls, to test if the inflammatory pathways in narcolepsy may interfere with CSF Abeta–42 and/or tau metabolisms.

**Materials and methods:** Lumbar CSF of patients with narcolepsy and healthy individuals was analyzed by ELISA tests in order to detect the CSF levels of orexin A, Abeta–42, t-tau and ptau proteins.

**Results:** We analysed 15 narcoleptic patients and 15 sex and age-matched controls. More than one-and-a-half Abeta–42 CSF levels decrease was detected in narcoleptic patients compared with healthy controls. Moreover in 5 narcoleptic patients (33%) we documented pathological CSF Abeta–42 levels ( $< 500$  pg/ml) and 14 of the 15 narcoleptic subjects (93%) presented CSF Abeta–42 levels lower than the CSF Abeta–42 mean value of the matched controls. Conversely, CSF levels of t-tau and ptau proteins did not statistically differ between groups.

**Conclusion:** We hypothesize that the significant decrease of the CSF Abeta–42 levels in narcoleptic patients may support the inflammatory/autoimmune hypothesis at the basis of the pathogenesis of narcolepsy. Therefore, our findings may be particularly appealing since narcolepsy is a neurological disorder caused by possible underlying autoimmune processes, aroused by viral or bacterial infections, responsible for the selective orexinergic neurons loss. In addition, a secondary explanation may be represented by the prevalence of an “amyloidogenic” pathway, due to the deficiency of the alpha-secretase ADAM10, previously described in narcolepsy, which cause the reduction of the CSF Abeta–42 levels in narcoleptic patients. Therefore, further studies are needed to better clarify the pathogenesis of narcolepsy, to understand the role of Abeta–42 and its links with degeneration and loss of the orexinergic neurons.

**Acknowledgements:** We thank for their precious help and assistance: N.B. Mercuri, PhD, S. Bernardini, PhD, M. Nuccetelli, MD.

<http://dx.doi.org/10.1016/j.sleep.2013.11.102>

### Validation of the efficacy of an anti-snoring pillow

J. Albares<sup>1</sup>, E. Esteller<sup>2</sup>, C. Estivill<sup>1</sup>, C. Martinez<sup>1</sup>, F. Segarra<sup>1</sup>, E. Estivill<sup>1</sup>

<sup>1</sup>USP Institut Universitari Dexeus, Clinica del Son Estivill, Spain

<sup>2</sup>Hospital general de Catalunya, Department of Otolaryngology, Spain

**Introduction:** The aim of the study is to test the functionality of a prototype anti snoring pillow (position “forced supine”) on three-dimensional tissues “spacer” in order to assess the possible reduction of snoring and the possible reduction of respiratory events (apneas/hypopneas).

**Materials and methods:** 15 patients have participated. Each had 2 full PSG studies evaluating the intensity and frequency of snoring by sound and visual recording of the patient's sleep. Also examined were the quality and quantity of sleep (using EEG and EOG), respiratory activity via cannula, thermistor and thoracic and abdominal bands, the number of respiratory events (apneas, hypopneas), the level of oxygen desaturation and lower limb muscle activity (PLM) by EMG. We evaluated the subjective data of comfort and sleep quality of both the prototype and the usual pillow by patient questionnaire completed in the morning. The results appear as numbers and percentages.

**Results:** No differences were observed in the macrostructure of sleep, or sleep efficiency between the patient's usual pillows and the prototype. There are no differences in assessing different types of comfort pillow (7.5 vs 7.4). As for the polysomnography values: The prototype reduces the AHI by 743%, the number of snoring by 2470%, the index snoring for hour in a 4369%, time snoring in 1759 min compared with the usual pillow. The average intensity of snoring is reduced by 51% with the prototype. With the usual pillow comfort was evaluated as greater than the prototype (9 vs 3.2).

**Conclusion:** These values show that these pillows could be a valid treatment for mild to moderate apnea.

<http://dx.doi.org/10.1016/j.sleep.2013.11.103>

### Partial continuous epilepsy as the initial condition of a patient diagnosed with Creutzfeldt–Jakob disease

C. Alcaide<sup>1</sup>, A. Juarez<sup>2</sup>, L. Marina<sup>3</sup>, C. Montes<sup>4</sup>

<sup>1</sup> Complejo Hospitalario de Toledo, Resident in Clinical Neurophysiology, Spain

<sup>2</sup> Complejo Hospitalario de Toledo, Resident in Neurology, Spain

<sup>3</sup> Complejo Hospitalario de Toledo, Intensivist, Spain

<sup>4</sup> Complejo Hospitalario de Toledo, Clinical Neurophysiologist, Spain

**Introduction:** clinical history: a 52 year old male, with no previous medical history of any particular interest, who was admitted due to a state of no coordination of the movements of the limbs on the left side and myoclonic movements in the upper and lower left limbs, which became progressively worse resulting in a complex partial crisis, treatment with three combined FAEs being ineffective. Associated deterioration of visual capacity, dysarthria, dysphagia, continual abnormal movements and worsening of EEG for which pharmacological coma was induced.

**Materials and methods:** Various EEGs were done in which we observed the negative development the brain activity showed, including persistent critical epileptic discharges predominantly emanating from the rolandic medial region with association with involuntary movements in upper left limbs and in inferior left limbs on occasion. In the last EEG we identified periodic diffuse epileptic discharges, which were generalized in both hemispheres, associated with myoclonias predominantly in the inferior right extremities. Between both extremes we performed a polysomnographic diurnal sleep test with video recording in which we observed continuous associated partial epileptic discharges predominant in the patient.

**Results:** discussion Epilepsy as the first manifestation of Creutzfeldt–Jakob Disease supposes, according to sources consulted, less than ten percent of cases. Our patient initially showed a partial continuous epilepsy which is even more unusual and suggests other differential diagnoses before citing the final diagnosis.

**Conclusion:** We present the polysomnographic diurnal sleep study and serial EEGs of the patient which, in addition to neuro imaging,

may help make an earlier diagnosis than in our case, given the peculiar implications in relation to prognosis and possible transmission of this type of degenerative prionic illness.

<http://dx.doi.org/10.1016/j.sleep.2013.11.104>

### Evaluation of sleep disordered breathing using non-contact remote bio-radiolocation method

M. Alekhin<sup>1</sup>, L. Anishchenko<sup>1</sup>, A. Zhuravlev<sup>1</sup>, S. Ivashov<sup>1</sup>, L. Korostovtseva<sup>2</sup>, Y. Sviryaev<sup>2</sup>

<sup>1</sup> Bauman Moscow State Technical University, Remote Sensing Laboratory, Russia

<sup>2</sup> Almazov Federal Heart, Blood and Endocrinology Centre, Hypertension Research Department, Russia

**Introduction:** One of the priority areas of sleep medicine is implementation of novel non-contact technical approaches for remote vital signs monitoring, including screening of sleep disordered breathing (SDB). Bio-radiolocation (BRL) is a modern remote sensing technology allowing non-contact respiratory monitoring, on the base of analysis of specific biometric modulation of radiolocation signal by reciprocal breathing movements of chest and abdominal wall. The objective of this study was to estimate diagnostic informativeness of BRL method in comparison with full-night polysomnography (PSG) for non-contact screening of SDB in adults.

**Materials and methods:** The sample included 7 subjects (4 males and 3 females, aged 43–62 years, with body mass index (BMI) of 21.6–57.7), depending on severity of obstructive sleep apnea syndrome (OSAS): 4 severe; 1 moderate; 1 mild; 1 normal. The PSG records were collected with Embla N7000 system in the sleep laboratory (Almazov Federal Heart, Blood and Endocrinology Centre). Simultaneously BioRascan system (RSLab, Bauman Moscow State Technical University) was applied. The internal clock of BRL and PSG systems were synchronized. Subsequently, PSG records were analyzed by a certified specialist and verification of corresponding BRL signals was performed manually by a trained operator.

**Results:** The analysis of PSG records revealed in total 2700 episodes of SDB: 1279 obstructive sleep apneas (OSA); 106 central sleep apneas (CSA); 495 mixed sleep apnea (MSA); 820 hypopneas (HYPA). The result of verification of BRL signal patterns for SDB in comparison with PSG was as follows: 1955 true positives; 745 false positives; 868 false negatives. Thus BioRascan system displayed a sensitivity of 69% and an accuracy of 72% in non-contact screening of SDB. The obtained results should be considered clinically significant in each case the estimate of apnea-hypopnea index (AHI) for BRL method got into the same range of OSAS severity scale as for PSG method.

**Conclusion:** Thus, the estimation of diagnostic informativeness of BRL method in comparison with full-night PSG allowed referring BioRascan system to Type 4 (continuous single or dual bioparameter recording) of portable monitoring devices for diagnostic assessment of patients with suspected OSAS, satisfying medical recommendations.

**Acknowledgements:** The study was supported by EU FP7- IRSES project AMISS (PIRSES-GA- 2010–269157) and grants of the Ministry of Education and Science of Russia (#14.B37.21.1929 and #7.305.2011) and RFBR (#12–07- 31014-a and #11–07-00213-a).

<http://dx.doi.org/10.1016/j.sleep.2013.11.105>

### Characterizing sleep–wake cycles of pre-health professional students

M. Ali, R. Chu, S. Nastos, S. Whelan

McMaster University, Faculty of Health Sciences BHSc (Honours) Program, Canada

**Introduction:** Concern regarding sleep quality among health professionals inspired our study to characterize sleep–wake cycles among pre-health professional students, who comprise the future workforce of caregivers. Set within the Bachelor of Health Sciences (Honours) Program, McMaster University, the purpose of our study was (a) to determine chronotype- and gender-specific effects on actual sleep-time duration, sleep onset latency, and sleep efficiency, in young adults; (b) to investigate the effects of irregular sleeping patterns, and ambient light during sleep, on sleep efficiency in university students; and (c) to characterize the sleep behavior of pre-health professional students.

**Materials and methods:** Seventy-one students (41 M, 30 F) were studied (mean age = 21.0 yr, SD = 0.6 yr) from Oct–Nov, 2010–12. Chronotype was determined via questionnaire, and activity–rest rhythms were measured via Actiwatch® 2 (and a standardized diary) for 3–7 consecutive days (median = 5 d; SD = 0.82 d). Actiware® sleep analysis software provided the sleep-parameters data. Data were analyzed for: gender–chronotype correlation; effect of gender and chronotype on sleep parameters; and correlation between (a) ambient light exposure during sleep and (b) sleep irregularity on sleep efficiency.

**Results:** Actigraphy-derived sleep data were summarized, by gender and chronotype. Evening types were most common ( $n = 32$ , 45.1%), followed by intermediate types ( $n = 27$ , 38.0%), and then morning types ( $n = 12$ , 16.9%). The distribution of chronotypes was related to gender: males displayed eveningness significantly more often than females (61.0% of males vs. 20.8% of females;  $p = 0.006$ ), while females exhibited greater morningness (12.2% of males vs. 23.3% of females;  $p = 0.006$ ). There were no significant gender- or chronotype-specific differences on actual sleep-time duration or sleep onset latency. Females had a higher sleep efficiency (86.5%, SD = 0.8%) than males (83.4%, SD = 0.9%;  $p = 0.018$ ), whereas the effect of chronotype on sleep efficiency was marginal ( $p = 0.051$ ). Both ambient light exposure during sleep ( $R = -0.261$ ,  $p = 0.028$ ) and sleep irregularity ( $R = -0.337$ ,  $p = 0.004$ ) negatively correlated with sleep efficiency.

**Conclusion:** Our study highlighted gender- and chronotype-specific effects on sleep parameters and the importance of regular activity–rest rhythms for sleep quality among university students. We also characterized sleep–wake cycles of pre-health professional students, to establish a baseline for to health professionals.

**Acknowledgements:** Special thanks to the fourth-year students in the Bachelor of Health Sciences (Honors) Program at McMaster University for participation in this study; Delsworth Harnish (assistant dean of the program) for his support; Marta Halytska (program student) for assistance in literature review; Guy Jennings (Bio-Lynx Scientific Equipment Inc.) for advice on Actiwatch® data; and James MacFarlane (University of Toronto) for contributions to the preparation of the manuscript.

<http://dx.doi.org/10.1016/j.sleep.2013.11.106>

### Prevalence of restless legs syndrome secondary to hemodialysis unit clinics hospital

X. Alvarado

Hospital de Clínicas La Paz Bolivia, Medico Internista

**Introduction:** Being frequent sleep disorders in their presentation, they probably are underreported, it is necessary to make us aware of

their importance to know its prevalence, the patients with ESRD on hemodialysis have a high cardiovascular risk would be added leg syndrome secondary restless already known for its complications. By knowing both their frequency would try wane in severity and improve callidd of life of these patients.

**Materials and methods:** Evaluation of patients in the hemodialysis unit of the University Hospital La Paz, Bolivia, identification of the most common sleep disorders and restless leg presentation, custom surveys, determination of serum iron and ferritin, hemoglobin, history of diabetes, pre-and post-dialysis uremia, serum calcium, serum phosphorus and serum potassium, turn of the hemodialysis session (morning, afternoon, evening, late night).

**Results:** Restless legs syndrome secondary is inversely proportional to the value of hemoglobin, 80% of patients are coupled diabetic neuropathy, hypocalcemia occurs in 85% of patients in the unit, are patients who have shift trasnoche most often sleep disorders.

**Conclusion:** In the hemodialysis unit of the University Hospital La Paz, Bolivia, the leading cause of kidney disease is Diabetes Mellitus with 80% prevalence, being kind microvascular renal injury is accompanied by diabetic neuropathy is associated with renal dysfunction that erythropoietin deficiency leads to anemia syndrome, has been the most studied iron deficiency anemia, however not without significance vitamin B12 deficiency and folic acid. Calcium deficiency is still one of the important characteristics of these patients with secondary hyperparathyroidism values 10 times higher than normal. Finally both uremia, peripheral vascular disease, and left ventricular hypertrophy by high stream you are on dialysis, anemia, hypertension and dyslipidemia, with high risk of ischemic heart disease, increase the vulnerability of these patients, which are flagellates by their disease as their socioeconomic conditions.

**Acknowledgements:** I thank each and every one of my patients for allowing me to share their ailments and teach me to maintain a spirit of constant struggle with faith and hope for life.

<http://dx.doi.org/10.1016/j.sleep.2013.11.107>

### Case report

X. Alvarado

**Introduction:** She was hospitalized for clinical case to start on 5 September 2012, with alteration in the conduct, the language fluency, delusions and hallucinations visual, treated with clonazepam 1 mg and 2 mg risperidone, then 30 min had higher thermal which referred to physical media, continuous treatment with benzodiazepines and fluoxetine, for 3 weeks; filing alert state commitment and reduction in force on a progressive left hemisphere, alternating with episodes of clarity sporadic. Clinical examination 56/min heart rate, blood pressure 90/60 mmhg, afebrile, respiratory 22/min, rhythmic heart noise bradycardic, drowsy, clueless, respond to cross with babbling, hemiparesis left.

**Materials and methods:** Medical history review.

**Results:** Liquid cerebrospinal 27-X-12 aseptic serology in LCR CMV 27-X-12 negative serology in LCR herpes virus 27-X-12 negative HIV elisa 27-X-12 negative cytomegalovirus IgG 27-X-12 positive ANA, ANTI-DNA, ANCAp, ANCAc, ENA profile. 27-X-12 negative benzodiazepines determination of serum 27-IX-12 negative EEG 16-IX-12 dysfunction corticosubcortical widespread moderate TAC without contrast 10-IX-12 normal CT with contrast 12-IX-12 tortuous appearance and prominent of the internal carotid left in intracavernous segment angiography 14-IX-12 tortuous appearance and prominent of the internal carotid left in intracavernous segment magnetic resonance 5-X-12 edema in region base front back and commitment of the core of the base.

**Conclusion:** NARcolepsy focused encephalitis.

**Acknowledgements:** Thanks to the whole team.

<http://dx.doi.org/10.1016/j.sleep.2013.11.108>

### Reliability of home respiratory polygraphy monitoring for diagnosis of sleep apnea/hipopnea syndrome in children

M. Alonso-Alvarez<sup>1</sup>, J. Terán-Santos<sup>1</sup>, J. Cordero-Guevara<sup>1</sup>, E. Ordax-Carbajo<sup>1</sup>, A. Navazo-Egüia<sup>1</sup>, J. Terán Perez<sup>2</sup>

<sup>1</sup>SACYL, Unidad Multidisciplinar de Sueño, Hospital Universitario de Burgos

<sup>2</sup>Universidad de Lleida, Unidad Multidisciplinar de Sueño, Hospital Universitario de Lleida

**Introduction:** Attended overnight polysomnography (PSG) performed in a sleep laboratory is the currently accepted technique used for the diagnosis of sleep apnea/hipopnea syndrome (SAHS) in children. Respiratory Polygraphy (RP) in children has been validated in the sleep laboratory. **AIM:** To evaluate the reliability diagnostic of home respiratory Polygraph (HRP) in children with a clinical suspicion of SAHS referred to one sleep unit.

**Materials and methods:** Cross-sectional study. We included children aged 2–14 years, of both sexes, with clinical suspicion of SAHS referred to the Sleep Unit on randomly selected days. The whole group underwent clinical history, physical examination, a first home respiratory polygraphy (HRP) and between 1 and 2 weeks later underwent a second PR and PSG in the same night in sleep laboratory. The criteria of the AASM 2007 were used for the assessment of sleep and respiratory events. We calculated the normal index of RP and PSG: Respiratory disturbance index (RDI), Obstructive respiratory disturbance index (oRDI) Obstructive Apnea-Hypopneas Obstructive index (oAHI). Intraclass correlation coefficients (ICC), Bland-Altman plots and receiver operator curves (ROC) were calculated for statistical analysis. We calculated confidence intervals at 95%.

**Results:** We studied 27 boys and 23 girls with a mean age of 5.3 (SD: 2.55). 39 (78%), 33 (66%), 26 (52%) were diagnosed with SAHS, when RDI  $\geq$  3, oRDI  $\geq$  3 and OAH  $\geq$  3 were taken as diagnosis of SAHS. The average of RDI was 13.92 (SD16, 57), 14.46 (SD: 13.23), 16.47 (SD: 15.32) in the PSG, Home RP, RP at laboratory respectively. The area under the ROC curve for RDI  $\geq$  3, oRDI  $\geq$  3 and OAH  $\geq$  3 in the laboratory RP were 93.5 (85.5 - 1), 96.8 (92.1 - 1), 95, 5 (90.6 - 1) and in the HRP were 93.5 (86.8 - 1), 93.9 (87.0 - 1), 92.9 (85.9 - 1), respectively.

**Conclusion:** Home respiratory polygraphy has a good agreement with the values of the PSG Respiratory Poligraphy performed at home is a useful technique for diagnosis of SAHS in children.

**Acknowledgements:** Funded by Ministry of Health Castilla – Leon and SEPAR.

<http://dx.doi.org/10.1016/j.sleep.2013.11.109>

### Insomnia, depression and subtypes of anxiety: does chronotype uniquely mediate these relationships during adolescence?

P. Alvaro<sup>1</sup>, R. Roberts<sup>1</sup>, J. Harris<sup>2</sup>

<sup>1</sup>The University of Adelaide

<sup>2</sup>Centre for Treatment of Anxiety and Depression, The University of Adelaide

**Introduction:** This study investigated the direct effect of depression and subtypes of anxiety on insomnia, and vice-versa, and the unique mediation effect of chronotype.

**Materials and methods:** Self-report questionnaires were completed by 318 South Australian high school students from years 7 to 11 (range 12–18, mean 14.96  $\pm$  1.34). Insomnia was assessed by the Insomnia Severity Index. Depression, anxiety and subtypes of anxiety were assessed by the Revised Child Anxiety and Depression Scale, and chronotype was assessed by the Morningness-Eveningness Questionnaire for Children. Generalised Estimating Equations were used to assess direct and indirect effects, which provided confidence intervals (CI) for direct and indirect effects. The proposed mediators for the relationship between insomnia and subtypes of anxiety were chronotype and depression, while the proposed mediators for the relationship between insomnia and depression were chronotype and anxiety.

**Results:** Insomnia predicted depression ( $\beta = 0.3765$ , 95%CI = 0.603–0.788) after the mediation variables were accounted for, whereas insomnia was predicted by depression and GAD (depression,  $\beta = 0.5255$ , 95%CI = 0.406–0.645; GAD,  $\beta = 0.180$ , 95%CI = 0.025–0.336). Insomnia was found to directly predict panic disorder (PD) ( $\beta = 0.064$ , 95%CI = 0.007–0.121), but not vice-versa. However, it is likely this result was due to a type II error. Obsessive compulsive disorder (OCD), separation anxiety (SAD) or social phobia (SP) were not significantly related to insomnia. The eveningness chronotype uniquely mediated the models where depression and PD predicted insomnia (Depression  $\beta = 0.0823$ , 95%CI = 0.043–0.121; PD  $\beta = -0.0551$ , 95%CI = 0.022–0.09) and vice versa (Depression  $\beta = 0.0553$ , 95%CI = 0.029–0.082; PD  $\beta = -0.026$ , 95%CI = -0.049–0.002). Eveningness also uniquely mediated the models when insomnia was predicted by OCD ( $\beta = 0.0646$ , 95%CI = 0.009–0.120), SAD ( $\beta = 0.067$ , 95%CI = 0.027–0.107) and SP ( $\beta = 0.0406$ , 95%CI = 0.0169–0.064).

**Conclusion:** The results indicate that insomnia directly predicts depression and is predicted by depression and GAD after controlling for mediators, but not other forms of anxiety. Chronotype was found to be a unique mediator for most analyses, but the mediation effects were of small magnitude. This suggests that chronotype partially accounts for the relationship between insomnia and depression, and insomnia and subtypes of anxiety above and beyond anxiety and depression. However, anxiety and depression are likely to have a much stronger mediation effect than chronotype.

**Acknowledgements:** Authors did not have conflict of interests, including specific financial interests and relationships and affiliations relevant to the subject of this manuscript. The principal author "had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis."

<http://dx.doi.org/10.1016/j.sleep.2013.11.110>

### Therapeutic use of Saint John's wort in RLS/Willis Ekbohm's disease

J. Pereira Jr<sup>1</sup>, M. Hallinan<sup>2</sup>, R Alves<sup>3</sup>

<sup>1</sup>Jundiai Medical School

<sup>2</sup>UNIFESP

<sup>3</sup>Sao Paulo Medical School, FMUSP, USP

**Introduction:** Different classes of drugs alleviate symptoms of RLS/Willis Ekbohm's disease (WED), whereas others may aggravate them: drugs that worsen symptoms usually inhibit the CYP4503A4 isoform, and drugs that ameliorate them induce CYP4503A4. The main objective of this study was to verify whether Saint John's wort (SJW), as an inducer of the CYP4503A4 isoform, would reduce the severity of RLS symptoms.

**Materials and methods:** Over the course of three months, in an open-label pilot trial, we treated 21 patients (12–76 years; median

48 years), with clinical criteria for RLS with a concentrated extract of Saint John's wort at a daily dose of 300mg. Hb, Ht, TSH and T4 levels were normal in all patients; eight patients had ferritin levels under 45 $\mu$ g/L (after the end of the trial they also received iron therapy). No side effects with SJW were reported.

**Results:** Saint John's wort reduced the severity of symptoms of WED in 17 of the 21 patients. Their median WED severity score, according to the International Restless Legs Syndrome Study Group (IRLSSG), ranged from 17 to 36 (median 24). After the initial ten-day treatment, 17 patients (81%) reported experiencing >70% improvement of their WED symptoms and also reported better sleep during treatment compared to before treatment. Four patients reported no improvement during the ten-day trial, all of whom were drug-naïve (median WED severity score of 24). All patients whose symptoms were alleviated by the ten-day SJW trial agreed to take the drug for three more additional months. Following cessation of the drug, they reported that they remained free of WED symptoms for 2–7 days (median 3). After completing the three-month trial, all 17 patients reported a desire to continuously take SJW as a WED treatment. At the beginning of the trial, these 17 patients scored a median of 24 ( $\pm$ 5.1) points in the IRLSSG rating severity scale, and after the three-month treatment, the score was 4.1 ( $\pm$ 1) ( $p < 0.0001$ ).

**Conclusion:** Results of this trial suggest that Saint John's wort may be useful for some RLS patients. Thus, the extent to which Saint John's wort is effective as a WED treatment will depend on future blind placebo-controlled studies.

**Acknowledgements:** Jundiai Medical School.

<http://dx.doi.org/10.1016/j.sleep.2013.11.111>

### **Influence of methamphetamine self-administration on sleep in rhesus monkeys using actigraphy**

M.L. Andersen  
UNIFESP

**Introduction:** Sleep disorders and substance abuse are highly comorbid. Although methamphetamine is a very commonly abused drug, to the best of our knowledge, no study has evaluated its effects on sleep during drug use and abstinence under well-controlled conditions in laboratory animals. The objective of this study was to examine the effects of methamphetamine self-administration on sleep-like measures in nonhuman primates.

**Materials and methods:** Adult male rhesus monkeys (*Macaca mulatta*;  $n = 4$ ) self-administered methamphetamine (0.01 and 0.03 mg/kg/injection, i.v.) under a fixed-ratio 20 schedule of reinforcement (60-min sessions once a day, 5 days per week) for 5 weeks. Sleep-like measures were evaluated with Actiwatch monitors before, during, and after each period of drug self-administration.

**Results:** Both doses of methamphetamine reliably maintained self-administration. Methamphetamine (0.03 mg/kg) increased derived measures of latency to sleep onset and sleep fragmentation, and decreased sleep efficiency compared to abstinence, and higher methamphetamine intake predicted worse sleep quality. However, sleep normalized immediately after the discontinuation of methamphetamine self-administration.

**Conclusion:** Methamphetamine markedly disrupted sleep-like measures; however, methamphetamine self-administration did not disrupt sleep quality during subsequent periods of drug abstinence.

**Acknowledgements:** This research was supported by USPHS Grants DA10344 (LLH), DA31246 (LLH), P51OD11132 (Yerkes National Primate Research Center), and by AFIP and CNPq (MLA).

<http://dx.doi.org/10.1016/j.sleep.2013.11.112>

### **Periodic Limb Movements Disorder in patients with specific language impairment: an important cause of sleep disruption**

M. Aguilar-Andújar, M. Ramos Jiménez,  
M. Guerrero Sánchez, C. Menendez  
Virgen Macarena Hospital

**Introduction:** Sleep problems, including Periodic Limb Movement Disorder (PLMD) in childhood, mainly associated with disorders like Attention Deficit Disorder and Hyperactivity (ADHD) have been well documented, but less is known about this specific sleep disorder in children with Specific Language Impairment. Sleep problems have effects in day-time cognitive and adaptive performance, so the presence of this disorder could be influence in the development of these children.

**Materials and methods:** 40 children (31 boys and 9 girls) with 3–5 years old, diagnosed of Specific Language Impairment (development quotient  $\leq 70$  in Brunet-Lezine Scale), derived from Maduration Unit to Sleep Disorder Unit for not good progression. These have a normal MRI, no hearing impairment, no epileptiform discharges in EEG and no other disorders. Children participated in a polysomnographic (PSG) sleep recording with control of movement in legs (tibialis anterior muscle) and arms (extensor indicis muscle).

**Results:** In our sample, we found PLMD in 87.5% of the children, with an average index of 9.08+/-5.93. 60% of these patients present foot flexion and extension movements and the remaining 40% present exaggerated movements with knee flexion and extension and sometimes with movements in arms. In this group, the index of movements is higher than in the first one, with statistically significant result (Pearson correlation). We found an average index of periodic limb movement with arousal of 5.86+/-3.56, average arousal index of 36.5+/-8.54 and average sleep efficiency of 86.14+/-8.37. There are no statistically significant correlation between periodic limb movement index and sleep efficiency. Only 4 patients present another specific sleep disorder (2 OSAP and 2 parasomnias).

**Conclusion:** We found that Periodic Limb Movement Disorder is common in children with diagnosis of Specific Language Impairment. This disorder disrupts sleep (mainly in microstructure) and secondarily may influence the daily behavior and development of these children. Treatment of this specific disorder could improve the day-time impairment and the language problem in these children. We need to extend the sample size and control the effect of the treatment in clinic and evolution of the children to have more consistent results.

<http://dx.doi.org/10.1016/j.sleep.2013.11.113>

### **Sleep characteristics in children with specific language impairment: macrostructure and microstructure analysis**

M. Aguilar-Andújar, C. Menéndez De León, I. Ramos Sánchez,  
L. Dinca Avarvarei, A. Márquez Luque  
Virgen Macarena Hospital

**Introduction:** Sleep is important for learning, memory and underlying neural plasticity. Studies support that children utilize a dual memory system when acquiring and integrating new vocabulary, and sleep (especially sleep spindles, slow waves sleep and REM sleep) is important for this process. We aimed to describe sleep characteristics in children with diagnosis of Specific Language Impairment because sleep disruption, especially of the microstructure, could have an important role in the development and evolution in these patients.

**Materials and methods:** 30 children (24 boys and 6 girls) with 3–5 years old, diagnosed of specific language impairment (development quotient  $\geq 70$  in Brunet-Lezine Scale), normal MRI, without epileptiform discharges in EEG, no hearing impairment, no other disorders and with parents in medium–high sociocultural level. Children participated in a polysomnographic (PSG) sleep recording. Sleep disorders like Obstructive Sleep Apnea Pediatric (OSAP), Periodic Limb Movement Disorder (PLMD) and parasomnias, and sleep characteristics like sleep stages percentage, spindles characteristics, presence of significant alpha rhythm during sleep (alpha-delta sleep), microarousal index, sleep efficiency and awakenings episodes were analyzed.

**Results:** In our sample, we found OSAP only in one patient, and parasomnias in 2 patients. However, data about PLMD was relevant, 93.3% present this disorder with an average index of  $9.316 \pm 6.11$ . We found an average of  $4.073\% \pm 3.41$  of stage 1,  $40.76 \pm 8.89$  of stage 2,  $25.381 \pm 6.91$  of stage 3,  $25.587 \pm 6.91$  of stage REM,  $112.76 \pm 25.65$  of body movements,  $3.10 \pm 1.6$  awakening episodes  $\geq 5$  min,  $85.14 \pm 9.07$  of sleep efficiency,  $37.556 \pm 9.6$  of microarousal index ( $83.4\%$  with microarousal index  $\geq 30$ ),  $80\%$  present significant percentage of alpha rhythm during sleep and  $66.7\%$  presented unsuitable spindles.

**Conclusion:** We observed that although the sleep architecture in terms of the macrostructure, like time spent in the different stage of sleep, appears to not be consistently altered in relation with normal values, it is very important the analysis of sleep microstructure because specific features would be altered in these patients and could be related to the problem of language skills. Treatment for specific sleep disorders and treatment to stabilize sleep structure, could improve the symptomatology in these patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.114>

### Association between clinical signs and symptoms related to sleep-disordered breathing in mouth breathers school children

N. Finck<sup>1</sup>, M. Araújo<sup>2</sup>, M. Pacheco<sup>1</sup>

<sup>1</sup>UFES, Programa de Pós-graduação em Clínica Odontológica

<sup>2</sup>UFES, Departamento de Ciências Fisiológicas

**Introduction:** Sleep-disordered breathing (SDB) is one of the causes of morbidity in children. The symptoms of SDB in children are varied and difficult to diagnose, especially in mouth breathing children (MB). The aim of this study was to associate the clinical signs of the MB and the self-perception of their symptoms related to SDB, focusing on nasal, sleep and masticatory problems.

**Materials and methods:** From a previous study, a sample of 73 pre-selected MB derived from elementary schools, aged 7–14 years old, was reevaluated about the presence of anatomical and functional facial and dental occlusion changes, the temporomandibular joint (TMJ) and posture alterations and breathing pattern abnormalities. Concomitantly, a questionnaire about symptoms of SDB was applied to the MB. This instrument contains 16 questions about TMJ, nasal and sleep problems. From 42 clinical variables reevaluated, 19 were selected by the Binomial test where the cutoff point was the average of the variables' prevalence. Afterwards, we used the logistic regression through Backward method and the Wald test to verify the association between these clinical variables and the 16 questions from the questionnaire.

**Results:** For TMJ symptoms the clinical variables were significant to: lack of lip closure, Class II malocclusion, deviation from interocclusal position, overbite, forward head position and palatine tonsil hypertrophy. For the nasal symptoms the clinical variables were significant to: turbinate hypertrophy and deviation from interocclusal

position. Lastly, for the sleep symptoms the clinical variables were significant to: turbinate hypertrophy, palatine tonsils hypertrophy, deviation from interocclusal position, lack of lip seal, obstructive Mallampati index (III and IV), and protrusion deviation. Most significant finds were those related to the sleep symptoms: mouth breathing and obstructive Mallampati index were related to complaints of snoring, waking up during the night and sleeping were related with the mouth open; mouth breathing and palatine tonsils hypertrophy were related to complaints of sleep problems and daytime sleepiness.

**Conclusion:** This study showed that craniofacial, upper airway and postural abnormalities are associated with an increased risk of SDB in mouth breathers children.

**Acknowledgements:** Management of Vitoria City, ES, Brazil.

<http://dx.doi.org/10.1016/j.sleep.2013.11.115>

### Sociocultural variations of sleep difficulties' coping strategies in couple relationships in Canada and in Brazil

T. Araújo, A. Vallières, Y. Leanza

Laval University, School of Psychology

**Introduction:** Sleep is a natural phenomenon that is deeply imbedded in cultural contexts where it takes place. However, contemporary sleep theories reflect mainly the north western industrialized society. This study explores the experience of sleep difficulties in everyday life of Canadian and Brazilian couples focusing on possible sociocultural variations.

**Materials and methods:** Five heterosexual couples without children aged between 24–47 years were recruited in Quebec-Canada and Fortaleza-Brazil. At least one partner reported having sleep problems. Participants attended two meetings one week apart: 1) completion of self-reported questionnaires (PSQI & DAS-16); 2) couple in-depth semi-structured interview. During the seven days between both meetings, partners wrote free reports about their previous night of sleep. Quantitative and qualitative data analyses were performed. The phenomenological method was used to analyze interview data. The cross-cultural comparison helped to highlight the relevant aspects of each context.

**Results:** Regardless of city, the experiences of sleep difficulties are mostly associated with professional- and adult lives-related stress that reflect symptoms of insomnia. Respondents self-reported satisfaction in their couple relationship and adoption of personal strategies to cope with sleep difficulties that seem to be influenced by their choice of marital status and the values rooted in their societies. In Quebec, where common-law union predominates, partners' strategies are more cooperative, focused on both partners. They seek a balance between their autonomy, freedom and well-being in bed-sharing/couple relationship. In Fortaleza, where marriage predominates, partners' strategies are more focused on oneself or in favor of another in a greater specialization of tasks and complementary roles.

**Conclusion:** Negative consequences of sleep difficulties in couples daily life seem to be overcome by the desire of being together in a healthy relationship. The strategies employed seem to shade the clinical aspect of sleep difficulties and to function as a "regulator" of what could affect the proper functioning of their union. The experience of healthy relationships seems then to promote appropriate behaviors related to sleep, but do not, necessarily, assure the lack of sleep difficulties within the couple. Recognition of the dyadic nature of sleep could contribute to the identification of the diagnosis and the management of sleep disorders and deserves further attention in other studies.

*Acknowledgements:* A grateful thanks to the collaborating Canadian and Brazilian couples who made possible the study data collection and analysis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.116>

### Medical technology assessment of polysomnography, type 2: full PSG at home – night to night variability in Apnea Hypopnea Index (AHI) and Periodic Limb Movement Index (PLMI)

W. Arends-Derks<sup>1</sup>, M. Horst-Haverkamp<sup>1</sup>, K. Schreuder<sup>1</sup>, L. Rohling<sup>2</sup>, A. De Weerd<sup>1</sup>

<sup>1</sup>Sleepcenter SEIN Zwolle-Groningen

<sup>2</sup>Sleepcenter SEIN Zwolle-Groningen, Technical Medicine of Sleep

*Introduction:* Polysomnography (PSG) in a clinical setting (CPSG, type 1) is time consuming and expensive. Type 2, i.e. full PSG at home, is thought to be a good alternative, but has never been evaluated in terms of regular Medical Technology Assessment (MTA). In some countries this lack of MTA precludes reimbursement for PSG type 2. This communication is part of a series of posters which add up to MTA of PSG, type 2, and deals with night to night sleep variability. This study is designed to investigate the differences between the first and the second night, during two full PSG's type 2, on AHI and PLMI.

*Materials and methods:* Retrospective case control study of 325 patients (49.1% male, mean age = 45.0, SD = 16.7) who underwent full PSG type 2 for two consecutive days. The number of patients who were diagnosed with Sleep Related Breathing Disorder (SRBD) ( $n = 54$ ), and those who were diagnosed with Sleep Related Movement Disorder (SRMD) ( $n = 47$ ), were compared with the total group of patients on the parameters AHI and PLMI.

*Results:* Looking at the two nights and a mean AHI less than 10 per hour, which implies no or a mild Obstructive Sleep Apnea Syndrome (OSAS), we found no internight variability. Looking at the two nights and a mean AHI greater than 15 per hour, which implies moderate or severe OSAS, we found high internight variability. The results referring to the group of patients who are diagnosed for SRMD (with a PLMI cut-off point of 8–10 per hour) are similar.

*Conclusion:* On the basis of this study, it can be concluded that one measurement would be valid in cases of no or mild disturbances in either Breathing Disorder or Movement Disorder. In order to determine the severity of OSAS or PLMD of clinical importance, a two-night PSG, type 2, is mandatory to give a valid diagnosis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.117>

### Sleep quality and sleepiness repercussion on cognitive impairment in community-dwelling older men and women

B. Gallego-Ariza, I. Cabrera-Martos, L. Cerón-Lorente, M. Flores-Barba, I. Torres-Sánchez, M. Valenza  
University of Granada, Department of Physical Therapy

*Introduction:* Elderly have recognized sleep disturbances. Chronically disrupted sleep has negative consequences such as deficits in attention, alertness, vigilance and memory. This study investigates whether poor sleep quality and sleepiness are associated with cognitive impairment.

*Materials and methods:* The sample comprises 200 community-dwelling older adults with a mean age of  $76.61 \pm 8.665$ . Participants were recruited in Granada, Spain. All subjects had a Mini-Mental score over than 24 to be included in the study. Data were obtained

from the participants during two in-home interviews separated 24. Sleep quality was measured by the Pittsburgh Sleep Quality Index (PSQI) and daytime sleepiness was assessed with Epworth sleepiness score (ESS). Cognitive impairment was evaluated with Trailmaking Test (TMT), memory alteration test (MAT) and clock drawing test (CDT). All the subjects were grouped according to their punctuations into three groups: Group 1 included participants without diurnal sleepiness ( $ESS < 6$ ) and good Sleep quality ( $PSQI < 6$ ), Group 2 included those people with bad sleep quality ( $PSQI \geq 6$ ) and Group 3 the participants with scores concerning bad sleep quality ( $PSQI \geq 6$ ) and daytime sleepiness ( $ESS \geq 6$ ). Differences between groups were analyzed using ANOVA test.

*Results:* Lower results on TMT were significantly ( $p < 0.05$ ) linked with poorer sleep quality group (F: 6,252 with significant differences between groups 1 and 3). Better results on MAT were significantly linked with better sleep quality group (F: 7,989 with significant differences with groups 2 and 3,  $p < 0.05$ ). Clock drawing test shows similar results, with higher scores in the group 1 and lower results in the group 3 ( $8.9 \pm 1.21$  vs  $8.7 \pm 1.77$  vs  $8.4 \pm 2.27$ , respectively).

*Conclusion:* Sleep quality in elders should receive particular attention by clinicians regarding to the relationship between poor sleep quality and cognitive decline. Further studies should examine whether the poor sleep quality preceding cognitive decline is the consequence of particular sleep disorders and/or an underlying neurodegenerative disorder.

<http://dx.doi.org/10.1016/j.sleep.2013.11.118>

### Impact of a supervised muscular training on perceived quality of sleep and health in a population with knee osteoarthritis

B. Gallego-Ariza, S. Mateos-Toset, I. Cabrera-Martos, A. Correa-Toledo, M. Badillo-Fontalvo, M. Valenza  
University of Granada, Department of Physical Therapy

*Introduction:* Knee osteoarthritis (KO) is the most prevalent type of osteoarthritis and it is expected to increase in the next years. It is characterized by stiffness and pain, commonly affecting both knees. The main symptoms of KO usually develop disorders in the performance of daily activities, such as climbing stairs or walking and they also affects subjective perception of health-related quality of life and quality of sleep. The purpose of this study was to evidence the effectiveness of an eight-weeks muscular training program with elastic theraband in patients with KO.

*Materials and methods:* Randomized controlled clinical trial, single-blind. Thirty-eight subjects with OA of the knee were randomly assigned to an exercise treatment group ( $n = 17$ ; 11 female; 6 male; mean age 76 years old) or a control group ( $n = 17$ ; 12 female; 5 male; mean age 72 years old). Subjects who were admitted to the study were diagnosed with OA by a clinician. The patients included in the theraband exercise group received supervised and individualized physical activity during 8 weeks. Measured outcomes were the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), the Pittsburgh Sleep Quality Index (PSQI) and the index of health-related quality of life Euroqol (EQ-5D).

*Results:* In the preintervention assessment, both intervention and control groups showed disturbances in health-related quality of life (intervention group  $8.00 \pm 1.5146$ , control group  $8.12 \pm 1.4738$ ) and also they reported a bad quality of sleep (intervention group  $9.23 \pm 3.6063$ , control group  $9.24 \pm 3.7168$ ). The intervention group showed clinically and statistically significant ( $p < 0.05$ ) improvements in WOMAC scores (mean change intervention group  $-11.44 \pm 7.0089$ ; control group  $0.18 \pm 0.6054$ ) at 8 weeks and in EQ-5D (mean change intervention group  $-1.18 \pm 0.7165$ ; control

group  $-0.06 \pm 1.0993$ ) and in the PSQI (mean change intervention group  $2.29 \pm 3.1094$ ; control group  $0.62 \pm 2.0153$ ).

**Conclusion:** The results shows that an 8-weeks supervised exercise program with thera-band provides benefits in health-related quality of life and subjective quality of sleep. The use of thera-band is cost-effective and well-tolerated and it has shown applicability in KO patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.119>

### **Sleep pattern, quality and sleepiness among patients with exacerbation of chronic obstructive pulmonary disease**

B. Gallego-Ariza, I. Torres-Sánchez, M. Flores-Barba, I. Cabrera-Martos, A. Correa-Toledo, M. Valenza  
*University of Granada, Department of Physical Therapy*

**Introduction:** Sleep is very important for optimal daily activities and contributes significantly to health and quality of life. Patients with chronic obstructive pulmonary disease (COPD) have various sleep related problems that can be increased on exacerbation periods. We aim to study sleep pattern and sleepiness in COPD patients with an acute exacerbation.

**Materials and methods:** 70 COPD patients were recruited from San Cecilio and Virgen de las Nieves Hospitals (Granada, Spain). Data regarding the sleep pattern, the clinical and the social characteristics were obtained. The assessment included the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale.

**Results:** 70 subjects were studied with a mean age of  $72.8 \pm 8.35$  years. 79.5% of the subjects were smokers. The predominant sleep problems were frequent night time awakenings which were present in 54 (60%), while problems initiating sleep were very prevalent among the cases 20 (22.2%). Sleepiness was reported in 14 (15.6%) and none (24, 26.7 %). Overall 8.9% of the cases described their sleep as good. PSQI is significantly related with level of dyspnea, Levels of Depression and Anxiety and Cough ( $p < 0.001$ ).

**Conclusion:** This study shows that COPD patients have poor sleep quality, disorders in the sleep pattern and daytime sleepiness during acute exacerbations. Their sleep quality is significantly related to anxiety, depression, cough and dyspnea.

<http://dx.doi.org/10.1016/j.sleep.2013.11.120>

### **An 8-weeks exercise muscle training improves subjective fatigue and quality of sleep in Parkinson Disease's patients**

B. Gallego-Ariza, I. Cabrera-Martos, A. Correa-Toledo, S. Mateos-Toset, M. Flores-Barba, M. Valenza  
*University of Granada, Department of Physical Therapy*

**Introduction:** Numerous studies have previously shown that physical activity improves quality of life in patients with Parkinson Disease (PD) in several areas. Between non-motor difficulties, PD patients develop sleep disturbances. Poor reported sleep quality is very common in this condition and it is important to be taken into account because it impacts seriously on daily function. The objective of this study was to assess the effectiveness of an eight weeks exercise program with elastic bands on the subjective quality of sleep in PD patients.

**Materials and methods:** A sample including 23 PD patients with more than 21 punctuation in the MiniMental State Examination were recruited from a local association. Each participant underwent an individual assessment. Anthropometric data were measured.

Outcomes measures were perceived sleep quality measured with the Pittsburgh Sleep Quality Index (PSQI) and perceived fatigue evaluated with the Piper Questionnaire. The participants were included in an eight weeks-physical activity program with elastic bands during an hour three times per week.

**Results:** The majority of the participants were men (74%) with a mean age of  $74.12 \pm 6.11$  years old. The Geriatric Functional Rating Scale (GFRS) showed a 70% value of functionality. Their Hoen & Yahr score in off condition was I in the 4.3% of participants, II in 17.4%, III in 52.2% and IV in the 26.1%. Pre-to-postintervention significant improvements ( $p = 0.011$ ) are important to consider regarding to perceived quality of sleep in total punctuation of PSQI. Significant differences ( $p = 0.005$ ) were found in the sleep disturbances subscale, that appear to be reduced after the 8 weeks training program. Perceived fatigue was also significantly better ( $p < 0.05$ ) after the exercise program. The participants reported improvements in the areas of behavioural, affective and sensorial fatigue.

**Conclusion:** The exercise program used in this study was safe and effective in order to improve perceived fatigue and quality of sleep in PD patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.121>

### **The clinical importance of obstructive sleep apnea in Alzheimers disease**

E. Arnardottir<sup>1</sup>, K. Hannesdottir<sup>2</sup>, S. Davidsdottir<sup>3</sup>, A. Valgardsdottir<sup>3</sup>, T. Gislason<sup>4</sup>, J. Snaeligidal<sup>3</sup>

<sup>1</sup>Department of Respiratory Medicine and Sleep, Landspítali and Faculty of Medicine, University of Iceland

<sup>2</sup>AstraZeneca R&D, Neuroscience iMed and Division of Psychiatry, Landspítali

<sup>3</sup>Department of Geriatrics, Landspítali

<sup>4</sup>Department of Respiratory Medicine and Sleep, Landspítali, Faculty of Medicine, University of Iceland

**Introduction:** Recent findings suggest that obstructive sleep apnea (OSA) is very common and underdiagnosed in the early stages of dementia and Alzheimer's disease (AD). The objective of this study was to assess the prevalence and nightly variance in OSA in mild AD patients in relation to repeated assessments of cognitive function and neuropsychiatric symptoms.

**Materials and methods:** Twenty mild AD patients (mini-mental state examination [MMSE]  $>20$ ; age 45–80 years), over a time period of four weeks, underwent a home type 3 sleep study including pulse oximetry, assessment of respiratory effort, airflow, body position and movement. CogState computerized cognitive assessments and the psychomotor vigilance test (PVT) were performed each morning following the sleep assessments to measure visual memory, attention/vigilance and working memory. Participants additionally completed the Epworth Sleepiness Scale and the Neuropsychiatric Inventory (NPI) was administered to their caregivers.

**Results:** The preliminary results showed an OSA prevalence of 90% (AHI  $\geq 5$ ) and an average ( $\pm$ SD) AHI of 13.0 ( $\pm 5.7$ ) events/hour over 5 assessments (12 patients had mild OSA, 3 moderate and 3 severe OSA). Substantial nightly fluctuations in OSA were seen with an average AHI fluctuation of 13.4 ( $\pm 9.9$ ) events/hour. Moreover, patients with an average AHI  $\geq 10$  ( $n = 10$  subjects) performed significantly worse on a test of visual attention/vigilance and presented with more apathy as a neuropsychiatric symptom than patients with an average AHI  $< 10$  ( $n = 10$  subjects). However, no differences were found in other cognitive tests performed or in the PVT performance and only 5% of patients reported excessive daytime sleepiness (Epworth Sleepiness Scale  $\geq 10$ ).

**Conclusion:** OSA appears to be underdiagnosed in AD and repeated assessments may lead to a more accurate diagnosis of OSA due to the nightly fluctuations in OSA severity. Preliminary findings suggest that cognition and neuropsychiatric symptoms in AD patients may be adversely affected by increased severity of OSA. Also, subjective reporting of sleepiness may not be suitable to screen for OSA in AD patients. Further studies are warranted to better understand the effects of OSA and its treatment on the clinical symptomatology of AD.

**Acknowledgements:** Grant support from AstraZeneca.

<http://dx.doi.org/10.1016/j.sleep.2013.11.122>

### How to measure snoring?

E. Arnardottir<sup>1</sup>, M. Sigurgunnarsdottir<sup>1</sup>, G. Sigurdsson<sup>2</sup>, G. Saevarsson<sup>3</sup>, S. Hoskuldsson<sup>3</sup>, T. Gislason<sup>1</sup>

<sup>1</sup>Department of Respiratory Medicine and Sleep, Landspítali

<sup>2</sup>Whiting School of Engineering, John Hopkins University

<sup>3</sup>Nox Medical

**Introduction:** Recently, snoring, independent of sleep apnea has been reported to have serious health consequences including carotid atherosclerosis. Detection of snoring is currently dependent on limited, poorly defined methods both for registration and analysis. Our study aims to add knowledge on how to measure and analyze snoring for future studies relating snoring to important health outcomes.

**Materials and methods:** Only subjects reporting habitual snoring were included in the study. Subjects were assessed with full in-laboratory polysomnography (Embla A10, Natus Medical Inc). Snoring was assessed with two overhead microphones, one chest microphone (T3 device, NoxMedical), a piezoelectric vibration sensor and an accelerometer on the neck and vibration in the nasal cannula.

**Results:** Our preliminary findings of  $n = 8$  snorers showed a high correlation between the measured noise level of the chest microphone and the average dB of the two overhead microphones with the majority of events within 3 dB of each other. The fundamental frequency of snore events was measured from 50–250 Hz by sound analysis. However the three vibration sensors (piezoelectric, accelerometer and cannula) could only measure a range from 0–100 Hz. Therefore they could not pick up all snore events. The cannula additionally had a high noise floor, allowing it to be maximally 67% sensitive to snore events. The piezoelectric sensor was more sensitive to postural effects than the accelerometer and showed a significant increase in measured power when the subject lay on the same side as the sensor was positioned.

**Conclusion:** Sound measurement of snoring is the most accurate objective analysis of snoring. Both cannula and neck vibration assessments of snoring have issues, causing them to miss out on a portion of snore events.

**Acknowledgements:** Research support from the ResMed Foundation and the Science Fund of Landspítali University Hospital.

<http://dx.doi.org/10.1016/j.sleep.2013.11.123>

### Sleep quality of nurses working in six hospitals of the Spanish national health system

M. Segura Aroca<sup>1</sup>, T. Gómez García<sup>2</sup>, M. Lopez Iborra<sup>1</sup>, E. Alonso Poncelas<sup>3</sup>, R. Santos Serrano<sup>4</sup>, X. Domenech López<sup>5</sup>

<sup>1</sup>School of Nursing

<sup>2</sup>Health Care and Nursing Unit Research

<sup>3</sup>Hospital José Molina Orosa

<sup>4</sup>Hospital Río Carrión

<sup>5</sup>Hospital Vall d'Hebron

**Introduction:** Sleep quality is an important clinical subject, because of two reasons, 15–35% of the adult population complains of frequent sleep quality disturbance and the poor sleep quality can be an important symptom of many sleep and medical disorders. The objective of this study was to evaluate sleep quality of nurses working on surgical, medical and intensive care units in six hospitals of the Spanish National Health System.

**Materials and methods:** A multicentric observational cross-sectional study was conducted between 2012 and 2013 in six hospitals belonging to the Spanish National Health System. The study was included, since the beginning, a total of 390 nurses working on surgical (S), medical (M) and intensive care (I) units. Demographic (age and gender) and occupational data (nursing experience, type of contract, work shift) and the Spanish version of Pittsburgh Sleep Quality Index (PSQI) were asked in the nurses' survey. Descriptive analysis was used to analyze this data of the nurses using mean and standard deviation (SD) results. To obtain the confidence intervals was used a level of confidence of 95%.

**Results:** The mean age was 41 (SD 9.80) years old and 85.4% ( $n = 333$ ) of them was females. The mean of work experience as nurse was 16 (SD 9.23) years old and 90.8% ( $n = 344$ ) of nurses was employed with a full-time contract. Nurses' global PSQI score mean was 6.73 (IC 6.36–7.09). Sleep assessments showed that 57.4% ( $n = 174$ ) of nurses were poor sleeper (PSQI > 5). According to PSQI's dimensions, 56.9% ( $n = 222$ ) of nurses assured to have "very good sleep quality", 40.5% ( $n = 158$ ) said that they have sleep latency between 16 and 30 min. 57% ( $n = 221$ ) of the nurses slept during 6–7 h and 46.2% ( $n = 180$ ) had a sleep efficiency of 85% or higher. Sleep disturbances' dimension showed that 63.8% ( $n = 249$ ) of nurses have suffered insomnia once a week. 79% ( $n = 309$ ) of nurses have been taken any hypnotics in the last month and 46.9% ( $n = 183$ ) have felt tiredness once a week.

**Conclusion:** Spanish nurses working in these hospitals had a medium prevalence of sleep disturbance, similar to nurses from studies carried out in other countries. The results showed that around half of nurses included in the study are poor sleepers (PSQI > 5). More than half of the nurses have had insomnia once a week, but personal factors and turnover have not been taken into account for this abstract. The rest of dimensions have the same scores than general population.

**Acknowledgements:** Study supported by RETICEF (RD12/0043/0011), FIS (PI11/00646).

<http://dx.doi.org/10.1016/j.sleep.2013.11.124>

### Sleep disturbances in children with attention deficit

S. Ashou Helal

Ain Shams University, Egypt

**Introduction:** The aim of the work was to study sleep disturbances associated with attention deficit hyperactivity, in a trial to clarify more the pathogenesis of this disturbance to allow better management and good quality of life.

**Materials and methods:** Twenty-four children with ADHD diagnosed according to the DSM-IV, and Conner's rating scale for ADHD to assess severity and diagnosis, were included in this study. They were all psychotropic drugs naïve, with absence of comorbid psychiatric conditions, as confirmed by appropriate rating scales. They were subjected to IQ testing, sleep habit questionnaire, digital electroencephalography and polysomnogram study. They were compared to 20 healthy children.

**Results:** There was a significant decrease in the sleep efficiency, number of the stage shifts, number of REM periods, REM stage

percentage and total sleep time. There was significant increase in the number of awakening. 41.7% of the patients had abnormal digital EEG, 75% had bed time resistance and increased movement during sleep. 58.6% of the patients had short sleep onset latency.

**Conclusion:** From the results of the present study ADHD is certainly associated with sleep disturbances, this might be a clue for a better management and hence a better quality of life.

<http://dx.doi.org/10.1016/j.sleep.2013.11.125>

### Chronotype distribution in bipolar disorder and major depressive disorder in an in-patient sample at a tertiary care center

R. Auger<sup>1</sup>, P. Das<sup>2</sup>, H. Cao<sup>2</sup>, S. Feeder<sup>2</sup>, R. Kashyap<sup>3</sup>, M. Frye<sup>2</sup>

<sup>1</sup> Mayo Clinic College of Medicine, Department of Psychiatry and Psychology, Mayo Center for Sleep Medicine

<sup>2</sup> Mayo Clinic College of Medicine, Department of Psychiatry and Psychology

<sup>3</sup> Mayo Clinic College of Medicine, Division of Pulmonary and Critical Care Medicine

**Introduction:** Circadian rhythm disturbances have been implicated in the etiopathogenesis of mood disorders. Chronotype is indicative of one's innate circadian preference, and correlates with physiological measures of circadian phase. A Korean study found a preponderance of "night owls" among clinically stable bipolar outpatients and other investigations have shown phase advances among various physiologic parameters in patients with major depressive disorder (MDD). This study examined chronotype distribution among inpatients with bipolar disorder and MDD. We hypothesized a preponderance of "night owls" among bipolar patients and "early birds" among MDD patients.

**Materials and methods:** Adult inpatients with well-established diagnoses of bipolar disorder (type I, II and NOS) and MDD were identified and recruited over a period of 2 years. Patients with cognitive impairment, disorganized thinking, and affective instability impairing questionnaire completion were excluded as were those <18 years of age. Controls without mood disorders were recruited separately. Chronotypes were assessed with the Horne Ostberg Morningness-Eveningness Questionnaire (MEQ). Patients were instructed to report according to their euthymic status. MEQ scores >58 correlate with morningness (early bird), and <42 correlate with eveningness (night owl). Scores outside of these ranges indicate neutral chronotypes.

**Results:** Out of 98 MDD, 98 bipolar patients and 59 controls, there were 59(60%), 61 (62%) and 47(80%) females [ $p = 0.03$ ], with median (IQR) age of 45(33–53), 44 (34–52) and 31(26–44) [ $p < 0.01$ ], respectively. Twenty-seven (28%), 24 (25%) and 8 (14%) were evening-types (48 (49%), 49 (50 %) and 29 (49%) were neither-types and 23 (23%), 25 (26%) and 22 (37%) were morning- types (MDD, bipolar, and controls, respectively), [ $p = 0.19$ ]. After adjusting for age and gender, the chronotypes continued to have no association with diagnosis [ $p = 0.49$ ].

**Conclusion:** Since there were no differences in baseline chronotypes among inpatients with mood disorders and controls, subjective chronotypes do not serve as reliable markers to differentiate bipolar disorder and MDD. Contrasting results from previous studies warrant clarification with further investigations. Objective circadian assessments such as the timing of the core body temperature minimum and the dim light melatonin onset should also be studied for correlations.

**Acknowledgements:** Dr. Simon Kung, MD.

<http://dx.doi.org/10.1016/j.sleep.2013.11.126>

### Subjective daytime sleepiness, eating disturbances and body mass index in female students

A. Arruda<sup>1</sup>, M. Marques<sup>2</sup>, L. Ferreira<sup>1</sup>, B. Maia<sup>3</sup>, A. Gomes<sup>4</sup>, M. Azevedo<sup>1</sup>

<sup>1</sup> Faculdade de Medicina, Universidade de Coimbra, Portugal

<sup>2</sup> Higher Institute of Miguel Torga, Portugal

<sup>3</sup> Higher Institute of Social Service of Porto, Portugal

<sup>4</sup> Dep. Sciences of Education, University of Aveiro, Portugal

**Introduction:** This report describes associations between subjective measures of sleepiness, eating disturbances and body mass index in female university students.

**Materials and methods:** 520 females (mean = 19.3 years, sd = 1.31), completed a series of questionnaires that assessed eating behaviours (Eating Attitudes Test-25), arousability, coping, emotional expressivity, worry, neuroticism/extraversion, perceived physical/mental health, academic stress, positive/negative affect, pre-sleep arousal (cognitive/somatic), body mass index (BMI; KG/M2) and sleep-wake aspects including subjective sleep propensity/Epworth Sleepiness Scale (ESS) and perceived daytime sleepiness (PDS, four items: feel excessively sleepy during the day, being sleepy during the day is a problem, feel performance is impaired due to daytime sleepiness, feel the need to nap during the day).

**Results:** ESS and PDS correlated moderately with each other ( $r = .415$ ,  $p < .001$ ). EAT-25 mean score was 24.25 (sd = 14.2). BMI mean score was of 20.7 (sd = 2.39; range = 14.5–34.7). 14.7% were classified as underweight (BMI < 18.5), 81.8% normal weight (BMI of 18.5–24.9), 2.9% overweight (BMI of 25.0–29), and 0.6 obese (BMI  $\geq 30.0$ ). Most students had very/good mental (75.7%) and physical health (82.7%). Logistic Regression analyses models showed that perceived daytime sleepiness/PDS (but not sleep propensity/ESS) and self-reported usual sleep duration were independent significant predictors of global eating disturbance (Odds ratio/OR = .57;  $p = .049$ ). Daytime sleep propensity, perceived daytime sleepiness, and perceived physical health were independent significant predictors of high BMI (respectively, OR = 1.58;  $p = .004$ ; OR = 0.62;  $p = .046$ ; OR = 0.034;  $p = .002$ ). Neither subjective sleep quality nor usual sleep duration were associated with BMI.

**Conclusion:** In young females, daytime sleep propensity/perceived sleepiness and perceived physical health were predictors of higher BMI. Perceived daytime sleepiness and usual sleep duration were both predictors of global disordered eating behaviours/attitudes.

<http://dx.doi.org/10.1016/j.sleep.2013.11.127>

### Sleep quality and eating behaviour in female students

L. Ferreira<sup>1</sup>, A. Arruda<sup>1</sup>, B. Maia<sup>2</sup>, A. Gomes<sup>3</sup>, H. Azevedo<sup>1</sup>, M. Marques<sup>4</sup>

<sup>1</sup> Faculdade de Medicina, Universidade de Coimbra, Portugal

<sup>2</sup> Higher Institute of Social Service of Porto, Portugal

<sup>3</sup> Dep. Sciences of Education, University of Aveiro, Portugal

<sup>4</sup> Higher Institute of Miguel Torga, Coimbra, Portugal

**Introduction:** To study the association between sleep quality/quantity and eating behaviours in female university students.

**Materials and methods:** 520 females (mean = 19.3 years, sd = 1.31), completed a series of questionnaires that assessed eating behaviours (Eating Attitudes Test-25), sleep-wake aspects, arousability, coping, emotional expressivity, worry, neuroticism/extraversion, perceived physical/mental health, academic stress, positive/negative affect, pre-sleep arousal (cognitive/somatic arousal) and Body Mass Index (BMI; KG/M2).

**Results:** BMI mean score was of 20.7 (sd = 2.39; range = 14.5–34.7). 14.7% were classified as underweight (BMI < 18.5), 81.8% normal weight (BMI of 18.5–24.9), 2.9% overweight (BMI of 25.0–29), and 0.6 obese (BMI  $\geq$  30.0). EAT-25 mean score was 24.25 (sd = 14.2; range = 0–78). 55.8% usually slept 7–8 h a night, 9.1% slept more than 8 h and 8.7% usually slept 6 h or less. 66% considered their sleep as “Very good/Good”. Logistic Regression analyses models showed that neuroticism, sleep reactivity to stress and sleep quality were independent significant predictors of drive for thinness (respectively, Odds ratio/OR = 1.220; OR = 1.506; OR = 1.926). Pre-sleep somatic arousal, negative emotion expressiveness, perceived academic stress, sleep reactivity to stress and usual sleep duration were independent significant predictors of bulimic behaviours (respectively, OR = 1.285; OR = 1.290; OR = 1.183; OR = 0.823; OR = 0.356). Pre-sleep cognitive arousal, usual sleep duration and sleep quality were independent significant predictors of Social pressure to eat (respectively, OR = 1.714; OR = 3.810; OR = 1.537). Pre-sleep cognitive arousal, perceived daytime sleepiness and usual sleep duration were independent significant predictors of global eating disturbance (respectively, OR = 1.293; OR = 0.577; OR = 0.148).

**Conclusion:** In young females, usual sleep duration/quality, neuroticism, emotion expressiveness, perceived stress, sleep reactivity to stress and pre-sleep arousal were predictors of disordered eating behaviours/attitudes.

**Acknowledgements:** The co-operation of Professors and Students is gratefully acknowledged.

<http://dx.doi.org/10.1016/j.sleep.2013.11.128>

### Sleep quality in Intensive Care Unit

S. Giménez Badia<sup>1</sup>, S. Batet<sup>1</sup>, S. Italiano<sup>2</sup>, F. Roche-Campo<sup>2</sup>, R. Antonijoan<sup>3</sup>

<sup>1</sup>Hospital de la Santa Creu i Sant Pau, Sleep Unit CIM-St. Pau (Drug Research Center), Spain

<sup>2</sup>Hospital de la Santa Creu i Sant Pau, Intensive Care Unit, Spain

<sup>3</sup>Hospital de la Santa Creu i Sant Pau, Pharmacology, Spain

**Introduction:** Critically-ill patients who require hospitalization are admitted to the Intensive Care Unit (ICU). Although sleep quality could be an important factor in the recovery of these patients, the ICU environment is not conducive to sleep (1). Since few studies have evaluated this matter, the objective of this study was to assess the quantity and quality of sleep in ICU patients.

**Materials and methods:** Polysomnography for consecutive hours (from 10 p.m. to 8 a.m.) were performed in conscious adult patients connected to artificial ventilation by an orotracheal tube or tracheostomy. All patients were not receiving sedation from 24 h prior to the study. Light and noise levels were measured. Results are presented as medians and percentiles (25th and 75th).

**Results:** To date, 13 polysomnography studies have been performed. Three studies were interrupted due to clinical deterioration of the patient. Of the remaining 10 patients, 4 tracings (40%) could not be scored by standard AASM criteria because characteristic graphoelements to define sleep staging were absent. In the other 6 patients, total sleep time was 182 min (130–228) with a sleep efficiency of 31% (22–38). Sleep time was as follows: N1, 56 min (39–75); N2, 112 min (68–132); and N3, 6 min (1–34). Only two patients presented REM sleep. During the 10-hour study, median light and noise levels were 19 lux (17–22) and 49 decibels (48–50), respectively.

**Conclusion:** In a non-negligible percentage of patients admitted to an ICU, polysomnography data did not fulfill the standard criteria for scoring. In those patients where standard criteria could be applied,

quantity and quality of sleep were highly abnormal, with short N3 and REM sleep stages. The present results fall in the line with previous studies which suggest the need of a new classification for sleep analysis in critically ill patients (2, 3). Moreover, further studies are necessary in order to evaluate the consequences of these sleep findings on patient outcomes.

**Acknowledgements:** Drouot X, Cabello B, d'Ortho MP, Brochard L. Sleep in the intensive care unit. *Sleep Med Rev.* 2008 Oct;12(5):391–403. Drouot X, Roche-Campo F, Thille AW, Cabello B, Galia F, Margarit L, d'Ortho MP, Brochard L. A new classification for sleep analysis in critically ill patients. *Sleep Med.* 2012 Jan;13(1):7–14. Watson PL, Pandharipande P, Gehlbach B et al., Atypical Sleep in Ventilated Patients: Empirical Electroencephalography Findings and the Path Toward Revised ICU Sleep Scoring Criteria. *Critical Care Medicine* 2013 August; 14(8):1–1.

<http://dx.doi.org/10.1016/j.sleep.2013.11.129>

### Nocturnal intermittent hypoxemia: utility for the evaluation of severity sleep apnea and cardiovascular comorbidity

E. Mañas Baena<sup>1</sup>, P. Lazo Meneses<sup>2</sup>, J. Fernandez Camara<sup>1</sup>, R. Esteban Calvo<sup>1</sup>, A. Pedrera Mazarro<sup>3</sup>, E. Perez Rodriguez<sup>1</sup>

<sup>1</sup>Hospital Ramon y Cajal, Medico Adjunto Neumología, Spain

<sup>2</sup>Hospital Ramon y Cajal, Medico Residente Neumología, Spain

<sup>3</sup>Hospital Ramón y Cajal, Medico Adjunto Neurofisiología, Spain

**Introduction:** Sleep apnea-hypopnea syndrome (SAHS) is a complex public health problem causing increased risk of cardiovascular diseases. Traditionally, evaluation of the severity of the disease is based on Apnea-Hypopnea Index (AHI). Oxygen desaturation index (ODI) could be a good parameter for the evaluation of the severity of SAHS and its potential cardiovascular consequences. TARGET: the aim of the present study was to examine the relationships between the overnight oxygen desaturation index (ODI), parameters sleep study and cardiovascular events in a sample of patients evaluated in the Unit Respiratory Sleep Disorders.

**Materials and methods:** We performed a retrospective study collecting data from 105 patients evaluated in the Unit Respiratory Sleep Disorders. In this study, diagnostic polygraphy recordings were retrospectively analysed. It was studied the correlation of ODI with AHI and the presence or absence of comorbidity, defining this as the presence of ischemic heart disease and / or arrhythmias and / or acute stroke.

**Results:** Among the 105 studied patients, 17(16%) had comorbidity. ODI values were correlated with AHI with a correlation coefficient of 0.87. There was a significant relationship between the severity of ODI and the presence of comorbidity ( $p$  0.038), and also a significant association between the AHI and the presence of comorbidity ( $p$  0.024).

**Conclusion:** ODI appears a good parameter to estimate the severity of OSA and may be associated with more prevalence of ischemic heart disease, arrhythmias and acute stroke.

**Acknowledgements:** Acknowledgements to authors of the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.130>

### Review of genioglossus muscle electrical stimulation effectiveness for the treatment of obstructive sleep apnea-hypopnea (OSAHS)

A. Bagué<sup>1</sup>, E. Esteller<sup>2</sup>

<sup>1</sup>Fisiolística, Spain

<sup>2</sup>Hospital General de Catalunya, Spain

**Introduction:** In 1978 Remmens determined that genioglossus (GG) is the main pharyngeal dilator muscle. His study showed an increase of neuromuscular activity of GG in the process of overcoming the obstruction of the upper airway. Accordingly, electrical stimulation (ES) of GG appears to be a suitable treatment for OSAH. However, recent studies do not support it due to the GG is a phasic muscle, which is more strong in untreated OSAH patients.

**Materials and methods:** We have searched articles in Medline, Embase and Cochrane Library.

**Results:** In favour: a study of Oliven showed a decrease of the critical pressure intrapharyngeal after applying ES in patients with OSAH. There was no difference between the electrodes implanted in the hypoglossal nerve and into the GG muscle. Later, Ludwing showed that the ES transcutaneous is also effective for toning GG. His study obtained an increase in the volume of GG (3D sonography measurement). There was no difference between the large electrode placed on the mouth's floor and multi-point electrodes. Against: fiber compositions of the pharyngeal muscles analysis performed by Wouldson showed that GG is a phasic muscle (type II fibers, which are strong and fatigables). Since maintaining the patency of upper airway is a typical function of type I fibers (which are slightly stronger and tireless) it seems that GG ES is not suitable. A study of Berry found that the GG neuromuscular activity in untreated OSAH patients was higher than in healthy subjects.

**Conclusion:** GG weakness is not the cause of upper airway obstruction. We can say that GG acts to compensate the upper airway blockage caused by postural muscles weakness (as tensor of the soft palate muscle). The most effective ES in OSAHS should impact on the postural muscles.

**Acknowledgements:** The authors thank Hospital General de Catalunya.

<http://dx.doi.org/10.1016/j.sleep.2013.11.131>

### **Intermittent fasting does not influence the circadian pattern of melatonin when controlling for meals, light exposure and sleep schedules**

A. Bahammam

University Sleep Disorders Center, King Saud University, Saudi Arabia

**Introduction:** Melatonin is considered to be one of the best markers for circadian rhythm disruption, as individual melatonin profiles are highly reproducible and are less subject to masking factors than are other rhythm markers like core temperature and cortisol. Two previous studies have suggested a shift delay in the peak of melatonin during Ramadan. However, both studies did not control for food intake, light exposure, sleep schedule and social habits that accompany Ramadan. We hypothesize that if we control for the above confounders, Islamic intermittent fasting will not influence the circadian pattern of circulating melatonin. Therefore, we designed this study to assess the circadian pattern of melatonin during inside and outside Ramadan month when controlling for potential confounders.

**Materials and methods:** Eight healthy volunteers with a mean age of  $26.6 \pm 4.9$  years and BMI of  $23.7 \pm 3.5$  reported to the Sleep Disorders Center on four occasions: (1) adaptation; (2) 4 weeks before Ramadan while performing the Islamic fasting for 1 week (baseline fasting (BLF)); (3) 1 week before Ramadan (non-fasting baseline) (BL); (4) during the second week of Ramadan while fasting (Ramadan). Serum levels of melatonin were measured using ELISA five times at 2200, 0200, 0400, 0600 and 1100. Each participant received meals with fixed caloric intake and fixed proportions of carbohy-

drate, fat and protein based on their ideal body weight. Light exposure and sleep schedules were maintained the same during the participants' stay in the SDC in the three study periods (BL, BLF and Ramadan). From 1800 until bedtime and during Suhur, light level was maintained at 50 lux. During sleep light level was  $<1$  lux.

**Results:** During fasting (BLF and Ramadan), melatonin maintained the same peak level at 0200. The documented trough level was at 1100 in all studied periods (BL, BLF and Ramadan). This indicates that there were no significant changes in the circadian pattern of melatonin during fasting.

**Conclusion:** Under controlled conditions of light exposure, meals and sleep-wake schedules, Islamic intermittent fasting has no significant influence on the circadian pattern of melatonin. The changes reported in the previous studies could be related to the attendant lifestyle changes during Ramadan.

**Acknowledgements:** This project was supported by a grant from National Plan for Science and Technology (King Abdulaziz City for Science and Technology and King Saud University), Riyadh, Saudi Arabia.

<http://dx.doi.org/10.1016/j.sleep.2013.11.132>

### **Validation of a modified hindi version of the Epworth Sleepiness Scale in a north Indian population**

G. Bajpai<sup>1</sup>, G. Shukla<sup>1</sup>, R. Pandey<sup>2</sup>, A. Gupta<sup>1</sup>, V. Goyal<sup>1</sup>,

A. Madhuri Behari<sup>1</sup>

<sup>1</sup>Department of Neurology, All India Institute of Medical Sciences, New Delhi, India

<sup>2</sup>Department of Biostatistics, All India Institute of Medical Sciences, New Delhi, India

**Introduction:** Since a majority of Indians do not drive automobiles, one item on the Epworth Sleepiness Scale requires modification and validation. In addition, data collected by us, indicated that a vast majority of rural and urban Indians regularly spend time in prayer/spiritual activity. The main purpose of this study was to develop a cross-cultural adaptation of the Epworth Sleepiness Scale for a north-Indian population (ESS-I). The study also provides evidence of reliability and validity of the modified version.

**Materials and methods:** The subjects included were normal volunteers aged 18–75 years (group 1) ( $n = 100$ ), compared with patients with complaints of excessive daytime sleepiness, who had undergone polysomnography (group 2) ( $n = 22$ ) and patients who had undergone MSLT (group 3) ( $n = 10$ ). The study was carried out in four phases: translation and retranslation of the original scale with modification of item8 (mainly addition of option of question on 'while offering prayers or in spiritual activity'); reliability (test-retest) ( $n = 30$ ); internal consistency (using Cronbach's alpha index) ( $n = 102$ ); and sensitivity to change ( $n = 8$ ).

**Results:** Group 1 showed spiritual activity as significantly more common activity than driving. The Cronbach's  $\alpha$  for the modified version, was 0.892, and this was not improved by removing the modified item. The  $\alpha$  value for group 1 versus group 2&3 was 0.667 and 0.892, respectively. The scale was reliable over time (test-retest) and it was sensitive to sleepiness change in patients with obstructive sleep apnea during treatment.

**Conclusion:** The ESS-I, is comparable to the original scale, It is reliable, valid, and change-sensitive. It is proposed that the modified version can be very useful for detecting sleepiness among Indian population, especially those who do not drive their own vehicles.

**Acknowledgements:** I am highly grateful to Jyoti Katoch, Shivani, Bharat Singh, Umesh Kumar, Nikhil at the Sleep disorders clinic and lab, Department of Neurology, AIIMS, New Delhi, India and my family specially my mother for their constant support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.133>

### The changes in cyclic alternating pattern(CAP) of epilepsy patients

B. Baklan

Dokuz Eylül University, Medical Faculty Neurology Dept., Epilepsy and sleep laboratory, Only ILAE, Turkey

**Introduction:** The aim of this study was to determine the changes in the polysomnographic parameters and the cyclic alternating pattern (CAP) in generalized and partial epilepsy patients (with and without epileptiform discharges on EEG) using video-EEG-PSG recording.

**Materials and methods:** 73 patients diagnosed with epilepsy and 19 healthy controls within the same age group (control group) underwent an 8-hour long sleep video-EEG-PSG recording. After the first evaluation, the CAP parameters were scored in 57 patients (31 generalized and 26 partial epilepsy) and 16 healthy subjects who had no sleep diseases and the results were compared within the groups.

**Results:** The total sleep time and the NREM I phase were found to be longest in the partial epilepsy group and shortest in the control group, while the REM phase was found to be exactly the opposite to this. The mean CAP ratios were found to be statistically higher in the generalized epilepsy group when compared to the other two groups. This difference was also found in the control group and the generalized epileptic patients who had no abnormality on EEG. No difference was found between the partial epilepsy and the control group regarding CAP ratios.

**Conclusion:** Patients with generalized epilepsy have differences compared to healthy individuals regarding the macro- and micro-structure of sleep, and it seems that these differences are independent from the epileptiform discharges. In partial epilepsy patients, no microstructural differences were detected, while macrostructural changes were evident.

**Acknowledgements:** we thanks to Our Sleep technicians Ýlkay,Sa-mime,Ummü and our patients.Support for this study were excluded.

<http://dx.doi.org/10.1016/j.sleep.2013.11.134>

### Reduction in regional cerebral blood flow in obstructive sleep apnea during wakefulness: A high-resolution SPECT study

A. Baril<sup>1</sup>, K. Gagnon<sup>2</sup>, J. Montplaisir<sup>1</sup>, J. Soucy<sup>3</sup>, J. Gagnon<sup>2</sup>, N. Gosselin<sup>1</sup>

<sup>1</sup> Université de Montréal, Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, Canada

<sup>2</sup> Université du Québec à Montréal, Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, Canada

<sup>3</sup> Mc Gill University, Montreal Neurological Institute, Canada

**Introduction:** Obstructive sleep apnea (OSA) is characterized by recurrent respiratory pauses that cause hypoxemia and sleep fragmentation. OSA is known to be associated with daytime sleepiness, cognitive deficits, and altered brain functioning. The objective of this study is to investigate changes in regional cerebral blood flow (rCBF) at rest using a high-resolution single photon emission computed tomography (SPECT) system in patients with OSA, compared to healthy subjects.

**Materials and methods:** rCBF of 9 OSA patients (apnea-hypopnea index (AHI):  $39.7 \pm 16.9$ ; age:  $66.1 \pm 7.8$  years) and 9 control subjects (AHI  $2.5 \pm 1.8$ ; age:  $67.9 \pm 9.0$  years) matched for body mass index were evaluated with 99Tc-HMPAO SPECT. Hypoperfusions in OSA subjects were compared to control subjects using statistical parametric mapping with independent *t*-tests with a significance threshold of 0.05 corrected for multiple comparisons for clusters and 0.001 uncorrected for peaks.

**Results:** OSA subjects showed significant reductions of rCBF in bilateral inferior parietal lobules (Brodmann area (BA): 40), left superior temporal gyrus (BA: 39) and left medial frontal gyrus (BA: 6) compared to control subjects.

**Conclusion:** These preliminary results show that OSA is associated with reduction of rCBF in several cortical regions that are known to be part of the default mode network. This network is a set of associative structures involved in internal cognition (e.g. planning and episodic memory). Altered rCBF in this network could be associated with cognitive deficits generally observed in OSA or with early signs of neurodegenerative disorders, but further studies with larger samples will be needed to investigate this relationship.

**Acknowledgements:** Supported by the Canadian Institutes of Health Research and the COPSE of the Faculty of Medicine of Université de Montréal.

<http://dx.doi.org/10.1016/j.sleep.2013.11.135>

### Insomnia complaints and associated factors in Georgian population

T. Basishvili<sup>1</sup>, M. Eliozishvili<sup>1</sup>, N. Lortkipanidze<sup>1</sup>, L. Maisuradze<sup>1</sup>, N. Darchia<sup>1</sup>, K. Espa-Cervena<sup>2</sup>

<sup>1</sup> Iliia State University, Georgia

<sup>2</sup> University Hospital of Geneva, Medecin Adjoint, Switzerland

**Introduction:** Insomnia is one of the most common of all sleep disorders. The prevalence rate of insomnia is not well described in Georgian population. The present study was aimed to examine the prevalence of insomnia and associated factors in the population of two largest cities of Georgia – Tbilisi and Kutaisi.

**Materials and methods:** 304 subjects from Tbilisi (mean age  $37.07 \pm 10.73$ , 67.4% female) and 91 subjects from Kutaisi ( $39.4 \pm 10.8$ , 67.1% female) were surveyed. Participants completed Insomnia Severity index (ISI), Epworth sleepiness scale (ESS), Pittsburgh Sleep Quality Index (PSQI), Beck depression inventory, short form (BDI SF), and STOP BANG questionnaire. Socio-demographic data and self evaluation of the overall health status were also obtained. Pearson chi-square tests were used to examine associations between ISI and sleep, health and socio-demographic variables. Multiple linear regression was used to examine the relationship between insomnia status and potential predictors.

**Results:** 33.2% of Tbilisi population had sub threshold insomnia, 9.5% moderate insomnia, and 1.3% severe insomnia. Mean ISI score was  $7.42 \pm 5.3$ . ISI score was significantly correlated with PSQI global score, BDI, health, education level, economic status, ESS and OSA severity. In Kutaisi population, 34.1% had sub threshold insomnia, 8.8% moderate insomnia, and 1.1% severe insomnia. Mean ISI score in Kutaisi sample was  $7.13 \pm 5.3$  and was significantly correlated with PSQI global score, BDI, ESS and health. Multiple regression analyses shows that moderate to severe insomnia is predicted by depression symptoms ( $\beta = 0.309$ ,  $p = .000$ ) and overall health status ( $\beta = -.229$ ,  $p = 0.000$ ) in Tbilisi population. For Kutaisi sample only BDI score was the significant predictor ( $\beta = -.220$ ,  $p = 0.048$ ).

**Conclusion:** This study provides evidence that insomnia complaints are high in Georgian population. Further analyses with more

subjects involved are needed to evaluate insomnia severity and its relation with health-related variables in Georgian population.

*Acknowledgements:* Study supported by Swiss National Science Foundation, SCOPES, grant IZ74Z0\_137415.

<http://dx.doi.org/10.1016/j.sleep.2013.11.136>

### The presence and the nature of dysfunctional cognitions and the focus of attention during pre-sleep period in shift workers

E. Bastille-Denis, M. Roy, A. Vallières

Université Laval, Centre de recherche de l'Institut universitaire en santé mentale de Québec, Canada

*Introduction:* While research concentrates on biological aspects of shift work sleep disorder (SWSD), few studies addressed psychosocial variables. To date, no studies have investigated cognition in SWSD. However, cognitive variables could play a role in the development and maintenance of this disorder. The present study examines the presence and the nature of dysfunctional cognitions and the focus of attention during pre-sleep period in shift worker with and without SWSD.

*Materials and methods:* The sample included 47 shift worker participants (mean age: 35.0%; 87.2% women), 25 with SWSD and 22 good sleepers. A semi-structured interview for sleep difficulties was administered to make the diagnosis. Participants wore an actigraph and completed sleep diaries during 2 weeks. Self-report questionnaires measuring pre-sleep content of thought were completed: Epworth sleepiness scale, Chronotype questionnaire, Thought control questionnaire-insomnia revised (TCQ-IR), Pre-sleep activation scale (PSAS), Glasgow Content of Thoughts Inventory (GCTI) et le Dysfunctional Beliefs and Attitudes about Sleep (DBAS). Harvey semi-structured interview designed to assess pre-sleep cognition was administered by a qualified graduate student in psychology after the 2-week period.

*Results:* Shift workers with SWSD scored significantly higher on GCTI ( $t = -2.05, p < .05$ ) and on cognitive activation subscale of PSAS ( $t = -2.75, p < .01$ ) compared to shift workers who were good sleepers. Harvey interview showed that SWSD group were significantly more likely than good sleepers to focus their attention on worries and preoccupations than good sleepers ( $F(1,45) = 6.07, p = .02$ ). SWSD were significantly more likely to listen to noises than good sleepers ( $F(1,45) = 5.24, p = 0.3$ ). SWSD group reported spending more time thinking or worrying about these topics compared with good sleepers ( $F(1,45) = 17.7, p = .00$ ).

*Conclusion:* This study is a first step in identifying cognitive variables involved in SWSD. These results suggest that pre-sleep activation and focus of attention are different depending of the presence or the absence of the disorder. It seems that cognitive variables could be a promising research avenue in a more multidimensional conceptualization of this sleep disorder. The development of the cognitive activation in shift workers with SWSD could be studied.

<http://dx.doi.org/10.1016/j.sleep.2013.11.137>

### Catastrophization process and themes of worry in shift workers

E. Bastille-Denis, M. Roy, A. Vallières

Université Laval, Centre de recherche de l'Institut universitaire en santé mentale de Québec, Canada

*Introduction:* This study constitutes the first step toward exploring the themes of worry related to sleep in shift workers. More specifi-

cally, this study aimed to (1) examine the presence of catastrophization, (2) define the themes of worry, and (3) explore the relationship between catastrophization and sleep difficulties.

*Materials and methods:* The sample included 47 participants shift workers (mean age: 35.0%; 87.2% women), 25 with shift work sleep disorder (SWSD) and 22 good sleepers. A semi-structured interview for sleep difficulties was administered. Participants wore an actigraph and completed sleep diaries during two weeks. Self-report questionnaires measuring pre-sleep content of thought were completed. The catastrophizing technique was conducted by a qualified graduate student in psychology. Data were entered and qualitative analysis was performed. Regression analyse was made to test the third objective.

*Results:* Thirty-six participants (77%) reported two catastrophes or more. More frequently reported themes were concerning fatigue and level of energy (64%), mood issues (44%), work performance (44%) and errors (44%). The presence of sleep difficulties does not predict the number of catastrophizing steps ( $\hat{\alpha} = .215, t = 1.474, p = .147$ ). The education level explained 22% of variance of the number of catastrophizing steps.

*Conclusion:* These results suggest that shift workers tend to catastrophize in pre-sleep period. While certain themes of worry resemble those find in studies on insomniacs, elderly and children populations, it appears that some themes are characteristics of shift workers.

<http://dx.doi.org/10.1016/j.sleep.2013.11.138>

### Analysis of mean transcutaneous carbon dioxide tension during polysomnographic extended monitoring in Sarah Network Hospital patients

P. Bastos, G. Pinnola, S. De Oliveira

Sarah Network Hospital, United States

*Introduction:* Transcutaneous CO<sub>2</sub> (PtcCO<sub>2</sub>) monitoring is a good non-invasive method of analysis to understand the PtcCO<sub>2</sub> behavioral tendency during sleep in a great variety of respiratory sleep disorders (RDB). When a patient is under investigation for sleep disorders like Sleep Apnea or Obesity/Hypoventilation Syndrome, this method can help the physician both in the diagnostic criteria and in the follow up of therapeutic responses. *Objective:* To analyze the PtcCO<sub>2</sub> in 179 consecutive patients submitted to a polysomnographic research at Sarah's Neurophysiology Department and to identify the normal variety of mean PtcCO<sub>2</sub> during the record of those patients that are considered normal ( $N = 53$ ). The normality distribution trend was also studied.

*Materials and methods:* 179 patients were submitted to a polysomnographic record (PSGR) with concomitant measure of PtcCO<sub>2</sub> using a TCM4 monitor (Radiometer, Switzerland). The group was classified into normal and non-normal patients. The normal group (N53) had an Apnea/hypopnea index <5 events/hour of sleep. The exclusion criteria were: existence of respiratory comorbidities, smoking history, existence of neurologic diseases that could be responsible for dynamic respiratory commitment and/or central PCO<sub>2</sub> deregulation. The age ranged from 7 to 76 years old.

*Results:* The age ranged from 7 to 76 years old in the normal group (mean of 43.13 and SD of 16.46); 32 patients were female and 21 were male. The Shapiro-Wilk test with Liliefors correction was accomplished to analyze the tendency to normality of data (sig 0.379). The mean of mean PtcCO<sub>2</sub> was 41.325 (confidence interval of 95% ranging from 40.122 to 42.325). The standard deviation was 4.363 and a 2 $\sigma$  reference was used for this appraisal. The normal values ranged from >33.0 to >50.0 mmHg of PtcCO<sub>2</sub>.

**Conclusion:** The mean PtcCO<sub>2</sub> values in the normal group showed a Gaussian distribution and in 98.7% of them, the PtcCO<sub>2</sub> ranged from 33.1 to 50.0 mmHg (SD 4.363 with 2|Ö of interval). Those results allowed the establishment of mean PtcCO<sub>2</sub> normative values to normal subjects.

**Acknowledgements:** Sarah Network Hospital.

<http://dx.doi.org/10.1016/j.sleep.2013.11.139>

### Lifestyle factors and risk of restless legs syndrome: prospective cohort study

S. Batool-Anwar, Y. Li, K. De Vito, J. Winkelman, A. Malhotra, X. Gao  
Brigham and Women's Hospital, Harvard Medical School, United States

**Introduction:** We conducted a prospective study to examine the association between lifestyle factors (i.e., obesity, physical activity, smoking, intake of alcohol and caffeine, and overall diet quality) and the risk of developing restless legs syndrome (RLS).

**Materials and methods:** The study population included 12,812 men participating in Health Professionals Follow-up Study and 42,728 women participating in the Nurses' Health study II, free of RLS at baseline (2002 for the HPFS and 2005 for the NHS II) and free of diabetes and arthritics through follow-up. RLS was assessed via a set of questions recommended by International Restless Legs Syndrome Study group. The Information was collected on height, weight, level of physical activity, dietary intake, and smoking status via questionnaires.

**Results:** During 4–6 years of follow-up, we identified 1,538 incident RLS cases. Participants with normal weight, and who were physically active, non-smoker, and with some alcohol consumption tended to have a lower risk of developing RLS. When we combined the effects of these four factors together, we observed a dose response relationship between the increased number of healthy lifestyle factors and a low risk of RLS: the adjusted pooled relative risk was 0.60 (95% CI: 0.42–0.86) for 4 vs.0 healthy factors (*P* trend = 0.01), after adjusting for age, depression, and other potential confounders. In contrast, we did not observe significant associations between caffeine consumption, diet quality, as assessed by the Alternate Healthy Eating Index, and altered RLS risk in men and women.

**Conclusion:** Several modified lifestyle factors may play an important role in RLS risk.

**Acknowledgements:** Funding by government grant: 5R01NS062 879-02 (PI: Xiang Gao). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

<http://dx.doi.org/10.1016/j.sleep.2013.11.140>

### Effort-based decision making in narcolepsy-cataplexy

S. Bayard, J. Cizeau, M. Georges, Y. Dauvilliers  
UnitÃ© des troubles du sommeil et de l'Ã©veil, Service de Neurologie, CHU Montpellier, France

**Introduction:** Narcolepsy-cataplexy (NC) is caused by the loss of hypothalamic neurons that produce hypocretins. By interacting with the mesolimbic dopamine structures (i.e. amygdala, prefrontal cortex, nucleus accumbens), hypocretins are involved in modulation of the reward system. Nucleus accumbens dopamine activity is crucially involved in valuing effort and probability costs. Thereby, NC represents an interesting model to study the implication of the hypocretin system in reward-based effort expenditure in humans.

**Materials and methods:** Eighty-nine adult participants were included, 7 drug-free patients with NC, 32 patients medicated with psychostimulant (including 17 with antidepressant), and 40 matched healthy controls (HC). All completed the Effort Expenditure for Rewards Task (EEfRT). In this task running approximately 20 min, participants are given an opportunity to choose between two different task difficulty levels: (1) easy trials (less motoric effort) for a small, stable reward; (2) hard trials (more motoric effort) for a variable but consistently larger reward. Trials (*n* = 40) had three levels of probability of receiving a monetary reward (i.e. 12%, 50%, and 88%). Intrinsic Motivation Inventory was administered in order to assess participants subjective experience of this task. The Karolinska Sleepiness Scale (KSS) was fulfilled by participants before and after the EEfRT completion.

**Results:** There was no difference in the percentage of trials successfully completed by patients with NC (99.1%) or controls (99.5%, *p* = 0.92). There were no group differences in average responses times for choosing between the easy and hard task (respectively, *p* = 0.24 and *p* = 0.19). No group effect was observed for reward magnitude (*p* = 0.98). However, we found that patients with NC were less willing to expend effort for rewards than HC when probability of winning was low (12%, *p* = 0.016) compared to medium (50%) and high (80%) probabilities. Patients with NC had higher level of intrinsic motivation (*p* = 0.019) with no association with the EEfRT performances. Finally, groups did not differ on the KSSs (*p* = 0.73 and *p* = 0.82).

**Conclusion:** This is the first demonstration in humans that patients with NC showed decrease willingness to incur effort costs when probability of reward receipt was low. This study provides a starting point for exploring contributions of hypocretin system to motivation in humans.

<http://dx.doi.org/10.1016/j.sleep.2013.11.141>

### The Glasgow Normal Sleep Checklist (GNSC): a research tool for describing control participants

L. Beattie<sup>1</sup>, C. Espie<sup>2</sup>, S. Biello<sup>1</sup>

<sup>1</sup> University of Glasgow, School of Psychology, United Kingdom

<sup>2</sup> University of Oxford, Nuffield Department of Clinical Neurosciences/ Sleep, Circadian Neuroscience Institute, United Kingdom

**Introduction:** A good understanding of healthy sleep is considered crucial to the understanding of disorders, such as insomnia (c.f. Espie, 2002). However, somewhat less attention has been paid to how control participants are defined in the literature, even though there are published criteria for this group (Edinger et al., 2004). This makes it harder to compare results across studies.

**Materials and methods:** We carried out a literature search to identify papers containing key terms (e.g. insomnia, poor sleep), within six sleep-society affiliated journals. An initial review of titles and abstracts resulted in the exclusion of papers on children, adolescents, or older adults, as well as animal studies, and those studies not primarily comparing poor sleepers to controls. Seventy-five papers were considered suitable for further review, and their details and methods were recorded.

**Results:** We found some differences in the inclusion criteria applied normal sleepers, with some components of the research diagnostic criteria assessed more rigorously than others (c.f. Edinger et al., 2004). Based on these results, we developed the Glasgow Normal Sleep Checklist (GNSC) to quantify how researchers apply the various criteria in their studies. This checklist ensures attention is given to all components of the RDC, and allows researchers to quantify how decisions were made and which level of analysis was

applied (e.g. disorder present/absent by medical exam, questionnaire cut-offs to describe symptomology, self-reported history, etc.).

**Conclusion:** Consistency in how controls are selected for research purposes is important for sleep research. However, some components may warrant greater attention, while the inclusion of some other questions may be unnecessary. We suggest that protocols are created using this checklist to aid comparability of results with normal sleeper groups across key domains.

**Acknowledgements:** LB is supported by an ESRC studentship.

<http://dx.doi.org/10.1016/j.sleep.2013.11.142>

### Subsided infections and autoimmune events in narcolepsy

P. Beitinger<sup>1</sup>, M. Ising<sup>2</sup>, G. Kohl<sup>2</sup>, A. Steiger<sup>2</sup>

<sup>1</sup>Max Plank Institute of Psychiatry, Sleeplab, Germany

<sup>2</sup>Max Planck Institute of Psychiatry, Germany

**Introduction:** Narcolepsy is a rare sleep-wake disorder characterized by excessive daytime sleepiness with imperative sleep attacks and cataplexy. In the vast majority of patients, the disease is closely linked to an acquired central orexin deficiency. Biochemical and neuroanatomical studies suggest an almost complete cessation of production of orexin prior to or around disease onset due to yet unknown causes; autoimmune mechanisms may be involved.

**Materials and methods:** In a retrospective study 62 narcoleptic patients completed a self-administrated questionnaire regarding subsided infectious and autoimmune diseases. The questionnaire had 27 items each asking whether a specific immune related disease or condition occurred in the medical history. In case of positive answer the frequency of incidence and the experienced severity of each event were asked. The reported incidence is compared to those of healthy controls from a large study population after matching for age and sex. T-tests were performed.

**Results:** 62 narcoleptic patients (NP: 38 female, 24 male, mean age  $54.4 \pm 17.0$  years) and 62 matched healthy controls (HC: 38 female, 24 male, mean age  $53.2 \pm 16.7$  years,  $p = 0.85$ ) could be included. Significantly more narcoleptic patients reported the occurrence of arthritis (NP 21, HC 9,  $p = 0.038$ ), chronic bronchitis (NP 27, HC 9,  $p = 0.005$ ), pneumonia (NP 18, HC 6,  $p = 0.002$ ), viral hepatitis (NP 10, HC 1,  $p = 0.009$ ) and drug induced immunodeficiency, i.e. agranulocytosis (NP 5, HC 0,  $p = 0.028$ ). The incidence of other infectious or autoimmune events did not differ between patient and controls.

**Conclusion:** Our case control study gave hints for a higher number of subsided diseases of the lower respiratory system like bronchitis and pneumonia as well an increased number of viral hepatitis and drug induced immune deficiency in the medical history of narcoleptic patients compared to healthy controls. This is in line with various former reports and studies for the arthritis and respiratory diseases. To our knowledge a significantly increased incidence of viral hepatitis or drug induced immune suppression is unknown. As narcolepsy and arthritis seem to coincide in a number of patients their might be a possible disposition for latent autoimmune processes. The increased number of lower respiratory tract infections, may be connected to the known association to upper airway infection around disease onset of narcolepsy. But especially in chronic bronchitis the often observed smoking may play an important role. The elevated incidence of drug induced immunodeficiency may result from the increased intake of drug in a chronic disease condition. Beside the low sample size important covariables like smoking habits, HLA status as well as rheumatologic blood parameters (i.e. rheumatoid factor) are lacking. These findings support the thesis of an increased autoimmune vulnerability as well as a possible role of respiratory tract infections in the pathogenesis of narcolepsy.

**Acknowledgements:** Deutsche Narkolepsie Gesellschaft DNG e.V.

<http://dx.doi.org/10.1016/j.sleep.2013.11.143>

### Sleep and pulmonary intensive care: insomnia and the paradox of

F. Rocca<sup>1</sup>, B. Campolo<sup>1</sup>, L. Gallelli<sup>2</sup>

<sup>1</sup>A.O.U. Mater Domini Catanzaro, Italy

<sup>2</sup>UMG Catanzaro, Italy

**Introduction:** The International Classification of Sleep Disorders of the American Academy of Sleep Medicine describes insomnia secondary to drugs or substances, highlighting some of the features which characterize it: (a) the iatrogenic nature (b) the diverse range of effects on sleep structure by the different substances, (c) the failure or the partiality of knowledge about it.

**Materials and methods:** FG, male, 82 years old, suffering from prostate cancer-treatment with bicalutamide (50 mg/day orally) and leuprorelin (3.75 mg sc per month), is hospitalized in urology for the evidence of two bladder neoplasms. Pre-treated with blood transfusions of G.R. concentrated, is undergoing surgery, in the postoperative setting is further transfused IIa and presents in the day, in the absence of subjectivity and objectivity in character infectious diseases, insomnia and severe decompensated respiratory acidosis associated with acute respiratory failure type II, which progresses despite medical therapy and oxygen-therapy. Speaking to counseling should be the day for the worsening of the clinical picture, is in the differential diagnosis TRALI with bilateral pleural effusions and it starts with the noninvasive mechanical ventilation with interface oro-nasal and oxygen. The urgency in making a HRCT allows you to exclude the commitment interstitial and to confirm the bilateral pleural effusions. Then, are performed in succession, two thoracentesis, right and left, in the course of non-invasive mechanical ventilation, with the respectively extraction of 1000 and 1700 ml of pleural fluid, which turns out to be a transudate. Meanwhile, ventilatory treatment allows a progressive compensation of respiratory failure, the follow-up ultrasound shows the gradual reformation of the pleural effusion bilaterally. The diagnostic analysis is then focused on insomnia marked: you run a PSG in the course of therapy and proves increase of latency, sleep fragmentation and made surface with marked reduction of N2 and especially REM sleep. While the bilateral recurrent hydrothorax is treated with the placement of pleural drainage, a series of investigations in blood chemistry are performed, designed to confirm the suspicion of a clinical condition consistent with the immediacy of insomnia and hydrothorax by drugs and / or substances (surgical stress-Cortisol-CRH-bicalutamide-leuprorelin-FSH-LH-DHEA).

**Results:** Discontinuation of treatment with bicalutamide and dose adjustment of leuprorelin have permission to remove the pleural drainage through exhaustion of recurrence hydro-thorax bilateral. The patient was discharged in XLIIIa day.

**Conclusion:** The knowledge and the cultural-methodological approach of the Sleep Medicine are almost always a real added value for a proper understanding of reality from respiratory clinics proposals in the various forms in which it manifests itself. The clinical case presented is paradigmatic of how Pulmonology intensivists is intimately hawkbill terms of pathophysiology and clinical interpretation, with the Sleep Medicine and how it is useful to have both the same cultural and methodological approaches.

**Acknowledgements:** 1. Spitz A, Young JM, Larsen L, Mattia-Goldberg C, Donnelly J, Chwalisz K. "Efficacy and safety of leuprolide acetate 6-month depot for suppression of testosterone in patients with prostate cancer". Prostate Cancer Prostatic Dis. 2011 Oct 25. doi: 10.1038/pcan.2011.50. 2. Tanaka N, Fujimoto K, Hirao Y, Shimizu

K, Tsujimoto S, Samma S. "Endocrine response to a single injection of goserelin 3.6 mg or leuprolide 3.75 mg in men with prostate cancer. Arch Androl. 2007 Mar-Apr;53(2):87-90. 3. Ferrari B, Pezzuto A, Coppola F. "Massive ascites and hydrothorax after leuprolide acetate administration in a down-regulated woman undergoing assisted reproduction". Fertil Steril. 2007 Oct;88(4):968.e9-11. Epub 2007 Apr 16. 4. Lodde M, Lacombe L, Fradet Y. "Salvage therapy with bicalutamide 150 mg in non metastatic castration-resistant prostate cancer". Urology. 2010 Nov;76(5):1189-93. Epub 2010 Mar 29. 5. Akaza H. "Combined androgen blockade for prostate cancer: review of efficacy, safety and cost-effectiveness". Cancer Sci. 2011 Jan;102(1):51-6. doi: 10.1111/j.1349-7006.2010.01774.x. Epub 2010 Nov 22. Review. 6. Labrie F. "Hormonal therapy of prostate cancer". Prog Brain Res. 2010;182:321-41.

<http://dx.doi.org/10.1016/j.sleep.2013.11.144>

### Sleep in restless legs syndrome improves during opioid treatment – Results from a large 1-year multi-center trial

H. Benes<sup>1</sup>, C. Trenkwalder<sup>2</sup>, D. Garcia-Borreguero<sup>3</sup>, B. Bosse<sup>4</sup>, M. Hopp<sup>4</sup>, R. Kohnen<sup>5</sup>

<sup>1</sup>Somni bene Institute for Clinical Research and Sleep Medicine, Germany

<sup>2</sup>Paracelsus-Elena Hospital, Centre of Parkinsonism and Movement Disorders, Germany

<sup>3</sup>Sleep Research Institute, Germany

<sup>4</sup>Mundipharma Research GmbH&Co. KG, Germany

<sup>5</sup>ReSearch Pharmaceutical Services Inc., Germany

**Introduction:** In severe cases of restless legs syndrome (RLS), symptoms result in bothersome impact on sleep and impairment of daytime function. This study showed superior efficacy of oxycodone/naloxone prolonged-release fixed-combination (OXNPR) vs. placebo for the primary endpoint (International Restless Legs Syndrome Study Group Rating Scale (IRLS) total score) in severely affected RLS patients. The impact of RLS on sleep quality was assessed as a secondary endpoint.

**Materials and methods:** After screening and a 7-day washout, 304 patients (age 62±11.2 years) with failed prior RLS therapy and an IRLS score ≥21 were randomized to double-blind OXNPR bid (mean oxycodone dose 21.9±15.0 mg/day) or placebo for 12 weeks. 197 patients participated in a 40-week open-label extension (mean oxycodone dose 18.1±10.5 mg/day). Sleep was subjectively assessed by the Medical Outcomes Study (MOS) sleep scale, by item 4 of the IRLS (sleep disturbance due to RLS symptoms) and 4 questions of the RLS-6: Q1 (sleep satisfaction), Q2/3 (RLS symptom severity at falling asleep/during the night), and Q6 (daytime tiredness).

**Results:** MOS sleep scale results showed greater improvement in sleep quality for OXNPR vs. placebo; OXNPR-treated patients fell asleep more quickly, slept for longer, experienced less sleep disturbance and greater sleep adequacy than placebo-treated patients ( $p < 0.001$ ). The IRLS item 4 showed that sleep disturbance was 'very severe' at baseline (median = 4 on a scale of 0–4) but had improved to 'mild' (median = 1) in the OXNPR group and severe (median = 3) in the placebo group at Week 12. These results support results for IRLS total score. The RLS-6 was scored on a 0–10 scale; higher values represent more severe symptoms. Patients were highly dissatisfied with sleep at baseline (score of 8.2±2.0 for Q1), but improved with a score of 3.8±3.1 for OXNPR at Week 12. Similarly, results for Q2 improved from 7.2±2.6 to 2.7±2.9, results for Q3 improved from 7.5±2.4 to 2.8±3.0 and results for Q6 improved from 6.4±2.8 to 3.7±3.0. The improvement was significantly larger for OXNPR than placebo ( $p < 0.001$ ).

**Conclusion:** In this analysis of an important secondary outcome measure, we demonstrated that treatment with OXNPR improves sleep quality in the context of an overall favorable treatment effect in severely affected RLS patients who failed on previous RLS medications.

**Acknowledgements:** Karen Paine provided medical writing services on behalf of Mundipharma Research. (Funded by Mundipharma Research; ClinicalTrials.gov number, NCT01112644).

<http://dx.doi.org/10.1016/j.sleep.2013.11.145>

### The effect on sleep inertia on pain perception depends on the type of pain

D. Benjamin, R. Inkley, A. Bentley

Brain Function Research Group, Faculty of Health Sciences, South Africa

**Introduction:** The impact of sleep inertia on cognitive performance has been well documented. There is a delay in full function which is worse when woken from slow wave sleep and may last for up to 60 min. The impact of this inertia on the perception of pain has been under-researched although some hypoalgesia with heat pain after waking from REM sleep has been documented. The objective of this research was to see the effect of sleep inertia on the perception of two different pain modalities.

**Materials and methods:** Eleven healthy male subjects aged 19–28 were brought into the sleep lab on three occasions. On each occasion pressure pain thresholds as well as a range of temperature (heat) pain stimuli were applied to the lateral thigh area twice 15 min apart while awake. Standard polysomnographic channels were recorded and subjects were woken during stage 2, slow wave sleep and REM sleep. After waking both pressure pain threshold and heat pain (measured by temperature and severity of pain measured by visual analogue scales) were repeated both 30 s and 15 min after waking.

**Results:** There were significant differences in the temperature data measured 15 min apart during waking but not in pressure pain thresholds. When compared to awake data the pressure pain thresholds were significantly lower measured at both 30 s ( $p = 0.001$ ) and 15 min ( $p = 0.001$ ) after waking from stage II. There was evidence of hypoalgesia after forced waking from SWS.

**Conclusion:** After forced waking from sleep there is consistent hyperalgesia for pressure pain thresholds which lasts for at least 15 min after waking. There is isolated hypoalgesia for increased temperatures after slow wave sleep only. While hypoalgesia may be explained by sleep inertia it is unclear how to explain excessive sensitivity to pressure pain.

**Acknowledgements:** Funding obtained from Wits Dial.a.Bed Sleep Laboratory.

<http://dx.doi.org/10.1016/j.sleep.2013.11.146>

### Sleepiness and driving performance in adults with Attention Deficit Hyperactivity Disorder (ADHD)

S. Bioulac<sup>1</sup>, A. Capelli<sup>2</sup>, A. Claret<sup>3</sup>, J. Taillard<sup>2</sup>, M. Bouvard<sup>3</sup>, P. Philip<sup>4</sup>

<sup>1</sup>Child and Adolescent University Psychiatry, USR CNRS 3413, United States

<sup>2</sup>USR CNRS 3413, United States

<sup>3</sup>Child and Adolescent University Psychiatry, United States

<sup>4</sup>USR CNRS, United States

**Introduction:** Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by a triad of symptoms involving hyperactivity, impulsivity and inattention. Several studies in children with ADHD showed a high prevalence of excessive daytime sleepiness. To our knowledge, no study has objectively assessed sleepiness in adults with ADHD. Moreover, it has been shown that adults with ADHD were at risk for driving accidents. The objectives of this study are to quantify objective sleepiness and its impact on driving performance in adult with ADHD.

**Materials and methods:** 36 subjects with ADHD (age (mean  $\pm$  SE) = 36.3  $\pm$  1.6) and 18 control subjects (age (mean  $\pm$  SE) = 31.2  $\pm$  1.2) were included. Nocturnal polysomnography was performed to identify potential sleep disorder. The next day patients were submitted to a Maintenance Wakefulness Test (MWT) at 10H, 12H, 14H, 16H to examine their level of daytime sleepiness. After a training of 15 min, a driving test of 1 h was carried out at 17H on a simulator (Oktal) to evaluate driving performance.

**Results:** ADHD subjects were divided into 2 groups according to their level of sleepiness at the MWT: the "sleepy" group consisted of twenty subjects (mean sleep latency (SL) = 23.9  $\pm$  1.3 min) and the "alert" group included sixteen subjects (LE = 37.3  $\pm$  1 min) ( $p = 0.001$ ). We observed that more than half of the ADHD subjects exhibit a sleep disorder: 31% among the alert ADHD subjects and 65% among sleepy ADHD subjects. But 35% of the sleepy ADHD subjects did not presented a sleep disorder. About driving performance, there were significant differences between driving performance (observed by the number of lines crossing) between the control group and the alert ADHD group ( $p = 0.05$ ) and the control group and the sleepy ADHD group ( $p = 0.02$ ).

**Conclusion:** This study supports the hypothesis that there is a subgroup of ADHD patients that present pathological sleepiness. In our sample, half of the patients suffer of excessive daytime sleepiness. But it is appropriate to question the origin of the sleepiness found in the other patients and to wonder if they represent a particular phenotype. ADHD impacts on driving performances, but it is not possible today to clearly explain them: attention deficit and/or sleepiness? But it is important to focus on this question to provide therapeutic strategy modulated by the clinic.

**Acknowledgements:** JP rénéric.

<http://dx.doi.org/10.1016/j.sleep.2013.11.147>

### Symptoms of insomnia among OSA patients before and after 2 years of PAP treatment

E. Bjornsdottir<sup>1</sup>, C. Janson<sup>2</sup>, E. Arnardóttir<sup>1</sup>, A. Pack<sup>3</sup>, T. Gislason<sup>1</sup>, B. Benediktsdottir<sup>1</sup>

<sup>1</sup> Faculty of Medicine, University of Iceland, Iceland

<sup>2</sup> Uppsala University, Sweden

<sup>3</sup> Center for Sleep and Circadian Neurobiology, Division of Sleep Medicine, Department of Medicine, United States

**Introduction:** To assess the changes of insomnia symptoms among patients with obstructive sleep apnea (OSA) from starting treatment with positive airway pressure (PAP) to a two-year follow-up.

**Materials and methods:** All subjects underwent a medical examination, type 3 sleep study and answered questionnaires on health and sleep before and 2 years after starting PAP treatment. The change in prevalence of insomnia symptoms by subtype were assessed by questionnaire and compared between individuals who were using or not using PAP at follow-up.

**Results:** Symptoms of middle insomnia were most common at baseline and improved significantly among subjects using PAP (from 59.4% to 30.7%,  $p < 0.001$ ). Symptoms of initial insomnia tended to

persist, regardless of PAP treatment and symptoms of late insomnia were more likely to improve among subjects not using PAP. Subjects with symptoms of initial and late insomnia at baseline were less likely to adhere with PAP (odds ratio (OR) 0.56,  $p = 0.007$ , and OR 0.53,  $p < 0.001$ , respectively).

**Conclusion:** PAP treatment significantly reduced symptoms of middle insomnia. Symptoms of initial and late insomnia, however, tended to persist regardless of PAP treatment and had a negative effect on treatment adherence. Targeted treatment for insomnia may be beneficial for patients with OSA comorbid with insomnia and has the potential to positively affect adherence to PAP.

**Acknowledgements:** Support: NIH grant HL72067 for "A Family Linkage Study of Obstructive Sleep Apnoea" and HL94307 for "Endophenotypes of Sleep Apnea and Role of Obesity", the Eimskip Fund of the University of Iceland and the Landspítali University Hospital Research Fund.

<http://dx.doi.org/10.1016/j.sleep.2013.11.148>

### A randomized controlled trial of the effects of bright light and melatonin for delayed sleep phase disorder

B. Bjorvatn<sup>1</sup>, I. Saxvig<sup>1</sup>, A. Wilhelmsen-Langeland<sup>1</sup>, Ø. Vedaa<sup>2</sup>, I. Nordhus<sup>1</sup>, S. Pallesen<sup>1</sup>

<sup>1</sup> Haukeland University Hospital, Norwegian Competence Center for Sleep Disorders, Norway

<sup>2</sup> University of Bergen, Department of Psychosocial Science, Norway

**Introduction:** Delayed sleep phase disorder (DSPD) is a circadian rhythm sleep disorder. Patients with DSPD have problems initiating sleep if they go to bed at a conventional time and they have serious problems waking at desired times. In the present study we investigated short- and long-term effects of timed bright light and exogenous melatonin treatment alongside gradually advanced rise times in adolescents/young adults with DSPD in a randomized controlled two-week trial with an open label 3-month follow-up study.

**Materials and methods:** Forty patients (16–25 years) diagnosed with DSPD were recruited to participate. The participants were randomized to receive treatment for 2 weeks in one of four treatment conditions: dim light + placebo capsules, bright light + placebo capsules, dim light + melatonin capsules or bright light + melatonin capsules. In the follow-up study, participants were re-randomized to either receive treatment with the combination of bright light and melatonin or no treatment in an open label trial for three months. Light and capsules were administered alongside gradual advancement of rise times. The main end points were sleep and daytime function as assessed by sleep diaries, actigraphy, sleepiness/fatigue recordings, cognitive function and circadian phase (assessed by salivary dim light melatonin onset (DLMO)).

**Results:** During the two-week intervention, the timing of sleep and DLMO were advanced in all treatment conditions with no interaction effects (two-way ANOVA); about one hour advance of bed time, 2 h advance of rise time and two hours advance of DLMO in all four groups. Sleep duration was reduced with one hour. Subjective sleepiness, fatigue and cognitive function also improved significantly after two weeks of treatment, again with no interaction effects. At three-month follow-up, the no-treatment group had returned to baseline on all measures, whereas the treatment group had maintained an advanced sleep phase as well as improved scores on sleepiness, fatigue, and cognitive function. Sleep duration had increased.

**Conclusion:** Gradual advancement of rise time produced a phase advance and an improved daytime function during the two-week intervention, irrespective of treatment condition. Termination of treatment caused relapse into delayed sleep times and poor daytime

function, whereas long-term treatment with bright light and melatonin allowed maintenance of the advanced sleep phase and improved daytime function.

*Acknowledgements:* Thanks to all the participants.

<http://dx.doi.org/10.1016/j.sleep.2013.11.149>

### Medical technology assessment of polysomnography, type 2: full PSG at home – How often do technical failures occur?

C. Blankvoort, H. Steinebach, I. Warnaar, L. Rohling, A. De Weerd  
Sleepcenter SEIN Zwolle-Groningen, The Netherlands

*Introduction:* Polysomnography (PSG) in a clinical setting (PSG, type 1) is time consuming and expensive. Type 2, i.e. full PSG at home, is thought to be a good alternative, but has never been evaluated in terms of regular Medical Technology Assessment (MTA). In some countries this lack of MTA precludes reimbursement for PSG type 2. This communication is part of a series of posters which add up to MTA of PSG, type 2, and deals with technical failures when recording full PSG at home.

*Materials and methods:* Retrospective study of 337 patients (49.1% male, mean age = 45.0, SD = 16.7) who underwent full PSG type 2 for two consecutive days. After 24 h, patients returned to the clinic for a check-up. The following signals were evaluated: EEG (including eye movement and chin EMG), EMG m.tibialis, nasal pressure, inductive belts thorax and abdomen, and oxygen saturation. Failure was indicated when there was limited recording time or due to technical interruptions. Besides, we estimated the amount of interruption within the recorded signals.

*Results:* Of all recordings 92.9% were successful, 3.9% failed on the first night, 3.0% in the second night, and 0.3% in both nights. Saturation (22.5%) and nasal pressure (22.7%) were the most vulnerable signals during complete PSG. Inductive belts thorax and abdomen (3.8%) EMG m.tibialis (3.7%) and EEG (3.3%) were less often wrong. Saturation seems to fail partly in 15.0% and total failures were 7.5% and nasal pressure seems to fail partly in 15.1% and total failures were 7.6%.

*Conclusion:* On the basis of this study, it can be concluded that PSG type 2 is reliable to obtain a diagnosis. Most errors occur in the first night but these failures can be solved at the second night. Despite of the failures, all diagnoses could be made.

<http://dx.doi.org/10.1016/j.sleep.2013.11.150>

### PGO activity after carbachol delivery in the oral and caudal pontine reticular nuclei: similarities and differences with spontaneous REM sleep in cats

C. Bódalo, L. Asensio-Gómez, I. Rego-García, I. De Andrés  
U.A.M., Spain

*Introduction:* Carbachol in the ventral part of the oral pontine reticular nucleus (vRPO) generates REM sleep with all its polygraphic characteristics. In contrast, cholinergic stimulation of the nearby rostral caudal pontine reticular nucleus (RPC) produces atonia and PGOs but with EEG synchronization. By quantifying PGO activity, this study further characterizes the effects of carbachol in these two pontine sites.

*Materials and methods:* Eight cats wearing electrodes for sleep polygraphic recordings were used; each had a guide-tube aimed at the vRPO or the RPC to administer carbachol (0.1 M, 20–30 nl) microinjections. Isolated PGO waves (Type I) and clusters with interspike

intervals of  $\leq 330$  ms of 2, 3 and  $\geq 4$  PGOs (Type II, III and IV respectively) were quantified using one-minute epochs of 4 consecutive spontaneous REM sleep episodes (control) and then after carbachol in the vRPO and the RPC at the following times: when PGO activity was first detected (T0) and 10–15 (T10), 30–45 (T30) and 60–75 (T60) min later. Data from the different experimental conditions were compared with ANOVAs for repeated measures and the post hoc Fisher test.

*Results:* Atonia, desynchronized EEG and different types of PGOs occurred shortly after carbachol delivery in the vRPO, while a predominance of Type IV PGO clusters, numerous REMs, atonia and with a striking EEG theta synchronization occurred after carbachol in the RPC. The total number of PGOs and Type IV clusters were significantly higher in RPC experiments than in either spontaneous or vRPO Rem sleep in the T0 to T60 samples. These parameters were slightly lower than the spontaneous REM sleep values after vRPO carbachol delivery but, significant decreases only occurred immediately after the first appearance of PGO activity (T0). Also, the four PGO type proportions were fairly well preserved in carbachol vRPO experiments. In the RPC experiments, the proportions of the PGO patterns were different from spontaneous or carbachol vRPO Rem sleep (Types I and II significantly decreased and Type IV significantly increased).

*Conclusion:* These results indicate that the vRPO is not only the prime region for the simultaneous appearance of tonic REM sleep signs (atonia and EEG desynchronization) but it can also to promote the cascade of events that establish the physiological pattern of PGO phasic activities. Cholinergic stimulation of the rostral RPC does not generate true REM sleep, but it is involved in the generation of atonia and of long trains of clustered PGO activity.

*Acknowledgements:* Supported by Grant BFU2009-06991 from MCyT, Spain.

<http://dx.doi.org/10.1016/j.sleep.2013.11.151>

### Histamine interaction with the ventral part of the oral pontine tegmentum: its implication in rem sleep modulation

C. Bódalo, I. De Andrés  
U.A.M., Spain

*Introduction:* Histamine is considered to be strongly involved in wakefulness mechanisms, although some studies have revealed that REM sleep is also sensitive to histaminergic stimulation, thus, suggesting that the histaminergic neurons of the hypothalamic tuberomammillary nucleus would have a descending control over generation of REM sleep pontine mechanisms. The ventral region of the oral pontine reticular nucleus (vRPO) – an effective region for REM sleep cholinergic generation – has histaminergic innervation. The aim of this work was to examine effects on REM and other sleep-wakefulness states after delivery of small volume histamine microinjections in the vRPO.

*Materials and methods:* Five cats with electrodes implanted for chronic sleep polygraphic recordings and with one or two cannulas stereotaxically aimed at the vRPO were used. Histamine microinjections (165 mM, 20–30 nl) in the vRPO and combined experiments with administration of pyrilamide i.p. (H1 antagonist, 1 mg/kg) and intracranial histamine were performed. Intracranial saline microinjections and i.p. pyrilamide administration were done as controls. Polygraphic recordings were obtained during 6 h after the different experiments.

*Results:* From the second to the fifth hour post drug NREM and REM sleep significantly decreased and wakefulness and drowsiness significantly increased. Architecture analyses of the sleep-wakefulness

cycle (SWC) in this period showed that histamine in the vRPO produced a specific blockage of the transitions from NREM to REM sleep. However, decreased REM sleep and its blockage did not take place early in the first hour after drug; in fact, in some of the animals, histamine in the vRPO produced a rapid entry in REM similar to the one that occurs in narcoleptic episodes. The previous application of pyrillamine blocked the early REM facilitatory effects and the late effects in wakefulness, drowsiness and NREM. Late REM suppression was not blocked by pyrillamine but, since the pyrillamine i.p. alone significantly decreased REM sleep, it was not possible to determine whether or not H1 receptors are involved in the late REM actions of histamine acting in the vRPO.

**Conclusion:** Histamine action in the vRPO has a regulatory role on REM sleep, with early facilitatory effects and a later suppression of this sleep state. H1 receptors seem to be involved in the early REM sleep enhancing effect and in the later modifications of the other SWC states.

**Acknowledgements:** Supported by FPU 2009-06991 MCYT Grant.

<http://dx.doi.org/10.1016/j.sleep.2013.11.152>

### Sleep quality and sleep-related symptoms in Pompe disease

M. Boentert<sup>1</sup>, N. Karabul<sup>2</sup>, S. Wenninger<sup>3</sup>, B. Schoser<sup>4</sup>, E. Mengel<sup>2</sup>, P. Young<sup>1</sup>

<sup>1</sup>University Hospital Münster, Department of Sleep Medicine and Neuromuscular Disorders, Germany

<sup>2</sup>University Hospital Mainz, Center for Pediatric and Adolescent Medicine, Germany

<sup>3</sup>Friedrich Baur Institute, Germany

<sup>4</sup>Ludwig-Maximilians-University Munich, Friedrich Baur Institute, Germany

**Introduction:** Late-onset Pompe disease (LOPD) is highly representative for neuromuscular disorders with progressive respiratory muscle dysfunction. Non-invasive ventilation almost inevitably becomes necessary in the majority of patients, and pulmonary complications of diaphragmatic weakness are the major cause of early death in patients with LOPD. Nocturnal hypercapnia is the first sign of respiratory muscle weakness, causing sleep disruption and non-restorative sleep. We investigated sleep-related symptoms along with motor performance, respiratory symptoms, and forced vital capacity (FVC) in 60 adult patients with LOPD.

**Materials and methods:** Patients answered the Fatigue Severity Scale (FSS), the Epworth Sleepiness Scale (ESS), the Pittsburgh Sleep Quality Index (PSQI), the Rotterdam 9-Item Handicap Scale (RHS), the SF-36 quality of life (QoL) questionnaire, and a questionnaire covering symptoms potentially indicative of respiratory muscle weakness. All patients performed the 6-min walk test (6-MWT), and FVC (upright and supine) was routinely measured.

**Results:** LOPD was confirmed bioptically or genetically in all patients (30 female, 48.0 ± 14.4 years). 55 patients received enzyme replacement therapy, and 31 individuals were on home ventilatory support. Excessive daytime sleepiness (EDS), sleep disturbances, and fatigue were highly prevalent (ESS > 10: 21.3%, PSQI > 5: 41.0%, FSS > 4: 68.9%). Severity of respiratory distress was significantly correlated with the ESS, FSS and PSQI scores. Fatigue was associated with reduction of supine FVC and walking distance in the 6-MWT. QoL was reduced in the physical domains, and was inversely correlated with fatigue, reduced sleep quality, disease duration, and FVC.

**Conclusion:** In LOPD, EDS, fatigue and sleep disturbances are very common. They show association with symptoms of respiratory muscle weakness and may incitate sleep-disordered breathing.

**Acknowledgements:** The authors are grateful to all patients who took part in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.153>

### Circadian variation of heart rate variability during different sleep stages

P. Boudreau<sup>1</sup>, G. Dumont<sup>2</sup>, D. Boivin<sup>3</sup>

<sup>1</sup>Centre for Study and Treatment of Circadian Rhythms, Douglas Mental Health University Institute, McGill University, Canada

<sup>2</sup>Department of Electrical and Computer Engineering, University of British Columbia, Canada

<sup>3</sup>Centre for Study and Treatment of Circadian Rhythms, Douglas Mental Health University Institute, Department of Psychiatry, McGill University, Canada

**Introduction:** Heart rate (HR) and heart rate variability (HRV) have been shown to be influenced by the circadian system during wakefulness and to be affected by sleep. The aim of the present study was to assess the effects of sleep stages on the circadian variation of HRV.

**Materials and methods:** Fifteen healthy subjects (12 men, 3 women in follicular phase; mean age ± SD: 24.6 ± 4.5 years) entered the laboratory for an 8-h baseline nocturnal sleep episode during which sleep disorders were ruled out. Upon awakening, they underwent a 72-h ultradian sleep-wake cycle (USW) procedure consisting of 60-min wake episodes in dim light (<10 lux) alternating with 60-min nap opportunities in darkness. HR was monitored, high and low frequencies (HF, LF), and the LF:HF ratio were calculated as indexes of HRV. Core body temperature (CBT) and polysomnographic sleep recordings were collected throughout the experiment. Circadian phase was determined based on CBT min (0°) and HRV data was analyzed based on circadian phase and its corresponding sleep stage using non-linear mixed models.

**Results:** A significant circadian rhythm was observed for HR during each sleep stage ( $P = 0.002$ ); for HF power during each sleep stage ( $P = 0.05$ ) except REM sleep; for LF power during each sleep stage ( $P = 0.02$ ) except slow wave sleep (SWS) and REM sleep; and for the LF:HF ratio only during wake epochs during naps and REM sleep ( $P = 0.003$ ). During stage 2 sleep and SWS, HR minimum occurred at the beginning of the night, advanced relative to the CBT minimum ( $P \leq 0.03$ ). During REM sleep, HR was maximal around the time of habitual awakening (10:13 ± 0:42). The acrophase of HF and LF power rhythms measured during sleep was aligned with CBT min. There was a trend for the HF power acrophase during SWS to be advanced relative to the CBT min ( $P = 0.07$ ). The acrophase of the LF:HF ratio during REM sleep occurred in the early morning, significantly advanced compared to that of wake episodes ( $P < 0.001$ ).

**Conclusion:** A significant circadian rhythm in parasympathetic cardiac modulation was observed during non-REM sleep with an acrophase around 02:00. Sympathovagal cardiac balance also followed a circadian pattern during REM sleep, with maximal sympathetic cardiac dominance occurring in the early morning. The temporal relationship between sleep stage-specific circadian rhythms in HRV and the diurnal distribution of adverse cardiovascular events lends support to the theory that autonomic balance modulates cardiovascular risks throughout the day.

**Acknowledgements:** Research was supported by the Canadian Institutes of Health Research (CIHR). P. Boudreau was supported by Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSSST).

<http://dx.doi.org/10.1016/j.sleep.2013.11.154>

### The circadian rhythm of blood pressure is masked by postural changes

W. Hsein Yeh<sup>1</sup>, P. Boudreau<sup>1</sup>, G. Dumont<sup>2</sup>, D. Boivin<sup>1</sup>

<sup>1</sup> Centre for Study and Treatment of Circadian Rhythms, Douglas Mental Health University Institute, Department of Psychiatry, McGill University, Canada

<sup>2</sup> Department of Electrical and Computer Engineering, University of British Columbia, Canada

**Introduction:** It is well known that blood pressure (BP) varies throughout the day with lower levels observed during nocturnal sleep. This diurnal rhythm is partly explained by the BP-lowering effect of sleep and by an endogenous circadian rhythm of BP with a nocturnal trough. As BP is acutely responsive to postural changes, the present study aimed at clarifying how posture affects the circadian variation of BP.

**Materials and methods:** Eleven healthy subjects (10 men, 1 woman; mean age  $\pm$  SD: 22.6  $\pm$  3.4 years old) were studied individually in time isolation for 6 consecutive days. After 2 baseline days on their regular sleep schedule, subjects underwent a 72-h ultradian sleep-wake cycle (USW) procedure, which consists of 60-min wake periods in dim light (<10 lux) alternating with 60-min naps in darkness (<0.3 lux). Subjects remained in a semi-recumbent posture throughout the first 48 h of the USW procedure. During the last 24 h of the USW procedure, they slept in a supine position during naps and changed into a sitting and standing position at 5 and 10 min after lights on, respectively. They returned to a sitting then supine position at 22 and 56 min after light on, respectively. BP was measured 1, 6, 11, 16 and 21 min after lights on. Circadian phase was assessed from core body temperature (CBT) (4x/min) which minimum was determined by a dual-harmonic regression and assigned a circadian phase of 0 degree. BP measures were averaged per subject by 60-degree bins and analyzed using non-linear mixed models.

**Results:** As expected, postural changes affected BP levels. No BP change was observed throughout wake periods when subjects remained in a semi-recumbent posture ( $P=0.38$ ). In comparison, during the last 24 h of the USW procedure, diastolic (DBP) and mean arterial BP (MAP) increased by 11.97  $\pm$  2.11 and 10.11  $\pm$  2.34 mmHg, respectively, when participants changed from the supine to the standing position (measured 1 and 21 min after lights on, respectively;  $P < 0.001$ ). Moreover, we observed a significant circadian rhythm of systolic BP (SBP), DBP, and MAP ( $P < 0.001$ ) during wake periods without postural change, with an acrophase occurring 7.4  $\pm$  0.2 h, 8.6  $\pm$  0.3 h and 7.0  $\pm$  0.3 h after subjects' regular wake time, respectively. In comparison, during the postural change segment of the USW procedure, none of these rhythms were of sufficient amplitude to be significant, even though average values were comparable.

**Conclusion:** Our observations indicate that postural changes significantly mask the endogenous circadian rhythm of BP. These results have practical implications for the measurement and interpretation of BP data collected in field conditions. Even when sleep is controlled for, the determination of circadian phase and amplitude of BP in ambulatory conditions is of limited value due to the confounding effects of changes in activity levels and posture.

**Acknowledgements:** This research was supported by an operating grant from the Canadian Institutes of Health Research (CIHR). P. Boudreau was supported by a fellowship from the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST).

<http://dx.doi.org/10.1016/j.sleep.2013.11.155>

### Medical technology assessment of polysomnography, type 2: full psg at home. detection of naps and their clinical correlates.

A. Bon<sup>1</sup>, R. Bossche<sup>1</sup>, E. Mattern-Coren<sup>1</sup>, A. De Weerd<sup>2</sup>

<sup>1</sup> Sleepcenter SEIN Zwolle-Groningen, sleeptechnician

<sup>2</sup> Sleepcenter SEIN Zwolle-Groningen, neurologist

**Introduction:** Background: Polysomnography (PSG) in a clinical setting (PSG, type 1) is time consuming and expensive. Type 2, i.e. full PSG at home, is thought to be a good alternative, but has never been evaluated in terms of regular Medical Technology Assessment (MTA). In some countries this lack of MTA precludes reimbursement for PSG type 2. This communication is part of a series of posters which adds up to MTA of PSG type 2, and deals with the detection of daytime naps during two consecutive PSG's at home. If successful, such PSG recordings might be an alternative for MSLT.

**Materials and Methods:** Retrospective study of 442 patients (59% male, mean age = 44.8, SD= 16.7) who underwent full PSG type 2 for two consecutive days. We focus on the daytime naps found on the continuous recording and the recognition of these naps by the patients themselves, as shown in their diaries. Furthermore the results of the two PSG's, type 2 were compared to continuous actigraphy over a period of 7 days. In our poster we try to give answers to the following questions: 1. Do patients have daytime naps? 2. Do patients who have daytime naps always recognize them? 3. Do the daytime naps contain REM and/or SWS? 4. Are the naps habitual or not?

**Results:** The results indicate that 58% of the patients have daytime naps during 2 consecutive 24-hour PSG's (type 2). Those daytime naps are in 27% of the cases not recognized by the patients. We discovered that during the daytime naps 50% contains REM and/or SWS. Fifty-five percent of the naps found in the PSG's (type 2) were habitual when assessed over 1 week actigraphy.

**Conclusion:** Twenty-four-hour PSG's type 2 gives good insight in the amount and quality of the sleep during daytime. One quarter of all naps was not recognized by the patients themselves. In comparison with the more global assessment through actigraphy, the PSG had a larger sensitivity.

<http://dx.doi.org/10.1016/j.sleep.2013.11.156>

### Sleep in frontotemporal dementia is equally or possibly more disrupted when compared to that in Alzheimer's disease

A. Bonakis<sup>1</sup>, N. Economou<sup>2</sup>, T. Paparrigopoulos<sup>2</sup>, E. Di Coscio<sup>3</sup>, E. Bonanni<sup>3</sup>, S. Papageorgiou<sup>4</sup>

<sup>1</sup> Department of Neurology-Eginition Hospital, University of Athens Medical School, Greece

<sup>2</sup> Sleep Study Unit, Eginition Hospital, University of Athens Medical School, Greece

<sup>3</sup> Department of Neurosciences, University of Pisa, Italy

<sup>4</sup> Department of Neurology, Attikon University General Hospital, Greece

**Introduction:** In contrast to other neurodegenerative diseases, such as Alzheimer's disease (AD), sleep in frontotemporal dementia (FTD) has not been studied adequately. Although some evidence exists that sleep-wake disturbances occur in FTD, little is known regarding sleep macrostructure and data on the presence of primary sleep disorders are lacking. The objective of the present study was to thoroughly investigate these issues in this population and compare them to similar issues in AD and in normal controls.

**Materials and methods:** Twelve drug-naïve behavioral-variant FTD (bvFTD) patients (7 men/ 5 women) of mean age  $62.5 \pm 8.6$  years were compared to seventeen drug-naïve AD patients (9 men/ 8 women) of mean age  $69.0 \pm 9.9$  years and twenty drug-naïve healthy elderly (HE) (12 men/ 8 women) of mean age  $70.2 \pm 12.5$  years. All participants were fully assessed clinically and through a sleep questionnaire and interview. Video-polysomnography recordings were performed in all participants.

**Results:** The two patient groups were comparable in terms of cognitive impairment. However, AD patients had a statistically significant longer disease duration compared to FTD patients. Overall, the sleep profile was better preserved in HE. Sleep complaints did not differ considerably between the two patient groups except of the fact that FTD patients reported daytime sleepiness more often. Sleep parameters and sleep macrostructure were better preserved in AD compared to FTD patients, regardless of primary sleep disorders (e.g., obstructive sleep apnea syndrome, periodic leg movements), which occurred equally in the two groups.

**Conclusion:** When compared to AD patients, FTD patients had several sleep parameters similarly or even more affected by neurodegeneration, but in a much shorter time span. The findings probably indicate a centrally originating sleep deregulation. Since in FTD patients sleep disturbances may be obvious from an early stage of their disease, and possibly earlier than in AD patients, physicians and caregivers should be alert for the early detection and treatment of these symptoms.

<http://dx.doi.org/10.1016/j.sleep.2013.11.157>

#### Urine drug screening in the evaluation of patients with excessive daytime sleepiness

D. Yogendran<sup>1</sup>, G. Hettiarachchi<sup>2,6</sup>, D. Bonakis<sup>3,6</sup>, P. Dargan<sup>4</sup>, P. Williams<sup>5</sup>, D. Kosky<sup>1</sup>

<sup>1</sup>West Australian Sleep Disorders Research Institute, Perth, Australia

<sup>2</sup>Medway Maritime Hospital, Gillingham, UK

<sup>3</sup>National and Kapodistrian University of Athens, Greece

<sup>4</sup>Clinical Toxicology, Guys and St Thomas' Foundation Trust, King's College London, UK

<sup>5</sup>Sleep Disorders Centre, Guys' Hospital, King's College London, UK

<sup>6</sup>Sleep Centre and Department of Neurology, St Thomas' Hospital, Guy's and St Thomas' Foundation Trust, UK

**Introduction:** Excessive daytime sleepiness is a frequent cause of presentation to sleep clinics. Drug testing has been suggested by the American Academy of Sleep Medicine to identify pharmacologically induced sleepiness. However, there is limited data on how common an issue this is and the effectiveness of drug testing in this setting.

**Materials and methods:** We undertook a retrospective study of all patients undergoing evaluation of sleepiness after referral to a tertiary sleep centre over a 30 months period from 2005 to 2007. Urine drug screening tests (UDST) were obtained following a recommended 2 weeks discontinuation of medications which may influence sleep; analysis was by gas-chromatography with mass spectrometry (GC-MS).

**Results:** 187 patients were included in the study. Prior to the results of the UDST, using standard diagnostic criteria, only 2 (1%) of patients were suspected to have hypersomnia due to drugs or medication. However, 61 patients had positive UDST results: opioids, cannabis and anti-depressants were the commonest drugs detected. In the 48 patients with suspected idiopathic hypersomnia, 23% had detectable sedatives in their UDST. 39% of the 44 patients with narcolepsy had a detectable stimulant and 42% of restless legs syndrome (RLS) and periodic limb movement disorder (PLMD) diagnoses had

detectable anti-depressants which are known to contribute to RLS/PLMD symptoms.

**Conclusion:** The role of drugs and medication are underappreciated in the assessment of patients reporting excessive sleepiness. Urine drug testing should be considered in all patients undergoing multiple sleep latency testing.

<http://dx.doi.org/10.1016/j.sleep.2013.11.158>

#### An innovative method for evaluating activity rest pattern based on position changes

M. Bonmati-Carrion<sup>1</sup>, B. Middleton<sup>2</sup>, V. Revell<sup>3</sup>, D. Skene<sup>2</sup>, A. Rol<sup>1</sup>, J. Madrid<sup>1</sup>

<sup>1</sup>University of Murcia, Chronobiology Laboratory, Department of Physiology, Faculty of Biology, University of Murcia, Spain

<sup>2</sup>University of Surrey, Chronobiology, Faculty of Health and Medical Sciences, United Kingdom

<sup>3</sup>University of Surrey, Surrey Clinical Research Centre (CRC), United Kingdom

**Introduction:** Since there is less movement during sleep than during wake, actigraphy permits to indirectly evaluate the sleep-wake cycle. In general, actigraphs are placed on the wrist and based on acceleration. In this validation study, we propose an alternative way of actigraphy at the level of the arm and expressed as change of degrees per minute. Its accuracy for phase prediction and for evaluating the sleep-wake cycle is assessed by comparing with the DLMO and sleep logs, respectively.

**Materials and methods:** In this study, subjects (N = 13) went about their daily routine for 7 days, kept daily sleep logs and wore ambulatory monitoring devices. These devices measured skin temperature at wrist level (WT), motor activity (Arm Activity, AA) and body position (P) on the arm and acceleration at wrist level (Wrist Acceleration, WA). Cosinor, non parametric and Fourier analysis were performed using AA and WA methods, and the results were compared by ANOVA test. Linear correlations were also performed between both methods and WT. DLMO was used to compare and correlate with estimated phase markers.

**Results:** Only mesor, RA (relative amplitude), VL5 and VM10 (value for the five and ten consecutive hours of lower and maximum activity, respectively) showed significant differences when estimated by both methods. The remaining parameters were not significantly different between both methods and all correlations between AA and WA were high. However, when phase markers were correlated with DLMO, acrophase, M10 and L5 (timing for the ten and five consecutive hours of highest and lowest activity, respectively) for AA showed a high correlation, while for WA, only acrophase did. Regarding sleep detection, WA showed higher specificity than AA, while the agreement rate and sensitivity were higher for AA.

**Conclusion:** An alternative actigraphy method (AA) can be used to evaluate more accurately sleep-wake and motor activity-rest rhythm than conventional actigraphy, since this alternative is more sensitive and presents higher agreement rate for detecting sleep. Besides, it estimates better the phase according to its correlation with the "gold standard" for phase detection: DLMO.

**Acknowledgements:** Study supported by Instituto de Salud Carlos III, RETICEF (RD12/0043/0011), MINECO (BFU 2010-21945-C02-01 and IPT-2011-0833-900000) with FEDER cofunding to JAM, and a research fellowship to MABC (FPU2009-1051). We thank Stockgrand Ltd. for melatonin assay reagents. DJ Skene is a Royal Society Wolfson Research Merit Award holder.

<http://dx.doi.org/10.1016/j.sleep.2013.11.159>

### **Ambulatory monitoring in humans: a new method to objectively assess circadian phase as compared with dim light melatonin onset (DLMO)**

M. Bonmati-Carrion<sup>1</sup>, B. Middleton<sup>2</sup>, V. Revell<sup>3</sup>, D. Skene<sup>2</sup>, A. Rol<sup>1</sup>, J. Madrid<sup>1</sup>

<sup>1</sup>University of Murcia, Chronobiology Laboratory, Department of Physiology, Faculty of Biology, Spain

<sup>2</sup>University of Surrey, Chronobiology, Faculty of Health and Medical Sciences, United Kingdom

<sup>3</sup>University of Surrey, Surrey Clinical Research Centre (CRC), United Kingdom

**Introduction:** It is important to develop a system able to detect the endogenous circadian phase easily, since current techniques imply either expensive hormonal quantification or uncomfortable monitoring of central temperature by rectal probes.

**Materials and methods:** In this work, a new ambulatory circadian monitoring system (ACM) was validated. To this, activity and position, wrist temperature rhythm as well as light exposure pattern were recorded for 10 days in 13 healthy subjects, thanks to an actimeter on the arm, a temperature sensor on the ventral side of the wrist and a pendant luxometer. DLMO was determined in saliva, and it was used as “the gold standard” to evaluate the accuracy of ACM to assess the circadian phase. Besides, subjects completed a sleep log and Horne-Östberg morningness–eveningness, Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale questionnaires to evaluate diurnal preference and its influence in sleep quality.

**Results:** The peripheral wrist temperature increase in the evening (and its new indexes WTONset or WTON and WT increase onset or WTiO) anticipated that of melatonin; while the decrease in motor activity, position and the composite variable TAP (including wrist temperature, activity and position), and the increase in sleep probability occurred after the increase in melatonin levels. The score of morningness–eveningness and sleep quality questionnaires showed high correlations with DLMO, confirming that the later the DLMO occurs higher eveningness and worse sleep quality are reported.

**Conclusion:** This ambulatory method allows accurately detecting the circadian phase while subjects maintain their normal life style. The proposed new phase markers based on wrist temperature rhythm (named WTON and WTiO) would be appropriate in Clinics when it is important to know the subject circadian phase, like in cancer chronotherapy or light therapy.

**Acknowledgements:** Study supported by Instituto de Salud Carlos III, RETICEF (RD12/0043/0011), MINECO (BFU 2010-21945-C02-01 and IPT-2011-0833-900000) with FEDER cofunding to JAM, and a research fellowship to MA Bonmati-Carrion (FPU2009-1051). We also thank Stockgrand Ltd. (UK) for the melatonin assay reagents. DJ Skene is a Royal Society Wolfson Research Merit Award holder.

<http://dx.doi.org/10.1016/j.sleep.2013.11.160>

### **Insomnia in postpartum and perceived infant difficult temperament**

D. Quental, S. Carvalho Bos, M. Marques, M. Soares, M. Azevedo, A. Macedo

Faculty of Medicine, University of Coimbra, Department of Psychological Medicine, Portugal

**Introduction:** Insomnia is considered to be the most prevalent sleep disorder (Morin and Benca, 2012). It is associated with physical

and mental health problems (Taylor et al., 2003). Yet, the prevalence of insomnia in the postpartum period and its association with infant's difficult temperament are less explored (Stremmler and Wolfson, 2011). The objectives of the present study were: 1) to determine the prevalence of insomnia in postpartum and 2) to investigate the association between mother's insomnia and their perception of baby's difficult temperament.

**Materials and methods:** A total of 103 mothers (M = 31.9, SD = 4.10 years) participated in the study at 3 months after delivery. The vast majority was married (68%), 71.7% were primiparae, 59.2% had boys and 64.1% were breastfeeding. Mothers answered a sleep questionnaire about insomnia symptoms (lot of difficulties falling asleep; woke up many times during the night; woke up too early in the morning and was unable to go back to sleep again) and insomnia daytime consequences (sleep problem interferes a lot with life and activities; due to sleep poorly feels tired, irritable, excited, nervous or depressed during the day) experienced in the previous month. The Difficult Infant Temperament Questionnaire was applied to assess infant emotional regulation difficulties (baby irritable or fussy, cries excessively, difficult to comfort or calm down) and infant sleeping problems (gives bad nights and has difficulties falling asleep). Mothers' depressive symptoms were assessed with the Beck Depression Inventory (BDI-II).

**Results:** It was observed that 39.2% of mothers were good sleepers, 36.3% had at least one insomnia symptom, 22.5% experienced insomnia (at least one insomnia symptom and two related insomnia daytime consequences) and 2% referred sleep daytime consequences without insomnia symptoms. In comparison to the good sleepers group, the insomnia group reported that their babies had more sleeping problems (M = 2.3, SD = 2.0 vs. M = 4.0, SD = 2.6,  $p = 0.030$ ). Differences between sleep groups were not observed relatively to infant emotional regulation difficulties. The association between mother's insomnia and their perception of infant sleeping problems was not present when cases of severe depressive symptoms (BDI-II total score  $\geq 9$ , quartile 75) were controlled/removed from the analysis.

**Conclusion:** Results of the present study suggest that the association between mother's insomnia in postpartum and the perception of baby sleeping problems is mediated by mothers' depressive symptoms.

**Acknowledgement:** AstraZeneca Foundation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.161>

### **Comparison between subjective and objective estimations of infants sleep**

S. Carvalho Bos, M. Marques, M. Soares, A. Amaral, M. Azevedo, A. Macedo

Faculty of Medicine, University of Coimbra, Department of Psychological Medicine, Portugal

**Introduction:** Validation studies between subjective reports of sleep and objective actigraphy parameters in infants are limited (Sadeh et al., 2011). The aim of this study is to investigate the agreement between mothers' subjective reports of infants sleeping problems and objective sleep parameters obtained with actigraphy.

**Materials and methods:** Mothers filled out a questionnaire about infants sleep and strapped on their infant's ankle an actigraph for a period of 7 days. Data were obtained for 29 infants (57.1% girls) twice, i.e., when babies were 3 and 6 months old.

**Results:** 3-month-old infants described by their mothers as having sleeping problems, who gave bad nights and who had difficulties falling asleep (items added as a Sleep factor) showed less sleep efficiency ( $r = -.379$ ;  $p = .021$ ), less actual sleep time percentage ( $r = .426$ ,  $p = .011$ ), less immobile percentage asleep ( $r = -.329$ ;  $p = .041$ ) and more moving time percentage asleep ( $r = .342$ ;  $p = .035$ ). These infants also revealed higher total activity score ( $r = .448$ ;  $p = .007$ ), mean activity score ( $r = .462$ ,  $p = .006$ ) and mean score in active asleep ( $r = .451$ ;  $p = .007$ ) as measured by actigraphy. These consistent associations were not observed in 6-month-old babies. The vast majority of 6-month-old infants slept in parents room (own crib;  $n = 14$ ; 51.9%) or own room ( $n = 11$ ; 40.7%) while nearly all 3-month-old infants slept in parents room (own crib;  $n = 26$ , 89.7%).

**Conclusion:** Agreement between subjective and objective estimations of sleep was particularly observed in 3-month-old babies. A possible explanation for this result is that mothers are more aware of their infants sleeping problems when their babies sleep in parents room.

**Acknowledgements:** AstraZeneca Foundation for financial support. The collaboration of Mothers and Health Staff is deeply acknowledged.

<http://dx.doi.org/10.1016/j.sleep.2013.11.162>

### Sleep patterns in Portuguese preschool aged children

S. Carvalho Bos, M. Marques, M. Soares, A. Amaral, M. Azevedo, A. Macedo

Faculty of Medicine, University of Coimbra, Department of Psychological Medicine, Portugal

**Introduction:** According to a recent review data related to sleep patterns among the toddler/preschool age group are lacking (Galland et al., 2012). The objective of the present study is to describe sleep patterns in a sample of Portuguese preschool children (3, 4 and 5-year-old children).

**Materials and methods:** A sleep questionnaire was completed by parents (mostly mothers, 88.7%) of preschool aged children who attended 5 schools located at 4 different cities in the central region of Portugal. These schools were selected as they shared similar daytime activities and routines. Data of 168 children were collected (Mean age = 4.17 years; SD = .838; 53% boys).

**Results:** In school days 3-year-old children showed later bedtimes ( $M = 21:51$ , SD = 0:35) than 4-year old ( $M = 21:34$ , SD = 0:35,  $p = .026$ ) or 5-year-old children ( $M = 21:30$ , SD = 0:32,  $p = .007$ ); sleep duration was also shorter in 3-year-old children ( $M = 09:43$ ; SD = 0:48) than in 4-year-old ( $M = 10:03$ ; SD = 0:39,  $p = .031$ ) and 5-year-old children ( $M = 10:11$ , SD = 0:41,  $p = .003$ ). Wake up time was not significantly different between age groups (3 years:  $M = 7:57$ , SD = 0:30; 4 years:  $M = 7:48$ , SD = 0:27; 5 years:  $M = 07:51$ , SD = 0:32,  $p > .05$ ). Results by gender revealed that in school days 3-year-old girls had later bedtimes ( $M = 21:50$ , SD = 0:26) and slept less ( $M = 9:40$ ; SD = 0:50) than 5-year-old girls (Bedtime:  $M = 21:22$ , SD = 0:32,  $p = .009$ ; Sleep duration:  $M = 10:21$ ; SD = 0:40,  $p = .005$ ). Younger girls also experienced more night awakenings (3-year-old: 61%) than older girls (5-year-old: 22.2%,  $p = .004$ ). Boys with 3 years required more often an object to fall asleep (76.7%) than boys with 4 years (32.4%,  $p < .001$ ) or 5 years old (24.0%,  $p < .001$ ). In comparison to children who never/occasionally needed parents to fall asleep in school days, children who always/frequently needed their help, slept less ( $M = 10:05$ , SD = 0:42 vs.  $M = 9:51$ , SD = 0:46,  $p = .038$ ) experienced more night awakenings (37.6% vs. 54.1%,  $p = .034$ ), had more difficulties getting back to sleep alone after

night awakenings (14.3% vs. 43.7%,  $< .001$ ) were more afraid of the dark (20.4%, vs. 34.2%,  $p = .034$ ) but showed less bedtime resistance (83.9% vs. 71.6%,  $p = .043$ ).

**Conclusion:** Throughout early child development night sleep becomes more consolidated. Parents help to sleep is associated with more disturbed sleep in preschool aged children but less bedtime resistance.

**Acknowledgements:** The collaboration of Parents (particularly Mothers), School Directors and Teachers is deeply acknowledged.

<http://dx.doi.org/10.1016/j.sleep.2013.11.163>

### Acceptance of insomnia

K. Bothelius<sup>1</sup>, S. Jernelöv<sup>2</sup>, K. Kyhle<sup>1</sup>, J. Broman<sup>3</sup>, T. Gordh<sup>4</sup>, M. Fredrikson<sup>1</sup>

<sup>1</sup>Uppsala University, Department of Psychology, Sweden

<sup>2</sup>Karolinska Institutet, Department of Clinical Neuroscience, Sweden

<sup>3</sup>Uppsala University, Department of Neuroscience, Psychiatry, Sweden

<sup>4</sup>Uppsala University, Department of Surgical Sciences, Sweden

**Introduction:** In behavioural medicine the concept of acceptance, that is willingness to accept things that can not be altered, has gained popularity and scientific support. How acceptance influences the experience of poor sleep in insomnia has not yet been investigated. To study acceptance in insomnia, we developed a questionnaire with 10 items, the Insomnia Acceptance Questionnaire (IAQ), following the model of the Chronic Pain Acceptance Questionnaire, CPAQ. The IAQ consists of two subscales, labelled Activity Engagement (AE) and Willingness (W).

**Materials and methods:** Acceptance data was collected in a randomised controlled insomnia treatment study in primary care ( $n = 66$ ). Correlations with other sleep related measures at baseline and follow-up assessments were analysed: the Insomnia severity index (ISI), sleep onset latency (SOL), wake time after sleep onset (WASO), total sleep time (TST), sleep quality (SQ), the Epworth sleepiness scale (ESS), the Fatigue severity scale (FSS), the Hospital anxiety and depression scale (HADS), and the Short-form health survey (SF-36).

**Results:** Acceptance correlated negatively with subjective insomnia severity at baseline, measured with ISI, with less acceptance associated with more insomnia. On the other hand, more objective measures derived from sleep diaries (SOL, WASO, TST) did not correlate with acceptance. There were negative correlations with fatigue and anxiety, but positive correlations with perceived sleep quality and mental health. Daytime sleepiness did not correlate with acceptance. Increased acceptance during treatment correlated with lower ISI-score, less anxiety and better mental health, but not with changes in objective sleep time assessed with SOL, WASO, or TST.

**Conclusion:** Low acceptance characterized by a lack of willingness to accept insomnia symptoms, seemed to be more closely correlated with the subjective experience of insomnia than with sleep diary parameters at baseline. During the course of treatment, increased acceptance correlated with decreased perceived insomnia and reduced anxiety, and was associated with better mental health. Thus, enhanced acceptance of symptoms could be an important target in insomnia treatment.

**Acknowledgements:** The study was supported by the Uppsala-Örebro Regional Research Council and the Disciplinary Domain of Medicine and Pharmacy, Uppsala University. The factor analysis behind the items of the IAQ was made by Viktor Kaldo, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden.

<http://dx.doi.org/10.1016/j.sleep.2013.11.164>

### Applicability of the Epworth Sleepiness Scale to fibromyalgic women with sleep apnea-hypopnea syndrome

L. Sacristán Bou<sup>1</sup>, F. Peña Blas<sup>2</sup>, L. Hernández Blasco<sup>3</sup>,  
F. Pascual Lledó<sup>3</sup>, C. Martín Serrano<sup>3</sup>

<sup>1</sup> Servicio de Neumología. Hospital General de Tomelloso, Spain

<sup>2</sup> Centro de Salud de Pedro Muñoz, Spain

<sup>3</sup> Servicio de Neumología del Hospital General Universitario de Alicante, Spain

**Introduction:** Sleep apnea-hypopnea syndrome (SAHS) and fibromyalgia (FM) are two diseases of unknown etiology that share a distinctive feature: the great importance of subjective symptoms when it comes to establishing their seriousness. Even though they are prevalent entities in Spain, as in the rest of Western civilization, there are few cases described in which these syndromes concur; likewise, differentiating elements which can influence in diagnosis and therapeutic management have not been established. Tools used in the study of SAHS are frequently used even though they have not been completely validated for all groups of patients, especially for the female population. This happens when applying the Epworth Sleepiness Scale (ESS), used to measure pathological daytime hypersomnia.

**Materials and methods:** For this analysis we have featured 11 incidental cases of women diagnosed with FM among all the 2824 patients that were diagnosed with SAHS by the Pneumology Service of the Hospital General Universitario de Alicante (HGUA) between the dates of January 1998 and December 2008 by polysomnographic or polygraphic study. It has been researched the relationship between self-referred somnolence and the scores obtained via the ESS. Both sets of data were complimented and were registered according to the protocol used when facing any case of suspected SAHS at the HGUA. For statistical treatment, the ESS has been stratified into two levels: from 12 to 24 points and less than 12 points – in keeping with the limit established between pathological hypersomnia and non-pathological somnolence.

**Results:** The validity values of the ESS have been calculated in base to a receiver operating characteristic (ROC) curve analysis: area under the curve (AUC) of 0.70 ( $p$ -value > 0.005, asymptotic 95% confidence interval [lower bound: 0, upper bound: 1]) with 40% sensitivity and 100% specificity.

**Conclusion:** In conclusion, there is not enough evidence to state that the Epworth Questionnaire is useful for establishing the presence of daytime somnolence in this group of fibromyalgic women with sleep apnea-hypopnea syndrome, but it could be more utile for controlling the evolution of patients under treatment. However, this tendency would need to be confirmed by wider range studies.

<http://dx.doi.org/10.1016/j.sleep.2013.11.165>

### Success predictors in uvulopalatopharyngoplasties for the treatment of Obstructive Sleep Apnea syndrome

A. Braga, F. Valera, A. Eckeli, D. Kupper, T. Grechi, L. Trawitzky  
School of Medicine of Ribeirão Preto, University of São Paulo, Brazil

**Introduction:** Obstructive Sleep Apnea syndrome ( OSAS ) has many treatment options clinical and surgical, all of them having your own successful index. Uvulopalatopharyngoplasty (UPPP) is described as a surgical treatment option to treat this disease. This disease, with variable reported results. The influence of facial bony and muscular structures on this rate of success has been poorly reported in literature. The muscular dysfunction is discussed and its influence on the failure of the treatment options.

**Materials and methods:** Patients have undergone UPPP for the last 7 years have enrolled this study. Inclusion criteria included full clinical evaluation, including body mass index and age at the moment of surgery and pre and post-operative polysomnography (PSG). They were also submitted to lateral cephalometry to evaluate 11 skeletal measures, a clinical myofunctional protocol and muscular strength force. Patients were divided into two groups, based on AHI (apnea and hypopnea index): those with UPPP success and those that failed with UPPP treatment.

**Results:** The rate of success of UPPP was not influenced by the measures age, BMI, pre-operative AHI and any of the cephalometric measures. Among the muscular evaluations, the muscle strength of the tip of tongue was significantly different between the groups. All the other measures were similar between groups.

**Conclusion:** We may consider OSAS having a multifactorial origin and the interaction of them playing role on the syndrome and its possibility on failure of the treatment. Neural and muscular dysfunction may have influence on the low rates of surgical success presented and its progressive decrease with the time even after surgical alternatives being considered. Our results showed muscular damage in the group that showed failure in polysomnographic evaluation after surgery. OSAS giving dilator muscle dysfunction may be considered as one of responsible for the failure of the treatment and a possible progression on the severity of the disease after time. OSAS has a multifactorial origin, and depends on the combination of various factors rather than an isolated one. It is still difficult to predict the patient that will have a better outcome on UPPP, based on simply clinical and radiological factors but muscular damage and its progression must be considered when patients is evaluated for all kinds of treatments proceed, surgical or not.

**Acknowledgements:** University of São Paulo, School of Medicine of Ribeirão Preto – correlated authors – hospital employees – professors – assistant doctors – patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.166>

### Toward a clinical and therapeutic classification of insomnia of childhood

O. Bruni<sup>1</sup>, E. Adessi<sup>2</sup>, M. Angriman<sup>3</sup>, A. Riccioni<sup>2</sup>, C. Dosi<sup>2</sup>, R. Ferri<sup>4</sup>

<sup>1</sup> Dept Social and Developmental Psychology, Sapienza University of Rome, Italy

<sup>2</sup> Faculty of Medicine and Psychology, Sapienza University of Rome, Italy

<sup>3</sup> Child Neurology and Neurorehabilitation Unit, Department of Pediatrics, Central Hospital of Bolzano, Italy

<sup>4</sup> Department of Neurology, Oasi Institute for Research on Mental Retardation and Brain Aging (IRCCS), Italy

**Introduction:** Background: The ICSID 2 recognizes only one type of insomnia of childhood, divided into two subtypes: (a) sleep onset association type and limit-setting type. However, from a clinical perspective, this classification is too simple compared to the different phenotypic expressions of insomnia in infancy and childhood and could limit the therapeutic approach to the cognitive-behavioral therapy (CBT) alone. There are several cases that are not solved by CBT and are considered to be “insomnia due to medical condition” or “insomnia due to mental disorder” but this is never specified in the childhood sleep literature. Furthermore, there are no specific guidelines for the drug treatment of insomnia in children while in adults the pharmacological approach is mainly based on the features of insomnia (sleep onset insomnia, sleep maintenance insomnia and end of sleep insomnia), and on the presence of comorbidity (i.e. anxiety or depression, restless symptoms, etc.). Objective: To evaluate

specific clinical and anamnestic features of behavioral insomnia of childhood (BIC) in order to classify it into different forms and to guide its pharmacological management.

**Materials and methods:** We performed a retrospective chart review of infants and children aged 0–6 years, referred for “insomnia” at the Pediatric Sleep Center of the S. Andrea Hospital, Sapienza University, Rome during the period from January 2010 to April 2013. A structured interview was included in each chart for the evaluation of the features of insomnia, together with specific anamnestic and family history questions. Exclusion criteria were: (a) presence of serious medical diseases, malformations, or neurological and psychiatric disorders, (b) intercurrent disease that would require drug treatments affecting sleep (e.g., steroids, antihistamines, etc.), (c) ineffectiveness of the cognitive-behavioral therapy.

**Results:** The medical record review allowed to identify 255 cases (165 M, 90 F) with a mean age of 25.1 months (SD 16.35; range 5–72 months) that fulfilled the inclusion and exclusion criteria. Bedtime was between 7 and 9 p.m. in 26 subjects (10.2%); between 9 and 10 p.m. in 102 (40%); between 10 and 11 p.m. in 98 (38.4%); after 11 p.m. in 29 (11.4%). Risetime was before 6 a.m. in 6 s. (2.3%); between 6 and 7 a.m. in 55 (21.6%); between 7 and 8 a.m. in 118 (46.3%); between 8 and 9 a.m. in 61 (23.9%); after 9 a.m. in 15 (5.9%). Regarding the falling asleep method only 99 (38.8%) fell asleep autonomously; 85 (33.3%) were rocked in their mother's arms; 13 (5.1%) fell asleep while breastfed; 11 (4.3%) needed a feeding bottle; 10 (3.9%) fell asleep out of their own bed; 37 (14.5%) practiced co-sleeping. One-hundred-seventy-four subjects (68.2%) had a sleep latency <30 min and 81 (31.8%) >30 min. The characteristics of the group are reported in the following table. N. % Colics of the first 3 months 125 49.0 Growing pains 7 2.7 Respiratory allergy 16 6.3 Food allergy (milk) 35 13.7 Atopic dermatitis 29 11.4 Gastroesophageal reflux 69 27.1 Iron deficiency 27 10.6 Migraine 4 1.6 Positive family history Insomnia 66 25.9 Parasomnias 22 8.6 Restless leg symptoms 43 16.9 Iron deficiency 67 26.3 Migraine 86 33.7 Mood disorders 99 38.8 Allergies 78 30.6 Sleep patterns were characterized by  $\geq 3$  night awakenings in 217 subjects (85.1%); associated with sleep latency  $\geq 30$  min in 82 subjects (32.2%) and with nocturnal hyperactivity in 77 cases (30.2%); midnight awakenings were found in 50 subjects (19.6%). Falling asleep difficulty was found in 109 subjects (42.7%) 49 of whom (19.2%) were associated with motor hyperactivity at bedtime. Nocturnal hyperactivity (whole night) was present in 93 (36.5%) subjects. Based on the clinical presentation and on the family history features, we propose three different models of insomnia: Type A – Insomnia with prevalent multiple night awakenings and falling asleep difficulties Type B – Insomnia with prevalent middle of the night awakenings Type C – Insomnia with motor hyperactivity We assume that these three groups represent different types of insomnia that are not strictly related to “medical conditions or mental disorders” and therefore cannot be classified into these categories but also do not comply with the criteria of behavioral insomnia of childhood. Moreover, if we look at the family history we can easily associate the Type A – to the presence of atopic dermatitis, milk allergy, gastro esophageal reflux while the Type B – seems to be associated to the presence of insomnia, parasomnias, headache/migraine, mood disorders; finally, Type C – is often associated with a family history of anemia, restless legs syndrome, periodic leg movements during sleep, growing pains. This type of clinical classification might be useful to guide the pharmacological approach.

**Conclusion:** There is evidence that although most sleep disturbances during early childhood are explained by environmental factors, genetic factors have a great influence. This assumption might explain why insomnia in childhood has different clinical presentations and why behavioral interventions are not always effective. The influence of genetic factors should not be underestimated and,

if correctly recognized, they might contribute to select appropriate personalized therapeutic approaches.

<http://dx.doi.org/10.1016/j.sleep.2013.11.167>

### **Periodic leg movements in sleep before and after continuous positive airway pressure treatment in patients with obstructive sleep apnea**

E. Bulus, G. Benbir, D. Karadeniz

*Istanbul University, Istanbul University, Cerrahpasa Faculty of Medicine, Department of Neurologys, Istanbul*

**Introduction:** Periodic leg movements in sleep (PLMS) are commonly reported to coexist together with obstructive sleep apnea syndrome (OSAS). Although PLMS usually disappear following continuous positive airway pressure (CPAP) treatment, an increasing number of patients have now introduced to have treatment-emergent PLMS. The underlying etiopathogenesis of temporal relationship between PLMS and CPAP treatment waits to be explored.

**Materials and methods:** Here we evaluated clinical and polysomnographic (PSG) data in four groups of OSAS patients: 10 patients with PLMS at first night and also at CPAP treatment night (present-present, PP group), 10 patients with PLMS at first night but not at CPAP treatment night (present-absent, PA group), 10 patients without PLMS at first night or at CPAP treatment night (absent-absent, AA group), and 10 patients without PLMS at first night but at CPAP treatment night (absent-present, AP group).

**Results:** Gender, age and presence of restless legs syndrome were similar between groups. Among PSG parameters, only the percentage of N3 sleep was significantly longer in patients without PLMS at first night (AA and AP group,  $p = 0.004$ ). The comparison of variables between two nights in each group revealed that, other than significantly decreased RDI in every group, PLMS index was also significantly decreased in PA group ( $p = 0.005$ ) and increased in AP group ( $p = 0.041$ ). Decrease in PLMS index was positively correlated with decrease in RDI in PA group ( $p = 0.053$ ), and increase in PLMS index positively correlated with increase in percentage of N3 sleep stage in AP group ( $p = 0.038$ ). We performed cyclic alternating pattern (CAP) analysis. At first night analysis, time, rate, cycle and index of CAP were lowest in AA group, and highest in PA group ( $p < 0.05$ ). There was no significant difference in CAP parameters in different sleep stages as N1, N2 and N3. In PP group, CAP time of A1 subtype in N2 sleep stage; and CAP time, CAP cycle and CAP index of A2 subtype in N2 sleep stage were observed to persist without any decrease at second CPAP night. In AP group, CAP time, CAP rate, CAP cycle and CAP index of A1 and A2 subtypes were observed to persist, or even increase, in N1 and N2 sleep stages at CPAP night; while total CAP time of A3 subtype was decreased. In PA group, as well as in AA group, CAP parameters decreased prominently at CPAP night in compared to first night.

**Conclusion:** Different mechanisms are probably responsible from vanishing, non-vanishing or newly-emerging PLMS in OSAS patients following CPAP treatment. Macrostructural elements of sleep do not seem to explain them all. Microstructural CAP analysis of the sleep showed different patterns of cortical-subcortical activation in different stages of sleep. Activation of different sites within the same arousal system, triggered by internal (such as rebound NREM sleep) or external (CPAP) stimuli, may explain these differences.

<http://dx.doi.org/10.1016/j.sleep.2013.11.168>

**Paroxysmal motor disorders of sleep misdiagnosed as epilepsy**

M. Caballero-Martinez<sup>1</sup>, M. Caballero-Martinez<sup>2</sup>,  
P. Martinez-Agredano<sup>3</sup>, C. Arenas-Cabrera<sup>4</sup>, R. Vazquez-Rodriguez<sup>5</sup>,  
M. Jimenez-Hernandez<sup>4</sup>

<sup>1</sup> Department of Clinical Neurophysiology, University Hospital Virgen del Rocío, Spain

<sup>2</sup> Department of Pneumology, Sleep Disorder Unit, Vivisol Iberica Clinical and Diagnosis Center, Spain

<sup>3</sup> Department of Neurology, University Hospital Virgen del Rocío, Spain

<sup>4</sup> Department of Neurology, University Hospital, Virgen del Rocío Hospital., Spain

<sup>5</sup> Department of Clinical Neurophysiology, University Hospital, Virgen del Rocío Hospital., Spain

**Introduction:** The diagnosis of paroxysmal events represents a significant challenge for the clinician. The differentiation of sleep disorders from epileptic seizures is often a cause for concern. Diagnostic error or uncertainty is not an uncommon situation. Here we review the number of patients diagnosed of drug-resistant epilepsy, admitted in a video-EEG monitoring (VEM) unit, which had actually an unrecognized sleep disorder.

**Materials and methods:** Data from a consecutive cohort of patients diagnosed of refractory epilepsy and admitted over a 1-year period to the inpatient VEM unit in a tertiary referral hospital were retrospectively analyzed. The preadmission diagnosis and management by the referring neurologist was compared with the diagnosis and management after the VEM.

**Results:** Of 52 patients, 23 (44%) were admitted for diagnostic evaluation and 29 (56%) for a presurgical workup. Mean evaluation period was 3.4 days. In 19 (36%) the diagnosis was clarified as a result of the VEM admission, with the greatest change being an increase in the pseudoseizures diagnosis group (6% to 31%), the generalized seizures diagnosis group (5–11%) and the paroxysmal motor disorders of sleep diagnosis group (0–4%).

**Conclusion:** The results of this study demonstrate that many patients with a sleep disorders are misdiagnosed of epilepsy. Future long-term cost-benefit studies of the treatment changes resulting of the correct diagnose would be necessary.

**Acknowledgements:** Inpatient Video-EEG Monitoring Unit, Epilepsy Unit, University Hospital Virgen del Rocío. Seville, Spain.

<http://dx.doi.org/10.1016/j.sleep.2013.11.169>

**Sleep disorders in patients with epilepsy**

M. Caballero-Martinez<sup>1</sup>, M. Caballero-Martinez<sup>2</sup>,  
R. Vazquez-Rodriguez<sup>1</sup>, P. Martinez-Agredano<sup>3</sup>, C. Arenas-Cabrera<sup>3</sup>,  
M. Jimenez-Hernandez<sup>3</sup>

<sup>1</sup> Department of Clinical Neurophysiology, University Hospital Virgen del Rocío, Spain

<sup>2</sup> Department of Pneumology, Sleep Disorder Unit, Vivisol Iberica Clinical and Diagnosis Center, Spain

<sup>3</sup> Department of Neurology, University Hospital, Virgen del Rocío Hospital., Spain

**Introduction:** The close relationship between sleep and epilepsy is widely documented in clinical and electrophysiological investigations. However comorbidity between epilepsy and sleep disorders is poorly investigated in the literature and rarely taken into consideration by clinicians in general practice. We try to assess the prevalence of sleep disorders in patients with drug-resistant partial-seizure epilepsy.

**Materials and methods:** Data from a consecutive cohort of patients with refractory partial-seizure epilepsy admitted in the inpatient video-EEG monitoring unit in a tertiary referral hospital over a two-year period were analyzed. Patients with a comorbidity of psychiatric disorders were excluded. Patients were tested for sleep disorders using the Thomas Memorial Hospital Sleep Disorders Centre questionnaire. Data were compared with a control group matched with patients by age and demography.

**Results:** 18 patients and 19 controls were included in the study. 19% of patients and 12% of controls complain of symptoms of possible insomnia, 20% of patients and 7% of controls of possible obstructive sleep apnea, 17% of patients and 10% of controls of excessive daytime sleepiness, 32% of patients and 11% of controls of possible restless leg syndrome and/or possible periodic leg movement syndrome, and 43% of patients and 5% of controls of possible parasomnia.

**Conclusion:** The results of this study demonstrate that many patients with epilepsy complain of sleep disorder symptoms. A greater awareness among clinicians of the comorbidities between sleep disorders and epilepsy may help to prevent misdiagnosis and mistreatment. Further studies are needed in order to investigate the prevalence and impact of these comorbidities in patients with controlled and untreated epilepsy.

**Acknowledgements:** Inpatient video-EEG monitoring Unit, Epilepsy Unit, University Hospital Virgen del Rocío. Seville, Spain.

<http://dx.doi.org/10.1016/j.sleep.2013.11.170>

**Echocardiography findings in a sleep apnea patients with morbid obesity**

E. López Cadena, N. Oleo, M. Gasa Galmes, C. Monasterio Ponsa,  
E. Aponte Torres, A. Ruiz Majoral

**Introduction:** Morbidly obese subjects have a high risk of left ventricular (LV) hypertrophy. Whether obstructive sleep apnea (OSA) contributes to LV hypertrophy is controversial. We performed a pilot descriptive study of echocardiographic parameters in a cohort of morbidly obese patients with OSA.

**Materials and methods:** We included retrospectively all patients form a bariatric surgery cohort assessed preoperatively with either polisomnography or respiratory polygraphy and transthoracic echocardiography. 2D images, M-mode and Doppler recording were obtained (General Electric Vivid 7). The following parameters were analyzed: LV diastolic diameter, LV systolic diameter, LV systolic diameter corrected by body surface area, % ejection fraction by Teichholz method, left ventricular mass index, septal thickness, posterior wall thickness and pulmonary hypertension.

**Results:** We included 59 patients with a mean age of 59±9 years, 34% of males, BMI 46±8 kg/m<sup>2</sup>. 59% had hypertension. All of them presented OSA with mean apnea hypopnea index (AHI) of 52±30 events/h, median of cumulative time under 90% of SpO<sub>2</sub> was 11(4–27). We split the population by the median AHI. Patients with more than 41events/h had wider aortic root (29,33 ± 4; 32,11 ± 4, p = 0,009), higher posterior wall thickness (9,8 ± 1; 10,6±1, p = 0,03), and tendency to have higher LV Mass that was no longer significant when it was adjusted by body surface. Patients with more than 41events/h had higher rates of hypertension (30% vs 70%). There was a positive correlation between AHI and diastolic diameter (r = 0.268, p = 0.043), aortic root (r = 0.275, p = 0.03), LV Mass (r = 0.352, p = 0.008) but it was lost when was corrected by body surface (r = 0.275, p = 0.065). There was also a positive correlation between pulmonary arterial pressure and AHI but it was available in 20 patients. Only 17 (37%) patients presented a LV abnormal

hypertrophy pattern (8 concentric remodeling, 1 eccentric hypertrophy, 8 concentric hypertrophy).

**Conclusion:** Despite the high prevalence and severity of OSA in the studied population of morbidly obese patients, a low percentage of echocardiographic abnormalities were found. Although more severe OSA patients presented higher LV Mass, it could be related to higher hypertension frequency and to obesity itself. Further prospective studies are necessary to elucidate if OSA has an additive effect to obesity on LV hypertrophy.

**Acknowledgements:** We thank the whole team of sleep laboratory (Maria Calvo, Carme Rodriguez, Tomas Brinquis and Neus Marti) for the help to recruit the patients and also the endocrinologist Theodora Michalopoulou.

<http://dx.doi.org/10.1016/j.sleep.2013.11.171>

### Sleep, EEG and behavioral responses after systemic administration of gaboxadol in the laboratory cat

Marta Callejo, Miguel Garzón, Isabel T. De Andrés  
U.A.M.

**Introduction:** GABA and its receptors are widely distributed in sleep-wakefulness cycle (SWC) network structures, but action of extrasynaptic GABA<sub>A</sub> receptors in SWC mechanisms is not yet fully understood. The cat has been extensively used in SWC research, but to our knowledge there are no previous studies about the response of this species to the administration of gaboxadol, an extrasynaptic GABA<sub>A</sub> receptor agonist. The present study aims to characterize the effects of systemic gaboxadol administration on SWC states, EEG and behavior in laboratory cats.

**Materials and methods:** Four adult cats with electrodes for chronic sleep polygraphic recordings were used. Gaboxadol (doses 0.2–10.0 mg/kg) and saline were i.p. administered. Polygraphic-video recordings were obtained for 8 h post-injections.

**Results:** The lowest doses of gaboxadol (0.2, 0.5 and 1 mg/kg) produced little effect on SWC state proportions and polygraphic patterns were associated with normal postural behavioral and autonomic behaviors. Power spectra analyses showed EEG features of NREM sleep to be in the range of delta band values for spontaneous slow wave sleep (SWS). Administration of the largest dose (10 mg/kg) produced continuous slow waves in the EEG associated with odd postures, stuporous behavior, shallow breathing and markedly increased respiratory rate. Intermediate doses (2 and 5 mg/kg), did not have these undesirable effects and the cats alternated between different SWC states, with an enhancement of slow wave EEG activity duration. However, during the first 4 h of the recordings, the periods that could be scored as SWS on the basis of this slow wave EEG activity, were dissociated from behavior, as the animals remained with eyes open in a postural attitude typical of relaxed wakefulness or drowsiness. During these episodes the cats barely closed their eyes only when PGO waves appeared in the lateral geniculate nucleus recordings. In spite of the EEG/behavioral uncoupling in these experiments, power spectra analyses indicated a definite increased delta band during EEG slow wave activity. REM sleep episodes presented all the typical electrophysiological and behavioral characteristics and the proportions of the REM sleep remained fairly stable.

**Conclusion:** Gaboxadol in cats produce SWC responses similar to that described in other species including man, but there is an unusual EEG/behavioral dissociation under gaboxadol that could be exploited to investigate extrasynaptic GABA<sub>A</sub> receptors not only in SWS but also in wakefulness.

**Acknowledgements:** Supported by Grant BFU2009-06991 from MCT, Spain

<http://dx.doi.org/10.1016/j.sleep.2013.11.172>

### Comorbidity and gender in patients with sleep apnea-hypopnea syndrome requiring performance of autocpap

C. Gotera Rivera, D. Barrios Barreto, P. Lazo Meneses, E. Mañas Baena, C. Jurkojc, J. Camara  
Ramon y Cajal Hospital, Resident of Pneumology, Spain

**Introduction:** Beyond hormonal differences and physical characteristics, there is evidence in the literature that relates sleep apnea-hypopnea syndrome (SAHS) with other cardiovascular risk factors. It might be interesting to assess the patients predominant risk factors by gender. Objectives: To analyze the association between gender and comorbidities in SAHS patients, who are treated by nasal continuous positive airway pressure (CPAP) in our hospital and given an overnight home automatic cPAP.

**Materials and methods:** We collected the data of 245 patients diagnosed with sleep apnea-hypopnea syndrome with respiratory polygraphy and polysomnography in treatment with CPAP from June 2007 to October 2009. The pressure was adjusted at first according to a formula, performing subsequent titration by autoCPAP in cases in which there was no clinical improvement, tolerance and/or compliance issues. We analyzed the presence or absence of comorbidities (heart disease, hypertension, depression, COPD, DM, stroke and Obesity hypoventilation syndrome). The statistical test used was Mann Whitney. All tests were two tailed and considered significant with a value of  $p < 0.05$ .

**Results:** Of a total of 256 patients analyzed, 199 were men (78%) and 57 women (22%). There were no significant differences among them in terms of apnea-hypopnea index (AHI), both showing severe SAHS (median 36 vs. 34). When comparing the characteristics it was observed that more women had a higher body mass index (BMI) (median 34.5 vs 30.8). In both groups we observed an average of 5–6 h of compliance. Pressure hrs approx 8–9 h approx similarly with respect to the prior initial pressure and the obtained formula autoCPAP. When comparing men and women after adjustment with autoCPAP parameters was observed in both groups good tolerance and compliance of hours of use before, however no significant differences in clinical improvement ( $p < .03$ ).

**Conclusion:** In our experience patients with lack of clinical improvement, poor tolerance and/or poor compliance were more women older when diagnosed, probably related to a lower suspicion of this disease in women or presentation symptoms later in life. They also have a higher BMI, finding differences in other parameters analyzed.

**Acknowledgements:** to Eva Manas Baena and the Sleep Unit the Ramon y Cajal Hospital, Madrid.

<http://dx.doi.org/10.1016/j.sleep.2013.11.173>

### Relationship between age and duration event number respiratory syndrome in patients with sleep apnea-hypopnea

D. Barrios Barreto<sup>1</sup>, C. Gotera Rivera<sup>1</sup>, P. Lazo Meneses<sup>1</sup>, J. Camara Fernandez<sup>2</sup>, R. Esteban Calvo<sup>2</sup>, E. Mañas Baena<sup>2</sup>

<sup>1</sup> Hospital Universitario Ramón y Cajal Madrid, Resident of Pneumology, Spain

<sup>2</sup> Hospital Universitario Ramón y Cajal Madrid, Spain

**Introduction:** Age may have influence in the response of the respiratory center and the dynamic systems that control breathing, so that younger patients presented respiratory events of shorter duration, compared with older patients, warning mechanisms which were more disturbed, they would present longer events. **Objectives:** To assess the influence of age in patients with sleep apnea–hypopnea sleep (OSA) on quantitative and qualitative profile (duration) of respiratory events.

**Materials and methods:** Data were collected prospectively from 81 patients polygraph SAHS during the months of September to November 2008. We evaluated the correlation between age and the duration and number of apneas. We used Spearman's rho correlation. SPSS vs. 15.0 was used for statistical analysis, a value considered significant at  $P < 0.05$ .

**Results:** A significant correlation between age of patients with SAHS and the duration and number of respiratory events, with a correlation coefficient of 0.447 and 0.21 respectively.

**Conclusion:** In OSAS patients was evidenced a longer duration of respiratory events in older patients. The cause is not clear and it could be in relation with respiratory control mechanisms or also with the natural history of the disease.

**Acknowledgements:** Medical staff, nursing and patients who are part of the sleep unit.

<http://dx.doi.org/10.1016/j.sleep.2013.11.174>

#### **Efficacy of the mandibular advancement device in patients with sleep apnea syndrome and no tolerance CPAP**

J. Fernandez Camara<sup>1</sup>, E. Mañas Baena<sup>1</sup>, C. Gotera Rivera<sup>2</sup>, D. Barrios Barreto<sup>3</sup>, P. Lazo Meneses<sup>2</sup>, R. Esteban Calvo<sup>4</sup>

<sup>1</sup> Hospital Ramon Y Cajal, MEDICO ADJUNTO NEUMOLOGÍA, Spain

<sup>2</sup> Hospital Ramón Y Cajal, MEDICO RESIDENTE NEUMOLOGÍA, Spain

<sup>3</sup> Hospital Ramón Y Cajal, MEDICO RESIDENTE NEUMOLOGIA, Spain

<sup>4</sup> Hospital Ramon Y Cajal, MEDICO ADJUNTO NEUMOLOGIA, Spain

**Introduction:** The high efficacy of continuous positive airway pressure (CPAP) in treating obstructive sleep apnea (OSA) is limited by poor compliance often related to pressure intolerance. Mandibular advancement devices (MAD) as a medical non-continuous positive airway pressure (CPAP) treatment have proven to reduce respiratory disturbances to a level which may be sufficient in mild to moderate sleep apnea. **Purpose:** The present study investigated the effectiveness of an intra-oral mandibular advancement device in the treatment of patients with OSA who could not tolerate or who had failed to comply with CPAP.

**Materials and methods:** A total of 27 sleep apnea patients treated during 2011–2012, who do not tolerate CPAP, participated in the study. The clinical, analytical and sleep apnea recordings were evaluated before and after application of MAD. Each subject underwent 2 sleep studies, before treatment and after a period of 30 days with MAD at the maximum protrusion.

**Results:** Of 27 patients, 20 (74.1 %) were men with a middle age of 53.15 (SD 9.6) and 7 were women (25.9 %) with a middle age of 60.43 (SD 4.5). The treatment with MAD improved the roncopathy in 25 patients. The median initial Epworth's scale reduced from 11.13 ± 7.67 ± 3.9,  $p < 0.05$ . The mean disturbed respiratory index (RDI) statistically decreased with MAD (16.8 ± 23 vs 27.1 ± 16,  $p < 0.05$ ). In addition, oxygen desaturation index (ODI) improved with MAD (19.84 ± 21.2 with MAD vs 26.42 ± 19 before MAD;  $p < 0.05$ ). The percentage of time spent below 90% saturation improved from 24.9 ± 31.21% to 14.75 ± 21.12,  $p > 0.05$ . Of the 27 patients, who had previously experienced CPAP, 26 of them felt it

was easier to tolerate the MAD. 85% of these patients stated the appliance was more portable and acceptable to their bed partner.

**Conclusion:** MAD may be considered for patients not compliant with CPAP treatment or those who refuse to use it. Even though CPAP is the more effective treatment modality, in the individual case, the better compliance seen in some patients with the MAD may be advantageous.

<http://dx.doi.org/10.1016/j.sleep.2013.11.175>

#### **Gender differences in obstructive sleep apnea**

J. Fernandez Camara<sup>1</sup>, C. Gotera Rivera<sup>2</sup>, D. Barrios Barreto<sup>3</sup>, P. Lazo Meneses<sup>4</sup>, E. Mañas Baena<sup>5</sup>, R. Esteban Calvo<sup>6</sup>

<sup>1</sup> Hospital Ramon Y Cajal, Medico Adjunto Neumología, Spain

<sup>2</sup> Hospital Ramon Y Cajal, Medico Residente Neumologia, Spain

<sup>3</sup> Hospital Ramón Y Cajal, Medico Residente Neumología, Spain

<sup>4</sup> Hospital Ramón Y Cajal, Medico Residente Neumología, Spain

<sup>5</sup> Hospital Ramón Y Cajal, Medico Adjunto Neumología, Spain

<sup>6</sup> Hospital Ramon Y Cajal, Medico Adjunto Neumologia, Spain

**Introduction:** Reviewing recent research on the roles of gender in obstructive sleep apnea syndrome (OSAS), female patients experience sleep apnea at an older age and with higher body-mass-index. Female OSAS patients report atypical symptoms more frequently. Knowledge about these distinct gender-related differences in clinical features of sleep apnea may contribute to an increased awareness and improved diagnosis. **Target:** This study investigated gender differences in a patient's cohort with sleep apnea.

**Materials and methods:** A retrospective review of patients referred to our sleep laboratory during 2006–2011 was done.

**Results:** We studied 146 patients, 98 males (67%) and 48 women (33%). Women were slightly older (58 years ± 12.3 vs 56 years ± 13.1,  $p < 0.2$ ), had higher body mass index (36.6, SD 8.6 vs 30.7, SD 4.7;  $p < 0.01$ ), and lower apnea/hipoapnea index (AHI) at the time of diagnosis (20.2, SD 18 vs 29, SD 21,  $p < 0.042$ ). Insomnia was more prevalent in the women (31% vs 16%,  $p < 0.01$ ). Daytime sleepiness (Epworth sleepiness scale) appeared more raised in men (15.09 ± 4.2 vs 10.53 ± 5.5;  $p < 0.02$ ). The proportion of positive diagnoses was similar (60.4% in women and 63.3% in men). There was similar prevalence of HTA, DM, ischemic heart disease and depression in men and women.

**Conclusion:** Women reported significantly less subjective daytime sleepiness, more insomnia, a higher body mass index, as well as a minor AHI. Some of these findings have been described before. Further larger studies may help confirm, as well as clarify, mechanisms that underlie the gender differences that we have noted. Clinicians need to be aware of these differences when assessing women for the possibility of sleep apnea in order to allow a correct management of the disease.

<http://dx.doi.org/10.1016/j.sleep.2013.11.176>

#### **Comic strips for health education – Comparative study of the effective between children with learning disabilities and regular school performance**

E. Pereira Camargo<sup>1</sup>, L. Bizari Coin Carvalho<sup>2</sup>,

L. Bizari Fernandes Prado<sup>2</sup>, G. Fernandes Prado<sup>1</sup>

<sup>1</sup> Universidade Federal de São Paulo, Neuro-sono Sleep Center, Center for Translational Medicine, Brazil

<sup>2</sup> Universidade Federal de São Paulo, Neuro-sono Sleep Center, Brazil

**Introduction:** The comic strips (CS) "Snory sleeps at home" (Ronco dorme em casa) was developed for educational action in pediatric health, and it was previously evaluated through randomized clinical trial and it proved to be very effective to inform the children aged between 6 and 10 years old about the snoring syndrome and the sleep hygiene. In order to continue this research, this study evaluated the CS effectiveness, by comparing the performance of children who were diagnosed with learning disabilities and children who showed regular school development. The children with learning disabilities belong to PIC – Project Intensive in the Cycle – governmental action to recuperate the students who even though are in the 4th grade, are not yet fully literate and they are incapable to progress in their studies.

**Materials and methods:** The sample was composed by 41 students (9–12 years old) from the same school and grade (4th year of an elementary school in the city of São Paulo, Brazil). After reading the CS, the students – 30 with regular school performance (G1) and 11 with learning disabilities (G2) – answered to 3 questions about sleep disorders (test). Question 1 about sleep hygiene ("what is a good thing to do before going to sleep?") and questions 2 and 3 about snoring syndrome ("is it normal to snore? Why do you think that?"). The answering alternatives about sleep hygiene were subdivided into 3 variables: a) to drink milk; b) to eat on bed and c) to do exercises; about snoring subdivided into 5 variables, at question 2, in "normal" and "abnormal" and at question 3 in a) everyone snores; b) it is a sign that something is wrong and c) it is impolite.

**Results:** For the question about sleep hygiene, there was no significant difference ( $p < 0.05$ ) between the correct answers of the children from G1 and G2 (question 1  $p = 0.3657$ ; G1 80% and G2 90.9%). However for the questions 2 and 3, there was significant difference of learning between group 1 and 2 (question 2  $p = 0.00145$ ; G1 56.7% and G2 9.1% and question 3  $p = 0.00057$ ; G1 60% and G2 9.1%).

**Conclusion:** The results showed that CS "Snory sleeps at home" was equally efficient to inform children with regular school performance and with learning disabilities, regarding the most elementary question about sleep hygiene, but was not equally efficient at the most complex questions about snoring syndrome, in which the children with learning disabilities had a worse performance.

**Acknowledgements:** We would like to thank the Federal research supporting agencies CAPES (Camargo EP, #3300915) and CNPq (Carvalho LBC, #559187; Prado LBF, #312587; Prado GF, #312584); Eliane Camargo for the grammatical suggestions.

<http://dx.doi.org/10.1016/j.sleep.2013.11.177>

### **Obstructive sleep apnea in a clinical setting of epilepsy patients: Prevalence and polysomnographic features of 100 consecutive cases**

C. Roser<sup>1</sup>, G. Lorena<sup>2</sup>, T. Marta<sup>3</sup>, S. Xavier<sup>4</sup>, T. Manuel<sup>4</sup>, L. Patricia<sup>5</sup>  
<sup>1</sup> Sleep Medicine Unit, Clinical Neurophysiology Department, Hospital Universitari Vall d'Hebron, Spain

<sup>2</sup> Clinical Neurophysiology Department, Hospital Universitari Vall d'Hebron, Spain

<sup>3</sup> Neurology Department, Hospital Universitari Vall d'Hebron, Spain

<sup>4</sup> Epilepsy Unit, Neurology Department, Hospital Universitari Vall d'Hebron, Spain

<sup>5</sup> Sleep Medicine Unit, Pneumology Department, Hospital Universitari Vall d'Hebron, Spain

**Introduction:** Both Obstructive Sleep Apnea Syndrome (OSAS) and epilepsy are prevalent conditions in general population. Recent publications have reported a higher prevalence of OSAS in clinical series

of epileptic patients, suggesting that untreated OSAS may contribute to a worse control of epilepsy. Since OSAS is often underdiagnosed in general population, the aim of our study was to determine OSAS prevalence and severity in a large clinical setting of unselected epileptic patients referred for polysomnographic (PSG) evaluation.

**Materials and methods:** We evaluated 100 consecutive epileptic patients (mean age 43.4, 55 men), referred to Sleep Unit for PSG recording due to the following reasons: epileptic syndrome diagnosis (47%), nocturnal seizures (19%), OSAS suspicion (12%), drug resistant epilepsy (9%), isolated convulsive seizure (7%), and parasomnia (6%). All patients underwent attended video-PSG. Patients with an Apnea-Hypopnea Index (AHI)  $\geq 5$  were classified as having OSA. Prior to PSG evaluation demographic and clinical data were recorded (epileptic syndrome and number and type of antiepileptic drugs).

**Results:** The overall prevalence of OSAS in our series was 51%, with a mean AHI of 22.4 (SD 17.4). Among OSAS patients, 49.1% had mild OSAS, 23.5% moderate OSAS and 27% severe OSAS, with significant worse nocturnal saturation indices when compared with no-OSAS group. OSAS was confirmed in all patients with previous clinical suspicion, and was also diagnosed in 39 patients with no suspected OSA prior to the PSG evaluation (21 mild, 9 moderate and 9 patients with severe OSAS). Compared with no-OSAS group, OSAS patients were older (mean age 51.8 vs 34.7), with a higher BMI (28.1 vs 23.8) and mostly men (36% vs 19%,  $p < 0.05$ ). Sleep architecture showed a higher percentage of non-REM sleep in OSAS patients ( $p < 0.05$ ), with no differences in the efficiency or REM sleep. No significant differences were observed in the Epworth Sleepiness Scale (ESS) or number of AEDs at the time of PSG.

**Conclusion:** A high prevalence of OSAS was observed in our clinical setting of epilepsy patients, especially among older men with a higher BMI. A large number of patients (39%) were diagnosed of OSAS with no prior clinical suspicion of nocturnal respiratory disturbance. Clinical screening of OSAS in settings of epileptic patients may be needed in order to diagnose maybe a potential and modifiable risk factor for epilepsy.

**Acknowledgements:** We thank Dr. Romero, Dr. Sampol, Dr. Jurado and Dr. Ferré for their support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.178>

### **Polysomnographic analysis of obstructive sleep apnea (OSA) in middle-aged adults following pharyngeal flap surgery for velopharyngeal insufficiency treatment**

L. Campos<sup>1</sup>, A. Sampaio-Teixeira<sup>1</sup>, R. Yamashita<sup>1</sup>, I. Trindade-Suedam<sup>2</sup>, G. Lorenzi-Filho<sup>3</sup>, I. Trindade<sup>3</sup>

<sup>1</sup> Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, Brazil

<sup>2</sup> Hospital for Rehabilitation of Craniofacial Anomalies and School of Dentistry, University of São Pau, Brazil

<sup>3</sup> Heart Institute, University of São Paulo School of Medicine, Brazil

**Introduction:** Individuals with cleft palate, even after surgical repair of the primary palate, may present velopharyngeal insufficiency. Pharyngeal flap surgery is frequently the procedure of choice for the improving speech in this group of patients. Previous studies have shown that the procedure may, however, impair upper airway patency, resulting in sleep-disordered breathing. The purpose of this study was to investigate the occurrence of OSA and related symptoms in middle-aged adults with repaired cleft palate with (F group) and without pharyngeal flap (NF group).

**Materials and methods:** Prospective study in 42 nonsyndromic individuals with repaired cleft palate (F = 22, NF = 20), aged 40–58 years. Prevalence of OSA was estimated according to

apnea-hypopnea index (AHI) greater than 5 events per hour of sleep, measured by nocturnal polysomnography (EMBLA-N7000 system). Apnea was defined as the complete cessation of airflow during sleep and hypopnea as a decrease in airflow of 30% or more, lasting for 10 s or more, and a decrease in SpO<sub>2</sub> of at least 4%. Symptoms were investigated by the Pittsburgh, Epworth, and Berlin questionnaires. The study was conducted at the Sleep Studies Unit- Laboratory of Physiology of the Hospital for Rehabilitation of Craniofacial Anomalies, Brazil.

**Results:** In the F group, the prevalence of OSA corresponded to 77% and when considering related symptoms (OSAHS), 64%. In the NF group, the percentages were lower (60% and 45%, respectively), but differences were not statistically significant. Questionnaire outcomes did not differ between groups.

**Conclusion:** Middle-aged adults with cleft palate have high prevalence of sleep-disordered breathing. Congenital anatomic or functional abnormalities of the upper airway or palatal surgeries may contribute to obstruction. However, results suggest that the flap is not an aggravating obstructive factor.

**Acknowledgements:** CAPES Pró-Equipamentos/FAPESP – Brazil, for the financial support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.179>

### CPAP titration: correlation between 2 different equations and autoCPAP

L. Cancelo, V. Hernandez, D. Bravo, C. Martinez, C. Egea, J. Duran  
HUA Sede Txagorritxu, Spain

**Introduction:** Standard practice for continuous positive airway pressure (CPAP) treatment in sleep apnea and hypopnea syndrome (SAHS) requires pressure titration during attended laboratory polysomnography. However, polysomnographic titration is expensive and time-consuming. Moreover, there are equations to predict optimal pressure that are not routinely used in clinical practice. Although there is literature which compares different prediction equations with other forms of CPAP titration with similar results, others, do not find this correlation. AIM: To compare two predictive equations against autoCPAP.

**Materials and methods:** Retrospective study from Vitoria cohort. All patients who had been titrated by autoCPAP [determining in one single night and using p90 pressure] were included. Two equations were used: Hoffstein [CPAP = (BMI × 0.16) + (NC × 0.13) (AHI × 0.04) – 5.12] and Series [CPAP = (BMI × 0.193) + (NC × 0.07) + (AHI × 0.02) – 0.611]. Patients titrated by PSG were excluded.

**Results:** 619 patients were included. Mainly men (474–76.4%), mean age was (53.9 + 12.6), mean AHI (45.9 + 23.4), mean BMI (31.6 + 5.4); and mean neck circumference (41.5 + 4.1). –Correlation found between CPAP pressure, measured by autoCPAP (p90, one single night) and the 2 equations was not good. –Series formula correlated better with autoCPAP pressure than Hoffstein formula. Despite average pressure was similar to that of autoCPAP (9.9 vs 9.6) a high internal dispersion was found. –Correlation did not improve when pressures were divided into groups (<8, 8–12, >12).

**Conclusion:** Given the lack of correlation of prediction equations for CPAP titration with autoCPAP (p90), the application of formulas for CPAP titration, in clinical practice, should be cautious and its effectiveness should be verified.

<http://dx.doi.org/10.1016/j.sleep.2013.11.180>

### Insomnia group therapy

M. Belber, L. De La Fuente, F. Canellas  
Ib-salut, University Hospital Son Espases

**Introduction:** Insomnia is the most frequent sleep complaint, cognitive-behavioral therapy (CBT) is one of its two evidence based therapeutic options. It's specially indicated in primary insomnia, insomnia associated with other chronic diseases and hypnotic-dependent insomnia patients. Despite this, CBT is not implemented yet in most sleep units in Spain. Group therapy is more efficient than the individual psychotherapy and can be a less expensive alternative. The basic philosophy of this program is that a time-limited intervention, focusing directly on the factors that perpetuate insomnia can be helpful regardless of the initial conditions that have precipitated it. The aim of this work is to describe the experience with the two first groups of CBT in insomnia patients performed at the University Hospital Son Espases, Palma de Mallorca.

**Materials and methods:** Subjects: Patients with chronic insomnia, motivated to participate and who had a reference therapist. Method: Each patient did two individual 60 min consultations, 8 weekly group treatment and two booster sessions one and three months after treatment has ended. Individual assessment: 1. Diagnostic and pre-selection consult done by a psychiatrist specialized in sleep disorders using a semi structured sleep clinical questionnaire. 2. Pre-treatment assessment and informed consent signature done by a clinical psychologist. Patient has to complete a pre-group sleep agenda for 1–2 weeks. Assessment tools: Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Beck Depression Scale (BDI), Spielberger Anxiety Scale (STAI E/R). Treatment Phase: Group (5–8 persons) 90 min duration. Pharmacological treatments (i.e. antidepressants) excepted hypnotic drugs were maintained during the length of treatment.

**Results:** Initial assessment was performed to 14 patients; all signed the informed consent. Only 8 patients (4 woman and 4 men, from 42 to 78 y) complete all sessions and assessment after treatment. Median scores of evaluation test pre / post treatment of these 8 patients were: PSQI 16,8/12,1; ISI 16,8/13,2; BDI 12,6/9,8; STAI E 31/25; STAI R 32,8/21,5. A notable result is that during group therapy all patients' abandoned hypnotic drugs they used in every-day or in episodic basis.

**Conclusion:** Even the limited number of patients our results supports the efficacy of group psychotherapy, improves insomnia and decreases depressive and anxiety symptoms. We encourage its use in the treatment of chronic insomnia.

<http://dx.doi.org/10.1016/j.sleep.2013.11.181>

### Detecting sleep respiratory disturbances in pregnancy

Teresa Canet<sup>1</sup>, Paula Gimenez<sup>2</sup>

<sup>1</sup> Hospital Virgen de Los Lirios, Wasm and Ses

<sup>2</sup> Istahermosa Sleep Unit Hospital, Ses

**Introduction:** Different sleep disturbances occur as a result of physiologic, hormonal, and physical changes associated with pregnancy. An emergent body of literature has reported a distinct association between sleep apnea and preeclampsia. Despite reports of the various sleep problems, the exact nature and incidence of sleep disorders in pregnancy is not known. objective: To investigate the frequency of sleep-disordered breathing during the pregnancy in a sample of healthy pregnant subjects.

**Materials and methods:** Thirty-five pregnant subjects completed the STOP, BERLIN and Epworth score questionnaires during the preg-

nancy prospectively. Polygraphy was recorded and snore, index apnea-hipoapneas (IAH) and respiratory disturbance index (RDI) was calculated. Demographic characteristics and STOP was also retrospectively investigated.

**Results:** Snoring presented before pregnancy in 8 cases and STOP was for high risk in a case. IAH>5 was present in 1 case (3%) in her first trimester, RDI>5 in 19 (54%) cases ( $x:6.6 \pm 6.1$ ): 4 in first, 6 in second and 9 in third. The STOP was positive for high risk in 6 (17.8%) cases and Berlin in 5 (17.8%). The sensibility (S) for STOP was 16% and the specificity (E) 93% and in the BERLIN S: 23% and E: 91%. Although 5 of 11 cases reported in STOP or BERLIN respectively habitual snoring during pregnancy in PCR it was recorded in 19. Among these, 42% were non-snorers before pregnancy. Daytime somnolence concerned 28.6% of the population with an Epworth score significantly increased after first trimester ( $P<0.01$ ) but not as significant in cases with RDI>5 (37%). The body mass index >25 was present in 46% and the gain of weight during pregnancy  $8.3 \pm 4.2$  and was not associated with RDI>5.

**Conclusion:** Sleep-disordered breathing is frequent during pregnancy especially when the respiratory disturbance index is used. STOP and BERLIN questionnaires were low sensibility but it is possible due the little number of severe cases. Questioning of patients at the first prenatal visit and monitoring for increased snoring during gestation may help detect early signs and symptoms of OSA but we have considered that many of them do not know that they are snoring, as the PCR revealed. Our results demonstrated that the exact incidence of snoring and sleep apnea in pregnant women is uncertain and the criteria used to define them are unclear. Further investigations are needed to determine if criteria that are used to define sleep apnea in the general population should be applied to pregnant women.

**Acknowledgements:** Thanks to patients for accepting and collaborating in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.182>

### Evolution of safety profile of different therapeutic alternatives in restless legs syndrome (rls)

Nerea Torres Caño<sup>1</sup>, Pau Giner Bayarri<sup>2</sup>, Rosa Chilet Chilet<sup>2</sup>, Gloria Zalve Plaza<sup>2</sup>, Antonia Blancas Carrasco<sup>3</sup>, Juan Moliner Ibáñez<sup>2</sup>

<sup>1</sup> Hospital Universitario Dr. Peset, Doctor (Registrar)

<sup>2</sup> Hospital Universitario Dr. Peset, Doctor

<sup>3</sup> Hospital Universitario Dr. Peset,

**Introduction:** To compare safety and tolerability of different therapeutic strategies in the management of Restless Legs Syndrome (RLS) in our Neurophysiology Unit, as well as their evolution over time.

**Materials and methods:** Retrospective analysis of the safety profile of the different therapies used on every patient in our clinic suffering RLS +/- Periodic Limb Movement (PLM) from year 2000 until 2012.

**Results:** A total of 138 subjects visited our clinic complaining about PLM (92%), RLS (70.3%) or PLM + RLS (62.3%), with an average age of onset of 55.5 years, 50% women. 18.8% of patients did not require any treatment. Of the other subjects (n=112), 50.7% (n=70) were treated in some moment of their disease with clonazepam (CLZ), 41.3% (n=57) with ropinirole (RPX), and 37.7% (n=52) with rotigotine (RTG). Considering the different availability of these drugs over time, the medication more frequently administered was CLZ, followed by RPX and RTG. Despite this, the average length of treatment with CLZ (2.5 years) was statistically higher to that of RPX (2 years) and RTG (1.4 years) ( $p=0.005$ , Kruskal-Wallis test), while not showing

this significant difference between RPX and RTG. 12.9% of CLZ treated patients showed some adverse event (AE) during treatment, this number increasing to a 15.8% in the RPX group, while only happening in 5.8% of the RTG patients. The most frequent AEs with CLZ were dizziness and somnolence; unspecified malaise and somnolence in the RPX group, and site application reactions in the case of RTG. Among the AEs causing drug withdrawal or switching, we must highlight the augmentation phenomenon, which was shown in 37.1% of patients treated with CLZ, 40.4% of the RPX group, and 0% in the RTG group ( $p<0.0001$ , Chi square test). Other AEs causing treatment withdrawal were: lack of efficacy (24.3% in the CLZ group, 42.1% in the RPX patients, 5.8% with RTG), and adherence to the treatment (1.4% of subjects with CLZ, 1.8% with RPX and 0% with RTG).

**Conclusion:** New therapeutic strategies in the management of RLS ensure not only efficacy, but also a safe and very well tolerated control of the patient, especially with long term treatments (augmentation phenomena).

<http://dx.doi.org/10.1016/j.sleep.2013.11.183>

### Sleep deprivation and obesity in shift workers in Southern Brazil

R. Canuto<sup>1</sup>, M. Teresa Anselmo Olinto<sup>2</sup>, M Pascoal Pattussi<sup>2</sup>, R. Liane Henn<sup>2</sup>, J. Block Macagnan<sup>3</sup>

<sup>1</sup> Federal University of Rio Grande do Sul State, Post-graduate Programme in Endocrinology, Brazil

<sup>2</sup> University of Vale do Rio dos Sinos, Post-graduate Programme in Collective Health, Brazil

<sup>3</sup> University of State of Santa Catarina, Nursing Department, Brazil

**Introduction:** The objective of our study was to explore the association between sleep deprivation and obesity among shift workers.

**Materials and methods:** A cross-sectional study was conducted on 905 shift workers among a poultry processing plant in southern Brazil. Obesity was defined as body mass index  $\geq 30$  kg/m<sup>2</sup>. Time of sleep was categorized as: > 5 h continuous/day;  $\leq 5$  h continuous/day with some additional rest (sleep deprivation level I); and  $\leq 5$  h/day without any additional rest (sleep deprivation level II). Socio-demographic, parental and behavioral variables were evaluated by means of a standardized pre-tested questionnaire. Potential confounding factors were controlling in the multivariable model.

**Results:** Obesity was more prevalent in the participants who were female, age 40 and older, had less schooling and reported excess weight in both parents. Sleep deprivation levels I and II were associated with increased income, number of meals consumed throughout the day and nightshift work. All of the workers who exhibited a degree of sleep deprivation worked the night shift. After controlling, the prevalence ratios of obesity were 1,32 (95% CI 0,84; 2,08) and 4,57 (95% CI: 2,51; 8,32) in the workers with sleep deprivation levels I and II, respectively, compared to the reference group.

**Conclusion:** These results show a strong association between sleep deprivation and obesity in shift workers, and that sleep deprivation may be a direct consequence of working at night.

**Acknowledgements:** This study was supported by the National Council of Technological and Scientific Development (CNPq; grants 477069/2009-6 and 478366/2011-6). R. Canuto received a scholarship from the Brazilian Federal Agency for Support and Evaluation of Graduated Education (CAPES). M.T.A. Olinto and M.P. Pattussi received research productivity grants from CNPq (grants 304793/2010-8 and 303424/2011-7).

<http://dx.doi.org/10.1016/j.sleep.2013.11.184>

**Associated factors with metabolic syndrome in shift workers**

R. Canuto<sup>1</sup>, M. Teresa Anselmo Olinto<sup>2</sup>, M. Pascoal Pattussi<sup>2</sup>,  
R. Liane Henn<sup>2</sup>, J. Block Macagnan<sup>3</sup>

<sup>1</sup>Federal University of Rio Grande do Sul State, Post-graduate  
Programme in Endocrinology, Brazil

<sup>2</sup>University of Vale do Rio dos Sinos, Post-graduate Programme in  
Collective Health, Brazil

<sup>3</sup>University of State of Santa Catarina, Department of Nursing, Brazil

**Introduction:** This study investigated the prevalence of metabolic syndrome (MS) and its association with demographic, socioeconomic and behavioral factors in shift workers.

**Materials and methods:** A cross-sectional study was conducted on a sample of 902 shift workers of both sexes in a poultry processing plant in Southern Brazil. The diagnosis of MS was determined according to the recommendations from “Harmonizing the Metabolic Syndrome”; and its distribution was evaluated according to the demographic (gender, skin color, age and marital status) socioeconomic (schooling, income and work shift) and behavioral characteristics (smoking, alcohol intake, leisure physical activity, number of meals and sleep duration) of the sample. The multivariate analysis followed a theoretical framework for determining MS on shift workers.

**Results:** The prevalence of MS on the sample was 9.3% (IC95%: 7.4–11.2). The most frequent altered component was waist circumference (RP 48.4; IC95% 45.5–51.2). After adjustment, the prevalence of MS was positively associated with women (RP 2.16; IC95% 1.28–3.64), workers of over 40 years of age (RP 3.90; IC95%: 1.78–8.93) and those who reported sleeping five or less hours per day (RP 1.70; IC95%: 1.09–2.24). On the other hand, MS was negatively correlated with higher educational level (RP 0.55; C 0.29–1.06) and having more than three meals per day (RP 0.43 IC95% 0.26–0.73).

**Conclusion:** Sex, age, educational level, eating habits and duration of sleep appeared as independent risk factors for MS in shift workers.

**Acknowledgements:** This study was supported by the National Council of Technological and Scientific Development (CNPq; grants 477069/2009-6 and 478366/2011-6). R. Canuto received a scholarship from the Brazilian Federal Agency for Support and Evaluation of Graduated Education (CAPES). M.T.A. Olinto and M.P. Pattussi received research productivity grants from CNPq (grants 304793/2010-8 and 303424/2011-7).

<http://dx.doi.org/10.1016/j.sleep.2013.11.185>

**Maternal obstructive sleep apnea and admissions to the neonatal intensive care unit**

T. Carbone, A. Violaris, K. Cahill

The Valley Hospital, Columbia University, United States

**Introduction:** Snoring and excessive daytime sleepiness are classic symptoms of obstructive sleep apnea (OSA). This condition is associated with significant pathophysiologic sequelae, including intermittent hypoxemia and hypertension. Multiple factors present during pregnancy increase the risk for OSA, and the presence of OSA during pregnancy has been associated with untoward consequences to both the mother and fetus. We studied the impact of maternal OSA during pregnancy on a group of infants admitted to the neonatal intensive care unit (NICU).

**Materials and methods:** Our study group consisted of postpartum mothers who had delivered an infant admitted to the NICU within the previous 24 h. Data was collected between 6/09 and 3/12. Mothers were randomly selected and they were asked to complete two

standardized questionnaires (Epworth Sleepiness Scale and Snoring Symptoms Inventory) to identify symptoms of OSA, specifically excessive daytime sleepiness and snoring. Maternal data regarding age, race, health status, pregnancy, labor, and delivery and infant data regarding gestational age, birthweight, and Apgar scores were collected.

**Results:** We enrolled 115 mothers. Their mean age was  $34 \pm 5$  years. Seventy percent were Caucasian, 18% Hispanic, 6% African American, and 5% Asian. Smoking and alcohol use during pregnancy were reported in 2%. Most deliveries were via elective c-section (42%), followed by NSVD (32%), and emergency c-section in 24%. The relationship between the ESS and the SSI was analyzed using a Pearson Correlation Statistic ( $r$ ). A high correlation between the two measures was seen ( $r = 0.506$ ;  $p < 0.0001$ ). The relationships among ESS totals and SSI totals and pregnancy outcomes were analyzed. Elevated scores on the SSI were associated with adverse pregnancy outcomes, most significantly with preeclampsia. Lower infant Apgar scores were also noted.

**Conclusion:** Pregnant women who demonstrate excessive daytime sleepiness are more likely to have sleep disturbances associated with snoring. Elevated scores on the SSI are associated with adverse pregnancy outcomes. We found symptoms of maternal OSA in a high percentage of infants requiring admission to a NICU. The potential for treatment of OSA using CPAP underscores the importance of early diagnosis in pregnant women.

**Acknowledgement:** NICU staff at The Valley Hospital for their support in completing this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.186>

**Physicians with restless legs syndrome are more likely to fail in the written test to get in the residency program in Brazil**

K. Carlos<sup>1</sup>, L. Carvalho<sup>1</sup>, A. Prado<sup>2</sup>, L. Prado<sup>1</sup>, G. Prado<sup>1</sup>

<sup>1</sup>Neuro-Sono Unifesp, Brazil

<sup>2</sup>Universidade de São Paulo, Brazil

**Introduction:** Restless legs syndrome (RLS) has been associated with cognitive problems mostly because of sleep deprivation. However a study has found better cognitive performance in patients with RLS, due to a possible adaptation of these patients to the sleep restriction regime. Objective. Evaluate the performance of physicians with RLS in a test to get in the residency program at Escola Paulista de Medicina of Universidade Federal de Sao Paulo.

**Materials and methods:** Before they began the written test, in the morning period, the doctors informed if they had RLS or not, according to the four criteria proposed by IRLSSG, which were presented to the candidates in a sheet attached to the test, along with a sleep diary (SD), in which they were to report the number of sleep hours the night before the test. The candidates to the residency program of EPM- UNIFESP came from all regions in Brazil.

**Results:** A total of 3860 doctors performed the test to the residency program of EPM-UNIFESP, and 2017 answered the question about RLS and filled the SD. Two hundred and ninety four physicians reported having RLS. Twenty did not identify their forms, and were not included in analyzes involving approved/not approved. Of the 2017 questionnaires analyzed, 274 physicians reported having RLS, resulting in a 13.58% prevalence of RLS in this population. The TTS among doctors with RLS was 338 min. Among physicians with RLS, 62 passed the test (22.62%), and among those without RLS 59% were approved ( $p < 0.0001$ ). Doctors with RLS that passed or failed the test showed no mean TTS difference.

**Conclusion:** Despite the controversial relation between RLS and cognitive performance, our data suggest that in this real situation

of evaluation in order to obtain a classification to get in the residency program, physicians with RLS showed the worst performance. Other variables will be considered subsequently, notably the TTS of approved and not approved in the test relatively to the TTS of doctors with RLS.

**Acknowledgements:** Supported by Capes e FAPESP (2009/16758- 4, 2010/02633-2, #2010/06188-3).

<http://dx.doi.org/10.1016/j.sleep.2013.11.187>

### **Disruption of sleepwake continuum in dementia and mild cognitive impairment: macrostructural and microstructural findings**

L. Carnicelli<sup>1</sup>, M. Maestri<sup>1</sup>, N.-T. Economou<sup>2</sup>, T. Paparrigopoulos<sup>2</sup>, G. Tognoni<sup>1</sup>, E. Bonanni<sup>1</sup>

<sup>1</sup> *UO Neurologia-Neurofisiopatologia, University of Pisa, Pisa, Italy*

<sup>2</sup> *University of Athens Medical School, Sleep Study Unit, Eginition Hospital, Athens, Greece*

**Introduction:** Mild Cognitive Impairment (MCI) defines an initial state in the process of cognitive impairment which is considered an intermediate stage towards dementia. Few works have focalized on sleep and its disorders in cognitive processes in this situation. Aim of our study was to evaluate sleep macro and microstructural variables in MCI subjects compared with cognitive intact elderly (HC) and Alzheimer's disease patients, and to correlate these parameters with neuropsychological tests.

**Materials and methods:** Twelve MCI subjects (7F, 5M; mean age  $73 \pm 4$ ) underwent PSG home recording. Sleep macrostructure and cyclic alternating pattern (CAP) were scored according with standard international criteria. According with previous findings we divided into subgroups based on daytime napping behaviour (>60 min). MCI were compared with 14 HC and 20 mild AD, defined by a CDR score of 1, both age and sex-matched. Macro and microstructural parameters were correlated with neuropsychological scores and patients were evaluated after 12 months of follow up.

**Results:** We found no statistically significant macrostructural difference in MCI subjects compared with AD and HC. A trend of decreasing CAP time and CAP rate in MCI subjects compared with healthy controls emerged and, while A3 subtypes were increased in MCI compared with HC, A1 subtypes were decreased. Macro and microstructural variables in daytime- napping patients showed decreased nocturnal slow wave sleep and A1 subtypes. Single microstructural variable and neuropsychological test correlates and several sleep parameters (daytime napping, less sleep continuity) were different in MCI subjects that progress to AD.

**Conclusion:** Our data show that microstructural sleep variables correlates with cognitive process also in this condition and that sleep-wake cycle stability and sleep microstructure could be considered as biomarkers underlining neurodegenerative cognitive disorders, even if other studies in bigger population are needed.

<http://dx.doi.org/10.1016/j.sleep.2013.11.188>

### **Drug-induced sleep endoscopy: a two drug comparison and simultaneous polysomnography**

M. Carrasco<sup>1</sup>, G. Agostini<sup>1</sup>, P. Giner<sup>2</sup>, A. Rodrigo<sup>2</sup>, F. Gómez<sup>3</sup>, J. Dalmau<sup>1</sup>

<sup>1</sup> *Hospital Universitario Dr. Peset, ENT, Spain*

<sup>2</sup> *Hospital Universitario Dr. Peset, Neurophysiology, Spain*

<sup>3</sup> *Hospital Francesc de Borja, Preventive Medicine, Spain*

**Introduction:** When CPAP intolerance is present in obstructive sleep apnea (OSA) patients, the assessment of pharyngeal obstruction areas is critical in order to increase surgical success rate. Drug-induced sleep endoscopy (DISE) allows visual pharynx evaluation of patients under sedation, artificially reproducing natural sleep. Although consensus has not yet been established on the sedation method, propofol and midazolam are the drugs most frequently used. The object of the present study is to compare pharyngeal and polysomnographical (PSG) findings during DISE performed either with propofol or midazolam as a single sedative in the same patient.

**Materials and methods:** Sixteen patients with sleep breathing disorders were sedated and endoscopically evaluated, under propofol sedation first, followed by midazolam, after confirmation of complete arousal. Simultaneous PSG was performed during sedation. Comparison of pharyngeal obstruction and vibration sites under each of the drugs is performed using the VOTE classification. PSG findings were also compared.

**Results:** There were 15 men and one woman; mean age 42.7 years old, mean body mass index (BMI) 26.9 Kg/m<sup>2</sup>. Average DISE duration was 20 min with Propofol and 14.3 min with Midazolam. The induced-sleep stage obtained was N2 with both drugs. There was a good correlation between DISE results with both drugs ( $p < 0.001$ ). A high level of agreement was found when evaluating tongue base and epiglottic collapse (97% and 87% respectively), and lower at the vellum (84.4%). There was a good correlation of the AHI and minimal O2 saturation with both drugs. (ICC 0.7 and 0.67).

**Conclusion:** A high level of agreement is found when DISE is performed with propofol and midazolam, under continuous perfusion.

**Acknowledgement:** To Juan Viñoles.

<http://dx.doi.org/10.1016/j.sleep.2013.11.189>

### **Alert level assessment associated with age and recent sleep in mining workers**

Héctor Anabalón<sup>1</sup>, Patricia Masalán<sup>2</sup>, Juan Carrillo<sup>3</sup>, Alvaro Berrizbeitia<sup>1</sup>, Constanza Anabalón<sup>4</sup>, Mauricio Bravo<sup>5</sup>

<sup>1</sup> *AlertPlus, Director*

<sup>2</sup> *School of Nursing Catholic University, Associate Professor*

<sup>3</sup> *Sueño & Salud, Director*

<sup>4</sup> *AlertPlus,*

<sup>5</sup> *Military Hospital, Neurologist*

**Introduction:** Complex productive activities that affect economy demand from workers the ability to maintain adequate levels of sustained concentration. This ability depends on the level of alertness, which is necessary, but difficult and complex to measure. The Reulecke's theoretical model considers concentration as an active state of focused attention, which is mainly based on three variables: 1) energy 2) function 3) and precision. For this investigation, we used a measurement system based on this model. Objective: Measure the level of alertness and study its association with age and recent sleep, in a group of mining workers.

**Materials and methods:** A cross-sectional study was performed, in the months of March and April 2013. It was applied to drivers managing heavy machinery in the copper mining industry, specifically in the IV region of Chile. A random sample of workers was selected, which went through an assessment tool called "Access Point". This was applied before the beginning of a workday. This tool consists of a questionnaire and a Cognitrone Test (Schuhfried Products). The variables considered were duration of the test (DT), number of correct answers (NCR), and the average time of correct answers (ACA). Subjects were classified according to their age: under 30 years

(Group 1, n=49), between 30 and 45 years (Group 2, n=157), and older than 45 years (Group 3, n=123). Sleep in the previous 48 hours was classified as Normal or Altered, according to the questionnaire's answers.

**Results:** 329 workers were studied, with an age average of 41.5  $\pm$  10.4 years (IQ = 33–49), of which 9 (2.7%) were women. Of the total, 33 (10%) reported disturbed sleep in the prior 48 hours to the measurement. The DT (minutes) in Group 1 was 9.69 ( $\pm$ 0.74) in Group 2 was 10.08 ( $\pm$ 1.02) and in Group 3 was 11.02 ( $\pm$ 1.73); ( $p$ <0.001). The NRC of Group 1 was 60.55 ( $\pm$ 6.88), for Group 2 it was 57.52 ( $\pm$ 7.59), and Group 3 was 50.51 ( $\pm$ 9.16); ( $p$ <0.001). The ACA (seconds) in Group 1 was 1.10 ( $\pm$ 0.05), in Group 2 was 1.13 ( $\pm$ 0.06), and in Group 3 was 1.16 ( $\pm$ 0.07); ( $p$ <0.001). For sleep in the previous 48 hours, the DT in the Normal group was 10.30 ( $\pm$ 1.34) and in the Altered group was 11.06 ( $\pm$ 1.73); ( $p$ <0.001). The NRC for the Normal group was 55.83 ( $\pm$ 8.81) and for the Altered group it was 51.06 ( $\pm$ 9.45); ( $p$ <0.001). The ACA for the Normal group was 1.14 ( $\pm$ 0.07) and for the Altered group was 1.15 ( $\pm$ 0.09); ( $p$ =0.28).

**Conclusion:** The basal alert level decreased significantly with age and disturbances in recent sleep in the study group. In the context of complex production processes, this could affect the performance on tasks requiring high levels of concentration, and increases the risk of accidents.

**Acknowledgement:** Workers who collaborated in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.190>

### Anxiety and depression associated with sleep disturbances in shift workers

J. Carrillo<sup>1</sup>, M. Becerra<sup>2</sup>

<sup>1</sup> Felix Bulnes Hospital, Occupational Health Unit, Chile

<sup>2</sup> Felix Bulnes Hospital, Personnel Unit, Chile

**Introduction:** There is increasing evidence that shift work has negative consequences for cardiovascular and metabolic level, and is associated with an increased risk of accident. These consequences would be mediated primarily by chronic sleep deprivation and circadian misalignment suffered by these workers. However, there is less evidence on the impact on the mental health of shift workers. Objective: Studying the effects of rotating night shift work on levels of anxiety and depression in health care workers.

**Materials and methods:** As a part of an occupational health program, we conducted a cross-sectional study among workers at a public hospital in Santiago, Chile. According to their work schedule they were classified in daytime work (DW) or shift work (SW). The whole group underwent a medical evaluation that included measurement of weight and height, and they were given a battery of questionnaires: Berlin Questionnaire (BQ), Hospital Anxiety and Depression Scale (ADS) and Pittsburgh's Sleep Quality Index (PSQI). The BQ classifies subjects into Low Risk (LR) or High Risk (HR) of suffering from obstructive sleep apnea syndrome (OSAS). According to their work schedule and outcome of BQ, they were classified into 4 groups: DW/LR (Group 1, n = 40), DW/HR (Group 2, n = 33), SW/LR (Group 3, n = 28) and SW/HR (Group 4, n = 34). ANOVA test was applied.

**Results:** The study group consisted of 136 workers, of whom 110 (80.9%) were women and 26 (19.1%) were men. Of the total, 74 (54.4%) were working in daytime, and 62 (45.6%) at night in a rotating shift system (37 in 4th Shift and 25 in 3rd Shift). The results according to age were: Group 1 = 39.41 ( $\pm$  13.27), Group 2 = 44.34 ( $\pm$  10.43), Group 3 = 42.34 ( $\pm$  14.25), and Group 4 = 49.25 ( $\pm$  12.51) ( $p$  = 0.011). For BMI, the results were: Group 1 = 24.63 ( $\pm$  6.65), Group 2 = 31.19 ( $\pm$  4.65), Group 3 = 28.87 ( $\pm$

4.99), and Group 4 = 33.49 ( $\pm$  8.56) ( $p$  < 0.001). The anxiety score was: Group 1 = 6.73 ( $\pm$  3.90), Group 2 = 10.39 ( $\pm$  5.25), Group 3 = 7.39 ( $\pm$  3.55), and Group 4 = 10.94 ( $\pm$  5.09) ( $p$  < 0.001). The depression score was: Group 1 = 4.08 ( $\pm$  3.49), Group 2 = 6.79 ( $\pm$  4.00), Group 3 = 4.14 ( $\pm$  3.11), and Group 4 = 8.06 ( $\pm$  4.82) ( $p$  < 0.001). The average hours of sleep reported were: Group 1 = 5.96 ( $\pm$  1.21), Group 2 = 5.92 ( $\pm$  1.13), Group 3 = 5.87 ( $\pm$  1.77), and Group 4 = 5.85 ( $\pm$  1.66) ( $p$  = 0.988). The PSQI score was: Group 1 = 7.95 ( $\pm$  3.29), Group 2 = 9.15 ( $\pm$  4.85), Group 3 = 9.50 ( $\pm$  4.99), and Group 4 = 11.29 ( $\pm$  4.93); ( $p$  = 0.019).

**Conclusion:** In the group studied one can see a level of anxiety and depression significantly higher in subjects with HR of OSAS, which is even greater when this condition is associated with SW. In addition, there was a reduced time spent sleeping in the entire studied group. Sleep, in general, is poor and worsens when subjects with HR of OSAS work in SW. These results suggest that the SW is associated with increased anxiety and depression, and exacerbates the negative consequences of OSAS on mental health.

**Acknowledgement:** Workers at the Felix Bulnes Hospital

<http://dx.doi.org/10.1016/j.sleep.2013.11.191>

### Hypertension and its association with shift work, sleep-disordered breathing and place in the organizational hierarchy

J. Carrillo<sup>1</sup>, I. Bastias<sup>2</sup>, P. Contreras<sup>3</sup>, D. Mistretta<sup>4</sup>, C. Vargas<sup>5</sup>

<sup>1</sup> Félix Bulnes Hospital, Sleep Studies Unit, Chile

<sup>2</sup> Félix Bulnes Hospital, Department of Medicine, Chile

<sup>3</sup> Catholic University of Chile, Sleep Medical Center, Chile

<sup>4</sup> Mayor University, Student of Medicine, Chile

<sup>5</sup> University of Santiago, Department of Mathematics and Computer Science, Chile

**Introduction:** Hypertension (HT) is a highly prevalent cardiovascular disease and a risk factor for coronary heart disease, stroke, and heart and kidney failure, among others. The obstructive sleep apnea (OSA) is a well-known causative factor of hypertension, but less known is the role of shift work systems and the place in the hierarchy of social organization. Objective: To study the risk factors associated with hypertension in a group of health workers.

**Materials and methods:** We conducted a cross-sectional study in a group of health workers, as part of an occupational health program in a public hospital in Santiago, Chile. All subjects underwent a medical evaluation, which included anthropometric parameters, blood pressure measurement, a battery of laboratory tests, and surveys of sleep by Berlin Questionnaire. According to this questionnaire went classified in Low or High Risk of OSA. According to the work schedule, the workers were classified into Daytime work, 3rd Shift, and 4th Shift; and as the plant to which they belonged within the organization in Professional, Administrative, Paramedical technician, and Auxiliary. We examined the association of hypertension with shift work, the risk of OSA, and place within the organizational hierarchy using a logistic regression model adjusted for sex, age, BMI, and smoking.

**Results:** The study group consisted of 353 workers, with an average age of 44.2  $\pm$  12.6 years (IQ = 31.8–54.7), of which 266 (75.4%) were women, and 87 (24.6%) were men. Of the total, 87 (24.6%) had hypertension. On the other hand, as the result of the Berlin Questionnaire, 151 (42.8%) had High Risk of OSA. According to the work schedule, 194 (55%) worked in daytime, and 159 (45%) were shift workers (114 in 4th Shift, and 45 in the 3rd Shift). Of the total, 44 (12.5%) were Professionals, 78 (22.1%) Administrative, 148 (41.9%) Paramedical technicians, and 83 (23.5%) Auxiliary. According to logistic regression, the 4th Shift had an OR = 2.03 (95% CI,

0.9–4.58;  $p = 0.088$ ), 3rd Shift an OR = 4.23 (95% CI, 1, 51–11.83;  $p = 0.006$ ); the trend test was significant with an OR = 2.05 (95% CI, 1.23–3.41;  $p = 0.006$ ). The High Risk of OSAS an OR = 4.1 (95% CI, 1.89–8.9;  $p < 0.001$ ). Regarding the location in the organization, the Administrative had an OR = 10.1 (95% CI, 1.76–57.88;  $p < 0.001$ ), Paramedical technicians OR = 5.55 (95% CI, 1.1–28.27;  $p = 0.039$ ), and the Auxiliary an OR = 5, 76 (95% CI, 1.11–29.86;  $p = 0.037$ ). Interactions between stratum and shift work and risk of OSA, were not significant in the multiplicative scale. The age variable reached statistical significance ( $p = 0.018$ ). The factors sex, BMI, and smoking showed no increased risk associated.

**Conclusion:** According to our results, the place within the organizational hierarchy, shift work and sleep-disordered breathing, are independent risk factors of hypertension in health workers. These results also suggest that sex, overweight and obesity, and smoking act through independent risk factors and not by themselves.

**Acknowledgements:** To health workers of Felix Bulnes Hospital.

<http://dx.doi.org/10.1016/j.sleep.2013.11.192>

### Patients' journeys to a narcolepsy diagnosis

L. Carter, C. Acebo, A. Kim

Jazz Pharmaceuticals, United States

**Introduction:** Narcolepsy is a lifelong neurologic disorder with debilitating symptoms for which no cure has been identified. Obtaining an accurate diagnosis, furthermore, is not always straightforward. A delay of 10–15 years between the onset of narcolepsy symptoms and receiving a diagnosis has been reported (Morrish et al., *Sleep Med*, 2004). This report describes results from a company-sponsored survey in which physicians provided information regarding patients and their journeys to a narcolepsy diagnosis.

**Materials and methods:** Physicians with neurology, pulmonology, or psychiatry as a primary specialty, and other specialists who were board certified in sleep medicine; who had 2–30 years of clinical experience; and who treated  $\geq 5$  narcolepsy patients per month were asked to complete up to six surveys using patient charts.

**Results:** Data from 252 patients were collected from 77 physicians. The patient sample was predominantly male (55%) and white (67%), with a median age of 37.5 years (range: 12–83) and a median BMI of 25.8 (range: 16.9–51.2). Specialists rated patients as having initial symptoms that were mild (15%), moderate (50%) or severe (35%). The most common initial symptoms were excessive daytime sleepiness (91%), trouble staying awake during the day (44%), trouble concentrating/functioning during the day (43%), fatigue or lack of energy/motivation (36%), and cataplexy (34%). Most patients completed a polysomnogram (83%), Multiple Sleep Latency Test (MSLT) (76%), and/or Epworth Sleepiness Scale (ESS) (62%). Mean sleep latency was 4.2 min (SD 2.3) and 91% of patients exhibited  $\geq 2$  sleep onset REM periods on the MSLT. Mean ESS score was 17.0 (SD 4.5). Before receiving a narcolepsy diagnosis, 60% of patients had been misdiagnosed with disorders including depression (31%), insomnia (18%), and/or obstructive sleep apnea (13%), and at least half of the patients saw  $\geq 2$  providers (range: 1–10). The median time from initial patient report of symptoms to diagnosis was 22 months (range: 0–126); 17.9% of patients had a diagnostic delay  $> 5$  years.

**Conclusion:** In this study, at least half of the patients' journeys to a narcolepsy diagnosis took nearly two years and required evaluation by multiple physicians. This occurred despite most patients (85%) suffering from moderate to severe symptoms. Taken together, these data highlight the need for increased awareness and timely diagnosis of the signs and symptoms of narcolepsy.

**Acknowledgements:** Chart survey support was provided by Jazz Pharmaceuticals.

<http://dx.doi.org/10.1016/j.sleep.2013.11.193>

### Osteotomy guides and customised osteosynthesis plaques made with CAD–CAM and rapid prototyping technology in the skeletal surgical treatment of severe OSA

J. Brunso<sup>1</sup>, J. Amilibia<sup>2</sup>, V. Cabriada<sup>2</sup>, J.A. Municio<sup>3</sup>, J. Gimeno<sup>4</sup>, J. Santamaria<sup>1</sup>

<sup>1</sup>Osakidetza, Cruces University Hospital, Maxillofacial Surgery, Spain

<sup>2</sup>Osakidetza, Cruces University Hospital, Neumology, Spain

<sup>3</sup>Osakidetza, Cruces University Hospital, Otorhinolaryngology, Spain

<sup>4</sup>Createch Medical, Spain

**Introduction:** Skeletal corrective surgery for severe OSA requires a large advancement of the maxillary and an exhaustive planning. We present the results of an improvement in surgical technique and planning in which digital 3D technology has been used as well as CAD–CAM and rapid prototyping for greater precision and safety.

**Materials and methods:** We present 5 cases of skeletal correction of severe OSA, in which a custom osteosynthesis system designed with CAD–CAM technology was used. After digital 3D surgical planning, we have obtained the STL files that have allowed the design of an osteosynthesis system adapted to the patient's skeletal surface. The use of biocompatible cutting guides allowed planning reproducibility.

**Results:** In the 5 cases planned objectives were achieved. Customised plates allowed a good fit of the facial buttresses, without altering the characteristics of the titanium and offering maximum stability, precision and safety compared to conventional osteosynthesis systems. The biggest drawbacks were planning times, manufacturing and cost, as well as the limitations of the 3D planning programs. A comprehensive study and an accurate reproduction of the expected movements by the surgeon are required, especially in occlusal plane change. In all the cases it was possible to reduce the Apnea-Hypopnea Index below 10, improve sleep architecture and reduce daytime sleepiness.

**Conclusion:** A significant proportion of patients with severe OSA probably have skeletal anomalies, especially young people. In severe OSA skeletal surgery may be an alternative to conservative medical treatment in selected cases. Customized systems can offer a very high level of accuracy, stability and safety.

**Acknowledgements:** Dr. Jose Amilibia, Dr. Valentin Cabriada, Dr. Jose Antonio Municio, Dr. Joseba Santamaria.

<http://dx.doi.org/10.1016/j.sleep.2013.11.194>



## Abstracts for the 5th World Congress on Sleep Medicine, 28 September to 2 October 2013, Valencia, Spain

### Sleeping disorders related with alterations of melatonin secretion circadian rhythm

I. Pitarch Castellano<sup>1</sup>, F. Puertas Cuesta<sup>2</sup>, A. Perez Pitarch<sup>3</sup>

<sup>1</sup>Servicio de Neuropediatría, Hospital Universitario y Politécnico la Fe, Spain

<sup>2</sup>Unidad del Sueño, Hospital Universitario la Ribera, Spain

<sup>3</sup>Servicio de Farmacia, Hospital Clínico Universitario, Spain

**Introduction:** Several circadian rhythms have been used as indicators of the endogenous circadian pacemaker phase, but circadian rhythm of pineal melatonin secretion has been proved to be the indicator that most exactly describes the function of the suprachiasmatic nucleus. Dim Light Melatonin Onset (DLMO) determination is the only marker available of circadian rhythm pacemaker phase. This determination requires 5 blood, saliva or urine samples. DLMO test is a precise tool used to distinguish between sleep disorder patients with or without a subjacent alteration of circadian rhythm.

**Materials and methods:** A sample ( $N = 146$ ) of 6–11 year old patients (65.75% men and 34.25% women) was selected. 730 determinations of salivary melatonin were carried out (5 per subject). Suitable samples were centrifuged 10 min to remove particulate material and frozen at  $-70^{\circ}\text{C}$  until analysis. Quantitative determination of melatonin was performed by a direct non-extraction ELISA assay using DSX analyser. DLMO levels for each patient were determined and were then classified as normal or altered. Patients were also subjected to the Paediatric Sleep Questionnaire of Chervin for Sleep disorder diagnosis. Statistical analysis was carried to evaluate the null hypothesis against the alternative hypothesis ( $H_0$ : DLMO is not related with sleeping disorders;  $H_1$ : a relation exists between DLMO and sleeping disorders).

**Results:** Statistical analysis of DLMO difference between patients with and without sleeping disorders led the following results: Excessive daytime sleepiness ( $p$ -value 0.5789), Respiratory disorder related with sleep ( $p$ -value 0.8649), Bruxism ( $p$ -value 0.5866), Enuresis ( $p$ -value 0.0138), sleepwalking ( $p$ -value 0.7443), nightmares ( $p$ -value 0.4822), night terrors ( $p$ -value 0.9695), rhythmic movement disorders ( $p$ -value 0.5951), Insomnia ( $p$ -value 0.0014), Somnolquy ( $p$ -value 0.0178), Arousals ( $p$ -value 0.0001), Sleep start delay ( $p$ -value 0.0166), Sleep latency ( $p$ -value 0.0123), Bed-time resistance ( $p$ -value 0.4209), Awakening and Bedtime irregularity ( $p$ -value 0.5138).

**Conclusion:** The following sleeping disorders proved to have a significant relation with DLMO levels ( $p < 0.05$ ): enuresis, somnolquy, insomnia, arousals, sleep start delay and sleep latency.

**Acknowledgements:** Hospital Universitario de la Ribera for the trust placed in researchers and in the present study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.196>

### Salivary determination of dim light melatonin onset as a tool in attention deficit hyperactivity disorder diagnosis

I. Pitarch Castellano<sup>1</sup>, F. Puertas Cuesta<sup>2</sup>, A. Perez Pitarch<sup>3</sup>

<sup>1</sup>Servicio de Neuropediatría, Hospital Universitario y Politécnico la Fe, Spain

<sup>2</sup>Unidad del Sueño, Hospital Universitario de la Ribera, Spain

<sup>3</sup>Servicio de Farmacia, Hospital Clínico Universitario, Spain

**Introduction:** Attention Deficit Hyperactivity Disorder (ADHD) has an estimated worldwide prevalence of 5.29%. Prevalence is estimated to be 6.48% (4.62–8.35) in children population and 2.74% (2.04–3.45) in adolescents. Biochemical, neuroimaging or electrophysiological tests are not available as confirmatory tools for ADHD clinical diagnosis. The aim of the present study is to determine if ADHA children show alterations of melatonin circadian rhythm by means of Dim Light Melatonin Onset (DLMO) salivary determination and to evaluate the suitability of this test as a tool in ADHD diagnosis.

**Materials and methods:** A sample ( $N = 146$ ) of 6–11 year old patients (98 ADHD children and 48 healthy controls) was selected and 730 determinations of salivary melatonin were carried out (5 per subject). Suitable samples were centrifuged 10 min to remove particulate material and frozen at  $-70^{\circ}\text{C}$  until analysis. Quantitative determination of melatonin was performed by a direct non-extraction ELISA assay using DSX analyser. DLMO levels for each patient were determined and were then classified as normal or altered (advanced, delayed and irregular). Detection of melatonin circadian secretion alterations was compared between groups by means of statistical analysis.

**Results:** The following parameter were calculated: Odds (ADHD/ no DLMO level disorder) = 1.36; Odds (ADHD/ DLMO level disorder) = 34.00; OR = 25.0 ( $p = 0.0018$ ); CI 95% (OR) = [3.3; 189.0]. DLMO determination as a test for ADHD detection had a SENSIBILITY of 34.69%, a SPECIFICITY of 97.92%, a positive predictive value (PPV) of 53.57% and a negative predictive value (NPV) of 95.58%.

**Conclusion:** Salivary determination of DLMO cannot be considered as a screening tool due to the low sensibility in disorder detection but can be a useful confirmatory test in ADHD diagnosis. The high specificity of the proposed test makes it suitable for false positive diagnosis prevention.

**Acknowledgements:** Participating children of the study and their parents for the selfless collaboration without which research studies such as this one would not be possible.

<http://dx.doi.org/10.1016/j.sleep.2013.11.197>

### Hypopnea-dominant sleep-disordered breathing in extreme obesity

R. Castriotta, R. Mathew

University of Texas Medical School at Houston, United States

**Introduction:** There appears to be a difference in the pathophysiological development of dynamic upper airway obstruction manifested as hypopneas in contrast to the static obstruction of apneas. We designed a study to test the hypothesis that extremely obese patients manifest sleep-disordered breathing predominantly as hypopneas with very few apneas.

**Materials and methods:** We performed a retrospective review of the data of 90 adults with obstructive sleep apnea-hypopnea syndrome (OSAHS), and assigned them to one of two groups. Group B had a body mass index (BMI)  $\geq 45$  kg/m<sup>2</sup>, while Group A had a BMI  $< 35$  kg/m<sup>2</sup>, matched for age and gender with Group B. We excluded all those with age  $< 18$  years, pregnancy, BMI  $\geq 35 < 45$  kg/m<sup>2</sup> and those with  $\geq 5$  central apneas/h. The primary outcome measure was the hypopnea/apnea ratio (HAR). The secondary measures were obstructive apnea-hypopnea index (AHI), obstructive and central apnea indices, hypopnea index, oxygen saturation (SpO<sub>2</sub>) nadir, end-tidal carbon dioxide tension (PetCO<sub>2</sub>), and presence or absence of obesity-hypoventilation syndrome (OHS). Data were analyzed with *t*-test for independent samples, and results expressed as group mean  $\pm$  standard deviation, with  $p < 0.05$  considered significant.

**Results:** There were 45 subjects in each group. The mean age was  $50.6 \pm 11.5$  years in Group A and  $47.4 \pm 12.7$  years in Group B. The mean BMI was  $28.9 \pm 4$  kg/m<sup>2</sup> in Group A and  $54.5 \pm 8$  kg/m<sup>2</sup> in Group B. There were 15 patients with OHS, 4 in Group A and 11 in Group B. The HAR was significantly higher in the extremely obese Group B ( $38.8 \pm 50.7$ ) compared to Group A ( $10.6 \pm 16.5$ ),  $p = 0.0008$ , as was the hypopnea index ( $28.7 \pm 28.6$  in Group B vs  $12.6 \pm 8.4$  in Group A,  $p = 0.0005$ ) and AHI ( $35.5 \pm 33.8$  vs  $22 \pm 23$ ,  $p = 0.03$ ), but not the apnea index ( $11.2 \pm 23.5$  in Group A and  $6.7 \pm 13.6$  in Group B,  $p = 0.25$ ). The SpO<sub>2</sub> nadir was lower in Group B ( $79.1 \pm 7.1\%$  vs  $83.1 \pm 6.7\%$ ,  $p = 0.007$ ). There were no significant differences in sleep capnometry or sleep architecture. The HAR was higher in Group B regardless of gender, race or presence of OHS. There were no significant differences in HAR between OHS and non-OHS subjects, even when matched for BMI. The difference in HAR between Groups A and B was more robust in men than in women.

**Conclusion:** Sleep-disordered breathing in extremely obese (BMI  $\geq 45$  kg/m<sup>2</sup>) subjects is manifested predominantly by hypopneas rather than apneas. This suggests a different pathophysiology, with implications for potential directed treatment modalities.

<http://dx.doi.org/10.1016/j.sleep.2013.11.198>

### Repercussion of sleep quality and daytime sleepiness on postural steadiness in menopausal women

L. Cerón-Lorente, B. Gallego-Ariza, I. Cabrera-Martos,

M. Badillo-Fontalvo, S. Mateos-Toset, M. Valenza

University of Granada, Department of Physical Therapy, Spain

**Introduction:** Changes on perceived sleep quality are recognized to impact severely on functionality. They have been reported to be increased in women menopause period. This study investigates whether poor sleep quality and daytime sleepiness in a midlife women sample are associated with postural steadiness.

**Materials and methods:** The sample comprises 112 women aged 51–69 characterized for being in the menopause period. Data were obtained from the participants during two laboratory assessment

separated by no more than one week. Sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI) and the daytime sleepiness with the Epworth Sleepiness Scale. Postural steadiness was measured according to different test scores: one leg stance test, Minibest test battery and dual task Timed up & Go Test (TUG) combined with manual and cognitive tasks. The relationship between sleep quality, sleepiness and postural steadiness were assessed by lineal correlations between these variables.

**Results:** Global PSQI score was linked significantly with TUG results ( $r: 0.488$ ,  $p < 0.001$ ). Sleep disturbances score ( $0.365$ ,  $0.425$ ,  $p < 0.001$ ), sleep duration ( $0.290$ ,  $0.267$ ,  $p < 0.001$ ) and sleep efficiency ( $0.263$ ,  $0.327$ ,  $p < 0.001$ ) were linked to lower values in cognitive and manual tasks added to TUG, respectively. Results in Minibest test showed no relationship with global PSQI score ( $0.269$ ,  $p = 193$ ).

**Conclusion:** There is a relationship between poor subjective quality of sleep and postural steadiness disturbances in menopausal women. Sleep quality disorders should be taken into account in this population because they are very prevalent and they play an important role in functionality.

<http://dx.doi.org/10.1016/j.sleep.2013.11.199>

### Sleep disturbances and manual dexterity in fibromyalgia

L. Cerón-Lorente, M. Badillo-Fontalvo, I. Cabrera-Martos,

I. Torres-Sánchez, B. Gallego-Ariza, M. Valenza

University of Granada, Department of Physical Therapy, Spain

**Introduction:** Manual dexterity involves fine motor movements being a key point in activities of daily life. To our knowledge, no studies have explored the impact of quality of sleep on manual dexterity in women with fibromyalgia syndrome. The purpose of this study was to assess the relationship between perceived sleep disturbances and manual dexterity in women with this condition and to correlate participants' dexterity punctuation with their quality of sleep.

**Materials and methods:** 34 women with fibromyalgia syndrome were recruited from a local association. Clinical and anthropometric measures were collected for all the women including age and body mass index. The clinical variables were evaluated using these questionnaires: the Fibromyalgia Impact Questionnaire (FIQ), the McGill Pain Questionnaire and the Hospital Anxiety and Depression Scale (HAD). Subjective sleep quality was measured using the Pittsburgh Sleep Quality Index and manual dexterity was assessed using a sensory-motor ability task included in the Chessington Occupational therapy Neurological Assessment Battery (COTNAB). It measures the stereognosis, coordination and dexterity using one-hand and both. Descriptive statistical analysis was performance. Each subscale of the PSQI was correlated with the different subareas of the COTNAB task.

**Results:** The mean age of the sample was  $53.2 \pm 7.95$  years old and they had a BMI value of  $29.11 \pm 6.13$ . The FIQ showed  $69.00 \pm 12.75$ . They reported a high punctuation in pain according to McGill Pain Questionnaire. They also showed high levels of anxiety and depression. Regarding to quality of sleep and manual dexterity in the women included in this study with this specific clinical profile, a significant correlation ( $p < 0.001$ ) was found between the total sleep quality. The most important subscales affecting the dexterity were the latency and duration of the sleep.

**Conclusion:** It was found a significant relationship between perceived quality of sleep and manual dexterity. These results suggest that further studies should focus on physical intervention improving the quality of sleep in order to study the repercussion on manual dexterity.

<http://dx.doi.org/10.1016/j.sleep.2013.11.200>

### Mechanism of sudden cardiac death in obstructive sleep apnea, revisited

A. Chan<sup>1</sup>, N. Antonio<sup>2</sup>

<sup>1</sup>Chanwell Clinic Institute for Heart & Sleep Disorders, Stanford University School of Medicine (1993–2012), United States

<sup>2</sup>Chanwell Clinic Institute for Heart & Sleep Disorders, United States

**Introduction:** Obstructive sleep apnea (OSA) raises the risk of sudden cardiac death (SCD) by 300–400% depending on the severity of OSA. However published reports raised the association between OSA and SCD but not the mechanism of SCD. It is known that OSA exerts profound oxidative stress in the cardiovascular system. Repetitive nocturnal hypoxemia and arousals lead to ischemia reperfusion, cellular degeneration, and apoptosis, cardiac remodeling such as diastolic and systolic dysfunctions; which provide fertile environment for reentrant arrhythmias. Increase temporal dispersion in myocardial depolarization has been shown to enhance the genesis of malignant arrhythmias that in turn raise sudden death risk. We postulated that OSA leads to higher incidence of SCD due to reentrant arrhythmias initiated by ventricular extrasystoles that excite myocardial fibers at the height of its vulnerable period, reentrant beats trigger runs of ventricular tachycardia and ventricular fibrillation.

**Materials and methods:** We deployed microvolt T-wave alternans (MTWA) as a tool to measure myocardial vulnerability. We attempted to determine if OSA leads to higher incidence of positive microvolt T-wave alternans (MTWA+); thus higher risk for arrhythmic death; and correlated MTWA result with severity of OSA as measured by apnea hypopnea index (AHI). 201 (M/F 1.1/1) patients with OSA of varying severity underwent MTWA in a random manner. We segmented the patients into MTWA positive (MTWA+), MTWA Indeterminate (MTWAI), MTWA negative (MTWA-). We then analyzed the MTWA result in relation to AHI. It has been shown that MTWA+ and MTWAI patients have higher risk of SCD usually from ischemia and cardiomyopathy.

**Results:** There was a higher incidence of MTWA+ ( $p$ -value < 0.004) and MTWAI ( $p$ -value < 0.001) in severe OSA “AHI 30–50” and unusually severe OSA “AHI >50” MTWA+ ( $p$ -value < 0.003), MTWAI ( $p$ -value < 0.001 respectively). These two subgroups of OSA could be at higher risk for arrhythmic deaths since MTWA+ and MTWAI patients have higher mortality rate from malignant arrhythmias than MTWA-.

**Conclusion:** The severity of OSA is directly proportional to the incidence of MTWA positive (MTWA+) and MTWA indeterminate test (MTWAI). Severe and unusually severe OSA patients could be at higher risk of arrhythmic death than milder OSA as measured by MTWA.

**Acknowledgements:** Cambridge Heart sold the equipment and supplies to Chanwell Clinic in the performance of MTWA test.

<http://dx.doi.org/10.1016/j.sleep.2013.11.201>

### Impact of continuous positive airway pressure (CPAP) on chronic cough in obstructive sleep apnoea (OSA) – A randomized controlled trial

K. Chan<sup>1</sup>, G. Cossa<sup>2</sup>, S. Birring<sup>3</sup>, L. Laks<sup>4</sup>, A. Ing<sup>4</sup>

<sup>1</sup>Department of Respiratory Medicine, Campbelltown Hospital, University of Sydney, Australia

<sup>2</sup>Respiratory Investigation Unit, Concord Repatriation General Hospital, Australia

<sup>3</sup>Department of Respiratory Medicine, King's College Hospital, Australia

<sup>4</sup>Department of Thoracic Medicine, Concord Repatriation General Hospital, University of Sydney, Australia

**Introduction:** Recent studies have suggested that chronic cough is prevalent in patients with sleep-disordered breathing (SDB). We investigated the effect of continuous positive airway pressure (CPAP) on cough in patients with obstructive sleep apnoea (OSA) and chronic cough in a randomised controlled trial.

**Materials and methods:** 22 consecutive patients with OSA confirmed on polysomnography (respiratory disturbance index (RDI) >15/h) and chronic cough >2 months were recruited. All patients underwent a CPAP titration study. 1 patient did not tolerate CPAP. 21 Patients were randomised to receive sham CPAP (4 cm H<sub>2</sub>O) or CPAP at pressures determined by the titration study for 1 month. The primary outcomes were objective 24-h cough count via the Leicester Cough Monitor (LCM), subjective cough severity via the visual analogue scale (VAS) and cough related quality of life via the Leicester Cough Questionnaire (LCQ).

**Results:** 13 (7 males) patients received sham CPAP and 8 (6 males) received titrated CPAP. There were no significant differences between groups [sham vs CPAP mean (SD)] in age [54.5 (2.8) years vs 59.9 (5.2) years,  $p$  = 0.34], BMI [37.4 (1.9) vs 32.5 (1.3),  $p$  = 0.08], RDI [41.5 (7.4) vs 36.5 (6.7),  $p$  = 0.65], baseline 24-h cough count [302.9 (66.0) vs 257.4 (57.5),  $p$  = 0.64], VAS [56.9 (6.9) vs 54.3 (6.7), in mm] and LCQ score [14.0 (1.0) vs 14.3 (1.3)]. After 1 month there were no significant changes in 24-h cough count in the sham CPAP group [−93.9 (222.2),  $p$  = 0.15] but there was significant improvement in the titrated CPAP group [−192.6 (162.1),  $p$  = 0.01]. There were no significant changes in VAS in the sham CPAP group [−9.9 (28.5),  $p$  = 0.25] but there was significant improvement in the titrated CPAP group [−26.75 (31.9),  $p$  = 0.05]. There were no significant changes in LCQ in the sham CPAP group [−0.50 (5.0),  $p$  = 0.73] or titrated CPAP group [−1.47 (5.1),  $p$  = 0.44].

**Conclusion:** CPAP may reduce objective and subjective cough severity in patients with cough associated with OSA.

**Acknowledgements:** University of Western Sydney.

<http://dx.doi.org/10.1016/j.sleep.2013.11.202>

### Chan score predicts presence and severity of sleep apnea at the bedside before polysomnogram sleep test

M. Chan<sup>1</sup>, A. Chan<sup>2</sup>, A. Ly<sup>2</sup>, N. Lim<sup>2</sup>

<sup>1</sup>Internal Medicine, Yale New Hospital, United States

<sup>2</sup>Chanwell Clinic Institute for Heart & Sleep Disorders, United States

**Introduction:** Obstructive sleep apnea–hypopnea (OSAH) increases the risk for metabolic syndrome, heart failure, myocardial infarction, stroke, sudden cardiac death and vehicular accidents. In spite of the wide prevalence of OSAH, physicians often miss the signs and symptoms of OSAH, thus a large number of undiagnosed patients remain at great risks. Furthermore, most effective methods of diagnosing OSAH or identifying its symptoms require the observation of a sleep technician, an overnight in-lab polysomnogram, and/or a portable home sleep-monitor which can be both costly and time consuming. As a result, we devised a method of predicting OSAH by assigning weighted numerical values that considers a patient's age, history of snoring, Epworth Sleepiness Scale (ESS), body mass index (BMI), and upper airway structure (Mallampati classification). Purpose: To predict the presence and severity of OSAH (in the form of an AHI

category) with a multilateral bedside scoring system wherein physicians with no training in sleep medicine may be able to use in order to enhance the awareness of OSAH and expedite referrals to sleep medicine specialists and sleep laboratories.

**Materials and methods:** Given known correlations of snoring, body mass index (BMI), Epworth Sleepiness Scale (ESS), Mallampati classification, and age with OSAH, we assigned simplified weighted values to the listed variable factors.

The total Chan score is the sum of the weighted values that corresponds to each variable. Analyses of 315 patients (Male:Female – 175:140), picked at random with scored in-lab polysomnograms, were retrospectively correlated to individual factors and used to optimize the weighting of the Chan score. Ordinal regression analyses were carefully executed using AHI-categories (1 – AHI <5, 2 – AHI 5–14.99, 3 – AHI 15–29.99, 4 – AHI 30–49.99, 5 – AHI ≥50) to obtain values for interpretation.

**Results:** We found that Age, ESS, Mallampati classification, BMI, and Snoring when analyzed individually proved to have less statistical significance in ordinal regression using AHI-categories (Age:  $p$ -value < 0.00001, ESS:  $p$ -value = 0.10, Mallampati:  $p$ -value = 0.007, Snoring:  $p$ -value = 0.02, BMI:  $p$ -value < 0.00001) than the multilateral Chan score ( $p$ -value < 0.000000001) which accurately predicted over 50% of the population's AHI-category (1–5) exactly, and diagnosed over 80% of the population's OSAH.

**Conclusion:** Our scoring system, Chan score, predicts the presence and severity of OSAH at the bedside and correlated remarkably well with polysomnogram results. It is a simple, valuable clinical tool for physicians, who may have no training in Sleep Medicine, to quickly identify patients who may have OSAH and predict its severity.

**Acknowledgements:** ROSALIA CABE, RPSGT for scoring the sleep tests.

<http://dx.doi.org/10.1016/j.sleep.2013.11.203>

### Compliance with nasal continuous positive airway pressure (cpap) in epilepsy and obstructive sleep apnea

C. Cheng<sup>1</sup>, V. Chiang<sup>2</sup>, M. Bernbaum<sup>1</sup>, E. Koziorynska<sup>3</sup>, A. Rodriguez<sup>4</sup>

<sup>1</sup> Department of Neurology, NYU School of Medicine, United States

<sup>2</sup> NYU School of Medicine, United States

<sup>3</sup> Department of Neurology, SUNY Downstate Medical Center, United States

<sup>4</sup> Department of Neurology, NYU School of Medicine, New York Sleep Institute, United States

**Introduction:** Obstructive sleep apnea (OSA) is prevalent in nearly a third of patients with epilepsy. Treatment with Continuous Positive Airway pressure (CPAP) is associated with improvement in seizure control. However, CPAP is often difficult to tolerate for various reasons, and it has been suggested that noncompliant patients with epilepsy and OSA are at higher risk of recurrent seizures than are CPAP-compliant patients. Our objective is to determine short-term compliance, which predicts long-term adherence, to CPAP therapy in patients with OSA and epilepsy.

**Materials and methods:** We retrospectively identified patients with moderate to severe OSA (AHI ≥15) started on nasal CPAP between 2012–2013 at the New York Sleep Institute. We divided them into OSA-only (control) and epilepsy–OSA groups. Patients with history of non-epileptic seizures, poor compliance with anti-epileptic drugs, greater than ten seizures a day, diagnosis of epilepsy within the past six months, a significant history of medical, psychiatric or substance abuse, or a two month compliance rate of less than ten percent were excluded. CPAP compliance (defined as percent of days with greater

than 4 h usage) was obtained via a monitoring card within the CPAP system.

**Results:** Sixty-five epilepsy patients were identified, forty-one (65%) of which were diagnosed with concomitant OSA. Thirty-two patients from the control group and fourteen epilepsy patients met inclusion criteria. Mean age was 50.7 and 60.4 ( $p = 0.018$ ), BMI was 32.3 and 32.4 ( $p = 0.48$ ), Epworth Sleepiness Scale was 8.4 and 9.8 ( $p = 0.23$ ), spontaneous arousal index 10.0 and 7.7 ( $p = 0.19$ ), sleep efficiency was 80.7% and 78.7% ( $p = 0.35$ ), optimal CPAP pressure was 11.4 and 10.6 cm H<sub>2</sub>O ( $p = 0.22$ ), and AHI 30.2 and 41.0 ( $p = 0.075$ ), in the epilepsy–OSA and OSA-only groups, respectively. One month compliance rates were 65.7% in epilepsy patients and 78.3% in the control group ( $p = 0.038$ ), and 2 month compliance rates were 68.3% and 71.5%, respectively ( $p = 0.33$ ).

**Conclusion:** Short-term compliance rates were decreased in epilepsy patients with concomitant OSA, most notably within the first month after beginning CPAP. This study demonstrates the importance of providing early and aggressive support, in this particularly vulnerable group.

**Acknowledgements:** We thank the staff at New York Sleep Institute for their dedication and support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.204>

### Using cyclic alternating pattern as a marker for cpap treatment in patients with obstructive sleep apnea

C. Chen<sup>1</sup>, C. Lin<sup>1</sup>, C. Lin<sup>2</sup>, M. Lo<sup>2</sup>, C. Lai<sup>1</sup>

<sup>1</sup> Shin Kong Wu Ho-Su Memorial Hospital, Sleep Center, Taiwan

<sup>2</sup> National Central University, Center for Adaptive Data Analysis, Taiwan

**Introduction:** Adequate flow support without oxygen desaturation is the main goal during titration test for continuous positive pressure support (CPAP). In addition to hypopnea or apnea, evidence has shown that correction of flow limitation without dropping of oxygen can improve the outcome of treatment for patients. However, mild flow limitation is hard to differentiate from normal flow. Cyclic alternating pattern (CAP) has been proposed to assess the stability of sleep which can be compromised in subjects with upper airway resistance syndrome or snoring. We hypothesized that CAP is also an important marker for determining optimal level of pressure during CPAP titration test.

**Materials and methods:** The patients with severe obstructive sleep apnea (OSA) starting CPAP treatment after the titration test were screened and the levels of pressure of CPAP in the patients were re-evaluated annually for two years. For the patients with successful treatment (e.g. lowering the CPAP pressure) in first reevaluation, they were enrolled to the study. After the second-year reevaluation, those patients were subdivided into relapse and success groups. Conventional parameters including sleep efficiency, respiratory disturbance index (RDI), ratio of NREM stage 3 sleep, ratio of REM sleep, arousal index as well as alternative parameter, CAP rate, of those patients were calculated.

**Results:** There were totally 23 subjects ( $N = 10$  for relapse and  $N = 13$  for success groups) recruited in this study. The age and body mass index did not differ between relapse and success groups during baseline ( $p > 0.05$ ). All of the parameters were significantly improved after CPAP treatment for 1 year ( $p < 0.05$ ) compared to baseline. While other conventional parameters showed no differences between relapse and success groups, CAP rate was significantly higher in relapse group ( $29.7 \pm 21.6$  vs  $14.2 \pm 14.8$ ,  $p = 0.036$ ).

**Conclusion:** Although the apnea and hypopnea events were significantly improved after CPAP treatment, some episodes of mild degree flow limitation might not be fully treated which

consequently cause micro-arousal during sleep. CAP rate could be used as a complementary marker to monitor the effect of treatment in addition to merely identifying desaturation or arousal by the conventional parameters.

<http://dx.doi.org/10.1016/j.sleep.2013.11.205>

### Effect of induced hypoglycemia on sleep-waking cycle in rats

E. Chijavadze, M. Babilodze, O. Mchedlidze, E. Chkhartishvili, N. Nachkebia

Lab. Neurobiology of Sleep-Wakefulness Cycle, I. Beritashvili Center of Experimental Biomedicine, Georgia

**Introduction:** Relation between sleep disorders and a risk for diabetes has presently been an issue of intensive debate. To unveil neurophysiological mechanisms of interaction between disturbance of sleep-waking cycle (SWC) and blood glucose level it is necessary to ascertain how this change affects SWC. Among other changes in the central nervous system functional state of metabolic genesis it is hypoglycemia that most commonly occurs in diabetes as well as in other diseases. Hypoglycemia is a set of symptoms that as a rule develops within a short time and is characterized by a number of features. One of the pronounced manifestations of hypoglycemia is a paroxysmal fit of drowsiness that differs from a typical pattern of hypoglycemic coma.

**Materials and methods:** Experiments were carried out on out bred albino rats. Hypoglycemia was produced by i.p. administration of Humulin, which has a short duration of action and with light deprivation method proposed by us causing more stable hypoglycemia. Blood glucose level was measured in controls and after procedures mentioned above. EEG recordings of SWC were made for 12 h.

**Results:** In the case of blood glucose level reduction obtained by both methods rats rendered more inert and less aggressive. Analysis of 12-h SWC dynamics in hypoglycemic rats has shown: 1. Latency of paradoxical sleep (PS) onset compared to baseline was reduced at the expense of change in the phase distribution – a considerable rise in deep slow-wave sleep (DSWS) and reduction of light slow-wave sleep and wakefulness. 2. Total time of various SWC phases did not alter substantially. However SWC 12-h dynamics was altered. The highest content of DSWS was observed from 9–11 am not followed by PS increase and the highest content of PS (13–15 pm) hypoglycemic hyper-somnia, occurred due to a rise of PS onset. These “peaks” coincided with the least concentration of blood glucose. At this time EEG showed high-amplitude activity. 3. Frequency of PS onset was increased. 4. Amount of self-deprived PS compared to baseline remained unchanged. 5. DSWS fragmentation was considerably reduced.

**Conclusion:** The present findings suggest possibility of using the animals with artificial blood glucose deficit as a model for hypoglycemic states while managing some problems of SWC disorders.

**Acknowledgements:** Supported by International Science and Technology Center in Moscow Grant G-391.

<http://dx.doi.org/10.1016/j.sleep.2013.11.206>

### Sleep architecture in patients with sleep apnea syndrome before CPAP therapy and at the background of CPAP

A. Chikadze<sup>1</sup>, L. Khuchua<sup>1</sup>, J. Burduladze<sup>2</sup>, M. Jibladze<sup>1</sup>, T. Chikadze<sup>1</sup>, R. Shakarishvili<sup>1</sup>

<sup>1</sup> P. Sarajishvili Institute of Neurology, Georgia

<sup>2</sup> Scientific Research Institute of Clinical Medicine, Georgia

**Introduction:** The syndrome of sleep apnea appears to be one of the most prevalent forms of sleep disorders. The goal of the research was to study the peculiarities of sleep architecture in patients with the syndrome of sleep apnea before CPAP therapy and at the background of CPA.

**Materials and methods:** The investigations were carried out at P. Sarajishvili Institute of Neurology. A total of 17 patients, ages 28–65, with sleep apnea were examined, including 15 men and 2 women. All patients completed the a questionnaire for their Epworth Sleepiness Score and their MBI was determined. For differential diagnostics of sleep apnea a polysomnography investigations (PSG) was carried out using Dr. Sagura Medizintechnik P59 polygraph accompanied by full video synchronized recording. For CPAP therapy the IntelliPAP AutoAdjust Travel CPAP Machine with SmartFlex (Manufactured by DeVilbiss) was used.

**Results:** According to the questionnaire all the patients have a high rate of night sleep disorders. Epworth Sleepiness Score (20–22, maximum 24) and body mass index (BMI) overall maximum (31–45 > 31). The patients were characterized by night sleep disorder, loud snoring, headache, apathy, problems concentrating, excess daytime sleep. PSG investigation has shown that the patients with both obstructive sleep apnea (OSA) (14) and central sleep apnea (3) are characterized by significant decrease in sleep architecture, which results in full absence of the II stage of sleep (superficial sleep), the increase of REM stage, frequent EEG and EMG awakenings, and by the fragmentation of sleep as a whole. It should be noted that a separate part of OSA patients (both women and men) was characterized by clearly expressed REM behavioral disorders. Central sleep apnea was characterized by relatively low index of snoring (SI) (80–120) and relatively high indices of the saturation (SP02) (87–93) in cases of obstructive sleep apnea (SI > 200, SP02-(36–91)). At the background of CPAP therapy the first significant effect was received after 2 h resulting in the regulation of respiration and snore index. The progressive increase of SP02 was within the limits of 92–95%. Sleep architecture considerably changed, EEG and EMG awakenings sharply decreased, NREM stages increased, in rare cases when NREM3 stage was noted, sleep fragmentation significantly decreased.

**Conclusion:** Thus, SA (both CSA and OSA) is characterized by significant disorder of sleep architecture. At the background of CPAP therapy a significant improvement of sleep architecture and the regulation of symptomocomplex characteristics of sleep apnea take place.

**Acknowledgements:** Dr. Sagura Medizintechnik.

<http://dx.doi.org/10.1016/j.sleep.2013.11.207>

### Sleep apnea and sexual dysfunction

J. Cho<sup>1</sup>, D. Kim<sup>1</sup>, K. Ki Kim<sup>2</sup>

<sup>1</sup> Pusan National University Yangsan Hospital, Department of Neurology, Republic of Korea

<sup>2</sup> Department of Neurology, Dongguk University Ilsan Hospital, Republic of Korea

**Introduction:** Obstructive sleep apnea (OSA) is associated with various health-related consequences. Recently, erectile dysfunction (ED) and other sexual dysfunction in men have been shown to associate with snoring and sleep apnea. However, it is still unknown what factors of sleep apnea produce sexual problems.

**Materials and methods:** Data collected from 62 male patients undergoing in-lab polysomnography for suspected snoring or sleep apnea. Sexual function was assessed by 15-item International Index of Erectile Function (IIEF-15) questionnaire. IIEF-15 has five sub domains: erectile function, intercourse satisfaction, orgasmic

function, sexual desire, and overall satisfaction. We compared each sub domain and total scores between severe (AHI >30,  $n = 30$ ) and mild-to-moderate ( $5 < \text{AHI} < 30$ ,  $n = 32$ ) OSA groups.

**Results:** 40% of all OSA patients had good sexual function (total score 60–75) and 25% had poor function (score 5–43). ED (<25) was present in 60% of patients with severe group, and 35% of patients with mild-to-moderate group, although these groups are almost same ages (45.5 vs 44.6). Severe OSA group had more general sexual dysfunction comparing to mild-to-moderate group (45.6 vs 50). Similar results were obtained for each sub domains. severe OSA group got lower score than mild-to-moderate group.

**Conclusion:** Erectile dysfunction and sexual dysfunction were prevalent in Korean OSA patients. Severe OSA group got lesser score for sexual function than mild-to-moderate OSA group, suggesting that severe OSA with high AHI is related with sexual dysfunction.

**Acknowledgements:** The Author declare that there is no conflict of interest.

<http://dx.doi.org/10.1016/j.sleep.2013.11.208>

### Relationships between sleep and headache in non-clinical population

S. Cho<sup>1</sup>, C. Yun<sup>1</sup>, S. Park<sup>1</sup>, M. Chu<sup>2</sup>

<sup>1</sup> Department of Neurology, Seoul National University of Bundang Hospital, Republic of Korea

<sup>2</sup> Department of Neurology, Hallym University College of Medicine, Republic of Korea

**Introduction:** The relationship between sleep and headache has been documented over a century. Migraine significantly impairs daytime function, it has been demonstrated to be associated with poor sleep quality in cross-sectional study of small clinical population. In this study, we aimed to explore evaluate the association of migraine and non-migrainous headache with sleep in the general population.

**Materials and methods:** A total of 2886 Korean general population were recruited, and they filled out the questionnaires after instructions of interviewer. The questionnaires included questions related sleep parameters involving Bedtime, Risettime, Mid sleep time, total sleep time, Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI) and Epworth Sleepiness Scale (ESS). The final sample included 2550 participants (51.2% females; age range 19–69 years), which were divided into three groups as migraine group, non-migrainous headache group and headache-free group, based on International classification of headache disorders 2nd edition (ICHD-2) criteria.

**Results:** According to ICHD-2 criteria, we classified 5.2% of study population as migraineur. Migraine group and non-migrainous headache group significantly showed late circadian preference ( $p = 0.002$ ), poor sleep quality (<0.001), daytime sleepiness ( $p = 0.038$ ) and insomnia (<0.001), after adjustment of age, gender and depression scale. No significant associations have been found between migraine group and non-migraine group about above mentioned sleep parameters after post hoc analyses.

**Conclusion:** The aim of the study was to evaluate associations between sleep patterns and headache in a large non-clinical population. Migraine and non-migrainous headache group showed significantly poorer sleep quality, insomnia and daytime sleepiness. Also, late circadian preference was shown in headache group, compared with headache-free group.

<http://dx.doi.org/10.1016/j.sleep.2013.11.209>

### Effects of pregabalin on patients with hypnotic dependent insomnia

Y. Cho, H. Moon, Y. Lee, M. Song

Keimyung University Dongsan Medical Center, Republic of Korea

**Introduction:** Long-term use of hypnotics runs the risk of dependency, and the patient usually experiences difficulties in withdrawal or discontinuing treatment. It has been reported that pregabalin has a positive effect on both sleep and withdrawing from hypnotics. The objective of this study was to investigate the efficacy of pregabalin on sleep in patients with hypnotic dependent insomnia.

**Materials and methods:** This is a prospective, open-label, single arm, and interventional study. We enrolled patients with hypnotic dependent insomnia who were 18 older. The starting dosage of Pregabalin was 75 mg/day and was increased up to as much as 300 mg/day, depending on the individual patients condition, while tapering off hypnotics. After four weeks of titration, the final dosage amount was maintained for at least another 4 weeks. Sleep and clinical variables were evaluated by using the Pittsburgh Sleep Quality Index (PSQI), Epworth sleepiness scale (ESS), Insomnia Severity Index (ISI), the hospital depression and anxiety scale (HADS), in addition to the polysomnography (PSG) at baseline and after treatment. A paired t-test was used for analyzing the effect of pregabalin using SPSS 18.0 program.

**Results:** We enrolled 40 patients whose mean age was  $52.33 \pm 8.39$ , 28 were women (70.0%). Twenty-one (52.5%) were successful in withdrawing from hypnotics. The duration of withdrawing from hypnotics was  $42.19 \pm 16.08$  days (range: 27.00–84.00). The mean pregabalin dose was  $121.43 \pm 69.05$  mg/day (range: 75.00–300.00). The results using pregabalin showed a significant improvement with the total score of the PSQI ( $15.05 \pm 2.11$ ,  $8.90 \pm 3.08$ ,  $p < 0.001$ ), insomnia severity index ( $20.95 \pm 4.32$ ,  $9.62 \pm 4.41$ ,  $p < 0.001$ ), BDI-2 ( $7.95 \pm 4.20$ ,  $5.67 \pm 3.69$ ,  $p = 0.013$ ) and HAS ( $7.24 \pm 4.90$ ,  $4.67 \pm 3.92$ ,  $p = 0.002$ ). The main adverse effects of pregabalin were nausea and dizziness.

**Conclusion:** Our results showed pregabalin is effective in allowing patients with hypnotic dependent insomnia to withdraw from hypnotics, with a success rate of more than half, and the quality of sleep improved in the group as a whole.

**Acknowledgements:** This work was supported by a research promoting grant from Pfizer, Korea.

<http://dx.doi.org/10.1016/j.sleep.2013.11.210>

### The association between sleep and body weight changes from birth to 3 years

S. Chung<sup>1</sup>, S. Chu<sup>2</sup>, Y. Huang<sup>3</sup>

<sup>1</sup> Chang Gung University, College of Medicine, School of Nursing, Taiwan

<sup>2</sup> Chang Gung Memorial Hospital, Department of Newborn Medicine, Taiwan

<sup>3</sup> Chang Gung Memorial Hospital, Department of Child Psychology, Taiwan

**Introduction: background:** Sleep is vital important for early childhood development. A growing body of work has found that sleep problems in Taiwan are common for children aged 0–6 years. Short sleep duration in infancy has been identified to be associated with childhood obesity in Western literatures. However, limited longitudinal evidence exists regarding the association between sleep status and body weight changes in early childhood for Taiwanese children. **Aim:** To investigate the longitudinal association between sleep status and body weight changes in healthy children from birth to 3 years of age.

**Materials and methods:** A convenience sampling technique is used to recruit interested primiparous (singleton delivery) mother–newborn pairs at a medical center located in North Taiwan. The newborns are eligible for a 3-year follow-up (from 08/2010 to 07/2013) if the following criteria are met: (1)  $\geq 37$  weeks gestation, (2) birth weight  $\geq 2500$  g, (3) discharge from newborn nursery (baby-room) or neonatal intensive care unit (NICU) without significant neonatal mobility, and 4) nursery or NICU stay less than 7 days. Eligible newborns are scheduled for collecting sleep, environmental light exposure, food intake, and anthropometric data every half-year from the 1st week after birth to 36-months of age. Sleep assessment is performed in the home environment by mother-reported infant sleep diary, the Brief Infant Sleep Questionnaire, and an actiwatch to monitor movement of the child.

**Results:** There were 102 infants recruited at their 1st week after birth. Among the 102 subjects, 46 subjects were followed for 12 months and 11 of them were followed for 24 months. The results show that (1) sleep efficiency, total time in bed, total sleep time and nocturnal sleep hours increase with age; (2) duration of night awakening decreases with age; (3) body weight is negatively correlated with total sleep time, total time in bed, diurnal sleep time and night awakening hours; (4) body weight is positively correlated with sleep efficiency and nocturnal sleep hours.

**Conclusion:** Study results are anticipated to understand the contemporaneous changes in sleep with changes in body weight, and to provide an informative reference regarding the effect of sleep on body weight changes for children aged 0–3 years.

**Acknowledgements:** This study is funded by the National Science Council of Taiwan (NSC 99-2314-B-182-032).

<http://dx.doi.org/10.1016/j.sleep.2013.11.211>

### Cognitive behavioural therapy for comorbid insomnia and depression: a randomised, controlled study

A. Norell-Clarke<sup>1</sup>, M. Jansson-Fröjmark<sup>2</sup>, M. Tillfors<sup>1</sup>, F. Holländare<sup>3</sup>, I. Engström<sup>3</sup>

<sup>1</sup> Örebro University, Center for Health and Medical Psychology, Sweden

<sup>2</sup> Stockholm University, Center for Health and Medical Psychology, Sweden

<sup>3</sup> Örebro County Council, Psychiatric Research Center, Sweden

**Introduction:** Insomnia and depression is a common comorbidity and several pilot studies have demonstrated promising results on both conditions by targeting insomnia only. The aim was to investigate the effects of CBT for insomnia (CBT-I) on both sleep and depressive symptoms in a sample with insomnia comorbid with major depression, minor depression or depressive symptoms, using a randomized controlled study.

**Materials and methods:** 64 participants were recruited through advertisements and randomised to receive either CBT-I or an active control (relaxation training: RT) in groups during four sessions over seven weeks. Insomnia and depressive severity was measured before, during and after treatment, using Insomnia Severity Index (ISI) and Beck Depression Inventory (BDI- II).

**Results:** We used independent *t*-tests to investigate if groups were different on symptom severity prior to treatment. There was no difference between CBT-I and RT regarding insomnia severity ( $t(55) = 1.30, p = 0.20$ ) or depression severity ( $t(53) = -0.77, p = 0.44$ ). Looking at development over time, mixed between-within subjects ANOVAs demonstrated a significant interaction between treatment type and time for both insomnia and depression (ISI:  $F(2,54) = 4.96, p = 0.01$ ; BDI:  $F(2,58) = 2.80, p = 0.07$ ) meaning that CBT-I meant a larger decrease of both insomnia and depressive

severity compared to control treatment. There was also a significant main effect for time with decreasing scores for both groups over time on ISI ( $F(2,52) = 28.86, p = 0.0005$ ) and BDI-II ( $F(2,58) = 7.11, p = 0.002$ ) and a main effect for group on ISI ( $F(1,53) = 9.25, p = 0.01$ ) but not on BDI-II ( $F(1,59) = 0.27, p = 0.60$ ). A six months follow-up assessment is currently conducted and those results will also be presented during the conference.

**Conclusion:** CBT-I was associated with a greater reduction in insomnia and depression severity compared to control treatment. These results show that it is possible to have an effect on both insomnia and depression during a relatively short and cost effective group treatment, targeting insomnia only.

**Acknowledgements:** This research was supported by grants from Stiftelsen Professor Bror Gadelius Minnesfond, Psykiatrifonden, and the Research Committee of Örebro County Council, Sweden.

<http://dx.doi.org/10.1016/j.sleep.2013.11.212>

### Coimbra sleep activation scale (C-SAS): psychometric properties in insomniacs

V. Clemente<sup>1</sup>, J. Almeida<sup>1,2</sup>, I. Martins<sup>1,3</sup>, A. Allen Gomes<sup>2,4</sup>, J. Moutinho Dos Santos<sup>1</sup>

<sup>1</sup> Coimbra University Hospital Centre (CHUC), Sleep Medicine Centre, Portugal

<sup>2</sup> University of Aveiro, Department of Education, Portugal

<sup>3</sup> University of Coimbra, Faculty of Psychology, Portugal

<sup>4</sup> IBILI (FMUC) – FCT R&D Unit, Portugal

**Introduction:** Hyper-arousal processes are believed to have an important role in the pathophysiology of primary insomnia, and are also a maintaining factor in co-morbid insomnia. Our purpose is to present the psychometric properties of a Portuguese instrument developed to access arousal in insomnia, originated from vast clinical experience, which may be useful in clinical practice: the Coimbra Sleep Activation Scale (C-SAS).

**Materials and methods:** A clinical sample was collected consisting of 100 selected participants (60 M and 40 F), 22–72 years-old ( $M = 45.14, DP = 12.54$ ), followed at a Sleep Medicine Centre, that did not fulfill criteria for a sleep disorder other than insomnia, and with no missing answers on the self-reported measures. The C-SAS is composed by 31 items, each one rated on a 5-point Likert scale, reported to the last month. The Insomnia Severity Index scale (ISI) was used to assess the severity of the insomnia.

**Results:** Cronbach's alpha for the C-SAS was .921, indicating a robust internal consistency. All items, except one, contributed to the internal consistency as shown by alpha values excluding each item. Corrected item-total correlations ranged from .29 to .69. An exploratory factor analysis using Varimax rotation and visual inspection of the Scree plot, yield four meaningful factors explained 51.53% of the total variance. A moderate significant correlation was found between C-SAS and ISI scores ( $r = .298, p < 0.01$ ), suggesting that, although sleep activation is associated with insomnia severity, the two sleep measures have some independence.

**Conclusion:** The results of the present study, albeit preliminary, suggest an adequate validity and internal consistency of the C-SAS in a clinical sample of insomniacs. However, future psychometric studies are needed in order to expand our knowledge about its validity and reliability using other samples.

**Acknowledgements:** Insomniac patients followed at the Sleep Medicine Centre of Coimbra University Hospital Centre (CHUC).

<http://dx.doi.org/10.1016/j.sleep.2013.11.213>

### REM sleep behavior disorder and periodic leg movements in sleep in patients with amyotrophic lateral sclerosis

D. Lo Cocco<sup>1</sup>, P. Mattaliano<sup>1</sup>, G. Gioi<sup>2</sup>, P. Congiu<sup>2</sup>, M. Fantini<sup>3</sup>, M. Puligheddu<sup>2</sup>

<sup>1</sup>ALS Research Center, University of Palermo, Palermo, Italy

<sup>2</sup>Sleep Disorders Center, University of Cagliari, Cagliari, Italy

<sup>3</sup>S.C. Neurology, Ospedali Riuniti Mondovì e Ceva, Cuneo, Italy

**Introduction:** In the last few years, it has been increasingly recognized that patients with amyotrophic lateral sclerosis (ALS) frequently suffer of sleep-related complaints, including insomnia, restless legs syndrome, and daytime sleepiness, although, in the past, many of the nocturnal symptoms have been mainly ascribed to chronic respiratory insufficiency and hypoventilation. In addition, excluding few single cases reported, polysomnographic studies did not look for abnormal motor activity during sleep that could be indicative of Rapid Eye Movements (REM) sleep behavior disorder (RBD) and REM sleep without atonia (RSWA), which are highly prevalent in other neurodegenerative disorders with brainstem involvement. Finally, data on the presence of periodic leg movements in sleep (PLMS) in patients with ALS are sparse. We sought to assess sleep characteristics and the occurrence of abnormal muscle activity during sleep, such as RSWA, RBD, and PLMS in patients with ALS.

**Materials and methods:** Forty-one patients with ALS and 26 healthy subjects were submitted to clinical interview and overnight video-polysomnography.

**Results:** Twenty-two patients with ALS (53.6%) reported poor sleep quality. Polysomnographic studies showed that patients with ALS had reduced total time of sleep, increased wakefulness after sleep onset, shortened REM and slow wave sleep, and decreased sleep efficiency compared to control subjects. Polysomnographic abnormalities were not different in patients reporting good or poor sleep, and were not correlated to clinical and demographic variables. PLMS index was significantly higher in patients with ALS than in healthy subjects, and 22 patients (53.6%) showed a PLMS index >15, vs 4 (15.4%) control subjects ( $p < 0.001$ ). Finally, two patients with ALS (4.9%) had RBD, and two more patients presented RSWA (4.9%), whereas no control subjects showed abnormalities of REM sleep.

**Conclusion:** Patients with ALS frequently present abnormalities of sleep that can be documented both at the clinical interview and at the polysomnographic evaluation, including insomnia, fragmented sleep, and increased PLMS. Moreover, abnormalities of REM sleep can sometimes be found in these patients.

**Acknowledgements:** The authors would like to thank Dr. A. Mattaliano, Ospedale Civico ARNAS of Palermo, Dr. V. La Bella, University of Palermo-Italy, and Dr. G. Borghero, University of Cagliari-Italy, for their important contribution.

<http://dx.doi.org/10.1016/j.sleep.2013.11.214>

### Sleep during an antarctic overwintering: comparing an altitude base and a coastal station

G. Collet<sup>1</sup>, O. Mairesse<sup>1</sup>, E. McDonald-Nethercott<sup>2</sup>, Y. Ducrot<sup>2</sup>, R. Meeusen<sup>3</sup>, N. Pattyn<sup>1</sup>

<sup>1</sup>Royal Military Academy, Belgium

<sup>2</sup>Institut Polaire Français, Belgium

<sup>3</sup>Vrije Universiteit Brussel, Belgium

**Introduction:** The occurrence of sleep disturbances in Antarctic regions is a consistent finding in literature. Indeed, spending winter in Antarctica, exposed to total darkness, has been significantly associated with total hours of sleep, duration of the longest sleep event,

time of sleep onset and quality of sleep. Considering the importance of light as a Zeitgeber, and the major role of the circadian rhythm in sleep-wake regulation, this hardly comes as a surprise. However, less is known about the potential side effect of the chronic exposure to hypobaric hypoxia, as experienced in stations at altitude, on these results. In the present study, we compared two different campaigns (winter and summer) over two different research station (Concordia – corrected altitude 3800 m and Dumont d'Urville – sea level).

**Materials and methods:** To do so, 24 h actigraphy recordings were collected over 8 expeditioners in Concordia and 16 expeditioners in Dumont d'Urville during winter and summer.

**Results:** The results showed that during the day time no differences were observed in the time spent to work ( $p = 0.16$ ), in the energy expenditure ( $p = 0.066$ ) and in the number of steps ( $p = .144$ ). This indicates quite similar settings in terms of the generation of homeostatic sleep pressure due to physical activity. However, comparing both settings for night time yielded a significant group effect for the total sleep time (DDU > Concordia;  $p = 0.036$ ), the sleep efficiency (DDU > Concordia;  $p = 0.035$ ) and the wake after sleep onset (WASO) (DDU < Concordia;  $p = 0.006$ ). Moreover, a significant session effect was observed for the fragmentation of sleep (summer > winter;  $p = 0.003$ ). All other parameters analyzed such as total sleep time? ( $F < 1$ ), energy expenditure ( $F < 1$ ), time in bed ( $F < 1$ ), sleep onset ( $F < 1$ ) remained non-significant.

**Conclusion:** Our results show that the main differences in sleep parameters were associated to the effect of altitude and that seasonality only affected the fragmentation of sleep. We can thus conclude that the altitude parameter needs to be more carefully taken into account in the future investigation of sleep in extreme environment.

**Acknowledgements:** This work was financially supported by ESA/Prodex and Institut Paul-Emile Victor (IPEV). The authors are grateful to all participants.

<http://dx.doi.org/10.1016/j.sleep.2013.11.215>

### Relationship of arterial hypertension and obstructive sleep apnea syndrome

D. Todea<sup>1</sup>, I. Todor<sup>2</sup>, A. Coman<sup>1</sup>

<sup>1</sup>University of Medicine and Pharmacy Iuliu Hatieganu, Department of Pneumology, Romania

<sup>2</sup>Regional Emergency Hospital, Department of Internal Medicine, Romania

**Introduction:** In recent years, obstructive sleep apnea (OSAS) has been defined as a cardio- metabolic disorder being considered an important risk factor for arterial hypertension. Intermittent hypoxia and sleep deprivation or defragmentation typical of OSAS, in the long term, can entail pathophysiological changes that induce the onset of this disease. The purpose of this study was to analyze the prediction of arterial hypertension in patients with OSAS.

**Materials and methods:** We examined the records of 151 patients referring to our Sleep Laboratory Center, between February to December 2011, to have nocturnal cardio-respiratory polygraphy for the evaluation of OSAS and extracted clinical data, blood pressure measurements, blood tests, weight and height as well as Epworth Sleepiness Scale (ESS). Including criteria was cut-off value of  $\geq 15$  events/h according to the Apnea Hypopnea Index (AHI).

**Results:** Ninety-nine patients (65.56%) had severe OSAS ( $\geq 30$  events/h); 100 patients (66.22%) had hypertension. Univariate analysis for categorical data has found statistic significance for: ischemic cardiopathy 32 (88.89%) vs 68 (59.13%),  $p < 0.01$ ; snoring 98 (68.53%) vs 2 (25%),  $p = 0.03$ ; restless sleep 79 (71.82%) vs 21 (51.22%),  $p = 0.02$ . A lower tendency was seen for diabetics 29

(78.38%) vs 71 (62.28%),  $p = 0.07$ ; heart failure 14 (87.5%) vs 86 (63.7%),  $p = 0.06$ ; sleep suffocation 57 (73.08%) vs 43 (58.9%),  $p = 0.07$ . Receiver operating characteristics (ROC) analysis reveals statistic significance for: age ( $p < 0.01$ , AUC = 0.69, cut-off = 49 years), neck circumference ( $p < 0.01$ , AUC = 0.67, cut-off = 44 cm), abdominal circumference ( $p < 0.01$ , AUC = 0.70, cut-off = 112 cm), BMI ( $p < 0.01$ , AUC = 0.70, cut-off = 32.03 kg/m<sup>2</sup>), glycemia ( $p = 0.03$ , AUC = 0.59, cut-off = 93 mg/dl), supine AHI position ( $p = 0.03$ , AUC = 0.59, cut-off = 48 events/h), medium O<sub>2</sub> saturation ( $p < 0.01$ , AUC = 0.70, cut-off <95%), oxygen desaturation index ( $p < 0.01$ , AUC = 0.63, cut-off = 17.88 ) and ESS ( $p = 0.03$ , AUC = 0.59, cut-off = 8). Multivariate analysis on logistic model on body mass index, neck circumference, age, abdominal circumference, glycemia, desaturation index, heart failure, medium O<sub>2</sub> saturation, snoring, sleep restless, sleep suffocation, supine AHI position and ESS retains only body mass index, neck circumference and age.

**Conclusion:** 1. Arterial hypertension from OSAS is significantly influenced by body mass index, neck circumference and age. 2. An increase of BMI by 1 kg/m<sup>2</sup> would entail the risk of hypertension by 2.4%. An increase of 1 cm neck circumference would entail the risk of hypertension by 0.6%. An increase in age by 10 years would entail the risk of hypertension by 7.8%.

<http://dx.doi.org/10.1016/j.sleep.2013.11.216>

#### Neurophysiological evaluation of spinal excitability in patients affected by primitive restless legs syndrome

P. Congiu<sup>1</sup>, G. Milioli<sup>2</sup>, G. Gioi<sup>1</sup>, P. Tacconi<sup>3</sup>, M. Fantini<sup>4</sup>, M. Puligheddu<sup>1</sup>

<sup>1</sup> Sleep Disorder Center, University of Cagliari, Italy

<sup>2</sup> Sleep Disorder Center, University of Parma, Italy

<sup>3</sup> Neurology UOC, University of Cagliari, Italy

<sup>4</sup> Dip di Neuroscienze, University of Torino, Italy

**Introduction:** Restless legs syndrome (RLS) is a frequent pathology, yet underrated and underestimated, affecting inasmuch as 5–10% of the population as a whole. However the pathophysiology has not been completely understood. The dopaminergic system has certainly a primary role, and some studies have highlighted a condition of spinal hyper-excitability. The aim of our study is to explore this hypothesis throughout the electrophysiological evaluation of the spinal and peripheral nervous system in primitives RLS patients.

**Materials and methods:** Among the patients affected by primitive RLS admitted to our Sleep Centerlab, we selected 15 women, and compared them with 17 control subjects of the same sex and age. All subjects had undergone ENG evaluation to exclude any secondary causes of lower limb paresthesia and to evaluate spinal excitability. According to a previous study, we considered two parameters which can be easily extracted from the routine tests normally carried out in the neurophysiopathology labs, the duration of F waves (FWD) of the Internal Popliteal (IPN) and ulnar nerves, and the relationship between FWD and the duration of the corresponding CMAP (CMAPD).

**Results:** None of the subjects (RLS and controls) included in our study presented alterations in the nerve conduction velocity. Compared to the control group, significantly higher values were found in the RLS patients for the FWD/CMAPD ratio average ( $p < 0.001$  test Mann–Whitney) and for the FWD average for both nerves ulnar ( $p < 0.05$  unpaired  $t$ -test) and IPN ( $p < 0.01$  unpaired  $t$ -test).

**Conclusion:** The results of our study confirm the absence of peripheral involvement in primitive RLS, while they indicate a spinal motoneuronal hyper-excitability, which seems widespread, as both IPN and ulnar nerve stimulation indicators are altered. Such condi-

tion could be due mainly to an alteration of the modulation in the interneuronal system. Presently, RLS diagnosis is based exclusively on clinical criteria. The FWD/CMAPD ratio can help to shed light on the pathogenesis of RLS, and can be used as an instrumental diagnostic indicator, easily obtainable and useful especially in cases of lower leg discomfort at night of unclear interpretation.

**Acknowledgements:** The authors would like to thank Prof. F. Marrosu and Dr. M. Frascini, University of Cagliari, Italy, and Prof. L. Parrino, University of Parma, Italy, for their important contribution.

<http://dx.doi.org/10.1016/j.sleep.2013.11.217>

#### Sleep breathing disorders screening in Chilean miners

J. Santin, P. Moya, P. Contreras, E. Pincheira  
Centro Médico del Sueño, Pontificia Universidad Católica de Chile, Chile

**Introduction:** Sleep Breathing Disorders (SDB) constitute a risk factor for workplace accidents whose consequences have cost in human lives and environmental damage. Since they can be aggravated in high altitude its identification in mining workers is crucial. **Objectives:** to establish the relation between a screening practiced with night pulse oximetry, and Epworth and Berlin questionnaires in patients clinically suspicious of SDB and polysomnography results, performed in a high altitude Chilean mine setting.

**Materials and methods:** A group of 100 consecutive mining workers had an all-night oxymetry done at their work place, (a 2600 meters high camp); those with abnormal oximetries had a PSG performed at the same setting, as part of a "Prevention of fatigue and sleep disorders" program. They also answered the Epworth scale and Berlin questionnaire.

**Results:** 78% of the workers had abnormal oxymetries and in 74 of them (94%) the PSG showed sleep apnea of different severity; in 24 of these patients (32%) it was related to posture. The average Epworth score was 4.28 while for the Berlin questionnaire it was 2.27.

**Conclusion:** All night oximetry is a reliable predictor of SDB as shown by the PSG in Chilean high altitude mine workers. SDB is highly prevalent in these type of patients. Epworth and Berlin questionnaires failed to suggest hypersomnolence or SDB; it is speculated that this latter finding can be explained by workers fear to lose their jobs if they recognize the presence of hypersomnolence or witnessed apneas.

**Acknowledgement:** We thank technical personnel support for this research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.218>

#### Prevalence and predictors of sleep disordered breathing in patients undergoing chronic ambulatory intermittent hemodialysis

F. Cornette<sup>1</sup>, A. Ognà<sup>1</sup>, V. Forni<sup>2</sup>, M. Burnier<sup>2</sup>, R. Heinzer<sup>1</sup>

<sup>1</sup> Center for Investigation and Research in Sleep (CIRS), CHUV, Switzerland

<sup>2</sup> Department of Nephrology and Hypertension, CHUV, Switzerland

**Introduction:** Sleep disordered breathing (SDB) is a common finding in chronic hemodialysis (CHD) patients. Two recent American studies investigated the prevalence of SDB in patients with different degree of chronic kidney disease and reported a prevalence of 26–57%. The purpose of this study is to evaluate the prevalence of SDB and to evaluate the predictive value of Berlin questionnaire, hemod-

alysis frequency and duration, and biometric parameters in a large group of European patients undergoing CHD.

**Materials and methods:** All the patients attending six CHD centers in the western part of Switzerland were screened. Eligible patients completed the Berlin questionnaire, a validated 11 items form used to evaluate the risk of obstructive sleep apnea and the Epworth Sleepiness Scale (ESS). All patients underwent a home nocturnal polygraphy (PG) using Apnea Link Plus system recording nasal pressure, oxygen saturation, thoracic movements and heart rate. Respiratory events were scored according to the AASM 99 criteria. Apnea-hypopnea index (AHI) was calculated by dividing the total number of apnea and hypopnea during the night by the recording time.

**Results:** Among 166 screening patients, 98 were included and 71 completed the study (50 men, mean age  $61.8 \pm 15.4$ , neck circumference  $40.6 \pm 4.6$  cm, BMI  $25.7 \pm 4.8$  kg/m<sup>2</sup>). Mean AHI was  $23.9 \pm 20.4$ /h (18% obstructive apnea, 8.5% central apnea, 2.4% mixed apnea). Among these 71 patients, 31% had severe SDB (AHI  $\geq 30$ /h), 23.9% had moderate SDB (AHI 15–30/h), 31% had mild SDB (AHI 5–15/h) and 14.1% were normal (AHI  $< 5$ /h). Berlin's questionnaire showed a high risk of SDB in 62.5% of the patients with a sensitivity of 65%, a specificity of 39%, a positive predictive value of 58% and a negative predictive value of 47%. According to ESS, 18.5% of the patients had significant sleepiness ( $>10/24$ ). Using a logistic regression model including age, sex, BMI, neck circumference, Berlin questionnaire, ESS, smoking, alcohol, number/week and duration of CHD session, the only independent predictor was neck circumference with odds ratio of 1.59 ( $p = 0.023$ ).

**Conclusion:** The prevalence of SDB in the CHD population is higher than expected. Berlin questionnaire is not useful to screen for SDB in CHD patients but neck circumference seems to be an independent predictor of SDB in this population.

**Acknowledgements:** Supported by the Leenaards Foundation, Ligue Pulmonaire Vaudoise, Swiss National Foundation for Research, GSK.

<http://dx.doi.org/10.1016/j.sleep.2013.11.219>

### **Orofacial myology therapy: a case report of upper airway resistance syndrome**

C. Corrêa, S. Megale, G. Berretin-Felix

Bauru School of Dentistry, University of São Paulo, Brazil

**Introduction:** The orofacial myology area is important in changing muscle tonus that composes the oropharynx in cases of sleep disorders, with emphasis on subjects diagnosed with obstructive sleep apnea syndrome (OSAS). However, there are not observed reports of patients with upper airway resistance syndrome (UARS) who did not have polysomnographic characteristics of OSAS. Therefore, the aim of this study was to analyze the before-and-after results of orofacial myology therapy through a case report of UARS.

**Materials and methods:** For this, we used the aspects of orofacial myology evaluation and quality of sleep in the Berlin Questionnaire and Epworth Sleepiness Scale (ESS). The patient is 61 years old, male, BMI 22.3, with high arterial blood. He swims regularly. He presented at the Clinic of Speech Pathology, Faculty of Dentistry of Bauru – University of São Paulo, with this complaint: "I wake up scared about six times during the night, and I feel tired during the day." According to diagnosis of an otorhinolaryngologist, the patient had UARS.

**Results:** In the orofacial myology evaluation, his observed neck circumference was 39 cm, Mallampati score IV, hypotonic tongue, increased size, altered mobility and tooth marks, hypotonic soft palate and altered mobility. He presented nasal breathing, lower–middle type, preferential unilateral chewing, contractions atypical of orbicu-

lar and menstrual in swallowing, and normal speech function. In terms of quality of sleep, he scored 13 points on the ESS and three positive categories in the Berlin Questionnaire, meaning high risk for sleep apnea. After 12 therapy sessions a week and exercising at home three times a day, orofacial myology reevaluation was done. This was the only mode of treatment during the study period. Observed neck circumference was 37 cm, Mallampati score III, normal tonus, size and mobility of tongue, normal tonus and mobility of soft palate. Functions found nasal breathing, lower–middle type, simultaneous bilateral chewing, adequate swallowing and speech. The questionnaires result a score of 9 on the ESS and one positive category in the Berlin Questionnaire; therefore, a low risk for sleep apnea.

**Conclusion:** Furthermore, the patient reported that he felt a significant improvement in quality of sleep, waking only three times during the night and realizing that he feels rested during the day. This clinical case showed that it is possible for orofacial myology to improve aspects of sleep quality.

**Acknowledgements:** To the patient who engaged during months of therapy and entrusted in Speech-Language Pathologist work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.220>

### **Electronic tutor about obstructive sleep apnea syndrome: development and evaluation of a health collaborative network**

C. Corrêa, G. Berretin-Felix, A. Fukushiro, W. Blasca

Bauru School of Dentistry, University of São Paulo, Brazil

**Introduction:** There are studies worldwide about the prevalence of obstructive sleep apnea syndrome (OSAS), including Brazil, where apnea was observed in 32.8% of general population. Although there is a high prevalence of OSAS, there is not always a diagnosis using the same scale because of the lack of information. The World Sleep Day, held on date, helped draw attention to the effects of sleep health; consequently, more people have become aware of the enormous importance of sleep for our health. The Cybertutor has valuable tools to promote sleep health through Interactive Teleducation. Such knowledge makes possible better dynamics, interactive access, and motivation. The aim of the present study was to develop and evaluate content about OSAS and sleep health for a Cybertutor.

**Materials and methods:** We used textual resources, based on scientific publications, selecting, summarizing, and adapting the material language. In addition, we used audiovisual resources to make the educational material motivating and attractive. For evaluation of language, we used the Flesch Reading Facility Index (FRFI) that results in a percentage of a given document's level of legibility; the higher the level of reading facility in the text, the better.

**Results:** This study has resulted in the creation of three modules on sleep health: "Obstructive Sleep Apnea Syndrome" with nine topics, "Treatment" with nine topics, and "Prevention" with six topics. Related to the contents, the modules contained 19 static images, along with figures and diagrams, 14 videos, and links to two other websites. It was observed that the content of the modules obtained an average of 56% on the FRFI, corresponding to a "reasonably hard" level that requires users to have a minimum level of instruction in high school to ensure language comprehension.

**Conclusion:** Therefore, it is important to carefully consider content development for the Cybertutor or other digital media and do evaluations of the language used to ensure adequate communication of the information and thus construct a health collaborative network. The results of this study were the creation of three modules about OSAS and sleep health, specific for use by a Cybertutor, which received an FRFI rating that indicated a language level corresponding to a minimum of high school instruction.

*Acknowledgements:* To the Professor Dr. Chao Lung Wen and the team of the Discipline of Telemedicine of the Medicine School, University of São Paulo, by availability the cybertutor on page of the Young Doctor Project and technical assistance for the feasibility of this project.

<http://dx.doi.org/10.1016/j.sleep.2013.11.221>

### Effects of sleep disturbance in the postpartum: are new mothers an exception to the rule?

L. Creti<sup>1</sup>, D. Rizzo<sup>2</sup>, C. Fichten<sup>3</sup>, S. Bailes<sup>1</sup>, P. Zekowicz<sup>1</sup>, E. Libman<sup>1</sup>  
<sup>1</sup>Jewish General Hospital, McGill University, Jewish General Hospital, Canada

<sup>2</sup>Jewish General Hospital, University de Montreal, Canada

<sup>3</sup>Jewish General Hospital, McGill University, Dawson College, Canada

*Introduction:* New mothers commonly experience sleep deprivation and sleep fragmentation. Normally, in other populations, such sleep disruption has been associated with decreased perceived sleep quality, daytime fatigue, and sleepiness. But is this necessarily the case in the population of first-time mothers? In order to examine the “pure” effect of sleep disruption on maternal functioning, we selected a homogeneous sample of well-functioning, non-depressed, first-time mothers, in stable marital relationships, whose singleton babies were vaginally delivered. The present study examines the natural progress of maternal and infant sleep through the first 6 postpartum months, and how new mothers’ sleep experience relates to perceived sleep quality and daytime functioning.

*Materials and methods:* A sample of 20 mothers was recruited from the postpartum unit of a Montreal hospital. At 2 and 6 months postpartum participants completed the Empirical Sleepiness/Fatigue Subscales and a sleep diary for themselves and their infants.

*Results:* Results showed that mothers slept significantly less than their infants, especially during the day, at both time periods. 24 h total sleep times increased at 6 months for mothers, but not for infants. Night time sleep duration increased at 6 months, while daytime sleep decreased for both mother and infant. Sleep was less fragmented at 6 months than at 2 months for both mothers and infants. Perceived sleep quality was related to sleep fragmentation and not to overall number of hours slept. Mothers’ level of daytime sleepiness was significantly less at 6 months relative to the 2-month level; however daytime fatigue was relatively low and not different at the two time periods.

*Conclusion:* These particularly well-functioning mothers were relatively sleep deprived at 2 months compared with 6 months postpartum. Interestingly, this resulted only in greater daytime sleepiness, which would be expected when sleep is curtailed, not in increased fatigue, which would have insomnia and/or depression implications. Perceived sleep quality was relatively high at both time periods, suggesting that this psychologically healthy sample of mothers adapted well to their circumstances; quality of sleep was related to fewer sleep interruptions rather than overall number of hours slept. Sleep deprivation and fragmentation in this healthy sample of first time mothers did not appear to have the usual negative consequences to daytime functioning seen in other populations.

*Acknowledgement:* This research was funded by the Canadian Institutes of Health Research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.222>

### Sleep-related behavioral interaction between school-age siblings. Evaluation with CSHQ-PT

M. Meira E. Cruz<sup>1</sup>, I. Duarte<sup>2</sup>, H. Loureiro<sup>3</sup>, M. Rodrigo<sup>4</sup>

<sup>1</sup>Biomedical Research Unit GS Clinical Center, Autonomic Cardiovascular Function Lab of Lisbon Faculty, Portugal

<sup>2</sup>Biomedical Research Unit GS Clinical Center, Portugal

<sup>3</sup>Pediatric Sleep Unit – Fernando da Fonseca Hospital, Portugal

<sup>4</sup>MJR Clinic, Portugal

*Introduction:* Young children are susceptible to sleep disturbances, particularly those related to behavior. Consequently they are more vulnerable to the negative impact of a disturbed sleep. There should exist a close monitoring to understand some factors that may act as disrupters on the balance of this vital function. Several studies have demonstrated that familial interaction can be a source of conflict in the context of the implementation and maintenance of adequate sleep habits, however there is only scarce data about the particular role of inter-individual interaction within the family members. The aim of this study was to evaluate how school-age siblings with different ages interact regarding important sleep-related neurobehavioral aspects.

*Materials and methods:* The portuguese validated version of the Children Sleep Habits Questionnaire (CSHQ-PT) was applied to 20 parents of siblings with a range of ages between 4 and 10 years old in a clinical context of a private pediatrics office.

*Results:* A total of 40 school-age healthy siblings were enrolled for this study. The mean age of the global sample was  $7.52 \pm 2.03$  years old ( $9.10 \pm 0.97$  for the older siblings and  $5.95 \pm 1.53$  for the younger siblings). CSHQ-PT global score was  $47.35 \pm 6.95$  ( $46.55 \pm 6.49$  for the older group and  $48.15 \pm 7.46$  for the younger group) without differences between groups and there was a moderate correlation between both groups regarding to this score ( $r = .602$ ;  $p = .005$ ). Sleep schedules and sleep duration were similar in both groups. Regarding the subscales of CSHQ-PT, a moderate correlation between groups was found in night awakenings ( $r = .648$ ;  $p = .002$ ) and sleep duration ( $r = .481$ ;  $p = .032$ ). Furthermore there was no statistically significant differences regarding the CSHQ-PT subscales between older and younger brothers.

*Conclusion:* Although in a relative small sample, these data suggest that similar inadequate sleep-related behaviors meaning behavioral sleep insomnia are shared by children of the same family. This points to the fact that education about sleep hygiene habits should be implemented continuously in pediatric clinical practice to avoid the maintenance of this deleterious sleep habits.

<http://dx.doi.org/10.1016/j.sleep.2013.11.223>

### Sleep bruxism as the main manifestation of sleep disordered breathing – Case report

M. Meira E. Cruz<sup>1</sup>, S. Rebocho<sup>2</sup>, M. Drummond<sup>3</sup>

<sup>1</sup>Cardiovascular Autonomic Function Lab – Lisbon, Faculty of Medicine, CENC – Sleep Center, Portugal

<sup>2</sup>CENC – Sleep Center, Portugal

<sup>3</sup>Pneumology Service – São João Hospital/Porto Faculty of Medicine, Portugal

*Introduction:* Sleep related motor activity is often interpreted as part of natural physiological response associated with the complex neurobiological process occurring during sleep. Nevertheless it can be either related with some pathological conditions which are classified in a specific group of sleep disorders – Sleep Related Move-

ment Disorders (ICSD-II). Among the many kinds of motor manifestation during sleep, rhythmic masticatory muscle activity and bruxism may occur in association with sleep disordered breathing. Authors report a case of a female patient with sleep bruxism secondary to undiagnosed sleep disordered breathing in which motor related symptoms where the reason for consultation.

**Materials and methods:** None.

**Results:** A female patient, aged 67, obese, come to our clinical unit for a dental appointment, referring, as the main reason for consultation, a widespread symmetrical tooth and face ache, usually felt soon after awakening in the morning. There were no signs of acute, local or systemic disease, no history of smoking or alcohol consumption nor chronic medication except anti-hypertensive one. Sleep disordered breathing was suspected after the initial clinical interview and it was also suspected that motor events could be induced by respiratory events. Sleep related breathing disorder was confirmed by an ambulatory cardio-respiratory sleep study showing an AHI of 18/h and ODI of 18/h. It was also confirmed by masseter activity register the diagnosis of sleep bruxism (MI = 10.6/h). Furthermore it was observed a persistent and regular synchrony between the final part of respiratory events and masseter activity, which was absent after the PAP therapy implementation. As the AHI and ODI improved to normal levels (0.9/h and 0.9/h) confirmed by cardiopulmonary sleep study, patient came to a follow-up visit showing significant clinical improvement. Neither respiratory nor motor events were observed in this later study.

**Conclusion:** Sleep bruxism can be the first and the main manifestation of sleep disordered breathing. Sleep bruxism related symptoms should therefore be adequately evaluated in a global context that should include sleep history, daytime function and sleep study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.224>

### Cognitive behaviour therapy: an additive treatment in delayed sleep phase disorder

K. Danielsson<sup>1</sup>, M. Jansson-Fröjmark<sup>2</sup>, J. Broman<sup>1</sup>, A. Markström<sup>3</sup>  
<sup>1</sup>Uppsala University, Department of Neuroscience, Psychiatry, Portugal  
<sup>2</sup>Stockholm University, Department of Psychology, Portugal  
<sup>3</sup>Uppsala University, Department of Medical Sciences, Respiratory Medicine and Allergology, Portugal

**Introduction:** Delayed sleep phase disorder (DSPD) is the most common circadian rhythm sleep disorder and yet there are still no established treatments with enduring effects. The aim was to examine if cognitive behaviour therapy (CBT) maintain and enhance the effect of light therapy (LT) in DSPD, regarding sleep onset, sleep offset and severity of sleep difficulties.

**Materials and methods:** Thirty-six subjects (17 women) with a mean age of 22 years (range 16–26) participated. All subjects fulfilled the criteria for DSPD according to ICSD-2. The study was a randomised controlled trial. Group I received LT for 2 weeks followed by no treatment for 4 weeks. Group II was administered LT for 2 weeks and then CBT in group once a week for 4 weeks. All patients filled out a sleep diary and the Insomnia Severity Index (ISI) at pre-treatment and at the 2 week, 6 week and 6 month assessments.

**Results:** For Group I baseline mean sleep onset was 02:56 am and sleep offset was 10:22 am. During second week of LT mean sleep onset and sleep offset were significantly advanced ( $p < .001$ ) to 01:08 am and to 08:14 am, respectively. At 6-week follow-up mean sleep onset and sleep offset were 01:57 am and 09:43 am, respectively. At 6-month follow-up mean sleep onset and sleep offset were 01:50 am and 09:40 am, respectively. A continuous decrease in ISI-score was observed from 15.7 at pre-treatment to 9.6 at 6 month fol-

low up ( $p < .001$ ). For Group II baseline mean sleep onset was 03:10 am and sleep offset was 10:22 am. During second week of LT mean sleep onset and sleep offset were significantly advanced ( $p < .001$ ) to 01:19 am and to 08:09 am, respectively. At 6-week follow-up mean sleep onset and sleep offset were 01:28 am and 09:02 am, respectively. At 6 month follow-up mean sleep onset and sleep offset were 01:22 am and 08:59 am. A continuous decrease in ISI-score was observed from 15.7 at pre-treatment to 6.4 at 6 month follow-up ( $p < .001$ ). Although non-significant, between-group effect sizes were in favor of the LT+CBT group for sleep onset (Cohen's  $d = 0.23$  and  $0.22$ ), sleep offset ( $d = 0.31$  and  $0.61$ ), and severity of sleep difficulties ( $d = 0.89$  and  $0.86$ ) at 6 week and 6 month assessments respectively.

**Conclusion:** LT improved diurnal rhythm in both groups. Although not significant, the trend suggests that CBT appear to maintain the effect of LT and slightly decrease severity in sleep difficulties, better than LT alone.

**Acknowledgement:** This project was supported by Bror Gadelius foundation and the Swedish Sleep Research Society.

<http://dx.doi.org/10.1016/j.sleep.2013.11.225>

### Excessive daytime sleepiness and the risk for obstructive sleep apnea in Georgian population

N. Oniani<sup>1</sup>, M. Datunashvili<sup>1</sup>, I. Saxelashvili<sup>1</sup>, V. Ibanez<sup>2</sup>, K. Espa-Cervena<sup>2</sup>, N. Darchia<sup>1</sup>

<sup>1</sup>Ilia State University, Georgia

<sup>2</sup>University Hospital of Geneva, Division of Neuropsychiatry, Switzerland

**Introduction:** Excessive daytime sleepiness (EDS) is a common complaint in obstructive sleep apnea (OSA) patients. OSA, the most prevalent sleep breathing disturbance, is a risk-factor for various adverse health conditions. Epidemiological data on this subject in the Georgian population are scarce. The present study is aimed at investigating self-reported daytime sleepiness and the severity of sleep apnea risk in the population of the two largest cities of Georgia – Tbilisi and Kutaisi.

**Materials and methods:** 304 subjects from Tbilisi (mean age  $37.07 \pm 10.73$ , 67.4% female) and 91 subjects from Kutaisi ( $39.4 \pm 10.8$ , 67.1% female) were surveyed. Participants completed Epworth sleepiness scale (ESS), Pittsburgh Sleep Quality Index (PSQI), and Beck depression inventory, short form (BDI SF). The risk of sleep apnea was screened using STOP BANG questionnaire (low risk – 0–2 positive answers; intermediate risk – 3–4 positive answers; high risk – 5 or more positive answers). Socio-demographic data and self evaluation of the overall health status were also obtained. EDS was defined as an ESS score  $\geq 11$ . Pearson chi-square tests were used to examine associations between OSA risk and sleep, health and socio-demographic variables. Group comparisons were conducted with unpaired t-test.

**Results:** Mean ESS score in the Tbilisi sample was  $6.9 \pm 3.8$ , and 19.7% had an EDS. These parameters were lower in the Kutaisi sample –  $5.64 \pm 3.54$ , and 7.7%. The between group differences in ESS score was statistically significant ( $t_{393} = 2.8$ ,  $p = 0.005$ ). Poor sleep quality was observed in 46.1% of Tbilisi sample (mean score  $5.56 \pm 3.13$ ), and 33% of Kutaisi sample ( $4.52 \pm 2.7$ ). The significant correlation between sleep quality and BDI score was found in both groups. 7.9% of the Tbilisi and 4.4% of the Kutaisi sample had a high risk for OSA. 26% of the Tbilisi and 25.3% of the Kutaisi sample had an intermediate risk for OSA. In the Tbilisi population EDS and OSA severity were significantly associated with health status, sleep quality, BMI, age, gender and with EDS for OSA. In the Kutaisi sample, EDS was associated with health status, sleep quality and gender,

and OSA severity was associated with EDS, age and gender. However, when the number of positive answers were checked the significant association was detected also with BMI ( $p = 0.14$ ).

**Conclusion:** The findings point to poor sleep quality and a high prevalence of OSA risk in the Georgian population. Further studies are needed to determine the target subpopulation for OSA treatment.

**Acknowledgement:** Study supported by Swiss National Science Foundation, SCOPES, grant IZ74Z0\_137415

<http://dx.doi.org/10.1016/j.sleep.2013.11.226>

### Effect of sodium oxybate (SXB), modafinil and combination on disrupted nighttime sleep in narcolepsy

Y. Dauvilliers<sup>1</sup>, T. Roth<sup>2</sup>, D. Guinta<sup>3</sup>, S. Alvarez-Horine<sup>3</sup>, E. Dynin<sup>3</sup>, J. Black<sup>3</sup>

<sup>1</sup>Hôpital Gui-de-Chauliac, Department of Neurology, France

<sup>2</sup>Henry Ford Hospital, Sleep Disorders and Research Center, France

<sup>3</sup>Jazz Pharmaceuticals, Inc, France

**Introduction:** Disrupted nighttime sleep (DNS) affects most narcolepsy patients. An expert consensus on DNS identified frequent shifts to lighter sleep and awakenings and reported poor sleep quality as important measures of DNS. In this study, data from a randomized trial retrospectively analyzed effects of three common narcolepsy treatments on DNS.

**Materials and methods:** Patients with narcolepsy ( $N = 231$ ) were randomized to placebo (PBO), 9 g SXB/nightly, 200–600 mg/day modafinil or a SXB/modafinil combination. Polysomnograms (PSGs) and sleep quality from the Pittsburgh Sleep Quality Index (PSQI) question 6 were obtained at baseline and 8 weeks. Analysis was performed for 155 patients with evaluable sleep stage and 201 patients with evaluable PSQI data.

**Results:** SXB given alone, or in combination with modafinil, decreased shifts from S2, 3, 4 or REM to 1/Wake significantly more than placebo ( $P \leq 0.015$ ). Median change from baseline was  $-1.5$  (range  $-37$  to  $37$ ),  $-13.0$  ( $-74$  to  $20$ ),  $0.0$  ( $-53$  to  $44$ ),  $-11.5$  ( $-58$  to  $45$ ) shifts in the PBO, SXB, modafinil and SXB + modafinil groups, respectively. Sleep quality showed greater improvement for SXB and SXB + modafinil versus placebo ( $P \leq 0.034$ ). For the population treated with SXB (given alone or in combination with modafinil), the most common adverse events ( $\geq 5\%$ ) were nausea, dizziness, headache, vomiting, nasopharyngitis, somnolence, tremor, and paraesthesia.

**Conclusion:** In this retrospective analysis, SXB appeared to improve PSG and patient-reported measures of DNS in narcolepsy.

**Acknowledgement:** This study was sponsored by Jazz Pharmaceuticals, Inc.

<http://dx.doi.org/10.1016/j.sleep.2013.11.227>

### How to evaluate sleepiness in Parkinson's disease?

V. Cochen De Cock<sup>1</sup>, S. Bayard<sup>1</sup>, I. Jaussent<sup>2</sup>, Y. Dauvilliers<sup>1</sup>

<sup>1</sup>Hôpital Gui De Chauliac, Unité des troubles du sommeil, France

<sup>2</sup>INSERM 1061, France

**Introduction: background:** Excessive daytime sleepiness is a frequent complaint in Parkinson's disease; however its determinants remain unclear. **Objective:** To assess the frequency and the determinants of subjective and objective sleepiness in patients with Parkinson's disease compared to controls.

**Materials and methods:** One hundred and thirty-four consecutive patients with Parkinson's disease, without selection bias for sleep complaint, and 34 controls underwent a semi-structured clinical interview and a one night of polysomnography followed by a multiple sleep latency test. Subjective sleepiness was defined as an Epworth sleepiness scale score over ten and objective sleepiness as mean sleep latency on multiple sleep latency test lower than eight minutes. Demographic and clinical data, treatment, pain, depressive symptoms, the presence of insomnia, restless legs syndrome, REM sleep behaviour disorder, and nighttime sleep measures were collected for all participants to control for confounding variables.

**Results:** Among 134 patients with Parkinson's disease, 62 (46.3%) had subjective and 18 (13.4%) had objective sleepiness. None of the patients presented several sleep onset REM periods on the multiple sleep latency test. Patients with Parkinson's disease had higher frequency of restless legs syndrome, REM sleep behaviour disorder, depressive and insomnia symptoms than controls. Patients had longer REM sleep latency and N3 sleep duration, shorter REM sleep duration and higher periodic leg movements during sleep and micro arousals indexes compared to controls but less apnea/hypopnea events. In patients with Parkinson's disease, a higher body mass index was associated with subjective and objective excessive daytime sleepiness. After adjustment for body mass index, pain complaint and mean daytime sleep latency were associated with subjective sleepiness, and a higher apnea/hypopnea index with objective sleepiness. A weak correlation was found between Epworth sleepiness scale and multiple sleep latency test. No between group-differences were found for depressive symptoms, sleep complaints, disease severity, treatment, and sleep parameters except apnea/hypopnea index.

**Conclusion:** The complaint of sleepiness is frequent in Parkinson's disease in contrast to objective sleepiness assessed by neurophysiological measure. New determinants for excessive daytime sleepiness were identified with pain for subjective sleepiness, sleep-disordered breathing for objective sleepiness and being overweight/obese for both subjective and objective sleepiness. As the sensitivity of multiple sleep latency test to identify Parkinson's disease patients with disabling sleepiness remained questionable further studies are required to validate the best methods to screen and objective hypersomnia in Parkinson's disease to propose wake promoting treatments and to prevent car accidents.

**Acknowledgement:** To all the patients who participated to the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.228>

### Gender differences in the dreams of canadian adolescents

A. Dale, C. Wong, J. De Koninck

Université d'Ottawa, University of Ottawa, Canada

**Introduction:** Previous studies using the most recent dream methodology and dream related questionnaires have examined the dreams of adolescents in Europe and the United States. They found that adolescent males have more males in their dreams and adolescent females have more females in their dreams, adolescent males have more total aggression and adolescent girls have a higher befriender percentage than adolescent boys. Adolescent girls have been found to engage in more conversation in dreams than boys and also have more household objects, where male dreams are more aggressive and have more stereotypical masculine objects such as sports equipment and tools. The current study attempts to replicate previous findings on gender differences in adolescent dreams using the

more reliable dreams diary method and explore additional features in the dreams of adolescent Canadians.

**Materials and methods:** Fifty males and 50 females, ages 12–17, kept a diary of day's events and dreams for 10 days. One dream per participant was scored by two independent judges, with inter-rater reliability, using the Hall and Van de Castle method of content analysis. All variables were controlled for dream report length by dividing by word count. DreamSAT was used for statistical comparisons and a control was used for family-wise multiple comparisons.

**Results:** Independent samples *t*-tests revealed that females had significantly more words in their dreams ( $t(78) = -3.543, p = .001$ ), and more female ( $t(98) = -2.785, p = .006$ ) and family characters ( $t(98) = -2.683, p = .009$ ), whereas males had significantly more strangers ( $t(61) = 3.578, p = .001$ ). Males had both more total aggression ( $t(74) = 2.452, p = .017$ ), and more recreation implement objects ( $t(60) = 2.572, p = .013$ ). In addition, a variable in DreamSAT measuring negative tone revealed that males had more negatively toned dreams than females ( $t(87) = 2.653, p = .009$ ).

**Conclusion:** These results support previous research on gender differences in the dreams of adolescents and stress the early appearance of aggression in male dreams compared to female dreams. It will be interesting to examine the evolution of these differences in older groups.

**Acknowledgement:** Supported by a grant from the Social Sciences and Humanities Research Council of Canada.

<http://dx.doi.org/10.1016/j.sleep.2013.11.229>

### **Influence of arterial hypertension on renal function in patients with obstructive sleep apnea hypopnea syndrome**

L. Dheryan<sup>1</sup>, G. Podosyan<sup>2</sup>, A. Matevosyan<sup>3</sup>, P. Zelveian<sup>2</sup>

<sup>1</sup>Yerevan State Medical University, Yerevan, Armenia

<sup>2</sup>Center of Preventive Cardiology, National Institute of Health, Yerevan, Armenia

<sup>3</sup>Sleep Research Laboratory at the Center of Preventive Cardiology, Armenia

**Introduction:** Aim of the study has been an investigation of possible relationship between glomerular filtration rate (GFR) and arterial hypertension (AH) in patients with obstructive sleep apnea hypopnea syndrome (OSAHS).

**Materials and methods:** Forty patients (35 male, 5 female, mean age  $43.3 \pm 12.5$  year) with OSAHS (apnea-hypopnea index (AHI)  $>5$  episodes/h) have been included in the study. Investigated 40 patients have been divided into the two groups: patients having only OSAHS (group I) and patients having OSAHS and AH (group II). GFR has been estimated using the Cockcroft–Gault formula. Normal rates for GFR have been estimated as  $100\text{--}130$  ml/m/1.73 m<sup>2</sup>. For statistical analysis of GFR classified groups median values have been used as a “dividing point”. Relationship between GFR and AH has been estimated according to Pearson  $\chi^2$  and Fisher exact test.

**Results:** Increased values for GFR have been revealed in both groups. However, relatively lower rates from median values of GFR have been detected in 11 patients from group I (55%; CI 34.2–74.2%) and in 12 patients from group II (60%; CI 38.7–78.1%). Statistically significant differences have not been observed between two groups of patients; while tendency of higher GFR values from median ones have been revealed in the group I ( $169.0 \pm 52.5$  vs.  $157.5 \pm 36.8$  ml/m/1.73 m<sup>2</sup>,  $p = 0.427$ ).

**Conclusion:** Hyperfiltration is common for patients with OSAHS. In the same time a presence of arterial hypertension is accompanied only by tendency for decrease of absolute values of glomerular filtration rate.

**Acknowledgement:** Anna Petrosyan laboratory technician.

<http://dx.doi.org/10.1016/j.sleep.2013.11.230>

### **Echocardiographic findings in patients with obstructive sleep apnea**

M. Dias<sup>1</sup>, R. Reis<sup>2</sup>, A. Antunes<sup>1</sup>

<sup>1</sup>Pneumology Department, Centro Hospitalar Vila Nova de Gaia/Espinho, Armenia

<sup>2</sup>Pneumology Department, Centro Hospitalar Trás-os-Montes e Alto Douro, Armenia

**Introduction:** Obstructive sleep apnea (OSA) is associated with several adverse cardiovascular effects. This study aims to compare the echocardiographic findings of patients with and without OSA.

**Materials and methods:** We performed a retrospective study which included patients referred to a pneumology outpatient department for suspected OSA between January 2012 and June 2013. Demographic and anthropometric data, cardiovascular risk factors, echocardiographic findings and polysomnographic data were collected. Comparisons were made between subjects with and without OSA.

**Results:** We included 127 patients with a mean age of  $56 \pm 12$  years, 85 (67%) were male. 89 (70%) patients had OSA (34% mild, 17% moderate, 18% severe) and this group was older ( $58$  vs.  $50$ ,  $p = 0.001$ ), had higher body mass index ( $31.7$  vs.  $27.2$ ,  $p < 0.001$ ) and a higher prevalence of hypertension ( $83\%$  vs.  $58\%$ ,  $p = 0.003$ ) and diabetes ( $88\%$  vs.  $66\%$ ,  $p = 0.048$ ). We found that OSA was significantly associated with left atrial enlargement ( $41.6$  mm vs.  $36.6$  mm,  $p < 0.001$ ). In those patients with moderate and severe OSA, pulmonary hypertension was more prevalent ( $62\%$  vs.  $39\%$ ,  $p = 0.047$ ) and the left ventricular ejection fraction (LVEF) was inferior. Moreover, there was a negative correlation between the apnea-hypopnea index (AHI) and the LVEF ( $\rho = -0.287$ ,  $p = 0.007$ ) and an even stronger negative correlation between oxygen desaturation index (ODI) and LVEF ( $r = -0.327$ ,  $p = 0.012$ ). However, no correlation was found between LVEF and minimal oxygen saturation. There was no significant difference between the prevalence of ventricular hypertrophy and diastolic dysfunction in different groups.

**Conclusion:** OSA can affect atrial diameter, pulmonary pressure and systolic function, which can be associated to a poorer prognosis. ODI is the best predictor of LVEF which seems to indicate that this index is the polysomnographic parameter more determinant in the deterioration of systolic function. The next step will be to investigate if these alterations can improve with PAP therapy.

<http://dx.doi.org/10.1016/j.sleep.2013.11.231>

### **Metabolic syndrome influences the severity of sleep apnea syndrome: from the cordioprev study**

A. Leon Acuna<sup>1</sup>, I. Ordonez Dios<sup>2</sup>, P. Perez Martinez<sup>1</sup>,

A. Jimenez Romero<sup>2</sup>, B. Jurado Gamez<sup>2</sup>, J. Lopez Miranda<sup>3</sup>

<sup>1</sup>Andalucia Health Service, Lipid and Atherosclerosis Unit, IMIBIC, Spain

<sup>2</sup>Andalucia Health Service, Department of Respiratory Medicine, Spain

<sup>3</sup>Andalucia Health Service, Lipid and Atherosclerosis Unit, Spain

**Introduction:** Sleep Apnea Syndrome (SAHS) represents a significant risk factor for the development of cardiovascular disease and evidence suggests a relation with Metabolic Syndrome (MetS). However, it is not clear whether SAHS exacerbates the metabolic

abnormalities in patients with MetS. **Objectives:** To determine the relationship between the MetS and the number of components of MetS and the severity of SAHS.

**Materials and methods:** The CordioPrev study (NCT00924937) is an ongoing prospective, controlled trial with a mean follow up of five years duration, including patients with high-risk coronary disease. Among 245 patients from the CordioPrev cohort, SAHS was diagnosed from the nocturnal polysomnography (Apnea–Hipopnea Index (AHS) >5) and MetS was evaluated according to the diagnostic criteria of Adult Panel Treatment III. MetS patients (120 men and 30 women; aged between 45 and 68 years) were divided into three groups based on the number of MetS components: subjects with 3, 4 and 5 MetS components ( $N = 86, 41$  and  $23$  respectively). Insulin resistance and other cardiometabolic parameters were analyzed.

**Results:** 150 patients were fulfilling MetS criteria. As expected, the SAHS severity defined for AHI was significantly higher in patients with MetS ( $p = 0.04$ ). However, no differences were observed between the AHI and the number of components of MetS ( $p = 0.27$ ). Interestingly body mass index (BMI) was correlated independently with AHI ( $p = 0.003$ ) and men with MetS presented major nocturnal desaturation compared with the rest of the population ( $p = 0.014$ ). We did not find any association between SAHS severity and HOMA-IR ( $p = 0.39$ ).

**Conclusion:** Patients with MetS showed a high prevalence and severity of SAHS independently of the number of components. Moreover, obesity is an independent risk factor for the SAHS development, influencing its severity. These findings may need to be taken into consideration when treating these related diseases.

**Acknowledgement:** To Dra. Feu Collado for her critical Reading of this paper.

<http://dx.doi.org/10.1016/j.sleep.2013.11.232>

### Validation of total sleep deprivation model in mice

G. Dispersyn<sup>1</sup>, F. Sauvet<sup>1</sup>, C. Drogou<sup>1</sup>, S. Ciret<sup>1</sup>, T. Gallopin<sup>2</sup>, M. Chennaoui<sup>1</sup>

<sup>1</sup>IRBA, France

<sup>2</sup>ESPCI, France

**Introduction:** Several models of sleep deprivation for rodents have been developed over years. One of the most relevant models is the activity wheel developed by Christie et al. for rats, presenting the advantages to induce few stress and physical activity. Even if this model is validated in rats, no data are available about its pertinence in mice. The aim of our study was to validate this model to mice by assessing that: i. the model do not generate high level of stress (determined by corticosterone assay and weight follow-up); ii. mice are awake 95% of time during sleep deprivation (determined by EEG); iii. the model induces a sleep rebound after sleep deprivation (determined by EEG, temperature and locomotor activity).

**Materials and methods:** 24 h total sleep deprivation (TSD) was produced by a slow rotational movement of an activity wheel programmed on a schedule of 3s “on” and 12s “off” in 13 male C57BL/6 mice. After sessions of wheel habituations, mice were exposed to a 24 h TSD (11 a.m.–11 a.m.). A first group of 8 mice were implanted with telemetry transmitter (TA10ETA-F20, DSI, USA) recording continuously EEG, locomotor activity and temperature before, during, and after 24 h TSD. At the end of 24 h TSD, mice of group 1 were recorded during 72 h to determine the sleep rebound and a second group of 5 mice were sacrificed to collect blood samples for corticosterone assay. A third group of 5 mice were not sleep deprived and were used as control, and sacrificed at the same time (11 a.m.).

**Results:** Corticosterone levels and weight curve were not different between control and sleep deprived mice. EEG recording during 24 h

TSD shows that mice were awakened 97% of time. EEG recording after 24 h TSD show a significant sleep rebound by increasing quantity, non-REM sleep and delta power (0.5–4 Hz) during non-REM sleep, with no effect on REM sleep during the 24 h following TSD. Temperature and locomotor activity recording show a desynchronization of the two rhythms after 24 h TSD by modifying values of acrophase and amplitude.

**Conclusion:** Total sleep deprivation was effective by limiting mice sleep at 3% during 24 h, by inducing a sleep rebound during the 24 h following the end of deprivation (increase of non-REM sleep and delta power), and desynchronising locomotor activity and temperature rhythms. In conclusion, this model is as little stressful for mice as rats and can be used as a validated method for total sleep deprivation in rodents.

**Acknowledgement:** Direction General de l'Armement Grant PDH-1-SMO-2–0506.

<http://dx.doi.org/10.1016/j.sleep.2013.11.233>

### A study on a gender based comparative association between dietary intake and obstructive sleep apnea syndrome

S. Dixit<sup>1</sup>, A. Dubey<sup>2</sup>, S. Kant<sup>3</sup>, S. Tiwari<sup>4</sup>

<sup>1</sup>Department of Nutrition, IT College, India

<sup>2</sup>KGMU, India

<sup>3</sup>Department of Pulmonary Medicine, KGMU, India

<sup>4</sup>Department of Physiology, KGMU, India

**Introduction:** Obesity is identified as the most important risk factor for obstructive sleep apnea syndrome (OSAS). Excessive weight gain results in deposition of the excessive visceral fat by the decrease in basal metabolism and the amount of less momentum despite of unchanging appetite which results in weight gain and upper respiratory tract becomes narrower, and it worsens obstructive sleep apnea syndrome (OSAS). The aim of this paper was to understand the Gender based Comparative Association between Dietary Intake and Obstructive Sleep Apnea Syndrome.

**Materials and methods:** Overnight sleep study was carried out in 190 index subjects in polysomnography unit of Department of Pulmonary Medicine, KGMU, UP, India. Obesity is measured in terms of anthropometric parameters (weight (wt) and body mass index (BMI) = wt (kilogram)/height (meter<sup>2</sup>)) and dietary intake was assessed by 24 h dietary recall method.

**Results:** In females significant association was found with calories ( $p = 0.040$ ), proteins ( $p = 0.034$ ), number of meals in a day (0.008), Apnea Hypopnea Index (AHI) ( $p = 0.000$ ) and Epworth Sleepiness Score (ESS) ( $p = 0.002$ ) whereas in males significant association was absent.

**Conclusion:** Dietary factors are significantly associated with females.

**Acknowledgements:** I would like to thank my guide and my co-guides who help me to walk in a right direction. I would also like to thank all the subjects who respond me so patiently. I would also like to thank to God for being with me throughout my work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.234>

### Consequences of rem-predominant and rem-exclusive sleep apnea on motor memory consolidation during sleep

M. Igue<sup>1</sup>, M. Guo<sup>1</sup>, A. Malhotra<sup>2</sup>, R. Stickgold<sup>3</sup>, I. Djonlagic<sup>1</sup>

<sup>1</sup>Brigham and Women's Hospital, Harvard Medical School, United States

<sup>2</sup>Division of Pulmonary and Critical Care Medicine, University of California San Diego, United States

<sup>3</sup>Beth Israel Deaconess Medical Center, Harvard Medical School, United States

**Introduction:** The clinical importance of sleep apnea during REM sleep is unclear. We have previously observed that sleep fragmentation from mild obstructive sleep apnea can impair motor memory consolidation as assessed by the motor sequence task (MST). Some sleep apnea patients experience respiratory events exclusively during REM sleep (REM-exclusive) whereas others have REM-predominance of events (ratio of REM:NREM AHI >2) and others have repetitive apneas throughout NREM and REM sleep. We sought to test the hypothesis that OSA during REM sleep does not impair motor memory consolidation and that observed abnormalities would be a function of disrupted NREM sleep.

**Materials and methods:** We assessed performance on the MST in 4 groups who had been referred to a sleep clinic for polysomnographic evaluation [healthy controls – HC ( $n = 13$ ), REM-exclusive OSA ( $n = 13$ ), REM-predominant OSA ( $n = 14$ ) and those with respiratory events throughout sleep – REM/NREM OSA ( $n = 15$ )]. We also gave subjects the psychomotor vigilance test (PVT) to control for attentiveness in the evening and in the morning after sleep. In addition, we administered a Profile of Mood State (POMS) survey.

**Results:** As expected, performance on the MST improved overnight in the healthy control group. An improvement which was similar in magnitude was also observed in the REM-exclusive OSA group. In contrast, patients with REM-predominant OSA and REM/NREM OSA had impaired overnight memory consolidation. PVT baseline average reaction time at night and the average reaction time in the morning showed no significant difference between the four subject groups. As for the POMS, REM-exclusive people felt the most negative emotion; they had the highest Total Mood Disturbance (TMD) score, with particularly low vigor. REM/NREM OSA patients had the next highest average TMD, but it was not significantly higher than that of REM-predominant OSA patients.

**Conclusion:** These findings suggest that NREM sleep fragmentation is detrimental to overnight motor memory consolidation, but that REM sleep fragmentation (and related OSA) is less critical. Furthermore, our study provided evidence that sleep apnea has a causal link to memory impairment, rather than poor MST performance being caused by general OSA-induced sleepiness. Our results also provide evidence that while apneas occurring only during REM sleep do not have an effect on the encoding and stabilization of motor memories they are deleterious for emotional health.

**Acknowledgements:** This work was supported by K23 HL103850-01 and American Board of Sleep Medicine Junior Faculty Research Award# 54-JF-1-10.

<http://dx.doi.org/10.1016/j.sleep.2013.11.235>

### Sleep parameter estimation from portable data

A. Domingues<sup>1</sup>, T. Paiva<sup>2</sup>, J. Sanches<sup>1</sup>

<sup>1</sup> *Institute for Systems and Robotics, Bioengineering Department, Instituto Superior Técnico, Technical University of Lisbon, Portugal*  
<sup>2</sup> *Centro de Electroencefalografia e Neurologia Clínica, Faculdade de Medicina da Universidade de Lisboa, Portugal*

**Introduction:** The advent of small and portable devices, with high storage and processing capabilities have allowed physiological data to be acquired outside clinical environments in a reliable way, often across several days. These sources of data include ECG, Respiratory Inductance Plethysmography (RIP), oxygen saturation, Actigraphy (ACT), among others. Due to the highly constrained conditions in which the Polysomnography (PSG), the golden standard for sleep disorders diagnosis, is performed, alternative methods are desired. These small and portable devices may provide an alternative for long term monitoring, thus complementing the information provided by

the PSG. In this work, we present an algorithm to estimate the Sleep Efficiency (SE), REM and Non-REM sleep percentages from multimodal data that can easily be acquired from portable devices, combining information from ECG, RIP and ACT.

**Materials and methods:** The data was acquired from fifteen healthy volunteers who performed a standard PSG+ Actigraphy. The average SE, REM and NREM percentages, computed from the hypnograms, are 87.2%, 18.87% and 81.13% respectively. An extended feature set was extracted from the RR, RIP and ACT signals. The extracted features were used to train a two Parzen classifiers with a rejection option. The computation of the 3 sleep parameters takes into account the result of each classifier and a final regularization step, which takes includes the a priori training information regarding the performance of the classifier.

**Results:** The described method resulted in an estimated average SE of 87.8% corresponding to an average estimation error of 5.62%. The estimated REM and NREM percentages were 18.91% and 81.9%, corresponding to an average estimation error of 8.22% and 5.95% respectively.

**Conclusion:** Reliable sleep parameters estimation is typically limited to PSG data, where EEG plays a fundamental role in the determination of the sleep state. The obtained results are encouraging since they were obtained with limited data yielding low estimation errors. The use of classifiers with rejection capability ensures that only non-ambiguous data is used in the estimation process.

**Acknowledgements:** This work was supported by FCT (ISR/IST pluriannual funding) through the PIDDAC Program funds and FCT project "Detection of Brain Micro-states in Fibromyalgia" (PTDC/SAU-BEB/104948/2008).

<http://dx.doi.org/10.1016/j.sleep.2013.11.236>

### Narcolepsy and odour: preliminary report

D. Dominguez-Ortega<sup>1</sup>, E. Diaz Gallego<sup>2</sup>, F. Pozo<sup>3</sup>, C. García-Armenter<sup>4</sup>, M. Serrano-Comino<sup>5</sup>, E. Dominguez-Sanchez<sup>6</sup>

<sup>1</sup> *Clínica Ruber, Instituto para la investigación de los trastornos del sueño (IITS), AASM, ESRS and SES, Spain*

<sup>2</sup> *Clínica Ruber, Universidad Complutense de Madrid, SES, Spain*

<sup>3</sup> *H. 12 de Octubre, Spain*

<sup>4</sup> *Clínica Ruber, SES, Spain*

<sup>5</sup> *Instituto para la Investigación de los trastornos del sueño (IITS), Spain*

<sup>6</sup> *Clínica Ruber, Spain*

**Introduction:** Narcolepsy is a primary sleep disorder characterized by excessive daytime sleepiness, sleep attacks, cataplexy, and sleep paralysis with hypnagogic hallucinations. The etiology of narcolepsy gives great importance to the role of the orexin/hypocretin system, both in animals and humans. The prevalence is 1/2000 in the general population and the diagnosis is based on clinical data and polysomnographic studies. Odours have been used as indicators of diseases dating back to traditional medicine. Dogs can be trained to detect any odorous substance even in the presence of other interfering odours. Numerous clinical studies based on scent detecting have been done with tumors and infections with a level of sensibility and specificity near 100%. This study has been carried out to test the clinical hypothesis of personal smell as a hint to the diagnosis of narcoleptic patients.

**Materials and methods:** Sweat samples from narcoleptic and controls were collected following the same protocol to avoid contamination, and tested independently by two trained dogs and their positive or negative detection compared to the gold standard diagnosis for narcolepsy. Neither trainer nor dog knew the source of the sample selected nor its placement in the search device. 12 narco-

leptic patients, both sexes and various ages, diagnosed according to standard criteria, made up the patient group. The control group was made up of 22 healthy volunteer without sleep disorders, both sexes and various ages. The same samples were analyzed using Head Space-Solid Phase MicroExtraction and Gas Chromatography-Mass Spectrometry (HS-SPME-GCMS) and with proper statistical techniques to distinguish the aroma profile between the two groups.

**Results:** 11 narcoleptic were detected positive by the dogs while only three controls. HS-SPME-GCMS results showed that the disease can be discarded with a classification rate of 75%. HS-SPME-GCMS technique can be proposed as screening method in a first diagnosis approach.

**Conclusion:** It seems that narcoleptic patients have a distinct typical odour that trained dogs and analytical techniques can detect. The development of olfactory test for the diagnosis of narcolepsy opens a new research area.

**Acknowledgements:** This was not an industry supported study. The authors would like to thanks the Civil Guard for his contribution regarding the dog's training and completion of the detection test for all the samples submitted. They have made this study possible.

<http://dx.doi.org/10.1016/j.sleep.2013.11.237>

### Risk factors associated with sleep disturbance following traumatic brain injury

Y. Dong<sup>1</sup>, P. Sheng<sup>1</sup>, W. Tong<sup>2</sup>, Z. Li<sup>3</sup>, D. Xu<sup>3</sup>, L. Hou<sup>1</sup>

<sup>1</sup>Department of Neurosurgery, Changzheng Hospital, Second Military Medical University, China

<sup>2</sup>Department of Neurosurgery, Pudong New Area People's Hospital, China

<sup>3</sup>Department of Neurosurgery, Fengxian Central Hospital, China

**Introduction:** Sleep disturbance is very common following traumatic brain injury (TBI), which may initiate or exacerbate a variety of co-morbidities and negatively impact rehabilitative treatments. To date, there are paradoxical reports regarding the associations between inherent characteristics of TBI and sleep disturbance in TBI population. The current study was designed to explore the relationship between the presence of sleep disturbance and characteristics of TBI and identify the factors which are closely related to the presence of sleep disturbance in TBI population.

**Materials and methods:** 98 TBI patients (72 males, mean age SD, 47 13 years, range 18–70) were recruited. Severity of TBI was evaluated based on Glasgow Coma Scale (GCS). All participants were performed cranial computed tomography and examined on self-reported sleep quality, anxiety, and depression.

**Results:** 37 of 98 patients (38%) reported sleep disturbance following TBI. Insomnia was diagnosed in 28 patients (29%) and post-traumatic hypersomnia in 9 patients (9%). In TBI with insomnia group, 5 patients (18%) complained difficulty falling asleep only, 8 patients (29%) had difficulty maintaining sleep without difficulty in initial sleep and 15 patients (53%) presented both difficulty falling asleep and difficulty maintaining sleep. Risk factors associated with insomnia were headache and/or dizziness and more symptoms of anxiety and depression rather than GCS. In contrast, GCS was independently associated with the presence of hypersomnia following TBI. Furthermore, there was no evidence of an association between locations of brain injury and the presence of sleep disturbance after TBI.

**Conclusion:** Our data demonstrate that TBI patients with insomnia are prone to suffer from concomitant headache and/or dizziness and report more symptoms of anxiety and depression. Severe TBI patients are likely to experience hypersomnia.

**Acknowledgements:** We would like to express our appreciation to all the patients who have participated in this study and Drs. Zhong-

xin Zhao, Liuqing Huang and You Yin for their valuable comments on this manuscript.

<http://dx.doi.org/10.1016/j.sleep.2013.11.238>

### Energy expenditure in narcolepsy patients and controls

C. Donjacour<sup>1</sup>, P. Schoffelen<sup>2</sup>, S. Overeem<sup>3</sup>, G. Lammers<sup>1</sup>, H. Pijl<sup>4</sup>, K. Westerterp<sup>2</sup>

<sup>1</sup>Leiden University Medical Centre, Department of Neurology, The Netherlands

<sup>2</sup>Maastricht University Medical Centre, Human Biology, The Netherlands

<sup>3</sup>Radboud University Medical Centre, Neurology, The Netherlands

<sup>4</sup>Leiden University Medical Centre, Department of Endocrinology, The Netherlands

**Introduction:** Hypocretin deficiency causes narcolepsy, a condition characterized by excessive daytime sleepiness, cataplexy, and fragmented nocturnal sleep. Co-morbid overweight is present in two thirds of narcolepsy patients. Moreover one third of them is obese. Why narcolepsy patients gain weight is not known. They do not seem to eat and/or sleep more during 24 h than controls. This study was performed to detect a possible decrease in energy expenditure that could be the cause for the overweight in narcolepsy. This is the first study using a respiration chamber to measure Energy Expenditure in narcolepsy.

**Materials and methods:** Nine hypocretin deficient male patients with narcolepsy-cataplexy, and nine sex, age and body mass index (BMI) matched controls were enrolled. Energy Expenditure was measured for 24 h in a respiration chamber. Spontaneous physical activity was measured by a radar system based on Doppler principle. Subjects were given a diet to maintain energy balance based on the Harris-Benedict equation. Total Energy Expenditure (TEE), Overnight Metabolic Rate (OMR) and lowest Sleeping Metabolic Rate (SMRmin) were calculated. In addition, measured SMR was compared with SMR calculated with a prediction equation based on body composition.

**Results:** Narcolepsy patients did not differ from controls in BMI ( $27.4 \pm 3.9$  vs.  $27.5 \pm 4.2$ ;  $P = 9.4$ ) or age ( $38.1 \pm 16.0$  vs.  $36.8 \pm 15.2$ ;  $P = .86$ ) respectively. There were no differences in TEE ( $10.6 \pm 1.2$  vs.  $10.6 \pm .80$  MJ/d;  $P = .99$ ) OMR ( $5.7 \pm .73$  vs.  $6.0 \pm .55$  MJ/d;  $P = .35$ ), SMRmin ( $5.4 \pm .76$  vs.  $5.4 \pm .51$  MJ/d;  $P = .99$ ) and spontaneous activity between narcolepsy patients and matched controls ( $2862 \pm 514$  vs.  $2732 \pm 245$  counts/d;  $P = .50$ ). For both groups, measured SMR was closely related to SMR predicted from body composition.

**Conclusion:** Energy expenditure in narcolepsy patients is similar to matched controls. It is conceivable that we were not close enough to onset of the disease, when patients usually gain weight, to detect a possible difference before a new metabolic set point establishes.

**Acknowledgement:** This study was supported by a grant from UCB Pharma.

<http://dx.doi.org/10.1016/j.sleep.2013.11.239>

### Prevalence of central sleep apnea among heart failure patients with preserved ejection fraction

K. Terziyski<sup>1</sup>, A. Draganova<sup>1</sup>, O. Aliman<sup>2</sup>, I. Ilchev<sup>3</sup>, A. Hristova<sup>1</sup>, S. Kostianev<sup>1</sup>

<sup>1</sup>Medical University – Plovdiv, Pathophysiology Dept, Bulgaria

<sup>2</sup>MHAT “St. Caridad”, Cardiology Dept, Bulgaria

<sup>3</sup>MHAT “St Ivan Rilski”, Cardiology Dept, Bulgaria

**Introduction:** Central sleep apnea (CSA) is common among patients with chronic heart failure (CHF) and has been associated with increased morbidity and mortality. However, scarce data about CSA prevalence in heart failure patients with preserved ejection fraction (EF) are available. The aim of the study was to determine the prevalence of CSA among ambulatory heart failure patients with preserved ejection fraction (HFPEF).

**Materials and methods:** Thirty-three ambulatory patients with HFPEF were recruited and subjected to full-night polysomnography. The presence of sleep-disordered breathing (SDB) was based on apnea-hypopnea index (AHI) – 5–15 – mild, 15–30 – moderate, >30 – severe. Preserved ejection fraction was defined as EF > 45%. All patients received drug treatment in concordance with the latest guidelines.

**Results:** The mean age was  $65.8 \pm 8.5$  years and the mean left ventricular ejection fraction was  $55.4 \pm 6.4\%$ . Among the 33 patients, 27 (81.8%) had SDB – 11 (33.3%) CSA, 4 (12.1%) obstructive sleep apnea and 12 (36.4%) mixed sleep apnea. Moderate or severe SDB was present in 24 of them (72.3%). No statistically significant differences between CHF patients with CSA and CHF patients without SDB were found regarding main anthropometric parameters (body-mass index (BMI) =  $28.5 \pm 6.9$  vs  $25.6 \pm 8.7$ , NS, age =  $70.2 \pm 9.9$  vs  $63.3 \pm 8.1$ , NS) and excessive daytime sleepiness (Epworth score =  $8.7 \pm 6.1$  vs  $7.2 \pm 2.6$ ).

**Conclusion:** CSA demonstrates very high prevalence in patients with HFPEF. Those patients should also be considered for screening for SDB and consequent therapy.

**Acknowledgement:** The study was financed by the Bulgarian Ministry of Youth and Science.

<http://dx.doi.org/10.1016/j.sleep.2013.11.240>

### **A study on association between obstructive sleep apnea syndrome (OSAS) and epworth sleepiness score (ESS), physical and mental components related with quality of life (QOL)**

A. Dubey<sup>1</sup>, S. Dixit<sup>2</sup>, S. Kant<sup>1</sup>, S. Tiwari<sup>1</sup>

<sup>1</sup>KGMU, India

<sup>2</sup>Department of Nutrition, IT College, India

**Introduction:** Obstructive sleep apnea syndrome (OSAS) put adverse impacts on the quality of life (QOL). Excessive sleepiness and other associated symptoms may negatively affect ability to learn, employment, and interpersonal relations, and directly degrade QOL. The objective of the present study was to evaluate the impact of OSAS on Epworth Sleepiness Score (ESS), Physical and Mental components related with QOL.

**Materials and methods:** *Design:* Observational, Hospital based study *Setting:* Study was carried out in 190 index subjects in polysomnography unit of Department of Pulmonary Medicine, KGMU, India. *Method:* Overnight sleep study was carried out in all subjects on polysomnography unit. Hindi version of HRQOL tool SF-36 was used to evaluate Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE), Mental Health (MH), Physical Component Summary (PCS) and Mental Component Summary (MCS) in these subjects.

**Results:** PCS was found to be associated with BMI, Neck Circumference, Blood Pressure, Hypopnea, and number of total Desaturation fall events below 5% while MCS was found to be associated with BMI and Hypopnea events in these subjects. In males, severity of disease was found associated with BP, RP and MCS ( $p = 0.05, 0.03$  and  $0.01$  respectively) whereas in females, severity of disease was signif-

icant association with parameters such as BP ( $p = 0.02$ ), GH ( $p = 0.01$ ), VT ( $p = 0.01$ ), SF ( $p = 0.02$ ), PF ( $p = 0.04$ ), RP ( $p = 0.001$ ) and PCS ( $p = 0.000$ ).

**Conclusion:** Physical Component Summary (PCS) and Mental Component Summary (MCS) are related with sleep related events in these subjects thus improvement in these parameters through various treatment modalities can be used to improve QOL in this population.

**Acknowledgements:** I would like to thank my guide and my co-guides who help me to walk in a right direction. I would also like to thank all the subjects who respond me so patiently. I would also like to thank to God for being with me throughout my work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.241>

### **Association between the consolidation of the rest-activity cycle and brain recovery in the acute phase of traumatic brain injury**

C. Duclos<sup>1</sup>, M. Dumont<sup>1</sup>, L. De Beaumont<sup>1</sup>, C. Wiseman-Hakes<sup>1</sup>, F. Bernard<sup>2</sup>, N. Gosselin<sup>1</sup>

<sup>1</sup>Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, Department of Psychiatry, Université de Montréal, Canada

<sup>2</sup>Traumatology program, Hôpital du Sacré-Coeur de Montréal, Department of Medicine, Université de Montréal, Canada

**Introduction:** Based on clinical observations, sleep-wake cycle disturbances, arise in the days following traumatic brain injury (TBI), and remain among the most persistent and debilitating symptoms. The aim of this study was to document the evolution of rest-activity cycle consolidation in the acute phase of moderate/severe TBI, and its association with injury severity and outcome, using actigraphy.

**Materials and methods:** Sixteen hospitalised patients (13 men;  $27.1 \pm 11.3$  years) with moderate/severe TBI wore actigraphs for 10 days. Recordings began in the intensive care unit (ICU) when continuous sedation was discontinued and patients had reached medical stability. The ratio of daytime (7:00–21:59) activity to total 24-h activity was used to quantify the level of consolidation of a day-night rest-activity cycle, and a ratio  $\geq 80\%$  was considered to reflect adequate consolidation. The Galveston Orientation and Amnesia Test and the Disability Rating Scale were used to assess posttraumatic amnesia (PTA) and functionality at discharge. An analysis of variance was used to characterize the evolution of the daytime activity ratio over the recording period. Pearson's correlations were carried out to measure associations between actigraphy and injury severity and outcome. T-tests for independent samples were used to compare the rest-activity cycle of patients with and without PTA at discharge.

**Results:** Most patients showed a very low daytime activity ratio during the first 48-h of recording (mean  $\pm$  SD =  $70.8 \pm 10.1\%$ ), with only 4 patients having a ratio  $\geq 80\%$ . Although this consolidation threshold was reached in only 46.6% of all recording days, there was a significant linear trend of improvement over the 10 days of recording ( $p < 0.05$ ). Greater TBI severity, and longer duration of ICU and hospital stay were associated with poorer rest-activity cycle consolidation and evolution ( $p$ -values  $< 0.05$ ). A greater improvement of rest-activity cycle consolidation was associated with better physical and cognitive state at hospital discharge ( $p < 0.05$ ).

**Conclusion:** TBI patients have severe rest-activity cycle disturbances during their hospital stay, but these disturbances globally improve over time. The absence of rest-activity cycle consolidation reflects severe fragmentation of sleep-wake patterns. A faster return to rest-activity cycle consolidation may predict enhanced brain recovery.

**Acknowledgements:** Research funded by the Canadian Institutes of Health Research (CIHR) and the Fonds de recherche du Québec – Santé (FRQS).

<http://dx.doi.org/10.1016/j.sleep.2013.11.242>

### Sleep problems in patients with parkinson's disease in a hospital setting from Romania

M. Dumitru

University Hospital of Psychiatry "Socola", Romania

**Introduction:** Sleep dysfunction is common among patients with Parkinson's disease and occurs in approximately two thirds of patients. The objective of this study was to examine the prevalence of sleep problems in patients with Parkinson's disease in Romania, and their associated factors.

**Materials and methods:** 44 consecutive PD inpatients (41% females) were included in a study of non-motor symptoms, including sleep problems. All participants responded to the Parkinson's Disease Sleep Scale (PDSS), where an overall score below 82 or a score below 5 on a sub-item indicate sleep problem. Factors associated with sleep were also investigated, with special emphasis on severity of PD, fatigue, mental health and restless legs syndrome (RLS).

**Results:** The mean age was 67.8 years (range 35–74); the mean Hoehn and Yahr stage was 2.13 (SD 0.89), and the mean UPDRS part III was 22.6 (SD 11.5). Sleep problems were common among PD patients. While only 17% of the sample had an overall score below 82 on the PDSS, 70% of the patients had a score below 5 on one item.

**Conclusion:** The current findings call for increased awareness of sleep problems in PD patients, especially focusing on the association with mental health problems, fatigue and RLS. Physicians and patients must be educated so that sleep problems can be appropriately recognized and treated.

**Acknowledgement:** I thank Professor Cornel Dinu Popescu for his skillfull assistance during the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.243>

### A new vibratory postural device for the treatment of positional obstructive sleep apnea (OSA). A pilot study

J. Duran-Cantolla<sup>1</sup>, F. Barbe<sup>2</sup>, J. Rigau<sup>3</sup>, D. Oreja<sup>1,2,3,4</sup>,  
C. Martinez-Null<sup>4</sup>, C. Egea Santaolalla<sup>4</sup>

<sup>1</sup>Araba University Hospital, UPV, BioAraba Institute, CIBERES, Spain

<sup>2</sup>IRB Lleida, CIBERES, Spain

<sup>3</sup>SibelMed SA, Spain

<sup>4</sup>Araba University Hospital, UPV, Sleep Unit, BioAraba, CIBERES, Spain

**Introduction:** Over 50% of patients suffering from obstructive sleep apnea (OSA) meet criteria for postural OSA. Postural OSA is defined by an apnea-hypopnea index (AHI) doubling in supine position vs. not supine. Different devices for postural OSA has been used but most of them are uncomfortable and their results for treating postural OSA are controversial. Our group in collaboration with the company SIBEL SA, have developed a patented postural device (PCT/ES2010707108 and P26018USPC). This is a vibratory device of 4 × 4 cm and a weight of about 50 grams integrating an accelerometer, a vibrator and other sensors. The device is placed on the patient's forehead and when the device detects that the patient is in the supine position for 30 s or more, it starts a vibration, with

increasing intensity, which ceases when the patient moves to lateral. The aim was to demonstrate a significant reduction in the AHI and that this reduction was maintained over time. We also want to assess the quality and quantity of sleep using the device.

**Materials and methods:** We present the results of a pilot study in patients with postural OSA. All patients were studied by standard polysomnography (PSG) three times; at baseline, and at 1 and 4 weeks of using the device.

**Results:** We studied 12 patients (75% male), body mass index of 25.7 kg/m<sup>2</sup> (SD 3.3). The baseline AHI was 33.5 (SD 14.7) and was reduced after 1 and 4 weeks using the device to 22.8 (SD 10.6;  $p = 0.004$ ) and 19.7 (SD 7.4;  $p = 0.002$ ), respectively. The percentage of total sleep time (TST) in supine changed from 51.5% (SD 14.8%) at baseline to 16.4% (SD 16.0%;  $p = 0.002$ ) and 25.2% (SD 21.0%;  $p = 0.005$ ) at 1 and 4 weeks of using the device, respectively. The device did not significantly modify the TST and significantly reduced the arousal index.

**Conclusion:** The results of this study suggest that this device is safe and could be useful as a treatment for postural OSA in a significant number of patients and its effect is maintained over the time.

**Acknowledgements:** Device designed and produced by Sibel Group SL with the collaboration and participation in all phases by the Sleep Units of Vitoria (Spain) and Lleida (Spain) The sponsorship of the different prototypes and this pilot study has been made possible by the Basque Institute of Research and by Sibel Group SL All Rights reserved by Sibel Group SL and the Basque Institute of Research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.244>

### REM sleep behavioral disorder in Parkinson's disease: preliminary results

A. Eckeli, M. Sobreira Neto, E. Sobreira, M. Chagas, V. Tumas,  
R. França Fernandes

Universidade de São Paulo, Faculdade de Medicina de Ribeirão Preto, Brazil

**Introduction:** REM Sleep Behavioral Disorder (RBD) is a parasomnia characterized by acting out during REM sleep, with a higher prevalence in Parkinson's Disease (PD), which changes from 46% to 58%. Moreover, PD patients with RBD show motor and non-motor characteristics distinct from other PD patients without RBD. Objectives: to estimate the prevalence and characteristics of RBD among patients with PD.

**Materials and methods: Methods and patients:** Patients were consecutively evaluated at a third level Outpatient Clinics for Movement Disorders, through the following clinical scales: PD sleep Scale validated for the Brazilian population (PDSS-Br), Epworth's daytime sleepiness scale, quality of life questionnaire in PD (PDQ-39), unified PD rating scale (UPDRS), Hoehn & Yahr's modified evaluation scale and Schwab & England's functional evaluation scale. All patients were submitted to polysomnography and diagnose of RBD was defined according to the 2nd International Classification of Sleep Disorders.

**Results:** seventy third (73) patients have been included so far, among whom we have found a prevalence of 61.6% of RBD (45 patients). There was a lower respiratory disorder index (RDI) among patients with RBD (10.53 ± 11.07) as compared to those without RBD (20.58 ± 17.89) ( $p = 0.020$ ). We also found history of self inflicted injury or wounding someone else during sleep acting out periods in 15 patients (33.3%) with RBD. Somniloquy was reported in 97.7% of RBD patients and it was the most frequently reported behavior. We did not find statistically significant differences between groups of patients with or without RBD related to age, time

duration of PD, as well as in regard to PD Sleep Scale validated for the Brazilian population (PDSS-Br), Epworth's daytime sleepiness scale, quality of life questionnaire in PD (PDQ-39), unified PD rating scale (UPDRS), Hoehn & Yahr's modified evaluation scale and Schwab & England's functional evaluation scale.

**Conclusion:** RBD is a very prevalent condition among PD patients, being associated to a lower RDI and higher risk of wounding during sleep. We found no association between RBD and reduced quality of life in PD patients.

**Acknowledgements:** FAEPA (Fundação de Apoio ao Ensino, Pesquisa e Assistência do Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto da Universidade de São Paulo) CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior).

<http://dx.doi.org/10.1016/j.sleep.2013.11.245>

### **Obstructive sleep apnea syndrome in Parkinson's disease: preliminary results**

M. Sobreira Neto, M. Pereira, E. Sobreira, R. França Fernandes, V. Tumas, A. Eckeli

Universidade de São Paulo, Faculdade de Medicina de Ribeirão Preto, Brazil

**Introduction:** the prevalence of Obstructive Sleep Apnea Syndrome (OSAS) among patients with Parkinson's Disease (PD) changes from 20% to 66%. OSAS also shows different characteristics in those patients as compared to general population. Objectives: to estimate the prevalence and characteristics of OSAS in patients with PD.

**Materials and methods:** *Methods and patients:* Patients were consecutively evaluated at a third level Outpatient Clinics for Movement Disorders, through the following clinical scales: PD Sleep Scale validated for the Brazilian population (PDSS-Br), Epworth's daytime sleepiness scale, quality of life questionnaire in PD (PDQ-39), unified PD rating scale (UPDRS), Hoehn & Yahr's modified evaluation scale and Schwab & England's functional evaluation scale. All patients were submitted to polysomnography and diagnose of OSAS was defined according to the 2nd International Classification of Sleep Disorders.

**Results:** Seventy third (73) patients have been included so far, among whom we have found a prevalence of 61.6% of OSAS (45 patients), of mild or moderate severity in 86.6%. OSAS patients had higher age than those without OSAS ( $p = 0.004$ ). The mean score in Epworth's scale was higher among OSAS patients ( $p = 0.05$ ). Snore was the prevalent symptom in the group of OSAS patients (74.5%), showing a sensitivity of 80%. Apneas witnessed by partners were the most specific symptom, ranking 92%. We did not find significant differences between the groups with and without OSAS in regard to PDSS-Br, PDQ-39, UPDRS), Hoehn & Yahr's modified evaluation scale and Schwab & England's functional evaluation scale.

**Conclusion:** OSAS is a prevalent sleep disorder among PD patients, in whom it is found in higher aging people and is associated to greater daytime sleepiness, in comparison to non-OSAS PD patients. Snore is the most sensitive symptom and apneas witnessed by the partner the most specific symptom in PD patients with OSAS.

**Acknowledgements:** FAEPA (Fundação de Apoio ao Ensino, Pesquisa e Assistência do Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto da Universidade de São Paulo) CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior).

<http://dx.doi.org/10.1016/j.sleep.2013.11.246>

### **A collaborative care model for improving sleep disorders management in primary care**

J. Edinger<sup>1</sup>, J. Grubber<sup>2</sup>, C. Ulmer<sup>2</sup>, J. Zervakis<sup>2</sup>, M. Olsen<sup>2</sup>

<sup>1</sup> National Jewish Health, United States

<sup>2</sup> VA Medical Center, United States

**Introduction:** Sleep disorders often are not adequately addressed in the primary care setting. The current study was conducted to determine the effects of a one-time consultation with a sleep specialist on sleep management patterns and outcomes in a primary care setting.

**Materials and methods:** The study entailed a prospective, randomized, clinical intervention trial. Participants were 137 veterans (Mage = 55.4 years; 29 women) enrolled in the primary care clinics of the Durham VA Medical Center. Eligible participants had a sleep complaint > 1 month duration,  $\geq 6$  on the Pittsburgh Sleep Quality Index-PSQI,  $\geq 24$  on the Folstein exam, no unstable medical or psychiatric disorders, and no previous sleep specialist treatment. Participants were randomized to an intervention (INT;  $N = 68$ ) or wait-list control (WLC;  $N = 69$ ). INT consisted of one meeting with a sleep specialist who administered structured interviews assessing sleep and psychiatric disorders, and then provided manualized treatment recommendations to patients and their respective healthcare providers. Providers' referral patterns and patient outcomes (sleep diaries, PSQI, Epworth Sleepiness) were then monitored for a subsequent 10-month period.

**Results:** Provider-initiated sleep-focused interventions were significantly more frequent for the INT group than for the WLC group including PSG referrals ( $p < .0001$ ), and mental health clinic referrals ( $p < .02$ ). INT recipients showed greater improvements in diary total wake time ( $p < .05$ ) and sleep efficiency ( $p < .03$ ) than did WLC recipients at 10-month follow-up. In addition, larger proportions of the INT group showed >one standard deviation decline on the PSQI (41% vs. 21%;  $p = 0.02$ ) and achieved normal (<10) Epworth Sleepiness Scale scores (69% vs. 50%;  $p = 0.03$ ) by the 10-month follow-up than did those in the WLC group.

**Conclusion:** A one-time sleep consultation significantly increased healthcare providers' attention to sleep problems and resulted in benefits to patients' sleep/wake symptoms.

**Acknowledgements:** Funded by US Department of Veterans Affairs Health Services Research and Development Grant # IIR 05–213.

<http://dx.doi.org/10.1016/j.sleep.2013.11.247>

### **Association between subjective sleepiness and severity of sleep-disordered breathing among truck drivers in Japan**

E. Eguchi<sup>1</sup>, T. Tanigawa<sup>1</sup>, M. Takahashi<sup>2</sup>, S. Sakurai<sup>3</sup>, K. Maruyama<sup>4</sup>

<sup>1</sup> Ehime University Graduate School of Medicine, Public Health, Japan

<sup>2</sup> National Institute of Occupational Safety and Health, Japan

<sup>3</sup> Tenri Health Care University, Japan

<sup>4</sup> Ehime University Graduate School of Medicine, Japan

**Introduction:** The purpose of this study is to investigate the association of subjective sleepiness and severity of sleep-disordered breathing among truck drivers in Japan.

**Materials and methods:** Age adjusted subjective daytime sleepiness was not significantly related to the severity of sleep-disordered breathing in this population ( $p = 0.36$ ). Among the subjects who had severe sleep-disordered breathing ( $RDI \geq 20$ ), ESS score of non-sleepiness and moderate sleepiness was 56.3% and 34.4% respectively. For the BMI stratified analysis, prevalence of non-sleepiness

and moderate sleepiness for severe sleep-disordered breathing was 60.0% and 30.0% for  $<25 \text{ kg/m}^2$ , and 54.6% and 36.4% for  $\geq 25 \text{ kg/m}^2$ .

**Results:** Age adjusted subjective daytime sleepiness was not significantly related to the severity of sleep-disordered breathing in this population ( $p = 0.36$ ). Among the subjects who had severe sleep-disordered breathing ( $\text{RDI} \geq 20$ ), ESS score of non-sleepiness and moderate sleepiness was 56.3% and 34.4% respectively. For the BMI stratified analysis, prevalence of non-sleepiness and moderate sleepiness for severe sleep-disordered breathing was 60.0% and 30.0% for  $<25 \text{ kg/m}^2$ , and 54.6% and 36.4% for  $\geq 25 \text{ kg/m}^2$ .

**Conclusion:** The results of our study showed that more than 90% of the participants who had severe sleep-disordered breathing did not have severe daytime sleepiness. Objective screening for sleep-disordered breathing is important even if the drivers have no subjective sleepiness.

**Acknowledgements:** We are indebted to Mr. Shuzo Fujioka, the president of Nara Trucking Association for great effort. This study was supported in part by grants from the International Association of Traffic and Safety Sciences Grant No. H2422, from the Japanese Ministry of Education, Culture, Sports, Science and Technology (Grant-in-Aid for research B: 22390134 in 2010–2012, Grant-in-Aid for research C: 23590796 in 2011–2013), and from the Japanese Society for the Promotion of Science, and by Health and Labour Sciences Research Grants from the Ministry of Health, Welfare and Labour, Japan. (Comprehensive Research on Life-Style Related Diseases including Cardiovascular Diseases and Diabetes Mellitus 201021038A in 2010–2012).

<http://dx.doi.org/10.1016/j.sleep.2013.11.248>

### Effect of adenotonsillectomy on nocturnal enuresis in children with obstructive sleep apnea

L. Elnabil<sup>1</sup>, H. Helmy<sup>2</sup>

<sup>1</sup> Ain Shams University, Egypt

<sup>2</sup> Faculty of Medicine, October 6 University, Egypt

**Introduction:** Pediatric obstructive sleep apnea (OSA) is the most severe form of sleep disordered breathing (SDB) and has a prevalence of 1–3% in otherwise healthy children. The most important risk factors for the development of pediatric SDB include adenotonsillar hypertrophy, obesity, craniofacial anomalies and neuromuscular disorders. On the other hand, nocturnal enuresis is a bothersome and common symptom that is associated with (OSA), through influencing the nocturnal secretion of antidiuretic hormone (ADH). We aimed to study the relation between polysomnography data of children with OSA due to adenotonsillar hypertrophy and levels of ADH, total and night urine volume, together with assessment of reversibility of OSA, improvement of the levels of ADH and nocturnal enuresis after adenotonsillectomy.

**Materials and methods:** The study is cross sectional study included 23 non obese children with age above 5 years old complaining of hypertrophied adenoids and tonsils, nocturnal enuresis. A polysomnographic evaluation was done together with serum level of ADH, total and nocturnal urine volume was measured pre and 3 months post adenotonsillectomy.

**Results:** There was a significant negative correlation between ADH and different polysomnographic data including respiratory events (apnea index, total hypopneas, hypopnea index and RDI), oxygen saturation data (desaturation index, average low oxygen level and minimum oxygen saturation) and the snoring index. There was also a significant negative correlation between night urine volume and

desaturation index. comparison between the data means before and after adenoidectomy were done using the paired  $t$ -test; there were a significant improvement of all the polysomnographic data values, there was a significant elevation of the abnormally decreased levels of serum ADH, also there was a significant difference in both the 24 h urine volume and the night urine volume being significantly decreased with improvement of polyuria.

**Conclusion:** Children with OSA, when accompanied with nocturnal enuresis, should be considered for early adenotonsillectomy or other treatments based on etiological factors to approve normal release of ADH, and normal urine volume, with subsequent improvement of nocturnal enuresis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.249>

### Performance assessment of a medical device for home monitoring of CPAP treatment in patients with obstructive sleep apnoea syndrome

M. Elbaz<sup>1</sup>, T. Joelle<sup>2</sup>, C. Amelie<sup>3</sup>, P. Benoit<sup>3</sup>, W. Claude<sup>3</sup>, L. Damien<sup>4</sup>

<sup>1</sup> Centre du sommeil et de la Vigilance, VIFASOM, Université Paris

Descartes, PRES Paris Cité Sorbonne, AP-HP, France

<sup>2</sup> Airliquide Healthcare, R and R Group, France

<sup>3</sup> Airliquide, Applied Mathematics R and D Group, France

<sup>4</sup> Centre du sommeil et de la Vigilance, VIFASOM, APHP, Université Paris Descartes, PRES Paris Cité Sorbonne, France

**Introduction:** Home monitoring of Continuous Positive Airway Pressure (CPAP) treatment is key to ensure on the long term patient compliance and normalisation of the apnoea-hypopnoea index (AHI). Those parameters are currently collected from CPAP devices in a heterogeneous manner as different parameters are measured and proprietary detection algorithms score differently respiratory events. The AL539 device was developed to allow remote control of treatment duration and of several efficacy parameters including residual AHI, in adults with obstructive sleep apnoea syndrome (OSA), whatever the CPAP they use. To assess the performance of the AL539 device, by comparing its measurements (CPAP treatment duration and residual AHI) to those obtained by respiratory polygraphy (Embletta GOLD<sup>®</sup>), used as reference.

**Materials and methods:** Monocentric, prospective, single-group clinical trial. Adult patients with OSA equipped with a CPAP for at least 2 months and requiring an in-lab control respiratory polygraphy were included (82% males, mean age 61 yrs, BMI ranging 23–41  $\text{kg/m}^2$ ). Recordings were performed while using their usual CPAP and interface. Descriptive analyses on 14 patients are presented.

**Results:** Recordings were performed with 6 different CPAPs and 3 different interfaces (nasal mask, face mask and nasal pillow). Minimum duration of the recording night was 6.75 h. Mean duration of CPAP treatment measured by the AL539 and the polygraph were similar, with an absolute difference of 2.4 min overall on the recording night (95% confidence interval  $-0.2$  to 5.1). AHI derived from polygraphic data was 6.4 3.4/h, and mean absolute difference of the corresponding AHI estimated by AL539 was 2.5/h (95% confidence interval 1.4–3.6).

**Conclusion:** AL539 allows a precise measurement of CPAP treatment duration. As expected by the difference in the methods used to score respiratory events, AL539.

**Acknowledgement:** Acknowledgements to sleep technologists of sleep center of Hôtel-Dieu.

<http://dx.doi.org/10.1016/j.sleep.2013.11.250>

### Sleep patterns in a sample of patients with post-traumatic disorder

T. Assad, H. Sadek, S. Elghonemy, M. Sarag  
Neuropsychiatry Department, Ain Shams University, Egypt

**Introduction: background:** Although sleep disturbance is considered as a hallmark of post-traumatic stress disorder (PTSD), objective evidence for sleep disturbance in patients with PTSD has been equivocal. A growing body of evidence shows that disturbed sleep is more than a secondary symptom of PTSD; it seems to be a core feature. **Objectives:** This study was carried out to explore subjective and objective sleep disturbances in PTSD patients and the interrelationship between the severity of PTSD and sleep disturbances.

**Materials and methods:** The study was designed as a case-control cross-sectional study, in which 20 patients fulfilling the criteria of PTSD according to the Diagnostic and Statistical Manual of Mental Disorders – 4th ed. were recruited from the outpatient psychiatric clinics of the Institute of Psychiatry, Ain Shams University. Patients were selected irrespective of their sex, age between 18 and 45 years, and those who had not received any psychotropic medication 2 weeks before the study. Those with Axis-I comorbidity or any concurrent medical or neurological diseases were excluded. The patient group was compared with a control group which included 10 healthy volunteers matched for age, sex, and social standard selected from among employees of the Institute of Psychiatry, Ain Shams University. All patients were subjected to: (a) general medical and neurological examinations, (b) a Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders – 4th ed. Axis-I (SCID-I), (c) A PTSD checklist, (d) a Standardized Sleep Questionnaire, and (d) polysomnography (PSG) overnight. The control group completed a General Health Questionnaire to exclude any psychiatric comorbidity and was subjected to a physical examination, SCID-I (nonpatient version), a Standardized Sleep Questionnaire, and polysomnography.

**Results:** Statistical analysis of the data was carried out. The case group was found to have initial insomnia and interrupted sleep; in addition, they experienced nightmares and sleep talking. Sleep latency, sleep efficiency and arousal index were markedly affected in the case group. The study showed that there was a significant increase in both stages I and II non-rapid eye movements sleep, whereas stages III and IV were significantly decreased in patients with PTSD compared to their healthy counterparts. When we compared the two groups with respect to rapid eye movements sleep parameters, respiratory variables of sleep including hypoapnea, respiratory disturbance index, and the desaturation index, we did not find any statistically significant differences. However, the apnea index and periodic leg movements were significantly higher in the PTSD group.

**Conclusion:** Our study showed that patients with PTSD had a disturbed sleep profile characterized by changes affecting non-rapid eye movements sleep parameters, with no marked correlation to the severity of PTSD. Thus, sleep hygiene counseling should be included in all treatment programs for PTSD patients.

**Acknowledgement:** Authors would like to thank all patients and volunteers who kindly accepted to participate in our work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.251>

### Evaluation of pharmacokinetic and pharmacodynamic interactions of sodium oxybate with ibuprofen: a randomized, double-blind, placebo-controlled, crossover study

M. Eller<sup>1</sup>, R. Skowronski<sup>1</sup>, K. Wesnes<sup>2</sup>, S. Alvarez-Horine<sup>1</sup>, B. Benson<sup>1</sup>, J. Black<sup>1</sup>

<sup>1</sup>Jazz Pharmaceuticals, Inc., United States

<sup>2</sup>Bracket, United States

**Introduction:** Sodium oxybate (SXB) is the sodium salt of gamma hydroxybutyrate (GHB), a substrate for the monocarboxylate transporter (MCT) that may be inhibited by nonsteroidal anti-inflammatory drugs. This study evaluated potential drug–drug interactions of SXB and ibuprofen with regard to pharmacokinetics (PK), pharmacodynamics (PD), and safety.

**Materials and methods:** Healthy volunteers were randomized to SXB + ibuprofen placebo, SXB + ibuprofen, or SXB placebo + ibuprofen in a three-period, double-blind, crossover design with a 2-day washout between periods. Ibuprofen/placebo (4x200mg capsules) was given qid every 4 h on days 1 and 2, and 1 h before and 3 h after the first SXB dose on day 3; SXB/placebo was given as two 3 g doses 4 h apart on day 3. Blood and urine samples were taken at predefined times for noncompartmental PK analysis. PD testing, performed during each treatment period, included the Karolinska Sleepiness Scale (KSS), and a selection of automated tests from CDR System ([www.bracketglobal.com](http://www.bracketglobal.com)) including the Simple Reaction Time, Digit Vigilance, Choice Reaction Time, Tracking, and Numeric Working Memory tasks. Safety was assessed at specified time points, and throughout the study.

**Results:** 21 subjects enrolled and completed the study (95% male; 57% white; mean age 34.4 ± 8.4 years). Although mean plasma SXB concentrations were approximately 5% lower with ibuprofen co-administration ( $P < 0.05$ ), the 90% CIs of the geometric LS means for SXB PK parameters with and without ibuprofen were within the 80–125% equivalence range. Urinary excretion of SXB increased ~2-fold with ibuprofen (mean renal clearance = 874.2 mL/h for SXB + ibuprofen and 463.6 mL/h for SXB alone;  $P < 0.0001$ ), and the percent mean ratio of the geometric LS means was 194% (90% CI 172%, 219%) exceeding the equivalence range. Cognitive function impairments and increased sleepiness were observed with SXB with and without ibuprofen, but no PD interactions were observed. The most common adverse events (AEs) were consistent with the drug profiles. AEs in ≥2 subjects with SXB + ibuprofen were somnolence ( $n = 15$ ), euphoric mood ( $n = 10$ ), dizziness ( $n = 5$ ), headache ( $n = 3$ ), and nausea ( $n = 2$ ), and reflect a combined effect of both drugs.

**Conclusion:** Although renal excretion of SXB increased, likely as a result of MCT inhibition by ibuprofen, plasma PK ratios were within the equivalence range, suggesting the interaction was not clinically significant. No PD interactions were observed, and AEs were consistent with the drug profiles.

**Acknowledgement:** This study was sponsored by Jazz Pharmaceuticals, Inc.

<http://dx.doi.org/10.1016/j.sleep.2013.11.252>

### Evaluation of drug–drug interactions of sodium oxybate with diclofenac: results from a pharmacokinetic/pharmacodynamic study

M. Eller, R. Skowronski, K. Wesnes, S. Alvarez-Horine, B. Benson, J. Black

Jazz Pharmaceuticals, Inc.,

**Introduction:** To evaluate drug–drug interactions between sodium oxybate (SXB) and diclofenac with regard to pharmacokinetics (PK), pharmacodynamics (PD), and safety. SXB is the sodium salt of gamma hydroxybutyrate (GHB), a substrate for the monocarboxylate transporter that may be inhibited by diclofenac, which also binds to GHB receptors in the brain.

**Materials and methods:** Healthy volunteers were randomized to SXB + diclofenac placebo, SXB + diclofenac, or SXB placebo + diclofenac in a 3-period, double-blind, crossover design with a 2-day wash-out between periods. Diclofenac/placebo (50 mg immediate-release) was given qid every 4 h days 1 and 2, and 1 h before and 3 h after the first SXB dose day 3; SXB/placebo was given as two 3 g doses 4 h apart day 3. Blood and urine were sampled at predefined times for noncompartmental PK analysis. PD testing at the end of each treatment period included the Karolinska Sleepiness Scale (KSS), and several automated tests from CDR System ([www.bracketglobal.com](http://www.bracketglobal.com)) including Simple Reaction Time, Digit Vigilance, Choice Reaction Time, Tracking, and Numeric Working Memory tasks. Safety was assessed at specified time points, and throughout the study.

**Results:** Of 22 subjects (77% male, 55% white, mean age 34.2±6.6 y), 20 completed the study. SXB PK were similar with and without diclofenac. Geometric LS mean percent ratios for SXB PK parameters with and without diclofenac were 106.7% for C<sub>max</sub>, 100.5% for AUC<sub>0–inf</sub>, and 94.8% for renal clearance; all 90% CIs were within the 80%–125% equivalence range, suggesting no PK drug–drug interaction. A similar lack of differences was observed for diclofenac PK. SXB induced sleepiness and attentional impairments. SXB + diclofenac had significantly less impairment at several time points compared with SXB alone on accuracy and speed on digit vigilance, choice reaction time, and power of attention ( $P < 0.05$ ). SXB effects on KSS and tracking performance were not reduced by diclofenac. The most common adverse events (AEs) were consistent with the drug profiles. AEs in 8 subjects with SXB + diclofenac (somnolence,  $n = 11$ ; dizziness,  $n = 6$ ; euphoric mood,  $n = 5$ ; nausea,  $n = 5$ ; headache,  $n = 4$ ; vomiting,  $n = 3$ ; dry mouth,  $n = 2$ ; and feeling hot,  $n = 2$ ) reflect a combined effect of both drugs.

**Conclusion:** Co-administration of SXB and diclofenac did not significantly change the PK of either drug. Diclofenac co-administration appeared to reduce SXB-associated impairments to attention and information processing relative to SXB alone. AEs with SXB + diclofenac reflect combined drug effects.

**Acknowledgement:** This study was sponsored by Jazz Pharmaceuticals, Inc.

<http://dx.doi.org/10.1016/j.sleep.2013.11.253>

### Polysomnographic picture of multiple sclerosis: correlation with MRI findings

L. Elnabil, E. Ibrahim

Ain Shams University, Egypt

**Introduction:** Very few studies have utilized polysomnogram (PSG) in studying sleep in MS patients; therefore, the objectives of the present study are to determine whether disturbance of sleep exists in patient with MS and whether they correlate with magnetic resonance imaging (MRI) findings.

**Materials and methods:** Twenty-two patients with MS were subjected to full clinical and neurological assessment, sleep history, an overnight and following day polysomnographic study, and MRI study. Fifteen healthy subjects were selected as a control group for polysomnographic data.

**Results:** MS patients had significantly reduced sleep efficiency % compared to control group ( $75 \pm 6$  versus  $90 \pm 2$ ), increased in sleep latency ( $38 \pm 24$  versus  $11 \pm 2$ ) and in arousal index ( $15 \pm 6$  versus  $4 \pm 2$ ), decreased depth of sleep ( $21 \pm 5$  versus  $23 \pm 1$ ), increased periodic leg movement (PLM) index ( $10 \pm 7$  versus  $4 \pm 1$ ), increased respiratory disturbance index ( $5 \pm 6$  versus  $0.4 \pm 0.7$ ), decreased rapid eye movement (REM) sleep percentages ( $17 \pm 4$  versus  $23 \pm 1$ ). MRI for patients with sleep disordered breathing (SDB) showed greater plaques in the medulla, those with PLM had greater plaques in the spinal cord, and greater plaques in the pons for those with abnormal REM sleep.

**Conclusion:** Sleep disturbances are pervasive in patients with MS, they may be due to; PLM, SDB, location of lesions and narcolepsy. Quality of life is affected and coping with the disease is made difficult by sleep disorders. Significant improvements in overall quality of life may be gained by an increased clinical awareness and appropriate treatment of sleep disorders.

<http://dx.doi.org/10.1016/j.sleep.2013.11.254>

### Insulin resistance in obstructive sleep apnea

M. Elshazly

Kasr Alaini School of Medicine, Egypt

**Introduction:** OSA is a common condition that is primarily characterized by intermittent and recurrent pauses in respiration results in multiple cycles of hypoxia/reoxygenation with an increased production of reactive oxygen species (ROS). Aim of work: Is to assess serum insulin level & insulin resistance in obese patients with & without OSA.

**Materials and methods:** Study was performed on 51 obese subjects who had been referred to Chest Department of Kasr Alaini Hospital with clinical suspicion of OSA in order to perform Polysomnography. They were classified into two groups; Cases: consists of 33 obese patients who were diagnosed as obstructive sleep apnea (OSA) & Controls: consists of 18 obese subjects, without OSA as a control group. The two groups were subjected to Full history taking, Clinical examination, Epworth sleepiness scale (ESS), Anthropometric measurements including body mass index (BMI in kg/m<sup>2</sup>) waist, hip circumferences, waist/hip ratio and neck circumference, Polysomnographic study, Serum Insulin by ELISA & Assessment of insulin resistance by calculation of HOMA index.

**Results:** It was found that cases included 10 females (30.3%) & 23 males (69.7%), while controls included 14 females (77.8%) & 4 (22.2%). There was statistically highly significant increase in Epworth sleepiness scale (ESS) among cases compared to controls. As regards the Polysomnographic data, there was statistically highly significant increase in AHI, desaturation index & duration of desaturation <90% among cases compared to control subjects. Regarding minimal O<sub>2</sub> sat% & average O<sub>2</sub> sat% were lower in cases than in the control subjects and this reduction was statistically significant also there was statistically significant increase in arrhythmias index among cases than control subjects & there was significant increase in snoring index among cases than control subjects. There was statistically highly significant increase in serum insulin, HOMA index among cases as compared to controls.

**Conclusion:** Insulin resistance in OSA is related to sleep associated hypoxaemia & hypoxic stress.

**Acknowledgement:** Chest Department, Faculty of Medicine Cai-ro University.

<http://dx.doi.org/10.1016/j.sleep.2013.11.255>

### Insomnia and death of marilyn monroe

M. De Entrambasaguas

Sleep Unit/Dept. Clinical Neurophysiology, Hospital Clínico Universitario de Valencia, Spain

**Introduction:** Marilyn Monroe (MM) was an American actress who died from an overdose of sleeping drugs in 1962. This presentation reviews the history and management of the insomnia she suffered.

**Materials and methods:** Source materials include police and toxicology reports on her death, prescriptions for sleeping drugs filled in the last few months of her life, photographs of her home, filmed or direct accounts from verified witnesses, and Donald Spoto's 1993 biography.

**Results:** MM valued nocturnal sleep to help her look good at work, but developed insomnia during her rise to fame in the context of stage fright. She might have presented jet lag following a flight from Japan, and started using barbiturates due to their easy availability. She became interested in psychoanalysis as a way of self-knowledge and acting improvement. Her psychiatrists treated her with Freudian psychoanalysis and an intensive use of drugs. Her last psychiatrist mostly dealt with psychoanalysis and had a general practitioner to prescribe her drugs. During the last few months of MM's life she was prescribed a dozen different psychoactive drugs, mostly barbiturates, but also other hypnotic drugs and amphetamines. The major issues regarding her death include the time of death, the position of the body and the sincerity of the witnesses. Blood/ liver samples tested for pentobarbital and chloral hydrate showed lethal concentrations of both. Disturbingly enough, her doctor claimed he only prescribed pentobarbital and never chloral hydrate, which is not true. Drugs complicated the course of MM's insomnia and had a negative effect on her general health and behaviour, a situation seemingly ignored by the two different psychiatric diagnoses given to her by both doctors ("addictive paranoid borderline personality", and "manic-depressive or bipolar personality"). Barbiturates had been available for several decades at the time, and the issues of tolerance, dependency and accidental overdose had to be well known to them. On the other hand, MM thought she exercised a reasonable control on her drug intake, which along with a lack of a real medical control and the presence of spurious interests set the conditions for the advent of a grim outcome.

**Conclusion:** The treatment based on Freudian psychoanalysis and drugs failed to improve MM's condition and arguably worsened it. The very drugs prescribed to her to combat insomnia would eventually cause her death.

<http://dx.doi.org/10.1016/j.sleep.2013.11.256>

### The frequency of patients with polysomnographic diagnosis as obstructive sleep apnea syndrome (OSAS) during one year in Eskisehir, Turkey

M. Alisan<sup>1</sup>, O. Erdinc<sup>2</sup>, S. Metintas<sup>3</sup>, G. Tekgol Uzuner<sup>2</sup>, H. Fidan<sup>4</sup>

<sup>1</sup> Republic of Turkey the Ministry of Health, Turkey

<sup>2</sup> Eskisehir Osmangazi University, Department of Neurology, Turkey

<sup>3</sup> Eskisehir Osmangazi University, Department of Public Health, Turkey

<sup>4</sup> Eskisehir Provincial Directorate of Health, Turkey

**Introduction:** We aimed to investigate the frequency of newly diagnosed patients with obstructive sleep apnea (OSAS) by using polysomnography (PSG) in healthcare organizations in Eskisehir city center during the year 2010.

**Materials and methods:** Patients over the age of 20 living in the province of Eskisehir and with diagnosis of OSAS in hospital information systems based on databases of ICD-10 coding system and with the diagnostic codes F51 (F51.0–F51.9), G47 (G47.0–G47.9) were selected. Using data from the medical and polysomnographic records between the 1st of January and the 31st of December 2010, patients with the diagnosis of OSAS for the first time were determined. Then these patients were invited to the research center. OSAS Patient Assessment Form, Assessment Fatigue Scale (FAS), Epworth Sleepiness Scale (ESS), Pittsburgh Sleep Quality Index (PSQI) and the SF-36 Life Quality Scale were fulfilled.

**Results:** In Eskisehir city center, 729 patients were preliminary diagnosed as OSAS. 526 (72.2%) of them were investigated by PSG in which 243 of them were diagnosed as OSAS for the first time by using PSG. The population over the age 20 in Eskisehir was 562,811 which makes the frequency of the newly diagnosed patients with OSAS as 43.18/100,000. Of the patients with OSAS, 36.6% were women, 63.4% were men with mean age  $52.20 \pm 11.57$  (range: 24–87) in both genders. 77 of the patients (31.7%) had mild, 53 (21.8%) had moderate and 113 (46.5%) had severe OSAS. In the severe OSAS group, the mean body weight, body mass index (BMI) and waist, hips and neck circumference measures were higher when compared with the others. The most commonly accompanying chronic diseases seen were obesity, hypertension and a history of previous nose operations. The 98.3% of the patients were snoring, 79.8% had apnea and 88% had excessive day time sleepiness (EDS). The mean scores of FAS and ESS increased with the disease severity. There was no difference in SF-36LQS scores between the groups.

**Conclusion:** Our results showed that the number of patients who were prediagnosed as OSAS were lower than expected, which meant that smaller number of patients were investigated by PSG. As OSAS is an important public health problem, we recommend that in order to increase the awareness of the patients and the physicians more studies should be done immediately.

**Acknowledgement:** We would like to thank to the Eskisehir Provincial Directorate of Health for the support and assistance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.257>

### The relationship between sleep disorders and excessive daytime sleepiness and anxiety in semi rural areas in Eskisehir, Turkey

S. Metintas<sup>1</sup>, O. Erdinc<sup>2</sup>, I. Arikas<sup>3</sup>, C. Kalyoncu<sup>1</sup>

<sup>1</sup> Eskisehir Osmangazi University Medical Faculty, Department of Public Health, Turkey

<sup>2</sup> Eskisehir Osmangazi University Medical Faculty, Department of Neurology, Turkey

<sup>3</sup> Republic of Turkey The Ministry of Health, Turkey

**Introduction:** The study was conducted on a sample of people from semi rural areas in Eskisehir Province, located in central Anatolia region of Turkey with ages 20 and over. The aim of this study was to determine the 3 major sleep disorders (insomnia, obstructive sleep apnea syndrome [OSAS] and restless legs syndrome [RLS]) and their relationship to excessive daytime sleepiness [EDS], anxiety and related symptoms.

**Materials and methods:** This was a cross-sectional study. The sample size determined by assuming the prevalence of sleep disordered breathing (SDB) prevalence is 30% in Turkey. Each region of sample size was calculated as 504 with 95% confidence interval and 4% error margin. A two-stage stratified cluster sampling procedure was used. The survey team visited the selected households and listed all the people age 20 and over between September 2009 and May 2010. A total of 1452 subjects were enrolled in the study. The survey was based on a questionnaire of six parts: socio-demographic

information, insomnia severity scale, symptoms of RLS, the Berlin questionnaire, Epworth Sleepiness Scale and Hamilton anxiety scale.

**Results:** In the study group 28.5% reported snoring, 7.6% apnea, 34.0% sleep onset problems, 30.3% problems returning to sleep after awakening, 30% fatigue, 33.5% EDS, 34.9% insufficient sleep. The frequency in the population of insomnia was 29.9%, OSAS 16.3%, RLS 7.3%, and EDS 7.3%. In the multivariable analysis the only the Hamilton anxiety score was related to insomnia. Older age, lower education, having low economic status, obesity, hypertension, EDS, high Hamilton anxiety scores were associated with OSAS. Hypertension and higher Hamilton anxiety scores were associated with RLS.

**Conclusion:** More attention should be paid to diagnosing specific sleep disorders in general practice particularly given the relationship between different sleep disorders and anxiety, obesity, diabetes and hypertension.

**Acknowledgement:** We would like to thank the interns who took part in collecting the questionnaires.

<http://dx.doi.org/10.1016/j.sleep.2013.11.258>

### **Sleep habits and sleep disorders in children with attention deficit-hyperactivity disorder. Influence of treatment. A multicenter study**

E. Jesus<sup>1</sup>, C. Soria-Bretones<sup>1</sup>, G. Pau<sup>2</sup>, D. Alberto<sup>1</sup>, O. Teresa<sup>2</sup>, G.M. Ángeles<sup>1</sup>

<sup>1</sup> Virgen de la Luz Hospital, Spain

<sup>2</sup> Doctor Peset University Hospital, Spain

**Introduction:** Lately, broad discussion has arisen about sleep in Attention Deficit-Hyperactivity Disorder (ADHD) and the influence of physiopathology and treatment on sleep quality in these patients. Our aims are to: describe the prevalence of sleep habits and sleep disorders in ADHD pediatric patients and find out if treatment plays a role on them.

**Materials and methods:** Observational descriptive cross-sectional study. **Sample:** children diagnosed of ADHD referred from Neuropediatrics and Child Psychiatry to Clinical Neurophysiology departments in two hospitals (in Cuenca and Valencia, Spain):  $n = 100$ , ages 5–17. These were divided in non-treated ( $n = 16$ ) and treated ( $n = 84$ ) subgroups. **Measures:** Child's Sleep Habits Questionnaire answered by parents, by phone or live interviews.

**Results:** ADHD patients show high prevalence of the following habits: fear of sleeping alone, sleeping in others' bed, short sleep onset latency (<20 min) and regular sleep timetable. They also show higher prevalence of bruxism and Restless Legs Syndrome. These prevalences are higher compared to normal pediatric population in the reviewed literature. ADHD subgroups: compared to non-treated ADHD subgroup, treated patients show better sleep habits: less need of parent in the room to fall asleep and less resistance going to bed. They also show lower sleep disorders prevalence: bruxism, restless sleep, number of nocturnal awakenings, daytime sleepiness and fatigue show lower scores in treated group.

**Conclusion:** ADHD patients show different sleep habits and sleep disorders prevalence than healthy pediatric population. Treatments for pediatric ADHD do improve some sleep habits and minimize some sleep disorders. Further studies are needed to define the physiopathology underneath these findings, as well as the relationship between different drugs and different sleep items affected.

**Acknowledgements:** This study has been supported by a grant given by FISCAM. Special thanks also to Dr. De las Heras-Martínez, E.

<http://dx.doi.org/10.1016/j.sleep.2013.11.259>

### **Types of insomnia and physical activity in college students**

J. Moo Estrella<sup>1</sup>, C. Rosado Narvaez<sup>1</sup>, A. Yañez oría<sup>1</sup>, M. Valencia Flores<sup>2</sup>

<sup>1</sup> Universidad Autónoma de Yucatán, Facultad de Psicología, Mexico

<sup>2</sup> Universidad Nacional Autónoma de México, Facultad de Psicología, Mexico

**Introduction:** Few epidemiological studies have examined the potential protective effects of physical activity on insomnia. It is little known about physical activity among different types of insomnia. The objective of this study was to determine whether or not differences in physical activity in groups with different forms of insomnia existed.

**Materials and methods:** The sample was conformed of 285 university students ( $20.37 \pm 2.5$  years old, 68% women) they were asked to complete a questionnaire about general and specific insomnia symptoms: acute, inadequate sleep hygiene, psychophysiological, due to medical condition, due to mental disorder or substance use, based on the international classification of sleep disorders (AASM 2005), it was also applied another questionnaire to know the regular physical activity index.

**Results:** The 33% of the total sample had insomnia, within this group, 53% had insomnia for inadequate sleep hygiene, 52% had psychophysiological insomnia, 27% had acute insomnia, 2% had idiopathic insomnia and 2% had insomnia associated with a medical condition. Only the group with psychophysiological insomnia presented differences with the control group in the following physical activity variables: Time Spent in bed sleeping ( $5.51 \pm 1.26$  vs.  $6.03 \pm 1.62$  h,  $p = .035$ ), while sitting in class ( $6.04 \pm 1.12$  vs.  $5.52 \pm 1.66$  h,  $p = .010$ ), number of blocks you walk a day ( $5.77 \pm 5.89$  vs.  $8.19 \pm 7.41$  h,  $p = .016$ ), physical exercise in college ( $.02 \pm .14$  vs.  $23 \pm 64$  h  $p = .001$ ). The group with psychophysiological insomnia does less physical activity in comparison with the group control.

**Conclusion:** Results show that physical activity is reduced only in the group with psychophysiological insomnia; this group spends more time sitting and less time walking and exercising.

**Acknowledgement:** College Students Participants.

<http://dx.doi.org/10.1016/j.sleep.2013.11.260>

### **Effects of a newly developed orexin-2 receptor-selective antagonist on the sleep/wake states in mice**

K. Etori<sup>1</sup>, Y. Saito<sup>1</sup>, N. Tsujino<sup>1</sup>, T. Sakurai<sup>2</sup>

<sup>1</sup> University of Kanazawa, Dept. Molecular Neuroscience and Integrative Physiology, Japan

<sup>2</sup> University of Niigata, Dept. Cellular Neurobiology, Brain Research Institute, Japan

**Introduction:** Hypothalamic neuropeptides orexins play critical roles in the regulation of sleep/wake states by activating two orphan G-protein coupled receptors (GPCRs), orexin 1 (OX1R) and orexin 2 receptors (OX2R). We examined the effect of a newly developed OX2R-selective antagonist (2-SORA), Compound 1m (C1m) and dual orexin receptor antagonist (DORA), suvorexant, on sleep/wakefulness states in C57BL/6J mice.

**Materials and methods:** Drugs were dissolved in 1% methylcellulose and administered to mice per os using disposable feeding needles.

**Results:** After oral administration in dark period, both C1m and suvorexant exhibited potent sleep promoting properties with similar efficacy in a dose dependent manner. While C1m did not increase

the duration of NREM and REM sleeps, suvorexant induced longer durations of NREM sleep as compared with both vehicle- and C1m-administered groups. When compounds were injected at ZT0, C1m did not show significant changes in sleep/wakefulness states in light period, whereas suvorexant slightly but significantly increased sleep amount. We also found that C1m did not significantly affect the amount of REM sleep, while suvorexant remarkably increased it.

**Conclusion:** We suggest that OX1R-mediated pathway plays an important role in suppression of REM sleep.

**Acknowledgements:** This study was supported by the Cabinet Office, Government of Japan through its funding Program for Next Generation World-Leading Researchers. Authors thank Takeda Pharmaceutical Company for providing us the C1m. We also thank Dr. Tatsuhiko Fujimoto for valuable discussion.

<http://dx.doi.org/10.1016/j.sleep.2013.11.261>

### Prevalence of restless legs syndrome in chronic liver diseases case-control study

C. Falup-Pecurariu<sup>1</sup>, F. Coman<sup>2</sup>, G. Moraru<sup>2</sup>, R. Alexandru<sup>3</sup>

<sup>1</sup> Department of Neurology, Faculty of Medicine, Transilvania University, Brasov, Romania

<sup>2</sup> Department of Gastroenterology, Emergency University County Hospital, Brasov, Romania

<sup>3</sup> Faculty of Medicine, Transilvania University, Brasov, Romania

**Introduction: Background:** restless legs syndrome (RLS) is affecting the quality of sleep and is encountered in many diseases. There are few data on the prevalence of restless legs syndrome (RLS) in chronic liver diseases (CLD). The purpose of this pilot study was to assess the prevalence and clinical features of RLS in chronic liver diseases patients in a case-control study.

**Materials and methods:** Prospective study on 90 patients with chronic liver diseases and 90 healthy volunteers, age and sex matched. RLS was diagnosed using the criteria of the International RLS Study Group, severity by International RLS Study Group Rating Scale. For quality of sleep and depression assessment we used Restless Legs Syndrome Quality of Life instrument, Epworth Sleepiness Scale, Pittsburgh Sleep Quality Index, Hospital Anxiety and Depression Scale.

**Results:** 35/90 (38.88%) patients with chronic liver diseases fulfilled the 4 criteria for RLS vs. 11/90 (12.22%) in the control group ( $p < 0.05$ ). There was a correlation between poor quality of sleep and presence of RLS. In the RLS positive group there was a higher prevalence of insomnia.

**Conclusion:** RLS symptoms have a high prevalence in chronic liver disease and affect quality of sleep.

<http://dx.doi.org/10.1016/j.sleep.2013.11.262>

### High prevalence of restless legs syndrome in systemic lupus erythematosus

C. Falup-Pecurariu<sup>1</sup>, L. Duca<sup>1,2</sup>, M. Moarcas<sup>2</sup>

<sup>1</sup> Department of Neurology, Faculty of Medicine, Transilvania University, Brasov, Romania

<sup>2</sup> Department of Neurology, County Emergency University Hospital, Brasov, Romania

**Introduction: Background:** data regarding the sleep disturbances in systemic lupus erythematosus (SLE) are scarce. **Objective:** the

aim of this study is to determine the prevalence of restless legs syndrome (RLS) and sleep disturbances in systemic lupus erythematosus.

**Materials and methods:** prospective study on consecutive patients with SLE. We used a standardized questionnaire with face-to-face interview. RLS diagnosed were based on the criteria of the RLS Study Group. The severity of RLS was assessed by Restless Legs Syndrome Rating Scale and quality of life by Restless Legs Syndrome Quality of Life Instrument. Sleep was assessed by Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale. The patients had to choose from a list of terms which described the sensations in their legs.

**Results:** 42 patients with SLE (40 women) were included in the study, mean age  $53.43 \pm 22.69$  years (limits 21–78). 17 patients (40.47%) met the criteria for RLS. Six patients describe frequency of occurring of RLS in 6–7 nights per week, 4 in 4–5, 3 in 1–3 nights, 2 in 2–4 times per month and 2 patients one time per month. Multivariate analyses showed that risk factors for RLS were age and disease duration. Severe insomnia was reported by 15 patients (35.71%).

**Conclusion:** the prevalence of RLS is high in SLE. The severity of disease is high and occurs in 58% more than 4 nights per week.

<http://dx.doi.org/10.1016/j.sleep.2013.11.263>

### Neurocognitive function in patients with idiopathic restless legs syndrome (iRLS) before and after treatment with dopaminergic agonist

L. Ferini Strambi, S. Marelli, A. Galbiati, L. Giarolli, A. Oldani, M. Zucconi

San Raffaele Scientific Institute, Dept of Clinical Neurosciences, Sleep Disorders Center, Italy

**Introduction:** RLS patients frequently report insomnia, characterized by difficulty falling asleep and frequent nocturnal awakenings. Daytime consequences such as fatigue, irritability, impaired concentration, depressed mood are frequently reported. Some authors observed cognitive deficit in tests used to assess executive functions similar to those observed in healthy subjects undergoing acute sleep deprivation. To assess cognitive functions, quality of life, sleep quality, anxiety and depressive symptoms in iRLS patients at baseline (BL) compared to age matched normal control (Ctrl), and to assess changes in iRLS after 3 months of treatment with a dopamine agonist drug at low doses.

**Materials and methods:** We evaluate 20 iRLS (F 60%) with severe RLS (mean IRLSRS 26, mean age  $46.80 \pm 10.10$ ) and 15 Ctrl matched on age and gender. All patients were evaluated with PSG at baseline (BL) and after 3 months of treatment (FU). Neurocognitive functions (global cognitive profile, memory, attention and executive functions, comprehension and language), daytime sleepiness (ESS), anxiety (STAY), depression (BDI), quality of life (SF-36) and quality of sleep (PSQI) were assessed at BL and FU.

**Results:** 18 iRLS completed the study. The PSG showed at BL a reduced TST, SWS%, SE%, an increase in SL, WASO, n° awakenings and PLMI. PLMI decreased significantly after 3 months of treatment. Almost all iRLS's cognitive domains at BL showed significantly lower scores compared to Ctrl: in particular short term memory, verbal long term memory, executive functions, attention, language production resulted significantly improved ( $p < 0.005$ ) after treatment. Moreover iRLS at BL showed significantly lower scores at EES, PSQI and SF-36 ( $p < 0.05$ ) than Ctrl. At FU we observed a statistically significant overall improvement in the cognitive domains as well as in ESS, PSQI, SF-36, BDI ( $p < 0.005$ ). Only the semantic fluency test and the anxiety did not show any significant improvement.

**Conclusion:** Our results on cognitive functions are in agreement with literature data on sleep deprivation. Our data showed that cognitive functions impaired at BL when compared to Ctrl significantly improved after 3-months pharmacological treatment reaching the scores of healthy subjects. Moreover, results about quality of life, daytime sleepiness and quality of sleep showed a significant improvement over time. Future studies on iRLS may confirm the involvement of the same cortical network involved in experimental sleep deprivation condition.

**Acknowledgements:** We thanks RLS patients for their availability in detailing their sleep and ill history. We thanks the sleep technicians for hard work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.264>

### One year monitoring of nocturnal periodic breathing at the antarctic pole

H. Fernandez<sup>1</sup>, N. Pattyn<sup>2</sup>, O. Mairesse<sup>1,2</sup>, R. Meeusen<sup>1,2</sup>, E. McDonald-Nethercott<sup>1,2</sup>, X. Neyt<sup>1,2</sup>

<sup>1</sup> University of Brussels, Human Physiology & Sportsmedicine, Belgium

<sup>2</sup> Royal Military Academy, LIFE Dept., Belgium

**Introduction:** At altitudes above 2.500 m, ventilation in healthy subjects commonly shows an oscillatory behavior with alternating periods of hyperventilation followed by apneas or hypopneas. This breathing pattern, called periodic breathing (PB), seems to prevail at altitudes above 5533 m. Although PB has been extensively observed, there are still aspects regarding the adaptation to high altitude that remain unknown. To address the influence of altitude on the respiratory system during longer periods of time, nocturnal periodic breathing was monitored at a constant equivalent altitude of 3659 m over the course of 12 months.

**Materials and methods:** The investigation took place at the Concordia station, in the framework of the European Space Agency's Life Science campaign, during the 2012 winter over. 13 healthy male participants were monitored using a wireless polysomnography (BioRadio, Clevedon Inc.). None of them had significant medical antecedents. Data collection was programmed through the whole campaign with a periodicity of six weeks and one habituation night. All recordings were analyzed by a professional sleep technician.

**Results:** PB was present at a clinically significant level during the whole campaign (AHI = 65.4 ± 14.55). Over time, PB does not seem to show a clear trend, with subjects having both episodes of increasing and decreasing PB levels.

**Conclusion:** There seems to be a controversy regarding the acclimatization mechanism to hypobaric hypoxia and the quantification of PB during the adaptation. Previous studies have reported an increase of periodic breathing during acclimatization to hypoxia, whereas others reported decreases or even no changes. However, previous investigations have observed this process of adaptation only over several days to weeks. Our results show that adaptation of respiration to moderate altitude is a process that might last more than several months. Stable inter-individual differences suggest the existence of responders and non-responders.

**Acknowledgement:** This work was funded under ESA/PRODEX funding through the Neuropole project.

<http://dx.doi.org/10.1016/j.sleep.2013.11.265>

### Is there a correlation between of the epworth sleepiness scale and the CPAP adherence?

J. Piña Fernandez<sup>1</sup>, A. Mochon Doña<sup>1</sup>, P. Cuellar Raya<sup>2</sup>, J. Cebrian Gallardo<sup>2</sup>

<sup>1</sup> VitalAire, Agencia Sanitaria Costa del Sol, Respiratory Nurse, Spain

<sup>2</sup> Agencia Sanitaria Costa del Sol, Neumology, Spain

**Introduction:** The aim of this study is determinate if there is a correlation between the adherence to the cpap treatment and the epworth scale. We have an specific protocol for the adherence in our sleep nurse consultation.

**Materials and methods:** We studied a cohort of patients with Obstructive Sleep Apnea that begins the treatment with cpap between January and December 2012. Scope: 2nd Level Hospital (reference population 340,458 habitants). Variables: Sex, age, pathology, Epworth Scale, Apnea Hipoapnea Index ( IAH ), Hours of daily use of cpap and Pressure of treatment.

**Results:** We analyzed 183 patients ( CI 95 % ).Sex: Male (142) 75%,Women (41)23%. Epworth Scale <10: Mean age 57 ± 25; Mean IAH 43 ± 33; Mean hours of daily use of CPAP 5 ± 3 h; mean pressure of treatment 8±3 cch2O. Epworth Scale >10: Mean age 55 ± 20; Mean IAH 43.5±32; Mean hours of daily use of CPAP 5.5;± 3 h; mean pressure of treatment 8 ± 3 cch2O.

**Conclusion:** The similars results obtained in the two groups studies shows that the Epworth Scale is not a predictor of the correct use of the CPAP treatment. The epworth scale results are very subjective. There are many factors that influence the correct adherence to the cpap treatment that we don't measure in our study, probably the interface ( mask ) has an important role in the adherence.

**Acknowledgement:** To the Agencia Sanitaria Costa del Sol and the sleep nurse consultation of the Hospital.

<http://dx.doi.org/10.1016/j.sleep.2013.11.266>

### The OSA patient in a specific sleep nurse department

J. Piña Fernandez<sup>1</sup>, A. Mochon Doña<sup>2</sup>, P. Cuellar Raya<sup>3</sup>, J. Cebrian Gallardo<sup>3</sup>

<sup>1</sup> VitalAire, Agencia Sanitaria Costa del Sol, respiratory Nurse, Spain

<sup>2</sup> VitalAire, Agencia Sanitaria Costa del Sol, Nurse, Spain

<sup>3</sup> Agencia Sanitaria Costa del Sol, Neumology, Spain

**Introduction:** The purpose was to describe the assistance process implemented in the hospital and how to handle patients suspected of having OSA referred to the sleep disorder nursing department until the starting of treatment, establishing a monitoring procedure for assuring correct compliance with the treatment.

**Materials and methods:** When the patient came to the hospital for the first visit with the pneumologist and there is a suspicion of OSA, a sleep test is ordered (poligraphy- Stardust™ 2 by RESPIRONICS®). The patient returns to the pneumologist in 3 months (more or less). The sleep test request also goes to the sleep department nurse when the patient was scheduled for the test. The test is performed at home, and the patient comes to the sleep department nurse and is instructed by the nurse through a talk and a practical demonstration of how to perform the poligraphy at home. On the following day, the information is downloaded and analyzed by the sleep nurse. When the patient has the next appointment with the pneumologist the result of the study is given to the patient and if there is a positive for OSA, the CPAP is implemented by the sleep nurse the same day

in the hospital. After a month with the CPAP, the patient has another appointment with the sleep nurse to see if there is any problem with the adaptation of the treatment (mask, secondary effects), if there is a problem it is dealt with by the nurse. Two months later the patient has another appointment in the sleep department with the nurse to make an adjustment test with an autoCPAP (Autoset Spirit® by Resmed and RemStar® Auto by RESPIRONICS). If everything is correct and the patient has adapted to the treatment there will only be a new appointment once a year in the sleep department. If the sleep nurse detected any problem with the patient a new appointment is scheduled with the pneumologist.

**Results:** Activity of the sleep nurse department in 2012: polysomnography performed: 39; Polygraphs performed: 750; Adjustments with autoCPAP: 420; First month with CPAP Adaptation: 442; 50 patients abandoned treatment. New patients with CPAP: 567. In January 2013 we have 2260 CPAP patients with CPAP at home and only 50 patients do not use the machine at least 4 h a day.

**Conclusion:** Adaptation is easier and faster when the patient is treated as soon as diagnosed and through the start of treatment by one nurse. The patients feel safer having someone they know in the hospital to solve their doubts and problems, only a few patients abandoned treatment. Better control of treatment was achieved by the pneumologist and the sleep nurse.

**Acknowledgement:** To the nurses of the sleep unit of the agencia sanitaria costa del sol.

<http://dx.doi.org/10.1016/j.sleep.2013.11.267>

### Importance of nurse intervention in the adaptation of patient treated with CPAP

J. Piña Fernandez<sup>1</sup>, A. Mochon Doña<sup>2</sup>, P. Cuellar Raya<sup>3</sup>, J. Cebrian Gallardo<sup>3</sup>

<sup>1</sup> VitalAire, Agencia Sanitaria Costa del Sol, Respiratory Nurse, Spain

<sup>2</sup> VitalAire, Agencia Sanitaria Costa del Sol, Nurse, Spain

<sup>3</sup> Agencia Sanitaria Costa del Sol, Neumology, Spain

**Introduction:** Thanks to the nurse taxonomy NANDA, NIC, NOC (NNN), for nursing practice, now plays an important role of nursing in patient education and in monitoring treatment. With this descriptive study, we tried to highlight the important role of nurses in patients treated with CPAP on Sleep Disorders Unit of the Costa del Sol Health Agency.

**Materials and methods:** Cross-sectional study. **Subjects:** Patients with OSA treated with CPAP. Study period: Database Sleep Disorders Unit of the Health Agency Costa del Sol, up to May 2013. Once the pulmonologist prescribes CPAP treatment, the patient is referred to the Sleep Unit to initiate therapy. This begins the nurse-patient relationship. In the introduction of treatment, the nurse teaches the correct use of the device ( RemStar™ M Series by RESPIRONICS®), and reviews the results of short-term treatment, the causes of their illness and possible solutions, thus reducing the anxiety response to their fears and unknowns. This emphasizes the Nurse role for "Decreased anxiety" and "Management of therapeutic treatment." Cited in a month in consulting adaptation, which prizes its compliance and re-educating the patient/caregiver. We work here to identify "Defaulting treatment" and "deficient knowledge" to get a better CPAP treatment patient compliance. We review the device and incidences. We solve problems for patients with respect to CPAP use. The patient is reviewed in 2–3 months for autoCPAP adjustment (RemStar™ Auto by RESPIRONICS® and Autoset™ Spirit by ResMed®). In consultation with autoCPAP Certification, re-evaluation of the patient and their adaptation to treatment. Is performed for 2–3 nights. Autoset

titration pressure is adjusted, as reported by autoCPAP, if require. If the patient is adapted and the nurse sees a good management of therapeutic treatment, the patient is placed on once a year annual review in consultation. At that time we evaluate the patient's current situation and its "effective therapeutic management." The patient has a Hotline to the sleep unit sleep for that year if any issues or concerns present regarding treatment. In addition to the appointments protocol, the nurses manage non compliant patients (compliance <3 h/night). The nurses analyze the reason for low compliance and resolve the problem over the telephone, through the intervention of the technical team home of VitalAire or assisting them in their rehabilitation consultation.

**Results:** Of the 2250 active patients as of May 2013, 215 patients are complying with treatment with CPAP (9.5% of total). Of these 215 patients, 145 patients (67% of non-compliance) are retrofitted to treatment after surgery nurse and only 45 patients (31% of non-compliant treatment) are written off because of intolerance or voluntary low compliance.

**Conclusion:** By continuing nursing intervention in these patients, the correct use of the treatment occurred for 95% of all patients. It is therefore effective to uses nursing intervention and monitoring of patients with CPAP.

**Acknowledgement:** sleep nurse department of agencia sanitaria costa del sol.

<http://dx.doi.org/10.1016/j.sleep.2013.11.268>

### Mandibular advancement devices as an alternative to conventional treatment with CPAP in selected patients: a health intervention analysis

M. Fernández-Barrales<sup>1</sup>, M. González<sup>1</sup>, E. Macías<sup>1</sup>, M. Martínez<sup>1</sup>, F. De Carlos<sup>2</sup>, J. Cobo<sup>2</sup>

<sup>1</sup> Sleep Unit, Hospital Universitario Marqués de Valdecilla, Spain

<sup>2</sup> Oviedo University, Spain

**Introduction:** Mandibular Advancement Devices (MAD) are the only A grade recommended treatment alternative for Obstructive Sleep Apnea in mild to moderate disease and in patients intolerant to Positive Airway Pressure treatment (PAP). Public Health Insurance covers all expenses of MAD manufacture and maintenance in our community since mid 2010 in selected patients. We estimate a direct cost reduction of up to 50% related to PAP conventional treatment (also fully covered by our insurance system). We analyze the results of our first 18 months of treatment with MAD within the Public Health Insurance Coverage Protocol.

**Materials and methods:** We prospectively analyzed patients treated with MAD at our Department since the beginning of the Public Health Insurance Coverage Protocol and until September 2012. Patients fulfilling financing criteria were included in the study protocol. Treatment was considered effective if Apnea Hipopnea Index (AHI) wearing MAD lowered below 10 and partially effective in cases with at least a 50% reduction in AHI.

**Results:** 58 out of 66 patients had finished the protocol at the time of analysis. 57.6% were treated with MAD as a first line treatment and 41.4% as a second line treatment (60% of the latter had failed to adhere to PAP therapy). MAD treatment was effective in 65% of patients, partially effective in an additional 7.5% and showed no difference in 27.5% – three of them actually worsened their AHI – AHI was significantly reduced in both first ( $p = 0,004$ ) and second ( $p = 0,001$ ) line treatments. Treatment success was not significantly related to any of the patients' morphologic, anatomic or polysomnographic features. 16.6% of patients suffered some sort of side effect.

Only 10% of these caused treatment cessation, and temporomandibular joint pain was the most common cause.

**Conclusion:** MAD treatment is a valid alternative to PAP treatment in selected patients and in those intolerant to PAP therapy. No clinical measurement predicted treatment success in our case series, prompting post-intervention sleep study to confirm its efficacy.

**Acknowledgement:** Sleep Unit Team.

<http://dx.doi.org/10.1016/j.sleep.2013.11.269>

### **Preliminary results of oral appliance device in mild to moderate obstructive sleep apnea syndrome**

A. Ferre<sup>1</sup>, J. Vila<sup>2</sup>, E. Gallardo<sup>3</sup>, E. Perello<sup>4</sup>, O. Romero<sup>1</sup>, G. Sampol<sup>5</sup>

<sup>1</sup>Hospital Vall d'Hebron, Multidisciplinary Sleep Unit, Clinica Neurophysiology, Spain

<sup>2</sup>Hospital Vall d'Hebron, Multidisciplinary Sleep Unit, Spain

<sup>3</sup>Centre d'atenció Primària Berga Centre, Spain

<sup>4</sup>Hospital Vall d'Hebron, Spain

<sup>5</sup>Hospital Vall d'Hebron, Multidisciplinary Sleep Unit, Pneumology, Spain

**Introduction:** The first line treatment of Obstructive Sleep Apnea-Hypnea Syndrome (OSAHS) is CPAP. Oral appliances are an useful therapeutic alternative, but its efficacy can vary between different studies, with approximately a mean efficiency of 52%, if we define therapeutic success as a final AHI of <5. To evaluate the efficacy of oral appliance (Orthoapnea®) in patients with mild to moderate OSAHS.

**Materials and methods:** We evaluated the quality of sleep (Pittsburgh), somnolence (Epworth Sleepiness scale (ESS), subjective snore (visual analogue snore scale (VASS), Snore Outcome Survey (SOS), Spouse/Bed Partner Survey (SBPS), and sleep parameters with conventional nocturnal Video-Polysomnography (V-PSG) before and after oral appliance treatment.

**Results:** We studied 25 patients 72% male 28% female with a mean age 50.6±10.3, mean body mass index (BMI) 27.6±2.8, and mean RDI 16.8±6.3. We obtain statistical differences in ESS, VASS, Pittsburgh, SOS and SBPS, N1, Arousal, Snore index, respiratory effort related to arousal, hypopnea, obstructive apnea, and ODI >3%. There is statistically significant improvement in: global RDI (-11.6) with RDI <5 in 68%, Supine RDI (-22.5) with RDI <5 in 55.6, non-supine RDI (-7.3) RDI <5 in 78.9% and NREM-RDI (-10.8) with RDI <5 in 80%. No significant improvement were observed in REM-RDI (-7.7) with RDI <5 in 53.3%. The improvement of the RDI did not have correlation with the age weight, and time in postural position.

**Conclusion:** Oral appliances are an effective treatment for mild to moderate OSAHS, with improvement of both, subjective and objective sleep parameters.

**Acknowledgement:** Thanks to the partial financial support by Orthoplus®.

<http://dx.doi.org/10.1016/j.sleep.2013.11.270>

### **Cardiorespiratory polygraphy diagnostic accuracy in mild to moderate obstructive sleep apnea hypopnea syndrome (OSAHS)**

A. Ferre, K. Rahnama, J. Vila, R. Cambrodi, M. Jurado, O. Romero  
Hospital Vall d'Hebron, Multidisciplinary Sleep Unit, Clinica Neurophysiology, Spain

**Introduction:** The gold standard in OSAHS diagnosis is nocturnal polysomnography (PSG). Nowadays is allowed to use cardiorespira-

tory polygraphy (PCR) in patients with a high pretest probability of OSAHS. PCR have some limitations that may underestimate AHI: impossibility to score total sleep time, respiratory effort related to arousal and hypopneas related to arousal without oxygen desaturation. To evaluate cardiorespiratory polygraphy (PCR) diagnostic accuracy in patients with mild to moderate OSAHS.

**Materials and methods:** We evaluated 96 patients with an AHI <30 determined by PCR and compared the results of PCR with conventional polysomnography (PSG).

**Results:** We studied 96 patients (69% male 30% female) with a mean age 52±12.5 years, mean body mass index (BMI) 27.7±3.6, mean Epworth sleepiness scale 7.54±4.8 and mean AHI in PCR 11.6±7.8. PCR showed 26% of patients with an AHI in the normal range, 39.6% with mild OSAHS and 34.4% with moderate OSAHS. When we compared the results of PCR with PSG we observed statistical differences in the AHI (19.2±14.9 & 11.6±7.8) and RDI (22.1±14.8 & 11.6±7.8) compute. The AHI and RDI mean difference was 7.6±12.0 and 10.4±12.1 respectively. When we obtained normal results with PCR we observed a 76% (IAH) or 48% (RDI) of mild to moderate OSAHS when we compared with PSG. When we obtained mild OSAHS with PCR we observed 42.1% (IAH) or 47% (RDI) moderate and 15.7% (IAH) or 21% (RDI) severe OSAHS when we compare with the PSG. When we obtained moderate OSAHS with PCR we observe in 21.2% (IAH) or 18% (RDI) mild and 42.5% (IAH) or 51% (RDI) severe OSAHS when we compare with the PSG.

**Conclusion:** Up to 50% mild to moderate OSAHS patients diagnosed by PCR could be classified as severe with PSG.

**Acknowledgement:** Thanks to Dr. G. Sampol and Dra. P. Lloberes for their contribution in this work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.271>

### **Polysomnographic results in Chiari I malformation type I**

A. Ferre<sup>1</sup>, M. Poca<sup>2</sup>, M. De La Calzada<sup>3</sup>, D. Moncho<sup>4</sup>, O. Romero<sup>5</sup>, J. Sahuquillo<sup>2</sup>

<sup>1</sup>Hospital Vall d'Hebron, Multidisciplinary Sleep Unit, Clinica Neurophysiology, Spain

<sup>2</sup>Hospital Vall d'Hebron, Neurosurgery Service, Investigation Unit of Neurosurgery and Neurotraumatology, Spain

<sup>3</sup>Hospital Vall d'Hebron, Investigation Unit of Neurosurgery and Neurotraumatology, Spain

<sup>4</sup>Hospital Vall d'Hebron, Clinical Neurophysiology, Spain

<sup>5</sup>Multidisciplinary Sleep Unit, Clinical Neurophysiology, Spain

**Introduction:** The most common symptom experienced by patients with Chiari I malformation (CM-I) is occipital headache many times started or worsened by Valsalva maneuvers<sup>a</sup> sneezing, coughing, or straining. They may also experience difficulties with balancing and dizziness, muscle weakness, coordination problems, as well as gait abnormalities. Some patients present with sleep disordered breathing symptoms such as hypersomnia, insomnia or sleep disorder breathing. Although several authors have found distinct types of apneas and hypopneas in patients with CM-I, there are no studies that analyze sleep quality with this malformation. The main purpose of this study is to establish the impact of CM-I on sleep architecture, respiratory parameters and leg movements (PLMs).

**Materials and methods:** A prospective study was conducted in a correlative series of 105 CM-I patients (67 women and 38 men, mean age of 41.9±12.5 years) admitted between 10/1997 and 04/2001. A whole-night video-polysomnography was performed in all patients.

**Results:** Sleepiness in pathological range (Epworth >10) was present in only 12 patients (11.4%). Sleep architecture only showed a

decrease in sleep efficiency due to wake after sleep onset with preservation in normal range of sleep stages proportions. Fifty-three patients showed a pathological respiratory disturbance index (RDI Y5) and in 29.5% moderate to severe range (RDIY15). The respiratory alterations were predominantly obstructive hypopneas during the supine position. Twenty-two patients showed PLMs > 15.

**Conclusion:** Patients with CM-I had an increased prevalence of fragmented sleep and sleep disordered breathing respect to normal population. These alterations may not be reported by patients and can only be detected by performing a specific sleep study. Its detection may help to screen patients and to establish surgical indications..

**Acknowledgements:** This work has been supported in part by the Fondo de Investigación Sanitaria (Instituto de Salud Carlos III) with grant PI07/0681, co-financed by the European Regional Development Fund (ERDF) and awarded to Dr. M.A. Poca.

<http://dx.doi.org/10.1016/j.sleep.2013.11.272>

### **Sleep related breathing disorders (SRBD) in patients with chiari type I malformation before and after posterior fossa decompression**

A. Ferre<sup>1</sup>, M. Poca<sup>2</sup>, M. De La Calzada<sup>3</sup>, D. Moncho<sup>4</sup>, O. Romero<sup>1</sup>, J. Sahuquillo<sup>2</sup>

<sup>1</sup>Hospital Vall d'Hebron, Multidisciplinary Sleep Unit, Clinica Neurophysiology, Spain

<sup>2</sup>Hospital Vall d'Hebron, Neurosurgery Service, Investigation Unit of Neurosurgery and Neurotraumatology, Spain

<sup>3</sup>Hospital Vall d'Hebron, Investigation Unit of Neurosurgery and Neurotraumatology, Spain

<sup>4</sup>Hospital Vall d'Hebron, Clinical Neurophysiology, Spain

**Introduction:** The symptoms in Chiari malformation type I (CM-I) have different presentations, and depends on certain malformation components. Posterior Fosse Decompression (PFD) is certainly first line therapy in CM-I. There are a few case reports demonstrating that effective surgical treatment of CM leads to normalization of SRBD, and the recurrence of SRBD may be an early indicator of recurrence of CM. The aim of this study is to examine the occurrence of sleep apneas in patients with CM I and the impact of decompression surgery on sleep- disordered breathing.

**Materials and methods:** Correlative 22 patients with CM-I (11 women and 10 men) with middle age of 39,2±14,2 years with pathological nocturnal polisomnography (PSG) (RDI > 5) underwent a new PSG 3 to 6 month after PFD.

**Results:** When we compare sleepiness and Sleep architecture before and after surgery we did not obtain statistically significantly differences in the sleep parameters. Respiratory sleep disorders were predominantly obstructive hypopnea during the supine position. We observe a significant improvement of the total sleep time RDI after surgery (27.5 ± 21.9 & 13.2 ± 18.3), in REM-RDI (30.2 ± 24.9 & 14.1 ± 20.2), and NREM-RDI (22.5 ± 25.0 & 5.7 ± 10.6). After surgery we obtain normal values in RDI (<5) in 11 patients.

**Conclusion:** Posterior decompression fosse in Patients with CM-I had a significant improvement of sleep and sleep disordered breathing.

**Acknowledgements:** This work has been supported in part by the Fondo de Investigación Sanitaria (Instituto de Salud Carlos III) with grant PI07/0681, co-financed by the European Regional Development Fund (ERDF) and awarded to Dr. M.A. Poca.

<http://dx.doi.org/10.1016/j.sleep.2013.11.273>

### **Positional sleep apnea therapy – Our experience**

A. Ferreira, A. Vale, D. Rocha, E. Matos, T. Calvo  
Centro Hospitalar de Trás-Os-Montes e Alto Douro (CHTMAD), Portugal

**Introduction:** In individuals with obstructive sleep apnea (SAOS), the body position during sleep can influence the obstructive events in 50–60% of patients. In these cases, the apnea-hypopnea index (AHI) is higher in the supine position than in the non-supine position. Some authors classify the duplication (or more) of obstructive events in supine position as positional sleep apnea. Studies are not enlightening, and positional therapy is controversial, with some authors advocating inefficiency. In the reviewed studies, the positional apnea patient is reported to be younger, with lower Body Mass Index (BMI), AHI and Respiratory Disturbance Index, with better sleep quality and less daytime sleepiness complaints, compared to non positional patients.

**Materials and methods:** We perform a retrospective study, based on clinical process review, of positional sleep apnea patients who realize positional therapy placing a tennis ball in their nightclothes, making supine position uncomfortable. For data analysis, we used IBM SPSS 20.

**Results:** In our sleep laboratory, we analyzed 10 positional sleep apnea patients, treated with positional therapy. Most patients were male ( $n = 9$ ), with mean age of  $56 \pm 14.5$  years. The mean Body Mass Index of  $27 \pm 3.5$  and mean Epworth Scale of  $10.1 \pm 4.7$ . Mean AHI was  $19.3 \pm 5.3$  events/h and oxygen desaturation index of  $19.1 \pm 12.0$  per hour. Snoring was the first clinical sign of disease, followed by daytime sleepiness. After 3 months of positional therapy treatment, all patients perform a home sleep study, which showed a significant reduction in obstructive events, with mean AHI of  $5.3 \pm 2.7$  events/h and oxygen desaturation index of  $7.3 \pm 5.3$  per hour. Only 4 patients claim to use positional therapy daily; one refused therapy and another is currently using CPAP for keeping daytime sleepiness with positional technique. It was interesting to realize how positional therapy was performed, with different and imaginative solutions. Currently, there are marketed devices all over the world to improve positional therapy technique. In our opinion, the main disadvantage of this therapy is the lack of control over treatment adherence. Further, some patients think this therapy is embarrassing, discrediting its therapeutic potential.

**Conclusion:** Despite the low number of patients involved in this study, the results were positive, with improvement of sleep events in patients with positional sleep apnea who fulfill the positional therapy.

**Acknowledgements:** We thank all the team of the CHTMAD sleep lab, as well as the patients in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.274>

### **Mandibular advancement splint for the treatment of obstructive sleep apnea**

C. Ferreira, F. Teixeira, L. Vaz Rodrigues, F. Carvalho, J. Moutinho Dos Santos  
Centro de Medicina do Sono, Hospital Geral – Centro Hospitalar e Universitário de Coimbra, Portugal

**Introduction:** Mandibular Advancement Splint (MAS) is a simpler alternative to continuous positive airway pressure (CPAP) for the treatment of mild and moderate OSA. The aim of the study was to evaluate the effectiveness of MAS for the treatment of OSA and determine if sleep apnea symptoms, cephalometric measurements and sleep study data are associated with MAS treatment outcome.

**Materials and methods:** We included 100 patients, 82 men and 18 women, mean age  $47.9 \pm 10.8$  years, 57% with mild and 38% with moderate OSA. MAS are personalized and advance the mandible 75% of maximum protrusion and provide approximately 5–10 mm opening vertically (between incisor edges). All patients had cephalometric evaluation and nocturnal sleep study at baseline and under treatment with MAS. According to the variation of respiratory disturbance index (RDI), with and without MAS, patients were divided into three groups: complete responders (if RDI with MAS was reduced to less than 5 events per hour), partial responders (reduction of 50% or more in RDI but remaining above 5 per hour) and non-responders (less than 50% reduction in RDI).

**Results:** The main symptoms of OSA were snoring (43%) and excessive daytime sleepiness (34%). There was a statistically significant reduction of Epworth Sleepiness Scale (ESS) with MAS. On the follow-up sleep study there was also a statistically significant reduction in RDI and increase in minimum oxygen saturation (MinSaO<sub>2</sub>) with MAS. Thirty-seven patients were considered complete responders, 31 partial responders and 32 non-responders. Comparison between these three groups revealed that they were not statistically different in terms of age, body mass index or ESS score. Eighty-eight per cent of patients referred clinical improvement with MAS. Patients without clinical improvement had statistically significant higher Body Mass Index, ESS score, RDI and apnea index and lower MinSaO<sub>2</sub> with MAS. Reduction of RDI with MAS was also less in this group. With regard to the sagittal skeletal relationships, there was a statistically significant alteration in ANB angle, ANS-Gn and PNS-P with MAS. Patients with no clinical improvement had statistically significant lower SNB angle and higher ANB angle with MAS. There was an association between clinical response and clinical Improvement ( $p = 0.002$ ).

**Conclusion:** MAS is an effective treatment for mild and moderate OSA. Evaluation of Epworth Sleepiness Scale (ESS), nocturnal sleep study indices and cephalometric measurements could predict successful outcome.

<http://dx.doi.org/10.1016/j.sleep.2013.11.275>

### How sleep studies are important to initiate noninvasive ventilation in Duchenne Muscular Dystrophy

C. Ferreira<sup>1</sup>, V. Martins<sup>1</sup>, G. Lopes<sup>1</sup>, N. Madureira<sup>2</sup>, J. Moita<sup>1</sup>

<sup>1</sup> Pulmonology Department, Hospital Geral, Centro Hospitalar e Universitário de Coimbra, Portugal

<sup>2</sup> Hospital Pediátrico de Coimbra, Portugal

**Introduction:** We speculate that in Duchenne Muscular Dystrophy (DMD) hypoventilation related to respiratory muscles weakness and thoracic deformation may induce abnormal sleep structure. Clinical diurnal manifestations, as excessive daytime sleepiness, are difficult to perceive, due to the complex context of the disease. To clarify our hypothesis we perform a polysomnography (PSG) to all DMD patients before they initiate noninvasive ventilation (NIV), even when they have a near normal pulmonary function.

**Materials and methods:** Included twenty-four patients with DMD, mean age of  $19.0 \pm 4.0$  years (13–31) and BMI  $19.0 \pm 6.2$  kg/m<sup>2</sup> (11.0–37.6). All patients had pulmonary function tests, maximal respiratory pressures, awake oxygen saturation, daytime arterial blood gases and polysomnographic evaluation prior NIV.

**Results:** Mean forced vital capacity (FVC) was  $33.9 \pm 18.3\%$  of predicted values (11–79%), with 63.6% of patients with severe restrictive ventilatory abnormality (FVC < 40%). Mean daytime

arterial oxygen tension (PaO<sub>2</sub>) was  $96.1 \pm 9.5$  mmHg and daytime arterial carbon dioxide tension (PaCO<sub>2</sub>) was  $38.4 \pm 9.7$  mmHg with only 2 patients with diurnal hypercapnia. Sleep efficacy was  $70.8 \pm 16.3\%$ , total sleep time  $336.5 \pm 77.1$  min, mean REM  $7.3 \pm 9.4\%$ , Stage one  $10.8 \pm 9.1\%$ , Stage two  $49.2 \pm 13.9\%$ , Stage three  $14.4 \pm 7.5\%$  and Stage four  $11.3 \pm 7.2\%$ . The total Respiratory Disturbance Index (RDI) mean was  $5.8 \pm 4.8$  (0–17.7). In REM RDI mean was  $11.7 \pm 19.2$  (0–74.3) and in NREM  $5.9 \pm 8.1$  (0–36.4). Mean oxyhemoglobin saturation (SpO<sub>2</sub>) was  $94.4 \pm 1.9\%$  with minimal SpO<sub>2</sub> of  $89.6 \pm 4.2\%$  (79–95%). Arousals were frequent with a mean Arousal Index of  $10.6 \pm 8.4$ . Arousal index was not correlated with RDI. Desaturation and high index of arousals were also not correlated with diurnal lung function. Even in less severe restrictive ventilatory abnormality without diurnal hypoxemia, desaturation during sleep was common.

**Conclusion:** Patients with DMD have poor sleep quality, with fragmented sleep due to high number of arousals and low mean SpO<sub>2</sub>, even in the absence of relevant respiratory events. Arousals can be seen as a compensatory mechanism to sleep hypoventilation and may contribute to poor quality of life. These findings may impact the decision to initiate NIV at earlier stages.

<http://dx.doi.org/10.1016/j.sleep.2013.11.276>

### Cyclic Alternating Pattern in congenital deaf – quantitative and topographic analysis

L. Ferreira<sup>1</sup>, T. Paiva<sup>2</sup>

<sup>1</sup> CHLN – EPE, HSM, CENC – Sleep Medicine Center, Portugal

<sup>2</sup> CENC – Sleep Medicine Center, IMM – FMUL, Portugal

**Introduction:** Sleep is a reversible behavioral state with attenuation of sensorial modalities and relative preservation of auditory function. Cyclic Alternating Pattern (CAP) is related to sleep instability and arousal. It is formed by CAP (phases A (A1, A2, A3) + B) and NCAP cycles. A1 subtype indicates maintenance of NREM sleep neuronal mechanisms; A2 and A3 are related to sleep instability and onset REM mechanisms. Congenital deaf sleep is a good model of sustained auditory deprivation and an important tool in the study of noise effect in sleep. In this study we aim to 1. Evaluate if the absence of acoustic perturbation in deaf promotes sleep stability; and 2. Evaluate the effect of provoked arousals in congenital deaf and normal-hearing subjects sleep.

**Materials and methods:** Eight congenital deaf and eight normal-hearing volunteers were matched according to age and gender. Video-polisonography were made on two consecutive nights, in lab environment, and provoked arousals after every 5 min of stable REM were performed. CAP Rate, Duration, Time Distribution and Topographic Mapping of the frequency bands 0.2–2.5 Hz (FB 1) and 7–12 Hz (FB2) were measured to accomplish aim 1; for aim 2 CAP density (no. events/ sleep time) were obtained for the periods before (PB) and after provoked arousals (AA – 30 min period after the arousal). SPSS 16.0 was used for statistical analysis purposes using  $p < 0.05$ : Mann–Whitney test and Multivariate test (aim 1); Wilcoxon test (aim 2) were also used.

**Results:** Contrary to the expectations, the sleep of the congenital deaf is more unstable as it presents increased A3 rate ( $p = 0.017$ ) and time variations ( $p = 0.045$ ) as well as evidence of decreased A1 rate and duration. The deaf subjects have compromised CAP rhythmicity: CAP cycle ( $p = 0.133$ ) and A1 subtype ( $p = 0.138$ ) do not vary along the night and there is no clear repetitive and cyclical A2 and A3 pattern in association with REM-on mechanisms. These subjects pre-

sented higher spectral power in parieto-occipital regions for A1 ( $p = 0.049 - BF1$ ) and temporal posterior for A2 ( $p = 0.015 - FB 1$ ) and B ( $p = 0.049 - FB 1$  e  $p = 0.033 - FB 2$ ) possibly as a result of cerebral modifications due to deafness. Deaf subjects seem more sensitive to provoked sleep interruption with remarkable decrease of A1 ( $p = 0/015$ ) in AA periods.

**Conclusion:** Deaf subjects have more unstable sleep and higher sensitivity to provoked sleep interruption; compromised CAP rhythmicity as well as cortical and spectral modifications in posterior regions, possibly related to their clinical condition.

**Acknowledgements:** Funded by: Fundação BIAL (No. 107/02). Work supported by Helder Bértolo, Joana Pires and Rosa Santos.

<http://dx.doi.org/10.1016/j.sleep.2013.11.277>

### **Congenital central hypoventilation syndrome presenting as pulmonary hypertension**

T. Nunes<sup>1</sup>, R. Ferreira<sup>1</sup>, R. Anjos<sup>2</sup>, O. Moldovan<sup>3</sup>, T. Bandeira<sup>1</sup>

<sup>1</sup> *Pneumology Unit, Department of Pediatrics, Santa Maria Hospital – CHLN, Academic Medical Center of Li, Portugal*

<sup>2</sup> *Santa Cruz Hospital, Portugal*

<sup>3</sup> *Genetic Service, Department of Pediatrics, Santa Maria Hospital – CHLN, Academic Medical Center of Li, Portugal*

**Introduction:** Congenital Central Hypoventilation Syndrome (CCHS) is part of a diffuse autonomic nervous system deregulation. Usually it presents as sleep hypoventilation with impaired responses to hypoxemia and hypercapnia. Noninvasive ventilation (NIV) has been described as an option in older children. We describe a case of an infant in whom pulmonary hypertension (PHT) was the first signal of disease, being NIV a successful option.

**Materials and methods:** Chart review.

**Results:** M.D., was a 2 month old female infant, the 3rd child of a healthy, non-related, young couple. Gestation, delivery and neonatal period were uneventfully. She was on exclusive breastfeeding with good weight gain. Parents described prostration in the previous 3 days, food refusal and cyanosis in the day before. She was examined by a pediatric cardiologist who diagnosed severe PHT and referred her to our hospital. Physical examination confirmed central and peripheral cyanosis and satO<sub>2</sub> was 91% breathing room air; other aspects were unremarkable including alertness, tonus, thorax examination and pulmonary auscultation. Hematological and biochemistry evaluations were normal except capillary blood gases that revealed respiratory acidosis (pH 7,26 mmHg) with pCO<sub>2</sub> 79,6 mmHg; chest X-ray was normal. There was no polipnea and during sleep apneic episodes were identified. Polysomnography revealed central apneas with severe desaturation in NREM sleep and hypercapnia, with delayed arousal response. After an initial decompensation period with increasingly high pCO<sub>2</sub> that needed invasive ventilation, she was started on nasal mask NIV with good adaptation and blood gases normalization, permitting rapid transition to home care. A genetic mutation on PHOX 2B confirmed CCHS. Actually, at one year old, she is clinically stable on sleep NIV with normal neurodevelopment and somatic progression and without PHT on cardiac evaluation.

**Conclusion:** Sleep central apneas are the most frequent presentation of CCHS in childhood but it can presents differently as shown on this patient. This case highlights the importance of clinical suspicion to diagnose this rare disease. The NIV support is a less common approach in younger patients, but it may be a successful option, avoiding tracheostomy and prolonged hospitalization and improving quality of life.

<http://dx.doi.org/10.1016/j.sleep.2013.11.278>

### **Impact of diagnosis and treatment of obstructive sleep apnea syndrome (OSAS) with non-invasive ventilation (NIV)**

V. Ferreira<sup>1</sup>, R. Nêveda<sup>1</sup>, E. Lombardia<sup>1</sup>, R. Pimenta<sup>2</sup>, J. Condeço<sup>2</sup>, H. Curado<sup>2</sup>

<sup>1</sup> *Local Health Unit of Alto Minho (ULSAM), Portugal*

<sup>2</sup> *Polytechnic Institute of Oporto – School of Health Technnology, Portugal*

**Introduction:** OSAS is a serious public health problem. This study attempted to measure the benefits of one year of treatment with NIV in patients with moderate-severe OSAS, as well as the economic impact for both the patient and the Portuguese National Healthcare System (NHS). Specifically, we tried to assess if the treatment with NIV reduces: daytime sleepiness; road traffic accidents; number of hospitalizations; number of days of hospitalization; number of emergency visits; number of medical specialty consultations; and respective costs. We studied all patients with moderate-severe OSAS who visited the Pulmonology Services of the Local Health Unit of Alto Minho (ULSAM) and used NIV for at least one year.

**Materials and methods:** To assess outcomes and costs, we used the Epworth Sleepiness Scale and the Homogeneous Diagnostic Groups (HDG's) approved by law and contracted between the ULSAM and the NHS. Statistical data analysis was conducted by using descriptive and inferential techniques (*t*-test for paired samples and Spearman's correlation coefficient), with a significance level of 5%. Patients with mild OSAS, weight reduction, subject to otolaryngology surgery and without one year of NIV treatment were excluded from the study.

**Results:** The sample consisted of 153 individuals, 20.9% female and 79.1% male between the ages of 33 and 90. Our results show a significant reduction in daytime sleepiness ( $p < 0.001$ ), road traffic accidents ( $p < 0.001$ ), number of emergency visits ( $p < 0.001$ ), number of hospitalizations ( $p < 0.001$ ), and number of hospitalization days ( $p < 0.001$ ). They also reveal a significant reduction in emergency costs ( $p < 0.001$ ) and medical specialty consultations ( $p < 0.001$ ) for the patient, as well as in emergency ( $p < 0.001$ ) and hospitalization costs ( $p < 0.001$ ) for the NHS. There was no significant reduction on the number of medical specialty visits ( $p = 0.269$ ) and costs to the NHS ( $p = 0.269$ ). The results were also not significant with regard to the relationship between the severity of OSAS and the number of road traffic accidents and daytime sleepiness.

**Conclusion:** Treatment of OSAS with NIV, even in the short time period of one year, reduces the use of health services and associated costs, as well as daytime sleepiness and road traffic accidents. It was also found that the value of HDG's medical hospitalization for OSAS contracted between ULSAM and NHS was insufficient, compared to HDG's medical hospitalization for the same pathology as defined by law, which represents an added burden for the health institution.

**Acknowledgements:** To the Local Health Unit of Alto Minho, Portugal (ULSAM), who made possible this study with real data of their patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.279>

### **Psychomotor assessment in sleep breathing disorder children – pilot study**

V. Ferreira<sup>1</sup>, J. Leite<sup>2</sup>, L. Prado<sup>3</sup>, G. Prado<sup>3</sup>, L. Carvalho<sup>3</sup>

<sup>1</sup> *Federal University of Sao Paulo, Neuro-Sono, Brazil*

<sup>2</sup> *Federal University of Sao Paulo, Fisioterapia, Neuro-Sono, Brazil*

<sup>3</sup> *University of Sao Paulo, Neuro-Sono, Brazil*

**Introduction:** The Sleep Disordered Breathing (SDB) affects important cognitive functions concerning to the learning process as atten-

tion, memory, and creativity, but just a little is known about the motor performance in those children. Suitable psychomotor development promotes better school learning. An assessment of the development and motor pattern contributes as preventive and reeducative to help or delete factors impeding the learning potential of the child. **Objective:** The aim of this study was to evaluate whether the psychomotor bases (fine motor coordination, global motor coordination, static and dynamic balance, body and image scheme, spatial and temporal organization) are impaired in SDB children.

**Materials and methods:** We studied 9 children (5 girls) from 7 to 11 years, attending elementary school in São Paulo city, Brazil. All children had SDB diagnosed with polysomnography and the psychomotor assessment was evaluated with Motor Development Scale (MDS). We compared children's motor performance with the expected for children at the same age.

**Results:** The children had, on average, Total Sleep Time  $412 \pm 47.6$  min, minimal oxygen saturation of  $89\% \pm 0.05$ , arousal index of  $8.1 \pm 8.8$  events/h, and sleep latency of  $48 \pm 56$  min. The average age of the children was  $9.2 \pm 1.1$  years. The results showed that the psychomotor assessment with MDS was lower than expected for their age in all children: 8 children (89%) in fine motor coordination, 6 children (67%) in global motor coordination, 8 children (89%) in static and dynamic balance, 5 (55.5%) in body and image scheme, 7 (78%) in spatial organization, and 5 (55.5%) in temporal organization. The laterality (eye, hand, and foot) of children was full left-handed or right-handed in 55% of them and cross lateralization in 45%.

**Conclusion:** Children with SDB showed lower performance than expected for children of the same age in all psychomotor bases, and it was more impaired in relation to fine motor coordination, global motor coordination static and dynamic balance, and spatial organization.

**Acknowledgements:** Acknowledgements for all children and families who took part in the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.280>

### Obstructive sleep apnea and P300 abnormalities in children with attention deficit

P. Henriques Filho<sup>1</sup>, R. Pratesi<sup>1</sup>, L. Gandolfi<sup>1</sup>, Y. Nobrega<sup>1</sup>, R. Tristao<sup>2</sup>  
<sup>1</sup>Laboratory of Pediatrics, Faculty of Medicine, University of Brasilia, Brazil

<sup>2</sup>University of Brasilia, Medicine Faculty, Brazil

**Introduction:** Obstructive sleep apnea (OSA), that causes abnormal breathing or chronic intermittent hypoxia during sleep, can cause attention and working memory deficits which can be related to cognitive impairment throughout the developing nervous system. **Aims:** To verify the ability to sustain attention in children and adolescents diagnosed with OSA compared to a control group.

**Materials and methods:** 80 participants of a local school (49 boys and 31 girls) aged 6 to 17 years (mean  $10.85 \pm 2.25$ ), with attention complaints by the school, accepted to participate in this study and underwent overnight polysomnography and P300 evoked potential test. This test was divided into three repeated series with 10 min interval between series and lasting 15 min each series. None of the participants had been using medication or had previous diagnoses of developing mental disorder.

**Results:** Among the 80 participants, 26 (32.5%) received the diagnosis of OSA and 61 (76.3%) had varied abnormalities at P300 tests, from these 26 met both OSA and ADD deficit attention disorder criteria, 19 participants had no altered results and composed the control group. Considering the entire sample, OSA was significantly

correlated with lower amplitudes ( $r = .79$ ;  $r = .77$  and  $r = .81$ ,  $p = .000$ ) and longer latencies ( $r = .60$ ;  $r = .57$ ;  $r = .76$ ,  $p = .000$ ) in all three tests, respectively. Two-Way ANOVA and repeated measures analyses showed no effect of age and gender on the P300 waves, though boys had a greater variability in all values. The apnea and hypoapnea index (IAH) had mainly effect on amplitudes of all tests and at latency of test 3 ( $F > 2.23$ ,  $p < .010$ ) and OSA diagnosis had effect over all P300 variables ( $F > 34.39$ ,  $p < .000$ ). Also, the group with OSA also presented decay in amplitude along the three tests, as showed by the repeated measures analyses, over all the three P300 amplitude measures ( $F = 297.57$ ,  $p = .000$ ), but not to latency, differently from the group without OSA that kept the values at the same levels during the three tests.

**Conclusion:** This study has found evidence of the relationship between OSA and P300 evoked potentials, amplitudes and latencies. These findings are in accordance with the literature showing that sleep disturbances might disrupt sustaining attention abilities leading to school complaints of learning capacity. Also, this may help to clarify the diagnosis of attention deficit disorder, when sleep disorder is present.

**Acknowledgements:** To the University of Brasilia, FAHUB and CNPq.

<http://dx.doi.org/10.1016/j.sleep.2013.11.281>

### Hypoxia predicts high blood pressure in patients with severe obstructive sleep apnea

C. Fiori<sup>1</sup>, E. Martins<sup>1</sup>, P. Lopez<sup>2</sup>, D. Martinez<sup>3</sup>

<sup>1</sup>Hospital de Clínicas de Porto Alegre (HCPA), Graduate Program in Cardiology and Cardiovascular Sciences, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil

<sup>2</sup>Hospital de Clínicas de Porto Alegre (HCPA), Undergraduate Program in Nursing, UFRGS, Brazil

<sup>3</sup>UFRGS, Cardiology Division, Hospital de Clínicas de Porto Alegre (HCPA), Porto Alegre, RS, Brazil

**Introduction:** Among the mechanisms causing hypertension in obstructive sleep apnea (OSA) patients, the roles of hypoxia and of arousals, leading to intermittent oxidative stress and repeated elevations of blood pressure, have been difficult to disentangle. The apnea-hypopnea index (AHI) reflects the number of arousals. The minimum arterial oxygen saturation (SaO<sub>2</sub>min) and the percent of total sleep time with SaO<sub>2</sub> below 90% (STB90) reflect the degree of hypoxic insult. Mild and moderate OSA are established causes of hypertension. Intense desaturation, however, occurs only in severe OSA. Most of the literature on the OSA-hypertension link uses only the AHI as OSA severity marker. The aim of this study was to quantify, in severe OSA, the influence of desaturation on blood pressure levels.

**Materials and methods:** We analyzed retrospectively a total of 1517 polysomnographies of patients with AHI > 30, ages between 18 and 60 years, of both genders, who underwent baseline polysomnography in a sleep clinic. Area under the ROC curve was used to identify desaturation cut points for prediction of systolic blood pressure (SBP) > 140 mm Hg. Multivariate models with SBP as dependent variable, using, AHI, SaO<sub>2</sub>min, and SBT90 as regressors were attempted.

**Results:** In the linear regression model to predict SBP in severe OSA (adjusted R square 0.04;  $P < 0.001$ ), all three regressors are weakly but significantly associated, being the beta for lnAHI (0.08;  $P = 0.006$ ) STB90 (0.09;  $P = 0.008$ ) and SaO<sub>2</sub>min ( $-0.06$ ;  $P = 0.048$ ). The binary logistic model, adjusted for age, BMI, and gender, the odds ratio for SBP > 140 mm Hg was 1.6 times higher in the group with SBT90 (95% CI 1.3–2.0).

**Conclusion:** These data suggest that, in severe OSA, the effect of desaturation on blood pressure is weak, probably, because it “saturates” at low severity levels. The duration of the STB90 and the low-est saturation are similarly weak predictors of hypertension in severe OSA. This is in agreement with epidemiological and patho-physiological data indicating that arousals in mild and moderate OSA are the main factors in the pathogenesis of hypertension in OSA.

**Acknowledgements:** This study was supported in part by CNPq, CAPES, and FIPE-HCPA (Brazil).

<http://dx.doi.org/10.1016/j.sleep.2013.11.282>

### The effects of a parental intervention on electronic media exposure and sleep patterns in adolescents

O. Flint-Bretler<sup>1</sup>, T. Shochat<sup>1</sup>, O. Tzischinsky<sup>2</sup>

<sup>1</sup>University of Haifa, Israel

<sup>2</sup>Emek Yezreel Academic College, Israel

**Introduction:** There is a gap that widens with age, between the recommended sleep duration and the actual sleep time of adolescents. Due to this gap, bodily and mental functions such as the metabolic and immune systems, performance, memory, school achievement and creative ability can be harmed. Moreover, lack of sleep involves an increased risk of accidents and injuries, conduct problems and the reduced quality of life. Biological factors that explain changes in sleep patterns include delays in the circadian timing system and in the homeostatic system that regulate sleep and wakefulness. These changes cause a growing and continuous delay in sleep phase during adolescence. In addition, a number of environmental factors affect sleep patterns; variables such as: early school start time, increased home work assignments, after school activities, lack of parental demand for adequate sleep hours, and increased “screen time”, or use of electronic media, including television, computer games, internet and cellular phones. Based on the Parental Style model (reference), the authoritative parenting style is characterized by parents' setting high demands of their children on the one hand, yet displaying high levels of responsiveness to their children on the other hand. The authoritarian parenting style is characterized by parents' setting high demands of their children on the one hand, and displaying low levels of responsiveness to their children on the other hand. The permissive parenting style is characterized by parents' setting low demands of their children on the one hand, and displaying high levels of responsiveness to their children on the other hand. In several investigations, the authoritative parenting style has been shown to have a positive influence on child development, promotion of academic achievement and psychosocial competency, and promotion of healthy behaviors in adolescents such as good eating habits, physical activity and the decrease of risky behaviors such as smoking, alcohol, extreme diets and early sexual behavior. The Conceptual Model (Golan, 2006) views the parents as the sole agents of change in their children's life and focuses on the power of personal example on environmental changes and promotion of the authoritative parental style. This model has been found to be effective in the field of eating disorders, but has never been implemented in the field of sleep. The main aim of the research is to evaluate the effectiveness of an intervention program which deals with increasing parents' awareness of the changes that characterize adolescents, encouraging the authoritative parental style based on the Parenting Style Model (Buri, 1999); and encouraging parents to make environmental changes at home based on the Conceptual Model (Golan, 2006), in order to promote healthy behaviors including healthy sleep patterns and controlled exposure to electronic media, in young normative adolescents (ages 10–12). Research Hypotheses: Hypothesis 1:

There is a link between the availability and the amount of time spent using electronic media. Adolescents that have media devices inside their rooms are exposed for a longer time to electronic media compared to those who don't have media devices in their rooms. In addition, there is a link between the availability of the media and sleep patterns. Adolescents that have media devices in their rooms will show delayed sleep patterns and shorter sleep durations compared to those that don't have media devices in their rooms. Hypothesis 2: There is a connection between parental style, sleep patterns and media exposure habits in young adolescents. Regarding the authoritative parental style it was hypothesized that sleep patterns and exposure to electronic media would be adequate in adolescents. Regarding the authoritarian parental style, it was assumed that sleep duration would be longer and the exposure to electronic media would be shorter compared with other parenting styles. Regarding the permissive parental style, it was assumed that sleep duration would be shorter and the exposure to electronic media would be longer compared to other parenting styles. Hypothesis 3: There is a connection between sleep patterns, media exposure habits and quality of life in young adolescents. The study will find that better sleep patterns and lower exposure to electronic media are related to higher quality of life in young adolescents. Hypothesis 4: The intervention program based on the Conceptual Model will lead to an increase in parents' knowledge about the changes that characterize adolescents and will promote the authoritative parental style. Hypothesis 5: The intervention program will lead to the improvement of healthy behaviors including sleep patterns, controlled use of electronic media and to the improvement in quality of life of young adolescents.

**Materials and methods:** Method. The sample included 70 dyads of parents (mostly mothers) and adolescents from schools in the Jezreel Valley. The experimental group and the control group each consisted of 35 subjects (35 girls) of average age 10.7 (0.9) years. There were three sessions of data collection: 1. baseline, 2. following intervention, 3. three months post intervention. Parents and adolescents reported on electronic media consumption, sleep patterns and quality of life. In addition, parents reported on their parenting styles and adolescents wore an actigraphy monitor (for monitoring their sleep patterns) and filled in a sleep diary for five days. Parents in the experimental group participated in 6 workshops while parents in the control group received information to read by mail, on healthy sleep habits and the effects of excessive media exposure.

**Results:** Results Findings showed that 30% of the adolescents didn't get the adequate amount of sleep and slept less than 8 h per night. In addition 30% were classified as “evening types”. Adolescents watched TV more than 3 h a day and used the computer for more than 2.5 h per day during the week. 40% of the adolescents had media devices in their bedroom. These adolescents consumed more media and slept less as compared to those who don't have media devices in their rooms. Most of the parents reported having an authoritative parental style; however, only few relationships between parental style and health related behaviors were found. A positive relationship between the permissive parental style and exposure to TV was found. Furthermore, negative relationships were found between inadequate sleep patterns and associated variables such as sleepiness and mood, quantity of media exposure and quality of life. The intervention program increased parents' knowledge of their children's health, compared to the control group. Furthermore, the intervention program moderated the negative relationship between age and health related behaviors, whereas this relationship was maintained in the control group. The intervention program improved sleep patterns (advanced bedtime and improved sleep efficiency), reduced media consumption (general media and computer use) and improved quality of life (physical and general). The intervention program created no changes in sleep duration and TV consumption, nor was the authoritative parental style enhanced.

**Conclusion:** Discussion. This research is the first to demonstrate the effectiveness of an intervention program for the improvement of health behaviors including sleep patterns, controlled use of electronic media and the improvement in quality of life of young adolescents, with parents as the sole agents of change. On the theoretical level the research supports and enhances the Conceptual Model and demonstrates that the model may be used in other health areas in adolescents apart from eating habits. This research adds to the body of the literature about the relationships between sleep patterns, exposure to electronic media and quality of life in young Israeli adolescents. Regarding the practical application, the findings show that programs tailored for parents can make changes in health related behaviors in young adolescents.

**Acknowledgements:** Based on the research limitations it is suggested that future research should be longer and accompany the parents also during the stage of long-term maintenance of the new behaviors. It is also recommended that future interventions should include the motivational component, which deals with elements related to the motivation for behavioral change, both within the parent and within the adolescent.

<http://dx.doi.org/10.1016/j.sleep.2013.11.283>

#### **Analysis of validity in adults of the expanded protocol of orofacial myofunctional evaluation with scores**

G. Aparecida Folha, F. Cardoso Pereira Valera, C. Giovana Borges, F. Claudia Maria De  
Faculty of Medicine of Ribeirão Preto, University of São Paulo, Brazil

**Introduction:** Patients with various acquired diseases (e.g. cerebrovascular accident, traumatic brain injury), degenerative diseases (e.g. Parkinson's disease, multiple sclerosis), obstructive sleep apnea (OSA), among others, may benefit from therapy protocols with orofacial exercise. But, an important role for this therapy process as documentation of the orofacial myofunctional characteristics is necessary. The Orofacial Myofunctional Evaluation Protocol with Scores (OMES) is an instrument validated to assess orofacial myofunctional status on children and adults. So far, the expanded version (OMES-E) in terms of numerical scales and items was validated for children only. The aims of this study were to analyze the validity, the reliability of the OMES-E protocol in adults.

**Materials and methods:** Participants were 50 subjects (21 to 59 years old, mean  $41.44 \pm 11.38$ ), without distinction of race and gender. The exclusion criteria were neurological or cognitive deficit, tumors or traumas in the head and neck, and use of medication. One speech therapist performed the examination. To analyze criterion validity, the subjects were evaluated individually with the OMES-E protocol, according to the previously described methodology. After, based on video-recorded images, the subjects were reevaluated using the OMES as reference protocol. The correlation between the protocols was calculated. The test of the reliability of interpretation of the OMES-E was performed with reevaluation of 20% of the sample. To analyze the construct validity, we calculated the sensitivity (S), specificity (E), accuracy (A) and predictive values (VP+ e VP-). For these, the cut-off point proposed for OMES and OMES-S, the 75th, was adopted. Thus, subjects who presented an OMES score lower than 80 and an OMES-E score lower than 152 were considered to have relevant OMD. Descriptive statistical analysis for the OMES-E protocol was performed. Spearman correlation and coefficient Kappa weighted (Kw) was performed using the MedCalc software. Significance level was 0.05.

**Results:** There was statistical correlation between the OMES and OMES-E protocols ( $r = 0.87$ ). Inter-examiner (E1  $\times$  E2) agreement and reliability with the OMES-E protocol was 0.74 and  $r = 0.75$

respectively. For the OMES-E protocol mean values of 0.90 for A, 0.67 for S, 0.91 for E, 0.77 for VP+ and 0.86 for VP- were found.

**Conclusion:** Thus, the OMES-E protocol is valid and reliable for adult orofacial myofunctional evaluation, with good S, E and A, as well as predictive values.

**Acknowledgements:** This work received support from CAPES, the Brazilian Federal Agency for Support and Evaluation of Postgraduate Education.

<http://dx.doi.org/10.1016/j.sleep.2013.11.284>

#### **Assessment of surface EMG supra-hyoid muscle activity in apneic patients compared to healthy subjects. A pilot study**

G. Folha, A. Mapelli, F. Cardoso Pereira Valera, L. Dantas Giglio, L. Vitaliano Voi Trawizki, C. Maria De Felício  
Faculty of Medicine of Ribeirão Preto, University of São Paulo, Brazil

**Introduction:** Snoring and obstructive sleep apnea (OSA) are associated with swallowing disorders, probably due to tissue trauma of the pharynx caused by snoring. Spontaneous swallowing (SS) is a frequent physiologic act, characterized by a complex and coordinated activation of many stomatognathic, pharyngeal, and laryngeal muscles. Surface electromyographic (sEMG) activation of the submandibular muscles is strictly connected to the swallowing biomechanical events. The strongest relationship is between the elevation and the anterior displacement of the hyoid bone and the sEMG signal of the supra-hyoid muscles. Objective. To assess the characteristics of supra-hyoid muscle activity during SS condition in patients with moderate-severe OSA and healthy subjects.

**Materials and methods:** Eleven patients with untreated moderate-severe OSA diagnosed by polysomnography (GOSA) and 11 subjects without OSA signs or symptoms (GC) were analyzed. Simultaneous bilateral sEMG activity from supra-hyoid muscle were evaluated during SS of saliva. Each sEMG signal was filtered and rectified. The onset of swallowing was detected when the signal rose clearly above the preceding background activity. The end was scored when the signal returned to levels of background activity. Right and left signals were averaged. The temporal difference between the beginning and end of the swallowing act determined the deglutition time. For amplitude evaluations, a standardization of the signal was applied considering the maximum peak of saliva swallowing amplitude as 100%. The amplitude value was extracted for the initial and final events of each standardized signal. For the maximum peak, the time delay from the beginning was also detected. The t-test was calculated for each parameters, with significance level at 5%.

**Results:** There was no difference regarding the age between groups ( $p = 0.23$ ), instead BMI were different ( $p < 0.01$ ). For the SS of saliva the GOSA showed greater mean values of initial (24% vs 15%,  $p < 0.01$ ) and final (22% vs 16%,  $p = 0.02$ ) standardized amplitude. Swallowing time duration was smaller, even if not statistically significant, in GOSA (0.855 vs 1.103 s,  $p = 0.08$ ) with an anticipated maximum peak delay (0.357 vs 0.569 s,  $p = 0.05$ ).

**Conclusion:** SS in moderate-severe OSA patients was characterized by both intensity and temporal differences in supra-hyoid muscle activity with respect to healthy subjects. Further investigations are being performed to deepen the characterization of different OSA degree of severity.

**Acknowledgements:** This work was supported in part by University of São Paulo – Protocol No. 11.1.21626.01.7 and the first author received a fellowship from Coordination of Improvement of Higher Education Personnel (CAPES), Brazil.

<http://dx.doi.org/10.1016/j.sleep.2013.11.285>

### CPAP compliance – the first year and beyond

L. Fordyce<sup>1</sup>, A. Siemens<sup>2</sup>, R. Rousseau<sup>1</sup>, E. Becerra<sup>1</sup>

<sup>1</sup>Sound Sleep Solutions Inc., Respiratory Homecare Solutions, Canada

<sup>2</sup>Respiratory Homecare Solutions, Canada

**Introduction:** For moderate to severe obstructive sleep apnea, the most common treatment is the use of a Continuous Positive Airway Pressure (CPAP) or Automatic Positive Airway Pressure (APAP) device. This device 'splints' the patient's airway open during sleep by means of a flow of pressurized positive air into the throat. Despite the effectiveness of this therapy, long-term compliance with CPAP/APAP therapy has been difficult for many patients. The purpose of this study was to determine the CPAP/APAP compliance of patients after one year of starting on CPAP/APAP therapy.

**Materials and methods:** Initially, patients were referred to private sleep diagnostic testing facilities (Respiratory Homecare Solutions {RHS}) by their primary care physician. Qualified professionals (RRTs and/or RPSGTs) completed Level III instruction and review of results (interpreted by a Board Certified Sleep Physician). If PAP therapy was prescribed, the patient was given a one month, Auto-CPAP (APAP) trial. During this APAP trial, patients were closely followed by a sleep clinician. At the start of the APAP trial, all patients were put on a wireless modem. This was done to monitor overall compliance and how the patient was doing on therapy. Each patient was given a phone call within 1–3 days of starting therapy. They were also scheduled and seen in office for a one month follow-up visit. If there were any problems that could not be addressed over the phone or via the modem, an office visit was scheduled in between this time. At the end of the APAP trial, patients were then scheduled to be seen again one month after they purchased. At this time, they were then given a 6 month follow-up phone call as well as a scheduled annual office visit the following year. At all office visits, the compliance card from the APAP machine was downloaded to obtain average hourly usage including compliance, the Apnea Hypopnea Index (AHI), and leak. The Epworth sleepiness scale (ESS) was also completed by the patient to assess their degree of sleepiness in comparison to their previous visit.

**Results:** The results revealed that there were 73 female and 225 male patients ( $N=298$ ) that met inclusion criteria. There were 275/298 (92.3%) patients that completed their one month PAP trial. At the end of the one month therapy trial visit, patients showed continued therapy use for an average of 5.40 h a night for 93.0% of the time. At the one month post purchase visit, patients showed continued therapy use for an average of 6.51 h a night for 97.0% of the time. After one year, there were 201/275 (73.9%) patients (76 female and 125 male) still on PAP therapy.

**Conclusion:** The preliminary results revealed that with close follow-up for APAP/CPAP patients, it is possible to obtain successful compliance of a minimum of 4 h/night, 70% of the time over a 30 day period. Our compliance for the 201 patients on APAP/CPAP after one year of PAP therapy was 6.33 h a night for 94.0% of the time.

**Acknowledgements:** All sleep staff at Respiratory Homecare Solutions – Calgary.

<http://dx.doi.org/10.1016/j.sleep.2013.11.286>

### Optogenetic and pharmacogenetic probing of rapid eye movement (REM) sleep circuitry

J. Fraigne<sup>1</sup>, Z. Torontali<sup>1</sup>, A. Adamantidis<sup>2</sup>, J. Kim<sup>3</sup>, J. Peever<sup>1</sup>

<sup>1</sup>University of Toronto, Dept. Cell & System Biology, Canada

<sup>2</sup>McGill University, Douglas Institute, Canada

<sup>3</sup>University of Toronto, Dept. Psychology, Canada

**Introduction:** Rapid eye movement (REM) sleep is characterized by the activation of cortical electroencephalogram (EEG) and loss of

muscle tone (atonia). The exact neuronal circuit mediating the generation and timing of this state is not fully understood. The subcoeruleus (Sub-C) neurons are hypothesized to generate REM sleep and its characteristics. Here we aimed to determine how optogenetics and pharmacogenetic stimulation impacts REM sleep expression.

**Materials and methods:** Study#1: To precisely control the neuronal activity of the Sub-C region, we bilaterally infused 200 nL of an adeno-associated viral vector (AAV) containing a light-sensitive opsin (AAV-hsyn-hChr2(H134R)-eYFP) virus into the Sub-C of 4 mice. Animals were instrumented for EEG and EMG recordings. Neurons were stimulated with short blue light pulses (5 ms) at 1 and 10 Hz either independently of behavioral state or specifically during REM sleep. Study#2: To stimulate the Sub-C population for longer time periods, we bilaterally microinjected 400 nL of an AAV harboring a modified muscarinic G-protein coupled receptor (AAV-HSYN-HA-hm3D(Gq)-IRES-mCitrine) into the Sub-C of 3 mice. Administration of clozapine-N-oxide (CNO, 5 mg/kg) activated neurons in the Sub-C. Only animals that had histological verification of Chr2 and hm3D(Gq) receptor expression in the Sub-C region were used for analysis.

**Results:** We found that semi-chronic bilateral light activation of Sub-C neurons at 10 Hz, but not 1 Hz, triggered REM sleep-like EEG activity (theta, 4–8 Hz) during light stimulation, and increased EEG Theta power by  $64 \pm 16\%$  compared to baseline. Under some conditions, light stimulation prolonged the duration of REM sleep episodes by almost 2-fold. Pharmacogenetic manipulation of the neurons in the Sub-C caused a change in behavioural phenotype where the distribution of EEG frequencies shifted towards a REM sleep-like pattern (theta, 4–8 Hz) independent of the behavioural state. Moreover, the average duration of REM sleep-like periods were greater than REM sleep periods under control condition (i.e., saline).

**Conclusion:** These results support the hypothesis that the Sub-C region is involved in controlling REM sleep and its associated phenomena.

**Acknowledgements:** This research was funded by the Natural Sciences and Engineering Research Council of Canada (NSERC), the Canadian Institutes of Health Research (CIHR) and the CIHR Sleep and Biological Rhythms Toronto.

<http://dx.doi.org/10.1016/j.sleep.2013.11.287>

### Cognitive characteristics of children with narcolepsy

A. Guignard-Perret<sup>1</sup>, C. Inocente<sup>1</sup>, S. Mazza<sup>2</sup>, S. Bayard<sup>3</sup>,

V. Herbillon<sup>1</sup>, P. Franco<sup>1</sup>

<sup>1</sup>Pediatric Sleep Unit, National Reference Center for Narcolepsy, Hôpital Femme Mère Enfant & Integrative Physiology of Brain Arousal System, CRNL, INSERM-U1028, University Lyon 1, Lyon, France

<sup>2</sup>Laboratoire EMC, Institut de Psychologie, Université Lyon 2, France

<sup>3</sup>Inserm U1061, Sleep Disorders Center, Department of Neurology, Gui-de-Chauliac Hospital, CHU Montpellier, France

**Introduction:** To conduct a descriptive analysis of cognitive characteristics in children and adolescents with narcolepsy.

**Materials and methods:** Clinical and electrophysiological characteristics of de novo patients from the Pediatric Lyon's Reference Center for narcolepsy were collected from 2008 to 2013. Due to the high frequency of school difficulties, intellectual ability (WISC-IV, full scale, verbal comprehension index (VCI), perceptual reasoning index (PRI), processing speed index (PSI), working memory index (WMI)) was usually proposed after the diagnosis. Some of these children were already treated at this time with stimulants (modafinil or methylphenidate).

**Results:** The cohort included 56 children (35 boys) with a median age of 12 years (range 5–17) (51.7% < 10 years). All children

presented with EDS, 84% with cataplexy, 44.6% with hypnagogic hallucinations and 14.3% reported sleep paralysis, 64.3% were obese. 18% had signs of depression on the CDI score, 1 child was hyperactive (CRS-P > 75). 57% of the children had school difficulties, 29% repeated a year. 39 children were evaluated with WISC-IV. No differences were found between the tested and non tested children for clinical and polygraphic characteristics. Fourteen out of the 39 tested children (35.9%) were gifted, essentially with VCI > 130. The gifted children came from high social levels ( $p < 0.001$ ), had more spontaneous arousals on PSG ( $p = 0.01$ ) and were more often treated with stimulants (98% vs 52% ( $p = 0.025$ )). VCI and Full IQ scales were correlated with social levels, spontaneous arousals, presence of treatment and school achievement. PRI was correlated with REM sleep % ( $r = 0.50$ ,  $p = 0.002$ ), REM sleep duration ( $r = 0.46$ ,  $p = 0.004$ ) and the presence of cataplexy ( $93 \pm 10.4$  for NwC and  $107.7 \pm 13.8$  for NC,  $p = 0.009$ ). A negative correlation was found between AHOI and PRI ( $r = -0.37$ ,  $p = 0.025$ ), WRI ( $r = -0.42$ ,  $p = 0.015$ ) and PSI ( $r = -0.51$ ,  $p = 0.002$ ). Low processing speed index was related to school difficulties ( $p = 0.02$ ).

**Conclusion:** In these preliminary results, we found an interesting relation between REM sleep %, abnormal REM manifestations such as cataplexy and the perceptual reasoning ability. Further studies have to be made to confirm these results and to understand the underlying mechanisms. In the other hand, this study pointed out the negative influence of sleepiness and obstructive breathing on the WISC-IV results.

**Acknowledgements:** Patricia Franco and Clara Inocente received respectively a grant from "INTERFACE-INSERM-Hôpitaux" and the Brazilian Grant "CAPES" to finance their research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.288>

### Characteristics of narcolepsy according to the age of diagnosis

C. Inocente<sup>1</sup>, M. Lecendreux<sup>2</sup>, Y. Dauvilliers<sup>3</sup>, X. Drouot<sup>4</sup>, I. Arnulf<sup>5</sup>, P. Franco<sup>1</sup>

<sup>1</sup> Pediatric Sleep Unit, National Reference Center for Narcolepsy, Hôpital Femme Mère Enfant & Integrative Physiology of Brain Arousal System, CRNL, INSERM-U1028, University Lyon 1, Lyon, France

<sup>2</sup> Centre pédiatrique des pathologies du sommeil, National Reference Center for Narcolepsy, Hôpital Robert Debré, France

<sup>3</sup> Inserm U1061, Sleep Disorders Center, National Reference Center for Narcolepsy, Department of Neurology, Gui-de-Chauliac Hospital, France

<sup>4</sup> Centre de diagnostic et de traitement des pathologies du sommeil, National Reference Center for Narcolepsy, Hôpital Henri Mondor, France

<sup>5</sup> Unité des Pathologies du Sommeil, National Reference Center for Narcolepsy, AP-HP, Groupe Hospitalier Pitié-Salpêtrière, France

**Introduction:** To conduct a descriptive analysis between narcoleptic patients diagnosed before and after 18 years.

**Materials and methods:** Data extracted from the National French multicentre research program on narcolepsy (PHRC AOM07-138), 23 pediatric patients from the Lyon's center were added to this data base. Clinical and electrophysiological characteristics were compared between de novo patients diagnosed before ( $n = 59$ ) and after 18 years ( $n = 108$ ).

**Results:** Mean ages  $\pm$  SD at diagnosis were respectively  $11.7 \pm 2.9$  in pediatric (PP) vs  $33.5 \pm 14.3$  years in adult (AP) patients. Sleepiness appeared earlier in children ( $10 \pm 2.8$  vs  $25 \pm 12.5$  years,  $p < 0.001$ ) with a shorter diagnosis delay ( $1.6 \pm 1.5$  vs  $8.1 \pm 11.9$  years,  $p = 0.01$ ). Cataplexy were reported in 84% of PP vs 49% of AP ( $p < 0.001$ ). PP had also less sleep paralysis than AP (18.6% vs 42.6% ( $p = 0.003$ )), but no difference for hypnagogic hallucinations (44.1% vs 50.9%). HLA DQB1\*0602 was found in 94.9% of the

PP vs 54.6% in AP ( $p < 0.001$ ). PP were more frequently obese (61% vs 12.9% ( $p < 0.001$ )) with earlier puberty ( $11.5 \pm 1.2$  vs  $13 \pm 1.5$  years ( $p = 0.003$ )). On PSG, PP had higher TST ( $p < 0.001$ ), low sleep efficiency ( $p = 0.045$ ), more N3% ( $p = 0.005$ ) and lower AHI ( $p = 0.019$ ) than AP. On MLST, PP had more SOREM than AP ( $p = 0.02$ ). No differences were found between PP and AP for sleep latencies on PSG or MLST, for EPWORTH and ISI scores. On Conners RS-R (>75), ADHD symptoms were only found in PP (5.13% vs 0%,  $p < 0.001$ ). Depressive feelings were found in 36% of AP vs 30% of PP (NS). However, AP had lower quality of life (QL) than PP ( $43.7 \pm 6.4$  vs  $61.5 \pm 13.5$ ,  $p < 0.001$ ). QL was affected by depressive feelings ( $r = -0.57$ ,  $p < 0.001$ ), fatigue ( $r = -0.43$ ,  $p < 0.001$ ), age ( $r = -0.46$ ,  $p < 0.001$ ) and obesity (BMI-z) ( $r = -0.31$ ,  $p = 0.001$ ).

**Conclusion:** The clinical presentation with obesity and ADHD was more marked in narcoleptic patients diagnosed during pediatric age, which could explain the short diagnosis delay. However, adult patients had lower QL than PP patients. We recommend a prompt diagnosis and a more thorough assessment and long term management of psychological health in this population.

**Acknowledgements:** The study was financed in part by a Brazilian Grant "CAPES" to Clara Inocente and a French Grant "PHRC AOM07-138" from the French Health Ministry to Isabelle Arnulf. Patricia Franco and Isabelle Arnulf benefit from a grant "INTERFACE-INSERM-Hôpitaux" to finance their research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.289>

### Respiratory-related leg movements: what is the evidence behind the rules?

S. Fulda<sup>1</sup>, I. Zavalko<sup>2</sup>, R. Ferri<sup>3</sup>, M. Manconi<sup>1</sup>

<sup>1</sup> Sleep & Epilepsy Center, Neurocenter of Southern Switzerland, Civic Hospital (EOC) of Lugano, Switzerland

<sup>2</sup> Severtsov Institute Ecology/Evolution, Russian Academy of Sciences, Russia

<sup>3</sup> Sleep Research Center, Department of Neurology I.C., Oasi Institute (IRCCS), Italy

**Introduction:** Current sleep scoring rules exclude leg movements that occur near respiratory events from the scoring of periodic leg movements during sleep. While the AASM rules exclude leg movements that occur during a period of 0.5 s preceding to 0.5 s following an apnea or hypopnea, the WASM/IRLSSG rules consider only leg movements during 0.5 s before to 0.5 s after the end of an apnea or hypopnea. So far, the distribution of leg movements in relation to respiratory events is unknown and the aim of the present study was therefore to describe this distribution and contribute to the question whether there is evidence that favors one over the other of the two scoring rules

**Materials and methods:** Retrospective chart review and analysis of polysomnographic recordings. We included all patients with polysomnographic recordings between January 2010 and July 2011, aged 18 to 75 years, and AHI > 20, ODI > 10, more than 50% of apneas being obstructive, more than 15 leg movements/hour of sleep, no more than 20% of total sleep time with artifacts and no medical condition or medication that could influence leg movements or respiratory disturbances. Onset and duration of all leg movements (0.5–10 s), apneas, and hypopneas during sleep were extracted from the polysomnographic recordings.

**Results:** Polysomnographic recordings of 64 patients (55 male,  $56 \pm 11$  years) were included in the analysis. Back-averaging of leg movement activity (LMA) with respect to the beginning, the middle, and the end of respiratory events revealed no indication that

LMA was increased in the middle of respiratory events. Increased LMA before the beginning of the respiratory event consisted mainly of the longer tail of LMA after the end of the previous respiratory event. Importantly, LMA increased shortly before the end of the respiratory events, with peak onset of LMA 2.5 s after the end of the respiratory event.

**Conclusion:** Our results showed that leg movements are not augmented at the beginning or middle of respiratory events but are increased around the end of respiratory events over a period significantly longer than specified in the AASM and the WASM/IRLSSG rules. Both rules therefore underestimate the number of respiratory leg movements in patients with obstructive sleep apnea.

<http://dx.doi.org/10.1016/j.sleep.2013.11.290>

### Nocturnal intermittent hypoxia as an associated risk factor for microalbuminuria in women with type 2 diabetes mellitus

S. Furukawa, E. Eguchi, K. Maruyama, T. Tanigawa  
Ehime University Graduate School of Medicine, Department of Public Health, Japan

**Introduction:** The International Diabetes Federation has expressed the need for further research into the links between sleep-disordered breathing (SDB) and type 2 diabetes mellitus. However studies on the association between SDB and microvascular complications among type 2 diabetes (T2DM) mellitus patients are limited.

**Materials and methods:** We recruited 513 Japanese patients with T2DM. Nocturnal intermittent hypoxia was diagnosed using the 3% oxygen desaturation index (ODI), with <5 events/h corresponding to normal, and 5 events or more/h corresponding to nocturnal intermittent hypoxia. Nephropathy was defined using the urinary albumin-creatinine ratio to classify the participants as follows: normoalbuminuria, <30 mg/mmol creatinine; microalbuminuria, 30 mg and over/mg creatinine; and nephropathy, 300 mg and over /mg creatinine.

**Results:** The prevalence of nocturnal intermittent hypoxia was 45.4% among T2DM patients. The nocturnal intermittent hypoxia group was older ( $P=0.007$ ), had a higher BMI ( $P=0.001$ ), greater weight change since the age of 20 years ( $P=0.001$ ), higher smoking rate ( $P=0.005$ ), and increased prevalence of hypertension ( $P=0.001$ ), hyperlipidaemia ( $P=0.001$ ), microalbuminuria ( $P=0.001$ ), and nephropathy ( $P=0.001$ ). Microalbuminuria (model 1: OR, 3.41; 95% CI, 1.85–6.40;  $P=0.001$ ; model 2: OR, 3.69, 95% CI, 1.85–7.59,  $P=0.001$ ; model 3: OR, 3.12; 95% CI, 1.45–6.95;  $P=0.001$ ) and nephropathy (model 1: OR, 3.12; 95% CI, 1.45–6.95;  $P=0.001$ ; model 2: OR, 7.31; 95% CI, 2.11–31.6;  $P=0.001$ ; model 3: OR, 5.23; 95% CI, 1.45–23.8;  $P=0.001$ ) were derived as factors from all 3 statistical models and constantly associated with nocturnal intermittent hypoxia only in women.

**Conclusion:** Nocturnal intermittent hypoxia was highly prevalent among T2DM patients, and may be an independent associated risk factor for microalbuminuria in Japanese women with T2DM.

**Acknowledgements:** We thank Isao Saito, Shin Yamamoto, Teruki Miyake, Teruhisa Ueda, Tetsuji Niiya, Masamoto Torisu, Teru Kumagai, Takenori Sakai, Hisaka Minami, Hiroaki Miyaoka, Susumu Sakurai, Bunzo Matsuura, and Morikazu Onji. This study was supported in part by Grants-in-Aid for Young Scientists (B) (grant number 217090583, 2008–2010) provided to SF from the Japanese Society for the Promotion of Science.

<http://dx.doi.org/10.1016/j.sleep.2013.11.291>

### Snoring is related to the elevation of morning blood pressure

T. Furukawa<sup>1</sup>, H. Nakano<sup>2</sup>, T. Tanahashi<sup>1</sup>, K. Yoshihara<sup>1</sup>, N. Sudo<sup>1</sup>  
<sup>1</sup> Kyushu University, Department of Psychosomatic Medicine Graduate School of Medical Sciences, Japan  
<sup>2</sup> National Hospital Organization, Fukuoka National Hospital, Sleep Disorders Center, Japan

**Introduction:** Consequences of snoring independent of obstructive sleep apnea remains controversial. We hypothesized that snoring sound intensity, as assessed by mean tracheal sound energy (Leq) during sleep, is related to morning blood pressure.

**Materials and methods:** Subjects were 191 government workers. Overnight tracheal sound recording at home was performed using an IC-recorder. The data were analyzed using a PC-based compressed sound spectrograph system, which yielded the respiratory disturbance index (RDI) and the equivalent tracheal sound pressure level (Leq). Blood pressure was measured in the morning following the overnight monitoring. We stratified the subjects into four groups: lean or normal-weight nonapneics (LNA; RDI < 5/h, BMI < 25,  $n=110$ ), overweight nonapneics (ONA; RDI < 5/h, BMI < 25,  $n=20$ ), lean or normal-weight apneics (LA; RDI < 5/h, BMI < 25,  $n=27$ ), and overweight apneics (OA; RDI < 15/h, BMI < 25,  $n=16$ ). Pearson's correlation analysis and multiple regression analysis were employed to elucidate the association between snoring and morning blood pressure.

**Results:** Both systolic and diastolic blood pressure values (SBP and DBP) in the morning in LNA were lower than those in ONA, LA and OA (116/73 vs. 127/80, 128/82, 133/84 mmHg). Leq was correlated to both SBP and DBP in the morning ( $r=0.38$ ,  $p<0.0001$ ;  $r=0.33$ ,  $p=0.0004$ , respectively) only in LNA, not in other groups. In LNA, multiple regression analysis showed that Leq was significantly associated with morning SBP after adjustment for the RDI, BMI and other confounding factors ( $p=0.022$ ), but not with morning DBP.

**Conclusion:** Snoring is independently related to the elevation of morning blood pressure in lean or normal-weight workers.

**Acknowledgements:** The authors thank Kenji Hirayama for useful suggestion.

<http://dx.doi.org/10.1016/j.sleep.2013.11.292>

### The impact of hypnotics usage on daytime function and associated factor for the usage in shiftwork nurses

K. Futemma<sup>1</sup>, A. Murakoshi<sup>1</sup>, Y. Takaesu<sup>1</sup>, S. Asaoka<sup>2</sup>, Y. Komada<sup>3</sup>, Y. Inoue<sup>4</sup>

<sup>1</sup> Department of Psychiatry, Tokyo Medical University, Tokyo, Japan

<sup>2</sup> Sleep Research Institute, Edogawa University, Tokyo, Japan

<sup>3</sup> Department of Somnology, Tokyo Medical University, Tokyo, Japan

<sup>4</sup> Japan Somnology Center, Neuropsychiatric Research Institute, Tokyo, Japan

**Introduction:** It has been known that a certain number of shiftwork nurses have shift work disorder (SWD) and regularly take hypnotics. However, impact of hypnotics usage on health-related quality of life (QOL) and daytime function in shiftwork nurses remain unclear. Especially, condition of usage of high dose or multiple kinds of hypnotics, which is likely to cause dependency of hypnotics, has not been investigated in this population. To clarify this issue, we investigated QOL and work performance status of hypnotic user and explored the factors associated with multiple hypnotics usage in shiftwork nurses.

**Materials and methods:** We conducted a questionnaire-based, cross-sectional survey on nurses working in university hospitals. The questionnaires included items relevant to age, gender, family member structure, work environment, history of work-related accidents/errors, social functioning 8 (SF8), chronotype, sleep problems, status of hypnotics usage, the Center for Epidemiological Studies Depression Scale (CESD) and presence/absence of SWD. Responses were obtained from 1202 nurses. Among them, 997 female shift work nurses including 696 two-shift workers and 281 three-shift workers were subjected for the analyses.

**Results:** The prevalence of hypnotics usage in the sampled shift-work nurses was 10.0% (6.9% were single hypnotics users and 3.1% were multiple hypnotics users). The diazepam equivalent dose of benzodiazepine or benzodiazepine agonist hypnotics were significantly higher in the multiple hypnotics users than in the single hypnotics users. The number of nurses having insomnia were not different between the single hypnotics users and the multiple hypnotics users. The sampled shiftwork nurses with usage of multiple hypnotics showed lower QOL, more severe depressive symptoms and greater frequencies of work-related accidents / errors than those with usage of single hypnotics. A multiple logistic regression analyses revealed that age (over 27 years old), insomnia, existence of SWD, longer working hours and having an eveningness-oriented chronotype were significantly associated with usage of hypnotics. However, as for multiple hypnotics, only existence of SWD was significantly associated with the usage.

**Conclusion:** The present study indicated that usage of multiple hypnotics does not necessarily bring about improvement of insomnia or QOL in shiftwork nurses. It was also suggested that prevention of SWD is needed to avoid multiple hypnotics usage in this population.

**Acknowledgements:** We thank members of the Department of Somnology of Tokyo Medical University for technical support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.293>

### Assessment of fragmentary myoclonus in healthy sleepers

D. Gabelia, T. Mitterling, D. Bregler, L. Ehrmann, B. Högl, B. Frauscher  
Department of Neurology, Innsbruck Medical University, Austria

**Introduction:** Fragmentary myoclonus (FM) is characterised by a multifocal synchronic and asymmetric distribution of EMG potentials with a duration of 75–150 msec and an amplitude exceeding 50  $\mu$ V. The extreme form of FM is excessive fragmentary myoclonus (EFM). The presence of FM has been described in many sleep disorders, its clinical relevance, however, is still under debate. In the International Classification of Sleep Disorders-2 it is therefore listed in the category “Isolated Symptoms, apparently Normal Variants and Unresolved Issues”. The aim of this study was to assess FM in healthy sleepers.

**Materials and methods:** One-hundred healthy sleepers (60 f, 40 m) aged 19–77 years were selected from a representative Tyrolean population sample. A two-step screening process (telephone interview, personal investigation by a sleep-trained physician) was performed for exclusion of a relevant sleep, neurological, psychiatric or internal comorbidity as well as any use of a CNS active medication. All participants underwent one video-polysomnography. Analysis of FM was part of the comprehensive analysis of motor phenomena during sleep. It was quantitatively assessed according to Lins et al. EFM was diagnosed according to AASM 2007.

**Results:** Every study participant had FM. Median FM index in sleep was 25.3/h [range 3/h–1102/h]. The highest rates were seen in REM 38/h [0/h–1102/h] sleep followed by N1 34.4/h [3/h–1048/h] and N2 22.3/h [1.5/h–1032/h] sleep. The lowest values were found in N3 37.8/h [0/h–1200/h] sleep. Men had higher rates of FM in sleep than women (median of 39.9/h [2.94/h–1032/h] vs. median 20.3/h [0/h–792.7/h];  $p < 0.001$ ). FM showed a positive correlation with age (Spearman rho = 0.558,  $p < 0.001$ ). Nine healthy subjects fulfilled criteria of EFM (f 3/m 6). None of these 9 subjects was below 50 years of age.

**Conclusion:** This is the first study systematically assessing FM in healthy sleepers on a quantitative base. Our data showed that FM was present in every healthy sleeper and is therefore an ubiquitous phenomenon. Of note, men are more frequently affected than women. As the rates of FM increased with age, one might suggest FM a normal physiological phenomenon of aging.

**Acknowledgements:** This study was supported by the Austrian Science Fund (KLI 236) for the project “Motor activity during sleep in health and disease” to Birgit Frauscher.

<http://dx.doi.org/10.1016/j.sleep.2013.11.294>

### Are cognitive deficits observed in obstructive sleep apnea associated with cognitive complaints?

M. Fortin, K. Gagnon, A. Baril, C. D'Aragnon, J. Gagnon, N. Gosselin  
Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, Canada

**Introduction:** Obstructive sleep apnea (OSA) causes sleep disruption and intermittent nocturnal hypoxemia, which can lead to daytime sleepiness and cognitive deficits. Cognitive deficits reported by individuals suffering from OSA can be severe enough to warrant a diagnosis of mild cognitive impairment (MCI). However, no study has focused on the specific cognitive complaints reported by OSA patients. Objectives: To investigate the cognitive complaints reported by OSA patients compared to control subjects, and to explore whether the presence of MCI in OSA is associated with increased or different cognitive complaints.

**Materials and methods:** Thirty-four subjects with OSA (apnea-hypopnea index (AHI) mean:  $32.5 \pm 14.5$ ; mean age:  $63.4 \pm 6.5$  yrs) and 24 healthy controls (mean age:  $64.3 \pm 6.5$  yrs), matched for sex and education, underwent an overnight polysomnography and a comprehensive neuropsychological assessment. All participants filled out the following questionnaires: Cognitive failure questionnaire (CFQ), a French adapted version of Cognitive Difficulties Scale (CDS), Beck depression inventory-II (BDI-II), Beck anxiety inventory (BAI) and Epworth Sleepiness Scale (ESS). MCI was defined as an objective evidence of cognitive decline and no major impact of cognitive deficits on activities of daily living. Groups were compared on respiratory variables, demographic characteristics and questionnaires using Student *t*-tests.

**Results:** Although OSA and control groups differ on body mass index ( $t(48) = 2.29, p < 0.05$ ) and AHI ( $t(48) = 18.83, p < 0.001$ ), there were no significant group differences for questionnaires measuring self-reported cognitive problems: CFQ (control:  $27.0 \pm 12.7$ , OSA:  $28.8 \pm 8.5$ ), CDS (control:  $28.0 \pm 19.3$ , OSA:  $31.3 \pm 12.8$ ). When the OSA group was divided into MCI ( $n = 14$ ) and non-MCI ( $n = 20$ ) sub-groups, no significant groups differences were observed for frequency or type of cognitive complaints: CFQ (OSA N-MCI:  $30.9 \pm 2.9$ , OSA MCI:  $28.4 \pm 1.8$ ), CDS (OSA N-MCI:  $35.3 \pm 15.7$ , OSA MCI:  $33.4 \pm 15.7$ ). No other group difference was found, except for a lower education in OSA patients with MCI compared with OSA without MCI and control subjects.

**Conclusion:** Patients with OSA do not have more or different self-reported cognitive impairments than healthy subjects. This absence of group difference was also found for OSA patients with a diagnosis of MCI. Further studies should investigate whether OSA patients with MCI are aware of their cognitive impairments and if the questionnaires used in this study are sensitive enough to detect self-reported cognitive difficulties among this population.

**Acknowledgements:** Supported by the Canadian Institutes of Health Research and the Fonds de recherche du Québec – Santé

<http://dx.doi.org/10.1016/j.sleep.2013.11.295>

### Mild cognitive impairment in obstructive sleep apnea

K. Gagnon<sup>1</sup>, A. Baril<sup>1</sup>, A. Cary<sup>2</sup>, C. Lafond<sup>3</sup>, J. Gagnon<sup>1</sup>, N. Gosselin<sup>1</sup>

<sup>1</sup>Center for Advanced Research in Sleep Medicine, Hôpital du

Sacré-Coeur de Montréal

<sup>2</sup>Department of psychiatry, Université de Montréal

<sup>3</sup>Pulmonology clinic, Hôpital du Sacré-Coeur de Montréal

**Introduction:** Obstructive sleep apnea (OSA) causes sleep disruption and intermittent nocturnal hypoxemia, which can lead to daytime sleepiness and cognitive deficits. Cognitive deficits reported in individuals suffering from OSA can be severe enough to warrant a diagnosis of mild cognitive impairment (MCI). However, the frequency of MCI in individuals with OSA is unknown and factors associated with co-morbid MCI and OSA need to be investigated. **Objectives:** Determine the frequency and subtypes of MCI in subjects with OSA and identify demographic and clinical variables associated with co-morbid MCI and OSA.

**Materials and methods:** Fifty-one subjects with OSA (apnea-hypopnea index 10; mean age: 60.13 ± 9.48 yrs) and 51 healthy controls (mean age: 61.82 ± 9.49 yrs), matched for sex and education, underwent an overnight polysomnography and a comprehensive neuropsychological assessment. MCI was defined as: 1) objective evidence of cognitive decline; and 2) no major impact of cognitive deficits in activities of daily living. MCI subtypes were categorized as nonamnestic single domain, amnestic single domain, nonamnestic multiple domains and amnestic multiple domains. Group difference in the proportion of MCI was assessed using a  $\chi^2$  test. Subjects with co-morbid OSA and MCI were compared to subjects with OSA alone on respiratory, demographic, questionnaire, and polysomnographic variables using Student *t*-tests.

**Results:** MCI was found in 37% (19/51) of OSA subjects. In contrast, only 13% (7/51) of controls had MCI ( $\chi^2 = 7.43$ , *df* = 1, *p* < 0.01). Eight (42%) of the 19 patients with comorbid OSA and MCI met the criteria for nonamnestic single domain (6 with impaired attention and executive functions and 2 with impaired visuospatial abilities), two (11%) for amnestic single domain, four (21%) for nonamnestic multiple domains and five (26%) for amnestic multiple domains. Subjects with co-morbid OSA and MCI showed a lower education level (*t* (52) = 5.17, *p* < 0.01) and a higher score on the vascular burden index (*t* (23) = -2.07, *p* < 0.05) compared to patients with OSA alone. No difference was found between these two groups for respiratory and polysomnographic variables.

**Conclusion:** Results showed that OSA subjects have higher risk of developing MCI compared to control subjects. Nonamnestic MCI subtypes with attention/executive dysfunctions were predominant in OSA. Low education level and high vascular burden were also

associated with the presence of MCI among OSA subjects. Future studies are needed to assess the effects of co-morbid MCI and OSA on the risk of converting to dementia.

**Acknowledgements:** Supported by the Canadian Institutes of Health Research and the Fonds de recherche du Québec – Santé

<http://dx.doi.org/10.1016/j.sleep.2013.11.296>

### Are sleep complaints following mild traumatic brain injury associated with changes in the characteristics of sleep slow waves?

K. Gagnon, S. Khoury, J. Carrier, J. Montplaisir, G. Lavigne, N. Gosselin  
Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, Canada

**Introduction:** Slow waves (SW) are low frequency (<4 Hz) and high amplitude (>75  $\mu$ V) waves that occur during non-rapid eye movement (NREM) sleep, and which are known to play a crucial role in synaptic plasticity and in the restorative function of sleep. In the present study, we sought to determine if changes in SW characteristics are observed after a mild traumatic brain injury (mTBI) and whether SW characteristics are associated with sleep complaints, which are reported by approximately 30–80% of individuals with mTBI.

**Materials and methods:** 34 mTBI subjects (mean age 34.2 ± 11.9 yrs) and 33 controls (mean age; 31.5 ± 11.4 yrs) matched for age, sex and education were included. Subjects with mTBI were tested on average 10.5 ± 10.4 weeks after their brain injury. All subjects underwent a laboratory polysomnography and filled out the Pittsburgh Sleep Quality Inventory (PSQI) and the Beck Depression Index (BDI). Student *t*-tests were used to compare groups on demographic characteristics, PSQI scores, BDI scores and sleep architecture. ANOVA with one repeated measure (sleep cycles (1 to 4)) were performed on C3 lead to compare groups for the following SW characteristics: density, amplitude, frequency, negative/positive phase duration and slope. Association between SW characteristics, clinical features, PSQI scores and BDI scores were measured in the mTBI group using Pearson partial correlations with age as a covariable.

**Results:** We found higher BDI scores in mTBI compared to control subjects (*t* (52) = 6.1; *p* < 0.001), reflecting more depression symptoms in the mTBI group. Subjects with mTBI also reported more sleep disturbances on the PSQI questionnaire compared to control subjects (*t* (52) = 6.3; *p* < 0.001). However, no significant group differences were found for sleep architecture and for SW characteristics. There were no significant correlations between SW characteristics, clinical features, PSQI and BDI scores.

**Conclusion:** Individuals with mTBI report depression symptoms and sleep disturbances, but these symptoms were not associated with altered sleep architecture or SW characteristics.

**Acknowledgements:** Supported by the Canadian Institutes of Health Research and the Fonds de recherche du Québec – Santé.

<http://dx.doi.org/10.1016/j.sleep.2013.11.297>

### miRNA profiling in plasma from patients with sleep disorders reveals dysregulation of miRNAs in narcolepsy and other central hypersomnias

A. Holm<sup>1</sup>, C. Bang-Berthelsen<sup>1</sup>, S. Knudsen<sup>2</sup>, B. Kornum<sup>1</sup>, P. Jennum<sup>2</sup>, S. Gammeltoft<sup>1</sup>

<sup>1</sup> Glostrup Hospital, Diagnostic Department and Glostrup Research Institute, Denmark

<sup>2</sup> Glostrup Hospital, Danish Center for Sleep Medicine, Department of Clinical Neurophysiology, Denmark

**Introduction:** miRNAs have been implicated in the pathogenesis of human diseases including neurological disorders. The aim is to address the involvement of miRNAs in the pathophysiology of central hypersomnias including narcolepsy with cataplexy and hypocretin deficiency (NC), narcolepsy without cataplexy (NwC) and idiopathic hypersomnia (IH) in comparison with healthy controls (HC).

**Materials and methods:** We conducted high-throughput analysis of miRNA in plasma from patients with NC, NwC and IH in comparison with HC using quantitative real-time polymerase chain reaction (qRT-PCR) panels. Data were analyzed with the following softwares: GenEx qRT-PCR data analysis, miRNA expression atlas in normal tissues and DIANA-mirPath pathway analysis.

**Results:** Using analysis of miRNA in plasma with qRT-PCR we identified 50, 24 and 6 miRNAs that were changed in patients with NC, NwC, IH, respectively, compared to HC. Twenty miRNA candidates which fulfilled the criteria of twofold change and  $p$ -value  $< 0.05$  were selected for validation of miRNA changes in an independent cohort of patients. Four miRNAs were significantly changed between NC patients and HC. Levels of miR-30c, let-7f and miR-26a were increased, whereas the level of miR-130a was decreased in NC compared to HC. The miRNAs changes were not specific for NC, since the levels of the four miRNAs were also altered in patients with NwC and IH compared with HC.

**Conclusion:** The levels of four miRNAs are changed in plasma from patients with NC, NwC and IH suggesting that alterations of miRNAs can be involved in the pathophysiology of central hypersomnias.

**Acknowledgements:** Lundbeck Foundation is acknowledged for financial support. Birte Kofoed is thanked for technical assistance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.298>

### Analysis of cyclic alternating patterns in Agrypnia Excitata (AE): insights from a case of limbic autoimmune encephalopathy (AE-LAE)

A. Garay<sup>1</sup>, S. Blanco<sup>2</sup>

<sup>1</sup> CEMIC, Argentina

<sup>2</sup> Facultad de Ingenieria, CONICET, Argentina

**Introduction:** Agrypnia Excitata" (AE) is a term coined originally by Lugaresi and Provini to describe a syndrome caused by a dysfunction in thalamo-limbic circuits producing severe insomnia, mental confusion, dream enactment, motor and autonomic activation. This syndrome is observed in fatal familial insomnia (FFI), limbic autoimmune encephalopathy, delirium tremens and the Mulvihill-Smith syndrome. Oscillatory EEG rhythms could be observed in these patients, resembling the named cyclic alternating pattern (CAP) in NoREM sleep, but, during REM sleep ("pseudosleep") in patients with FFI (Garay A., Neurology 1994). Now, we attempt to characterize a peculiar CAP rhythm observed in our case of proven LAE.

**Materials and methods:** We analyzed polysomnograms of our case of LAE-VGKC (PSGs,  $n = 3$ ). During PSGs the following variables were monitored: electroencephalogram (EEG), electrooculogram (EOG), electromyogram (EMG), nasal and oral airflow, thoracic and abdominal effort and pulse oximetry. Sleep-wake patterns were scored in 30 s. epochs according standard criteria (AAMS2007) and 3–5 s epochs for spectral analysis of the frequency components from Fast Fourier Transform (FFT) of the raw data of EEG and ECG activities and thorough continuous wavelet transform (CWT) using a multiresolution wavelet filter (Daubechies-level 7) we analyzed synchronized EEG–ECG activity removing muscular artifacts related to CAP rhythm.

**Results:** (a) LAE was characterized by a drastic decrease of TST, sparse atypical REM/NoREM sleep and for a CAP rhythm during states named as quiet and active wakefulness (qW–aW), (b) LAE intra-wakefulness structure showed a CAP rhythm with an increase of 30–60 s centered bursts ( $p < 0.05$ . K.W. NP test), (c) wakefulness EEG activity showed oscillations below 1 Hz, (d) CWT ECG R-R interval analysis showed reduced variability when analyzing qW–aW transitions.

**Conclusion:** The AE-LAE case of this study presented sparse episodes of atypical sleep and showed presleep behavior during quiet and active wakefulness with a CAP behavior expressed as brief episodes of motor quiescence and overactivity. The observed reduction of variability of CWT R-R interval analysis and background FFT EEG activity below 1 Hz could be related to thalamo-cortico-limbic altered modulation/disconnection and to the appearance of cortical top-down oscillations liberated of caudal- rostral influences (Kuhn B. et al. PNAS, 2008). Thus, subtyping AEs could be a way to the understanding of the role of thalamus regulation in wakefulness and sleep during health and illness.

**Acknowledgements:** CEMIC-CONICET, Buenos Aires, Argentina.

<http://dx.doi.org/10.1016/j.sleep.2013.11.299>

### Facial muscle contractions during REM sleep and its association to emotional dreamed content

A. Rivera Garcia, I. Ramirez Salado, E. Lopez Ruiz

Instituto Nacional de Psiquiatria Ramon de la Fuente, Chronobiology and Sleep Laboratories, Neuroscience Division, Mexico

**Introduction:** Facial muscle contractions (FMC) are features commonly associated with emotional expression during waking, yet poorly studied during sleep. Recent studies show a pattern in both healthy subjects and patients with major depression during sleep in which FMC have a significantly higher frequency and amplitude during Rapid Eye Movement (REM) sleep than in non-REM (NREM) sleep and that they are associated to the Rapid Eye Movements (REMs) in this sleep stage. Notably, REMs are also associated with emotional dream mentation (EDM). Yet, the possible functional relationship between FMC and EDM, remains unexplored. This study analysed FMC of the corrugator and zygomatic major – two facial muscles typically associated with emotional expression – and explores possible temporal correlations of EDM in healthy subjects during REM sleep. Additionally, it examined the interaction between FMC and REMs with EDM.

**Materials and methods:** Two 8 h sleep recordings were obtained from 6 female volunteers. Facial EMG recordings were obtained from the corrugator supercilii and zygomatic major (left and right) muscles. Sleep was scored using the standard AASM criteria. On the second night, FMC were visually measured. Experimental awakenings exploring EDM (through narration, rating of a dream scale, and Dreams Qualified Report) were performed during REM sleep stages that lasted at least three minutes, they were determined by a FMC

that lasted more than 100 ms and by the amplitude of any facial muscle that exceeded by 500% the background EMG activity. Additionally, experimental awakenings were performed during NREM and REM sleep stages without FMC. Following sleep recordings, FMC and REMs were quantified and analyzed for possible correlations between them. EDM global scores were gauged by exploring their correlation coefficients.

**Results:** Periods with FMC and REMs were associated to higher levels of EDM in healthy subjects as compared to periods without FMC. Moreover, EDM modality (e.g. happy vs. anxious) was linked to certain muscle activation (e.g. higher FMC of zygomatic vs. lower corrugator).

**Conclusion:** The present study shows that during REM sleep with FMC (vs. periods without FMC) the corrugator, zygomatic muscles and REMs are associated to EDM. Additionally, FMC were differentially associated to emotional modality according to the activated facial muscle. Altogether, these findings are consistent with theoretical perspectives of higher emotional variations during REM sleep associated to dream content. Implications are discussed.

**Acknowledgements:** Isidoro Camacho Garcia Carlos Jimenez Rodriguez Carlos Camacho Garcia.

<http://dx.doi.org/10.1016/j.sleep.2013.11.300>

### Sleep deprivation induce morphology changes in the hippocampus and prefrontal cortex in young and old rats

F. García-García<sup>1</sup>, E. Acosta Peña<sup>1</sup>, M. Melgarejo Gutierrez<sup>1</sup>, G. Flores<sup>2</sup>

<sup>1</sup>Universidad Veracruzana, Instituto de Ciencias de la Salud, Mexico

<sup>2</sup>Benemérita Universidad Autónoma de Puebla, Instituto de Fisiología, Mexico

**Introduction:** During normal aging several changes in sleep/wake patterns are observed, which include frequent awakenings during sleep and increased daytime naps, among others. Likewise, aging has also been associated with a deterioration of cognitive function, learning and memory, although widespread loss of nerve cells does not occur, the most of age-related structural changes observed in nerve cells are modifications in dendrites, dendritic spines or even axons. Evidence accumulated over the last years indicates that these functional changes observed during sleep loss, aging, or both could be due to modifications in synaptic connectivity and intracellular signaling; for example, excitatory synaptic transmission at the hippocampal CA1 region is affected by sleep deprivation; in the locus coeruleus (involved in both arousal system and cognitive performance) the number of neurons projecting to areas such as the cortex and the hippocampus declines with age. Therefore, it has been hypothesized that sleep deprivation may compromise neurophysiological and behavioral events; however, relatively few studies have investigated links between sleep loss and structural changes in neurons and, despite the seemingly similar effects of age and sleep deprivation on cognition and the prevalence of sleep changes with age, little is known about the impact of sleep loss on cellular morphology in aging neurons. For that reasons, the aim of this study was to evaluate the effects of total sleep deprivation on neuronal morphology in the hippocampus and prefrontal cortex of both young and aged animals.

**Materials and methods:** A total of 28 male Wistar rats (14 “young-adult” rats, 3–4 months old; 14 “aged rats”, 22–23 months old; 7 for control and 7 for sleep deprivation for each age) were used in this study. Total sleep deprivation was carried out in both experimental groups (young-adult and aged,  $n = 7$  per group) by gentle handling: once sleep-behaviour was observed or low amplitude waves first

appear in sleep recording, rats were softly touched in their tails, whiskers or handling them to prevent falling asleep during 24 h. Immediately after sleep deprivation finished, animals were deeply anesthetized with sodium pentobarbital (75 mg/kg, i.p.) and then perfused intracardially with 0.9% saline solution. Brains were removed and stained by modified Golgi-Cox method. Pyramidal neurons from layer 3 of prefrontal cortex and hippocampus (CA1 area) were selected for study. Five neurons from each region of each brain hemisphere per animal were drawn using a camera lucida. Basal dendrites, including all branches, were reconstructed for each neuron and their dendritic tracings were quantified by Sholl analysis.

**Results:** Results showed that total dendritic length of prefrontal cortex and hippocampus was not affected either age or after 24 h of sleep deprivation compared to their corresponding control group. However, after 24 h of sleep deprivation (SD) aged animals had an increase in spine density in prefrontal cortex but not in hippocampus.

**Conclusion:** Sleep deprivation could be considered a factor that induces neuronal plasticity, which may depend on age.

**Acknowledgement:** This study was supported by CONACYT grant 133178.

<http://dx.doi.org/10.1016/j.sleep.2013.11.301>

### Melatonin for sleep disorders: a bibliometric approach during the last 20 years

P. García-García<sup>1</sup>, C. Alamo<sup>2</sup>, F. Munoz<sup>3</sup>

<sup>1</sup>Departamento de Ciencias Biomédicas

<sup>2</sup>Facultad de Ciencias de la Salud, Universidad Camilo José Cela, Madrid, Spain

<sup>3</sup>Department of Neurobiochemistry, The George S. Wise Faculty of Life Sciences, Tel-Aviv University

**Introduction:** Melatonin is a neurohormone that it has high interest for sleep researchers. There are some substances uses for sleep disorders. In this sense, melatonin prolonged release has been approved like drug for treatment of primary sleep disorder, and included in a new class of drugs: melatonergic agonist. We would like to review, first of all the evolution of scientific research about use of melatonin in sleep disorder, and then the evolution of scientist's paper about melatonin's formulation, covering the period 1993–2012.

**Materials and methods:** Using Medline database we selected those document that content in their title one or several of the following descriptors: “sleep disorder\*” and “melatonin\*”. This study took into account all original articles, brief reports, reviews, editorials, letters to the editor, and so on. One of main bibliometric laws were applied: Price's Law on the increase in scientific literature. This law, undoubtedly the most widely used indicator for the analysis of productivity in a specific discipline or a particular country, takes into account an essential feature of scientific production, which is its exponential growth. Moreover, we conduct a sub-analysis for evolution to different formulation (immediate release and prolonged release melatonin).

**Results:** From the search on Pubmed 36,128 documents (sleep disorder) and 1,140 (combined with melatonin) were selected. In order to assess whether the growth of scientific production in sleep disorder and melatonin follows Price's Law of Exponential Growth, we carried out a linear adjustment of the data obtained, according to the equation  $y = 5.9707x + 23.258$ , and another adjustment to an exponential curve, according to the equation  $y = 27,915e^{0.0927x}$ . Mathematical adjustment to an exponential curve, allows us to obtain a correlation coefficient  $r = 0.828$ . On the other hand, linear adjustment to the measured values provides an  $r = 0.924$ . The reper-

toire analyzed is more suited to a linear adjustment than an exponential adjustment. Moreover, 2% of total documents corresponding to prolonged release melatonin. And of these, 80% have been published in the last 5 years.

**Conclusion:** To conclude a high papers on sleep disorder has been published, but for melatonin not fulfillment of Price Law. However, prolonged-release melatonin has increase in the last few years.

<http://dx.doi.org/10.1016/j.sleep.2013.11.302>

### **Incidence of sleep disorders in a simple of down syndrome patients**

L. Dominguez Ortega<sup>1</sup>, S. Cabrera García-Armenter<sup>2</sup>,  
E. Díaz Gállego<sup>2</sup>, M. Serrano Comino<sup>3</sup>

<sup>1</sup> *Clínica Ruber. Instituto para la investigación de los trastornos del sueño (IITS), AASM, ESRS, SES, Spain*

<sup>2</sup> *Clinica Ruber, SES, Spain*

<sup>3</sup> *Instituto para la investigación de los trastornos del sueño (IITS), Spain*

**Introduction:** Down syndrome is the most common congenital disease in new born babies. The face abnormalities, mental retardation and sleep disorders are the most common and persistent affectation in such population. Our study has aimed to evaluate the prevalence of different sleep disorders in a sample of Down syndrome patients belonging to the Down Syndrome Foundation of Madrid (FSDM).

**Materials and methods:** We send to the FSDM a total of 325 sleep questionnaire that the FSDM distributed among the families. Once completed by the families there were returned to us for evaluation. From a total of 172 questionnaires received, we have reviewed 119: 88 have been diagnosed and treated, 31 have been reviewed and are waiting for polysomnography, 36 have not yet been reviewed ( impossible to locate, not be able to come yet), 16 didn't want to participate in the study and 1 missing.

**Results:** At this moment, with 88 patients reviewed and diagnosed, our study confirms a high incidence of obstructive sleep apnea-hypopnea syndrome (58.96%) from moderate to severe in Down population, in accordance with previous studies. Also a high incidence of gastroesophageal reflux (55.44%), bruxism (13.2%), primary snoring (14.96%), restless legs syndrome (2.64%), and narcolepsy (2.64%).

**Conclusion:** Incidence of sleep disorders is high between Down syndrome. There is also comorbidity of at least two sleep disorders in near 100% of the cases studied. It should be very important an early diagnosis and effective treatment of those sleep disorders to prevent a greater cognitive dysfunction. As we think the incidence of narcolepsy could be higher in Down syndrome than in normal population. Larger samples side are needed to confirm this preliminary results.

**Acknowledgement:** The authors would like to thanks the FSDM for his support and collaboration.

<http://dx.doi.org/10.1016/j.sleep.2013.11.303>

### **Utility of pulse transit time in the detection of high blood pressure in patients admitted in a sleep unit**

T. Gómez García, M. Acevedo, G. Camacho, M. Gonzalez, J. Sanabria, N. Mangado

*Fundación Jimenez Diaz, Spain*

**Introduction:** Pulse transit time (PTT) is the time that the pulse wave takes to travel between two different arterial points, and may be useful in estimating blood pressure. Being a free of charge noninvasive technique, it offers the advantage of avoiding "arousals"

during sleep by measuring with ambulatory blood pressure monitoring (ABPM). We aim to confirm the usefulness of PTT for the detection of hypertension, and to study the correlation between both measurements.

**Materials and methods:** Prospective observational study in a multidisciplinary sleep unit. We recruited 24 consecutive patients attending sleep clinic and ran a baseline PSG followed by an ABPM the following day. We calculated the average systolic and diastolic blood pressure (SBP, DBP) in the PTT and compared it with ABMP results.

**Results:** Mean age of 59 years. 67% male, 79% suffered from sleep apnea (OSAS). Considering the ABPM as the reference technique, we found that the diagnostic sensitivity of PTT is 82% with a specificity of 92% in the case of SBP, with a positive predictive value of 90% and negative predictive value of 86%. By studying the relationship between the mean SBP measured by the ABPM and PTT, we found a linear correlation coefficient (R2) of 0.87, showing a distribution of all subjects between  $\pm 15$  mmHg difference between tests. There is also a positive correlation between the mean DBP measured for the two tests.

**Conclusion:** Pulse transit time show a strong correlation with blood pressure measured by ABPM. Without assuming an additional cost, the PTT achieves continuous, non-invasive and cuff-less blood pressure monitoring and could be an alternative screening hypertension.

**Acknowledgements:** Thankful to all members of the multidisciplinary sleep unit and nephrology department, whose encouragement, guidance and support from the initial to the final level enabled us to develop an understanding of the subject.

<http://dx.doi.org/10.1016/j.sleep.2013.11.304>

### **Restless legs syndrome and its association with poor sleep quality, mood disorders, and one year cardiovascular mortality in patients on chronic dialysis**

A. Gholamrezaei<sup>1</sup>, M. Masoumi<sup>2</sup>, M. Mortazavi<sup>2</sup>, B. Amra<sup>3</sup>

<sup>1</sup> *Isfahan University of Medical Sciences, Medical Students' Research Center, Iran*

<sup>2</sup> *Isfahan University of Medical Sciences, Isfahan Kidney Diseases Research Center, Iran*

<sup>3</sup> *Isfahan University of Medical Sciences, Department of Internal Medicine, Iran*

**Introduction:** Restless legs syndrome (RLS) is common among uremic patients. We assessed RLS and its association with sleep quality, psychological well-being, and one year cardiovascular mortality in patients on chronic hemodialysis (HD) and peritoneal dialysis (PD).

**Materials and methods:** Patients on chronic HD and PD were consecutively included from two medical centers in Isfahan city (Iran). Diagnosis of RLS was based on the International Restless Legs Syndrome Study Group criteria, confirmed by the validated Cambridge-Hopkins questionnaire. Patients also completed the Pittsburgh Sleep Quality Index (PSQI) and the Hospital Anxiety and Depression Scale (HADS). Laboratory tests were done for iron state, kidney function, and electrolytes. Patients were followed for one year, cardiovascular mortality and new events were recorded. Univariate and multivariate analyses were performed to analyze the data.

**Results:** Ninety patients were evaluated (53 males, age =  $54.2 \pm 15.2$  years, disease duration =  $5.3 \pm 4.5$  years). RLS was diagnosed in 26.6% of the patients (35.1% in females vs. 20.7% in males,  $P = 0.019$ ). Poor sleep quality was frequent in 86.6% of the cases in each group of the HD and PD patients. RLS severity was associated

with poor sleep quality ( $r = 0.503$ ,  $P = 0.009$ ) and depression ( $r = 0.380$ ,  $P = 0.05$ ). Both anxiety and depression were also associated with poor sleep quality ( $r = 0.463$  and  $0.478$ , respectively,  $P < 0.001$ ). In multivariate analysis, having RLS ( $\beta = 1.334$ ,  $P = 0.007$ ), anxiety ( $\beta = 0.291$ ,  $P = 0.005$ ), and depression ( $\beta = 0.246$ ,  $P = 0.020$ ), were independently associated with poor sleep quality. No specific association between laboratory tests' results and overall sleep quality was observed. One year new cardiovascular events (26.0% vs. 12.3%,  $P = 0.113$ ) and subsequent mortality (13.0% vs. 7.6%,  $P = 0.347$ ) were more frequent, though not statistically significant, in those with RLS than those without RLS.

**Conclusion:** Among patients on chronic dialysis, RLS and poor sleep quality are highly frequent. Mood disorders and RLS are important independent predictors of poor sleep quality. On the other hand, RLS may be associated with increased risk of cardiovascular risk and mortality in dialysis patients. Further studies with larger sample size and longer follow-ups are required for better understanding of risk factors and also cardiovascular risk of RLS and poor sleep quality in these patients.

**Acknowledgements:** Authors are thankful to Prof. Richard Allen from the Johns Hopkins University and Dr. Mohammad Saadatnia from the Isfahan University of Medical Sciences for helping us in designing the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.305>

### Sleep quality in women with systemic lupus erythematosus

A. Gholamrezaei, N. Hosseini, Z. Sayed Bonakdar  
Isfahan University of Medical Sciences, Iran

**Introduction:** There is a lack of data on sleep quality in women with systemic lupus erythematosus (SLE). We evaluated sleep quality and its possible determinants in Iranian women with SLE.

**Materials and methods:** Seventy-two women with SLE were investigated. Disease activity was assessed using the Systemic Lupus Erythematosus Disease Activity Index and disease damage was assessed with the SLICC/ACR Damage Index. Participants completed standardized questionnaires assessing sleep quality (Pittsburgh Sleep Quality Index (PSQI)), anxiety and depression (Hospital Anxiety and Depression Scale), and quality of life (LupusQoL).

**Results:** Poor sleep quality (PSQI  $\geq 5$ ) was present in 57.7% of the patients and sleep latency was the most frequent sleep problem (50% with moderate to severe score). Compared with those with good sleep quality, patients with poor sleep quality were older ( $p < 0.001$ ), and had less physical activity ( $p = 0.01$ ), higher BMI ( $p = 0.003$ ), more frequent concurrent disease ( $p = 0.04$ ), higher anti-dsDNA antibody level ( $p = 0.01$ ), higher anxiety ( $p = 0.001$ ) and depression (0.009) scores. They had also lower quality of life in all domains of the LupusQoL ( $p < 0.01$ ). Disease activity or damage indices were not significantly associated with sleep quality. In linear regression analysis, depression was significantly associated with PSQI score ( $B = 0.1272$ ,  $p = 0.04$ ).

**Conclusion:** A significant proportion of women with SLE suffer from poor sleep quality which is associated with poor quality of life. Depressed mood is an important contributor to decreased overall sleep quality.

**Acknowledgement:** This study was supported by the Isfahan University of Medical Sciences.

<http://dx.doi.org/10.1016/j.sleep.2013.11.306>

### P-wave duration and dispersion in Holter electrocardiography of patients with obstructive sleep apnea

M. Hashemi Jazi, B. Amra, M. Yazdchi, M. Jahangiri, F. Tabesh,  
A. Gholamrezaei  
Isfahan University of Medical Sciences, Iran

**Introduction:** There is an association between obstructive sleep apnea (OSA) and atrial fibrillation (AF) with remained unclear underlying mechanisms. We investigated P-wave parameters as indicators of atrial conduction status among OSA patients.

**Materials and methods:** This cross-sectional study was conducted on 42 untreated OSA patients diagnosed using polysomnography and categorized to mild (6), moderate (18), and severe (18) OSA based on the apnea/hypopnea index (AHI). The control group consisted of 18 healthy subjects without any sleep or cardiac complaints. We applied 24-h Holter electrocardiography for measurement of P-wave parameters including duration and dispersion.

**Results:** No significant difference was observed among the groups in P-wave duration ( $P = 0.281$ ), P-wave dispersion and P max were significantly longer in those with moderate ( $P = 0.002$  and  $0.014$ , respectively) and those with severe OSA ( $P = 0.001$  and  $0.003$ , respectively) than controls. No correlation was found between age, gender, and BMI with P-wave parameters. AHI was significantly correlated with the P max ( $r = 0.407$ ,  $P = 0.012$ ) and P-wave dispersion ( $r = 0.431$ ,  $P = 0.008$ ). With linear regression analysis controlling for age, gender, and BMI, the AHI was independently associated with P-wave dispersion ( $\hat{\alpha} = 0.482$ ,  $P = 0.002$ ).

**Conclusion:** The severity of OSA is associated with prolonged P max and P-wave dispersion, indicating that patients with severe OSA have more severe disturbance in atrial conduction. This is the first study which has used Holter monitoring for measurement of P-wave parameters and repeating this study in a larger sample of patients is warranted.

**Acknowledgements:** This study is supported by the Isfahan University of Medical Sciences. We are thankful to Reihaneh Sadat Daneshmand who participated in designing the Holter monitoring software, and also we are thankful to Foroogh Hesabi, head of department of Holter monitoring of Noor Hospital (Isfahan).

<http://dx.doi.org/10.1016/j.sleep.2013.11.307>

### Technological insomnia and actigraphy

P. Giner-Bayarri, N. Torres-Caño, T. Oviedo-Montés,  
K. Quintero-Hernandez, A. Mazzillo-Ricaurte  
Hospital Universitario Dr. Peset, Department of Clinical  
Neurophysiology, Spain

**Introduction:** Technological insomnia is a new emerging disease that is based on the difficulty of initiating and maintaining sleep due to excessive and inappropriate use of the new technologies. The increase in the use of these new technologies such as smartphones, tablets, computers, video games and television with multiple schedules have caused a difficulty in initiating and maintaining sleep in the population, which affects not only adults but especially children and adolescents. This implies a social problem with a decreased academic or work achievement, which sometimes leads to the use of medications that are not indicated in these kind of patients.

**Materials and methods:** The actigraphy is a simple technique which consists of a wristwatch that contains an accelerometer, a memory and a light detector which is usually placed on the hand of the patient to assess sleep patterns. This technique allows us to make

long-term recordings in the patient's usual environment, as well as getting to know an approximate pattern of their sleep habits.

**Results:** Patients with insomnia are often polymedicated patients who do not respond adequately to treatment. Therefore, it is important to make the correct diagnosis and differentiate it from other diseases. Moreover, sometimes they deny their abuse of these new technologies. In the patients studied in our department actigraphy is shown as a technique that has allowed the diagnosis of patients with technological insomnia.

**Conclusion:** Actigraphy is a simple and noninvasive technique that allows us to make an objective diagnosis in patients with technological insomnia.

**Acknowledgements:** Our acknowledgements to Dr. Juan Moliner for his support with the new technologies for the study of sleep disorders.

<http://dx.doi.org/10.1016/j.sleep.2013.11.308>

### Is cortisol associated with poor sleep in autism? A laboratory study in high functioning adults

M. Chicoine<sup>1</sup>, É. Limoges<sup>1</sup>, É. Chevrier<sup>1</sup>, S. Lupien<sup>2</sup>, L. Mottron<sup>3</sup>, R. Godbout<sup>4</sup>

<sup>1</sup> Sleep Laboratory & Clinic, Hôpital Rivière-des-Prairies, Canada

<sup>2</sup> Centre d'études sur le stress humain, Institut en santé mentale de Montréal, Dept Psychiatry, Université de Montréal, Canada

<sup>3</sup> Autism Excellence Center, Hôpital Rivière-des-Prairies, Dept Psychiatry, Université de Montréal, Canada

<sup>4</sup> Sleep Laboratory & Clinic, Hôpital Rivière-des-Prairies, Dept Psychiatry, Université de Montréal, Canada

**Introduction:** Higher cortisol output is known to correlate with poor sleep. Sleep in autism is characterized by disorders such as increased awakenings and less slow wave sleep (SWS) compared to typically developed individuals. This study explores the relationship between saliva cortisol levels and sleep in young adults with and without autism. It was predicted that higher salivary cortisol output would be associated with increased signs of poor sleep.

**Materials and methods:** Thirteen individuals with high functioning autism (HFA: 12 M, 1F, 22.2 ± 3.7 years) and 12 typically developed individuals (TYP: 11 M, 1F, 21.8 ± 4.2 years) were recorded for two consecutive nights. Saliva cortisol was measured five times in the evening and twice in the morning. The association between cortisol levels and signs of poor sleep was tested in both groups of participants using Pearson correlation coefficients.

**Results:** The TYP group and the HFA group showed a comparable salivary cortisol rhythm, with steady low levels in the evening and high levels in the morning. Only the evening cortisol levels showed the expected correlation with signs of poor sleep. The TYP group showed a significant positive correlation between evening cortisol levels and the number and duration of nocturnal awakenings as well as a significant negative correlation with sleep efficiency. The TYP group also showed a negative correlation between evening cortisol and EEG delta activity in SWS over occipital region. In the HFA group, evening cortisol was correlated negatively with the duration of stage 4 SWS and with EEG delta activity over prefrontal and central regions but not with the number and duration of nocturnal awakenings. Sleep spindles and K-complexes, two EEG markers of cortical sleep protective mechanisms, showed no relationships with cortisol in the control group; K-complexes in the ASD group were associated with morning cortisol.

**Conclusion:** Young adults with autism showed a significant association between high salivary cortisol output and signs of poor sleep

but the relationship pattern is different from that of their typically developed counterpart: less SWS and low levels of slow EEG activity rather than awakening per se were associated with cortisol output. This atypical relationship pattern between sleep markers and cortisol levels possibly reflects an alternative coupling between neuronal and endocrine mechanisms of sleep control in autism.

**Acknowledgements:** Canadian Institute for Health Research; "Fonds de recherche du Québec".

<http://dx.doi.org/10.1016/j.sleep.2013.11.309>

### Sleep in children with high functioning autism: polysomnography, questionnaires and diaries in a non-complaining sample

A. Lambert<sup>1</sup>, S. Tessier<sup>1</sup>, É. Chevrier<sup>1</sup>, P. Scherzer<sup>2</sup>, L. Mottron<sup>3</sup>, R. Godbout<sup>4</sup>

<sup>1</sup> Sleep Laboratory & Clinic, Hôpital Rivière-des-Prairies, Canada

<sup>2</sup> Department of Psychology, Université du Québec à Montréal, Canada

<sup>3</sup> Autism Excellence Center, Hôpital Rivière-des-Prairies, Department of Psychiatry, Université de Montréal, Canada

<sup>4</sup> Sleep Laboratory & Clinic, Hôpital Rivière-des-Prairies, Department of Psychiatry, Université de Montréal, Canada

**Introduction:** Sleep disorders in children with autism are frequently reported on questionnaires filled by parents. The aim of this study was to characterize sleep using objective and subjective measures in the same sample of autistic children without comorbidities and no primary complaints of sleep disorders.

**Materials and methods:** Eleven autistic children (10.3 ± 2.2 years) diagnosed with ADI-R and ADOS criteria and 13 typically-developing children (10.2 ± 2.0 years) were recruited. Exclusion criteria comprised the use of psychotropic medication, a full IQ lower than 75, a history of epilepsy and spontaneous complaints of sleep disorders from the parents. After their children were recruited, parents filled a sleep diary for 2 weeks and the Child Sleep Habit Questionnaire (CSHQ); children were then recorded for 2 consecutive nights in a sleep laboratory. Sleep stages of night 2 were scored according to Rechtschaffen and Kales (1968) using 20 s. epochs. Stage 2 sleep spindles and K-complexes were visually scored on bilateral prefrontal and central electrodes; REM sleep rapid eye movements were also scored. Variables were log transformed when abnormally distributed. Groups were compared using *t*-tests for independent samples.

**Results:** Sleep diaries showed a longer sleep latency in autistic children (43.6 ± 39.0 mn vs. 17.2 ± 17.5 mn, *p* = .037). The CSHQ showed no significant group differences. Polysomnographically recorded sleep latency was longer in autistic children (33.0 ± 8.3 min vs. 14.4 ± 4.6 min, *p* = .023), the duration of stages 3 and 4 (slow-wave sleep: SWS) was shorter (18.2 ± 3.2% vs 23.6 ± 5.7%; *p* = .009) but total sleep time was similar (539.7 ± 54.3 vs. 560.8 ± 60.2; *p* = .94). Sleep spindle density (per hour of Stage 2) was similar in both groups at central electrodes and Fp1 but it was lower at Fp2 (119.2 ± 97.7 vs. 225.5 ± 122.2, *p* = .03). The density of K-complexes was lower at the four electrodes (.0001 < *p* < .01). REM sleep parameters (latency, duration, distribution, eye movement density) were not different between groups.

**Conclusion:** These results show that autistic children without subjectively reported sleep difficulties according to the CSHQ show signs of poor sleep on sleep diaries and polysomnography. Sleep diaries disclosed longer sleep latencies. Most polysomnographic differences were in nonREM sleep, raising the hypothesis of a difficulty for autistics to synchronize their cortical activity, possibly leading to

impaired cortical sleep protective mechanisms such as sleep spindles and K-complexes.

*Acknowledgements:* Canadian Institute for Health Research; "Fonds de recherche du Québec – Santé".

<http://dx.doi.org/10.1016/j.sleep.2013.11.310>

### Wake EEG coherence before and after sleep in adults with autism: decreased morning frontal connectivity

C. Léveillé<sup>1</sup>, C. Bolduc<sup>1</sup>, É. Limoges<sup>1</sup>, É. Chevrier<sup>1</sup>, L. Mottron<sup>2</sup>, R. Godbout<sup>3</sup>

<sup>1</sup> Sleep Laboratory & Clinic, Hôpital Rivière-des-Prairies, Canada

<sup>2</sup> Autism Excellence Center, Hôpital Rivière-des-Prairies, Department of Psychiatry, Université de Montréal, Canada

<sup>3</sup> Sleep Laboratory & Clinic, Hôpital Rivière-des-Prairies, Department of Psychiatry, Université de Montréal, Canada

*Introduction:* Autism is a neurodevelopmental disorder characterized by atypical connectivity between brain regions. People with autism are known to have sleep disorders and the purpose of this study was to analyze brain connectivity before and after a night of sleep using EEG coherence analysis.

*Materials and methods:* Nine adults with autism ( $21.1 \pm 4.0$  years) and 20 control participants ( $20.8 \pm 4.2$  years) were recorded for two consecutive nights in a sleep laboratory, using a 22-electrode montage. Every participant had a normal IQ and none were taking medication. Wake EEG was recorded for 5 min at bedtime and just before final rise time in the morning, while lying in bed with eyes closed. EEG coherence values were compared with a multivariate repeated measures design using Group  $\times$  Moment  $\times$  Frequency band factors for each electrode separately, followed by post hoc tests.

*Results:* In the evening, the autistic group displayed more Alpha coherence than controls within the left visual area (P3-O1:  $p = 0.049$ ; T5-O1:  $p = 0.03$  and T5-P3:  $p = 0.014$ ). In the morning more Alpha coherence in the autistic group within the left visual area was also measured (T5-O1:  $p = 0.009$  and T5-P3:  $p = 0.015$ ) as well as more Delta coherence at the T5-O1 electrode pair ( $p = .027$ ). Moreover, morning recordings showed less Delta coherence within the right frontal area, (Fp2-F8:  $p = 0.037$ ; F4-F8:  $p = 0.011$ ) and between left and right hemispheres (F3-F4:  $p = 0.019$ ; F7-F8:  $p = 0.003$ ).

*Conclusion:* A previous study performed during REM sleep (Léveillé et al., 2010) found a greater intrahemispheric EEG coherence in autistic participants compared to controls between the left visual cortex and regions either close to or distant from it. The present results are in the same direction, upon both evening and morning wake recordings, suggesting that sleep per se is not responsible for these signs of overconnectivity. The present results also revealed a morning specific lower EEG coherence values for slow frequencies in the right frontal area in participants with autism compared to controls, suggesting that sleep per se could be responsible for these signs of underconnectivity.

*Acknowledgements:* Canadian Institute for Health Research; "Fonds de recherche du Québec – Santé".

<http://dx.doi.org/10.1016/j.sleep.2013.11.311>

### Stage 2 sleep and intelligence measures in autistic children

S. Tessier<sup>1,2</sup>, A. Lambert<sup>1,2</sup>, É. Chevrier<sup>1,2</sup>, P. Scherzer<sup>3</sup>, L. Mottron<sup>4</sup>, R. Godbout<sup>1,2</sup>

<sup>1</sup> Sleep Laboratory & Clinic, Hôpital Rivière-des-Prairies, Montréal, Canada

<sup>2</sup> Centre de recherche de l'Institut universitaire en santé mentale de Montréal, Hôpital Rivière-des-Prairies, Montréal, Canada

<sup>3</sup> Department of Psychology, Université du Québec à Montréal, Canada

<sup>4</sup> Autism Excellence Center (CETEDUM), Centre de recherche de l'Institut universitaire en santé mentale de Montréal, Hôpital Rivière-des-Prairies, Montréal, Canada

*Introduction:* Studies showed that sleep spindle activity correlate with IQ scores in typically developing individuals. Sleep spindles are diminished in children and adults with autism compared to typically developing individuals. We investigated the relationship between IQ scores and sleep spindles activity in children with autism.

*Materials and methods:* Thirteen boys with high functioning autism (HFA:  $10.2 \pm 2.1$  years old) and 13 comparison children (COM:  $10.2 \pm 2.0$  years old) were recorded for two consecutive nights. They completed the WISC-III in the morning after night 2. The absolute number of sleep spindles and spindle index (number/hour) sigma EEG power (slow: 12–13 Hz, fast 13.25–15.75 Hz) were recorded and computed from frontal (Fp1, Fp2) and central (C3, C4) electrodes during S2 sleep. Results from the two groups were compared using Student t-tests and Mann–Whitney U- tests. Correlations between EEG measure and IQ were tested using Pearson's rho ( $\alpha = .05$ ).

*Results:* There were no group differences on IQ (HFA: Global =  $105.2 \pm 18.7$ , Performance =  $106.2 \pm 13.0$ , Verbal =  $103.8 \pm 22.3$ ; COM:  $115.8 \pm 10.3$ ,  $114.1 \pm 12.1$ , and  $115.1 \pm 12.8$ , respectively). Spindle number and index were lower in the HFA than the COM group at Fp2 electrode ( $669.7 \pm 467.3$  and  $126.8 \pm 87.1$  vs.  $1018.8 \pm 466.4$  and  $216.2 \pm 121.2$ ). The HFA group showed a negative correlation between C3 spindles index in the first quarter part of the night and the WISC global ( $r = -0.52$ ) and verbal (C3 1/4  $r = -0.62$ ) scales. Sigma power was lower in the HFA than the COM group for C3 and C4 electrodes in the last quarter of the night (HFA: C3 =  $0.925 \pm 0.096$ , C4 =  $0.650 \pm 0.226$ ; COM: C3 =  $1.06 \pm 0.18$ , C4 =  $0.888 \pm 0.301$ ). The COM group showed a positive correlation between C4 fast Sigma activity in the last quarter of the night and global IQ ( $r = 0.592$ ). There were no significant correlation between IQ and Sigma activity in the HFA group.

*Conclusion:* These findings indicate that the relationship between sleep EEG and IQ is different in autistic and typically developing children, both with normal IQ scores. These differences are in terms of scalp location (frontal vs. more posterior), EEG markers (spindles vs. Sigma activity) and time of night (early and late night).

*Acknowledgements:* Supported by the Canadian Institutes of Health Research and the "Fonds de la recherche du Québec – Santé".

<http://dx.doi.org/10.1016/j.sleep.2013.11.312>

### Development of tolerance to ethanol in the sleep-wakefulness cycle

M. Gogichadze, M. Nemsadze, N. Oniani, N. Lortkipanidze, E. Khachturovy, T. Aladashvili

Iliia State University, United States

*Introduction:* The development of tolerance to drugs is a primary stage from neuroadaptation to neurodegeneration. This applies to alcohol, which due to its complex impact on the nervous system

and easily accessible, is the widespread psychotropic substance. Tolerance to alcohol can take place in many behavioral tests. However, the structure of the sleep-wakefulness cycle (SWC) is not taken into account, despite the fact that the structure of the SWC is sensitive to a variety of actions (pharmacological and non-pharmacological) and, can be considered as valid model to study them, including ethanol administration. Therefore the question whether tolerance to ethanol might be reflected in changes of the structure of SWC is relevant in the sense that these alterations might be primary risk- indicators at alcohol consumption. Reasoning from the above mentioned, the purpose of the present work was to study the effects of tolerance to ethanol on the SWC structure.

**Materials and methods:** Experiments were carried out on the adult cats ( $n = 5$ ). The following methods were used: the stereotaxic; polysomnographic. Alcoholization (0.2–2.5 g/kg 25% ethanol solution) was conducted by i/p injections, that lasted for two weeks. The obtained results were processed statistically and significance of the changes was determined by the Student *t*-test.

**Results:** Low single doses of ethanol (0.2–0.5 g/kg) did not induce any significant changes in the structure of the SWC. While using doses of 0.6 g/kg it was noted only increasing of the latent period of the onset of sleep. However, the structure of the SWC recovered within 1–2 h after injection. Increasing the dose to 1 g/kg caused severe intoxication, which reflected in a behavioral (anxiety, tremor, vocalizations) and autonomic (vomiting and frequent urination) disorders. Against the background of restless behavioral wakefulness recurrent synchronization, that is the EEG correlate of light slow-wave sleep, developed. The total volume of deep slow-wave sleep was significantly decreased and the latent period of the onset of paradoxical sleep was increased. The structure of sleep was fragmented, coursed by frequent awakenings. For the fifth-eighth day of alcoholization the structure of the SWC restored, behavioral and vegetative signs of intoxication moved out.

**Conclusion:** The obtained results signify that development of tolerance to ethanol can be reflected in the alteration of the structure of SWC.

<http://dx.doi.org/10.1016/j.sleep.2013.11.313>

### Diurnal type in children: preliminary results about the European Portuguese version of the CCTQ

D. Douro<sup>1</sup>, A. Allen Gomes<sup>2</sup>, M. Pinto De Azevedo<sup>3</sup>, V. Clemente<sup>4</sup>, S. Carvalho Bos<sup>5</sup>, C. Silva<sup>1</sup>

<sup>1</sup> Universidade de Aveiro, Departamento de Educação., University of Aveiro, Department of Education, Portugal

<sup>2</sup> Universidade de Aveiro, Departamento de Educação., University of Aveiro, Department of Education, FCT R&D Unit IBILI-FMUC, Portugal

<sup>3</sup> Faculdade de Medicina, Universidade de Coimbra., Faculty of Medicine, University of Coimbra, Portugal

<sup>4</sup> Centro de Medicina do Sono. CHUC., Centre of Sleep Medicine, Coimbra University Hospital Centre, Portugal

<sup>5</sup> Faculdade de Medicina, Universidade de Coimbra., Institute of Medical Psychology, Faculty of Medicine, University of Coimbra, Portugal

**Introduction:** Few tools exist to measure morningness–eveningness in young children. Recently, Werner, LeBourgeois, Geiger and Genni published the Children Chronotype Questionnaire (CCTQ), a parental 27 item questionnaire designed to extract three chronotype measures, in 4–11 years old children. The aim of the present study was to develop an European Portuguese version [PT] of the CCTQ and to examine its psychometric properties.

**Materials and methods:** A permission request to develop a Portuguese version was sent to the CCTQ authors. A first translation draft

was generated; next it was examined by experts; the resulting version was after that tested using “thinking aloud” procedures, and then an experimental CCTQ [PT] version was defined. This version was completed by a sample of parents/tutors of 397 children (47.1% boys), 4–11 yrs-old. Based on their answers, three chronotype measures were computed: the morningness/eveningness scale score (M/E); the midsleep point on free days (MSF); the five point chronotype score (CT).

**Results:** As to internal consistency, Chronbach alpha for the M/E scale was 0.71. Corrected item-total correlations ranged from .28 to .55, with an average of .39. With regard to the chronotype measures, scores on the M/E scale showed a gaussian distribution with a mean of 28.2 (SD = 6.0, Min = 15 and Max = 44); for MSF a mean of 3:47 (SD = 44 min) was obtained; and at the CT measure a median of 2 was found. Correlation coefficients between the chronotype measures revealed moderate to strong associations (from  $r_s = .34$  to  $r = .54$ ).

**Conclusion:** These preliminary results found in our sample for the Portuguese CCTQ were similar to the ones obtained on the original CCTQ, for the M/E scale. However, our children showed later schedules, as expressed by MSF. This first Portuguese study, together with the authors’ comments on the back translation, highlighted the strengths of our experimental version, but also some aspects to refine, which led us to define the final Portuguese version of the CCTQ. A study in a larger national sample is now needed.

**Acknowledgements:** We are grateful to Dr. Werner, Professor Jenni, and remaining CCTQ authors for their permission to develop the Portuguese version. Thanks are also due to the Dep. of Education (Univ. Aveiro) for the support regarding the printed materials used in data collection. The present work is currently supported by Research Project PTDC/PSI-EDD/120003/2010 funded by FCT/COMPETE/QREN.

<http://dx.doi.org/10.1016/j.sleep.2013.11.314>

### Brief Insomnia and Quality of Sleep Scale (BIQSS): reliability and validity in higher education students

A. Gomes<sup>1</sup>, D. Marques<sup>1</sup>, J. Tavares<sup>2</sup>, M. Azevedo<sup>3</sup>

<sup>1</sup> University of Aveiro, Dep. of Education, University of Aveiro, Dep. of Education, IBILI (FM-UC) R&D FCT Unit, Portugal

<sup>2</sup> University of Aveiro, Dep. of Education, University of Aveiro, Dep. of Education, Portugal

<sup>3</sup> Fac. Medicine, Univ. Coimbra, Fac. Medicine, Univ. Coimbra, Portugal

**Introduction:** The present work aims to characterize in higher education students the reliability and validity of a brief self-reported measure to assess insomnia complaints and perceived sleep quality (Gomes et al., 2001, 2005, 2011), used from more than a decade by our research team members, and henceforth labeled the Brief Insomnia and Quality of Sleep Scale (BIQSS).

**Materials and methods:** In study 1, the 7-items scale now termed BIQSS was developed, as part of a larger self-response questionnaire on higher education sleep-wake patterns, and its internal consistency and item homogeneity were analyzed based on the answers of 1654 undergraduates. In study 2, focused mainly on validity, 323 undergraduate and master degree students completed the BIQSS together with the PSQI (Buysse et al., 1989). Using an additional question on perceived sleep problems, item discriminative power and ROC analyses were also performed. Higher BIQSS scores equate to poorer sleep, and each item is rated in a 5 point scale from 0 to 4 (or in reversed way when appropriate), thus total score may range from 0 to 28.

**Results:** Internal consistency was assessed by Chronbach alpha, which was .73 in study 1 and .78 in study 2. Corrected item-total correlations ranged from .32 to .57 (study 1), and from .40 to .60 (study

2). All items contributed to the internal consistency of the scale, as shown by drops in Chronbach alpha values when excluding each item. As to validity (study 2), the correlation coefficient between the BIQSS and the PSQI score was  $r = 0.65$  ( $p < 0.001$ ). Students that reported a sleep problem ( $n = 40$ ) obtained significantly higher BIQSS scores in comparison to those who deny having any sleep problem, and all items were able to discriminate between them. In ROC analysis, the Area Under the Curve (AUC) was .832, indicating moderate precision/acuity.

**Conclusion:** The BIQSS is composed by a small number of items, is very easy to administer in higher education students, and seems to possess reasonable reliability, validity, and acuity. Therefore, it may constitute a convenient tool to screen for insomnia and poor sleep complaints, both for research purposes and in clinical settings. Further studies are now needed in other samples.

**Acknowledgements:** Successive research studies leading to the present work have been supported by different entities: Dep. of Education – Univ. Aveiro; Projects LEIES (FCG), SPASHE (FCT); Research Unit CCPSF and CIECC (FCT).

<http://dx.doi.org/10.1016/j.sleep.2013.11.315>

### Reliability and initial validation of the Pittsburgh Sleep Quality Index, European Portuguese version: a preliminary study in a sample of higher education students

D. Marques<sup>1</sup>, A. Allen Gomes<sup>2</sup>, A. Meiaivia<sup>3</sup>, A. Salgueiro<sup>1</sup>, C. Carlos Ribeiro<sup>1</sup>, J. Dischler<sup>1</sup>

<sup>1</sup> Universidade de Aveiro., Departamento de Educação., University of Aveiro, Department of Education, Portugal

<sup>2</sup> Universidade de Aveiro., Departamento de Educação., University of Aveiro, Department of Education, FCT R&D Unit IBILI-FMUC, Portugal

<sup>3</sup> University of Aveiro, Department of Education, Portugal

**Introduction:** The Pittsburgh Sleep Quality Index (PSQI) is probably the most used self-response scale to measure sleep quality worldwide. However, surprisingly, in our country we are still lacking data on the metric characteristics of the European Portuguese version of this tool, which limits its use both in research and especially in clinical practice. The aim of the present study was thus to examine the psychometric properties of the official European Portuguese (PT) version of the PSQI.

**Materials and methods:** After having Dr. Buysse (U. Pittsburgh) permission to use the European Portuguese version of the PSQI, we recruited a sample of 355 undergraduates and master degree students of both sexes, who completed a set of demographic questions, selected items from a previously validated undergraduate sleep-wake questionnaire containing a Sleep Quality Index (SQI), and the PSQI [PT].

**Results:** The reliability coefficients concerning internal consistency were satisfactory: Cronbach's alpha = .65 for the PSQI [PT] components, and .74 considering the PSQI [PT] items. Comparing groups who did versus who did not consider having any sleep problems, the formers obtained significantly higher scores in all items of the PSQI [PT], meaning poorer sleep quality, which supports the discriminative power of each item. The computation of the cut-off point using ROC curve for this sample was 6, which is similar to the one found in the original study (i.e., 5). The PSQI [PT] scores were significantly correlated with the SQI (Spearman  $r_s = .59$ ;  $p < 0.001$ ), which indicates convergent validity.

**Conclusion:** The official European Portuguese version of the PSQI, despite its limitations, seems to be an instrument with adequate reliability and validity for assessing self-reported sleep quality, at least

in Portuguese higher education students. However, it is necessary to replicate these analyses using larger and clinical samples.

**Acknowledgements:** We are grateful to Dr. Buysse (U. Pittsburgh) for the permission to use the European Portuguese version of the PSQI. Thanks are also due to the Department of Education of the University of Aveiro, which supported the printed materials for data collection.

<http://dx.doi.org/10.1016/j.sleep.2013.11.316>

### Quality of sleep and quality of life in higher education students

A. Meiaivia<sup>1</sup>, D. Marques<sup>2</sup>, A. Allen Gomes<sup>3</sup>

<sup>1</sup> Universidade de Aveiro., Departamento de Educação. Mestrado em Psicologia., University of Aveiro, Department of Education, Portugal

<sup>2</sup> Universidade de Aveiro., Departamento de Educação., University of Aveiro, Department of Education, FCT R&D Unit IBILI-FMUC, Portugal

<sup>3</sup> Universidade de Aveiro., Departamento de Educação., University of Aveiro, Department of Education, FCT R&D Unit IBILI-FMUC, Portugal

**Introduction:** Numerous studies exist about the associations between sleep and quality of life (QoL), in samples with diagnosis of sleep disorders (e.g., insomnia, sleep apnea) or other medical conditions (e.g., cancer). However, very few studies have examined community samples. The purpose of the present work was to analyze the associations between subjective sleep quality and several dimensions of QoL in higher education students. A secondary specific aim was to examine whether or not sleep quality would be a significant predictor of QoL after statistically controlling for psychopathological symptoms.

**Materials and methods:** A sample of 324 undergraduate and master degree students completed the Portuguese versions of the Pittsburgh Sleep Quality Index (PSQI), WHOQOL-Bref to measure QoL, and Brief Symptom Inventory (BSI) to measure psychopathological symptoms.

**Results:** All PSQI components were significantly associated (at least  $p < .05$ ) with the QoL General Facet, and with the Psychological and Physical QoL domains. As to the Environment QoL domain and the PSQI components, four statistically significant associations emerged; as to the Social Relationships QoL domain and the PSQI components, only two significant associations emerged. The strongest associations found were between the PSQI Component 1-Subjective Sleep Quality, and the Psychological QoL domain ( $r = -.546$ ,  $p < .0001$ ), followed by the Physical QoL domain ( $r = -.446$ ,  $p < .0001$ ). Two PSQI components, C1-Subjective Sleep Quality and C7-Daytime Dysfunction, were systematically associated with all WHOQOL-Bref domains and general facet. Hierarchical regression analyses showed that the PSQI components added significant contributions to the general QoL facet, and to the Psychological and Physical QoL domains, after controlling for psychopathological symptoms.

**Conclusion:** Our results suggest that in non-clinical samples composed of predominantly healthy and young adults, there are numerous significant associations between several components of sleep quality and different facets of quality of life, and that these associations emerge regardless of psychopathological symptoms.

**Acknowledgements:** To the Dep. of Education – Univ. Aveiro, for the support with the printed materials. To the Psychology Master Degree Coordinator, who authorized this study. To Ana R. Salgueiro, Carolina T. Carlos, Joana M. Ribeiro and Raphaëlle G. Dischler, for their help in data collection.

<http://dx.doi.org/10.1016/j.sleep.2013.11.317>

### Sleep differences in auto-adjustable CPAP devices and manual standard CPAP titration in a sleep laboratory

E. Gomez-Siurana<sup>1</sup>, P. Rubio<sup>2</sup>, O. Urdanibia<sup>1</sup>, M. Blasco<sup>1</sup>, M. Diaz<sup>1</sup>, O. Ciopat<sup>1</sup>

<sup>1</sup>Unidad de Sueño, Servicio de Neurofisiología Clínica, Hospital Universitari I Politècnic La Fe, Agencia valenciana de Salud, Spain

<sup>2</sup>Agencia Valenciana de Salud, Hospital Universitari I Politècnic La Fe, Spain

**Introduction:** Continuous positive airway pressure (CPAP) and auto-adjusting positive airway pressure (APAP) devices are the mainstay of treatment for moderate to severe obstructive sleep apnea (OSA). The normalizing of sleep architecture may be one of the consequences of the treatment and may be related to treatment compliance and the relief of sleepiness. Determination of the positive pressure required by a patient may be determined by standard CPAP (s-CPAP) or APAP, but there isn't a universally accepted method to determine the optimal positive pressure value. Knowledge of the night sleep architecture in unselected OSAs patients by using s-CPAP or APAP devices during the determination of the positive pressure by means of a full polysomnography (PSG) in the sleep lab attended by a sleep technician.

**Materials and methods:** 107 OSAs patients were one night full PSG controls to titrated CPAP pressure, 63 of them (41 males and 22 females) by using APAP device and 44 patients (32 males and 12 females) by using s-CPAP. All patients were previously treated almost three months before (the pressure was calculated with a prediction formula). The groups were not different in their respective ages or BMIs. The PSG did not show differences in both groups in Total sleep time, sleep efficiency, sleep stage N1 or R, but the proportion of stage N3 was higher ( $p = 0.035$ ) and stage N2 was lower ( $p = 0.022$ ) in the APAP group. Other variables, such as taking hypnotics, CPAP tolerance, improving clinical manifestation with CPAP use, Epworth sleepiness scale, sleep position and previous randomized pressure did not show significant differences between groups. This is especially interesting taking into account that the APAP group had slept more hours the previous night. The mean CPAP pressure of the APAP group was higher ( $10.553 \pm 1.78$ ) than that of the s-CPAP group ( $9.250 \pm 1.69$ )  $p = 0.000$ .

**Results:** The sleep structure was better on the APAP adjusted group than on the s-CPAP group, despite its mean CPAP pressure being higher. Only a minority of studies found in the bibliography are in agreement with this last observation. Both findings cannot be explained, but they could be a consequence of the slower increase of pressure in s-CPAP than in APAP.

**Conclusion:** Therefore, it can be concluded that the use of APAP devices could be considered a good method for the adjustment of pressure levels and for normalizing sleep structure.

<http://dx.doi.org/10.1016/j.sleep.2013.11.318>

### Sleep disordered breathing and growth hormone therapy in children with Prader Willi syndrome

C. Gomes<sup>1</sup>, C. Pereira<sup>2</sup>, R. Ferreira<sup>3</sup>

<sup>1</sup>Department of Pediatrics, Santa Maria Hospital-CHLN, Academic Medical Center of Lisbon, Portugal

<sup>2</sup>Endocrinology Unit, Department of Pediatrics, Santa Maria Hospital-CHLN, Academic Medical Center of Lisbon, Portugal

<sup>3</sup>Pneumology Unit, Department of Pediatrics, Santa Maria Hospital-CHLN, Academic Medical Center of Lisbon, Portugal

**Introduction:** Children with Prader Willi Syndrome (PWS) have several sleep abnormalities, including reduced REM sleep, altered sleep structure, oxygen desaturation and both central and obstructive apnea. PWS is now widely accepted as an indication for Growth

Hormone (GH) treatment. GH may worsen sleep disordered breathing (SDB) presumably due to an IGF-1 mediated lymphoid tissue hypertrophy. Our study aims to evaluate the role of polysomnography (PSG) and non-invasive ventilation in children with PWS undergoing GH treatment.

**Materials and methods:** Descriptive observational study by review of medical charts and PSG reports in all children with PWS undergoing GH, at a tertiary hospital. Obstructive sleep apnea (OSA) was defined as an apnea-hypopnea index (AHI)  $>1/h$ . Statistic descriptive analysis was done.

**Results:** A total of 11 children were identified, with a median age of 13 years (5;17), 6 (55%) were male and the median Body Mass Index (BMI) Z-score was 2,4 (1,1;2,8). All children underwent PSG, 9 of them before GH treatment, 1 soon after, and 1 before and after that therapy. Reduced REM sleep was found in all cases, and in 3 children was associated with reduced slow-wave sleep. Median AHI was 0,2/h (0;9,7) and median desaturation index (DSI) was 4,2 (0;50). Two children were already on non-invasive ventilation (NIV) when GH treatment was begun and performed PSG with ventilation. OSA was diagnosed in four children who initiated NIV before GH treatment, with elimination of respiratory events. The OSA group had a median BMI Z-score of 2,5 (2,3;2,8) versus 2,2 (1,1;2,4) in the non-OSA group. After treatment sleep respiratory symptoms were reported only in one child; she repeated PSG that didn't reveal significant alterations. All children are still in treatment, without respiratory sleep complaints. Adenotonsillectomy (AT) was performed in three patients before GH treatment and in one afterwards.

**Conclusion:** As others, we have shown that children with PWS have altered sleep architecture with reduced REM and slow-wave sleep. The group with OSA had higher BMI Z-score, although the small dimension of the samples prevents a significant statistic analysis. When OSA is diagnosed and AT is not indicated, NIV is a successful therapeutic option, allowing GH treatment.

**Acknowledgements:** Raquel Firme Irina Carvalheiro.

<http://dx.doi.org/10.1016/j.sleep.2013.11.319>

### The impact of benzodiazepine use in nocturnal O2 saturation of OSAS patients

M. Gonçalves<sup>1</sup>, A. Oliveira<sup>1</sup>, A. Leão<sup>1</sup>, S. Maia<sup>1</sup>, P. Brinca<sup>2</sup>

<sup>1</sup>Centro de Medicina do Sono-Hospital Cuf, Porto, Portugal

<sup>2</sup>Department of Economics, Stockholm University, Sweden

**Introduction:** Benzodiazepines, sedative hypnotic drugs, are indiscriminately used in patients with insomnia, independently of the OSA exclusion. It's well known these drugs may adversely affect the control of ventilation during sleep, leading to a worsening of various respiratory parameters, including peripheral O2 saturation. To evaluate the impact of use of benzodiazepines in AHI and O2 peripheral saturation on OSA patients.

**Materials and methods:** Methodology: We retrospectively analyzed 515 patients diagnosed in our Sleep Medicine Centre with obstructive sleep apnea syndrome (OSA) and collected polysomnography, demographic, clinical, and anthropometric data as well as Epworth Sleepiness Scale (ESS) value, and use of benzodiazepines (BZD) at diagnosis. Comparisons interesting the AHI and minSO2 and the presence of benzodiazepines were made.

**Results:** A total of 515 patients with OSA were included and had mean age of  $52.6 \pm 13.4$  years, 67% men and a mean BMI of  $28.8 \pm 4.8$  kg/m<sup>2</sup>. Of the 515 OSA patients, 39% had mild, 29% moderate and 32% severe OSA. Benzodiazepines were used by 26.6% (137) patients. Of these 137 patients, 55 had mild, 36 moderate and 46 severe OSA. In our population, AHI was associated with male

gender, greater BMI and ESS value, but not with BZD use. The minSO<sub>2</sub> was negatively correlated with AHI ( $p < 0.05$ ) and associated with the use of BZD ( $p < 0.05$ ). However, the relation between minSO<sub>2</sub> and BZD use was observed only in those with mild and moderate OSA ( $p < 0.05$ ) and not in severe OSA.

**Conclusion:** These results show that the use of benzodiazepines is associated with a lower minSO<sub>2</sub> during sleep among OSA patients, but the weight of these drugs effect is diluted with the severity index, which can be explain by the gain of impact of a higher number of apneas/hyponneas. This emphasize the importance of have caution with benzodiazepine prescription as they can increase the effects of other diseases in particular sleep disorders breathing.

**Acknowledgement:** We thank to Ricardo Reis who helps analysing the data.

<http://dx.doi.org/10.1016/j.sleep.2013.11.320>

### Heart rate variability predicts sleep efficiency

J. Gouin<sup>1</sup>, K. Wenzel<sup>1</sup>, S. Deschenes<sup>1</sup>, T. Dang-Vu<sup>2</sup>

<sup>1</sup>Concordia University, Department of Psychology, Center for Clinical Research in Health, United States

<sup>2</sup>Concordia University, Department of Exercise Science, Center for Studies in Behavioral Neurobiology, United States

**Introduction:** Heart rate variability (HRV) provides information about autonomic nervous system function, and has been shown to vary across the sleep-wake cycle. Measures of HRV have also been found disturbed in sleep disorders such as sleep apnea and insomnia. However, it remains unclear whether HRV could be used as a biomarker of sleep quality. Here we evaluated the association between HRV and sleep efficiency in a group of healthy volunteers.

**Materials and methods:** 39 (9 men) young university students with a mean age of 23.85 (SD = 6.92) completed a psychological distress questionnaire (Depression Anxiety Stress Scale, DASS), and a sleep diary for seven consecutive days. At the end of the daily diary period, participants completed a laboratory visit between 9 AM and 12 PM. During the visit, participants wore a digital interbeat interval recorder (Polar 800CX) and were instructed to relax as they remained seated during 7 min. Average sleep efficiency (time asleep/time in bed) over one week was computed for each participant from the aggregated sleep diary data. The HRV parameters rMSSD, pNN50, and Respiratory Sinus Arrhythmia (RSA) were extracted using Kubios HRV (version 2.1, University of Eastern Finland) and CardioBatch (University of Illinois at Chicago). The association between HRV parameters and sleep efficiency was tested by Pearson correlations and linear regressions on log-transformed variables.

**Results:** rMSSD,  $r = .44$   $p = .007$ , pNN50,  $r = .50$   $p = .002$ , and RSA,  $r = .45$   $p = .005$ , were positively correlated with average sleep efficiency. In hierarchical regressions, rMSSD,  $p = .01$ , pNN50,  $p = .002$ , and RSA,  $p = .005$ , predicted sleep efficiency over and above differences in age, sex, ethnicity, and current psychological distress.

**Conclusion:** Greater HRV during resting wakefulness is associated with better sleep efficiency measured with sleep diaries over one-week period in healthy young individuals. This relationship remains significant after taking into account demographic and psychological variables. Therefore our results indicate that HRV during a short resting period is an independent index of sleep efficiency, and could be used as a clinical biomarker of sleep quality. Future studies should reassess this relationship in various clinical populations.

**Acknowledgements:** Support from the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC), the Fonds de Recherche du

Québec – Santé (FRQS), the Sleep Research Society Foundation (SRSF), and the Petro-Canada Young Innovators Awards Program.

<http://dx.doi.org/10.1016/j.sleep.2013.11.321>

### Obstructive sleep apnea and obesity are associated with reduced GPR120 plasma levels in children

D. Gozal, L. Kheirandish-Gozal, A. Carreras, A. Khalyfa, E. Peris  
University of Chicago, Pediatrics, United States

**Introduction:** Obstructive sleep apnea (OSA) is a common health problem, particularly in obese children, in whom a vicious cycle of obesity and OSA interdependencies promote increased food intake. GPR120 is a long-chain free fatty acid (FFA) receptor that plays an important role in energy homeostasis, and protects from insulin resistance and systemic inflammation. Thus, we hypothesized that GPR120 levels would be reduced in children with OSA, particularly among obese children.

**Materials and methods:** 226 children (mean age:  $7.0 \pm 2.1$  years) underwent overnight polysomnographic evaluation and a fasting blood draw the morning after the sleep study. In addition to lipid profile, HOMA-IR and hsCRP assays, monocyte GPR120 expression and plasma GPR120 levels were assessed using qPCR and ELISA kits.

**Results:** Obese children and OSA children had significantly lower GPR120 monocyte expression and plasma GPR120 levels. Furthermore, when both obesity and OSA were concurrently present, GRP120 levels were lowest. Linear associations emerged between GRP120 plasma levels and BMI z score, as well as with AHI, SpO<sub>2</sub> nadir, and respiratory arousal index, the latter remaining statistically significant when controlling for age, ethnicity, gender, and BMI z score ( $p < 0.001$ ). Similarly, HOMA-IR was significantly associated with GRP120 levels, but neither LDL nor HDL cholesterol or hsCRP levels exhibited significant correlations.

**Conclusion:** GPR120 levels are reduced in pediatric OSA and obesity, particularly when both are present, and may play a role in modulating the degree of insulin resistance. The short-term and long-term significance of reduced GPR120 in food intake and glycemic deregulation remains undefined.

**Acknowledgements:** Supported by National Institutes of Health grants HL-65270, HL-086662, and HL- 107160.

<http://dx.doi.org/10.1016/j.sleep.2013.11.322>

### Exacerbated phagocytosis and sleep apnea syndrome

T. Grippe, M. Afflalo, E. Gaio, S. Couto, S. Goncalves, W. Mesquita, M. Muniz-Junqueira  
Universidade de Brasilia, Brazil

**Introduction:** The Obstructive Sleep Apnea Syndrome (OSAS) intermittent hypoxia and sleep fragmentation contributes to alter sleep architecture, damaging the cellular immune mechanism regulated by the sleep wake cycle and stimulating the production of pro inflammatory cytokines and reactive oxygen species by phagocytes. Thus, patients with OSAS have a non-functional pro-inflammatory immune response. So, it is important to evaluate the phagocytic function of polymorphonuclear cells and its correlation with increased susceptibility to acute infections.

**Materials and methods:** 34 volunteers divided in two groups: 15 with polysomnographic diagnosis of moderate to severe OSAS (Apnea Hypopnea Index  $> 15$  and Arousal Index  $> 20$ ) and 13 with the diagnosis excluded by the absence of snoring, daytime sleepness

and complaints of sleep disorder. The exclusion criteria were conditions that change immune function and OSAS differential diagnosis diseases. The phagocytosis test with subsequent blind analysis has determined the proportion of cells engaged in phagocytosis (% F), the average of yeasts phagocytosed (ML) and phagocytic index (PI).

**Results:** The phagocytosis was increased in individuals with OSAS in a sensitized medium with yeast concentration of 20 per phagocyte in macrophages (M) and neutrophils (N): % phagocytosis [N: S - 91.0 (77.6/94.9) x-C 73.6 (52.4/91),  $p = 0.03^*$ ] [M: S - 68.8 (61.3/81.4) x C - 46.9 (34.9/63.7),  $p = 0.003$ ] yeasts average [N: S - 3.4 ( 2.7/3.8) x C - 2.7 (2.4/3.2),  $p = 0.05^*$ ] [M: S - 2.624 ( $\pm 0.1016$ ) x C - 2236 ( $\pm 0.1763$ ),  $p = 0.06$ ] and phagocytic index [ N: S-313.9  $\pm 30.58$  x C-221.4  $\pm 33.11$ ,  $p = 0.053$ ] [M: S - 188.4 ( $\pm 13.73$ ) x C-114.9 ( $\pm 17.68$ ),  $p = 0.003$ ]. There was no statistical difference in these parameters in a non-sensitized or sensitized medium with 5 yeasts per phagocyte.

**Conclusion:** There was correlation of clinical parameters with predisposing factors for OSAS. Individuals with OSAS obtained higher rates of phagocytosis through more stimuli, which correlates with hyperactivation of the other immune functions already described in individuals with OSA. These findings were not found in environments with little stimulation, showing the dependence of a triggering factor, which could correspond to an acute infection *in vivo*. This mechanism elucidated confirms the presence of a polymorphonuclear hyperstimulation in OSAS, and contribute to the elucidation of the pathophysiology and possible complications of the disease.

<http://dx.doi.org/10.1016/j.sleep.2013.11.323>

### Can snoring be a cause of aggressive behaviour in children?

T. Grochowski<sup>1</sup>, W. Kukwa<sup>2</sup>, A. Ga<sup>3</sup>, Z. Gronkiewicz<sup>3</sup>, A. Kukwa<sup>4</sup>, A. Krzeski<sup>3</sup>

<sup>1</sup>Medical University of Warsaw, WASM, ESRS, Poland

<sup>2</sup>Medical University of Warsaw, ESRS, Poland

<sup>3</sup>Medical University of Warsaw, Poland

<sup>4</sup>University of Warmia and Mazuria School of Medicine, ESRS, Poland

**Introduction:** Snoring, as a first symptom of impaired breathing during sleep, seems to be an important risk factor for behavioural disturbances in children. The study was conducted to find out how sleep disordered breathing (SDB) in a population of first graders in one province of Poland influences their behaviour.

**Materials and methods:** A population single-stage cross-sectional study using a parent-reported questionnaire was applied. 1480 first graders were involved. We collected data about snoring, age, weight, height and parent-reported problems with child behaviour. The data were analysed in terms of BMI, breathing disturbances and aggressive behaviour.

**Results:** We've got completed 1107 (74.8%) of 1480 sent questionnaires. 560 girls and 547 boys were recruited. The mean age of the children was 7.31. There were 64.7% children considered non-snorers, and 35.3% snorers. 7.5% were considered habitual snorers. We also divided children into two subgroups: normal-weight and overweight. There was a linear association of aggressive behaviour with the increasing severity of snoring on a 5-point scale with highly significant differences ( $p < 0.00001$ ). In both the overweight and normal-weight subgroups, snorers showed statistically more aggressive behaviour ( $p < 0.0019$ ;  $p < 0.0098$ ) than non-snorers.

**Conclusion:** Snoring can drive to aggressive behaviour in population of first graders. The severity of breathing disturbances during

sleep is associated with increasing aggressive behavioural problems, both in the subgroups of normal weight and overweight children.

**Acknowledgements:** The Authors thank Wielka Orkiestra Swiatecznej Pomocy Foundation (The Great Orchestra of Christmas Charity) which supported the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.324>

### Effects of social defeat on sleep and behavior: importance of the confrontational behavior

A. Kinn Rød, R. Murison, J. Mrdalj, A. Milde, F. Jellestad, J. Grønli  
University of Bergen, Dept of Biological and Medical Psychology, Norway

**Introduction:** We studied the short- and long-term effects of a double social defeat (SD) on sleep architecture, EEG power and behavior. A few studies have shown that rats that fight back or oppose the resident during the social conflict seem less affected by the defeat than those that show quick submission and passivity. Our hypothesis was that rats showing rapid submission in the social defeat would exhibit the most pronounced alterations in sleep architecture and behavior.

**Materials and methods:** All rats were surgically implanted with telemetric transmitters for sleep recording. Rats in the SD group ( $n = 10$ ) were exposed to 1 h SD on two consecutive days, while control rats ( $n = 10$ ) were left undisturbed. Telemetric sleep recordings were performed before SD (day -1), day 1, day 14 and day 21 post SD. The open field emergence test was performed on day 9, day 16 and day 23. Acoustic startle responses were tested on day 24.

**Results:** Overall, SD rats as a group were not affected, neither short-term nor long-term, by the social conflict with regard to sleep architecture, EEG power or behavior. Effects of SD seemed to vary according to the behaviors that the intruder displayed during the confrontation with the resident. Compared to those SD rats showing quick submission (SDS, latency to defeat:  $56 \pm 20$  s,  $n = 5$ ), SD rats fighting the resident during one or both SD confrontations before defeat (SDF rats, latency to defeat:  $158 \pm 45$  s,  $n = 5$ ) showed more fragmented SWS, both in SWS1 and SWS2 ( $p < 0.05$ , both) at day 1. This effect became more robust after day 14 ( $p < 0.05$  and  $p < 0.01$ , respectively) and day 21 ( $p < 0.01$ , both). Descriptively, SDS and SDF rats showed different sleep architecture prior to SD. SDF rats were less awake, had more SWS2, less SWS1, and more REM sleep. The pattern of differences in SWS1 and SWS2 was maintained throughout the experiment, suggesting that this might reflect a trait rather than an effect of social conflict. REM sleep descriptively increased in the SDS group compared to their own baseline prior to SD on day 1 and day 14. The change across days was not seen in SDF rats. In the emergence test, SDF rats showed longer latency to leave the start box at day 23 ( $p < 0.05$ ) and spent less time in the arena compared to those showing quick submission and passivity at day 16 and day 23 ( $p < 0.05$ , both). The SDF rats failed to show response decrement in the startle test at the lowest sound level ( $p < 0.01$ ).

**Conclusion:** Our results indicate that aggressivity in a social conflict induces chronic fragmented sleep. A rapid submission during a social confrontation induces less sleep change and this behavior might reflect greater flexibility and to be more adaptive than fighting back.

**Acknowledgements:** University of Bergen and Norwegian Competence Center for Sleep Disorders.

<http://dx.doi.org/10.1016/j.sleep.2013.11.325>

**Daytime peripheral temperature changes during MWT and MSLT**

M. Guaita<sup>a</sup>, A. Martínez<sup>b</sup>, J. Madrid<sup>b</sup>, M. Rol<sup>b</sup>, M. Salamero<sup>c</sup>, J. Santamaría<sup>a</sup>

<sup>a</sup>Neurology Service and Multidisciplinary Sleep Disorders Unit, Hospital Clínic, IDIBAPS, University of Barcelona, Spain

<sup>b</sup>Chronobiology Lab., Dept of Physiology, Faculty of Biology, University of Murcia, Spain

<sup>c</sup>Clinical Psychology and Psychiatry Service and Multidisciplinary Sleep Disorders Unit, Hospital Clínic, University of Barcelona, Spain

**Introduction:** Changes in core and peripheral temperature precede sleep onset but there is no information about these changes during the objective tests of excessive daytime sleepiness (EDS). We aimed to measure wrist temperature (WT) during the maintenance of wakefulness test (MWT) and multiple sleep latency test (MSLT) in patients with symptoms of sleep disordered breathing (SDB).

**Materials and methods:** Sixty-four consecutive patients complaining of snoring or breathing pauses during sleep with and without subjective EDS were included for this study. Patients with irregular sleep-wake schedules, sleep deprivation or medical problems during the tests were excluded. After a nocturnal PSG, patients underwent 5 trials of MWT followed by a research version MSLT, every two hours starting at 8:30 am. WT rhythm was analyzed throughout the day with an Ibutton device (ThermoChron<sup>®</sup>, Data loggers I-button). WT values were obtained during 3 conditions: in a sitting position 15 min before starting the MWT and during the MWT and MSLT naps. Repeated ANOVA of WT values was used with 2 factors (time and condition) and the interaction. Post-hoc least significant difference was calculated between conditions. Pearson's correlation were performed between means sleep latencies and mean WT values during MWT and MSLT.

**Results:** Fifty-five patients were analyzed. Patients were mostly overweighted adult male (81% male, mean age  $52.4 \pm 10.2$ , BMI  $29.6 \pm 5.4$ ) and they represented a wide spectrum of SDB (mean Apnea-Hypopnea Index  $30.5 \pm 24.9$ , range 0.4–90.4). The main results were: (A) WT values during MWT were higher than during MSLT in all naps except in the fourth nap ( $p$  range  $<0.001$ – $0.02$ ). The lowest WT value was detected during the 3rd nap (around midday), in both tests. The interaction between time and condition was significant ( $F = 23.000$ ,  $p = 0.003$ ). (B) A negative correlation was found between sleep latency and WT values during MSLT ( $r = -0.3$ ,  $p$  value = 0.04), but not during MWT.

**Conclusion:** We have found measurable changes in peripheral temperature during a clinical protocol of MWT/MSLT. Wrist temperature is higher during MWT than during MSLT. Both tests showed similar patterns of oscillation with a minimum value throughout midday. Finally, WT was significantly higher in patients with the shortest MSLT latencies.

**Acknowledgements:** Study supported by (A) FIS PI07/0318 to M.S., cofinanced by FEDER. (B) RETICEF (RD12/0043/0011), MINECO (BFU2010-21945-C02-01), and INNPACTO (IPT-2011-0833-900000) with FEDER cofunding to J.A.M.

<http://dx.doi.org/10.1016/j.sleep.2013.11.326>

**Heart rate variability during the MSLT and MWT in patients with and without excessive daytime sleepiness**

M. Guaita<sup>1</sup>, M. Umberto<sup>2</sup>, V. Montserrat<sup>2</sup>, P. Caminal<sup>2</sup>, M. Salamero<sup>3</sup>, J. Salamero<sup>1</sup>

<sup>1</sup>Neurology Service and Multidisciplinary Sleep Disorders Unit, Hospital Clínic de Barcelona, IDIBAPS, University of Barcelona, Spain

<sup>2</sup>Dept. ESAIL, Centre for Biomedical Engineering Research, CIBER-BBN, Universitat Politècnica de Catalunya, Spain

<sup>3</sup>Clinical Psychology and Psychiatry Service and Multidisciplinary Sleep Disorders Unit, Hospital Clínic, University of Barcelona, Spain

**Introduction:** Autonomic heart regulation changes during the transition from wakefulness to sleep. Heart rate variability (HRV) can be used to assess the autonomic nervous system function (ANS). We aimed to evaluate ANS in patients with and without excessive daytime sleepiness (EDS) during the maintenance of wakefulness test (MWT) and multiple sleep latency test (MSLT).

**Materials and methods:** From a series of 98 consecutive patients with symptoms of sleep disordered breathing (SDB) studied with 5 trials of MWT followed by a research version MSLT two groups of patients (matched by age and gender) were selected consecutively based on mean sleep latencies: the sleepy group (SG) with 17 patients (MWT  $< 20$  min and MSLT  $< 8$  min) and the alert group (AG) with 20 patients (AG: MWT  $> 20$  and MSLT  $> 8$  min). For each test, the first 120-s window of RR signals during wakefulness was analyzed in the following frequency bands: VLF,  $<0.04$  Hz; LF, 0.04–0.15 Hz; HF, 0.15–0.4 Hz; TB, total-frequency band. ANS activity was described by measures obtained from traditional power spectral analysis (PSA) and from time–frequency representation (TFR). Non-linear measures – Correntropy (CORR) and auto-mutual-information function (AMIF) – were used to describe the RR regularity. Mean values from all day were compared between groups. Cohen's effect size was calculated to measure the strength of each difference. Finally, a conditional forward logistic regression analysis was performed to find the best discriminatory variables between groups.

**Results:** TFR (in HF and VLF band), AMIF (in all bands) and CORR (in Total band) analysis showed that the SG had higher values than the AG ( $p$  range 0.000–0.02) during the MSLT. The strongest differences were found in HF band from TRF and AMIF and in Total band from AMIF and CORR. The best sensitivity (82.4%) and specificity (85%) to distinguish patients with and without sleepiness were achieved with the combination of AMIF and CORR in Total band, respectively. No differences were found in traditional PSA measures.

**Conclusion:** Heart rate variability analysis during the first 2 min of the MSLT while the patient is awake show specific changes in TFR and non-linear measures that differentiate sleepy from non-sleepy patients.

**Acknowledgements:** Study supported by FIS PI07/0318 to MS, cofinanced by FEDER.

<http://dx.doi.org/10.1016/j.sleep.2013.11.327>

**Fatal familial insomnia (FFI) in Basque country. Clinical manifestations, polysomnographic patterns and pathologic findings in three cases**

A. Asencio Guerra<sup>a</sup>, A. Alvarez Ruiz De Larrinaga<sup>a</sup>, C. Egea Santaolalla<sup>b</sup>, J. Durán Cantolla<sup>b</sup>, E. Alvarez Vadillo<sup>a</sup>, F. Julián Villaverde<sup>c</sup>

<sup>a</sup>Hospital Universitario Araba-Txagorritxu, Neurofisiología Clínica, Spain

<sup>b</sup>Hospital Universitario Araba-Txagorritxu, Sleep Unit, Spain

<sup>c</sup>Hospital Universitario Araba-Txagorritxu, Servicio de Neurología, Spain

**Introduction:** The FFI is a rare prion disease, originated by the mutation D178N in the PRNP gene. It has an autosomal dominant inheritance pattern. Patients characteristically develop progressive insomnia with loss of the normal circadian sleep-activity pattern, inattention, impaired concentration and memory, confusion, hallucinations, motor disturbances (hyperreflexia, dysarthria, myoclonus, ataxia, spasticity), signs of autonomic hyperactivity (increased sweating, tearing, salivation, mild nocturnal hyperthermia, tachycardia, and hypertension). We expose three cases of patients who died with FFI in our hospital.

**Materials and methods:** We reviewed the medical records of three patients with molecular diagnosis of FFI who died in our hospital, comparing the clinical aspect, polysomnographic patterns and pathologic findings.

**Results:** Clinical characteristics were very similar; patients developed insomnia as a prominent and early complaint, associated with excessive daytime sleepiness, ataxia, diplopia, progressive dysphagia, myoclonus, autonomic hyperactivity, confusion and disorientation. Sleep studies showed significant reduction in total sleep time, disorganization of the structure of sleep, decreased sleep efficiency, reduced slow wave sleep, decrease in the number of spindles and K complexes and presence of irregular, choreiform or stereotypic movements. One patient did not reach REM sleep and showed a slow wave sleep ratio of 72.5%. The pathologic alterations in the patients showed severe atrophy with significant neuronal loss in dorsomedial, and pulvinar thalamic nuclei, reactive astrocytosis, gliosis and vacuolation of the neuropil, more intensely in the mid brain, cerebellum (cortex, vermis and dentate nucleus), striatum and hippocampus.

**Conclusion:** The patients with FFI may exhibit a variety of symptoms and signs. The patients described shared many of the clinical and pathological findings. One patient presented a polysomnographic pattern with a ratio of slow wave sleep 72.5%, rare in the FFI.

**Acknowledgements:** All the people that made possible this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.328>

### **Sleep-disordered-breathing in Ehlers–Danlos syndrome (a genetic model of obstructive sleep apnea)**

C. Guilleminault<sup>1</sup>, M. Primeau<sup>1</sup>, H. Chiu<sup>1</sup>, K. Yuen<sup>1</sup>, D. Leger<sup>2</sup>, A. Metlaine<sup>2</sup>

<sup>1</sup>Stanford University, Sleep Medicine Division, United States

<sup>2</sup>Universite Paris-Descartes, Hopital de l'Hotel Dieu, France

**Introduction:** Investigation of presence of sleep-disordered-breathing (SDB) and its cause in Ehlers–Danlos–(ED) Syndrome patients. ED is a genetic disorder characterized by cartilaginous defects including the nasal-maxillary cartilages.

**Materials and methods:** Retrospective series of 34 ED patients presenting to a sleep medicine clinic with complaints of fatigue and poor sleep, evaluated using clinical history, physical examination, polysomnography (PSG) and in a subgroup with anterior rhinometry. Prospective clinical investigation of 9 ED patients followed in a specialized medical ED clinic.

**Results:** All sleep clinic patients had SDB on PSG. SDB included sleep-apnea and hypopnea but also flow limitation; there was an inverse relationship between age of subjects and amount of flow limitation versus apnea–hypopnea during sleep but clinical complaints were similar independent of abnormal polysomnographic finding. Of the subgroup of patients on whom nasal rhinometry was obtained, increased nasal resistance was noted relative to normative values. Nasal CPAP importantly improved symptoms of patients. ED patients in medical clinic presented symptoms and clinical signs of SDB but were never referred for evaluation of SDB.

**Conclusion:** In ED patients, abnormal breathing during sleep is commonly unrecognized and is responsible for daytime fatigue and poor sleep. ED patients are at particular risk for SDB due to genetically related cartilage defects causing these patients to develop facial structures known to cause SDB. ED may be a genetic model for obstructive sleep apnea because of abnormalities of oral-facial growth. Early recognition of SDB may allow treatment with orthodontics and myofacial reeducation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.329>

### **The clinical and polysomnographic differences associated with hypertension in the patients that have OSA symptoms and the effect of OSA on hypertension**

B. Gulbay, T. Acican, F. Ciftci, M. Erdemir Isik, Z. Onen  
Ankara University School of Medicine, Department of Pulmonary Disease, Turkey

**Introduction:** It has been well known that obstructive sleep apnea (OSA) and hypertension (HT) are closely related. We compared the effect of HT on the clinical and polysomnographic findings on patients who received polysomnography testing for suspicion of OSA.

**Materials and methods:** The polysomnographic data of 158 consecutive patients that underwent a sleep study were retrospectively assessed in two groups in respect of HT history.

**Results:** There were 66 patients (26F/38 M) with HT and 92 patients (27F/65 M) who did not have an HT history. The patients with HT were older and more obese (respectively;  $p = 0.000$ ,  $0.008$ ). OSA [apnea hypopnea index (AHI)  $>5/$ sa] was diagnosed in 50 patients (76%) with HT. This rate was 68% (62) in the normotensive patients. Although not statistically significant, HT was 1.5 times greater in patients with OSA (RR = 1.51). Between the two groups, except witnessed apnea and sweating [these symptoms were more in the hypertensive patients ( $p = 0.015$ ,  $0.019$ )], there were no differences in other OSA symptoms and sleep stages ( $p > 0.05$ ). Although not statistically significant, in the patients with HT the total sleep time was lower and the AHI was higher. It was determined that the 54% of hypertensive patients had high ESS score (ESS  $> 10$ ), the same rate was 43% in the normotensive patients. In the patients with HT, the average oxygen saturation at sleep was lower ( $p = 0.003$ ) and the rate of systemic disease was higher.

**Conclusion:** Although HT was more frequent in the patients with OSA, it was also found that the HT is related to the BMI that is a part of metabolic syndrome. It was shown that alone the presence of HT was not an important guide in the diagnosis of OSA.

**Acknowledgements:** We are highly indebted to Ankara University School of Medicine Pulmonary Disease Department for their guidance and constant supervision as well as for providing necessary information regarding the project and also for their support in completing the project.

<http://dx.doi.org/10.1016/j.sleep.2013.11.330>

### **Periodic limb movements on 713 consecutive video supported polysomnography VPSG**

I.G. De Gurtubay<sup>a</sup>, B. Martin<sup>b</sup>, M. Alonso<sup>a</sup>, G. Morales<sup>a</sup>, J. Cascante<sup>c</sup>, V. Eguia<sup>c</sup>

<sup>a</sup>Complejo Hospitalario de Navarra, Multidisciplinary Sleep Unit, Neurophysiology, Spain

<sup>b</sup>Complejo Hospitalario de Navarra, Neurophysiology, Spain

<sup>c</sup>Complejo Hospitalario de Navarra, Multidisciplinary Sleep Unit, Pulmonary Medicine, Spain

**Introduction:** Periodic limb movements during sleep (PLMs) can be an incidental finding, or they can be associated with several sleep disorders. They can even be a biological marker of diseases such as Restless Legs Syndrome (RLS).

**Materials and methods:** 713 adult patients underwent vPSG during 2012. We describe the epidemiology, clinical complaints, sleep diary data, symptoms, suspected diagnosis, associated diseases, vPSG measures, medication management and evolution of those (115) in which pathological PLMs index was reported.

**Results:** In 84/115 the study was done because of a clinical suspicion of sleep disorders: 57 sleep related breathing disorders (SRBD), 15 sleep disruption (insomnia ± daytime sleepiness), and 12 suspected parasomnias. 20/115 were conducted because of poor improvement after RLS treatment. Finally, 11/115 were to check PLMs as a supportive feature when essential criteria for RLS failed. Group data: 30 patients had a previous diagnosis of RLS (7 were not medicated and 12 were taking inappropriate drugs). 42 had never been asked about RLS symptoms. 57/115 had PLMs index higher than 15. Final diagnosis: Using vPSG data (mainly sleep disturbance and PLMs) and after an exhaustive clinical interview, 50 new RLS/PLMs diagnoses were made: In the suspected SRBD group 10/57 showed just RLS/PLMs and 14/57 showed an OSA as well, 11/15 had been sent to us because of insomnia, 9/12 from suspected parasomnia group fulfilled RLS criteria, and 6/11 showed PLMs as an associated feature when an RLS diagnosis was previously established just as possible, helping to resolve clinical uncertainty. In 4 patients, the previous diagnosis of RLS was changed by periodic limb movement disorder (PLMD). In 35 cases, the registered PLMs could be an incidental finding.

**Conclusion:** Although a simple questionnaire about RLS symptoms is a mandatory item to fill in before sending a patient to our sleep unit, when SRBD is suspected clinicians in our area overlooked it in a large percentage of cases (over 68%) Strong association was observed between PLMs index >15 and severe RLS diagnosis, as well as for augmentation and PLMs index and/or PLM while awake (PLMw) data. We have found inappropriate therapy prescribed by both specialist and primary care doctors. Specialists working closely with a sleep unit, follow better treatment guidelines. When the specialist just suggests medication by therapeutic group with no concrete trade or generic name, clinicians in primary care do not follow practice guidelines. During the first months after the treatment, the patient should be closely followed up to check the effectiveness of the given pharmacological agents. That is not as common as it should be. Educational activities should still be done in primary care as well as in a specialized environment.

<http://dx.doi.org/10.1016/j.sleep.2013.11.331>

#### Antidepressants and RLS/PLMS in the general population

J. Haba-Rubio<sup>a</sup>, P. Marques-Vidal<sup>b</sup>, D. Andries<sup>a</sup>, N. Tobback<sup>a</sup>, M. Tafti<sup>a</sup>, R. Heinzer<sup>a</sup>

<sup>a</sup>Center for Investigation and Research in Sleep (CIRS), University Hospital (CHUV), Switzerland

<sup>b</sup>Institute of Social and Preventive Medicine (IUMSP), University Hospital (CHUV), Switzerland

**Introduction:** Restless Legs Syndrome (RLS) and periodic leg movements during sleep (PLMS) can occur as a primary disorder or as a secondary condition. The claim that antidepressant use induces RLS or PLMS is controversial and has significant implications considering the widespread use of these medications. The aim of this study was to explore the association between antidepressant drugs intake and the frequency of both RLS and PLMS in a large unselected middle-aged general population sample.

**Materials and methods:** Data from 5064 subjects (2542 women, mean age 56.7 ± 10.1) participating in an ongoing population-based cohort study (HypnoLaus, Lausanne, Switzerland) was collected. All them completed a series of sleep related questionnaires and 2019 underwent polysomnographic recordings at home. RLS was ascertained by the presence of the 4 basic diagnostic criteria of the International Restless Legs Syndrome Study Group. PLMS index (PLMSI)

was determined according to AASM 2007 criteria. A PLMSI > 15/h was considered to be abnormal.

**Results:** Among the 5064 participants, 457 (9%) were taking antidepressive drugs: 291 (5.7%) took SSRIs, 44 (0.8%) tricyclics and 122 (2.4%) other antidepressive drugs (a heterogeneous group including Trazodone, Mirtazapine, Mianserine, Venlafaxine, Bupropion, Duloxetine). Overall, the prevalence of RLS in subjects taking antidepressive drugs was 21% vs 12.1% in the other subjects ( $p < 0.001$ ). Analyses of individual antidepressants class revealed an association between RLS and SSRIs (RR = 1.78, CI = 1.32–2.42) and for the group “other antidepressive drugs” (RR = 1.8, CI = 1.14–2.84) but no association was found for tricyclic antidepressants, after adjusting for age, gender, diabetes (yes/no), neuroleptic use (yes/no) and glomerular filtration rate. Among the 2019 participants that underwent PSG, 131 (6.5%) took SSRIs, 18 (0.9%) took tricyclics and 48 (2.4%) took other antidepressive drugs. The prevalence of PLMSI > 15/h in subjects taking antidepressive drugs was 34.4% (vs. 26.1%,  $p = 0.039$ ). A significant association was found between PLMSI > 15/h and SSRIs (RR = 1.84, CI = 1.23–2.76) and tricyclics (RR = 3.84, CI = 1.44–10.2), but no for the group other antidepressants, after adjusting for confounding factors.

**Conclusion:** RLS and PLMS in the general population are associated with antidepressant use. SSRIs are associated with RLS and PLMS whereas tricyclic are associated only with PLMS.

**Acknowledgements:** Funding: Fondation Leenaards, FNS, GSK, Ligue Pulmonaire Vaudoise and CIRS.

<http://dx.doi.org/10.1016/j.sleep.2013.11.332>

#### Prevalence and characteristics of sleep disordered breathing in pre- and post-menopausal women

J. Haba-Rubio, S. Vat, D. Andries, N. Tobback, M. Tafti, R. Heinzer  
Center for Investigation and Research in Sleep (CIRS), University Hospital (CHUV), Switzerland

**Introduction:** Historical studies suggest that there is an increased male/female ratio in the prevalence of sleep disordered breathing (SDB). Moreover, SDB was reported to increase in postmenopausal women. The aim of this study was to assess the prevalence and the characteristics of SDB in pre-menopausal and post-menopausal women.

**Materials and methods:** 2114 subjects (50.4% women, 58.5 ± 10.7 y.o, BMI 26.2 ± 4.4 kg/m<sup>2</sup>) participating in an ongoing population-based sleep cohort study (HypnoLaus, Lausanne, Switzerland) underwent full polysomnographic recordings at home. They also had a complete clinical workup including metabolic, cardiovascular, genetic and morphometric evaluation. Hormonal status was recorded in 981 women (30.6% pre-menopausal and 69.4% post-menopausal). Respiratory events were scored according to the AASM 2013 criteria.

**Results:** The prevalence of SDB in women with AHI thresholds of 5/h, 15/h and 30/h was 60.9%, 22.8% and 7.5%. Prevalence of an Epworth score >10 and SDB with the same thresholds was 18.9% (AHI > 5/h), 11.5% (AHI > 15/h) and 5% (AHI > 30/h) with a male/female ratio of 1.75, 2.4 and 2.8 respectively. Male vs female prevalence was significantly different in each severity group ( $p < 0.0001$ ). Compared to men, women with an AHI > 15/h were older ( $p < 0.0001$ ), had a lower neck circumference ( $p = 0.0001$ ), a lower Mallampati score ( $p = 0.0001$ ), a lower waist/hip ratio ( $p < 0.0001$ ) but the BMI was not significantly different: 28.2 kg/m<sup>2</sup> in women vs 28.1 kg/m<sup>2</sup> in men ( $p = 0.711$ ). Women also reported less sleepiness at the wheel ( $p < 0.0002$ ), less witnessed sleep apnea ( $p = 0.0006$ ) but more morning fatigue ( $p = 0.034$ ), more sleeping pill

intake ( $p = 0.0003$ ) but the same rate of snoring ( $p = 0.55$ ). Compared to post-menopausal, pre-menopausal women had a lower SDB prevalence. AHI > 5/h: 26.6% vs 42.5% ( $p < 0.0001$ ), AHI > 15/h: 7.2% vs 18.6% ( $p < 0.0001$ ), AHI > 30/h: 1.3% vs 10.2% ( $p < 0.0001$ ). Post-menopausal women had a larger neck ( $p = 0.006$ ) a higher waist-hip ratio ( $p = 0.0001$ ) and a higher Mallampati score ( $p = 0.009$ ) but the BMI was not significantly different ( $p = 0.5$ ).

**Conclusion:** The prevalence of SDB is lower in women than in men with a male/female ratio increasing with SDB severity. Women with SDB tend to report more morning fatigue but less sleepiness at the wheel and less witnessed sleep apnea than men. Post-menopausal compared to premenopausal women have a higher SDB prevalence not due to an increased BMI but mainly because differences in fat distribution.

**Acknowledgements:** Funding: Fondation Leenaards, FNS, GSK, Ligue Pulmonaire Vaudoise and CIRS.

<http://dx.doi.org/10.1016/j.sleep.2013.11.333>

### Sleep disorders in patients with asthma referring to general Hospital of Gachsaran

F. Habibi

Shaheed Rajaei Hospital, Shiraz, Iran

**Introduction:** Asthma is a common respiratory disorder that is often exacerbated during sleep. This study has been done in order to determine sleep disorders in these individuals.

**Materials and methods:** In this cross-sectional descriptive study, 95 asthmatic patients were selected with convenient sampling method and two question sheets were given to them which included demographic data and Global Sleep Assessment questionnaire. Results were analyzed by SPSS version 15.

**Results:** The results showed that a high percent of asthmatic patients suffer from sleep disorders. The prevalence of disorder differs from  $1\% \pm 1$  (sleep waking), to  $78 \pm 9$  (interruption in sleep maintenance).

**Conclusion:** According to the high prevalence of sleep disorders in these patients, attention for early detection and treatment is recommended.

**Acknowledgement:** I appreciate the assistance from all personnel of General Hospital of Gachsaran.

<http://dx.doi.org/10.1016/j.sleep.2013.11.334>

### The relationship between objectively measured sleepiness and driving ability

I. Haimov, M. Cale, Y. Shafran, O. Tzischinsky

Department of Psychology and The Center for Psychobiological Research, The Yezreel Valley College, Israel

**Introduction:** The complex task of driving requires driver vigilance, attention and ability to perceive, comprehend, react and adapt. While it appears self-evident that most, if not all, of these functions are affected by fatigue and drowsiness, little direct, concrete proof exists. Therefore, the aim of the present study was to examine the relationship between objectively measured sleepiness and driving ability.

**Materials and methods:** Twelve adults (mean age  $24.5 \pm 1.4$  years: 6 males, 6 females) participated in the study. During the entire study period (24 h of continuous awakening) participants were tested

every three hours with a battery of computerized tests (Vienna Test System) known to significantly correlate with accident involvement and with the Pupillographic Sleepiness Test (PST) that objectively measures sleepiness. The PST consists of an 11-minute recording by infrared video pupillography of the sitting participant's pupil diameter, followed by automated data analysis. Spontaneous pupillary oscillations provide objective and quantitative measures of tonic central nervous activation, which is a precondition for higher level mental performance. In sleepy subjects the pupil shows spontaneous oscillations with a predominantly low frequency component and amplitudes reaching several millimeters.

**Results:** Analysis revealed significant difference between day and night tests in mean motor reaction time [ $t(11) = 3.61$ ;  $p < 0.01$ ], in distribution reaction time [ $t(11) = 2.89$ ;  $p < 0.05$ ], and in the percentage of wrong responses [ $t(11) = -1.80$ ;  $p < 0.001$ ]. Likewise, analysis revealed a significant correlation between PST Index and mean motor reaction time ( $r = 0.94$ ;  $p < 0.01$ ), between PST Index and distribution reaction time ( $r = 0.84$ ;  $p < 0.05$ ), and between PST Index and percentage of wrong responses ( $r = 0.80$ ;  $p < 0.005$ ).

**Conclusion:** The results suggest that driving ability is directly and highly related to fatigue and sleepiness. This exploratory study can shed light on the role fatigue plays in decreased driving skills and increased road accidents.

**Acknowledgement:** The authors thank Paula S. Herer for assisting in the statistical analysis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.335>

### The effects of acupuncture treatment on sleep quality and on emotional measures among individuals living with schizophrenia

I. Haimov<sup>1</sup>, B. Bloch<sup>2</sup>, L. Vadas<sup>1</sup>, S. Ravid<sup>2</sup>, I. Kremer<sup>2</sup>, A. Reshef<sup>2</sup>

<sup>1</sup> Department of Psychology and the Center for Psychobiological Research, Yezreel Academic College, Israel

<sup>2</sup> Psychiatric Department, Ha'emek Medical Center, Israel

**Introduction:** Insomnia is a sleep disorder frequently observed among individuals living with schizophrenia. Its causes are varied, and it has serious consequences on daytime functioning and quality of life. Moreover, studies have confirmed that individuals living with schizophrenia are resistant to insomnia medications. Since previous studies have demonstrated the positive influence of acupuncture on several diseases and disorders, the aim of the present study was to examine the effects of acupuncture on sleep quality and on emotional measures among patients with schizophrenia.

**Materials and methods:** Twenty patients with schizophrenia participated in the study (mean age = 43.15, SD = 9.42; 10 males and 10 females). The study comprised a seven-day running-in no-treatment period, followed by an eight-week experimental period. During the experimental period, participants were treated with acupuncture twice a week. During the first week (no-treatment period) and the last week of the experimental period, participants filled out a broad spectrum of questionnaires and their sleep was continuously monitored by wrist actigraph.

**Results:** A paired-sample *t*-test was conducted, comparing psychopathology score, level of anxiety and objective sleep parameters manifested by patients before and after acupuncture treatment. The results indicated that acupuncture improved total psychopathology score (PANNS) ( $t(19) = 8.261$ ,  $p < .0001$ ), level of anxiety ( $t(19) = 5.959$ ,  $p < 0.001$ ), and objective sleep efficiency ( $t(18) = 2.857$ ,  $p < 0.01$ ).

**Conclusion:** The present study implies that acupuncture can have beneficial effects in improving emotional measures and in treating insomnia in schizophrenic patients.

**Acknowledgement:** The authors thank Paula S. Herer for assisting in the statistical analysis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.336>

### **The latest development of low resistance thought imprint psychotherapy sleep-regulating technique of insomnia**

W. Weidong, Z. Haisheng, D. Hui

Guanganmen Hospital, China Academy of Traditional Chinese Medicine Science, China

**Introduction:** Thought Imprint Psychotherapy Sleep-regulating Technique (TIP3-2) under Lower Resistance (TIP) is one of the techniques for TIP “theory and practice” symptomatic treatment of insomnia. Through the study of TIP sleep-regulating technology, Huangdi Neijing (The Yellow Emperors Internal Classic) with “theory traceability” and “study” of psychological pathological mechanism of insomnia related the episode of acute insomnia and acute insomnia to chronic insomnia process to the important roles of personality and cognitive factors. Thought Imprint Psychotherapy under Lower Resistance (TIP) of insomnia clinical operation norm introduces the operating rules of the method.

**Materials and methods:** Literature research, pathology mechanism research, 70 patients with primary insomnia were enrolled and randomly divided into the TIP combined with Western medicine group and the Western medicine only group. Each group consisted of 35 cases. The Western medicine group was given estazolam (1–2 tablets) a half hour before going to bed. TIP combined with western medicine group had two times a week TIP sleep regulation technique and estazolam tablets as needed. The Pittsburgh sleep quality index (PSQI) was evaluated for changes after the 4 week observation period.

**Results:** TIP combined with western medicine group had significant ( $p < 0.05$ ) improvements in PSQI score, sleep quality, sleep time, sleep efficiency, sleep disorders, daytime function. The western medicine only group had significant ( $P < 0.05$ ) improvement in PSQI score and sleep quality. Comparison of efficacy between the two groups after treatment showed significant ( $p < 0.05$ ) difference for PSQI score, sleep quality, daytime function, use of hypnotic drugs. TIP combined with western medicine group did better than western medicine group alone for improvements on PSQI score, sleep quality, sleep time, sleep medication use, Daytime function was significantly different between the two groups ( $P < 0.05$ ), TIP combined with western medicine group was better than western medicine group. A comparison of efficiency: TIP combined with western medicine group, the total efficiency = 72% vs. western medicine group, the total efficiency is 29%. **Conclusion:** This study suggests that for these two different intervention methods to improve the level of primary insomnia, TIP combined with western medicine group is better than estazolam only group, suggesting that psychological therapy combined with drug therapy is more effective for insomnia. Clinical observation of “TIP sleep therapy control technique of insomnia reported the Western medicine the method of randomized controlled clinical study results, results show the efficacy of TIP in treating insomnia sleep regulation technology is significantly better than western medicine group. Thus the need to improve a system theory, clinical practice, clinical effective for insomnia and reliable method of psychotherapy. The results of this study show psychological drug combination with western medicine in the treatment of primary insomnia than simply using western medicine is obviously better curative effect. However, treatment of insomnia is more time-saving for doctors and patients drug treatment, psychological treatment of insomnia doctors is very limited, the current treatment methods commonly used medications or clinically, there is sufficient evidence

that the drug therapy is effective in the short term; medicine can quickly relieve the symptoms, but after stopping the drug effect cannot be maintained. This allows people to explore and use more effective therapy methods and more optimal treatment.

**Conclusion:** Regulation of technical ideas into sleep low impedance is systemic TCM Psychotherapy (SPT) is an important part of the technical system, the “Yellow Emperor’s Canon of internal medicine” Chinese medicine theory as a guide to absorb modern clinical psychology knowledge, combined with the clinical experience of Professor Wang Weidong in 20 years, a native of psychological therapy gradually evolved, is a symbol of TCM psychology changed from theory to modern clinical application results. The latest research on the treatment of insomnia and sleeping pills in the application of indigenous psychotherapy method TIP sleep regulation technology and combined with western medicine in the process of reduction have made a bold exploration, preliminary clinical prove the validity and applicability of TIP sleep regulation technology, but the treatment effect is also need to design a more rigorous clinical trials to further large sample the curative effect was also indicted.

**Acknowledgements:** This project is supported by National Natural Science Foundation. Thanks to the support of national science and technology support program.

<http://dx.doi.org/10.1016/j.sleep.2013.11.337>

### **Bed partner and sleep quality in elderly**

A. Hamel, S. Desjardins, J. Loranger, S. Lapierre, L. Marcoux  
Université du Québec à Trois-Rivières, Canada

**Introduction:** Some studies have shown that many elderly couples sleep together. Even if this is not a majority, the fact is that we do not have much information about the sleep quality of these ones. The objective of this study was to investigate the interaction between bed partners and sleep quality in the elderly.

**Materials and methods:** A sample of 624 elderly people aged 65–93 was recruited from the community. Seventy percent of them were women. Information was obtained on marital status, the presence of a bed partner and the time taken to fall asleep. We evaluated quality of sleep using the Insomnia Severity Index. Other characteristics of subjects such as napping habits were collected.

**Results:** About 56% of elderly couples sleep together, including married couples and single ones. The Insomnia Severity Index is not correlated with the presence of a bed partner ( $p = 0.502$ ). However, we observed that women take more time to fall asleep than men, with or without a bed partner ( $p < 0.000$ ). Women with a bed partner require about 27 min falling asleep while women without a bed partner require about 32 min. On the men’s side, with or without a bed partner, they all take about 19 min to fall asleep. Also, women with a bed partner take more time than men before getting up in the morning ( $p = 0.016$ ) about 14 min while women without a bed partner take about 23 min. Moreover, men, with or without a bed partner, take 15 min before getting up in the morning.

**Conclusion:** Our results suggest that women spent more time in bed than men, with or without a bed partner. Also, having a bed partner does not influence the sleep quality according to the Insomnia Severity index. This raises the importance to understand, in future studies, why women take more time in their bed when they are alone, and why this is not the case for men.

**Acknowledgement:** Research supported by the Fonds québécois de recherche sur la société et la culture.

<http://dx.doi.org/10.1016/j.sleep.2013.11.338>

### Pilot quantitative analyses of rem sleep without atonia in children and adolescents with rem sleep behavior disorder

K. Hancock<sup>1</sup>, S. Mccarter<sup>2</sup>, E. St. Louis<sup>3</sup>, S. Kotagal<sup>4</sup>, R. Lloyd<sup>5</sup>, B. Boeve<sup>3</sup>

<sup>1</sup> Mayo Medical School, United States

<sup>2</sup> Mayo Clinic College of Medicine, United States

<sup>3</sup> Mayo Center for Sleep Medicine, Departments of Medicine and Neurology, United States

<sup>4</sup> Mayo Center for Sleep Medicine, Departments of Pediatrics and Neurology, United States

<sup>5</sup> Mayo Center for Sleep Medicine, Department of Pediatrics, United States

**Introduction:** Growing evidence suggests that idiopathic REM sleep behavior disorder (RBD) may be a forme fruste of synucleinopathy neurodegeneration in older adults. The clinical significance of REM sleep without atonia (RSWA) and overt RBD in children and adolescents remains unclear. Furthermore, the lower age bound for occurrence of RSWA, the neurophysiologic substrate for RBD, is not well established. This pilot quantitative analysis of RSWA in pediatric patients with clinical RBD or RSWA – to our knowledge the first such data available in children – aims to determine the relationship between age, RBD symptoms, and RSWA.

**Materials and methods:** We analyzed phasic and tonic RSWA according to established methods in 12 RBD/RSWA patients and 12 age-gender matched controls with primary snoring who underwent polysomnography (PSG) at Mayo Clinic between 2008 and 2013, and reviewed medical records to determine RSWA or RBD diagnosis. We then measured phasic muscle activity durations and made group comparisons of phasic, tonic, and “any” muscle activity percentage densities as well as phasic muscle activity burst durations with non-parametric statistical tests. Multiple regression models were fit to explore potential associations between clinical and muscle activity dependent variables.

**Results:** Among the 12 RSWA/RBD cases, 7 were male, with a mean (range) age of 8.6 (1–17) years when PSG was performed. One RBD patient received clomipramine; no others were on medications associated with RSWA. Phasic and tonic densities were no different between cases and controls, although there appeared to be a subgroup of RSWA/RBD cases with higher phasic densities. Univariate regression analyses demonstrated that higher phasic density was associated with increasing age ( $p = 0.009$  for chin and  $p = .004$  for “any” muscle activity). Anterior tibialis phasic burst duration was significantly longer in the RSWA/RBD group compared to controls ( $p = 0.02$ ), prolonged to a degree similar to that of adult RBD subjects. Multivariate regression demonstrated an independent association of anterior tibialis phasic burst duration with RBD/RSWA diagnosis, controlling for age.

**Conclusion:** In our pilot study, the earliest detectable manifestation of RSWA appears to be increased phasic burst duration in anterior tibialis. We also found that phasic muscle activity density increases with age in pediatric patients. We plan continued analysis in an expanded group of pediatric subjects to better elucidate the influences of age and RBD symptoms on quantitative RSWA metrics.

**Acknowledgements:** The project described was supported by the National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health, through Grant No. 1 UL1 RR024150-01. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

<http://dx.doi.org/10.1016/j.sleep.2013.11.339>

### Self- and parent reported sleep problems in children and youths with epilepsy. Preliminary findings from a study in a tertiary epilepsy center

B. Hansen<sup>1</sup>, K. Alfstad<sup>2</sup>, B. Van Roy<sup>1</sup>, M. Lossius<sup>2</sup>

<sup>1</sup> Division of Mental Health, Akershus University Hospital, Norway

<sup>2</sup> National Centre for Epilepsy, Department of Children and Youth, Division for Surgery and Clinical Ne, Norway

**Introduction:** Introduction Sleep problems are common in childhood epilepsy; however studies are mainly based on parental reports. How children and youths with epilepsy report their sleep, and how self- and parent reports correlate is largely unknown. Studies in typically developing children yield higher frequencies of sleep problems when children are used as informants, with low to moderate correlations between self- and parent reports. Sleep problems in children with epilepsy may exacerbate seizure frequency, impair cognitive and behavioral functioning, and reduce quality of life, thus reliable assessment of sleep is important in this population. Objectives To investigate the prevalence of sleep problems and the correlation between self- and parent reported sleep problems in children and youths with epilepsy.

**Materials and methods:** We report preliminary findings from 53 children and youths aged 10–19 years with generalized or focal epilepsy, referred to a tertiary epilepsy treatment center in Norway. They are participants in a larger ongoing study on psychiatric symptoms and executive dysfunction in children and youths with epilepsy. Sleep problems were measured at time of inclusion by self-report on the Sleep Self Report (SSR), and parent report on the Children’s Sleep Habit Questionnaire (CSHQ).

**Results:** 40.5 % of children and youths reported to have “problems with sleep”, while 58.3% of parents reported clinically significant sleep problems (total CSHQ score above 41) in their children. The correlations between corresponding items in the self-report (SSR) and the parent report (CSHQ) were all significant ( $p$  values between 0.03 and  $<0.001$ ), with the exception of “sleeps too little” and “moves to someone else’s bed”. Mean correlation coefficients (Spearman’s rho) for significant correlations were 0.55 (range 0.37–0.69).

**Conclusion:** Sleep problems were commonly reported by both children and parents. There were significant correlations between self- and parent reports on the majority of sleep problems. Our findings suggest a stronger agreement between self- and parent reports in children and youths with epilepsy compared to typically developing children.

**Acknowledgements:** The study was financed by Oslo University Hospital and grants from the Norwegian branch of the International League Against Epilepsy (ILAE).

<http://dx.doi.org/10.1016/j.sleep.2013.11.340>

### Morbid obesity and women age are related to the obstructive sleep apnea syndrome

J. Perez, F. Sánchez-Narváez, A. Labra, R. Haro  
Sleep disorders Clinic, UNAM, Mexico

**Introduction:** The obstructive sleep apnea syndrome (OSAS) is characterized by a history of snoring and upper airway recurrent obstruction, leading to sleep fragmentation and excessive day time somnolence. Its prevalence is higher in men (2:1), and it has been reported that older women have a higher risk for its appearance. The main objective our work was to relate BMI, age with OSAS in obese women.

**Materials and methods:** In this study, we included 39 women with morbid obesity, with a BMI higher than 30. All of them underwent an overnight polysomnography. We performed linear regression and correlation tests for the statistical analysis.

**Results:** The mean age for these women was  $40.6 \pm 1.77$ , the mean BMI  $45.10 \pm 1.53$  and the mean of AHI was  $45.21 \pm 7.5$ . Pearson correlation IAH–BMI showed 0.727\*, AHI–age 0.435\*, BMI–age 0.17. IAH–BMI  $R^2 = 0.52^*$ . Linear regression AHI–BMI–age,  $R = 0.79^*$ ,  $R^2 = 0.63^*$ , ( $*P < 0.01$ ). Risk factor for OSAS with BMI Odds ratio 3.3\*, with a confidence interval CI (2.3–4.3), and age odds ratio 1.3\*, CI (0.4–2.2)  $*P < 0.01$ .

**Conclusion:** These data suggest a strong correlation between OSAS, BMI and age in women. There is a significant correlation between AHI and BMI. This relation increases when age is included. We did not find any relation between BMI and age. It is necessary to include more groups of women, with normal weight and overweight.

<http://dx.doi.org/10.1016/j.sleep.2013.11.341>

### Restoration of orexin signaling in the dorsal raphe and locus coeruleus differentially ameliorate symptoms of narcoleptic mice

E. Hasegawa<sup>1</sup>, M. Yanagisawa<sup>2</sup>, B. Roth<sup>3</sup>, T. Sakurai<sup>1</sup>, M. Mieda<sup>1</sup>

<sup>1</sup>Kanazawa University, Fac. Med, Japan

<sup>2</sup>UTSW, Japan

<sup>3</sup>UNC, Japan

**Introduction:** Loss of orexin neurons is associated with narcolepsy in the human, a sleep disorder characterized by excessive daytime sleepiness and cataplexy. Mice lacking orexin peptides, as well as those lacking orexin receptors (OX1R<sup>-/-</sup>; OX2R<sup>-/-</sup> mice), display a phenotype similar to narcolepsy, highlighting a critical role of orexin signaling in the maintenance of wakefulness. However, precise neural mechanisms downstream to orexin neurons have remained uncertain.

**Materials and methods:** We generated recombinant adeno-associated viruses (AAV) to express either OX1R or OX2R fused to EGFP and stereotactically microinjected into the of OX1R<sup>-/-</sup>; OX2R<sup>-/-</sup> mice, then recorded EEG/EMG to score sleep/wakefulness states. The subtype of orexin receptors expressed was determined according to expression of endogenous orexin receptors in wild-type mice.

**Results:** We found that targeted restoration of orexin receptor expressions in noradrenergic neurons of the locus coeruleus and in serotonergic neurons of the dorsal raphe in OX1R<sup>-/-</sup>; OX2R<sup>-/-</sup> mice differentially inhibited pathological fragmentation of wakefulness (i.e., sleepiness) and direct transitions from wakefulness to REM sleep (cataplexy-like episode), respectively. Furthermore, pharmacogenetic activation of these neurons using DREADD technology significantly ameliorated narcolepsy of mice lacking orexin neurons.

**Conclusion:** These results suggest that orexin neurons consolidate wakefulness and suppress cataplexy by activating locus coeruleus noradrenergic and dorsal raphe serotonergic neurons, respectively. Our success in improving narcoleptic symptoms by DREADD may lead to a novel type of gene therapy.

**Acknowledgements:** This study was supported in part by Grants-in-Aid for Scientific Research (B) and for Challenging Exploratory Research from the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) of Japan (M.M.), by the Mochida Memorial Foundation for Medical and Pharmaceutical Research (M.M.), and by the Cabinet Office, Government of Japan through its *g*Funding Program for Next Generation World-Leading Researchers\_h (T.S.). We thank Dr. Karl Deisseroth for pAAV-DIO-hChR2 (H134R)-EYFP-WPRE-pA; Dr. Scott M. Sternson for pAAV-FLEX-rev-ChR2mCherry;

Dr. Kwang-Soo Kim for the PRSx8 promoter; Dr. Masahiko Watanabe for the anti-GFP antibody; and Dr. Arun Srivastava for pACG-2-Y730F.

<http://dx.doi.org/10.1016/j.sleep.2013.11.342>

### Clinical correlates of periodic limb movements in sleep in parkinson's disease in Egypt

A. Mansour, T. Kamel, M. Yaser, T. Asaad, H. Aref, N. Salah

Faculty of Medicine, Ain Shams University, Egypt

**Introduction:** Patients with Parkinson's disease (PD) are prone to sleep disturbances and disorders, with a prevalence of 78–98% (Norlinah et al., 2009). One of the common sleep disturbances that might occur in PD is periodic limb movement disorder (PLMD) which have been found to be more common in PD than in controls (Freedom, 2007). Both RLS and PLM are sensitive to dopamine and dopamine agonists being drugs of choice for these disorders (Chaudhuri et al., 2006). Objective: The aim of the current study was to investigate the frequency of periodic limb movements in sleep (PLMS) in Parkinson's disease (PD) and their impact on nocturnal sleep and correlation with severity of parkinsonian symptoms.

**Materials and methods:** 36 Parkinson's disease (PD) patients were enrolled from involuntary movement outpatient clinic in Ain Shams University hospital and submitted to clinical assessment by unified Parkinson disease scale (UPDRS) part III, Hamilton depression scale, structured sheet for sleep questionnaire, Pittsburg sleep scale, Epworth sleepiness scale and polysomnography. Patients were divided into two groups based on their PLMS index (PLMSI): PLMSI >15 (PLMS +ve) and PLMSI <15 (PLMS –ve).

**Results:** There were 8 (22.2%) PD patients in the PLMS +ve group and 28 (77.8%) patients in the PLMS –ve group. Assessment by UPDRS (III) revealed an association between PLMS + status and greater PD motor symptoms severity, in addition to lower sleep quality reflected by higher scores of PITTSBURG scale in the PLMS +ve. No significant group differences were detected on PSG measures.

**Conclusion:** We observed that PLMS occurred frequently in PD and increased with more severe PD. Although PLMS did not affect objective sleep, it was associated with increased sleep complaints and reduced sleep quality. Overall, our findings support the association between PLMS and PD as well as the clinical relevance of sleep disturbances in PD.

<http://dx.doi.org/10.1016/j.sleep.2013.11.343>

### Multi-scale entropy-based measures of electroencephalogram during sleep as quantitative criteria for chronic insomnia

D. He<sup>1</sup>, A. Gamalido<sup>2</sup>, M. Smith<sup>3</sup>, R. Allen<sup>4</sup>, C. Gamalido<sup>5</sup>, R. Salas<sup>5</sup>

<sup>1</sup>Johns Hopkins University, School of Medicine, Division of Health Sciences Informatics, United States

<sup>2</sup>National Institute on Aging, Laboratory of Behavioral Neuroscience, United States

<sup>3</sup>Johns Hopkins University, School of Medicine, Department of Psychiatry and Behavioral Medicine, United States

<sup>4</sup>Johns Hopkins University, School of Medicine, Department of Neurology, United States

<sup>5</sup>Johns Hopkins University, School of Medicine, Department of Neurology, Neuro-Sleep Division, United States

**Introduction:** Patterns of transient EEG correlates of sleep, such as sleep spindles, can potentially serve as fingerprint of the underlying neurological disease. Our primary goal was to explore the feasibility of adopting complexity measures of sleep architecture as quantitative criteria for insomnia diagnostics and to assess its discriminative power in comparison with traditional polysomnography (PSG) measures through Receiver Operating characteristic (ROC) analyses.

**Materials and methods:** Participants were 29 normal sleepers and 26 insomnia patients who underwent 1 overnight ambulatory PSG. Records were scored by a registered sleep technician and were finalized by a doctoral level sleep specialist. Sleep spindles were detected from EEG waveforms during NREM sleep with frequency ranges 11–15 Hz. The three entropy-based measures used: (1) univariate entropy measuring the variability of spindle events over REM cycles, (2) multi-scale entropy measuring the variability of REM periods over time (MSER) and (3) multi-scale entropy measuring the variability of spindle event intervals (MSES). ROC was conducted to compare sensitivity and specificity of primary measures at varying thresholds. Area Under the Curve (AUC) served as the primary index of accuracy. Finally, Spearman correlation between entropy scores and the sleep severity index were calculated within 26 insomnia patients.

**Results:** ROC analyses of traditional PSG-based measures show the following rank of AUC: sleep efficiency (0.60) > WASO (0.57) > sleep latency (0.56) > sleep duration = REM duration = spindle numbers (0.55). Sleep efficiency is the best discriminator, consistent with published literature on ROC analysis of PSG-based measures in insomnia, but all measures fall into the “low” discriminative class (AUC < 0.7). The entropy-based measures have the following rank of AUC: MSES full range (0.81) > MSER (0.69) > cyclic spindles (0.57). Only the full-range spindles demonstrated significant association with sleep severity index among insomnia patients ( $r_s = 0.410$ ,  $p = 0.0466$ ).

**Conclusion:** Our proposed multi-scale entropy measures demonstrates superior performance over traditional PSG measures in discriminating insomnia from normal sleepers by integrating the temporal patterns at multiple layers. Interestingly, entropy analysis of spindles show increased variability at all scales in insomnia patients ( $F$ -test  $p < .001$ ). Proper event patterns may be crucial in maintaining biological functions, and the increasing unpredictability of events such as sleep spindles in insomnia may serve as a fingerprint of the underlying disease process.

**Acknowledgements:** The project described was supported by the following grants NIAMS R01AR059410 and NIDA R01DA032922.

<http://dx.doi.org/10.1016/j.sleep.2013.11.344>

### Zonisamide reduces obstructive sleep apnea: a randomized placebo-controlled study

D. Eskandari<sup>1</sup>, D. Zou<sup>1</sup>, M. Karimi<sup>1</sup>, K. Stenlöf<sup>2</sup>, L. Grote<sup>1</sup>, J. Hedner<sup>1</sup>  
<sup>1</sup>Center for Sleep and Wake Disorders, Institute of Medicine, University of Gothenburg, Sweden

<sup>2</sup>Department of Molecular and Clinical Medicine, Sahlgrenska Academy, University of Gothenburg, Sweden

**Introduction:** Carbonic anhydrase inhibition is associated with reduction of apneic events in sleep disordered breathing. Zonisamide has carbonic anhydrase inhibitory properties, and induces weight loss in obese patients. Our aim was to determine the therapeutic effects of zonisamide in obstructive sleep apnea (OSA).

**Materials and methods:** Forty-seven patients with moderate to severe OSA and a body mass index 27–35 kg/m<sup>2</sup> were randomized

to zonisamide, placebo or continuous positive airway pressure (CPAP) treatment for 4 weeks. In the open extension phase, all participants except those on CPAP received zonisamide for 20 weeks. Polysomnography, biochemistry and symptoms were evaluated.

**Results:** The placebo controlled effect of zonisamide at 4 weeks was a reduction of apnea hypopnea index (AHI) 33 ± 39% and oxygen desaturation index 28 ± 31% ( $p = 0.02$  and 0.014, respectively). At 24 weeks the mean reduction of AHI after zonisamide and CPAP (adjusted for compliance) was 14 and 61% ( $p = 0.001$  between groups). CPAP but not zonisamide reduced sleepiness. Body weight was marginally changed at 4 weeks but reduced after zonisamide and increased after CPAP at 24 weeks (−2.7 ± 3.0 vs. 2.3 ± 2.0 kg,  $p < 0.001$ ). Zonisamide decreased bicarbonate at 4 and 24 weeks. Drop-out rate was similar in the zonisamide and CPAP groups.

**Conclusion:** Zonisamide reduced OSA independent of body weight potentially by mechanisms related to carbonic anhydrase inhibition. Added weight loss after long term zonisamide treatment may generate a further therapeutic potential for this class of drugs in OSA.

**Acknowledgements:** The study was supported by the Swedish Heart and Lung Foundation, the Swedish Society of Medicine and the Göteborg Medical Society.

<http://dx.doi.org/10.1016/j.sleep.2013.11.345>

### Associations between sleep disturbances and leisure activities in late-life

A. Hellström<sup>1,2</sup>, P. Hellström<sup>1</sup>, A. Willman<sup>1,3</sup>, C. Fagerström<sup>1</sup>

<sup>1</sup>School of Health Science, Blekinge Institute of Technology, Sweden

<sup>2</sup>Department of Health Sciences, Lund University, Sweden

<sup>3</sup>Department of Care Science, Malmö University, Sweden

**Introduction:** Staying active in older age is associated with benefits in health and sleep. The aim of our study was to investigate the associations between sleep difficulties and leisure activities in older persons (≥60 years) in Sweden, through a cross-sectional study.

**Materials and methods:** Nine-hundred and forty-five persons from the Swedish National Study on Aging and Care participated. Sleep disturbances were measured by the eight-item Sleep Disturbance Scale and questions about sleep medication use and sleep duration. Seventeen variables of leisure activities were included. The influence of functional status and age on sleep was also investigated. Descriptive analyses, group comparisons and multivariate analysis were performed.

**Results:** Sleep disturbances were associated with short sleep duration and use of sleep medication. Multivariate analysis of the total sample showed that dependency in functional status, female gender, or being octogenarian were most likely to be associated with sleep disturbances. Leisure activities such as playing chess/cards or gardening were associated with less sleep disturbances. Women reported higher use of sleep medication and more co-existing sleep disturbances than men. Multivariate analysis by gender showed that women who exercised or picked berries were less likely to have sleep disturbances, as were men who strolled in the country. Being octogenarian was associated with sleep disturbances in men.

**Conclusion:** Thus we suggest leisure activities that include physical components, preferably outdoors and activities that combine social and intellectual components, enhance sleep.

**Acknowledgements:** We would like to thank the participants, participating counties and the municipality. The Swedish National Study on Aging and Care receives financial support from the Swedish Ministry of Health and Social Affairs and the participating county councils, municipalities and university departments. Finally, we thank

Lund University and the School of Health Science, Blekinge Institute of Technology, for supporting the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.346>

### The role of sleep and sildenafil in the progression of chronic kidney disease: a new therapeutic approach

C. Hirotsu, S. Tufik, M. Andersen

Universidade Federal de Sao Paulo, Brazil

**Introduction:** The prevalence of chronic kidney disease (CKD) is increasing rapidly throughout the world. Also, CKD is associated with comorbidities such as sexual dysfunction and sleep disorders which may impact the patients' quality of life. Although sleep loss is inherent to the lifestyle of people suffering from CKD, its effects on the disease progression are unknown. Moreover, there are few studies evaluating potential alternative treatments that could attenuate some CKD comorbidities. Thus, the aim of this study was to evaluate the outcomes of a chronic treatment with sildenafil in an animal model of CKD subjected to sleep restriction (SR).

**Materials and methods:** The study was performed using 140 male adult Wistar rats distributed into 4 groups: sham treated with vehicle (SHAM + V), sham treated with sildenafil (SHAM + S), CKD treated with vehicle (CKD + V) and CKD treated with sildenafil (CKD + S). After 46 days, all groups were sub distributed in sleep control (SC) and SR. Blood pressure and heart rate was assessed once a week. In the end, we performed the evaluation of the sexual behavior followed by euthanasia and collection of blood.

**Results:** Sildenafil was able to prevent the disease progression, demonstrated by higher levels of serum creatinine in CKD + V + SC compared to SHAM + V + SC and CKD + S + SC groups. Nevertheless, creatinine levels of CKD + S + SR was significantly higher than SHAM + S + SR group. Moreover, sildenafil prevented the development of systemic hypertension, although this was not sustained after SR. Heart rate was only affected by disease and SR, both contributing to tachycardia. Sildenafil treatment also reduced the excessive body weight loss, the iron deficit, the dyslipidemia, the decrease of serum testosterone and LH and the increase of proinflammatory cytokines IL-1 $\alpha$ , TNF $\alpha$  e IL-17. However, many of these effects were attenuated or abolished by SR. Regarding the sexual behavior, CKD + V + SC group had lower sexual activity index than SHAM + V + SC and CKD + S + SC. Overall, SR had a stimulant-like effect on sexual behavior by increasing the sexual motivation and performance in the animals. This effect was also followed by increased corticosterone, progesterone and FSH levels.

**Conclusion:** The early chronic treatment with sildenafil in CKD plays a role as possible adjuvant in the therapy for CKD and its comorbidities. Importantly, its effectiveness demands the maintenance of the sleep quality.

**Acknowledgements:** This work was supported by grants from AFIP, FAPESP, CAPES and CNPq.

<http://dx.doi.org/10.1016/j.sleep.2013.11.347>

### Multicentric, epidemiological study of prevalence of newly diagnosed sleep apnea in patients with nocturnal hypertension (assessed by 24 h blood pressure monitoring)

M. Hobzová<sup>1</sup>, K. Šonka<sup>2</sup>, M. Pretl<sup>3</sup>, M. Plačková<sup>4</sup>, J. Zapletalová<sup>5</sup>, V. Kolek<sup>1</sup>

<sup>1</sup>University Hospital Palacky University, Department of Pneumology, Czech Republic

<sup>2</sup>Charles University, First Faculty of Medicine and General University Hospital, Department of Neurology, Czech Republic

<sup>3</sup>Inspamed, s.r.o., Neurology and Sleep laboratory, Czech Republic

<sup>4</sup>University Hospital Ostrava, Department of Pneumology, Czech Republic

<sup>5</sup>Faculty of Medicine and Dentistry, Palacky University Olomouc, Department of medical Biophysics, Czech Republic

**Introduction:** Sleep apnea syndrome (SAS) is a common sleep-related breathing disorder. Despite the fact that this syndrome is frequently associated with nocturnal and pharmaco-resistant hypertension, the presence of SAS is, in these patients, underdiagnosed. The aim of this study was to assess the percentage of patients with nocturnal hypertension (assessed by 24 h ambulatory blood pressure monitoring—ABPM) and yet non-diagnosed and non-treated with SAS.

**Materials and methods:** 188 patients (125 males) average age 57.8  $\pm$  10.6 with nocturnal hypertension according to ABPM (<120/70 mmHg) was done in 4 sleep centers in the Czech Republic. In addition we have separately evaluated patients with the following parameters: age <70 years and body mass index (BMI) <35—group I ( $n$  = 130, 89 males, average age 56.8  $\pm$  10.4). And group II—patients with Epworth sleepiness scale (ESS) score 39 ( $n$  = 56, 36 males, average age 57.0  $\pm$  9.6). All these patients underwent screening with ApneaLink device (Resmed corp.) and anthropometric and sleep apnea parameters were measured. The data were statistically analysed (using the SPSS Statistics 15 software Chicago, USA).

**Results:** In full sample of 188 patients with nocturnal hypertension, treated arterial hypertension was present in 88.3%. In 72.9% of patients SAS was newly diagnosed and apnea–hypopnea (AHI) index <sup>3</sup> 15 was present in 43.6% of patients. We have not found a statistically significant correlation between AHI and Epworth Sleepiness Scale <9 vs. <sup>3</sup>9 ( $p$  = 0.050). In group I ( $n$  = 130) treated hypertension was present in 86.4% of patients, in 65.4% of patients, SAS was newly diagnosed, AHI <sup>3</sup> 15 was present in 36.9%. In group II ( $n$  = 56) treated hypertension was present in 87.5% of patients, in 82.1% of patients, SAS was newly diagnosed, AHI <sup>3</sup> 15 was present in 58.9%. We have not found a statistically significant correlation (in the full sample, group I, II) between AHI and nocturnal systolic ( $p$  = 0.701;  $p$  = 0.700;  $p$  = 0.688) and diastolic ( $p$  = 0.479;  $p$  = 0.435;  $p$  = 0.059) hypertension.

**Conclusion:** This study has shown a high prevalence of non-diagnosed and non-treated SAS in patients with resistant nocturnal hypertension. It is important to evaluate clinical signs of SAS in patients with nocturnal hypertension and to refer them to a sleep center for further investigation.

**Acknowledgement:** Supported by MH CZ – DRO (FNOI, 00098892).

<http://dx.doi.org/10.1016/j.sleep.2013.11.348>

### Sleep to boost (re-) learning a fine-motor skill

K. Hoedlmoser<sup>1</sup>, M. Petzka<sup>1</sup>, J. Birklbauer<sup>2</sup>, G. Gruber<sup>3</sup>, J. Benjamins<sup>4</sup>, E. Van Someren<sup>5</sup>

<sup>1</sup>University of Salzburg, Laboratory for Sleep and Consciousness Research, Austria

<sup>2</sup>University of Salzburg, Department of Sport Science and Kinesiology, Austria

<sup>3</sup>Medical University of Vienna, Department of Psychiatry, Austria

<sup>4</sup>Netherlands Institute for Neuroscience, Austria

<sup>5</sup>VU University & Medical Center, Austria

**Introduction:** Relearned fine-motor skills, like typing on a mirrored keyboard, are supposed to require suppression of over-practiced

motor skills, like typing on a regular keyboard. Interestingly, performance on the habitual skill often worsens after practicing such an unusual skill. The aim of our study was to investigate whether sleep modifies this interfering effect.

**Materials and methods:** 25 males ( $25.44 \pm 4.56$  years) had to practice touch typing of words with 5 letters length as rapidly and accurately as possible on a regular keyboard and on a mirrored keyboard. The training period for the regular keyboard consisted of four 3 min blocks. This regular typing period was followed by three times four 3 min blocks on the mirrored keyboard. Testing on the regular and mirrored keyboard (each typing condition was tested during two 3 min blocks) occurred after 8 h of diurnal wakefulness (wake group,  $n = 11$ ) or nocturnal sleep (sleep group,  $n = 14$ ). The sleep group spent two nights with polysomnography (baseline and experimental night) in the sleep laboratory. Fine-motor performance was measured by the number of correctly typed letters per 30 s. Sleep was scored visually according to AASM criteria and sleep spindles were detected automatically (The Siesta Group, Vienna, Austria).

**Results:** A  $2 \times 2 \times 2$  ANOVA for repeated measures with the within-subject factors TIME (pre vs. post sleep/wakefulness) and CONDITION (regular vs. mirrored typing) and the between subject factor GROUP (sleep vs. wake) revealed a significant interaction between TIME  $\times$  CONDITION  $\times$  GROUP ( $F_{1,23} = 9.959$ ,  $p = 0.004$ ). Subjects in the sleep group showed a significant decrease in regular typing speed after nocturnal sleep whereas mirrored typing did not change. On the other hand, for subjects in the wake group we found a significant deterioration in mirrored typing but no change in regular typing. Furthermore, we could demonstrate a significant correlation ( $r_{14} = 0.644$ ,  $p = 0.013$ ) between fast (13–15 Hz) sleep spindle number during sleep stage N2 and overnight gains in mirrored typing.

**Conclusion:** Our results indicate an increased retroactive interference during regular keyboard typing after sleep which may occur because of a more effective consolidation of the mirrored keyboard typing skill during sleep in comparison to wakefulness. Additionally, we provide evidence that fast sleep spindle number during N2 promotes unlearning of an overlearned automated motor skill and facilitates learning of a replacement skill.

**Acknowledgement:** This study was funded by the Austrian Science Fund (P25000).

<http://dx.doi.org/10.1016/j.sleep.2013.11.349>

### Comparisons of clinical and polysomnographic findings between narcolepsy without cataplexy and idiopathic hypersomnia

S. Hong, T. Kim, S. Joo, J. Jeong, J. Han

Department of Psychiatry, The Catholic University of Korea, St. Vincents Hospital, Suwon, Republic of Korea

**Introduction:** Narcolepsy and idiopathic hypersomnia are known to show hypersomnia related to central nervous system origin with symptom of excessive daytime sleepiness. But little is known about the differences of clinical characteristics between narcolepsy without cataplexy and idiopathic hypersomnia. The aim of this study is to compare the clinical, polysomnographic and multiple sleep latency test characteristics of narcolepsy without cataplexy and idiopathic hypersomnia.

**Materials and methods:** Seventy-nine narcolepsy with cataplexy patients and Seventy-one idiopathic hypersomnia patients were recruited at Sleep Center of St. Vincent's hospital. The demographic, clinical data, the multiple sleep latency test data and polysomnographic findings from the time of their diagnosis were reviewed.

**Results:** Results indicated that Epworth sleepiness scale score and nocturnal sleep disturbance were not significantly different between two groups. 25.0% of narcolepsy without cataplexy patients showed hypnagogic hallucinations positive, while 35.0% of idiopathic hypersomnia patients were hypnagogic hallucinations positive with no statistical differences. 33.3% of narcolepsy without cataplexy patients reported sleep paralysis, while 28.8% of idiopathic hypersomnia patients experienced sleep paralysis. Results showed no significant differences between two groups in onset age of hallucinations or onset age of sleep paralysis. Mean sleep latency was shorter in narcolepsy without cataplexy, and the number of SOREMPs were lower in idiopathic hypersomnia. The sleep efficiency was significantly greater in narcolepsy without cataplexy patients. The REM latency was shorter in narcolepsy without cataplexy patients. The percentage of REM sleep was significantly greater in narcolepsy without cataplexy patients.

**Conclusion:** The narcolepsy without cataplexy and idiopathic hypersomnia showed no significant differences in clinical characteristics although they have significant differences in objective findings such as mean sleep latency, REM latency, and percentage of REM sleep.

**Acknowledgements:** No conflicts of interest.

<http://dx.doi.org/10.1016/j.sleep.2013.11.350>

### CPAP acceptance and compliance in sleep apnea patients in Oman

M. Al Hooti, D. Jaju, M. Abri

Sultan Qaboos University Hospital, Oman

**Introduction:** Obstructive sleep apnea (OSA) is a common sleep disorder affecting an average of 4% of men and 2% of women. Continuous positive airway pressure (CPAP) is the standard treatment for patients with OSA. CPAP compliance and acceptance are major problems among OSA patients and that requires a regular follow up and monitoring. This study is aimed to evaluate CPAP usage and compliance in our local population.

**Materials and methods:** Patients recommended for CPAP treatment following overnight polysomnography (PSG) at Sultan Qaboos University Hospital during the period 2008 to 2011 were reviewed. The data were collected from patients' medical records, Polysomnography reports and by contacting them by telephone call. Comparative statistics were done between years 2008–2009 and 2010–2011.

**Results:** Total PSGs done between years 2008–2011 were  $N = 779$  and CPAP was recommended for 429 (55%) patients. Only 229/429 patients could be contacted. 89 patients regularly using CPAP (39%) and out of these; 50 patients had bought CPAP and 39 received CPAP through a donation service. 47 patients were using CPAP (19%) with patients who bought their own CPAP. 24 (10%) patients received donated machines. The study also showed that 49 (20%) patients refused to use CPAP, 60 (24%) patients could not purchase CPAP (for financial reasons). Comparison was performed between 2008, 2009, and 2010, 2011 it showed significant improvements (33.33%) in patients who bought their own CPAP. (30.43%) and patients who received donated machines.

**Conclusion:** This study revealed that CPAP usage and acceptance has improved over the last two years in Omani sleep apnea patients.

**Acknowledgement:** Deepali Jaju, Mohammed Al-Abri.

<http://dx.doi.org/10.1016/j.sleep.2013.11.351>

### Hypothalamo–pituitary–adrenal axis, glucose metabolism and TNF- $\alpha$ in narcolepsy

E. Maurovich-Horvat<sup>1,2,3</sup>, M. Keckeis<sup>2,3</sup>, Z. Lattová<sup>2,3</sup>, D. Kemlink<sup>1</sup>, T.C. Wetter<sup>3,4</sup>, A. Schuld<sup>2</sup>, K. Šonka<sup>1</sup>, T. Pollmächer<sup>2,3</sup>

<sup>1</sup>Department of Neurology and Center of Clinical Neuroscience, First Faculty of Medicine, Charles University in Prague and General University Hospital in Prague, Prague, Czech Republic

<sup>2</sup>Centre of Mental Health, Klinikum Ingolstadt, Ingolstadt, Germany

<sup>3</sup>Max Planck Institute of Psychiatry, Munich, Germany

<sup>4</sup>Present address: Department of Psychiatry and Psychotherapy, University of Regensburg, Regensburg, Germany

**Introduction:** Narcolepsy with cataplexy is caused by a deficiency in the production of hypocretin, which regulates sleep and wakefulness and also influences appetite, neuroendocrine functions and metabolism.

**Materials and methods:** In this case-control study 11 patients with narcolepsy and cataplexy and 11 healthy adults underwent an oral glucose tolerance test and dexamethason-inhibition cortisol releasing hormone stimulation test.

**Results:** The average age of patients and controls was  $35.1 \pm 13.2$  and  $41.0 \pm 2.9$  years, respectively, the body mass index (BMI)  $28.1 \pm 6.6$  and  $25.5 \pm 4.7$ . We did not find evidence of a significantly increased prevalence of disturbed glucose tolerance in narcolepsy patients. After hypothalamo-pituitary–adrenal axis suppression, the number of non-suppressors did not differ between the groups, indicating normal negative feedback sensitivity. The level of cortisol after dexamethason suppression was significantly lower in narcoleptic patients suggesting a slight basal down-regulation and/or a slightly increased negative feedback sensitivity of the major endocrine stress system in narcolepsy. Following CRH stimulation, there were no significant differences in levels of ACTH or cortisol, and in adrenocortical responsivity to ACTH. Finally, narcoleptic patients displayed significantly higher plasma levels of TNF- $\alpha$ , solubleTNFR p55, soluble TNFR p75 and IL-6 after adjustment for BMI.

**Conclusion:** The present study confirms that narcolepsy by itself is not associated with disturbances of glucose metabolism, but goes along with a subtle dysregulation of inflammatory cytokine production. We also found that dynamic HPA system response is not altered, whereas negative feedback to dexamethasone might be slightly enhanced.

**Acknowledgement:** This study was supported by the grant of the Czech Ministry of Health NT 13238-4/2012, PRVOUK-P26/LF1/4 and by the European Union Framework 6 (MCRN-CT-2004-512362).

<http://dx.doi.org/10.1016/j.sleep.2013.11.352>

### A novel technique to detect cardiac function by analyzing air-flow to fingertip-oxygen lag time on polysomnography in patients with sleep disordered breathing and heart failure

K. Hosokawa<sup>a</sup>, S. Ando<sup>b</sup>, T. Tohyama<sup>a</sup>, H. Otsubo<sup>a</sup>, R. Nakamura<sup>a</sup>, T. Kadokami<sup>a</sup>

<sup>a</sup>Cardiovascular Medicine, Saiseikai Futsukaichi Hospital, Japan

<sup>b</sup>Sleep Apnea Center, Kyushu University Hospital, Japan

**Introduction:** Patients with sleep disordered breathing (SDB) are 2.4 times higher predisposed to heart failure (HF) (Wang, 2007) and the prevalence of comorbid SDB rises by 76% in patients with HF (Oldenburg, 2007). Although polysomnography (PSG) is a potent tool for testing SDB, it has no power for screening HF. If it can estimate cardiac function out of PSG datasets, it would become more attractive tool for a physician treating patients with both SDB and HF. Circulation time, which indicates how long blood takes to travel

a certain amount of distance in the vasculature, is one of the most important indices for estimating severity of cardiac dysfunction. In a patient with SDB, repetitive swings in SpO<sub>2</sub> following apneic event occur with a somewhat fixed lag time (LT). This LT from air flow to finger-tip SpO<sub>2</sub> is supposed to reflect circulation time. The aim of this study is to develop an algorithm that can detect such a LT and verify whether the LT correlates to cardiac function.

**Materials and methods:** We analyzed PSG data obtained from HF patients with central sleep apnea (CSA) ( $n = 32$ ) and obstructive sleep apnea (OSA) ( $n = 23$ ) who underwent also echocardiography in our hospital. The COMPUMEDICS E-series (COMPUMEDICS Co Ltd) was used for sleep examination. SpO<sub>2</sub> sensor was attached to the left finger-tip. In signal processing, we full-rectified the airflow signals and applied low-pass filter with 0.5 Hz cutoff frequency to the airflow and SpO<sub>2</sub> signals. These data were analyzed using cross-correlation algorithm and LT was determined. We examined correlation between LT and left ventricular ejection fraction (LVEF). Data processing and statistical analysis were performed with MATLAB 2007a (MathWorks Inc) and Excel 2010 (Microsoft Corp), respectively.

**Results:** Patients background were age;  $64.2 \pm 14.3$  year-old, apnea hypopnea index;  $46.2 \pm 30.1$ /h, LVEF;  $55.9 \pm 19.0\%$ . With the cross-correlation algorithm, LT was robustly detected at every apnea/hypopnea events. As compared with OSA to CSA, significant difference in LVEF and LT were found (OSA vs. CSA, LVEF;  $66.8 \pm 7.6\%$  vs.  $48.1 \pm 20.7\%$ ,  $p = 0.0001$ , LT;  $28.6 \pm 3.8$  s vs.  $36.4 \pm 7.4$  s,  $p < 0.0001$ ). Overall scatter plots shows significant linear correlation between LT and LVEF (LVEF =  $3.2 * (50.3 - LT)$ ,  $R^2 = 0.64$ ,  $p < 0.0001$ ).

**Conclusion:** Our novel analysis algorithm using data of usual PSG can be a simple and useful tool for screening HF and estimating cardiac function.

**Acknowledgement:** We thank Tanaka Y, Tanaka K for data acquisition.

<http://dx.doi.org/10.1016/j.sleep.2013.11.353>

### Subjective sleepiness is not required to adhere to cpap therapy

K. Hosokawa<sup>a</sup>, R. Sariola<sup>a</sup>, H. Huhtala<sup>b</sup>, O. Polo<sup>c</sup>

<sup>a</sup>University of Tampere School of Medicine, Department of Pulmonary Diseases, Finland

<sup>b</sup>University of Tampere School of Health Science, Finland

<sup>c</sup>Tampere University Hospital, Department of Pulmonary Diseases, Finland

**Introduction:** Randomized controlled studies have proved the efficacy of CPAP therapy in patients with obstructive sleep apnea syndrome (OSAS) with subjective sleepiness (ESS higher than 10). However, half of the patients with OSAS do not suffer from excessive sleepiness (Lavie 2007) and they may be less motivated to adherence to CPAP therapy.

**Materials and methods:** We enrolled 1493 patients (71% males) who were diagnosed with obstructive sleep apnea and started with CPAP therapy at Tampere University Hospital Sleep Clinic. Median AHI was 20.7/h in bed and median ESS 9.0/24. ESS was controlled after 3 and 12-month visits.

**Results:** At 12-month follow-up, CPAP was still being used by 939 subjects (63%), while 554 subjects had discontinued CPAP. 65.6 % of those with initial excessive sleepiness (ESS > 10) and 61.0% of those without sleepiness (ESS < 11) at the time of diagnosis remained adherent to CPAP at 12-month follow-up. In a multivariate analysis, adherence to CPAP at 12 month follow-up was predicted by AHI, BMI and improvement of sleepiness at 3-month follow-up visit.

**Conclusion:** About two thirds of patients with OSAS, irrespective of whether they feel sleepy or not, adhere to CPAP. Placebo-response is unlikely to motivate patients with OSAS to become regular CPAP

users. The benefits may include better sleep quality and/or less impact of obesity of other co-morbidities. How to measure the benefits of long-term CPAP therapy in patients with OSAS but without sleepiness remains a challenge for randomized controlled studies.

**Acknowledgement:** The team would like to thank the staff at Tampere University Hospital Sleep Clinic.

<http://dx.doi.org/10.1016/j.sleep.2013.11.354>

### Sleep apnea and/or ohs in morbid obesity: analysis of gender differences

M. Hoyo, E. Lopez, M. Ibañez  
Hospital Lluís Alcanyis, Xàtiva, Spain

**Introduction:** The aim of this study is to analyze differences in morphology and severity of OSA and obesity hypoventilation Syndrome in morbidly obese patients in our area health.

**Materials and methods:** Sample: All consecutive patients of our Area (period 2004–2013) diagnosed with OSA and / or obesity-hypoventilation syndrome by polysomnography, with a BMI  $\geq 40$  kg/m<sup>2</sup>. 243 patients: 136 men (56%) and 107 women (44%). Description of the sample mean: Age: 54.5 years (24–80). BMI: 44.3 kg/m<sup>2</sup> (40–66.5). Circumference of neck: 46.9 (36.5–61). Epworth: 11.6 (1–24). AHI 68.4 (3–25). SO<sub>2</sub> min: 79.3%  $\pm 20.1$ . % SO<sub>2</sub> <90%: 42.4  $\pm 30.1$ . ETCO<sub>2</sub>: 54  $\pm 6.8$  mmHg. % SO<sub>2</sub> > 50 mmHg: 17.7%  $\pm 22.7$ . Treatment was applied to 203 patients with CPAP (mean pressure: 11.3 (6–19) and 24 patients with BiPAP (9 men and 15 women), 15.8 mB inspiratory P (20–12) and expiratory P 9 8 mbar (13–7). Statistical method: two-sample t.

**Results:** The subjective sleepiness (Epworth) has not been different between the sexes. However, differences were found between sexes markedly with respect to patient age, with older women in the sample: 51.0 m/59.3 years w ( $p < 0.0001$ ), with a higher BMI: 43.0 kg/m<sup>2</sup>m/45.9 kg/m<sup>2</sup> m ( $p < 0.0001$ ) and yet despite the obesity increased neck circumference was significantly lower women: 49.5 cm m/43.5 cm w. The AHI has been higher in males 78.5  $\pm 31.1$  m/54.7  $\pm 36.4$  w ( $p < 0.0001$ ). Regarding blood gas values showed no differences regarding the value of the SO<sub>2</sub> or ETCO<sub>2</sub>. The women have required significantly lower CPAP pressure to control obstruction: 11.7  $\pm 2.0$  mBar m/10.7  $\pm 2.2$  mBar w ( $p < 0.001$ ).

**Conclusion:** Morbidly obese patients affects of OSAS and/or SOH of our health area differ by gender in terms of greater severity of OSA in men, and need higher CPAP pressure to overcome the obstruction, although women have presented a higher BMI. The lower neck circumference thereof, seems to be related to the different distribution of body fat female, less tending to fat accumulation in the cervical than men.

**Acknowledgements:** Thanks to colleagues in the work area of sleep disorders.

<http://dx.doi.org/10.1016/j.sleep.2013.11.355>

### Sleep alterations in the interleukin-1 type 1 receptor knockout mice

T. Huang  
National Taiwan University, Taiwan

**Introduction:** Interleukin-1 enhances non-rapid eye movement sleep (NREMS) and is associated with many sleep disorders. Previous studies usually determined the role of interleukin-1 by pharmacological strategy; in this study we evaluated the influence of interleu-

kin-1 by a mouse model of knockout of interleukin-1 type 1 receptors.

**Materials and methods:** We recorded the electroencephalograms (EEGs) to determine the difference of sleep paterms between interleukin-1 type 1 receptor homozygous knockout mice (IL-1 R1  $-/-$ ) and wild-type mice.

**Results:** NREMS and rapid eye movement sleep (REMS) showed significant decreases during the 12-h light period in IL-1 R1  $-/-$  mice ( $n = 6$ ) comparing to those of wild-type mice ( $n = 8$ ). The amount of NREMS was reduced from 46.70 $\pm$ 1.64% obtained from wild type mice to 41.36 $\pm$ 1.85% acquired from IL-1R1  $-/-$  mice (one-way ANOVA,  $p < 0.05$ ); REMS was also suppressed from 15.56 $\pm$ 0.89% to 11.55 $\pm$ 0.94% (one-way ANOVA,  $p < 0.05$ ). There was no significant sleep alteration between IL-1 R1  $-/-$  mice and wild type mice during the dark period.

**Conclusion:** Lack of endogenous interleukin-1 effect in IL-1 R1  $-/-$  mice resulted in reducing NREMS, accompanying the suppression of REMS. Influences of interleukin-1 in dark period was unremarkable; therefore, no significant sleep alteration in the dark period was found. This result further confirmed that interleukin-1 is a somnogenic factor.

**Acknowledgements:** This study is supported by National Science Council grant (NSC 101-2321- B-002-065).

<http://dx.doi.org/10.1016/j.sleep.2013.11.356>

### The effect of continuous positive airway pressure (CPAP) treatment on the neurocognitive function of patients with obstructive sleep apnea

R. Ignacio-Alcantara, R. Espiritu-Picar, L. Ledesma  
Makati Medical Center, Philippines

**Introduction:** Obstructive Sleep Apnea (OSA) affects up to 5% of the population in Western countries but as many as 80% of cases remain undiagnosed (1). OSA is characterized by repeated cessation of breathing during sleep and is recognized as a significant public health problem which imposes substantial neurocognitive morbidities (2). Several studies in patients with OSA demonstrated the presence of cognitive deficits concerning memory, attention, executive functions, motor abilities (3), concentration, verbal and visuospatial memory, constructional abilities, and psychomotor functioning (4). The negative effect of the cognitive dysfunction greatly affects the quality of life of these patients. There is growing evidence that intermittent hypoxia is more damaging than the sustained condition. OSA patients experience this intermittent hypoxia while sleeping, during periods of apnea-hypopnea. To address this problem, the gold standard treatment for OSA is continuous positive airway pressure (CPAP). It is said that CPAP reduces hypoxia, normalizes blood-oxygen saturation and reduces sleep fragmentation thereby improving a majority of the effects of OSA including the neurocognitive domain (4). This study aimed to determine the neurocognitive function of patients with Obstructive Sleep Apnea (OSA) and assess the effectiveness of two weeks Continuous Positive Airway Pressure (CPAP) treatment in patients with OSA in a tertiary hospital from January 1, 2012 to June 30, 2012 as measured by improvement in results in the Montreal Cognitive Assessment (MoCA) test and the Rey-Osterrieth Complex Figure Test.

**Materials and methods:** This study employed a quasi-experimental study design. Fifteen patients (15) who presented with symptoms suggestive of OSA and confirmed by polysomnography were included in the study. The patients' demography as well as the OSA severity, number of hours of CPAP use, Epworth Sleepiness Scale score and other co morbid conditions were assessed using a data

sheet. The Montreal Cognitive Assessment Test was used to evaluate the following cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. To assess visuospatial processing, memory and certain executive functions, which are based on the incidental-learning paradigm, the Rey–Osterrieth Complex Figure Test was used.

**Results:** Only nine subjects had information on the ESS, MoCA and CFT scores both at the initial and follow up periods. Of these, seven patients who were able to use CPAP served as the treatment group, while the other two served as the control group. All patients who used CPAP had a notable increase in MoCA scores, from a median score of 24–30. Those who did not use CPAP had no notable change in MoCA score ( $p = 0.037$ ). Changes in score in both the copy and recall portions of the CFT was statistically significant ( $p = 0.037$ ).

**Conclusion:** This study conducted in our setting demonstrated that patients with OSA have impairment in different domains of cognitive function. This includes attention, concentration, executive function, visuoconstructional skills, conceptual thinking, language and memory. This study also proved that CPAP improves these cognitive impairments as shown in the improvement of scores in both the MoCA and CFT.

**Acknowledgements:** Neurophysiology and Sleep Disorders Laboratory, Makati Medical Center Department of Neurosciences, Section of Neurology, Makati Medical Center.

<http://dx.doi.org/10.1016/j.sleep.2013.11.357>

### Cognitive and behavioral after adenotonsillectomy in apnea syndrome obstructive sleep childhood

E. Esteller<sup>1</sup>, F. Segarra<sup>2</sup>, M. Barceló<sup>3</sup>, M. Girabent<sup>4</sup>, N. Roure<sup>5</sup>, E. Estivill<sup>5</sup>

<sup>1</sup> Department of Otolaryngology Hospital General de Catalunya, Sociedad Española del Sueño, Spain

<sup>2</sup> Clínica del son Estivill, Hospital Universitario Quirón Dexeus and Unidad del Sueño del Hospital Gen, Sociedad Española de Sueño, Spain

<sup>3</sup> Child Psychologist, Spain

<sup>4</sup> Department of Biostatistics, International University of Catalonia, Spain

<sup>5</sup> Clínica del son Estivill, Hospital Universitario Quirón Dexeus, Sociedad Española del Sueño, Spain

**Introduction:** Adenotonsillectomy is an effective treatment for paediatric obstructive sleep apnea. Your ability to resolve the cognitive and behavioral problems arising is not so clear. Objective: To analyze the evolution of these alterations to a year after surgery.

**Materials and methods:** We studied behavioral and cognitive abnormalities of 45 children with OSA and 30 healthy controls, between 3 and 13 years. Both groups are analyzed using psychological tests, at baseline and one year.

**Results:** Preoperatively, all cognitive and behavioral variables were more affected in the study group than in the control. Attention in 46.7% of cases in the study group and 20% in the control group ( $p = 0.016$ ), anxiety 60.9% and 40.9% (not significant); Memory 55.6% and 36.7% ( $p = 0.019$ ); spatial structuring 64.4% and 36.7% ( $p = 0.017$ ); Hyperactivity 42.9% and 12.5% ( $p = 0.016$ ) and Attention Deficit 46.4% and 8.3% ( $p = 0.003$ ). After one year the study group remains the more affected in all the study variables, although significant differences remain only in spatial structure (31.3% versus 3.3%,  $p = 0.017$ ) and Attention Deficit (40.5% versus 16.7%,  $p = 0.031$ ). The percentages of patients who improved at one year are not significantly different in both groups.

**Conclusion:** The cognitive and behavioral disorders of children with sleep apnea are partially resolved with adenotonsillectomy.

The improvements obtained in the variables did not differ significantly in the normal evolution of the children and are independent of the resolution of respiratory disorders.

<http://dx.doi.org/10.1016/j.sleep.2013.11.358>

### Correlation between clinical and polysomnography respiratory disorders in children sleep

E. Esteller<sup>1</sup>, F. Segarra<sup>2</sup>, M. Girabent<sup>3</sup>, J. Albares<sup>4</sup>, N. Roure<sup>4</sup>, E. Estivill<sup>4</sup>

<sup>1</sup> Department of Otolaryngology of Hospital General de Catalunya and Universitat Internacional de Catal, Sociedad Española del Sueño, Spain

<sup>2</sup> Clínica del son Estivill, Hospital Universitario Quirón Dexeus and Unidad del sueño del Hospital Gene, Sociedad Española del Sueño, Spain

<sup>3</sup> Department of Biostatistics, International University of Catalonia, Spain

<sup>4</sup> Clínica del son Estivill, Hospital Universitario Quirón Dexeus, Sociedad Española del Sueño, Spain

**Introduction:** Although polysomnography is the diagnostic test for excellence in sleep-disordered breathing in children, there is controversy about its indication in all cases. Among the arguments, both for and against, is the lack of correlation between objective values and symptomatology. Objective: To evaluate the correlation between clinical and apnea hypopnea index in our work environment.

**Materials and methods:** We compared statistically the preoperative clinic and apnea hypopnea index of 170 children with sleep-disordered breathing undergoing polysomnography. We also evaluated the correlation to postoperative level, with a subgroup of 80 children undergoing adenotonsillectomy with one year follow-up polysomnography.

**Results:** At preoperative level only the degree of tonsillar hypertrophy showed significant correlation with apnea-hypopnea index. The postoperative evidence for change in apnea-hypopnea index: 38.1% of children improve and for children with parents in the group with persistent polysomnography 66.7% showed disease resolution ( $p = 0.023$ ). It also showed a post-operative snoring improvement, assessed by visual analog scale. The average VAS score dropped 5 points in the persistent group and 6.1 in the group with resolution of the disease ( $p = 0.047$ ).

**Conclusion:** Despite the limited correlation between clinical and polysomnography, especially in the preoperative condition, the data ultimately documented subjective-objective correlation. Efforts should be made to obtain objective parameters that provide a higher level of correlation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.359>

### Diagnosing restless legs syndrome: the patient experience

J. Jaarsma, S. Sevborn

EARLS – European Alliance for Restless Legs Syndrome, The Netherlands

**Introduction:** In order to determine the total time between onset of symptoms and getting the diagnosis RLS, members of RLS patient organizations in Europe and North America were asked to supply this information.

**Materials and methods:** A detailed questionnaire was sent to 11,731 members of RLS Patient organizations in Austria, Belgium, Finland, France, Great Britain, Italy, Norway, Spain, Sweden, The Netherlands, Canada and the USA. 4278 questionnaires were returned, of which 4107 (35.0%) could be analyzed. Questions were

asked on age, gender, heredity, affected body parts, symptom severity, sick leave, disablement, diagnosis, current and previous RLS treatment, co-morbidity treatment and sleep disorders. With regard to diagnosis, patients were asked to indicate when their symptoms began, how many years it took before they were diagnosed with RLS, and how many doctors they visited before the diagnosis was made.

**Results:** The majority of RLS respondents (75%) were between 60 and 89 years old (average 69.7, SD 12, range 12–102). Female:male ratio was 68:32. 47% reported a family history of RLS: 1st degree parents 36% and children 22% with RLS. 52% of the respondents visited more than 1 doctor before they were diagnosed with RLS. The average number of visits before diagnosis was 2.4, range 1–50, SD 2.8 (note: maximum of 50 visits for one respondent) Years from first symptom to diagnosis: average 15.6, SD 15.7, range 0–73 (69% of the respondents had to wait more than two years for a correct diagnosis.)

**Conclusion:** The authors conclude that physicians should be better educated about RLS in order to significantly decrease the many unnecessary consultations, misdiagnoses and long-term untreated suffering. If this were to be achieved, the total saving on health care cost would be 1.1 visits less per RLS patient. Extrapolated to 3% of the general population, this would result in a significant reduction in social costs and work time lost.

**Acknowledgements:** The authors wish to acknowledge the dedication of the thousands of RLS patients worldwide who helped complete this questionnaire and provided us with detailed and accurate information not hitherto known.

<http://dx.doi.org/10.1016/j.sleep.2013.11.360>

### **Sick leave and absence from work due to restless legs syndrome**

J. Jaarsma, S. Sevborn

EARLS – European Alliance for Restless Legs Syndrome, The Netherlands

**Introduction:** In order to assess the impact of RLS on their working life, members of RLS patient organizations were asked to provide information on the total time they had to spend at home due to their RLS symptoms – RLS only, no other illness.

**Materials and methods:** A detailed questionnaire was sent to 11,731 members of RLS patient organizations in Austria, Belgium, Finland, France, Great Britain, Italy, Norway, Spain, Sweden, The Netherlands, Canada and the USA. 4278 questionnaires were returned, of which 4107 (35.0%) could be analyzed. Questions were asked on a variety of topics, among which sick leave and disability benefit.

**Results:** Sick leave 165 respondents (4.0%) are/have been on sick leave due to RLS. Symptoms in sick leave respondents compared to 3942 respondents not on sick leave are more severe (range 0–40). Average without treatment 24.58 (21.27), SD 9.08 (8.75),  $p$  0.000022. Average with treatment 12.96 (9.70), SD 8.50 (7.00),  $p$  0.000028. Time from onset to diagnosis was shorter for sick leave respondents. Average 13.16 (15.61) years (SD 13.07 (15.74)  $p$  0.0232). Treatment of sick leave respondents is not optimal. Dopamine agonists were given in only 68.5% (72.3%) of cases, antiepileptics in 16.4% (13.9%). Sick leave respondents showed a higher use of antidepressants: 23.0% (17.5%),  $p$  0.00017. Disability insurance benefit – DIB 75 (1.8%) of all respondents receive DIB due to RLS. Symptoms in DIB respondents compared to 4032 respondents not on DIB are more severe (range 0–40). Average without treatment 25.90 (21.31), SD 9.39 (8.76),  $p$  0.00018. Average with treatment 13.29 (9.77), SD 9.14 (7.05),  $p$  0.0046. Time from onset to diagnosis was longer for DIB respondents: average 16.53 (15.49), SD 16.01 (15.64),  $p$  0.592. Treatment of DIB respondents is not optimal: Dopamine agonists were given in 70.7% (72.2%) of cases, antiepileptics in 16.0% (13.9%). DIB respondents showed a lower use of antidepressants: 9.3% (17.9%),  $p$  0.00008. Despite treatment an overall 2–4% of patients report sick or are on disability benefits because of RLS.

**Conclusion:** The authors conclude that correct and early diagnosis and optimal medical treatment may lead to decreased sick leave as well as disability insurance benefits in severe RLS and thus reduce health care expenditure and increase quality of life for these patients.

**Acknowledgements:** The authors wish to acknowledge the dedication of the thousands of RLS patients worldwide who helped complete this questionnaire and provided us with detailed and accurate information not hitherto known.

<http://dx.doi.org/10.1016/j.sleep.2013.11.361>

### **Dosing patterns of dopamine agonists for restless legs**

J. Jaarsma, S. Sevborn

EARLS – European Alliance for Restless Legs Syndrome, The Netherlands

**Introduction:** In order to find out the total consumption of medicines by RLS patients, members of RLS patient organizations in Europe and North America were asked to supply this information.

**Materials and methods:** A detailed questionnaire was sent to 11,731 members of RLS Patient organizations in Austria, Belgium, Finland, France, Great Britain, Italy, Norway, Spain, Sweden, The Netherlands, Canada and the USA. 4278 questionnaires were returned, of which 4107 (35.0%) could be analyzed. Questions were asked on a variety of topics, including the total daily of the various medicines used.

**Results:** 73% of pramipexole doses and 80% of ropinirole doses reported were in line with internationally approved doses, ( $\leq 0.75$  mg/day for pramipexole, and  $\leq 4.0$  mg/day for ropinirole. Respondents in the USA tend to take significantly ( $p < 0.01$ ) higher total daily doses of the dopamine agonists than do respondents in Europe; mean pramipexole, Europe 0.53 mg, USA 1.05 mg, Ropinirole, Europe 3.06 mg, USA 3.97 mg. There is no difference in respondent satisfaction with treatment in relation to dose.

**Conclusion:** In view of the most recent scientific data on the intake of the dopamine agonists and the current opinion on optimal dosages of these medicines, the study indicates that both medicines are used in abundance, leading to significant over consumption, a much higher risk of augmentation and other side effects, lesser quality of life for these patients, as well as overspending of the healthcare costs worldwide.

**Acknowledgements:** The authors wish to acknowledge the dedication of the thousands of RLS patients worldwide who helped complete this questionnaire and provided us with detailed and accurate information not hitherto known.

<http://dx.doi.org/10.1016/j.sleep.2013.11.362>

### **Sleep quality and associated factors in residents of a major teaching hospital in Iran**

S. Jafarpour<sup>1</sup>, K. Sadeghniaat-Haghighi<sup>2</sup>

<sup>1</sup>Occupational Sleep Research Center, Tehran University of Medical Sciences, Iran

<sup>2</sup>Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, Iran

**Introduction:** Residency is a challenging part of medical training among different specialties. Long work hours and shift work and

the consequent sleep deprivation have several adverse effects on patient care and residents themselves. The aim of this study was to determine sleep quality of residents in a major teaching hospital in Iran and investigate the key factors contributing to poor sleep quality.

**Materials and methods:** 250 residents from different surgical and medical specialties were enrolled in the study. Demographic questionnaire along with the Persian version of Pittsburgh Sleep Quality Index (PSQI) were administered to the subjects.

**Results:** Mean Global PSQI score was  $6.06 \pm 2.68$ , which is higher than the mean score of general urban adult population of Tehran (5.06, CI: 4.9–5.1). 55.8% of residents had a global PSQI score greater than 5. We tested a model predicting global PSQI score using age, age of the youngest child, academic level, number of overnight duties, average daytime duty extent, total time of extra shifts and specialty as predictive factors. Number of overnight duties was the only significant predictor of PSQI score in this model ( $R^2 = 0.890$ ,  $df = 7$ ,  $F = 5.78$ ,  $p$ -value = 0.036).

**Conclusion:** A great percentage of residents had poor sleep quality. Number of overnight duties was the key factor contributing to poor sleep quality. Our findings support the need for duty hour reform in residency programs in Iran.

**Acknowledgement:** This project was funded in part by Tehran University of Medical Sciences.

<http://dx.doi.org/10.1016/j.sleep.2013.11.363>

### Introducing insomnia meditation therapy: a novel behavioural intervention for insomnia

S. Jain<sup>1</sup>, G. Shapiro<sup>2</sup>

<sup>1</sup>Sleep and Alertness Clinic, Canada

<sup>2</sup>Sleep Research Laboratory, Canada

**Introduction:** Insomnia is a common condition, which is often trivialized by treating physicians. Primary Insomnia is widely viewed as a disorder of underlying inappropriate hyper-arousal interfering with sleep. Pharmaceutical treatments are effective during their duration of use but one needs to be cautious with potential adverse effects. Behavioral interventions maintain their efficacy long after the treatment period but their use is limited for a variety of reasons including the significant time involvement. There has been growing interest in alternative and complementary therapies with much of their appeal in their ability to be used in conjunction with or instead of conventional pharmaceutical therapies. Insomnia Meditation Therapy was developed during a Sleep Medicine fellowship at the University of Toronto as an easy to learn, brief behavioral intervention. Learning Objectives: (1) Review current evidence for underlying hyperarousal as it relates to Insomnia; (2) Become familiar with a novel meditation intervention specifically targeting hyperarousal; and (3) Review promising preliminary clinical results and ongoing future research.

**Materials and methods:** Thirty-four participants had three instructional sessions of meditation in a group format over the course of a month during 2011–2012. Each session lasted 45 min and incrementally taught breathing exercises, a technique of meditative imagery (MI) and a Non-Judgmental Awareness (NJA) meditation. Participants were asked to practice once during the day and immediately prior to bedtime for 20–30 min each time. The impact of IMT was assessed by validated questionnaires, AIS and PSQI. In addition the seven components of the PSQI were independently evaluated to determine which aspect of sleep quality improved.

**Results:** The results showed that 65% ( $N = 22$ ) participants' improved as assessed by scores on both the AIS and PSQI. Specifically

the mean AIS score of these 22 participants improved from 12.9 to 7.9 ( $SD = 3.6$ ) at 3–4 weeks post introduction of IMT. Furthermore an analysis of the PSQI components revealed participant improvement as follows: 45.5% on daytime dysfunction, 44% on sleep efficiency, 39% on sleep latency, 38% on sleep quality, 34% on sleep duration, 21% on decreased medication use. Thus a substantial number of participants improved, and the improvements were substantial and critical. Not only did 65% of participants improve, on average they improved to a point of clinical significance ( $AIS < 10$ ). Sleep quality improved (latency, efficiency and daytime dysfunction) and there was a trend towards decreased medication use. The implications of these observations are far reaching indeed if confirmed in future research.

**Conclusion:** Compared to the other major meditation therapy developed to date (MBT-I), IMT is easier to teach and learn, less time invasive and less demanding for the practitioner and professional, produces a palpable reaction during the first session and has demonstrated improved nocturnal sleep and daytime function at 3–4 weeks post introduction. It can be considered the ultimate wind down routine prior to bedtime and be used in conjunction with other behavior and pharmaceutical treatments.

**Acknowledgements:** The mentorship and opportunity offered by Drs. Colin Shapiro and Henry Moller, Sleep Research Laboratory and Sleep and Alertness Clinic, Toronto, Ontario, Canada.

<http://dx.doi.org/10.1016/j.sleep.2013.11.364>

### Pre-sleep arousal, unhelpful beliefs and maladaptive sleep behaviors as mediators in cognitive behavior therapy for insomnia

R. Sunnhed, M. Jansson-Fröjmark

Department of Psychology, Stockholm University, Sweden

**Introduction:** The purpose with the investigation was to examine whether improvements in pre-sleep arousal, unhelpful beliefs about sleep, and maladaptive sleep behaviors mediate the outcomes in in-person CBT-I.

**Materials and methods:** Thirty participants with chronic insomnia previously involved in a randomized controlled trial testing cognitive behavioral therapy versus a waitlist participated. At pretreatment and post-treatment, participants completed questionnaires and sleep diaries assessing pre-sleep arousal, unhelpful beliefs about sleep, maladaptive sleep behaviors, insomnia severity, dysfunction, anxiety, depression, and subjective sleep parameters. Outcome measures were re-administered at a 3-month follow-up.

**Results:** The results indicated that decreases in pre-sleep cognitive arousal mediated the effect on dysfunction, and that decreases in pre-sleep somatic arousal had a mediating effect on sleep quality. Reductions in unhelpful beliefs mediated the treatment effect on insomnia severity, dysfunction, and depression. Decreases in bedtime variability mediated the outcome on insomnia severity, and reductions in time in bed had a mediating effect on total wake time and sleep quality. Noteworthy is also that improvements in the outcomes could be attributed to reductions in the mediators (50–70% of the variance). Neither rise time variability nor napping mediated the improvements.

**Conclusion:** These findings are clearly supportive of cognitive-behavioral models of insomnia by highlighting pre-sleep arousal, unhelpful beliefs about sleep, and maladaptive sleep behaviors as mediators in the treatment of insomnia. The results are also important for clinical work and for testing new approaches in future research.

**Acknowledgements:** We would like to express our appreciation to Sparbankstiftelsen Nya for funding and to the two audiology clinics in Örebro and Karlstad for recruitment.

<http://dx.doi.org/10.1016/j.sleep.2013.11.365>

### **Behavior therapy singly and combined with constructive worry for insomnia: Cognitive and behavioral processes as mediators**

R. Sunnhed, M. Jansson-Fröjmark

Department of Psychology, Stockholm University, Sweden

**Introduction:** The purpose with the investigation was to examine whether improvements in insomnia-related worry and time in bed mediate the outcomes in in-person CBT-I.

**Materials and methods:** A randomized, controlled design was used, including a two-week baseline, a four-week intervention phase [sleep restriction and stimulus control (BT) or sleep restriction and stimulus control plus constructive worry (BT + CW)], and a two-week follow-up. Thirty-one patients with primary insomnia participated. At pretreatment and mid-treatment, participants completed questionnaires and sleep diaries assessing insomnia-related worry and time in bed. At pretreatment and follow-up, outcome measures (insomnia severity, dysfunction, and subjective sleep parameters) were administered.

**Results:** The results indicated that decreases in insomnia-related worry mediated the effect on insomnia severity and sleep quality. Reductions in time in bed mediated the treatment effect on dysfunction and total wake time. Noteworthy is also that improvements in the outcomes could be attributed to reductions in the mediators (21–60% of the variance).

**Conclusion:** These findings provide support for cognitive-behavioral models of insomnia by highlighting insomnia-related worry and time in bed as mediators in the treatment of insomnia. The results are also important for clinical work and for testing new approaches in future research.

**Acknowledgements:** We would like to express our appreciation to Mikael Bermås and Andreas Kjellén for collaboration on recruiting the participants.

<http://dx.doi.org/10.1016/j.sleep.2013.11.366>

### **Beyond sleep duration: distinct sleep dimensions are associated with obesity in children and adolescents**

D. Jarrin<sup>1</sup>, J. McGrath<sup>2</sup>, C. Drake<sup>3</sup>

<sup>1</sup> Université Laval, Canada

<sup>2</sup> Concordia University, Canada

<sup>3</sup> Henry Ford Hospital, Canada

**Introduction:** Short sleep duration is recognized as a significant risk factor in childhood obesity; however, the question as to how sleep contributes to the development of obesity remains largely unknown. The majority of pediatric studies have relied on sleep duration as the exclusive measure of sleep; this insular approach may be misleading given that sleep is a dynamic multidimensional construct beyond sleep duration, including sleep disturbances and patterns. Although these sleep dimensions partly overlap, it is necessary to determine their independent relation with obesity, which in turn, may inform a more comprehensive understanding of putative pathophysiological mechanisms linking sleep and obesity. The aim of the present study was to investigate whether sleep dimensions

including sleep duration, disturbances, and patterns were individually associated with obesity, independent of multiple covariates. The second objective was to examine whether sleep disturbances and patterns were independently associated with obesity, after adjusting for sleep duration.

**Materials and methods:** Participants included 240 healthy children and adolescents (Mage = 12.60, SD = 1.98; 45.8% females). Anthropometric measures included measured waist and hip circumference, body mass index Z-score, and percent body fat. Subjective sleep measures included sleep duration, sleep disturbances, sleep quality, and sleep patterns from youth- and parental report.

**Results:** Youth with larger adiposity and body composition measures reported poorer sleep quality ( $\beta_{avg} = 0.14, p < 0.01$ ), more sleep disturbances ( $\beta_{avg} = 0.13, p < 0.05$ ), and showed a delayed sleep phase pattern ( $\beta_{avg} = 0.15, p < 0.05$ ), independent of age, sex, pubertal status, physical activity, screen time, socioeconomic status, and sleep duration. Shorter sleep duration was significantly associated with obesity; however, this link was attenuated after adjustment of covariates.

**Conclusion:** The results suggest that sleep measures beyond duration may more precisely capture influences that drive the negative association between sleep and obesity, and thus, yield more robust associations. As such, future studies are needed to better understand how distinct sleep dimensions confer risk for childhood obesity.

**Acknowledgements:** This work was made possible through funding support from the Canadian Institutes of Health Research (MOP89886; OCO79897; 127383) and the Fonds de la recherche en santé du Québec (16965).

<http://dx.doi.org/10.1016/j.sleep.2013.11.367>

### **Does vulnerability to stress-related insomnia predict future incident and persistent insomnia among good sleepers?**

D. Jarrin, I. Chen, H. Ivers, C. Morin

Université Laval, Canada

**Introduction:** Clinical and research evidence suggest that individuals who are more prone to experience situational insomnia under stressful conditions may also be at greater risk to eventually develop chronic insomnia. While there is substantial cross-sectional data on the association between heightened vulnerability to stress-related insomnia and sleep disturbances (i.e., low sleep efficiency, sleep fragmentation), there is limited data on its predictive value. The aim of the present study was to prospectively evaluate whether heightened vulnerability to stress-related insomnia was associated with increased risk of incident and persistent insomnia in a population-based sample of good sleepers.

**Materials and methods:** Data were derived from a larger epidemiological study conducted in Québec, Canada. Participants were 1449 adults (Mage = 47.4 yrs, SD = 15.1; 41.2% male) without insomnia at baseline and evaluated four times over 3-years. Vulnerability to stress-related insomnia was measured using the Ford Insomnia Response to Stress Test (FIRST). The Life Experience Survey was used to assess the frequency and perceived impact of positive and negative events that occurred in the past year. Incident insomnia was defined as a case reporting insomnia symptoms or syndrome at any of the follow-up evaluations (non-cumulative). Persistent insomnia was defined as a case reporting insomnia symptoms or syndrome at least twice during the follow-up evaluations.

**Results:** Of the sample, 91.7% completed the 6-month follow-up, 87.8% completed the 1-year follow-up, 84.1% completed the 2-year follow-up, and 71.5% completed the 3-year follow-up. After controlling for age, sex, depressive symptoms, and stressful events and per-

ceived impact, individuals with a heightened vulnerability to stress-related insomnia had an odds ratio of 1.05 (95% CI: 1.03–1.07) of developing insomnia over a 3-year period and an odds ratio of 1.08 (95% CI: 1.05–1.11) of having persistent insomnia. When the FIRST was categorized into high and low scores (median score 20), odds ratio increased to 1.53 (95% CI: 1.23–1.91) and 2.11 (95% CI: 1.55–2.87) for incident and persistent insomnia, respectively.

**Conclusion:** Results suggest that heightened vulnerability to stress-related insomnia is associated with an increased risk of developing new onset and persistent insomnia in good sleepers. Knowledge of such premorbid differences is important to identify at-risk individuals, as this may help develop more targeted prevention and intervention strategies for insomnia.

**Acknowledgements:** This study was supported by the Canadian Institutes of Health Research (MOP42504) and (127383).

<http://dx.doi.org/10.1016/j.sleep.2013.11.368>

### **Hypnotics and mortality in an elderly general population: a 12-year prospective study**

I. Jaussent<sup>1</sup>, M. Ancelin<sup>1</sup>, C. Berr<sup>1</sup>, A. Besset<sup>1</sup>, K. Ritchie<sup>1</sup>, Y. Dauvilliers<sup>2</sup>

<sup>1</sup>Inserm, U1061, France

<sup>2</sup>CHU, Service de Neurologie, Unité des Troubles du Sommeil, Hôpital Gui-de-Chauliac, France

**Introduction:** Hypnotics are widely used by the elderly, and their impact on mortality remains controversial. The objective was to examine the association between the use of hypnotics and mortality risk in a large cohort of community-dwelling elderly, taking into account a wide range of potential competing risks including sociodemographic characteristics, lifestyle, and chronic disorders as well as underlying psychiatric disorders, excessive daytime sleepiness, and insomnia complaints.

**Materials and methods:** Analyses were carried out on 6696 subjects aged 65 years or older randomly recruited from three French cities and free of dementia at baseline. Adjusted Cox proportional hazards models with delayed entry, and age of the participants as the time scale, were used to determine the association between hypnotic use and 12-year survival.

**Results:** At baseline, 21.7% of the participants regularly used at least one hypnotic. During follow-up, 1307 persons died; 480 from cancer and 344 from cardiovascular disease. Analyses adjusted for study center, age and gender showed a significantly greater risk of all-cause and cardiovascular-related mortality with hypnotics, particularly benzodiazepines, and this increased with the number of hypnotics used. None of these associations were significant in models adjusting for socio-demographic characteristics, lifestyle, chronic disorders including cardiovascular pathologies, sleep and psychiatric disorders. Results remained unchanged when duration of past-hypnotic intake or persistent vs intermittent use during follow-up were taken into account.

**Conclusion:** When controlling for a large range of potential confounders, the risk of mortality was not significantly associated with hypnotic use regardless of the type and duration. Underlying psychiatric disorders appear to be the principal confounders of the observed association.

**Acknowledgements:** The 3C Study is conducted under a partnership agreement between Inserm, the Bordeaux II University and Sanofi-Synthelabo. The FRM funded the preparation and first phase of the study. The 3C-Study is also supported by the CNMETS, DGS, MGEN, Institut de la Longévité, AFSSPS, the Regional Governments of Aqu-

taine, Bourgogne and Languedoc-Roussillon and, the Fondation de France, the Ministry of Research-Inserm Programme "Cohorts and collection of biological material". Part of this project is financed by grants from the ANR and Fondation Plan Alzheimer.

<http://dx.doi.org/10.1016/j.sleep.2013.11.369>

### **All-cause mortality of sleep apnoea with and without CPAP treatment in male and female patients: a controlled national study**

P. Jennum

Danish Center for Sleep Medicine, Department of Clinical Neurophysiology, Denmark

**Introduction:** We aimed to evaluate the all-cause mortality of sleep apnoea (SA) with and without treatment with continuous positive airway pressure (CPAP) in middle aged and elderly males and females.

**Materials and methods:** Using data from the Danish National Patient Registry patients with a diagnosis of SA ( $n = 30,278$ ) were included. They were compared to ages-, sex- and community location-matched citizens, ratio 1:4 (120,506 control subjects, respectively).

**Results:** The survival was lower in patients with SA, the total 10 year mortality being 0.907 (0.891–0.897) in SA versus 0.910 (0.907–0.913) in controls, hazard ratio = 0.80,  $p < 0.001$ . Females SA patients had higher survival than males irrespective of CPAP treatment. Survival was lower in females and males in those aged 60+ compared to 20–59 years, irrespective of CPAP treatment. CPAP treatment improved survival with a hazard ratio of 0.62,  $p < 0.001$ . This effect was dependent on gender: CPAP improved survival in 20–59 and 60+ year old males; whereas no such effects were identified in females. Positive predictors for survival were young age, female gender, education, and low 3 year prior co-morbidity. Negative predictors for survival were age 60+, male gender, co-morbidity, and low education.

**Conclusion:** SA causes significant all-cause mortality especially in males and aged subject. CPAP reduce mortality in middle aged and elderly males.

**Acknowledgement:** Center for Healthy Aging, Faculty of Health Sciences, University of Copenhagen.

<http://dx.doi.org/10.1016/j.sleep.2013.11.370>

### **Mortality of obesity hypoventilation with and without CPAP Treatment : a controlled national study**

P. Jennum

Danish Center for Sleep Medicine, Department of Clinical Neurophysiology, Denmark

**Introduction:** We aimed to evaluate the mortality of obesity hypoventilation (OHS) with and without treatment with continuous positive airway pressure (CPAP).

**Materials and methods:** Using data from the Danish National Patient Registry patients with a diagnosis of SA ( $n = 30,278$ ) were included. Using data from the Danish National Patient Registry 1562 patients with a diagnosis of OHS ( $n = 1,562$ ) were included. They were compared to ages-, sex- and community location-matched citizens with a ratio of 1:4 a total of 6241 control subjects, 71% were

males. Morbidity, all-cause mortality adjusted for the presence of age, gender, education and co-morbidity were evaluated. They were compared to ages-, sex- and community location- matched citizens, ratio 1:4 (120,506 control subjects, respectively).

**Results:** Patients with OHS in general showed increased endocrine, metabolic, neurological and pulmonary morbidities irrespective of CPAP treatment. Cardiovascular and infectious diseases were increased among those who were non-treated but not significantly increased in CPAP treated patients. The total 10 year survival were 0.639 (0.582–0.690) in OHS versus 0.855 (0.819–0.872) in controls, Hazard Ratio = 0.29,  $p < 0.001$ . Negative predictors for lower survival were age above 60 years, low education and pre- or post- diagnostic morbidities. CPAP treatment showed no significant effect on survival.

**Conclusion:** Patients with OHS present significant morbidity and mortality. Factors associated with elevated mortality were male gender, age and prior co- morbidity. In this open, non- randomized study CPAP did not show any effect on mortality neither in male or female gender but we cannot exclude that patients treated with CPAP may present higher co-morbidity.

**Acknowledgements:** Center for Healthy Aging, Faculty of Health Sciences, University of Copenhagen.

<http://dx.doi.org/10.1016/j.sleep.2013.11.371>

### Usage of psychotropic medication in obstructive sleep apnea: a controlled national study

P. Jennum

Danish Center for Sleep Medicine, Department of Clinical Neurophysiology, Faculty of Health Science, University of Copenhagen, Denmark

**Introduction:** We aimed to evaluate the all-cause mortality of obstructive sleep apnoea (OSA) treated with hypnotics, antidepressants, and antipsychotics in middle aged and elderly males and females.

**Materials and methods:** Using data from the Danish National Patient Registry patients with a diagnosis of OSA ( $n = 18475$  adult ( $\geq 20$  years)) were included. They were compared to ages-, sex- and community location-matched citizens, ratio 1:4 (74,978 control subjects, respectively) were followed for a period of at least 3 years. Information of usage medication (hypnotics, antidepressants, antipsychotic were derived from the Danish Medicine Agency).

**Results:** The survival was lower for selective serotonin re-uptake inhibitors (SSRI), Serotonin Noradrenaline re-uptake inhibitors (SNRI), Tricyclic antidepressants (TCA), Benzodiazepines (BZD), cyclopyrrolones. Combinations of all types of psychotropic drugs were associated with lower survival. The lowest survival was observed in those treated with combinations of drugs, especially in antidepressants or antipsychotic in combination with benzodiazepines. Studies of interactions between subtypes of psychotropic drugs showed no significant associations. Positive predictors for survival were female gender and discontinuation of drugs showed lower Hazard ratios (higher survival).

**Conclusion:** Increased all-cause mortality was observed in those treated with hypnotics, antidepressant and antipsychotics in OSA patients and their controls.

**Acknowledgements:** Center for Healthy Ageing, Faculty of Health Sciences, University of Copenhagen.

<http://dx.doi.org/10.1016/j.sleep.2013.11.372>

### Parkinsonism as an outlier detection problem

J. Kempfner, P. Jennum

Department of Clinical Neurophysiology, Glostrup University Hospital, Danish Center for Sleep Medicine, Denmark

**Introduction:** REM sleep behavior disorder (RBD) without current signs of PD, or any other diseases, is designated as idiopathic RBD (iRBD), and is most likely one of the earliest signs of PD. In long-term prospective studies the percentage of subjects with iRBD, who will eventually develop PD or AP, ranges from 40% to 65% after average 10–15 years. Correct detection of iRBD is therefore essential, especially if treatment of PD becomes available. Our hypotheses is that high EMG activity can be considered as an outlier detection problem, in which atonia, as seen in the healthy elderly, are assumed to be inliers, while abnormally high EMG activity during REM sleep, as seen in iRBD, are considered outliers.

**Materials and methods:** A total of forty-eight subjects from the Danish Center for Sleep Medicine, Department of Clinical Neurophysiology, Glostrup University Hospital, Denmark, were enrolled in this study. They were divided into four equal-sized age- matched groups according to their diagnosis; elderly healthy controls, PLMD, iRBD and PD patients. All involved subjects underwent one full night polysomnography in accordance with the international standard from AASM. The submentalis and the left and right anterior tibialis were analyzed. The recorded EMG signals were pre-filtered to reduce the influence of artifacts. The EMG activity was described by two envelope curves, a baseline-envelope (5 s) and an activity-envelope curve (0.5 s). In this study the envelope curves are obtained by smooting the full- wave-rectified preprocessed EMG signals. The EMG activity was computed as the ratio of the activity-envelope with the minimum of the baseline-envelope. The one-class support vector machine is an unsupervised learning algorithm, which finds the smallest possible boundary that encloses the inliers. The voting principle was used to classify each REM sleep epoch into normal or abnormal. If six or more mini-epochs in each epoch was classified as an outlier, then the whole epoch was labeled as abnormal. The number of abnormal epochs of all REM epochs in percentage was used muscle activity score.

**Results:** It was possible to separate all controls and PLMD patients from iRBD patients. Only 25% of the PD patients were classified as not having RBD.

**Conclusion:** Detection of abnormal high muscle activity during REM sleep can be considered as an outlier detection problem and that iRBD muscle activity is more grouped and complex compared to PLMD activity.

**Acknowledgements:** We would like to express our gratitude to all those who helped collecting the data, especially Marielle Zoetmulder and Rune Frandsen.

<http://dx.doi.org/10.1016/j.sleep.2013.11.373>

### Validity and reliability of the Mexican scale of sleep quality

K. Fernández<sup>1</sup>, M. Ramos<sup>2</sup>, H. Marín<sup>3</sup>, R. Haro<sup>4</sup>, U. Jiménez<sup>4</sup>

<sup>1</sup> Universidad Veracruzana, Mexico

<sup>2</sup> Universidad Nacional Autónoma de México, Mexico

<sup>3</sup> Facultad de Psicología, Universidad Cooperativa de Colombia, Mexico

<sup>4</sup> Clínica de Trastornos de Sueño, Facultad de Medicina, Universidad Nacional Autónoma de México, Mexico

**Introduction:** Since 1988, Pittsburgh Sleep Quality Index has been used to evaluate sleep quality in healthy subjects and patients with sleep disorders and comorbidity; however have different faults con-

cerned to items that ask about insomnia complaints caused by climatic issues, and PSQI have not categories of severity apart from good or bad sleep quality. The aim was to determine reliability and validity of the Mexican Scale of Sleep Quality (MSSQ).

**Materials and methods:** This was a prospective, psychometric research. In a consensus of experts were selected 18 items as a first version of the MSSQ. The MSSQ includes items related to nocturnal and diurnal symptoms; it was applied to 70 students in a pilot study in Xalapa city, Mexico. The first studied group was integrated by 35, male and female, between 18 and 24 years old; and 35 subjects older than 25 years. With these data we delete some items and corrected format of answers. In a second pilot study we applied the corrected scale to 60 participants between 18 and 50 years old. With the aim to determine the most adequate items we developed a logistic regression model, performed a exploratory factorial analysis (principal component analysis) and evaluate reliability with the Cronbach's alpha test. In the MSSQ, the total lowest score is 0 (the best sleep quality) until 65 indicating the worst sleep quality. We propose the following 5 categories according the total score: Good Sleep Quality, and Bad Sleep Quality (BSQ) of mild, moderate, severe and extremely severe intensity.

**Results:** According to reliability, in the first pilot study we determined an acceptable but low Cronbach's alpha of 0.68, but with the second sample Cronbach's alpha was 0.81. Concerned to construct validity, with an exploratory factorial analysis we found that only three factors obtained an eigenvalue equal or more than one; and explains 61.7% of the variance. These three factors were named diurnal symptoms, sleep quality and nocturnal sleep duration.

**Conclusion:** MSSQ has been developed with a consensus of experts, classical psychometrics procedures and mathematical models. With relatively two small samples of students the new scale obtained very acceptable psychometric values. We pretend to increase sample size, including patients with diagnosis of sleep disorders (using PSG records), and test concurrent validity performing correlations with another good accepted scales such as Epworth Sleepiness Scale, Athens Insomnia Scale and the SF-36.

**Acknowledgements:** National council of science and technology, México, Veracruzana University and National Autonomous University of Mexico.

<http://dx.doi.org/10.1016/j.sleep.2013.11.374>

### Severe bruxism in a patient suffering Nasu-Hakola disease for ten years

A. Juárez<sup>1</sup>, C. Alcaide<sup>2</sup>, F. Muñoz<sup>3</sup>, C. Montes<sup>4</sup>

<sup>1</sup> Complejo Hospitalario de Toledo (Spain), Resident in Neurology, Spain

<sup>2</sup> Complejo Hospitalario de Toledo, Resident in Clinical Neurophysiology, Spain

<sup>3</sup> Complejo Hospitalario de Toledo, Neurologist, Spain

<sup>4</sup> Complejo Hospitalario de Toledo, Clinical Neurophysiologist, Spain

**Introduction:** CLINICAL HISTORY: 42 year old woman with no previous medical condition of any interest. For the last ten years she has been suffering a mental deterioration of a frontal sub cortical subtype, spasticity, hyperreflexia, bradikinesia and a parkinsonian gait which has become progressively worse over time. Multiple bone cysts have also developed with the final diagnosis being Nasu-Hakola disease.

**Materials and methods:** Four years ago, during a check up in the outpatient clinic, she had a seizure event which was finally diagnosed as a generalized epileptic associated disease and treatment with carbamazepine and levetiracetam was initiated. Periodic EEG studies show a generalized deterioration which is more notable as

the disease progresses and a multifocal irritation which was limited to the posterior areas after the antiepileptic treatment. Within the last year a severe bruxism (not only sleep related) has been identified in a videoEEG study.

**Results:** Periodic EEG studies show a generalized deterioration which is more notable as the disease progresses and a multifocal irritation which was limited to the posterior.

**Conclusion:** Nasu-Hakola disease is an autosomal recessive inherited disorder (TREM2 and DAP12 gen mutation) characterized by progressive dementia and bone symptomatology with pathological fractures without pain. It has an evolution which includes personality changes, progressive amnesia, apraxia, agnosia, acalculia and disorientation. Some patients exhibit urinary or stool incontinence, convulsive attacks and pyramidal signs as with our patient. The sleep related bruxism is characterized by involuntary masticator muscle activities during sleep and is classified under somatoform disorders in the ICD-10. In the past two decades, it has been shown that it is a phenomenon regulated more within the central nervous system than peripherally with alteration in diverse neurotransmitters (serotonin and dopamine). There has been no clear relationship between Nasu-Hakola disease and bruxism. However, due to the possible central origin of sleep related bruxism, we consider this relationship a possible other condition of the Nasu-Hakola disease.

**Acknowledgements:** Nasu-Hakola disease: The first case reported by Nasu and review. Minoru Kaneko, et al. *Neuropathology* 2010;30,463–70. Association of genetic, psychological and behavioral factor with sleep bruxism in a Japanese population. Yuka Abe, et al. *J. Sleep Res* 2012;21,289–96. Genetic factors account for half of the phenotypic variance in liability to sleep-related bruxism in young adults: A nationwide finnish twin cohort study. Katariina Rintakoski, et al. *Twin Research and Human Genetic* 2012; 15(6),714–19. Genetic factors account for half of the phenotypic variance in liability to sleep-related bruxism in.

<http://dx.doi.org/10.1016/j.sleep.2013.11.375>

### Search methods for monitoring patients with obstructive sleep apnea treated with CPAP

S. Juarros<sup>1</sup>, D. Bejarano<sup>1</sup>, M. Del Olmo<sup>1</sup>, I. Muñoz<sup>2</sup>, I. Ramos<sup>1</sup>, E. Macias<sup>1</sup>

<sup>1</sup> University Clinical Hospital from Valladolid, Pulmonology Service, Spain

<sup>2</sup> University Clinical Hospital Valladolid, Rehabilitation Service, Spain

**Introduction:** The monitoring of patients receiving CPAP is important to ensure adequate compliance and efficacy. The usual management measure is assessing clinical control. When symptoms recur, may be necessary to make a new sleep study (polysomnography) to reevaluate the CPAP settings; not always accessible. Some authors (SEPAR) propose to use autotitrating positive airway pressure (APAP) devices to titrate patients who are poorly controlled, because it provides information about compliance and efficacy. Register nocturnal oximetry, may also be useful in the management of these patients. The objective of this study is to determinate if the APAP record and nocturnal oximetry may be appropriate tools, to control patients treated with CPAP, along its evolution.

**Materials and methods:** We studied a sample of patients treated with CPAP whom we have made a record of APAP control, and within a subgroup who were also subsequently been assessed by nocturnal oximetry. The analyzed data were: APAP parameters (use per day, titration pressure, leak, Apnea-Hypopnea Index (AHI) residual), nocturnal oximetry parameters (Oxygen Desaturation Index per hour-

ODI) and CPAP compliance (use per day). We made a descriptive statistical analysis of bivariate variables (Chi-square, *T*-test).

**Results:** We analyzed 237 patients. The APAP data that were related to poor compliance with home CPAP (less than 4 h) were: APAP used less than 4 h ( $p < 0.001$ ), residual AHI greater than 10 ( $p = 0.002$ ) and higher average leakage (difference 5.26 L/min, 95% Confidence Interval (CI):  $-10.24$  to  $-0.28$ ,  $p = 0.039$ ). Lower APAP pressure was related to a home CPAP use less than 6 h (difference 1.1 cmH<sub>2</sub>O, 95%CI: 0.3 to 1.9,  $p = 0.010$ ). In a subgroup of 82 patients that were subsequently underwent to a nocturnal oximetry monitoring, the ODI greater than 10 was associated: with less use of APAP (more than 120 min difference, 95%CI: 31.3 to 212.8,  $p = 0.013$ ), with a higher average titration pressure (difference 1.7 cmH<sub>2</sub>O, 95%CI:  $-3.3$  to  $-0.2$ ,  $p = 0.024$ ), with greater leaks (difference 10.93 L/min, 95%CI:  $-19.03$  to  $-2.84$ ,  $p = 0.009$ ) and with higher residual AHI (difference 4.2, 95%CI:  $-7.1$  to  $-1.4$ ,  $p = 0.004$ ).

**Conclusion:** In our experience, the evidence of poorer compliance and control effectiveness with APAP is related to an insufficient use of home CPAP. About nocturnal oximetry recording, an ODI over 10 shows concordance with poor compliance and poor efficacy of APAP. APAP and nocturnal oximetry, can be useful to monitoring and control of patients treated with CPAP.

**Acknowledgements:** OXIGEN SALUD S.A. RESMED. PHILIPS-RESPIRONICS.

<http://dx.doi.org/10.1016/j.sleep.2013.11.376>

### Evaluation of the expression of pigment epithelium derived factor (PEDF) in chronic intermittent hypoxia: validation and choice for best housekeeping genes in the model

G. Silva Julian, R. Watanabe De Oliveira, J. Cini Perry, S. Tufik, B. Visniauskas, J. Ribeiro Chagas  
Universidade Federal de São Paulo, Brazil

**Introduction:** Pigment-Epithelium Derived Factor (PEDF) is a member of the family of the non-inhibitory serpins, distributed in almost all tissues, including CNS, where it is largely expressed. Comparatively, PEDF has been described as highly active in the Central Nervous System (CNS) acting as antiangiogenic, anti-vasopermeability, neurotrophic, neurogenic and neuroprotector factor. PEDF expression in hypoxia models has already been investigated in neuronal and glial cells, but only in acute sustained hypoxia models. Hypoxia is present in many diseases, including Obstructive Sleep Apnea (OSA). The consequences of hypoxia are largely variable, including complications in angiogenesis, cardiovascular system and the CNS, among many others. The impact of chronic intermittent hypoxia (CIH) in the CNS of adult rats, in PEDF levels is still unknown. The objectives of this work are to evaluate PEDF gene and protein expression in the CNS, as well as evaluate the best housekeeping genes for Real Time PCR for CIH model.

**Materials and methods:** 24 Wistar male rats were separated in three groups: (1) Control group ( $n = 8$ ); (2) CIH group ( $n = 8$ ) was submitted to intermittent hypoxia (IH) cycles of 3 min of 21% to 5% of O<sub>2</sub>, from 9 to 17 h, during six weeks; (3) CIH + 2 weeks of normoxia group ( $n = 8$ ) was submitted to the same treatment as CIH, followed by two weeks of recovery in normoxia. Housekeeping genes (HKG) and PEDF gene expression of Hippocampus, Hypothalamus, Frontal and Temporal Cortices were performed, as well as PEDF Western blot (WB) analysis. HKG stability was analyzed by geNorm Software.

**Results:** PEDF gene and protein levels in the CNS remained unaltered in experimental groups, CIH and CIH + 2 weeks. HKG analysis was performed and the genes classified, by decreasing order of sta-

bility: 1) HPRT; 2)  $\beta$ -Actin; 3) GAPDH; 4)  $\beta$ 2-Microglobulin. All the four HKG achieved the criteria for use (M number  $< 1.5$ ), thus all suitable to use.

**Conclusion:** Although PEDF plays important roles in several processes affected by CIH, its unaltered levels indicate that it is not playing an essential role in CIH. On the other hand, even though CIH is a very widely studied model, our study is the first to explore and validate HKG for use in this model.

**Acknowledgements:** This work was developed in the Department of Psychobiology of Universidade Federal de São Paulo.

<http://dx.doi.org/10.1016/j.sleep.2013.11.377>

### Anatomical analyses of mandibular structure using three-dimensional facial ct for effectiveness and prevention of complications in genioglossus advancement

S. Jung, S. Shin, K. Lee, J. Cho, S. Kim  
Department of Otorhinolaryngology, Head and Neck Surgery, School of Medicine, Kyung Hee University, Seoul, Republic of Korea

**Introduction:** Genioglossus advancement (GA) is one of popular procedure for the treatment of obstructive sleep apnea (OSA). This procedure is usually performed with mandibular osteotomy and advancement of genial tubercle (GT). The purposes of this study were to measure and analyze the position and dimension of GT, mental foramen (MF) and accessory mental foramen (AMF). And to make a reference in designing a location of the osteotomy during GA.

**Materials and methods:** Two hundreds and ten patients were included who performed 3D facial CT and the genial tubercle and mental foramen were evaluated in the CT. Subjects were divided into 4 groups by genders and skeletal type. Seven variables were measured, including: (1) height of GT (GTH); (2) width of GT (GTW); (3) distance from apices of lower incisors to superior border of GT (Li-SGT); (4) distance from inferior border of GT to inferior border of mandible (IGT-IBM); (5) thickness of anterior mandible (MT); (6) distance from symphysis of mandible to MF (S-MF); and (7) distance from superior border of GT to inferior border of mandible (SGT-IBM). In addition, the presence of AMF was analyzed.

**Results:** All the parameters showed big personal differences. There was no differences in GTW and Li-SGT among groups ( $p > .05$ ). Class I male showed longer GTH, MT and SGT-IBM than class I female ( $p < .05$ ). IGT-IBM and S-MF were longer in class II male than in class I female ( $p < .05$ ). Li-SGT showed personal variation with less than 7 mm in 62 cases, 7–10 mm in 122 cases, and more than 10 mm in 26 cases. IGT-IBM also showed variation with less than 10 mm in 61 cases, more than 10 mm in 149 cases. AMF were observed in 14 patients.

**Conclusion:** The osteotomy for effective GA without dental complication may not be possible in some patients because of short Li-SGT. AMF were observed in some patients. The variable position and dimensions of the GT, MF and AMF among patients suggest the need for 3D facial CT before attempting GA to treat OSA. These findings may be helpful for the surgeons to design the osteotomies in the anterior mandible for the treatment of OSA.

**Acknowledgements:** Financial Disclosure Information: The authors have no funding or financial relationships to disclose. Conflicts of interest: The authors have no conflicts of interest to report.

<http://dx.doi.org/10.1016/j.sleep.2013.11.378>

**Sleep pattern in adults patients with cerebral palsy**L. Giannasi<sup>1</sup>, S. Roberto<sup>2</sup>, N. S Faria-Junior<sup>2</sup>, L. Oliveira<sup>2</sup>, M. Gomes<sup>3</sup><sup>1</sup> UNESP/ UNINOVE, Brazil<sup>2</sup> UNINOVE, Brazil<sup>3</sup> UNESP, Brazil

**Introduction:** Patients with cerebral palsy (CP) are in risk to sleep respiratory disorders, due to the presence of neuromuscular alteration. There are many studies evaluating sleep pattern using questionnaires in children, but very few using polysomnography (PSG) in adults with CP. The aim of this study was evaluate the sleep pattern in adults patients with CP through PSG.

**Materials and methods:** 22 patients with diparegic CP, 11 female and 11 male, mean neck circumference 35.4±2.6, mean age 26.9±5.8 and mean BMI 22.0±3.63. All CP patients were recruited from the Training Program in Dentistry for Persons with Disabilities, UNESP-SP-Brazil. Inclusion criteria were patients with partially preserved cognition function and ability to respond to verbal commands. Patients or caregivers that did not sign the informed consent did not participate. All patients underwent the PSG exam at Sleep Disorders Laboratory- UNINOVE University-SP-Brazil. After the habituation night, the PSG for the evaluation of sleep pattern was performed. This study was approved by the Human Research Ethics Committees of UNESP/SJC, n. 25000.058696/2010–74.

**Results:** 45.0% (10) patients presented obstructive sleep apnea (OSA). Mean sleep stage 1,2,3, and REM were 35%, 41%, 10% and 14% respectively. Mean oxyhemoglobin median and minimum were 96% and 91% respectively. The mean total sleep time was 210 min. Many patients had difficulty to sleep during PSG.

**Conclusion:** This the first study to evaluate the sleep pattern, through PSG exam, in a group of adults with CP. The difficulty to sleep, represented for short total sleep time, may be due to neuromuscular disease characteristics. Although, even with a short sleep time, 45% of patients presented OSA. Short-sleep patterns and OSA may interfere with habilitation activities and community adjustment in this population. Diagnose of sleep pattern should be taken as early as possible to achieve improvement of their quality of live.

**Acknowledgements:** We thanks to Coordination for the Improvement of Higher Education Personnel/Postdoctoral National Program (CAPES/PNPD) for supporting this study- Grant No. 02495/09–0, for supporting this study. The Sleep Laboratory receives funding from the Nove de Julho University (UNINOVE) and EMG Laboratory is supported by Sao Paulo State University (UNESP).

<http://dx.doi.org/10.1016/j.sleep.2013.11.379>

**Increased cortical arousal propensity in opiate users with complex sleep apnea syndrome**M. Junna<sup>1</sup>, E. St. Louis<sup>1</sup>, P. Shepard<sup>1</sup>, W. Pao<sup>2</sup>, V. Somers<sup>3</sup>, T Morgenthaler<sup>4</sup><sup>1</sup> Center for Sleep Medicine, Section of Sleep Neurology, Department of Neurology, Mayo Clinic, United States<sup>2</sup> Mankato Clinic, Mayo Clinic Health System, United States<sup>3</sup> Division of Cardiovascular Diseases, Department of Internal Medicine, Mayo Clinic, United States<sup>4</sup> Center for Sleep Medicine, Division of Pulmonary and Critical Care Medicine, Department of Internal, United States

**Introduction:** Complex sleep apnea syndrome (CompSAS) presumably involves unstable ventilatory control mechanisms, possibly including cortical brain arousal indexed by NREM cyclic alternating pattern (CAP) sleep microarchitecture. CompSAS has been associated with opiate use, but may also be idiopathic or associated with underlying cardiac disease. We aimed to determine whether cortical arousal propensity indexed by NREM CAP differed between CompSAS opiate users (OU) and non-opiate users (NOU), and OSA controls.

**Materials and methods:** A retrospective analysis of clinical and diagnostic polysomnographic data of 39 consecutive CompSAS patients (18 OU, 21 NOU) and 18 OSA controls without CompSAS matched for age, gender, body mass index, and polysomnographic apnea-hypopnea index (AHI) was performed. Polysomnograms were manually analyzed for CAP and log transformed CAP A Ratio Index (ARI, with higher values indicating higher sleep-preservation propensity) according to standard methods using Hypnolab scoring software (ATES Medica Labs, Verona, Italy). Groups were compared utilizing Wilcoxon Rank Sum tests, and multivariable regression was performed to determine associations between predictor variables and CompSAS.

**Results:** AHI ( $p = 0.66$ ) and arousal indices ( $p = 0.42$ ) were similar between OU, NOU, and OSA controls. CAP rate was lower in OU than NOU or OSA controls (66 vs. 77 vs. 77,  $p = 0.13$ ). OU had lower CAP A1 and higher A2 indices (A1: 52 vs. 94 vs. 88,  $p = 0.096$ ; A2: 39.7 vs. 24.0 vs. 21.1,  $p = 0.068$ ), resulting in a significantly lower ARI in OU ( $p = 0.02$ ) with ARI below 0.55 associated with CompSAS ( $p = 0.0026$ ).

**Conclusion:** CompSAS OU demonstrated a higher cortical arousal propensity when compared to CompSAS NOU and OSA controls, resulting from reduced A1 (slow, sleep promoting) and higher A2 (fast, sleep fragmenting) CAP rhythms. Our findings suggest that opiates alter cortical arousal mechanisms that could induce central apnea, possibly causing postarousal/sleep-onset central apneas during positive airway pressure treatment.

<http://dx.doi.org/10.1016/j.sleep.2013.11.380>



## Abstracts for the 5th World Congress on Sleep Medicine, 28 September to 2 October 2013, Valencia, Spain

### Assessment of noninvasive PACO<sub>2</sub> and nasal-cannula pressure transducer during polysomnography in children younger than 3 years with osas

M. Jurado, G. Sampol, O. Romero

Multidisciplinar Sleep Unit, Hospital Universitari Vall d'Hebron, Universitat Autònoma de Barcelona, M.D, Spain

**Introduction:** Polysomnography (PSG) is the gold standard method for the diagnosis of obstructive sleep apnea syndrome (OSAS) in children. Few studies have assessed the validity of nasal-cannula pressure transducer (NC), and end-tidal CO<sub>2</sub> (PetCO<sub>2</sub>) and transcutaneous CO<sub>2</sub> (PtcCO<sub>2</sub>) monitoring during PSG in the 0-to-3 age subgroup of children with OSAS. Aims: 1/To evaluate the efficacy of the NC compared with the oronasal termistor (Th) in the detection of obstructive events; 2/To compare PetCO<sub>2</sub> and PtcCO<sub>2</sub> values, during PSG in children under 3 years.

**Materials and methods:** Prospective observational study. We studied 121 consecutive patients (53 girls and 68 boys, mean age 2.3 + 1.1 years) referred for suspected OSAS. All children underwent a PSG including both Th and NC, and PtcCO<sub>2</sub> and PetCO<sub>2</sub> monitoring. PSG was scored manually according to American Association Sleep Medicine criteria by an experienced scorer. Respiratory scoring was repeated using three different montages for each patient, including as the airflow measurement: NC only, Th only and both NC + Th. The respiratory disturbance index (RDI) was calculated. PetCO<sub>2</sub> and PtcCO<sub>2</sub> mean and maximum values were analyzed. Percent of sleep time with interpretable NC, Th, PetCO<sub>2</sub> and PtcCO<sub>2</sub> was also assessed.

**Results:** NC + Th detected more events than Th alone (15.5 + 23.4vs14.4 + 23.5,  $p < 0.001$ ); NC + Th detected more events than NC alone (15.5 + 23.4vs10.9 + 21.1,  $p < 0.001$ ) and Th detected more events than NC (14.4 + 23.5vs10.9 + 21.1,  $p < 0.001$ ). The Th signal was interpretable for a significantly greater percentage of sleep time than was the NC signal (93.7 + 14.6vs70.9 + 32.5,  $p < 0.001$ ), because of dislodgement and intolerance of NC and mouth breathing. In 90 (74.4%) children was possible monitoring both PetCO<sub>2</sub> and PtcCO<sub>2</sub>. On average, interpretable data was available for 93.1 + 19.4vs60.7 + 37.4% of sleep time from the PtcCO<sub>2</sub> and PetCO<sub>2</sub> channels respectively. Mean and maximum PtcCO<sub>2</sub> values were greater than PetCO<sub>2</sub> values: 6.6 + 6.5  $p < 0.005$  and 6.5 + 6.8 ( $p < 0.005$ ) respectively. The difference between mean and maximum PtcCO<sub>2</sub> and PetCO<sub>2</sub> values was within 5 mmHg in 30.8% and 33.3% of children respectively. Obstructive hypoventilation was detected by PtcCO<sub>2</sub> in 10 (11.1%) children and missed by the PetCO<sub>2</sub>.

**Conclusion:** In children younger than 3 years: The Th measurements were superior to NC measurements for detecting respiratory events. The use of NC in conjunction with Th was more sensitive

than the Th or NC alone. PtcCO<sub>2</sub> is more sensitive than PetCO<sub>2</sub> for detecting obstructive hypoventilation during sleep.

**Acknowledgements:** The authors thank Maribel Martínez, Lucinda de Miguel, Pilar Ramos, Pilar Villanueva and Anahita Saheb, for their technical assistance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.382>

### The prevalence and impact on sleep of periodic limb movements during sleep in the elderly

S. Kang<sup>1</sup>, I. Yoon<sup>2</sup>

<sup>1</sup> VHS Medical Center, Department of Psychiatry, South Korea

<sup>2</sup> Seoul National University Bundang Hospital, Department of Psychiatry, South Korea

**Introduction:** Periodic limb movements during sleep (PLMS) are common in the elderly population, but there remains much controversy over the clinical significance of PLMS. The aim of this study was to investigate the prevalence and impact on sleep of PLMS in the elderly population in South Korea.

**Materials and methods:** A cross-sectional and community-based study was conducted in Jukjeon-dong, South Korea, from November 2010 to January 2012. Among 6959 individuals aged 60 years or older, 696 subjects were selected using systemic random sampling. All the subjects were invited to visit a hospital for overnight polysomnographic study. Periodic leg movements (PLM) were scored according to the American academy of sleep medicine (AASM) manual. Subjective sleep complaints were assessed using Pittsburgh Sleep Quality Index (PSQI), and insomnia was diagnosed according to the criteria of DSM-IV-TR.

**Results:** Of the 696 subjects sampled, 348 subjects (135 male, 213 female, mean age 68.3+/-5.6 years) were analyzed and final response rate was 50.0%. The prevalence of PLMS (PLM index > 15) was 29.3% (male 24.1%, female 33.5%). There was no significant effect of PLM severity for polysomnographic sleep parameters and subjective sleep quality. Diagnosis of insomnia was significantly higher in individuals with PLM arousal index (PLMA) >=5 than in those with PLMA < 5 (46.2% vs. 29.2%;  $\chi^2 = 4.69$ ,  $P < 0.05$ ). The subjects with insomnia, compared to ones without it, showed higher PLMA, lower body mass index (BMI), lower apnea-hypopnea index (AHI) and women predominance. After adjustment for sex, BMI and AHI, higher PLMA was independently related with insomnia diagnosis (adjusted odds ratio 2.03 [1.01–4.08]).

**Conclusion:** The PLMS prevalence of 29.3% in this study was comparable to those of previous studies. PLMS has little impact on

nocturnal sleep quality and daytime sleepiness, but PLMA  $\bar{A}5$  may increase the occurrence of insomnia more than twice.

<http://dx.doi.org/10.1016/j.sleep.2013.11.383>

### Topographical characterisation of the painful restless legs syndrome

E. Karroum<sup>1,2,3,4</sup>, S. Leu-Semenescu<sup>1,3,4,5</sup>, I. Arnulf<sup>1,2,3,4</sup>

<sup>1</sup> Service des Pathologies du Sommeil, Hôpital universitaire Pitié-Salpêtrière, Paris, France

<sup>2</sup> Univers, Service des Pathologies du Sommeil, Hôpital universitaire Pitié-Salpêtrière, Paris, France

<sup>3</sup> Université Pierre et Marie Curie (UPMC), Paris, France

<sup>4</sup> Centre de Recherche de l'Institut du Cerveau et de la Moelle épinière (CRICM)- UPMC/Inserm UMR\_S975/CNRS UMR7225, Paris, France

<sup>5</sup> Centre d, Service des Pathologies du Sommeil, Hôpital universitaire Pitié-Salpêtrière, Paris, France

**Introduction:** The restless legs syndrome (RLS) is characterized by a core sensory component that is an urge to move the limbs. This sensation is frequently associated with pain of the same limbs. No previous studies have compared topographically painful to non-painful RLS subgroups. The aim of this study was to evaluate the clinical and especially topographical features of the painful RLS subtype.

**Materials and methods:** Forty-four patients with primary RLS all treated but without augmentations, were interviewed face to face with a semi-structured questionnaire. The patients responded to the presence or absence of painful RLS sensations. They also answered questions about demographics, clinical RLS features, RLS treatment, RLS impact (sleep disturbances, depression, and fatigue scales), and RLS sensations' topography (anatomical localization, lateralization and spatial spreading when symptomatic). The patients reported subsequently the localization of their RLS sensations by drawing on a human body diagram. The paper drawings were scanned and specific surface areas of the body diagram were measured (complete body diagram, both upper limbs, and both lower limbs surface areas; and the respective surface areas affected by RLS sensations). We then calculated for each patient the percentage of surface area affected by RLS sensations for all the above mentioned variables. Finally, we superposed together the body diagrams of the patients in the painful RLS subgroup and did the same for those in the non-painful RLS subgroup.

**Results:** Twenty-seven (61%) patients considered their RLS sensations to be painful. There were no statistical differences for all the demographical, clinical and topographical variables tested between the painful (27 patients) and the non-painful (17 patients) RLS subgroups (based on the Bonferroni correction for multiple testing). However, the patients with painful RLS had a tendency toward a higher daytime sleepiness ( $10.1 \pm 3.9$  versus  $6.8 \pm 5.7$ ;  $p = 0.0174$ ) and a more frequent treatment with opioids (41% versus 12%;  $p = 0.0402$ ) compared to the patient with non-painful RLS. Moreover, the patients in the painful RLS subgroup tended to have a more frequent involvement of the upper limbs (74% versus 29%;  $p = 0.0036$ ) with mainly the forearms (48% versus 18%;  $p = 0.0406$ ).

**Conclusion:** Painful RLS could be a more severe and frequently upper limb affecting subtype of RLS.

**Acknowledgements:** The authors are grateful to the French Association of Patients with RLS (Association France Ekbon, AFE) for funding this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.384>

### Sleep-related problems and restless legs syndrome in the children with learning and developmental disorders

S. Kasradze<sup>1</sup>, T. Ediberidze<sup>1</sup>, M. Alkhidze<sup>1</sup>, L. Maisuradze<sup>2</sup>

<sup>1</sup> Institute of Neurology and Neuropsychology, Georgia

<sup>2</sup> Iliia State University, Georgia

**Introduction:** It is known that Restless Legs Syndrome (RLS) is accompanied by sleep disturbances in children. Although there are used sleep and RLS questionnaire the RLS is often undiagnosed in childhood, particularly in children with learning and developmental disorders (LDD). The aim of this work was to identify RLS and sleep problems in the children living in Georgia.

**Materials and methods:** Participants and RLS symptoms and sleep-related problems of 1247 children (804 boys, 443 girls) aged 3–6 years, admitted at the Institute of Neurology and Neuropsychology (Tbilisi, Georgia), were analyzed using adapted Pediatric Sleep Questionnaire for Parents (PSQP). In all cases, neurological assessment, neuropsychological investigations and screening of RLS symptoms were conducted from 01.01.2010 to 10.10.2012 within the Georgian State Program: "Prevention and Early Diagnosis of Learning and Developmental Disorders in Children". Following these investigations children were divided into two groups: with LDD ( $n = 881$ ) and Normal Developmental rate (ND,  $n = 366$ ). The comparison of RLS and sleep difficulties was made between the LDD and ND groups.

**Results:** In overall, main symptom of RLS was identified in 25 children (2%): 5 out of 366 (1.4%) in ND group and 20 out of 881 (2.3%) in LDD group. Significant gender difference was not found between these groups. Sleep problems such as sleep onset difficulty, daytime sleepiness and restricted nocturnal sleep with frequent awakenings, nightmares and sleep-talking were more often related to the RLS in children of LDD group than ND group.

**Conclusion:** The results of presented initial study clearly indicate on the necessity of longitudinal investigations concerning an identification of sleep-related problems in children, in general, and the children with LDD, in particular, as RLS may cause negative effect on the sleep quality and neurological consequences, as well.

**Acknowledgement:** We are thankful to Georgian state Program organizers.

<http://dx.doi.org/10.1016/j.sleep.2013.11.385>

### Drowsiness and low energy metabolism in the following morning induced by nocturnal blue light exposure

M. Kayaba<sup>1</sup>, K. Iwayama<sup>1</sup>, H. Ogata<sup>2</sup>, Y. Seya<sup>1</sup>, K. Tokuyama<sup>2</sup>, M. Satoh<sup>3</sup>

<sup>1</sup> University of Tsukuba, Graduate School of Comprehensive Human Sciences, Japan

<sup>2</sup> University of Tsukuba, Faculty of Health and Sports Sciences, Japan

<sup>3</sup> University of Tsukuba, Faculty of Medicine, Japan

**Introduction:** Evening light exposure debilitates the circadian rhythm and elicits sleep disturbance. Blue light peak wavelengths, around 460 nm, suppress melatonin secretion via the non-image-forming system. The effects of nocturnal blue light exposure on sleep have been reported to be specific but rather small (Münch, 2008). This study was designed to assess the effect of nocturnal blue light exposure on sleep and energy metabolism until noon the next day.

**Materials and methods:** Nine healthy male volunteers aged between 21 and 25 participated in this study which had a balanced cross-over design with intrasubject comparisons. After 2 h dark adaptation, the subjects were exposed to blue light or no light for 2 h. The peak wavelength of the blue LED was 465 nm, and the

horizontal irradiance of the blue light at the height of eye was at  $7.02 \mu\text{W}/\text{cm}^2$ . Sleep was recorded polysomnographically, and energy metabolism was measured with a whole body indirect calorimeter.

**Results:** There were no significant differences in sleep architecture and energy metabolism during the night. However, dozing (stages 1 and 2) was significantly higher ( $26.0 < 29.4$  vs  $6.3 < 8.1$  min,  $P < 0.05$ ), and energy expenditure,  $\text{O}_2$  consumption,  $\text{CO}_2$  production and the thermic effect of food (increase in energy expenditure after breakfast) were significantly lower the following morning in the blue light exposure subjects.

**Conclusion:** Contrary to our expectation, sleep architecture and energy metabolism during sleep were not affected by evening exposure to blue light. It might be due to our milder intervention by which subjects in a sitting position did not gaze at the light source set on the ceiling, while the subjects in previous studies directly received brighter light via custom built goggles (Cajochen, 2005; Münch, 2008) or gazed at a light source under the influence of mydriatic agents to dilate pupils (Brainard, 2001). New findings of the present study were that dozing (stages 1 and 2) was significantly increased, and energy metabolism was significantly lower the following morning in blue light exposed subjects. This suggests that modulation of the circadian rhythm is affected by nocturnal blue light exposure and the effect continues in the following daytime even if the intervention was mild.

**Acknowledgements:** The present study was supported by a Grant-in-Aid for Scientific Research (No. 23650428). We thank Brian K. Purdue, MECC, University of Tsukuba, for his editorial assistance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.386>

### **Kleine Levin syndrome presenting after H1N1 vaccine**

C. Crowe<sup>1</sup>, S. Keane<sup>2</sup>, E. Purcell<sup>1</sup>

<sup>1</sup> Mater Private Hospital, Sleep Disorders Clinic, Ireland

<sup>2</sup> Mater Private Hospital, Ireland

**Introduction:** A 13-fold higher risk of narcolepsy was found Irish children/adolescents vaccinated with Pandemrix compared with unvaccinated children/adolescents. Most vaccinations took place between week 42 of 2009 and week 15 of 2010. Median delay between vaccine and first symptom of narcolepsy was 2.2 months. We report a case of Klein Levin syndrome that presented in the same time frame. Objective of report is to see if other centres have experience of KLS post vaccine or post H1N1.

**Materials and methods:** Case report: 15 y f patient received Pandemrix on 15/1/2010 and suddenly became very sleepy Case report: A 15 y female got H1N1 vaccine on 15/1/2010 and suddenly on 2/4/2010 developed severe hypersomnia with no precipitating factors, history of swine flu or other virus. Hypersomnolent phase lasted 10 days where she slept almost continuously. When awake was in trance – like state. No increase in appetite or sexual behaviour noted. A 2nd episode occurred in 2010 and 3 in 2011. A trial of lithium was unsuccessful. Further less severe but more frequent episodes have occurred since. Apart from good lifestyle and the pill she is on no treatment.

**Results:** Nocturnal polysomnography, MSLT and EEG (carried out outside somnolent period) were normal. Brain MRI was normal CSF hypocretin level – 344 pg/ml Actigraphy was carried out during the last 4 days of a somnolent period and shows the contrast in daytime activity. Routine blood tests were normal.

**Conclusion:** No cases of Klein–Levine syndrome have been reported in the literature following H1N1 vaccine. Viral etiology is postulated at least for first episode of sleepiness. We propose that onset of KLS in this case is related to vaccine as it occurred in the middle of the Irish epidemic of narcolepsy. A second case is currently under investigation.

**Acknowledgement:** Thanks to patient for allowing us to present her case.

<http://dx.doi.org/10.1016/j.sleep.2013.11.387>

### **Restless legs syndrome during pregnancy in czech women**

D. Kemlink<sup>1</sup>, L. Plchova<sup>1</sup>, Z. Srutkova<sup>1</sup>, J. Pavlickova<sup>1</sup>, K. Sonka<sup>1</sup>, A. Parizek<sup>2</sup>

<sup>1</sup> General University Hospital, Department of Neurology, Czech Republic

<sup>2</sup> General University Hospital, Department of Gynecology and Obstetrics, Czech Republic

**Introduction:** The objective of this study was to identify the prevalence of restless legs syndrome (RLS) among pregnant Czech women, with questionnaire based survey during the third trimester of pregnancy, and to determine risk factors.

**Materials and methods:** It was a cross-sectional study. We surveyed 776 pregnant women (18–49 years old) who came to the prenatal outpatient clinic to consult an obstetrician at the third trimester (36th–38th week of pregnancy). We used the 3 minimal set epidemiological questions to assign RLS status, disease course and frequency of symptoms. Further, we asked for previous pregnancies and comorbidities.

**Results:** The prevalence of RLS during pregnancy was 28.0% (95% confidence interval from 24.9% to 31.2%) in our sample, among which 63% of the cases started with their symptoms during the current pregnancy. On the other hand 16.6% reported positive family history of RLS. More than two thirds of the patients (71.0%) presented symptoms more than once per week and the largest proportion of them (49.3%) reported onset or major worsening of previous symptoms in the third trimester. There were no demographic differences between these groups. We did not observe any differences in prevalence of screened comorbidities between RLS positive and RLS negative pregnant women, only leg cramps were marginally more frequent in the RLS group (23% vs. 16%,  $p = 0.022$ ) and also hypothyreosis (13% vs. 8%,  $p = 0.033$ ). We also could not confirm higher prevalence of RLS among multiparous women.

**Conclusion:** RLS during pregnancy is more frequent than in the general population. Moreover, about two thirds of the pregnant women with RLS suffer from the symptoms frequently. It occurs especially in the third trimester. Despite relatively young age of the patients, family history is positive relatively rarely.

**Acknowledgements:** Supported by grant IGA-NT 12141–3 and MSM 0021620849.

<http://dx.doi.org/10.1016/j.sleep.2013.11.388>

### **Treatment of paradoxical insomnia with atypical antipsychotic drugs: a comparison of olanzapine and risperidone**

H. Khazaie<sup>1</sup>, L. Rezaie<sup>1</sup>, F. Darvishi<sup>1</sup>, F. Najafi<sup>2</sup>, K. Avis<sup>3</sup>

<sup>1</sup> Sleep Research Center, Department of Psychiatry, Farabi Hospital, Kermanshah University of Medical Sciences (KUMS), Iran

<sup>2</sup> School of Population Health, Kermanshah University of Medical Sciences (KUMS), Iran

<sup>3</sup> UAB Department of Pediatrics, Pulmonary Division and Children's Hospital, Iran

**Introduction:** To compare the efficacy of 2 atypical antipsychotic drugs, olanzapine and risperidone, in the treatment of paradoxical insomnia.

**Materials and methods:** In this cross-sectional study over a 2-year period patients with paradoxical insomnia, diagnosed in Kermanshah, Iran by both psychiatric interview and actigraphy, were randomly assigned to 2 groups. For 8 weeks, the first group ( $n = 14$ ) was treated with 10 mg olanzapine daily, and the second group ( $n = 15$ ) was treated with 4 mg risperidone daily. All participants completed the Pittsburgh Sleep Quality Inventory (PSQI) at baseline and at the end of the study.

**Results:** As expected, a baseline actigraphy analysis showed that total sleep time was not significantly different between the 2 treatment groups ( $p < 0.3$ ). In both groups, sleep quality was improved ( $p < 0.001$ ) with treatment. When comparing the 2 treatments directions, a significant difference emerged ( $9.21 \pm 2.35$ ,  $6.07 \pm 4.46$ ) among the 2 treatment groups based on data from the PSQI. Patients who were treated with olanzapine showed greater improvement than patients who were treated by risperidone ( $p < 0.04$ ).

**Conclusion:** Atypical anti-psychotic drugs such as olanzapine and risperidone may be beneficial options for treatment of paradoxical insomnia. Larger clinical trials with longer periods of follow-up are needed for further investigation.

**Acknowledgement:** This work was supported by a grant from the Department of Research, Kermanshah University of Medical Sciences (KUMS).

<http://dx.doi.org/10.1016/j.sleep.2013.11.389>

### Prevalence of symptoms and risk of obstructive sleep apnea syndrome in the general population

H. Khazaie<sup>1</sup>, F. Najafi<sup>2</sup>, L. Rezaie<sup>1</sup>, M. Tahmasian<sup>1</sup>, A. Sepehry<sup>3</sup>, F. Herth<sup>4</sup>

<sup>1</sup> Sleep Research Center, Department of Psychiatry, Farabi Hospital, Kermanshah University of Medical Sciences (KUMS), Iran

<sup>2</sup> Kermanshah Health Research Center (KHRC), School of Population Health, Kermanshah University of Medical Sciences (KUMS), Iran

<sup>3</sup> Department of Psychology, University of Victoria, Iran

<sup>4</sup> Department of Pneumology and Critical Care Medicine, Thoraxklinik, University of Heidelberg, Iran

**Introduction:** Obstructive sleep apnea (OSA) syndrome is one of the most common sleep breathing disorders with significant consequences. The present study aims to determine prevalence of symptoms and risk of OSA in the general population of Kermanshah, Iran.

**Materials and methods:** 527 adult subjects were selected from the urban region of Kermanshah. The age range of the sample was from 20 to 87 years. Assessment was carried-out using the Berlin questionnaire, a valid scale that determined those at “high risk” and “low risk” for OSA symptoms. Common symptoms were later defined.

**Results:** There were 144 (27.3%) out of the 527 subjects with a mean age of  $48.6 \pm 16.6$  years and a body mass index (BMI) of  $25.1 \pm 3.3$  at high risk for OSA (men 19%; women 8.3%); 261 (49.5%) suffered from snoring with a higher frequency among women (51.5%). From those who snored during sleep, 51 (10%) reported a breathing pause more than once per week. Subjects considered at high risk had a clinical history of diabetes (15.3%) and heart failure (16.7%).

**Conclusion:** Prevalence of symptoms, risk of OSA and associated factors in Kermanshah are noticeable. Considering the adverse effects of this condition on quality of life, further research in an effort for early diagnosis and treatment are recommended.

**Acknowledgement:** The authors wish to express their gratitude to all who participated in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.390>

### Evaluation of dream content among patients with schizophrenia, their siblings, patients with psychiatric diagnoses other than schizophrenia, and healthy control

H. Khazaie<sup>1</sup>, M. Tahmasian<sup>1</sup>, G. Younesi<sup>1</sup>, D. Schwebel<sup>2</sup>, M. Rezaei<sup>3</sup>, L. Rezaie<sup>1</sup>

<sup>1</sup> Sleep Research Center, Department of Psychiatry, Farabi Hospital, Kermanshah University of Medical Sciences (KUMS), Iran

<sup>2</sup> Department of Psychology, University of Alabama at Birmingham, Iran

<sup>3</sup> Department of Biostatistics, Kermanshah University of Medical Sciences (KUMS), Iran

**Introduction:** Schizophrenia is a chronic psychotic disorder with unknown etiology that causes cognitive impairment, affecting thinking, behavior, social function, sleep and dream content. This study considered the dream content of patients with schizophrenia, siblings of patients with schizophrenia, patients with psychiatric diagnoses other than schizophrenia, and a group of healthy controls. The aim of this study was to compare the dream content of patients with schizophrenia with dream content of individuals with other mental disorders, first degree relatives of patients with schizophrenia, and community controls.

**Materials and methods:** Seventy-two patients were selected and placed in 4 groups. The first group consisted of 18 inpatients with schizophrenia whose medications were stable for at least four weeks; the second group consisted of 16 nonpsychotic mentally ill inpatients; the third group consisted of 18 individuals who were siblings of patients with schizophrenia; and the fourth group consisted of 20 healthy individuals in the community with no family history of mental or somatic disorders. The four groups were matched by age and gender. A 14-item dream content questionnaire was administered for all the participants, and the Positive and Negative Symptoms Scale (PANSS) was also administered for the two groups of hospitalized patients.

**Results:** There were significant differences in dream content among groups included friends acquaintances, females and colorful components. No significant differences were found between the positive and negative subscales of PANSS and any of the dream questionnaire subscales.

**Conclusion:** Our results suggest that there were a few changes in the dream content of the patients with schizophrenia compare to other groups.

**Acknowledgement:** This work was supported by a grant from Department of Research, Kermanshah University of Medical Sciences (Research No. 85010).

<http://dx.doi.org/10.1016/j.sleep.2013.11.391>

### Reduced nitric oxide production in monocytes is associated with abnormal endothelial dysfunction in children with OSA

L. Kheirandish-Gozal, Y. Wang, R. Duggan, H. Molero Ramirez, S. Harshan Vardhan, D. Gozal

University of Chicago, United States

**Introduction:** Obstructive sleep apnea (OSA) has been associated with an increased risk for cardiovascular morbidity in children manifesting as elevated systemic blood pressure and endothelial dysfunction. Indeed, children with OSA are at higher risk to exhibit delayed endothelial post-occlusive hyperemic responses, which are primarily mediated by endothelial nitric oxide synthase (eNOS) activity. We hypothesized that reduced eNOS activity in circulating monocytes may provide a reliable correlate of the vascular phenotype in pediatric OSA.

**Materials and methods:** Age-, gender-, ethnicity-, and BMI-matched pre-pubertal children with polysomnographically-confirmed OSA and controls (CO) were recruited from sleep clinics and the community, underwent an overnight sleep study, and in the morning were subjected to a blood draw from which peripheral blood monocytes and their ability to generate nitric oxide (NO) were assessed using flow cytometry. In addition, post-occlusive hyperemic responses were also assessed as maximal time to peak reperfusion (Tmax) by laser Doppler flowmetry.

**Results:** 14 children with OSA and 8 CO were examined. Overall, mean age was  $7.3 \pm 1.7$  years, 50% were males, and 24% were obese (BMI z score  $>1.65$ ), and mean AHI was  $11.4 \pm 6.8$ /h of sleep for the children with OSA, and  $0.85 \pm 0.35$ /h of sleep in CO. Monocytes from children with OSA exhibited overall reduced NO kinetics and production ( $1250.8 \pm 118.9$  MFI in CO vs.  $887.2 \pm 116.9$  MFI in OSA;  $p < 0.03$ ) However, eNOS activity in OSA with abnormal endothelial function was  $537.6 \pm 156.3$  ( $n = 6$ ;  $p < 0.01$  vs. OSA with normal endothelial function or CO) A significant association emerged between NO bio-availability and Tmax ( $r^2: -0.71$ ;  $p < 0.0001$ ), but not between AHI and NO or AHI and Tmax.

**Conclusion:** Children with OSA and abnormal vascular function exhibit markedly reduced eNOS activity in their circulating monocytes. We postulate that such alterations in eNOS may reflect higher risk for vascular dysfunction in the context of individual susceptibility to OSA, possibly via epigenetic alterations in eNOS gene.

**Acknowledgement:** Supported by NIH grant HL-65270.

<http://dx.doi.org/10.1016/j.sleep.2013.11.392>

### Multiple sclerosis associated fatigue and sleep disturbances

M. Kiziria, A. Chikadze, L. Khuchua, M. Jibladze, A. Tsiskaridze, R. Shakarishvili

P. Sarajishvili Institute of Neurology, Georgia

**Introduction:** Fatigue is the most frequent symptom in multiple sclerosis (MS) patients and often is profoundly debilitating. It is poorly understood and difficult to treat. Patients with MS do not often distinguish between fatigue and sleepiness. Excessive somnolence, inappropriate daytime sleep and sleep disorders (restless legs syndrome, REM-sleep behavioral disorders, obstructive sleep apnea and others) are common in patients with MS. In one study there was a significant correlation between fatigue and disrupted sleep in patients with MS. The goal of this study was to determine sleep disturbances associated with fatigue in patients with MS and look for a correlation with the location of demyelinating lesions seen on magnetic resonance imaging (MRI).

**Materials and methods:** Ten consecutive patients with relapsing-remitting (RR) MS (Mc Donald diagnostic criteria) who had fatigue based on fatigue questionnaire (Modified Fatigue Impact Scale – MFIS) undergo nocturnal polysomnography, utilizing standard technique with additional arm electromyography leads and time-synchronized digital video recording. There were 3 men and 7 women aged between 20 and 32 with Expanded Disability Status Scale (EDSS) ranging between 2.0 and 4.5. Eight patients reported sleep-related problems. These included difficulties initiating sleep and/or frequent awakenings due to spasms in the legs (7), difficulties in initiating or maintaining sleep (4), snoring (2) and nocturia (3). All patients were screened for depression with Beck Depression Inventory (BDI) and no one had a score of more than 14. MRI scans were performed on all patients on the day of polysomnography.

**Results:** Of the 10 fatigued patients with MS all had REM-sleep without atonia, 2 had REM-sleep associated motor activity in legs, 7 had frequent awakenings and significantly reduced sleep effi-

ciency, 5 had hypopnea. One of the patients with sleep apnoea and fatigue was especially prominent in this case. 2 had snoring. All patients had MRI brain stem lesions and two of them had demyelinating lesions in pons.

**Conclusion:** We have noted a relationship between fatigue-associated sleep abnormalities in MS patients and MRI brain stem lesions. These abnormalities may play a role in the pathophysiology of poorly understood MS fatigue. Large-scale studies are needed to confirm our findings.

**Acknowledgement:** P. Sarajishvili Institute of Neurology.

<http://dx.doi.org/10.1016/j.sleep.2013.11.393>

### Excessive daytime sleepiness in patients with epilepsy: contributing factors and impact on quality of life

B. Kim, Y. No, G. Lee, S. Lee

Asan Medical Center, University of Ulsan, Republic of Korea

**Introduction:** Excessive daytime sleepiness (EDS) is common complaint in patients with epilepsy (PWE). Generally, antiepileptic drug (AED) is regarded as the cause of EDS. In recent studies, however, prevalence of EDS in PWE was similar to that in healthy subjects. And comorbid sleep disorders with epilepsy were more related to EDS than AEDs. The purposes of this study were (1) to evaluate EDS in PWE compared with healthy control, (2) to explore the potential factors contributing to EDS, (3) and to determine the impact of EDS on quality of life (QoL) in PWE.

**Materials and methods:** PWE were recruited unselectively from university hospital in Korea. Patients who agreed to participate were asked to complete the following questionnaires: (1) for detecting sleep problems, Epworth Sleepiness Scale (ESS), Medical Outcomes Study Sleep Scale (MOS-SS), Sleep Apnea scale of the Sleep Disorders Questionnaire (SA-SDQ), four questions by International Restless legs Syndrome Study Group, questions for insomnia, and Sleep Hygiene Index (SHI), (2) for depression, Hospital Anxiety and Depression Scale (HADS), (3) for measure QoL, Quality of Life in Epilepsy survey (QOLIE-10). EDS was defined as ESS  $\geq 11$ . Healthy subjects were recruited unselectively. Demographic and clinical information were obtained by neurologists.

**Results:** A total of 165 PWE and 149 controls subjects were enrolled in the study. (1) Patient and control groups did not differ in age and gender. There was no difference in degree of sleepiness between epilepsy and control groups. Mean raw ESS scores in both groups did not differ. The proportion of EDS was somewhat higher in epilepsy (24.2%) than in control group (17.4%), but it was not statistically significant ( $p = 0.088$ ). (2) EDS in PWE was significantly associated with the number of AEDs ( $p = 0.033$ ), MOS-SS Problem Index-2 ( $p = 0.004$ ), and a subscale of MOS-SS i<sup>®</sup>Shortness of Breath j<sup>-</sup> ( $p = 0.029$ ). Logistic linear regression showed that the number of AEDs and MOS-SS Problem Index-2 remained significantly associated with EDS. (3) QoL in PWE was significantly associated with MOS-SS Problem Index-2 and sleep hygiene, but not with EDS and the number of AEDs based on multiple regression analysis.

**Conclusion:** EDS in PWE was significantly associated with the number of AEDs and poor sleep quality. QoL of PWE was related to their overall poor sleep quality and bad sleep hygiene, but not related to their EDS.

**Acknowledgements:** The authors have no financial conflicts of interest.

<http://dx.doi.org/10.1016/j.sleep.2013.11.394>

### Heart rate variability (HRV) in sleep apnea patients

H. Kim<sup>1</sup>, J. Bae<sup>2</sup>

<sup>1</sup>Ajou University, School of Medicine, Department Otolaryngology-Head and Neck Surgery, Republic of Korea

<sup>2</sup>Ewha Womans University, School of Medicine, Department Otolaryngology-Head and Neck Surgery, Republic of Korea

**Introduction:** Obstructive sleep apnea syndrome (OSAS) is a common disease with the prevalence of about 10% in general population. This disease entity is considered to be highly related with the development of cerebrovascular and cardiovascular diseases. In the pathogenesis of cardiovascular disease, maintaining the homeostasis of autonomic nervous system (ANS) is critical. To evaluate the homeostasis of ANS, heart rate variability (HRV) is commonly used. The object of this study was to evaluate the homeostasis of ANS using the parameters of HRV and to elucidate the correlation between the parameters and apnea-hypopnea index (AHI).

**Materials and methods:** Retrospective review of 806 patients was performed and 164 patients who met the criteria of age, sex, and body mass index (BMI) were enrolled.

**Results:** Between the control group ( $N = 81$ ;  $AHI < 5$ ) and OSAS patient group ( $N = 83$ ;  $AHI > 15$ ), SDNN, SDNN index, HRV triangular index, VLF, LF, TP, and LF/HF ratio showed significant differences. In the correlation analysis between AHI and HRV parameters, only LF/HF ratio was proven to be significant.

**Conclusion:** Elucidating the imbalance of ANS in OSAS patients was feasible by HRV and its parameters.

<http://dx.doi.org/10.1016/j.sleep.2013.11.395>

### Faulty perception of sleep status in Korean adolescents

J. Kim<sup>1</sup>, S. Han<sup>2</sup>, S. Hong<sup>3</sup>

<sup>1</sup>Department of Neurology, Dankook University Hospital, Republic of Korea

<sup>2</sup>Department of Neurology, Wonkwang University Sanbon Hospital, Republic of Korea

<sup>3</sup>Department of Neurology, Sungkyunkwan University Samsung Medical center, Republic of Korea

**Introduction:** The aims of this study were to investigate the current sleep status and the extent of sleep deprivation in Korean adolescents as well as their perception of their own sleep status.

**Materials and methods:** The computer-assisted online survey was performed in July 2011. 150 schools were selected nationwide including junior high and high school in Korea. They answered questions regarding schooldays and weekend sleep schedule, sleep duration, napping, mood (Beck depression inventory, BDI), suicidal ideation (Beck suicidal index, BSI), sleep-related complaints including insomnia and sleepiness (Epworth sleepiness scale, ESS), and satisfaction with their current sleep amount.

**Results:** A total of 26,539 students aged 13–18 years participated in the survey. They fell asleep (23h51 vs. 0h14,  $p < 0.001$ ) and woke up (6h27 vs. 09 h 28,  $p < 0.001$ ) earlier on schooldays than on weekends. Their mean (SD) sleep duration was 399.4 min (81.9) and 543.65 min (116.86), on schooldays and on weekends, respectively. Significant difference of sleep duration between 9th grader and 12th grader were revealed both on schooldays (452.5 min vs. 330.5 min,  $p < 0.001$ ) and on weekends (572.69 min vs. 482.35 min,  $p < 0.001$ ). The shorter sleep they have, the higher BDI and BSI they reported ( $p < 0.001$ ). Their perceived ideal sleep duration was 528.68 (88.25) vs. 474.21 min (90.14), less in high school students

than in junior high school, shortest in senior high school students. Although 37.1% of total students felt they sleep enough, only 45% of the group of the students who sleep less than 7hours (13,432) felt that they do not have enough sleep.

**Conclusion:** Our study showed Korean adolescents currently have significant sleep deprivation on schooldays with long catch-up sleep on weekends, especially most severe in senior high school students. However, many students with short sleep duration have faulty perception of their sleep status, which would aggravate behavioral induced sleep deprivation. The perception of current sleep duration and ideal sleep duration seems to be related to academic year rather than physiological need.

**Acknowledgement:** Supported by grants from Korea Centers for Disease Control and Prevention.

<http://dx.doi.org/10.1016/j.sleep.2013.11.396>

### Effect of bedside light on sleep quality and background eeg rhythms

J. Kim<sup>1</sup>, K. Hwang<sup>1</sup>, J. Cho<sup>1</sup>, D. Koo<sup>2</sup>, E. Joo<sup>1</sup>, S. Hong<sup>1</sup>

<sup>1</sup>Sleep Center, Department of Neurology, Samsung Medical Center, Sungkyunkwan University School of Medicine, Republic of Korea

<sup>2</sup>Department of Neurology, Seoul National University Boramae Hospital, Republic of Korea

**Introduction:** Artificial lighting has benefited society by extending the length of a productive day, but it can be "light pollution" when it becomes excessive. Unnecessary exposure to artificial light at night can cause myopia, obesity, metabolic disorders and even some type of cancers.

**Materials and methods:** We recruited 10 subjects (4 females, mean age 27) who are good sleepers and have no history of any major health problems. They underwent two fullnight polysomnographic (PSG) and electroencephalographic (EEG) recordings with one month interval, once with bedside light off and again with light on. Sleep staging was performed and PSG variables were obtained for two conditions. Spectral analysis was performed on EEG recordings and spectral power of functional frequency bands was calculated. Analysis and comparison was also performed on slow waves and sleep spindles.

**Results:** Eight participants reported subjective discomfort when they woke up after light on condition. Comparison between PSG variables showed that sleep with light on was associated with increased stage N1, decreased slow wave sleep, and increased arousal index ( $p < 0.05$ ). Spectral analysis revealed that slow oscillation and delta power during NREM and theta during REM were significantly decreased ( $p < 0.05$ ) in light on condition. Spindle activity was also increased during NREM period, but did not survive multiple comparisons test. Slow wave analysis showed that the number and amplitude of slow waves were decreased during sleep with light on.

**Conclusion:** Our study reports that sleeping with light on not only causes change in sleep quality during sleeping, but also has persistent effect on brain oscillations. Change in slow wave and spindle activities during NREM sleep, both hallmarks of deep sleep, and theta in REM sleep provides electrophysiological evidence that bedside light can disturb the quality of sleep. Current study provides additional hazardous effect of light at night on health and sleep quality.

<http://dx.doi.org/10.1016/j.sleep.2013.11.397>

### Palatal sensory threshold reflects nocturnal hypoxemia and airway occlusion in snorers and obstructive sleep apnea patients

S. Seoul<sup>1</sup>, D. Chang<sup>1</sup>, S. Won<sup>1</sup>, S. Jeon<sup>1</sup>, D. Kim<sup>2</sup>

<sup>1</sup>Gyeongsang National University, Republic of Korea

<sup>2</sup>Seoul National University, Republic of Korea

**Introduction:** Upper airway sensory deficit has been reported to be associated with snoring or obstructive sleep apnea. There are limited data on the correlation between disease severity and upper airway sensation. In this study, we investigated the relationship between clinical parameters and standardized palatal sensory threshold (SPST) using Semmes Weinstein monofilaments.

**Materials and methods:** We recruited 40 snorers and 19 control subjects. Palatal sensory threshold was measured in all study subjects, using Semmes Weinstein monofilaments. Standardized palatal sensory threshold was determined by subtraction of hard palate sensation from uvular sensation. All subjects with snoring underwent a modified Muller maneuver during wakefulness before polysomnography.

**Results:** SPST was higher in snorers than in control subjects, but did not differ according to the severity of obstructive sleep apnea. Patients with higher SPST ( $\geq 0.45$  g/mm<sup>2</sup>) were of older age and had more severe hypoxemia indices: lower nadir oxyhemoglobin saturation (SaO<sub>2</sub>) and higher percentage of sleep time at <90% oxyhemoglobin saturation. Adjusted for age, neck circumference, and body mass index, SPST was correlated with the apnea-hypopnea index and hypoxemia indices. With a cutoff value of  $\geq 0.45$  g/mm<sup>2</sup>, the sensitivity of SPST for nocturnal hypoxemia (nadir SaO<sub>2</sub> <80%) was 81.3%. Patients with higher SPST ( $\geq 0.45$  g/mm<sup>2</sup>) showed more airway occlusion in modified Muller maneuver, compared with those with lower values.

**Conclusion:** The SPST measured using Semmes Weinstein monofilaments reflects nocturnal hypoxemia and airway occlusion. This test provides a potential tissue marker of the severity of hypoxemia in patients who snore.

**Acknowledgement:** The authors report that no potential conflicts of interest exist.

<http://dx.doi.org/10.1016/j.sleep.2013.11.398>

### Change in position dependency in non-responders after multi-level surgery for obstructive sleep apnea

S. Kim, S. Jung

Department of ORL-HNS, School of Medicine, Kyung Hee University, Republic of Korea

**Introduction:** This study was aimed to evaluate change in positional dependency by analyzing polysomnographic data in non-responders that previously underwent multilevel surgery for obstructive sleep apnea (OSA).

**Materials and methods:** A total 48 consecutive patients who had a <50% reduction of apnea/hypopnea index (AHI) and a postoperative AHI of  $\geq 20$  after multilevel surgery were enrolled in this study. Postoperative polysomnography (PSG) was carried out at least six months after surgical treatment, and both pre- and postoperative PSG data were analyzed.

**Results:** No significant differences were found in any of the measured polysomnographic parameters before and after multilevel surgery in non-responders. In position dependent patients (PPs), supine AHI, non-supine AHI, supine oxygen desaturation index (ODI) and non-supine ODI did not significantly improve after surgery. However, non-supine AHI and non-supine ODI in non-position dependent

patients (NPPs) improved significantly. Ten of 15 initially NPPs had position dependency after surgery, increasing the proportion of PPs from 68.8% (33/48) to 83.3% (40/48).

**Conclusion:** These results suggest that positional therapy may be a useful adjuvant therapy in non-responders with position dependency.

<http://dx.doi.org/10.1016/j.sleep.2013.11.399>

### Cases of chronic insomnia patients treated by group cognitive behavioral therapy for insomnia

T. Kim, M. Yi, S. Joo, J. Jeong, J. Han, S. Hong

Department of Psychiatry, The Catholic University of Korea,

St. Vincent's Hospital, Suwon, Republic of Korea

**Introduction:** Pharmacotherapy is currently widely used in the treatment of insomnia can be helpful in transient insomnia, but research regarding its effectiveness and safety of long-term use is not enough. Therefore, to complement the limitations of pharmacotherapy in the treatment of patients with insomnia, non-pharmacologic treatment methods (cognitive behavioral therapy; CBT) are used. But CBT for insomnia appear to be costly and time-consuming compared to pharmacotherapy, clinical practice in the field can be difficult to apply. The authors took the format of group therapy rather than individual therapy to complement the disadvantages of CBT and now we would like to have a thought into its meaning by reporting several cases of patients who reduced taking sleeping pills through group CBT.

**Materials and methods:** Patients were recruited at Sleep Center of St. Vincent's hospital, 2 men and 3 women led to a group of five patients. CBT is a treatment for correction factors that cause and maintain insomnia, it includes a variety of techniques such as sleep hygiene education, stimulus control, sleep restriction, relaxation and cognitive therapy. A series of treatment were performed five sessions once a week with a frequency from February to March 2012 and were proceeded for about 1 hour and 30 min per session.

**Results:** Results indicated that the subjective quality of sleep and sleep efficiency of all patients improved and PSQI (Pittsburgh Sleep Quality Index) and BDI (Beck Depression Inventory) were decreased in spite of reducing dose of medication.

**Conclusion:** Like these cases, we can contribute to reduce the time and economic burden by performing group therapy for insomnia CBT rather than individual therapy.

**Acknowledgements:** Keywords: Insomnia, Cognitive Behavioral Therapy, Group therapy. Pharmacotherapy There are no conflicts of interests.

<http://dx.doi.org/10.1016/j.sleep.2013.11.400>

### Critical periodic limb movement disorder followed by cardiovascular arrest (CPA) two months later: a case report

M. Kodama

Hirakata Kohsai Hospital, Department of Neurology, Japan

**Introduction:** One of the causes of epidemiological association of restless legs syndrome and cardiovascular disease is thought of as periodic limb movement during sleep associated with substantial elevation in heart rate (HR) and blood pressure. We describe a pacemaker-implanted patient with bradycardiac atrial fibrillation (AF), who was diagnosed with periodic limb movement disorder without

marked HR elevation on polysomnographic examination, and progressed to CPA two months later.

**Materials and methods:** A 79-year old man came to our clinic because of daytime sleepiness. He had multiple histories, a cardiac pace-maker for bradycardiac AF and old myocardial infarction, hypertension, diabetes mellitus, coagulation factor deficiency, and renal failure.

**Results:** Polysomnography showed short sleep latency (1 min) with few respiratory events (AHI = 4.3) and few arousals (arousal index = 8.0). Sleep structure was poor with increased N1, decreased N2 and R. Periodic leg movement (PLM) during sleep index was 93.0. Heart rate increments for PLM without arousal and PLM with arousal are  $0.585 \pm 2.006$  (0–36) and  $1.029 \pm 1.834$  (0–10), respectively. Percentage of PLMs with HR elevation was only 27.8%.

**Conclusion:** This patient is a good example of critical PLM, with higher PLM index, decreased percentage of PLM associated HR elevation and decreased HR increments.

**Acknowledgements:** This was not an industry supported study. The author has indicated no financial conflict of interest.

<http://dx.doi.org/10.1016/j.sleep.2013.11.401>

### No augmentation during opioid treatment in restless legs syndrome – Results from a 1 year long-term trial

R. Kohnen<sup>1</sup>, B. Bosse<sup>2</sup>, M. Hopp<sup>3</sup>, J. Winkelmann<sup>3</sup>, R. Allen<sup>4</sup>, C. Trenkwalder<sup>5</sup>

<sup>1</sup>ReSearch Pharmaceutical Services Inc., Germany

<sup>2</sup>Mundipharma Research GmbH & Co.KG, Germany

<sup>3</sup>Klinikum rechts der Isar, Technische Universität München (TUM), Klinik für Neurologie & Institut für Humangenetik, Germany

<sup>4</sup>Johns Hopkins University, Department of Neurology, Germany

<sup>5</sup>Center of Parkinsonism and Movement Disorders, Paracelsus-Elena Hospital, Germany

**Introduction:** Dopaminergic treatments, the mainstay of restless legs syndrome (RLS) therapy, are often associated with augmentation (worsening of RLS symptom severity after initial significant response). This multinational European study investigated oxycodone/naloxone prolonged-release fixed-combination (OXNPR) in severely affected RLS patients and used a unique prospective, standardized and stepwise evaluation procedure to assess the incidence of augmentation over up to 1 year.

**Materials and methods:** 304 patients (age  $62 \pm 11.2$  years) with failed prior RLS therapy were randomized to double-blind (DB) OXNPR bid (mean oxycodone dose  $21.9 \pm 15.0$  mg/day) or placebo for 12 weeks. 197 patients then participated in a 40 week open-label extension (mean oxycodone dose  $18.1 \pm 10.5$  mg/day). Augmentation rate was a pre-defined secondary endpoint. Patients were asked at every visit if their symptom severity had changed. If worsened, patients were assessed by the investigators using the Max-Planck Institute diagnostic criteria for augmentation (MPI) checklist. If augmentation was suspected, the Augmentation Severity Rating Scale (ASRS) was used to quantify the severity of augmentation and afterwards, patients were interviewed by phone within 1 week by an independent national expert in augmentation. Results were discussed with an Independent Augmentation Expert who made the final decision on the presence or absence of clinically relevant augmentation.

**Results:** There were no confirmed cases of augmentation during the study. 35 patients in the DB and 28 patients in the extension phase had reported a worsening of their RLS symptoms after initial response to treatment and were further assessed by the local investigators for augmentation using the MPI criteria checklist. One

patient was assessed as having augmentation using the MPI criteria checklist. The investigator did not consider the augmentation to be clinically significant and the National and Independent Augmentation Experts did not consider clinically relevant augmentation to be present for this patient. Significant improvements in other features of RLS were shown for OXNPR vs placebo. Adverse events with OXNPR were consistent with the expected safety profile.

**Conclusion:** This 1 year study did not reveal any risk for augmentation as evidenced by a rigorous, prospective multi-level augmentation assessment procedure. Further large-scale trials are needed to confirm that opioids are not prone to cause augmentation.

**Acknowledgements:** Karen Paine provided medical writing services on behalf of Mundipharma Research. (Funded by Mundipharma Research; ClinicalTrials.gov number, NCT01112644).

<http://dx.doi.org/10.1016/j.sleep.2013.11.402>

### Twenty-four-hour sleep-wake monitoring in narcolepsy: comparison with MSLT

M. Kohsaka<sup>1</sup>, N. Fukuda<sup>2</sup>

<sup>1</sup>Ishikane Hospital, Dept. of Psychiatry, Japan

<sup>2</sup>Hokkaido University School of Medicine, Japan

**Introduction:** The diagnosis of narcolepsy (ICSD-2) should be confirmed by a whole night polysomnographic recording followed by a Multiple Sleep Latency Test (MSLT). MSLT is designed to provide information about the sleep tendency when the patients lie down. However, narcoleptics fall asleep during daily life under the variety of conditions. A 24-h monitoring is superior to MSLT in the identification of sleepiness during the day. The objective of this study was to detect SOREMPs by 24-h ambulatory monitoring and diagnose more precisely.

**Materials and methods:** Ten patients with narcolepsy (6 women and 4 men; age range, 8–64 years) enrolled in this study: 5 narcoleptics with cataplexy and 5 narcoleptics without cataplexy. The sleep-wake monitoring procedure as follows: (1) 24-h sleep-wake monitoring, after that (2) nocturnal sleep monitoring from 22:00 to 7:00, followed the next day by 3) MSLT at 10:00, 12:00, 14:00, and 16:00. Patients were instructed to maintain wakefulness in their rooms, reading books, listening to the radio. Sleep stages were visually scored for 20-s epochs according to Rechtschaffen and Kales criteria.

**Results:** 1) 24-h monitoring: Eight out of ten narcoleptics (5 patients: narcolepsy with cataplexy) showed SOREMPs on nocturnal recording. During daytime, SOREMPs were detected in another 8 out of 10 narcoleptics, although the patients fell asleep sitting in their chairs. Two or more SOREMPs were recognized during 24-h monitoring in 80% narcoleptics with narcolepsy. The amount of daytime sleep was  $123.7 < 104.7$  min and REM sleep was  $15.3 < 9.7$  min. During nighttime, average total sleep time was  $486.4 < 59.5$  min and REM sleep was  $102.7 < 34.3$  min. (2) MSLT: The number of sleep onset REM periods was  $2.9 < 0.9$ . On the night before the MSLT, average total sleep.

**Conclusion:** Hishikawa et al. reported that sleep of narcoleptics was markedly influenced by the posture in which they fell asleep. In our study, narcoleptics were instructed to maintain wakefulness. Although narcoleptics tended to get deprivation of REM sleep under these conditions, SOREMPs were detected in 80% of narcoleptics. Twenty-four-hour sleep-wake monitoring appears to be a useful procedure for diagnosis of narcolepsy.

**Acknowledgement:** Syouji Yasuyo.

<http://dx.doi.org/10.1016/j.sleep.2013.11.403>

### Comparison of clinical features between primary and secondary sleep-related eating syndrome

Y. Komada<sup>1</sup>, Y. Takaesu<sup>2</sup>, S. Nishida<sup>1</sup>, T. Sasai<sup>1</sup>, N. Furudate<sup>1</sup>, Y. Inoue<sup>1</sup>

<sup>1</sup>Tokyo Medical University, Department of Somnology, Japan

<sup>2</sup>Tokyo Medical University, Department of Psychiatry, Japan

**Introduction:** Sleep-related eating disorder (SRED) is a condition with recurrent episodes of involuntary eating and drinking during arousal from sleep resulting in problematic consequences. SRED is a syndrome in which pathophysiological features seem to be heterogeneous. The aim of this study is to ascertain the similarity and difference in the clinical characteristics between primary SRED and secondary SRED induced by medication of hypnotics or DSPT.

**Materials and methods:** This study was approved by the ethics committee of the Neuropsychiatric Research Institute. Eligible cases comprised a series of 52 consecutive patients with SRED, who visited outpatient clinic of the Japan Somnology Center. We retrospectively investigated demographics, and descriptive informations. The patients were classified into three types; primary SRED ( $n = 32$ ), secondary SRED induced by DSPT ( $n = 10$ ), and secondary SRED induced by hypnotics medication ( $n = 10$ ).

**Results:** The demographic of the total 52 individuals diagnosed with SRED in our sample are as follows: the female ratio was 67.3%, mean age of onset of the symptoms  $29.0 < 11.4$  years old. There were significant differences in age at self-reported onset of SRED among the three categories. The post hoc test revealed that age in the category with secondary SRED induced by hypnotics medication were significantly higher than the other types. The proportion of NES-comorbidity in secondary SRED induced by hypnotics medication was lower compared to the other types. The ratio of episode occurring at one third of time was significantly higher in primary SRED, whereas it was significantly lower in secondary SRED induced by DSPT. The ratio of episode with total unconsciousness in secondary SRED induced by hypnotics medication was significantly higher, while those in secondary SRED induced by DSPT was significantly lower. With respect to history of sleepwalking during childhood, primary SRED showed significantly higher ratio than the other types.

**Materials and methods:** Primary SRED shows features as parasomnia, i.e. high ratio of history of sleepwalking during childhood, episode occurred at first half of sleep. Among secondary SRED induced by DSPT, time zone in which the episodes mainly occurred delayed. Among secondary SRED induced by hypnotics medication, onset age was older, and episode with total unconsciousness was high. In light of our results, we suggest there are different clinical features between primary and secondary SRED.

**Acknowledgement:** This study was supported by a Ministry of Education, Culture, Sports, Science and Technology grant, Japan.

<http://dx.doi.org/10.1016/j.sleep.2013.11.404>

### Stress management techniques in primary insomnia: a randomized controlled trial

A. Konsta<sup>1</sup>, D. Dikeos<sup>1</sup>, A. Bonakis<sup>1</sup>, N. Economou<sup>1</sup>, G. Chrousos<sup>2</sup>, C. Darviri<sup>3</sup>

<sup>1</sup>National and Kapodistrian University of Athens, Medical School, Sleep Research Unit, 1st Department of Psychiatry, Eginition Hospital, Greece

<sup>2</sup>National and Kapodistrian University of Athens, Medical School, 1st Department of Pediatrics, Aghia Sofia Children's Hospital, Greece

<sup>3</sup>National and Kapodistrian University of Athens, Medical School, Postgraduate Course Stress Management and Health Promotion, Greece

**Introduction:** Background Insomnia is conceived as the subjective complaint of reduced sleep quantity and/or quality. In order for the diagnosis to be made, this complaint must be present quite frequently (at least three times per week) for a considerable period of time (at least for one month). Psychophysiological factors such as stress are often presumed to play a major role in the onset and maintenance of primary insomnia. The treatment should not only focus on ameliorating sleeplessness, it should also address all those factors that cause and maintain insomnia, turning it to a chronic condition. Non-pharmacological treatments, such as stress management techniques can be easily and inexpensively administered in treatment with good results. The aim of this study is to identify the effectiveness of stress management techniques as a treatment in primary insomnia.

**Materials and methods:** This is a two-armed parallel group, randomized controlled trial. Primary insomniacs were randomly assigned to undergo either an 8-week CD-based stress management program ( $n = 27$ ) (relaxation breathing, progressive muscle relaxation and guided imagery twice a day) or a control condition ( $n = 26$ ) both of the groups took information about insomnia and they participate once in a week in consultative meetings for the treatment of insomnia). Self-reported validated measures were used to evaluate insomnia, quality of sleep and symptoms of depression and anxiety at baseline, at the 4th week and at the end of 8 weeks. Also, we measured perceived stress and "health locus of control" (through scale which is appropriate to identify what it is responsible for the health problems of an individual) at baseline and at the end of the 8 weeks. Also, free cortisol, as a biological marker of stress, was measured in saliva samples taken three times a day at baseline, at the 4th week and at the end of 8 weeks. Finally, we measured the satisfaction with the stress management program and the compliance with the therapeutic instructions.

**Results:** At the end of 8 weeks of the relaxation program, in the intervention group, we noticed decrease in insomnia and improvement on sleep quality. Also, in this group, we found improvements on perceived stress and salivary cortisol, biological marker of stress. As far as symptoms of depression and anxiety are concerned, there was significant decrease at the end of the relaxation program. Finally, there was no change in health locus of control after the practice of stress management techniques.

**Conclusion:** The training of patients with primary insomnia in relaxation techniques contributes to decrease in stress and the symptoms of primary insomnia. Simple techniques such as diaphragmatic breathing, progressive muscle relaxation and guided imagery which are easily applicable, may be regarded as effective and low cost non-pharmacological treatment of insomnia.

**Acknowledgements:** I would like to thank Dimitrios Dikeos, Associate Professor of Psychiatry at Eginition Hospital for his help to fulfill this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.405>

### Respiratory analysis in patients with obstructive sleep apnea syndrome (OSAS): mixed vs. predominant obstructive vs. pure obstructive

D. Koo<sup>1</sup>, D. Kim<sup>2</sup>, J. Kim<sup>2</sup>, J. Kim<sup>2</sup>, E. Joo<sup>2</sup>, S. Hong<sup>2</sup>

<sup>1</sup>Department of Neurology, Seoul National University Boramae Hospital, Republic of Korea

<sup>2</sup>Sleep Center, Department of Neurology, Samsung Medical Center, Sungkyunkwan University School of Medicine, Republic of Korea

**Introduction:** Mixed apnea has been classified as a subtype of obstructive apnea by current guideline. However, recent study

suggested that different breathing patterns before sleep onset were demonstrated between mixed apnea and pure obstructive apnea. We aim to investigate the respiratory signal patterns among 3 subtypes of obstructive sleep apnea (OSA).

**Materials and methods:** We enrolled 60 patients who were not only diagnosed with OSA by polysomnography but also underwent nasal continuous positive airway pressure (CPAP) therapy more than at least 6 months. Ten healthy subjects were also included. Patients were divided into 3 types of OSA: pure-OSA (obstructive apnea 100%), predominant-OSA (70%–100%), mixed-OSA (mixed apnea > 30% of total apneic events). Respiration signal was calculated as respiratory interval, which means time difference between discrete respirations during 30 s. Stable sleep time, which was defined by two conditions, was extracted from total sleep duration. First, respiration rate has to fit within 12–20 per minute. Second, respiration interval was ranged from 3 to 5 s. We compared the synchrony of thorax-abdominal movements during sleep among 3 OSA subtypes and healthy subjects.

**Results:** Out of 60 patients, 50 (90%) patients were male. Mean age was 56.3±3/410.5 years and mean apnea-hypopnea index (AHI) was 41.7±3/416.0/h. The proportion of stable sleep time was significantly decreased in both predominant-OSA and mixed-OSA groups ( $P < 0.05$ ), compared to pure-OSA group. The value of respiratory interval in mixed OSA showed significant higher variance, compared to 2 subtypes of OSA ( $P < 0.01$ ). Furthermore, significant disharmony between thorax and abdominal movement was demonstrated in patients with mixed-OSA.

**Conclusion:** We reports that mix-OSA reveals not only unstable respiratory pattern but also desynchronized movement of thorax and abdominal wall during sleep, compared to patients with pure-OSA or predominant-OSA and normal subjects. Current study provides some evidence for the different pathophysiology of respiration according to OSA subtypes.

<http://dx.doi.org/10.1016/j.sleep.2013.11.406>

### Occurrence of sleep disordered breathing in acromegaly

L. Korostovtseva<sup>1</sup>, A. Semenov<sup>1</sup>, D. Vaulina<sup>2</sup>, S. Kravchenko<sup>2</sup>, U. Tsoy<sup>3</sup>, Y. Sviryayev<sup>1</sup>

<sup>1</sup>Almazov Federal Heart, Blood and Endocrinology Centre, Hypertension Research Department, Russia

<sup>2</sup>Pavlov St Petersburg State Medical University, Russia

<sup>3</sup>Almazov Federal Heart, Blood and Endocrinology Centre, Research Department of Clinical Endocrinology with the course of Neuroendocrinology, Russia

**Introduction:** To assess the occurrence, severity and type of sleep disordered breathing in patients with acromegaly.

**Materials and methods:** Thirty three patients [5 males and 28 females, mean age – 55 (95% CI 51.1–61.2) years, body mass index 28.7 (95% CI 27.2–30.3) kg/m<sup>2</sup>] with active form of acromegaly lasting for 3 (95% CI 0.9–36.4) months on average (since the diagnosis was verified) underwent full polysomnography (Embla N7000, Med-Care, USA). The assessment of sleep disordered breathing was performed according to the Scoring rules of American Academy of Sleep Medicine (2009).

**Results:** In eleven (34%) females [median age 46 (95% CI 35.7–61.2) years] apnea/hypopnea index (AHI) was less than 5 episodes per hour of sleep [median 3.2 (95% CI 1.7–4.4) episodes/h], in 6 subjects [one male and 5 females, median age 59 (95% CI 51.4–76.3) years] – 12.9 (95% CI 8.2–14.8) episodes/h. Two females aged 52 and 62 years (AHI 23.1 and 16 episodes/h) had moderate obstructive sleep apnea (OSA) and 14 patients [3 males and 11 females, median

age 55 (95% CI 53.0–64.8) years] had severe sleep disordered breathing with median AHI 53 (95% CI 46.9–66.4) episodes/h ( $\chi^2 = 30$ ;  $p < 0.001$ ). Among them 12 subjects [3 males and 9 females, median age 59 (95% CI 53.9–67.6) years] demonstrated OSA, and 2 patients (one 50-year-old male and one 53-year-old female) had mixed apnea. Those with severe apnea had higher values of BMI that was 31.7 (95% CI 28.9–34.3); 28.4 (95% CI 24.4–31.7) and 25.5 (95% CI 23.8–28.0) kg/m<sup>2</sup> in patients with severe, mild apnea and in subjects without sleep breathing disorders, respectively ( $\chi^2 = 8.7$ ;  $p = 0.03$ ). In two females with moderate sleep apnea BMI was 29.7 and 28.7 kg/m<sup>2</sup>. BMI positively correlated with the severity of sleep apnea ( $\rho = 0.8$ ;  $p < 0.001$ ) and negatively – with mean oxygen saturation ( $\rho = -0.9$ ;  $p < 0.001$ ) and the size of adenoma ( $\rho = -0.5$ ;  $p < 0.05$ ).

**Conclusion:** Sleep disordered breathing, and mostly obstructive sleep apnea, are highly prevalent among patients with acromegaly, affecting almost 2/3 of patients that exceeds general population statistics. The severity of sleep disordered breathing is associated with BMI that might be a contributing factor, but the search for other potential contributing factors is required in this group of patients.

**Acknowledgement:** Authors declare no conflict of interest.

<http://dx.doi.org/10.1016/j.sleep.2013.11.407>

### Narcolepsy with cataplexy and parkinson's disease – A case report

M. Krcmarova, P. Dusek, P. Kovalska, B. Roth, K. Sonka

Department of Neurology, First Faculty of Medicine, Charles University in Prague, General University Hospital in Prague, Czech Republic

**Introduction:** Narcolepsy with cataplexy (NC) is a sporadic neurological disease with prevalence 0.02–0.067% and it is caused by the loss of hypocretin neurons in lateral hypothalamus. NC is associated with HLA DQB1\*06:02 allele. Parkinson's disease (PD) is a degenerative disorder manifested by hypokinetic-rigid syndrome, caused by degeneration of dopamine-producing cells in the substantia nigra pars compacta. The prevalence of PD is 0.1–0.2%. In addition to cardinal motor symptoms (akinesia, rigidity, tremor and postural instability), autonomic and sensory disturbances as well as cognitive, behavioral and sleep problems can occur during the disease progression.

**Materials and methods:** This is a case report presentation.

**Results:** An 86-year-old Caucasian woman suffering from NC was diagnosed at our department in 1980s. Daytime polysomnography (PSG) was performed, demonstrating typical SOREMPs. The patient was treated by phenmetrazin and imipramin or clomipramin. In 1995 the patient was retired and her narcoleptic symptoms became less prominent. The patient stopped the therapy and dropped out from the contact with our department. Hypokinetic-rigid syndrome with symmetric rigidity and akinesia in upper extremities and mild gait difficulty with instability was diagnosed when the patient was 83 year old. Patient's symptoms stabilized after pramipexol 0.7 mg bid initiation. At the age of 85, the patient reported disturbing hypersomnia and frequent falls, which led to reevaluation in our department. Patient reported frequent daytime sleep attacks with variable duration. The sleepiness was present in rest as well as during social activities. The falls, mostly backwards were not caused by emotions nor associated with decreased muscle tone. Sometimes these were preceded by lightheadedness and pre-syncope syndromes, but mostly were related to gait instability. Patient did not report hypnagogic hallucinations or sleep paralysis. Night PSG revealed frequent PLMS, severe sleep apnea (AHI 43), MSLT confirmed narcolepsy (short sleep latency and 2 SOREMPs), HLA typing showed haplotype HLA DQB1\*06:02. Clinical examination showed typical parkinson's syndrome (motor subscale of UPDRS 28) with

good response to dopaminergic treatment and the diagnosis of idiopathic PD was established.

**Conclusion:** We report this case because the co-occurrence of NC and PD is very rare according to the literature.

**Acknowledgement:** IGA MZ ÈR: NT 13238–4/2012.

<http://dx.doi.org/10.1016/j.sleep.2013.11.408>

### CAV1.2 calcium channel is involved in the circadian regulation of sleep

D. Kumar, N. Dedic, C. Flachskamm, J. Deussing, M. Kimura  
Max Planck Institute of Psychiatry, Germany

**Introduction:** Two L-type  $\text{Ca}^{2+}$  channels (Cav1.2 & Cav1.3) are expressed in the mouse brain with Cav1.2 contributing to a major proportion (85%). The expression of L-type  $\text{Ca}^{2+}$  channels is greatly densified in the suprachiasmatic nuclei, a neuronal area capable of functioning as autonomous clock and as a generator of circadian rhythms. Although one of the most important aspects regarding the circadian rhythm is the sleep–wake cycle, yet the role of Cav1.2 in the sleep–wake cycle is unclear. Therefore, we investigated whether depletion of Cav1.2 in a transgenic mouse line Cav1.2 (+/–) would alter spontaneous sleep–wake activities.

**Materials and methods:** Sleep–wake patterns were monitored by means of EEG and EMG recordings in Cav1.2 (+/–) mice and their wild-type littermates under baseline and sleep deprivation conditions (6 h by gentle handling).

**Results:** Under basal condition, Cav1.2 (+/–) mice showed increased sleep onset latency but subsequent hypersomnolence as compared to wild-type. The hypersomnolence observed in these mice was characterized by higher slow wave activity. Moreover, these heterozygous mice also exhibited drastically shorter wake episodes in the dark period, due to an increased number of NREM sleep episodes. Analysis of sleep architecture further revealed that these mice showed frequent transitions from wake to NREM sleep and vice versa. After sleep deprivation, the sleep onset latency decreased drastically and the trend for higher NREM sleep was observed in Cav1.2 (+/–) mice.

**Conclusion:** Our results demonstrate that depletion of Cav1.2 significantly impacts circadian sleep regulation indicated by increased NREM sleep and decreased time spent in wake in the dark period. However, homeostatic regulation of sleep was unaltered. It has been reported that L-type  $\text{Ca}^{2+}$  channels are involved in wake-promoting effects of hypocretin1. Therefore, decreased wakefulness in Cav1.2 (+/–) mice suggests that a depletion of Cav1.2 might attenuate the hypocretin 1 mediated excitation of wake-related neurons. The alpha-1 subunit of L-type  $\text{Ca}^{2+}$  channels (Cav1.2) is encoded by the CACNA1C gene. Genome-wide association studies (GWAS) have suggested that polymorphisms in the CACNA1C gene are associated with sleep disorders, e.g., insomnia and narcolepsy. Increased sleep onset latency and fragmented sleep architecture displayed by Cav1.2 (+/–) mice might be signs of symptomatic sleep disorders but further studies are needed to elucidate this. Nevertheless, several GWAS studies have significantly associated the CACNA1C gene with psychiatric disorders.

<http://dx.doi.org/10.1016/j.sleep.2013.11.409>

### Do fathers suffer from postpartum fatigue? The roles of sleep quality and stress

T. Kushnir<sup>1</sup>, S. Israeli-Tedgi<sup>2</sup>, J. Urkin<sup>3</sup>

<sup>1</sup> Ben-Gurion University of the Negev, Faculty of Health Sciences, Israel

<sup>2</sup> Ben-Gurion University of the Negev, Faculty of Health Sciences, Public Health Israel

<sup>3</sup> Ben-Gurion University of the Negev, Faculty of Health Sciences, Medical Education, Israel

**Introduction:** Background: Childbirth and the responsibilities of parenting require a great deal of energy. Sleep disturbances that are common in the postpartum period, are important correlates of fatigue and could affect energy levels. Postpartum fatigue (PPF) is the most common unpleasant symptom following childbirth. It is an overwhelming sense of energy loss, exhaustion and decreased capacity for physical and mental work following childbirth. There have been no direct studies of PPF and its correlates among fathers. Aims: To compare PPF levels of fathers and wives in the post delivery period; to assess the contribution of sleep quality and stress to fathers' PPF.

**Materials and methods:** Participants were 50 married couples ( $n = 100$ ), ages 20–40, four to six weeks post delivery. They were attending routine pediatric appointments in community clinics. We excluded women with postnatal depression (based on Edinburgh Postnatal Depression Scale). A self reporting questionnaire assessed: postpartum fatigue (FCS), sleep quality (PSQI), stress (PS) and post-natal depression (EPDS).

**Results:** PPF levels of fathers and wives were highly correlated ( $r = 0.644$ ,  $p < .001$ ). There were no significant differences in PPF between fathers and wives. Among fathers sleep quality was strongly correlated with stress ( $r = 0.690$ ,  $p < .001$ ) and PPF ( $r = 0.633$ ,  $p < 0.01$ ). Multicollinearity was not found. In a multiple regression analysis with sleep quality and stress as independent predictors of PPF, the effect of sleep quality on PPF was greatly reduced ( $r = 0.28$ ,  $p < .05$ ). A Sobel test of the significance of this reduction confirmed that stress mediated the association between sleep quality and PPF. Thus the effect of sleep quality on fatigue was indirect.

**Conclusion:** In this preliminary investigation with a small sample, fathers and their wives in the post delivery period had similar levels of PPF. It is well known that most mothers in the post-partum period suffer from PPF. Our results indicate that this phenomenon may be common among fathers too. Thus PPF may adversely affect both mothers' and fathers' quality of life. Our results also suggest that among the fathers sleep issues probably raised stress levels which in turn increased PPT levels. This possibility requires further systematic confirmation. Further systematic studies are needed to uncover the extent and correlates of PPF and the interconnections between the factors implicated in this phenomenon among fathers.

**Acknowledgement:** We acknowledge the help of Dr. Nir Madjar who greatly contributed to the statistical analysis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.410>

### Period lengths of temperature and melatonin circadian rhythms in delayed sleep phase disorder

G. Micic<sup>1</sup>, L. Lack<sup>1</sup>, N. Lovato<sup>1</sup>, H. Burgess<sup>2</sup>, S. Ferguson<sup>3</sup>

<sup>1</sup> Flinders University of South Australia, School of Psychology, Australia

<sup>2</sup> Rush University Medical Center, Circadian Rhythms Research Laboratory, Australia

<sup>3</sup> Central Queensland University, Appleton Institute, Australia

**Introduction:** Delayed Sleep Phase Disorder (DSPD) is characterized as an abnormally delayed sleep period. The currently assumed aetiology is simply a phase-delay in individuals' biological body clocks. However, DSPD cases treated to produce a corrective phase advance are very prone to relapse. It has been suggested that this may be due to an abnormally long period length (time taken to complete one cycle of the rhythm). Circadian period lengths of endogenous core body temperature and salivary melatonin were measured to investigate this premise.

**Materials and methods:** Following rigorous screening procedures, nine healthy controls and nine persons with DSPD were selected for a 80-h protocol consisting of an ultradian modified constant rou-

tine in order to measure the endogenous circadian rhythms. Participants resided in a dimly lit (<15 lux), time-free environment in semi-supine position. They followed “1-h days” which involved 20-min sleep opportunities alternating with 40-min of enforced wakefulness. Core body temperature and salivary melatonin were recorded hourly and best fit temperature curves and dim light melatonin onsets were determined to derive circadian period length measures from the 80-h of data.

**Results:** Although core temperature period lengths showed a trend in DSPD to be longer than controls, this trend was not statistically significant in this study. However, the melatonin period length was on average 23.4 min longer ( $p = .010$ ) in the DSPD group ( $M = 24.64$  h,  $SD = 0.35$ ) than the healthy control sleepers ( $M = 24.25$  h,  $SD = 0.21$ ).

**Conclusion:** Together these findings suggest that abnormally long biological circadian rhythms contribute to delayed sleeping patterns of individuals with DSPD. These outcomes may explain patients' persistent tendency to delay and relapse post-treatment. Therefore, continuing treatment with morning bright light stimulation and early evening low dose melatonin administration are recommended to treat DSPD and prevent relapse.

**Acknowledgement:** Australian Research Council grant # DP120101401.

<http://dx.doi.org/10.1016/j.sleep.2013.11.411>

### **Hypnosis for insomnia: an exaggerated myth or an underrated intervention?**

T. Lam

*Social Welfare Department, Approved Consultant/American Society of Clinical Hypnosis, Fellow/Royal Statistical Society, China*

**Introduction:** Hypnosis is one of the oldest forms of complementary and alternative medicine as well as a psychological intervention. Derived from its Greek origin, the term was once mythically associated with sleep. Because hypnosis is commonly more related to relaxation and imagery under suggestion, the approach may be helpful to improve insomnia by reducing hyperarousal. This presentation discusses its components, effectiveness and potential for treating insomnia.

**Materials and methods:** Review of literature on the nature, characteristics and components and measurements of hypnosis and critical appraisal of 6 randomized controlled trials (RCTs) from 1970s to 2000s identified from keywords search in databases on the components, treatment regime of hypnosis as well as study design, methodology and limitations.

**Results:** Despite lacking a unique definition, some characteristics of hypnosis such as lack of voluntary initiation and a fading of generalized reality orientation are recognized. Hypnotic responses are often assessed by behavioural scales or self-reported inventories. Another practice to operationalize hypnosis is the use of hypnotizability scales to measure the extent a subject responds to standardized suggestions presented after a standardized hypnotic induction procedure. The appraisal of the studies found that methodological quality of the included studies was low. Limitations include imprecise enrollment criteria and diagnostic procedure, unclear randomization and allocation concealment methods, inadequate outcome assessment and descriptions of withdrawal and dropouts, and lack of adverse event monitoring. None of the reviewed RCTs have assessed the hypnotic responses or the success of blinding of participants, though some argue that blinding is not possible in hypnosis. Despite low quality, most RCTs reported that a significant improvement in sleep parameters could

be achieved in 4 weekly sessions or less and no adverse events were reported.

**Conclusion:** Although the overall results suggested that hypnosis treatment was safe and efficacious for treating insomnia, due to the methodological limitations, the generalizability of the positive findings remained questionable. Future studies with larger sample size, better study design and methodological quality are needed to ascertain the efficacy of hypnosis for insomnia.

**Acknowledgements:** This presentation is part of my research project for PhD candidature at the Department of Psychiatry, University of Hong Kong.

<http://dx.doi.org/10.1016/j.sleep.2013.11.412>

### **Sleep diaries for shift workers**

M. Lamy<sup>1</sup>, E. Bastille-Denis<sup>2</sup>, A. Vallières<sup>2</sup>

<sup>1</sup>Centre d'étude des troubles du sommeil, Université Laval, Canada

<sup>2</sup>Laval University, Canada

**Introduction:** Sleep diaries have long been the preferred method for collecting data on self-reported sleep over time in insomnia research. Only a few studies were dedicated to daily self-reports of sleep difficulties associated with shift work. The aim of this study is to qualitatively document the use of sleep diaries in the context of shift work and to present a diary template that reflects the reality of shift work.

**Materials and methods:** The sample included 46 shift workers (86.9% women; mean age = 35.4 years old) taking part in a study on bio-psychosocial factors involved in the evolution of shift work sleep disorder. Among them the first 10 were given a sleep diary used in previous insomnia studies. This sleep diary consisted of 7-day report presented on a single page with a column for each day of the week. This format is similar to the one proposed recently as a consensus sleep diary by a committee of experts. The other 36 participants received a diary with a 24-h scale on each page. Both sleep diaries included 6 questions on sleep and wake time, and a question on medication, alcohol and caffeine use. Both formats used a sleepiness rating scale (Likert scale from “1” to “7”) to be completed after each sleeping period.

**Results:** 55.5% of the total sample (26 out of 46 participants) reported at least 3 sleep periods per day when working at night, 41.3% reported 2 sleep periods per day and only 1 participant reported 1 sleep period per day. The first 10 participants were unable to comply with the 7 columns for each day of the week diary. All of them reported that this version did not reflect the reality of their sleep schedules. A few added an extra column in order to report transitions before and after night shift. Most of them did not report napping periods as they consider that they had more than one sleep period per day rather than a nap. Most of them wanted to comment on their sleep difficulties occurring at different time point. The 36 participants using the second sleep diary format did not report any of these difficulties.

**Conclusion:** Qualitative reports suggest that within the context of shift work, sleep diaries need to be adjusted in order to capture the sleep patterns over 24 h. Moreover, this tool will help clinicians to better investigate difficulties with sleep in the shift work population and to develop a treatment plan that better suits the reality of shift work sleep disorder.

**Acknowledgement:** Supported by the Canadian Institutes of Health Research (#197171).

<http://dx.doi.org/10.1016/j.sleep.2013.11.413>

### Dysphoric dreaming and eveningness during the third trimester of pregnancy predict adverse delivery outcomes

J. Lara-Carrasco<sup>1</sup>, V. Simard<sup>2</sup>, T. Nielsen<sup>3</sup>

<sup>1</sup>Center for Advanced Research in Sleep Medicine, Department of Psychology, Université de Montréal, Canada

<sup>2</sup>Department of Psychology, Université de Sherbrooke, Canada

<sup>3</sup>Center for Advanced Research in Sleep Medicine, Department of Psychiatry, Université de Montréal

**Introduction:** Sleep disturbances during pregnancy affect delivery outcomes, including shorter pregnancies and longer labour (Okun, 2009). Studies also reveal associations between recall of negative dreams and shorter labour (Mancuso et al., 2008; Winget and Kapp, 1972). However, prospective longitudinal studies assessing the value of pregnancy dreams in predicting delivery outcomes are lacking. Whether dream measures constitute better predictors of delivery outcomes than do sleep measures also remains to be determined. This 2-stage longitudinal study assessed whether prospective dream measures during pregnancy (Time-1; T1) predict delivery outcomes (Time-2; T2) controlling for pregnancy, sleep and psychosocial risk factors.

**Materials and methods:** Fifty-two 3rd trimester pregnant women ( $M = 29.78 \pm 3.62$  wks of gestation) aged 18–37 years ( $M = 28.48 \pm 4.06$  yrs) and not planning to undergo caesarean sections were followed-up post-delivery. At T1, pregnant women completed demographic and psychological questionnaires and a 14-day home log to assess sleep/dream characteristics. Gestational length and labour duration were assessed at T2. Deliveries occurred at 36–42 weeks of gestation ( $M = 39.29 \pm 1.46$ ); labour lasted 1–40 h ( $M = 13.62 \pm 8.99$ ). Four women had unplanned caesareans; their labour duration did not differ from women who delivered vaginally ( $M = 13.40 \pm 9.28$  vs.  $16.25 \pm 0.03$ ;  $p = 0.60$ ). Two sets of hierarchical multiple regression analyses were run to predict delivery outcomes from pregnancy dream variables (#dreams, positive–negative dreams ratio, dream clarity, dream impact), controlling for sleep (duration, quality, bedtime/rise time, night awakenings), demographic (age, employment status, family income, education) and psychosocial (mood/concerns, stress, history of emotional problems) characteristics. All demographic variables, prenatal psychosocial factors and sleep variables associated with outcomes at  $p < 0.1$  were considered as potential confounders.

**Results:** More negative dreams during pregnancy predicted shorter gestation ( $\text{Beta} = -0.61$ ,  $p = 0.00002$ ); no adjustment was required. Controlling for age, education, stress and sleep duration, later bedtime/rise time predicted longer labour ( $\text{Beta} = 0.28$ ,  $p = 0.04$ ).

**Conclusion:** The study provides new evidence that pregnant women who report more negative dreams are at greater risk for shorter pregnancies. Results are also consistent with the possibility that chronotype mediates relationships between sleep and labour duration.

**Acknowledgement:** Research was supported by the Canadian Institutes of Health Research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.414>

### Trazodone as co-treatment for insomniac patients

A. Alvarez Ruiz-Larrinaga<sup>1</sup>, J. Majón Caballero<sup>1</sup>, A. López Picado<sup>2</sup>, M. Mendaza Ortiz<sup>1</sup>, C. Egea Santaolalla<sup>1</sup>, J. Duran-Cantolla<sup>1</sup>

<sup>1</sup>Sleep Unit, Hospital Universitario Araba, Spain

<sup>2</sup>Araba Research Unit, Hospital Universitario Araba, Spain

**Introduction:** Trazodone is an antidepressant belonging to the class of serotonin receptor antagonists and reuptake inhibitors. Trazodone

is widely prescribed as a sleep aid, although it is indicated for depression, not insomnia. The aim of this study was to describe the usefulness of trazodone in the treatment of insomnia in our sleep unit.

**Materials and methods:** This retrospective cross-sectional study was conducted at a multidisciplinary sleep center (Hospital Universitario Araba) in Vitoria. Patients with insomnia treated with trazodone were analyzed. Average dose was  $11.25 \pm 54.9$  mg (50–300 mg). The quantified perceived insomnia severity were then assessed with the Insomnia Severity Index (ISI) questionnaire before and after taking trazodone. The use of benzodiazepine hypnotics, non-benzodiazepine hypnotics, antidepressants and other drugs were picked up on an average time of the intake for  $6.1 \pm 4.4$  months.

**Results:** From December of 2011 to June of 2013, 166 patients were clinically diagnosed for insomnia, and 40 (24%) of them were started a treatment with trazodone or we added up more dose of it. 37.5% were men and mean age was  $53.9 \pm 12.9$ . 33 (82.5%) had comorbid insomnia, and 50% associated with psychiatric disorder. Compared to pre-treatment, trazodone improved scores on ISI ( $p < 0.001$ ), as well as reduce the use of benzodiazepines ( $p = 0.008$ ). However, there was an increase in the number of non-benzodiazepine hypnotics taken. 13 patients (32.5%) discontinued the trazodone treatment because they did not perceive any benefit with treatment and/or they developed side effects.

**Conclusion:** In the group studied, the use of the trazodone could help to reduce the dose of benzodiazepine hypnotics taken. In some cases it could be possible to stop benzodiazepines and to improve the sleep. One third of the patients discontinued the treatment of trazodone. More studies are necessary to demonstrate the risk/benefit ratio for trazodone in insomnia.

**Acknowledgement:** All the people that made possible to develop this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.415>

### How much one sleeps at night affects napping effects on emotional memory consolidation

K. Lau, M. Wong, E. Lau

Sleep Laboratory, The University of Hong Kong, Sleep Laboratory, The University of Hong Kong, China

**Introduction:** Sleep schedule of participants were regulated and varied across experiments, so it remains unclear if nighttime sleep and daytime nap play a different role in memory consolidation thus yielding conflicting results about the effect of sleep on consolidation of emotional memory. This study explored the interactive effect of habitual sleep duration and daytime nap on consolidation.

**Materials and methods:** Sixty-three young adults (Mean age = 20.38, SD = 1.39, 63.5% male) were randomly assigned to either the Nap or the Wake group with no significant group differences in age, sex, body mass index, habitual sleep duration and sleep quality. Average baseline sleep duration (SLEEP) was calculated from sleep diaries completed five days before the lab day. Participants were instructed to rate the valence of eyes stimuli adopted from *Reading the Mind in the Eyes* test. The Nap group then obtained a 90-min polysomnograph-monitored sleep opportunity, when the Wake group remained awake. An incidental recognition test of the stimuli was administered after the Nap/Wake period. Memory discriminability of stimuli of positive, neutral and negative valence, was compared using two-way analysis of variance with CONDITION (Nap&Wake) and SLEEP (<5 h, 5–6.5 h, >6.5–8 h & >8 h) as between-subject factors.

**Results:** For neutral memory, there were significant main effect of CONDITION with the Nap group performing better ( $p = .009$ ) and main effect of SLEEP ( $p = .003$ ) with worse performance in those with

<5 h sleep. There was significant CONDITION\*SLEEP interaction,  $p = .016$ . Post-hoc tests indicated that the nap group performed better in the <5 h sleep group ( $p < .05$ ) but not in the other three groups ( $ps > .05$ ). For negative memory, a significant main effect of CONDITION was found with better performance in the Nap group ( $p = .004$ ). No main effect of SLEEP but significant CONDITION\*SLEEP interaction was found ( $p = .045$ ). Post-hoc tests indicated that better performance in the Nap group was found among those with <5 h, 5–6.5 h and >6.5–8 h sleep ( $ps < .05$ ), but not those with >8 h sleep ( $ps > .05$ ). For positive memory, no main or interaction effects were found.

**Conclusion:** Our results showed that a nap strengthened memory of neutral valence in only the most sleep-restricted group, but the napping effects on memory of negative valence were present in groups of all sleep duration, except for the most sleep-satiated. This study provided the first evidence on the interaction between habitual sleep duration and a daytime nap on emotional memory.

**Acknowledgement:** This work was supported by HKU Seed Funding Program for Basic Research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.416>

### Tasimelteon treatment entrains the circadian clock and demonstrates significant benefit on sleep and wake parameters in totally blind individuals with non-24 hour circadian rhythms

S. Lockley<sup>1</sup>, M. Dressman<sup>2</sup>, R. Torres<sup>2</sup>, C. Lavedan<sup>2</sup>, L. Licamele<sup>2</sup>, M. Polymeropoulos<sup>2</sup>

<sup>1</sup> Division of Sleep Medicine, Harvard Medical School, MA, United States

<sup>2</sup> Vanda Pharmaceuticals, United States

**Introduction:** The majority of totally blind individuals exhibit non-24-h circadian rhythms due to light signals not reaching the suprachiasmatic nucleus, resulting in Non-24-h Sleep-Wake Disorder (Non-24), a serious circadian rhythm disorder with no approved treatment. Tasimelteon is a novel circadian regulator in development for Non-24 with selective agonist activity for melatonin MT1 and MT2 receptors.

**Materials and methods:** Two phase III placebo-controlled studies in blind Non-24 patients assessed safety, efficacy and maintenance of effect of tasimelteon treatment (20 mg/day). Circadian period was assessed from urinary 6-sulfatoxymelatonin (aMT6s) and cortisol. Clinical assessments included a Non-24 Clinical Response Scale (N24CRS), nighttime sleep, daytime naps and Clinical Global Impression of Change (CGIC).

**Results:** Entrainment Study (SET) ( $n = 84$ ): Tasimelteon entrained the circadian clock (aMT6s: 20.0% vs. 2.6%; cortisol: 17.5% vs. 2.6%), had more clinical responders on the N24CRS (23.7 vs. 0%), improved CGIC (2.6% vs. 3.4), increased sleep in the worst quartile of nights (LQ-nTST) (57% vs. 17 min), and decreased nap duration in the worst quartile of days (UQ-dTSD) (46% vs. 18 min), compared to placebo ( $p < 0.05$ ). Maintenance Study (RESET) ( $n = 20$ ): Tasimelteon-entrained patients were randomized to continued treatment or placebo. Tasimelteon maintained entrainment compared to placebo (aMT6s: 90% vs. 20%; cortisol: 80% vs. 20%). In treated patients, nighttime sleep (LQ-nTST) increased, and daytime sleep (UQ-dTSD) decreased, by 67 and 59 min/day, respectively ( $p < 0.05$ ). During the run-in phase of the study, the rate of entrainment among tasimelteon treated patients ranged from 55% to 75% in subpopulation sensitivity analysis. Tasimelteon was safe and well-tolerated in both studies.

**Conclusion:** Tasimelteon entrained the circadian pacemaker in blind patients with Non-24, and caused significant clinical improvement in multiple measures of sleep, wake and global functioning. Discontinuation of tasimelteon abolished circadian entrainment,

resulting in an hour less sleep each night and an hour more sleep each day. These studies demonstrate that tasimelteon is an effective circadian regulator, and that continued treatment is required to maintain entrainment and the resulting clinical benefits.

**Acknowledgements:** Support for the study was provided by Vanda Pharmaceuticals Inc. (ClinicalTrials.gov NCT01163032 and NCT01430754). Statistical and Analytical Support was provided by Dennis Fisher at "P Less Than" company.

<http://dx.doi.org/10.1016/j.sleep.2013.11.417>

### Motor memory consolidation potentiated by exposition to a conditioned stimulus in stage 2 sleep

S. Laventure, S. Fogel, G. Albouy, P. Sévigny-Dupont, J. Carrier, J. Doyon

Université de Montréal, Canada

**Introduction:** Motor sequence learning refers to the process by which simple, stereotyped movement elements come to be performed effortlessly as a unitary sequence through multiple sessions of practice. Numerous studies have convincingly demonstrated that sleep (at night and daytime) plays a critical role in the consolidation of motor sequence learning. Yet there is no consensus regarding the sleep stages implicated in the consolidation of various motor skills. Mounting evidence indicates that stage 2 sleep and spindle activity in particular, are critical for motor memory consolidation to occur, but most of those studies are only correlational in nature. In this study, we probed a possible causal role of stage 2 sleep in motor memory consolidation using an olfactory stimulation/motor sequence learning (MSL) conditioning protocol.

**Materials and methods:** We conditioned a first group of participants ( $n = 26$ ) with a rose-like odor during learning of a sequence of finger movements, and re-exposed them to the odor during stage 2 sleep (ST2). A second group ( $n = 26$ ) was conditioned with the same odor while doing the MSL task and was re-exposed during REM sleep (REM). Finally, a third group ( $n = 22$ ) was not conditioned with the odor during the MSL task, but was exposed to it during stage 2 sleep (CTL). All subjects were re-tested in the morning 2 h after waking up. Performance was assessed by comparing the mean time to complete the four first blocs of retest to the four last blocs of training.

**Results:** Analysis of gains in performance revealed a significant interaction between the experimental manipulation and participant's gender ( $(F(2,68) = 5.10, p = .01)$ ). Gains were significantly higher for men than women in the ST2 group ( $p = .01$ ). Also, results demonstrated that men in the ST2 group showed greater gains in performance than those in the CTL ( $p = .01$ ), but not the REM group ( $p = .73$ ). Men's performance in REM group showed no significant difference to CTL group ( $p = .20$ ).

**Conclusion:** These findings not only show that it is possible to potentiate the consolidation of a motor memory trace during sleep but also strongly support the proposal that the association between stage 2 sleep and motor memory consolidation is critical. However, in regards to our results we can't designate that effect to be specific to stage 2 sleep. Gender differences could be caused by several factors as (1) familiarity to the odor, (2) hormonal fluctuations (Genzel, 2012) or (3) differences in sleep and its characteristics during cuing.

**Acknowledgements:** Ovidiu Lungu, Bradley King, Arnaud Boré.

<http://dx.doi.org/10.1016/j.sleep.2013.11.418>

## The effects of OSA in sleep, physical symptoms, and mood in patients with COPD and ASTHMA

J. Lazarte<sup>1</sup>, I. Ferreira<sup>2</sup>

<sup>1</sup>University of Toronto, Canada

<sup>2</sup>Centre for Sleep and Chronobiology, Toronto, Asthma and Airways Center, Toronto, McMaster University, Canada

**Introduction:** Background: COPD and sleep apnea are common disease and many individuals would be expected to have them in combination. It has been believed that the presence of COPD could predispose to development of OSA, but this was not confirmed by epidemiological studies. More recently, Wincosin Sleep cohort suggests that Asthma may increase the chance of developing sleep apnea.

**Objectives:** To investigate if OSA had significant impact on sleep, physical symptoms, and mood in patients with COPD and ASTHMA and if these patients had similar response to treatment with nasal CPAP.

**Materials and methods:** We included 85 patients; 34 with COPD&OSA (mean age  $68.5 \pm 10.1$  years, B.M.I  $35.3 \pm 12.3$  kg/m<sup>2</sup>), 34 with OSA (mean age  $56.1 \pm 12$  years, B.M.I  $35.3 \pm 6.8$  kg/m<sup>2</sup>) and 17 with OSA&ASTHMA (mean age  $62 \pm 13.7$  years, B.M.I  $39.4 \pm 6.8$  kg/m<sup>2</sup>). They had PSG, Pulmonary Function tests, answered Beck inventory, Whaler Physical Symptoms, Sleep Assessment Questionnaire (SAQ) and the Epworth Sleepiness Scale (ESS). Age, BMI, gender and baseline AHI were compared for the 3 groups using the Chi-square test for gender and the Kruskal–Wallis test for the others. Mann–Whitney test was used for pair wise comparisons where appropriate, ANCOVA for group comparisons in order to adjust for baseline values and regression analysis for comparison of the questionnaires.

**Results:** Median AHI was higher in OSA group as compared to OSA&ASTHMA  $p = 0.002$  and COPD&OSA  $p = 0.05$ . Median age was higher in COPD&OSA than in OSA group  $p = 0.0002$ . Median BMI was significantly higher for the OSA&AS when compared to COPD&OSA  $p = 0.03$  and borderline higher when compared to OSA  $p = 0.06$ . Regression analysis did not find significant differences in the Beck score, WPS, SAQ and ESS between the three groups. The pulmonary function test, comparing COPD&OSA and OSA had significant differences in all parameters except TLC %. COPD had significant lower FEV1 post % and DLCO %. Comparing COPD&OSA and OSA&ASHTMA there was significant different in post FEV1% ( $p = 0.008$ ). Post FEV1% was significant lower for COPD&OSA. For OSA and OSA&ASHTMA there was a significant difference in post FEV1% ( $p = 0.003$ ) but not in TLC %, RV % or DLCO %.

**Conclusion:** Despite lower AHI, patients with COPD&OSA and OSA&ASTHMA had similar SE, daytime sleepiness, Beck Score, WPS and SAQ to OSA patients, suggesting that OSA has a negative impact patient with Asthma and COPD. There was no difference between the groups in regards to response to treatment with nasal CPAP.

<http://dx.doi.org/10.1016/j.sleep.2013.11.419>

## Effects of interactions between different clinical presentations of coronary heart disease and timing of polysomnography on diagnosis of obstructive sleep apnea

C. Lee<sup>1</sup>, W. Hong<sup>1</sup>, T. Low<sup>1</sup>, B. Tai<sup>2</sup>, A. Tan<sup>3</sup>, S. Khoo<sup>3</sup>

<sup>1</sup>National University Heart Centre, Singapore

<sup>2</sup>National University of Singapore, Singapore

<sup>3</sup>National University Health System, Singapore

**Introduction:** Obstructive sleep apnea (OSA) is a novel risk factor for coronary heart disease and screening polysomnography is recommended. Yet, optimal time to perform polysomnography is

unknown. We sought to determine if the diagnosis of OSA is influenced by the timing of polysomnography and its interaction with different presentations of coronary heart disease.

**Materials and methods:** We prospectively recruited 160 patients admitted with acute myocardial infarction (AMI) or stable coronary artery disease (CAD) for either in-hospital ( $n = 80$ ) or post-discharge ( $n = 80$ ) polysomnography.

**Results:** The median time from admission to polysomnography for in-hospital and post-discharge groups was 1 day and 17 days, respectively ( $p < 0.001$ ). Overall, 59 patients (36.9%) were diagnosed with OSA (apnea-hypopnea index [AHI]  $\geq 15$ ). In patients presenting with AMI ( $n = 80$ ), the average AHI was higher in the in-hospital than post-discharge group (55.0 vs. 27.5,  $p = 0.022$ ). In patients presenting with stable CAD ( $n = 80$ ), no significant differences were observed (27.5 vs. 37.5,  $p = 0.474$ ). OSA patients were more likely to have the polysomnography done during the in-hospital than post-discharge period (55.9% vs. 46.5%,  $p = 0.037$ ). Logistic regression analysis revealed a significant interaction between clinical presentation and effect of polysomnography timing on diagnosis of OSA ( $p = 0.003$ ). The timing of polysomnography predicted the risk of OSA in patients presenting with AMI (adjusted OR 3.84%, 95% CI 1.42–10.41,  $p = 0.008$ ), but not those presenting with stable CAD. Other independent predictors included body mass index, diabetes mellitus and hyperlipidemia.

**Conclusion:** The timing of polysomnography influences the diagnosis of OSA in patients presenting with AMI, but not in those presenting with stable CAD. There is a higher chance of diagnosing OSA in AMI patients when polysomnography is done in-hospital compared to post-discharge. The role of AMI-induced myocardial stunning in the diagnosis of OSA and deserves further study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.420>

## Non-invasive ventilation (NIV) in obesity hypoventilation syndrome (OHS): the Singapore experience

C. Lee, P. Pang, C. Tan

Tan Tock Seng Hospital, Singapore

**Introduction:** The World Health Organization estimated that worldwide obesity has more than doubled since 1980 and that nearly 500 million adults were obese in 2008. There is also increasing prevalence of obesity in Singapore as affluence and economic security improved. Obesity is related to many health complications, one of which is OHS. There are currently few studies examining OHS and its management in the Asian population.

**Materials and methods:** We report on two patients with OHS, one of whom presented acutely with decompensated hypercapnic respiratory failure, while the other presented in the chronic state.

**Results:** Case reports of 2 patients with their attached diagnostic and titration sleep studies.

**Conclusion:** NIV has been used with increasing success in OHS patients presenting with acute to chronic respiratory failure, thus avoiding intubation. A recent study by Carrillo et al. (American Journal of Respiratory and Critical Care Journal in October 2012, “Non-invasive ventilation in acute hypercapnic respiratory failure due to obesity-hypoventilation syndrome and COPD”) demonstrated comparable efficacy of NIV in treatment of OHS and patients with chronic obstructive pulmonary disease patients (COPD). They also found better outcomes for the former group of patients. Interestingly, the maximal IPAP used in this study was  $18.4\text{cmH}_2\text{O} \pm 3.5$  and maximal EPAP was  $7.2\text{cmH}_2\text{O} \pm 1.1$ , similar to that used in their COPD group of patients. This is in stark contrast to our local experience where significantly higher pressures are needed in both our

COPD and OHS patients. Indeed, Hoffstein's formula, used widely in Caucasian patients to predict continuous positive airway pressure, tends to underestimate the required CPAP in Asian patients with OSA. In Japanese and Korean studies, this was largely attributed to racial differences in craniofacial anatomy and possibly, airway compliance. Our second case further illustrates that high pressures are required to reduce respiratory events in our group of OHS patients. However, overtitration may lead to treatment-emergent central apneas, as in our case. It is currently unknown if the Asian patients are more susceptible to treatment-emergent central apneas compared to their Caucasian counterparts. More studies are required to further elucidate this hypothesis.

**Acknowledgements:** We would like to acknowledge our supervisors, Dr. Yap Wee See and Dr Lee Yeow Hian, for their guidance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.421>

### Effects of sleep deprivation on pain sensitivity in healthy subjects

J. Lee<sup>1</sup>, J. Kim<sup>2</sup>, H. Shin<sup>3</sup>

<sup>1</sup>Pusan National University Yangsan Hospital, Department of Psychiatry, Australia

<sup>2</sup>The University of Sydney, Brain Dynamics Centre, Australia

<sup>3</sup>Komoki Sleep Center, Australia

**Introduction:** The relationship between sleep and pain has recently been seen as reciprocal. Pain may disturb sleep, but changes in sleep pattern could also influence pain perception. The aim of this study was to investigate the effects of partial sleep deprivation (PSD) on electrical pain sensitivity in healthy adults.

**Materials and methods:** Twenty healthy male subjects with good sleep quality (age 20–39 years) were investigated twice, once after habitual sleep (HS) and once after partial sleep deprivation. Overnight polysomnographic recordings were done during the night of HS, and actigraphic recordings were done during the night of PSD (2 h of time-in-bed at dawn). Electrical pain detection thresholds and tolerance thresholds were measured in the morning after each night. Subjective pain intensity during repetitive electrical pain stimulation was measured with visual analogue scale, and sleepiness was measured with Stanford sleepiness scale. All subjects completed daily sleep and pain diaries during the experimental period.

**Results:** Total sleep time of HS and PSD nights were 449 ± 20.6 min and 96.1 ± 12.3 min. Compared to HS, PSD decreased significantly electrical pain detection threshold (28.5 ± 4.5 mA vs. 23.6 ± 5.4 mA,  $p < 0.01$ ) and tolerance threshold (54.5 ± 48.7 mA vs. 43.5 ± 45.4 mA,  $p < 0.01$ ), but increased significantly subjective pain intensity (5.5 ± 1.1 vs. 6.8 ± 1.7,  $p < 0.01$ ). After PSD, subjective sleepiness was negatively correlated with pain detection threshold ( $p < 0.05$ ).

**Conclusion:** These findings suggest that reduced sleep time is associated with increased pain sensitivity, and there is an interaction between sleep and the brain mechanism of pain perception.

<http://dx.doi.org/10.1016/j.sleep.2013.11.422>

### Effects of sleep disordered breathing on quality of life

S. Lee<sup>1</sup>, Y. Chung<sup>1</sup>, M. Jo<sup>2</sup>

<sup>1</sup>Department of Otolaryngology, Asan Medical Center, University of Ulsan, College of Medicine, South Korea

<sup>2</sup>Department of Preventive Medicine, Asan Medical Center, University of Ulsan, College of Medicine, South Korea

**Introduction:** Sleep disordered breathing (SDB) is a considerably common sleep disorder that can be very disruptive to your sleep

which in turn can affect your overall wellbeing and quality of life. EuroQol (EQ-5D) is a standardized instrument for use as a measure for health outcome. The purpose of this paper is to compare quality of life in SDB and that in healthy controls with Korean version of listed measurements.

**Materials and methods:** Data was collected from a total of 600 representative healthy controls and 288 SDB patients. After ruling out for snoring and controlling for age and gender, remaining 229 controls were enrolled in this study. All SDB patients completed overnight polysomnography (PSG) and divided into four subgroups (simple snoring, mild, moderate, severe) according to apnea-hypopnea index (AHI). Three patients showing normal PSG findings were excluded. We evaluated quality of life using Korean version of the EQ-5D index, EQ-visual analogue scale (EQ-VAS) and Epworth sleepiness scale (ESS).

**Results:** The mean age of patients and healthy controls were 46 and 42.3, respectively. The proportions of male subjects were 86.8% and 85.8%. EQ-VASs were 73.2 ± 15.7 and 81.5 ± 12.3 in patients group and healthy controls, respectively ( $p < 0.005$ ). EQ-5D index were 0.939 ± 0.094 and 0.963 ± 0.059 in patients group and healthy controls ( $p < 0.001$ ). The EQ-VASs and EQ-5D index were lower in patients group than in healthy controls. ESS scores were 11.3 ± 5.0 for patients group and 4.3 ± 3.0 for healthy controls ( $p < 0.005$ ). ESS scores were higher in patients group than in healthy controls. Patients group was classified as 42 (14.7%) simple snoring, 52 (18.3%) mild-, 77 (27%) moderate -, 114 (40%) severe sleep apnea patients. The mean ESS score of simple snoring and severe sleep apnea patients were 10.0 ± 4.0 and 12.06 ± 5.12. Statistically significant differences were found between two subgroups ( $p < 0.05$ ). Correlation analysis revealed a significantly negative linear correlation between ESS scores and EQ-VAS ( $p = 0.003$   $r = -0.174$ ).

**Conclusion:** We founded that general quality of life in sleep apnea were poorer than that in healthy controls using Korean version of EQ-5D, ESS scores and EQ-VAS.

**Acknowledgements:** The authors would like to thank Sun Ok Kim from Asan Medical Center Department of Preventive Medicine for help with statistical analysis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.423>

### Watsu therapy in the treatment of fibromyalgia syndrome

J. Resende Silveira Leite, D. Almeida Galdino Alves, D. Alves Silva, L. Fernandes Do Prado, G. Fernandes Do Prado, L. Bizari Coin De Carvalho

**Introduction:** Fibromyalgia is a rheumatic syndrome characterized by diffuse and chronic pain at specific points, called tender points. Among the hydrotherapy techniques is Watsu which combines passive stretching with the centralization of breathing, promoting deep relaxation for the patient, causing physical and emotional relief. Objective: This study aimed to verify the effectiveness of Watsu method in symptoms of pain, anxiety and sleep quality in patients with fibromyalgia.

**Materials and methods:** The sample consisted of 12 participants with confirmed medical diagnosis of fibromyalgia, aged 30–60 years. The assessment instruments were: Visual Analogue Pain Scale (VAS) ranging from zero (little pain) to 10 (maximum pain), Beck Anxiety Inventory ranging from 0 (no anxiety) to 63 (severe anxiety) and Pittsburgh Sleep Quality Index ranging from zero to X being the worse the sleep the higher the score. The patients underwent 15 sessions, 3 times per week, and evaluated pre and post-treatment.

**Results:** We observed by the VAS that the pain symptom decreases from 6.04 before treatment to 1.12 post-treatment ( $p = 0.00001$ ), the

anxiety reduced from 32.5 before treatment to 13.6 after treatment ( $p = 0.0024$ ), and sleep quality improved from 12.67 in the pre-treatment to 5.58 post-treatment ( $p = 0.00004$ ).

**Conclusion:** It was concluded that Watsu method was effective in improving symptoms in patients with fibromyalgia related to pain, anxiety and sleep quality.

**Acknowledgement:** Thanks to the support and encouragement Unilavras research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.424>

### Assessment questionnaire of children with Sleep Apnea (TUCASA): translation, cultural adaptation and validation

J. Resende Silveira Leite, V. Ruotolo Ferreira, L. Fernandes Do Prado, G. Fernandes Do Prado, L. Bizari Coin De Carvalho

**Introduction:** Tucson Children 's Assessment on Sleep Apnea Study (TuCASA) was developed by Goodwin and coworkers in the United States - Tucson in 2003. It is a questionnaire consisting of 13 questions that assess the symptoms of Sleep Disordered Breathing (SDB) in children from 04 to 11 years. The aim of this study was to translate, culturally adapt and validate the questionnaire TuCASA to Brazilian Portuguese.

**Materials and methods:** It was performed in the 1st phase: translation, synthesis of translations, back translation, committee review and technical test with 30 children. The instructions of the scale and its items were adapted, taking into account the semantic, conceptual, experiential and cultural equivalences. We are holding the 2nd phase, validation of the questionnaire at Neurosono Sleep Center, Unifesp, São Paulo SP, Brazil and at Unilavras, Lavras MG, Brazil, in 60 children diagnosed with SDB and 60 children without the diagnosis of SDB by polysomnography.

**Results:** Preliminary Results: Up to now, 59 questionnaires were applied, 19 children with SDB, 20 with primary snoring and 20 without DRS.

**Conclusion:** The questionnaire demonstrates to be a suitable instrument for checking symptoms of SDB that will assist in the indication of polysomnography diagnostic.

**Acknowledgements:** Thank Capes, CNPq and institutions UNILAVRAS and UNIFESP.

<http://dx.doi.org/10.1016/j.sleep.2013.11.425>

### Utility of the statistical and nonlinear analysis for the actigraphic sleep pattern characterization

D. Martin Martinez<sup>1</sup>, P. Casaseca De La Higuera<sup>1</sup>, C. Alberola Lopez<sup>1</sup>, J. Garmendia Leiza<sup>2</sup>, J. Andres De Llano<sup>3</sup>, S. Alberola Lopez<sup>4</sup>

<sup>1</sup>LPI Research Group, ETSI Telecomunicacion, University of Valladolid, Spain

<sup>2</sup>EAP Jardinillos, SACYL, LPI Reserach Group, Spain

<sup>3</sup>Servicio de Pediatria, CAP Palencia, LPI Research Group, Spain

<sup>4</sup>EAP Jardinillos, SACYL, Spain

**Introduction:** Actigraphy is a useful tool for the assessment of the sleep pattern being mainly addressed by means of the Sadeh's algorithm; hence several aspects of sleep, such as regularity, have not been appropriately studied so far. This paper strives for showing the utility of both analysis of the sleep registries to complement the sleep pattern characterization. The discriminant capability of some statistical and nonlinear features has been evaluated over two cohorts (institutionalized and non-institutionalized elderly) in

which the features resulting from the Sadeh's algorithm do not show significant differences.

**Materials and methods:** Case/control study of elderly patients (65 years older). The case group was 144 institutionalized patients, while the control group were 124 patient home-living. Subjects were monitored with the Actigraph GT3x device, 24 h a day from Monday to Thursday, using 1 s epochs. Statistical features are composed by the mean, median, standard deviation, the interquartile range and the variation coefficient (VC). Nonlinear features are formed by those extracted through the analysis with the central tendency measure (CTM) and symbolic dynamics (SD). CTM evaluates the regularity at the ro scale (ro = 0, typically), while the SD (3 symbols long alphabet; 2 symbols/word) provides a set of word appearance probabilities that indicates either regularity or variability; Besides, the Shannon's entropy (ES) has been also included as complexity measure. All these features have been analysed by means of the U-test of Mann-Whitney to determine the existence of significant differences between the cohorts.

**Results:** As for the statistical features, only the VC shows significant differences, being higher in the control group ( $p < 0.05$ ). Regarding the nonlinear features, both CTM and SD give out discriminant features; specifically, the control group shows higher values of CTM ( $p < 0.04$ ), P02, P20 and P22 ( $p < 0.02$ ), whereas higher values of ES are achieved in the case group ( $p < 0.05$ ).

**Conclusion:** Both the VC, the CTM and the SD are useful to complement the characterization of the sleep pattern. In the current study, these features allow for the assessment of the regularity and the intensity of activity during sleep. Results of both the CTM and the ES point out that the activity of institutionalized elderly is less regular than the activity of those who live at home, which is in line with the results of P22.

**Acknowledgement:** Research supported by the Health Service of the Regional Government of Castilla y Leon.

<http://dx.doi.org/10.1016/j.sleep.2013.11.426>

### Influence of institutionalization on the sleep pattern in elderly population

J. Garmendia Leiza<sup>1</sup>, M. Aguilar Garcia<sup>2</sup>, J. Andres De Llano<sup>3</sup>, D. Martin Martinez<sup>4</sup>, P. Casaseca De La Higuera<sup>4</sup>, C. Alberola Lopez<sup>4</sup>

<sup>1</sup>EAP Jardinillos (SACYL) Palencia, LPI Research Group, University of Valladolid, Spain

<sup>2</sup>SACYL, EAP La Puebla, Spain

<sup>3</sup>SACYL, Servicio de Pediatria, Cap Palencia, Spain

<sup>4</sup>University of Valladolid, LPI Research Group, ETSI Telecomunicacion, Spain

**Introduction:** More common health complaints in institutionalized patients are insomnia and sleep disorders comparing with home-living elderly patient. The aim of this study was for analyze sleep pattern in elderly population, comparing institutionalized elderly and home-living elderly.

**Materials and methods:** Case and control study comparison between 266 elderly patients (65 year older), 142 institutionalized whereas the control group was 124 patients living at home. Subjects were monitored with the Actigraph GT3x device (placed on the right wrist) 24 h a day during seven consecutive days, using 1 s lasted epochs. The sleep patterns of both groups have been extracted through the well known Sadeh's algorithm and analysed by means of the U-test of Mann-Whitney (a non-parametric variant of the Student's t-test) in order to determine the existence of statistically significant differences between the groups under analysis.

**Results:** Statistically significant differences arise only during the three last days of the week (Friday, Saturday and Sunday). The number of minutes awake ( $p < 0.02$ ) and the average awakening ( $p < 0.04$ ) are higher in the case group on both Friday and Saturday, whilst the total sleep time ( $p < 0.03$ ) and the largest sleep time ( $p < 0.05$ ) are higher in the control group on Sunday. We not found statistically significant differences during working days in the analyzed variables.

**Conclusion:** The effects of institutionalization over the sleep pattern in elderly population are only significant on weekends (Friday, Saturday and Sunday). Institutionalized subjects suffer from either less or poorer sleep than those subjects that live at home. Working days, significant differences are not observed in the sleep pattern between both groups of patients. A possible explanation for this fact stems from the disruption of the institutionalized subject's daily routine as a consequence of both their weekend habits (activities with their families, for instance) and some variations on the schedule of the staff (on-call staff instead of regular staff, for instance).

**Acknowledgements:** Research supported by the Health Service (SACYL) of the Regional Government of Castilla y Leon in Spain.

<http://dx.doi.org/10.1016/j.sleep.2013.11.427>

### The comparison of sleep disorders among shift workers and non-shift workers in doorod hospital

M. Bagherian Lemraski

Lorestan University of Medical Sciences, Lorestan University of Medical Sciences, Lorestan, Iran

**Introduction:** Health workers ability to provide high quality care can be adversely affected by many factors such as sleep deprivation associated with shift work. The aim of this study was comparing sleep problems among shift workers and non shift workers.

**Materials and methods:** At first we collected demographic data from the hospital workers. We divided 153 Volunteers into shift worker and non shift worker groups. They completed the Global Sleep Assessment Questionnaire for sleep problems. The results were analyzed by z-test and  $\chi^2$ , in SPSS (V,16).

**Results:** Shift workers suffered significantly from daily sleeping ( $p = 0/001$ ), daily dysfunction due to sleepiness ( $p = 0/001$ ), insufficient sleep ( $p = 0/001$ ) and sleep apnea ( $p = 0/001$ ) as compared with non-shift workers.

**Conclusion:** This study showed that there is relation between shift work and sleep problems such as daily sleepiness and apnea. Those sleep problems can affect clinical performance and may be an important factor in patient safety and the health worker's well being.

**Acknowledgement:** Acknowledgment to the personnel of Shahid Rajaie Hospital for their cooperation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.428>

### Utility of sleep study in children with laryngomalacia

R. Peralta Lepe<sup>1</sup>, G. Castaño De Las Pozas<sup>2</sup>, M. Alonso Álvarez<sup>1</sup>, J. Cordero Guevara<sup>2</sup>, E. Ordax Carbajo<sup>1</sup>, J. Terán Santos<sup>1</sup>

<sup>1</sup>Hospital Universitario de Burgos, Sleep Unit, Respiratory Department, Spain

<sup>2</sup>Hospital Universitario de Burgos, Sleep Unit, Spain

**Introduction:** Laryngomalacia (LM) is one of the most frequent congenital laryngeal anomalies in children and it has been associated

with sleep disorder. Our main objective was to describe the sleep study findings in children with LM using polysomnography (PSG) or respiratory polygraphy (RP).

**Materials and methods:** We studied 18 children diagnosed with laryngomalacia by flexible nasolaryngoscopy. We performed a sleep study: PSG or RP and complete medical history on all of them.

**Results:** 18 children were studied, 5 by PSG and 13 by RP. 11 (61.1%) of them were females, with a mean age of 3.38 ( $\pm 3.01$ ) months and weight 4674 ( $\pm 1418$ ) g. LM type 1 was present in 7 (38.9%), type 2 in 6 (33.3%) and type 3 in 5 (27.8%) children. Premature birth described 4 (22.2%) children. Stridor was the most frequent symptom, in 15 (83.3%) followed by feeding difficulties in 8 (44.4%). Apneas were referred in 7 (38.8%), intercostal retraction and regurgitation in 6 (33.3%). Gastroesophageal reflux disease was confirmed in 10 (55.5%) by pHmetry requiring surgery in 2 cases. Echocardiography was performed in 14 (77.8%) showing cardiac anomalies in 4 (22.2%). In the sleep study the mean values were: sleep efficiency 83% ( $\pm 5.85$ ), NREM% 36.9 ( $\pm 11.1$ ), REM% 30.5 ( $\pm 7.7$ ) and indeterminate 32.4% ( $\pm 18.2$ ), apnea-hypopnea index (AHI) 13.74 ( $\pm 10.90$ ), hypopnea 30.5 ( $\pm 48.2$ ), obstructive apneas 58.8 ( $\pm 67.3$ ), central apneas 13.6 ( $\pm 20.8$ ), cumulative percentage of time spent at saturation  $< 90\%$  (CT90) 2.09% ( $\pm 4.72$ ), mean oxygen saturation 96% ( $\pm 1.94$ ) and heart rate 126 ( $\pm 14.24$ ) bpm. 16 children (88.8%) were diagnosed with sleep-disordered breathing (SDB).

**Conclusion:** Our findings confirmed the necessity to do a sleep study in children with laryngomalacia, regardless of the type of laryngomalacia in nasolaryngoscopy.

**Acknowledgements:** The authors would like to thank Dra. Navazo Eguía and the Sleep Unit staff at the University Hospital of Burgos for their help.

<http://dx.doi.org/10.1016/j.sleep.2013.11.429>

### Prevalence and correlates of nightmare disturbances in patients with sleep disorders other than REM-parasomnias

S. Li, J. Lam, J. Zhang, M. Yu, Y. Wing

Department of Psychiatry, Faculty of Medicine, The Chinese University of Hong Kong, China

**Introduction:** Nightmare disturbances represent a distressing sleep complaint often indicative of REM-parasomnias. Despite some evidence in the literature of posttraumatic stress disorder (PTSD) suggesting an association of nightmare complaints with sleep disordered breathing and increased periodic limb movements, less is known regarding the prevalence and clinical presentation of nightmare disturbances in the patients with other sleep disorders. The aim of this study was to investigate the prevalence and clinical correlates of frequent nightmares in a consecutive series of patients assessed in a sleep medical facility.

**Materials and methods:** A retrospective chart review was conducted on a large, consecutive series of patients assessed in a university hospital-based sleep assessment unit during 2001–2011. All the patients underwent comprehensive examinations including clinical interview, polysomnographic assessment and a battery of intake questionnaires including general sleep questionnaire, Hospital Anxiety and Depression Scale (HADS) and Beck Depression Inventory (BDI). Frequent nightmares were defined as having nightmares at least once per week as reported in the sleep questionnaire.

**Results:** After excluding those diagnosed with REM-parasomnias, the final analysis consisted of 820 patients (mean age: 46.6 years, s.d. 12.2; female 37.7%) with complete data on nightmare frequency as well as clinical and polysomnographic information. Approximately 18% of subjects reported frequent nightmares. Subjects with

frequent nightmares were more likely to be female ( $p < .01$ ) and have a diagnosed psychiatric disorder ( $p < .001$ ). Frequent nightmares were associated with various self-reported sleep symptoms such as difficulty in maintaining sleep ( $p < .05$ ), sleep paralysis ( $p < .05$ ) and sleep related injuries to self ( $p < .05$ ). Amongst different sleep disorders, sleep related bruxism was significantly associated with frequent nightmares (OR = 5.76, 95% C.I. 1.20–26.6). After excluding those diagnosed with a psychiatric disorder, subjects with frequent nightmares were found to score significantly higher on HADS-anxiety subscale ( $p < .001$ ) and BDI ( $p < .01$ ).

**Conclusion:** Frequent nightmares are common in patients with sleep disorders other than REM parasomnias. The associations of frequent nightmare with psychopathology and self-perceived insomnia in sleep patients suggest a need of enhanced clinical attention to the nightmare complaint in the routine assessment of treatment seeking patients at sleep medical settings.

<http://dx.doi.org/10.1016/j.sleep.2013.11.430>

### Insomnia subtypes in sleep apnea: implications for screening and treatment

E. Libman<sup>1</sup>, L. Creti<sup>1</sup>, C. Fichten<sup>2</sup>, D. Rizzo<sup>3</sup>, M. Baltzan<sup>4</sup>, S. Bailles<sup>1</sup>  
<sup>1</sup>Jewish General Hospital, McGill University, Jewish General Hospital, Canada  
<sup>2</sup>Jewish General Hospital, McGill University, Dawson College, Jewish General Hospital, Canada  
<sup>3</sup>Jewish General Hospital, Universite de Montreal, Jewish General Hospital, Canada  
<sup>4</sup>OSR Medical, Mount Sinai Hospital, McGill University, Canada

**Introduction:** Screening of obstructive sleep apnea in primary care settings is challenging for the family doctor, given the wide variety of patients' symptom complaints. We developed the Sleep Symptoms Checklist (SSC), which groups common complaints into four subscales: Insomnia, Daytime Distress, Sleep Disorder, and Psychological Distress. In the present study, we investigated whether different SSC profiles exist for sleep apnea and chronic insomnia, in patients with and without an insomnia complaint.

**Materials and methods:** Participants were 88 primary care patients with OSA; 57 individuals, without OSA, who sought cognitive-behaviour therapy for insomnia (CBT-I); and 14 healthy community controls without sleep apnea or sleep complaints. All completed the SSC and a sleep questionnaire. Sleep apnea participants were segregated into three groups according to their sleep questionnaire responses: no insomnia (OSA),  $n = 21$ ; insomnia including a complaint and objective poor sleep (OSA-I),  $n = 30$ ; and insomnia by objective criteria but no complaint (OSA-I-NC),  $n = 37$ .

**Results:** There was no statistical difference in the severity of sleep apnea for the 3 OSA groups. All five groups were compared using ANOVA on the SSC subscale scores. The 3 OSA groups were characterized by worse Sleep Disorder scores than the CBT-I and Control groups. The two OSA groups with insomnia had worse Insomnia scores than the OSA and Control groups. The CBT-I participants had significantly worse Insomnia and Psychological Distress scores than the other clinical groups and their Sleep Disorder scores were similar to those of the Control group. Psychological Distress was worse for groups with insomnia (OSA-I-NC, OSA-I, CBT-I) compared to the OSA and Control groups.

**Conclusion:** The present study demonstrates that the SSC can be used to identify distinct clinical "profiles" for sleep apnea patients

with and without the complaint of insomnia and for chronic insomnia patients with without sleep apnea. Of particular clinical importance is the identification of two subgroups of sleep apnea patients – those who have diagnosable insomnia and those who meet objective criteria for insomnia but are uncomplaining. The sleep problems of the non-complaining group of apnea patients with insomnia may not come to the attention of their treating sleep doctor and yet may interfere with CPAP therapy acceptance and adherence. These profiles help identify sleep apnea patients who could benefit from additional treatment for insomnia.

**Acknowledgement:** This research was supported by the Canadian Institutes of Health Research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.431>

### Restless legs syndrome in a patient with dysmetabolic iron overload syndrome and abnormal iron deposits in basal ganglia and substantia nigra

L. Lillo<sup>1</sup>, A. Del Castillo<sup>2</sup>, M. Morán<sup>3</sup>, J. Guzmán De Villoria<sup>4</sup>, A. Guillem<sup>1</sup>, R. Peraita-Adrados<sup>5</sup>

<sup>1</sup>University Hospital Gregorio Marañón, Neurology Service, Spain  
<sup>2</sup>University Hospital Gregorio Marañón, Internal Medicine Service, Spain  
<sup>3</sup>Research Foundation, Spain  
<sup>4</sup>University Hospital Gregorio Marañón, Neuroradiology Department, Spain  
<sup>5</sup>University Hospital Gregorio Marañón, Sleep Unit-Clinical Neurophysiology, Spain

**Introduction:** Restless Legs Syndrome (RLS) is a sensorimotor disorder involving primarily leg discomfort and motor restlessness. Iron deficiency anemia occurs in secondary cases and a decreased brain iron status in CSF and decreased regional iron particularly in the substantia nigra has been postulated.

**Materials and methods:** A 50 years old patient was referred for severe RLS and periodic leg movements (PLM) while sleeping. Past medical history showed completed bladder cancer remission, overweight, high blood pressure and dyslipidemia.

**Results:** Neurological examination and standard EEG were normal. The Epworth Sleepiness Scale score was 18. Polysomnography showed a disturbed and fragmented sleep with a reduction in total sleep time, low sleep efficiency, mild OSA with an apnea-hypopnea index of 14.4/h and periodic leg movements index 37.2/h. The serum ferritin was 390  $\mu\text{g/L}$ , serum iron 175  $\mu\text{g/dl}$ , transferrin 189  $\text{mg/dl}$ , and transferrin saturation index 73%. The genetic study revealed heterozygosity for the H63D mutation of HFE gene and another mutation in the 5'UTR region of HFE gene, both not identified as pathological. The cranial MRI initially normal, showed two years later to RLS diagnosis abnormal iron deposits in globus pallidus, dentate, red nuclei and substantia nigra. Liver MRI showed mild iron overload. The diagnosis was dysmetabolic iron overload syndrome.

**Conclusion:** RLS with PLM was associated with high serum ferritin and iron levels, low transferrin and high saturation transferrin index suggesting an impaired mechanism of mobilization of stored iron. The abnormal iron deposits in basal ganglia and substantia nigra revealed a complex disorder of iron central metabolism.

<http://dx.doi.org/10.1016/j.sleep.2013.11.432>

### Association between poor sleep quality and C-reactive protein

R. Liu<sup>1</sup>, X. Liu<sup>2</sup>, Z. Zheng<sup>3</sup>, P. Zee<sup>4</sup>, J. Du<sup>1</sup>

<sup>1</sup>Beijing Institute of Heart, Lung and Blood Vessel Diseases, Capital Medicine University, China

<sup>2</sup>Mary Ann and J. Milburn Smith Child Health Research Program, Northwestern University Feinberg School of Medicine, Ann & Robert H. Lurie Children's Hospital of Chicago and Children's Hospital of Chicago Research Center, China

<sup>3</sup>Beijing Institute of Geriatrics, Beijing Xuanwu Hospital, Capital Medicine University, China

<sup>4</sup>Department of Neurology, Northwestern University, China

**Introduction:** Our objective was to explore the association between poor sleep quality and hs-CRP in an adult U.S. population.

**Materials and methods:** This study focused on 9317 participants in the National Health and Nutrition Examination Survey (NHANES) from 2005–2008 who were aged 20–85 years, completed a sleep disorder questionnaire, and had available information on serum hs-CRP. Sleep quality was classified into three categories (good, moderate, poor) based on the responses of participants to the NHANES sleep disorder questionnaire. High CRP was defined as hs-CRP >1 md/dL. Linear regression model was applied to investigate the association between poor sleep quality and log-transformed hs-CRP. And logistic regression model was fitted to evaluate the association between sleep quality and the risk of high CRP.

**Results:** Females were more likely to report poor sleep quality than males (26% vs. 19%,  $p < 0.0001$ ). In fully-adjusted linear regression model, poor sleep quality was significantly associated with elevated hs-CRP (log transformed) among the overall sample and in females only ( $\beta = 0.10$ ,  $se = 0.03$ ,  $p < 0.01$  and  $\beta = 0.13$ ,  $se = 0.04$ ,  $p < 0.01$ , respectively). In fully-adjusted logistics regression model, poor sleep quality was linked with risk of high CRP (OR: 1.42, 95%CI: 1.15–1.76 in overall sample and OR: 1.59, 95%CI: 1.18–2.14 in females, respectively).

**Conclusion:** We found that poor sleep quality was independently associated with elevated hs-CRP in females but not in males in a U.S. adult population.

**Acknowledgements:** We thank Tami R. Bartell in Mary Ann and J. Milburn Smith Child Health Research Program, Children's Hospital of Chicago Research Center, for English editing.

<http://dx.doi.org/10.1016/j.sleep.2013.11.433>

### Sleep problems among Chinese preschool children: prevalence and associated factors

Z. Liu<sup>1</sup>, G. Wang<sup>2</sup>, L. Geng<sup>3</sup>, R. Chen<sup>1</sup>, G. Tan<sup>1</sup>, Z. Wang<sup>1</sup>

<sup>1</sup>Sichuan University, West China School of Public Health, China

<sup>2</sup>East China Normal University, School of Psychology and Cognitive Science, China

<sup>3</sup>Shijiazhuang Preschool Teachers College, China

**Introduction:** Sleep is a critical issue in child development and may be affected by a range of socio-demographic variables, parenting style and emotional/behavior, etc. This study aimed to (1) characterize sleep patterns and sleep disturbances among Chinese preschool children, (2) determine the prevalence of sleep disturbances according to published norms, and (3) examine socio-demographic factors, parenting factors and emotional/behavioral problems that might be associated with sleep disturbances.

**Materials and methods:** A sample of 561 preschool children (53.2% male) aged 2–6 years was recruited from 10 kindergartens in Shijiazhuang city, China. Their parents completed the Children's

Sleep Habits Questionnaire (CSHQ), Strengths and Difficulties Questionnaire (SDQ) and self-made questionnaire including demographic characteristics, using of electronics as well as parenting styles.

**Results:** The mean bedtime was 21:23 (SD = 33 min), mean wake-up time was 7:02 am (SD = 21 min), mean sleep duration was 9 h 20 min (SD = 42 min). Overall, 49.4% of the children suffered from global sleep disturbances (CSHQ total score above 41). The prevalence of specific sleep disturbances ranged from 4.3% (falling asleep while watching TV) to 32.4% (needing parents in room to sleep). Correlations between most domains of sleep disturbances and emotional/behavioral problems were statistically significant, with Pearson's correlation coefficients varying from 0.1 to 0.3 ( $p < 0.05$  or  $p < 0.01$ ). Hierarchical multiple regression analysis revealed that age ( $\beta = -0.13$ ,  $p < 0.01$ ), co-sleeping ( $\beta = 0.17$ ,  $p < 0.01$ ), parenting attitude ( $\beta = 0.15$ ,  $p < 0.01$ ), emotional symptoms ( $\beta = 0.18$ ,  $p < 0.01$ ), peer problems ( $\beta = 0.14$ ,  $p < 0.01$ ), and hyperactivity ( $\beta = 0.14$ ,  $p < 0.01$ ) accounted for significant variance in CSHQ total score.

**Conclusion:** Short sleep duration and sleep disturbances are prevalent among Chinese preschool children. Sleep disturbances are associated with age, co-sleeping, parenting attitude, emotional symptoms and hyperactivity.

<http://dx.doi.org/10.1016/j.sleep.2013.11.434>

### Reliability and validity of CSHQ in urban preschool-aged children of mainland China

Z. Liu

Social Medicine Dept., West China School of Public Health, Sichuan University, China

**Introduction:** The Children's Sleep Habits Questionnaire (CSHQ) is a useful and well-established survey tool for screening sleep problems primarily in 4–10 years old children. Its reliability and validity have been examined in Chinese school age children. This study aimed to assess its reliability and validity in a large representative preschool-aged sample in China urban areas.

**Materials and methods:** Altogether 4050 questionnaires were distributed to kindergarten children and completed by their parents or other guardians. Another 113 CSHQ questionnaires were distributed for test-retest reliability and analyzed with intraclass correlation coefficients. Internal consistency was evaluated by Cronbach  $\alpha$ . The construct validity was preliminarily explored by subscale-level factor analysis.

**Results:** Of the 4050 distributed questionnaires, 3320 (86.2%) were reclaimed. Mean age was 4.82 (SD = 1.06) and 52.4% were boys. For test-retest questionnaires, 113 distributed and 106 (93.8%) were reclaimed. The Cronbach  $\alpha$  for the full scale was 0.72 and for subscales it ranged from 0.44 (Night awakenings) to 0.63 (Daytime sleepiness); the test-retest reliability for the full scale was 0.77 and ranged from 0.38 (Sleep duration) to 0.76 (Sleep anxiety) for subscales, with exceptionally low. Factor analysis showed that the 8 domains loaded on three common factors, which could explain 61.35% of the total variance.

**Conclusion:** The CSHQ demonstrated a not optimum but basically acceptable psychometrical properties in urban Chinese kindergarten children.

**Acknowledgements:** We are grateful for those informants and kindergartens participated in our study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.435>

### Behavioural evidence that modafinil and amphetamine do not produce equivalent qualities of wake promotion in sleep-restricted rats

S. Loomis<sup>1</sup>, A. Mccarthy<sup>1</sup>, D. Edgar<sup>2</sup>, M. Tricklebank<sup>1</sup>, G. Gilmour<sup>1</sup>

<sup>1</sup>Eli Lilly, UK

<sup>2</sup>Eli Lilly, USA

**Introduction:** Performance effects of sleep restriction are generally assessed across three broad domains: cognitive performance, motor performance and mood. Within the domain of cognition, the psychomotor vigilance task (PVT) provides a means to assess vigilant attentional capacity with low cognitive demand, allowing robust deficits following sleep restriction. Using rats, we directly compared equipotent doses of modafinil with amphetamine (in terms of their EEG wake-promoting effects) to assess their capacity to reverse attention deficits following 11hrs of sleep restriction.

**Materials and methods:** During the PVT task, Reaction Time (RT) latencies are measured to the onset of an imperative light cue that signals food reward, occurring under a variable interval 5s schedule following a houselight preparatory cue. Previous in house studies have demonstrated marked behavioural deficits following 11 h automated biofeedback sleep restriction, where both median RTs slowed and omissions increased.

**Results:** Using PVT testing following such a sleep restriction protocol modafinil reversed the effects of sleep restriction with regard to trials completed and omissions. However, there was a pronounced increase in premature responding at the highest dose tested. Administration of amphetamine worsened the behavioural effects of sleep restriction, decreasing trials and increasing response omissions and median response latencies. Both modafinil and amphetamine produced similar wake-promoting effects with regard to EEG measurements.

**Conclusion:** In conclusion, these studies demonstrate that simple reaction time measures following sleep restriction can preclinically determine functional differences in wake-promoting compounds that would otherwise remain undetectable using EEG measurements alone.

**Acknowledgement:** I'd like to acknowledge Christopher Baxter for his technical involvement in this work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.436>

### Sleep quality in college students: a study about the contribution of lifestyle, academic performance and general well-being

E. Lopes<sup>1</sup>, I. Milheiro<sup>2</sup>, A. Maia<sup>3</sup>

<sup>1</sup>Unidade Local de Saúde do Alto Minho, E.P.E., Departamento de Psiquiatria e Saúde Mental da Unidade Local de Saúde do Alto Minho, E.P.E., Portugal

<sup>2</sup>Centro Hospitalar de Entre-Douro-e-Vouga, E.P.E., Serviço de Psiquiatria do Centro Hospitalar de Entre-Douro-e-Vouga, E.P.E., Portugal

<sup>3</sup>Universidade do Minho, CIPSI, School of Psychology, Portugal

**Introduction:** Sleep assumes a major role in human functioning. The aim of this study was to describe features concerning sleep quality, lifestyle, general well-being and academic satisfaction/ performance in college students; characterize the relationship between sleep quality and several aspects related to lifestyle, levels of personal/social well-being and academic performance/satisfaction and to identify predictive factors of poor sleep quality in this population.

**Materials and methods:** The sample of this descriptive, cross-sectional, analytic study was collected during six days, in November 2009. 574 students from Minho University completed an online sur-

vey about sleep habits. The questionnaire included the Pittsburgh Sleep Quality Index and an author-designed group of questions about lifestyle, academic performance and general wellbeing. All statistical analysis was performed using Statistic Package for the Social Sciences version 17.

**Results:** From the assessed students, 64.8% presented poor sleep quality. An association was found between those subjects and lower levels of academic success and satisfaction, worse adaptation to scholastic demands, worse opinion about conditions of the place where sleep occurs, more physical and psychological symptoms, learning problems, daily and academic organization problems and poorer relationships with peers and intimate relationships. Logistic regression analyses identified smoking habits and caffeine intake, a higher punctuation on "Symptoms/difficulties/problems" index and less satisfaction with life and support received from social relationships as predictors of poor sleep quality. Still, 53.3% of students considered the quality of their sleep as fairly good, and the vast majority (88.7%) denied use, in the previous month, of psychotropic medication with effects on sleep. Nonetheless, about 10.1% of the subjects admitted having resorted to any kind of expert help for problems related to sleep.

**Conclusion:** In Portugal, there is still a lack of information regarding this subject. Results showed that poor sleep quality is present at alarming levels in this college student population. The recognition of the factors involved in the deterioration of sleep quality in this group, namely through prospective design studies, would contribute to outline prevention and intervention health programs, improving global assistance to these subjects.

**Acknowledgement:** The authors thank to all participants and institutions involved in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.437>

### Sleep complaint as a biomarker of bipolar disorder in children and adolescent

M. Lopes

Child and Adolescent Affective Disorder Program Department, Sao Paulo University, Brazil

**Introduction:** Depressive episodes are common healthy problem and patients with (BD) bipolar disorder have higher risk of suicidal than healthy individuals. Poor quality of sleep in depressive disorders is an important marker of response to treatment and to risk of recurrence. However, the association between sleep duration and subsequent mood is less consistent for depression than for mania or hypomania. The aim of this study was assessing sleep complaints in children and adolescents with BD, and analyzing differences between their depressive episode and mania episode in a transversal study of children and adolescents with BD.

**Materials and methods:** Our sample includes 72 children (10±2y) and adolescents (15±2y) with BD. The data were obtained from two research databases of patients consecutively referred for BD treatment in an outpatient clinic at the Child and Adolescent Affective Disorder Program at the Institute of Psychiatry – Sao Paulo University in Brazil. We obtained signed consent forms from legal guardians. Depressive psychopathology was ascertained by face-to-face clinical interview and with the DSM-IV version of the Diagnostic Interview for Children and Adolescent DSM IV version – DICA IV. Sleep disturbance was defined as sleep complaints (SC) noted, during a manic and a depressive episode. we considered four disturbances: Initial Insomnia (II), Night Awakening (NA); Early Awakening (EA), Hypersomnia (Hy). The data were analyzed by Chi-Square tests.

**Results:** There were 22 girls and 50 boys: 42% of patient had sleep-disordered- breathing. The occurrence of SC was higher during mania than during depression (66.4% versus 52.3%, respectively). II and EA correlated with depressive episode while; NA and Hy with mania episode ( $p < 0.05$ ). The time in bed was higher during depression ( $p = 0.01$ ), and patients with Night Awakening had higher chances to develop mania. The total sleep time was shorter in child group than in an adolescent group ( $p < 0.05$ ), but the complaint of non-restorative sleep was significant higher in adolescents, particularly during mania episode ( $p = 0.048$ ).

**Conclusion:** Sleep complaints may be used as a predictor of the occurrence of a specific episode in bipolar disorder. More investigation on the sleep changes in young individuals with bipolar disorders is needed.

**Acknowledgement:** I would love to thank the Institute of Psychiatry at University of Sao Paulo Medical School, Brazil.

<http://dx.doi.org/10.1016/j.sleep.2013.11.438>

### **The relationship between sleep complaints and suicidal behaviour in a mild to severe depressed sample of children and adolescents**

M. Lopes

*Child and Adolescent Affective Disorder Program, Institute of Psychiatry of the University of Sao, University of Sao Paulo, Brazil*

**Introduction:** Changes in sleep schedule are considered a warning sign of suicide. Recently, studies reported the association of short sleep (6 h) to Suicidal Ideation and Suicidal Attempt in the context of an active psychiatric disorder, with depressive episodes being the psychiatric disorder most commonly associated with suicide. The aim of this study was to evaluate the relationship between current sleep complaints (SC) and suicidal behaviour (SB) in a sample of depressed children and adolescents.

**Materials and methods:** Target population of 214 youths with current MDD, according to DSM-IV, from two research databases consecutively referred to an outpatient clinic between 1998 and 2006. Mean age of the target population was 12.5 y.o. with 56.1% of males. The occurrences of SC and SB were 66.4% and 52.3%, respectively. 37.9% (81) patients presented both, SC and SB, with more severe symptomatology and greater global functioning impairment. SC and SB were directly questioned to the patients during interview and thru DSM-IV DICA IV, while depressive episode severity was scored by CDRS-R and CGAS. We separated the cohort into four groups: patients with any SC, any SB, patients who did not describe any SC or SB and finally patients with both SC and SB (analysed group). All statistical tests of significance were performed using 2-tailed tests with  $\alpha = 0.05$ . Logistic regression analysis was performed to look at the clinical association between SC and SB.

**Results:** Taken SC as the dependent variable, we found correlations of Early Awakening (EA) with SB, odds ratio (OR) = 4.4, Night Awakening (NA) with Suicidal Ideation (SI) (OR = 2.4) and Initial Insomnia (II) with SB, (OR = 2.1). When SB was the dependent variable, the correlations remain with SB and II (OR = 1.8) and EA (OR = 4.3). Also there were important correlations between SI and SC (OR = 9.8) and SI and II (OR = 7.5).

**Conclusion:** We found a positive association between SC and SB. Our patients presented association of Initial Insomnia with SB clusters, as well as Night Awakening and Early Awakening. We found that the interaction between SC and SB can influence the severity of the affective disorders.

**Acknowledgements:** We thank Boris Birmaher, M.D. (Director of the Child and Adolescent Anxiety Program at the University of Pittsburgh

School of Medicine) and Christian Guilleminault, MD, DSc (Stanford University Medical School) for suggestions and advises.

<http://dx.doi.org/10.1016/j.sleep.2013.11.439>

### **Events disturbing sleep quality among elderly**

J. Loranger, S. Desjardins, A. Hamel, S. Lapierre, L. Marcoux  
*Université du Québec à Trois-Rivières, Canada*

**Introduction:** It is common to find, in the elderly, an inability to sleep due to several concerns. Our aim was to determine the association between sleep disturbing events and the quality of sleep in the community-dwelling elderly.

**Materials and methods:** The sample included 188 male and 436 female subjects aged 65 years and over ( $79.7 \pm 5.0$  years old). Participants answered questions about their sleep difficulties, their worries level and the type of events disturbing their sleep. Sleep quality was assessed using the Insomnia Severity Index, and level of worries was assessed using the Penn State Worry Inventory.

**Results:** About 28% of seniors reported having experienced an event disturbing their sleep. However, these people have a similar sleep quality than those who did not report having experienced any events ( $p = 0.127$ ). Also, about 14% of seniors have a level of concern between moderate to high. Those ones actually suffer from a more severe level of insomnia than other reporting a low level of concern ( $p < 0.000$ ). Our results showed that there is no correlation between any type of event and the level of insomnia ( $p = 0.405$ ) or worries ( $p = 0.175$ ).

**Conclusion:** Our results suggest that concerns who affected sleep quality do not come from events reported but from general tendency to worry. Future studies should investigate what cause this general tendency to worry in elderly to prevent future sleep disturbances.

**Acknowledgements:** Research supported by the Fonds québécois de recherche sur la société et la culture.

<http://dx.doi.org/10.1016/j.sleep.2013.11.440>

### **Sleep disturbances in Portuguese asthmatic children-preliminary results**

H. Loureiro, A. Sokolova

*Hospital Professor Doutor Fernando Fonseca, Portugal*

**Introduction:** Asthma is the most common chronic lower respiratory disease in childhood throughout the world. Nighttime respiratory symptoms constitute one of the criteria of disease control, but other sleep disturbances exist in patients with asthma. The aim of this study was to screen for sleep disturbances in children with asthma.

**Materials and methods:** Outpatients with asthma were evaluated with two sleep screening questionnaires. Parents of children aged between 4 and 10 years with asthma were asked to answer Children Sleep Habits Questionnaire (CSHQ-PT). Their children aged between 7 and 10 years answered Sleep Self Report (SSR-PT). Asthma control was assessed according to ICON Guidelines. We compared the obtained results with a group of 574 healthy children studied previously for the validation of both questionnaires for the Portuguese population (control group). The total score of both questionnaires and the 8 subscales of CSHQ-PT, bed time resistance (BTR), sleep onset delay (SOD), sleep duration (SD), sleep anxiety (SA), night awakenings (NW), parasomnias (PS), sleep disorder breathing (SDB), day time sleepiness (DTS) were analyzed.

**Results:** We obtained data from 23 children (mean age 7.7 years  $\pm$  1.7), 52.2% male. Considering ICON Guidelines, only in 5 (21.7%), asthma was totally controlled. Sleep habits evaluation showed mean sleep duration of 9.6 h/day  $\pm$  1.4, median of 10 h (6.30–12.30 h) with a difference of sleeping time between week and week-end of 1 h  $\pm$  0.76. The CSHQ-PT mean total score in this sample was 54.7  $\pm$  10.9 and in the control group was 43.8  $\pm$  6.1. Comparing both groups using Mann Whitney U test, the total score showed a z score of  $-3.91$  ( $p.000$ ). Regarding the subscales, z score was statistically significant in SDB, PS, SD, SOD and ranged from  $-5.36$  ( $p.000$ ) in SDB to  $-3.55$  ( $p.000$ ) in SOD. SSR-PT had a mean score of 36.4  $\pm$  6.1 in the asthma group and of 34.9  $\pm$  5.7 in the control group.

**Conclusion:** These are the preliminary results of the evaluation of sleep disturbances in a sample of asthmatic children with sleep screening questionnaires validated for Portuguese population. The obtained results alert for the need of performing the screening of sleep disturbances in asthmatic children, since besides SDB these children have other sleep disturbances presumably related with sleep deprivation and anxiety, namely altered sleep duration, sleep onset delay and the existence of parasomnias.

**Acknowledgement:** Pediatric Department of HFF.

<http://dx.doi.org/10.1016/j.sleep.2013.11.441>

### Sleep habits in a pediatric population of a suburban area of Lisbon

A. Martins<sup>1</sup>, P. Chaves<sup>2</sup>, A. Papoila<sup>3</sup>, H. Loureiro<sup>1</sup>

<sup>1</sup>Hospital Fernando Fonseca, Pediatric Department, Portugal

<sup>2</sup>Monte Abrão Primary Health Care Center, Portugal

<sup>3</sup>Faculdade Ciências Médicas, UNL, Portugal

**Introduction:** Sleep disorders (SD) are among the most common complaints in childhood, often undervalued by clinicians. Extrinsic and intrinsic factors influence sleep, particularly socio-cultural environment. It is known that poor sleep hygiene has physical, educational and social consequences. In Portugal there are few published studies about sleep habits in children and rarely based on validated questionnaires. The aim of this study is to determine the prevalence of SD and associated factors in an outpatient pediatric population of a primary health care center (PHCC).

**Materials and methods:** Observational study of 4–10 year-old children admitted to a medical appointment at a PHCC of a suburban area of Lisbon during a 4 month period. Children Sleep Habits Questionnaire validated for the Portuguese population (CSHQ-PT) for the screening of SD (cut-off = 44 points) with 8 subscales (bedtime resistance (BTR), sleep onset delay (SOD), sleep duration (SLD), parasomnia (PS), night wakings (NW), sleep anxiety (SA), sleep disordered breathing (SDB) and daytime sleepiness (DTS)) was applied to parents or legal guardian, as well as an inquiry with demographic, anthropometric and health information. Body Mass Index (BMI) z-score was determined by Center for Disease Control growth charts. Non-parametric Mann–Whitney, Chi-squared and exact Fisher's tests were used. A level of significance  $\alpha = 0.05$  was considered.

**Results:** From 128 children, 57.8% were male; mean age was 6.5 ( $\pm 0.1$ ). Mean of cohabitants was 4.0 ( $\pm 0.1$ ). 21.1% live in a single-parent family. Median BMI z-score was 0.4 (min  $-6.2$ ; max 3.4). From CSHQ-PT, 59.4% scored above the cut-off, with the following subscales score: DTS - 43.8%; BTR - 25.8%; SA - 20.3%; PS - 14.8%; SLD - 10.9%; NW - 7%; SOD - 4.7%. Mean duration of sleep was 9h57m ( $\pm 0.1$ h6m). Data showed that children living in a single-parent family had more SD ( $p = 0.048$ ), particularly PS ( $p = 0.019$ ). Children with SDB showed higher BMI z-scores ( $p = 0.055$ ) and more DTS ( $p = 0.012$ ).

**Conclusion:** The prevalence of SD found was higher than reported in medical literature. Subscales related with behavioral SD were the most relevant in this population. The study suggests that family structure influences children's sleep hygiene. Early intervention on family is needed to overcome this issue. Regarding SDB, early identification of Ear, Throat, Nose disorders and an approach towards an adequate nutritional status are crucial to healthy sleep hygiene and therefore better performance in children daily life activities.

**Acknowledgement:** Patients Primary Health Care Center.

<http://dx.doi.org/10.1016/j.sleep.2013.11.442>

### Proactive coping moderates the relationship between meaning of life and sleep quality in university students

N. Lu

The Research and Counseling Center of Applied Psychology of Shenzhen University, The Chinese Psychological Society, Guangdong, China

**Introduction:** Sleep is very important in human life. A lot of factors interfere with sleep quality. This is a growing problem in university students in China. Meaning of life is an important affecting factor as individual grow. The proactive coping refers to a management by objectives which individuals utilize all kinds of actual, informational and emotional effective resources in advance to realize the target and individual growth when facing challenges in the future. The purpose of the study was to examine the relationship between Proactive coping, meaning of life and self-reported sleep quality in university students and to assess whether Proactive coping mediate the relationship between meaning of life and Sleep Quality.

**Materials and methods:** Testing a total of 1753 Students from 5 universities in China with the following self-report measures: The Meaningful Life Scale, Proactive Competence Scale and Sleep Quality Scale. The final sample included 1685 university students 18 – 23 years old with a mean age of 20.21  $\pm$  1.182 (856/50.8% male and 829/49.2% female). Structural Equation Modeling was employed to analyze the relationship of all the parameters.

**Results:** A moderate-to-strong linear relationship was found between meaning of life and sleep quality. A moderate-to-strong linear relationship was found between meaning of life and Proactive Competence. Proactive Competence Play a partial mediation role in the relationship between meaning of life and Sleep Quality.

**Conclusion:** Finding of the study confirmed a partial Moderating effect of Proactive coping on the relationship between meaning of life and Sleep Quality. **Keywords:** university students; Proactive coping; Meaning of life; Sleep quality.

**Acknowledgements:** This research was supported by Prof. Cao, Yiwei of Department of Psychology, Shenzhen University, a research partner Jianqiong Wang.

<http://dx.doi.org/10.1016/j.sleep.2013.11.443>

### Daytime work and evening classes: reports on sleepiness among young working students

A. Luz, F. Fischer

University of São Paulo, Brazil

**Introduction:** Brazil has approximately 18 million of young workers. Among those, 17.9% are working students. A significant number of high school and college students in Brazil work more than 30 h per week and attend classes in the evening hours, striving to

improve their financial conditions. Several studies have shown the negative effects on health and sleep among young working students and excessive sleepiness during evening classes and work are common complaints. The sleep/wake cycle of adolescents are influenced by biological and social factors, which, in conjunction with partial sleep deprivation, could harm their school performance. The purpose of this study was to identify and analyze reports of young workers regarding their sleepiness and school performance.

**Materials and methods:** The current study was carried out in a non-governmental organization (NGO) located in the outskirts of São Paulo, Brazil. Research participants were 20 young students (14–20 years old) of a first job training program. Data collection was conducted during June and November 2011, in two steps: (1) before they start working and (2) after three months working. All participants worked 6–8 h during the day, and attended 4 h evening school. Sleep and school performance were measured using semi-structured collective and individual interviews. Empirical data analysis was performed using Content of Analysis.

**Results:** Better financial conditions were described as the main factor responsible for early admission into the labor force. Approximately 90% of the participants mentioned that concomitantly activities, such as work and study affected their sleep time and school performance. Reports of excessive sleepiness during evening classes were related to partial sleep deprivation. The main factors were the use of Internet after 11 pm to do homework and the need to wake up very early (between 5am and 6am) to go to work. A number of participants reported that their school performance became worse and school grades declined due to the concomitant activities - work during the day and attending classes in the evening hours. Moreover, physical fatigue and excessive sleepiness were also mentioned as the main factors responsible for the lack of attention and focus during classes and work activities.

**Conclusion:** These results indicate that Brazilian public policies related to young working students should take into account the impact of long working hours on their sleep, health and school performance.

**Acknowledgements:** Financial support: CNPq and FAPESP (Grants # 563906/2012–03 and 08/51661–9, respectively).

<http://dx.doi.org/10.1016/j.sleep.2013.11.444>

### **Heart rate variability, t wave alteration and prolonged qt interval as markers of arrhythmogenesis in patients with sleep apnea syndrome and arterial hypertension**

S. Lypovetska

Ternopil State Medical University, Ukraine

**Introduction:** Many researches have provided evidence supporting the associations between obstructive sleep apnea (OSA) with cardiovascular morbidity and mortality. But underlying mechanisms explaining these associations are not entirely delineated.

**Materials and methods:** Cross-sectional study of 58 patients, aged 45–65 years old, 29 males and 15 females with arterial hypertension, who underwent Holter ECG with rheopneumogram. Demographics, cardiovascular risk factors, heart rate variability, QT intervals, microvolt T wave alteration were examined. Patients were divided in three groups according to sleep apnea hypopnea index (AHI): group 1 (AHI < 5, n = 15), group 2 (AHI = 5–29, n = 12), group 3 (AHI > 30, n = 11). Control group – 20 patients without breath disturbances.

**Results:** Positive test on microvolt T wave alteration was found in 36.3 % patients with severe and 41.6 % moderate OSA and in 1 patients of control group. Decreased heart rate variability, predominating of sympathetic activity, rigid rhythm, transient prolonged QT

interval especially at night were common for patients with severe and moderate OSA. Significant positive correlation was found between AHI and QT interval ( $p = 0.03$ ,  $r = 0.3$ ), QTc interval ( $p = 0.04$ ,  $r = 0.5$ ), negative correlation between AHI and SDNN ( $p = 0.04$ ,  $r = -0.3$ ).

**Conclusion:** Decreased heart rate variability, predominating of sympathetic activity, prolonged QT interval and T wave alteration are important background for fatal arrhythmias and predictors of sudden cardiac death in patients with OSA.

**Acknowledgement:** Thank You for a possibility to deal with my modest research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.445>

### **A new approach to sleep study: does heart tell us a lot?**

Y. Ma<sup>1</sup>, S. Sun<sup>2</sup>

<sup>1</sup> Eye Hospital, China Academy of Chinese Medical Sciences, China

<sup>2</sup> Guang'anmen Hospital, China Academy of Chinese Medical Sciences, China

**Introduction:** It has been proven that ECG-derived respiration signal is highly correlated with the actual respiration waveforms. Cardiopulmonary coupling (CPC) analysis is derived from an estimation of the coupling between the autonomic and respiratory drives, using heart rate and respiratory modulation of QRS amplitude, respectively. This dual information can be extracted from a single channel of ECG, and is highly correlated with the actual respiration waveforms. High frequency coupling (HFC) is the marker of stable sleep, and low-frequency coupling (LFC) is the marker of unstable sleep. Fragmented sleep is characterized by coupled low-frequency behaviors across numerous sleep based physiological stream. There have been an increasing number of papers evaluating CPC or using CPC as a clinical measurement.

**Materials and methods:** The literature search was performed via the internet using the PubMed, the Cochrane database and Sleep abstract supplements. The search included papers only in English, published up to June 2013. The key words which were searched in the titles and abstracts were the terms “cardiopulmonary”, “coupling”, “CPC”, “ECG-derived” “Electrocardiogram-based spectrogram” in combination with the name of all types of sleep disorders (e.g. “insomnia”).

**Results:** 46 relevant English articles were found, 29 (63%) was cardiopulmonary coupling. 9 (19.6%) articles explain mechanism, 30 (65.2%) articles are studies on SDB, and 7 (15.2%) articles relate to other sleep disorders or comorbidities. The methods of CPC analysis as a measurement of sleep evaluation has been compared with conventional PSG or PTT. While most of the articles are about sleep apnea, sleep quality, detecting central and obstructive, and evaluating effects of PAP therapies, studies have covered sleep quality study in sleep apnea, insomnia, hypertension, chronic heart failure, diabetes, fibromyalgia, as well as healthy subjects.

**Conclusion:** Using data derived from ECG can be used as clinical screen or post-treatment follow-up. This review confirmed the association between sleep physiology and sleep spectrums analyzed by cardiopulmonary coupling. As sleep problems are of growing concern, easier access of overnight ECG data can be used broadly when sleep monitor is necessary. With the techniques of cardiopulmonary analysis, a portable monitor for sleep can be effective by collecting enough data for sleep analysis, meanwhile be more convenient and cost-effective. Furthermore, adding actigraphy and/or oximetry will be recommended for clinical applications.

**Acknowledgements:** I would like to thank Professor C.K. Peng (Division of Interdisciplinary Medicine & Biotechnology in BIDMC) for his

help in organizing a project and mentoring me with the Cardiopulmonary Coupling techniques. I would also like to thank Dr. Robert Thomas (Sleep specialist in BIDMC, affiliated Hospital of Harvard Medical School) for his mentoring me with sleep clinic observation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.446>

### Detecting pediatric sleep apnea: consistency on cardiopulmonary coupling and oximetry measurement

Y. Ma<sup>1</sup>, J. Yeh<sup>2</sup>, S. Sun<sup>3</sup>, J. Qiao<sup>4</sup>, C. Peng<sup>5</sup>

<sup>1</sup> Eye Hospital, China Academy of Chinese Medical Sciences, China

<sup>2</sup> Center for Dynamical Biomakers and Translational Medicine, National Central University, Taiwan, ROC

<sup>3</sup> Guang'anmen Hospital, China Academy of Chinese Medical Sciences, China

<sup>4</sup> Otorhinolaryngology Dept., First Teaching Hospital of Tianjin, University of TCM, China

<sup>5</sup> Division of Interdisciplinary Medicine and Biotechnology, Beth Israel Deaconess Medical Center, Harv, China

**Introduction:** Cardiopulmonary coupling (CPC) analysis is an approach of data extracted from a single channel of ECG, and is highly correlated with the actual respiration. There have been an increasing number of papers evaluating CPC or using CPC as a clinical measurement. It has been recommended, based on several studies, to be a screening tool for sleep disorders, especially sleep related breathing disorders (SDB). Previous studies have suggested that adding oximetry would improve the reliability of clinical evaluation. This study was designed to investigate the consistency rate between CPC sleep spectrogram and Oximetry results on detecting sleep apneas.

**Materials and methods:** Target subjects are children with OSA, 2–8 yr, who have full-night oximetry and ECG-recorded data with at least 80% qualified data for analysis. All data was time synchronized with ECG data. Value of SpO<sub>2</sub> and pulse rate was collected from full night oximetry, and sensors were placed on the fingertips. Based on the sleep physiology and mechanism of CPC, High frequency coupling (HFC) and low-frequency coupling (LFC) are the marker of stable sleep and unstable sleep respectively. Fragmented sleep is characterized by coupled low-frequency behaviors across numerous sleep based physiological stream.

**Results:** 37 children (14 girls and 23 boys, 5.0±1.7 yr, BMI:16.10±2.25) were included with recorded SPO<sub>2</sub> min (77.94±7.69)% and the total consistency rate between CPC sleep spectrogram and Oximetry result was (78.17±11.46)%. With mild OSA, 5 children (3 girls and 2 boys, 5.6±2.2 yr, BMI:15.47±1.20) showed SPO<sub>2</sub> min with (91.64±2.04)% and consistency rate (87.05±6.43)%. With moderate OSA, 9 children (5 girls and 4 boys, 5.6 ±1.6 yr, BMI:15.65±2.00) were recorded with SPO<sub>2</sub>min (84.12±2.1)% and consistency rate was (79.07±14.80)%. With sever OSA, 23 children (5 girls and 17 boys, 4.7±1.6 yr, BMI:16.77±2.44) showed SPO<sub>2</sub>min (72.81±2.48)% and consistency rate (77.93±10.44)%.

**Conclusion:** CPC can be used for clinical evaluation, such as detecting sleep apneas. It has advantage for screening sleep on pediatric populations. In addition to its simplicity and cost-effectiveness, the reliable results and acceptability can make it practical. Adding actigraphy and/or oximetry will improve its clinical applications. More and better designed clinical studies are worth expecting in the future.

**Acknowledgements:** First, I appreciate the participation of all children and their parents, as well as the efforts of all the people

involved in the research. I would like to thank Professor C.K. Peng and Dr. Robert Thomas at Beth Israel Deaconess Medical Center, affiliated Hospital of Harvard Medical School for their help in organizing a project and mentoring me with the Cardiopulmonary Coupling techniques and sleep clinic observation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.447>

### Sleep related eating disorder (SRED) and night eating syndrome (NES): same or different disorders?

M. M<sup>a</sup> Ángeles<sup>1</sup>, J.A. Gómez Del Barrio<sup>2</sup>, C. Marta<sup>3</sup>, G. Mónica<sup>3</sup>, O. Roberto<sup>4</sup>, C. Rosario<sup>4</sup>

<sup>1</sup> Marqués de Valdecilla University Hospital, Neurophysiology Section, Sleep Unit, Spain

<sup>2</sup> Marqués de Valdecilla University Hospital, Eating Disorders Unit, Spain

<sup>3</sup> Marqués de Valdecilla University Hospital, Pneumology Section, Sleep Unit, Spain

<sup>4</sup> Marqués de Valdecilla University Hospital, Neurophysiology Section, Sleep Unit, Spain

**Introduction:** The last revision of the International Classification of Sleep Disorders (ICDS-2) has considered SRED as a parasomnia and it has established precise diagnostic criteria in order to differentiate it from NES. The presence of a variable level of awareness during the nocturnal eating episodes, consumption of some peculiar food combinations or dangerous behaviors or sleep related-injuries during the night are more typical in SRED. However the overlap between the clinical and polysomnographic features of both disorders is evident and some authors have postulated that they are “opposite poles of a continuous clinical spectrum”. We expose the results of the study of 30 patients with recurrent involuntary eating episodes during the night.

**Materials and methods:** 6 males and 24 females. Age range: 19–67 years. All subjects underwent a semi structured clinical and psychological interview. The behaviours and the severity of the compulsive nocturnal eating was measured using the Night Eating Questionnaire. A video – polysomnographic study (v-PSG) was done placing a table with food and drinks at the bedside.

**Results:** 1. Variable number of nocturnal eating episodes per night (1–20) depending on the emotional state of the patient. Frequent association with depressive – anxious syndrome. 2. Involuntary eating with reward sensation. 3. Variable level of consciousness during the episodes within a single night and across the longitudinal course of the disorder. 4. Consumption of high caloric food but no inedible or toxic substances. Morning anorexia common. 5. 2/3 of the patients were night and evening eaters. 6. Insomnia (100%) and frequent comorbid sleep disorders. 7. Obstructive Sleep apnea treatment with CPAP failed to reduce the number of episodes. However some therapeutic benefit was achieved with dopaminergic agents in patients with concomitant Restless leg syndrome.

**Conclusion:** 1. Sleep, eating or mood disorder? Probable observation bias between different specialists. 2. At present there isn't a clear-cut border between SRED and NES. Our results support the hypothesis that they are ends of a continuum with the same underlying pathophysiology.

**Acknowledgements:** All medical staff, nurses and technicians of our Multidisciplinary Marqués de Valdecilla Sleep Unit. Thanks to my family.

<http://dx.doi.org/10.1016/j.sleep.2013.11.448>

### Maxillary expansion in children with obstructive sleep apnea (OSA): meta-analysis

A. Machado Júnior, E. Zancanella, A. Crespo  
UNICAMP, Brazil

**Introduction:** Obstructive Sleep Apnea (OSA) in childhood leads to physical impairment and psychomotor important. Thus, it must be recognized and treated early, in an attempt to prevent or mitigate the consequences, as they may be harmful to the proper development of the child. The adenotonsillectomy, and in selected cases, the Continuous Positive Airway Pressure (CPAP) have been the treatments of choice for OSAS in children, without having absolute success in treating this syndrome. Minimally invasive treatments have been proposed more recently, intra-oral devices, extra-oral and speech therapy. **Objective:** To perform a meta-analysis of maxillary expansion in OSA in children.

**Materials and methods:** Citations to potentially relevant published trials were located by searching PubMed, Embase, Scopus and Medline. Inclusion criteria were (1) randomized controlled trials, case-control trials, or cohort studies with controls; (2) studies in non-syndromic children 0 to 12 years of age (3) polysomnography with apnea-hypopnea index (AHI) before and after treatment; and (4) maxillary expansion treatment. The quality of the studies selected was evaluated by assessing their methodologies. Treatment effects were combined by meta-analysis with the random-effects method.

**Results:** The total sample of these articles was 116 children with a mean age of 6.7 years. Of the six items assessed four underwent two periods of follow-up. Mean AHI in the first follow-up was  $-4.958$  ( $p < 0.0001$ ) and second follow-up was  $-1.801$  ( $p < 0.0001$ ).

**Conclusion:** Meta-analysis of six international papers, we concluded that maxillary expansion in children with OSA is an effective method in the treatment of this syndrome being supplementary maintained in the medium term. Further studies are needed to assess whether this effectiveness remains in adulthood.

**Acknowledgement:** FAPESP process 2012/00092–0.

<http://dx.doi.org/10.1016/j.sleep.2013.11.449>

### Erectile dysfunction is an early predictor of cardiovascular diseases in men with obstructive sleep apnea

I. Madaeva, L. Kolesnikova

Scientific Center of Family Health Problems, Human Reproduction of Siberian Branch of Russian A, Russia

**Introduction:** Studies about the relationship between erectile dysfunction and obstructive sleep apnea (OSAS) in men are in the literature. OSAS might also be associated with cardiovascular diseases (CVD). It is known that erectile dysfunction of vascular origin and coronary artery disease have the same mechanism. The aims of the present study were to assess nocturnal penile erections (NPT) and lipid profile to determine the risk of developing CVD in men with OSAS.

**Materials and methods:** We examined 51 men aged 46–55 years: 37 patients with OSAS, 14 – men without OSAS (control). There were no significant differences in age and body mass index. The PSGs were recorded on a GRASS-Telefactor Twin (Comet) with amplifier As-40 with integrated module for sleep SPM-1 (USA) with amplifier for NPT-sensor. Lipid profile was evaluated by an automatic analyzer BTC-330 (Poland). Statistical analysis was performed by non-parametric tests.

**Results:** Prolongation of the 1st and the 2nd sleep stages ( $p < 0.05$ ), reduction of the 3rd and the 4th sleep stages ( $p < 0.05$ ) as soon as the

REM-sleep reduction ( $p < 0.05$ ) were registered in men with OSAS. The apnea-hypopnea index was  $58.13 \pm 10.68$  events per hour. The desynchronizing of NPT with the REM-sleep was found in these patients. The number of NPT in men with OSAS was less than in the control ( $p < 0.05$ ). The levels of total cholesterol, low-density lipoproteins, very low-density lipoproteins, triglycerides were significantly higher ( $p < 0.05$ ), but the levels of high-density lipoproteins were significantly lower ( $p < 0.05$ ) in the group with OSAS. The relative risk of CVD development in men with erectile dysfunction and OSAS is 4 times higher (RR = 3.9; 95% CI = 1.44–10.61). The attributable risk of erectile dysfunction in respect of CVD was 66% (95% CI = 44.6 – 87.4%).

**Conclusion:** The results our study have shown that erectile dysfunction in OSAS may be an early predictor of CVD in men.

**Acknowledgement:** The authors reported no conflict of interest in this work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.450>

### Circadian impairment of the wrist temperature rhythm in patients with sleep disordered breathing

A. Martinez-Nicolas<sup>1</sup>, M. Guaita<sup>2</sup>, J. Santamaría<sup>1</sup>, J. Montserrat<sup>3</sup>, J. Madrid<sup>1</sup>, A. Rol<sup>1</sup>

<sup>1</sup>University of Murcia, Chronobiology Lab, College of Biology, Spain

<sup>2</sup>Hospital Clinic de Barcelona, Neurology Service, Hospital Clinic de Barcelona, IDIBAPS, Spain

<sup>3</sup>Hospital Clinic de Barcelona, Pneumology Service, Hospital Clinic de Barcelona, IDIBAPS, CIBERES, Spain

**Introduction:** The effects of sleep disordered breathing (SDB) on the circadian sleep-wake rhythm are not well known. Wrist temperature (WT) rhythm is subordinated to the master circadian clock (suprachiasmatic nucleus of hypothalamus) and is related to autonomic balance, thermoregulation and sleep propensity. The aim of this study was to analyze the WT changes in a large group of SDB patients.

**Materials and methods:** WT rhythm of 98 AH patients (73 men and 25 women, 24–74 years old and BMI range 20–48) were recorded during a week and PSG was performed the last night of that week while wearing an Ibutton device (ThermoChron®, Data loggers I-button) for WT and a Deltamed (Natus) coherence system for Polysomnographic recording. Arousal Index, Apnea-Hypoapnea Index (IAH), Oxygen Desaturation Index (ODI), Mean Oxygen Saturation and Nadir of Oxygen Saturation were calculated for SDB severity; whereas Interdaily Stability (IS), Intradaily Variability (IV), Relative Amplitude (RA), Circadian Function Index (CFI), Mean Night-time Value (MN) and Night-Time phase (NTP) were determined for circadian assessment of WT rhythm. A correlation matrix was performed to select the best relationship between OSAHS severity and WT rhythm.

**Results:** Wrist temperature rhythm in SDB patients is characterized by lower temperatures during the last phase of sleep and increased temperatures during late afternoon and evening when compared with healthy subjects ( $34.32 \pm 0.06$  vs.  $34.60 \pm 0.06$  respectively for the last phase of sleep and  $33.70 \pm 0.08$  vs.  $32.63 \pm 0.09$  respectively for late afternoon and evening). Most WT circadian parameters (IS, IV, RA, CFI, MN and MNP) were significantly correlated with apnea severity. The highest correlation between PSG and circadian parameters was found for ODI and CFI. Higher ODI values are related to lower IS, RA, CFI, MN, higher IV and a NTP advance.

**Conclusion:** SDB generates potent chronodisruptive effects on circadian system as measured by WT rhythm. In addition, apnea severity could be assessed by stability, fragmentation, amplitude, CFI, and

Nigh-Time value of WT rhythm, indicating an increase of sympathetic activation and circadian disruption as severity of apnea progresses.

**Acknowledgements:** Study supported by RETICEF (RD12/0043/0011), MINECO (BFU2010–21945–C02–01), INNPACTO (IPT-2011–0833–900000) with FEDER cofounding to JAM, and FIS (PI07/0318) cofinanced by FEDER to JS, and a research fellowship to Antonio Martinez-Nicolas (University of Murcia).

<http://dx.doi.org/10.1016/j.sleep.2013.11.451>

### Day–night contrast as source of health for humans

A. Martinez-Nicolas, J. Madrid, A. Rol

University of Murcia, Chronobiology Lab, College of Biology, Spain

**Introduction:** Modern lifestyle is mainly characterized by no environmental differences between day and night, either in light exposure (artificial light) or in activity (sedentarism), or environmental temperature or feeding (frequent snacking), and as a consequence, an impaired circadian system (CS) through a process known as chronodisruption appears. This process is related to human pathologies such as certain cancers, metabolic syndrome, and affective and cognitive disorders. However, little is known about CS enhancement. The aim of this work is to propose increased day/night contrast as a strategy for chronoenhancement.

**Materials and methods:** Light exposure, environmental temperature, Wrist Temperature (WT), activity, body position and sleep were recorded under free-living conditions during one week young volunteers (n = 131). Subjects were classified according to contrast in each variable. High contrast (HC) or low contrast (LC) for each variable were selected to analyze the effect of light exposure, environmental temperature, activity, body position, and sleep day/night differences would have on WT and to obtain the circadian pattern for all this variables that corresponds to HC or LC for WT.

**Results:** HC in lifestyle variables showed better rhythms than LC subjects except sleep that it is higher stability and lower fragmentation for WT. Subjects with HC and LC for WT also demonstrated differences in lifestyle, where HC subjects showed a slightly advanced night phase onset and a general increase in day/night contrast. Besides, simulated high day/night contrast by mathematical models suggests an improvement in WT parameters by increasing lifestyle contrast. Finally, some individuals were classified as belonging to the HC group in terms of WT when they were exposed to the lifestyle characteristic of the LC group, while others exhibit WT arrhythmicity despite their good lifestyle habits, revealing two different WT components: an exogenous one modified by lifestyle and another endogenous component that is refractory to it.

**Conclusion:** Although some subjects could be refractory to chronoenhancement, potentiating day/night contrast in subject's lifestyle has proven to be a feasible measure to attenuate chronodisruption in modern societies.

**Acknowledgements:** Study supported by RETICEF (RD12/0043/0011), MINECO (BFU2010–21945–C02–01), and INNPACTO (IPT-2011–0833–900000) with FEDER cofounding to JAM, and a research fellowship to Antonio Martinez-Nicolas (University of Murcia).

<http://dx.doi.org/10.1016/j.sleep.2013.11.452>

### Non dipping blood pressure pattern is related to an increase in daytime distal skin temperature

A. Blazquez, A. Martinez-Nicolas, A. Rol, J. Antonio

University of Murcia, Chronobiology Laboratory, Department of Physiology, Spain

**Introduction:** The circadian pattern of blood pressure (BP) is closely associated to sleep-wake cycle, target organs damage and cardiovascular events. Thus, BP circadian pattern diagnosis should be based on an objective procedure to determine patient's actual sleep and wake time instead of standard sleep schedules. Wrist temperature (WT) rhythm is subordinated to the master circadian clock and it is related to autonomic balance, thermoregulation, sleep propensity and sleep wake cycle and also responds to postural changes. Thus, the purpose of this research is to determine accurately the BP pattern using circadian ambulatory monitoring and the association between WT rhythm and the BP dipping status.

**Materials and methods:** WT, Activity (A) and Position (P) were recorded during five days in 33 healthy subjects, aging from 21 to 63 years old, by means of two data loggers, an Ibutton device (ThermoChron<sup>®</sup>,) and a Hobo actimeter (Hobo<sup>®</sup> Pendant G, Acceleration Data Logger). Ambulatory BP was determined during 24 h using a BP monitor (Spacelabs<sup>®</sup> Medical) with a sampling rate of one measure every 20 min during day and every 40 min during night. An alertness variable (TAP) was calculated averaging normalized values for WT, A and P. Sleep time was automatically considered when  $P < 30^\circ$  and  $A < 25^\circ/\text{min}$ .

**Results:** Non-dipper subjects showed higher systolic BP during nighttime ( $124.62 \pm 6.00$  mmHg vs  $112.36 \pm 2.50$  mmHg) as it was expected. In addition, we found a significant increase in WT during daytime ( $33.81 \pm 0.18^\circ\text{C}$  vs  $32.88 \pm 0.19^\circ\text{C}$ ), but not during nighttime, and higher TAP values during nighttime ( $0.19 \pm 0.03$  a.u. vs  $0.14 \pm 0.01$  a.u.) in non-dipper compared with dipper subjects, while no differences were found for activity and body position.

**Conclusion:** Considering individual sleep pattern when evaluating BP pattern provides a more accurate diagnosis of dipping pattern. The use of P, A and WT information might change the interpretation of ambulatory BP monitoring data and improve the diagnosis of circadian BP pattern. Furthermore, circadian monitoring could distinguish between dipper and non-dipper pattern using daytime WT values.

**Acknowledgements:** Study supported by RETICEF (RD12/0043/0011), MINECO (BFU2010–21945–C02–01), and INNPACTO (IPT-2011–0833–900000) with FEDER cofounding to JAM, and a research fellowship to Antonio Martinez-Nicolas (University of Murcia).

<http://dx.doi.org/10.1016/j.sleep.2013.11.453>

### Association between the impairment of skin temperature rhythm and hypertension

A. Blazquez, A. Martinez-Nicolas, A. Rol, J. Antonio

University of Murcia, Chronobiology Laboratory, Department of Physiology, College of Biology, Spain

**Introduction:** An increasing amount of bibliography relates hypertension to certain sleep disorders and reduced sleep quality. Wrist temperature (WT) circadian rhythm is related to autonomic balance, thermoregulation, sleep propensity and sleep wake cycle; hence, it has been proposed as possible screening technique to assess blood

pressure (BP) dipping status. Thus, the aim of this work is to determine if hypertension is associated to changes in WT rhythm.

**Materials and methods:** 33 healthy subjects (21–63 years old) were monitored for WT, Activity (A) and Position (P) by means of two data loggers, an Ibutton device (ThermoChron®, Data loggers I-button) and a Hobo actimeter (Hobo® Pendant G, Acceleration Data Logger). Ambulatory BP was determined during 24 h using a BP monitor (Spacelabs® Medical), with a sampling rate of one measure every 20 min during day and every 40 min during night. An alertness variable (TAP) was calculated averaging normalized values for WT, A and P. Sleep time was considered when  $P < 30^\circ$  and  $A < 20^\circ/\text{min}$ .

**Results:** Hypertensive patients showed increased heart rate when were compared with normotensive patients ( $79.94 \pm 2.76$  bpm vs.  $71.00 \pm 1.84$  bpm,  $p < 0.05$ ) and a significant decrease in WT during sleep period ( $34.22 \pm 0.14^\circ\text{C}$  vs.  $34.63 \pm 0.09^\circ\text{C}$ ,  $p < 0.05$ ) and lower position values during daytime ( $47.83 \pm 1.97^\circ$  vs.  $52.57 \pm 1.23^\circ$ ,  $p < 0.05$ ) respect to normotensive subjects, while no differences were founded in activity and TAP.

**Conclusion:** Hypertension is closely related to a significant impairment in WT circadian rhythm, allowing differentiating between normotensive and hypertensive patients. In fact, lower nighttime WT values are connected to sleep disorders such as insomnia or sleep disordered breathing, which are related to higher nighttime blood pressure probably due to the increase in nocturnal sympathetic activation in hypertensive patients.

**Acknowledgements:** Study supported by RETICEF (RD12/0043/0011), MINECO (BFU2010–21945–C02–01), and INNPACTO (IPT-2011–0833–900000) with FEDER cofunding to JAM, and a research fellowship to Antonio Martinez-Nicolas (University of Murcia).

<http://dx.doi.org/10.1016/j.sleep.2013.11.454>

### Influence of shift-work schedule on circadian disruption in nursing staff

M. Martínez Madrid<sup>1</sup>, M. Rol<sup>1</sup>, T. Gómez-García<sup>2</sup>, C. Fuentelsaz-Gallego<sup>2</sup>, J. Madrid Pérez<sup>1</sup>

<sup>1</sup>University of Murcia, Department of Physiology, Faculty of Biology, Spain

<sup>2</sup>Unidad de Investigación en Cuidados de Salud, Instituto de Salud Carlos III, Spain

**Introduction:** Many shift work schedules (SWS) have been proposed to promote performance and to reduce circadian impairment, however, few studies have been devoted to demonstrate the benefits of such shifts under real work conditions. The aim of this study was to characterize the impact of different SWS, on circadian disruption assessed by ambulatory circadian monitoring (ACM), in nursing staff. To this, wrist temperature (T), motor activity (A), body position (P), light exposure (L) and environmental temperature (ET) were recorded.

**Materials and methods:** Two hundred eighty-six healthy nursing staff (45 males and 241 females) enrolled in eight different SWS (Permanent 8 h-day, PD; Permanent night, PN; morning with nights, MN; evening with nights, EN; permanent 12 h-day, 12D; anti-stress, AS and rotating three-shifts, R3), from 22 to 62 years old, participated in this study. Volunteers were monitored by ACM during 7–10 days using a multichannel device (Kronowise™, Chronolab, Univ. of Murcia). Circadian robustness was assessed by the circadian function index (CFI) of composite TAP variable. The regularity of life style was measured by calculating Interdaily stability (IS). Restfulness (RS), a measure of sleep quality, was calculated from L5 of TAP and expressed as a score from 0 to 10 (10 = very restfully sleep).

As phase marker was selected the midpoint of TL5 from TAP (the midpoint of five consecutive hours of minimum values).

**Results:** The circadian status evaluation on nurses staff by ACM showed that those subject engaged in both PD and 12D shifts presents higher stability (IS) and RS scores than those subjects on PN, MN, EN and R3 schedules. However, the more disruptive shift seems to be PN, since nurses under this schedule show the lowest stability, CFI and RS values, besides presenting the most delayed TL5. The remaining shifts present an intermediate situation between PD and PN.

**Conclusion:** As expected, the two permanent day shifts (PD and 12D) are the less chonodisruptive, since nurses under this schedule present more robust and regular rhythms with deeper sleep during the night. On the contrary a PN shift produces higher rhythm instability and more superficial sleep. So according to our results when working during the night is a must rotating shifts (AS, R3) seems to be more recommendable than MN or EN.

**Acknowledgements:** To RETICEF (RD12/0043/0011), MINECO (BFU2010–21945–C02–01), and INNPACTO (IPT-2011–0833–900000) with FEDER cofunding to JAM.

<http://dx.doi.org/10.1016/j.sleep.2013.11.455>

### The challenge of chronodisruption assessment. The case of nursing staff shift workers

M. Martínez Madrid<sup>1</sup>, M. Campos<sup>2</sup>, J. Madrid Pérez<sup>1</sup>, M. Rol<sup>1</sup>, T. Moreno-Casbas<sup>3</sup>

<sup>1</sup>University of Murcia, Department of Physiology, Faculty of Biology, Spain

<sup>2</sup>Faculty of Computer Science, Artificial Intelligence and Knowledge Engineering, Spain

<sup>3</sup>Unidad de Investigación en Cuidados de Salud, Instituto de Salud Carlos III, Spain

**Introduction:** Shift work circadian disorders have been mainly evaluated by actigraphy (A) and classical methods of time series analysis. However, to determine the degree of chronodisruption (CD) it is necessary: a) to establish a marker of internal desynchronization (including different variables in ambulatory circadian monitoring or ACM such as skin temperature WT, body position P and light exposure L) and b) to modify classical procedures, based in a unique mean waveform analysis, to take account of the day to day differences in rhythms in response to scheduled work. The aim of this work is to determine the usefulness of ACM in conjunction with a new mathematical procedure to determine the severity of CD in nursing staff.

**Materials and methods:** Ten healthy day shift and ten night shift workers (6 males and 18 females, from 22 to 62 y. o.) participated in this study. Volunteers were monitored by ACM during 7–10 days using ACM (Kronowise™, Chronolab, Univ. of Murcia) integrating five sensors: three built into a wristwatch (T, L; environmental temperature, ET) and two on a bracelet (A and P). Circadian status was inferred using the integrated variable TAP, calculated from T, A and P. Circadian robustness was assessed by the circadian function index (CFI) of TAP variable. Internal desynchronization was measured as difference between the non-parametric phase markers of T (M5 = five consecutive hours of maximum T) and A (L5 = five consecutive hours of minimum activity). The restfulness was calculated from L5 of TAP and expressed as a score from 0 to 10 (10 = very restfully sleep).

**Results:** Despite the stability in their working schedule, permanent nocturnal shift workers showed more CD than diurnals and lower circadian robustness, higher internal desynchronization between T

and A rhythms and low values in the restfulness score. When a day-to-day time series analysis was performed instead of using the mean waveform, a significant improvement in the three CD markers was observed, although their values still were worse than those observed in diurnal workers.

**Conclusion:** The ACM allows a reliable assessment of the degree of chronodisruption in shift workers, however, mathematical procedures based on day to day analysis should be mandatory to avoid bias derived from the irregular life styles associated to nocturnal shifts.

**Acknowledgements:** To RETICEF (RD12/0043/0011), MINECO (BFU2010-21945-C02-01), and INNPACTO (IPT-2011-0833-900000) with FEDER cofunding to JAM.

<http://dx.doi.org/10.1016/j.sleep.2013.11.456>

### **Polysomnographic findings and respiratory management in leigh syndrome – A case report**

N. Madureira, M. Estevo, M. Ferreira, P. Garcia, M. Felix  
*Laboratório do Sono e Ventilação, Hospital Pediatrico, Centro Hospitalar e Universitário, Portugal*

**Introduction:** Leigh syndrome (LS) is a neurodegenerative disorder with symmetric necrotizing lesions mainly in the basal ganglia, thalamus and brainstem. Respiratory disturbances are a common feature, may have a fluctuating nature and vary from irregular breathing, deep sighing, hyperventilation or hiccups with lethargy to acute respiratory failure. Since this is a rare condition, there are few published descriptions of respiratory symptoms and polysomnographic (PSG) findings. The authors describe clinical and PSG data of a child with LS.

**Materials and methods:** Case report with description of the clinical and PSG data of a recently diagnosed LS. The analysis of PSG data was based on the AASM guidelines. Post-sigh apnea (P-S apn) was defined as a pause of chest movements for  $\geq 10$  s. preceded by an augmented breath ( $\geq 2$ x amplitude of the preceding stable respiration).

**Results:** A 4 years-old boy was born uneventfully and developed normally until the age of three. He was admitted in a comatous state due to central hypoventilation during an acute respiratory infection. Five months before he had initiated ataxic gait, motor regression, irregular breathing, hiccups and sighs. On examination he had dysmorphic features, hypertrichosis, vertical gaze paralysis, squint, ataxia and tremor. MRI showed bilateral, symmetric focal hyperdensities in basal ganglia and thalamus. Biochemical study identified a complex IV deficiency in mitochondrial respiratory-chain. After respiratory stabilization, non invasive ventilation (NIV) was initiated during sleep. Some days later, he began to refuse it and, as desaturation and hypercapnia had subsided, NIV was suspended. During follow-up he maintained irregular breathing with periods of apneusis-like breathing, frequent sighs and hiccups. PSG was performed six months after diagnosis. Sleep structure was normal with an arousal index of 7.2. Respiratory rhythm was very irregular, with clustered breathing on stage NREM 1/2. There were no obstructive events or isolated central apneas, sighs were very frequent (11/hour) and 40 P-S apn were observed (5/h). Mean SpO<sub>2</sub> was 98 % (92–100), TcCO<sub>2</sub> 40–46 mmHg. During follow-up he maintained frequent sighs and hiccups. The parents were informed that the child should be admitted if irregular breathing with apnea was noticed.

**Conclusion:** The PSG findings are consistent with those described in the rare literature for LS. The respiratory management in LS is challenging due to the fluctuation of the respiratory symptoms.

<http://dx.doi.org/10.1016/j.sleep.2013.11.457>

### **Obstructive sleep apnea syndrome in children younger than 2 years of age**

N. Madureira  
*Laboratório do Sono e Ventilação, Hospital Pediatrico, Centro Hospitalar e Universitário de Coimbra, Portugal*

**Introduction:** Obstructive sleep apnea syndrome (OSAS) occurs in 1–3% of the pediatric population and may result in severe complications if left untreated. The prevalence of OSAS peaks at 3–7 years of age, when adenotonsillar hypertrophy (AH) is maximum. In infants and young toddlers, OSAS results frequently from craniofacial malformations and neurologic abnormalities; AH may be also related, isolated or in association to the previous conditions. In these cases, OSAS may be more severe and with a high recurrence or incomplete recovery rate after surgery. The authors characterize their clinical experience in OSAS in children younger than 2 years of age.

**Materials and methods:** Retrospective analysis of clinical and polysomnographic (PSG) data of children younger than 2 years of age followed in a pediatric sleep laboratory between January/2007 and June/2013. The analysis of PSG data was based on the AASM guidelines.

**Results:** Twenty-eight children younger than 2 years were studied, 67.9% were male and the median age of the onset of snoring was 7.5 months (0 – 23 months). Five patients (17.8%) had medical syndromes associated with increased risk of OSAS – Crouzon, Down, Goldenhar, polymalformative, chromosomopathy – and 17 (60.7%) had adenotonsillar hypertrophy grade 3 or 4. PSG showed moderate or severe OSAS in 78.5% patients. Median respiratory disturbance index was 16.7 (1.7 – 280.8) and nadir SpO<sub>2</sub> varied between 38% and 95% (median 81%). Twenty-two patients underwent adenotonsillectomy, 1 is waiting surgery, 3 are under medical treatment and 2 in non-invasive ventilation (syndromic patients). In all patients, clinical symptoms resolved or improved after treatment. PSG was performed in ten patients 3 – 6 months after ENT surgery: 3 syndromic and 7 with severe OSAS. Nine out of the 10 PSG were abnormal: upper airways resistance syndrome (7) and moderate OSAS (2). Median respiratory disturbance index after surgery was 4.5 (0.6 – 5.4) and nadir SpO<sub>2</sub> after surgery varied between 89% and 97% (median 91%).

**Conclusion:** The present series, although small, alerts medical attention to the possibility of precocious onset of OSAS and that in this age severe adenotonsillar hypertrophy may be associated. In spite of the clinical improvement, almost all PSG performed after surgery showed alterations, pointing to the need of post-treatment control of sleep parameters and follow-up in this age group.

<http://dx.doi.org/10.1016/j.sleep.2013.11.458>

### **Management of augmentation in restless legs syndrome with pramipexole extended-release**

M. Maestri<sup>1</sup>, S. Fulda<sup>1</sup>, L. Ferini-Strambi<sup>2</sup>, M. Zucconi<sup>2</sup>, C. Bassetti<sup>3</sup>, M. Manconi<sup>1</sup>

<sup>1</sup> Sleep and Epilepsy Center, Neurocenter of the Southern Switzerland, Civic Hospital of Lugano, Switzerland

<sup>2</sup> Sleep Disorders Center, Division of Neuroscience, Università Vita-Salute San Raffaele, Milan, Italy

<sup>3</sup> University Department of Neurology, Inselspital, Bern, Switzerland

**Introduction:** Dopamine agonists represent the first-line treatment in restless legs syndrome (RLS), however in the long term, a substantial portion of patients will develop augmentation, which is a severe drug-related exacerbation of symptoms and the main rea-

son of late therapy withdrawal. The mechanism underlining augmentation is unknown and no guidelines are available to treat it. Objective of the study was to evaluate the role of extended release dopaminoagonist in the management of augmentation.

**Materials and methods:** Twenty-four consecutive RLS outpatients (10 M, 14 F, mean age 68.4±10 yrs) treated with immediate-release dopamine agonists (pramipexole 11 pts, ropinirole 7 pts, cabergoline 1 pts, levodopa 1 pts, combined DA treatment 4 pts) for a mean period of 6.7 yrs ±5 were diagnosed as affected by severe, clinically relevant augmentation. Since an inverse relationship between DA half-life and augmentation has been postulated we decided to switch the treatment to the long-acting extended release (ER) formula of pramipexole, given at 5 pm and progressively increased until a satisfactory control of the symptoms was achieved (at a mean dose of 0.75 mg, range 0.375–1.125 mg), accompanied by a complete withdrawal of the other dopaminergic agents.

**Results:** Resolution of augmentation was observed in all patients in 2–3 weeks and persisted so far for a mean follow-up interval of 7 months. Mean dose of dopamine agonist was not significantly different before and after the shift of therapy (pramipexole equivalent dosage during augmentation 0.84 mg±0.51 vs. extended release pramipexole 0.67 mg±0.28). RLS severity scale decreased from 32±4 to 16±9 ( $p < .001$ ).

**Conclusion:** Pramipexole extended release might represent an easy, safe and fast pharmacological option that needs to be evaluated with prospective and controlled investigations. The findings support the hypothesis that the duration of action of the drug plays a key role in the mechanism of augmentation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.459>

### Macro and microstructure sleep changes in insomniacs with high dose abuse of BZ

M. Maestri<sup>1</sup>, R. Ferri<sup>2</sup>, V. Bottasini<sup>3</sup>, L. Ferini-Strambi<sup>3,4</sup>, M. Manconi<sup>1</sup>

<sup>1</sup> Sleep and Epilepsy Center, Neurocenter of the Southern Switzerland, Civic Hospital of Lugano, Switzerland

<sup>2</sup> Sleep Research Center, Department of Neurology I.C., Oasi Institute, Troina, Italy

<sup>3</sup> Sleep Disorders Center, Division of Neuroscience, Università Vita-Salute San Raffaele, Milan, Italy

<sup>4</sup> Miano, Neuroscience, Mental Health and Sense Organs Department, Chair of Pediatrics, Sleep Disorder Centre, La Sapienza University, II Faculty, Medicine, Rome, Italy

**Introduction:** Chronic and high-dosage intake of benzodiazepine (BZ) is a common problem in patients with insomnia. No data have been reported on the effects on PSG variables induced by high doses of BZ in patients with chronic insomnia. The aim of this study was to evaluate sleep architecture, microstructure (CAP) and EEG power spectra of patients with chronic primary insomnia and chronically treated with high-dose BZ, that were referred to the Sleep Center for drug discontinuation.

**Materials and methods:** Consecutive enrolment of 20 subjects affected by primary insomnia (DSM-IV) and of 13 control subjects was carried out. All patients underwent a nocturnal polysomnographic recording. Sleep stages were scored following standard criteria on 30-s epochs while all CAP phases during NREM sleep were detected and classified into three subtypes (A1, A2, and A3) according to Terzano et al. (2001). Average relative power spectra were calculated using the sleep analysis software Hypnolab 1.2, by means of the Fast Fourier Transform, for frequencies between 0.5 and 25 Hz.

**Results:** A significant difference was found for Time in Bed, REM sleep latency and percentage of sleep stage 1 which were increased in BZ patients. Total CAP rate was dramatically decreased (8%) in patients (especially during sleep stage 2 and slow-wave sleep) because of the significant decrease in the number of CAP A1 and A2 subtypes. As concern power spectra, during NREM sleep, BZ patients show a clear decrease in the relative power of the delta band of NREM sleep, accompanied by a relative increase of the sigma and beta bands. A time-dependent general decrease of the delta power was observed for control subjects, but not for patients during sleep stage 2 and SWS.

**Conclusion:** Macrostructure of sleep seems to be quite preserved in BZ patients, while sleep instability is decreased to severe pathological values, lower than any other reduction that has been previously reported. This reduction could be responsible for the low sleep quality and the cognitive deficits usually reported. Also power spectral analysis confirm the reduction in slow wave activity and the loss of its dynamic regulation. BZ overuse and insomnia seem to interact both leading to a sleep whose continuity parameters are conserved, but whose organization and microstructure is completely altered.

<http://dx.doi.org/10.1016/j.sleep.2013.11.460>

### Serial electrical stimulations of hypothalamic orexin-containing neuronal regions lead to elevation of CSF OrexinA concentration and fasten the recovery of sleep-wakefulness cycle from experimentally induced comatose state

N. Maglakelidze, E. Chkhartishvili, S. Dzadzamia, E. Chijavadze, M. Babilodze, N. Nachkebia

Lab. Neurobiology of Sleep-Wakefulness Cycle, I. Beritashvili Center of Experimental Biomedicine, Georgia

**Introduction:** Study is aimed at assessing the Hypothalamic Orexinergic system as the neuronal substrate that increases the speed of regulation of disturbed sleep homeostasis and wakefulness recovery from some pathological conditions, namely from experimental comatose state. Pre-clinical evidences on this topic is sparse and we are studying this question for the first time.

**Materials and methods:** Using white wild rats, ( $n = 12$ ) modeling of semi-chronic experimental comatose state was induced by kainic and/or ibotenic acid lesion of intra-collicular layers. EEG registration was started immediately, lasting continuously for 72 h. 30 min after comatose state, serial electrical stimulations (8–12v, 200c/s, 0.1 ms) of dorsal, lateral, posterior and perifornical Hypothalamic Orexin-containing neurons began. Stimulation periods, lasting for 1 h, with 5 min intervals between subsequent stimulation, were applied in turn to the left and to the right side hypothalamic regions. CSF OrexinA concentration was measured by ELISA method. Statistical processing was made by Students' *t*-test.

**Results:** Kainic and/or ibotenic lesioning of intra-collicular layers wholly disrupts cyclic alternation of sleep-wakefulness cycle (SWC) behavioral states. Isolated forebrain falls into comatose state and pathological pattern of electrical activity (exaggerated spindle activity with strongly desynchronized inter-spindle periods) takes the dominant position in neo- and paleo-cortical structures. Dominance of this pathological pattern of EEG activity takes approximately 30 h and then the first signs for spontaneous normalization appears. Spontaneous recovery from comatose state starts by restoration of light slow wave sleep EEG picture, taking approximately 40 h after lesioning. Serial electrical stimulations of dorsal, lateral, posterior and perifornical hypothalamic Orexin-containing neurons significantly speed up light slow wave sleep recovery, taking 30–35 h after comatose state. Deep slow wave sleep

recovery was speed up by 13–15 h. Acceleration was also noted in forced restoration of passive and active wakefulness EEG picture. Significant elevation was noted in CSF OrexinA Concentration.

**Conclusion:** Serial electrical stimulations of hypothalamic Orexin-containing neuronal regions significantly elevates CSF OrexinA concentration, speed up recovery from comatose state, and manifest in accelerated restoration of sleep-wakefulness cycle behavioral states.

**Acknowledgements:** Supported by Shota Rustaveli National Science Foundation, Grant #11/04.

<http://dx.doi.org/10.1016/j.sleep.2013.11.461>

### Recognition of sleep-related breathing disorders from Holter-ECGSC a new robust method suitable for clinical screening applications

C. Maier<sup>1</sup>, H. Wenz<sup>2</sup>, H. Dickhaus<sup>1</sup>

<sup>1</sup>Heidelberg University, Institute of Medical Biometry and Informatics, Department of Medical Informatics, Germany

<sup>2</sup>Heidelberg University Hospital, Thoraxklinik, Sleep Medicine Center, Germany

**Introduction:** Detection of sleep-related breathing disorders (SRBD) in an early stage is highly desirable in order to route patients to appropriate diagnostics and therapy before severe consequences become overt. We present a traceable, robust and accurate method for detection and quantification of SRDB from Holter ECGs. It provides an epoch-based (1 min) statement as well as an estimate of the apnea-hypopnea-index (AHI) and appears suitable for screening for SBAS in routine Holter-ECGs.

**Materials and methods:** Time-series of QRS-amplitude (QRSa) and respiratory myogram interference (RMI) were extracted from 140 overnight Holter-ECGs recorded in parallel to polysomnograms (PSGs) in 121 patients. The only exclusion criterion was persistent atrial fibrillation; other co-morbidities such as diabetes, myocardial infarction or periodic limb movements as well as concomitant medication were admitted. The PSG annotations served as reference for ECG-based detection of the presence of respiratory events in epochs of 1 min duration. Detection was based on ROC analysis of a single classification feature that quantifies the joint time-locked occurrence of characteristic modulations in QRSa and RMI using normalized cross-correlation. Two different ROC-thresholds were considered, the first balancing sensitivity and specificity (Tbal), the second maximizing accuracy (Tacc). For AHI assessment, the local period of modulations in the QRSa-series was determined from its zero crossings. Epochs classified as apnea-positive were weighted with a factor 60s/period providing an estimate of the number of respiratory events in that epoch. The sum of these weights, normalized for the duration of the record, served as an AHI estimate. A threshold of AHI  $\hat{y}$  15 was used for screening. We implemented a ternary strategy where a borderline-class collected all records with conflicting decisions for the two thresholds Tbal and Tacc.

**Results:** For the epoch-based detection, sensitivity was 85.5% and specificity was 86%. In the screening application (AHI  $\hat{y}$  15), 16% of the recordings were classified as  $\hat{y}$ borderline; = . The sensitivity for the remaining 84% (117 recordings) was 100% with a specificity of 91% and a kappa coefficient of 0.91.

**Conclusion:** Robust, traceable and accurate detection of SRDB is possible from the Holter-ECG for a very heterogeneous real-world sample including different types of SRDB and typical co-morbidities. Since our approach does not make use of heart rate information, it may be even applicable in patients with severe arrhythmias.

<http://dx.doi.org/10.1016/j.sleep.2013.11.462>

### A novel experimental design to avoid rem sleep rebound

L. Maisuradze<sup>1</sup>, N. Lortkipanidze<sup>2</sup>, N. Oniani<sup>2</sup>

<sup>1</sup>Ilia State University, I. Beritashvili Center of Experimental Biomedicine, Georgia

<sup>2</sup>Ilia State University, Georgia

**Introduction:** Several studies report about the phenomenon of REM sleep rebound which is occurred after cessation of deprivation of this sleep stage conducted by various instrumental techniques. According to our previous works REM sleep replacement by waking episodes does not lead to accumulation of REM sleep need. On the basis of this statement we have elaborated special experimental scheme of to avoid REM sleep rebound appearance. Here we present the results of these experiments.

**Materials and methods:** Eight mature cats weighing 2.8–3.5 kg were implanted with electrodes for standard sleep-wake cycle (SWC) recordings. After establishment of baseline SWC REM sleep deprivation was performed using classic method of short-term awakenings using MRF stimulation during eight hours. Then, the four animals (experimental (E)) were not allowed to fall asleep through the maintenance of active waking state during one hour by using electrical stimulation of the posterior hypothalamus; this procedure was followed by the six- hour post-deprivation period. Another four cats (control (C)) could realize SWC without any interventions. Duration of individual episodes of different SWC phases/stages, their total amount and percent ratio were calculated and compared with corresponding baseline data.

**Results:** As it was expected, REM sleep propensity increased during deprivation hours with frequent enforced awakenings from this stage, and REM sleep rebound was occurred in the C - group animals with significant decrease of REM sleep latency. However, in E- cats, either total REM sleep amount or the time needed for the transitions of slow- wave sleep to REM sleep did not differ from baseline. No increase of ponto- geniculo-occipital waves or rapid-eye- movements was found in the episodes of E-cat's REM sleep while the frequency of these indices increased significantly in the C-group.

**Conclusion:** Results provide additional support for our opinion that active waking state is able to satisfy the inner need for REM sleep even in the conditions of substantial increases in the REM sleep propensity and prevents the occurrence of REM sleep rebound.

**Acknowledgement:** We are very thankful to Prof. Tengiz Oniani who was supervisor of the present study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.463>

### Respiratory-related leg movements and periodic leg movements during sleep

M. Manconi<sup>1</sup>, I. Zavalko<sup>2</sup>, C. Bassetti<sup>3</sup>, E. Colamartino<sup>1</sup>, M. Pons<sup>4</sup>, R. Ferri<sup>5</sup>

<sup>1</sup>Civic Hospital (EOC) of Lugano, Sleep and Epilepsy Center, Neurocenter of Southern Switzerland, Switzerland

<sup>2</sup>Sechenov First Moscow State Medical University, Laboratory of Autonomic Nervous System Disorders, Switzerland

<sup>3</sup>Bern University Hospital, Universitätsklinik für Neurologie, Inselspital, Switzerland

<sup>4</sup>Civic Hospital (EOC) of Lugano, Department of Internal Medicine, Switzerland

<sup>5</sup>Oasi Institute (IRCCS), Sleep Research Centre, Department of Neurology I.C., Switzerland

**Introduction:** The aim of the study was to describe the time structure of leg movements (LM) in obstructive sleep apnea syndrome

(OSAS), in order to add new knowledge to the understanding of their clinical significance.

**Materials and methods:** Eighty-four patients (16 females, 68 males, mean age 55.1 years, range 29–74) were recruited. All subjects underwent full-night polysomnography and the leg motor pattern was evaluated by means of advanced tools of analysis particularly able to detect and describe LM time structure (periodicity and distribution). In particular, respiratory-related LM (RRLM) were separated from those not related to respiratory events (NRLM).

**Results:** OSAS patients with RRLM had leg movement parameters generally higher subjects without RRLM; the effect was strong for the periodic LM during sleep (PLMS) index, in particular during NREM sleep. The NRLM intermovement interval distribution histogram of patients with RRLM showed a prominent first peak at 4 s, followed by another at approximately 24 s (corresponding to typical PLMS). In the same group, RRLM showed a single wide lower peak with a maximum at about 42 s. In patients without RRLM, NRLM were evident with a single peak at 2–4 s. Patients with RRLM showed a gradually decreasing number of NRLM, from the first to the last hours of sleep; this pattern was less clear for RRLM. A stepwise linear regression analysis showed that, even when controlling for RLS status and AHI, PLMS were highly significantly associated with RRLM.

**Conclusion:** This study shows that RRLM might be part of the true PLMS because they cluster clearly in the patients who also have typical PLMS not correlated with the respiratory events.

<http://dx.doi.org/10.1016/j.sleep.2013.11.464>

### Subjective sleep quality in epilepsy patients with sleep-related seizures

R. Manni<sup>1</sup>, R. Cremascoli<sup>1</sup>, C. Sguazzin<sup>2</sup>, M. Terzaghi<sup>1</sup>

<sup>1</sup> National Institute of Neurology IRCCS C, Mondino Foundation, Italy

<sup>2</sup> Psychological Unit, Salvatore Maugeri Foundation IRCCS, Scientific Institute, Italy

**Introduction:** Sleep quality is expected to be poor in epilepsy patients with sleep-related seizures as a consequence of the disruptive effect of seizures themselves on sleep patterns, a potentially heightened pre sleep emotional arousal due to patient's worries about having seizures during sleep and associated sleep comorbidities. This study is aimed at investigating subjective sleep quality and features in adult patients with seizures occurring exclusively or predominantly during sleep. Patients affected with Nocturnal Frontal Lobe Epilepsy were not included.

**Materials and methods:** Fifty-seven subjects (18–72 years of age; 27 males), 27 (47.3%) diagnosed with sleep related undetermined epilepsy and 30 (52.7%) with focal epilepsy based on clinical, awake/sleep EEG and brain MRI findings, were investigated. Most of the patients (94%) had <1 seizure per month, with the seizures being in most cases generalized convulsive seizures during sleep. All the patients were given Pittsburgh questionnaire (PQ), Morningness – Eveningness Questionnaire (MEC), STAI 1 and 2, Beck Depression inventory (BDI). Patients reporting snoring and/or witnessed apneas during sleep underwent a nocturnal polysomnographic screening for obstructive sleep apnea (OSA). At the time of the questionnaire compiling the patients had had at least 1 seizure during the previous month (seizures recency) in 19% of the cases and they all were on antiepileptic drugs at bed time, with valproate, levetiracetam and carbamazepine, alone (89.5%) or in combination (10.5%) being the most frequently used drugs. Fifty-seven healthy subjects matched for age and sex served as controls. Univariate analyses were preliminary performed in comparing categorical (chi square test) and continuous variables (T-test)

between patients and controls and patients with PSQI >5 and those with PSQI <5.

**Results:** Neither PSQI total score ( $5.2 \pm 3.6$  in patients and  $5.3 \pm 3.4$  in controls) nor its components differ significantly between patients and controls. PSQI >5 patients (39%) and PSQI <5 patients (61%) do not differ significantly for age ( $47.1 \pm 15.0$  vs.  $43.9 \pm 15.0$  years), sex (41% vs. 50% males), STAI 1 ( $46.2 \pm 13.2$  vs.  $37.9 \pm 9.6$ ) and STAI2 scores ( $44.2 \pm 10.5$  vs.  $39 \pm 10.7$ ), BDI ( $12.8 \pm 8.0$  vs.  $9.1 \pm 9.0$ ), MEQ chronotype, OSA prevalence (15.8% vs. 7.1%). As for illness-related parameters, PSQI >5 patients proved to have a significantly longer illness duration than PSQI <5 patients ( $17.5 \pm 18.2$  years vs.  $8.2 \pm 0.3$  years;  $p = 0.035$ ) and a higher rate of seizures recency (54.5% vs. 15.4%;  $p = 0.04$ ).

**Conclusion:** Our data indicate that subjective sleep quality in adult patients with seizures occurring exclusively or predominantly during sleep is not poorer than in healthy controls. Patients' sleep quality is influenced by some illness related parameters, with poor sleep quality being associated with longer disease duration and seizure recency. The relatively low frequency of seizures along with a blunting effect of antiepileptic treatment on arousal instability during sleep may explain the finding of a substantially good sleep quality in our patients series. However also epilepsy patients' life style and their good compliance to sleep hygiene rules may account for a preserved sleep quality.

**Acknowledgements:** The Authors wish to thank the technologists Valter Rustioni, Daniele Marchese, Laura Spelta, Federica Camasso for their technical support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.465>

### ApoE genotype and obstructive sleep apnea syndrome

J. Pinzón Martínez<sup>1</sup>, J. Díaz<sup>2</sup>, J. Ortega<sup>1</sup>, C. Martínez<sup>3</sup>, M. Latorre<sup>4</sup>, P. Ruiz<sup>1</sup>

<sup>1</sup> Department of Clinical Neurophysiology, Hospital General de Castellón, Spain

<sup>2</sup> Sleep Research Unit, Hospital General de Castellón, Spain

<sup>3</sup> Genetic Department, Hospital Provincial Castellón, Spain

<sup>4</sup> Molecular Biology Laboratory, Hospital Provincial Castellón, Spain

**Introduction:** The obstructive sleep apnea syndrome (OSAS) is frequently associated with obesity, hypertension, diabetes and dyslipidemia and other cardiovascular risk factors. In addition, patients with untreated OSAS have an increased cardio-vascular mortality and morbidity Apolipoprotein E (ApoE) plays an important role in the metabolism and transport of lipids. The three main isoforms (E2, E3, and E4) are coded by three common alleles ( $\epsilon 2$ ,  $\epsilon 3$ , and  $\epsilon 4$ ), resulting in six main genotypes:  $\epsilon 2/\epsilon 2$ ,  $\epsilon 2/\epsilon 3$ ,  $\epsilon 2/\epsilon 4$ ,  $\epsilon 3/\epsilon 3$ ,  $\epsilon 3/\epsilon 4$ , and  $\epsilon 4/\epsilon 4$ . Presence of the APOE  $\epsilon 4$  allele is also associated with HDL (High Density Lipoprotein). The aim of this study was to determine what is in our population the prevalence of different alleles of the ApoE gene, if there is an association of allele  $\epsilon 4$  with OSAS and what is their contribution to metabolic syndrome.

**Materials and methods:** Cross-sectional study of 440 men patients. Mean age  $54 \pm 12$  years (range 25–79 years), referred to the sleep unit for study. Written informed consent was obtained from all subjects for the extraction of genetic material, with exclusive analysis of the ApoE gene. Each patient has a clinical history reflecting metabolic and cardiovascular risk and medication in use. Anthropometric data were recorded: weight, height, waist circumference and neck circumference. Determination of blood pressure (BP) at baseline. The study protocol included polysomnography (PSG) overnight in our sleep unit. Upon awakening, the BP was measure and simultaneously blood samples were collected, one for biochemical and other

for the molecular biology laboratory, in order to extract DNA. The recorded variables were studied with the statistical program Statview. Parametric test was applied ANOVA for quantitative variables and chi-square ( $\chi^2$ ) for qualitative variables. Accepting a degree of significance of  $p < 0.05$ .

**Results:** The distribution of genotypes revealed that the prevalence of the  $\epsilon 3/3$  allele was the most predominant (73.6% of cases), followed by the  $\epsilon 4$  allele in 16.4, which is heterozygous in 15.4% ( $\epsilon 3/4$ ) and 1% homozygous ( $\epsilon 4/4$ ). The  $\epsilon 2$  allele was the 10% off the population of the study. The ApoE  $\epsilon 4$  patients have more severe OSAS with longer arterial oxygen desaturation during sleep, expressed by the T90. This genotype was associated with a statistically significant increase of inflammation markers and decreased melatonin. Also note that these patients has high tobacco consumption.

**Conclusion:** In our population the distribution of the genotype correlates with is in the literature; there is an evidence of a relationship between ApoE  $\epsilon 4$  genotype with moderate to severe sleep breathing disordered.

**Acknowledgement:** sleep unit, Hospital General de Castellón.

<http://dx.doi.org/10.1016/j.sleep.2013.11.466>

### Partial sleep deprivation in Portuguese Navy militaries

C. Mário<sup>1</sup>, P. Teresa<sup>2</sup>

<sup>1</sup>Hospital de Santa Maria, Faculdade de Medicina da Universidade de Lisboa, Portugal

<sup>2</sup>Faculdade de Medicina da Universidade de Lisboa, Portugal

**Introduction:** Partial sleep deprivation is a growing public health problem in modern society. It has consequences in various organic systems and has a particular impact in some professional groups, for example the military people. The present observational study seeks to evaluate the effects of sleep restriction on attention and mood of militaries involved in an operational mission with 7 days duration.

**Materials and methods:** 33 elements of a Portuguese Navy ship had their nocturnal sleep period assessed, and their sleepiness (Stanford Sleepiness Scale (SSS), Visual Analog Scale (VAS)), attention (Toulouse-Pieron test) and mood (POMS) were measured in the beginning and at the end of the mission.

**Results:** Mean nocturnal sleep time was about 6 h (SD:  $\pm 63$  min). While attention measures did not show noteworthy modifications, mood was altered, with diminished vigour and increased mood negative dimensions, most notorious in fatigue and confusion scores. It was also perceived that these modifications were larger in those individuals who had higher sleep restriction and higher sleepiness grades in SSS.

**Conclusion:** Sleep restriction, even if moderate, had consequences in militaries sleepiness and mood, with no allocated effect in attention. These modifications correlate well with nocturnal sleep time and with SSS sleepiness score.

**Acknowledgements:** Professor Dr. Teresa Paiva, Professor at FMUL. Professora Manuela Guerreiro, Hospital de Santa Maria Professor José Cruz, Psychology Investigation Center at Minho University Sónia Barroso, coordinator of GAPIC at FMUL Tiago Oliveira, MD Command and garrison of "N.R.P. Afonso Serqueira".

<http://dx.doi.org/10.1016/j.sleep.2013.11.467>

### Comparison of frequency of sleep disorders in MMT volunteers and opium dependant patients

A. Maroufi<sup>1</sup>, H. Khazaie<sup>2</sup>

<sup>1</sup>Kurdistan University of Medical Sciences, Department of Psychiatry, Kurdistan University of Medical Sciences, Sanandaj, Iran

<sup>2</sup>Kermanshah University of Medical Sciences, Sleep Research Center, Kermanshah University of Medical Sciences, Iran

**Introduction:** Use of any sedative or narcotic substance may change the quality of sleep, and quitting these substances can affect sleep as well. Nowadays, Methadone Maintenance Treatment (MMT) is the most common method for treating substance dependence. The relationship between substance and sleep is a bidirectional one in which use of a substance directly causes sleep disturbance and sleep problems is a critical factor for substance- use relapse.

**Materials and methods:** This study seeks to analyze and compare sleep disorders in MMT patients and opium- dependent patients who have not received any treatment yet. Both MMT patients and opium-dependents filled Pittsburg Sleep Quality Questionnaire and GSAQ.

**Results:** For the purpose of this study we recruited 126 men; 65 and 61 patients in MMT and opium dependent group, respectively. According to PSQI from total of 126 patients 104 (82.5%) had a PSQI score  $\geq 5$  meaning a bad sleep quality. Both groups were comparable in terms of six areas of sleep quality but higher proportion of daytime dysfunction among those who were dependent to opium compared to those who were under MMT ( $p = 0.001$ ).

**Conclusion:** The findings of the present study are in the same direction as the previous studies. We can conclude that comparing to opium, MMT is more effective in reducing sleep problems and has a better prognosis.

**Acknowledgement:** Thanks from Dr. Atena Azami for cooperation to doing this work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.468>

### Impact of respiratory events associated with autonomic arousals using type 1 sleep laboratory and type 3 ambulatory recordings

S. Marshansky<sup>1</sup>, V. Jobin<sup>2</sup>, P. Rompré<sup>3</sup>, G. Lavigne<sup>1</sup>, P. Mayer<sup>2</sup>

<sup>1</sup>Université de Montréal, Faculté de Médecine, Spain

<sup>2</sup>Université de Montréal, Clinique du sommeil de l'Hôtel-Dieu, Spain

<sup>3</sup>Université de Montréal, Faculté de Médecine Dentaire, Spain

**Introduction:** The aim was to compare standard apnea-hypopnea indices (AHI) and respiratory disturbance indices with RERA (RDI) to indices including breathing events with autonomic arousals (AA) recorded in suspected sleep-disordered breathing populations using AASM type 1 and 3 recordings.

**Materials and methods:** Type 1: 73 subjects underwent overnight in-laboratory polysomnography. The following respiratory outcomes were scored: 4% oxygen desaturation index (ODI), apnea-hypopnea index (AHI), respiratory disturbance index with EEG arousals (RDle), and RDI with AA (RDla). Type 3: 89 subjects underwent home recordings for one night with ambulatory monitoring. As above, ODI, AHI, and RDla were scored (not RDle). Patients were classified into severity categories as no (0) to mild (1), moderate (2), and severe (3). Analyses performed were: (1) frequency of migration from lower to higher category; (2) Bland-Altman (B-A) to assess agreement between AHI, RDle, and RDla (type 1 monitoring), and

AHI and RDla (type 3 monitoring) (limits of agreement defined as the interval of the mean difference  $\pm 1.96 \times \text{SD}$ ).

**Results:** Type 1: A linear severity trend was observed for all mean values of ODI, AHI, RDle, and RDla. 29% (21/73) of subjects migrated using RDle vs. RDla: 14% from 0 to 1, 11% 1 to 2, and 4% 2 to 3. B-A plots show a 6.63 mean difference (interval [−1.39; 14.66]) for RDla vs. AHI, and 3.95 difference for RDla vs. RDle with interval [−2.83; 10.73]. Type 3: No linear trend was observed for ODI, AHI, and RDla. 57% (45/79) of subjects migrated using AHI vs. RDla: 33% from 0 to 1, 14% 1 to 2, 4% 2 to 3, and 4% 0 to 2. B-A plots show a 6.91 mean difference between RDla and AHI (RDla-AHI) with limits of agreement [−2.90; 16.73].

**Conclusion:** Autonomic arousal events produce a similar increase in indices over AHI in type 1 and type 3 recordings, with a smaller difference compared to RDle for type 1. Presumably, AA events captured most of the EEG arousal events not counted in type 3 studies. Unsurprisingly, the impact on AHI severity change was greater in the type 3 study (no EEG). The significance of events with AA remains unclear: their identification in type 3 studies may lead to better concordance with type 1 studies and improved disease definition.

**Acknowledgements:** Supported by Canada Res Chair and CHUM.

<http://dx.doi.org/10.1016/j.sleep.2013.11.469>

### Functional imaging of NREM recovery sleep slow waves in young and older subjects : preliminary results

N. Martin<sup>1</sup>, J. Godbout<sup>1</sup>, P. Pouliot<sup>2</sup>, J. Doyon<sup>3</sup>, P. Maquet<sup>4</sup>, J. Carrier<sup>1</sup>

<sup>1</sup>Center for Advanced Research in Sleep Medicine, Hôpital Sacré-Cœur de Montréal, Spain

<sup>2</sup>École Polytechnique, Université de Montréal, Spain

<sup>3</sup>Functional Neuroimaging Unit, Institut Universitaire de gériatrie de Montréal, Spain

<sup>4</sup>Cyclotron Research Center, Université de Liège, Spain

**Introduction:** During non-rapid eye movement (NREM) sleep, the level of neural synchronization is mainly reflected on the electroencephalogram (EEG) by large-amplitude slow waves (SW). Factors such as age and sleep homeostasis modify SW characteristics and their underlying neural processes. Recent neuroimaging studies have identified brain regions recruited by SW mechanisms in young, non-sleep-deprived humans. In these preliminary analyses, we aimed to identify brain regions implicated in SW onset and SW amplitude in young and older subjects during a recovery morning sleep following prolonged wakefulness.

**Materials and methods:** Thirty-one healthy, right-handed volunteers were divided in two age groups: young ( $n = 16$ ; 7 females; 20–30 years,  $M = 23.06$ ,  $SD = 3.34$ ) and older ( $n = 15$ ; 9 females; 52–69 years,  $M = 59.47$ ,  $SD = 5.89$ ). Subjects underwent 26 h of sleep deprivation before the recording session. Sleep was recorded in the morning for a maximum of 90 min, using simultaneous EEG and fMRI acquisitions. EEG data were corrected for gradient and ballistocardiographic artifacts, sleep stages were identified, and SW were detected using an automatic algorithm. Event-related fMRI analyses were performed on functional volumes corresponding to periods of uninterrupted N2 and N3 sleep. SW events were modeled as one onset regressor and one parametric modulator accounting for the wave's amplitude, both convolved with the hemodynamic response function basis set. Individual  $t$ -maps (first level analysis) were included in an ANOVA with basis set and age group as factors (second level analysis). Significant voxels ( $p < 0.001$  uncorrected;  $p < 0.05$  small volume correction) related to SW onset or amplitude modulation were assessed with F-contrasts.

**Results:** In young subjects, SW onset was associated to significant BOLD changes in the cerebellum, whereas older participants showed BOLD changes in the pons, thalamus, caudate nucleus and putamen. SW amplitude significantly modulated BOLD changes in the insula and in frontal, temporal and supramarginal regions in older subjects, but not in the young.

**Conclusion:** After prolonged wakefulness, SW onsets in young and older subjects are mostly associated to changes in subcortical brain regions. SW amplitudes in older subjects modulate neural activity in several cortical and subcortical areas.

**Acknowledgements:** This work was supported by the Canadian Institutes of Health Research and the Fonds de Recherche en Santé du Québec.

<http://dx.doi.org/10.1016/j.sleep.2013.11.470>

### Propiospinal myoclonus at sleep onset (PSM) after spinal anesthesia in a patient with restless legs syndrome (RLS) and periodic limb movements during sleep (PLMS): a case report

M. Maria Ángeles<sup>1</sup>, O. Roberto<sup>1</sup>, G. Mónica<sup>1</sup>, M. Jessica Guadalupe<sup>1</sup>, G. Andrés<sup>2</sup>, M. José Luis<sup>3</sup>

<sup>1</sup>Marqués de Valdecilla University Hospital, Neurophysiology Section, Multidisciplinary Sleep Unit, Spain

<sup>2</sup>Radiology Department, Marqués de Valdecilla University Hospital, Santander, Spain

<sup>3</sup>Sierrallana Hospital, Neurology Department, Spain

**Introduction:** PMS is a rare disorder that consist of repetitive axial jerks arousing mainly during drowsiness preceding falling asleep. The last revision of the International Classification of Sleep Disorders (ICDS-2) has considered PMS into the apparently normal variants and unresolved issues. PMS have been occasionally reported to occur in idiopathic RLS. Our objective is to expose the results of the study of a patient with RLS who started with axial jerks resembling PSM after spinal anesthesia.

**Materials and methods:** A 56-year-old woman had a 6-year history of uncomfortable sensations involving the legs and sometimes also the arms when sitting or laying down, worsening in bed and impending sleep. Her husband also reported frequent limb movements during sleep. In the last 2 years sudden jerks of her trunk and abdomen had additionally appeared during relaxed wakefulness. Apparently the axial jerks began immediately after spinal anesthesia for a left lower extremity orthopedic procedure. The patient underwent a clinical interview, physical and neurological examination, video electroencephalographic recording (VEEG), video-poly-somnographic recording (VPS), jerk-related EEG-EMG back averaging, electroneurography (ENG), somatosensory-evoked potentials (SEPs), magnetic stimulation motor evoked potentials (TMS) and brain and spinal cord magnetic resonance imaging (MRI).

**Results:** VPS showed repetitive jerks with variable regularity during relaxed wakefulness, intra sleep wakefulness and even during light sleep involving axial and leg muscles. On the other hand, isolated PLMs during sleep involving both anterior tibial muscles were registered. Spinal cord MRI showed degenerative changes present in the lower cervical and lumbar spine without apparent medullar compromise. TMS however revealed a slight but significant delay of central conduction to left lower limb. Jerk – related EEG – EMG back- averaging did not disclose any preceding cortical potential. No significant findings were found in the rest of the tests.

**Conclusion:** From our knowledge this is the first description of PMS after spinal anesthesia in a patient with SPI and PLMS. The causal relationship remains unclear.

**Acknowledgements:** I must thank all the contributors: Dr. Fernández – Torre and Dr. Orizaola Balaguer of the Neurophysiology Department. All medical staff, nurses and technicians of our Multi-disciplinary Marqués de Valdecilla Sleep Unit.

<http://dx.doi.org/10.1016/j.sleep.2013.11.471>

### **Circadian rhythm of wrist temperature and night shift-work**

L. Ruiz Carmona Ferreira  
UNICAMP, Brazil

**Introduction:** Due to the increasing industrialization of society, the work in shifts is becoming increasingly common, as well as the development of night work, although with a pronounced negative effect on the workers sleep, performance and health. Objective: to investigate the patterns of sleep-wake cycle and the circadian rhythmicity of peripheral body temperature, through measures taken at the wrist of nursing students who study during the day and work on the night shift.

**Materials and methods:** longitudinal descriptive study, with a quantitative approach, involving 27 adult subjects, nursing assistants and technicians who worked on the night shift and were students of undergraduate nursing at a private college in São Paulo State, during the daytime. The following instruments were used: Identification Form, Morningness Eveningness Questionnaire of Horne and Östberg, Sleep Diary, for 32 days, divided into school term and school vacations, and a thermistor (Thermochron iButton) on the non-dominant hand wrist to check the temperature of the wrist every 30 min.

**Results:** The adjustment of the temperature data of the wrist to a cosine curve, within a 24-h period, a significant rhythmicity was verified in 35.3% of subjects in the school term and 93.7% of subjects in the vacation period, apart from the existence of different rhythms of the 24 h such as 12 h and 16 h. There was a statistically significant difference in the time that the acrophase occurred, when comparing the school term on the days-off and on working days ( $p < 0.0001$ ), school vacation on the days-off and working days ( $p < 0.0001$ ). The sleep time during the school vacation was higher when compared to the school term, as well as on the days off and on the days when the subjects did not sleep immediately after work. There was a significant difference when comparing the sleep time on the vacation period and days off (8:34) and school term and days off (7:24),  $p < 0.0001$ , and also on vacation on working days (5:11) and school term on working days (4:19),  $p = 0.0496$ . For the Middle Phase of Sleep (MPS) there was a statistically significant difference between the school and vacation periods on working days and days off.

**Conclusion:** The presence of rhythms different than 24 h, was observed especially during the school term, and the phase transfer of the wrist temperature, according to the period of work/study, with phase opposition on working days when compared to days off. The greatest spectral power was observed in the 24-h rhythm, either during school term or vacation, confirming the hypothesis that the region of the wrist shows a well-defined and robust rhythmic expression. The findings reinforce the idea that the study favors the establishment of routine, but has little influence in displacing the body temperature, which proved to be strongly influenced by the night shift work. Similar to the acrophase, the MPS showed great diversity in times of occurrence, but with a phase relation maintained between the rhythms on the different times of study.

**Acknowledgement:** CAPES.

<http://dx.doi.org/10.1016/j.sleep.2013.11.472>

### **Sleep apnea and aggressiveness**

A. Carissimi<sup>1,2</sup>, C. Caruccio Montanari<sup>2</sup>, L. Jihe Kim<sup>2</sup>, E. Martins<sup>2,3</sup>, A. Amestoy De Oliveira<sup>2</sup>, D. Martinez<sup>2,4,5</sup>

<sup>1</sup> Hospital de Clínicas de Porto Alegre (HCPA), Graduate Program in Medical Sciences: Psychiatry, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil

<sup>2</sup> Cardiology Division, Hospital de Clínicas de Porto Alegre (HCPA), Porto Alegre, RS, Brazil

<sup>3</sup> Graduate Program in Cardiology and Cardiovascular Sciences, UFRGS, Porto Alegre, RS, Brazil

<sup>4</sup> Graduate Program in Cardiology and Cardiovascular Sciences, UFRGS, Porto Alegre, RS, Brazil

<sup>5</sup> Graduate Program in Medicine: Medical Sciences, UFRGS, Porto Alegre, RS, Brazil

**Introduction:** Obstructive sleep apnea (OSA) affects the sleep quality and is associated with psychosocial problems. Testosterone participates both in the pathophysiology of OSA, affecting the upper airway collapsibility, and is the leading hormone related to aggressive conduct. The relationship between decreased sleep quality and irritability or aggressiveness is a frequent anecdotal quote, but the experimental evidence validating this relation is still scarce. Thus, we hypothesized that OSA severity influences aggressiveness in men, independently of the sleepiness and testosterone levels. The present study aimed to evaluate the association of OSA with aggressivity scores on a questionnaire, controlling for sleepiness and testosterone level.

**Materials and methods:** A case-control study was conducted from August 2012 to February 2013 in patients who underwent full overnight polysomnography to investigate sleep disorders. Inclusion criteria were: men aged 18 to 50 years, without organic or mental disorders, social problems, and use of behavior-altering medication, alcohol or illicit drugs. All answered the Brazilian version of the Kurzfragebogen zur Erfassung von Aggressivitätsfaktoren (K-FAF) and of the Epworth Sleepiness Scale (ESS). In this analysis, seven questions scoring peaceful manners were excluded. In the morning after the polysomnography, blood was sampled for the dosage of testosterone. Cases had an apnea hypopnea index (AHI) >15 events/hour and controls, an AHI <15/h.

**Results:** The 127 men included, 87 cases and 40 controls, were aged (mean±SD) 37±8.5 years. In uncontrolled analyses, cases are older than controls ( $P < 0.001$ ), had higher body mass index ( $P < 0.001$ ), had lower testosterone levels ( $p = 0.001$ ), and lower K-FAF scores ( $P = 0.005$ ) than controls. In bivariate correlation, the AHI correlates significantly with testosterone levels ( $\rho = -0.40$ ;  $P < 0.001$ ) and with scores in K-FAF questionnaire ( $\rho = -0.23$ ;  $P = 0.008$ ). The only significant variable to predict K-FAF scores was AHI ( $\beta = -0.27$ ;  $P = 0.022$ ), adjusting for age, body mass index, ESS scores, and testosterone levels in the linear regression model (adjusted  $R^2 = 0.103$ ;  $p = 0.008$ ).

**Conclusion:** The results of this study demonstrate an effect of sleep apnea in reducing scores of aggressive behavior in a specific questionnaire, controlling for confounders.

**Acknowledgement:** Casa do Psicologo, Capes, CNPq, and FIFE-HCPA.

<http://dx.doi.org/10.1016/j.sleep.2013.11.473>

### Sleep apnea and sleep efficiency as predictors of survival after polysomnography

E. Martins<sup>1</sup>, C. Fiori<sup>1</sup>, B. Peukert<sup>2</sup>, M. Fagundes<sup>2</sup>, D. Martinez<sup>2</sup>

<sup>1</sup>Hospital de clínicas de porto alegre, Graduate Program in Cardiology and Cardiovascular Sciences, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil

<sup>2</sup>Hospital de clínicas de porto alegre, Cardiology Division, Hospital de Clinicas de Porto Alegre (HCPA), Porto Alegre, RS, Brazil

**Introduction:** Obstructive sleep apnea (OSA) has been associated with increased mortality. It is not known, however, how sleep apnea affects the relation between short and long sleep duration and mortality risk. Despite the existence of many studies, the association between sleep duration and mortality is still unclear due to the large number of confounders, such as OSA. In the context, the relationship between mortality and sleep efficiency in sleep apnea patients remained less studied. The present study aims to investigate the association between survival time, sleep apnea severity, and sleep efficiency in patients with sleep disorders who underwent full night polysomnography.

**Materials and methods:** A list with 17,778 names and demographics of people who underwent polysomnography between January 1985 and June 2012 was sent to the Health Information Group of the State Health Department. The search in the database of death certificates from 2000 to 2012 obtained 227 patients. Subjects had signed a form consenting in the anonymous use of their data. The subjects were divided at the median survival time in SHORT (<5 years) and LONG survival (>5 years).

**Results:** Among the deceased, 173 were men and 54 women, with ages of (mean±SD) 58±14 and 59±12 years, respectively. Two cases had sleep apnea as cause of death. The mean survival time was similar for men and women (6.2±4.3 and 6.3±4.4 years). Comparing the SHORT and LONG survival, all variables examined were similar, including the apnea-hypopnea index (37±28 and 39±31 events/hour;  $P=0.6$ ), gender, age, body mass index, systolic and diastolic blood pressure, waist and neck circumference, average and minimum oxygen saturation, as well as time and cause of death. The number of years of survival only correlates significantly with sleep efficiency ( $\rho=0.17$ ;  $P=0.01$ ). The sleep efficiency, however, was lower in the LONG survival group (76±16% and 80±16%;  $P=0.049$ ) and the total sleep time was 27 min shorter ( $P=0.01$ ). In the linear regression to predict survival time, sleep efficiency remains the only variable with a significant beta value ( $-0.16$ ;  $P=0.03$ ). The odds ratio for SHORT survival was 2.8 times higher in the group with sleep efficiency >84% (95% CI 1.5–5.0).

**Conclusion:** In the present study, the only variable that explains years of survival is sleep efficiency. This may suggest that hyperexcitability evidenced in the polysomnography by reduced sleep efficiency is a feature that enhances survival.

**Acknowledgements:** This study was supported in part by CNPq, CAPES, and FIPE-HCPA (Brazil).

<http://dx.doi.org/10.1016/j.sleep.2013.11.474>

### Is there a correlation between clinical factors and nocturnal oximetry in cystic fibrosis children?

R. Martins<sup>1</sup>, A. Silva<sup>1</sup>, S. Mexia<sup>2</sup>, I. Asseiceira<sup>2</sup>, L. Pereira<sup>1</sup>, R. Ferreira<sup>1</sup>

<sup>1</sup>Santa Maria Hospital, Pneumology Unit, Department of Pediatrics, Santa Maria Hospital, CHLN, Academic Medical Center of Lisbon, Portugal

<sup>2</sup>Santa Maria Hospital, Nutrition Department, Santa Maria Hospital, CHLN, Academic Medical Center of Lisbon, Portugal

**Introduction:** Cystic Fibrosis (CF) patients develop sleep hypoxemia and hypercapnia in the course of disease. The magnitude of nocturnal oxygen desaturation (NOD) may correlate with the severity of lung disease and the development of pulmonary hypertension. In children studies are scarce and controversial. Aim: to identify predictive factors of NOD using nocturnal Oxygen Desaturation Index (ODI) and its association with clinical severity in CF children.

**Materials and methods:** Twenty-four CF patients were included, January 2012 to June 2013. Clinical files were reviewed and data about nutritional status (BMI z-score), hospitalizations, bacterial isolates and pattern, and X-ray imaging findings were collected. Patients underwent a nocturnal pulse oximetry and ODI was classified as normal (<3 h), mild ( $\geq 3$ /h and <6/h), moderate ( $\geq 6$ /h and <10/h) and severe ( $\geq 10$ /h). Exploratory statistics and Pearson's and Spearman's correlations were done, as appropriate.

**Results:** Twenty-four patients, median age 12.5 years (min7; max 18), twelve (50%) are homozygous for delF508. Twelve (50%) patients had nocturnal hypoxemia, either mild (6;50%), moderate (3;25%) or severe (3;25%). Twenty-two patients (92%) had bacterial isolates, sixteen (67%) of which were chronic. Seven patients (29%) had been hospitalized during the period of study. None children had a normal imaging and sixteen (67%) had bronchiectasis. No correlation was found between ODI and number of hospitalizations, total number and chronic isolates, microorganisms identified, BMI z-score and imaging changes. After ODI severity stratification, a significant correlation was found between moderate ODI and number of chronic isolates ( $\rho=0.999$ ,  $p=0.021$ ). Although non significant, we found a moderate correlation between mild ODI and total number of isolates ( $\rho=0.639$ ,  $p=0.172$ ) and isolation of MRSA ( $\rho=0.644$ ,  $p=0.150$ ), moderate ODI and isolation of MRSA ( $\rho=0.866$ ,  $p=0.333$ ) and severe ODI and isolation of B. cepacia ( $\rho=0.866$ ,  $p=0.333$ ).

**Conclusion:** We couldn't find a correlation between ODI and clinical severity. The only factor that showed a strong and statistically significant ODI correlation was the number of chronic bacterial isolations in the moderate ODI group. The small number of patients may explain some of the non-significant correlations, further and larger studies in children are needed.

**Acknowledgements:** - Dr. Rita Jotta – Patients and their families.

<http://dx.doi.org/10.1016/j.sleep.2013.11.475>

### Underreport of energy intake modified the association between sleep disturbance and overweight among middle-aged japanese: toon health study

K. Maruyama<sup>1</sup>, T. Tanigawa<sup>1</sup>, E. Eguchi<sup>1</sup>, S. Sakurai<sup>2</sup>, I. Saito<sup>1</sup>

<sup>1</sup>Ehime University, Graduate School of Medicine, Japan

<sup>2</sup>Susumu Sakurai, Tenri Health Care University, Department of Clinical Laboratory Science, Japan

**Introduction:** Sleep problems are associated with consider to be obesity. The potential reasons are higher energy intake and lower frequency of physical activity. However, the obese people had been reported to underreport their energy intake, and this effect to the association between sleep problems and obesity is not clear. Therefore, we examined whether underreport of energy intake modified the association between sleep quality and obesity.

**Materials and methods:** We conducted a cross-sectional study. The subjects were 720 men and 1297 women aged 30–79 y in Toon Health Study between 2009 and 2012. In this study, body mass index  $\geq 25.0$  was defined as overweight. Energy intake (EI) and expenditure (EE) were assessed with a validated food frequency questionnaire and physical activity questionnaire, and calculated ratio of

energy intake to energy expenditure (EI-to-TEE ratio). In this study, lower EI-to-TEE ratio reflects underreport of energy intake. Sleep disturbance was assessed with the Pittsburgh Sleep Quality Index, and its score  $\geq 6$  was defined as sleep disturbance. The logistic regression model was used to assess the association between disturbance and overweight, and effects of modification by EI, EE and EI-to-TEE ratio.

**Results:** The sleep disturbance was associated with higher risk of being overweight. The multivariable odds ratio and 95% confidence intervals for the subjects with sleep disturbance compared to those without sleep disturbance was 1.44 (1.17–1.78). The effect modification by ratio of EI-to-TEE ratio to above association was statistically significant ( $p$  for interaction = 0.03), while those by EI and EE were not significant. After stratification by median-value of EI-to-TEE ratio, there was a significant association between sleep disturbance and being overweight among lower group, but not among higher group.

**Conclusion:** We found a significant effect modification by underreport of energy intake to the association between sleep disturbance and being overweight. Further research is needed to clarify the mechanism of this modification.

**Acknowledgements:** We are grateful to the participants of the Toon health study, and those who supported for this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.476>

### Effectiveness of home single-channel nasal pressure for sleep apnea diagnosis

J. Masa

*Servicio Extremeño de Salud (SES), Hospital San Pedro de Alcántara, Neumología, Spain*

**Introduction:** Home single-channel nasal pressure (HNP) may be an alternative to polysomnography (PSG) for obstructive sleep apnea (OSA) diagnosis but no cost studies have been carried out. Automatic scoring is simpler but less effective than manual scoring. However, there have been no studies comparing the efficacy and cost of PSG with HNP with manual scoring, automatic scoring or sequential protocol (automatic and then manual scoring for undiagnosed subjects).

**Objectives:** To determine the diagnostic efficacy and cost of two HNP protocols, manual and sequential, compared with in-hospital PSG.

**Materials and methods:** We included suspected OSA patients in a multicentric study. They were assigned to home and hospital protocols at random. We constructed Receiver Operating Characteristic (ROC) curves for manual and automatic scorings. Diagnostic efficacy was explored for several HNP apnea-hypopnea index cut-off points and costs were calculated for equally effective alternatives.

**Results:** Of 787 randomized patients, 752 underwent HNP. Manual scoring produced better ROC curves than automatic scoring. 67% of the patients who underwent HNP were correctly classified (OSA or not) with manual scoring, as were 61% with sequential protocol. The costs of PSG were more than double those of the manual HNP and sequential HNP protocols, with minimal differences between them.

**Conclusion:** HNP is a significantly cheaper alternative for diagnosis in patients with suspected OSA. The costs of the sequential protocol (automatic scoring and then manual scoring for invalid automatic recording) were lower than automatic scoring and similar to manual scoring, for the same diagnostic efficacy as PSG.

**Acknowledgements:** Instituto de Salud Carlos III (Fondo de Investigaciones Sanitarias, Ministerio de Sanidad y Consumo) PI050402, Spanish Respiratory Foundation 2005 (FEPAR) and Departamento de Sanidad del Gobierno Vasco (2005111010) and Caja Vital (2005).

<http://dx.doi.org/10.1016/j.sleep.2013.11.477>

### Diagnostic value of berlin questionnaire as a screening tool for obstructive sleep apnea-hypopnea syndrome

A. Matevosyan<sup>1</sup>, G. Podosyan<sup>2</sup>, G. Khandanyan<sup>3</sup>, A. Shukuryan<sup>3</sup>, P. Zelveian<sup>2</sup>

<sup>1</sup> *Sleep Research Laboratory at the Center of Preventive Cardiology, Yerevan, MD, Armenia*

<sup>2</sup> *Center of Preventive Cardiology, National Institute of Health, Member of ESC, Yerevan, Armenia*

<sup>3</sup> *Yerevan State Medical University, Yerevan, Armenia*

**Introduction:** The aim of our study was to estimate the diagnostic value of Berlin Questionnaire (BQ) for screening obstructive sleep apnea-hypopnea syndrome (OSAHS).

**Materials and methods:** One hundred fifty-five OSAS suspected patients were referred to "Sleep Research Laboratory" at the "Center of Preventive Cardiology". They were all screened by translated BQ and subsequently underwent full polysomnographic (PSG) examination. All PSG were done using "Embla N7000" and "Somnologica Studio 4.0" software. The statistical analysis was performed by CIA 2.2.0 software.

**Results:** From the studied sample, 138 (89.0%) were males, with a mean age of  $44.8 \pm 12.0$  years, body mass index –  $34.6 \pm 6.3$  kg/m<sup>2</sup>. Each category from three sections of BQ was estimated separately. Categories 1, 2 and 3 were positive in 92.3%, 56.8% and 85.8%, respectively. Sensitivity, specificity, and positive and negative predictive values (PPV and NPV) of BQ was calculated considering an apnea-hypopnea index (AHI)  $\geq 5$ /h as cutoff criteria for OSAHS, assessed by PSG. BQ sensitivity and specificity were 93.4 (95% CI 87.9–96.5%) and 52.6% (95% CI 31.7–72.7%). PPV and NPV were 93.4% (95% CI 87.9–96.5%) and 52.6% (95% CI 31.7–72.7%), respectively.

**Conclusion:** In our sample the BQ provides a high level sensitivity and moderate specificity for OSAHS diagnosis. Thus, BQ is a useful tool for screening, but it has a limited value for OSAHS diagnosis.

**Acknowledgements:** Anna Petrosyan laboratory technician.

<http://dx.doi.org/10.1016/j.sleep.2013.11.478>

### Mandible behavior during wakefulness and sleep-disordered breathing: intra- and inter-scorer variability for the visual recognition of the mandible movement isolated

G. Maury<sup>1</sup>, F. Senny<sup>2</sup>, C. Laurent<sup>3</sup>, A. Albert<sup>4</sup>, S. Laurence<sup>4</sup>, P. Robert<sup>3</sup>

<sup>1</sup> *Service de Pneumologie, Université catholique de Louvain, CHU Mont Godinne Dinant, Belgium*

<sup>2</sup> *Montefiore Department for Microsystems and HELMO Gramme, University of Liège, Belgium*

<sup>3</sup> *Sleep/Wake Center of the University Hospital of Liège, University of Liège, Belgium*

<sup>4</sup> *Medical Informatics and Biostatistics, University of Liège, Belgium*

**Introduction:** Mandible movement (MM) study has been recently used in an automated analysis in a screening portable device for sleep apnea. This signal provides information on the mandible activity. It could be read visually to assess sleep/wake state and respiratory events. The aims were (1) to evaluate the possibility to teach 4 independent raters to recognize the signal specificities in seven conditions; (2) to assess the intra-scorer reproducibility and (3) the inter-scorer variability.

**Materials and methods:** MM were collected in the mid-sagittal plane of the face of 40 patients addressed for polysomnography. The typical MMs were extracted and classified in 7 patterns that were divided to form an atlas for educational sessions and to build a database subsequently submitted for 2 sessions of analysis.

**Results:** The intra-scorer reproducibility was good, ranging from 0.61 to 0.87. At the first and second lectures, the recognition rates of abnormal respiratory events (obstructive: O, central: C, mixed: M and RERA) was excellent: inter-scorer mean agreement was respectively 90.1% (Cohen's Kappa 0.83; 95%CI: 0.76–0.89) and 91.2% (Cohen's Kappa 0.85; 95%CI: 0.78–0.91). The discrimination of O/C/M characteristics (the recognition of respiratory event classes) was good, inter-scorer mean agreement was respectively 78.4% (Cohen's Kappa 0.61; 95% CI: 0.56–0.65) and 83.1% (Cohen's Kappa 0.68; 95% CI: 0.64–0.73).

**Conclusion:** The recognition rates of events, as well as the intra and inter-rater stability provided very good results. The study demonstrated that the visual analysis of the MM isolated was useful to assess sleep/wake state, (ab-) normal respiration and to recognize the presence of respiratory effort.

<http://dx.doi.org/10.1016/j.sleep.2013.11.479>

### **The costs of sleep related breathing disorders: a prospective, representative study in the German state of Hessen**

G. Mayer<sup>1</sup>, P. Hessmann<sup>2</sup>, J. Reese<sup>2</sup>, R. Dodel<sup>2</sup>, S. Apelt<sup>3</sup>, J. Heitmann<sup>4</sup>

<sup>1</sup> Hephata Klinik, Dpt. of Neurology, Germany

<sup>2</sup> Philipps Universität Marburg, Dpt. of Neurology, Germany

<sup>3</sup> Philipps Universität Marburg, Dpt. of Physiotherapy, Germany

<sup>4</sup> Universität Giessen, Dpt. of Pneumology, Germany

**Introduction:** The aim of this analysis was to obtain the indirect and direct cost of sleep related breathing disorders (srbd) and to identify relevant other cost factors.

**Materials and methods:** The study was performed in a total of 627 srbd patients ( $f = 124$  und  $m = 503$ ) recruited by 18 sleep centers in the German state of Hessen. Baseline investigation comprised a detailed clinical investigation with a retrospective questionnaire for the last three months on the demographic and socio-economic situation, and the course of the disease (duration, severity of symptoms, time of diagnosis, daytime sleepiness, depression, quality of life, responsible physician etc.). Direct costs were drawn from the reported consumption of resources, the indirect costs were drawn according to the human capital method. The costs were obtained from the societal, the caretaker and the patient's perspective.

**Results:** Patients had a mean age of 56,1 years, 80.1% were married, 37.0% had a high school diploma and 26.5% a secondary school diploma. 12.7% of all patients reported disease related changes of their professional situation (among others 12.8 days of absence in the study period/per patient). At the time of the study patients had undergone medical treatment for a mean of 8,3 months. 31.7% had been treated by general physicians, 6.1% by neurologists, and 45.8% by other physicians (interns, pulmonologists etc.). A large part of the total costs was caused by the indirect costs (mean of 422±1745€). During the study period the mean costs for ambulatory consultations was 54±61€. About 21% of all patient were treated in a hospital setting, causing mean costs of 249±537€ per patient. The

influence of the severity of the disease and it's duration, daytime sleepiness, BMI and depression on the variance of the total costs and of direct costs was studied by multivariate analyses.

**Conclusion:** Srbd can cause a high financial burden for the health system as well as for the single patient. The subjective burden for the patient is reflected by a relevant reduction of quality of life (EQ 5D 0.86±0.19 und EQ VAS 66.8±19.3).

**Acknowledgements:** This study was commissioned and financed by the German Sleep Society DGSM.

<http://dx.doi.org/10.1016/j.sleep.2013.11.480>

### **Modafinil for the treatment of idiopathic hypersomnia – results of a randomized, double-blind, placebo controlled study**

G. Mayer<sup>1</sup>, H. Benes<sup>2</sup>, P. Young<sup>3</sup>, A. Rodenbeck<sup>4</sup>

<sup>1</sup> Hephata Klinik, Dpt. of Neurology, Germany

<sup>2</sup> Somnibene, Neurology, Germany

<sup>3</sup> Universität Münster, Dpt. Neurology, Germany

<sup>4</sup> Charité Berlin, Institute for Physiology, Germany

**Introduction:** The European Medicines Agency withdrew modafinil for the indications idiopathic hypersomnia (IH) and narcolepsy in children due to the lack of sufficient evidence based literature. The literature provides mainly retrospective data. Lavault et al. (Sleep Medicine 2011) found modafinil to be the medication of first choice in 96% of IH patients resulting in a reduction of ESS of 2.6–3 points. The purpose of our study was to study the effects of modafinil on ESS and sleep latency in the MWT (primary variables) of IH patients.

**Materials and methods:** In this investigator initiated study only drug naïve IH patients without long sleep according to ICSD2 criteria were included. Disease onset had to be before the age of 30 years. Patients were consecutively recruited from 3 German Sleep Centers and randomized to placebo or 200 mg modafinil once daily in the morning. Visit 1 on day 1 (drug naïve) included vital signs, ESS, medical history, physical investigation and laboratory tests. Throughout the 28 days patients filled in evening morning protocols. Patients were on medication from days 8–21. On days 7, 14 and 21 MWT, ESS and CGI were performed. 14 IH were randomized to modafinil (10 m, 4f, mean age 38.4±12.7 years), 17 (9 m, 8f, mean age 34.8 ± 13.5 years) to placebo. One patient was excluded due to protocol violation.

**Results:** In the intention to treat analysis ESS was significantly reduced in the modafinil group by 5.4 points, compared to 1.9 points in the placebo group ( $p < 0.023$ , effect size 0.64), sleep latency in the MWT was not significantly prolonged (4.9 vs. 1.5 min.), CGI was significantly improved (−0.14 vs. −0.36,  $p < 0.028$ , effect size 0.61). Manovas showed no interaction of gender and ESS, but the differences were smaller for men than for women. There was no age effect.

**Conclusion:** Modafinil 200 mg improves ESS and CGI significantly when compared to placebo. The increase of sleep latency in the MWT is not significant. There is no interaction with age and gender. Modafinil is an effective medication in adult patients with idiopathic hypersomnia without long sleep.

**Acknowledgement:** This investigator initiated study was financed by Cephalon Germany.

<http://dx.doi.org/10.1016/j.sleep.2013.11.481>

**The Penelope syndrome not always means bad prognosis**

N. Cuéllar-Ramos, V. Cortés-Jiménez, J. Álvarez-Sánchez,  
A. Pedrera-Mazarro  
Hospital Ramón y Cajal, Spain

**Introduction:** Penelope spun during the day and undid it during the night so, which the brain makes during the day, is erased during the night by the epileptic activity. The epileptic syndromes with continuous spike-wave during slow sleep (CSWS) are a group of authentic epileptic encephalopathies and show a wide clinical spectrum with common characteristics that includes the increase and generalization of epileptiform discharges in the EEG during sleep. In addition, patients have neuropsychological disturbances, including aphasia. The onset of these syndromes is around 4 or 5 years of age and stabilize or even improve around puberty. It is a rare syndrome that occurs exclusively in childhood, with a variable etiology. Prognosis is influenced by the age of onset and the persistence over the time of the CSWS pattern, being worse in cases in which this abnormality appears at early ages and longer permanence.

**Materials and methods:** We report two cases of children with CSWS pattern but with different clinical presentations.

**Results:** The first one is a 6 years aged girl with a diagnosis of benign epilepsy of childhood, who changes her seizures pattern and starts to have delay in the school, showing a CSWS in the sleep EEG. She was diagnosed of atypical benign partial epilepsy of childhood, treated, with a good outcome (disappearance both seizures and CSWS pattern). This case would be the benign side of the CSWS encephalopathies spectrum. The second one is a case of a sudden acquired aphasia when the patient was 6 years old, who never suffered epileptic seizures, but shows a CSWS pattern in the EEG. He was diagnosed of Landau-Kleffner syndrome, treated with antiepileptic drugs and corticosteroids, with a benign clinical course (language recovering and EEG normalization). However this case would be at the more severe end of the spectrum.

**Conclusion:** The status epilepticus during slow sleep can cause serious neurocognitive development alterations of children affected. Early age of onset and persistence of CSWS pattern significantly influence the prognosis of these patients. Our cases would confirm this assumption, because the delayed onset and benign course, despite one of them was a case of Landau-Kleffner syndrome. In a child with sudden decrease in school performance or language difficulties would be entirely necessary to carry out a study of sleep EEG.

**Acknowledgements:** Dres. Paloma Quintana, Julia Sáez and Félix Paradinas

<http://dx.doi.org/10.1016/j.sleep.2013.11.482>

**Nocturnal Paroxysmal Dystonia (NPD), two cases report**

A. Pedrera-Mazarro, K. Escajadillo-Vargas, J. Álvarez-Sánchez,  
N. Cuéllar-Ramos  
Hospital Ramón Y Cajal, Spain

**Introduction:** Nocturnal Paroxysmal Dystonia (NPD) is a rare condition characterized by recurrent attacks during NREM sleep of variable duration (seconds to minutes), with a complex clinical expression: repetitive stereotyped dystonic, ballistic or choreoathetoid movements involving single or all extremities and neck. It is associated with other conditions such as paroxysmal arousals, episodic nocturnal wanderings, dyskinetic or semipurposful movements and vocalizations, often no ictal epileptic in surface EEG activity, and normal brain neuroimaging. Nowadays, it is clear that most of patients who fit the diagnosis of NPD have a form of

sleep-activated focal epilepsy (nocturnal frontal lobe epilepsy). Our aim is to present two patients diagnosed with NPD.

**Materials and methods:** It is a descriptive study, enrolling two patients with NPD diagnosis.

**Results:** We report two cases. The first one, a 13 years old boy without relevant personal and family medical history, who debuted at 5 years old with dystonic and dyskinetic attacks during sleep that occurred many times per night. The second case is a 39 years old man, without relevant personal and family medical history. Since aged 31 years, he complained attacks of motor agitation with stereotypical movements every night and often several times per night. Both patients remained without neurological abnormalities in physical examination and brain neuroimaging. The EEGs during wakefulness and sleep were normal. Initially they were diagnosed as NREM parasomnia and followed many years without evidence of developing any neurocognitive disorder or neurological impairment, despite no treatment.

**Conclusion:** The attacks of Nocturnal Paroxysmal Dystonia are a form of nocturnal frontal lobe epilepsy. The application of deep brain electrodes has led to the recognition that "hypermotor seizures" may also be found in seizures originated from the temporal lobe and the insula. Functional brain imaging in frontal lobe seizures confirms that the peculiar motor patterns involve mesial and especially cingulate, motor areas. It is necessary to keep into consideration this rare and not well-known entity in the differential diagnosis of atypical parasomnias. Although the latest advances in Neurosciences, the polysomnography and the clinical history continue being pillars in the diagnosis of nocturnal frontal lobe epilepsy so the neurophysiological studies must always be considered when the diagnostic of a parasomnia is not well established.

**Acknowledgements:** Dres. Quintana, Sáez y Paradinas.

<http://dx.doi.org/10.1016/j.sleep.2013.11.483>

**Insomnia and mortality among older people in five Latin American countries: a population based cohort study**

D. Mazzotti, S. Garbuio, M. Ferri, S. Tufik, C. Ferri  
Universidade Federal de São Paulo, Departamento de Psicobiologia,  
Brazil

**Introduction:** It has been suggested that individuals with impaired sleep are subjected to increased mortality, especially older adults. However it is not fully understood how this association is affected by different factors as socio demographics and adverse health behaviors, or by physical and mental chronic conditions. Also there is scarce information on this association from Latin American countries where aging is happening fast. We aimed to estimate the association between insomnia and mortality in large epidemiological samples from older people living in five urban catchment areas in Latin American.

**Materials and methods:** The vital status of 9205 people aged 65 years and over was determined 3–5 years after baseline survey in five urban sites in Latin America. We reported crude mortality rates for those with and without insomnia complaints and adjusted for socioeconomic factors, adverse health behaviors and physical and mental chronic conditions using Cox's proportional hazards regression to look at their separated contribution to the association between insomnia complaints and mortality.

**Results:** Insomnia was reported by one third of the total sample ranging from 19.2% (95%CI = 17.1–21.3) in Peru to 36.6% (95%CI = 34.5–38.8) in Dominican Republic. Mortality rates were in general higher in participants who reported insomnia and varied from 16.4 (95%CI = 9.3–28.9) per 1000 person years in Peru to 66.2

(95%CI = 57.2–76.7) in Dominican Republic. A statistically significant association between insomnia and mortality (crude HR = 1.15; 95%CI = 1.02–1.28) was found, which was not explained by socio demographic characteristics (adjusted HR = 1.15; 95%CI = 1.02–1.29). The model adjusted for adverse health behaviors had the highest impact in the initial model (HR = 1.05; 95%CI = 0.92–1.17), followed by the model adjusted for mental disorders (HR = 1.10; 95%CI = 0.97–1.23) and for the model adjusted for physical conditions (HR = 1.13; 95%CI = 1.00–1.27).

**Conclusion:** In Latin American urban catchment areas there is a strong association between insomnia and mortality, which is not explained by socio demographic factors alone. Adverse health behaviors had the strongest effect on this association compared to mental and physical conditions.

**Acknowledgements:** AFIP, FAPESP and CNPq.

<http://dx.doi.org/10.1016/j.sleep.2013.11.484>

### **Serial electrical stimulations of hypothalamic Orexin-containing neuronal regions lead to elevation of CSF OrexinA concentration, shorten anesthesia time and fasten recovery of normal sleep cycles from deep anesthesia induced sleep**

O. Mchedlidze, E. Chkhartishvili, N. Maglakelidze, V. Tsomaia, N. Rogava, N. Nachkebia

*Lab. Neurobiology of Sleep-Wakefulness Cycle, I. Beritashvili Center of Experimental Biomedicine, Georgia*

**Introduction:** The aim of the study was to assess the hypothalamic Orexinergic system as the neuronal substrate for speeding up regulation of disturbed sleep homeostasis and recovery of sleep-wakefulness cycle in different behavioral states from some pathological conditions, namely from deep anesthesia induced sleep. Pre-clinical evidence in relation to this question are very sparse and therefore their investigation is highly topical.

**Materials and methods:** In white wild rats ( $n = 12$ ) after Surgical implantation of recording electrodes and postoperative recovery deep anesthesia was induced by chloralhydrate and/or sodium ethaminal. EEG registration was started immediately and lasted continuously for 48 h. 10 min after administration of anesthetic drugs serial electrical stimulations (8–12 v, 200 c/s, 0.1 ms) of dorsal, lateral, posterior and perifornical hypothalamic Orexin-containing neurons were started. Stimulations lasted for 1 h with the 5 min intervals between subsequent ones applied by turn to the left and right side hypothalamic parts. CSF OrexinA concentration was measured by ELISA method. Statistical processing was made by Students' *t*-test.

**Results:** Spontaneous recovery of the first fragments of EEG wakefulness from deep anesthesia-induced sleep required 5.0–5.5 h depending on the depth of narcosis. Serial electrical stimulations of dorsal, lateral, posterior and perifornical hypothalamic Orexin-containing neurons significantly speed up wakefulness recovery from both types of narcotic sleep with the first fragments of wakefulness appearing 3.5–4 h after deep anesthesia. The first fragments of wakefulness were rapid (20–30 min) followed by normal deep slow wave sleep episodes. Especially strong influence of serial electrical stimulations of hypothalamic Orexin neuron containing parts was manifested in the recovery of REM sleep. Spontaneous recovery of this behavioral state took 23–24 h after deep anesthesia but under the impact of electrical stimulations of above mentioned hypothalamic parts REM latency became more than two times shorter. Significant elevation was noted in CSF OrexinA concentration in stimulated animals.

**Conclusion:** Serial electrical stimulations of hypothalamic Orexin-containing neuronal regions significantly elevate CSF OrexinA concentration and speed up recovery of normal sleep-wakefulness cycle behavioral states from deep anesthesia-induced sleep.

**Acknowledgements:** Acknowledgements. Supported by Shota Rustaveli National Science Foundation, Grant #11/04.

<http://dx.doi.org/10.1016/j.sleep.2013.11.485>

### **Efficacy and tolerability of Zolpidem in a group of Venezuelan patients with insomnia undergoing hemodialysis**

O. Medina<sup>1</sup>, G. Rojas<sup>2</sup>, E. Santos<sup>2</sup>, C. Moreno<sup>2</sup>, M. Paolini<sup>2</sup>, N. Sánchez-Mora<sup>1</sup>

<sup>1</sup> *University of Los Andes, Colombia*

<sup>2</sup> *Hospital Central de San Cristóbal, Bolivarian Republic of Venezuela*

**Introduction:** Assessing the efficacy and tolerability of a simple dose of Zolpidem LC in a group of patients undergoing hemodialysis and afflicted by insomnia.

**Materials and methods:** A screening test was performed on patients of the hemodialysis unit at the Central Hospital and the Social Security Hospital in San Cristobal, Venezuela. The patients included had scored 5 or above in the Athens Insomnia Scale, and had not received treatment for insomnia in at least the last three months. During week 1, a simple dose of placebo was administered to all patients; during week 2, a 12.5 mg simple dose of Zolpidem LC was given to patients under 65 years old and a 6.25 mg dose to patients above 65 years old. The following instruments were applied: the Athens Insomnia Scale, the Pittsburgh Sleep Quality Index, the International Restless Legs Scale, the Beck Inventory for Depression, and the UKU Side Effect Rating Scale.

**Results:** One hundred and thirty-three patients were evaluated and 24 were included in the study. The average age was 57.33 (24–83). Males represented the 58.3%. The average time of hemodialysis was 3.92 months and the time with insomnia 12.92 months. Scores for the Athens scale during the basal period and after Zolpidem were 12.58 versus 4.63 ( $p < 0.0001$ ) and after Zolpidem as compared to placebo 9.50 versus 11.75 ( $p < 0.0001$ ). Sleep latency with Zolpidem was 42.08 min, as compared to the basal latency, which equaled 79.17 min ( $p = 0.035$ ), whereas placebo latency was 68.96 min ( $p = 0.133$ ). Sleep hours with Zolpidem were 6.29 as compared to basal 3.68 ( $p < 0.0001$ ) and to placebo 4.81 ( $p = 0.004$ ). The most frequent side effect was drowsiness (4.10%).

**Conclusion:** After a simple dose, Zolpidem improved the different sleep patterns of the patients with insomnia undergoing hemodialysis, such as sleep latency and number of sleep hours, being well tolerated. Zolpidem LC could represent an alternative to be taken into account in this group of patients.

**Acknowledgements:** Department of Psychiatry and Sleep Medicine, University of Los Andes, San Cristóbal, Venezuela.

<http://dx.doi.org/10.1016/j.sleep.2013.11.486>

### **Prevalence and risk factors of the obstructive sleep apnea among Iranian patients with type 2 diabetes mellitus**

K. Sadeghniai-Haghighi<sup>1</sup>, M. Mohajeri-Tehrani<sup>2</sup>, A. Khajeh Mehrizi<sup>1,2</sup>, F. Fathi<sup>1,2</sup>, F. Saremi-Rasouli<sup>1,2</sup>, B. Larjani<sup>1,2</sup>

<sup>1</sup> *Baharloo Sleep Center, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Iran*

<sup>2</sup> *Endocrinology and Metabolism Research Center, Tehran University of Medical Sciences, Tehran, Iran*

**Introduction:** Obstructive sleep apnea (OSA) is prevalent in diabetes mellitus patients. This reveals the importance of evaluation of the risk factors of sleep apnea in diabetic patients.

**Materials and methods:** This study was conducted to evaluate the prevalence and risk factors of the OSA among Iranian patients with type 2 diabetes mellitus. We conducted a cross sectional study on randomly selected 173 diabetic patients aged 30–65. We assessed the OSA with the STOP-BANG questionnaire. Further information was demographic and anthropometric characteristics plus metabolic profile.

**Results:** Of all, 122 (74%) patients were at high risk for OSA. Patients at high risk for OSA were older and had higher BMI, waist circumference, neck circumference, systolic and diastolic blood pressure. In addition, men were significantly at a higher risk for OSA than women. Logistic regression revealed that age, male sex and neck circumference were independent predictors of risk for OSA.

**Conclusion:** Patients with type 2 diabetes mellitus are at high risk for OSA. Our results suggest that the evaluation of OSA and its risk factors might be included in the clinical management of T2DM patients.

**Acknowledgements:** This research has been supported by Tehran University of Medical Sciences & health Services.

<http://dx.doi.org/10.1016/j.sleep.2013.11.487>

### **Time- and state-dependent analysis of autonomic control in narcolepsy: higher heart rate with normal heart rate variability**

W. Van Der Meijden, R. Fronczek, R. Reijntjes, G. Lammers, G. Van Dijk, R. Thijs

Leiden University Medical Center, The Netherlands

**Introduction:** Narcolepsy with hypocretin deficiency is known to alter cardiovascular control during sleep. The underlying etiology has been disputed. To discriminate the effects of sleep architecture on cardiovascular autonomic control from the consequences of hypocretin-deficiency per se, the present study examined heart rate modulations while taking into account the effects of sleep state duration, and sleep state transitions.

**Materials and methods:** One-night ambulatory polysomnography was recorded from 12 hypocretin-deficient narcolepsy patients with cataplexy (11 male, 16–53 years) and 12 healthy controls (11 male, 19–55 years). Heart rate and its variability were calculated per 30-s epoch. Heart rate variability was computed through fast Fourier transforms. Respiratory frequency was derived from a thoracic respiratory band.

**Results:** Heart rate was continuously elevated in narcolepsy patients compared to controls. This effect was found in sleep stage 1 (Mean  $\pm$  SEM, controls vs. patients:  $54.3 \pm 2.2$  vs.  $60.4 \pm 3.1$ ), sleep stage 2 ( $51.0 \pm 2.1$  vs.  $57.8 \pm 3.0$ ), slow wave sleep ( $52.1 \pm 2.3$  vs.  $59.5 \pm 3.2$ ), and rapid eye movement (REM) sleep ( $53.5 \pm 2.1$  vs.  $61.5 \pm 3.0$ ). No substantial changes in sympathovagal balance were found between patients and controls, even if differences in respiration frequency were taken into account. Heart rate alterations after sleep state onset and during transitions from non-REM to REM sleep were comparable between cases and controls. However, patients showed a blunted heart rate augmentation in response to transitions from NREM to wake.

**Conclusion:** Heart rate was continuously elevated in patients, and was not only explained by sleep fragmentation. This indicates that autonomic changes are may also be attributable to a direct effect of hypocretin-deficiency.

**Acknowledgements:** We would like to thank Noortje van der Kleij – Corssmit, Hanno Pijl and Nienke Biermasz for their contribution to the data collection.

<http://dx.doi.org/10.1016/j.sleep.2013.11.488>

### **Relationship between the wrong reasons for clinical and change control pressure adjustment resulting with therapeutic AutoCPAP**

C. Jurkojc Mohremberger, P. Lazo Meneses, D. Barrios Barreto, E. Manasbaena, J. GarciaDe Leaniz, R. Esteban Calvo  
Hospital Ramon Y Cajal, Spain

**Introduction:** Assess whether there is a relationship between the reason for a poor outcome and therapeutic pressure variation determined by AutoCPAP.

**Materials and methods:** Patients with poor outcome after establishing fixed pressure CPAP with formula, they were placed in 3 groups according to the reason for poor control: poor tolerance, no clinical improvement and poorly compliance. We evaluated clinical and polygraphic characteristics and we sought relationship between these reasons and the parameters analyzed. Variable was used as a pressure difference calculated minus initial pressure set with AutoCPAP, and we compared this difference to the improvement or not, compliance and tolerance or not or not using the *U* test of Mann Whitney.

**Results:** We collected 150 patients whose average age was 62 years, BMI of 31.4 and RDI of 38.6. No significant differences were found between the pressure set by formula and fixed by AutoPAP in any of the three reasons valued. Smaller differences were calculated pressures for between 7 and 9 cmH<sub>2</sub>O. The differences between the values set by formula and AutoCPAP were calculated pressures higher for extreme values (<6 and  $\geq 9$ ).

**Conclusion:** In our environment we have not found significant differences between the set pressure with formula and with AutoCPAP, perhaps in relation to the set pressure initially were adjusted not only with formula, but also considering clinical, comorbidity and monitor closely.

**Acknowledgements:** Hospital Ramon y Cajal.

<http://dx.doi.org/10.1016/j.sleep.2013.11.489>

### **Elderly patients and sleep apnea**

P. Lazo Meneses, D. Barrios Barreto, E. Mañas Baena, C. Gotera Rivera, C. Jurkojc Mohremberger, J. Garcia De Leaniz  
Hospital Ramón Y Cajal, Spain

**Introduction:** Several studies have suggested that sleep apnea syndrome is extremely frequent in the elderly. In Spain, apnea hypopnea syndrome during sleep affects 2–6% of the middle-aged population and 15–20% of individuals between 70 and 100 years of age, representing millions of people in our country. Because this disease is so prevalent, it is essential to study the differential characteristics of SAHS in the elderly. **Objective:** Analyze the differential characteristics of sleep apnea syndrome in older patients.

**Materials and methods:** We performed a retrospective study collecting data from patients evaluated in the respiratory sleep disorders unit, during the years 2006–2011.

**Results:** A total of 146 patients were analyzed, 77 < 60 years and 69  $\geq$  60 years. The gender was similar in both groups (70% of men <60 years and 63% of men  $\geq$  60, *p* 0.2). The average age of the younger group was of 46 (SD 8.19) and the oldest group was 67 (SD 5.8). In the first group 75% of patients were SAHS and 71% in the second group. Regarding symptoms, no significant differences were found, except nycturia, more prevalent in the group  $\geq$  60 years. Body mass index was similar in both groups. The elderly group had higher prevalence of hypertension and diabetes. Sleep studies features were similar in both groups (RDI 25.8 younger group vs 26.9 older group).

**Conclusion:** In our cohort of patients, we did not find significant differences in clinical presentation, or sleep study profile. These findings could be justified perhaps by studying a group of patients not excessively old. Moreover, our older patients were more hypertensive and diabetic, justifying the need for closer monitoring.

<http://dx.doi.org/10.1016/j.sleep.2013.11.490>

### Are currently attended patients in a unit of Respiratory Sleep Disorders different respect those who were attended 5 years ago?

P. Lazo Meneses, E. Mañas Baena, D. Barrios Barreto, C. Gotera Rivera, C. Jurkojc Mohremberger, A. Pedrera Mazarro  
Hospital Ramon Y Cajal, Spain

**Introduction:** After a long career in the evaluation of patients with suspected sleep apnea, it could be expected that the current cohort is younger, thinner, less severe, and there is a greater predominance of women. These results may be due to the idea that "typical" patients have already been diagnosed and there is better information about the disease. **Target:** To analyze the difference in the profile of patients diagnosed in a Respiratory Sleep Disorders unit in 2006 compared with those diagnosed in 2011.

**Materials and methods:** We performed a retrospective study, collecting data from medical records of patients evaluated in a Respiratory Sleep Disorders unit, during 2006 and 2011.

**Results:** A total of 146 patients were studied, 72 during 2006 and 74 during 2011. There are not significant differences between the two groups in sex and age. The 2006 cohort was composed of 71% of males and 28% women and in 2011 65% men and 35% women. The average age of patients in 2006 was 56 (SD 11.08) and in 2011 of 57 years (SD 14.07). Regarding clinical symptoms, no significant differences were observed between both groups comparing snoring, apneas, nycturia, morning headache, insomnia, daytime sleepiness measured by Epworth test and depression. The mean BMI in both groups was 31 (SD 7.21 in 2006, 5.21 in 2009) There was a slight increase in positive diagnosis in 2011 compared to 2006 (65, 88% vs 46, 58.80%,  $P = 0.3$ ). The average of the respiratory disturbance index in 2006 was 24.5 (SD 19.1) and in 2011 of 28.01 (SD 24.1), with no significant differences between groups ( $p = 0.06$ ).

**Conclusion:** Our current population of patients with sleep apnea is similar to that of 5 years ago, reflecting the persistence of patients with typical clinical and elevated body mass index. There were increases in the number of positive diagnoses, and there is a trend toward greater severity.

<http://dx.doi.org/10.1016/j.sleep.2013.11.491>

### Pulsed portable oxygen concentrators do not detect inspiration when connected to bilevel ventilators or CPAP

P. Lazo Meneses, D. Barrios Barreto, C. Gotera Rivera, S. Diaz Lobato, S. Mayoralas Alises, E. Perez Rodriguez  
Hospital Ramón Y Cajal, Spain

**Introduction:** Incorporating portable concentrators to the world of home oxygen therapy has revolutionized technology and an expansion of the possibilities of prescribing oxygen equipment to our patients. However, as with all technological innovations, this new scenario poses new questions. Connecting oxygen equipment to CPAP or bilevel ventilators is a routine in our clinical practice. We would like to know the behavior of portable concentrators operating

at pulse, when connected to pressure equipment. **Objective:** The goal of our study was to check if the trigger of portable concentrators common in our environment, responds in a contaminated environment pressure.

**Materials and methods:** We have analyzed the pulse dose portable concentrators Inogen One, ECLIPSE, AIR SEP, EverGo in all ranges of prescribing each. They were connected to a ventilator Vivo 40 (Breas) in the form of bi-level mode and CPAP mode. Ventilator was scheduled 14/4 cm water (IPAP/ EPAP) and 10 cm water (CPAP) respectively. Oxygen was connected to a T-piece at the beginning of the pipe, the end of the tubing and used in the mask itself. The tests were conducted in healthy volunteers via a nasal mask.

**Results:** None of the analyzed pulse dose portable concentrators were able to detect inspiration after connecting to the ventilator in bi-level or CPAP mode at the proximal pipe or distal mask.

**Conclusion:** Pulse technology used by the portable concentrators we use in our environment does not work when connected to equipment bilevel pressure or CPAP.

<http://dx.doi.org/10.1016/j.sleep.2013.11.492>

### Lower levels of Epworth sleepiness score predicts sleep apnea syndrome in a sleep laboratory

S. Mihaicuta<sup>1</sup>, S. Paralescu<sup>1</sup>, I. Toth<sup>2</sup>

<sup>1</sup>UMF Timisoara, Romania

<sup>2</sup>Politehnica University, Mathematics Department, Romania

**Introduction:** Daytime sleepiness is the major symptom associated with sleep apnea syndrome (SAS). The Epworth sleepiness scale (ESS) is one of the most used questionnaires to assess daytime sleepiness. The aim of the study was to evaluate the performance of the ESS as a screening tool for SAS on a population from a sleep laboratory.

**Materials and methods:** Between June 2005 and March 2013, we evaluated 1592 ( $\geq 18$  years old) consecutive patients from Victor Babes Timisoara sleep lab with suspected SAS, using the ESS, anthropometric data, somnography or polysomnography for apnea hypopnea index (AHI). With the area under curve (AUC) derived from the receiver-operating characteristic (ROC) curve we assessed the classification ability of ESS for the diagnostic of SAS. The ROC curve plots the true positive rate against the false positive rate using a binary classifier referring to the presence or absence of SAS. Sensitivity, specificity and positive and negative values were calculated for different cutoff points.

**Results:** 1165 (69.7%) Male, 427 (30.3%) female, median age 53 +/- 11.89 years (19–86), AHI 34.10 +/- 27.41. 1304 (92.5%) patients were diagnosed with SAS. ESS ranged from 0 to 24 with a median of 10 (interquartile range 6–14). Key variables were not normally distributed (Kolmogorov–Smirnov test); correlations were analyzed by Spearman's rank test. The area under the ROC curve of 0.68 (95%CI 0.62–0.73,  $p < 0.001$ ) indicates that 68% of SAS diagnosed subjects had a higher ESS score than subjects with no SAS. No significant correlation was found between age, gender and ESS scores ( $r = 0.021$ ,  $p = 0.42$  and  $r = 0.05$ ,  $p = 0.045$  respectively). At patients with SAS, the ESS correlated significantly with AHI  $r = 0.38$ ,  $p < 0.001$ ) and was significantly higher ( $p < 0.001$ , Mann Whitney test). The optimal ESS score was 8/9 with a sensitivity of 0.6365 and specificity of 0.6346. Positive predictive values were 0.9562, indicating that 95.62% of patients with an ESS score  $\geq 9$  had SAS. Somnolent patients had a 3.04 increase risk of SAS as compared to non-somnolent patients (OR = 3.04, 95% CI 2.45–4.61).

**Conclusion:** ESS is a good and reliable screening tool. Lower than reported levels of somnolence have a positive predictive value for SAS. The gold standard of somnography/polysomnography cannot be replaced and should be used to confirm the diagnostic of SAS.

**Acknowledgements:** Laboratory technicians for assistance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.493>

### Obesity stratification as a predictor for sleep apnea syndrome

S. Mihaicuta<sup>1</sup>, S. Frent<sup>2</sup>, O. Deleanu<sup>3</sup>

<sup>1</sup>UMF Timisoara, Sleep Lab Victor Babes Hospital, Romania

<sup>2</sup>UMF Timisoara, Romania

<sup>3</sup>UMF, Carol Davilla Bucharest, Marius Nasta Institute of Pneumology, Romania

**Introduction:** Obesity is a common comorbidity at patients with sleep apnea syndrome (SAS).

**Materials and methods:** Between June 2005 and June 2012 we evaluated at Timisoara „V. Babes” Hospital 968 consecutive patients with suspected SAS, using the Epworth sleepiness questionnaire, anthropometric data for body mass index (BMI) and abdominal circumference (AC), somnography or polysomnography for apnea – hypopnea index (AHI) assessment). We use univariate statistical analysis of data related to BMI in four layers to assess the odds ratio (OR) of developing SAS.

**Results:** Seven hundred twenty-seven male (75.1%), 241 female (24%), age  $52 \pm 11.89$  years (16–84), AHI  $34.10/h \pm 27.41$ , AC  $120.06 \text{ cm} \pm 15.10$  (88–157), mean BMI  $33.06 \pm 6.32 \text{ kg/m}^2$  (17–56). BMI > 25 kg/m<sup>2</sup> (84%). 92.23% had a AHI over 10 /h. Obesity grade 1 (35%), grade 2 (22%), grade 3 (14%). In univariate statistical analysis, OR for obesity was 2.57,  $p = 0.004$  (moderate predictor); overweight OR was 2.33,  $p = 0.095$  (moderate predictor). Obesity grade 1 OR was 2.67,  $p = 0.043$  (moderate predictor), obesity grade 2 OR was 3.97,  $p = 0.012$  (strong predictor), obesity grade 3 OR was 3.78,  $p = 0.027$  (strong predictor). OR for mean BMI was 2.37,  $p = 0.040$ .

**Conclusion:** Correlation between obesity and sleep apnea syndrome is powerful. Mean BMI is a moderate predictor for SAS and obesity grade 2 and 3 are strong predictors for SAS.

**Acknowledgements:** Technicians for assistance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.494>

### Polisomnographic phenotype is linked with genetic findings in Prader-Willi syndrome

M. Mila<sup>1</sup>, M. Aguilera Vergara<sup>2</sup>, A. Martínez-Bermejo<sup>3</sup>, J. Quero-Jiménez<sup>3</sup>

<sup>1</sup>Pediatric Sleep Unit, University Hospital La Paz, Spain

<sup>2</sup>University Hospital Central de la Defensa, Spain

<sup>3</sup>University Hospital La Paz, Spain

**Introduction:** Prader-Willi syndrome (PWS) is a rare genetic disorder, usually sporadic, affecting 1/25,000 births, in which a critical region of chromosome 15 (15q11–q13) is affected. At birth, PWS infants exhibit characteristic facial features, small hands and feet, severe hypotonia with suckling and swallowing troubles, delay in psychomotor development and lethargy. After this initial phase, hyperphagia and absence of satiety (severe obesity and sleep apneas), growth hormone deficiency (short stature) and incomplete pubertal development are striking signs. Diagnosis is based on clin-

ical criteria confirmed by genetic study, showing a deletion (DEL) or, less frequent and less severe, uniparental disomy (UPD).

**Materials and methods:** Eight newborn with dysmorphic features, weak reactivity to stimuli and hypotonia were evaluated. Genetic findings confirmed or excluded PWS diagnosis. Patients underwent a daily polysomnographic study (EEG, EOG, EMG, ECG, nasal airflow, respiratory movements and oxymetry); sleep and associated events were scored based on international rules for newborns (Anders et al., 1971). In 5 cases, CSF Hcrt-1 was measured.

**Results:** Genetic study confirmed PWS in 6 cases (DEL,  $n = 5$ ; UPD,  $n = 1$ ). Mean value of CSF Hcrt-1 in PWS-patients was  $106.7 \pm 16.9 \text{ pg/ml}$  (>220 in non-PWS infants). EEG tracing was normal in 7 infants according to postconceptional age (one with slightly generalized slowing). The most relevant finding was a dramatic reduction of arousals and reactivity to stimuli, more severe in DEL-PWS, moderate in UPD-PWS and absent in non-PWS hypotonic infants (mean arousal index 4.1 /h, 5.4 /h and 14 /h; mean fragmentation index 4.1 /h, 18.3 /h and 21 /h). No significant respiratory events were recorded and other sleep parameters were similar to those seen in healthy neonates evaluated in our hospital.

**Conclusion:** Sleep disturbances are already found in newborns, even before respiratory events appear. This data suggests that lack of reactivity to stimuli in newborns may be related to difficulty in regulation of sensory stimuli, leading to further symptoms of PWS (poor satiety recognition, decreased sensitivity to pain and sleep disorders). This generalized hypoarousal-state could be the primary mechanism underlying the sleep abnormalities in PWS patients.

**Acknowledgements:** We thank Dr. J. Santamaría (H. Clinic, Barcelona, Spain) for his cooperation in typing and measurement of cerebrospinal fluid hypocretin-1 level.

<http://dx.doi.org/10.1016/j.sleep.2013.11.495>

### Evaluation of oral iron supplementation in pediatric maintenance insomnia

M. Mila<sup>1</sup>, A. Cecilia<sup>2</sup>, A. Gracia<sup>3</sup>, M. Antonio<sup>4</sup>, T. Oscar<sup>3</sup>, P. Patricio<sup>2</sup>

<sup>1</sup>Pediatric Sleep Unit, University Hospital La Paz, Spain

<sup>2</sup>INTA, Sleep and Neurobiology Laboratory, University of Chile, Chile

<sup>3</sup>Clinical Neurophysiology Department, University Hospital La Paz, Spain

<sup>4</sup>Pediatric Neurology Department, University Hospital La Paz, Spain

**Introduction:** Iron deficiency anemia (IDA) is a very common problem that increases spontaneous nocturnal restless motor activity and night wakings during sleep. IDA has been linked to cognitive problems such as poor attention, lack of concentration and learning difficulties. We conducted a prospective and open-label study of children and adolescents with IDA (defined by serum ferritin under 50 ng/ml, iron deficiency and/or anemia) and maintenance insomnia (IM) with nocturnal restless activity and night waking, treated with oral iron supplementation to evaluate the efficacy of this treatment, administered during the course of clinical care.

**Materials and methods:** The study included 116 children and adolescents (67 boys and 49 girls) with IDA and MI who visited the Pediatric Sleep Unit. Sleep quality was assessed with PSQ, SDSC questionnaires and CGI-C. Blood tests were made in all patients; night-time polysomnography was performed in 46 cases. After IDA and MI diagnosis, oral iron supplementation (ferric sulfate) was administered to all children and adolescents (4 mg/kg/day; 325 mg/day after 12 yo). Blood parameters and sleep quality were reassessed 3–6 months after.

**Results:** Patient age at onset of symptoms ranged from 0.5 to 17 years (mean  $\pm$  SD,  $5.4 \pm 4.1$ ) and 2 groups were observed: with

(I+) or without improvement. (I–). A positive family history of insomnia, PLM or RLS was recognized in 40 patients and RLS was found in 13 subjects (no differences related with improvement) but PLMD was more prevalent in I+ group (28% vs 13%;  $p = 0.09$ ). Serum ferritin level before therapy was 5–96 ng/ml ( $30.3 \pm 18.2$ ) and oral iron supplementation was reported to be effective in 83.6% patients (85% highly effective, CGI-C 1 or 2). Lower serum iron levels were seen in patients with higher apnea/hipopnea index ( $p = 0.077$ ). Though serum ferritin and iron concentrations were not improvement related (I+ vs I–,  $p > 0.05$ ), ferritin "in range" (below 50 ng/ml but higher than lower normal limit) was strongly related with clinical improvement ( $p = 0.001$ ). The onset of treatment effect was approximately 3 months.

**Conclusion:** Supplemental iron was consistently associated with less night waking and sleep quality improvement. Iron treatment has demonstrated to be effective in pediatric MI and IDA.

**Acknowledgements:** We thank Dr. J. García-Sicilia (Department of Pediatrics) for helping us in coordinating Hospital Sleep Unit with Primary Care physicians.

<http://dx.doi.org/10.1016/j.sleep.2013.11.496>

### **Mother-child bed-sharing associated with more wheezing in early childhood**

M. Luijk<sup>1</sup>, V. Mileva-Seitz<sup>2</sup>, A. Sonnenschein-Van Der Voort<sup>3</sup>, M. Van Ijzendoorn<sup>4</sup>, J. De Jongste<sup>5</sup>, L. Duijts<sup>6</sup>

<sup>1</sup>Erasmus University Rotterdam, School of Pedagogical and Educational Sciences, The Netherlands

<sup>2</sup>Erasmus University Medical Center, The Generation R Study Group, The Netherlands

<sup>3</sup>Erasmus Medical Center, The Generation R Study Group, The Netherlands

<sup>4</sup>Leiden University, Center for Child and Family Studies, The Netherlands

<sup>5</sup>Erasmus Medical Center, Department of Paediatrics, The Netherlands

<sup>6</sup>Erasmus Medical Center, Sophia Children's Hospital, The Netherlands

**Introduction:** Household crowding, including the number of people sharing the child's bedroom, may place young children at risk of acute lower respiratory infection [1]. However, crowding may also protect against asthma, according to the hygiene hypothesis [2]. Thus bed-sharing in early childhood might either increase or decrease the risk for asthma. On the other hand, parents may adopt bed-sharing practices that allow for closer monitoring of their already asthmatic children. In a recent review, Koinis-Mitchell et al. [3] suggested that asthma underlies sleep problems as a consequence of sleep disordered breathing and frequent awakenings at night. No studies have yet investigated the associations between bed-sharing and asthmatic symptoms. In the current study, we assessed whether bed-sharing practices protect young children from developing asthmatic symptoms, or place them at risk for these symptoms.

**Materials and methods:** In the current population-based prospective cohort study ( $N = 5,543$ ) we assessed bed-sharing at ages 2 and 24 months, and wheezing, the most important asthma symptom, at ages 1 through 4 years by questionnaires. Generalized estimating equation models (GEE) were used to assess repeated measures of wheezing, and multinomial regression analysis to assess patterns of wheezing over time.

**Results:** Results indicated that bed-sharing at 2 or 24 months were not associated with wheezing at later ages. However, assessing patterns of wheezing over the preschool years shows that bed-sharing at 24 months is associated with early-only wheezing (i.e. wheezing reported only at ages 1 and 2 years; OR 1.64, CI 1.13–2.37,  $p < .01$ ),

even after controlling for maternal educational level, history of atopy and asthma, smoking, body mass index (BMI), breastfeeding, parity, child ethnicity, gender, gestational age at birth, daycare attendance, pet keeping, eczema, and lower respiratory tract infections.

**Conclusion:** Bed-sharing at 2 and 24 months of age was not associated with wheezing later in the preschool years, or with persistent wheezing over time. However, children who bed-shared with their parents at 24 months of age had higher odds to be in the early-only wheezing group. This suggests that bed-sharing children wheeze more, but only at early ages. The transient nature of these children's wheezing might be associated with the relatively high prevalence of viral infections in the first years of life. It could also be that parents of early-only wheezers bring their child to the parental bed in order to monitor their breathing. This large longitudinal study is the first to explore the associations between bed-sharing practices and wheezing, and shows important associations between this sleep related parenting practice and children's asthma symptoms.

**Acknowledgements:** The Generation R Study is conducted by the Erasmus Medical Centre in close collaboration with the School of Law and the Faculty of Social Sciences at the Erasmus University, Rotterdam, the Municipal Health Service, Rotterdam area, and the Stichting Trombosedienst and Artsenlaboratorium Rijnmond (Star-MDC), Rotterdam. We gratefully acknowledge the contribution of general practitioners, hospitals, midwives and pharmacies in Rotterdam.

<http://dx.doi.org/10.1016/j.sleep.2013.11.497>

### **International scientific communications in sleep apnea-related quality of life**

M. Milkov, T. Tonchev, P. Nedev, F. Kirov, H. Madjova

Medical University of Varna, Bulgaria

**Introduction:** Recently, quality of life in patients with sleep apnea is very intensively studied worldwide. The purpose of the present study is to analyze the dynamic international scientific communications in the interdisciplinary field of quality of life in sleep apnea patients.

**Materials and methods:** Retrospective problem-oriented search was carried out for a 20-year period (1993–2012) in five data-bases and information portals: Web of Knowledge (WoK) – Web of Science (WoS), Biosis Citation Index (BCI) and MEDLINE (WoK), Scopus and PubMed version of MEDLINE. A comprehensive analysis by means of a set of specific scientometric parameters revealed a series of essential features of the publication and citation activity

**Results:** Our results demonstrated a continuous growth of the number of the abstracted publications, journals containing them, institutions and countries of authors, and languages of publications although these trends were reflected to a different extent in these data-bases and information portals. There were 2235 abstracted publications in Scopus, 1565 in WoS (in 577 journals), 1233 in PubMed, 1194 in MEDLINE (WoK), and 621 in BCI. There were more than 5300 unique author's names in WoS only and more than 4400 ones in MEDLINE (WoK). N.J. Douglas, S. Israel-Ancoli, S. Redline, S. Tufik, and D. Gozal presented with most papers on this topic in these data-bases. The 'core' journals included 'Sleep', 'Sleep Medicine', 'Chest', 'American Journal of Respiratory and Critical Care Medicine', and 'Sleep and Breathing'. There were 61 countries of authors in Scopus and 57 ones in WoS. Far behind the USA came Canada, UK, Germany, Australia, France and other countries. English language of publications strongly dominated followed by 22 other languages in Scopus, 20 – in MEDLINE (WoS), 15 – in MEDLINE (PubMed), 8 – in WoS and 7 – in BIC. The citation analysis in WoS indicated that 15 papers had

received more than 200 citations until February, 2013. The sum of the times cited without self-citations was 25410 by 17316 citing articles. The average citations per item were 19.86 and those per year were 1480.29. The value of *h*-index was high – of 72 arguing of the prestige of this topic worldwide.

**Conclusion:** Permanent internationalization and effective interdisciplinary collaboration in the field of sleep apnea and patient's quality of life could overcome the considerable stratification at regional and national level and contribute to the solving of this severe pathology and socially significant pathology.

**Acknowledgements:** Douglas, S. Israel-Ancoli, S. Redline, S. Tufik, and D.

<http://dx.doi.org/10.1016/j.sleep.2013.11.498>

### Usage of Coblator-2 (Arthrocare) and ENT Celon (Olympus) systems for soft palate reduction in habitual snoring patients

M. Milkov<sup>1</sup>, P. Nedev<sup>2</sup>, T. Tonchev<sup>1</sup>, F. Kirov<sup>2</sup>, H. Madjova<sup>1</sup>

<sup>1</sup> Medical University of Varna, Faculty of Dental Medicine, Bulgaria

<sup>2</sup> Medical University of Varna, Bulgaria

**Introduction:** Recently, numerous devices soft palate reduction are currently applied for the treatment of habitual snoring. They aim at hardening the soft palate and its subsequent correction. The purpose of this communication was to prove the effectiveness of Coblator-2 (Arthrocare) and ENT Celon (Olympus) systems in habitual snoring without any sleep apnea.

**Materials and methods:** The suitable patients were selected by means of polysomnographic examination. Some 32 patients (27 males and 5 females aged between 32 and 64 years) who presented with habitual snoring without any sleep apnea were operated by means of Coblator-2. A slight sleep apnea was diagnosed in 9 out of a total of 42 other habitual snoring patients (35 males and 7 females aged between 29 and 60 years). They were operated by using of ENT Celon (Olympus). The patients were carefully examined on the first and fifth postoperative day.

**Results:** The apnea/hypopnea index was normal. Our results did not demonstrate any postoperative complications and side effects such as pain, hampered eating, fever and sleep disorders. Immediately following intervention, snoring events disappeared. The application of these two systems was successful in most patients. On the other hand, due to snoring relapse, Coblator-2 usage required a reoperation in four patients after 10 weeks. After the same period, 6 patients operated by using of ENT Celon necessitated reoperation, too. One year after the intervention, 6 patients (18.75%) having undergone Coblator-2 and 10 patients (23.81%) having undergone ENT Celon continued to snore. There was no soft palate ptosis, however, a slight nasal septum deviation was established.

**Conclusion:** It could be concluded that there were no significant differences between these two devices concerning their therapeutic effect and postoperative patient's status. Further applied investigations of a greater contingent are needed to improve research evaluation, patient's selection and procedures of application for the patients with habitual snoring and accompanying slight sleep apnea.

**Acknowledgements:** Gasparini G., Azzuni C., Rinaldo F.M., Cervelli D., Marianetti T.M., Sferrazza A., Pelo S.

<http://dx.doi.org/10.1016/j.sleep.2013.11.499>

### Interrelationship of sleep quality with fatigue, neuroticism and global health in unexplained chronic fatigue

A. Mariman, E. Tobback, I. Hanouille, L. Delesie, D. Pevernagie, D. Vogelaers

University Hospital Ghent, Department of General Internal Medicine, Infectious Diseases and Psychosomatics, Belgium

**Introduction:** The interrelationship of different dimensions (fatigue, neuroticism, sleep quality, global mental and physical health) in patients with unexplained chronic fatigue, referred with presumed chronic fatigue syndrome (CFS), was explored.

**Materials and methods:** Patients with unexplained chronic fatigue filled out two independent fatigue scales (Fatigue Questionnaire, FQ and Checklist Individual Strength, CIS), NEO-Five Factor Inventory (NEO-FFI), Pittsburgh Sleep Quality Index (PSQI) and Medical Outcomes Study 36-item Short Form Health Survey (SF36). Path and regression analyses were performed.

**Results:** Out of 296 eligible patients, 203 subjects were included (mean age 39.0 years, SD 10.37, 89% female). In a first path analysis, using FQ for assessment of fatigue, night-time PSQI sleep quality had a direct effect on SF36 physical health quality of life (PHQL) and no effect on FQ fatigue. This was confirmed by a subsequent path analysis with CIS fatigue and by regression analyses. These unexpected results raised the question whether FQ or CIS fatigue sufficiently reflects fatigue. For both scales, the introduction of a latent variable into the model resulted in a significant improvement of fit, with an indirect effect of PSQI sleep quality on SF36 PHQL through this latent variable. Furthermore, this variable had a direct effect on FQ or CIS fatigue, respectively, and on the two SF36 variables.

**Conclusion:** A latent variable was introduced as missing link in the relationship between different subjective complaints of patients with presumed CFS and outcome measures of quality of life. Hence, this finding holds promise for a more cohesive framework of the different dimensions in the construct of chronic fatigue and CFS and needs to be developed as a clinical tool.

<http://dx.doi.org/10.1016/j.sleep.2013.11.500>

### Striatal dopamine transporter imaging (FMT-PET) in patients with idiopathic rapid eye movement sleep behavior disorder – A cross-sectional study

M. Miyamoto<sup>1</sup>, T. Miyamoto<sup>2</sup>, K. Hirata<sup>1</sup>

<sup>1</sup> Dokkyo Medical University School of Medicine, Department of Neurology, Japan

<sup>2</sup> Dokkyo Medical University Koshigaya Hospital, Department of Neurology, Japan

**Introduction:** It has become clear that Parkinson's disease (PD) can have a premotor stage such as idiopathic REM sleep behavior disorder (IRBD). Imaging technologies such as dopamine transporter imaging currently offer the highest degree of accuracy for identifying premotor PD. Recent dopamine transporter SPECT and PET studies demonstrated decreased striatal dopaminergic innervations in IRBD patients.

**Materials and methods:** Positron emission tomography (PET) with 6-[(18)F](FMT), which can assess the level of the presynaptic dopaminergic nerve, were performed in 44 patients with IRBD, 14 patients with PD and 14 control subjects to assess nigrostriatal function.

**Results:** There were significant differences in the group 6-[(18)F] FMT uptake levels in bilateral putamen between PD patients and

both IRBD patients and control subjects. IRBD patients with no signs of parkinsonism had almost intact striatal dopaminergic innervation, similar to the controls. In contrast, PD patients had parkinsonism by definition and had lost striatal dopaminergic innervation, as evidenced by decreased striatal uptake.

**Conclusion:** PET imaging seem to be helpful in identifying patients with IRBD potentially at risk to develop PD, dementia of Lewy body (DLB), or multiple system atrophy (MSA). However, more longitudinal follow-up studies are necessary to estimate the ratio of patients with dopaminergic cell loss in the basal ganglia who will develop PD, DLB, or MSA in the future.

**Acknowledgements:** This work was supported by Grant-in-Aid for Scientific Research (C) from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan (Grant No. 24621009). The authors thank Junichi Saitou and Toshihiko Satou (PET Center, Ustunomiya Central Clinic) for their technical support in performing FMT/PET.

<http://dx.doi.org/10.1016/j.sleep.2013.11.501>

### Daily alteration of melatonin and oxidative stress markers in developmental disorders

R. Miyata<sup>1</sup>, N. Tanuma<sup>2</sup>, M. Hayashi<sup>2</sup>, J. Kohyama<sup>3</sup>

<sup>1</sup> Department of Pediatrics, Tokyo Kita Social Insurance Hospital, Tokyo, Japan

<sup>2</sup> Department of Brain Development and Neural Regeneration, Tokyo Metropolitan Institute of Medical Science, Japan

<sup>3</sup> Tokyo Bay Urayasu Ichikawa Medical Center, Japan

**Introduction:** We have examined oxidative stress markers and antioxidant substances including melatonin sulfate in urine in patients with acute and chronic neurological diseases in children. Herein, we analyzed the daily alteration of such biomarkers in urine.

**Materials and methods:** In thirteen patients with severe motor and intellectual disabilities, sleep disorders and autistic spectrum disorders (ASD) (7 females and 6 males) aged from 8 to 67 years, and one normal girl aged 6 years. The levels of biomarkers were determined using ELISA. Parents granted the analysis and protocols were approved by the institutional ethics committee.

**Results:** The urinary levels of melatonin sulfate in urine changed through a day. They tended to elevate in early morning, whereas the peak level was found at noon in some patients with sleep disorders, Rett syndrome, and xeroderma pigmentosum type A. The urinary levels of 8-hydroxy-2-deoxyguanosine (8-OHdG) and hexanoyl-lysine adduct (HEL) levels also changed through a day, and seemed to increase in early morning. The daily alteration of total antioxidant power was observed in a few patients.

**Conclusion:** There were daily alteration in values of urinary levels of melatonin sulfate was identified in all subjects, but those were shifted abnormally in some patients with sleep disorders. It should be noted that the urinary levels of 8-OHdG and HEL, oxidative stress marker for DNA and lipid, respectively, also had daily alteration, which seemed to be synchronized with that of urinary levels of melatonin sulfate. Oxidative stress is involved in aging and some neurodegenerative diseases such as Alzheimer's disease, Rett syndrome, ASD and xeroderma pigmentosum. The presence of daily alteration in urinary levels of 8-OHdG and HEL may suggest the possibility that sleep and/or melatonin, well known antioxidant substance, can modify redox state in children with developmental disorders.

**Acknowledgements:** I would thank to our coworkers.

<http://dx.doi.org/10.1016/j.sleep.2013.11.502>

### Hypertension and endothelial dysfunction in obstructive sleep apnea (OSA) – Is it related to hypoxia?

V. Mohsenin<sup>1</sup>, B. Jafari<sup>2</sup>

<sup>1</sup> Section of Pulmonary, Critical Care and Sleep Medicine, Yale School of Medicine, United States

<sup>2</sup> Section of Pulmonary, Critical Care and Sleep Medicine, University of California, Irvine, United States

**Introduction:** OSA is a prevalent disorder causing hypertension. Endothelial dysfunction appears to underlie development of hypertension. It is generally believed that intermittent hypoxemia during sleep is the underlying process leading to hypertension. However, patients with OSA and hypertension have increased sympathetic tone while awake so as patients with OSA without hypertension. We have previously shown that both hypertensive (H-OSA) and normotensive OSA (N-OSA) patients have elevated plasma levels of catecholamines. It is not established whether hypoxia during sleep is necessarily the prerequisite process for endothelial dysfunction and hypertension in OSA. We therefore examined the relationship between endothelial-dependent vasodilatory capacity (using brachial artery flow-mediated method, FMD), arterial oxygen saturation (SaO<sub>2</sub>) in OSA and non-OSA patients with and without hypertension. We also investigated the role of angiogenic inhibitors that are known to cause endothelial dysfunction and hypertension.

**Materials and methods:** We studied 95 subjects with and without OSA and hypertension. Plasma angiogenic inhibitors, endoglin (sEng) and fms-like tyrosine kinase-1 (sFlt-1), were measured using ELISA.

**Results:** The apnea-hypopnea indexes were  $41 \pm 5$  and  $48 \pm 4$  /h in N-OSA ( $n = 27$ ) and H-OSA ( $n = 36$ ), respectively, indicating severe OSA. Asleep SaO<sub>2</sub> < 90% ( $T < 90\%$ ) were  $34 \pm 8$  and  $40 \pm 9$  min, respectively. FMD was markedly impaired in H-OSA ( $8.0\% \pm 0.5$ ) compared to N-OSA ( $13.5\% \pm 0.5$ ,  $P < 0.0001$ ), H-non-OSA ( $10.5\% \pm 0.8$ ,  $P < 0.01$ ,  $n = 13$ ), and N-non-OSA ( $16.1\% \pm 1.0$ ,  $P < 0.0001$ ,  $n = 19$ ). There was no correlation between  $T < 90\%$  and FMD. Both OSA groups had elevated levels of sFlt-1 ( $62.4 \pm 5.9$  and  $63.9 \pm 4.7$  pg/ml) compared to N-non-OSA ( $32.1 \pm 6.5$ ,  $P = 0.0008$  and  $P = 0.0004$ , respectively) and H-non-OSA ( $41.2 \pm 7.0$ ,  $P < 0.05$  and  $P = 0.03$ , respectively). sEng was elevated in H-OSA ( $4.20 \pm 0.17$  ng/ml) compared with N-OSA ( $3.64 \pm 0.14$ ,  $P = 0.01$ ) and N-non-OSA ( $3.48 \pm 0.20$ ,  $P = 0.01$ ). There was a modest but statistically significant inverse correlation between sEng and FMD in only H-OSA group ( $r = -0.38$ ,  $P < 0.05$ ).

**Conclusion:** These data show that patients with OSA and hypertension have marked impairment of FMD independent of hypoxia exposure. FMD is not uniformly affected by exposure to intermittent hypoxia or apnea in patient with OSA. Impaired FMD is associated with increased sFlt-1 and sEng. The differences in sEng concentrations between H-OSA and control groups are comparable to those with target organ damage and hypertension and high risk for cardiovascular adverse outcome.

<http://dx.doi.org/10.1016/j.sleep.2013.11.503>

### Pre-sleep worry decrease by adding reading and guided imagery to insomnia treatment

Y. Molen<sup>1</sup>, G. Santos<sup>2</sup>, L. Carvalho<sup>1</sup>, L. Prado<sup>1</sup>, G. Prado<sup>1</sup>

<sup>1</sup> Universidade Federal de São Paulo, Departamento de Neurologia, Brazil

<sup>2</sup> Universidade Federal de São Paulo, Setor de Estatística Aplicada, Brazil

**Introduction:** Worry is considered an important insomnia maintenance factor. There is an urge in researching new treatments for

insomnia that target diminishing pre-sleep cognitive arousal or worry. Although reading is a popular method of getting to sleep, it is recommended in stimulus control not to read in bed. Guided imagery is considered a way of dealing with cognitive pre sleep arousal. Our aim is to compare the effect on pre-sleep worry from reading and guided imagery added to insomnia treatment.

**Materials and methods:** Eighty volunteer participants were divided in reading ( $n = 42$ ; 30 females; mean age = 52.1 years) and imagery ( $n = 38$ ; 27 females; mean age = 53.3 years) groups after two baseline weeks. Treatment lasted 3 weeks and after 4 weeks follow-up was made during one week. Pre-sleep arousal scale (PSAS) was measured at baseline, post treatment and follow-up. PSAS is a 16-item scale that measures separately the somatic and cognitive arousal associated with pre-sleep time. Treatment included lectures on sleep hygiene, dysfunctional beliefs and attitudes about sleep, microanalytic and cognitive models of insomnia and the role of worries in maintaining insomnia. Reading group was asked to read during 15 min before sleep a boring, or difficult or calming book. Imagery group received a 14 min CD with imagery instructions related to get rid of worries that disturbed sleep to be listened before sleep. The Federal University of São Paulo Ethics Committee approved the protocol, and all candidates signed the study consent form (#01677/04).

**Results:** The comparison shows that there is no difference between reading ( $p = 0,977$ ) and somatic ( $p = 0,877$ ) groups at baseline (B), post treatment (PT) and follow-up (FU) for the cognitive and somatic components. Compared to baseline, cognitive component at post treatment and follow-up decreased significantly ( $p < 0.001$ ). There was no change in cognitive component from post treatment to follow-up. Somatic component compared to baseline had no statistical difference in post treatment ( $p = 0,233$ ) and decreased at follow-up ( $p = 0,001$ ). When compared to post treatment, somatic component showed significant decrease at follow-up ( $p = 0,003$ ).

**Conclusion:** Reading and guided imagery added to insomnia treatment are useful tools in reducing pre-sleep arousal. However, both had a quicker effect on cognitive components, while effects on somatic components appeared just at follow-up. As thoughts and worry are very important in maintaining insomnia, reading and guided imagery added to the treatment may help to cope with cognitive arousal.

**Acknowledgements:** I acknowledge Dr. Charles Morin for his generous help.

<http://dx.doi.org/10.1016/j.sleep.2013.11.504>

### Treatment patterns among those who experience middle-of-the-night awakening (MOTN)

M. Moline<sup>1</sup>, D. Brown<sup>2</sup>, M. Dibonaventura<sup>2</sup>, R. Lorenzo<sup>2</sup>, D. Shah<sup>1</sup>, R. Ben-Joseph<sup>1</sup>

<sup>1</sup> Purdue Pharma LP

<sup>2</sup> Kantar Health

**Introduction:** Middle-of-the-night awakening (MOTN) is a common insomnia symptom, but it is unclear how patients treat their condition in the real world. A cross-sectional patient survey was used to assess treatment patterns.

**Materials and methods:** 300 respondents from the 2011 US National Health and Wellness Survey who reported experiencing MOTN and were taking a prescription medication for their sleep condition were recontacted in December 2012 with a follow-up Internet survey. Data on demographics, sleep characteristics, treatment usage (both prescription and over-the-counter), and attitudes were assessed. While there is a currently approved treatment specifically

for MOTN insomnia, this product (buffered zolpidem sublingual tablets) had been marketed for <1 year at the time of this survey.

**Results:** 63.3% of respondents were female, with mean age 54.7 years (SD = 12.7). Respondents reported experiencing MOTN 19.7 days in the past month (SD = 8.8) and 4.9 (SD = 2.1) days in the past week. 6.7% ( $n = 20$ ) reported MOTN as their sole sleep symptom (MOTN only). 73.0% of all respondents reported using zolpidem IR and 19.0% reported using zolpidem CR. 13.7% of all respondents and 25.0% of MOTN only respondents reported that their physician instructed them to either dose their prescribed medication in the MOTN or before and during the MOTN; 16.0% (and 35% of MOTN only respondents) reported using their medication in one of those two ways. Among respondents whose physicians instructed MOTN dosing, 21.4% and 28.6% ( $n = 6$  and 8) advised patients to split a 5 mg or 10 mg zolpidem IR tablet, respectively. 66.0% used something other than a prescription sleep medication when going to bed (27.33% used prescription depression/anxiety medication, 23.67% used an over-the-counter [OTC] sleep drugs). However, only 40% used something other than a prescription sleep medication when experiencing MOTN (12.33% used an OTC sleep medication; 10.33% used soft music). Respondents reported an inadequacy of current treatment dosages (e.g., 21.7% need more medication over time; 10.3% take more medication than prescribed).

**Conclusion:** Those who experience MOTN and who are using a prescription medication still experience MOTN frequently (>65% of all nights). Respondents primarily use their medication before bed, though will also use medication against prescribing guidelines (occasionally splitting pills or using more than prescribed) to return to sleep if they experience middle-of-the-night awakening.

**Acknowledgements:** Funding was provided by Purdue Pharma LP.

<http://dx.doi.org/10.1016/j.sleep.2013.11.505>

### Sleep architecture following treatment of patients with middle-of-the-night insomnia with buffered sublingual zolpidem compared to placebo

T. Roth<sup>1</sup>, N. Singh<sup>2</sup>, F. Steinberg<sup>2</sup>, A. Waldron<sup>3</sup>, M. Moline<sup>3</sup>

<sup>1</sup> Henry Ford Hospital, United States

<sup>2</sup> Transcept Pharmaceuticals, Inc., United States

<sup>3</sup> Purdue Pharma LP

**Introduction:** Aside from inducing and maintaining sleep, hypnotic medications also impact sleep stages. Historically, the barbiturates were REM suppressants, while the benzodiazepines were Stage 3–4 (SWS) suppressants. The newer benzodiazepine receptor agonists like zolpidem increase stage 2 and latency to REM. Previous research, however, was conducted utilizing bedtime dosing. Across the night, there are dramatic changes in sleep stages, with the first half being primarily enriched with SWS, and the last half with REM sleep. A buffered zolpidem sublingual formulation (ZST) is approved to be taken in the middle of the night (MOTN) by patients with MOTN insomnia (and at least 4 h of bedtime remaining). The question then arises regarding possible sleep stage effects following MOTN ZST dosing taking pharmacologic and circadian influences into consideration.

**Materials and methods:** A double-blind, placebo-controlled 3-way cross-over sleep laboratory polysomnography study conducted with 1.75 and 3.5 mg buffered zolpidem tartrate sublingual tablets (ZST) demonstrated efficacy, compared to placebo, on latency to persistent sleep (LPS) when administered to patients with primary insomnia whose chief complaint was MOTN awakenings with difficulty returning to sleep. 58 Female and 24 male patients were randomized. Patients were dosed with 3.5 mg, 1.75 mg or placebo 4 h after

lights out, kept awake for 30 min, then returned to bed for 4 h. Sleep stages were scored centrally by standardized criteria in 30 s epochs for 4 h predose and 4 h postdose. The mean of each sleep parameter was calculated from the postdose periods of the 2 treatment nights. Subjective ratings of sleep quality and morning alertness were also obtained.

**Results:** LPS, total sleep time, and sleep efficiency all improved significantly postdose with both ZST doses compared to placebo. Post-dose, there was a dose-dependent change in NREM sleep. The percent of light stage 1 decreased, while the % and minutes of deeper stages 2 and 3–4 increased. While REM sleep minutes were stable, % REM declined with a minor dose-dependent increase in REM latency. The overall improvements in sleep quality and daytime alertness reported by patients on mornings post ZST dosing may be related to the differential effects in NREM sleep stages.

**Conclusion:** In summary, sleep after MOTN dosing with ZST included all sleep stages, including SWS typically not observed in the latter half of the night. These findings may relate to the improved ratings of sleep quality and alertness.

**Acknowledgements:** Funding was provided by Transcept Pharmaceuticals, Inc. and Purdue Pharma LP.

<http://dx.doi.org/10.1016/j.sleep.2013.11.506>

### Fatigue in Ontario workers with head trauma: frequencies and correlations

S. Mollayeva<sup>1</sup>, C. Shapiro<sup>2</sup>, T. Mollayeva<sup>3</sup>, A. Colantonio<sup>1</sup>

<sup>1</sup>University of Toronto, Acquired Brain Injury Research Lab, Toronto Rehabilitation Institute, Canada

<sup>2</sup>University of Toronto, Toronto Western Hospital, The Youthdale Child and Adolescent Sleep Centre, Canada

<sup>3</sup>University of Toronto, Graduate Department of Rehabilitation Science, Collaborative Program in Neuroscience, Canada

**Introduction:** Fatigue is one of the most disabling symptoms in patients with Traumatic Brain Injury (TBI) and it is difficult to clarify the nature of this symptom and manage it. In the context of workplace disability, fatigue is defined subjectively by self-report and objectively as degraded performance and inability to perform occupational duties. While workers have little difficulty recognizing physical tiredness, they have less insight in detecting the more subtle signs of mental fatigue, and may fail to indicate and appreciate its impact on their performance. As fatigue after head trauma may be the end result of a common pathway integrating multiple factors, the aim of this study is to evaluate the frequency and correlations of fatigue in a sample of Ontario workers with trauma to the head.

**Materials and methods:** A cross-sectional study of a population with mild to moderate TBI with persistent symptoms, who were seen for assessment at the Toronto Rehabilitation Institute's Worker's Safety and Insurance Board outpatient clinic May–September 2012. Twenty-five Ontario workers (60% males, 40% females) were asked to complete the Fatigue Severity Scale (FSS), Patient's Health Questionnaire (PHQ-9), Hospital Anxiety Scale (HADS-A), Insomnia Severity Index (ISI), Epworth Sleepiness Scale (ESS) and Toronto Hospital Alertness Test (THAT) questionnaires. Frequency distribution and Pearson correlation were used for data analysis. Workers also reported on the number of work-related injuries occurring in the past 5 years.

**Results:** Twenty-eight percent of workers named fatigue as one of their three most disabling symptoms. Fifty-two percent of our sample performed shift work at the time of their injury. Fatigue requiring further evaluation based on self-report (FSS total) was found in 88%, depression in 96%, anxiety in 64%, excessive daytime sleepiness in

52%, and impaired alertness in 64% of our participants. Clinical insomnia based on ISS was found in 96% of workers. A significant association was found between outcome of interest (FSS total score) and the number of work-related injuries occurring in the past 5 years ( $r = 0.48$ ,  $p = 0.016$ ), PHQ-9 total score ( $r = 0.49$ ,  $p = 0.012$ ), anxiety total score ( $r = 0.48$ ,  $p = 0.015$ ) and alertness total score ( $r = -0.78$ ,  $p < 0.0001$ ). Weak correlation was found between fatigue total score and insomnia ( $r = 0.36$ ,  $p = 0.078$ ). No association was found between outcome of interest and daytime sleepiness total score ( $r = 0.29$ ,  $p = 0.15$ ).

**Conclusion:** Fatigue was strongly associated with depression and weakly with insomnia. A moderate positive association found between fatigue and the number of previous work-related injuries and the strong negative association between fatigue and alertness may indicate workers' inability to perform tasks that require sustained attention. Future research in the area of sleep timing and medications effect as a determinant of fatigue, alertness and performance is warranted.

**Acknowledgements:** Shirin Mollayeva was funded through the Ontario Work Study Program, University of Toronto.

<http://dx.doi.org/10.1016/j.sleep.2013.11.507>

### Self-report instruments for assessing sleep dysfunction in an adult traumatic brain injury population: a systematic review

T. Mollayeva<sup>1</sup>, T. Kendzerska<sup>2</sup>, A. Colantonio<sup>3</sup>

<sup>1</sup>University of Toronto, Graduate Department of Rehabilitation Science/Collaborative Program in Neuroscience, Canada

<sup>2</sup>University of Toronto, Faculty of Health Policy, Management, and Evaluation, Canada

<sup>3</sup>University of Toronto, Canada

**Introduction:** Studies on sleep and TBI have shown that patients represent different sleep and wakefulness symptoms from an acute or chronic inability to sleep adequately at night (insomnia), chronic fatigue, sleepiness, disturbances of circadian rhythm to behavioral manifestations associated with sleep itself. The recognition of the importance of systematically assessing sleep difficulties in TBI population has been influencing clinical practice and research in the field of TBI recently. This reflects clinicians' concern for better evaluation and treatment of persons with TBI who report significant disturbances of sleep/wake cycles post-injury. Self-reported questionnaires are often the instrument of first choice to assess sleep, given its cost effectiveness, ability to collect patient's unique experience and the added privacy which can enhance the validity of the responses. Objectives of the study were: (1) to comprehensively assess a variety of the existing self-report sleep measures that have been applied to the evaluation of TBI adults' impaired sleep and wakefulness; (2) to examine these instruments in terms of their fit in patients' population; (3) to discuss the strengths and weaknesses of the self-report sleep measures when applied to TBI population.

**Materials and methods:** Comprehensive peer-reviewed literature search of Medline, Embase, PsychInfo, Cinahl and bibliographies of identified articles. All studies on TBI adult population that used a standardized patient-report sleep measure were considered for this review.

**Results:** Identified 16 self-report measures used in TBI research and clinical practice. Five were of generic nature, five were symptom-related and six were condition-specific measures. The Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale have been partially validated in post-acute TBI.

**Conclusion:** Although no instrument has been specifically developed for TBI patients, there are scientific benefits to using existing

Additional research is needed to examine their applicability to a TBI population. Designing an instrument that is able to triage sleep-related complaints between depressive, medical and primary sleep disorders, with part for a caregiver included, may assist in better identifying sleep dysfunction in persons with TBI. Whether the investigator selects or invents a questionnaire, consideration of which domains the measure must screen, diagnose or monitor should be given a priority. Polysomnography is recommended for the diagnosis of specific sleep disorders which cannot be fully disentangled by a self-report measure.

**Acknowledgements:** Dr. Mollayeva was supported by the 2011–2013 Toronto Rehabilitation Institute Scholarship and the University of Toronto Open Award. We recognize the support of the Toronto Rehabilitation Institute Foundation and a grant to the Ministry of Health and Long Term Care to the Toronto Rehabilitation Institute.

<http://dx.doi.org/10.1016/j.sleep.2013.11.508>

### Can CBT for insomnia also improve pain sensitivity in fibromyalgia patients?: results from a randomized clinical trial

J. Edinger<sup>1</sup>, M. Sanchez Ortuño<sup>2</sup>, K. Stechuchak<sup>3</sup>, C. Coffman<sup>3</sup>, A. Krystal<sup>4</sup>

<sup>1</sup>National Jewish Health, United States

<sup>2</sup>University of Murcia, School of Nursing, Spain

<sup>3</sup>VA Medical Center, United States

<sup>4</sup>Duke University Medical Center, United States

**Introduction:** Recent studies support the notion that cognitive behavioral therapy for insomnia (CBT) may be effective among insomnia patients who have comorbid pain disorders. Several studies have also shown that sleep deprivation among healthy subjects is hyperalgesic and results in enhanced pain sensitivity. Taken together, these findings lead to the question as to whether sleep improvements resulting from CBT help reduce the pain of patients with chronic pain disorders. This study used a mediation analysis to formally test the hypothesis that CBT exerts a positive effect on pain intensity through an improvement of insomnia in a sample of patients with fibromyalgia (FM).

**Materials and methods:** Sixty-one individuals (59 women; ages 24–65) meeting research diagnostic criteria for insomnia and the American College of Rheumatology diagnostic criteria for FM were randomized to three treatment conditions: treatment as usual (TAU;  $n = 21$ ), TAU + quasi-desensitization sham therapy (ST;  $n = 20$ ), or TAU + CBT ( $n = 20$ ). TAU comprised lifestyle suggestions and medication management provided during 2 visits within the 8-week treatment phase. CBT and the ST were delivered during 4 biweekly sessions. Participants were assessed at baseline, at posttreatment and 6 months later. The primary sleep outcome for this study was the score on the Insomnia Severity Index (ISI) at posttreatment. The Manual Tender Point Survey (MTPS) was used to evaluate pain. This is a standardized method to assess the intensity of pain (rated on a 0–10 scale) by pressure in 18 tender points. Total scores on the MTPS can range from 0 to 180 points, with higher scores indicating worse pain. Scores on the MTPS at posttreatment and at 6-month follow-up were used herein. We used the mediation model with bootstrapping analysis from Preacher and Hayes (2004) to explore whether exposure to CBT has a beneficial effect on pain through insomnia improvement.

**Results:** When compared to TAU, individuals receiving CBT showed statistically significant lower insomnia scores at posttreatment ( $p = .006$ ). Furthermore, individuals with lower insomnia scores tended to show lower pain intensity, even after controlling for whether or not they received CBT ( $p = .02$ ). We also found a sta-

tistically significant indirect effect of CBT on pain at posttreatment occurring through insomnia improvement (point estimate of  $-15.22$ ; 95% bias-corrected bootstrap confidence interval =  $-33.20$  to  $-1.70$ ). Similarly, we found a statistically significant indirect effect of CBT on pain scores at 6-month follow-up (indirect effect point estimate =  $-14.02$ ; 95% bias-corrected bootstrap confidence interval =  $-31.01$  to  $-0.57$ ). Although the group of subjects receiving the ST showed statistically lower scores on the ISI at posttreatment, when compared to the TAU group ( $p = .03$ ), we found no significant effect of ST on pain through sleep at posttreatment or follow-up.

**Conclusion:** These results are consistent with the hypothesis that exposure to CBT in individuals with FM improves insomnia which, in turn, lowers the intensity of pain. Beneficial effects of CBT on pain via insomnia improvement at posttreatment were also present at 6-month follow-up, well beyond the time point when formal treatment was complete. The findings support the notion that disturbed sleep is related to pain perception and underscore the usefulness of CBT for the overall management of FM symptoms.

**Acknowledgements:** NIAMS, Grant # R01 AR052368

<http://dx.doi.org/10.1016/j.sleep.2013.11.509>

### Interventions to improve adherence to PAP in patients with obstructive sleep apnea: does the patient's personality matter?

M. Sanchez Ortuño<sup>1</sup>, T. Lee-Chiong<sup>2,3</sup>, K. Goelz<sup>2</sup>, J. Harrington<sup>2</sup>, J. Edinger<sup>2,4</sup>, M. Aloia<sup>2,3</sup>

<sup>1</sup>University of Murcia, School of Nursing, Spain

<sup>2</sup>National Jewish Health, United States

<sup>3</sup>Philips/Respironics, United States

<sup>4</sup>Duke University Medical Center, Durham, NC, United States

**Introduction:** Our previous research suggests that some obstructive sleep apnea patients respond best to educational interventions whereas others respond best to motivational enhancement therapy to improve their adherence to positive airway pressure (PAP) therapy. The objective of this study was to explore whether patients' personality profiles could predict their responses to distinctive interventions to optimize PAP adherence.

**Materials and methods:** A total of 275 PAP-naïve patients with newly diagnosed OSA (mean age = 52.6 years, SD = 11.3; 60.4% men) were randomly allocated to three treatment conditions: Motivational Enhancement Therapy, MET ( $n = 89$ ), Education, ED ( $n = 83$ ) or Standard Care, SC ( $n = 103$ ). Prior to PAP treatment, patients completed a battery of questionnaires. For the purpose of this study we selected patients' scores on the Self-efficacy scale and on the six subscales of the Conscientiousness Scale of the NEO-Personality inventory. These data were first analyzed using profile analysis via multidimensional scaling (PAMS) to derive prototypic core profiles for the sample. We then related the person parameters derived by PAMS (each individual's weights on the profiles and the profile level parameter) to adherence outcomes, such as (1) number of nights the PAP was used, regardless of its duration of use (all use) (2) number of nights the PAP was used for more than 4 h (optimal use). Both adherence measures were computed at week 1, and at month 3, after the interventions were completed.

**Results:** We retained a 2-dimensional solution because of its fit and interpretability (Stress = .13, RSQ = .95), with 2 prototypical profiles associated to each dimension. In a multivariate multiple regression analysis including the person parameters and controlling for the apnea severity index, we found that patients' loadings on the profile marked by high self-efficacy was positively associated with adherence to PAP during the first week of treatment (all use,  $p = .007$ , and optimal use,  $p = .01$ ). Likewise loadings on the profile defined

by high self-efficacy remained a positive predictor of PAP adherence at 3 months, even when adding to the factor Treatment to the statistical model (all use,  $p = .005$  and optimal use,  $p = .01$ ). However, there was an interaction between Treatment and weights on dimension 2's profiles,  $p = .01$ . Post-hoc analyses revealed that, among individuals in the ED group, higher weights on the profile characterized by high scores on the Competence and Dutifulness scale were associated to higher number of nights the PAP was used ( $p = .02$ ). By contrast, among individuals receiving the MET, higher weights on the profile marked by high scores on the Order and Deliberation subscales, was associated to greater PAP use ( $p = .04$ ).

**Conclusion:** Whereas individuals with higher self-efficacy may not need additional educational or motivational interventions to bolster their PAP adherence, MET and ED may have different impact for patients with distinctive personality profiles. This data suggest that assessing the patients' self-efficacy and personality profiles prior to PAP treatment may be a helpful strategy to optimize patient allocation to interventions to improve their adherence.

**Acknowledgements:** Research funded by the National Institute of Health, US. MMSO was a recipient of a Fundación Séneca's award.

<http://dx.doi.org/10.1016/j.sleep.2013.11.510>

### There is no meaningful difference in the respiratory event index calculated using the actigraph estimated sleep time versus total recording time

L. Wittine<sup>1</sup>, E. Olson<sup>2</sup>, T. Morgenthaler<sup>2</sup>

<sup>1</sup> Mayo Clinic, Center of Sleep Medicine, United States

<sup>2</sup> Mayo Clinic, Center of Sleep Medicine, Pulmonary and Critical Care, United States

**Introduction:** Out-of-center sleep tests (OCSTs) are increasingly being used to diagnose obstructive sleep apnea (OSA). Several OCST devices include an embedded actigraph that helps to limit the analysis times to those most likely to represent sleep. The respiratory event index (REI) can thus be determined either by dividing the sum of apneas and hyponeas by the total recording time (REI-TRT) or by dividing by the actigraphic estimate of sleep time (REI-ACTI). This study examines how closely the REI-TRT compares to the REI-ACTI for the diagnosis of OSA.

**Materials and methods:** A retrospective analysis was conducted for 129 OCSTs performed at the Mayo Clinic from October 2009 to May 2012 using the portable Embletta™ system. The REI-TRT was compared to the REI-ACTI by a paired-t test and concordance correlation coefficient (CCC). The clinical endpoint of each study, namely the presence and severity of OSA, was determined using the actigraphic estimate of sleep and the total recording time to verify if there was a difference in the clinical outcome between the REI-TRT and REI-ACTI, respectively.

**Results:** There was a significant difference between the actigraphic sleep time and the total recording time ( $p$  value  $< 0.0001$ , CCC 0.809) with a mean difference of 18.5 min (CI 15.2–21.8) between them. Despite a statistically significant difference between the REI-TRT and REI-ACTI ( $p$  value  $< 0.001$ ), they were highly concordant with a CCC of 0.997 and the mean difference between the REI-TRT and REI-ACTI was only 0.8 (CI 0.59–0.98). This difference did not change the clinical diagnosis of OSA nor the severity designation for any of the 129 studies.

**Conclusion:** These results suggest that the difference between the REI-TRT and REI-ACTI is clinically negligible and that the REI-TRT is a reasonable surrogate for the REI-ACTI. Rather than estimating the

total sleep time, the actigraph seemed most useful at determining the beginning and end of the total recording time.

<http://dx.doi.org/10.1016/j.sleep.2013.11.511>

### Alterations in central sleep apnoea following 10-d exposure to hypoxia: influence of exercise

S. Morrison<sup>1</sup>, A. Pangerc<sup>2</sup>, O. Eiken<sup>3</sup>, I. Mekjavic<sup>1</sup>, L. Dolenc-Groselj<sup>2</sup>

<sup>1</sup> Department of Automation, Biocybernetics and Robotics, Jozef Stefan Institute, Slovenia

<sup>2</sup> Institute of Clinical Neurophysiology, Institute of Clinical Neurophysiology, University Medical Centre

<sup>3</sup> Department of Environmental Physiology, School of Technology and Health, Royal Institute of Technology, Sweden

**Introduction:** Exposure to hypobaric or normobaric hypoxia elevates chemosensitivity and loop gain, leading to periodic breathing during sleep. Exercise impacts gas exchange and may also alter chemosensitivity; however, interactions between sleep, exercise and hypoxia have not been examined. Thus, this study aimed to determine whether exercise exacerbates central sleep apnoea with exposure to normobaric hypoxia.

**Materials and methods:** Fourteen active, healthy men (age:  $25 \pm 3$  years, height:  $1.79 \pm 0.06$  m, weight:  $74 \pm 8$  kg,  $VO_2$  max:  $41 \pm 5$  mL  $kg^{-1} min^{-1}$ ) were confined for 10-d at the Olympic Training Centre Planica (940 m), in which all activities were conducted at a simulated elevation of 4000 m ( $FIO_2 = 0.14$ ). In random design, 50% of participants were assigned an exercise intervention (2 x 60-min cycle exercise per day conducted at an heart rate at 50% of their hypoxia-specific peak power output (EX)); the remainder did not complete any daily exercise (CON). Sleep and breathing stability were assessed after 24-h acute exposure during in night 1 (N1) and again on night 10 (N10) using full polysomnography (PSG). Duty ratios were calculated as a surrogate for loop gain. Data were analysed using mixed-ANOVA with one within-(time) and one between-subjects factor (group: CON v EX).

**Results:** Although total sleep time was not different between N1 ( $5.5 \pm 1.1$  h) and N10 ( $5.7 \pm 1.1$  h), nor between groups ( $p = 0.830$ ), the EX group spent more time in stage 1 sleep (N1:  $11 \pm 3\%$  N10:  $12 \pm 5\%$  v CON N1:  $12 \pm 6\%$  N10:  $7.0 \pm 2\%$ ;  $p = 0.013$ ). NREM deep sleep and REM were both increased on N10 by 22% and 27%, regardless of group ( $p = 0.980$ ). Apnoea-hypopnea index (AHI) was different between groups (N1 EX:  $91 \pm 59$  /h CON:  $39 \pm 51$  /h, N10 EX:  $92 \pm 48$  /h CON:  $32 \pm 32$  /h;  $p = 0.021$ ). Time spent in periodic breathing was increased in EX (N1:  $164 \pm 122$  to N10:  $182 \pm 78$  min) compared to CON (N1:  $61 \pm 82$  to N10:  $59 \pm 61$  min;  $p = 0.012$ ). The duty ratio was  $0.68 \pm 0.02$ , regardless of day ( $p = 0.617$ ), or group ( $p = 0.684$ ). Resting awake  $SpO_2$  values were equivalent between groups on day 1 (EX:  $82 \pm 2\%$  CON:  $83 \pm 5\%$ ;  $p = 0.526$ ); however, during sleep, the proportion of time spent at low  $SpO_2$  (70–80%) was greater on N1 for EX ( $62 \pm 34\%$ ) compared to CON ( $35 \pm 36\%$ ;  $p = 0.033$ ). On N10, CON spent a greater proportion of sleep at higher  $SpO_2$  (85–88%;  $20 \pm 15\%$  [EX] vs.  $38 \pm 19\%$  [CON];  $p = 0.036$ ).

**Conclusion:** Despite no change in surrogate measures of loop gain across the 10-d hypoxic exposure, exercise exacerbated the AHI, time spent in periodic breathing, and aspects of sleep architecture.

**Acknowledgements:** Support from: Slovene National Research Agency (ARRS: L3–4328 & L3–3654) & Michael Smith Foundation for Health Research (ST-PDF-03269(11–1) CLIN).

<http://dx.doi.org/10.1016/j.sleep.2013.11.512>

**Sleep disorders in Venezuelan fibromyalgia patients**M. Isaac<sup>1</sup>, P. Franca<sup>2</sup>, R. Rafael<sup>1</sup>, H. Alonso<sup>1</sup>, P. Gabriela<sup>1</sup>, I.L. Maria<sup>1</sup><sup>1</sup> INNAP<sup>2</sup> INNAP, IB, UCV

**Introduction:** Sleep disorder is thought to be responsible, at least in part, for poor neurocognitive outcomes in much pathology while obstructive respiratory events are associated. Fibromyalgia (FM) patients report early morning awakenings, awakening feeling tired or unrefreshed, insomnia, as well as mood and cognitive disturbances; they may also experience primary sleep disorders including sleep apnea. FM is a chronic condition characterized by widespread pain and associated with symptoms like fatigue, irritable bowel, sleep disorder, chronic headaches, jaw pain, cognitive or memory impairment, sleep disorders etc. However, polysomnography study was not used as a routine diagnosis methodology in FM patients. The aim of this study was to evaluate the value of the polysomnography studies to diagnose sleep disorder in Fibromyalgia patients.

**Materials and methods:** We evaluated 194 FM patients who assisted to Neurological and Neurosciences Institute, Caracas, Venezuela, by a multidisciplinary team work, we performed physical exam including ACR criteria for fibromyalgia diagnosis, neurological and cognitive evaluation, Hamilton depression and anxiety scales, visual analogical pain scale. Sleep disruption or fragmentation was evaluated with a polysomnography study.

**Results:** The mean age of patients was 48.39 + 13.75. According to American academy of sleep medicine we found that all FM patients had sleep disruption. 31.38 had sleep disorder related to their medical condition, 23.19 had sleep apnea and 45.43 has restless legs syndrome (RLS). We found a correlation ( $p = 0.069$ ) between sleep efficiency and awake. We also found that moderate to severe apnea was found in 26% of FM patients. The median value of PLM in sleep of FM patients was 84.31.

**Conclusion:** It is important to note that 100% of FM patients had non reparatory sleep and sleep disorder was present first than the other FM symptom. Our data confirm that sleep disruption had been consider as one of the main symptoms in the criteria of FM patients according to the new criteria of American college of reumatology.

**Acknowledgements:** INNAP PERSONAL.

<http://dx.doi.org/10.1016/j.sleep.2013.11.513>

**Hospital sleep unit and primary care collaboration in diagnosis of respiratory sleep diseases: assessment of a six-year experience**S. Mota-Casals<sup>1,2</sup>, A. Obrador-Lagares<sup>3</sup>, S. Eizaguirre Antón<sup>4</sup>, M. Haro-Estarriol<sup>5</sup><sup>1</sup> Hospital Santa Caterina, Spain<sup>2</sup> Hospital Hospital Universitari Josep Trueta and Universitat de Girona, Respiratory Unit and Sleep Unit. Medicine Dpt., Spain<sup>3</sup> Hospital Hospital Universitari Josep Trueta, Sleep Unit and Respiratory Dpt., Spain<sup>4</sup> Hospital Hospital Universitari Josep Trueta, Respiratory Dpt., Spain<sup>5</sup> Hospital Hospital Universitari Josep Trueta and Universitat de Girona, Respiratory Dpt., Spain

**Introduction:** Respiratory sleep diseases (RSD) are one of the most frequent reasons for consultation at Hospital Sleep Units (HSU), and RSD high prevalence generates significant diagnostic waiting lists. The joint work with Primary Care (PC) according to a common protocol may be advisable to improve the care of these patients (P) and reduce health care costs. We aimed to evaluate the usefulness of a

model of collaboration between a HSU with PC centers in the diagnosis of patients with suspected RSD.

**Materials and methods:** Between June 2006 and November 2012, 1531 p. (997 men and 534 women) were examined at 6 PC centers for suspected RSD. We previously agreed on a diagnostic circuit for these patients and a common working protocol. The PC physician, performed the 1st visit using a specific Form for RSD (F), that was sent by the health intranet to the HSU where a home sleep polygraphy at (PH).was scheduled. After the PH an HSU physician decided to conduct according to the protocols: (1) if Apnea Hypopnea Index (AHI)  $\geq 30$  /h or AHI  $\geq 5$  /h associated with risk work and/or severe drowsiness CPAP treatment was indicated and titrated and P subsequently visited with the HSU staff. (2) If protocol 1 criteria were not met, the study was technically poor, the P had not slept or if more sleep studies were required, P was sent to the HSU consultation to determine studies and treatment to perform. Clinical and study data were stored in an information database.

**Results:** 1361 PC PH were performed in the period studied. According the 1st protocol CPAP was indicated for 559 P, (58 P rejected it ) and 802 P followed the 2nd protocol: (1) 490 P ( 257 snorers and 233 Sleep Apnea Syndrome (SAS) light-moderate) did not require other studies and were referred to their PC doctor without CPAP. (2) 312 P required more sleep studies (polysomnography, Multiple Sleep Latency Test) and diagnosis was made: periodic limb movements 12 P, circadian rhythm disorders 9 P, narcolepsy 9 P, primary idiopathic, hypersomnia 10 P, snoring 21 P, and RSD 251 P [12 Upper Airway Resistance Syndrome ( 4 CPAP), 239 SAS (189 CPAP)].

**Conclusion:** The PC-HSU collaboration could solve and treat a significant percentage of consultations for suspected RSD (37–73%) without a previous visit by the HSU specialist. The HSU will ease the burden of care and serve a greater number of patients at a lower cost by coordinating with PC as well as manage patients with more complex RSD, CPAP adaptation problems or sleep disorders other than RSD.

**Acknowledgements:** To Dr. Salvi Sendra.

<http://dx.doi.org/10.1016/j.sleep.2013.11.514>

**Relationship between snoring with sleep behavioral and movement disturbance (SBMD) in children 2–12 years of Qom city**

A. Mozaffari

Islamic Azad University of Qom, Iran

**Introduction: Background:** sleep disturbance is one of the most important subjects in pediatric medicine which it's prevalent in society and have many important effects on child social function and quality of life. Sleep behavior and movement disturbance (SBMD) is seen in different kind of sign and symptom such as night terror, leg movement, walking and go to bed lately. Also Snoring is common in children. Approximately prevalence is 12% that is one of the important reasons of sleep disturbance. This study aim to assessment of relationship between snoring and SBMD in Qom city 2–12 years children.

**Materials and methods:** We have chosen 100 children with snoring as study group and 100 healthy children as control group during 3 months. Their parents fill two questionnaire of Berlin about snoring Childhood Sleep Questionnaire comprise of 22 item of SBMD like sleep walking, sleep talking, night terror. Pearson correlation coefficient was used to measure the strength of association between continuous variables. For analysis of qualitative parameters, we use from chi-square and if it was required, checked by fisher's exact test. Data analysis was done in SPSS version 18 and P value below than 0.05 was significant.

**Results:** Result: The mean age of children was 6/8 years, mean height 116 cm, mean weight was 25.39 kg and 35% were male. There were significant correlation among SBMD in case and control (13.78 vs 11.45 item,  $p < 0.001$ ), snoring and adenotonsillar hypertrophy ( $p < 0.001$ ), apnea and SBMD in case group ( $p = 0.036$ ), but no relationship among SBMD in children less and more than 7 years ( $p = 0.231$ ) and severity of snoring with SBMD in case group ( $p = 0.202$ ).

**Conclusion:** This study has showed the importance of sleep medicine in children we can prevent children from many sleep disturbances with on time diagnosis of snoring. It is important that we educated sleep subject to parents for helping to achieve better sleep in children. **Keywords:** Snoring, sleep behavioral and movement disturbance, children.

**Acknowledgements:** Thanks from staff of Islamic Azad University of Qom.

<http://dx.doi.org/10.1016/j.sleep.2013.11.515>

### Factors associated with development of benzodiazepine dependence

A. Murakoshi<sup>1</sup>, Y. Takasu<sup>1</sup>, Y. Komada<sup>2</sup>, J. Ishikawa<sup>1</sup>, Y. Inoue<sup>2</sup>

<sup>1</sup>Tokyo Medical University, Department of Psychiatry, Japan

<sup>2</sup>Tokyo Medical University, Department of Somnology, Japan

**Introduction:** Benzodiazepine hypnotics (BZDs) are widely prescribed for patients with insomnia. However, prevalence of the BZDs dependence is unclear. Furthermore, there has been no large study on large sample to elucidate the associated factors for the development of dependence. The aim of this study was to clarify these issues.

**Materials and methods:** This questionnaire survey was conducted on all the outpatients ( $N = 1971$ ) who visited the psychiatric departments of Tokyo Medical University Hospital during one month period in January 2013. After excluding the subjects who did not agree to respond to questionnaires and those with incomplete to answers, 1043 BZDs users were proceeded to the analyses. The contents of the questionnaire were (1) demographic variables: age, sex, body mass index (BMI), family member, presence/absence of shift work, educational background, and habitual alcohol ingestion, (2) psychotic diagnosis, duration of hypnotics medication, diazepam equivalent BDZs hypnotic dose, and combined use of other psychotropic, (3) the Japanese version of the Pittsburgh Sleep Quality Index (PSQI), (4) dependency questionnaire (D 2-A). Based on the result of D 2-A, we divided the subjects into the two groups: the subjects with dependency of BZDs (dependence group), and the subjects who did not have the dependency (non-dependence group). We compared clinical descriptive variable and the number of patients having side effect symptoms of BZDs. Thereafter, logistic regression analyses were made to ascertain the factors associated with BZDs dependence.

**Results:** 82 Our subjects (7.9%) were judged to have BZDs dependence. The rate of the subjects having side effect symptoms of BZDs was significantly higher in the dependence group compared with the non-dependence group. Multiple logistic regression analysis revealed that younger age ( $OR = 0.97$ ,  $P < 0.01$ ), higher PSQI scores ( $R = 1.15$ ,  $P < 0.01$ ), higher BZDs dose ( $R = 1.03$ ,  $P < 0.01$ ) were significantly associated with the presence of the dependence. However, neither drinking habit, psychiatric diagnosis nor educational background were associated with the dependence.

**Conclusion:** Our results suggested that younger age, higher BZDs dose and severe insomnia symptom may contribute to the development of BZDs dependence.

<http://dx.doi.org/10.1016/j.sleep.2013.11.516>

### Malfunctioning of brain muscarinic cholinergic system in the period of early postnatal development leads to behavioral and sleep disturbances in adult age rats and changes in density of M2/M4 muscarinic receptors

N. Nachkebia, E. Chkhartishvili, O. Mchedlidze, S. Dzadzamia,

N. Maglakelidze, E. Chijavadze

Lab. Neurobiology of Sleep-Wakefulness Cycle, I. Beritashvili Center of Experimental Biomedicine, Georgia

**Introduction:** The goal of this work is to develop an animal model of depression through a methodical approach of inducing malfunctioning of the Muscarinic Cholinergic System (MChS) in rat pups during early postnatal period. We believed that experimentally induced early post-natal deficiency in MChS functioning would produce lasting super-sensitivity of MChS in adult age. We studied behavioral and sleep disturbances, as well as changes in the rate of M2/M4 muscarinic cholinoreceptors in neocortex and hippocampus of adult rats exposed postnatally to Atropine (Atr) and/or Scopolamine (Scop).

**Materials and methods:** Rat pups ( $n = 30$ ) received subcutaneously Atr and/or Scop (15 mg/kg) injections daily for 2 weeks starting at postnatal days 7 (P7) and/or at P14. Adult control rats received saline injection during the same period of postnatal development. After discontinuing the drugs, rat pups were maintained in home cages under special care. Starting 8–12 weeks after treatment, EEGs, conducted for 10 h daily over 7 consecutive days, recorded the sleep cycles. Assessments of behavioral changes were take by open field test, and forced swim. Density of M2/M4 Muscarinic Cholinoreceptors in synaptic membranes of the Hippocampus and Neocortex were measured by Western Blotting through the use of specific antibodies. Statistical processing was made by Students' *t*-test with computer program "Farm".

**Results:** Adult rats exposed post-natally to anticholinergic drugs showed motor retardation in open field, increased immobilization time, "behavioral despair" in forced swim condition, and signs of anhedonia assessed by sucrose preference test. Slow wave sleep became fragmented and superficial. REM latency appeared four times shorter than in control rats. Sleep was frequently started by REM episodes. REM incidence was significantly more frequent and REM total time was increased for three times. The rate of M2/M4 sub-types of muscarinic cholinoreceptors appeared significantly higher in hippocampal plasma membranes in rats with postnatal exposure to muscarinic antagonists.

**Conclusion:** Malfunctioning of brain MChS in early period of postnatal development leads to adult age MChS super sensitivity, behavioral and sleep disturbances similar to depression, and significant up-regulation of M2/M4 cholinoreceptors. Interrelationship between up-regulation of M2/ M4 Cholinoreceptors and pathogenesis of depression is supported.

**Acknowledgements:** Supported by Science and Technology Center in Ukraine and Shota Rustaveli National Science Foundation, Grants # 545 and 6-465.

<http://dx.doi.org/10.1016/j.sleep.2013.11.517>

### Relationship among nightmare, insomnia and depression among residents in Japanese rural community

S. Nakajima<sup>1</sup>, I. Yuichi<sup>1</sup>, I. Okajima<sup>2</sup>, S. Taeko<sup>1</sup>, Y. Komada<sup>1</sup>, T. Nomura<sup>3</sup>

<sup>1</sup>Tokyo Medical University, Department of Somnology, Japan

<sup>2</sup>Yoyogi Sleep Disorder Center, Japan

<sup>3</sup>Tottori University Faculty of Medicine, Department of Neurology, Japan

**Introduction:** Either nightmare or insomnia is known as independent factor associated with aggravation of depression. The aim of this community-based study was to clarify the relationship between the impacts of nightmare and insomnia on depressive status.

**Materials and methods:** This cross-sectional survey was conducted on residents in a rural community of Japan. A total of 2822 persons were eligible for this questionnaire survey including demographic variables, sleep hygiene related variables, the Pittsburgh Sleep Quality Index (PSQI) assessing the severity of insomnia, and a 12-item version of the Center for Epidemiological studies Depression scale (CES-D) manifesting the severity of depression. The frequency of nightmare was assessed with an item of nightmare on the PSQI. The total score of CES-D after excluding the insomnia item was used as the score of depression and that of PSQI after excluding the nightmare item was used as the score of insomnia.

**Results:** The result of multiple regression analysis revealed that both nightmare score and insomnia score were significantly associated with CES-D score (adjusted R<sup>2</sup> = 0.18,  $p < 0.01$ ), and significant positive determinants of CES-D score (nightmare item score:  $f\Delta = 0.09$ ,  $p < 0.01$ ; PSQI score:  $f\Delta = 0.39$ ,  $p < 0.01$ ). The CES-D score was significantly different among the four groups; healthy group, group with nightmare alone, group with insomnia alone, and group with coexistence of nightmare and insomnia ( $p < 0.01$ , partial  $f\Delta^2 = 0.12$ ). Post-hoc analysis revealed that the group with coexistence of nightmare and insomnia had significantly higher score than the healthy group ( $p < 0.01$ ), the group with nightmare alone ( $p < 0.01$ ) and the group with insomnia alone ( $p < 0.01$ ). In addition, the group with insomnia alone and the group with nightmare alone had significantly higher score than the healthy group (group with insomnia alone vs. healthy group:  $p < 0.01$ , group with nightmare alone vs. healthy group:  $p < 0.01$ , respectively). However, no significant difference in the score was found between the group with nightmare alone and the group with insomnia alone.

**Conclusion:** Coexistence of nightmare and insomnia was thought to synergistically aggravate depressive symptom. Moreover, both nightmare and insomnia was thought to become a risk factor for the depression independently in the Japanese rural population.

**Acknowledgements:** We thank Kiyohisa Takahashi (Japan Foundation for Neuroscience and Mental Health) for helpful comments on the manuscript.

<http://dx.doi.org/10.1016/j.sleep.2013.11.518>

### Analysis of age effect to determine optimal nasal pressure in Korean patients with obstructive sleep apnea

H. Nam<sup>1</sup>, W. Shin<sup>1</sup>, R. Yoo<sup>1</sup>, M. Sung<sup>1</sup>, H. Cho<sup>1</sup>, Y. Shon<sup>2</sup>

<sup>1</sup>Department of Neurology, Kyung Hee University Hospital at Gangdong, South Korea

<sup>2</sup>Department of Neurology, Catholic University of Korea, College of Medicine, South Korea

**Introduction:** Determining of the optimal CPAP pressure is the key procedure of applying adequate CPAP for patients with Obstructive Sleep Apnea (OSA). There are some studies for predictors of optimal

CPAP pressure, most of them emphasized the apnea hypopnea index, importance of anthropometric factors, especially body mass index, neck circumference. As The purpose of this study is to analysis of aging factors affecting CPAP pressure as well as polysomnographic data in Korean patients with OSA

**Materials and methods:** We retrospectively reviewed the records of 169 Korean patients with OSA who had undergone CPAP titration at the Sleep Clinic of Kyung Hee university hospital at Gangdong. The patients were examined by otolaryngologist for grading the anatomy of nasopharyngeal, oropharyngeal, retropharyngeal area before diagnostic polysomnography. Anthropometric data was consisted of Friedman palate position, modified Friedman palate position, Tonsil hypertrophy grade, nasopharyngeal endoscopy, retropharyngeal grade, uvular size and body mass index (BMI). We divided them sub-groups according to age ; below 40 (group 1,  $n = 38$ , male 37, female 1), 41 ~ 60 (group 2,  $n = 98$ , male 91, female 7), above 60 years old (group 3,  $n = 32$ , male 29, female 3).

**Results:** The mean optimal CPAP pressure in 169 patients was  $8.40 \pm 2.73$  cmH<sub>2</sub>O and the apnea hypopnea index (AHI), respiratory distress index (RDI), arousal index (AI) and BMI were correlated with optimal CPAP level. There were no difference optimal CPAP pressure and modified Friedman palate position, tonsil hypertrophy grade, nasopharyngeal endoscopy, uvular size between groups. But, the retropharyngeal grade was correlated with optimal CPAP pressure in young age group. Patient with low optimal pressure group had tendency of longer uvula and Patient with high optimal pressure group had more narrow retropharyngeal area than in patient with low optimal pressure.

**Conclusion:** Our study shows that anatomic problem of retropharyngeal area influence to high optimal pressure only in young OSA patient. Previous studies for affecting factor of optimal CPAP pressure focused anthropometric factors. Our study suggests that functional problem as well as retropharyngeal anatomy may affect to determine optimal CPAP pressure in old OSA patient.

<http://dx.doi.org/10.1016/j.sleep.2013.11.519>

### Sleep fragmentation and deprivation in critically ill patients – Is noise a factor?

S. Nannapaneni, K. Ramar, T. Morgenthaler, J. Elmer, S. Lee  
*Mayo Clinic*

**Introduction:** High noise levels disrupt quality and reduce quantity of sleep. Excessive noise may thereby increase the risk of delirium, resulting in increased Medical Intensive Care Unit (MICU) length of stay and possibly increased mortality.

**Materials and methods:** The study was conducted in a 24 bed tertiary care academic MICU where Physicians, Nurses, and other allied health care providers were involved. A pre-post intervention design methodology was used for this study. MICU staff responded to an online survey assessing baseline perceptions about patients' sleep quality and quantity. Data was also gathered on providers' perception of noise levels in the MICU and factors contributing to high noise levels. In addition, baseline measurements of noise levels (in decibels (dBA)) were obtained using a dosimeter. Decibel levels for different noise sources such as ventilator alarms, infusion pumps, telephones, pagers and staff conversations were measured. Multi-pronged interventions involving environmental changes (reducing alarm sound levels, reducing telephone ringer levels etc.), provider education and patient level interventions (use of sleep enhancement order sets, closing room doors at night time to reduce noise exposure) were implemented. A repeat survey was performed post-intervention to re-assess provider perceptions regarding patients' sleep

and noise levels in the MICU. Also, noise levels were re-measured with the dosimeter.

**Results:** Baseline survey data revealed that 88% of the MICU staff agreed that patients slept poorly in the MICU, 69% felt that on an average our patients slept for less than 4 h per day, and more than half (52%) of the interruptions to sleep were secondary to high noise levels. Noise level measurements revealed that alarms (64 dBA), pagers (64 dBA) and staff conversations (60 dBA) were the most significant contributors to noise. Post-intervention, we noted an increase in the proportion of respondents (26% vs 35%  $p = 0.07$ ) who felt that our patients slept more than 5 h per day. Also, post-intervention, staff continued to perceive that greater than 50% of the interruptions to sleep were secondary to noise. Although mean noise levels were not significantly different pre and post intervention (54.2 dBA vs 53.8 dBA), there was a significant reduction in the number of episodes of peak noise level elevations above 60 dBA (1735 vs 1289,  $p = <0.00$ ).

**Conclusion:** High noise level in the MICU is a contributing factor to patient's sleep fragmentation and deprivation in the ICU. Reducing mean and peak noise levels in an ICU proved difficult, and gains may be difficult to sustain over time. In addition to noise reduction, efforts to modify the patient experience of noise, such as provision of hearing protection or white noise, may be more fruitful in reducing influence on sleep.

**Acknowledgements:** Medical Intensive Care Unit staff at Mayo Clinic, Rochester, MN.

<http://dx.doi.org/10.1016/j.sleep.2013.11.520>

### **Surgical management of nasal alar rim and valve collapse**

P. Nedev<sup>1</sup>, M. Milkov<sup>1</sup>, G. Iliev<sup>1</sup>, R. Benchev<sup>2</sup>, D. Vicheva<sup>3</sup>

<sup>1</sup> *Medikal University Varna, Bulgaria*

<sup>2</sup> *Hill Clinic Sofia, Bulgaria*

<sup>3</sup> *Medical Universiti Plovdiv, Bulgaria*

**Introduction:** Nasal valve collapse can provoke sleep-related breathing disorders in adults. Congenital and acquired alar rim collapse necessitates surgical treatment. The purpose of the present communication is to share our experience with the procedures for reconstruction of the external nasal valve after septoplasty on the occasion of nasal septal deviation, reconstruction and rhinoplasty.

**Materials and methods:** During the period from 2000 till 2010, we treated 33 patients with bilateral alar rim collapse and 4 patients with unilateral one. Fifteen patients presented with a congenital pathology. Rhinoplasty was previously performed in 18 patients but septoplasty in four ones. There were nasal septum deformities in 32 patients. The following surgical techniques were applied: lateral rhinopexy, autologous cartilage transplantation, modified lateral rhinopexy, fixation of the cranial end of alar cartilage to the caudal end of triangular cartilages, and suturing techniques as well. In two cases, percutaneous fixation of the alar rims was carried out.

**Results:** The immediate postoperative results were satisfactory. A better aesthetics and an improved breathing function could be achieved in all the patients. The comparative evaluation of the surgical techniques identified the advantages of the external rhinoplasty approach, lateral rhinopexy, cartilage transplantation and suturing techniques. However, there patients complained of relapse two months after operation.

**Conclusion:** Based on our experience and the data from the world literature available the conclusion can be drawn that nasal valve and alar rim collapse represent a serious challenge for contemporary rhinosurgery. An individualized surgical approach to the single patients is obligatory. The aggressive surgical methods seem to be more effective.

**Acknowledgements:** P. Nedev M. Milkov R. Benchev D. Vicheva.

<http://dx.doi.org/10.1016/j.sleep.2013.11.521>

### **The signs of depression in "depressive" and "non-depressive" rats – Correlation with density of $\mu$ -receptors in the brain structures**

M. Nemsadze, M. Gogichadze, M. Datunashvili, T. Basishvili,

L. Shanshiashvili, D. Mikeladze

*Ilia State University, Georgia*

**Introduction:** Alterations of the structure of the sleep-wakefulness cycle (SWC) are observed in various psycho-neurological disorders including depression in relationship with dysfunction of the different neurotransmission systems. The signs of the disturbances refer to decrease of REM-sleep onset, increase of intensity and duration of this phase and related mood disorders are caused by depletion of one or more of these neurotransmitters. Although even with the amount of clinical and experimental data the problems of participation of the opioid system in the sense of its importance in the development of depression and regulation of SWC are not still solved. The objective of the present study was to analyze the behavioral parameters and character of the structure of the SWC in the "depressive" (D) and the "non-depressive" (ND) rats in correlation of the  $\mu$ -opioid receptors density in the limbic structures of the brain.

**Materials and methods:** Experiments were conducted on the mongrel albino adult rats ( $n = 10$ ) using the following methods: the Porsolt's and sucrose (32% liquid) preference tests – for definition of the depressive signs; the stereotaxic – for electrodes implantation; the polysomnographic (Cadwell system) – for registration of the structure of SWC; biochemical investigation of opioid MOR-1  $\mu$  – for definition of the receptors density in the various structures of the brain. The obtained results were processed statistically and significance of the changes was determined by the Student  $t$ -test.

**Results:** The structure of the daily SWC was difference in the D as compared with the ND rats. The fragmentation of the SWC was more noted in D animals ( $p < 0.05$ ). Average of the duration of PS phases was higher in the D rats ( $p < 0.05$ ). Biochemical method shown that density of  $\mu$ -receptors was elevated in amygdala and nucleus caudatus, in D rat's compared to ND rats.

**Conclusion:** The signs of depression – low of motor activity and level of motivation, increasing of the PS duration, fragmentation of the SWC significantly correlate with high density of  $\mu$ -receptors in the brain structures especially in amygdala in D rats as compared with the ND rats.

**Acknowledgements:** The study was supported by GNSF N232 grant.

<http://dx.doi.org/10.1016/j.sleep.2013.11.522>

### **Complex sleep apnea during CPAP titration: prevalence and predictive factors**

A. Balkissou<sup>1,2</sup>, D. Neu<sup>1</sup>, E. Pefura-Yone<sup>2</sup>, O. Mairesse<sup>1</sup>, A. Noseda<sup>2,3</sup>

<sup>1</sup> *Sleep Laboratory and Unit for Chronobiology U78, Brugmann University Hospital, Université Libre de Bruxelles (U.L.B.), Brussels, Belgium*

<sup>2</sup> *Department of Internal Medicine and Subspecialties, Faculty of Medicine and Biomedical Sciences, University of Yaounde I, Yaounde, Cameroon*

<sup>3</sup> *Department of Pneumology, Brugmann University Hospital U.L.B., Brussels, Belgium*

**Introduction:** Obstructive sleep apnea syndrome (OSAS) patients may develop central apneas during initiation of continuous positive

airway pressure (CPAP) (1). This is referred to as complex sleep apnea (CSA). To assess the prevalence of CSA during CPAP titration and to identify potential predictive factors.

**Materials and methods:** Data of consecutive patients attending a general hospital sleep laboratory spanning 15 months (January 2012 to March 2013), diagnosed with OSAS after a first full-night polysomnography (PSG) were retrospectively reviewed. All patients underwent a PSG monitored CPAP titration. Patients with a central apnea index (CAI)  $\geq 5$ /hour during the CPAP titration (2) were compared to the remainders. Chi2 tests and multivariate logistic regression were carried out.

**Results:** A sample of 263 patients (184 males, mean age 54.8) was eligible for analysis. The prevalence of CSA [95% confidence interval (CI)] during CPAP titration was 9.1% [5.6–12.6]. CSA patients presented with a significantly higher prevalence of cardiac insufficiency (16.3% vs. 3.3%;  $p=0.016$ ). Other co-morbidities were similar between groups. Diagnostic PSG showed a higher median apnea hypopnea index (51.7 vs. 30.3;  $p=0.054$ ), a higher median mixed apnea index (MAI) (2.3 vs. 0.3;  $p=0.001$ ), and a higher median CAI (3.9 vs. 0.3;  $p<0.001$ ). Multivariate analysis showed solely the increase of 1 unit of CAI and/or MAI before CPAP being associated with a higher probability for the occurrence of CSA with respective odds ratio (95%CI) of 1.05(1.00–1.10) and 1.09(1.01–1.18).

**Conclusion:** About 1 in every 10 patients has CSA during CPAP titration. Independent predictive factors of CSA include higher CAI and higher MAI before CPAP titration.

<http://dx.doi.org/10.1016/j.sleep.2013.11.523>

### Bright light exposure improves the sleep–wake rhythm in institutionalized elder

M. Fiol De Roque, J. Rubiño, D. Ottmann, S. Muñoz, M. Nicolau  
Universitat de les Illes Balear, Spain

**Introduction:** Aging causes deep disturbances in the circadian rhythms of sleep–wake and activity–rest, with reduced activity, increased sleep fragility and phase advances. These changes have been attributed to degenerative changes in the circadian clock (suprachiasmatic nucleus) and to poor light exposure, the most important external synchronizer. This report aims at assessing the effectiveness of bright light therapy to improve the rest activity and temperature rhythms of elderly institutionalized subjects.

**Materials and methods:** Activity, wrist temperature and environmental light exposure were continuously monitored in 9 female institutionalized elder (mean age 76) during three weeks using Hobo sensors for light exposure and activity. IButtons (Maxim®) were used to record wrist temperature (Cronobiotech, R&D). The reference level was established during the first week. During the second week, subjects underwent 50 min of bright light therapy (10.000 lux) every day. The third week served to assess the permanence of the consequences of the bright light administered during the second week.

**Results:** Exposure to bright light produced significant changes in wrist temperature and activity parameters. In both cases, the amplitude of the rhythm was increased. A significant phase delay was recorded and the robustness and stability of the rhythm were increased. These results show that the normal phase advance observed in old subjects may be reverted after bright light exposure. In addition, the increased amplitude of the activity rest rhythm suggests that the sleep–wake rhythm also was improved.

**Conclusion:** Bright light is an efficient therapeutic procedure to improve the quality of life in elderly subjects.

<http://dx.doi.org/10.1016/j.sleep.2013.11.524>

### Significance of plasma apoptosis inhibitor of macrophages levels in patients with obstructive sleep apnea syndrome: a new biological indicator of severity and treatment responses

T. Nishijima

Iwate Medical University School of Medicine, Division of Behavioral Sleep Medicine, Japan

**Introduction:** The apoptosis inhibitor of macrophages (AIM) is a peptide that has important roles in the processes inducing chronic inflammation in visceral fat. At present, AIM is known (1) to be increased in blood concentration according to obesity progression and (2) to directly affect adipose tissue to induce lipolysis which stimulates release of free fatty acids and consequently induces infiltration of macrophages. AIM dynamics in OSAS remains unknown. This study aimed to compare plasma AIM concentration (CAIM) changes in OSAS patients before and after nCPAP therapy and to evaluate the usefulness of AIM as a marker for chronic inflammation of visceral fat in OSAS patients.

**Materials and methods:** Out of 62 male patients who visited the Division of Behavioral Sleep Medicine, Iwate Medical University with a suspicion of concomitant OSAS based on snoring, respiratory arrest during sleep, daytime sleepiness, diabetes mellitus, and drug-resistant hypertension, followed by admission to undergo PSG, this study included 27 patients who were started on nCPAP therapy and provided consent for PSG using nCPAP therapy.

**Results:** CAIM correlated positively with the AHI, the arousal index, and the desaturation index. However, there was no correlation with BMI. CAIM were significantly higher in the AHI  $\geq 30$  group than in the AHI  $<30$  group. And, CAIM were significantly decreased after nCPAP therapy. Clep correlated positively with AHI, the arousal index, and the desaturation index. In comparison by severity, the concentrations tended to be increased in the AHI  $\geq 30$  group but the difference did not reach statistical significance. Moreover, Clep were significantly decreased after nCPAP therapy. Although hsCRP did not correlate with either AHI or the arousal index, there was a positive correlation with the desaturation index. However, comparison between the AHI  $\geq 30$  and AHI  $<30$  groups revealed no significant difference in hsCRP concentrations, nor was there any significant difference between before and after nCPAP therapy.

**Conclusion:** This study suggested that AIM might be a novel marker not only for the existence (or the extent) of chronic inflammation of visceral fat due to OSAS but also for the severity of sleep-disordered breathing.

**Acknowledgements:** We are indebted to MS Fumiyo E who is laboratory medical technologist of Iwate Medical University School of Medicine for analysis of PSG.

<http://dx.doi.org/10.1016/j.sleep.2013.11.525>

### Evaluations of effects of high rebound and low rebound mattress pads on nocturnal sleep and its associated physiology

S. Chiba<sup>1</sup>, T. Yagi<sup>2</sup>, M. Ozone<sup>1</sup>, M. Sato<sup>3</sup>, S. Nishino<sup>4</sup>

<sup>1</sup> Jikei University School of Medicine, Otorhinolaryngology, Japan

<sup>2</sup> Ota Sleep Disorders Center, Japan

<sup>3</sup> Stanford University, United States

<sup>4</sup> Stanford University, Psychiatry and Behavioral Sciences, United States

**Introduction:** Recently, several new materials for mattresses become introduced. Although some of these, such as low rebound (or pressure-absorbing) and high rebound mattresses have fairly different characteristics, effects of these mattresses on sleep have never

evaluated. In the current study, we have evaluated effects of air-weave (a high rebound [HR] mattresses using a highly breathable material) on sleep and its associated physiology and the effects were compared to those of a low rebound mattress (LR).

**Materials and methods:** The study was conducted in 10 healthy males, with a randomized cross over single-blind design of one night PSG (23:00 to 7:00) at the sleep laboratory with 1–2 day intervals. The mattress pads were placed on regular beds equipped in the laboratory. The mean age ( $\pm$ SD) of the 10 subjects was  $26.7 \pm 7.7$  yrs, height,  $169.6 \pm 6.3$  m, weight,  $61.9 \pm 5.2$  kg, BMI,  $21.2 \pm 1.7$ , PSQID,  $3.0 \pm 0.7$ , 3% ODI,  $2.3 \pm 1.1$ , RDI,  $1.8 \pm 1.2$ . In addition to the PSG, number of roll-over during sleep, autonomic nerve activity (by monitoring EKG heart rate variability), core rectal temperature monitoring were assessed. Subjective sleep evaluations were done on the following morning, using visual analogue scales (good sleep [VAS-S] and performance [VAS-P]) and the Stanford sleepiness scale (SSS). Performance was also evaluated with psychomotor vigilance test (PVT). The significances of the effects (between HR and LR) were evaluated with the paired-*t* test, except effects of rectal temperature monitoring for which a repeated measures ANOVA with a grouping factor (mattress types) was applied.

**Results:** Subjects slept quickly with both HR ( $7.1 \pm 2.1$  min) and LR ( $9.1 \pm 2.6$  min). Interestingly, the core body temperature was rapidly and continuously decreased with HR and reached the nadir ( $36.0$  °C) at 2:00–3:00 while decline of the temperature with LR was modest and retained  $0.4$  °C higher than that with HR between 1:00 and 2:00. A significant increase in Stage 4 sleep was found with HR between 23:00 and 1:00. In addition, decrease in sympathetic nerve activity was prominent with HR between 23:00 and 1:00. There was non-significant tendency to decline in numbers of rollover and elapsed time to fall in sleep after the rollover with HR. Subjective wakefulness and performance in the next morning with HR was improved marginally significantly.

**Conclusion:** Our results suggest that effective heat loss during the initial phase of sleep occurred with HR (i.e., Airweave), and this may facilitate restorative sleep.

**Acknowledgements:** This study is supported by Airweave Inc.

<http://dx.doi.org/10.1016/j.sleep.2013.11.526>

### EDS in Parkinson's disease: pharmacology and new mouse model

N. Sakai<sup>1</sup>, Y. Yoshida<sup>2</sup>, M. Sato<sup>1</sup>, M. Okuro<sup>3</sup>, S. Nishino<sup>1</sup>

<sup>1</sup>Stanford University, Psychiatry and Behavioral Sciences, United States

<sup>2</sup>Yoshida Clinic, Japan

<sup>3</sup>Kanazawa Medical University, Geriatric Medicine, Japan

**Introduction:** Excessive daytime sleepiness (EDS) can affect 20–50% of patients with Parkinson's disease (PD), and sudden onset of sleep attacks (SA) in PD behind the wheel often leads to fatal car accidents. Although non-treated PD patients exhibit EDS and SA, SA in PD is often associated with use of DA agonists, especially the recent non-ergot DA D2/3 agonists. We have therefore initiated a pharmacological study to study the pharmacodynamics of the D2/3 agonists on sleep.

**Materials and methods:** Male rats underwent surgery for EEG and EMG electrodes. Vehicle was injected (i.p.) 5 min before the beginning of lights-off period (ZT12) on day 1, and sleep was recorded for 24-h. On day 2, quinpirole (Qu:  $30 \mu\text{g}$  or  $1000 \mu\text{g}/\text{kg}$ ), a non-ergot DA D2/3 agonist, was injected. Amounts of sleep parameters for the 24-h following Qu administration were compared to those following vehicle injections. Change in the extra-

cellular DA levels after drug administration was also measured in the prefrontal cortex.

**Results:** Low dose of Qu significantly increased SWS and REM sleep, and decreased wakefulness. On the contrary, high dose of Qu significantly enhanced wakefulness which lasted for 3–4 h followed by a large increase in sleep that lasted until the end of the active period. This increase in sleep was much larger than the sleep loss in the initial hours, and was also much larger than sleep rebound seen after the total sleep deprivation of 4-h (ZT12–16). A low dose of Qu reduced DA release immediately by 60%, and the level gradually returned to the baseline over 7-h. A high dose of Qu produced much longer reduction in DA release, and the effect lasted for 12-h. Interestingly, the recovery of DA release started to occur at 4 h after the high dose injection, and the slope of the recovery after 4 h is identical to the slope that occurred after the low quinpirole dose administration (which accompanied sleep induction).

**Conclusion:** D2/3 agonists reduce dopamine release by acting on pre-synaptic D2/3 autoreceptors, while high doses predominantly activate postsynaptic D2 receptors. The results of microdialysis experiments suggest that a shift from postsynaptic (excitatory) to presynaptic (inhibitory) action may occur 4 h after the administration of a high dose of Qu. This mechanism may partially explain the D2/D3 agonist-induced excessive sleepiness seen in human patients and we are testing this hypothesis using a new mouse model of PD with cre-loxP recombinant conditional knockout of DA neurons.

**Acknowledgements:** Research supported by R21 NS072942.

<http://dx.doi.org/10.1016/j.sleep.2013.11.527>

### Sleep phenotype characterization of peripheral and central mouse models of myotonic dystrophy

N. Sakai<sup>1</sup>, M. Sato<sup>2</sup>, K. Charizanis<sup>3</sup>, K. Lee<sup>3</sup>, M. Swanson<sup>3</sup>,

S. Nishino<sup>2</sup>

<sup>1</sup>Stanford University, Psychiatry and Behavioral Sciences, United States

<sup>2</sup>Stanford University, United States

<sup>3</sup>Univ. of Florida, Molecular Genetics and Microbiology and the Ctr. for Neurogenetics, United States

**Introduction:** Excessive daytime sleepiness and associated alterations in REM sleep patterns are among the most characteristic non-muscular features of myotonic dystrophy (DM). The symptoms of DM are caused by an expanded C (C) UG repeat that sequesters muscleblind-like protein 1 (MBNL1) and MBNL2, proteins that regulates alternative splicing required for fetal to adult developments. A recent study strongly suggests that major pathological changes in the DM brain are attributable to MBNL2 sequestration by toxic RNAs and dysregulation of specific alternative splicing events required for normal adult CNS function. We thus performed sleep EEG/EMG evaluations on Mbnl1 and Mbnl2 knockout (KO) mice.

**Materials and methods:** Adult wild and KO mice of Mbnl1 or Mbnl2 at 6 month of age (Mbnl1;  $n = 7$ , Mbnl2;  $n = 8$ ) were implanted with EEG and EMG electrodes along with E-mitters. Sleep deprivation was performed for 6 h after one full day of baseline by gentle handling.

**Results:** Mbnl1 and Mbnl2 KOs had normal amounts, and natural diurnal distributions, of wakefulness and NREM sleep in the 12:12 LD condition. Shorter sleep latency and modest wake fragmentation during dark periods (frequent/shorter wake episodes) were observed in the Mbnl2 KO mice. However, the most profound sleep phenotypes observed in the Mbnl2 KO mice were an increase in REM sleep amounts, associated with increased numbers of REM sleep episodes, and increased EEG theta power. This change was most notable during the dark/active period. No direct transition from Wake to REM

sleep, an EEG/EMG phenotype equivalent to behavioral cataplexy, was seen in either WT or Mbnl2 KO mice. A change in REM sleep in Mbnl2 KOs was also observed during rebound sleep after a 6-h sleep deprivation period initiated at ZT 0, where a more profound REM sleep rebound was observed in Mbnl2 KO mice, compared to WT mice. These REM specific changes were not observed in the Mbnl1 KO mice.

**Conclusion:** Our results indicate that Mbnl2, but not Mbnl1, KO mice exhibit increased REM sleep propensity, suggesting REM-associated sleep abnormality in Mbnl2 KO are caused by dysregulation of specific alternative splicing events in the brain, and this may be one of the most important sleep abnormalities in DM. REM sleep characteristics in DM might be a residual of infant-type REM sleep, as infants of altricial species, including human and mice, spend large majority of time in REM sleep.

<http://dx.doi.org/10.1016/j.sleep.2013.11.528>

### Social jetlag more than the evening crototype is the main cause of chronic sleep privation in teen people

C. Martínez<sup>1</sup>, A. López Picado<sup>2</sup>, C. Egea Santaolalla<sup>1</sup>, J. Manjón Caballero<sup>1</sup>, I. Izaguirre Martínez<sup>1</sup>, J. De Andrés Eciolaza<sup>1</sup>

<sup>1</sup>Unidad Funcional de Sueño., Hospital Universitario Araba

<sup>2</sup>Unidad de Investigación, Hospital Universitario Araba

**Introduction:** Evening chronotype has been associate with chronic sleep privation (defined as a total sleep time (TST) equal to or less than 9 h/night) in teen people. In our population, the presence of social jetlag more than the evening chronotype is the main cause of circadian delay phase and also therefore of the chronic sleep deprivation. This sleep deprivation has been associated with a higher prevalence of toxic habits, the development of mental diseases and academic failure. **Aim:** To assess social jetlag prevalence in teens from different Vitoria High schools and to compare these data with evening chronotype in this population.

**Materials and methods:** Teen people (12–16 years old) from Vitoria high schools were evaluated. For all population we collected a minimal anthropological data (weight and height), a screening questionnaire for sleep problems (BEARS) and a validated questionnaire for chronotype establishment (MESOC).

**Results:** A total number of 1117 subjects (52% boys and 48% girls) were studied: BMI of 19.6 + 2.6 kg/m<sup>2</sup>. The percentage of children with weekdays Total Sleep Time (TST) >9 h was 28%, and the percentage of children with weekends TST >9 h was 70%. A total of 38.9% of the children had a weekdays TST <7 h. Only 5.1% had evening chronotype, and the 94% of the population had intermediate chronotype.

**Conclusion: Discussion:** According to our data, social jetlag is the main cause of chronic sleep insufficiency among adolescents. Small changes in sleep habits can improve the harmful effects of social jetlag and reduce health costs due to comorbidity own of such pathologies. The high prevalence of this disorder it becomes a public health issue that must be addressed.

**Acknowledgements:** To the investigators of the Funcional Sleep Unit of the Araba University Hospital and the BIOARABA investigation Institute. To Joaquín Durán Cantolla.

<http://dx.doi.org/10.1016/j.sleep.2013.11.529>

### Prevalence of sleep apnea–hypopnea syndrome (SAHS) among a bruxism population. Preliminary data

C. Martínez<sup>1</sup>, E. Anitua Aldecoa<sup>2</sup>, J. Durán Carro<sup>1</sup>, J. Aguirre<sup>2</sup>, J. Durán Cantolla<sup>1</sup>

<sup>1</sup>Unidad de Trastornos del Sueño, Fundación Eduardo Anitua

<sup>2</sup>Fundación Eduardo Anitua, Fundación Eduardo Anitua

**Introduction:** Sleep bruxism is a very common oral pathology which has been associated with different clinical manifestations (sleeping disorders, orofacial pain, broken teeth, headaches, muscle spasms, etc.). The apnea–hypopnea syndrome (OSA) is also a highly prevalent disease and could be associated to bruxism during sleep. Both of them are underdiagnosed and could share some pathophysiological mechanisms. To investigate if these disease are associated could improve their appropriate diagnosis and would facilitate an early treatment. **Aim:** To determine the prevalence of OSA in patients with protrusive bruxism diagnosed at a dental clinic and establish its potential association with OSA.

**Materials and methods:** Between June and March of 2011, 30 consecutive patients older than 18 years were identified in a dental clinic. Bruxism was diagnosed according to the International Classification of Sleep Disorders criteria (ICSD-2) and they had a protrusive profile. A sleep study was performed with a validated device (Embleta Gold, ResMed, USA) to assess the presence of OSA. Anthropometric parameters (weight, height, body mass index, BMI, blood pressure, pharmacological and toxic habits, and presence of comorbidity) and Epworth Sleepiness Scale to assess daytime sleepiness were collected. The analysis of the sleep study was done manually according to the Spanish Society of Pneumology and Thoracic Surgery (SEPAR) criteria.

**Results:** We studied 30 patients (70% male): age 59.5 + 10.8 years old, body mass index (BMI) 27.9 + 3.4 kg/m<sup>2</sup>; Prevalence of hypertension was 44%; Epworth Sleepiness Scale was 9.5 + 32.4 and an apnea–hypopnea index (AHI) 32.4 + 24.9. The prevalence of OSA defined by an AHI > 5 was 93.3%, and 86% for moderate-severe OSA (AHI > 15) and 36.7 for severe OSA (AHI > 30). Also observed was a positive correlation between the severity of bruxism and OSA severity (Spearman correlation coefficient of 0.52; *p* = 0.004).

**Conclusion: Comments:** Our data suggest that the prevalence of OSA in patients with protrusive bruxism is fourfold when compared to the general population and there is a dose- response relationship between the severity of tooth wear caused by bruxism and the severity of OSA. If these data are confirmed in a larger study it would imply that all patients with protrusive bruxism should be examined for the presence of OSA.

**Acknowledgements:** To the workers of the dental clinic.

<http://dx.doi.org/10.1016/j.sleep.2013.11.530>

### Assessment of the reliability of the nocturnal tcCO<sub>2</sub> signals with trend lines

J. Nupponen<sup>1</sup>, V. Rimpilä<sup>1</sup>, A. Salminen<sup>1</sup>, O. Polo<sup>2</sup>

<sup>1</sup>Unesta Research Centre, Finland

<sup>2</sup>University of Tampere, Finland

**Introduction:** Nocturnal tcCO<sub>2</sub> signal has often an ascending or a descending drift. This drift might have biological and technical components. Biological components could originate from breathing patterns and other phenomena during sleep. The object of this study was to evaluate the reliability of two Radiometer's TCM40 tcCO<sub>2</sub> monitors drift with trend lines.

**Materials and methods:** The signals were obtained from overnight studies ( $N = 103$ ) where the signals were recorded simultaneously with two similar Radiometer's TCM4 devices with the E5280 sensor. Both measurements were made from the chest. The signals were included to the analyses if they contained six hours of non-zero signal starting 10 min after lights off. Trend line was calculated for each signal by linear model fitting and signals were classified as ascending or descending according to their slope. Pairwise comparison of the signals was performed by classifying each recording into a one of three classes: (1) both ascending, (2) both descending and 3) opposite slopes. Amounts of these occurrences were calculated.

**Results:** 16 Recordings were excluded because the signal included zero values in the analysis period. Seven recordings were excluded because the signal length was less than 6 h in the analysis period. This left 80 recordings for the analysis. In 28 (35.0%) recordings the trend lines belonged to class 1 ( $2.361e-05$ , IQR  $1.772e-05-3.675e-05$ ). In 21 (26.3%) recordings the trend lines belonged to the class 2 ( $-2.135e-05$ , IQR  $-3.496e-05-1.284e-05$ ). In 31 (38.8%) recordings the trend lines belonged to class 3 ( $1.893e-08$ , IQR  $-1.426e-05-9.861e-06$ ). In 38 of total 160 accepted signals the drift was greater than the 10% tolerance reported by Radiometer.

**Conclusion:** Drift can occur in the same direction when measuring  $tcCO_2$  with two devices. Drifting can also occur in different directions when measuring with two devices which raises concerns with the reliability of the measurement. Further analysis is needed to identify markers for the erroneous signals without using a double measurement. Also further investigations should include the study of correlation in slow and fast fluctuation of the signals.

<http://dx.doi.org/10.1016/j.sleep.2013.11.531>

### Childhood non-REM parasomnia associated with obstructive sleep apnea: effectiveness of CPAP treatment

Y. Oka<sup>1</sup>, Y. Tokui<sup>2</sup>

<sup>1</sup> Center for Sleep Medicine, Ehime University Hospital, Japan

<sup>2</sup> Hiroshima Sleep Center, Japan

**Introduction:** Parasomnias are neurological disorders characterized by undesirable physical events or experiences that occur during sleep. Obstructive sleep apnea (OSA) is increasingly recognized as an aggravating factor for parasomnias, however, the association between the two disorders has not been well elucidated among children. The aim of the study was to identify the association between non-REM parasomnia and OSA in cases of children especially focusing on the effect of OSA treatment.

**Materials and methods:** Two cases of non-REM parasomnia (9 and 11 years old) presented with sleepwalking, sleep terrors and snoring were involved. Polysomnography (PSG) was conducted to identify the characteristics of nocturnal events and the severity of OSA. Treatment of OSA was introduced with CPAP and the PSG parameters under CPAP were evaluated. Improvement of parasomnia events were followed for at least 3 months.

**Results:** Nocturnal events were observed during slow wave sleep and severe OSA (apnea hypopnea index of more than 15) was also noted in both cases. Treatment with CPAP dramatically improved non-REM parasomnia in one case, however, nocturnal event did not decrease with CPAP in another case.

**Conclusion:** Presence of OSA could aggravate the severity of non-REM parasomnia in children. Importance of conducting the screening of OSA among children with non-REM parasomnia has been suggested.

<http://dx.doi.org/10.1016/j.sleep.2013.11.532>

### Diuretic drugs benefit patients with hypertension more with night time dosing

B. Okeahialam<sup>1</sup>, E. Ohihoin<sup>2</sup>, J. Ajuluchukwu<sup>1</sup>

<sup>1</sup> University of Jos, Nigeria

<sup>2</sup> General Hospital, Lagos, Nigeria

**Introduction:** Night time chronotherapy in antihypertensive drugs has been shown to produce better blood pressure control and protect from cardiovascular morbidity and mortality. To date, this has been proven for several drug classes excluding thiazide diuretics. Given the peculiar response of blood pressure to thiazides in black people, we sought to determine whether night time chronotherapy with thiazides produces better control as already shown with other drug classes.

**Materials and methods:** A sub analysis of a larger chronotherapy study with antihypertensives in Nigerian Africans was done. The sub-population of those whose disease was controlled after 12 weeks of diuretic monotherapy was analyzed. Those who received drugs in the morning and at night were compared along control lines and some cardiac indices.

**Results:** Both groups were similar on all scores at baseline. After 12 weeks of monotherapy, patients who received drugs at night had significantly lower systolic and diastolic blood pressures though control was achieved with both morning and night time dosing. Also the left ventricular posterior and septal walls regressed better as well as left ventricular mass in the night time group.

**Conclusion:** Though equally effective in reducing blood pressure and cardiac indices related to hypertension, patients who took their drugs at night recorded better values. This makes diuretics equally amenable to night time chronotherapy as other drug classes. This effect should be explored to reduce the morbidity and mortality consequences of hypertension.

**Acknowledgements:** Dr. Aigbe Ohihoin and Mr. Toro for statistical analysis.

<http://dx.doi.org/10.1016/j.sleep.2013.11.533>

### Difference between automatic and manual analysis of respiratory events in sleep studies

K. Olafsdottir<sup>1</sup>, S. Sigurdardottir<sup>1</sup>, T. Gislason<sup>1</sup>, O. Johannesdottir<sup>1</sup>, O. Hilmarsson<sup>2</sup>, E. Arnardottir<sup>1</sup>

<sup>1</sup> Department of Respiratory Medicine and Sleep, The National Hospital of Iceland, Iceland

<sup>2</sup> Nox Medical, Reykjavik, Iceland

**Introduction:** A reliable automatic analysis of respiratory and oxygen desaturation events in sleep studies can decrease the time needed for manual scoring. This study aimed to assess the validity of automatic vs. manual analysis and verify obstructive sleep apnea (OSA) categorization.

**Materials and methods:** A general population cohort ( $n = 27$ ) was assessed twice ('06/'12). The first study was performed with Embla A10 (Natus Medical Inc.) but the latter with T3 device (Nox Medical). All studies were scored in Noxturnal software. Recordings with no cannula flow signal were scored using respiratory inductive plethysmography (RIP) flow.

**Results:** The apnea hypopnea index (AHI) ranged from 0 to 20 events/h in the Embla recordings and 0–23 in the T3 by manual scoring. The Embla recordings showed a correlation of  $r = 0.96$  between automatic and manual scoring for AHI and  $r = 0.99$  for oxygen desaturation index (ODI). For T3 recordings the correlation was  $r = 0.98$  and  $r = 1.00$ , respectively. For Embla recordings the sensitiv-

ity and specificity of the automatic scoring was 0.89 and 0.81 for AH events and 1.00 and 0.88 for OD events. For T3 it was 0.94 and 0.74 for AH events and 1.00 and 0.97 for OD events, respectively. When looking at how subjects were classified by OSA category (non OSA (AHI < 5), mild OSA (AHI 5–15), moderate to severe OSA (AHI ≥ 15)) using automatic analysis only, we found that 19% of individuals fell into the wrong category when diagnosed with Embla and 41% when diagnosed with T3. AHI was overestimated in 93% of wrongly classified cases.

**Conclusion:** The automatic scoring was acceptable regarding sensitivity and specificity of AH and OD events but its tendency to overestimate respiratory events makes OSA categorizing inaccurate so manual overview is recommended.

<http://dx.doi.org/10.1016/j.sleep.2013.11.534>

### **Obstructive sleep apnea and pulmonary function in morbid obesity before and after bariatric surgery: a randomized controlled clinical trial**

I. Aguiar<sup>1</sup>, I. Santos<sup>1</sup>, S. Nacif<sup>1</sup>, W. Freitas Junior<sup>2</sup>, C. Malheiros<sup>2</sup>, L. Oliveira<sup>1</sup>

<sup>1</sup> Nove de Julho University - UNINOVE, Sleep Laboratory, Brazil

<sup>2</sup> Santa Casa de Misericórdia, Surgery Department

**Introduction:** The aim of the present study was to assess daytime sleepiness, sleep architecture and pulmonary function in patients with morbid obesity before and after bariatric surgery.

**Materials and methods:** Patients were divided into a bariatric surgery group and control group. The clinical evaluation was performed at the Sleep Laboratory of the Universidade Nove de Julho (Sao Paulo, Brazil) and consisted of the collection of clinical data, weight, height, body mass index (BMI), measurements of neck and abdomen circumferences, spirometry, respiratory pressure measurements, full standard polysomnography (PSG) and the administration of the Berlin Questionnaire and Epworth Sleepiness Scale.

**Results:** Fifty-two patients participated in the study and underwent PSG, 16 of whom also underwent bariatric surgery. Following surgery, mean BMI decreased from  $48.15 \pm 8.58$  to  $36.91 \pm 6.67$  kg/m<sup>2</sup>. Significant differences were found between the preoperative and postoperative periods regarding neck and waist circumference ( $p < 0.001$  and  $p < 0.001$ ), maximum inspiratory pressure ( $p = 0.002$  and  $p = 0.004$ ) and maximum expiratory pressure ( $p = 0.001$  and  $p = 0.002$ ) for women and men, respectively, as well as sleep stage N3 ( $p < 0.001$ ), REM sleep ( $p = 0.049$ ) and the apnea-hypopnea index ( $p = 0.008$ ).

**Conclusion:** Bariatric surgery effectively reduces neck and waist circumference, increases maximum respiratory pressures, enhances sleep architecture and reduces respiratory sleep disorders, specifically obstructive sleep apnea, in patients with morbid obesity.

**Acknowledgements:** The Sleep Laboratory receives funding from the Universidade Nove de Julho (Brazil) and research projects approved by the Brazilian fostering agencies Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação de Amparo a Pesquisa do Estado de São Paulo (FAPESP). LVFO received a grant from CNPq (Research Productivity modality - PQID, process number 307618/2010-2).

<http://dx.doi.org/10.1016/j.sleep.2013.11.535>

### **Sleep study and pulmonary function in morbidly obese**

I. Carvalho Aguiar<sup>1</sup>, I.R. Santos<sup>1</sup>, W. Rodrigues Freitas Junior<sup>2</sup>, C. Malheiros<sup>2</sup>, L. Franco De Oliveira<sup>1</sup>

<sup>1</sup> Nove de Julho University - UNINOVE, Brazil

<sup>2</sup> Departamento de Cirurgia da Santa Casa de Misericórdia

**Introduction:** Obesity causes a series respiratory physiology and sleep changes. Its treatment aims to improve health and quality of life. The objective was evaluate pulmonary function and sleep in morbidly obese patients pre-bariatric surgery.

**Materials and methods:** The study had 38 patients recruited at two bariatric surgery services and referred to the Laboratório do Sono da Universidade Nove de Julho (Uninove), Sao Paulo, Brazil. The adopted criteria were: BMI between 40 kg/m<sup>2</sup> and 50 kg/m<sup>2</sup> and BMI between 35 kg/m<sup>2</sup> and 39.9 kg/m<sup>2</sup> with associated comorbidities.

**Results:** Mean age was  $42 \pm 10$ , the mean body mass index was  $50.09 \pm 7.64$ . The average waist circumference was  $132.48 \pm 11.07$  and  $134.31 \pm 16.26$ ; the neck circumference was  $42.34 \pm 2.08$  and  $44.48 \pm 3.67$ , respectively for women and men. The maximum inspiratory pressures were  $57.57 \pm 18.93$  and  $60.6 \pm 3.72$  and  $56.63 \pm 16.69$  maximal expiratory and  $60 \pm 18.52$  for women and men, respectively. The rapid eye movement sleep presented a mean of  $16.93 \pm 13.61$  and minimum oxy-hemoglobin saturation of  $79.33 \pm 10.26$  during sleep. In 44.74% of the cases studied changes were observed in the Epworth Sleepiness Scale; and in 76.30% the presence of the syndrome of obstructive sleep apnea (OSA) was confirmed.

**Conclusion:** We observed changes in maximum pressure ventilation in sleep structure associated with significant nocturnal desaturation of oxy-hemoglobin showing a high prevalence of OSA in morbidly obese patients.

**Acknowledgements:** The Sleep Laboratory receives funding from the Universidade Nove de Julho (Brazil) and research projects approved by the Brazilian fostering agencies Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação de Amparo a Pesquisa do Estado de São Paulo (FAPESP). LVFO received a grant from CNPq (Research Productivity modality - PQID, process number 307618/2010-2).

<http://dx.doi.org/10.1016/j.sleep.2013.11.536>

### **Ventilatory muscle strength and quality of life in obese patients undergoing bariatric surgery. Preliminary results**

I. Carvalho Aguiar<sup>1</sup>, I.R. Santos<sup>1</sup>, W. Rodrigues Freitas Junior<sup>2</sup>, C. Malheiros<sup>2</sup>, L. Franco De Oliveira<sup>1</sup>

<sup>1</sup> Nove de Julho University - UNINOVE, Brazil

<sup>2</sup> Departamento de Cirurgia da Santa Casa de Misericórdia

**Introduction:** Obesity is one of the public health problems more relevant in modern society, leading to a series of changes in mechanical ventilation. Obesity treatment is aimed at improving the health and quality of life.

**Materials and methods:** The study included 13 female patients, obese grade III, recruited from two bariatric surgery services and referred to the Sleep Laboratory at the Nove de Julho University. Inclusion criteria included patients who were obese grade III (BMI ≥ 40 ) or grade II (BMI 35.0–39.9), age between 18 and 65 years, accepting voluntarily to participate in the study by reading and signing the informed consent form.

**Results:** Mean age was  $40.08 \pm 9.86$ , after bariatric surgery the mean body mass index was  $36.91 \pm 6.67$ , with  $p = 0.004$  and maximum inspiratory pressures were  $84.12 \pm 9.36$  and  $82.36 \pm 12.21$  the maximum expiratory, with a  $p < 0.001$  and  $p < 0.001$  respectively. With the BAROS questionnaire there was an report of good to excellent response to surgery in terms of quality of life in 75% of patients.

**Conclusion:** After bariatric surgery an optimization in maximum inspiratory and expiratory pressures was observed. The BAROS questionnaire is standardized and easily applied to evaluate the results after bariatric surgery.

**Acknowledgements:** The Sleep Laboratory receives funding from the Universidade Nove de Julho (Brazil) and research projects approved by the Brazilian fostering agencies Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação de Amparo a Pesquisa do Estado de São Paulo (FAPESP). LVFO received a grant from CNPq (Research Productivity modality - PQID, process number 307618/2010–2).

<http://dx.doi.org/10.1016/j.sleep.2013.11.537>

### Sleep study on patients with non-cystic fibrosis bronchiectasis: a pilot study

N. Faria Junior<sup>1</sup>, I. Santos<sup>2</sup>, R. Pasqual<sup>3</sup>, F. Leitão Filho<sup>4</sup>, J. Jardim<sup>5</sup>, L. Oliveira<sup>2</sup>

<sup>1</sup> Santa Casa School of Medicine São Paulo, Doctoral Program in Surgery Research, Brazil

<sup>2</sup> Nove de Julho University, São Paulo, Sleep Laboratory of Master's and Doctoral Programs in Rehabilitation Sciences, Brazil

<sup>3</sup> Nove de Julho University, São Paulo, Undergraduate Medicine, Scientific Initiation, Brazil

<sup>4</sup> Fortaleza University, Fortaleza, Department of Medicine, Brazil

<sup>5</sup> Universidade Federal de São Paulo, São Paulo, Pulmonary Rehabilitation Center, Pneumology Sector, Brazil

**Introduction:** Due to irreversible dilation of the bronchi, the presence of secretions and airflow obstruction, subjects with bronchiectasis may be predisposed to hypoxemia during sleep or symptoms that might lead to arousal. Therefore, we describe these subjects sleep through the complete nocturnal sleep study (polysomnography).

**Materials and methods:** An observational study was carried out involving the evaluation of 21 patients with non-cystic fibrosis bronchiectasis at the Sleep Laboratory of the Master's and Doctoral Program in Rehabilitation Sciences of the Universidade Nove de Julho in the city of Sao Paulo, Brazil.

**Results:** Mean age was  $51.6 \pm 15.1$  years; 57.1% of the patients were female and mean body mass index was  $23.9 \pm 3.7$  kg/m<sup>2</sup>. Mean income was 1.3 times the minimum wage and only 28.6% had completed high school. The median Epworth Scale score was 7.5 (0–23). A low risk for the obstructive sleep apnea (OSA) syndrome was found in 61.9% (by Berlin) of the subjects and there was a predominance of obstructive lung disease. Mean total sleep time was  $282.7 \pm 69.5$  min, with sleep efficiency of  $79.2 \pm 29.2\%$ . Stages 1 and 2 were altered and the mean sleep apnea and hypopnea index was  $3.7 \pm 4.9$  events/h. The number of arousals was  $5.6 \pm 2.9$ /h. The oxyhemoglobin desaturation index was  $5.9 \pm 8.9$ /h and minimum oxyhemoglobin saturation was  $84.5 \pm 5.8\%$ , during polysomnography.

**Conclusion:** Patients with non-cystic fibrosis bronchiectasis had a low risk of OSA and changes in sleep quality.

**Acknowledgements:** We thank the Foundation for Research Support of the State of São Paulo (FAPESP) and National Council for Sci-

entific and Technological Development (CNPq) for supporting this research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.538>

### Evaluation of the effect of hypoxia on the expression and activity of neprilysin (EC 3.4.24.11), a protease involved on Alzheimer's disease

R. Watanabe De Oliveira, G. Silva Julian, J. Cini Perry, S. Tufik, B. Visniauskas, J. Ribeiro Chagas  
Universidade Federal de São Paulo, Brazil

**Introduction:** Hypoxia is characterized by reduced oxygen content in blood and is related to several pathologies, including Obstructive Sleep Apnea Syndrome (OSAS). Its consequences are not completely understood, but some evidences from the literature show that hypoxia has biochemical effects that lead to changes on behavior and significant outcomes in systems like the central nervous, respiratory and cardiovascular. Hypoxia and ageing seem to have a very close involvement in the development of Alzheimer's disease. Neprilysin or neutralendopeptidase (NEP, EC 3.4.24.11) is a metalloprotease present in various body tissues such as kidneys, intestines, lungs, brain, among others. It was recently shown that one of its main activities in the central nervous system is the degradation of beta amyloid (A $\beta$ ), a peptide involved in the onset and progression of Alzheimer's disease. Our goal is to study the gene and protein relative expression of NEP using chronic intermittent hypoxia (CIH), a model of OSAS.

**Materials and methods:** 24 Wistar male rats, 3 months old, were separated in 3 groups: Control ( $n = 8$ ), CIH group ( $n = 8$ , 3-min cycles of 21–5% O<sub>2</sub> from 9 to 17 h for 6 weeks), and CIH + 2 group ( $n = 8$ , 3-min cycles of 21–5% O<sub>2</sub> from 9 to 17 h for 6 weeks), followed by two weeks of normoxia. Gene and protein relative expression from the hippocampus, frontal and temporal cortices were analyzed by the RT-PCR and Western blot (WB).

**Results:** A 3-times fold increase for the relative NEP gene expression was shown in the hippocampus, although protein expression remained unaltered. On the other hand, in the temporal cortex, relative protein expression for NEP increased, while the relative gene expression maintained unaltered.

**Conclusion:** As observed, CIH can increase the gene and/or protein expression of NEP in specific brain tissues, which returned to control levels after 2 weeks of normoxia. On hippocampus, although the levels of mRNA increased almost 3 times on CIH group, the protein levels remained unaltered compared to control group, which indicates a possible regulation mechanism of gene expression. On the other hand, the increase NEP levels on temporal cortex, a region known to be involved in the onset of Alzheimer's disease, possibly results from a positive feedback control, induced by A $\beta$  peptide.

**Acknowledgements:** This study was developed on the Department of Psychobiology.

<http://dx.doi.org/10.1016/j.sleep.2013.11.539>

### Prevalence of restless legs syndrome among tertiary hospital workers in South-South Nigeria

Y. Obiabo

**Introduction:** Restless legs syndrome is the third most common sleep disorder and one of the most common causes of severe insomnia. It is characterized by abnormal leg movements that are associ-

ated with sleep quality. It is a parasomnia that comprises part of the movement and behavioral disorders related to sleep. The symptoms of restless legs syndrome have variable imprecise descriptions by most people but the most common denominator is that of an unpleasant discomfort or sensation in the legs associated with an urge to move the legs and a transient ease of symptoms on getting the legs to move. Prevalence of this disorder is not known in our population. The aim of this study is to document the prevalence of restless legs syndrome and symptoms of day time sleepiness and their relationship to shift working among the hospital workers.

**Materials and methods:** This was a cross-sectional study of the workers in Delta State University Teaching Hospital. A structured questionnaire designed using the International Classification of Sleep Disorders (ICSD) was administered to the study participants. There are 1008 workers in the hospital and using a random sampling method of one in five a representative sample of 300 subjects were interviewed. The diagnosis of restless legs syndrome was based on the minimal criteria provided by ICSD and the International Restless Legs Syndrome Group (IRLSG) criteria.

**Results:** Two hundred and fifty-seven (257) subjects responded (participation rate of 85.6%). This included 138 (57.7%) males and 119 (46.3%) females. The mean age was  $32.5 \pm 6.9$  years. Shift workers constitute 58% of the population studied. The prevalence of RLS was 6.6%. Excessive daytime sleepiness was reported in 20.6% of the study participants, while 3.1% reported having trouble at work due to sleepiness. Among those that meet minimal criteria for RLS 58.8% had excessive daytime sleepiness and 17.6% reported having trouble at work due to sleepiness. Restless legs syndrome was significantly correlated with day time sleepiness and impaired performance at work ( $p < 0.0001$ ). There was no significant relationship between shift working and restless legs syndrome in this study ( $p > 0.05$ ).

**Conclusion:** Restless legs syndrome and symptoms of excessive daytime sleepiness are prevalent among the study population. Restless legs syndrome when moderate or severe can be quite distressing and seriously disrupt sleep quality which impairs motor function, speech, concentration and decision-making abilities leading to decreased performance at work and increased risk of work-place accidents. Awareness of the burden of this disorder among physicians, other health workers and the public will help to reduce the negative consequences associated with it.

**Acknowledgements:** I sincerely appreciate the assistance of my house-officers and students who trained as interviewers to assist the neurologist in administering the questionnaire to the participants. I also thank Prof Dosumu for reading through protocol.

<http://dx.doi.org/10.1016/j.sleep.2013.11.540>

### **We need to pay special attention on sleep postures and heart diseases in down syndrome with sleep disordered breathing**

J. Ono<sup>1</sup>, H. Sawatari<sup>1</sup>, A. Chishaki<sup>1</sup>, A. Rahmawati<sup>2</sup>, H. Kuroda<sup>2</sup>, S. Ando<sup>3</sup>

<sup>1</sup> Kyushu University, Department of Health Sciences, Faculty of Medicine, Japan

<sup>2</sup> Kyushu University, Department of Medicine, Faculty of Medicine, Japan

<sup>3</sup> Kyushu University, Sleep Apnea Center, Kyushu University Hospital, Japan

**Introduction:** Down syndrome (DS) is known to be often (30–50%) comorbid with sleep disordered breathing (SDB) for their facial anatomical deformation, muscular hypotonia. Daytime sleepiness resulted from SDB may relate to impaired cognitive function even in general public. In DS, congenital heart diseases (CHD) are also

highly complicated (30–60%). Such CHD and SDB may cause a vicious cycle and early intervention to SDB in DS would contribute to their better intellectual and physical development. We reported that some of the DS slept in unusual postures. Thus, we studied the mutual relation among them in DS.

**Materials and methods:** We recruited 90 caregivers of the DS in Fukuoka. The questionnaires for the DS contained demographic descriptions including CHD, sleeping postures, Epworth sleepiness scale (ESS), and SDB symptoms (easiness of getting to sleep, snoring, arousal, witnessed apneic episodes, nocturnal urination, nap, hardness of awakening). We calculated individual Caup index (0–5 yo), Rhorer index (6–13 yo), and BMI (14–yo) for judging obesity. We analyzed the relation between SDB symptoms and these items using chi-square test.

**Results:** Seventy of 90 DS (34 men,  $18 \pm 10$  yo) responded to the survey. Thirty-seven DS (53%, 15 men,  $15 \pm 9$  yo) had CHD. Symptoms of SDB were as follows: "easiness of getting to sleep" in 90%, "snore" in 75%, "nocturnal arousal" in 52%, "witnessed apneic episodes" in 40%, "night urination" in 19%, "nap" in 41%, "hard to awaken" in 15%. There was significantly higher proportion of obese DS in "hard to awaken" than in "easy to awaken" (78% vs. 33%,  $P < 0.05$ ), and tendency of higher proportion of unusual sleep postures in "easy to awaken" than "hard to awaken" (67% vs. 33%,  $P < 0.1$ ). Furthermore, higher ESS was in "nocturnal arousal" and "night urination" than in "no arousal" and "no night urination" (38% and 55% vs. 4% and 13%,  $P < 0.01$ , respectively). Finally, there were tendencies of higher comorbidity of CHD in those with SDB symptoms.

**Conclusion:** Preventing obesity seems to be useful to improve SDB also in DS. The complication of CHD in the DS with SDB suggested formation of the vicious cycle. The unusual sleeping postures in the DS seem to be self-defending behaviors to protect from SDB. In conclusion, we need not only to take general care of SDB like reducing weight but also to give attention to specific risk factors of SDB in DS.

**Acknowledgements:** Our deepest appreciation goes to the members of the Fukuoka branch of Japan Down Syndrome Society.

<http://dx.doi.org/10.1016/j.sleep.2013.11.541>

### **Faciomandibular myoclonus during sleep: video-EEG recording rule out epilepsy as a cause of nocturnal tongue biting**

C. Montes, C. Alcaide, A. Juarez, J. Segundo, C. Cabeza  
Complejo Hospitalario de Toledo

**Introduction:** Nocturnal tongue biting as an isolated entity has been rarely reported. In the few published cases has not been possible to observe the tongue biting itself. The aim of this communication is the presentation of a patient in whom this symptom was dramatically presented due to its intensity and frequency and in which after several studies we were able to confirm eventually the tongue biting using video-EEG recording in a day nap.

**Materials and methods:** A 18 year old boy had been presenting, since 12 year old, several episodes per week of nocturnal tongue biting during sleep. He has a past history of a severe traffic crash with craneocephalic trauma, but without evident lesions in the MRI. Seriated EEGs were performed in basal conditions or after sleep deprivation and a photo paroxistic response with generalized discharges was evidenced at intermediate photostimulation frequencies (10–15 Hertz). Anticonvulsant therapy was initiated that controlled the episodes, reappearing after the withdrawal. At that moment, a video-EEG recording was performed.

**Results:** During the video-EEG study the patient presented one episode of tongue biting during sleep, without the presence of epileptiform abnormalities in the EEG. In this basis, the episodes were diagnosed as facio-mandibular myoclonus.

**Conclusion:** During sleep, several motor activities affecting orofacial musculature have been described, both physiological and pathological entities. Apart from the facio-mandibular myoclonus, the differential diagnosis comprises the orofacial automatism, the bruxism, the epilepsy or the parasomnias with rhythmic or periodic movements. In our case, the final diagnosis was delayed and several treatments were essayed, and this allowed us to analyze the response to them.

<http://dx.doi.org/10.1016/j.sleep.2013.11.542>

### **Chronotypes in an Uruguayan population affected by multiple sclerosis**

C. Orellana, C. Oheninger, J. Gil, M. Arbildi, F. Martinez  
Instituto de Neurología, Hospital de Clínicas

**Introduction:** Sleep disturbances in Multiple Sclerosis (MS) are common. Disturbances of the sleep-wake cycle have social, working and even therapeutic implications (i.e. regarding the timing at which treatments are delivered).

**Objectives:** The aim of our study was to evaluate the morningness-eveningness preferences in a group of MS affected patients and compare this results with the chronotypes of a control group free from neurological diseases.

**Materials and methods:** Fifteen patients from the outpatients MS clinic were included, 12 women and 3 men, with median age 47 [32–67] years. The control group included 8 individuals, 6 women and 2 men, with median age 46 [30–56] years. Both groups were paired by age and sex. A validated Spanish translation of the Horne-Ostberg Morningness-Eveningness Questionnaire (MEQ) was used to study chronotypes. Percentages between groups were compared by the Fisher Exact test and scores by the Mann-Whitney test.

**Results:** In the studied population, MEQ test total score showed a median of 56 points in controls [50–66], belonging to the neither chronotype, and a median of 64 in patients [36–75], classified as moderately morning chronotype. Individualized classifications analysis showed: 1. Patients: a. Definitely Evening Chronotype (EEC): 0 patient (0%); b. Moderately Evening Chronotype (MEC): 2 patients (13%); c. Neither Chronotype (IC): 3 patients (20%); d. Moderately Morning Chronotype (MMC): 5 patients (33%); e. Definitely Morning Chronotype (EMC): 5 patients (34%). 2. Controls: a. DEC: 0 (0%); b. MEC: 0 (0%); c. N: 7 (88%); d. MMC: 1 (12%); e. DMC: 0 (0%). MMC and DMC were more frequently observed in MS patients (67 % vs. 12 % in controls;  $p = 0.019$ ). Controls showed higher proportion of NC (88% vs. 20% in MS patients;  $p = 0,003$ ).

**Conclusion:** (1) Chronotypes in the analyzed MS population tend to be morning types. (2) They differ from control population, which presents a non preferential (neither) circadian trend. (3) There appears also a tendency in MS towards a moderately evening preference, although not statistically significant, probably due to the small number of cases and controls studied. (4) Differences should be confirmed studying a larger population.

**Acknowledgements:** Hospital de Clínicas - Instituto de Neurología.

<http://dx.doi.org/10.1016/j.sleep.2013.11.543>

### **The effectiveness of adenotonsillectomy in children with obstructive sleep apnea**

C. Orte, E. Vicente, A. Herrero, I. Rodriguez, F. De Miguel

**Introduction:** To evaluate the cure rate of adenotonsillectomy (T&A) in children with different weight status and obstructive sleep apnea (OSA).

**Materials and methods:** A systematic review was performed based on the best databases (Medline, Cochrane, Embase) from 2006 to 2013. Reviewed studies are about T&A in children with OSA. The effectiveness was analyzed from three points of view: clinical symptoms and signs, sleep parameters and systemic inflammatory markers.

**Results:** T&A therapy can improve Apnea-Hypopnea index (AHI), oxygen saturation nadir (nadir SaO<sub>2</sub>) and clinical symptoms in most of obese and non-obese children with OSA. The success of T&A therapy is about 60% in children with OSA. In obese children, this percentage can decrease up to 25%. Severe or moderate preoperative OSA is associated with residual OSA after T&A in pediatric sleep apnea. It is not clear that inflammation levels of TNF-, IL-6 and hs CRP return to control level after T&A.

**Conclusion:** T&A is more effective in non-obese children than in obese children. Pediatric sleep apnea is not always cured by T&A. That is why it is necessary to introduce supplementary therapies for OSA. It should be a priority to reduce childhood obesity. Because of residual OSA in children, it is essential to monitor them for a long time.

**Acknowledgements:** Dr. Vicente

<http://dx.doi.org/10.1016/j.sleep.2013.11.544>

### **Relevance of hypoxia in sleep disordered breathing: distinct clinical, sleep, and autonomic features in obstructive sleep apnea with and without hypoxia**

J. Palma Carazo, S. Cieza Ortiz, E. Urrestarazu Bolumburu, J. Artieda González-Granda, M. Alegre Esteban, J. Iriarte Franco  
Clínica Universidad de Navarra

**Introduction:** Some patients with obstructive sleep apnea do not exhibit hypoxemia. However, there is a lack of studies characterizing this subgroup of patients. We aimed to analyze the clinical, sleep, and autonomic features of a group of patients with obstructive sleep apnea without hypoxia (OSAwh).

**Materials and methods:** Twenty-eight patients with OSAwh, 32 patients with OSA with hypoxia, and 22 control subjects were studied. Patient groups were matched in age and gender. Clinical and sleep features were analyzed. Besides, time- and frequency-domain heart rate variability (HRV) measures (mean R-R interval, SDNN, LF oscillations, HF oscillations, and the LF/HF ratio) were calculated across all sleep stages during a one-night polysomnography.

**Results:** We found that OSAwh patients had a lower body mass index, a lower waist circumference, and a higher frequency of previous naso-pharyngeal surgery when compared to OSA with hypoxia patients. In terms of heart rate variability, OSA had increased LF oscillations (i.e., baroreflex function) during N1-N2 and REM sleep when compared to OSAwh and controls. OSA and OSAwh had decreased HF oscillations (i.e., vagal inputs) during N1-N2, N3 and REM sleep when compared to controls. The LF/HF ratio was increased during N1-N2 and REM sleep, only in patients with OSA.

**Conclusion:** In conclusion, patients with OSAwh exhibit distinctive clinical, sleep, and autonomic features when compared to obstructive sleep apnea with hypoxia. These differences must be taken into

account in future studies when analyzing therapeutic approaches for sleep apnea patients.

*Acknowledgements:* Clínica Universidad de Navarra.

<http://dx.doi.org/10.1016/j.sleep.2013.11.545>

### The application of continuous positive airway pressure in association with obstructive sleep apnea syndrome and subconjunctival hemorrhage due to hypertensive attacks: case reports

B. Özkar<sup>1</sup>, H. İpekçetbeyođlu<sup>2</sup>, D. Tađ<sup>3</sup>

<sup>1</sup> Etimesgut Military Hospital, Pulmonary Medicine Service

<sup>2</sup> Konya Military Hospital, Pulmonary Medicine Service

<sup>3</sup> GMMA Haydarpađa Educational Hospital, Pulmonary Medicine Department

*Introduction:* Spontaneous subconjunctival hemorrhage associated with hypertension (HT) is common. Obstructive sleep apnea syndrome (OSAS) is an independent risk factor for HT. Blood pressure during obstructive sleep apnea can increase up to 20% and reaches its highest level with the end of apnea.

*Materials and methods:* Case: 60-year-old male patient, BMI: 30.9 kg/m<sup>2</sup>, had complaints of subconjunctival hemorrhage in the morning after sleeping, repeated three times in the last two years. He described occasional complaints of snoring and daytime sleepiness. There was no history of trauma, antiplatelet therapy, and bleeding disorders. He was being taken regular medication for 5 years with a diagnosis of hypertension. In the color fundus imaging, hypertensive retinopathy was detected. Twice Holter monitoring was performed in patient with hypertension (Table 1). Day-night rates of the critical levels of systolic BP, day: 0%, 7%, and night: increased to 15%, 13%, diastolic BP, day: 0%, 0%, and night: increased to 0% to 13% were found. Oxygen saturation was monitored during sleep at night, and desaturation was observed. Then polysomnography test was performed. In polysomnography, apnea hypopnea index (AHI) was 45.8, and the patient was diagnosed with OSAS.

*Results:* Consequently, continuous positive airway pressure (CPAP) therapy was given. After the current antihypertensive treatment and CPAP treatment, systole: 2% at night, 1% critical level during the day was found significantly lower in the Holter monitoring. There was no recurrence of bleeding after CPAP treatment.

*Conclusion:* In our case, recurrence of subconjunctival hemorrhage due to hypertensive episodes caused by OSAS was observed. After CPAP treatment, subconjunctival hemorrhage due to hypertensive attacks did not relapse, because of regular course of blood pressure. The patients with complications of hypertension should be considered in terms of OSAS, because CPAP treatment prevents hypertensive episodes by night.

*Acknowledgements:* OSAS, subconjunctival hemorrhage due to hypertensive attacks.

<http://dx.doi.org/10.1016/j.sleep.2013.11.546>

### Soleus MEP-80 response latency in restless legs syndrome

O. Parlak, I. Oztura, B. Baklan

Dokuz Eylul University Neurology Department

*Introduction:* The purpose of this study was to investigate the latency of soleus MEP-80 response in patients with restless legs syndrome (RLS). We aimed to figure out the etiopathogenesis and to determine an objective diagnostic tool and prognosis indicator.

*Materials and methods:* In this study, 40 patients with RLS and 40 controls were included. For all patients and controls routine laboratory investigations, electroneurography (ENG) and transcranial cortical magnetic stimulation (TCCMS) were performed. Finally the MEP-80 response latency of 40 RLS patients and 40 age and gender matched controls were compared. All patients were diagnosed with the 4 criteria defined by ICSD 2 and the severity was classified according to the international restless legs syndrome scaling group (IRLSSG) classification.

*Results:* The soleus MEP-80 response latency in RLS patients and controls was 96 ms (SD: ±12.5) and 81.8 ms (SD:±3.4), respectively. The difference between both groups was statistically significant ( $p < 0,001$ ). According to the severity of RLS, the MEP-80 latency was significantly longer in the severe group (104.5 ms; SD:±8.3 ms  $n = 24$ ) than in mild-moderate RLS patients (83.2 ms; SD:±3.4;  $n = 16$ ).

*Conclusion:* In restless legs syndrome it is known that the corticospinal tract is not directly affected but subcortical inhibition is influenced due to functional spinal neuron impairment. As a result of this study we determined a direct functional impairment of spinal afferent and efferent long reflexes and we recognized that corticospinal late responses are affected in RLS. According to the results of our study we think that Soleus MEP 80 response can be a new diagnostic modality and a prognostic indicator for RLS patients.

*Acknowledgements:* Department of Neurophysiology, Dokuz Eylul University Medical School.

<http://dx.doi.org/10.1016/j.sleep.2013.11.547>

### Poor sleep quality in systemic lupus eritematosus: does it depend on depression?

L. Palagini<sup>1,5</sup>, R. Bruno<sup>1,2</sup>, C. Tani<sup>1,3</sup>, A. Gemignani<sup>1,4</sup>, A. Ciapparelli<sup>1,5</sup>, M. Mosca<sup>1,3</sup>

<sup>1</sup> University of Pisa, Italy

<sup>2</sup> Clinical and Experimental Medicine, Hypertension Unit, University of Pisa, Italy

<sup>3</sup> Clinical and Experimental Medicine, Rheumatology Unit, Pisa, Italy

<sup>4</sup> Clinical and Experimental Medicine, University of Pisa, Italy

<sup>5</sup> Clinical and Experimental Medicine, Psychiatric Unit, University of Pisa, Italy

*Introduction:* Sleep disturbances are frequently observed in rheumatic diseases and significantly affect the quality of life of patients. The prevalence and characteristics of sleep disturbances in Systemic Lupus Erythematosus (SLE) are poorly studied.

*Objectives:* This study aimed at evaluating both prevalence of sleep disorders and sleep quality in a cohort of SLE women in comparison with patients suffering from a chronic disease as hypertension (H). In addition we explored determinants of sleep quality in SLE.

*Materials and methods:* In this cross-sectional study, 86 consecutive SLE women patients were evaluated from January 2012 through December 2012. 81 Have been recruited. The Pittsburgh Sleep Quality Index (PSQI), the Insomnia Severity Index (ISI), the Beck Depression Inventory (BDI) and the Self-Rating-Anxiety Scale (SAS) were administered to all subjects. Poor sleep quality was defined as PSQI >5, insomnia as ISI >15, depressive symptoms as BDI >10, and trait anxiety as STAI-Y2 >40. Patients with other sleep disorders were excluded. Socio-demographic data were collected and a rheumatologic assessment was performed, including disease activity and damage scales, comorbidities and ongoing treatments. A control group of 53 H age matched women were also recruited.

**Results:** For the SLE cohort (mean age  $44.0 \pm 7.8$  years; mean disease duration  $15.5 \pm 7.8$  years, in disease remission) poor sleep quality resulted in 62.2% SLE patients versus 39.6% of H group ( $p < 0.01$ ) Insomnia was observed in 29.7% SLE vs 22.6% H patients: respectively 26.4% SLE patients had difficulties in initiating sleep vs 25.7% H patients and 62.2% vs 22.9% ( $p < 0.001$ ) had difficulties in maintaining sleep and/or early morning awakening. A depressive disorder was present in 35.1% of SLE vs 13.3% H patients ( $p < 0.001$ ) while an anxiety disorder was more common in H patients, with a prevalence of 35.8% vs 16.2% SLE ( $p < 0.01$ ). Regression analysis in unadjusted model showed a higher risk for having poor sleep quality in SLE vs H (OR. 2.5 [CI 1.21–5.16]). After adjusting for confounding factors (BMI, SAS, BDI), only depression accounted for poor sleep quality in SLE (OR. 6.9 [CI 1.07–23.6]). Poor sleep quality was not related to corticosteroid therapy ( $p = ns$ ) while it was related to immunosuppressive therapy (mycophenolate  $p < .05$ , azathioprine  $p < .05$ ). Neither disease duration and activity or SLE organ damage was related to the presence of poor sleep quality ( $p = ns$ ).

**Conclusion:** In this cohort of SLE women, insomnia and poor sleep quality were common. Especially poor sleep quality, difficulties in maintaining sleep and/or early morning awakening were more common in SLE than in H patients. In addition, depression was highly prevalent in SLE and was a major determinant of poor sleep quality. In addition poor sleep quality may be related to immunosuppressive therapy. These data highlight the importance of investigating sleep disorders, depressive symptoms and the role of therapy in SLE patients.

**Acknowledgements:** L. Carli, L. Ghiadoni.

<http://dx.doi.org/10.1016/j.sleep.2013.11.548>

### Metacognition selectively defines primary insomnia

L. Palagini<sup>1,2</sup>, A. Piarulli<sup>3,4</sup>, E. Lai<sup>1,5</sup>, E. Cheli<sup>1,6</sup>, C. Espie<sup>7,8</sup>, A. Gemignani<sup>1,5</sup>

<sup>1</sup> University of Pisa, Italy

<sup>2</sup> Department of Clinical and Experimental Medicine, Psychiatric Unit, University of Pisa, Italy

<sup>3</sup> Scuola Superiore S. Anna, Pisa, Italy

<sup>4</sup> PERCRO Lab, Scuola Superiore Sant'Anna, Pisa, Italy

<sup>5</sup> Department of Clinical and Experimental Medicine, Pisa, Italy

<sup>6</sup> Department of Clinical and Experimental Medicine, University of Pisa, Italy

<sup>7</sup> University of Oxford, UK

<sup>8</sup> Nuffield Department of Clinical Neurosciences/Sleep & Circadian Neuroscience Institute, University of Oxford, UK

**Introduction:** Metacognitive beliefs and associated actions seem to be a stigma of primary insomnia. Indeed mental activity of primary insomniacs during the night is mainly devoted to generate thought control strategies, including reappraisal, worry and thought suppression. These strategies, in turn, induce a vicious cycle, maintaining insomnia. Our aim is to identify whether metacognitive aspects are a specific mental pattern of primary insomnia or an aspecific correlate of sleep alterations.

**Materials and methods:** We have studied 24 primary insomniacs (test group), 24 snorers, complaining nocturnal awakenings without diagnosis of obstructive sleep apnea syndrome (control group), and 20 healthy controls (sham group). Quality of sleep was assessed by Pittsburgh Sleep Quality Index (PSQI), while metacognitive aspects by means of Metacognitions Questionnaire – Insomnia (MCQI). Total score of both indices were log-transformed and tested for normality (Lilliefors test). PSQI scores were normally distributed whereas for MCQI scores the null hypothesis was rejected. On this basis, PSQI was submitted to analysis of variance with group as a 3 level

between factor (test, control and sham groups) while MCQI to Kruskal–Wallis test with group as a between factor. Parametric post hoc were conducted applying unpaired *t*-tests with Sidak correction whereas non-parametric ones through Mann–Whitney test with Sidak correction.

**Results:** For both tests a significant group effect ( $p < 0.001$ ) was found. PSQI discriminates primary insomniacs from normal sleeper, but not from snorers, instead MCQI discriminates primary insomniacs from both normal sleepers and snorers. All described post hoc are highly significant ( $p < 0.001$ ).

**Conclusion:** These preliminary results allowed us to draw two main conclusions: (i) metacognitive aspects selectively characterize mental activity of primary insomniacs; (ii) MCQI, with respect to PSQI, showed higher sensitivity in defining primary insomniacs. In conclusion, the promising psychometric properties of MCQI will help to develop a specific metacognitive model of primary insomnia.

**Acknowledgements:** Dr. A.Agrimi, Dr. D.Menicucci.

<http://dx.doi.org/10.1016/j.sleep.2013.11.549>

### Cross-sectional study on relationships between hypertension and insomnia

L. Palagini<sup>1,2</sup>, A. Piarulli<sup>3,4</sup>, M. Bergamasco<sup>3,4</sup>, R. Bruno<sup>1,5</sup>, L. Ghiadoni<sup>1,5</sup>, A. Gemignani<sup>1,6</sup>

<sup>1</sup> University of Pisa, Italy

<sup>2</sup> Clinical and Experimental Medicine, Psychiatric Unit, University of Pisa, Italy

<sup>3</sup> Scuola Superiore S. Anna, Pisa, Italy

<sup>4</sup> PERCRO Lab, Scuola Superiore Sant'Anna, Pisa, Italy

<sup>5</sup> Clinical and Experimental Medicine, Hypertension Unit, University of Pisa

<sup>6</sup> Pathology Department University of Pisa, Italy

**Introduction:** Hypertension (HT) and insomnia seem to be associated but, to date, only few studies have described this relationship. Insomnia seems to represent an independent factor influencing the negative outcome of HT while other studies indicate, although non-consistently, a possible negative influence of anxiety/depression on HT. Objective of this study is to determine relationships between insomnia and HT, taking into account also anxiety/depression factors.

**Materials and methods:** In this cross-sectional cohort study, 270 consecutive essential hypertensive patients were recruited at the Outpatient Hypertension Unit, University of Pisa, Italy. Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Beck Depression Inventory (BDI), Perceived Stress Scale (PSS), Self-Rating Anxiety Scale (SAS) and State-Trait Anxiety Inventory (STAI-Y2) were administered to all subjects. Patients with Sleep-Disordered Breathing were excluded. Possible associations between HT, insomnia and anxiety/depression factors were evaluated using a statistical approach based on Principal Components Analysis (PCA).

**Results:** After varimax rotation, PCA allowed us identifying two principal components which explain 35% and 24% of variance respectively: 1) PC1, named Insomnia Factor, includes PSQI 1, 2, 3, 4, 5 factors, ISI, and sleep duration (SD) (SD is negatively correlated with PC1 while the other parameters are positively correlated); PC2, named Anxiety/Depression Factor, includes PSQI 6 and 7 components, BDI, SAS, STAI and PSS (all positively correlated with PC2). The study of clinical degree of HT allowed us disentangling Non Resistant HT patients (NRHT, No: 230; 51% males) from Resistant HT patients (RHT, No: 40; 51% females). Thus, Kruskal–Wallis test with Resistant HT as between factor has been computed on both PC1 and PC2. RHT patients showed significantly higher Insomnia Factor (PC1) values than NRHT ones ( $p < 0.01$ ). No significant

difference has been detected for Anxiety/Depression Factor (PC2). Interestingly, differences identified for the Insomnia Factor show a gender effect: RHT females show significantly higher values with respect to NRHT ones, while no significant difference ( $p < 0.15$ ) is apparent for males.

**Conclusion:** These preliminary results allowed us to draw two main conclusions: (i) insomnia and anxiety/depression status are independent factors in modulating HT; (ii) insomnia is significantly associated with resistance to treatment in hypertensive women, independently of any other psychological confounders. In conclusion, the promising results of this study will help to develop specific therapeutic strategies towards Resistant Hypertension, which should include hypnotic treatment.

**Acknowledgements:** Elisa Lai, Carolina De Bernardo.

<http://dx.doi.org/10.1016/j.sleep.2013.11.550>

### Sleep quality in drug resistant epilepsy patients

I. Alvarez Guerrico, B. Garcia Parra, P. Lluís, I. Royo, F.M. Isabel, R. Rocamora

Hospital del Mar

**Introduction:** Sleep and psychiatric disorders are frequent comorbidities in patients with epilepsy. Sleep quality is affected by anxiety or depressive conditions which worsen the seizures control. Reciprocally, epilepsy itself determines sleep disturbances, although mechanisms are not well known. The aim of our study was to evaluate sleep quality in patients admitted to the Epilepsy Monitoring Unit (EMU) of our centre for diagnostic purposes. Parameters to be considered were gender, age, epilepsy type, antiepileptic drug (AED) therapy, anxious and depressive scores and quality of life index.

**Materials and methods:** 92 Patients over 18 years-old with drug resistant epilepsy were analysed. The day of admission at EMU, all patients completed the Pittsburgh Sleep Quality Index (PSQI), Hospital Anxiety and Depression Scale (HADS), Beck Depression Inventory (BDI), State-Trait Anxiety Inventory (STAI) and Quality of Life in Epilepsy Inventory (QOLIE-10). Patients with pseudoseizures were excluded. Univariate and multivariate linear regression models were calculated to assess variables associated with PSQI.

**Results:** Patients evaluated at EMU showed a lower sleep quality on PSQI ( $6.79 \pm 3.81$ , cut-off value of 5). Also the quality of life measured by QOLIE-10 (normal index  $< 21$ ) was reduced ( $26.71 \pm 8.17$ ). Significant differences in PSQI according to gender ( $F = 52$ ;  $M = 40$ ), age ( $39 \pm 12$  years) or epilepsy form (generalized = 9; temporal = 55; frontal = 13; occipital = 7; other = 8) were not found. Correlations between sleep quality and antiepileptic therapy could not be established. The univariate analysis showed a positive correlation between PSQI and depression and anxiety scores. Nevertheless, the multivariate analysis established a stronger correlation between PSQI and HADS-anxiety index ( $8.45 \pm 4.14$ ).

**Conclusion:** Patients with drug resistant epilepsy have reduced sleep quality and quality of life. Anxiety seems to be the most important condition over sleep quality in pharmacoresistant epilepsy patients. In order to establish correlations between sleep disturbances and epilepsy form or AED therapy, new clinical trials should be developed.

**Acknowledgements:** Epilepsy Monitoring Unit Team, Hospital del Mar.

<http://dx.doi.org/10.1016/j.sleep.2013.11.551>

### Sleep difficulties in Parkinson's disease

M. Partinen<sup>1</sup>, A. Ylikoski<sup>1</sup>, K. Martikainen<sup>2</sup>

<sup>1</sup> Vitalmed Research Center, Helsinki Sleep Clinic

<sup>2</sup> The Finnish Parkinson Association

**Introduction:** Insomnia is often complained by patients with Parkinson's disease (PD). We studied occurrence of different complaints of insomnia, fatigue and sleepiness.

**Materials and methods:** The base populations consisted of 1447 patients with Parkinson's disease. A structured questionnaire was sent. 649 subjects were included (55.7% men). Mean age was 68.1 y (SD 8.5). Average duration of PD was 5.9 y (SD 4.9). The questions were derived from the Basic Nordic Sleep Questionnaire.

**Results:** Occurrence of complaints on at least three nights/days per week were: difficulties falling asleep 16.6%, nocturnal awakenings 77.5%, early morning awakenings 37.8%, fatigue 43.4%, tiredness 52%, sleepiness 44.4%, snoring 38.8%, nocturnal breathing pauses (apnea) noted by others 6.8%, bruxism 2.9%, waking up to urinate at least once at night 70.3%. Of all 11.7% woke up at least thrice and 41.1% woke up at least twice per night to urinate. Altogether 47.5% complained of chronic insomnia lasting for at least one month. Using the Rimon Depression Scale 24.8% were depressive and using the WHO-5 scale (WHO-5  $< 28$ ) the respective figure was 11.9%. Using the Marburg RBD scale 36.7% had at least 6/10 points. The mean ESS score was 8.2 (SD 4.9). ESS was  $> 10$  in 30.5% of the responders. Previous restless legs syndrome had been diagnosed in 5% of all but 17% fulfilled the IRLS criteria for RLS.

**Conclusion:** The most common sleep complaints are nocturnal awakenings and nocturia while bruxism and difficulties falling asleep were less frequent. RLS had been rarely diagnosed despite of the complaints.

**Acknowledgements:** This study was supported by the Finnish Parkinson Foundation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.552>

### Pharmacogenetic inhibition of the subcoeruleus region influences REM sleep and cataplexy in narcoleptic mice

K. Sanghera, J. Kim, J. Peever

University of Toronto, Canada

**Introduction:** Cataplexy – the sudden involuntary loss of skeletal muscle tone – is a defining feature of narcolepsy. A longstanding, but untested, hypothesis is that cataplexy results from intrusion of REM sleep paralysis into wakefulness. This hypothesis is built on the assumption that cataplexy and REM sleep paralysis share a common neural mechanism. The current study aimed to determine if cataplexy is influenced by direct manipulation of REM sleep circuitry. We did this by pharmacogenetically inhibiting cells in the subcoeruleus – a region important for REM paralysis – while monitoring REM sleep and cataplexy in narcoleptic mice.

**Materials and methods:** Vally-mediated transduction of hM4D-Gi/o was bilaterally targeted to the subcoeruleus (Sub-C) in hypocretin knockout mice ( $n = 7$ ). Standard electrophysiological (i.e., EEG/EMG) and behavioural criteria were used to characterize cataplexy and REM sleep. Intraperitoneal administration of clozapine-n-oxide (CNO, 10 mg/kg) was used to inhibit Sub-C cells expressing hM4D-Gi/o. Saline injections served as controls for CNO administration. Histological and immunohistochemistry were used to verify hM4D-Gi/o expression in the left/right Sub-C.

**Results:** Sub-C inhibition markedly influenced REM sleep and cataplexy. Compared to saline, Sub-C inhibition increased REM sleep amounts by increasing both the number ( $p = 0.001$ ) and duration of REM episodes ( $p < 0.0001$ ). This intervention also triggered increases in basal levels of muscle tone during REM sleep, i.e., it blocked REM sleep paralysis ( $p < 0.05$ ). Silencing Sub-C cells also lead to marked sleep fragmentation by increasing the number of NREM to REM transitions. Sub-C inhibition lead to an 88% decrease ( $p = 0.04$ ) in time spent in cataplexy as well as 75% fewer cataplexy episodes ( $p = 0.025$ ). There were no measureable changes in the duration of cataplectic events ( $p > 0.05$  for all variables).

**Conclusion:** Pharmacogenetic manipulation of the Sub-C influences REM sleep expression as well as cataplexy expression in narcoleptic mice. At first glance, these preliminary data suggest that REM sleep paralysis and cataplexy may be mediated by a similar neural mechanism.

<http://dx.doi.org/10.1016/j.sleep.2013.11.553>

### Association between the amount of daytime sleep variability and cognitive flexibility in older adults

S. Reyes<sup>1</sup>, C. Algarín<sup>1</sup>, D. Bunout<sup>2</sup>, P. Peirano<sup>1</sup>

<sup>1</sup> Sleep Lab, INTA, University of Chile, Chile

<sup>2</sup> Aging Lab, INTA, University of Chile, Chile

**Introduction:** Disrupted sleep patterns are commonly referred in the older population. They are often manifested by decreased total sleep time, increased waking after sleep onset, and napping. Napping may also be associated with increased risk of cognitive impairment, particularly compromised executive function, like cognitive flexibility. Recent evidence showed that variability in nap duration from day to day was predictive of greater medical morbidity. The aim of the study is to assess the association between variability in the amount of daytime and nighttime sleep and cognitive flexibility in older adults.

**Materials and methods:** Participants were 76 subjects: 72% were women and mean age was  $75.4 \pm 3.9$  years (1). Motor activity was recorded continuously for a week with actigraphs (Actiwatch-16/64) worn in the nondominant wrist, yielding estimates of the amount of daytime and nighttime sleep. The variability of daytime and nighttime sleep amounts were calculated by dividing the standard deviation of sleep amounts within the week by the square root of the number of data points. Participants also performed the Stroop test: the words red, blue and green and a string of Xs were displayed on a monitor in red, blue, or green color. Three keys from the computer keyboard were covered by corresponding color patches, and the participants were told to press the key corresponding to the color of the target. The color words served as stimuli in the incongruent condition (e.g., the word red displayed in blue color), and was considered as the cognitive flexibility. We obtained the reaction time (RTI) and percentage of correct responses (PCI) for incongruent stimuli. 1. Reyes S, Algarín C, Bunout D, Peirano P. Sleep/wake patterns and physical performance in older adults. *Aging Clin Exp Res* 2013;25:175–181.

**Results:** The logistic regression model showed that subjects with greater variability in the amount of daytime sleep were more likely to have longer RTI (OR = 1.07,  $p < 0.05$ ) and lower PCI (OR = 1.08,  $p < 0.05$ ). Variability in the amount of nighttime sleep showed no significant associations. Analyses were adjusted by gender and age.

**Conclusion:** Our results show an association between daytime sleep amount variability and cognitive flexibility in older subjects. They provide support to the hypothesis relating sleep patterns and cognitive functioning, and suggest the relevance of daytime duration regularity for cognitive performance.

**Acknowledgements:** Support: FONIS SA06120038/Fondecyt 1110513; (\*) CONICYT, PhD program fellowship.

<http://dx.doi.org/10.1016/j.sleep.2013.11.554>

### The effectiveness of a community pharmacist-led intervention to improve screening for sleep apnea in primary care – A cohort study

C. Perraudin

Centre de Recherches Médecine Sciences Santé Mentale Société (CER-MES3), UMR 8211 - INSERM U 988

**Introduction:** Despite the high prevalence and major public health ramifications, obstructive sleep apnea syndrome (OSAS) remains underdiagnosed. In many developed countries, because community pharmacists (CP) are easily accessible, they have been developing additional clinical services that integrate the services of and collaborate with other healthcare providers (general practitioners (GPs), nurses, etc.). Alternative strategies for primary care screening programs for OSAS involving the CP are discussed.

**Objectives:** We aimed to determine whether the involvement of a CP in the care pathway of a patient at risk for OSAS, through the implementation of a GP-CP collaborative intervention, was effective that is to say if it improved the detection rate and diagnosis of the disease in this population.

**Materials and methods:** Setting: 31 community pharmacies in 5 regions in France. **Participants:** Patients at risk for OSAS, i.e taking 1 or more anti-hypertensive drugs, being overweight (BMI > 25), snoring nearly every night. **Intervention:** The CP intervention consisted in (i) a discussion with the patient on the risks and comorbidities associated with untreated OSAS, (ii) guiding the patient to fill in the Berlin Questionnaire and the Epworth Sleepiness Scale and (iii) encouraging the patient to consult his/her referent GP with the questionnaires results and urging the doctor, in a letter written to his/her intention, to continue investigations. **Measurement:** Proportion of patients who had performed a diagnostic test for OSAS.

**Results:** 782 Patients were analysed (88 patients exposed and 694 patients unexposed). After a 6 months follow-up, the number of patients who had performed a diagnostic test for OSAS was significantly higher in the exposed group compared to the unexposed group (22.7% versus 11.4%,  $p = 0.003$ ). Being exposed to the CP intervention was associated with a higher chance of having a diagnostic test for OSAS, (adjusted OR: 2.34 [1.26–4.35]).

**Conclusion:** These findings provide arguments for the implementation of a CP-GP collaborative OSAS screening intervention in community pharmacy routine practice. Future research should focus on potential economic benefits of such an intervention.

**Acknowledgements:** We would like to thank the Ordre National des Pharmaciens and all the community pharmacists who participated in this study for their support in this new adventure.

<http://dx.doi.org/10.1016/j.sleep.2013.11.555>

### Sleep and mood disorders in epilepsy

M. Pereira<sup>1</sup>, L. Zuccolo<sup>2</sup>, S. Cieza Ortiz<sup>1</sup>, E. Urrestarazu Bolumburu<sup>1</sup>, J. Iriarte Franco<sup>1,2</sup>

<sup>1</sup> Clínica Universidad de Navarra

<sup>2</sup> Higa san martin la plata

**Introduction:** Epilepsy has a prevalence of 1% in general population, sleep disorders are common complications. Determine the fre-

quency of sleep disorders (SD) and excessive daytime sleepiness (EDS) in patients with epilepsy and to identify the factors that are related to those described.

**Materials and methods:** The factors analyzed included age, sex, type of epilepsy, duration of epilepsy disease, nocturnal seizures, frequency of seizures, electroencephalogram (EEG) interictal pathological, altered brain MRI, antiepileptic drug (AED) used; sleep quality, daytime sleepiness and mood disorders.

**Results:** 58 patients were evaluated by interview and questionnaires on sleep quality (Pittsburgh scale), the degree of EDS (Epworth scale) and anxiety-depression (hospital depression and anxiety (HAD)). The rest of the data were obtained from medical history. SD among patients with epilepsy studied had a prevalence of 55%. Significant differences were found between patients with sleep disorders versus (vs) patients with normal sleep in the following variables: frequency of difficulty (1 attacks/month: 8 (25%) vs 1 (4%);  $p$  0.03), EDS (Epworth scale) 8 (25%) vs 1 (4%);  $p$  0.03), presence of anxiety (HAD scale) 11 (22%) vs 3 (6%);  $p$  0.001; presence of depression (HAD scale) 1 (4%) vs 10 (20%);  $p$  0.003. No significant differences between epileptic patients with and without sleep disorders when analyzing the rest of the variables.

**Conclusion:** Sleep disorders are common among patients with epilepsy and are associated with a higher frequency of daytime sleepiness, anxiety and depression. It was shown that epileptic patients with sleep disorders showed a significant difference in seizure frequency of 1 time/month. However, this difference was not observed with a lower seizure frequency, possibly due to insufficient sample size. This would also explain the lack of association of other variables such as temporal lobe epilepsy, interictal EEG, AED disease and sleep disorders. While it is known the deleterious effect of epilepsy on sleep architecture, it is important to consider mood disorders predisposing factors of such alterations.

**Acknowledgements:** Laura Zuccolo.

<http://dx.doi.org/10.1016/j.sleep.2013.11.556>

### Circadian and homeostatic processes influence daytime nap architecture

S. Pereira, F. Beijamini, R. Spada, F. Menon, J. Clementin, F. Louzada  
Universidade Federal do Paraná, Brazil

**Introduction:** Besides being a useful tool for coping with sleep deprivation, naps can reduce sleepiness and improve cognitive performance. However, few studies so far have examined what factors regulate its structure. Therefore, we aimed to investigate if circadian preference influences daytime nap architecture.

**Materials and methods:** Following a week of actigraphy monitoring of the sleep/wake cycle, a total of 43 healthy young adults (19 females, 22.16 ( $\pm$ 3.82) years) filled out the Morningness-Eveningness Questionnaire (MEQ) and took a 90 min polysomnography-recorded nap. MEQ score, nocturnal sleep data and minutes of prior wakefulness were correlated with nap sleep variables.

**Results:** There is a negative correlation between MEQ Score (47.93 ( $\pm$ 10.93)) and Slow Wave Sleep% (SWS) ( $r = -.364$ ,  $p = .044$ ) and a positive correlation with Stage N1% ( $r = .371$ ,  $p = .014$ ), meaning that morning preference is associated with increased SWS and decreased N1 in a daytime nap. No correlations were found between MEQ Score and total sleep time (nap or nocturnal, for either the previous night or the mean 5 previous nights), Stage N2%, or REM%. The mean 5 previous nights bedtime ( $r = -.381$ ,  $p = .038$ ) and wake time ( $r = -.362$ ,  $p = .049$ ) were also negatively correlated with SWS, whereas the previous night bedtime ( $r = .375$ ,  $p = .013$ ) and wake time ( $r = .302$ ,  $p = .049$ ) were positively correlated with N1, that is, going to bed

and waking up earlier predicted greater SWS% and smaller N1%, supporting MEQ Score correlations. To rule out homeostatic sleep drive as an explanation for increased nap SWS in individuals with a morning preference, minutes of prior wakefulness were correlated with nap sleep data. No association was found between homeostatic sleep drive and SWS ( $r = 0.244$ ,  $p > 0.05$ ). However, increasingly amounts of N1 were associated with less time between waking and napping ( $r = -0.370$ ,  $p = 0.015$ ).

**Conclusion:** Morningness is associated with increased SWS in a daytime nap and prior wakefulness predicts time spent in N1, in healthy young adults. It is possible that this is because the scheduled nap timing was more suitable for individuals with a morning preference. Both components (circadian and homeostatic) should be taken into account when prescribing naps to ensure maximal restorative effects.

**Acknowledgements:** Supported by grants from CAPES and CNPq. We would like to thank all the subjects that volunteered for this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.557>

### Determining the efficacy of temporary mandibular advancement splint in mild to moderate obstructive sleep apnea patients at baseline polysomnography

W. Phuapradit<sup>1</sup>, P. Mahakit<sup>2</sup>

<sup>1</sup> Phramongkutklao Hospital, Dental Department

<sup>2</sup> Phramongkutklao Hospital, Otolaryngology Department

**Introduction:** Mandibular advancement splint (MAS) have become increasingly popular as alternatives to continuous positive airway pressure (CPAP) for the treatment of obstructive sleep apnea (OSA). However, the acceptance of MAS is limited to the efficacy rate of 50–70% and inability to predict which patients will respond to this treatment. To overcome this limitation, the temporary mandibular advancement titration was performed in mild to moderate OSA patients during baseline polysomnography (PSG). **Objective:** To determine the efficacy of temporary mandibular advancement splint in mild to moderate OSA patients during baseline polysomnography (PSG).

**Materials and methods:** This pilot study consisted of ten undiagnosed subjects with OSA symptoms. The Temporary mandibular advancement splint, fabricated at 50% and 70% of maximum jaw protrusion, had been delivered to all subjects before each subject underwent baseline PSG. After the first half of the night, five subjects had severe OSA (AHI > 30) and CPAP titration was performed in this group, four subjects had mild to moderate OSA (AHI 5–30) and temporary mandibular advancement splint titration was performed in this group, one subjects was normal (AHI < 5) and no any device was performed on this subject.

**Results:** Mean apnea-hypopnea index (AHI) was significantly reduced from 20.60 (SD  $\pm$  8.28) to 5.65 (SD  $\pm$  4.49) after treatment with Temporary mandibular advancement splint ( $p < 0.05$ ). Three patients were considered treatment success and one patient was considered treatment failure as defined by AHI < 5.

**Conclusion:** This pilot study shows that it is possible to utilize temporary mandibular advancement splint titration in mild to moderate OSA patients during baseline PSG and these results suggest that temporary mandibular advancement splint can be used as a tool in predicting treatment response in terms of efficacy prior to oral appliance therapy by means of using mandibular advancement splint in treating OSA.

**Acknowledgements:** This study is granted by dental department, Phramongkutklao hospital, Bangkok, Thailand.

<http://dx.doi.org/10.1016/j.sleep.2013.11.558>

### Comparison between the objectively measured and the subjective sleep in a group of patients

A. Piquer, A. Cutillas, P. Perales, G. Besa, D. Goyo, E. Gomez Siurana  
 Unidad de Sueño. Hospital Universitari I Politenic La Fe. Valencia,  
 Agencia Valenciana de Salud

**Introduction:** It is known that there are some discrepancies between the objectively measured sleep and the subjective feeling of a good sleep night in a general population. Moreover there is a lack of procedures for the evaluation of both variables, because self-reported sleep may not reflect objective sleep patterns, being this a matter of discussion. The comparison among the feeling of a good sleep and several objective variables from the sleep measured by one night full polysomnography (PSG) in Obstructive Sleep Apnea (OSA) patients during the determination of the continuous positive air pressure (CPAP) in the sleep lab.

**Materials and methods:** The self-reported feeling of a good sleep was characterized by the answer to the question "Have you slept well?; (yes or not)?" Provided by the patients in the morning after the PSG, and was compared with the values obtained for several variables measured from the PSG in 107 patients to titrate CPAP pressure from a single night in the sleep laboratory.

**Results:** A group of 107 patients was studied. From them, 68 cases (45 males and 23 females) considered that the sleep was "good", whereas the remaining 39 cases (27 males and 12 females) answered that the sleep was "bad". The following variables were compared between both groups: The body mass index (BMI), proportion of different sleep stages, latency of sleep onset, number of awaking from sleep, CPAP pressure and sleep efficiency (SE). The results obtained revealed that only SE ( $p = 0.003$ ), total sleep time (TST), ( $p = 0.011$ ) and CPAP pressure ( $p = 0.035$ ) showed significant differences between groups. The value of SE was high within the group feeling a good sleep, which also showed higher valued of CPAP. Nevertheless, according with the majority of the bibliography, this last behavior would be associated with a worse sleep thus, the results obtained in this work may be indicate better CPAP adjustment in this group. As was expected, the TST also showed significant differences between groups, being higher in the group that felt a better sleep. The complete interpretation of these results will be difficult because the feeling of the "good" or "bad" sleep may be influenced by several no controlled factors.

**Conclusion:** The sleep efficiency and the Total sleep time could be an objective marker of a subjective feeling of a good sleep in a subset of patients.

**Acknowledgements:** There isn't commercial or institutional support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.559>

### OSA in REM and NREM – Individual subjective complaints

J. Pires, C. Bentes, A. Peralta

**Introduction:** The syndrome of obstructive sleep apnoea (OSA) may occur predominantly in REM sleep (REM OSA) or NREM (NREM OSA) or occur undifferentiated (OSA indif). Different types of OSA may origin different clinical complaints. Analyze the subjective complaints of sleep in the three types of OSA.

**Materials and methods:** Consecutive sample of patients undergoing polysomnography (PSG) type 2 in period from January 2010 to August 2012, with apnoea hypopnoea index (AHI) >5 and REM sleep time >0 min. The evaluation of clinical characteristics was performed with a standardized questionnaire conducted prior to PSG. REM OSA:

IAH\_REM/ IAH\_NREM > 2 and IAH\_NREM < 15; OSA NREM: reverse. Statistical analysis with Chi-square test ( $P < 0.05$ ) for categorical variables and  $t$  test for continuous variables.

**Results:**  $N = 87$ , 62 (68.9%) men, 26–82 years. 35 (40.2%) REM OSA, 12 (13.8%) OSA NREM and 40 (46.0%) OSA indif. In women and also in postmenopausal women REM OSA (45.7%) was more frequent. REM OSA had more complaints of pain and headaches as nocturnal symptoms and nocturnal waking with confusion and disorientation than OSA NREM. The remaining variables were similar in the 3 groups.

**Conclusion:** In this sample of patients referred for PSG, the clinical and subjective complaints of patients with different types of OSA were similar. This study also suggests that OSA can be used as a natural model of selective deprivation of REM sleep or NREM. In particular, future studies could explore more specific consequences in pain control, the consequences cognitive, cardiovascular and metabolic diseases.

**Acknowledgements:** We thank technicians of EEG/ Sleep laboratory of Hospital Santa Maria, Lisbon.

<http://dx.doi.org/10.1016/j.sleep.2013.11.560>

### Validation of the minimum question set for diagnosis of the restless legs syndrome in epidemiology study in the population of Czech pregnant women

L. Plchová<sup>1</sup>, Z. Šrůtková<sup>1</sup>, J. Pavlíčková<sup>1</sup>, A. Pařízek<sup>2</sup>, K. Sonka<sup>1</sup>,  
 D. Kemlink<sup>1</sup>

<sup>1</sup> Neurologická klinika 1.LF UK a VFN Praha

<sup>2</sup> Gynekologická klinika 1.LF UK a VFN Praha

**Introduction: Background:** The aim of this study was to estimate diagnostic accuracy of the minimum question set used to estimate the Restless Legs Syndrome (RLS) prevalence using self administered questionnaire. The original English version was published in 2003 by Richard P. Allen et al. in Sleep Medicine. The data set was constructed along with the diagnostic criteria and was indented to be used in epidemiology studies. The minimum set consists of three questions to diagnose RLS and the forth question estimating frequency of the symptoms.

**Materials and methods:** The questions were translated to Czech language and blindly reversely translated to assure no shift in the original meaning. Pregnant women were asked to fill the questionnaire between 34–38 week of pregnancy at the Department of Obstetrics of the First Medical Faculty, Charles University in Prague. Subsequently and independently, the women were contacted over telephone by an sleep physician trained in diagnosing RLS. The results of both methods were compared to estimate the diagnostic profile of the minimum question set. Any women, answering first question as "no" were set to answer all three questions as negative.

**Results:** In total 187 questionnaires were validated, in 57 the personal interview confirmed the diagnosis of RLS. When the patient answered all three questions positively, in twelve cases RLS was not confirmed by the telephone interview. Thus positivity of all three questions yields specificity of 90.8%, but only 79.0% both sensitivity and positive predictive value. When a patient answered "no" to the first question, then RLS was found to be present in only three women. Thus positivity of only the first question has sensitivity 94.7% and negative predictive value 97.4%.

**Conclusion:** Diagnosing RLS using self-administered questionnaire is a fast and cheap method, representing a major advantage when screening larger population. Our study validated Czech version of the questions and found high total diagnostic accuracy, even when using only the first question, with highest sensitivity, thus being very

useful for screening. Adding the other two questions led to increase in specificity, but at the costs of losing some patients. Such approach is encouraged e.g. in genetic studies, where including a false positive patient may lead to distortion of the result.

**Acknowledgements:** Supported by grant IGA-NT 12141–3 and MSM 0021620849.

<http://dx.doi.org/10.1016/j.sleep.2013.11.561>

### MacDonald Critchley's description of Ekbom's syndrome in 1955 with a reference to Thomas Willis

J. Poceta

*Scripps Clinic, Division of Neurology and Sleep Medicine, United States*

**Introduction:** There are at least a few different threads of knowledge that weave the tapestry we now call Willis-Ekbom Disease, also known as Restless Legs Syndrome.

**Materials and methods:** The awareness of WED/RLS as a specific medical condition has a hazy origin. In the modern literature Karl-Axel Ekbom described the condition in 1944 in *Acta medica Scandinavia* in the article "Asthenia crurum paraesthetica (irritable legs)". This was followed in 1945 with a detailed case series in the form of a thesis or monograph entitled "Restless Legs", and in 1950 another 70 cases were added. In 1960 he wrote "Restless legs syndrome" in *Neurology* and the condition was fully exposed to American neurologists. Ekbom referred to the condition as "an earlier overlooked disorder," or "a disease, or rather a syndrome... which has not been described previously," or "a hitherto overlooked disease characterized by peculiar paresthesia." However, he was able to find in the literature some cases that were possibly the same condition. Owing to World War II and what he refers to as "difficulty with communication," many British texts were not available to him. He references Theodor Wittmack in 1861 (Germany) who described a patient and called the ailment "anxietas tibiarum." Bing in 1913 (Germany) also used this term, but Ekbom did not believe that the two cases were the same condition. He was also aware of a 1936 report of Code and Allen (USA) describing three cases of "neurosis involving the legs."

**Results:** The parallel thread, which was unknown to Ekbom, jumps to the British neurologist MacDonald Critchley in 1955. In that year he wrote an article in *Revue Neurologique* entitled "The Pre-dormitum" in which he describes several of the features of the transition from wake to sleep, including Ekbom's syndrome. As far as I can find, this paper was the first to acknowledge that Thomas Willis described a case of RLS in 1695 (actually 1685) in *The London Practice of Physick*. This reference was later cited by Ekbom in his 1960 paper and by Lugaresi in his 1965 paper on PLMS in patients with RLS.

**Conclusion:** We owe a debt of gratitude to MacDonald Critchley for keeping alive the knowledge about RLS from Thomas Willis—one of a far earlier generation of British physicians—to the modern times. His description of a patient with RLS is also unique and wonderful; befitting of one of the world's great medical minds and authors. This description—which indirectly includes the four modern diagnostic criteria—is reproduced in this poster presentation.

**Acknowledgement:** The works of Macdonald Critchley; Google Books.

<http://dx.doi.org/10.1016/j.sleep.2013.11.562>

### Sleep forensic case reports

F. Ingravallo<sup>1</sup>, F. Poli<sup>1</sup>, L. Vignatelli<sup>2</sup>, F. Pizza<sup>3</sup>, G. Plazzi<sup>3</sup>

<sup>1</sup> *University of Bologna, Department of Medical and Surgical Sciences, Italy*

<sup>2</sup> *Local Health Trust, Bologna, Department of Primary Care, Italy*

<sup>3</sup> *University of Bologna, Department of Biomedical and NeuroMotor Sciences, IRCCS Institute of Neurological Sciences, Italy*

**Introduction:** Sleep assessment in suspected sleep related violence (SRV) and sleep-related abnormal sexual behaviour (SRASB) cases is mandatory. When such behaviours are suspected or purported to have caused a criminal offence (i.e. assault, attempted murder, murder, sexual assaults) sleep experts asked to provide report/testimony relied on previous forensic cases as a valuable source of information. We aimed at analyzing reported forensic cases of SRV and SRASB to investigate if they provided information about a minimal set of medical-legal key elements.

**Materials and methods:** Systematic review was performed searching MEDLINE and PSYCHINFO databases from January 1980 through December 2012. One expert in legal medicine and two experts in sleep medicine reviewed all reports to assess whether they provided information about 15 key elements grouped in four categories: (1) legal issues (charge, defense, verdict); (2) defendant and victim characteristics (sex, age, relationship); (3) circumstantial factors (timing of the event, proximity, psychophysical condition of the defendant at the time of the event); and (4) forensic evaluation (clinical sleep assessment, polysomnography (PSG), PSG findings, other medical evaluations).

**Results:** Out of 624 retrieved references we included 35 reports (19 SRV and 16 SRASB), ranging from single case reports to case series up to summaries of legal cases. The number of provided key elements ranged from 4 to 14. The most frequently reported were the defendant's sex and the relation with the victim (97%), while the less frequent were PSG (37%) and PSG findings (29%). In average, legal issues were provided in 84% of reports, defendant and victim characteristics in 74%, circumstantial factors in 77%, and forensic evaluation in 47%.

**Conclusion:** Criminal trials involving SRV and SRASB are rare. In this light, exhaustive reporting is essential. This is the first attempt to analyze the information provided by published SRV/SRASB forensic cases. We disclosed that a minimal set of medical-legal key elements was never provided. While information about legal issue is frequently provided, the lack of key elements concerning defendant and victim characteristics, circumstantial factors and especially forensic evaluation weakens the forensic relevance and the scientific interest of many reports. Improving the quality of reports of forensic cases of SRV/SRASB would provide essential information for sleep medicine experts called for forensic evaluation and a homogeneous body of data for scientific research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.563>

### Influence of cytochrome P450 and ABCB1 genetic polymorphisms on drug efficacy in narcolepsy with cataplexy

F. Poli<sup>1</sup>, M. Moresco<sup>1</sup>, L. Riccardi<sup>1</sup>, G. Plazzi<sup>2</sup>, F. Ingravallo<sup>1</sup>, S. Pelotti<sup>1</sup>

<sup>1</sup> *Forensic Medicine, Department of Medical and Surgical Sciences, University of Bologna, Italy*

<sup>2</sup> *Department of Biomedical and NeuroMotor Sciences, University of Bologna, Italy*

**Introduction:** Treatments for narcolepsy-cataplexy (NC) are so far only symptomatic and aim to reconsolidate sleep and waking states as well as cataplexy attacks. The patients' clinical response is influenced by a high interindividual variability. This leads, in clinical practice, to an empirical case-by-case management, mainly based

on increasing drug dosages, but without a precise clue of the mechanisms of such variability. Genetic polymorphisms of cytochrome P450 (CYP450) are involved in drug metabolism and known to be responsible for the interindividual variability of drug response in different population groups. We genotyped CYP450 genes, CYP3A4 and CYP3A5, involved in the metabolism of two common NC drugs (i.e. modafinil (Mod), a wake promoting agent, and venlafaxine (Ven), a noradrenaline- serotonin reuptake inhibitor). Moreover, we genotyped the glycoprotein-P ABCB1 (P-gp), also called multidrug resistance protein 1, a transmembrane efflux pump. Finally, genotypes were correlated with Mod and Ven efficacy and dosage, to provide a clue for the interindividual variability in clinical response of NC patients.

**Materials and methods:** 45 Caucasian NC patients (28 males, mean age  $42 \pm 20$  y.o.), on chronic therapy with Mod alone or Mod plus Ven underwent blood withdrawal for genetic analysis. Mod and Ven efficacy was empirically scored by a sleep expert (1 = full, 2 = mild, 3 = low efficacy). Multiplex PCR was used for CYP3A4, CYP3A5 and P-gp loci amplification, followed by enzymatic purification, minisequencing reaction, and capillary electrophoresis typing.

**Results:** Out of 45 patients 17 were on Mod alone (38%), 28 on Mod plus Ven (62%). No significant correlation was found between CYP3A4/CYP3A5 genotypes and Mod or Ven efficacy or dosage. The CGC/TTT P-gp-haplotype (wild type/mutated allele), corresponding to a decreased activity, showed a significant correlation with an increased Mod efficacy ( $p = 0.017$ ). CGC/TTT haplotype was also the most represented in NC, according to general Caucasian population frequency distribution.

**Conclusion:** This is the first attempt to correlate the interindividual variability of drug response to Mod and Ven in NC patients with the genotypes of proteins involved in their metabolism and transport. An increased Mod efficacy resulted to be related to a partially decreased activity of P-gp (partially mutated haplotype), suggesting that the Mod efficacy may be related to the intracellular permanence of Mod, consequent to damaged cell efflux.

**Acknowledgements:** We thank the patients of the Italian Narcolepsy Association (AIN) for the precious collaboration.

<http://dx.doi.org/10.1016/j.sleep.2013.11.564>

### Sleep related rhythmic movements and periodic limb movements in schizophrenia: a clinical case

P. Porcacchia, F. Mora Granizo, G. Botebol Benhamou  
Servicio de Neurofisiología, UGC de Neurociencias, Hospital Universitario Virgen del Rocío, Sevilla, Spain

**Introduction:** Schizophrenic patients may present sleep troubles that classically include abnormality of circadian rhythm, a reduction of sleep efficiency and the electroencephalogram's finding of reduced sleep spindles. Nevertheless we do not know the prevalence of other sleep related conditions in these patients, such as rhythmic and/or periodic limb movements.

**Materials and methods:** We describe a nocturnal, laboratory based, video-polysomnography (PSG) of a 36 years-old man, with a diagnosis of schizophrenia 14 years before. During his childhood he presented sleep related rhythmic movement (head banging) that progressively disappeared when he was a teenager. He was remitted to our laboratory with a clinical suspect of parasomnia, for presenting in the last months limb and arm movements, usually at the beginning of the sleep. His medications include Risperidone, Biperiden and Clorazepate.

**Results:** The PSG showed a reduction of sleep efficiency and the presence of polymorphic periodic and rhythmic movements during

sleep. Rhythmic movements took place during the awakening and N1, with the patient in the supine position and consisted of a rhythmic external rotation of the hip (usually the left) with flexed knee. Three types of periodic movement were detected: typical limb movements with dorsal extension of the foot; forearm extension, with adduction and internal rotation of the arm; a fast extension-flexion of the forearm, as rubbing the hand together with the abdominal wall and frequently correlated with arousals.

**Conclusion:** The unusual association of typical and atypical periodic movement during sleep as well as sleep related rhythmic movements suggest a possible relation with the psychiatric condition and/or the medication of the patient.

**Acknowledgements:** Clinical staff.

<http://dx.doi.org/10.1016/j.sleep.2013.11.565>

### Subjective sleep characteristics associated with anxiety and depression in older adults: a population-based study

O. Potvin<sup>1</sup>, D. Lorrain<sup>2</sup>, G. Belleville<sup>3</sup>, S. Grenier<sup>4</sup>, M. Préville<sup>2</sup>

<sup>1</sup> Centre de recherche de l'Institut universitaire en santé mentale de Québec, Québec, Canada

<sup>2</sup> Université de Sherbrooke, Sherbrooke, Canada

<sup>3</sup> Université Laval, Canada

<sup>4</sup> Centre de Recherche de l'Institut Universitaire de gériatrie de Montréal, Canada

**Introduction:** At the moment, population-based data on the subjective sleep characteristics related to anxiety disorders in older adults are scarce and the few results do not agree with the view proposed by the DSM concerning sleep difficulties related to anxiety. This study examines the subjective sleep characteristics specific to anxiety and depression in older adults.

**Materials and methods:** The sample comprises a random population-based sample of 2393 individuals aged 65 years or older. Anxiety and depression were identified by a structured interview and categorized using DSM-5 criteria for phobias, panic disorder, generalized anxiety disorder, unspecified anxiety disorder, major depressive episode (MDE) and depressive episode with insufficient symptoms (DEIS). Subjective sleep characteristics were measured using the Pittsburgh Sleep Quality Index (PSQI). The association between subjective sleep characteristics and anxiety/depression were assessed using logistic regression adjusted for age, education level, cognitive functioning, subjective health, anxiolytic/sedative/hypnotic use, antidepressants use, cardiovascular conditions, and the number of chronic diseases.

**Results:** The prevalence of poor sleep (PSQI >5) was 64% in participants with anxiety disorder (Adjusted odds ratio: 2.16, 95% CI: 1.30–3.60) and 55% in participants with unspecified anxiety disorders (1.59, 1.12–2.26) compared to 37% in those without anxiety. Nearly all PSQI subscales were significantly associated with anxiety, but these subscales shared variance and only short sleep duration, sleep disturbance and daytime functioning subscales were independently related to anxiety. Within these significant subscales, the main specific sleep complaints associated with anxiety were daytime sleepiness and sleep disturbances related to breathing, coughing/snoring, feeling hot or cold, pain, and bad dreams. The prevalence of poor sleep was 54% in participants with MDE (1.07, 0.70–1.64) and 58% in participants with DEIS (1.70, 1.22–2.36) compared to 36% in those without depression. The use of sleeping medication was the only specific sleep characteristic associated with depression.

**Conclusion:** These results suggest that in older adults, symptoms of short sleep duration, daytime sleepiness and sleep disturbances

are specific related to anxiety while the use of sleep medication is associated to depression.

**Acknowledgements:** This study was supported by research grants from the Canadian Institutes of Health Research (CIHR) and the Fonds de recherche en santé du Québec. Olivier Potvin is supported by a fellowship award from the CIHR.

<http://dx.doi.org/10.1016/j.sleep.2013.11.566>

### **RLS patients can also develop compulsions on dopaminergic agonists**

E. Pourcher, L. Bond

*Clinique Sainte-Anne "Mémoire et Mouvement", Laval University, Canada*

**Introduction:** The aim of this study was to assess the frequency of self-reported compulsive behaviours, depressive and stress symptoms and sleep disorders in a population of Restless legs patients treated with DA agonists. Reports by Tippmann-Peikert et al. (2007) and Ritz et al. (2006) extend the risk of developing DA agonists related impulse control disorders such as gambling, heightened sexual drive or unreasonably overinvested repetitive activities to RLS patients.

**Materials and methods:** A questionnaire covering RLS severity (IRLSSG-Walters et al. 2003), mood variables, The Beck Depression Inventory II (Beck et al. 2003), a visual Analog Scale of current level of stress and sleep parameters (The MOS Sleepscale, Hays & Stewart 1992) was sent at 3 points in time over twelve months in 2005 (February, June, October) to 150 RLS patients cared for at the Quebec Memory & Motor Skills Disorders Clinic. A last section exploring changes in hobbies, development of new habits and compulsions was added at the third mailing.

**Results:** Data derived from a population of 97 patients having answered all three mailings identified 17 positive responses to compulsions. After re-evaluation only 12 (8 women and 4 men) were found to have truly compulsive behaviours. In two women, simple motor stereotyped sequences in response to sensory urge evoked the phenomenology of Gilles de La Tourette Syndrome. In two other, one male, one female, a reactivation of trichotillomania previously exhibited in childhood was observed. For the other eight patients, abnormal behavioural display was similar to complex compulsory behaviours with short-term rewarding properties such as buying clothes, buying food, eating or gambling. In addition BDI and stress scores significantly contrasted the compulsion (+) vs. compulsion (-) patients. Their MOS sub-scale sleep problem Index I and II showed significantly higher scores and finally, the augmentation phenomenon was of higher prevalence in the C + group at the time of the 3rd questionnaire.

**Conclusion:** In summary, 12 out of 97 RLS patients on stable DA agonist therapy presented with progressive dishinhibition of behaviour possibly shaped by pre treatment gender and individual specificities. None had a previous diagnosis of anxious generalized disorder or obsessive compulsive disorder. They showed more dysphoric and recognized themselves as more stressed than the compulsion (-) group of RLS patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.567>

### **Obstructive sleep apnea and snore treatment with tongue stabilizer device: randomized clinical trial, preliminary data**

L. Prado<sup>1</sup>, A. Jung<sup>1</sup>, A. Prado<sup>2</sup>, K. Carlos<sup>1</sup>, L. Carvalho<sup>1</sup>, G. Prado<sup>1</sup>

<sup>1</sup>Neuro-Sono, UNIFESP, Brazil

<sup>2</sup>Universidade de São Paulo, Brazil

**Introduction:** Obstructive sleep apnea (OSA) treatment with intra-oral devices can be effective especially in mild/moderate OSA. The tongue retention devices (TRDs) demonstrated significantly respiratory events reduction during sleep and improved sleep quality. Objective. Evaluate the efficacy of TRDs in the treatment of OSA.

**Materials and methods:** We included patients with OSA treated in outpatient clinic Neuro-Sono Sleep Center, Neurology Department, Escola Paulista de Medicina, São Paulo, Brazil. Patients with mild or moderate OSA on polysomnography were randomized to start treatment with one of two types of interventions: TRD or dental splint (placebo). Patients were treated for four weeks and then the second polysomnography was performed using the interventions that were randomly allocated. This study continues under blinding and interventions are referred to as A or B, to keep the allocation concealment.

**Results:** We consecutively included 75 patients, of whom 15 did not meet the inclusion criteria and 18 did not attend for evaluations. Forty-two patients were randomized. Twenty-one began treatment with device A and 21 with device B. There were 7 dropouts in total. Among the patients who used device A, only one patient showed no snoring at the end of treatment, compared to 9 patients in group B ( $p = 0.008$ ). In the intra- group analysis, for intervention with device A, there was no difference in mean AHI at baseline and at the endpoint, and for device B, the mean AHI decreased from 18.4 to 12.1 events/h ( $p = 0.05$ ). In the inter group analysis, there was no significant difference in mean AHI between the two devices, but 44% of patients who used device B decreased AHI to less than 10 events/hour, compared to zero in the group with device A.

**Conclusion:** Intervention with devices A and B showed statistically significant differences, but the effect of the interventions with both devices appear to be discrete, and device B seems more effective in solving snoring problems.

**Acknowledgements:** Supported by FAPESP 2009/16758–4, 2010/02633–2, #2010/06188–3.

<http://dx.doi.org/10.1016/j.sleep.2013.11.568>

### **Sleep architecture disturbances in children with bipolar disorder versus attention deficit and hyperactivity disorder: a pilot study**

X. Estrada Prat<sup>1</sup>, I. Alvarez Guerrico<sup>2</sup>, A. Principe<sup>1</sup>, S. Batlle Vila<sup>1</sup>,

L. Martín López<sup>1</sup>, L. Duñó Ambrós<sup>1</sup>

<sup>1</sup>PARC DE SALUT MAR, Child and Adolescent Mental Health Services, Spain

<sup>2</sup>Hospital del Mar, Neurology and Clinical Neurophysiology Department, Spain

**Introduction:** Sleep disturbances on Bipolar Disorder have been widely described and, bidirectionally, some reports point on sleep role on Bipolar Disorder physiopathology. Pediatric Bipolar Disorder (PBD) and Attention Deficit and Hyperactivity Disorder (ADHD) comorbidity is common. Useful biological markers should be found in order to achieve the correct management of both diseases. The

aim of this study is to describe sleep architecture on PBD patients and compare to ADHD children.

**Materials and methods:** Participants: 4 PBD children (3 males; 4 European Hispanic) and 4 ADHD children (4 males; 3 European Hispanic) aged from 7 to 18 years were recruited from the Child and Adolescent Mental Health Services. Instruments: International Neuropsychiatric Interview for Kids and Adolescents (MINI-Kid) was used for diagnostic purposes. WISC-IV below 70 was an exclusion criterion. Socio-demographic data were recorded. BEARS Algorithm and Sleep Disturbance Scale for Children (SDSC) were applied for sleep disturbances screening. Child Depression Inventory (CDI), Child Mania Rating Scale (CMRS) and Young Mania Rating Scale parent's version (p-YMRS) were measured the same day of Nocturnal Polysomnography (NPSG) was performed. Hypnogram characteristics were manually scored. Parameters analyzed were Sleep Efficiency, Sleep Time in N1, N2, N3 and REM stages, NoREM and REM Sleep Latencies, duration and number of REM cycles and REM density values.

**Results:** All PBD and ADHD participants had at least one current comorbid Axis I disorder. Sleep architecture showed a wide diversity. Significant differences in NPSG values according to PBD or ADHD conditions were not found. Only REM density showed a higher mean value on PBD than on ADHD children. 100% of PBD and 75% of ADHD participants were taking psychotropic medication. Correlations between sleep architecture and current medical treatments could not be established. No correlation between scales for the assessment of mood and sleep variables was found.

**Conclusion:** Sleep architecture in PBD and ADHD patients presents heterogeneous patterns. REM density seems to play an important role as biological marker in differential diagnosis of PBD and ADHD. New trials should be applied in order to establish correlations between NPSG variables and PBD or ADHD conditions, psychotropic drugs effects and mood disturbances.

**Acknowledgement:** Neurophysiology Department, Hospital del Mar.

<http://dx.doi.org/10.1016/j.sleep.2013.11.569>

### Treatment of restless legs syndrome with lacosamide. Report of eight cases

F. Prieto<sup>1</sup>, R. Saus-Cantos<sup>2</sup>, F. Puertas<sup>1</sup>

<sup>1</sup> University Hospital La Ribera, Sleep Unit, Spain

<sup>2</sup> University Hospital La Ribera, Family Medicine, Spain

**Introduction:** Restless Legs Syndrome (Willis-Ekbom disease) is a neurological disorder characterized by a strong urge to move the legs, usually accompanied or caused by uncomfortable and unpleasant sensations in the legs; these symptoms worsen during periods of rest or inactivity, are relieved by movement and are worse during evening or night than during the day. As established by scientific evidence and guidelines, non-ergot dopaminergic agonist (DA) are the first line treatment for idiopathic RLS, alternative medications and second line treatments include antiepileptic agents (AED), opioids and benzodiazepines. Among the AED, the ligands of alpha-2 delta subunit of voltage-gated calcium channels gabapentin, gabapentin enacarbil and pregabalin, have demonstrate a therapeutic efficacy in RLS and also in neuropathic pain. RLS successful treatment is frequently limited by the partial effect of current therapies, fluctuations of the symptoms or drugs adverse effects. Lacosamide, a new anti-convulsant and neuropathic pain drug that modulates voltage-gated sodium channels, has no data about its effect in RLS to date.

**Materials and methods:** Eight idiopathic RLS patients followed up at the Hospital de la Ribera Sleep Medicine Center from 2009 to

2012, under conventional treatment with DA and/or other AED, that showed none or partial response of RLS symptoms, were treated with lacosamide. The impact of lacosamide in RLS symptoms were measured using validated scales such as Restless Legs Syndrome Rating Scale (IRLSSG-RS), before and after the lacosamide introduction. Dose adjustment and adverse effect were monitored during follow up visits.

**Results:** All results are presented as mean  $\pm$  standard deviation. Time of treatment with lacosamide ranges from 4 to 36 months, (21 $\pm$ 11.01). Single dose varies from 50 mg. to 250 mg. four patients are taking two daily doses (afternoon and evening) and three one bedtime dose. IRLSSG-RS showed a significant improvement, with pretreatment scores of 36  $\pm$ 3.03, (range 32–40) and post-treatment scores of 5.16  $\pm$ 4.35 (range 0–10). The mean change of score was 30.83  $\pm$ 5.56 (range 25–40). In only one case lacosamide was withdrawn because no effect after 3 weeks of treatment.

**Conclusion:** Our preliminary results show that lacosamide, as other antiepileptic drugs widely studied for RLS, appears to be a reasonable option of treatment when other drugs fail or can be used as adjunctive therapy in cases of partial response.

<http://dx.doi.org/10.1016/j.sleep.2013.11.570>

### A simplified approach to model-based analysis of the ultradian sleep homeostasis through fitting time courses of its eeg indicators obtained across routine clinical sleep lab recordings of all-night sleep and multiple 20-min napping attempts

A. Putilov

Research Institute for Molecular Biology and Biophysics, United States

**Introduction:** A mathematical formulation of an ultradian process proposed by the elaborated version of the two-process model of sleep-wake regulation appears to be relatively complex compared to a very simple formulation of a homeostatic process suggested by this, and all earlier versions of the model. The methodology of numerical simulation of these two processes is based on fitting time courses of electroencephalographic (EEG) slow-wave activity obtained during, at least, two sleep episodes, a baseline sleep episode and the following episode challenged by shortening or prolongation of wakefulness. The aim of the present paper was to test a suggestion that the simulating approach to investigation of the diurnal and ultradian alternations between sleep-wake states and sub-states can benefit from several conceptual, mathematical, and methodological simplifications.

**Materials and methods:** In order to derive the parameters of both processes, similar (very simple) formulae were used for fitting time courses obtained during only baseline sleep of 14 women of different ages.

**Results:** The correlation coefficient between the simulated and empirical time courses attained value above 0.98. The derived parameters were used to predict a time course obtained across 12 very short (20-min) napping attempts of 9 sleep deprived and 9 sleep restricted young men. A coefficient between the predicted and empirical time courses (0.89) was only slightly lower than a coefficient between the same empirical time course and its direct simulation with the two-process model (0.92).

**Conclusion:** In theoretical terms, the suggested simplified approach to modeling and simulation of the ultradian sleep homeostasis provides a parsimonious explanation of the basic principles of sleep-wake regulation. In practical terms, it can be implemented into a model-based analysis of numerous polysomnographic recordings of normal and disturbed sleep that are routinely collected every night in many clinical sleep laboratories around the world.

**Acknowledgements:** The experimental and theoretical studies were supported by the Russian Foundation for Basic Research, and the Russian Foundation for Humanities (grants 07–06–00263–à, 10–06–00114– à, 06–06–00375–a, and 12–06–18001–e). I have benefited greatly from help of Olga Donskaya, Dr. Vladislav Palchikov, Dr. Konstantin Danilenko, and Dmitriy Zolotarev (Hefele) in the EEG data collection and analyses, and from help of Dr. Evgeniy Verevkin in simulation of these data.

<http://dx.doi.org/10.1016/j.sleep.2013.11.571>

### The role of psychological morbidity on sleep quality and lifestyle in adolescents

S. Pucci, M. Graça Pereira

Universidade do Minho, School of Psychology, Universidade do Minho

**Introduction:** To analyze the mediating role of psychological morbidity in the relationship between daytime sleepiness and sleep quality as well as between daytime sleepiness and lifestyle.

**Materials and methods:** A sample of 272 adolescents, from both genders, between 12 and 18 years old, participated in the study. The instruments used were: Modified Excessive Sleepiness Scale to Adolescent (Billings & Berg-Cross, 2010), Pittsburgh Sleep Quality Index (Buysse et al, 1989), Hospital Anxiety Depression Scale (Zigmond & Snaith, 1983) and Lifestyle Questionnaire (Pereira & Pedras, 2008). All instruments were adapted to the Portuguese population.

**Results:** Mediation analysis was tested through bootstrapping. Psychological Morbidity (anxiety and depression) mediated the relationship between excessive daytime sleepiness and sleep quality ( $p = .005$ ), and between excessive daytime sleepiness and lifestyle, in adolescents ( $p = .01$ ).

**Conclusion:** The results emphasize the importance of psychological morbidity on sleep quality and lifestyle, in adolescents. Therefore, interventions to increase sleep quality should target daytime sleepiness in adolescents and focus on psychological morbidity, as early as possible.

**Acknowledgements:** The work was partially carried out under the Erasmus Mundus Student Mobility grant 2009–1670/001–001–ECW.

<http://dx.doi.org/10.1016/j.sleep.2013.11.572>

### Assessment of the movements in REM sleep behaviour disorder (RBD) patients during the rapid ocular movement in REM sleep

M. Pujol<sup>1</sup>, F. Cruz<sup>2</sup>, J. March<sup>3</sup>, L. Gispert<sup>1,2,3</sup>, F. Barbé<sup>2</sup>

<sup>1</sup> H. Santa María, SEN, SES, United States

<sup>2</sup> H. Santa María, United States

<sup>3</sup> IRB Lleida, United States

**Introduction:** REM sleep behaviour disorder is characterized by the intermittent loss of REM sleep atonia and by the appearance of motor activity associated with dream mentation. Although the characteristic RBD movements are well known there are few descriptions of the relationship between these movements and the typical rapid eye movements occurring during REM sleep. To assess the occurrence, frequency and characteristics of REM sleep movements in RBD patients and their association with rapid ocular movements.

**Materials and methods:** Eighteen consecutive patients with RBD underwent synchronized audiovisual polysomnography recording the mentalis muscle, bilateral biceps brachii and anterior tibialis. Eleven patients with sleep disordered breathing effectively treated with CPAP, matched for age and sex served as controls. We analyzed

EMG activity associated to the movements or vocalization detected in the video and studied if they occurred simultaneously with the bursts of rapid ocular movements (RemB).

**Results:** Eighteen RBD patients, 16 with Parkinson disease and 2 with idiopathic RBD (16 men; mean age 71 years) were included. Mean percentage of REM sleep was  $7.64\% \pm 4.3$  in patients and  $9.27\% \pm 5$  in controls. In RBD: for upper extremities the mean number of movements associated with RemB was 12.9 and 19.7 for those not associated with RemB ( $P: 0.2$ ). For body jerking these values were 5.7 and 1.9 respectively ( $P: 0.1$ ); for complex movements 4.9 and 2.7 ( $P: 0.4$ ); for mouth movements 2.7 and 3.6 ( $P: 0.4$ ), for neck myoclonus 1.05 and 1.0 ( $P: 0.65$ ); and for vocalization 0.7 and 0.6 ( $P: 0.2$ ). RBD patients had significantly more movements during REM than controls ( $P < 0.018$ ). In all the muscle groups analyzed there were no significant differences between the number of movements associated with RemB and those occurring independent of RemB ( $P > 0.1$ ).

**Conclusion:** The frequency of the involuntary movements during REM sleep in RBD patients does not depend on the presence of rapid ocular movements of REM sleep.

**Acknowledgement:** We thank Dr. Joan Santamaria for his scientific supervision.

<http://dx.doi.org/10.1016/j.sleep.2013.11.573>

### Study of neck myoclonus isolated and associated to other involuntary movements during the sleep

M. Pujol<sup>1</sup>, J. March<sup>2</sup>, M. Utgés<sup>3</sup>, F. Cruz<sup>4</sup>, F. Barbé<sup>5</sup>

<sup>1</sup> Hospital Santa Maria, SEN, SES, United States

<sup>2</sup> IRB, United States

<sup>3</sup> Hospital Santa Maria, psychiatrist, United States

<sup>4</sup> Hospital Santa Maria, United States

<sup>5</sup> Hospital Santa Maria, IRB, United States

**Introduction:** We assessed the frequency and characteristics of neck myoclonus during sleep in a prospective sleep-disorder cohort, and investigated its correlates and associations with other involuntary movements.

**Materials and methods:** We studied 51 consecutive patients with parasomnia or hipersomnia (37 men; mean age  $54 \pm 18$ ) undergoing routine time-synchronized videopolysomnography at the sleep laboratory. Neck myoclonus was defined as sudden, non-sustained dorsal or ventral flexion or version of the head to one side with varying amplitude from mild to intense. We differentiated between isolated neck myoclonus and that associated to other involuntary movements in the limbs or body. We excluded neck movements preceded by arousals, positional change, apnea or periodic legs movements.

**Results:** Ninety-six per cent of the patients had at least one neck myoclonus during sleep. The mean number of neck myoclonus was 1.18/h sleep (IC 95%: 0.65–1.72). Movements were more frequent during REM sleep than NREM (1.16 and 0.36 respectively,  $p: 0.016$ ). Isolated and associated neck myoclonus occurred with similar frequency (isolated  $4.0 \pm 5.7$  and associated  $4.7 \pm 7.1$ ). About half of the neck myoclonic movements were accompanied by simultaneous movements of other body parts, predominantly in the arms (mean  $1.8 \pm 2.5$ ), and approximately 50% of them induced an arousal. The number of patients was too small to establish a study by ages.

**Conclusion:** In the sleep laboratory neck myoclonus is observed in most patients but it occurs occasionally, most of them in REM sleep. Isolated neck myocloni are as frequent as neck myocloni associated with other movements in the body, especially arm movements.

*Acknowledgements:* We thank Dr. Joan Santamaria for his scientific supervision.

<http://dx.doi.org/10.1016/j.sleep.2013.11.574>

---

### **Sleep disorders and near-miss accidents among summer long-distance highway drivers**

M. Quera-Salva<sup>1</sup>, F. Barbot<sup>2</sup>, S. Hartley<sup>1</sup>, R. Sauvagnac<sup>3</sup>,  
M. Machou<sup>1</sup>, P. Philip<sup>4</sup>

<sup>1</sup> AP-HP HOPITAL RAYMOND POINCARE, Sleep Unit, France

<sup>2</sup> INSERM CIC-IT 805, AP-HP, Hôpital Raymond Poincaré, France

<sup>3</sup> APHP HOPITAL RAYMOND POINCARE, Physical Health Department,  
France

<sup>4</sup> CNRS SANPSY USR 3413, Université de Bordeaux, France

*Introduction:* To identify risk factors for sleep-related near miss accidents in highway drivers.

*Materials and methods:* Cross-sectional survey including the Epworth sleepiness questionnaire, Basic Nordic Sleep Questionnaire, a travel questionnaire, sleep data for the past 24 h, and usual sleep schedules. Highway-patrol officers in France invited a random sample of automobile drivers to participate.

*Results:* 3051 drivers (mean age,  $46 \pm 13$  years; 75% males) completed the survey, yielding an 80% participation rate; 87 (2.9%) drivers reported sleepiness-related near-miss events during the trip and 8.5% during the past year and 2.3% reported sleepiness-related accidents in the past year. Mean driving time was  $181 \pm 109$  min, mean sleep duration during workweeks was  $468 \pm 74$  min, and mean sleep duration in the past 24 h was  $480 \pm 104$  min. Significant risk factors for sleep-related near misses during the trip were near miss in the past year, non-restorative sleep and snoring in the past 3 months, and sleepiness during the interview. Neither sleep time in the past 24 h nor acute sleep debt (sleep time difference between workweeks and past 24 h) correlated with the occurrence of near misses.

*Conclusion:* Sleep-related near miss accidents remain unacceptably common during long drives on the highway, despite improvements in sleep time before the departure. The exact contribution of sleep-related breathing disorders to sleepiness at the wheel needs to be investigated.

*Acknowledgements:* The study was funded by a grant from the Fondation Vinci pour une conduite responsable.

<http://dx.doi.org/10.1016/j.sleep.2013.11.575>

---



## Abstracts for the 5th World Congress on Sleep Medicine, 28 September to 2 October 2013, Valencia, Spain

### Evaluation of adenotonsillectomy outcome for obstructive sleep apnea syndrome in children, by pre and postoperative polysomnography

R. Ocón Quintial, M. Martínez Martínez, Y. Wu, M. Cabello Najera, M. González Martínez, J. Molina Osorio  
HUMValdecilla, Sleep Unit - HUMV, Spain

**Introduction:** We evaluated, using objective data from pre- and postoperative polysomnography (PSG) data, the outcome of adenotonsillectomy for obstructive sleep apnea syndrome (OSAS) in children in our sleep unit.

**Materials and methods:** Retrospectively study was conducted including 55 healthy children (3–12 years of age) with OSAS, diagnosed on the basis of polysomnography as having an apnea hypopnea index (AHI) of 3 or greater, who underwent adenotonsillectomy between January 2010 and January 2013. Postoperative polysomnography was performed at least 3 months after surgery. Scores from pre- and postoperative polysomnography were compared using statistical analysis software.

**Results:** For all children, the preoperative AHI value was higher than the postoperative value. The mean preoperative AHI was 22.8 with 58.1% (32) with severe OSAS (AHI > 10). The mean postoperative AHI was 2.9. Pathological residual apnea/hypopnea index (defined in this study as residual AHI > 3), was found in 34.5% (19). 68.4% of these children, with pathological residual index, had preoperative severe OSAS. 6 children (31.6%), with preoperative AHI 3–10, had pathological residual apnea/hypopnea index postoperatively.

**Conclusion:** Adenotonsillectomy improves respiratory parameters, measured by polysomnography, in the majority of children but does not resolve OSAS in all children of this group of patients. High preoperative AHI is associated with persistence of pathological residual apnea/hypopnea index after adenotonsillectomy.

**Acknowledgement:** Sleep Unit – HUMValdecilla.

<http://dx.doi.org/10.1016/j.sleep.2013.11.577>

### Patterns of cortical thinning in idiopathic rapid eye movement sleep behavior disorder

S. Rahayel<sup>1</sup>, J. Montplaisir<sup>1</sup>, O. Monchi<sup>2</sup>, C. Bedetti<sup>2</sup>, R. Postuma<sup>1</sup>, J. Gagnon<sup>1</sup>

<sup>1</sup>Centre for Advanced Research in Sleep Medicine, Hôpital du Sacré – Coeur de Montréal, Montreal, Quebec, Canada

<sup>2</sup>Research Centre, Institut universitaire de gériatrie de Montréal, Montreal, QC, Canada

**Introduction:** Rapid eye movement sleep behavior disorder (RBD) is a parasomnia considered as a risk factor for synucleinopathies, such as Parkinson's disease (PD) and dementia with Lewy bodies

(DLB). We investigated gray matter thickness, gray matter density, and white matter integrity in idiopathic RBD (iRBD) patients using corticometry, voxel-based morphometry (VBM), and diffusion tensor imaging (DTI), respectively.

**Materials and methods:** Twenty patients with polysomnography-confirmed iRBD (mean age, 64.2 ± 7.0; 20 men) and 42 age- and gender-matched healthy controls (mean age, 63.2 ± 7.3, 28 men) underwent a 3T structural and diffusion MRI examination. Corticometry, VBM, and DTI data were analyzed respectively using both the CIVET pipeline for minctools and the SurfStat toolbox for MATLAB, FSL-VBM, and Tract-Based Spatial Statistics (TBSS) in FSL. For the corticometry and VBM analyses, age and gender were covaried out, whereas only age was used for DTI analyses.

**Results:** Several regions of the brain presented with decreased cortical thickness in iRBD patients compared to the controls, mainly in the frontal cortex (i.e., gyrus rectus, orbitofrontal cortex, superior frontal gyrus, supplementary motor area), the cingulate and paracingulate cortices, the precuneus, and the lingual and fusiform gyri. As regards gray matter density and white matter integrity, no significant differences between groups were found.

**Conclusion:** iRBD patients have structural alterations in gray matter thickness, mainly in the frontal and cingulate cortices, the precuneus, and the fusiform and lingual gyri. Corticometry appears to be more sensitive than traditional VBM for visualizing gray matter alterations in iRBD patients. The pattern of cortical gray matter abnormalities found in iRBD patients shares several similarities with that found in PD and DLB.

**Acknowledgements:** The study was supported by grants from the Canadian Institutes of Health Research and the Fonds de Recherche du Québec – Santé.

<http://dx.doi.org/10.1016/j.sleep.2013.11.578>

### Insomnia symptoms and mortality

O. Rahkonen<sup>1</sup>, P. Haaramo<sup>1</sup>, E. Lahelma<sup>1</sup>, T. Lallukka<sup>2</sup>

<sup>1</sup>University of Helsinki, Finland

<sup>2</sup>Finnish Institute for Occupational Health, Finland

**Introduction:** Insomnia symptoms are associated with several health outcomes such as somatic and mental health, sickness absence and disability retirement. However, studies on the association between insomnia symptoms and mortality are few and their results inconsistent. In some studies frequent symptoms are associated with higher mortality risk, some others have found no or even reverse associations. Our aim was to examine the association of insomnia symptoms with all-cause mortality among ageing employees.

**Materials and methods:** The Helsinki Health Study baseline questionnaire survey data on 40–60-year-old City of Helsinki employees were collected in 2000–2002 (response rate 67%). These data were linked with register data on mortality until the end of 2011 ( $n = 188$  deaths) for those with written consent for such linkages (74%;  $N = 6,464$ ). Insomnia symptoms included difficulties initiating and maintaining sleep, and non-restorative sleep (none, occasional, i.e. 1–14 nights per month, and frequent, i.e. 15 + nights per month). Baseline covariates included age, sex, education, marital status, obesity, alcohol drinking, physical inactivity, and mental health. Cox regression analysis was used to calculate hazard ratios (HR) and their 95% confidence intervals (CI).

**Results:** At baseline, 21% of women and 17% of men reported frequent insomnia symptoms. The summary measure examining any insomnia symptoms was not associated with all-cause mortality among men or women. However, difficulties in initiating sleep were strongly associated with mortality among men (HR 4.46, 95% CI 2.03–9.77). After adjusting for all covariates, the association attenuated but remained (HR 2.78, 95% CI 1.19–6.48). No associations could be confirmed among women or for difficulties maintaining sleep and non-restorative sleep.

**Conclusion:** Difficulties initiating sleep were associated with mortality among men. Otherwise insomnia symptoms were unassociated with mortality. Studies need to examine insomnia symptoms separately, especially as they may have contrasting associations with mortality. Health care should emphasise early detection and prevention of insomnia symptoms, especially difficulties initiating sleep.

**Acknowledgements:** Funding from the Academy of Finland, Finnish Work Environment Fund and University of Helsinki.

<http://dx.doi.org/10.1016/j.sleep.2013.11.579>

### Magnetic resonance imaging study of peripharyngeal mucosal intensity in obstructive sleep apnea patients

A. Rahmawati<sup>1</sup>, A. Chishaki<sup>2</sup>, M. Nagao<sup>3</sup>, K. Adachi<sup>4</sup>, M. Nishizaka<sup>1,5</sup>, S. Ando<sup>5</sup>

<sup>1</sup> Department of Cardiovascular Medicine, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

<sup>2</sup> Department of Health Sciences, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

<sup>3</sup> Department of Molecular Imaging and Diagnosis, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

<sup>4</sup> Department of Otorhinolaryngology, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

<sup>5</sup> Sleep Apnea Center, Kyushu University Hospital, Fukuoka, Japan

**Introduction:** Obstructive sleep apnea (OSA) is a common sleep disorder characterized by repetitive episodes of airway closure which usually occur in the retro-palatal region of the oropharynx. It has been known that upper airway mucosa in OSA patients is described as edematous. Recurrent injuries owing to vibration of the upper airway tissues or repetitive negative pressure may contribute to this phenomenon. On the other hand, fluid redistribution from the lower to the upper body during nocturnal recumbency could shift the fluid into neck and tissue around airway. The combination of these might contribute the occurrence or worsening of OSA by compressing the airway. Therefore, this study aims to investigate and establish simple magnetic resonance imaging (MRI) parameters, namely T2 mucous-to-masseter intensity ratio (T2MMIR), to assess the degree of tissue water content at the retro-palatal level and its relationship with sleep parameters in OSA patients.

**Materials and methods:** Twenty-seven subjects with OSA underwent polysomnography and cervical MRI with 1.5-tesla during

wakefulness (age  $55.0 \pm 16.5$  y, 77.8% male, with apnea-hypopnea index (AHI)  $54.1 \pm 27.6$  and a body mass index (BMI)  $29.4 \pm 5.5$ ) were included. On the axial T2-weighted images from the epipharynx to the oropharynx, the signal intensities for masseter muscle and peripharyngeal mucosa were measured. T2 mucous-to-masseter intensity ratio was calculated, and was used as an estimate of water content in the retro-palatal region. Pearson correlation analysis was performed to examine the correlation between peripharyngeal T2MMIR and polysomnography parameters.

**Results:** T2 mucous-to-masseter intensity ratio had moderate, positive correlation with supine AHI ( $r = 0.388$ ,  $P < 0.05$ ), AHI ( $r = 0.408$ ,  $P < 0.05$ ), arousal index ( $r = 0.411$ ,  $P < 0.05$ ), and stage 1 sleep ( $r = 0.419$ ,  $P < 0.05$ ). Strong, positive correlation in the T2MMIR and REM AHI was also noted ( $r = 0.645$ ,  $P < 0.001$ ). Meanwhile, mean oxygen saturation had moderate, negative correlation with T2MMIR ( $r = -0.401$ ,  $P < 0.05$ ).

**Conclusion:** This is the first report to establish peripharyngeal T2MMIR as one simple parameter representing peripharyngeal mucosal water contents due to inflammatory edema and/or fluid redistribution during recumbency, related to severity of OSA. This finding suggested its potential usefulness in reevaluation of change of peripharyngeal mucosa after OSA treatment to confirm its success.

<http://dx.doi.org/10.1016/j.sleep.2013.11.580>

### Hyperarousal in insomnia

R. Wix Ramos<sup>1</sup>, A. De Abreu Arvelo<sup>1</sup>, R. Wix Ramos<sup>2</sup>, J. Pastor Gomez<sup>3</sup>

<sup>1</sup> University Hospital "La Princesa" Madrid, Spanish Sleep Society, Spain

<sup>2</sup> Carabobo University, Venezuela

<sup>3</sup> University Hospital "La Princesa" Madrid, Spain

**Introduction:** Insomnia is a common sleep disorder in the world, studies show that has been associated with affective disorders. The hyperarousal state associated with primary insomnia is usually present throughout wakefulness and during sleep, and may be due to an increase in activity of ascending reticular activating system or a reduction in the adaptive drive to sleep. Objectives: analyse the association between insomnia and hyperarousal.

**Materials and methods:** Retrospective study in a sleep medicine unit, 55 patients (27 men's and 28 woman's) age between 17 and 84 (57, 2 years old) with a primary diagnosis of insomnia without medication were included. Insomnia diagnosis was defined by ICSD2. In the polysomnography (PSG) objective insomnia was defined by: sleep onset latency longer than 30 min (sleep onset insomnia), wake after sleep onset lasting more than 30 min (sleep maintenance insomnia), total sleep time shorter than 360 min and a terminal wakefulness longer than 30 min (insomnia with too short duration or early morning awakening) or a combination of previous quantitative criteria (mixed type insomnia). The hyperarousal state was defined by index 14/hour of arousal spontaneous index in no REM sleep (ANREM). Association between depressive and anxiety symptoms was determined by a cut-off 50 in each by zung test and compare the PSG of patients who had normal zung test, insomnia severity index (ISI) 15 has defined as clinical insomnia moderate or severe.

**Results:** Patient with comorbidity anxiety and depression (81%) were categorized and 19% without mood disorders. 28% of the patients had sleep onset insomnia, 22% sleep maintenance insomnia, 28% insomnia with too short duration or early morning awakening and 22% mixed type insomnia. Of all patients 78% had hyperarousal state, the arousal spontaneous index in no REM sleep was 28.4 per hour (0.8–71). The correlation coefficients were

significant between ANREM and anxiety ( $P < 0.05$ ), and not significant in depression. The ANREM was significant higher in patients with mood disorder compare with other patients ( $P < 0.001$ ) and depression have a significant correlation with an increase of REM sleep. ISI found 94% of all patients had clinical insomnia moderate or severe.

**Conclusion:** There are electrophysiological evidence of hyperarousal and anxiety in patients with primary insomnia. This suggests that the hyperarousal disorder underlying this condition affects both sleep and wake-fulness.

**Acknowledgement:** Hospital La Princesa, Almevan, Circadin.

<http://dx.doi.org/10.1016/j.sleep.2013.11.581>

### Obstructive sleep apnea out patient screening study

E. Rasul<sup>1</sup>, A. Patel<sup>1</sup>, A. Khan<sup>2</sup>

<sup>1</sup> Crozer Chester Medical Center, Temple University, United States

<sup>2</sup> Pulmonary Consultants, Crozer Chester Medical Ctr, United States

**Introduction:** Obstructive sleep apnea (OSA) is increasingly being recognized as an important health care issue. Incidence and prevalence of OSA are gradually increasing worldwide. There is increasing evidence that OSA is being considered as an independent risk factor for hypertension, diabetes mellitus, cardiovascular diseases and stroke, leading to increased cardio-metabolic morbidity and mortality. Many questionnaires are available for OSA screening. Many studies done in peri-operative population showed that the STOP-BANG questionnaire (Snoring, Tiredness, Observed apnea, high blood Pressure, BMI >30, Age >50, neck Circumference, Gender male) is the simplest, with a high positive predictive value. A sleep study is advised for anyone who has 3 or more positive variables from STOP-BANG. The purpose of our study was to analyze the STOP-BANG questionnaire's validity for OSA screening in the primary care setting. Currently, there is no available screening tool for OSA in an outpatient setting.

**Materials and methods:** Study involved a retrospective chart analysis from outpatient clinics. Patients from neurology and sleep clinic were excluded. Electronic medical record was used for patient selection. We randomly selected the first 400 patients who had 3 out of 8 variables from STOP-BANG.

**Results:** Out of 400 selected patients, 124 (31%) had 3 variables, 180 (45%) had 4 variables, 54 (13.5%) had 5 variables, 32 (8%) had 6 variables and 10 (2.5%) had 7 variables. Neck circumference was not documented in the charts so the 8th variable was not available. Out of 400 patients with 3–7 positive STOP-BANG variables, only 25% (100/400) received a sleep study and 73% (73/100) were diagnosed with OSA. Out of 400 patients, 124 (31%) had 3 variables, 16/124 (12.9%) got the sleep study and 10/16 (62.5%) were diagnosed with sleep apnea. Similarly 180/400 (45%) had 4 variables, 26/180 (14.4%) got the sleep study and 15/26 (57.7%) were diagnosed with sleep apnea. 54/400 (13.5%) had 5 variables, 28/54 (51.8%) got the sleep study and 21/28 (75%) were diagnosed with sleep apnea. 32/400 (8%) had 6 variables, 23/32 (71.8%) got the sleep study and 18/23 (78.2%) were diagnosed with sleep apnea. Lastly, 10/400 (2.5%) had 7 variables, 7/10 (70%) got the sleep study and 6/7 (85.7%) were diagnosed with sleep apnea. As mentioned earlier, the 8th variable (neck circumference) was not available in the charts so it was not included in the study. Increasing positive variables translated into more patients with confirmed sleep apnea when tested with sleep study.

**Conclusion:** Primary care physicians should screen all high-risk patients using STOP-BANG questionnaire. STOP-BANG is an affirmative screening tool in peri-operative population and our study indicates that it can also be an efficient screening questionnaire in

primary care clinics. However more studies are needed to validate it. OSA is an easily diagnosable condition but often overlooked. Early recognition and treatment of obstructive sleep apnea may prevent adverse health consequences.

**Acknowledgement:** Ashish Rana, M.D.

<http://dx.doi.org/10.1016/j.sleep.2013.11.582>

### Headaches, sleep and academic success in adolescents

T. Rebelo-Pinto<sup>1</sup>, J. Carneiro-Pinto<sup>2</sup>, H. Rebelo-Pinto<sup>2</sup>, T. Paiva<sup>1</sup>

<sup>1</sup> Sleep Medicine Center – CENC, Lisbon, Portugal

<sup>2</sup> FCH, UCP, Portugal

**Introduction:** Sleep complaints often correlate with other health and social problems. During a national study about sleep habits in adolescents, we observed a very high frequency of headaches, so the aim of this work was to analyse what could be correlated with this complaint in terms of sleep duration, daytime sleepiness, academic success, age and gender.

**Materials and methods:** We used a specific questionnaire that included Cleveland Adolescent Sleepiness Scale (CASQ) and other variables concerning sleep related habits, sleep complaints, health complaints and demographics. Teachers from 31 schools across Portugal collected data between January and April, 2012. We used SPSS to analyse data.

**Results:** The 6838 participants were between 12 and 22 years old, mean = 14.97(1.99); 53.3% were females. From the whole sample, 53.8% (3671) students reported having headaches regularly. Those with a headache complaint slept less hours during weekdays ( $p = 0.008$ ) and more hours on weekends ( $p = 0.045$ ); they also had more daytime sleepiness ( $p = 0.000$ ), but showed no differences on academic success ( $p > 0.050$ ). As expected girls had more headaches than boys ( $p = 0.000$ ) and there were no differences across age, since all groups had high frequency of headaches ( $p = 0.098$ ).

**Conclusion:** These results suggest that in adolescents headaches are also related to sleep deprivation or sleep problems. In the future, we should pay more attention to headaches as a symptom of sleep problems and explore which factors may mediate the risk of academic failure in the presence of headaches. Furthermore, the high level of headaches in younger people across all age groups supports the need of early intervention.

**Acknowledgements:** The Sleep-Schools Project team Sleep Medicine Center – CENC, Lisbon.

<http://dx.doi.org/10.1016/j.sleep.2013.11.583>

### A taxometric analysis of the children's sleep habits questionnaire

F. Ren<sup>1</sup>, G. Wang<sup>2</sup>, M. Wang<sup>3</sup>, J. Zhang<sup>1</sup>

<sup>1</sup> Institute of Psychology, Chinese Academy of Sciences, China

<sup>2</sup> East China Normal University, China

<sup>3</sup> Central South University, China

**Introduction:** Sleep problems characterized by later bedtimes, insomnia and excessive daytime sleepiness occur in different populations. Sleep problems are highly prevalent, affecting approximately 20–30% of children, and they influence multiple domains of child and family functioning as proven studies using different methods. Sleep problems are connected with many psychiatric disorders, including ADHD, autism, cognitive functioning problems, and behavior problems et al. There is an old important issue in the psychopathology field as to whether the latent construct is dimensional or taxometric. This study

examined the latent structure of the sleep problems measured by the Childrens Sleep Habits Questionnaire (CSHQ).

**Materials and methods:** Participants We took the cluster-stratified sampling procedure, and chose 4 districts in Shenzhen. In each district, a primary school was chosen, and in each school, one class was chosen in each grade. 950 parents of the selected children participated in the paper-and-pencil survey during parents' meetings held at the schools between late February and early March in 2011. Finally, we had 912 questionnaires available. The sample population consisted of 912 children aged 6–14 years inclusive, including 495 boys (54.3%), 413 girls (45.3%) and 4 missing values about gender (0.4%), with a mean age of 8.9 years ( $SD = 1.9$ ). The children were comprised of first through sixth grade and they came from schools in Shenzhen City, which is located in the south of China mainland. The number and the portion of each grade are as follows: the first grade 235 (25.8%), the second grade 135 (14.8%), the third grade 155 (17.0%), the fourth grade 133 (14.6%), the fifth grade 136 (14.9%), and the sixth grade 118 (12.9%). There were 170 missing values in total, and we took the expectation maximization (EM) method to replace them. Measures The CSHQ is a sleep questionnaire for children designed for screening a wide range of sleep problems among school age children. According to recall of a recent typical week, parents rated the occurrence of 33 sleep habits or sleep problems on a 3-point scale: 3 = usually (5–7 times/week), 2 = sometimes (2–4 times/week), 1 = rarely (0–1 times/week). The questionnaire yields a total score and eight subscale scores: Bedtime Resistance, Sleep Onset Delay, Sleep Duration, Sleep Anxiety, Night Wakings, Parasomnias, Sleep Disordered Breathing and Daytime Sleepiness. The higher the score, the more likely to have sleep problems. A total score above 41 is considered to have a serious sleep problem. The CSHQ has demonstrated adequate reliability (coefficient alpha 0.68–0.78, test-retest reliability 0.62–0.79) and validity. In this study, we took the Chinese language version of the CSHQ. Reliability (coefficient alpha 0.71) and validity (content and construct) of the Chinese version of CSHQ are good. In order to identify the latent structure of CSHQ, we used three independent taxometric procedures: MAMBAC (mean above minus below a cut), MAXEIG (maximum eigenvalue) and L-Mode (latent-mode factor analysis). We applied three taxometric procedures to analysis our data and used Ruscio's taxometric R program (<http://www.tcnj.edu/~ruscio/taxometrics.html>) to get taxometric plots and ran all calculations.

**Results:** Sleep problems were measured by three main factors – we called F1–F3 (bad sleep habit/problems about sleep disorders/problems about sleep time and daynapping). We took three taxometric analysis procedures (MAMBAC/MEIGN/LMODE) to apply in the latent structure analysis of the CSHQ. Three indicators were used in the taxometric analysis procedures, which have enough wide range and proper Skewness and Kurtosis. The correlations between indicators were around 0.3. Most of the Cohen's  $d$  values except one are larger than 1.25SD, indicating the indicators deemed appropriate for taxometric analysis.

**Conclusion:** The present study indicates that the latent structure of the CSHQ is dimensional. It aids in better understanding of the latent structure of CSHQ-measured sleep problems among Chinese school-aged children.

**Acknowledgements:** The authors thank the lovely children and their parents and teachers. We also appreciate the efforts of Rui Ma (Nanshan Xuefu Primary School, Shenzhen, China), Lin Lin and her three classmates (Shenzhen University, China) for their help with data collection and entry.

<http://dx.doi.org/10.1016/j.sleep.2013.11.584>

## Melatonin reverts signs of aging in the sleep of rats

P. Barceló, M. Akaârîr, M. Fiol De Roque, G. Vallés  
Universitat de les Illes Balears, Spain

**Introduction:** Two basic properties summarize the biological effects of melatonin: the antioxidant properties and its activity as a marker of biological time. Both effects may counteract the deleterious consequences of aging. First, the cellular damage caused by free radicals has been claimed as a factor to explain many effects of aging. In addition, aged individuals suffer important perturbations in their sleep and biological rhythms. Both effects coincide with the practical suppression of melatonin secretion in aged individuals, a fact suggesting the therapeutic effectiveness of melatonin to revert the consequences of aging. The present study aims at recording the effects of melatonin administration to revert the effects of age in the sleep of rats.

**Materials and methods:** Wistar young and old rats (3 and 24 months, respectively, at the beginning of experiments) were used for the study. Two weeks before starting treatment, each animal was surgically implanted with two monopolar electrodes in the surface of the cortex for EEG recording and two bipolar EMG electrodes in the neck muscles for EMG. EOG electrodes were not used. Instead, REM sleep was identified by the presence of theta waves in the EEG and eye movements were monitored through a closed video system. After recovery, the rats were housed individually and received ad libitum food. For drinking, old rats of the experimental group received melatonin dissolved in ethanol and then diluted in water in a proportion of 2%. The melatonin contents was calculated to provide an approximate daily dose of 1 mg/kg bw during 30 days. The volume of consumed liquid was recorded every day and the proportions were corrected accordingly to maintain the desired dosage. Young and old control animals only received the 2% ethanol/water mixture. After 30 days of melatonin administration, the sleep of the rats was recorded during two hours (12:00–14:00). Samples of the recordings were selected corresponding to unambiguous waking, NREM and REM stages avoiding artifacts. The EEG recordings were submitted to Fourier analysis to obtain the power in the four typical frequency ranges.

**Results:** Aged control rats showed a significant reduction in delta and theta EEG power when compared to young controls. Melatonin administered to the experimental group reverted the changes, increasing delta and theta power during NREM and NREM, respectively. No significant changes were observed in waking. These results suggest the effectiveness of exogenous melatonin administration to correct the sleep perturbations observed in aged individuals.

**Conclusion:** Chronic low doses of melatonin improve the sleep quality in aging rats.

<http://dx.doi.org/10.1016/j.sleep.2013.11.585>

## The glycemic index of a mid morning snack modifies the body temperature rhythm

J. Belzunce, C. Noguera, L. Gené, R. Rial  
Universitat de les Illes Balears, Spain

**Introduction:** The structure of a circadian rhythm depends on the activity of the suprachiasmatic clock, on the presence of zeitgebers, and on the presence of masking factors. Regarding body temperature, a clear circadian rhythm is well recognized, with maximal values approaching dusk and minimal in the small hours, near dawn. However, masking factors can enhance or reduce the amplitude of

the circadian rhythms. Food eating is a masking factor on the body temperature rhythm, probably related to the Thermal Effect of Food (TEF), a measure of the energy spent for the digestion, absorption, and disposal of a given amount and type of food. Also, the Glycemic Index (GI) shows how quickly blood glucose rises after eating a given amount and type of food. As high GI foods require lower digestive processing, their TEF should be lower than that of lower GI. The present study aims at recording the consequences of modifying the GI of a mid morning snack on the whole 24 h body temperature cycle in young human subjects.

**Materials and methods:** The study was conducted on 15 university students (8 female, 7 male, 19–25 years old). Each subject was provided with an activity meter and a wrist temperature holder during two non consecutive periods of 5 days. During the experimental days, each subject ingested between 10.30–11.30 AM one of two snacks of precise composition with low and high GI. Each participant was blind to the GI of the snack ingested.

**Results:** Significant differences were found between the averaged peripheral temperature of the subjects during light and dark periods. Also, the 2nd harmonic component (12 h) was modified. From the well known phase opposition between central and peripheral temperature, the results point to changes in the central temperature cycle. Arguably, TEF dependent changes in the peripheral dissipation could occur without real changes in the core temperature. However, the TEF consequences does not extend beyond 6 h after ingestion, while the recorded changes in peripheral temperature showed long term effects, being extended up to the whole 24 h cycle. Therefore, the body temperature seems to have been modified as a consequence of the nutritional properties of a small mid morning snack.

**Conclusion:** The body temperature cycle shows a high sensitivity to the GI of a minor meal.

<http://dx.doi.org/10.1016/j.sleep.2013.11.586>

### Transcutaneous carbon dioxide during episodes of apnea and upper airway flow-limitation

V. Rimpilä<sup>1</sup>, T. Saaresranta<sup>2</sup>, K. Hosokawa<sup>3</sup>, H. Huhtala<sup>1</sup>, O. Polo<sup>3</sup>

<sup>1</sup> University of Tampere, School of Medicine, Finland

<sup>2</sup> University of Turku, Department of Physiology, Sleep Research Unit, Finland

<sup>3</sup> University of Tampere, School of Medicine, Department of Pulmonology, Finland

**Introduction:** Falling asleep is associated with decreasing chemosensitivity and increasing transcutaneous carbon dioxide (tcCO<sub>2</sub>). We hypothesize that the ventilatory gain for respiratory stimuli can be estimated by measuring the level of tcCO<sub>2</sub>. Therefore, the level of tcCO<sub>2</sub> measured during repetitive episodes of various respiratory events should follow the order of decreasing ventilatory gain (central apnea, mixed apnea, obstructive apnea, hypopnea and flow limitation). To test our hypothesis, we analyzed the tcCO<sub>2</sub> levels during wakefulness, steady breathing during sleep and during the above-mentioned respiratory abnormalities.

**Materials and methods:** A total of 174 consecutive cardio-respiratory sleep recordings were retrospectively analyzed. Recordings were included if three of the following episodes and corresponding tcCO<sub>2</sub> levels could be determined: (1) wakefulness, (2) highest steady level of tcCO<sub>2</sub> during steady breathing (to exclude REM), and (3) repetitive respiratory event (central, mixed, obstructive apnea or hypopnea). Inspiratory flow limitation was included when present. Minimum duration of an episode was either five minutes or at least ten similar respiratory events. TcCO<sub>2</sub> during the respiratory episodes were tested against those measured

during wakefulness and steady breathing during sleep (Wilcoxon signed ranks test).

**Results:** Thirty-one recordings (29 m/2f) with 69 episodes were included to the study. Mean age was 51 (range 32–71) and mean AHI was 25.8/h (range 8.6–52.9/h). TcCO<sub>2</sub> while awake (5.21 kPa) did not differ from that during central (5.12 kPa,  $p = 0.128$ ,  $n = 7$ ) or mixed apnea (5.14 kPa,  $p = 0.068$ ,  $n = 4$ ), whereas it did differ from obstructive apnea, hypopnea, steady breathing and flow-limitation ( $p \leq 0.002$ ). TcCO<sub>2</sub> during steady breathing (5.63 kPa) was higher during episodes of central apnea (5.12 kPa,  $p = 0.018$ ) and hypopnea (5.59 kPa,  $p = 0.014$ ,  $n = 20$ ) but lower during flow limitation (5.64 kPa,  $p < 0.000$ ,  $n = 26$ ). TcCO<sub>2</sub> during steady breathing was at similar level as recorded during episodes of mixed (5.14 kPa,  $p = 0.273$ ,  $n = 4$ ) or obstructive apnea (5.32 kPa,  $p = 0.136$ ,  $n = 12$ ).

**Conclusion:** As predicted by our hypothesis, tcCO<sub>2</sub> levels reflect the ventilatory gain: respiratory events associated with high ventilatory gain are accompanied by tcCO<sub>2</sub> levels higher than wakefulness but lower than steady breathing. In contrast, flow limitation with low ventilatory gain appears with high tcCO<sub>2</sub>. TcCO<sub>2</sub> signal during sleep could be used to rank respiratory events according to their ventilatory gain.

**Acknowledgement:** The authors would like to thank Aaro Salminen for providing valuable assistance in the preparation of this work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.587>

### Comparison of the clinical and polysomnographic findings in OSA patients vs REM SDB

D. Rocha, E. Matos, A. Ferreira, M. Calvo

CHTMAD, Portugal

**Introduction:** Currently the prevalence of OSAS associated with REM sleep is 10–36% of the population with OSA. Previous studies have shown that the symptoms, clinical and sleep structure of REM-related sleep disordered breathing (REM SDB) is very similar to the OSA, however, there are other studies that point to the gender and age may have an important role in REM SDB, and another suggests that this reflects only the normal progress of the disease. The aim of this study is to compare the clinical, symptoms and polysomnographic characteristics between patients with OSA and the patients with REM SDB.

**Materials and methods:** We analyzed all exams from CHTMAD database between January 2010 and June 2012. From the patients with suspected of OSA (915), were selected as sample 268 patients who had AHI >5/h in TTS, and weren't subjected to split-night, subsequently were analyzed for anthropometric characteristics, clinical symptoms and polysomnographic features. Patients were divided into two groups, 150 patients with OSA and REM SDB 118 patients. For REM SDB inclusion criteria were AHI >5/h, and the ratio of AHI rem/IAHnrem 2, and to included patients with OSAS the criterion was IAH >5/h and ratio rem/IAHnrem >2.

**Results:** Of the 268 patients 79 were female. The mean BMI was 30.4 kg/m<sup>2</sup>. The mean AHI was 20.6/h. The mean age was 56.1 years. There was statistically significant differences between OSA and REM SDB in pulmonary pathology, wasn't found differences between OSA and REM SDB in the symptoms, within the anthropometric variables there was statistically significant differences by gender, where males had a higher prevalence in the OSA, while in REM SDB the prevalence was similar in both genders. In the polysomnographic characteristics, there were significant differences in the severity of disease, in both IAH and RDI total result, no differences for the remaining parameters.

**Conclusion:** We verified that we can't consider REM SDB as a separate entity from OSAS, presenting generally in patients with the same characteristics and the same symptomatic clinical complications that OSAS. However, it should point out to a greater prevalence of REM SDB in women when compared with the OSA, as well as the severity of the disease that is usually more severe in OSA than in REM SDB, which may indicate an initial phase of the condition, this suggestion, should be explored in further studies, including evaluating the evolution of REM SDB patients over time and evaluate the progression of the disease or not.

**Acknowledgements:** To our family and colleagues.

<http://dx.doi.org/10.1016/j.sleep.2013.11.588>

### **Ambulatory circadian monitoring (ACM), a complementary tool in sleep medicine**

B. Rodríguez-Morilla<sup>1</sup>, M. Campos Martínez<sup>2</sup>, J. Paniagua Soto<sup>3</sup>, C. Estivilldomènech<sup>4</sup>, M. Rol De Lama<sup>5</sup>, J. Madrid Pérez<sup>5</sup>

<sup>1</sup>Chronolaboratory, Department of Physiology, University of Murcia, Spain

<sup>2</sup>Departamento de Informática y Sistemas, Facultad de Informática, Universidad de Murcia, Spain

<sup>3</sup>Unidad del Sueño, Servicio de Neurofisiología Clínica, Hospital Universitario Virgen de las Nieves, Spain

<sup>4</sup>USP Institut Universitari Dexeus, Clínica del son Estivill, Spain

<sup>5</sup>Laboratorio de Cronobiología, Departamento de Fisiología, Facultad de Biología, Universidad de Murcia, Spain

**Introduction:** In developed societies it is common to suffer from sleep disorders due to primary alterations in the circadian system (CS). Moreover, sleep disorders lead to CS disturbances, thus diagnosis and treatment of circadian and sleep disorders should not be addressed separately. The aim of this work is to present the ambulatory circadian monitoring (ACM) and its utility for sleep medicine. To this, wrist temperature (T), motor activity (A), body position (P), light exposure (L) and environmental temperature (ET) were monitored in subjects suffering from different sleep pathologies.

**Materials and methods:** Eight healthy volunteers and eight patients, attending to two sleep clinics, with different pathologies (SHAOS, ASP, DSP, free-running rhythm, short sleeper, aging and menopause), participated in this study. Volunteers were subjected to ACM during a week using a multichannel device (Kronowise™, Chronolab, Univ. of Murcia) integrating five sensors: three built into a wristwatch (T, L, ET) and two on a bracelet (A and P). Sleep-wake states were inferred using the integrated variable TAP and Circadianware software (Chronolab, Univ. Murcia). Rhythmic and sleep analysis were performed by non-parametric, Fourier and periodogram analysis. Circadian robustness was assessed by the circadian function index (CFI) calculated from rhythm stability, fragmentation and amplitude of TAP variable.

**Results:** Polygraphic representation of variables recorded by ACM allowed the differentiation of sleep pathologies. Accurate circadian phase estimation, and thus, ASP and DSP detection, was determined using the L5 timing (the five consecutive hours of minimum TAP). SHAOS was associated with impaired T rhythm, together with increased A during the five consecutive hours of minimum activity (L5). Sleep pathologies can be discriminated by biphasic representation of CFI and one index of sleep depth, (L5 for A or TAP). Patient with SHAOS, DSP and free-running sleep, suffered from chronodisruption (dissociation between T and A, P and sleep rhythms).

**Conclusion:** The ACM allows a reliable assessment of CS status and the detection of sleep pathologies, particularly abnormal sleep phase

and non-deep and fragmented sleep, such occurs in SAHOS, insomnia, and hot flushes. The proposed procedure contributes to an integrated diagnosis and treatment for sleep and circadian disorders in sleep clinics.

**Acknowledgements:** Study supported by RETICEF (RD12/0043/0011), MINECO (BFU2010-21945-C02-01), TIN2009-14372-C03-01 to MC and INNFACTO (IPT-2011-0833-900000) to JAM.

<http://dx.doi.org/10.1016/j.sleep.2013.11.589>

### **Restless legs syndrome in pregnancy**

P. Giménez<sup>1</sup>, T. Canet<sup>2</sup>, E. Adsuar<sup>3</sup>

<sup>1</sup>Sleep Center, Vistahermosa Hospital, Spain

<sup>2</sup>Sleep Center, Virgen de los Lirios Hospital, Spain

<sup>3</sup>Gynecology Department, Vistahermosa Hospital, Spain

**Introduction:** RLS affects 5–10% of the general population, but it affects 25% of pregnant women. Sleep disorders are common in RLS. The aim of this study was to determine the frequency of RLS in pregnancy, its characteristics and associated sleep complaints.

**Materials and methods:** 50 pregnant women followed at the gynecology department of Vistahermosa Hospital. They completed Stop, Berlin and Pittsburgh questionnaires. The IRLSSG criteria were investigated by self-administered questionnaire and by telephone interview by a sleep specialist. Polysomnograms were obtained with a recording of the movements of both legs.

**Results:** 35 of 50 patients (70%) completed all questionnaires and polysomnograms was recorded in 100%. Middle age was 34 ± 4. 20% of the patients meeting IRLSSG criteria, 71% reporting the beginning of the symptoms at the end of the second trimester of pregnancy and 42% described sporadic symptoms before pregnancy ( $p < 0.05$ ). 66% described a moderate-severe intensity of the symptoms, with a frequency of 4–7 nights/week (17%), 2–5 nights/week (33%) and 50% with a low frequency. One pregnant woman was evaluated in the second and the third trimester with worsening intensity and frequency of symptoms and she was completely asymptomatic the first night after delivery. Family history was present in the 45% of the cases and PLM >5 were found in 14%. Patients with RLS were younger ( $\leq 35$  years) ( $p < 0.05$ ). No correlation was found between RLS and time of sleep onset longer than 30 min, night awakenings or total sleep time, reporting sleep quality in the last month as good. RLS pregnant were not more sleepy during the day nor did they have a significant frequency of mood disorder. No differences were found in IAH, RDI or the presence of previous snoring. Of the patients who had delivered at the time (57%) reported resolution of the symptoms, 75% immediately after delivery and in the one case two weeks after it.

**Conclusion:** RLS is frequent during pregnancy affecting 20% of pregnant woman especially in the second half and usually resolving after delivery. We want to highlight that a considerable number of patients reported RLS symptoms just before pregnancy and a family history was present. Our patients described symptoms mainly as moderate-high intensity, they didn't complain of sleep disturbances, perhaps because 50% of them reported a low frequency of symptoms (less than 2–5 nights/week).

**Acknowledgements:** We want to thank to all the pregnant women who have participated in the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.590>

**Restless legs during pregnancy: the role of ferritin**P. Giménez<sup>1</sup>, T. Canet<sup>2</sup>, E. Adsuar<sup>3</sup><sup>1</sup> Sleep Center, Vistahermosa Hospital, Spain<sup>2</sup> Sleep Center, Virgen de los Lirios Hospital, Spain<sup>3</sup> Gynecology Department, Vistahermosa Hospital, Spain

**Introduction:** RLS affects 5–10% of the general population, but it also affects 25% of pregnant women. Although iron, genetics and central nervous dopamine have been shown to play a major role in RLS unrelated to pregnancy, its etiology in pregnancy remains unclear. The aim of this study was to determine risk factors associated to RLS in pregnancy.

**Materials and methods:** Healthy pregnant women treated at the Vistahermosa Hospital Gynecology Department were asked to complete IRLSSG criteria by self-administered questionnaire and a sleep specialist made the clinical diagnosis of RLS by telephone interview. PCR was registered with a recording of the movements of both legs. Ferritin levels were determined.

**Results:** Fifty patients were registered and 35 (70%) completed all questionnaires and everyone was studied by PCR. Average age was  $34 \pm 4.20\%$  were in the first trimester, 37% in the second and 43% in the third. Ferritin levels were determined in 66% of cases. 20% of the patients met IRLSSG criteria, when asked by both a self assessment questionnaire and when they had a telephone interview with a sleep specialist. 85% of them had iron supplementation during pregnancy. We found low ferritin levels ( $\leq 40$  ng/dl) in a high percentage of pregnant women (75%) and 83% of RLS symptomatic patients had low ferritin levels. The difference was not significant. Family history was positive in 43% of the cases. Of the patients who had delivered at the time 57% reported resolution of the symptom, 75% immediately after delivery and in one case two weeks after it.

**Conclusion:** Pregnancy is a period with special conditions affecting the development of RLS but it has not been well investigated. We have found a family history of RLS in almost 50% of the patients, results indicate a genetic predisposition maybe manifested for first time during pregnancy. We also investigated ferritin levels, and although low ferritin levels were frequent during pregnancy in our sample it was not significantly associated with RLS symptoms. Both results and the fact that symptoms usually resolved in the days after delivery, suggests in our opinion that there must be other mechanisms implicated.

**Acknowledgements:** We want to thank to all pregnant women who have participated in the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.591>

**Medical technology assessment of polysomnography, type 2: full PSG at home – Difference of two unattended PSG at home systems**L. Rohling, C. Blankvoort, E. Mattern-Coren, A. De Weerd  
Sleep Center SEIN Zwolle, Groningen, The Netherlands

**Introduction:** Polysomnography (PSG) in a clinical setting (PSG, type 1) is time consuming and expensive. Type 2, i.e. full PSG at home, is thought to be a good alternative, but has never been evaluated in terms of a medical technology assessment (MTA). In some countries this lack of MTA precludes reimbursement for PSG type 2. This communication is part of a series of posters which add up to MTA of PSG, type 2, and deals with technical failures when recording full PSG at home. This study is designed to evaluate the technical reliability of two different full PSG systems at home, Titanium (Embla) and Siesta (Compumedics Limited).

**Materials and methods:** A retrospective study was set up for evaluation of the two full PSG systems at home. The population which used the Titanium system (T) consisted of 337 patients (age:  $45 \pm 17$  yrs) and for Siesta (S) of 100 patients (age:  $45 \pm 17$  yrs). Patients underwent for two consecutive days type 2 PSG at home with one system. After 24 h, patients returned to the clinic for a check-up. The following signals were evaluated within both systems: EEG (including eye movements and chin EMG), EMGm.tibialis, nasal pressure, inductive beltsthorax and abdomen, and oxygen saturation. Failure was indicated when there was limited recording time or due to technical interruptions. We also estimated the amount of interruption within the recorded signals.

**Results:** Both systems were similar in percentages of patients without any failures in both nights (T:92.9%; S:90.0%,  $p = 0.34$ ). The T-system failed in 3.9% on the first, and 3.0% on the second night. During one recording (0.3%) both nights failed. Failures within the first and second night (5.0%) were similar in the S-system and there were no recordings with failures in both nights. Within the successful recordings there were more saturation and inductive belts interruptions of the S-system. This resulted for saturation in T:22.5% and S:35.1% ( $p = 0.01$ ) and the inductive belts T:3.7% and S:10.0% ( $p = 0.02$ ).

**Conclusion:** It is reliable to perform full PSG type 2 at home with both PSG systems. To minimize the errors in particular for saturation, there is a preference for the Titanium system. Despite the failures, all diagnoses could be made.

<http://dx.doi.org/10.1016/j.sleep.2013.11.592>

**Sleep and ADHD**O. Ciopat<sup>1</sup>, M. Díaz Román<sup>2</sup>, O. Urdanibia Centelles<sup>1</sup>, P. Rubio Sánchez<sup>1</sup>, E. Gomez Siurana<sup>2</sup>, D. Goyo Ibarra<sup>3</sup><sup>1</sup> Agencia Valencia de Salud, Unidad del Sueño Hospital Universitario y Politécnico La Fe, Spain<sup>2</sup> Agencia valenciana de Salud, Unidad del Suelo Hospital Universitario y Politécnico La Fe, Spain<sup>3</sup> Agencia Valencia de Salud Hospital Universitario y Politécnico La Fe, Spain

**Introduction:** Published studies have examined the differences between Attention Deficit and Hyperactivity Disorders (ADHD) subtypes and sleep problems, nevertheless revealing inconsistent results. Retrospective description of subjective and objective sleep parameters in children with ADHD subtypes.

**Materials and methods:** We studied a sample of 25 patients (24 boys and 1 girl), aged 6–17 years old, sent for further PSG study for sleep disorders, that were clinically diagnosed ADHD according to the DSM-IV criteria (5 hyperactive-impulsive subtype (ADHD-H-I), 10 inattentive subtype (ADHD-I), and 10 combined subtype (ADHD-C), twelve taking specific medication. The subjective sleep variables were given by parents in a scheduled clinical interview following a sleep questionnaire. The objective variables were obtained by a one night polysomnography (PSG) study performed in our sleep laboratory.

**Results:** More than 50% of the patients suffered of more than one sleep symptom, the most frequent being: Motor activity during sleep was referred by 60%, somniloquy (56%), bruxism (56%) and awakenings from sleep (56%). Snoring (56%) was reported by parents, observed sleep apnea was in 8% of patients. Other symptoms observed were daytime Sleepiness (24%) and Rest legs Syndrom (RLS) (20%). According to subtypes, the most relevant findings were that the motor activity during sleep was more common in ADHD-H-I (100%), and ADHD-C (60%). Parasomnias were present in the ADHD-H-I

(80%). The snoring was more frequent in the ADHD-H-I (60%) and ADHD-I (70%). RLS was more prominent in ADHD-H-I (40%) and daytime sleepiness in ADHD-I (40%). PSG recordings had similar efficiency and the same sleep structure characteristics in all subtypes, except in the ADHD-I, it was found the maximum awakening time from sleep (WASO), more arousals and periodic limb movement, but only in 30% of them the index was higher than 5/hour. Regarding respiratory disorders, we found a pathological respiratory disturbance index (RDS) in 12% of ADHD patients, 8% out of these belonged to ADHD-C.

**Conclusion:** There are many different subjective complaints about sleep in ADHD patients, but the objective PSG dates showed alterations only in ADHD-I and ADHD-C. The ADHD-I that showed the highest sleep fragmentation and motor activity also had the highest percentage of daytime sleepiness. The percentage of SA cases found in ADHD was scared.

**Acknowledgement:** Unidad del Sueño Hospital Universitario y Politécnico La Fe.

<http://dx.doi.org/10.1016/j.sleep.2013.11.593>

### **An orthodontic–orthognathic conceptual approach to OSAS surgery: our experience and results**

F. Laganà, D. Rossi, M. Romano, A. Gianni

Maxillo-Facial Surgery, I.R.C.C.S Fondazione Ca' Granda Policlinico Maggiore Milano, Italy

**Introduction:** It is well recognised that obstructive sleep apnea syndrome is linked with upper airway obstruction during sleep. The psychomotor sequelae of OSAS, including excessive daytime sleepiness, cefalea, daytime fatigue, increased cardiovascular morbidity and mortality and poor sleep quality with performance impairment due to sleep fragmentation, are also well described. In 1983 Powell and coauthors described the first mandibular advancement (MMA) to treat OSAS and subsequently they advocated simultaneous maxillary and mandibular advancement in an attempt to improve results.

**Materials and methods:** Nowadays, the surgical techniques, borrowed from orthognathic surgery are used with great success in surgical OSAS treatment. Long-term success with MMA is valuable in 90–100% of cases. This surgical approach has been shown repeatedly to be a highly effective treatment modality for OSAS in patients with maxillo-mandibular deficiency, but also in OSAS patients without maxillo-mandibular deficiency with equally successful outcomes. The aesthetic appearance of a patient, who exhibits normal craniofacial skeletal morphology, will get worse after surgical procedure leading to a biprotrusion profile. When planning the surgery, the surgeon has to consider the aesthetic deterioration degree in order to obtain the maximum enlargement of the upper airway whilst maintaining an acceptable aesthetic. Concerning the efforts to minimize the aesthetic impairment, pre-surgical orthodontic treatment and, subsequent, orthognathic surgery may improve the aesthetic and functional treatment results.

**Results:** The authors describe their approach to OSAS presenting a 10 patients series composed of very different kinds of maxillo-mandibular conditions related to OSAS. We reached a 100% success for AHI <10.

**Conclusion:** MMA as described in the literature concerned with the forward reposition of maxillo-mandibular complex preserving the personal dental occlusion. Using the CPAP support during presurgical orthodontic preparation we can spend some time to normalize dental arches form and compensation in order to obtain at surgery the best skeletal position and dental occlusion. Even the eumorphic

patients can take advantage of presurgical orthodontic treatment, the orthodontist may plan the best occlusion according to the MMA. It entails a more stable dental occlusion which itself fights against the deterioration tendency of the surgical result. Pre-surgical orthodontic treatment qualifies as orthognathic surgery even in OSAS patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.594>

### **Osteotomytechniques a key in OSAS treatment: a five years experience**

F. Laganà<sup>1</sup>, D. Rossi<sup>1</sup>, M. Romano<sup>1</sup>, M. Manconi<sup>2</sup>, A. Gianni<sup>1</sup>

<sup>1</sup>Università degli Studi di Milano, Department of maxillo-Facial Surgery, Italy

<sup>2</sup>Ospedale Civico di Lugano, Department of Neurology, Italy

**Introduction:** The multidisciplinary approach to the obstructive sleep apnea syndrome among the adults is strongly linked to the awareness of therapies opportunities offered by facial osteotomy techniques, which are normally used by the maxillofacial surgeon in the maxillary bones deformation domain. We are going to present the results of our experience that show and confirm the therapeutic potentials of the maxillomandibular advancement.

**Materials and methods:** We have evaluated, in terms of polyisomnographic and cephalometric data and reaction tests, the results of 40 surgery operations of maxillomandibular advancement, with a follow up of at least 12 months, held in the last 5 years in our center.

**Results:** The results are encouraging: average of AHI  $6.3 \pm 3.6$  and average of Epworth sleepness scale  $1.8 \pm 1.8$  confirm the healing (AHI < 10) of almost all the treated cases.

**Conclusion:** The osteotomic facial technique brings to a considerable increase of the rear volume and to a tension of the suprahyoid muscles and palate and pharynx. This surgery is particularly effective in several categories of people affected by the OSAS. Nowadays the maxillomandibular advancement represents the first therapeutic choice among the surgery opportunities, thanks to the 90% of success.

**Acknowledgements:** All our patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.595>

### **Sleep breathing disorders and peripheral arterial disease in patients with coronary artery disease**

A. Jimenez Romero<sup>1</sup>, A. Leon Acuña<sup>2</sup>, P. Perez Martinez<sup>2</sup>,

I. Ordoñez Dios<sup>1</sup>, J. Lopez Miranda<sup>2</sup>, B. Jurado Gamez<sup>1</sup>

<sup>1</sup>Andalucía Health Service, Department of Respiratory Medicine, Spain

<sup>2</sup>Andalucía Health Service, Lipid and Atherosclerosis Unit, IMBIC, Spain

**Introduction:** Obstructive Sleep Apnea (OSA) is a common disorder in the Sleep Unit. Nocturnal intermittent hypoxemia leads to oxidative stress and endothelial dysfunction and may facilitate the development and progression of atherosclerosis. People with peripheral arterial disease have four to five times more risk of heart attack or stroke but its relationship with OSA is unclear.

**Objectives:** To determine the prevalence of peripheral arterial disease in patients with a coronary event and its relationship with sleep breathing disorders.

**Materials and methods:** The study was performed at the Sleep Unit, Reina Sofia University Hospital, Cordoba, Spain, a third level referral center. The CordioPrev study is an ongoing prospective, controlled trial with a mean follow up of five years duration, including patients

with high- risk coronary disease. The study was approved by the Ethics Committee (NCT00924937), and all participants gave written informed consent. Exclusion criteria included severe disease and positive airway pressure treatment before the study. In this cohort of high risk patients, all of them underwent a home respiratory polygraphy. OSA was considered when the apnea-hypopnea index (AHI)  $\geq 10$  events per hour. We also determined the ankle-brachial index to assess lower limb circulation. Values lower than 0.9 were considered pathological.

**Results:** 238 patients were included (mean age  $60 \pm 9.6$  yrs, body mass index  $30 \pm 3.8$ ). There were 193 (80%) males and 45 (20%) females. 111 subjects (46%) were diagnosed of OSA. The subgroup with higher OSA showed higher body mass index ( $p = 0.02$ ) and a lower oxyhemoglobin saturation ( $p = 0.03$ ). There were no significant differences in the rate of diabetes mellitus, cholesterol levels and smoking, but hypertension was slightly higher in the OSA group. Both groups had a similar ankle-brachial index, OSA ( $1.1 \pm 0.17$ ) vs non-OSA patients ( $1.1 \pm 0.14$ ), ( $p = 0.2$ ). The prevalence of peripheral arterial disease was 4% (10 subjects). No relationship between ankle-brachial index value and respiratory variables (number of events and nocturnal oxyhemoglobin saturation), were observed.

**Conclusion:** In our population the prevalence of peripheral arterial disease assessed by the ankle-brachial index was low and no correlation between ankle-brachial index values and respiratory variables associated with a diagnosis of OSA was observed. At this point it is essential to increase our sample size in order to reject this hypothesis.

**Acknowledgements:** To Dra Feu Collado for her critical reading of this paper.

<http://dx.doi.org/10.1016/j.sleep.2013.11.596>

### Importance of CPAP school. Improving treatment adherence?

I. Ordóñez Dios<sup>1</sup>, A. Jiménez Romero<sup>1</sup>, M. García Amores<sup>1</sup>, B. Villar Pastor<sup>2</sup>, N. Feu Collado<sup>3</sup>, B. Jurado Gamez<sup>3</sup>

<sup>1</sup>Andalucía Health Service, Department of Respiratory Medicine, Spain

<sup>2</sup>Andalucía Health Service, Linde Medicinal, CPAP School, Spain

<sup>3</sup>Andalucía Health Service, Department of Respiratory Medicine and Sleep Unit, Spain

**Introduction:** Gold standard treatment of obstructive sleep apneas (OSA) is with a Continuous positive airway pressure (CPAP) machine. Lack of adherence to CPAP is the major cause of treatment failure in OSA. Factors influencing CPAP acceptance are multi-factorial. One of the most important medical objectives is improving adherence.

**Objectives:** To determine whether installation of a CPAP device in a CPAP-school modifies final adherence, and analyze the factors associated with CPAP adherence at four months.

**Materials and methods:** Study undertaken at the Sleep Unit of a Tertiary University Hospital. All consecutive patients diagnosed with OSA that met indication for CPAP in a four month period were included. Anthropometric characteristics and baseline measures of disease severity were assessed. Subjects from another health area and those who had neurocognitive disorders or severe disease were excluded. Randomly, CPAP was installed at the CPAP school (intervention group) or at home (control group). The same protocol was used by the same group of selected nurses when installing the CPAP in both groups. CPAP adherence was assessed by memory cards in the machine. A multivariate linear regression model was built to determine factors associated with adherence.

**Results:** 166 patients were included; 49 of them were women (30%), mean age =  $53 \pm 10$  years, BMI =  $31 \pm 3.4$ , and score on the Epworth scale =  $13 \pm 2.6$ . Intervention group consisted of 81

patients and the control group of 85. Age, Epworth Sleepiness Scale, motivation, BMI and OSA severity were similar in both groups ( $p > 0.05$ ). The intervention group had a higher number of patients with  $\leq 4$  per hour rate ( $p = 0.047$ ) and a lower number rejected CPAP ( $p = 0.001$ ) than in the control group. In the treatment group the rate of use at the fourth month was about  $4.8 \pm 1.2$  h while it was  $3.7 \pm 1.6$  h ( $p = 0.001$ ) in the control group. A multiple linear regression model showed that intervention and ratio in the first month were variables independently associated with treatment adherence. Four months adherence showed significant correlation with rate of use during first month, Epworth Score, apneas-hypopneas index and intensity of intermittent hypoxia. In multivariate linear regression model ( $R^2 = 0.632$ ;  $p = 0.001$ ) only ratio at first month and installation of device at CPAP-school were independent variables.

**Conclusion:** Ratio at first month and school CPAP are essential to increase CPAP adherence. This is relevant as school CPAP increases adherence over 1 h and decreases rejection of CPAP.

**Acknowledgement:** To Mrs. Inmaculada Jurado, a Linde nurse at CPAP school, for helping us to achieve this paper.

<http://dx.doi.org/10.1016/j.sleep.2013.11.597>

### Oral appliances in obstructive sleep apnea syndrome: our experience

M. Martín Romero<sup>1</sup>, N. Reina Marfil<sup>1</sup>, E. Ortega Sáenz De Tejada<sup>1</sup>, R. Hidalgo Sánchez<sup>2</sup>, N. Amecrane<sup>3</sup>, M. Hidalgo Sanjuán<sup>1</sup>

<sup>1</sup>Hospital Universitario Virgen de la Victoria, Pulmonology Department, Spain

<sup>2</sup>University of Malaga, Department of Biostatistics and Preventive Medicine and Public Health, Spain

<sup>3</sup>Orthoplus, Internationla Department, Spain

**Introduction:** Mandibular Advancement Devices (MAD) are employed in the treatment of mild or moderate obstructive sleep apnea syndrome (OSAS) or in severe patients who do not tolerate the CPAP or who refuse surgery. The target of our study was to evaluate the response to a MAD designed by Orthoapnea in the treatment of OSAS in adults.

**Materials and methods:** This is a prospective study, where we included 103 patients with mild or moderate OSAS diagnosed by respiratory polygraphy. We excluded those patients with serious comorbidity, severe obesity, anatomic problems that prevent MAD placing, high gag reflex and pregnant women. A polygraphy and a 3D i-CAT CT scans were performed before and after one month of treatment with MAD. We registered the following variables: sex, age, airway area and volume, total apnea-hypopnea index (AHI) – in supine and other positions – total number of apneas, number of obstructive apneas and hypopneas, oxygen desaturation per hour index (ODI) and percentage of time during which the saturation was under 90% (CT90). We considered an effective treatment when the control polygraphy with MAD was normal (AHI lower than 5) or a significant reduction in the AHI was reached. The results were analyzed by Student's T- test for paired data, nonparametric Wilcoxon test and McNemar test.

**Results:** Of the 103 patients included, 84 were men (81.6%) and 19 were women (18.4%). The average age was of  $46.47 \pm 9.71$ . The body mass index (BMI) average was of  $27.36 \pm 2.45$  kg/m<sup>2</sup>. The airway area patency and volume increased after the treatment (area from 256 to 308 mm<sup>2</sup>; volume from 4533 to 6356 mm<sup>3</sup>). We obtained after treatment a statistically significant decreases ( $p < 0.05$ ) in the following respiratory parameters: average AHI (from 16.2 to 6), both in supine (from 25.1 to 6.9) and other

positions (from 7.8 to 3.9), average of total apneas (from 69.2 to 9.5), average of obstructive apneas (from 34 to 8.7), average of hypopneas (from 70.1 to 24.8), desaturation per hour index average (from 13.7 to 5.5) and average CT90 (from 1.6 to 0.6). In 72.80% of the cases the AHI was halved. In 90.30%, an AHI under 10 was reached and in 61.2%, under 5.

**Conclusion:** In our opinion, the use of Orthoapnea MAD is an efficient therapeutic alternative in patients with mild and moderate OSAS, increasing airway area patency and volume, thus reducing the respiratory events as the AHI and desaturation and improving some of its pathophysiologic consequences.

<http://dx.doi.org/10.1016/j.sleep.2013.11.598>

### Sleep disorders in myotonic dystrophy type 2: a controlled polysomnographic study and self-reported questionnaires

A. Romigi, M. Albanese, F. Placidi, F. IZZI, M. Marciari, R. Massa  
University of Rome Tor Vergata, Neurophysiopathology Dpt, Italy

**Introduction:** Sleep disturbances in myotonic dystrophy type 1 (DM1) are common and include sleep-disordered breathing (SDB), periodic limb movements (PLMS), central hypersomnia, REM sleep dysregulation. Scarce data are available regarding the occurrence of sleep disorders in Myotonic Dystrophy type 2 (DM2). To investigate sleep-wake cycle and daytime sleepiness in DM2 patients compared with healthy subjects and patients with DM1.

**Materials and methods:** Twelve DM2 outpatients, twelve age- and sex-matched healthy controls and 18 patients with adult-onset DM1 were evaluated. Subjective quality of sleep was assessed by means of the Pittsburgh Sleep Quality Index (PSQI). Both the Epworth Sleepiness Scale and the Daytime Sleepiness Scale were performed in order to evaluate excessive daytime sleepiness (EDS). All participants underwent a 48-h polysomnographic monitoring and the Multiple Sleep Latency Test.

**Results:** Sleep efficiency was <90% in 12/12 DM2 patients, and significantly reduced when compared with controls or with DM1. Decreased sleep efficiency was associated with SDB in 7/12 DM2 patients and/or PLMS in 3/8 patients. Six DM2 patients showed REM sleep without atonia, whereas none of controls and DM1 patients showed REM sleep dysregulation. The global PSQI score was higher in DM2 versus controls and versus DM1.

**Conclusion:** We demonstrated a poorer sleep quality in DM2 than in DM1 patients and controls. Sleep apnoea are the most common sleep disorders in DM2. OSA and sleep fragmentation may represent the main cause of EDS, whereas PLMS are a frequent finding in DM1 but not in DM2 in our sample.

**Acknowledgements:** No conflict of interest.

<http://dx.doi.org/10.1016/j.sleep.2013.11.599>

### High frequency spectral power of sleep EEG increases with depressive and insomnia symptoms in kidney transplant recipients

K. Ronai<sup>1</sup>, A. Szentkiralyi<sup>2</sup>, L. Alpar<sup>3</sup>, I. Mucsi<sup>4</sup>, R. Bodizs<sup>1</sup>, M. Novak<sup>5</sup>

<sup>1</sup>Institute of Behavioral Sciences, Semmelweis University, Budapest, Hungary

<sup>2</sup>Münster Institute for Epidemiology and Socialmedicine, Westfälische Wilhelms – Universität, Münster, Germany

<sup>3</sup>Centre for Brain Repair, Department of Clinical Neurosciences, University of Cambridge, Cambridge, United Kingdom

<sup>4</sup>Nephrology, McGill University Health Centre, Royal Victoria Hospital, Montreal, Canada

<sup>5</sup>Neuropsychiatry Program, University of Toronto, Toronto, Canada

**Introduction:** The prevalence of depression and insomnia is high among kidney transplant recipients and the co-occurrence of the two disorders is frequent. Hyperarousal of the central nervous system (CNS) might play a role in the pathomechanism of both conditions. The hypervigilant state of the CNS is characterized by heightened beta- and gamma spectral power of the EEG. We investigated whether depressive and insomnia symptoms correlate with high frequency spectral power among kidney transplant recipients.

**Materials and methods:** Fifty-six kidney transplant recipients participated in the study (35 males, mean age 49 ± 13 years, BMI 26 ± 4 kg/m<sup>2</sup>, estimated glomerular filtration rate 50 ± 17 ml/min). Symptoms of insomnia and depression were measured by the Athens Insomnia Scale (AIS) and the Center for Epidemiologic Studies Depression Scale (CESD), respectively. After one-night polysomnography (PSG) each recording was visually scored and EEG absolute spectral power was computed within the sigma (11.25–15 Hz), beta1 (15.25–25 Hz), beta2 (25.25–35 Hz), and gamma (35.25–45 Hz) frequency bands.

**Results:** AIS score correlated with sleep latency ( $r = 0.274$ ,  $p < 0.05$ ) among the PSG macrostructure parameters while CESD score did not correlate with any PSG variables. CESD score correlated with NREM and REM gamma ( $r = 0.35$ ;  $r = 0.27$ ), beta2 ( $r = 0.28$ ;  $r = 0.3$ ), beta1 ( $r = 0.32$ ;  $r = 0.27$ ) spectra, respectively. AIS score correlated with NREM and REM gamma ( $r = 0.27$ ;  $r = 0.31$ ), beta2 ( $r = 0.27$ ;  $r = 0.44$ ), NREM sigma ( $r = 0.29$ ) and REM beta1 ( $r = 0.37$ ) spectra, respectively ( $p < 0.05$  for each correlation). In multivariable linear model after controlling for age, gender, kidney function and BMI, the CESD score was an independent predictor of NREM gamma (Beta: 0.276;  $p < 0.05$ ) and AIS was in independent relation with REM beta2 (Beta: 0.328;  $p < 0.05$ ).

**Conclusion:** We demonstrated for the first time in this population that the symptoms of depression and insomnia correlate with increased neurocognitive activity of the CNS during sleep, in particular, with increased NREM gamma and REM beta2 activity. These data support the hypothesis that CNS hyperarousal might contribute to the emergence of both conditions among kidney transplant recipients. Compared to routinely used sleep variables, quantitative analysis of EEG reveals further information about these conditions.

**Acknowledgements:** The authors have no conflict of interest to declare in relation to this work.

<http://dx.doi.org/10.1016/j.sleep.2013.11.600>

### The impact of sleep position preference on supine sleep during overnight polysomnography

L. Rosenthal, A. Rosenthal

Sleep Medicine Associates of Texas, United States

**Introduction:** Body position influences upper airway configuration and lung volumes. In particular, increased frequency of respiratory events is documented among some OSA patients when sleeping in the supine position. Concern about possible underestimation of the AHI when supine sleep is not recorded during a diagnostic assessment has raised uneasiness about possible diagnostic misclassification. However, little data is available on how the subjects' preferred sleep position is reflected on diagnostic assessments. We have previously reported on subjective sleep position preference in a cohort of subjects completing ambulatory assessment of sleep-disordered breathing; the study showed that those subjects who

voiced preference for sleep in the supine position were documented to spent significantly more time supine when compared to those voicing preference for lateral or prone position during sleep. In this study we characterized how subjective sleep preference is reflected in the time spent in the supine position during overnight polysomnography.

**Materials and methods:** Consecutive patients who completed a clinical assessment for evaluation of OSA and were scheduled for a full in-laboratory diagnostic polysomnography were included in the present report. During the clinical assessment, patients' were asked to identify their preferred sleep position; they were divided in 2 groups (supine vs. no-supine) based on whether they voiced preference for supine sleep. Patients were required to be in stable medical condition and continued taking their regular medications. The overnight polysomnography was completed according to AASM guidelines. Continuous video-monitoring documented position during sleep. For each subject, the time spent in the supine position during sleep was estimated. An overall AHI and supine AHI were also derived.

**Results:** Data has been accrued on 26 subjects. The supine (S) group included (so far) 4 females and 7 males (age: 39 + 12; BMI: 30 + 8; AHI: 20 + 26; average oxygen saturation: 96 + 2); the no-supine (No-S) included 15 males (age: 54 + 18; BMI: 29 + 4; AHI: 25 + 17; average oxygen saturation: 94 + 2). Time in Bed was comparable (S: 449 + 53; No-S: 447 + 66; however, sleep efficiency was marginally higher for the S group: 90 + 7 vs 83 + 10 for the No-S group). REM sleep percent was comparable for both groups (23 + 7 vs 18 + 7, respectively). The percent sleep recorded in the supine position differed in the 2-groups ( $p < 0.05$ ; (S) 56 + 21 vs (No-S) 25 + 27, respectively). Of interest, the AHI during supine sleep showed differential severity ( $p < 0.06$ ; (S) 24 + 29 vs (No-S) 53 + 36, respectively).

**Conclusion:** Subjectively reported preference of sleep position was found to reflect objective differences of time spent in the supine position during nocturnal polysomnography. This difference is particularly relevant given the multiple factors likely to impact sleep position during the polysomnographic test. The data substantiates the importance of questioning patients about their preferred position during sleep and including this information when deciding therapeutic intervention.

<http://dx.doi.org/10.1016/j.sleep.2013.11.601>

### Effect of sodium oxybate on sleep stage shifts and sleep quality in patients with narcolepsy

T. Roth<sup>1</sup>, Y. Dauvilliers<sup>2</sup>, D. Guinta<sup>3</sup>, S. Alvarez-Horine<sup>3</sup>, E. Dynin<sup>3</sup>, J. Black<sup>3</sup>

<sup>1</sup>Henry Ford Hospital, Sleep Disorders and Research Center, United States

<sup>2</sup>Hôpital Gui-de-Chauliac, Department of Neurology, France

<sup>3</sup>Jazz Pharmaceuticals, Inc., United States

**Introduction:** Disrupted nighttime sleep (DNS) is a well-recognized symptom affecting 50–80% of narcolepsy patients. Recent expert consensus on the definition and measurement of DNS identified that frequent shifts to lighter stages of sleep and awakenings and patient-reported poor sleep quality are defining clinically important measures of DNS. Xyrem®, sodium oxybate (SXB) is approved for the treatment of cataplexy and excessive daytime sleepiness in narcolepsy. The effects of SXB on DNS in narcolepsy have not been reported. In the present study, polysomnograms (PSGs) from a randomized clinical trial were analyzed retrospectively to evaluate the effects of SXB on DNS in patients with narcolepsy.

**Materials and methods:** Subjects were randomized to 4.5, 6, or 9 g SXB or placebo nightly for 8 weeks; those receiving 6 and 9 g/night

doses were titrated in weekly 1.5 g increments. PSGs and sleep quality diaries were obtained at baseline and after 4 and 8 weeks. Sleepiness, cataplexy measures and safety have been previously reported. Post-hoc analysis of shifts from S2, 3, 4 or REM to 1/W was performed for 159 patients with evaluable sleep stage data and for 211 patients with evaluable sleep quality rated from 1 = Excellent to 4 = Poor.

**Results:** SXB significantly decreased the number of shifts from Stage 2, 3, 4 or REM to Stage 1/Wake. The median (range) change from baseline was  $-0.5$  ( $-38$  to  $24$ ),  $-7^*$  ( $-37$  to  $33$ ),  $-10^*$  ( $-35$  to  $21$ ), and  $-13^*$  ( $-59$  to  $33$ ) shifts in the placebo, SXB 4.5 g, 6 g, and 9 g groups, respectively;  $*P < 0.01$ . Patient reported sleep quality was improved with LS Mean change (SE) 0.11 (0.081),  $-0.42^*$  (0.077),  $-0.31$  (0.081), and  $-0.48^*$  (0.093), respectively. For the population treated with SXB (all doses combined), the most commonly reported adverse events ( $\geq 5\%$ ) were headache, nausea, dizziness, enuresis, nasopharyngitis, diarrhea, and vomiting.

**Conclusion:** This retrospective analysis suggested that sodium oxybate may help improve PSG and patient-reported measures of sleep that define DNS in narcolepsy.

**Acknowledgements:** This study was sponsored by Jazz Pharmaceuticals, Inc.

<http://dx.doi.org/10.1016/j.sleep.2013.11.602>

### Improving CPAP use with telemonitoring and social media

S. Royant-Parola<sup>1</sup>, S. Hartley<sup>1</sup>, L. Violaine<sup>1</sup>, P. Lefevre<sup>1</sup>, S. Dagneaux<sup>1</sup>, P. Escourrou<sup>2</sup>

<sup>1</sup>Reseau Morphée, France

<sup>2</sup>Hopital Antoine Bèclère, Laboratoire d'Exploration du Sommeil, France

**Introduction:** Respir@dom is an innovative French telemedicine project that combines the automatic transmission of CPAP data with an internet based support programme. Respir@dom aims to improve patient observance by combining improved education and support with continually updated data, accessible to both the patient and his health care team, on machine use and patient satisfaction.

**Materials and methods:** The Respir@dom platform was developed to harness the power of social media in improving patient education and autonomy. The site acts as a source of high quality information on sleep apnea. This information is accessible to all site visitors. Information is presented not only as text but also in the form of a serious game, in which players learn key messages about sleep apnea and treatment. The site also presents information dedicated to users of continual positive airway pressure (CPAP) machines with videos demonstrating key competences (ex. cleaning a humidifier). Patients can participate in the Respir@dom community, which enables them to exchange information, participate in the forums, create blogs and complete their secure online medical record in which they monitor sleepiness, satisfaction and motivation with their CPAP. Patients randomized to telemonitoring can also access the information automatically transmitted by their CPAP via GPRS in graphic form. An inbuilt algorithm generates alerts which remind the patient to adjust his mask in case of leaks or to increase nightly use. These electronically generated alerts are also transmitted via the medical record to the health care team contact the patient with suggestions if the difficulty continues.

**Results:** The Respir@dom site <http://respiradom.fr>, including the serious game, has been created and the community is growing. A cost-efficiency study is underway. 200 patients will be included of whom half will be randomised to telemonitoring and half to normal treatment. Both groups of patients will have access to the Respir@dom site, but only patients randomized to telemonitoring will receive continual monitoring of CPAP indicators and alerts, thus enabling the study to determine which of the elements (site + community vs. telemonitoring) is responsible for changes in CPAP use.

**Conclusion:** Respir@dom offers a new approach to improving care of patients treated by CPAP.

**Acknowledgement:** Supported by a grant from french government (DGCIS).

<http://dx.doi.org/10.1016/j.sleep.2013.11.603>

### **Title effect of multicomponent cognitive behavioral therapy in a sample of chronic insomniacs in hypnotic treatment**

J. Guallar Ballester<sup>1</sup>, J. Agusti Visiedo<sup>2</sup>, M. Bagueña Puigcerver<sup>3</sup>, E. Rueda Ravasco<sup>2</sup>, J. Ortega Albás<sup>4</sup>

<sup>1</sup> City Hall of Valencia, Health Service, Medical Doctor of Health Service of the City of Valencia, Section Public Health Programs, Spain

<sup>2</sup> Psychologist

<sup>3</sup> University of Valencia, Spain

<sup>4</sup> Conselleria Sanitat (Health Department) of the Comunitat Valenciana, Sleep Unit of Castellón General Hospital, Spain

**Introduction:** The objective of this study is to analyze the improvements in sleep and quality of life, as well as to evaluate the decrease or cessation of drug treatment in a sample of insomniacs in hypnotic drug treatment after CBT-I application.

**Materials and methods:** This is a pre-post quasi-experimental design, with a monitoring performed 6 months later in which information of an Experimental Group (EG = 17) is given and evaluated during three times, and also a Control Group (CG = 44), with measures only at the pre- post. According to Perlis Protocol and after an Insomnia Interview by Morin, all patients qualified as candidates for CBTI. Patients were given a daily sleep log and the Spanish version of the following assessment tools: Insomnia Severity Test (IST), Pittsburg Sleep Quality Index (PSQI), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI) and Health Survey (SF-36). The following variables were noticed through these tests: Sleep Onset Latency (SOL); Total Sleep Time (TST); Total Time in Bed (TTB); Sleep Efficiency index (SE%); aWakenings (W), Total Wake Time (TWT); time aWake After Sleep Onset (WASO), Sleep Quality (SQ).

**Results:** The CBT-I produced the following positive effects: (i) significant pre-post effects that were maintained at 6 months: STI ( $p < .01$ ), PSQI ( $p < .01$ ), BDI ( $p < .05$ ), SQ ( $p < .01$ ), SOL ( $p < .05$ ), SE% ( $p < .01$ ), TWT ( $p < .01$ ) and WASO ( $p < .05$ ); (ii) significant pre-post effects that increased significantly the benefit of therapy at 6 months: General Health ( $p < .05$ ), TBT ( $p < .01$ ); (iii) The TST, anxiety and physical function were significantly improved at 6 months ( $p < .05$ ). Regarding the control group and the experimental group in post, there were significant differences which showed the beneficial effects of the therapy on the following variables: STI ( $p < .01$ ), anxiety ( $p < .01$ ), depression ( $p < .01$ ), QS ( $p < .05$ ), physical function ( $p < .05$ ), general health ( $p < .05$ ), TBT ( $p < .01$ ), SOL ( $p < .05$ ), Awakes ( $p < .01$ ), SE% ( $p < .019$ ), TWT ( $p < .01$ ) and WASO ( $p < .01$ ). The frequency of the hypnotic dose decreased in the GE but not significantly.

**Conclusion:** CBT-I, has been useful for the improvement of sleep quality, diminishing the severity of insomnia and improving other aspects of physical health (physical function and general health), as well as other aspects of mental health, particularly reducing anxiety. The diminution of TBT and TWT, along with the increase of TST, caused an increase in the SE. These seem to be the most evident influences of CBT-I in sleep parameters.

**Acknowledgements:** W. Galke for his help in the transferring data; Dr. J. Marquez and Dra. A. Perez, Health Service of the city of Valencia; University of Valencia: Practicum; J.R. Diaz and A. Batalla, Sleep Unit of Castellon Hospital; M. A. Maroto, for his teachings.

<http://dx.doi.org/10.1016/j.sleep.2013.11.604>

### **Polysomnography (PSG) correlation in patients with moderate – severe OSAS at the time of diagnosis and after treatment with CPAP**

J. Rugeles-Plata, C. Espín-Giménez, M. Guaba-Camilo, A. Fernandez-Caballos, F. Ferrandis-Ballester

Hospital General de Alicante, Unidad de Sueño, Servicio de Neurofisiología Clínica, Spain

**Introduction:** Obstructive sleep apnea syndrome (OSAS) is a common and escalating health problem related to substantial morbidity and mortality. The use of continuous positive airway (CPAP) in most cases of OSAS has been proved that improves sleep quality, excessive daytime sleepiness (EDS) and quality of life. And it can also reduce morbidity and mortality in cardiovascular diseases, as well as consumption of healthcare resources. In our sleep unit we have tried to present the polysomnography correlation of patients submitted with diagnosis of moderate- severe OSAS before and after the treatment with CPAP.

**Materials and methods:** The study is based in a descriptive retrospective design. All patients were recruited from the sleep unit at the General Hospital of Alicante (Spain) including 130 patients during the years 2007–2012, previously diagnosed of OSAS, and we have compared the polysomnography before and after the treatment with CPAP. Data were obtained from review of all clinical records, patient and spouse questionnaires completed at the time of the original consultation, sleep study results, and objective CPAP use records. Patients taking antidepressants, hypnotics or benzodiazepines, with renal failure and hemodialysis or Chronic obstructive pulmonary disease (COPD) were excluded. Data were analyzed based on age, sex, BMC and comparative percentage of sleep phases and cycles.

**Results:** We analyzed 130 patients (104 male and 26 women), two studies per patient (at the diagnosis moment and post-treatment with CPAP; 260 PSG in total, middle age 51.3 years, 5% normal weight, 43% overweight and 50% obese. No significant difference was found between the groups; sex, age, BMI or the severity of the OSAS. Differences were found in the increase of percentage in the deep sleep state and REM sleep, specially in obese patients with severe OSAS.

**Conclusion:** The continued use of CPAP in obese patients with moderate and severe OSAS notably improves the sleep structure and therefore the quality of it.

**Acknowledgements:** Dr. Valentin García and Dra. Francisca Selles. Thanks you for your help.

<http://dx.doi.org/10.1016/j.sleep.2013.11.605>

### **Objective evaluation of RLS daytime symptoms by means of the multiple suggested immobilization test (M-SIT)**

D. Sanchez Ruiz, D. Garcia Borreguero

Sleep Research Institute, Spain

**Introduction:** Daytime RLS symptoms, are not uncommon in treated moderate to severe RLS, and according to a recent survey<sup>1</sup>, are reported by 41–67% of subjects. However, assessment of daytime symptoms is difficult as it depends strongly on the degree of activity. The Multiple Suggested Immobilization Test (m-SIT) is a recently validated objective test that elicits/ evaluates RLS symptoms during the daytime.<sup>2</sup>

**Materials and methods:** Nineteen RLS patients underwent an m-SIT on two consecutive days while on 24-h dopaminergic treatment, as well as 1–3 days following treatment discontinuation. Ten healthy subjects underwent the m-SIT once. The procedure consisted of five

SITs1 performed every 2 h between noon and 8PM. Each SIT lasted one hour, during which the subject reclined immobile but was allowed to move the legs if symptoms occurred. Periodic leg movements (PLMW) were recorded and a m-SIT disturbance scale (mSIT-DS) on sensory discomfort was completed every 10 min (range 0–10; 0–60 per SIT). Clinical significance was defined by the presence of either NSSS score >2 or PLMW index >152. Patients also completed a 7-day, 24-h diary and were assessed by means of RLS-6 and Johns Hopkins RLS scale (JHRLSS).

**Results:** The m-SIT was able to elicit significant sensory symptoms in 14/19 patients on both treatment conditions. Mean (SD) NSSS score increased after treatment discontinuation by 15.9 (18.2) points ( $p < .001$ ). Overall, untreated NSSS scores correlated well with RLS-6 (item-4: daytime symptoms at rest) and JHRLSS (Pearson's  $r$ : 0.30 and 0.22, respectively). However, 5/19 (sensitivity: 26.3%) of those patients with no daytime symptoms on rating scales (RLS-6, JHRLSS), had a clinical significant NSSS value on m-SIT. Furthermore, patients with breakthrough symptoms on the 24-h diary had higher NSSS- and PLMW-scores than those without (mean AUC  $\pm$  SD:  $7.9 \pm 3.4$  vs  $1.2 \pm 2.8$ ,  $p > 0.05$ ).

**Conclusion:** The m-SIT is a useful objective test to elicit and evaluate the severity of daytime symptoms in RLS.

**Acknowledgements:** 1. Tzonova D et al. Breakthrough symptoms during the daytime in patients with restless legs syndrome (Willis-Ekbom disease). *Sleep Med*, 2012; 13(2):151–5. 2. Garcia-Borreguero D. et al.: Validation of the Multiple Suggested Immobilization Test: A Test for the Assessment of Severity of Restless Legs Syndrome (Willis-Ekbom Disease). *Sleep*, 2013, in press.

<http://dx.doi.org/10.1016/j.sleep.2013.11.606>

### Changes in sleep architecture after Type 2 Diabetes Mellitus (T2DM)

E. Lopez Ruiz, A. Rivera Garcia, I. Ramirez Salado  
*Instituto Nacional de Psiquiatria Ramon de la Fuente, Chronobiology and Sleep Laboratories, Neuroscience Division, Mexico*

**Introduction:** Type 2 Diabetes Mellitus (T2DM) is a syndrome in which multiple physiological changes are observed. The pathophysiology of diabetes such as polyphagia, polyuria, polydipsia, weight loss and/or changes in mood, such as depression or less physical activity and stress, contribute to physical and mental deterioration. Epidemiological studies report that the leading cause of death in diabetic patients is due to cardiovascular problems. It has been shown that the decrease in sleep duration combined with T2DM, increases the risk of cardiovascular events in hypertensive patients. Also, chronic sleep deprivation is linked to metabolic and cardiac disorders, and it has been suggested that respiratory conditions, such as obstructive sleep apnea, correlate with cardiovascular disease, diabetes and cancer. In order to explore if there is an association between T2DM and sleep quality, we analyzed through polysomnographic recordings (PSGR), the changes in the macro and micro sleep architecture using a streptozotocin model of T2DM.

**Materials and methods:** Six adult male Wistar rats (300–350 g) were implanted with chronic electrode for PSGR. Rats were adapted to a 12/12 h light/dark cycle (light from 8:00 to 20:00). For T2DM induction, each rat was administered with 45 mg/kg of streptozotocin (SI) i.p. Measures of glucose level were taken on the third or fourth day after SI administration. Rats were selected with a 200 mg/dL minimum blood glucose level. Each rat underwent at least four PSGR which lasted six continuous hours (10:00–16:00). Sleep latency and duration, number of sleep stages, total percentage of Non REM sleep stages I, II and REM sleep, were quantified. Sleep

spindles and theta activity were analyzed as well. All PSGR were compared to previous control recordings.

**Results:** Our preliminary results show that there is a significant increase in the density and voltage of sleep's phasic phenomena (e.g. sleep spindles, theta activity, etc.) associated to T2DM induction, as well as a significant decrease in the number and duration of sleep stages.

**Conclusion:** Sleep micro architecture in both REM and NREM sleep is particularly enhanced by T2DM induction, whereas sleep stages are diminished. These preliminary results show a possible association between metabolic mechanisms (glucose) and sleep homeostatic processes.

**Acknowledgements:** Eva Gonzalez Trujano Carlos Jimenez Rodriguez Carlos Camacho Garcia Raul Cardoso Jose Luis Calderon.

<http://dx.doi.org/10.1016/j.sleep.2013.11.607>

### Rotigotine use in long-term treatment of restless legs syndrome: Experience in General University Hospital of Castellon

P. Ruiz-Elena, J. Pinzon-Martinez, A. Gomis-Devesa, I. Barreda-Altaba, J. Ortega-Albas, M. Estrelles-Marco  
*Department of Neurophysiology – Sleep Medicine Unit, University General Hospital of Castellon, Cas, Sleep Medicine Unit, Spain*

**Introduction:** The restless legs syndrome (RLS) is neurologic disorder characterized by an urge to move the legs, accompany by dysesthesias that are exacerbated at rest or inactivity, yield with movement and worse in the evening and night. The quality of life can be severely compromised according to seriousness of the symptoms. Rotigotine in long-term treatments showed good result to control moderate and severe symptoms. This study described evolution of RLS evaluating efficacy of rotigotine transdermal delivery system (patch per day) in long-term treatment.

**Materials and methods:** Patients came to our service, presenting exacerbated symptoms of RLS unimproved with previous treatments, we began treatment Rotigotine and followed in a period greater than six months. Database were obtained from clinical stories since 2010 until May 2013. Performing a literature search include, MedLINE, Cochrane Library, drug company Web sites, related with long-term pharmacological treatment and common complications that may arise. All our variables were analyzed and compared with results of the other studies.

**Results:** Obtained 57 patients with moderate and severe symptoms most affected age range is from 40 to 59 years (49%). 43.8% of patients received previously: Pramipexole dose 0.18 mg/day (36%) and 0.7 mg/day (8%), Ropinirole 0.25 mg (12%) and 0.5 mg daily (24%) and Clonazepam 0.5 mg/day (20%), no improvement. We began Rotigotine with onset dose of 2 mg/day in 65% of cases. Maintenance dose with a favor evolution was 2 and 4 mg/day in 42% and 22% of patients, respectively. Some adverse effects obtained: a single case of Augmentation with more than 1 year of treatment and in 4 patients had to suspend treatment because application skin reactions, between 6 months until 1 year of treatment. Dopaminergic adverse effects only be obtained in 3 patients within the first week. It exists a 67% patient with good evolution, including 6 patient with free symptoms, after 1 year of treatment.

**Conclusion:** Some other carried out double-blind randomized compared with placebo, obtained good results improving the symptoms at dose 0.5 mg–4 mg/day of Rotigotine long-term treatment, and getting as more side effects skin reactions. As these studies, we get a significantly results an over half of the patients had an good evolución at dose of 2 mg/day. Less skin reactions, were obtained possible due to the cleaning measures we propose. It can be

concluded that the results are consistent with the literature, getting less effect side comparing other studies.

**Acknowledgements:** Sleep Medicine Unit, University General Hospital of Castellon Service of Neurology, University General Hospital of Castellon.

<http://dx.doi.org/10.1016/j.sleep.2013.11.608>

### Prevalence, clinical significance, and predictors for sleep-related hypoventilation among obese Asians with obstructive sleep apnea syndrome

M. Ruthranesan<sup>1,3</sup>, N. Chirakalwasan<sup>1,2</sup>

<sup>1</sup> Excellence Center for Sleep Disorders, King Chulalongkorn Memorial Hospital, Thai Red Cross Society, Thailand

<sup>2</sup> Division of Pulmonary and Critical Care Medicine, Department of Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

<sup>3</sup> Institute of Respiratory Medicine, Kuala Lumpur, Malaysia

**Introduction:** Sleep-related hypoventilation may be important in the development of hypercapnic respiratory failure in obstructive sleep apnea syndrome (OSAS) particularly in obese group. Current available data on clinical significance of sleep-related hypoventilation is still lacking. **Objective:** To study the prevalence, clinical significance, and predictors of sleep-related hypoventilation among obese OSAS patients.

**Materials and methods:** Retrospective analysis of 221 patients diagnosed with OSAS. Sleep-related hypoventilation was defined as definite or possible using criteria as follows; an increase of >10 mmHg of end tidal CO<sub>2</sub> during sleep in comparison to an awake supine value or low baseline asleep oxygen saturation ≤85% not explained by apnea or hypopnea; respectively. No hypoventilation was defined if the patients did not meet above two criteria. We conducted two arms of analysis; study arm I compared the group with definite and possible hypoventilation against no hypoventilation group and study arm II compared the group with definite hypoventilation against possible hypoventilation and no hypoventilation groups.

**Results:** 35.75% and 31.22% exhibited sleep-related hypoventilation in study arm I and II, respectively. Sleep-related hypoventilation group in both study arms had more cardiovascular comorbidities and more severe sleep disordered breathing. Logistic regression analysis showed that BMI, total AHI, ESS, and morning headache (at least 3–4 times a week) were independent predictors of sleep-related hypoventilation in both study arms. Using regression co-efficient analysis, prediction scores using the above variables were derived to predict the likelihood of sleep-related hypoventilation at different sensitivity and specificity rates.

**Conclusion:** We established important clinical significance and predictors of sleep-related hypoventilation which can be utilized to predict the probability of having sleep-related hypoventilation with reasonable sensitivity and specificity.

**Acknowledgements:** We would like to thank Mr. Dittapol Muntham, a statistician, at the Section of Clinical Epidemiology and Biostatistics, Faculty of Medicine, Ramathibodi Hospital for additional statistical review.

<http://dx.doi.org/10.1016/j.sleep.2013.11.609>

### Chronotype and daytime sleepiness in nurses working in six hospitals of the Spanish National Health System

M. Ruzafa Martínez<sup>1</sup>, T. Moreno Casbas<sup>2</sup>, A. Serrano Pinto<sup>1</sup>, E. González-María<sup>2</sup>, M. Heredia Reina<sup>3</sup>, A. Otero Fernández<sup>4</sup>

<sup>1</sup> School of Nursing, RN, Spain

<sup>2</sup> Health Care and Nursing Unit Research, RN, Spain

<sup>3</sup> Fuenlabrada Hospital, RN, Spain

<sup>4</sup> A Coruña General Hospital, RN, Spain

**Introduction:** In registered nurses (RN), the chronotype and the daytime sleepiness are features that have been assessed because of the peculiarities of the care units as well as some demographics data that could affect the timing of human sleep. The objective of this study is to evaluate daytime sleepiness and morning–evening chronotype by questionnaire in RN in six hospitals of the Spanish National Health System (SNHS).

**Materials and methods:** A multicentric, observational, descriptive and cross-sectional study in 6 hospitals of the SNHS was carried out. RN has been collected in three types of units: medical (M), surgical (S) and intensive care (I). The study started in 01/12 and will continue until 12/14. Two questionnaires have used to evaluate daytime drowsiness and chronotype: Spanish version of Epworth Daytime Sleepiness Scale (EDSS) and Horne & Östberg Morning and Evening Questionnaire (MEQ). Frequency distribution, arithmetic mean, variance analysis (One-Way ANOVA), and independent t student statistic have been carried out.

**Results:** A total of 390 nurses have been included, 85.4% ( $n = 333$ ) of them was female and the mean age was 41 (SD 9.80) years old. The mean of work experience is 16 (SD 9.23) years and 90.8% ( $n = 344$ ) of RN has a full-time contract. The distribution of nurses by the care unit is so equal: 120 nurses in I (30.8%), 131 nurses in M (35.1%) and 133 nurses in S (34.1%). 39.5% ( $n = 232$ ) of the nurses included said to be very satisfied with being nurses and 53% ( $n = 199$ ) of RN showed excessive daytime sleepiness. In relation with the MEQ, intermediate type was the most common (56.7%;  $n = 212$ ) followed by moderate morningness (20.3%;  $n = 79$ ). Comparison between chronotype and work experience was significantly related, showing the higher work experience in nursing care the higher trend to be intermediate or morningness type ( $p < 0.016$ ). Also there was a significant relationship between the chronotype and age ( $p < 0.001$ ), showing that the higher age is related to be morningness type.

**Conclusion:** Most of the RN showed an excessive daytime sleepiness, but no differences between the EDSS scores and the sociodemographics data have been found. The more common chronotype is intermediate and morningness; also there is a relationship between chronotype and work experience, as well as nurse's age. In this way, the more experience and age of the nurse displays an intermediate and morningness type.

**Acknowledgements:** Study supported by RETICEF (RD12/0043/0011), FIS (PI11/00646).

<http://dx.doi.org/10.1016/j.sleep.2013.11.610>

### Child sleep – The Finnish birth cohort study

O. Saarenpää-Heikkilä<sup>1</sup>, J. Paavonen<sup>2</sup>, S. Himanen<sup>3</sup>, A. Kylliäinen<sup>4</sup>, P. Pölkki<sup>5</sup>, T. Paunio<sup>6</sup>

<sup>1</sup> Pediatric Clinics, Tampere University Hospital, Finland

<sup>2</sup> National Institute for Health and Welfare, Helsinki University Hospital, Finland

<sup>3</sup> Pirkanmaa Hospital District, University of Tampere, Finland

<sup>4</sup> University of Tampere, Finland

<sup>5</sup> University of Eastern Finland, Finland

<sup>6</sup> National Institute for Health and Welfare, University of Helsinki, Finland

**Introduction:** Sleep need is large and highly variable in infancy and early childhood, but the factors that moderate the developmental

changes in sleep are not well characterized. This cohort was set up to study prospectively the factors that moderate the sleep development and its disturbances and to study whether the large variability has an impact on child's development.

**Materials and methods:** The CHILD SLEEP cohort is based on a random sample of 2245 families from Tampere, Finland during 2011–2012. Parental questionnaires with a focus on development of sleep, emotions, and family environment were collected prenatally, at 3, and 8 months of age; the 24 month -survey is currently ongoing. A sub-sample of infants was assigned into two sleep registration groups (actigraphy with/without ambulatory polysomnography). Blood/saliva samples were collected for genetic analyses. A protocol for prevention and treatment of children's sleeping difficulties was developed and a systematically selected sample of families was assigned in the prevention group and its control group. After the labor the mothers were interviewed about their labor experiences. All data was stored in one database maintained by Institute for Health and Welfare at secured net system of Technology Center of the Finnish Institute for Molecular Medicine (FIMM).

**Results:** 75% (1678 mothers, 1645 fathers) of the families from the initial recruitment agreed to participate to the study. The cord blood samples were gathered from 1501 babies and blood or saliva samples were collected from 1589 mothers and 1519 fathers. The PSG + ACG group covers 92 and the ACG group 283 infants. The registrations are performed at 1, 3 and 8 months. The prevention study consists of 406 families (199 in the prevention program, 207 in the control group), and half of them are followed up by ACG and sleep diary (98/199 (49%) and 98/207 (47%)), and the rest with sleep diary.

**Conclusion:** The CHILD SLEEP birth cohort will provide a unique possibility to evaluate multiple biological, developmental, prenatal and environmental factors that affect the sleep development in the childhood and the intertwining sleeping difficulties in the family.

**Acknowledgements:** We are grateful to Tarja Stenberg for her continuous help and advice during our study and to Dr. Hannu Turunen for his help in establishing the data base.

<http://dx.doi.org/10.1016/j.sleep.2013.11.611>

### Evaluation of sleep disorders in flight crew and ground staff worker in Iran private flight airline

K. Sadeghniaat-Haghighi<sup>1</sup>, S. Khazaei<sup>2</sup>, O. Aminian<sup>3</sup>, P. Momeni<sup>1,2,3</sup>

<sup>1</sup> Tehran University of Medical Sciences, Sleep Research Center, Baharloo Hospital, Iran

<sup>2</sup> Tehran University of Medical Sciences, Iran

<sup>3</sup> Tehran University of Medical Sciences, Center for Research on Occupational Medicine, Iran

**Introduction:** Sleep disorders in pilots due to its impact on flight safety, flight crew and passenger health are important. This study evaluates the frequency of sleep disorders in pilots by standard questionnaires and compares it with ground staff.

**Materials and methods:** This was a cross-sectional study on flight crew and other workers of a private flight airline. The cases were selected randomly. All participants were asked to fill 2 standard questionnaires: ISI (Insomnia Severity Index) and ESS (Epworth Sleepiness Scale). Excessive daytime sleepiness and insomnia were considered by ESS > 10 and ISI > 8, respectively.

**Results:** The frequency of insomnia and sleepiness in flight crew was 66% and 24%, respectively compared to the 60% and 27% in other workers, respectively.

**Conclusion:** It is proved in this study that excessive day time sleepiness has high frequency in pilots and also insomnia is the main complication in this group.

**Acknowledgements:** Staff of baharloo sleep clinic and staff of Iranian airline.

<http://dx.doi.org/10.1016/j.sleep.2013.11.612>

### Sleepiness, fatigue and road traffic accidents

K. Sadeghniaat-Haghighi<sup>1</sup>, M. Moradi Nia<sup>2</sup>, O. Aminian<sup>3</sup>,

A. Esmaeeli<sup>4</sup>

<sup>1</sup> Tehran University of Medical Sciences, Sleep Research Center, Baharloo Hospital, Iran

<sup>2</sup> Tehran University of Medical Sciences, Iran

<sup>3</sup> Tehran University of Medical Sciences, Center for Research on Occupational Medicine, Iran

<sup>4</sup> Police University, Iran

**Introduction:** Road traffic accidents are one of main problems in Iran. Multiple factors cause traffic accidents the most important of which is fatigue and sleepiness. This factor is given less attention in our country.

**Materials and methods:** In this study, all road traffic accidents which were reported by police to have been caused due to fatigue and sleepiness were studied in the three provinces (Tehran, Qazvin and Semnan) over a three-year period (2006–2008).

**Results:** The risk of road traffic accidents due to fatigue and sleepiness, which were reported by police, increased by more than seven-fold (Odds ratio = 7.33) in low alertness hours during circadian rhythm (0–6 A.M) compared to other times during the day. The risk of road traffic accidents due to fatigue and sleepiness decreased 0.15-fold (Odds ratio = 0.15) in hours with maximum of alertness (18–22 h.) of circadian rhythm compared to other times during the day.

**Conclusion:** The occurrence of road traffic accidents due to fatigue and sleepiness have significant statistical relation with driving on highways and freeways and it has a 2.6-fold increase compared to driving on the other types of roads.

**Acknowledgements:** Police officers work in the three provinces (Tehran, Qazvin and Semnan).

<http://dx.doi.org/10.1016/j.sleep.2013.11.613>

### More complex dreams with emotions or aggressions are associated with longer reports

I. Saez-Urribarri

**Introduction:** Report length is an indicator of dream recall, cognitive activity of the dreamer and biases due to recording data in the laboratory as opposed to at home. The aim was to investigate the way in which the number of characters, aggressions and emotions affect report length.

**Materials and methods:** Hall and Van de Castle's normative data were taken from DreamBank.net, composed of the dreams of 491 women and 499 men, all of them university students. Data were extracted on the number of characters, aggressions and emotions in the dreams. Subsequently, the relationship between these variables and report length was analysed. A multiple correspondence analysis was also carried out to explore the relationship of emotions and aggressions involving the Dream Self with the number of characters and report length.

**Results:** A significant relationship was found between report length and the number of characters ( $r = .47, p < .001$ ), the number of aggressions ( $r = .21, p < .001$ ) and the number of emotions ( $r = .26, p < .001$ ). The correspondence analysis showed that report

length was associated with non-physical aggressions, a greater number of characters and emotion (anger). However, other emotions such as apprehension, happiness, sadness and confusion also produced significant differences in the number of words in the report. A clear differentiation between physical and non-physical aggressions was also observed.

**Conclusion:** The presence of more characters, the role of the Dream Self as the aggressor or victim, and emotions were related to an increase in the length of dream reports. More complex dreams required more words in order to report them. The results show that physical aggressions should be analysed differentially from non-physical aggressions. The latter are associated with threats of a social nature, involving greater anger and more characters.

<http://dx.doi.org/10.1016/j.sleep.2013.11.614>

### Recalling your dreams won't make you nervous in the morning

I. Saez-Uribarri

**Introduction:** Nightmares are terrifying dreams – sometimes recurring and with drawn out plots – which wake up the sleeper. The CEAD is a useful test for evaluating nightmares which has been specifically designed to measure anxiety upon awakening. The original sample for the CEAD was composed of subjects who recalled a dream at the time of awakening. This could have introduced biases to the results. The first aim is to confirm whether there is a difference in scores obtained on the CEAD between dream recallers and non-recallers. The second aim is analyse the relationship between the CEAD and criteria involved in nightmares (anxiety and fear on awakening, awakening due to dreamed content, recurrence of content and recall quality).

**Materials and methods:** 252 Spanish-speaking volunteers were questioned about their awakening that same day. 70 of them were men and 181 were women. The mean age was 39.6 years (Sd = 13.6).

**Results:** 22.2% of participants recalled a dream with several scenes and 9.1% recalled several dreams during the night. 38.9% had no recall. No significant differences were found on the CEAD between recallers and non-recallers,  $F(1,175) = .172, p = .679$ . 9.9% of participants reported that they woke up because of what they were dreaming about. On comparing them with those who awoke for some other reason, no significant differences were found on the CEAD,  $F(1,237) = 3.48, p = .063$ . 17.1% of awakenings were accompanied by fear, anxiety or both. This produced significant differences on the CEAD,  $F(3,247) = 4.59, p = .004$ . 5.6% stated that they had a nightmare and 9.9% were not sure if what they dreamed was a nightmare. There were differences compared to those who had not had a nightmare or did not recall their dream,  $F(1,249) = 16.7, p < .0001$ . 1.6% of participants reported having had a dream which had been repeated on several occasions and in 3.6% it was almost identical to another recalled dream. Recurring dreams also produced differences,  $F(5,246) = 5.41, p < .0001$ .

**Conclusion:** Dream recall is not a symptom of anxiety. No significant differences in anxiety were found between dreamers and non-dreamers. CEAD scores were related to reports of nightmares, to a feeling of fear or anxiety caused by the dream, and to recurring content. The CEAD was not related to report length or to awakening as a result of dream content.

<http://dx.doi.org/10.1016/j.sleep.2013.11.615>

### Night-work shifts and inflammatory markers

A. Safaeian

Isfahan University of Medical Sciences, Iran

**Introduction:** There are some certain side effects for shift work documented in occupational references. Sleep deprivation has been shown to be associated with an elevation in inflammatory makers such as IL-6, TNF- $\alpha$  and CRP; and also inflammation is associated with increased risk of cardiovascular disorders, inflammatory disorders, cerebrovascular disorders, and mortality which seen in shift work too. The purpose of the present study was to investigate the relationship between night work and inflammatory marker.

**Materials and methods:** After selecting 50 workers according to inclusion and exclusion criteria, we designed a cross over study and a specific shift schedule for them. They were divided randomly to 2 groups. Group 1 (25 persons) went on a schedule likes 3 days as day-worker, one day off, and 3 days as night-worker. Group 2 were vice versa, 3 days as night-worker, one day off, and 3 days as day-worker. (cross over) Blood samples were obtained between 7 and 8 AM after the periods of day- work and night-work. IL6, TNF- $\alpha$  and CRP were assayed by ELISA, and WBC was measured by cell counter H1.

**Results:** Night-work increased IL6, WBC, Neutrophils, Lymphocytes significantly, compared with day-work. TNF- $\alpha$  was increased but it was not statistically significant, and also changes in monocyte count was not significant.

**Conclusion:** This study showed an increased inflammatory markers after night work, which have been reported in some previous studies on sleep deprivation. No significant changes in Monocyte count can be justified by the results of a study showed the elevation in blood levels of inflammatory markers is due to increase in gene expression, not in monocyte count. These results make the hypothesis that increase in inflammatory markers may have a relationship with night work side effects.

**Acknowledgements:** We thank Dr. Roohi Qureshi, MD, MEng, FRCPC, for correction in English and edition, and Chodan sazan factory (Isfahan, Iran); Hoseyn Ansari (manager of the factory), Maryam Farhang (health, safety and environment unit) for cooperation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.616>

### Gabaergic transmission by POA neurons to orexin neurons

Y. Saito<sup>1</sup>, N. Tsujino<sup>1</sup>, M. Mieda<sup>1</sup>, M. Abe<sup>2</sup>, K. Sakimura<sup>2</sup>, T. Sakurai<sup>1</sup>

<sup>1</sup> University of Kanazawa, Dept. Molecular Neuroscience and Integrative Physiology, Japan

<sup>2</sup> University of Niigata, Dept. Cellular Neurobiology, Brain Research Institute, Japan

**Introduction:** Populations of neurons in the hypothalamic preoptic area (POA) fire rapidly during sleep, exhibiting sleep/waking state-dependent firing patterns that are the reciprocal of those observed in the arousal system. The majority of these preoptic\_gsleep-active\_h neurons contain the inhibitory neurotransmitter GABA. These neurons are thought to play an important role in initiation and maintenance of sleep by sending inhibitory projections to the arousal systems that reside in the brain stem. Recently, several studies have suggested that orexinergic neurons in the hypothalamus, which play a critical role in maintaining arousal, are also influenced by these neurons. We examined the connectivity between POA GABAergic neurons and orexin neurons.

**Materials and methods:** We applied the DREADD technology to pharmacogenetically manipulate the activity of POA GABAergic neurons. To express hM3Dq in GABAergic neurons in the POA, we injected AAV-DIO- HAhm3Dq into the POA of Gad67-Cre mice, in which GABAergic neurons specifically express Cre recombinase. The sleep/wakefulness states of these mice were examined by simultaneous EEG/EMG recording. Activity of orexin neurons were examined by Fos- immunostaining. We expressed Chr2 selectively in GABAergic neurons in the POA to examine the projection sites of Chr2 expressing axons. We also examined the effects of optogenetic stimulation of Chr2-positive fibers on the firing rates of orexin neurons in slice preparations.

**Results:** Pharmacogenetic stimulation of POA GABAergic neurons resulted in increase of NREM sleep along with inhibition of orexin neurons. We also found that POA GABAergic neurons send widespread projections to wakefulness-related areas in the hypothalamus and brain stem, including the LHA where these fibers make close appositions to orexin neurons. Optogenetic stimulation of these fibers resulted in inhibition of orexin neurons.

**Conclusion:** These observations suggest direct connectivity between POA GABAergic neurons and orexin neurons.

**Acknowledgements:** This study was supported by the Cabinet Office, the Government of Japan through its\_gFunding Program for Next Generation World-Leading Researchers\_h.

<http://dx.doi.org/10.1016/j.sleep.2013.11.617>

### Nocturnal blood pressure regulation in stroke patients with sleep apnea

M. Saletu, S. Kotzian, I. Schiefer, M. Hillberger, J. Spatt  
NRZ Rosenhügel, Vienna, Austria  
Neurology, Sleep Medicine, Austria

**Introduction:** In clinical routine, stroke patients with sleep apnea (SA) show a different blood pressure (BP) response to respiratory events. The aim of the study was to evaluate the impact of age, comorbidity, medication, etiology and location of cerebral lesions on nocturnal (BP) in stroke patients with SA.

**Materials and methods:** Respirographic sleep studies were performed in all stroke patients that underwent neurorehabilitation. Their systolic BP was determined by means of a non-linear algorithm and an individual one-point calibration of the pulse transit time obtained with a cuff-based BP measuring (SOMNOmedics GmbH, Germany). The number of systolic rises (defined as >15 mmHg) was scored. Risk factor evaluation, Oxfordshire Community Stroke Project (OCSP) and TOAST classification were performed.

**Results:** Out of the 203 stroke patients (age  $58 \pm 12$ ;) enrolled in the study, 38% were suffering from SA (AHI > 15). They showed a median of  $47 \pm 38$  BP rises per hour, with a median rise by  $19 \pm 3$  mmHg, and a median nocturnal systolic BP of  $138 \pm 26$  mmHg. In 7 patients, no apnea-related BP rises were observed (non-responders). Etiologically, they showed an equal distribution of small-artery occlusion (3), large-artery atherosclerosis (1), stroke of other determined cause (1), or undetermined cause (1), cardioembolism (1) and cerebral hemorrhage (1). There were neither differences in OCSP vessel lesions nor influence factors for the non-responders.

**Conclusion:** 9.1% of stroke patients with SA show an atypical blood pressure response to apneas (non-responders). The missing blood pressure response doesn't seem to be correlated with age, comorbidity, clinical symptoms, medication, etiology, or cerebral lesion.

<http://dx.doi.org/10.1016/j.sleep.2013.11.618>

### Periodic leg movements in spinal cord injury: evaluation of arousals and treatment effect

A. Salminen<sup>1</sup>, M. Manconi<sup>2</sup>, V. Rimpilä<sup>1</sup>, T. Luoto<sup>3</sup>, R. Ferri<sup>4</sup>, O. Polo<sup>5</sup>  
<sup>1</sup> University of Tampere, Finland  
<sup>2</sup> Civic Hospital of Lugano, Switzerland  
<sup>3</sup> Tampere University Hospital, Finland  
<sup>4</sup> Oasi Research Institute (IRCCS), Italy  
<sup>5</sup> Tampere University Hospital, Finland

**Introduction:** Periodic Leg movements (PLM) have been previously reported in spinal cord injury (SCI), but never analyzed thoroughly. The objective of this study was to investigate the association between PLM and cortical and autonomic arousals in a patient with a complete SCI. Also the effect of a dopamine agonist was evaluated.

**Materials and methods:** Characterization of the SCI was done following the "International Standards for Neurological Classification of Spinal Cord Injury" and by performing a cervical MRI. Two separate baseline sleep recordings were performed with tibialis anterior EMG. A third similar recording was carried out under dopamine agonist medication.

**Results:** The SCI was found motor and sensory complete, indicating an injury of ASIA A severity. The MRI finding supported the clinical assessment of complete injury. PLM indexes were 148.2/h and 36.4/h in the baseline sleep studies. Leg movements were disconnected from cortical arousals, as well as from respiratory or heart rate events. Heart rate events were associated with respiratory cortical arousals. All leg movements were abolished by pramipexole.

**Conclusion:** The presence of PLM in a patient with a complete cervical SCI indicates that they may appear without a generator of the movements in the brain. The disconnection of PLM from cortical, respiratory or cardiac events also supports a spinal pacemaker or peripheral trigger mechanism. Suppression of movements during the dopaminergic intervention suggests that the site of action of pramipexole in our patient is either in the spinal cord or periphery. Our observations add significant knowledge to the current models of the genesis for PLM and warrant studies in larger populations.

**Acknowledgements:** Professor Juha Öhman and Dr. Eerika Koskinen from Department of Neurosciences and Rehabilitation, University of Tampere, are acknowledged for their valuable contribution to the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.619>

### A new characterization of adherence patterns to auto-adjusting positive airway pressure in severe obstructive sleep apnea syndrome: clinical and psychological determinants

R. Sampaio<sup>1</sup>, M. Pereira<sup>1</sup>, J. Winck<sup>2</sup>  
<sup>1</sup> School of Psychology, Minho University, Portugal  
<sup>2</sup> Department of Medicine, Oporto University, Portugal

**Introduction:** The aim of this study was to examine the joint role of demographic, clinical, and psychological variables as predictors of a stable adherence pattern to auto-adjusting positive airway pressure (APAP).

**Materials and methods:** After overnight sleep study and OSA diagnosis, a total of 153 patients underwent a three time psychological protocol evaluation, during a 6 months APAP treatment period.

**Results:** Of these, 107 patients maintained a stable adherence pattern to APAP (47% were poorly adherent, 27% were moderately adherent and 26% were optimally adherent), during the treatment period. Several factors distinguished the three adherence patterns

and some of these emerged as the main predictors. In T1, the first model included age, apnea-hypopnea index (AHI), outcome expectations and coping spiritual support, as main predictors to distinguish adherence patterns. In T2 and T3, two models emerged adjusted for the variables of model 1, that included leakage, self-efficacy, family coping (mobilizing family acquire/accept support and reframing) in model 2 and self-efficacy in model 3. Generally, the areas under the ROC curve, presented a good discrimination.

**Conclusion:** Findings revealed an integrative heuristic model that accounted for the joint influence of demographic, clinical, and psychological factors on poor, moderate and optimal adherence patterns.

**Acknowledgements:** This work was supported by a grant (SFRH/BD/38388/2007) from the Portuguese Foundation of Science and Technology. We thank all patients that agreed to participate in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.620>

### Polysomnographic features in three insomnia subtypes

F. Sánchez-Narváez, D. De La Orta, A. Labra, R. Haro

Sleep Disorders Clinic, National University of Mexico, México D.F, Mexico

**Introduction:** Insomnia is a prevalent condition worldwide. Anxiety is a frequently observed symptom in insomnia and benzodiazepines (BZD) are one of the most common prescribed drugs not only for anxiety treatment but also for sleep difficulties assessment. It has been described that a class effect of BZDs is to cause negative changes on sleep pattern, so it could be possible that sleep features worsen in insomniacs treated with BZD. So our objective was to compare PSG values in insomniac patients with anxiety (AI), insomniacs with benzodiazepine use (BZDI), and primary insomnia (PI) to a group of good sleepers (GS).

**Materials and methods:** The study included 148 insomniacs and 50 GS. Subjects underwent a nocturnal PSG study under standard procedures and they were divided in the 3 mentioned conditions according to their etiology. Results were analyzed by ANOVA.

**Results:** TST (min.): GS (8.0 + 0.002) vs. PI (7.89 + 0.1), AI (8.0 + 0.02) and BZDI (7.9 + 0.05). Sleep efficiency index (%): GS (91.5 + 0.3) vs. PI (78.9 + 1.4), AI (76.8 + 1.09) and BZDI (79.5 + 1.39). Sleep onset latency (min): GS (9.5 + 0.7) vs. PI (38.4 + 4.1), BZDI (20.2 + 2.4) and AI (45.8 + 4.5); BZDI (20.2 + 2.4) vs. PI (38.4 + 4.1) and AI (45.8 + 4.5). Sleep onset REM (min.): GS (98.1 + 1.7) vs. PI (112.8 + 6.4), AI (52.8 + 2.8) and BDZI (119.05 + 7.6); AI (52 + 2.8) vs. PI (112.8 + 6.4) and BDZI (119.05 + 7.6). N1 (%): GS (10.3 + 0.2) vs. AI (14.3 + 0.5) and BDZI (15.2 + 0.6); PI (12.2 + 0.7) vs. BDZI (15.21 + 0.6). N2 (%): GS (51.2 + 0.4) vs. AI (59.2 + 0.5) and BDZI (63.8 + 1.2). AI (59.2 + 0.6) vs. PI (50.4 + 1.2) and BDZI (63 + 1.2); PI vs. BDZI. N3 (%): BDZI (5.9 + 0.7) vs. AI (9.5 + 0.6), PI (19 + 1.2) and GS (18.3 + 0.2); PQI (9.5 + 0.6) vs. GS and PI. REM (%): GS (20.1 + 0.3) vs. AI (17.04 + 0.6) and BZDI (15.02 + 0.7); PI (18.03 + 0.7) vs. BDZI. \**p* < 0.05.

**Conclusion:** Our data indicate that there are several significant changes in PSG parameters between the 3 groups of insomnia: PI, insomnia secondary to anxiety and in patients with benzodiazepines use. Changes are also present when compared to GS. These changes must be considered at the time of choosing the therapeutic tool to manage insomnia.

<http://dx.doi.org/10.1016/j.sleep.2013.11.621>

### Nicturia and morbid obesity: predictors for severe AHÍ and SaO2 decrease

A. Palacios, F. Sánchez-Narváez, A. Labra, R. Haro

Sleep Disorders Clinic, National University of Mexico, Mexico

**Introduction:** Nicturia is defined by the International Continence Society as the complaint of getting up more than twice a night to urinate. Nicturia is a frequently found symptom in patients with obstructive sleep apnea syndrome (OSAS). Its prevalence has been found from 41% to 80%. Despite the description of the relationship between nicturia and sleep apnea; the risk factors are not yet clear. The aim of this study is to describe the risk association of OSAS, nicturia and SaO2.

**Materials and methods:** We included 349 patients with sleep apnea and no other morbidity. They were divided into 2 groups, 191 were patients without, and 158 with nicturia. Nicturias was defined as getting up to urinate at least twice during the night. They underwent supervised cardiorespiratory polygraphy. The results were analyzed with a Students t test for not related samples.

**Results:** Nicturia vs No nicturia: AHÍ\* (37.8 + 2.4 vs 61.79 + 3.01), mean SaO2\* (90.8 + 0.25 vs 86.4 + 0.58), minimal SaO2\* (77.2 + 0.87 vs 70.1 + 1.32), BMI\* (27.8 + 0.31 vs 31.21 + 0.53), Epworth\* (9.4 + 0.45 vs 11.8 + 0.55) \**P* < 0.01. Odds ratio controlled by age and gender for AHÍ higher than 30 with confidence interval. 2.1\* (1.3–3.5). Morbid Obesity 3.5\* (2.1–6.0). Somnolence. 2.03\* (1.2–3.3). Odds ratio controlled by age and gender for mean SaO2 with confidence interval 4.49\* (2.7–7.4), Morbid obesity 3.09\* (1.8–5.1). Somnolence 1.7\* (1.02–2.85). \**P* < 0.05.

**Conclusion:** Our results suggest that patients with Nicturia higher than 2, show a higher AHÍ, lower mean SaO2 and an increase in the somnolence scale and BMI. The significant risk factors for AHÍ higher than 30 and SaO2 lower than 89% were the number of urinating events, morbid obesity and somnolence.

<http://dx.doi.org/10.1016/j.sleep.2013.11.622>

### The effect of two nights of partial sleep restriction on objective and subjective pain measurements

S. Ødegård, P. Omland, K. Nilsen, G. Gravdahl, M. Stjern, T. Sand

Department of Neuroscience, Faculty of Medicine, NTNU, Norway

**Introduction:** The exact nature of the relationship between sleep reduction and pain is still not known and further clinical studies are needed to elucidate the relationship between sleep and pain further.

**Materials and methods:** Students were recruited through intranet advertisement at our University and Hospital. Of the 80 students who responded to the invitation, 34 (mean age 22.9) were included in the present paper and randomly assigned to either sleep deprivation (SD) or habitual sleep (HS) subgroups. They had repeated neurophysiological examinations with two nights of sleep deprivation or habitual sleep in between. Pain responses were measured with laser evoked potentials (LEP), thermal threshold and suprathreshold test. Repeated measures ANOVA was used to evaluate the possible interaction between sleep deprivation and pain measures. The effect of sleep deprivation was also investigated using two additional categorizations; as actual PSG-recorded REM sleep and SWS (median splits). The difference between N2P2 amplitude, thermal pain threshold and pain ratings were compared between sleep categorization subgroups with Mann-Whitney *U*-test. The difference between baseline and follow-up values within the sleep groups where investigated with the Paired *T*-test.

**Results:** RANOVA revealed a significant interaction between day x sleep for the N2P2 amplitude ( $p = 0.02$ ) because amplitude decreased in the 4-h group ( $p = 0.03$ ) while it was more stable in the 9-h group. We also found a significant interaction between day x sleep for cold pain threshold at thenar ( $p = 0.003$ ), and further analyses with the Paired *T*-test demonstrated that cold pain threshold was significantly decreased after sleep deprivation ( $p = 0.02$ ), while no change was observed within the habitual sleep group.

**Conclusion:** Partial sleep deprivation has minor, but significant effects on objective and subjective pain measurements. Subject randomized to four hours sleep had a smaller LEP N2P2- amplitude, no change in suprathreshold pain ratings and a lower threshold for cold pain the at day 3, compared to subjects randomized to nine hours sleep.

**Acknowledgements:** The authors are most grateful to the subjects of the present study for their participation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.623>

### **Non-random temporal distribution of sleep onset REM periods in the MSLT in narcolepsy**

G. Sansa, C. Falup-Pecurariu, M. Salamero, A. Iranzo, J. Santamaria  
*Hospital Clinic of Barcelona, Spain*

**Introduction:** The diagnosis of narcolepsy is supported by the presence of two or more sleep onset REM periods (SOREMPs) in the multiple latency sleep test (MSLT). The distribution of SOREMPs throughout the MSLT has not been systematically studied in narcolepsy. An uneven occurrence of SOREM throughout the day could influence the diagnostic resolution of the test in narcolepsy, particularly when using short MSLT versions. We studied the temporal distribution of SOREMPs in the MSLT of a large series of narcoleptics and the diagnostic value of the three and four- nap versions of the test.

**Materials and methods:** One hundred and twenty-nine patients consecutively diagnosed with narcolepsy underwent nocturnal polysomnography followed by a five-nap MSLT.

**Results:** Four hundred and twenty-nine SOREMPs were recorded in 645 MSLT naps (66.5%). The probability of presenting SOREMPs in the fourth nap (3:30 pm) was significantly lower than in the remaining four naps: 22.4% SOREMPs in the first nap, 20.5% in the second, 20.5% in the third, 16% in the fourth and 20.5% in the fifth nap ( $p < 0.034$ ). Shortening the MSLT to three or four naps decreased the capability of the test to support the diagnosis of narcolepsy 2 or more SOREMPs in 14.7% and 10% of the patients, respectively.

**Conclusion:** The temporal distribution of SOREMPs in the different naps of the MSLT is not even in narcolepsy, with the fourth nap having the lowest probability of presenting a SOREMP. This should be taken into account when evaluating the results of the MSLT, and particularly when using shorter (three or four nap) versions of the test.

**Acknowledgements:** This work is not an industry supported study. Dr. Sansa, Salamero, Iranzo and Santamaria indicate no conflicts of interest and nothing to disclose financially. Dr. Falup-Pecurariu was supported through an European Neurological Society fellowship research project.

<http://dx.doi.org/10.1016/j.sleep.2013.11.624>

### **Three-dimensional cone-beam computed tomography for assessment of airway changes with mandibular advance splint**

P. Mayoral Sanz, E. Calvo

*Instituto de Investigaciones del Sueño, Spain*

**Introduction:** Upper airway constriction is an important contributing factor to obstructive sleep apnea (OSA), which may be treated in a palliative manner with mandibular advancement devices (MADs) to increase patency of the airway. It may be the treatment of choice for affected individuals who cannot use a continuous positive airway pressure device or who are not candidates for surgical correction of OSA. The specific distance applied during mandibular advancement, however, is often arbitrarily determined. This project uses cone beam computed tomography imaging in patients with OSA to determine a quantifiable relationship between airway patency and mandibular advancement. This correlation may be the basis to create an ideal technique to diagnose and treat patients having OSA.

**Materials and methods:** Twenty-six subjects successfully treated for OSA with a MAD received 2 cone beam computed tomography scans; 1 with and 1 without the MAD. Volumetric, cross-sectional, and cephalometric measurements were gathered from these scans. With the use of linear regression statistical analysis, specific predictor parameters have been identified for volumetric and cross-sectional airway information.

**Results:** An average oropharyngeal volume increase of approximately 2800 mm<sup>3</sup> was achieved with MAD therapy.

**Conclusion:** Lateral airway dimensions of the cross-section at C2, total volume, and cross-sectional area gained in the oropharynx can be predicted from the amount of mandibular forward movement.

**Acknowledgements:** Instituto de Investigaciones del Sueño for support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.625>

### **Predictive value of laryngoscopy with reference to the treatment of obstructive sleep apnea with mandibular advance device**

P. Mayoral Sanz

*Instituto de Investigaciones del Sueño, Orthodontist, Spain*

**Introduction:** The diagnosis of sleep-related breathing disorders is based primarily upon targeted history-taking and upon night-time polysomnography. Diagnostic measures should be completed by laryngopharyngoscopy (LPS). Frequently in cases of relevant obstructive sleep-related breathing disorders, a collapse of the pharyngeal lumen may be detected already in the waking state: either during spontaneous breathing or through adequate provocation (snoring manoeuvre).

**Materials and methods:** 34 patients with AHI mild to moderate (20.8) were selected to treatment with mandibular advance splint. To predict outcome, a special occlusal splint with 8 mm advance was placed and nasal laryngoscopy was performed.

**Results:** 30 patients (88.23%) showed good response to advance with an increment of 6 mm on the diameter of upper airway.

**Conclusion:** Laryngoscopy with mandibular advance splint shows changes in upper airway and predicts outcome in patients with mild to moderate sleep apnea candidates for treatment with mandibular advance device.

**Acknowledgements:** Instituto de Investigaciones del Sueño.

<http://dx.doi.org/10.1016/j.sleep.2013.11.626>

### Long-term sleep measurement with a smartphone-connected flexible bed sensor strip

J. Paalasmaa<sup>1</sup>, T. Sarkanen<sup>2</sup>, M. Partinen<sup>2</sup>

<sup>1</sup>Beddit Ltd., Finland

<sup>2</sup>Helsinki Sleep Clinic, Vitalmed Research Centre, Finland

**Introduction:** There are few methods to follow sleep for months or years. Long-term measurement of sleep would enable following up the course and treatment of sleep disorders. Our goal has been to develop a sleep measurement system that is completely unobtrusive (no wearable components) and thus suitable for long-term measurement. A flexible force sensor is placed under the bed sheet and sleep is analyzed and presented to the user with a smartphone application, enabling personalized sleep advice based on measurement. In addition to an actigraphy-like movement signal, respiration information, heart rate and the sleeping environment can be measured. In this contribution, results on the correlation with standard actigraphy measurement, as well as heart rate measurement precision, are presented.

**Materials and methods:** A flexible piezoelectric sensor measures the vibrations caused by body movements, heartbeat and respiration. Sleep/wake classification is done based on these parameters. The sensor measures 70 by 3 cm, is 0.2 mm thick and is placed under the bed sheet. Signals are analyzed in the user's smartphone (iOS, Android), where the signal is continuously transmitted over Bluetooth connection. The sleeping environment is measured with ambient noise and luminosity sensors in the mobile device. Based on the user's measured sleep information, personalized sleep advice is given with the smartphone. A clinical study with 17 volunteers has been carried out. The force sensor measurement was compared to actigraphy (7 nights per subject) and to an ECG reference (1 night).

**Results:** Preliminary results from the clinical study show good agreement between the force sensor measurement and actigraphy: Average correlation coefficient between activity counts (3-min epochs) was found to be 0.7. A validation of the sleep/wake classification against polysomnography (one night for each of the 17 subjects) is being carried out. Validation against ECG shows good heart rate detection precision, with an average heart rate error of 0.4 BPM.

**Conclusion:** The presented method provides interesting information about sleep, without any disturbance. Movement measurement is comparable to actigraphy. In addition, heart rate and respiration information can be measured. For example, the detection of central apneas seems promising, because the cessation of breathing is prominently visible in the signal. Using a smartphone for measurement and analysis makes the product affordable and accessible to many individuals suffering from sleep disorders.

**Acknowledgements:** The research has been supported by Beddit Ltd.

<http://dx.doi.org/10.1016/j.sleep.2013.11.627>

### Narcolepsy with coexisting type 1 diabetes: a case report

T. Sarkanen, A. Huuttoniemi, M. Partinen

Helsinki Sleep Clinic, Finland

**Introduction:** Narcolepsy is strongly associated with HLA-DQB1\*06:02 which is protective for type 1 diabetes. The combination of these two diseases is extremely rare. Sodium oxybate (SBX) is an efficient treatment of narcolepsy. In a 24 year old Caucasian woman with suspected narcolepsy SBX increased hyperglycemia and ketosis.

**Materials and methods:** We report a case of a 15 year old Finnish boy with type 1 diabetes who developed narcolepsy and cataplexy after Pandemrix vaccination (PDRX).

**Results:** At age 12 the boy received PDRX and he developed excessive daytime sleepiness (EDS) 1 month later. Ambiguous cataplexy (CPL), sleep paralysis and hypnagogic hallucinations started 5 months after EDS and disturbed sleep 1 month after the vaccination. The TST was 400 min, sleep efficiency 82%, SL 3 min and REM latency 56 min. AHI was 0.3. MSLT SL was 0.75 min with 4/5 SOREM periods. He is HLA-DQA1\*03:01, 01:02 and DQB1\*03:02, 06:02. EDS was treated with modafinil, and CPL with clomipramine and later with venlafaxine 75 mg. SBX was started at age 15 because of disturbed night sleep and insufficient control of CPL. His diabetes was treated with a sensor-augmented insulin pump. SBX treatment started with 4 g (1.5 g × 2). Tissue glucose was followed continuously with the pump. No significant increase in glucose has been observed and SBX has been well tolerated. Presently he is treated with SBX 7.5 g, modafinil 200–300 mg and venlafaxine 75 mg. The BMI has decreased from 22.4 to 20.7 kg/m<sup>2</sup>, PDSS score from 20 to 12 and UNS from 15 to 5. WHO5 quality of life score has increased from 45% to 85%. HbA1c has decreased from 64 mmol/mol (8.0%) to 57 mmol/mol (7.4%) during treatment with SBX.

**Conclusion:** A combination of narcolepsy (Brighton level 2) and type 1 diabetes is rare. Contrary to a previous case report SBX ameliorated glucose balance in addition to ameliorating narcolepsy.

**Acknowledgements:** This study was supported by Academy of Finland (NARPANord, 260603). We thank study nurses of our sleep clinic and the courageous boy and his parents for collaboration.

<http://dx.doi.org/10.1016/j.sleep.2013.11.628>

### Symptoms of narcolepsy in relation to pandemrix vaccination and CSF-hypocretin-1 levels

T. Sarkanen, A. Huuttoniemi, M. Partinen

Helsinki Sleep Clinic, Finland

**Introduction:** The incidence of narcolepsy increased in Finland, Sweden, Norway, Ireland, UK and France after the H1N1 influenza vaccination (Pandemrix) campaign in 2009–2010. The increase has been noted especially in people aged <20 years and in lesser degree in adults. The phenotype and disease severity are various. Cataplexy (CPL) is associated with low CSF-hypocretin-1 (hcr1) but few studies have investigated the relation of hcr1 with other symptoms of narcolepsy. Our aim is to compare symptoms and findings of narcolepsy related to Pandemrix- and hcr1 status.

**Materials and methods:** In all 89 [45 post- (19 men, 26 women) and 44 pre-Pandemrix (19 men, 25 women)] patients with diagnosed narcolepsy (ICSD-2 criteria) were clinically examined. A modified Basic Nordic Sleep Questionnaire was used. PSG, MSLT and/or hcr1 measurements were done.

**Results:** All subjects with Pandemrix-association (post-PDRX) and 95% without association (pre-PDRX) were HLA-DQB1\*06:02

positive. Median ages at diagnosis were 16.4 and 26.5 years, respectively. 34 (77%) and 25 (68%), respectively, had onset at age <20. Age at onset was <10 years in 6 (14%) vs 5 (14%) subjects. One patient in post-PDRX and 2 in pre-PDRX had onset after 40 years. The median age of onset (15.2 years) in the post-PDRX did not differ significantly from the pre-PDRX (16.8 years). Patients <20 years had more SOREMPs (median 4 vs. 2,  $P = 0.001$ ). Hcrt levels were similar, mean 44.7 pg/ml vs 48.3 pg/ml and median 3 pg/ml (0–264) vs 27 pg/ml (0–313). SL in MSLT was shorter in post-PDRX (median 2.4 min vs 3.6 min,  $P = 0.028$ ). There were no significant differences in occurrence of CPL (88% vs 86%), hypnagogic hallucinations (58% vs 71%) or sleep paralysis (42% vs 39%) at diagnosis. There were no differences in ESS, Ullanlinna Narcolepsy Scale (UNS), Skogby Excessive Daytime Sleepiness Scale (SEDS), Rimon's Brief Depression Scale (LKDA) or WHO Well-Being Scale (WHO5). Hcrt correlated with shorter SL in MSLT ( $r = 0.362$ ,  $P = 0.012$ , Pearson correlation), diagnostic delay ( $r = 0.299$ ,  $P = 0.032$ ) and REM-latency in PSG ( $r = 0.564$ ,  $P = 0.010$ ) but not with sleep efficiency, ESS, UNS, WHO5, LKDA or number of CPL per week. CPL at time of diagnosis was present in 41/47 (87%) of subjects with hcrct <110 pg/ml and in 4/8 (50%) with hcrct  $\geq 110$  pg/ml ( $P = 0.012$ ).

**Conclusion:** Pre- and post-Pandemrix narcolepsies do not differ significantly. Hypocretin-1 levels correlated poorly with most symptoms. In sum our results implicate that also non-hypocretin-related mechanisms play an important role in narcolepsy.

**Acknowledgement:** This study has been funded by the Academy of Finland grant 260603.

<http://dx.doi.org/10.1016/j.sleep.2013.11.629>

### Change in heart rate variability precedes the occurrence of periodic leg movements during sleep: an observational study

T. Sasai-Sakuma<sup>1</sup>, M. Matsuura<sup>2</sup>, Y. Inoue<sup>1</sup>

<sup>1</sup>Tokyo Medical University, Japan

<sup>2</sup>Tokyo Medical and Dental University, Japan

**Introduction:** Several previous studies have reported that individual PLMS activities are associated with autonomic nervous system activity occurring shortly before each PLMS activities. However, there is no study investigating dynamic changes of autonomic nervous system activity before onset of PLMS. The aim of this study is to detect changes in heart rate variability (HRV) at the onset of the period in which periodic leg movements during sleep (PLMS) are observed using complex demodulation method.

**Materials and methods:** This study enrolled 14 patients diagnosed as having idiopathic PLMS disorder (PLMD). HRV-variables and spectral power of fluctuation of mean frequency in a high frequency band (HF-fluctuation; HFF) during sleep stage 2 were analyzed and compared between the period with and without PLMS. In addition, the changes of above parameters in periods in transition from the period without PLMS to that with PLMS were explored.

**Results:** Spectral power in the low frequency (LF) band and very low frequency (VLF) band were higher in the period with PLMS. Additionally, the average frequency in HFF was higher and the frequency in this band fluctuated during the period with PLMS with remarkable elevation of HFF. Moreover, the spectral powers in HFF, LF, and VLF were remarkably elevated shortly before the beginning of the period with PLMS (HFF, -65 s; LF, -53 s; and VLF, -45 s).

**Conclusion:** The elevation of sympathetic nervous activity and the HF frequency fluctuation can occur several tens of seconds before the beginning of the period with PLMS. Dynamic changes in the autonomic nervous system activity could be related with the vulnerability to PLMS occurrence during a night.

**Acknowledgements:** This study was supported by an Intramural Research Grant (21B-4) for Neurological and Psychiatric Disorders of NCNP, Fellowship for Young Clinical Sleep Researchers of the Japan Sleep Research Society, and MEXT/JSPS KAKENHI (Grant-in-Aid for Young Scientists, Grant Number: 24791235).

<http://dx.doi.org/10.1016/j.sleep.2013.11.630>

### Screening of sleep apnea syndrome during a full medical checkup: a comparison between an optical fiber-type sleep apnea sensor and an overnight pulse oximetry

K. Satoh<sup>1</sup>, S. Mitachi<sup>2</sup>

<sup>1</sup>Tohoku Rosai Hospital, Department of Medical Examination, Japan

<sup>2</sup>Tokyo University of Technology, Japan

**Introduction:** F-SAS sensor, a simple sensor that utilizes plastic optical fibers to assess breathing changes through optical signal changes, may provide a much needed easy-to-use, non-invasive screen sleep apnea syndrome (SAS).

**Materials and methods:** To evaluate the eligibility of F-SAS sensor, for screening of sleep apnea syndrome (SAS).

**Results:** Assuming a full medical checkup, we created a "multi-channel F-SAS sensor system" by adding to the conventional single-type F-SAS communication interface functions to measure multiple subjects at the same time. We measured the arterial blood oxygen saturation with a PLSX in 34 persons (27 men and 7 women,  $56.0 \pm 7.5$  years old with a BMI of  $25.8 \pm 4.1$  and Epworth Sleepiness Scale of  $6.8 \pm 3.8$ ) undergoing an overnight full medical checkup. We measured their thorax respiratory fluctuations by placing this instrument under their bed pad while they were sleeping. We simultaneously compared the of F-SAS sensor to the overnight pulse oximetry (PLSX) during an overnight full medical checkup. Thirty of the 34 examinees demonstrated a possible diagnosis of SAS with a pro-AHI index (Number of "apneas of 10 s or more" and "hypopneas with 70% or less of the normal breathing") greater than 5/h from the F-SAS sensor measurement. The simultaneous measurement with the PLSX showed a significant correlation ( $r = 0.79$ ,  $p < 0.01$ ) between the pro-AHI and the oxygen desaturation index (ODI-3%). Among them, 17 examinees had a pro-AHI  $\geq 10$  and were recommended to consult at an outpatient clinic specializing in SAS, taking into consideration the results of the PLSX as well. The four persons who underwent a detailed inspection of SAS with polysomnography (PSG) were all started on continuous positive airway pressure (CPAP) treatment.

**Conclusion:** The F-SAS sensor has the characteristics of being non-invasive and non-restrictive and is not expected to disturb normal sleep even during an examination. In this study, we demonstrated from the PSG detailed examination that PLSX correlated with that the F-SAS measures. The F-SAS sensor is effective for SAS screening during a full overnight medical checkup.

**Acknowledgement:** This investigation is partially supported by JST (A-STEP, #AS2114072A) in Japan.

<http://dx.doi.org/10.1016/j.sleep.2013.11.631>

### Leg thermal therapy improved sleep structure and subjective sleep quality in chronic heart failure

H. Sawatari<sup>1</sup>, M. Miyazono<sup>1</sup>, M. Nishizaka<sup>2</sup>, S. Ando<sup>3</sup>, K. Sunagawa<sup>2</sup>, A. Chishaki<sup>1</sup>

<sup>1</sup>Department of Health Sciences, Graduate School of Medical Sciences, Kyushu University, Japan

<sup>2</sup>Department of Cardiovascular Medicine, Graduate School of Medical Sciences, Kyushu University, Japan

<sup>3</sup>Sleep Apnea Center, Kyushu University Hospital, Japan

**Introduction:** An increasing number of patients with chronic heart failure (CHF) is suffering from insomnia, which is also impairing their quality of life (QOL) and might worsen heart failure. Previous studies reported that sleep depth and sleep onset were strongly affected by body temperatures before sleeping. We developed a leg thermal therapy (LTT) in which we used infra-red radiation to heat lower legs and could increase core body temperatures by 0.4 °C without any harmful hemodynamic changes in patients with CHF. We also found that the LTT was effective in improving the hemodynamics, vascular endothelial function, and reducing oxidative stress in patients with CHF. In present study, we evaluated the effects of the LTT on sleep quality in CHF from both subjective and objective sides.

**Materials and methods:** Fifteen inpatients with CHF (age: 53 ± 14 y.o., Male: 13, NYHA: II–III) underwent the LTT (45 °C) for 15 min followed by 30 min insulation for 3 consecutive nights before sleep. For objective evaluation of the LTT on sleep fragmentations, we recorded type-2 polysomnography before the LTT and just after three days' LTT. We assessed subjective sleep quality using the Oguri-Shirakawa-Azumi sleep inventory and St. Mary's Hospital sleep questionnaires every morning. We evaluated vascular endothelial function using flow-mediated vasodilation measurement in the early morning.

**Results:** Three consecutive nights protocol of the LTT showed significant decrease of sleep stage I, and the sum of sleep stage I and II ( $p < 0.05$  and  $p < 0.05$ , respectively). Furthermore, from the questionnaires, the LTT improved subjective sleep quality of difficulty in falling asleep, decreased frequency of dreams, and lengthened sleeping duration ( $p < 0.1$ ,  $p < 0.05$ , and  $p < 0.1$ ; respectively).

**Conclusion:** Three nights protocol of the LTT actually decreased light sleep and improved subjective sleep quality in patients with CHF. LTT had potential as a safety and complementary therapy that can improve sleep quality, QOL and prognosis in patients with CHF. Although the long term effects of LTT on sleep disturbance or prognosis on CHF remain to be investigated, current result suggests that the LTT could be used to improve QOL of CHF patients through improvement of their sleep quality.

<http://dx.doi.org/10.1016/j.sleep.2013.11.632>

### Sleep-disordered breathing in adults with down syndrome: a cross cultural comparison

H. Sawatari<sup>1</sup>, E. Hill<sup>2</sup>, M. Nishizaka<sup>3</sup>, A. Chishaki<sup>1</sup>, R. Riha<sup>2</sup>, S. Ando<sup>3</sup>

<sup>1</sup>Department of Health Sciences, Graduate School of Medical Sciences, Kyushu University, Japan

<sup>2</sup>Sleep Research Unit, University of Edinburgh, Department of Sleep Medicine, Royal Infirmary of Edinburgh, Japan

<sup>3</sup>Sleep Apnea Center, Kyushu University Hospital, Japan

**Introduction:** Individuals with Down syndrome (DS) are at increased risk of sleep disordered breathing (SDB). Anatomical characteristics of DS, such as mid-facial hypoplasia, small jaw and

obesity, are also risk factors for SDB, and may differ with ethnicity. Untreated SDB can lead to adverse cardiac outcomes and impaired cognitive function, thus early diagnosis and treatment may be important in DS. To date, no systematic population survey or cultural comparison has been made in DS individuals. This study aims to compare prevalence of SDB among adults aged >16 years with DS in two diverse cultures: Japan and Scotland.

**Materials and methods:** Questionnaires including physical profile, traditional or pictorial Epworth Sleepiness Scale (ESS) and witnessed signs of SDB (e.g. apnoeic episodes and snoring) were sent to adults aged >16 years with DS and their caregivers in Japan (J) and Scotland (S). 705 questionnaires were valid for analysis (J: 461; S: 244). Standard statistical analysis was undertaken.

**Results:** Similar gender distributions (male/female J: 259/202 vs. S: 139/105) and ESS (J: 6 ± 5 vs. S: 7 ± 5) were observed among Japanese and Scottish responders. Adults with DS in Scotland were older and had higher BMI than those in Japan (J: 24 ± 8 vs. S: 32 ± 11 years; J: 24.0 ± 4.1 vs. S: 29.6 ± 7.4 kg/m<sup>2</sup>). In Japan, 80% of responders snored and 30% had witnessed apnoeas. Similarly, in Scotland, 74% snored and 24% had witnessed apnoeas. In Japan, snorers had significantly higher BMI (OR 1.1, 95%CI 1.0–1.2,  $p < 0.01$ ) and ESS (OR 1.2, 95%CI 1.1–1.3,  $p < 0.001$ ), and tended to be younger (OR 1.0 95%CI 0.9–1.0,  $p = 0.06$ ). Similar associations were found in Scotland, with snorers being younger (OR 1.0, 95%CI 0.9–1.0,  $p < 0.05$ ) and having significantly higher ESS (OR 1.3, 95%CI 1.0–1.4,  $p < 0.01$ ). In Japan, witnessed apnoeas were significantly associated with higher ESS (OR 1.2, 95%CI 1.1–1.2,  $p < 0.001$ ).

**Conclusion:** Prevalence of symptoms of SDB was high among adults with DS in both countries. The DS population in Scotland was significantly more obese. These results imply that the anatomical characteristics of DS might overshadow the racial and anatomical differences in terms of causing SDB, although further research is required. Appropriate evaluation and treatment should be offered if symptoms of SDB are observed, regardless of ethnicity, in adults with DS. Both studies are ongoing.

**Acknowledgements:** We sincerely appreciate Donna Fairley, RN, for helpful effort. Hiroyuki Sawatari and Elizabeth A Hill were joint 1st author. Renata L Riha and Shin-ich Ando were Joint supervisors.

<http://dx.doi.org/10.1016/j.sleep.2013.11.633>

### Non-pharmacological treatment of primary insomnia using sensorimotor-rhythm neurofeedback

M. Schabus, H. Griessenberger, D. Heib, J. Lechinger, K. Hoedlmoser  
University of Salzburg, Laboratory for Sleep and Consciousness Research, Austria

**Introduction:** A non-pharmacological intervention, namely instrumental conditioning of 12–15 Hz oscillations (ISC), for improving sleep quality and memory is introduced. EEG recordings over the sensorimotor cortex show a prominent oscillatory pattern in a frequency range between 12 and 15 Hz (sensorimotor rhythm, SMR) under quiet but alert wakefulness. This frequency range is also known to be abundant during light non-rapid eye movement sleep, and is overlapping with the sleep spindle frequency band. Some early findings indicated that ISC of SMR during wakefulness can influence subsequent sleep. In the present study we intend to clarify the nature of these effects and apply neurofeedback (NFT) to insomnia patients.

**Materials and methods:** Twenty-four subjects (Mean = 34.83; SD = 10.60) with clinical symptoms of primary insomnia were tested. A counterbalanced within-subjects design (19 lab visits over the course of 3–6 weeks) was adopted. Each patient participated in

an ISC–NFT as well as a sham–NFT training block. Polysomnographic sleep recordings were scheduled before and after training blocks.

**Results:** Data confirm a significant increase of 12–15 Hz activity over the course of the ten SMR training sessions which was also positively related to overnight memory consolidation changes. Number of awakenings were reduced and slow-wave sleep was increased following ISC but not following sham–NFT. In addition, subjective sleep quality was enhanced over the course of the trainings. Last but not least sleep spindles in slow-wave sleep were found to be exclusively enhanced after SMR training.

**Conclusion:** Current results indicate that besides healthy individuals also people suffering from primary insomnia can experience subjective as well as objective benefits from ISC–NFT. Replication studies are yet awaited.

**Acknowledgements:** Research was supported by a FWF research (P-21154–B18) fund from the Austrian Science Foundation. We would like to thank Barry Sterman, Alexander Kunz, Wiebke Böning, Katharina Engl, Martina Feichtinger, Cornelia von Gamm, Daniela Tschann, Gabriela Werner, and Michaela Wittek for their support with the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.634>

## Medical technology assessment of polysomnography, type 2: full PSG at home

J. Scheper, R. Bossche, N. Jansen, L. Rohling, A. De Weerd  
Sleepcenter Sein Zwolle/Groningen, The Netherlands

**Introduction:** Background: Polysomnography (PSG) in a clinical setting (PSG, type 1) is time consuming and expensive. Type 2, i.e. full PSG at home, is thought to be a good alternative, but has never been evaluated in terms of regular Medical Technology Assessment (MTA). In some countries this lack of MTA precludes reimbursement for PSG type 2. This communication is part of a series of posters which add up to MTA of PSG, type 2, and deals with night to night sleep variability. This study investigates the differences between the first and the second night, during two consecutive full PSG's type 2, on all sleep parameters.

**Materials and methods:** Retrospective study of 325 patients (49,1% male), mean age = 45.0, SD = 16.7) who underwent full PSG type 2 for two consecutive days. Their final diagnoses were (all ICSD-2 subcategories of) Insomnia ( $n = 193$ ), Sleep Related Breathing Disorder (SRBD) ( $n = 54$ ), Circadian Rhythm Sleep Disorder (CRSD) ( $n = 22$ ), Sleep Related Movement Disorder (SRMD) ( $n = 47$ ), Idiopathic Hypersomnia (IH) or Narcolepsy ( $n = 11$ ), Parasomnia ( $n = 6$ ) and No Diagnosis ( $n = 9$ ). The subjects with the diagnosis Insomnia, SRBD, CRSD, SRMD and the total group were compared on all sleep parameters of the first and the second night. We also compared two age groups: patients aged up to 45 years ('<sup>®</sup>younger patients') and a group over 45 years ('<sup>®</sup>older patients').

**Results:** The results indicate significant differences in sleep variables for the total group, the older patients and the insomnia patients. The patients diagnosed with Insomnia have a significant higher duration of Sleep Onset (SO) and more NREM1 in the first night. The total group spends more Time In Bed (TIB). The results of the group of ages '<sup>®</sup>45, have significant differences in various sleep parameters: TIB, SO, WASO are longer, their SE en NREM 3 decreased.

**Conclusion:** For the total group of 325 patients there are no significant differences between the first and the second night during two PSG's at home, on all sleep parameters, except more Time In Bed. For the Insomnia group, the patients have significantly more NREM1 and

longer SO in the first night compared to the second night. This is remarkable, since previous research suggests that there are far more significant differences in night to night sleep variability or reverse night in insomnia patients. Most differences between both recordings were found in the group of middle-aged and older patients. They appear to have some greater adaptation problems as many sleep parameters were disturbed and their sleep quality decreased when assessed over two nights.

<http://dx.doi.org/10.1016/j.sleep.2013.11.635>

## Primary sleep disorder categorization into clinical practice: a pilot study with the PRIMSC coding system

D. Carvalho<sup>1</sup>, R. Margis<sup>2</sup>, A. Schuh<sup>1</sup>, G. Gerhardt<sup>3</sup>, C. Rieder<sup>2</sup>, S. Schönwald<sup>1</sup>

<sup>1</sup> Sleep Disorders Unit, Neurology Section, Hospital de Clinicas de Porto Alegre, RS, Brazil

<sup>2</sup> Movement Disorders Unit, Neurology Section, Hospital de Clinicas de Porto Alegre, RS, Brazil

<sup>3</sup> Department of Physics and Chemistry, Universidade de Caxias do Sul (UCS), Brazil

**Introduction:** The 2005 International Classification of Sleep Disorders (ICDS 2) considers six primary diagnostic categories: Parassomnia, Respiratory, Insomnia, Movement, Sleepiness (Hypersomnia) and Circadian Sleep Disorders (not necessarily in that order). The PRIMSC acronym is being suggested as a mnemonic aid for primary care in Sleep Medicine, as it immediately calls attention to those sleep disorder categories. This pilot study explores usefulness of a diagnostic compilation tool (PRIMSC coding system) in the clinical setting.

**Materials and methods:** Chart information pertaining to 183 patients (age 57 + 13.25 years; 99 female) who attended a University Hospital-based Outpatient Sleep Disorder Clinic during the past 16 weeks was retrospectively reviewed. Global clinical impression on general sleep problems according to ICDS-2 Primary Sleep Disorders was recorded, except that the presence of a Sleepiness complaint was recorded regardless of its central or secondary origin. For each category – Parassomnia, Respiratory, Insomnia, Movement, Sleepiness and Circadian – the presence (2), possibility (1) or absence (0) of diagnosis was recorded. Insufficient information was coded as X. For instance, a sleepy patient with suspected OSA awaiting a sleep study (PSG), for whom no information regarding sleep-related motor activity had been obtained, was coded as 010X20.

**Results:** Seven patients received codings indicating insufficient information and were not further analyzed. The remainder 176 patients could be categorized into nine diagnostic clusters as follows: Suspected Parassomnia awaiting PSG (13); Definite Parassomnia With our Without Insomnia (4); Suspected OSA awaiting PSG, with or without Excessive Daytime Sleepiness (EDS) (75); Suspected OSA with different combinations of Insomnia, EDS and atypical RLS symptoms (4); Definite OSA with or without EDS (38); Isolated Insomnia (12); Restless Legs Syndrome (RLS) (6); Isolated Sleepiness due to Central Hypersomnia (19); Sleep Deprivation with Shift-Work Disorder (6).

**Conclusion:** Application of the PRIMSC coding system was fast and simple. Gaps on information recorded during the original unstructured interview were immediately highlighted. Moreover, patients with definite diagnosis and those still under investigation could be included in the same coding frame in a practical way. In

the Portuguese Language, PRIMSC acronym worked well as a mnemonic aid for primary patient care in Sleep Medicine, and its use helped improve the quality of the first clinical interview. Another study is now under development, whereby a minimal structured interview is tested in connection with this coding system (the PRIM-SCale).

*Acknowledgement:* No disclosures.

<http://dx.doi.org/10.1016/j.sleep.2013.11.636>

### **Prolonged daytime dissociative nrem3 sleep state in hypersomnolence with kleine levin symptomatology, a case report**

K. Schreuder<sup>1</sup>, J. Sie<sup>2</sup>, X. De Vries<sup>3</sup>, A. Hoekema<sup>4</sup>, K. Finnema<sup>5</sup>, A. De Weerd<sup>1</sup>

<sup>1</sup>SEIN Zwolle, Department of Clinical Neurophysiology, Epilepsy and Sleep Centre, The Netherlands

<sup>2</sup>Tjongerschans Hospital, Neurology, The Netherlands

<sup>3</sup>Tjongerschans Hospital, ENT Surgery, The Netherlands

<sup>4</sup>Tjongerschans Hospital, Maxillo-facial Surgery, The Netherlands

<sup>5</sup>Tjongerschans Hospital, The Netherlands

*Introduction:* We present a case of recurrent hypersomnolence. A diagnostic approach was performed.

*Materials and methods:* Medical evaluation by neurologist, ENT-surgeon, Maxillofacial surgeon, orthodontist and expert in sleep medicine and epilepsy.

*Results:* History: 7 weeks: stenosis pylori, 10th year: head injury; 41: Narcolepsy? HLADQ2 DQ8: neg.; negative effect of modafinil and sodium-oxybate; 41 years: IGM: Monoclonal Gammopathy of Underdetermined Significance (MGUS). Symptoms: staring at childhood. At 42 years: 3 days a week hypersomnolence during daytime: sleeps from 12 am to 4 pm, a feeling of unreality, works at home on automatic pilot, has no recollection of what he has done for several hours. In this period he is highly emotional and irritated, is sexually hyper aroused and has changed eating habits, with vomiting, automatic behaviour during eating, dysbasia and atonic jerks during defecation. Neurology: no abnormalities. Polysomnography: daytime sleep 1:30–4 p.m.: deep sleep with steep sws during 40 min. Nighttime sleep 0–6.30 am; SE = 91%; awakenings 24; nrem3 = 111 min (30%); rem = 66 min (18.4%); apnea-hypopnea-index = 18.3/h. MSLT: SL = 4.1 min, no sorem. Two days EEG and video monitoring: at start and next morning a normal background EEG. At 0 pm headache, double vision, faster speaking, followed by automatic behaviour for 3 h in the late afternoon, without recollection. EEG: frontal intermittent delta activity, changing into diffuse slowing in EEG to 1–2/s. and frontal regions zeta waves 1–3 s. Magnetic resonance imaging: no abnormalities in gray and white matter. CSF fluid: Hypocretine-1: 362 ng/l (range 224–653); liquor ery: 0. 0 × 106/l; leu, 5.0 × 106/l; gluc 3.3; total protein 0.51 g/l; virology: DNA HSV-1, HSV-2 and VZV: neg. Hormonal axis: GH:5.4 mU/l; TSH:1.88 mU/l; Cortisol; 8 a.m.:411; 4 p.m.:157 nmol/l; ACTH:3.3 pmol/l; Testosteron: 13.4 nmol/l; Vit D: 30 nmol/l. Blood sample; BSE 4 mm/h; CRP < 1 mg/l; gluc 4.5 mmol/l; IgA 1.2 g/l; IgM 1.0 g/l; MGUS.; IgLambda: 12.6 g/l.

*Conclusion:* Diagnosis: Kleine–Levin syndrome, OSAS. No epilepsy. Treatment of OSAS with MRA was started and Vit D supplied. Therapy of KLS stabilizing deep and REM sleep during nighttime with Valproate 300–150 mg, zopiclon 7.5 mg; clonazepam 1 mg an; Mirtazapine 18 mgr an, followed by stimulating daytime vigilance with methylphenidate 10 mg 4 dd. Nighttime sleep improved to 7 h, daytime nap lessened to 2 h, dissociative deep sleep state in afternoon to 1/2 h. Conclusion: This case suggests a possible auto-immune mediation.

*Acknowledgements:* To the co-workers of the Department of Clinical Neurophysiology, Epilepsy and Sleep Centre SEIN Zwolle.

<http://dx.doi.org/10.1016/j.sleep.2013.11.637>

### **Sleep deprivation impairs functional muscle recovery following injury**

P. Schwarz<sup>1</sup>, W. Graham<sup>1</sup>, F. Li<sup>1</sup>, M. Locke<sup>2</sup>, J. Peever<sup>1</sup>

<sup>1</sup>University of Toronto, Dept. of Cell & Systems Biology, Canada

<sup>2</sup>University of Toronto, Dept. of Kinesiology & Physical Education, Canada

*Introduction:* Skeletal muscles possess the ability to completely regenerate following muscular injury. Sleep is believed to play an important role in this regenerative process; however, the nature of this role has not been previously tested. Our aim was to investigate the effects of sleep deprivation on molecular, histological and functional indices of muscle repair following myotoxic injury.

*Materials and methods:* Male rats were injected with 1.5% bupivacaine into the masseter muscle to induce myotoxic damage. Subjects were either sleep deprived for 8 h during the light period using a forced locomotion activity wheel, or served as activity controls. They were subsequently sacrificed at 2, 7 or 14 days post-injection. Western Blot analysis was used to assay for protein expression of positive (MyoD, myogenin) and negative (myostatin) molecular repair markers. Evans Blue Dye staining for damaged muscle fibres was used to examine histopathology. Functional muscle repair was evaluated after 2 weeks using in situ contractility testing to measure the force–frequency relationship during isometric contractions.

*Results:* Sleep deprivation suppressed MyoD protein levels in the masseter at 2 and 7 days, and myogenin at 2 days post-injection, compared to activity controls. Myostatin levels were unaffected. Histopathology revealed no effect of sleep deprivation on the extent of muscle fibre degeneration following injury. The force-frequency curve tended to shift downward and to the right in response to sleep loss, indicating compromised contractile force at moderate to high stimulation frequencies.

*Conclusion:* We demonstrate that sleep loss impairs functional recovery of the masseter muscle following myotoxic injury. Specifically, 8 h of sleep deprivation acutely downregulated molecular markers of muscle repair and resulted in contractile function deficits during recovery. Together, these findings suggest that sleep normally plays a permissive role in the regeneration of damaged muscle tissue.

*Acknowledgements:* PS thanks the National Sciences and Engineering Research Council of Canada (NSERC) for his Ph.D. funding. This research is supported by funds from Canadian Institutes of Health Research (CIHR) and NSERC.

<http://dx.doi.org/10.1016/j.sleep.2013.11.638>

### **Nonlinear analysis of heart rate variability in patients with sleep apnea hypopnea syndrome (SAHS). A severity study**

A. Crespo<sup>1</sup>, F. Del Campo<sup>2</sup>, J. Gómez<sup>2</sup>, D. Álvarez<sup>2</sup>, J. Marcos<sup>2</sup>, R. Hornero<sup>2</sup>

<sup>1</sup>Hospital Universitario Río Hortega, Spain

<sup>2</sup>Biomedical Engineering Group (GIB), Spain

*Introduction:* Patients with sleep apnea hypopnea syndrome (SAHS) show an increased risk of suffering from cardiovascular diseases. Although this is a multifactorial relationship, sympathetic activation seems to carry out an essential role. The analysis of heart

rate variability (HRV) from ECG, i.e. the RR interval (time between consecutive R peaks) time series, has been widely used as a measure of autonomous control. HRV recordings have been mainly analyzed in the frequency domain. However, as other physiological signals, heart rate is not strictly periodic. Therefore, the use of nonlinear techniques could provide additional and essential information about HRV dynamics in SAHS patients. This study is aimed at quantifying different nonlinear metrics from HRV recordings of SAHS patients in order to characterize their dependence with the severity of the disease.

**Materials and methods:** A total of 240 subjects derived to the sleep-related breathing disorders unit were involved in the study. Standard in-hospital polysomnography (PSG) were carried out in order to diagnose SAHS. Subjects with an apnea–hypopnea index (AHI), 10 events per hour (e/h) from PSG were diagnosed as suffering from SAHS. According to PSG, 160 out of 240 patients suffered from SAHS. ECG was recorded at a sampling rate of 200 Hz. A QRS detection algorithm based on the Hilbert transform was applied to obtain the HRV signal. Three nonlinear methods were subsequently applied: Sample Entropy (SampEn), which quantifies irregularity; Lempel–Ziv complexity (LZC), which measures complexity; and Central Tendency Measure (CTM), which is a variability measure. Patients were divided into 4 groups according to their AHI: Non-SAHS subjects ( $0 < \text{AHI} < 5$ ), mild ( $5 < \text{AHI} < 15$ ), moderate ( $15 < \text{AHI} < 30$ ) and severe ( $\text{AHI} > 30$ ).

**Results:** Population under study had mean age of 52.2 years, mean body mass index (BMI) of 29.6 kg/m<sup>2</sup>, and 77.5% of patients were male. SAHS positive patients showed a mean AHI of 33.2 e/h. Regarding nonlinear analysis, HRV recordings from SAHS positive patients showed lower irregularity (0.370 vs. 0.432), lower complexity (0.333 vs. 0.363) and lower variability (0.946 vs. 0.880) than non-SAHS subjects. A significant correlation was found between AHI and nonlinear measures:  $-0.296$  (SampEn),  $-0.268$  (LZC), and  $0.256$  (CTM). These correlations remain significant when adjusted for age. In stratified analyses by sex, in female patients only LZC showed correlation between AHI and HRV. In male patients CTM, SampEn and LZC show a significant correlation between AHI and HRV.

**Conclusion:** Fluctuations of HRV decreases as SAHS severity increases (higher AHI index). Therefore, HRV recordings from severe SAHS patients ( $\text{AHI} > 30$ ) show significantly lower nonlinear irregularity, complexity and variability.

**Acknowledgements:** Acknowledgements to the Sleep Group of Hospital Universitario Río Hortega and Biomedical Engineering Group (GIB).

<http://dx.doi.org/10.1016/j.sleep.2013.11.639>

### Association between apolipoprotein E gene polymorphism and hypertension in obstructive sleep apnea syndrome patients

A. Crespo<sup>1</sup>, F. Del Campo<sup>1</sup>, J. De Frutos<sup>1</sup>, A. Arroyo<sup>1</sup>, T. Ruiz<sup>1</sup>, M. Alonso<sup>2</sup>

<sup>1</sup> Hospital Universitario Río Hortega, Spain

<sup>2</sup> Instituto Biología y Genética Molecular, Spain

**Introduction:** Obstructive sleep apnea (OSA) is a common disorder with a high prevalence. There is increasing evidence to implicate OSA as a major risk factor for arterial hypertension, but to date a direct etiologic link between these diseases has not been established definitively. Although, several studies have shown that apolipoprotein E (ApoE) A genotypes have influence on the lipid metabolism, atherosclerosis and coronary artery diseases, is still no clear whether apoE gene is a predictor of hypertension. Few studies evaluated the

influence of ApoE genotype on hypertension in sleep apnea patients. This study focused on investigates the association between APOE gene polymorphisms and arterial hypertension (AH) in OSA patients from Spain.

**Materials and methods:** APOE genotypes were obtained from 113 consecutively recruited patients with a diagnosis of OSA after polysomnography from the Sleep unit of the Río Hortega Hospital. The following baseline variables were assessed: age (years), body mass index (kg/m<sup>2</sup>), (BMI), gender, alcohol intake (g/day), smoking status (never, current or former smoker) and use (packs-year). An AHI  $\geq 5$  events per hour was considered as diagnostic of OSA.

**Results:** The prevalence of hypertension in OSA patients was 44.2%. The mean age of the OSA was 55.78 years and 16.8% were women. E3/E3 was the most common genotype: E3E3 (62.8%); E2E3 (14.2%), E3E4 (16.8%), E2E4 (6.2%). APOE E4 positive subjects only differ significantly from E4negative subjects in age (61.5 vs 54.6 years). OSA patients carrying the E3/E4 genotype showed an increased frequency of AH: OR 4.72 (CI 1.56–14.2 in unadjusted analyses. These findings keep significant even after correction for age, BMI, sex, AHI and cholesterol: 3.95 (CI 1.15–13.4)). We did not found a relationship between E3/E4 genotype with lipids profile in OSA patients. The mechanisms underlying this association are uncertain.

**Conclusion:** Our results strongly indicate that the presence of the E3/E4 genotype is associated with arterial hypertension in obstructive sleep apnea patients, even after adjusted for cardiovascular risk factors.

**Acknowledgements:** Acknowledgements to the sleep group of Hospital Río Hortega and the Molecular Biology and genetics Institute.

<http://dx.doi.org/10.1016/j.sleep.2013.11.640>

### Failure in restricting atonia in REM stage caused dysfunction of the dopamine neuron in childhood

M. Segawa

Segawa Neurological Clinic for Children, Japan

**Introduction:** Most of the neuropsychological disorders of children are caused by dysfunction of the serotonin and/or the noradrenergic neuron. Furthermore, neurological examination and neuropsychological examination reveal involvement of the dopamine neuron. In this study involvement of the dopamine neuron in these cases were also evaluated.

**Materials and methods:** Cases with infantile autism, Rett syndrome and Down syndrome, were subjected to this study. Involvement of specific monoamine neuron for the disease are assessed by failure of specific epoch of development of the Sleep–Wake (S–W) cycle and dysfunction of the antigravity activity by leakage of atonia of REM-stage into NREM stage by EEG polygraph. Dysfunction of the dopamine neuron was assessed by neurological examination.

**Results:** All cases showed delay in development of S–W cycle. Autism showed failure of development of circadian S–W cycle by four months of age, the first epoch of development of S–W cycle and failure in development of locomotion in infancy. Cases with Rett syndrome and Down syndrome showed delay in restriction of day sleep once in the afternoon by age one year three months, failure of the second epoch of development of the S–W cycle. All cases could not crawl with normal pattern and showed marked failure in locomotion in early childhood. Neurological examination revealed mild rigid hypertonus with asymmetry in all cases, i.e. the dominantly affected side of sternocleidomastoid muscle (SCM) and extremity muscles was contralateral to each other. Thus, dysfunction of afferent structure to the striatum, that

is the nigrostriatal dopamine (NS-DA) neuron is considered. Discussion Dysfunction of the brainstem aminergic neuron, particularly the serotonergic neuron causes failure in antigravity activities. This causes failure in locomotor and in restriction of atonia in REM sleep. This induces dysfunction of the pedunculopontine nucleus and consequently causes dysfunction of the dopamine neuron of the substantia nigra and the ventro tegmental area. This induces symptoms of dopamine deficiency.

**Conclusion:** Disturbance of the S–W cycle in particular epoch in each disorder implicates dysfunction of the specific monoaminergic neurons for each. This dysfunction causes dysfunction of the anti-gravity activity and causes dysfunction of the dopamine neuron by dysfunctioning the pedunculopontine nucleus.

**Acknowledgements:** Yoshiko Nomura, M.D., Segawa Neurological Clinic for Children.

<http://dx.doi.org/10.1016/j.sleep.2013.11.641>

### Development of a software system of video-integrated analysis made for the motion detection and analysis of sleep. A

S. Dittoni<sup>1</sup>, M. Scatena<sup>1</sup>, R. Maviglia<sup>2</sup>, M. Pennisi<sup>2</sup>, C. Vollono<sup>1</sup>, G. Della Marca<sup>1</sup>

<sup>1</sup>Sleep Medicine Laboratory, Department of Neuroscience, Italy

<sup>2</sup>Department of Anaesthesiology and Intensive Care, Catholic University of the Sacred Heart, Rome, Italy

**Introduction:** The study aims to validate the system for the automatic analysis of the video-polygraphic, comparing with traditional methods of visual analysis. In particular, we will: detect motor activity and compare the analysis of PLM by classical methods: video-actigraphy versus Immobilization Test. Analyze the results of motion detection by comparing epoch by epoch.

**Materials and methods:** 24 Patients studied with Immobilization Test in sleep laboratory and video analysis. Movement study with video analysis offline through software system composed by ManyCam, WebCamXP, ZoneMinder, ZoneMinderAnalyzer (ZMA), Actiwatch Activity & Sleep Analysis 7. The motion was classified according to the AAMS criteria and calculated the leg movement and the motion sequence. The video analysis was performed with combined use of ManyCam and WebCamXP which permits obtain an IP virtual Camera. ZMA use the provided data by video analysis performed with ZoneMinder. ZM reveals the differences of video frame in input, quantifies them and then stores them in a database SQL. ZMA divides the time in epochs of  $x$  seconds and calculates for those epochs compatible values with these obtained through polygraphic analysis used the database data. The obtained data are transformed in a format readable by Psg software analysis. The results obtained were compared with the analysis performed by the system software (Zoneminder). The comparison was made epoch by epoch.

**Results:** The video analysis offline offers an approach to study the motion during sleep, not always visible with the classic video system and with EMG electrodes on the surface. This system permits an analysis of body movements, along with those of the face and the limbs. The ManyCam and WebCamXP system is more complete in comparison on macrostructure sleep, visual analysis of body movements, spectral analysis of EMG and actigraphy analysis. We analyzed a total of 4512 times. Time-period analysis, the coefficient K Cohen has established a degree of agreement between ZM and Immobilization Test equal to 0.252. The Bland–Altman analysis confirmed that scores of ZM were not significantly different from those

obtained with test Immobilization. The results of the analysis of Bland–Altman show a substantial overlap between the scores obtained with ZM and Immobilization Test with a slight tendency to overestimate ZM motor events. The Pearson coefficient, equal to 0.2523 (corresponding to a significance value of  $p < 0.001$ ) indicates that the two statistical variables were directly related. ZM shows a good level of accuracy (0.726) compared to test Immobilization, high specificity (0.815) and a relatively more low sensitivity (0.440).

**Conclusion:** Our study makes it possible to collect the following conclusions: The motor pattern analyzed with different methods shows a substantial overlap; Zoneminder allows detection of motor events also minimal compared with the analysis carried out visually test of immobilization. By adjusting the sensitivity of motion detection you can analyze a specific body area or a specific region. From our study shows an easy applicability of the method especially in long recordings, allowing effective results with cost containment. This method also allows the non-invasive nature of the system on patient therefore making themselves available for recordings of newborns and infants.

<http://dx.doi.org/10.1016/j.sleep.2013.11.642>

### That's one small book for a man, one giant leap for CPAP compliance. Association between patient education and CPAP compliance in an urban and a rural setting in Canada

C. Shapiro<sup>1</sup>, D. Zalai<sup>2</sup>

<sup>1</sup>University Health Network and West Parry Sound Health Centre, Canada

<sup>2</sup>Ryerson University, Canada

**Introduction:** Many patients and many physicians do not appreciate the health ramifications of sleep apnea or the economic impact of low treatment rates. Placing this information in an easily and repeatedly accessible form can have many benefits including education, personal relevance for those affected with CPAP compliance difficulties. Patient education can have long term positive impact of patient outcome. For example, a single enhanced patient education session delayed initiation of dialysis by 4.6 months (Devins et al., 1993). The objective of this study was to determine the association between patient education and CPAP compliance.

**Materials and methods:** 200 consecutive patients of an urban sleep clinic and 200 consecutive patients in a small rural facility were enrolled in the study. 100 patients in each location received the standard consultation with their physicians after the diagnosis of obstructive sleep apnea before receiving their CPAP machine. The other 100 patients in each location received an educational booklet (Sleep Apnea, CPAP and Me by Shapiro G, Zalai, D. Trajanovic N, & Mallea, J) on sleep apnea in addition to the standard consultation with their doctors. All patients had a one month and a one year follow up follow up with the consultant. CPAP compliance was assessed at the one year follow up visit. Compliance was defined as a regular CPAP use five or more nights per week and a minimum of 5 h each night.

**Results:** At one year follow-up 75% patients in the standard consultation group in the urban location were compliant CPAP users. The compliance rate of patients who received the booklet in addition to the consultation was 87% at follow up. There was a significant association between the receiving the booklet and CPAP compliance ( $\div 2 = 4.68$ ,  $p < .05$ ) in this group. In the rural location the compliance rate of 89% in the special education group was not significantly higher than the compliance rate of 82% in the control group.

**Conclusion:** Education clearly helps but this may be less so in an already highly compliant group. In a review we have previously showed very high compliance rates at the rural center. There may be several reasons for this and these should be explored. On the basis of “Bang for Buck” the provision of this \$10 booklet appears to be valuable and has become a pattern for a number of CPAP suppliers when so asked by physicians running a sleep clinic. At this point in time there is the need to translate the book into other languages. Any takers?

<http://dx.doi.org/10.1016/j.sleep.2013.11.643>

### **RLS around the globe: Diagnosis and epidemiology**

D. Sharon<sup>1</sup>, M. Shamsnia<sup>2</sup>, C. Mack<sup>1</sup>

<sup>1</sup> *Comprehensive Sleep Medicine Center, Tulane University School of Medicine, United States*

<sup>2</sup> *Advanced Sleep Center, Tulane University School of Medicine, United States*

**Introduction:** RLS is a sensorimotor disorder characterized by a complaint of a strong, nearly irresistible urge to move the limbs. This urge is worse at rest, relieved by movement and predominantly occurs in the evening or night. The diagnosis is clinical and requires ruling out “mimics” and assessing comorbidities. This is a time consuming process affecting epidemiology. Several instruments have been used to diagnose RLS. The diagnostic methodology can affect epidemiology. The prevalence of RLS seems to be multifactorial: genetics, gender, pregnancy, iron status, latitude, altitude or cold weather. This review of published data will summarize these effects.

**Materials and methods:** Studies published since the IRLSSG proposed the RLS diagnostic criteria were reviewed for diagnostic methodology and factors possibly affecting epidemiology data. These included: pregnancy, geographic location such as latitude, altitude, setting and weather. If the geographic location was not mentioned, it was assumed that it corresponded to the first author's location.

**Results:** Over 70 epidemiological reports around the globe were reviewed. Some of the reports included control groups. Most of the reports included limited data regarding the methods used to determine the diagnosis of RLS. The following tables present the data reviewed.

**Conclusion:** Diagnostic methodology affects the data on RLS prevalence and therefore it is imperative to report it in detail in epidemiological studies. Geographic parameters such as latitude, altitude, weather and urbanization may affect the prevalence of RLS and therefore future epidemiological studies may consider reporting it.

**Acknowledgements:** Many thanks to the investigators that contributed additional information for this review.

<http://dx.doi.org/10.1016/j.sleep.2013.11.644>

### **Pain sensitivity in healthy young men is modified by time-of-day**

J. Aviram, D. Pud, T. Shochat

*University of Haifa, Faculty of Social Welfare and Health Sciences, Israel*

**Introduction:** Time-of-day has been suggested as a contributing factor to sensitivity to pain. However, inconsistent findings have been found regarding the specific time-of-day in which sensitivity to pain is at its peak. Methodological differences in study settings and samples preclude firm conclusions to be drawn, leaving this issue unresolved. The present study aimed to assess the effect of

time-of-day on sensitivity to experimentally evoked pain in healthy subjects exposed to multi modal pain tests. It was hypothesized that time-of-day response patterns to pain would demonstrate stability across pain modalities.

**Materials and methods:** Forty-eight healthy men were tested in the morning, early afternoon and evening in a randomized order repeated measures design. Four pain threshold measures: mechanical (pressure algometer), heat (thermal sensory analyzer) and cold (thermal sensory analyzer and cold bath) were assessed in each session, and were compared by repeated measures ANOVA with Bonferroni post hoc tests to assess specific time-of-day differences. Also, pain threshold measures were standardized and hierarchical clustering and K-means cluster analyses were performed to identify subgroups of low vs. high sensitivity subjects by time-of-day. MANOVA was performed to validate differences in pain thresholds by clusters.

**Results:** Significant differences were found for the two cold pain thresholds, with lowest sensitivity in the morning; and for the heat pain threshold, with highest sensitivity in the afternoon ( $p < 0.05$ ). No differences were found for the mechanical pain threshold. Cluster analyses varied by time-of-day, so that the high sensitivity subgroup increased from 50% of the subjects in the morning to 75% in the afternoon and 86% in the evening. For all times of day, significant differences in all pain thresholds were found between low and high sensitivity clusters ( $p < 0.05$ ).

**Conclusion:** Sensitivity in different pain modalities displays different time-of-day patterns, yet the overall frequencies of pain sensitivity increase throughout the day, with lowest frequency in the morning and highest frequency in the evening. Whether time-of-day effects in pain sensitivity reflect underlying circadian and/or homeostatic sleep/wake mechanisms is yet to be determined. Subgrouping subjects based on sensitivity to pain should take into account time-of-day differences. Findings may provide valuable information for clinical trials on chronic pain patients.

**Acknowledgement:** The study was funded by a grant from the Israel Pain Society.

<http://dx.doi.org/10.1016/j.sleep.2013.11.645>

### **Hemostatic markers in shift working female nurses**

G. Saharov<sup>1</sup>, Y. Nadir<sup>2</sup>, I. Zoran<sup>2</sup>, A. Keren<sup>2</sup>, B. Brenner<sup>2</sup>, T. Shochat<sup>1</sup>

<sup>1</sup> *University of Haifa, Faculty of Social Welfare and Health Sciences, Israel*

<sup>2</sup> *Rambam Health Care Campus, Coagulation Institute, Israel*

**Introduction:** Studies indicate an increased risk of cardiovascular disease (CVD) among shift workers, yet the mechanisms underlying this relationship are not well understood. The hemostatic system significantly impacts CVD, and several hemostatic markers demonstrate circadian rhythmicity. Thus, circadian misalignment of hemostatic markers due to shift work may be involved in the increased risk of CVD. This study aimed to compare hemostatic markers among healthy shift working vs. daytime working female nurses. It was hypothesized that hemostatic markers are elevated in shift compared to day workers, beyond the effects of sleep disturbance and other factors known to detrimentally affect health in shift workers.

**Materials and methods:** Thirty shift and 30 day working female nurses ages 30–45 were recruited by quota sampling at Rambam Health-Care Campus. Nurses were included if they were healthy, did not smoke, had a BMI  $\leq 26$ , had no family history of CVD at a young age, were not using medication regularly (except oral contraceptives), did not have a fever in the past month and were not pregnant. Shift workers had at least two non day shifts and one night

shift per week. For all participants, blood was drawn at 07:00 in the morning (not following a night shift) for the measurement of seven markers of coagulation, including Plasminogen activator inhibitor-1 (PAI-1), heparanase procoagulant activity, tissue factor (TF) + heparanase complex, protein C, D-dimer, Von Willebrand factor (vWF) and fibrinogen. Sleep quality was assessed by self report (Pittsburgh Sleep Quality Index).

**Results:** All coagulation markers were in the normative range. PAI-1 levels were significantly higher among shift compared to day workers (36.6 ng/ml vs 24.3 ng/ml,  $p < 0.05$ ). In shift workers, Heparanase procoagulant activity was 2-fold and TF + heparanase complex was 1.5-fold compared to day work nurses (both  $p < 0.05$ ). Sleep quality was significantly lower for shift compared to day workers ( $p < 0.001$ ). No group differences were found for Protein C, D-dimer, vWF and fibrinogen. Logistic regression analyses showed that shift work and poor sleep quality were significant predictors of high levels of PAI-1 ( $R^2 = 0.17$ ), heparanase procoagulant activity ( $R^2 = 0.13$ ) and TF + heparanase ( $R^2 = 0.10$ ).

**Conclusion:** Elevated levels of PAI-1 and heparanase markers in healthy shift working nurses suggest subclinical disturbances in the hemostatic system, which together with reduced sleep quality may contribute to future cardiovascular morbidity.

**Acknowledgements:** The authors acknowledge the support and assistance of the coagulation laboratory at Rambam Health Care Campus.

<http://dx.doi.org/10.1016/j.sleep.2013.11.646>

### Longer sleep duration is related to increased pain sensitivity in healthy young men

T. Shochat, J. Aviram, D. Pud

University of Haifa, Faculty of Social Welfare and Health Sciences, Israel

**Introduction:** In recent years, evidence demonstrating that deprived and/or disturbed sleep increase sensitivity to pain, has been obtained both in clinical pain patient samples and in experimental protocols involving sleep deprivation and evoked pain in healthy subjects. However, sleep deprivation studies typically assess total/partial sleep deprivation in controlled laboratory conditions that bear little resemblance to the natural sleep environment. This study aimed to assess relationships between habitual sleep patterns, i.e., sleep duration, bedtime and wake-time, based on objective measurement in the home environment, and sensitivity to experimental pain in healthy subjects exposed to multi modal pain tests. It was hypothesized that increased sleep duration would be related to decreased sensitivity in different pain modalities.

**Materials and methods:** Forty-eight healthy men underwent experimental pain testing for four pain threshold measures: mechanical (pressure algometer), heat (thermal sensory analyzer) and cold (thermal sensory analyzer and cold bath), in the morning, early afternoon and evening, in a randomized order repeated measures design. Pain threshold scores were standardized and averaged to create a generic threshold score. Sleep patterns were assessed by actigraphy for seven days prior to testing. Pearson correlation coefficients were used to assess relationships between sleep patterns and pain thresholds.

**Results:** Longer sleep duration was associated with decreased pain thresholds (i.e., increased sensitivity) in mechanical pain in the afternoon and evening ( $r = -.33$  and  $r = -.31$  respectively,  $p < .05$ ), cold (bath) pain in the morning and evening ( $r = -.35$  and  $r = -.31$  respectively,  $p < .05$ ) and generic pain threshold in the afternoon and evening ( $r = -.34$  and  $r = -.35$  respectively,  $p < .05$ ). Later wake-times were associated with decreased pain thresholds in cold

(bath) pain in the morning ( $r = -.29$ ,  $p < .05$ ), afternoon and evening (both:  $r = -.41$ ,  $p < .01$ ), and generic pain threshold in the evening ( $r = -.34$ ,  $p < .05$ ). Bedtime was unrelated to pain thresholds.

**Conclusion:** Unexpectedly, findings show that habitual longer sleep duration and later wake-time are associated with increased sensitivity in some pain modalities. Pending further investigation, it may be claimed that a U shaped relationship characterizes sleep duration and pain, with short and long sleepers demonstrating increased sensitivity to painful stimuli.

**Acknowledgement:** This study was supported by a grant of the Israel Pain Society.

<http://dx.doi.org/10.1016/j.sleep.2013.11.647>

### The effects of a scheduled nap during the nightshift on performance, sleepiness and vigor in nurses

T. Shochat, N. Zion

University of Haifa, Faculty of Social Welfare and Health Sciences, Israel

**Introduction:** Nighttime shift-work has been found to be a culprit of negative consequences in terms of safety and performance. In nurses, these consequences also pose a threat to the care and safety of patients. Evidence suggests that a scheduled nap may be an effective countermeasure. However little is known about the effects of a brief planned nap on measures that reflect the performance of nurses during the actual night shift. This field study aimed to examine the effectiveness of a planned nap during the nadir of alertness, on cognitive performance, evaluation of duty transfer, and self-reported sleepiness and vigor, in nursing staff working eight hour night shifts in the hospital.

**Materials and methods:** In this prospective, within subjects experimental study design, thirty female and male nurses working shifts were recruited by cluster sampling from several hospital wards at Bnei Zion Medical Center in Haifa. All nurses had an appointment of 75% and above and worked at least one night shift per week. Nurses who were pregnant, had a diagnosed sleep disorder or chronic medical condition that could affect sleep or functioning, were excluded. The study protocol was conducted in the course of nurses' usual work schedule, and included two nights with and two nights without a nap, intermittently. Cognitive testing, performed at 06:30, included the Letter Cancellation task (LCT) and the Digit Symbol Substitution Task (DSST). At 07:00, they transferred the shift to the head nurse of the department, who completed a written evaluation of the duty transfer and was blinded to the experimental condition. During planned nap nights, nurses went to sleep in a dark quiet room at 04:00 for 30 min, and on non-nap nights they continued to work as usual. To monitor sleep patterns and duration, nurses wore an actigraph 24-h before and during the night shift.

**Results:** Compared to non-nap nights, performance measures were significantly higher on the LCT ( $p < 0.05$ ), and tended to be higher on the DSST ( $p < 0.08$ ), and evaluation of duty transfer was improved ( $p < .05$ ) on nap nights. Levels of sleepiness were lower at 05:00, 06:00 and 07:00 and measures of vigor were higher at 05:00 and 07:00 on nap vs. non-nap nights ( $p < 0.01$ ).

**Conclusion:** A planned nap is an effective, cheap and simple strategy to improve occupational safety and performance of the nursing staff and to improve the safety and quality of patient care.

**Acknowledgement:** The study is supported by a grant from the Israel Ministry of Industry, Trade and Labor.

<http://dx.doi.org/10.1016/j.sleep.2013.11.648>

### Spectrum of sleep disordered breathing among patients with mucopolysaccharidoses: a clinico-polysomnographic study

G. Shukla<sup>1</sup>, A. Gupta<sup>1</sup>, N. Gupta<sup>2</sup>, M. Kabra<sup>2</sup>

<sup>1</sup> Department of Neurology, All India Institute of Medical Sciences, New Delhi, India

<sup>2</sup> Department of Pediatrics, Clinical Genetics Section, All India Institute of Medical Sciences, New Delhi, India

**Introduction:** Sleep disordered breathing (SDB) has been reported in approximately 80% patients with different types of Mucopolysaccharidoses (MPS), which is often multi-factorial. There is little detail regarding the specific types of SDB among this group of patients, in published literature. Aim: To evaluate and categorize the types of SDB among patients with MPS referred to our Sleep disorders facility.

**Materials and methods:** Consecutive patients with biochemically confirmed MPS were evaluated with a Pediatric sleep questionnaire in addition to detailed clinical history and examination followed by overnight polysomnography (PSG). Detailed ophthalmological, neurological, cardiac and skeletal system evaluation had been carried out in all patients, prior to referral for PSG.

**Results:** Among 17 patients (9F) aged 9 + 5.4 years, 11 were diagnosed as MPS 1 (6 on enzyme replacement therapy <6 months duration), 5 as MPS 2 and 1 as MPS 4. SDB was diagnosed in 15/17 patients (88%). History of snoring, witnessed apneas and excessive daytime somnolence was found in 14, 5 and 3 patients respectively. A Mallampati score of >3 was found in 12/17 patients. Mean sleep efficiency was 73 + 23%; mean REM and N3% were 8 + 5 and 33 + 14, respectively. Three patients had severe and 1 mild non-stage-dependent obstructive sleep apnea (OSA), 3 had severe REM dominant OSA, 1 had non-REM dominant OSA, 3 had upper airway resistance syndrome and 4 patients had very high desaturation index with mild OSA (reflecting hypoventilation). Mean AHI was 14 + 19 (range 0.22–34), mean arousal index was 19 + 9 and mean desaturation index was 21 + 17.2. High periodic limb movement index (PLMI) was found in 1/17 patients, with mean PLMI of 5 + 2.

**Conclusion:** We report a wide spectrum of SDB among patients with MPS including upper airway resistance syndrome to severe stage dependent OSA to OSA with hypoventilation. The high prevalence and variable polysomnographic presentation emphasize the importance of early PSG for all patients with MPS.

**Acknowledgements:** Jyoti Katoch, Ram Iyer.

<http://dx.doi.org/10.1016/j.sleep.2013.11.649>

### Patterns of EEG, blood pressure and heart rate changes preceding and following periodic limb movements

M. Sieminski<sup>1</sup>, J. Pyrzowski<sup>1</sup>, M. Partinen<sup>2</sup>

<sup>1</sup> Medical University of Gdansk, Department of Adults' Neurology, Poland

<sup>2</sup> Vitalmed Helsinki Sleep Clinic, Poland

**Introduction:** Periodic limb movements (PLMs) are associated with transient increases in blood pressure and heart rate, which has been proposed to explain increased values of blood pressure in patients with restless legs syndrome (RLS) and PLMs. The dynamics of this phenomenon was so far studied within short periods directly preceding and following leg movements. The aim of our study was to assess whether the changes in blood pressure and heart rate start earlier and could persist for longer time after a PLM. We have also measured the changes in parameters of central nervous system activation and additional cardiovascular parameters to verify whether they precede or follow PLMs.

**Materials and methods:** We selected 6 patients with RLS and PLMS index above 30 who underwent full polysomnography. There were 3 men and 3 women in the examined group, mean age of the group was 57.0 years; mean PLMSI was 57.9. 15 episodes of PLM were selected for each patient. The 30-s time period surrounding each PLM was divided into 5-s epochs. We have selected 10 30-s periods of PLM-free sleep for each of the patients, as control data. For each epoch the following parameters were calculated: EEG spectral power of alpha + beta and delta bands, sympato-vagal balance (SVB), average systolic and diastolic blood pressure levels (SBP and DBP) and the average heart rate (HR) together with low and high frequency heart rate variability coefficients.

**Results:** Statistical analysis has revealed highly significant peri-PLM fluctuations in SBP and HR ( $p < 0.001$ ) with SBP decreasing directly before and increasing even up to 15 s following a PLM. We also identified significant ( $p < 0.05$ ) post-PLM decrease in DBP and increases in alpha + beta EEG power and SVB. There were no significant fluctuation patterns of heart rate variability parameters and EEG delta power as well as in the control non-PLM intervals.

**Conclusion:** We have identified significant patterns of fluctuation of a set of physiological parameters around PLMs. PLMs are followed by persistent increases in SBP for up to 15 s associated with increases of parameters related to arousal. This points to a potential clinical importance of PLMs in hypertensive RLS patients. Significant decreases in SBP also precede PLMs which may shed some new light on the complex pathophysiology of these events.

**Acknowledgements:** The authors want to thank all workers of Vitalmed team for their help in preparing this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.650>

### Amplitudes of blood pressure and heart rate during obstructive apneas are related to duration of apnea and to desaturation

M. Sieminski<sup>a</sup>, M. Partinen<sup>b</sup>

<sup>a</sup> Medical University of Gdansk, Department of Adults' Neurology, Poland

<sup>b</sup> VitalMed Helsinki Sleep Clinic, Poland

**Introduction:** Obstructive sleep apnea (OSA) is a well known factor influencing cardiovascular status of the patients. It is strongly linked with increased frequency of coronary heart disease and hypertension. The aim of our study was to define which trait of the apnea – duration or desaturation – has larger impact on the blood pressure and heart rate during apneic episodes.

**Materials and methods:** We have retrospectively analyzed polysomnographic data of 6 patients with severe OSA syndrome (5 men; mean age 61.2 years; mean BMI 36.1; mean AHI 53.75). Patients underwent full polysomnography with beat-to-beat blood pressure monitoring. For each patient 10 episodes of OSA were selected for analysis. For each episode maximal and minimal values of diastolic blood pressure (DBP), systolic blood pressure (SBP) and heart rate (HR) were found and the difference between them was calculated (respectively delta\_DBP, delta\_SBP and delta\_HR). Apneic episodes were divided into groups according to values of desaturation and to duration of apnea (episodes with desaturation or duration below the median and above the median). Amplitudes of DBP, SBP and HR were then compared between the groups.

**Results:** Amplitude of systolic blood pressure was not related to desaturation or duration of sleep apnea. Amplitude of diastolic blood pressure was lower in episodes with smaller desaturation (1,93 mmHg vs. 3,39 mmHg,  $p = 0.01$ ) and in episodes of shorter duration (1,75 mmHg vs. 3,55 mmHg,  $p = 0.0009$ ). Amplitude of heart rate was also lower in OSA episodes with smaller desaturation (7.00 vs. 11.00,  $p = 0.02$ ) and with shorter duration (5.6 vs 12.4,  $p = 0.0003$ ).

**Conclusion:** Our results suggest that both desaturation and duration of apnea influence the amplitude of diastolic blood pressure and heart rate, without any impact on systolic blood pressure.

<http://dx.doi.org/10.1016/j.sleep.2013.11.651>

### Sleep disorders diagnosis by genetic assessment

A. Martins-Da-Silva<sup>1</sup>, J. Ramalheira<sup>2</sup>, L. Silva<sup>3</sup>, D. Cunha<sup>4</sup>, S. Brás<sup>5</sup>, C. Carvalho<sup>5</sup>

<sup>1</sup> Serviço Neurofisiologia and UMIB/ICBAS, Hospital Santo António/CH Porto and ICBAS/University of Porto, Portugal

<sup>2</sup> Serviço Neurofisiologia, Hospital Santo António/CH Porto, Portugal

<sup>3</sup> Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde, CESPU, Portugal

<sup>4</sup> Laboratório Imunogenética, ICBAS-Universidade do Porto, Portugal

<sup>5</sup> Laboratório de Imunogenética, UMIB/ICBAS-Universidade do Porto, Portugal

**Introduction:** Diagnosis of Sleep Disorders (SD) is frequently a difficult task. Environmental and genetic factors influence the clinical SD phenotype masking its correct identification. The definition of such factors will help the physicians to easily classify SD. Accordingly a better treatment for such disorders should be obtained. The objective of the present work is to identify, on a cohort of SD patients, the possible genetic factors involved.

**Materials and methods:** Four hundred and twenty-one SD patients were assessed at the Out Patient Sleep Clinic of Hospital Santo António/CH Porto – by means of clinical history, physical and neurological evaluation, night sleep polygraphic EEG-Video recording (EEG, EOG, EMG – chin and L Limbs; Respiratory effort; O<sub>2</sub> saturation; EKG; snoring). For Narcolepsy without (N) or with Cataplexy (NC) and for Hypersomnia (H) qualification/quantification a MSLT was performed on the day after night registration. Blood venous sample was taken after informed consent. Ethical approval was obtained for research studies. For the purpose of distinction between diverse Sleep Disorders HLA-DRB1\* was genotyped using a PCR-Sequence Specific Primer (SSP) methodology. A control population (223 individuals) was matched to age, gender, ethnicity and geographical origin. Statistical analysis was performed and the phenotypic frequencies were evaluated by chi-square of 2 × 2 contingency tables. Odds Ratios and their respective 95% confidence interval were calculated. Values of  $p < 0.05$  were considered as statistically significant.

**Results:** From the 421 SD patients studied 302 were classified as obstructive sleep apnea syndrome (OSAS); 64 as H; 37 NC and 16 N. Significant values ( $p < 0.05$ ) of HLA-DRB1\* alleles were found to OSAS: HLA-DRB1\*09 (1% OSAS vs. 6% PC); NC: HLA-DRB1\*13 (14% NC vs. 30% PC) and 15 (76% NC vs. 21% PC); N: HLA-DRB1\*15 (44% N vs. 21% PC); H: HLA-DRB1\*03 (33% H vs. 15% PC).

**Conclusion:** Our studies emphasize that the HLA-DRB1\* genetic characterization of SD patients may identify different profiles. The results point out to the identification of susceptibility alleles, HLA-DRB1\*15 for N and NC and HLA-DRB1\*03 for Hypersomnia. The frequencies of HLA-DRB1\*09 in OSAS and of HLA-DRB1\*13 in NC indicate that these alleles may act as protective factors. These findings point to the value of immunogenetic approach to a better understanding of the pathophysiology of SD and to a better classification of patients with sleep disorders.

**Acknowledgement:** \*Studies on SAOS were granted by a CESPU Project.

<http://dx.doi.org/10.1016/j.sleep.2013.11.652>

### Incidence and remission of sleep related symptoms in children and associations with health-related quality of life; A 7-year follow-up of the TuCASA cohort

G. Silva<sup>1</sup>, J. Goodwin<sup>1</sup>, K. Archibald<sup>1</sup>, M. Vasquez<sup>1</sup>, S. Quan<sup>2</sup>

<sup>1</sup> University of Arizona, United States

<sup>2</sup> Harvard Medical School, United States

**Introduction:** Sleep disturbances are common in adolescents; some studies have shown that this may adversely affect their quality of life. However, there is little evidence on incidence and remission of sleep problems from childhood to adolescence and the association with health-related quality of life (QoL).

**Materials and methods:** Sleep Screening questionnaires were collected on Hispanic and Caucasian children 6–12 years of age at baseline, and again 7 years after during follow-up, when participants were 12–20 years. Excessive daytime sleepiness (EDS) and difficulty initiating and maintaining sleep (DIMS) were present if they occurred frequently or more. Health-related QoL was assessed at follow-up using the Pediatric Quality of Life Inventory and three summary scores, ranging from 1 to 100, were evaluated: psychosocial health (PS), physical function (PF), and total scale scores (TS). Prevalence, incidence, and remission of sleep symptoms were computed and analyzed for association with health-related QoL.

**Results:** The mean ages at baseline and follow-up were 8.8 and 15.4 years. There were 50.2% males and 30.6% Hispanics. Incidence rates of EDS and DIMS were 39.1% and 58.9%, and remission rates were 53.1% and 36.2%, respectively. Separate linear regressions models predicting health-related QoL showed that participants with persistent EDS had lower mean values for TS (coeff. =  $-9.2$ ,  $p = .006$ ), PS (coeff. =  $-8.8$ ,  $p = .025$ ), and PF (coeff. =  $-10$ ,  $p = .002$ ) as compared with participants who never had EDS or those with remittent EDS combined. Participants with persistent DIMS had lower mean values for TS (coeff. =  $-6.8$ ,  $p = .001$ ) and PS (coeff. =  $-8.4$ ,  $p = .001$ ) as compared with participants who never had DIMS or those with remittent DIMS combined. When participants with persistent DIMS were compared with those with remittent DIMS only, the associations between DIMS and health-related QoL, became non-significant. However, the association between EDS and health-related QoL remained (coeff. =  $-13.3$ ,  $p = .02$ ).

**Conclusion:** Substantial variability of self-reports of sleep problems exists as children age from childhood to adolescence. Nevertheless, there are a small number of young children who persistently have sleep problems over this age span and these problems are associated with lower health-related quality of life. These associations appear to be driven primarily by EDS.

**Acknowledgements:** The TuCASA study was supported by NHLBI grant HL 62373. Silva, G.E. was supported by NHLBI grant HL 62373-05A2S1.

<http://dx.doi.org/10.1016/j.sleep.2013.11.653>

### Predictive power of HLA-DQB1\* to identify narcoleptic patients

M. Silva<sup>1</sup>, J. Lopes<sup>2</sup>, C. Carvalho<sup>1</sup>, D. Cunha<sup>1</sup>, P. Pinho Costa<sup>3</sup>,

A. Martins-Da-Silva<sup>4</sup>

<sup>1</sup> Laboratório Imunogenética, UMIB/ICBAS, Portugal

<sup>2</sup> Serviço Neurofisiologia, Hospital Santo António/CH Porto, Portugal

<sup>3</sup> Instituto Nacional Saúde Ricardo Jorge/Porto and UMIB/ICBAS,

<sup>4</sup> Instituto Nacional Saúde Ricardo Jorge/Porto, Portugal

<sup>5</sup> Serviço Neurofisiologia and UMIB/ICBAS, Hospital Santo António/CH Porto and UMIB/ICBAS-University of Porto, Portugal

**Introduction:** The determination of HLA class II genotype is widely used to confirm the diagnosis of Narcolepsy without (N) or with Cataplexy (NC). The use of HLA genotyping in clinical diagnosis is reliable and is a contributing factor to the reinforcement of the wide acceptance of the hypothesis of autoimmune origin for Narcolepsy. We evaluate the contribution of genetic markers (HLA) in the differential diagnosis between narcolepsy with and without Cataplexy and their relevance in the context of our population (Northern Portugal).

**Materials and methods:** A cohort of 53 patients with Narcolepsy with Cataplexy (NC) or without (N) was studied. Patients followed up to the Outpatient Sleep Clinic of Hospital Santo António/CH Porto were assessed by clinical, night sleep polygraphic recording, MSLT on the following day. Blood sampling for HLA-DQB1\* analysis was performed after informed consent. The genotyping was achieved by using a PCR-Sequence Specific Primer (SSP) methodology. Control Population (CP) comprised 206 reportedly healthy individuals from the same geographic origin. Data from laboratory parameters was confronted with the clinical diagnostic hypothesis. Patients' clinical reevaluation was considered if phenotype-genotype did not match.

**Results:** Of the 53 patients, 14 were classified as N and 39 as NC. The frequency of HLA-DQB1\*06:02 allele was overrepresented in N and NC patients (43% and 69%, respectively) when compared with the control population (16%) –  $p$  value =  $1.38 \times 10^{-12}$  for NC. Interestingly the frequency of the HLA-DQB1\*03 allele was decreased in NC patients (36% NC vs. 56% CP,  $p = 0.01917$ ). No differences were found in other DQB1\*06 frequencies between the cohort of patients and the control population.

**Conclusion:** The HLA-DQB1\*06:02 allele, a susceptibility factor for other autoimmune disorders, was confirmed as the most important susceptibility allele to NC in our population. The frequency of this allele in our NC patients (69%) is within the range of other studies. Such values pointed out to 11.8 OR for NC comparing with 3.9 OR for N patients. These findings point out to the relevance of the allele DQB1\*0602 in this sleep entity and on the autoimmune involvement in the picture of Narcolepsy-Cataplexy.

<http://dx.doi.org/10.1016/j.sleep.2013.11.654>

### Inadequate sleep and unhealthy food habits in portuguese adolescents

M. Silva<sup>1</sup>, H. Silva<sup>2</sup>, T. Paiva<sup>3</sup>

<sup>1</sup> Faculty of Health Sciences, University Fernando Pessoa, Oporto, Portugal

<sup>2</sup> Ministry of Education, Lisbon, Portugal

<sup>3</sup> Sleep Medicine Center, CENC, Lisbon, Portugal

**Introduction:** Adolescence is a unique stage of life time that often promotes changes in sleep habits, meals frequency and body composition, reflecting on the physical, mental and social well-being. The aim of this study was to analyze sleep quality and food habits in adolescents of both sexes. And to determine whether the food consumed favor the regulation of sleep cycle in accordance with its nutritional properties.

**Materials and methods:** 143 Portuguese adolescents (15.6 ± 2.71 years old): 73 girls (15.16 ± 1.02 years old) and 70 boys (15.20 ± 1.10 years old) were evaluated by a questionnaire, which collected: anthropometric data (weight, height and body mass index-BMI); food habits from a semi-quantitative questionnaire and; sleep assessed by the Epworth Sleepiness Scale and the Pittsburgh Sleep Quality Index. Descriptive linear regression analysis and Pearson correlation coefficients were used. The significance level was 5%. Data was analyzed using SPSS, version 18.0.

**Results:** Most adolescents presented poor sleep quality ( $n = 72; 50.3\%$ ) and severe somnolence ( $n = 52; 36.4\%$ ). Adolescents consumed more macronutrients than recommended. On the other hand, skipping meals was very frequent ( $n = 89; 62.4\%$ ), as well as the consumption of snacks rich in fat and soft drinks. Adolescents with higher levels of energy intake showed poorest sleep quality and more daytime somnolence ( $p < 0.05$ ). Snacks and soft drinks consumption were associated to a high BMI ( $> 30 \text{ Kg/m}^2$ ).

**Conclusion:** Poor sleep quality and quantity can influence energy intake in adolescents and BMI. Energy balance was altered, which can compromise adolescents health and daily behaviors.

<http://dx.doi.org/10.1016/j.sleep.2013.11.655>

### Sleep, precompetitive stress and achievements in young performance athletes

M. Silva, T. Paiva

Institute of Molecular Medicine, Medical Faculty of Lisbon, Lisbon, Portugal

**Introduction:** High quality of sleep and adequate rest periods have an important contribution in the athlete's ability to respond to stress. During a competition two abilities are critical for athletic success – attention and memory, which are very sensitive to stress and regulated by sleep. The main purpose of this study was to evaluate sleep quality and stress levels before an international competition.

**Materials and methods:** 67 rhythmic gymnasts (18.67 ± 2.93 years old) of high performance level (36.60 ± 7.56 h of training/week) were evaluated by a questionnaire, which collected: training data; sleep assessed by the Epworth Sleepiness Scale and the Pittsburgh Sleep Quality Index and pre- competitive stress: Competitive Anxiety Test (Sport Competition Anxiety Test Form A-SCAT-A) or Illinois Competition Questionnaire. The final competition results were recorded. Descriptive linear regression analysis and Pearson correlation coefficients were used. The significance level was 5%. Data was analyzed using SPSS, version 18.0.

**Results:** Most gymnasts presented poor sleep quality ( $n = 52; 77.61\%$ ), mild somnolence ( $n = 45; 67.2\%$ ) and a minority had severe somnolence ( $n = 9; 13.5\%$ ) and good sleep quality ( $n = 15$  athletes; 22.39%). The total average score obtained by the gymnasts in SCAT-A was 22.68 (3.17) points, and varied between 13 and 30 points, which means the average of the sample showed a level of moderate pre-competitive stress. Gymnasts having normal daytime levels and a good sleep quality showed medium levels of precompetitive stress; on the other hand, gymnasts with poor sleep quality demonstrated high levels of pre- competitive stress ( $p = 0.000$ ). Gymnasts with low or moderate stress levels before competition had better ratings than those who experienced high levels of pre-competitive stress ( $p = 0.017$ ).

**Conclusion:** Sleep characteristics influences both precompetitive stress and competitive achievements, with negative consequences when curtailed.

<http://dx.doi.org/10.1016/j.sleep.2013.11.656>

### Sleep, training volume and body composition in young gymnasts

M. Silva<sup>1</sup>, T. Paiva<sup>2</sup>

<sup>1</sup> Institute of Molecular Medicine, Medical Faculty of Lisbon, Lisbon, Portugal

<sup>2</sup> Institute of Molecular Medicine, Medical Faculty of Lisbon, Lisbon, Portugal

**Introduction:** Young gymnasts are under a great pressure of keeping a lean body while they are undergoing important processes of growth and development for their future life. Gymnastics requires gracefulness and technique. Although athletes often have a poor sleep quality and, since it is known that sleep influences body composition, its relation to sleep quality deserves extended research. Our main purpose was to evaluate sleep quality, training volume and body composition in young female gymnasts before an international competition.

**Materials and methods:** 67 rhythmic gymnasts ( $18.67 \pm 2.93$  years old) of high performance level ( $36.60 \pm 7.56$  hours of training/week) were evaluated by a questionnaire, which collected: training data; medical and gynecological history; sleep assessed by the Epworth Sleepiness Scale and the Pittsburgh Sleep Quality Index; body composition (weight, height, body mass index (BMI), fat mass (FM), muscle mass (MM) and total body water) was measured by anthropometry and bioelectrical impedance. Descriptive, linear regression analysis and correlation analysis were used. The significance level was 5%. Data was analyzed using SPSS, version 18.0.

**Results:** Gymnasts showed a high body density ( $1.074 \pm 0.009$  g/cc) and reduced fat mass ( $9.06 \pm 2.09\%$ ), muscle mass ( $13.97 \pm 5.10$  Kg) and total body water ( $51.41 \pm 6.13\%$ ). Gymnasts' anthropometric profile was  $48.39 \pm 4.93$  Kg;  $1.66 \pm 0.05$  m and  $17.39 \pm 1.14$  Kg/m<sup>2</sup>. Athletes with a good sleep quality had a BMI  $\geq 18.5$  kg/m<sup>2</sup>, while those with a bad sleep quality had a lower BMI ( $p = 0.005$ ). Gymnasts presenting a FM equal to or lower than 8% slept longer than those with lower FM ( $p = 0.014$ ). However gymnasts with lower BMI showed better results in competition ( $p = 0.018$ ).

**Conclusion:** Sleep duration and quality influences body composition and anthropometric characteristics in young female athletes. Balancing success and health is a crucial, and the long term consequences of body composition abnormalities at young ages in females deserve further research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.657>

### Sleep duration and energy intake in female gymnasts from preparatory training period to competition season

M. Silva<sup>1</sup>, T. Paiva<sup>2</sup>

<sup>1</sup>Institute of Molecular Medicine, Medical Faculty of Lisbon, Lisbon, Portugal

<sup>2</sup>Institute of Molecular Medicine, Medical Faculty of Lisbon, Lisbon, Portugal

**Introduction:** Sleep and energy intake can maximize the benefits of training process during the athletic season. Only an adequate amount of sleep and a balanced diet can promote an optimal athletic performance. Although gymnasts seem to be at a low level of energy intake and suffer from insufficient sleep, few investigations have examined this concern, especially in female athletes. The main purpose of this study was to evaluate the amount of sleep and energy intake from the preparatory period to the competition period of an athletic season.

**Materials and methods:** 70 competition female gymnasts ( $11.1 \pm 2.8$  years old;  $35.8 \pm 10.4$  Kg;  $140.4 \pm 13.6$  m) taking part in the Portuguese Gymnastic Federation were evaluated by a questionnaire, which collected: training data; number of sleep hours in weekdays and weekend days; energy and nutrients intake by a three days consecutive food record and; anthropometric measures (weight, height and body mass index). Descriptive linear regression analysis and Pearson correlation coefficients were used. The significance level was 5%. Data was analyzed using SPSS, version 18.0.

**Results:** Gymnasts slept more in the weekend days than in weekdays during the athletic season, but sleep duration decreased from the preparatory period ( $8.5 \pm 1.4$  h/day) to the competitive period ( $8.0 \pm 0.6$  h/day). Gymnasts' energy intake decreased from preparatory periods ( $1603 \pm 487$  Kcal/day) to competitive period ( $1400 \pm 461$  Kcal/day). Gymnasts' height and weight increased among the season.

**Conclusion:** Gymnasts presented an insufficient sleep duration for their age and physical requirements and an unbalance and hypo caloric diet, which can compromise their athletic performance and efficiency.

<http://dx.doi.org/10.1016/j.sleep.2013.11.658>

### REM sleep behavior disorder is absent in de novo parkinson disease patients with parkin mutations: a report from the DEN-OPA cohort

F. Sixel-Döring<sup>1</sup>, K. Lohmann<sup>2</sup>, C. Klein<sup>2</sup>, B. Mollenhauer<sup>1</sup>, C. Trenkwalder<sup>1</sup>

<sup>1</sup>Paracelsus-Elena-Klinik, Germany

<sup>2</sup>Institute of Human Genetics, Universität Lübeck, Germany

**Introduction:** We are currently prospectively investigating non-motor symptoms of 159 at baseline de novo patients with Parkinson disease (PD) and 110 healthy controls matched for age and gender in a single-centre cohort study (DeNoPa cohort). In this substudy we analyzed the occurrence of REM sleep behaviour disorder (RBD) in de novo PD patients with heterozygous Parkin mutations.

**Materials and methods:** Video-supported PSG (vPSG) was performed on two consecutive nights. All REM phases were reviewed in real time video analysis for identification of RBD. The night with the most severe RBD manifestation was used for further analysis of sleep architecture. If no RBD was registered in REM sleep, the second night was analyzed. REM without atonia (RWA) was measured as any muscle activity on chin EMG in three second mini epochs with a duration exceeding 0.1 s and an amplitude greater than double baseline and calculated as percent of total REM.

**Results:** We identified 6/159 (4%) de novo PD patients with heterozygous Parkin mutations. All six were male and not related. Mean age was  $63.3 \pm 11.5$  years. (range 48–76), compared to  $65 \pm 10$  (40–85) in the non-Parkin group. Hoehn & Yahr stage was determined at  $1.3 \pm 0.27$  (range 1.0–1.5), compared to  $1.8 \pm 0.7$  (1–3) in the non-Parkin group. None of the Parkin mutation carriers was identified with RBD, whereas 40/152 (26%) non-Parkin PD patients with valid vPSG showed RBD according to current diagnostic criteria as defined by ICSD 2. RWA values were measured at  $5.9 \pm 3.9\%$  (range 0.7–11.1%) in the Parkin group, which corresponded to  $6 \pm 8\%$  (0–51%) in the non-Parkin PD group without RBD. Two Parkin PD patients had a positive history for potential RBD. However, RWA was determined at 0.7% and 5.1% in these two study subjects.

**Conclusion:** RBD is absent in PD subjects with heterozygous Parkin mutations. This finding implies a crucial role of alpha-synuclein misprocessing in the pathogenesis of RBD.

**Acknowledgements:** The authors thank T.Wicke, E. Lang and N. Drescher for technical assistance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.659>

### REM sleep behavioral events (RBE): a new marker for neurodegeneration in early parkinson's disease?

F. Sixel-Döring, E. Trautmann, B. Mollenhauer, C. Trenkwalder  
Paracelsus-Elena-Klinik, Germany

**Introduction:** To analyze potential markers in sleep for early recognition of neurodegenerative disease in newly diagnosed, unmedicated patients with Parkinson's disease (PD) compared to controls.

**Materials and methods:** Video-polysomnography (vPSG) was available in 158 newly diagnosed, unmedicated PD patients and 110 healthy age-, gender- and education-matched controls (HC). REM sleep was analyzed for REM without atonia (RWA) and studied by review of time-synchronized video. Motor behaviors and/or vocalizations in REM sleep with a purposeful component other than comfort moves were identified as REM sleep behavioral events (RBE). Two or more events had to be present to be classified as "RBE positive". RBE subjects included RBD and non-RBD subjects based upon the presence or absence of RWA >18.2%.

**Results:** RBE were detected in 81/158 de novo PD patients (51%) and 17/110 HC (15%) ( $p < 0.001$ ). RBD was identified in 40/81 RBE positive PD patients (25% of all PD patients) and 2/17 RBE positive HC (2% of all controls). RBE positive patients showed no specific motor or neuropsychological features compared to RBE negative patients. PD patients and HC with RBE had more REM sleep ( $p = 0.002$ ) and a higher periodic leg movements in sleep index ( $p = 0.022$ ) compared to subjects without RBE.

**Conclusion:** This first description of RBE shows it occurs more frequently in de novo PD patients than in HC and may be an early sign of neurodegeneration and precede RBD. There is no specific phenotype of PD associated with newly defined RBE or RBD at this early stage.

**Acknowledgements:** The authors would like to thank Arthur Walters, Department of Neurology, Division of Sleep Medicine, Vanderbilt University, Nashville, Tennessee, USA for his most helpful advice.

<http://dx.doi.org/10.1016/j.sleep.2013.11.660>

### Personalized sleep medicine applied to melatonin treatment for circadian rhythm sleep disorders: current status and future

M. Smits<sup>1</sup>, H. Keijzer<sup>2,3</sup>, W. Braam<sup>4,3</sup>, J. Vervoort<sup>5</sup>, L. Curfs<sup>6,3</sup>

<sup>1</sup> Centre for sleep-wake disturbances and chronobiology, The Netherlands

<sup>2</sup> Department of Clinical Chemistry and Hematology, Rijnstate Hospital, Arnhem, The Netherlands

<sup>3</sup> Governor Kremers Centre, University Maastricht, The Netherlands

<sup>4</sup> 's Heeren Loo Zuid-Veluwe, Wekerom, The Netherlands

<sup>5</sup> Wageningen University and Research, Laboratorium of Biochemistry, The Netherlands

<sup>6</sup> Department of Clinical Genetics, Academic Hospital Maastricht/University Maastricht, Maastricht, The Netherlands

**Introduction:** Personalized sleep medicine is an emerging area of research and practice. Recent studies have identified clear inter-individual differences in performance vulnerability to sleep loss. Although clear biomarkers for this vulnerability are not known, new research indicates that genetic influences on sleep and circadian systems may be important. To assess the clinical applicability of these findings for diagnosis and treatment of patients with circadian rhythm disorders we summarized the present knowledge and speculate about future developments.

**Materials and methods:** Literature search using PubMed.

**Results:** Dim Light melatonin Onset (DLMO) plays a key role in the diagnosis of circadian rhythm sleep disorders. It cannot be predicted by sleep parameters or polymorphisms of clock- or other sleep related genes. For melatonin treatment DLMO is crucial, as this treatment is most effective if administered at a time which is related to the DLMO. Efficacy of melatonin treatment depends not only on its personalized time of administration, but also on the speed of its metabolism. For slow melatonin metabolism may pile up daily melatonin levels and consequently stop melatonin efficacy. Melatonin metabolism is influenced by CYP1A2 gene activity. Several methods to assess Cyp1A2 activity are being developed, using melatonin, coffee, green tea and chocolate as test substances or measuring CYP1A2 polymorphisms. Co-morbidities including ADHD and autism spectrum disorder (ASD) influence circadian sleep rhythm and their response to melatonin treatment. CYP1A2 polymorphisms might be correlated with slow melatonin metabolism and ASD.

**Conclusion:** DLMO, melatonin metabolism tests and assessment of psychiatric co-morbidity are crucial for effective diagnosis and treatment of circadian rhythm sleep disorders. Further development of techniques to measure melatonin and its metabolism will increase the clinical applicability.

**Acknowledgement:** This is a non-sponsored study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.661>

### Association between the activity of salivary alpha-amylase and the severity of pediatric sleep disordered breathing (SDB)

C. Park<sup>1</sup>, H. Son<sup>1</sup>, H. Hong<sup>2</sup>

<sup>1</sup> St. Vincent's hospital of Catholic University of Korea, Republic of Korea

<sup>2</sup> Public Health Center, Republic of Korea

**Introduction:** SDB has its common features, that is, abnormal breathing patterns shown in children with SDB during sleep, ranging from reduced airflow (flow limitation, hypopnea) with increased respiratory efforts with repetitive cessation of airflow (apnea). Considering autonomic nervous system (ANS), parasympathetic tone is elevated during apneas and hypopneas and sympathetic tone is elevated after respiratory events. Therefore, children with SDB may have unstable status of ANS during sleep and show irregular pattern of sympathetic and parasympathetic nervous system (ANS and PNS, respectively). We hypothesized that children with SDB would have altered autonomic balance and changes of sAA level caused by SDB would be predictive of severity during sleep. Therefore, the aim of this study was to evaluate the change of sAA during sleep and its correlation with PSG parameters in pediatric subjects with SDB.

**Materials and methods:** Seventy-three children who attended our clinic during 1 year were enrolled prospectively and underwent full-night polysomnography. Their saliva was collected for quantitative analysis of alpha-amylase before and after polysomnography. The level of salivary alpha-amylase were measured and analyzed with polysomnography parameters. The subjects ( $n = 73$ ) were divided into control ( $n = 32$ , AHI <1) and OSAS ( $n = 41$ , AHI  $\geq 1$ ) groups.

**Results:** The ratio and substrate of the sAA after PSG to sAA before PSG in the severe subgroup were significantly larger than those in the control and mild-moderate subgroup. Receiver operating characteristic curves were constructed to determine the optimal sAA measurements for predicting severe OSAS. The area under the curve in the sAA measurements was approximately 0.82 and a value approximately yielded a sensitivity of 80% and a specificity of 55%.

**Conclusion:** Sampling for salivary cortisol is an easy, safe, and non-invasive method that is especially appropriate for multiple sampling in children. Our data suggest the ratio of post- to pre-sleep cortisol to be a consistent index that is well-correlated with AHI.

**Acknowledgements:** Measurement of salivary cortisol in children with OSAS may represent a useful screening tool for identification of those with OSAS and high AHI and management of follow-up care.

<http://dx.doi.org/10.1016/j.sleep.2013.11.662>

### **Restless legs syndrome in attention deficit-hyperactivity disorder: what about the role of treatment? A multicenter study**

C. Soria-Bretones<sup>1</sup>, J. Escribá-Alepuz<sup>1</sup>, P. Giner-Bayarri<sup>2</sup>, S. Hernández-Muelas<sup>3</sup>, T. Oviedo-Montés<sup>2</sup>, M. García-Jiménez<sup>1</sup>

<sup>1</sup>Virgen de la Luz Hospital, Clinical Neurophysiology, Spain

<sup>2</sup>Dr. Peset University Hospital, Clinical Neurophysiology, Spain

<sup>3</sup>Virgen de la Luz Hospital, Pediatrics, Spain

**Introduction:** In our clinical practice we find a high co-morbidity of Attention Deficit-Hyperactivity Disorder (ADHD) and Restless Legs Syndrome (RLS). Our aim is to describe the prevalence of RLS in children diagnosed of ADHD, as well as find out if ADHD treatment plays a role in RLS symptoms and prevalence.

**Materials and methods:** Observational descriptive cross-sectional study in children diagnosed of ADHD referred from Neuropediatrics and Child Psychiatry to Clinical Neurophysiology departments in two hospitals (in Cuenca and Valencia, Spain):  $n = 36$ , ages 5–17. These were divided in non-treated ( $n = 16$ ) and treated ( $n = 20$ ) subgroups. Measures: questionnaire based on Owen's test for RLS and Periodic Leg Movements (PLM), answered by parents by phone or live interviews. International RLS Study Group criteria for RLS (2002) were followed.

**Results:** Global RLS prevalence in our ADHD patients: 36.1%. Among them, criteria of definite RLS are fulfilled in 30.8%, probable RLS in 46.1% and possible RLS in 23.1%. RLS prevalence in non-treated group: 50.0%. Definite RLS in 12.5%, probable in 62.5% and possible in 25.0% of them. RLS prevalence in treated group: 25.0%. Definite RLS in 60.0%, probable in 20.0% and possible in 20.0%.

**Conclusion:** The prevalence of RLS symptoms in children with ADHD is higher than in normal population, according to the reviewed literature. In treated ADHD, overall RLS prevalence is only 50% of that in non-treated group, while "Definite RLS" prevalence is 4.8 times higher. These findings suggest: The symptoms of ADHD and RLS may be overlapping and lead to misdiagnosis of both disorders. In the same way, a lower prevalence of RLS in treated ADHD could be explained by an improvement in ADHD or in RLS symptoms. Further studies are needed to better understand these findings, as well as the specific role of the different drugs commonly used in ADHD.

**Acknowledgements:** This study has been supported by a grant given by FISCAM. Special thanks also to our colleagues Dr. García-Bellón, M. and Dr. De las Heras- Martínez, E.

<http://dx.doi.org/10.1016/j.sleep.2013.11.663>

### **Clinical and polysomnographic studies on nocturnal enuresis: are there any news?**

L. Soster, A. Rosana Cardoso, F. Simone Nascimento, L. Adrienne Suri, G. Eliana, K. Vera Hermina Kalika

University of Sao Paulo Medical School, Brazil

**Introduction:** Nocturnal enuresis (NE) has received recent attention in the medical literature: more specific studies have been performed on those children in an attempt to better understand its physiopathology. This study is a part of this new interest: clinical aspects and their correlation with polysomnographic (PSG) data, based on the new AASM criteria were evaluated.

**Materials and methods:** One hundred and eighteen children with NE, aged 6–16 years old, defined by 2010 International Children's Continence Society (ICCS) criteria (on the basis of renal, neurological and sleep evaluation) were clinically evaluated and had polysomnographic studies. Excluding criteria were: any neurological or psychiatric condition (e.g., children with ADHD were excluded). Full PSGs were performed in a single night study, with digital EMBLA N700.

**Results:** Eighty-four children (72%) were male and although the inclusion criteria, by clinical history were monosymptomatic NE (MNE), on clinical evaluation we found some non monosymptomatic (NMNE) ones (24/118). Their age were 9.94 ( $\pm 2.7$ ) years old; sleep latency was 21.78 ( $\pm 24$ ); sleep stage percentages were, 4.8 on N1, 61.3 on N2, 16.7 on N3 and 17 on REM sleep. The WASO was 45.65 min.

**Conclusion:** The new AASM criteria showed larger N1 time and WASO when compared to other previous studies which used Rechtschaffen & Kales criteria. Although this study did not show differences in sleep fragmentation, it is an interesting aspect which should be studied in further studies.

**Acknowledgement:** FAPESP grant.

<http://dx.doi.org/10.1016/j.sleep.2013.11.664>

### **Multiple sleep latency test in patients with suspected narcolepsy. Review of 45 cases**

J. Paniagua-Soto, J. Ruiz-García, M. Iznola-Muñoz, L. Ruiz-Serrano  
Clinical Neurophysiology Service, Virgen de las Nieves Hospital, SAS, Spain

**Introduction:** Narcolepsy is a sleep disturbance with an unknown etiology and genetic predisposition, whose main symptom is excessive daytime sleepiness (100%), with recurrent episodes of irresistible sleep. The second most common symptom is cataplexy (80%). Prevalence: 0.20–0.18% in general population, with a low incidence in children. The Multiple Sleep Latency Test (MSLT) is the most widely used neurophysiological test for narcolepsy diagnosis. Objectives: (1) Establish the diagnostic utility of MSLT in narcolepsy, especially not associated with cataplexy. (2) Comparison of the clinical and MSLT results between patients with positive and negative MSLT.

**Materials and methods:** Review of 45 patients cases derived to our sleep clinic suspicion of narcolepsy (40 adults –17 males and 23 women) and 5 children aged between 8 and 12 years – 4 males and 1 girl. Were submitted to a MSLT in our sleep laboratory (January/07–May/13), protocol according to the American Academy of Sleep Medicine ("Practice Parameters for clinical use of the Multiple Sleep Latency Test and the Maintenance of Wakefulness Test", 2005).

**Results:** MSLT (+): 46.67% ( $n = 21/45$ ). MSLT (–): 53.33% ( $n = 24/45$ ). Mean sleep latency (4 naps) MSLT (+): 2.96 min. MSLT (–): 8.01 min. (1) MSLT (+): narcolepsy with cataplexy had 76.2% ( $n = 16$ ). 23.8% ( $n = 5$ ) had narcolepsy without cataplexy. (2) MSLT (–): narcolepsy discarded. Final diagnoses were varied: idiopathic hypersomnia, hypersomnia of psychiatric etiology, Sleep Apnea– Hypopnea Syndrome, poor sleep hygiene, restless leg

syndrome, etc. About children, MSLT was positive in 60% ( $n = 3$ ), in all cases associated cataplexy.

**Conclusion:** (1) In our review, 46.67% of MSLT performed in patients with suspicion of narcolepsy was positive, of which 76.2% was diagnosed of narcolepsy associated cataplexy and 23.8% narcolepsy without cataplexy. (2) MSLT is a useful method in the diagnosis of narcolepsy, mainly in cases not associated with cataplexy or when these episodes are doubtful and genetic studies are negative.

**Acknowledgements:** Manuel Piñero, Alberto Galdón y Yolanda Sánchez.

<http://dx.doi.org/10.1016/j.sleep.2013.11.665>

### Children sleep clinic in clinical neurophysiology service in Virgen de las Nieves Hospital in Granada (Spain)

J. Paniagua-Soto, M. Iznaola-Muñoz, J. Ruiz-García, L. Ruiz-Serrano  
Clinical Neurophysiology Service, Virgen de las Nieves Hospital, SAS, Spain

**Introduction:** The increasing demand of a monographic clinic of sleep disturbances in children from different specialities like Otorhinolaryngology (ORL), Maxillofacial Surgery or Neuropediatrics stimulated the differentiation from adult sleep clinic existing in our service since 1998. We show the characteristics of the attended population in first consultant since January 2012.

**Materials and methods:** We show age, sex, origin, petitioner doctor, motive of consultation, complementary tests, diagnosis and follow-up of 80 children.

**Results:** Children Sleep Clinic is available last Thursday of each month (3–4 first consultant and 2–3 reviews are attended). The age is between 15 months and 16 years, 67.5% boys. Children come mainly from Granada and its district (70%) but also from the rest of Andalusia. Petitioner doctors are 28.75% ORL, 17.5% Pediatrics, 16.25% Neuropediatrics, 15% Neumology, and 22.5% Others (Odontostomatology, Mental Health, Maxillofacial Surgery, Cardiology, etc.). Motive of consultation-Suspicious Diagnosis: 62.5% AHS, 13.75% insomnia y 23.75% others (narcolepsy, restlesslegs syndrome, circadian rhythm disorders, etc.). We requested in 87.5% of children any kind of complementary test (70% PSGN, 14.28% PSGN-MSLT, 15.7% EEG, EEG after sleep deprivation or Video-EEG). The percentage of AHS is 19.75% (47.36% of them are treated with CPAP and the rest received any kind of surgery –adenoidectomy or jaw advancement, mainly–), 2 children were narcoleptics, one girl had restlesslegs syndrome, 2 benign snoring and in 22.5% we have rejected the suspicious diagnosis of AHS.

**Conclusion:** The monographic children sleep clinic allows a better attention, control and follow-up of children population in children with sleep disturbances.

**Acknowledgements:** Manuel Piñero, Alberto Galdón y Yolanda Sánchez.

<http://dx.doi.org/10.1016/j.sleep.2013.11.666>

### Clinical case: Ten-year-old girl with impossibility to wake up

J. Paniagua-Soto, L. Ruiz Serrano, C. Iznaola Muñoz, J. Ruiz García  
Hospital Virgen de las Nieves, Servicio de Neurofisiología Clínica, SAS, Spain

**Introduction:** The impossibility and difficulty to wake up is a sign that can appear in several sleep disorders in children: Delayed Sleep-Phase Syndrome, insomnia, Restless Legs Syndrome,

Inadequate Sleep Hygiene and others like neuropsychiatric sleep disorders.

**Materials and methods:** CLINICAL CASE Ten-year-old girl with suspected diagnosis of epilepsy with daily episodes of hypotonia, repetitive speech and impossibility to wake up. Several EEG studies and cranial NMR were normal. Treatment with Valproate was initiated without clinical changes, so the treatment was suspended and parasomnia diagnosis was given. She was referred to sleep disorders clinic because the impossibility to wake up with school absenteeism. Her mother reports remarkable leg movements during first part of the night. Polysomnography and Multiple Sleep Latency Test, serum iron and ferritine level and Actigraphy were requested.

**Results:** Polysomnography with Multiple Sleep Latency Test results were a low increase of the Leg Movements Index in both legs regarding the diagnosis of mild Restless Legs Syndrome. Narcolepsy and infantile sleep apnea disorder were rejected. Actigraphy showed signs of Delayed Sleep-Phase Syndrome. Treatment with two drops of clonazepam before going to bed, had given good results, reducing the difficulty to wake up and improving her school performance.

**Conclusion:** Restless Legs Syndrome in children can give different clinical presentation, so insomnia and difficulty to wake up must be considered in differential diagnosis.

**Acknowledgements:** Servicio de Neurofisiología Clínica, Hospital Virgen de las Nieves.

<http://dx.doi.org/10.1016/j.sleep.2013.11.667>

### Impact of bariatric surgery on OSAS in obese individuals

S. Santos, C. Caramujo, M. Silva, P. Duarte  
Pneumology Department, General Surgery Department, Centro Hospitalar de Setúbal, EPE, Portugal

**Introduction:** Weight loss may reduce the severity of Obstructive Sleep Apnea Syndrome (OSAS). This study aims to evaluate the impact of bariatric surgery on OSAS in obese individuals.

**Materials and methods:** We conducted a study in a sample of patients referred for sleep polysomnography before and after bariatric surgery, that included gastric banding procedures, gastric bypass and vertical sleeve gastrectomy. We compared the effects of weight loss on apnea-hypopnea index (AHI), oxygen desaturation index (ODI) and percentage of cure of disease.

**Results:** Thirty-six patients were enrolled (14 male, 22 female), with a mean age of 49 years (range from 29 to 64 years). The mean body mass index (BMI) was 45.7 kg/m<sup>2</sup> and ranged from 32.7 to 68 kg/m<sup>2</sup>. All patients presented OSAS, with an average AHI of 39 events per hour (11 mild, 6 moderate and 19 severe disease). The mean ODI was 41.6 ± 27 desaturations per hour. After surgery intervention we observed a significantly statistical difference ( $p < 0.001$ ) in BMI (33.8 ± 5.3) and a reduction in AHI (7.33 ± 8.0). The ODI was significantly reduced to a mean value of 9.3 ± 9.9 desaturations per hour. Fifty percent of patients experienced cure of disease and 15 patients had an improvement of disease, with a reduction in the level of severity of disease.

**Conclusion:** Weight loss after bariatric surgery is associated with a reduction of AHI and ODI, allowing a complete resolution or significant improvement in Obstructive Sleep Apnea Syndrome.

<http://dx.doi.org/10.1016/j.sleep.2013.11.668>

### Prevalence of OSAS in obese individuals

S. Santos, C. Caramujo, M. Silva, P. Duarte, J. Baptista, A. Andre, T. Trindade, L. Cortez, S. Sousa

Pneumology Department, General Surgery Department, Centro Hospitalar de Setúbal, EPE, Portugal

**Introduction:** The prevalence of Obstructive Sleep Apnea Syndrome (OSAS) is known to be higher among obese patients. This study aims to evaluate the prevalence of OSAS in obese individuals.

**Materials and methods:** We conducted a cross-sectional study in a sample of patients referred for sleep polysomnography before bariatric surgery. The severity of OSAS was categorized by the apnea-hypopnea index (AHI) as follows: absent <5; mild 5–14; moderate 15–29; severe >30 events per hour. Baseline demographic and sleep study data were registered.

**Results:** One hundred and thirty-four (134) patients were enrolled (21 male, 113 female), with a mean age of 44.9 years (range 19 to 64 years). The body mass index (BMI) was averaged 44.5 kg/m<sup>2</sup> and ranged from 32.7 to 68 kg/m<sup>2</sup>. Eighty patients (60%) presented OSAS, with an AHI averaged 17.2 events per hour (40 mild, 14 moderate and 26 severe disease). The mean ODI was 19 desaturations per hour. We observed a significant statistical difference between male and female patients, with men experiencing a higher prevalence of disease (100%), a more severe disease (mean AHI of 42 events per hour in male and 12 events per hour in female) and a higher ODI (41.4 in male and 14 in female).

**Conclusion:** OSAS had a prevalence of 60% in obese patients referred to a multidisciplinary obesity treatment unit. We observed that men experienced a higher prevalence and a more severe disease, as described in literature.

<http://dx.doi.org/10.1016/j.sleep.2013.11.669>

### The influence of continuous positive airway pressure therapy on prevalence of masked hypertension in patients with obstructive sleep apnea

M. Sova<sup>1</sup>, E. Sovova<sup>2</sup>, M. Hobzova<sup>1</sup>, M. Kamasova<sup>2</sup>, V. Kolek<sup>1</sup>

<sup>1</sup> University Hospital and Palacky University Olomouc, Department of Respiratory Diseases, Czech Republic

<sup>2</sup> University Hospital and Palacky University Olomouc, Internal Department – Cardiology, Czech Republic

**Introduction:** Obstructive sleep apnea (OSA) is a common disorder with important clinical consequences. Many studies have proven that OSA is one of the most important causes of secondary hypertension. Masked hypertension (MH) is defined as a presence of normal office blood pressure together with abnormal results in 24 h ambulatory blood pressure monitoring (ABPM). The prevalence of this condition in patients with OSA is not well defined. Continuous positive airway pressure (CPAP) is the most effective method of OSA therapy. The influence of CPAP therapy on prevalence of masked hypertension is not well known. The aim of this study was to evaluate the influence of CPAP therapy on prevalence of MH in patients with OSA.

**Materials and methods:** 43 patients (40 men) were included, average age 54.2 ± 10.5. All of these patients were evaluated using polysomnography with diagnosis of OSA, average apnea-hypopnea index (AHI) 60.6 ± 23.6. Patients were treated with CPAP for one year. Patients with low compliance (CPAP usage <4 h/night) were excluded. ABPM was done before and after CPAP therapy. Patients with change in their antihypertensive treatment were excluded.

**Results:** Masked hypertension was initially present in 25 (58.1%) patients. After one year of CPAP therapy the MH was present in 26 (60.5%) patients. McNemar test did not found significant change in

prevalence of MH ( $p = 1.000$ ) after CPAP treatment. In 15 patients (35.9%) was MH present initially and after CPAP therapy, in 10 (23.3%) patients was MH present initially but not after CPAP therapy and in 11 (25.6%) patients was MH present only after one year but not initially. In 7 (16.3%) patients MH was not present at all.

**Conclusion:** Masked hypertension is highly prevalent in patients with OSA. According to these results CPAP treatment does not influence prevalence of MH in patients with OSA. Because of long term consequences of suboptimal arterial hypertension compensation, it is crucial to perform ABPM in patients with OSA, preferably together with sleep study. With this algorithm we can better diagnose and treat patients with OSA and arterial hypertension.

**Acknowledgement:** This study has been supported by grant: LF\_2013\_17.

<http://dx.doi.org/10.1016/j.sleep.2013.11.670>

### Analysis of pharmacotherapy and compensation of arterial hypertension in patients with obstructive sleep apnea

M. Sova<sup>1</sup>, E. Sovova<sup>2</sup>, M. Hobzova<sup>1</sup>, M. Kamasova<sup>2</sup>, V. Kolek<sup>1</sup>

<sup>1</sup> University Hospital and Palacky University Olomouc, Department of Respiratory Diseases, Czech Republic

<sup>2</sup> University Hospital and Palacky University Olomouc, I. Internal Department – Cardiology, Czech Republic

**Introduction:** Obstructive sleep apnea (OSA) is a common disorder with important clinical consequences. It is one of the most important causes of a secondary hypertension. Current European Society of Hypertension (ESH) guidelines offer relatively accurate manual how to treat arterial hypertension, but it is usually not known whether physicians are following these guidelines. The aim of this study was to analyze pharmacotherapy and compensation of arterial hypertension in patients with OSA.

**Materials and methods:** 98 hypertensive patients (86 men), average age 53.9 ± 0.9 years were evaluated using polysomnography with diagnosis of OSA, average apnea-hypopnea index (AHI) 54.6 ± 2.3. Patients underwent 24 h ambulatory blood pressure monitoring and current pharmacotherapy data was taken. Appropriate combinations of antihypertensive drugs were derived from ESH guidelines.

**Results:** 36 (36.7%) patients were taking appropriate combination of antihypertensive drugs. Compensated blood pressure evaluated by ABPM was present in 15 (15.3%) patients. From this group 7 (46.7%) patients were taking drugs according to guidelines. The most common therapy in optimal compensation group was ACEi/ARB (3 patients-20%) and ACEi/ARB + beta blocker (3 patients-20%). 9 (60%) patients were taking ACEi, average dose 6.4 mg of perindopril equivalent, 7 (46.7%) patients were taking beta blocker, average dose 62.5 mg of metoprolol equivalent.

**Conclusion:** In patients referred to sleep laboratory because of OSA symptoms is arterial hypertension treated according to current guidelines in only 36.7%. Arterial hypertension is not well compensated in 84.7% of patients. From these results is evident that optimization of antihypertensive treatment can be in patients with OSA much better.

**Acknowledgement:** This study has been supported by grant: LF\_2013\_17.

<http://dx.doi.org/10.1016/j.sleep.2013.11.671>

### Diagnostic thresholds for quantitative REM sleep muscle densities, phasic burst duration, and REM atonia index in REM sleep behavior disorder with co-morbid obstructive sleep apnea

E. St. Louis<sup>1</sup>, S. Mccarter<sup>1</sup>, D. Sandness<sup>1</sup>, B. Boeve<sup>2</sup>, M. Silber<sup>2</sup>

<sup>1</sup> Mayo Clinic and Foundation, Departments of Neurology and Medicine, United States

<sup>2</sup> Mayo Clinic and Foundation, Department of Neurology, United States

**Introduction:** Previous REM sleep without atonia (RSWA) studies have excluded patients with sleep apnea, potentially limiting application to clinical REM sleep behavior disorder (RBD) populations. We determined whether phasic burst duration and conventional RSWA methods could accurately diagnose RBD patients with co-morbid OSA.

**Materials and methods:** We analyzed RSWA phasic burst durations, phasic, “any” and tonic densities, and automated REM atonia index (RAI) in RBD and matched controls with OSA. Group RSWA metrics were then analyzed and regression models fit to explore associations with clinical variables, with receiver operator characteristic (ROC) curves determining the best diagnostic cut-off thresholds for RBD diagnosis.

**Results:** All mean RSWA phasic durations and densities were higher in RBD patients than controls ( $p < 0.0001$ ), and RSWA metric associations with RBD remained significant when adjusting for age, gender, and REM AHI ( $p < 0.0001$ ). Diagnostic RSWA density (phasic, “any”) cut-offs were: submental (SM) (15.5%, 21.6%); anterior tibialis (AT) (30.2%, 30.2%); and combined SM/AT (37.9%, 43.4%). Tonic density cut-off of 1.2% was 100% sensitive and specific, while RAI (SM) cut-off was 0.88. Combining phasic burst durations with RSWA densities improved sensitivity and specificity of RBD diagnosis.

**Conclusion:** This study provides evidence for RSWA diagnostic thresholds applicable in clinical RBD patient populations with co-morbid OSA using conventional EMG lead placements during split-night polysomnograms, with suggested cut-offs for combined SM/AT muscles of 43.4%, RAI of 0.88, and phasic muscle burst durations of 0.65 and 0.79 s in the SM and AT muscles, respectively. Future studies with similar methods in idiopathic RBD patients with co-morbid OSA are planned.

**Acknowledgements:** The project described was supported by a Mayo Clinic Alzheimer’s Disease Research Center Grant Award from the National Institute on Aging (P50 AG016574), and the National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health, through Grant No. 1 UL1 RR024150-01. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

<http://dx.doi.org/10.1016/j.sleep.2013.11.672>

### Predictors of injury in REM sleep behavior disorder

E. St. Louis<sup>1</sup>, S. Mccarter<sup>1</sup>, C. Boswell<sup>1</sup>, B. Boeve<sup>2</sup>, M. Silber<sup>2</sup>

<sup>1</sup> Mayo Clinic and Foundation, Departments of Neurology and Medicine, United States

<sup>2</sup> Mayo Clinic and Foundation, Department of Neurology, United States

**Introduction:** REM sleep behavior disorder (RBD) is widely recognized to involve potentially injurious dream enactment behaviors (DEB), but which clinical factors are associated with RBD-related injuries remain largely unknown. We aimed to identify injury predictors in RBD.

**Materials and methods:** We surveyed consecutive RBD patients seen at Mayo Clinic between 2008 and 2010 regarding RBD-related injuries and reviewed medical records to determine idiopathic (iRBD) or symptomatic RBD diagnosis. Associations between injuries prior to treatment and demographic, clinical, and medication variables were then determined with odd’s ratios and multiple logistic regression analyses. The primary outcome variables were injury and injury severity.

**Results:** Fifty-three patients (40%) responded. Median age was 69 years and 35 (75%) were men. Twenty-five (47%) had symptomatic RBD. Twenty-nine (55%) reported injury, including self (37.8%) and bed partner (16.7%) injury. iRBD diagnosis (OR = 6.8,  $p = 0.016$ ) and dream recall (OR = 7.5,  $p = 0.03$ ) were associated with injury, and iRBD diagnosis was independently associated with injury and injury severity, adjusting for age, gender, DEB frequency and duration. Falls during DEB ( $p = 0.03$ ) were also associated with more severe injury, while DEB frequency was not associated with injury, injury severity, or falls.

**Conclusion:** Injuries are a frequent complication of RBD. iRBD patients are more likely to suffer injury, and more severe injuries, than symptomatic RBD patients. In addition, recall of dreams was also associated with injury, and DEB-related falls were associated with more severe injuries. Frequency of DEB did not predict RBD-related injuries, highlighting the importance of timely initiation of treatment for RBD in patients having even rare DEB episodes.

**Acknowledgements:** The project described was supported by the National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health, through Grant No. 1 UL1 RR024150-01. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

<http://dx.doi.org/10.1016/j.sleep.2013.11.673>

### Circadian variation of myocardial infarction onset in patients with sleep apnea

O. Ludka<sup>1,2</sup>, R. Stepanova<sup>2</sup>, L. Galkova<sup>1,2</sup>, M. Vyskocilova<sup>2</sup>, J. Spinar<sup>1,2</sup>, T. Kara<sup>2,3</sup>

<sup>1</sup> Department of Internal Medicine and Cardiology, University Hospital Brno and Faculty of Medicine, Masaryk Memorial Clinical Institute, Brno, Czech Republic

<sup>2</sup> International Clinical Research Center, St. Anne’s University Hospital, Brno, Czech Republic

<sup>3</sup> Division of Cardiovascular Diseases, Department of Internal Medicine, Mayo Clinic and Foundation, Rochester, MN, United States

**Introduction:** Sleep apnea (SA) has a high prevalence in patients with acute coronary syndrome. Acute nocturnal pathophysiological responses to SA, including sympathetic activation, hypoxemia and increased coagulation, may increase the risk of nocturnal myocardial infarction (MI). There is limited evidence about circadian variation of onset of MI on dependence of having SA. Therefore, we examined the day- night variation of onset of MI in acute MI patients.

**Materials and methods:** We prospectively studied 782 consecutive patients admitted to the hospital, where primary percutaneous coronary intervention is the standard of care in the treatment of acute MI, with the diagnosis of acute MI. All subjects underwent sleep evaluations using a portable diagnostic device after at least 48 h post-admission, provided they were in a stable condition. The median duration from hospital admission to overnight sleep study was 4 days (range 2–14 days). Using the apnea- hypopnea index (AHI), groups were defined as patients without SA (<5 events/hour), mild

SA (5–15 events/hour), moderate SA (15–30 events/hour), and severe SA (>30 events/hour).

**Results:** One hundred and seventy-five patients were eliminated from the final analysis due to the poor quality of their sleep study. Therefore, our final sample was represented by 607 patients. The day- night variation of the MI onset in all groups of SA patients was similar to that observed in non-SA patients. From 6 AM to 12 PM, the frequency of MI was higher in both SA and non-SA patients, as compared to the interval from 12AM to 6AM (all  $p < 0.05$ ).

**Conclusion:** Peak time of MI onset in SA patients was between 6AM to noon, similar to that in the general population.

**Acknowledgements:** Supported by European Regional Development Fund – Project FNUSA-ICRC (No. CZ.1.05/1.1.00/02.0123) and by European Social Fund within the project ICRC Human Bridge – Support of Study Stays of Czech Researchers Abroad: Young Talent Incubator (No. CZ.1.07/2.3.00/20.0022).

<http://dx.doi.org/10.1016/j.sleep.2013.11.674>

### Psychological and behavioral treatment of primary and secondary insomnia in patients from San Juan de Dios Hospital, Sleep Department of Guatemala

A. Stokes, H. Stokes

Hospital General San Juan de Dios, Guatemala

**Introduction:** Insomnia is a common condition that occurs in one third of the population, it can be associated with poor quality of life, anxiety, depression, impaired daytime functioning and chronic medication use. In addition headaches and difficulties in concentration occurs.

**Materials and methods:** We worked with 65 patients who had regular assistance during 8 months, who had a diagnosis of chronic Insomnia with comorbidity; Depression, Anxiety, Personality disorder and Epilepsy. Polysomnography evidence of prolonged sleep latency was seen in most. Principal Symptoms of Mood disturbance, problems with memory and concentration, day time fatigue, stress and day time hypersomnia were noted. The firststep was an specific interview with neurophycological tests evaluating memory, personality, anxiety and depression. The patients had a sleepdiary, according to the results they received individual therapy, also we worked support groups with differents topics like quality of life, stress management, relaxation, sleep hygiene, cognitive therapy, sleep and sleep restriction.

**Results:** 80% of the patients got better with the combined therapy, improving the quality of life and the psychological problems, decreased use of chronic medication and night sleep condition greatly improved.

**Conclusion:** Behavioral and pharmacological therapy are effective in the management of chronic insomnia and improving sleep, helps to have a better quality of life.

**Acknowledgements:** Insomnia, behavior and cognitive treatment, quality of life.

<http://dx.doi.org/10.1016/j.sleep.2013.11.675>

### Obstructive sleep apnea syndrome and hormonal status of obese patients

N. Strueva<sup>1</sup>, M. Poluektov<sup>2</sup>, G. Melnithenko<sup>1</sup>, L. Saveleva<sup>1</sup>, G. Katsya<sup>3</sup>, N. Goncharov<sup>3</sup>

<sup>1</sup>Endocrinology Research Centre, Clinical Endocrinology Department, Russian Federation

<sup>2</sup>First Moscow State Medical University by I.M. Sechenov, Neurology Department, Russian Federation

<sup>3</sup>Endocrinology Research Centre, Laboratory of Clinical Biochemistry and Hormonal Analysis, Russian Federation

**Introduction:** The aim of this research is to estimate the influence of sleep apnea on hormone metabolism of patients with obesity.

**Materials and methods:** 60 patients (36 males and 24 females, age  $40 \pm 11$ , body mass index (BMI)  $40 \pm 7.3$  kg/m<sup>2</sup>) with obesity were included in this study. Exclusion criterion were severe depression, alcohol abuse, hypothyroidism, diabetes mellitus. Samples of serum insulin-like growth factor I (IGF-I), total testosterone, insulin were made after overnight fasting, at 08:00. Free cortisol levels were determined for the day and night in urine collected for 24 h.

**Results:** After night polysomnography all patients were divided in two groups comparable by age and BMI. The first group consisted from 32 patients with obstructive sleep apnea syndrome (OSAS), the second (controls)–28 patients without breath disorders during sleep. The level of basal insulin ( $p < 0.05$ ) and HOMA IR index was higher in patients with OSAS ( $22 \pm 9.3$  vs.  $16 \pm 9.1$   $\mu$ U/ml, respectively). Statistically significant positive correlation was found between basal insulin and respiratory disturbance index (RDI) ( $r = 0.37$ ), oxygen desaturation index (ODI) ( $r = 0.4$ ), night free urine cortisol excretion (NFUC) ( $r = 0.36$ ); negative correlation with mean arterial oxygen saturation (SAT) ( $r = -0.29$ ) and minimal oxygen saturation (minSaO<sub>2</sub>) ( $r = -0.45$ ) during the night was observed. The levels of 24-h urinary and daytime urine free cortisol were not significantly different between groups. NFUC significantly increased in patients with OSAS compared with control group ( $125 \pm 106$  vs.  $60 \pm 26$  nmol/l,  $p = 0.01$ ). Statistically significant negative correlation between NFUC and SAT ( $r = -0.34$ ), slow-wave sleep (SWS, %) ( $r = -0.47$ ) were found. The serum levels of IGF-1 were lower than those of the control group ( $161 \pm 62$  vs.  $220 \pm 82$  ng/ml,  $p < 0.02$ ). Testosterone level in men was significantly lower in OSAS group compared with control group ( $7.7 \pm 3$  vs.  $14 \pm 7.5$  nmol/liter,  $\delta = 0.008$ ). Serum IGF-1 and testosterone levels were positively correlated with SWS percentage; testosterone levels were positively correlated with the minSaO<sub>2</sub>, SAT and negative – RDI, ODI ( $p < 0.05$ ).

**Conclusion:** Obstructive sleep apnea is accompanied by the increase in urinary cortisol during the night, high levels of basal insulin, disturbances of hepatic production of IGF-1 and dysfunction of the pituitary–gonadal axis. Our results show that sleep-related breathing disorders markedly and negatively affect hormonal parameters of patients with obesity.

<http://dx.doi.org/10.1016/j.sleep.2013.11.676>

### Cortical thinning in patients with persistent insomnia and its relation with insomnia progression

H. Kim<sup>1</sup>, S. Suh<sup>2</sup>, H. Kim<sup>2</sup>, E. Cho<sup>2</sup>, C. Shin<sup>2</sup>

<sup>1</sup>McGill University, Department of Neurology and Brain Imaging Center, Montreal Neurological Institute and Hospital, Canada

<sup>2</sup>Korea University, Ansan Hospital, Institute of Human Genomic Study, Republic of Korea

**Introduction:** Previous studies have demonstrated that insomnia is associated with cortical atrophy, but the impact of progressive decline in sleep quality to such structural changes has not been investigated, which can be assessed accurately through a longitudinal study.

**Materials and methods:** Sixty patients presenting persistent insomnia at three time points spaced two years apart (PI,

age =  $51.13 \pm 8.06$ , males = 60%) and 44 good sleepers (GS, age =  $48.09 \pm 6.47$ , males = 56.8%) were randomly selected from a larger population-based study. All participants underwent 1.5 Tesla MRI at the endpoint. Outer and inner cortical interfaces were extracted using the CIVET image processing pipeline developed at Montreal Neurological Institute. A total of 80,492 points were sampled on these surfaces, and cortical thickness was measured as the shortest distance between the two interfaces. Participants also completed the Pittsburgh Sleep Quality Index (PSQI) and Beck Depression Inventory (BDI) at each visitation. We defined longitudinal change of PSQI scores as 'PSQI at the 3rd – 1st time point'. Linear regression analysis was conducted with insomnia progression, insomnia groups, and an interaction as independent variables, and cortical thickness as the dependent variable. All statistical tests included age, sex, and depression as covariates. Multiple comparisons were corrected based on a random field theory for image data.

**Results:** The PI group presented cortical thinning in the precentral cortex of both hemispheres and the superior/mid frontal areas ( $p < 0.05$  corrected). We also found a trend of atrophy in the focal areas of the angular gyrus and the cuneus ( $p < 0.025$  uncorrected). The PI group moreover presented cortical thinning in relation to progressive increase in PSQI (i.e. worsening in sleep quality), which were localized in the left angular gyrus and in the right prefrontal cortex ( $r = -.44$ ,  $p < 0.001$ ). A significant interaction between group and insomnia progression was found, with cortical thinning progressing faster in the PI group compared to GS ( $F = 3.1$ ,  $p = 0.001$ ).

**Conclusion:** We found cortical atrophy in multiple brain regions, including bilateral frontal lobes in the PI group relative to GS groups. Additionally, having PI had implications for regions in the parietal and frontal lobe, especially with progressive decline in sleep quality over time. Further studies using neuropsychological assessments may reveal cognitive deficits that are secondary to structural brain changes resulting from PI.

**Acknowledgements:** This study was performed at the Korea University Hospital, Ansan, Republic of Korea. This study was supported by grants from the Korean Center for Disease Control, Prevention and the Korean Ministry for Health and Welfare, and the National Research Foundation of Korea Grant funded by the Korean Government. [Grants 2005-E71001-00, 2006-E71005-00, 2007-E71001-00, 2008-E71001-00, 2009-E71002-00, 2010-E71001-00, 2011-E71004-0, 2011-E71005-00, 2012-E71005-00, 2013-E71005-00, NRF-2012-S1A5BA01].

<http://dx.doi.org/10.1016/j.sleep.2013.11.677>

### Subnuclei atrophy in the amygdala in patients with persistent insomnia and its relation with insomnia progression and depression

S. Suh<sup>1</sup>, H. Kim<sup>2</sup>, H. Kim<sup>1</sup>, E. Cho<sup>1</sup>, C. Shin<sup>1</sup>

<sup>1</sup> Korea University, Ansan Hospital, Institute of Human Genomic Study, Republic of Korea

<sup>2</sup> McGill University, Department of Neurology and Brain Imaging Centre, Montreal Neurological Institute and Hospital, Canada

**Introduction:** Despite high comorbidity rates of insomnia and depression, the pathways in which insomnia and depression are linked are still unclear. The high comorbidity and heightened level of arousal in both neuropsychiatric conditions calls for a study of the amygdala, which plays a crucial role in the neurobiological mechanisms underlying emotional disorders. We thus studied MR local volumetry of the amygdala in insomnia patients and controls with a longitudinal study design.

**Materials and methods:** Sixty patients presenting persistent insomnia at three time points spaced two years apart (PI, age =  $51.13 \pm 3/48.06$ , males = 60%) and 44 good sleepers (GS, age =  $48.09 \pm 3/46.47$ , males = 56.8%) were randomly selected from a larger population-based study. All participants underwent 1.5 Tesla MRI at endpoint. Vertex-wise volumetry was performed using spherical harmonic-based surface models extracted from manual delineation of the amygdala. We performed vertex-wise *t*-tests for group comparisons between PI and GS. Participants also completed the Pittsburgh Sleep Quality Index (PSQI) and Beck Depression Inventory (BDI) at each visitation. We defined longitudinal change of PSQI scores as 'PSQI at the 3rd PSQI at 1st time point' to measure insomnia progression. Linear regression analysis was then conducted to predict amygdalar volume, with insomnia progression and insomnia groups as independent variables. All statistical tests included age and sex, and depression as covariates. Multiple comparisons were corrected using the False Discovery Rate.

**Results:** PI presented atrophy in the laterobasal subnuclei of the amygdala (LBA) relative to GS ( $p < 0.05$  corrected). Progressive worsening of sleep quality was significantly associated with LBA atrophy ( $r < -.47$ ,  $p < 0.001$ ). Further interaction analyses demonstrated that the association in the PI group was stronger than the GS group ( $F = 3.2$ ,  $p < 0.001$ ). The BDI in PI correlated negatively with volumes located in the centromedial amygdala (CMA).

**Conclusion:** This pioneer neuroimaging study reveals the presence of LBA atrophy in patients with PI, which increases in relation to progressively worsening insomnia. Extracellular recordings suggest that the neuronal activity pattern in LBA is deeply related to the sleep-wake cycle, whereas an MRI study observes that volume changes in CMA are associated with anxiety. Our findings may facilitate further clarification of the bidirectional relationship between insomnia and depression.

**Acknowledgements:** This study was performed at the Korea University Hospital, Ansan, Republic of Korea. This study was supported by grants from the Korean Center for Disease Control, Prevention and the Korean Ministry for Health and Welfare, and the National Research Foundation of Korea Grant funded by the Korean Government. [Grant 2005-E71001-00, Grant 2006-E71005-00, Grant 2007-E71001-00, Grant 2008-E71001-00, Grant 2009-E71002-00, Grant 2010-E71001-00, Grant 2011-E71004-0, NRF-2012-S1A5BA01].

<http://dx.doi.org/10.1016/j.sleep.2013.11.678>

### Herba schizonepetae versus nasal steroid: how do they affect CPAP pressure on OSAHS patients?

S. Sun<sup>1</sup>, Y. Zhao<sup>1</sup>, J. Qiao<sup>1</sup>, Y. Ma<sup>2</sup>

<sup>1</sup> Otolaryngology Department, Guang'anmen Hospital, China Academy of Chinese Medical Sciences, China

<sup>2</sup> Sleep Clinic, Eye Hospital, China Academy of Chinese Medical Sciences, China

**Introduction:** To lower the pressure of nasal CPAP is one of the critical issues of improving patients' acceptance and compliance. This study was designed to compare the effects of Herba Schizonepetae and nasal steroid on OSAHS patients with CPAP treatment.

**Materials and methods:** Male patients with moderate to severe OSAHS, excluded anatomical abnormalities of nose, throat and oral cavity, were recruited and divided into 2 groups. Subjects in the Herba Schizonepetae (HS) group, boiled twice a day, nasally breathed in the herbal steam before orally took the decoction. Subjects in the nasal steroid (NS) group used the steroid twice a day for the first 5 days, and then once a day for the following day. Measurement including CPAP pressures, SaO<sub>2</sub>, AHI, and Visual

Analogue Scale (VAS) of nasal ventilation conditions were recorded. Baseline data were collected when all subjects continued their effective CPAP treatment every night for 2 weeks. Each group stopped CPAP and only used nasal interventions for 2 weeks. After that, all subjects took their CPAP treatment as before for 2 continuous nights, where data were collected as post-treatment measurements.

**Results:** 56 subjects (31 in HS group and 25 in NS group) completed the whole study. In the HS group, pre- and post-treatment pressure were  $10.45 \pm 2.26$  cm H<sub>2</sub>O and  $9.19 \pm 2.06$  cm H<sub>2</sub>O respectively. In the NS group, that were  $10.27 \pm 2.10$  cm H<sub>2</sub>O and  $9.03 \pm 2.11$  cm H<sub>2</sub>O respectively. Significant difference was shown in both groups before and after treatment, while no significant difference between the two groups. The scores of VAS were  $6.194 \pm 1.731$  and  $3.968 \pm 1.335$  respectively, showing significant difference.

**Conclusion:** Abnormalities of nasal mucosa are common among OSAHS patients. It is practical to lower the CPAP pressure by improving the nasal ventilation conditions, thus the compliance of CPAP can be improved. Several papers with the same point of view have been published in recent years. Our study showed no significant difference on the improvement of nasal ventilation and the change of CPAP pressures between the two groups. Both Herba Schizonepetae and nasal steroid for continuous two weeks can lower the therapeutic pressure with no significant difference. However, the cost of Herba Schizonepetae is only one-fifth of the nasal steroid. Therefore Herba Schizonepetae is practical and cost-effective for people who are comfortable with herbal medicine, which is popular in China.

**Acknowledgement:** We appreciate the participation of all subjects and the efforts of all the staff involved in the research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.679>

### Comparison of eeg power spectra between patients with primary insomnia and good sleeper controls, accounting for the effects of age, gender, and sleep period, using a large compilation of PSG recordings from three clinical trials

V. Svetnik, E. Snyder, N. Ivgy-May, J. Ma, P. Tao, W. Herring  
Merck&Co., Inc, United States

**Introduction:** Spectral analysis has been used to quantify differences in the sleep EEG between primary insomniacs (PI) and good sleeper controls (GSC). Previous studies have been based on relatively small samples with varying inclusion criteria, and have not typically examined the effects of important factors such as age, gender, and sleep period of the night. These limitations may be responsible for the conflicting results reported not only with respect to the magnitude but also in the direction of differences in EEG power spectra between PI and GSC. By utilizing a large database of sleep laboratory EEG recordings from clinical trials from the same development program, this study provides a comprehensive comparison of EEG power spectra in NREM and REM within sleep period between patients with PI and GSC, within gender and age subgroups.

**Materials and methods:** Spectral analysis was performed on PSG recordings from 847 PI patients and 818 GSC collected in sleep laboratory setting in three clinical trials. EEG power spectra of PI and GSC were computed during NREM and REM sleep over the entire night and by sleep period (defined by thirds of the night or by sleep cycle) as a function of age and gender.

**Results:** Differences in the EEG spectral profile between PI and GSC in NREM strongly depend on age, gender, and sleep period (defined

by either thirds of the night or sleep cycle). Specifically, PI aged <45 years, regardless of gender, had reduced NREM delta power in the early part of the night. NREM gamma power across the entire night was elevated in PI females aged >35 years but not in males of any age. Results of analyses by parts of the night were in general agreement with those by sleep cycle. EEG spectral power was higher for females than males of all ages and in all sleep periods across almost all frequencies for both PI and GSC. Within each group (PI and GSC), gender differences in spectral power appear to be larger than the differences observed between PI and GSC. Differences in REM sleep were similar but less consistent.

**Conclusion:** Analysis of a large database of sleep EEG recordings from several clinical trials with consistent recording and scoring procedures reveals differences in the EEG spectral profile of PI and GSC that are dependent on age, gender, and sleep period, thus providing new information on characteristics of the sleep EEG in patients with primary insomnia.

**Acknowledgement:** This work was supported by funding from Merck&Co., Inc.

<http://dx.doi.org/10.1016/j.sleep.2013.11.680>

### Association between periodic limb movements and co-morbidities in heart failure

Y. Sviryaev<sup>1</sup>, L. Korostovtseva<sup>1</sup>, Y. Sazonova<sup>2</sup>, S. Kravchenko<sup>3</sup>,  
A. Konradi<sup>1</sup>, E. Shlyakhto<sup>4</sup>

<sup>1</sup>Almazov Federal Heart, Blood and Endocrinology Centre, Hypertension Research Department, Russia

<sup>2</sup>Almazov Federal Heart, Blood and Endocrinology Centre, Second Cardiology Department

<sup>3</sup>Pavlov St Petersburg State Medical University, Russia

<sup>4</sup>Almazov Federal Heart, Blood and Endocrinology Centre, Russia

**Introduction:** Periodic limb movements (PLMs) were shown to be associated with cardiovascular diseases. There are many factors that can potentially contribute to PLMs occurrence in heart failure (HF), however, the incidence, role and causes of PLMs in HF are not fully understood. The objective of this study was to assess the incidence, severity of PLMs and their relation with co-morbidities in moderate-severe chronic HF.

**Materials and methods:** Sixty-six patients were enrolled (57 males and 9 females), median age – 56.5 (27; 77) years, body mass index – 27.6 (18.9; 49.2) kg/m<sup>2</sup>. HF resulted from coronary heart disease in 46 (43 males and 3 females) subjects, and from different types of cardiomyopathy in 20 (14 males and 6 females) subjects. The main inclusion criteria were the diagnosis of systolic HF, verified by Simpson ejection fraction  $\leq 45\%$  at heart ultrasound (GE Vivid 7, Norway, 2008), and increased N-terminal brain natriuretic pro-hormone level. All patients underwent full polysomnography (Embla N7000, Natus, US, 2007).

**Results:** According to the sleep study 33 subjects had no abnormal limb movements [27 males and 6 females, median age – 56 years (27; 71), median PLM index – 0.6 (0; 4.7) episodes per hour of sleep]. The distribution of PLMs by severity in the left 33 patients was the following. Ten patients showed mild PLMs [9 males and 1 female, median age – 56 years (48; 67); median PLM index – 11.3 (7.3; 24.1) per hour]. Nine patients had moderate PLMs [8 males and 1 female; median age – 55 (39; 77) years; median PLM index – 37 (27.1; 49.6) per hour of sleep]. Eight subjects showed severe PLMs [7 males and 1 female; median age – 59 (31; 77) years; median PLM index – 67.2 (50.8; 80.4) per hour of sleep]. There was no significant association between PLMs and co-morbid disorders, including underlying heart disease ( $\chi^2 = 0.8$ ;  $p > 0.05$ ); varicose veins of lower limbs ( $\chi^2 = 0.06$ ;  $p > 0.05$ ); sleep disordered breathing ( $\chi^2 = 0.1$ ;

$p > 0.05$ ); sleep apnea type ( $\chi^2 = 1.3$ ;  $p > 0.05$ ). However, there was a tendency towards the higher prevalence of PLMs in patients with mild and severe sleep apnea ( $\chi^2 = 5.2$ ;  $p = 0.07$ ). There was no significant association between PLMs incidence and prescribed therapy, including calcium channel antagonists ( $\chi^2 = 0.8$ ;  $p > 0.05$ ), beta-blockers ( $\chi^2 = 1.5$ ;  $p > 0.05$ ), any kind of diuretic ( $\chi^2 = 3.6$ ;  $p > 0.05$ ), acetazolamide ( $\chi^2 = 0.2$ ;  $p > 0.05$ ), and thiazide diuretics ( $\chi^2 = 0.1$ ;  $p > 0.05$ ). However, there was a trend towards higher incidence of PLMs in patients taking potassium saving diuretics ( $\chi^2 = 3.4$ ;  $p = 0.06$ ) and loop diuretics ( $\chi^2 = 2.9$ ;  $p = 0.08$ ).

**Conclusion:** PLMs are highly prevalent in patients with moderate-to-severe HF, and are likely to be associated with diuretic treatment; possible association between PLMs and electrolyte changes in HF patients and their impact on prognosis needs further investigation.

**Acknowledgements:** The research leading to these results has received funding from the European Union Seventh Framework Programme [FP7/2007–2013] under grant agreement no 241558 (SICA-HF). The research leading to these results has received funding from the Russian Ministry of Science and Education within the FTP "R&D in priority fields of the S&T complex of Russia 2007–2012" under state contract no 02.527.11.0007.

<http://dx.doi.org/10.1016/j.sleep.2013.11.681>

### Multimorbidity and the risk of restless legs syndrome in two prospective cohort studies

A. Szentkiralyi<sup>1</sup>, H. Völzke<sup>2</sup>, W. Hoffmann<sup>2</sup>, C. Trenkwalder<sup>3</sup>, K. Berger<sup>1</sup>

<sup>1</sup>Institute of Epidemiology and Social Medicine, University of Münster, Germany

<sup>2</sup>Institute for Community Medicine, University Medicine Greifswald, Germany

<sup>3</sup>Department of Neurosurgery, University Medicine, Göttingen, Germany

**Introduction:** The majority of studies analysing the associations between chronic diseases and RLS is of cross-sectional design and focus on the presence of individual conditions only. The cumulative effect of existing co-morbidities has not been considered. Aim of this analysis was to evaluate the association between multimorbidity and the risk of RLS in two population-based cohort studies.

**Materials and methods:** Two independently conducted, population-based prospective cohort studies, the Dortmund Health Study (DHS,  $n = 1312/1122$  (baseline/follow-up), median follow-up time: 2.1 years) and the Study of Health in Pomerania (SHIP,  $n = 4308/3300$ , median follow-up time: 5.0 years) were used for the analyses. RLS was assessed in both studies at baseline and follow-up according to the RLS minimal criteria. A co-morbidity index was calculated as a sum of the following conditions: diabetes mellitus, hypertension, myocardial infarction, obesity, stroke, cancer, renal disease, anemia, depression, thyroid disease, and migraine. The independent relationship between co-morbidities and incident RLS was analyzed with multivariate logistic regression models. Pooled odds ratios were calculated using a fixed-effect model and the Mantel-Haenszel method.

**Results:** An increase in the number of co-morbid conditions at baseline was associated both with prevalent RLS (DHS: trend odds ratio (OR) = 1.24, 95% CI 0.99–1.56; SHIP: trend OR = 1.34, 95% CI 1.18–1.52) and incident RLS (DHS: trend OR = 1.32, 95% CI 1.04–1.68; SHIP: trend OR = 1.59, 95% CI 1.37–1.85) after adjustment for age, gender, education, alcohol consumption, smoking, and physical activity. The ORs for incident RLS associated with three or

more co-morbid diseases (DHS: OR = 2.51, 95% CI 1.18–5.34; SHIP: OR = 4.30, 95% CI 2.60–7.11) were the highest of all the ORs, and they were also greater than the pooled ORs calculated for the single diseases (DHS: OR = 1.43, 95% CI 1.18–1.73; SHIP: OR = 1.56, 95% CI 1.39–1.75).

**Conclusion:** Multimorbidity is a strong risk factor for RLS in two independently conducted population-based cohort studies. The association was stronger for incident RLS than for prevalent RLS, and the presence of three or more diseases increased the risk clearly beyond that of any single disorder. The results support the hypothesis that the cumulative disease burden is more important than the presence of a specific single disease in the pathophysiology of RLS.

**Acknowledgements:** We are indebted to all participants for their outstanding commitment and cooperation, to the entire staff of each study for their expert and unfailing assistance. Data collection in the Dortmund Health Study was supported by the German Migraine & Headache Society and by unrestricted grants of equal share from Almirall, Astra Zeneca, Berlin Chemie, Boehringer, Boots Health Care, Glaxo-Smith-Kline, Janssen Cilag, McNeil Pharma, MSD Sharp & Dohme and Pfizer to the University of Muenster. SHIP is part of the Community Medicine Research Net of the University of Greifswald (available at <http://medizin.uni-greifswald.de/cm>) and was funded by grant ZZ9603 from the Federal Ministry of Education and Research, Berlin, and the Ministers of Cultural and Social Affairs of the Federal State of Mecklenburg West Pomerania, Schwerin.

<http://dx.doi.org/10.1016/j.sleep.2013.11.682>

### The impact of the use of amalgams in the dentition on the appearance of the symptoms of restless legs syndrome developed by older people

M. Szklarek, T. Kostka

Department of Geriatrics, Medical University of Lodz, Poland

**Introduction:** Key words: amalgam, lesions to brain cells, restless legs syndrome. The incidence of restless legs syndrome (RLS) increases with advancing age. RLS impairs normal functioning and decreases quality of life in the older population. Many older subjects have amalgam dental fillings containing mercury. Toxic mercury contained in these fillings may injure nervous cells and thus cause the occurrence of restless legs syndrome.

**Materials and methods:** We assessed the relationship of RLS symptoms to the use of amalgam in the dentition in 104 older polish immigrants aged 59–97 years living in Penrhos (North West Wales). We applied the diagnostic criteria of the International Restless Legs Syndrome Study Group (IRLSSG) in the form of four questions of internationally used questionnaire in order to determine the appearance of the problem of RLS. In medical anamnesis we tackled the issue of the past and current possession of amalgam in the dentition, and the number of amalgam dental fillings and other metal dental restorative materials was examined.

**Results:** Subjects who answered yes (indicating presence of RLS) to the four consecutive questions had significantly higher number of amalgam dental fillings (2.3 vs 1.0; 2.5 vs 0.9; 2.3 vs 1, 2 and 2.5 vs 1.1; respectively) as compared to the subjects without RLS symptoms (Kruskal-Wallis test  $p$ -values were 0.04, 0.01, 0.08 and 0.03, respectively). The number of other metal dental restorative materials had no influence on RLS symptomatology.

**Conclusion:** We conclude that while examining the correlates of the appearance of restless legs syndrome the use of amalgam in the dentition should be taken into account.

**Acknowledgements:** The authors thank the elderly persons involved for their participation in this project.

<http://dx.doi.org/10.1016/j.sleep.2013.11.683>

### Evaluation of sleep problems in preeclamptic, healthy pregnant and non-pregnant women in Kermanshah, Iran

M. Tahmasian<sup>1</sup>, H. Khazaei<sup>2</sup>, A. Heidarpour<sup>2</sup>, M. Rezaei<sup>3</sup>, A. Maroufi<sup>4</sup>, M. Ghadami<sup>2</sup>

<sup>1</sup> Sleep Research Center, Department of Psychiatry, Kermanshah University of Medical Sciences (KUMS), Iran

<sup>2</sup> Sleep Research Center, Department of Psychiatry, Farabi Hospital, Kermanshah University of Medical Sciences (KUMS), Iran

<sup>3</sup> Department of Biostatistics, Social Development and Health Promotion Research Center, Kermanshah University of Medical Sciences (KUMS), Iran

<sup>4</sup> Department of Psychiatry, Kordestan University of Medical Sciences, Iran

**Introduction:** Sleep problems are common complaints among pregnant women. This study was designed to compare sleep problems in healthy pregnant, non-pregnant and preeclamptic women. We hypothesized that some sleep problems are more prevalent in females with preeclampsia.

**Materials and methods:** In this cross-sectional study, 102 women with preeclampsia, 106 healthy pregnant women in the third trimester and 103 healthy non-pregnant women were recruited. Age and parity were matched in three groups. We used Global sleep assessment questionnaire (GSAQ) to check subjective sleep problems. Data were analyzed by Kruskal–Wallis, Mann–Whitney *U* and Pearson Chi-square tests using SPSS 16.0 software.

**Results:** Some types of sleep problems were more common in preeclamptic rather than the other two groups. For example, Initial insomnia occurred in 21.4% of the non-pregnant, 12.3% of the healthy pregnant and 26.5% of the preeclamptic subjects ( $P = 0.034$ ). Additionally, we found significant differences in fragmented sleep ( $P = 0.022$ ), snoring ( $P < 0.001$ ), non-idiopathic insomnia ( $P = 0.045$ ) and sadness and anxiety ( $P = 0.001$ ) between three groups. Some sleep problems are more common in preeclamptic subjects in comparison to the others such as initial insomnia, fragmented sleep, snoring, sleep apnea and non-idiopathic insomnia.

**Conclusion:** Females with preeclampsia reported more problems in falling asleep, staying asleep, snoring and non idiopathic insomnia than healthy non-pregnant and healthy pregnant subjects. These results showed that different kinds of sleep problems can occur in subjects with preeclampsia in comparison to the non-pregnant and healthy pregnant women. Sleep problems should be evaluated during pregnancy particularly in pregnant women with preeclampsia.

**Acknowledgements:** This work was supported by a grant from Department of Research, Kermanshah University of Medical Sciences (research No. 67145/86/1915).

<http://dx.doi.org/10.1016/j.sleep.2013.11.684>

### Changes in subjective excessive daytime sleepiness after the Great East Japan Earthquake

T. Tanahashi<sup>1</sup>, T. Furukawa<sup>1</sup>, K. Hirayama<sup>2</sup>, H. Nakano<sup>3</sup>, N. Sudo<sup>1</sup>

<sup>1</sup> Graduate School of Medical Sciences, Kyushu University, Department of Psychosomatic Medicine, Japan

<sup>2</sup> Haradoi Hospital, Department of Psychosomatic Medicine, Japan

<sup>3</sup> Fukuoka National Hospital, Sleep Center, Japan

**Introduction:** We have investigated the degree of subjective excessive daytime sleepiness (EDS) in Japanese visitors to our homepage, which explains about snoring, since 2009. The Great East Japan Earthquake occurred on 11 March 2011, and resulted in more than 20,000 people dying or going missing. The aim of this study is to examine changes in EDS after the Great East Japan Earthquake.

**Materials and methods:** The subjects were visitors to our homepage between 12 March and 3 June, both in 2010 and 2011, and 20 years old or older. The exclusion criteria were sedative hypnotic use, antiallergic agents use, previous diagnosis of sleep apnea, and time in bed (TIB) of less than 3 h or 9 h or more. Visitors before the earthquake (over 12 weeks in 2010) constituted the control group. Visitors after the earthquake (over 12 weeks in 2011) were assigned to 6 groups according to when they visited our homepage (2-week intervals over the 12-week period). We compared adjusted mean Epworth Sleepiness Scale (ESS) scores between groups through analysis of covariance (ANCOVA) with the following variables: gender, age, BMI, snoring frequency, being informed of having apnea (e.g. by a spouse), dry feeling in the pharynx at waking, night-time nasal obstruction, nocturia frequency, difficulty falling asleep, and time in bed.

**Results:** The characteristics of the subjects before the earthquake ( $n = 474$ ) and after the earthquake ( $n = 426$ ) were: male (63% vs. 65%), mean age (39 vs. 39 years old), mean BMI (23.7 vs. 23.8 kg/m<sup>2</sup>), mean ESS (8.3 vs. 8.1 score), mean TIB (6.4 vs. 6.3 h), mean nocturia frequency (0.31 vs. 0.35/night), requiring 30 min or more to fall asleep (4.2% vs. 5.4%), snoring once a week or more (88% vs. 89%), and being informed of having apnea (47% vs. 51%), respectively. Adjusted mean ESS scores differed significantly between the control group and visitors 5–6 weeks after the earthquake (8.5 vs. 6.6 score, respectively;  $P < 0.01$ ). There were no other significant differences between the groups regarding the other variables. The prevalence of difficulty falling asleep in the group of visitors 5–6 weeks after the earthquake was 10.6% and was the highest rate among the groups.

**Conclusion:** The group of Japanese visitors to our homepage 5–6 weeks after the earthquake had the lowest degree of EDS. This might be related to insomnia due to stress from the earthquake and its aftermath.

**Acknowledgements:** All members of the Department of Psychosomatic Medicine, Kyushu University Hospital.

<http://dx.doi.org/10.1016/j.sleep.2013.11.685>

### Does the suggested immobilization test permit predicting the efficacy of dopaminergic agonists in the treatment of RLS?

M. Tanaka, M. Okura, M. Taniguchi, M. Ohi

Sleep Medical Center, Osaka Kaisei Hospital, Japan

**Introduction:** The etiology and pathophysiology of primary Restless Legs Syndrome (RLS) remain unknown. Although the diagnosis of RLS is based primarily upon interviews with the patient, it is sometime difficult to diagnose by interviews alone. The Suggested Immobilization Test (SIT) may be helpful in such cases. Dopamine agonists are symptomatically effective in the majority of RLS patients. However, efficacy of dopaminergic medication is not uniform in RLS patients. The relationship between the response to dopaminergic medication and the results of SIT has not been reported.

**Materials and methods:** The diagnosis of RLS was made based on the International Classification of Sleep Disorders 2nd edition criteria. Data from patients who were diagnosed from June 2005 to June 2012, with full polysomnography (PSG) and SIT recordings were analyzed. The subjects were divided into two groups according to the

response to dopamine agonists: group A were treated with dopaminergic agonists only and group B required additional medication three months after the start of the treatment. We compared the PSG and SIT findings between the two groups.

**Results:** In group A, 12 women and 13 men (mean age 66.2\_9.9 years) were included, and in group B, 15 women and 12 men (mean age 58.1\_15.8 years). Sleep efficiency was higher in group B, on the other hand, periodic limb movement index during sleep was significantly higher in group A. At SIT, subjects of group B had a higher index in both the leg movement and visual analog scale score.

**Conclusion:** In comparison between group A and B, results of the leg movement index in SIT were not concordant with the index from PSG findings. Efficacy of dopamine agonists was not clearly related to the results of SIT. Further studies are needed to clarify what indicators permit predicting the efficacy of dopaminergic agonists in RLS.

<http://dx.doi.org/10.1016/j.sleep.2013.11.686>

### **A cross-sectional study on the associations of sleep-disordered breathing with subjective and objective sleepiness among local police officers**

A. Saeki<sup>1</sup>, T. Tanigawa<sup>2</sup>, K. Maruyama<sup>2</sup>, E. Eguchi<sup>2</sup>, I. Saito<sup>2</sup>

<sup>1</sup> Ehime University, Faculty of Medicine, Japan

<sup>2</sup> Ehime University, Graduate School of Medicine, Japan

**Introduction:** It is indicated that Sleep-Disordered Breathing (SDB) increase the risk of motor vehicle crashes and injuries because of their daytime sleepiness. However, to date the potential SDB without daytime sleepiness also increase the risk of accidents. Therefore, not only the subjective sleepiness but also the objective sleepiness are needed to measure for the detection of SDB. The aim of this study was to examine the associations of severity of SDB with subjective sleepiness by Epworth Sleepiness Scale (ESS) and objective sleepiness by Psychomotor Vigilance Test (PVT).

**Materials and methods:** Among police officers who usually drive by their work, 928 men aged 22–59 years [mean age was 41.4 years] were tested by ESS questionnaire and 10 min PVT and were measured blood oxygen saturation level using pulse-oximeters during night. In PVT, participants were compelled to push buttons right after increasing number was displayed, and they were estimated objective sleepiness by reaction time. We selected three indicators in this study; Fastest 10% RT, Mean 1/RT and Slowest 10% 1/RT. Data was divided into three groups by 3% oxygen desaturation index (3%ODI) [ $<5$ , 5–15 and  $\geq 15$ ], and we examined associations of severity of SDB with mean values of ESS and three PVT indicators of each groups.

**Results:** We calculated age-adjusted mean values of subjective and objective sleepiness indicators for each 3% ODI groups [ $<5$ , 5–15 and  $\geq 15$ ], and found the positive associations of severity of SDB with subjective and objective sleepiness; ESS [5.1, 5.7, 5.9 ( $p$  for trend = 0.02)], Fastest 10% RT [195.3, 196.2, 198.5 ( $p$  for trend = 0.05)], Mean 1/RT [4.28, 4.22, 4.18 ( $p$  for trend = 0.02)], Slowest 10% 1/RT [3.01, 2.93, 2.87 ( $p$  for trend = 0.01)]. Additionally we also compared the Receiver Operating Characteristic Curves of ESS with those of each PVT indicator for severe or moderate SDB (3%ODI  $\geq 15$ ), and then each PVT indicator were more evident but non-significant difference from ESS ( $p < 0.10$  for differences from ESS).

**Conclusion:** Our study showed that the severity of SDB is positively associated with subjective and objective sleepiness indicators, but relationship of SDB with objective sleepiness is tend to be more evident than with subjective sleepiness.

**Acknowledgement:** We are grateful to Dr. Yasuhiko Tanno for his technical assistance.

<http://dx.doi.org/10.1016/j.sleep.2013.11.687>

### **How do neurological and psychiatric signs and symptoms which are indicative of lewy body disease appear in apparent idiopathic rem sleep behavior disorder? – A descriptive study in the clinical setting**

K. Taniguchi, T. Oguri, H. Sugiyama, T. Hamano, N. Tachibana  
Department of Neurology and Center for Sleep-related Disorders, Kansai Electric Power Hospital, Japan

**Introduction:** There has been accumulating evidence that idiopathic RBD (iRBD) could be pre-motor or pre-dementing state of Levy body disease (LBD) (Parkinson's disease (PD) and dementia with Lewy bodies). Since the transition from apparent iRBD to full-blown LBD is considered gradual development, various symptoms and signs could appear in this process. This observational study outlines when and how neurological and psychiatric signs and symptoms appeared in our patients with apparent iRBD.

**Materials and methods:** We retrospectively reviewed the sleep clinic records of consecutive 19 polysomnographically confirmed iRBD patients who made the first consultation from December 2005 to December 2009 with successful continual follow-up period (once per 1–3 months) up to June 2013. One patient who had end-stage renal disease under hemodialysis was excluded. 18 patients (15 men and 3 women, 66.4  $\pm$  6.5 years of age at the first clinic visit, 71.7  $\pm$  6.6 at the last clinic visit) were analyzed. 16 out of the 18 patients underwent myocardial 123I-MIBG scintigraphy within two months from the first clinic visit, the result of which was taken into consideration whether it helps to predict the later development into LBD.

**Results:** The follow-up duration was 5.2  $\pm$  1.2 years (range 3.5–7.5). The onset age of iRBD was 59.8  $\pm$  6.9 years old and the duration from the onset to the first clinic visit was 6.6  $\pm$  4.7 years (range 2–19), therefore, our patients have been suffering from RBD for 11.8  $\pm$  5.3 years (range 6.5–26). Seven out of 18 patients (38.9%) showed muscle rigidity at the 7.8  $\pm$  4.6 years from the onset of iRBD, and 2 of them fulfilled the British Brain Bank Criteria of PD at 4.2 years and 1 year respectively after the appearance of rigidity. About the remaining 5 patients with muscle rigidity, 4 of them also showed other symptoms (temporary depressive episodes in 2, mild cognitive impairment in 1, and episodic decreased activity [bedridden all day] continuing a few weeks in 1. All of the 7 patients with rigidity had showed decreased 123I-MIBG uptake. One patient is overall anxious with the past depressive episode (after the onset of RBD), and one started to experience visual hallucination at night which was clearly differentiated from RBD behaviors. Eight out of 18 patients (44.4%) still remained as apparent iRBD at 12.0  $\pm$  4.0 years after the onset of iRBD, however, 7 patients of this group had 123I-MIBG scintigraphy and all but one had showed decreased uptake. The last one patient revealed to be possible multiple system atrophy, of whom 123I-MIBG uptake was within normal limits. In this woman, mild cerebellar signs appeared at the 3.6 years from the onset of iRBD and it took another 2.3 years to have this diagnosis.

**Conclusion:** Our results strongly support that iRBD is a predictor of LBD, but neurological and psychiatric signs and symptoms in iRBD which are indicative of LBD seem to appear in a long time span with various severities and combinations. It is still difficult to expect when and what will be overt in the daily clinical settings.

**Acknowledgement:** We thank Keiichi Marumoto and Youko Uozumi for their technical support for performing PSG.

<http://dx.doi.org/10.1016/j.sleep.2013.11.688>

### Sleep patterns and sleep disorders among university students in Lebanon

S. Assaad<sup>1</sup>, F. Tannous<sup>2</sup>, C. Costanian<sup>3</sup>

<sup>1</sup>Lebanese University, Lebanon

<sup>2</sup>Holy Spirit University of Kaslik, Lebanon

<sup>3</sup>Queen's University, Lebanon

**Introduction:** The aim of this research was to study sleep habits and sleep disorders in a population of university students across Lebanon by using the Pittsburg Sleep Quality Index as a tool to investigate sleep quality.

**Materials and methods:** Sleep habits and problems were investigated using a convenience sample of students mainly aged between 20 and 23 years old, from six universities across Lebanon. The study was carried out during 2012. A self-administrated questionnaire was used. All data were coded, entered, and then analyzed using the Statistical Package for Social Sciences program (SPSS), version 18.

**Results:** 735 students responded, of which 61.1% were between the age of 20 and 23 years old. Reported mean duration of night sleep was 6.67 ± 1.67 h. 58.4% woke up between 6 and 8 am, and 40.4% went to bed after midnight. The average of sleep latency was 24.64 ± 1.1 min. 21.1% of the students reported using medications to enhance sleep. Around 41% of the study sample had trouble maintaining enthusiasm to accomplish tasks, and more than 50% had daytime sleepiness. Sleep quality was reported as fairly good in 47.3% and fairly poor in 23.8%. Poor sleep quality was significantly associated with daytime dysfunction and sleep-enhancing medication using.

**Conclusion:** Recent studies showed that sleep disorders are a cause of mental illness. Insomnia was common among Lebanese students which predispose them to depression and mood disorders.

**Acknowledgement:** Holy Spirit University of Kaslik.

<http://dx.doi.org/10.1016/j.sleep.2013.11.689>

### Effect of nasal CPAP therapy on functional respiratory parameters and cardiopulmonary exercise test in obstructive sleep apnea syndrome

Ö. Oral Tapan<sup>1</sup>, C. Sevinç<sup>2</sup>, B. Ýtil<sup>2</sup>, Ý. Öztura<sup>3</sup>, M. Kayatekin<sup>4</sup>, Y. Demiral<sup>5</sup>

<sup>1</sup>Department of Chest Diseases, Karaman State Hospital, Karaman, Turkey

<sup>2</sup>Department of Chest Diseases, Dokuz Eylul University, Izmir, Turkey

<sup>3</sup>Department of Neurology, Dokuz Eylul University, Izmir, Turkey

<sup>4</sup>Department of Physiology, Dokuz Eylul University, Izmir, Turkey

<sup>5</sup>Department of Public Health, Dokuz Eylul University, Izmir, Turkey

**Introduction:** Nasal CPAP treatment is an effective treatment modality for patients with OSAS. It can improve physical and mental functions by reducing daytime hypersomnolence, arousal index and sleep fragmentations. The purpose of this study was to evaluate whether pulmonary functions, exercise limitation confirmed with CPET, and quality of life can be improved after eight weeks of nCPAP treatment.

**Materials and methods:** We evaluated our case group with physical examination, SF-36 health survey, body composition analysis before and after nCPAP treatment for 8 weeks. Spirometric flow rates, P<sub>lmax</sub>,

P<sub>Emax</sub>, lung volumes and exercise capacities with CPET were measured.

**Results:** 31 of 40 patients (4 female, 27 male) completed the study. The mean age was 53.41 ± 1.46, 51.6% of cases had comorbidities and the smoking history rate was 54.8%. All of them had exercise limitation before treatment. After treatment there were increases in P<sub>lmax</sub>–P<sub>Emax</sub> ( $p < 0.05$ ), VO<sub>2</sub> peak ( $p:0.001$ ), load max ( $p:0.000$ ), maximal heart rates ( $p:0.000$ ), all SF-36 scores except pain ( $p < 0.05$ ) and a decrease in systolic blood pressure ( $p:0.005$ ). We did not see any changes in body compositions, spirometric flow rates except FEV<sub>1</sub> and lung volumes.

**Conclusion:** OSAS may lead to exercise limitation. nCPAP treatment is effective in reducing exercise limitation, can help to control blood pressure and improves respiratory muscle strength. nCPAP can also improve the quality of life scores in OSA patients without any comorbidity or with comorbidities under control. Our findings may suggest that these changes are the results of improvements in patients' cardiac function, daytime somnolence and fitness.

**Acknowledgement:** Thanks to my professors, patients and friends for helping me to continue this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.690>

### Exposure to bright light during evening class hours increases sleep quality and mood among working college students

L. Teixeira

Oswaldo Cruz Foundation, Sergio Arouca National School of Public Health, Brazil

**Introduction:** The sleep–wake cycle (SWC) is a biological rhythm influenced by internal and external informations, as environmental and psychological factors and work/study times. Recent studies show that bright light over specific hours of the day might act as SWC synchronizer, reducing working college students' sleepiness. The aim of this study was to evaluate the effects of exposure to bright light on sleep quality, mood and easiness of sleep and to wake up during evening hours among working college students.

**Materials and methods:** The subjects were healthy 21–24 years old young men attending night classes and working during the day. Over three weeks the subjects filled activities protocols, which include four analog visual scales (VAS: sleep quality, mood and easiness to sleep and wake up), wore actigraphs and registered their sleepiness levels three times each night (19:00 h, 20:30 h and 22:00 h) using Karolinska Sleepiness Scale (KSS). At second and third weeks the subjects, divided in two groups, were exposed to bright light (8.000 lux) for 20 min at 19:00 h or 21:00 h in a crossover design. Salivary melatonin samples were collected prior and after exposure. Pearson Correlation tests were performed. Melatonin onset points (20:00 h and 21:30 h) were defined at 4 pg/mL salivary concentrations.

**Results:** After variables relativization, statistical differences were found when comparing the week prior intervention and 19 h intervention week (prior and intervention weeks means, respectively): 7.1/ 7.3 pts for easiness of sleep ( $r = 0,69$ ;  $p < 0.01$ ); 3.9/4.5 pts for easiness to wake up ( $r = 0,66$ ;  $p < 0.01$ ); 5.7/6.7 pts for sleep quality ( $r = 0,74$ ;  $p < 0.01$ ) and 6.1/5.4 pts for mood ( $r = 0,66$ ;  $p < 0.01$ ). No differences were found for VAS values over the 21 h exposure week.

**Conclusion:** Despite the sample size and literary evidences on different time and duration of intervention (one hour at least, in the middle of the day), the results of this study point out to a better perception of sleep quality, easiness of sleep and to wake up,

and worse perception of mood with reduced exposure and in the evening hours.

**Acknowledgements:** Support: CNPq (501766/2007-3; 500782/2008-3; 472153/2006-4; 307919/2006-4); CAPES, FAPESP (07/04648-4; 06/59053-2), FAPERJ (E-26/102.965/2012), PIBIC-CNPq.

<http://dx.doi.org/10.1016/j.sleep.2013.11.691>

### OSA and oxidative stress: Preliminary analysis

E. Ordax<sup>1</sup>, J. Terán-Santos<sup>1</sup>, M. Alonso<sup>1</sup>, M. Coma<sup>2</sup>, R. Peralta<sup>1</sup>

<sup>1</sup> Multidisciplinary Unit of Sleep Medicine, Burgos University hospital, Spain

<sup>2</sup> Research Unit, Burgos University hospital, Spain

**Introduction:** OSA is a succession of obstructive events to the VAS that occur at night during which a state of intermittent hypoxia reoxygenation can cause through oxidative stress mechanisms permanent damage to reactive oxygen species and nitrogen with different biomolecules. This may be the basis of the multiple cardiovascular complications of sleep apnea.

**Materials and methods:** A Preliminary analysis of prospective observational study included consecutive patients with severe sleep apnea (AHI > 30): no drowsiness ( $n = 40$ ) and drowsiness ( $n = 40$ ), known as groups I and II respectively. We analyzed demographics, polysomnographic variables and comorbidities, as well as the values of biomarkers: nitric oxide (NOx) and malondialdehyde (MDA) as markers of oxidative damage and lipid peroxidation. patient data collected at baseline and after three months of treatment with CPAP were analyzed.

**Results:** There were no differences in demographic or polysomnographic variables, except in the Epworth. The biomarkers baseline results showed significant differences between the values of NOx and MDA in patients with and without drowsiness. The biomarker values for CPAP patients of both groups before and after treatment showed no significant difference.

**Conclusion:** In our study we found differences in baseline NOx and lipid peroxidation (estimated as MDA) in patients with severe OSA with and without drowsiness. The data are consistent with increased oxidative stress in patients without drowsiness. Evaluating results before and after treatment with CPAP did not find variations in these markers of oxidative stress despite what results in previously published literature, confounding factors may intervene.

**Acknowledgement:** Staff multidisciplinary sleep unit and research unit.

<http://dx.doi.org/10.1016/j.sleep.2013.11.692>

### Response to hypoxic provocation in patients with chronic heart failure and its predictive value for central sleep apnea

K. Terziyski<sup>1</sup>, A. Draganova<sup>1</sup>, O. Aliman<sup>2</sup>, I. Ilchev<sup>3</sup>, A. Hristova<sup>1</sup>, S. Kostianev<sup>1</sup>

<sup>1</sup> Medical University – Plovdiv, Pathophysiology Dept, Bulgaria

<sup>2</sup> MHAT “St. Caridad”, Cardiology Dept, Bulgaria

<sup>3</sup> MHAT “St Ivan Rilski”, Cardiology Dept, Bulgaria

**Introduction:** Central apneas are usually clustered in periodic sequences in patients with chronic heart failure (CHF) and central sleep apnea (CSA), triggered by destabilizing events. We hypothesized that a provocation with exogenous hypoxic hypoxia may destabilize a system with abnormal gain (controller and plant) enough to trigger visually recognizable central events during wakefulness in those patients. The aim of the study is to investigate the

response to hypoxic provocation in patients with CHF and its capability to predict the presence of CSA.

**Materials and methods:** Nineteen patients with CHF (age =  $65.5 \pm 7.3$ , EF =  $51.9 \pm 6.6$ ) have been recruited and subjected to polysomnography and hypoxic provocation. Central apnea-hypopnea index (cAHI) > 5 determined the presence of CSA, dividing the patients in 2 groups – with CSA ( $n = 13$ , cAHI =  $29.2 \pm 16.2$ ) and CHF “controls” without CSA ( $n = 6$ , cAHI =  $4.0 \pm 1.6$ ,  $p < 0.001$ ). The hypoxic provocation comprised of 3 subsequent periods of 10 min: prehypoxic, hypoxic – breathing hypoxic air (~3000 m altitude) and posthypoxic. Hypopneas, apneas and desaturations >3% were scored for each period and respective indices for apneas and hypopneas (hAHI) and oxygen desaturations (hODI) have been calculated in the classical manner (count per 1 h).

**Results:** No differences were present between the 2 groups in the prehypoxic period (hAHIpre =  $27.6 \pm 26.7$  vs.  $16.3 \pm 27.3$ , NS; hODIpre =  $18.6 \pm 23.5$  vs.  $12.9 \pm 17.6$ , NS; average desaturation (hAvDespre) =  $2.5 \pm 2.4$  vs.  $2.3 \pm 1.9$ , NS in patients and controls, respectively). Significantly higher values for these parameters were found after the hypoxic provocation in the CHF + CSA group, compared to CHF controls (hAHIpost =  $54.5 \pm 28.8$  vs.  $18.8 \pm 28.8$ ,  $p = 0.022$ ; hODIpost =  $37.0 \pm 23.2$  vs.  $2.4 \pm 4.5$ ,  $p < 0.001$ ; hAvDespost =  $4.5 \pm 2.1$  vs.  $1.3 \pm 2.1$ ,  $p = 0.007$ ). Exogenous hypoxia provoked significantly more events in the posthypoxic period, compared to baseline values only in CHF + CSA patients (hAHIpre/hAHIpost,  $p = 0.002$ ; hODIpre/hODIpost,  $p = 0.002$ ; hAvDespre/hAvDespost,  $p = 0.008$ ). Strong significant correlation was found between cAHI and hAHI3 ( $\rho = 0.553$ ,  $p = 0.05$ ) and hODI3 ( $\rho = 0.564$ ,  $p = 0.05$ ). Patients presenting with positive hypoxic provocation test (empirically chosen if hAHIpost > 30) had 11.8 times higher odds (95% CI = 1.34–105,  $p = 0.026$ ) to have CSA.

**Conclusion:** Hypoxic provocation triggers central events during wakefulness in the majority of CHF + CSA patients and may be used as a predictor of the presence and magnitude of CSA in CHF.

**Acknowledgement:** The study was financed by the Bulgarian Ministry of Youth and Science.

<http://dx.doi.org/10.1016/j.sleep.2013.11.693>

### A multimodal approach to treating patients with psg evidence of cycling alternating pattern (CAP) and/or alpha electroencephalography pattern (alpha-EEG): strategies for fibromyalgia syndrome and chronic fatigue (FMS/CF)

C. Thirlwell<sup>1</sup>, S. Anand<sup>1</sup>, D. Love<sup>2</sup>, L. Janelle<sup>3</sup>

<sup>1</sup> Centre for Sleep and Chronobiology, Canada

<sup>2</sup> Naturopathic Clinic, Canadian College of Naturopathic Medicine, Canada

<sup>3</sup> Centre for Heart Living, Canada

**Introduction:** CAP and alpha-EEG are markers of sleep instability which are commonly seen in patients suffering from FMS/CF. Sleep instability is associated with autonomic instability and generally does not respond longer-term to hypnotic medication. Patients with FMS/CF with PSG evidence of CAP and alpha-EEG suffer from intractable, debilitating fatigue and nonrestorative sleep, in addition to variable musculoskeletal pain symptoms, poor memory and concentration, and low or irritable mood. It has been observed that patients with CAP and alpha-EEG have a history of significant stressors (psychological and/or physical) and often exhibit marked anxiety. States of stress and high anxiety, stimulate the sympathetic nervous and increase adrenal output. It can be postulated that if these high-output states persist, there sleep quality is affected; possibly predisposing them to developing significant sleep instability with the presence of CAP and/or alpha-EEG and adrenal fatigue.

**Materials and methods:** We have identified FMS/CF patients with CAP and/or alpha-EEG, who have abnormally high scores on an Adrenal Fatigue Questionnaire and have clinical evidence of low saliva cortisol throughout the day. In addition, on the Symptom Checklist-90 (SCL-90), which is a self-report instrument used in evaluating a broad range of psychological symptoms, patients report moderate to excessive psychological distress with anxiety and depressive symptoms. In these same patients, the Wahler Physical Symptoms Inventory revealed self-reported evidence of marked physical fatigue and discomfort. Over a 1 year treatment period, 8 out of 9 patients with FMS/CFS and PSG evidence of CAP and/or alpha-EEG responded clinically to a multimodal approach addressing the biochemical, physical, and psychological factors influencing their clinical presentation. The patients were assessed and treated by a naturopathic doctor for adrenal fatigue and nocturnal hypoglycemia, as well as addressing any other biochemical abnormalities. Their physical therapy included optimizing sleep hygiene and engaging, on a weekly basis, in activities which enhance parasympathetic nervous system tone. Such activities include restorative yoga, tai chi, swimming, and/or Mindfulness Based Stress Reduction (MBSR). Brief psychodynamic psychotherapy and Neuro Emotional Technique (NET) were used as psychological treatment modalities. Patients had monthly follow-up with a psychiatrist and regularly scheduled visits with a certified NET practitioner. NET is a psychotherapeutic/chiropractic system that combines a number of techniques and principles from the meridian system in traditional Chinese.

**Results:** One patient was lost to follow-up. On self-report, 8 patients reported a subjective improvement in their sleep, feeling more refreshed upon awakening and improvement in their daytime fatigue and daytime functioning. There was also an improvement in the scores of self-report inventories. In 5 of the patients there was PSG evidence of a decrease in CAP and/or alpha-EEG.

**Conclusion:** These preliminary findings warrants further investigation and offers potential avenues for treatment with FMS/CFS patient with nonrestorative sleep and debilitating fatigue.

**Acknowledgements:** We wish to acknowledge the ongoing academic guidance and inspiration of Dr. Havey Moldofky and his contributions to Sleep Medicine.

<http://dx.doi.org/10.1016/j.sleep.2013.11.694>

### **Is oral appliance as efficacious as NCPAP in patients with positional-dependent obstructive sleep apnea?**

Y. Takaesu<sup>1</sup>, S. Tsuiki<sup>2</sup>, M. Kobayashi<sup>2</sup>, Y. Komada<sup>3</sup>, Y. Inoue<sup>3</sup>

<sup>1</sup> Tokyo Medical University, Department of Psychiatry, Japan

<sup>2</sup> Japan Somnology Center, Neuropsychiatric Research Institute, Japan

<sup>3</sup> Tokyo Medical University, Department of Somnology, Japan

**Introduction:** Oral appliance is generally accepted to be less efficacious than nasal continuous positive airway pressure (nCPAP) for the treatment of Obstructive Sleep Apnea (OSA). However, it was hypothesized that oral appliance was as efficacious as nCPAP when positional-dependent OSA (pOSA) patients were targeted.

**Materials and methods:** The gender (male), Body Mass Index (BMI) ( $20 < \text{BMI} < 30$ ), age ( $30 < \text{age} < 60$ ), and the Apnea Hypopnea Index (AHI) ( $15 < \text{AHI} < 30$ ) were considered for inclusion. Patients were defined as positional-dependent OSA when the ratio of a lateral AHI to a supine AHI was  $< 0.5$  in conjunction with a lateral AHI  $< 15$ . Subjects whose lateral sleep time less than 60 min were excluded. Twenty-six patients were recruited for oral appliance group while 32 patients were joined for nCPAP therapy. Second

polysomnography was undertaken with oral appliance in place for oral appliance group, whereas it was undertaken during an overnight titration study for nCPAP patients. recruited for oral appliance group while 32 patients were joined for nCPAP therapy. Second polysomnography was undertaken with oral appliance in place for oral appliance group, whereas it was undertaken during an overnight titration study for nCPAP patients.

**Results:** There was no significant difference in the baseline AHI between oral appliance patients ( $20.92 \pm 4.34$ ) and nCPAP subjects ( $22.84 \pm 2.65$ ). The AHI was lowered significantly with oral appliance in place ( $16.05 \pm 6.44$ ,  $p < 0.01$ ) similarly to the AHI of nCPAP users ( $20.19 \pm 5.12$ ,  $p < 0.01$ ). While controlling effect of AHI at the baseline, no significant difference was observed between follow-up AHI in oral appliance subjects ( $4.49 \pm 0.72$ ) and the AHI obtained from nCPAP titration study ( $3.70 \pm 0.65$ ).

**Conclusion:** These findings suggest that oral appliances are as efficacious as nCPAP in the treatment for patient with positional-dependent OSA. This information is available in discussing treatment of choice for OSA patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.695>

### **Polysomnographic and MSLT data in a large sample of patients with unexplained chronic fatigue: comparison with a reference sample and relation with subjective scores**

E. Tobbacq, A. Mariman, I. Hanouille, L. Delesie, D. Vogelaers, D. Pevernagie

Department of General Internal Medicine, Infectious Diseases and Psychosomatics, Belgium

**Introduction:** This study aimed to assess objective parameters of sleep and sleepiness in a large sample of patients with unexplained chronic fatigue and to compare the results with data from a reference population. Furthermore, the relation was assessed between these objective parameters and subjective scores probing mental and physical health, sleep quality, daytime sleepiness and fatigue.

**Materials and methods:** Objective sleep parameters were derived from polysomnography (PSG) and multiple sleep latency testing (MSLT). Subjective assessment consisted of the administration of validated questionnaires: Medical Outcomes Study 36-item Short Form Health Survey for the assessment of global mental and physical health, Epworth Sleepiness Scale for excessive daytime sleepiness, Pittsburgh Sleep Quality Index for global sleep quality and Fatigue Questionnaire for fatigue severity.

**Results:** Out of 377 eligible patients, 245 subjects were included (mean age 38.6 years, SD 10.69, 86.1% female). Sleep disorders were prevalent in 55.5% (sleep apnea, 32.7%; insomnia, 16.7%; periodic limb movements, 13.9%). Significant differences in several objective sleep parameters were observed between the unexplained chronic fatigue and reference groups (i.e. decreased total sleep time, sleep efficiency and %REM; increased sleep latency, %NREM1, wake after sleep onset and arousal index). Neither PSG nor MSLT data were correlated with fatigue, and were only weakly correlated with mental health and subjective sleepiness. Increased sleepiness in the Epworth Sleepiness Scale was not substantiated by objective data from the MSLT.

**Conclusion:** An insomnia phenotype was suggested in patients with unexplained chronic fatigue, based on the observed sleep profile. The overall lack of correlation between subjective scores and objective indices derived from PSG and MSLT may suggest that the latter are inappropriate to explain symptoms of daytime sleepiness and fatigue in patients with unexplained chronic fatigue. However,

their application remains justified for the demonstration of comorbid primary sleep disorders in this patient group.

<http://dx.doi.org/10.1016/j.sleep.2013.11.696>

### Effects of real vs simulated altitude on sleep and sleep disordered breathing

R. Heinzer<sup>1</sup>, J. Saugy<sup>2</sup>, N. Tobback<sup>1</sup>, T. Rupp<sup>3</sup>, J. Haba-Rubio<sup>1</sup>, G. Millet<sup>2</sup>

<sup>1</sup>Centre for Investigation and Research in Sleep, University of Lausanne, Switzerland

<sup>2</sup>ISSUL, Department of Physiology, Switzerland

<sup>3</sup>University of Chambery, Switzerland

**Introduction:** “Real altitude” (e.g. hypobaric hypoxia) has been reported to impair sleep and induce sleep disordered breathing (SDB). It is however not clear whether for the same ambient Oxygen pressure (PO<sub>2</sub>) “simulated altitude” in a hypoxic chamber (e.g. normobaric hypoxia;) generates similar sleep alterations.

**Materials and methods:** Full polysomnography was performed on 13 healthy volunteers (33.9 ± 9.1 y.o, BMI: 23.5 ± 2.2 kg/m<sup>2</sup>) under three conditions: Hypobaric hypoxia (HH, Junfrauoch Switzerland, 3454 m), normobaric hypoxia (NH, Sion, Switzerland, 500 m, FiO<sub>2</sub> = 0.138 ) and Normobaric normoxia (NN, control night, Sion). NN and NH recordings were performed in a hypoxic chamber (randomized order, double blind). Polysomnography recordings were performed and scored according to the AASM recommendations.

**Results:** For SDB, compared to NN condition, apnea hypopnea index (AHI) increased significantly in both hypoxic conditions (ANOVA): NN 7.1 ± 1.2/h, NH 35.9 ± 11.2/h (*p* = 0.04), HH 38.0 ± 9.7/h (*p* = 0.02). The same was found for hypopnea: NN 6.7 ± 1.2, NH 18.3 ± 4.4 (*p* = 0.04), HH 25.3 ± 5.2 (*p* = 0.004), oxygen desaturation index (ODI3%): NN 3.8 ± 0.5/h, NH 43.9 ± 10.9/h (*p* = 0.008), HH 53.3 ± 9.9/h (*p* = 0.0009) and mean oxygen saturation (SaO<sub>2</sub>): NN 96.5 ± 0.2%, NH 83.6 ± 0.5% (*p* < 0.0001); HH 81.2 ± 0.87 (*p* < 0.0001). Despite the same ambient PO<sub>2</sub> (105 mmHg), there was a significant difference between HH and NH in mean SpO<sub>2</sub>: -2.4% (*p* = 0.04), and an increase in hypopnea index: +7/h (*p* = 0.04) but no difference in AHI or central sleep apnea. Regarding sleep, compared to NN, there was in NH and HH a significant decrease in total sleep time: NN 388 ± 13 min, NH 317 ± 18 min (*p* = 0.01), HH 351 ± 17 min (*p* = 0.05), a significant increase in microarousal index: NN 17.3 ± 1.8/h, NH 26.2 ± 3.9/h (*p* = 0.03), HH 24.6 ± 3.8 (*p* = 0.05) and a decrease in sleep efficiency between NN and HH: 8.4% (*p* = 0.027). We also observed a significant increase in heart rate in hypoxic condition: NN 48.1 ± 1.5, NH 54.7 ± 1.6 (*p* = 0.001), HH 61.2 ± 2.7 (*p* = 0.002). HR in HH was significantly higher (+6.5 bpm, *p* = 0.018) than in NH.

**Conclusion:** Compared to NN, both HH and NH conditions increased AHI, hypopnea index, ODI 3%, heart rate and decreased total sleep time and mean SaO<sub>2</sub>. There was a further decrease in mean SpO<sub>2</sub> and increase in HR and hypopnea in HH compared to NH, suggesting that HH and NH may have different physiological effect despite the same PO<sub>2</sub>.

**Acknowledgement:** Swiss national science foundation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.697>

### Poor sleep – An early sign of incipient delirium, or a risk factor in itself? a clinical observational study

O. Todd

Evangelische Krankenhaus Bielefeld, Germany

**Introduction:** Sleep and delirium share risk multiple factors. Altered sleep architecture or deficit may cause delirium, or rather represent early markers of established delirium. Recent studies suggest that altered sleep causes brain injury. Sleep disturbance correlated with cognitive decline in a 3 recent large population studies with 10–15 year follow up. Disrupted sleep amongst elderly, mediated by structural change has also been associated with cognitive decline. Ascertaining a direction of causality between sleep and delirium is crucial to further understanding of delirium pathophysiology, to identify at-risk sub-groups, as well as direct future efforts in seeking methods of evidence-based prevention.

**Materials and methods:** We aim to recruit 120 patients older than 65 years who are admitted for elective knee and hip replacement operations in a German Teaching Hospital. Wrist-actigraphy objectively measures sleep efficiency and total sleep time 1 night pre-op, and 5 nights post-operatively. Pre-operatively we also ascertain baseline subjective sleep quality at home (Pittsburgh Questionnaire), cognitive function (MMST), mood (GDS), chronotype (Morning-Eveningness Questionnaire) and daytime sleepiness (Epworth). CAM scores are performed daily on each of the first 5 post-operative days, and positive scores indicated clinical geriatric assessment. Known predisposing factors for delirium that may present confounders were assessed by auditing patient notes and anaesthetic records.

**Results:** We will present the data from 80 patients. A pilot of 30 patients demonstrates an Effect size of 0.677, 95% CI -0.0784 to 1.4328, *v* = 0.1486, of poor sleep (measured by Pittsburgh) and a positive post-operative CAM suggestive of Delirium.

**Conclusion:** Poor sleep increases susceptibility to a deliriogenic insult in the form of elective surgery. Characterising this relationship may enable targeted prevention methods.

**Acknowledgement:** Professor Alasdair MacLullich, University of Edinburgh Dr. Christine Thomas, EvKB Dr. Stefan Kreisel, EvKB.

<http://dx.doi.org/10.1016/j.sleep.2013.11.698>

### Opioid treatment is efficacious in the short- and long-term in patients with severe restless legs syndrome after failure of previous medications

C. Trenkwalder<sup>1</sup>, H. Benes<sup>2</sup>, D. Garcia-Borreguero<sup>3</sup>, L. Grote<sup>4</sup>, M. Hopp<sup>5</sup>, R. Kohnen<sup>6</sup>

<sup>1</sup>Centre of Parkinsonism and Movement Disorders, Paracelsus-Elena Hospital, Germany

<sup>2</sup>Somni bene Institute for Clinical Research and Sleep Medicine, Germany

<sup>3</sup>Sleep Research Institute, Germany

<sup>4</sup>Sahlgrenska University Hospital, Sleep Disorder Center, Germany

<sup>5</sup>Mundipharma Research GmbH&Co. KG, Germany

<sup>6</sup>ReSearch Pharmaceutical Services Inc, Germany

**Introduction:** Opioids are mainstay for pain therapy and used in several countries as off-label therapy in RLS after failure of first-line therapy. This study investigated the efficacy and safety of oxycodone/naloxone prolonged-release fixed-combination (OXNPR) in severely affected RLS patients (International RLS Study Group Rating Scale (IRLS) score ≥ 21 at randomization) with previously insufficient RLS therapy.

**Materials and methods:** Patients (*N* = 304, mean age 62.4 ± 11.2 years) were randomized to OXNPR twice daily (mean oxycodone dose 21.9 ± 15.0 mg/day) or placebo after screening and a 7 day washout period. After the 12-week double-blind (DB) phase, 197 patients participated in a 40-week open-label extension (mean oxycodone dose 18.1 ± 10.5 mg/day). The primary objective of the DB phase was to demonstrate superior efficacy of OXNPR compared with placebo in reducing RLS symptom severity using the universally

accepted IRLS. Secondary endpoints included assessment of RLS severity using the RLS-6 Rating scale, and RLS-specific quality of life (QoL) using the QoL-RLS Scale.

**Results:** Mean IRLS total score was significantly reduced from  $31.6 \pm 4.5$  at randomization (indicating severe symptom load) to  $15.1 \pm 10.6$  after 12 weeks of OXNPR treatment. The 12-week OXNPR treatment resulted in a statistically significant reduction in symptom severity compared to placebo with a clinically relevant treatment difference of 8.15 in the mean IRLS total score (95% CIs:  $1^{*}5.46; 10.85; \pm; p < 0.001; n=269$ ). The beneficial effects of OXNPR during the night and day when at rest were maintained throughout the extension phase. The mean IRLS total score was  $9.7 \pm 7.8$  at end of study ( $n = 152$ ), representing a mild RLS symptom severity level, on average. RLS-6 scores (0–10 scale) supported the IRLS results and showed a clinically relevant decrease in RLS symptom severity for OXNPR versus placebo (reduction RLS-6 daytime at rest severity after 12 weeks: OXNPR  $6.7 \pm 2.2$ – $2.5 \pm 2.7$  vs placebo  $6.7 \pm 2.5$ – $4.4 \pm 3.3$ ). Despite a prospective augmentation assessment during the trial, no case of augmentation was verified in the DB or extension phases. OXNPR treatment was well tolerated in accordance with the expected safety profile of opioid treatment.

**Conclusion:** Oxycodone/naloxone prolonged-release effectively reduces RLS symptom severity over the short- and long-term in patients with severe RLS, inadequately controlled with previous medications, with accompanying quality of life benefits.

**Acknowledgements:** Karen Paine provided medical writing services on behalf of Mundipharma Research. (Funded by Mundipharma Research; ClinicalTrials.gov number, NCT01112644).

<http://dx.doi.org/10.1016/j.sleep.2013.11.699>

### The relationship between sleep disturbances and fatigue with multiple sclerosis – A case report

F. Peverini<sup>1</sup>, G. Tropeano<sup>2</sup>

<sup>1</sup> *Fondazione per la ricerca e la cura dei disturbi del sonno – Onlus, Centro Multidisciplinare per la ricerca e la cura dei disturbi del sonno, Italy*

<sup>2</sup> *IRPPI – Istituto Romano di Psicoterapia Psicodinamica Integrata, Italy*

**Introduction:** Sleep disorders is a common complaint in patients with multiple sclerosis (MS). These include insomnia, nocturnal movement disorders, sleep-disordered breathing, narcolepsy, excessive daytime sleepiness (EDS), fatigue and REM dysregulation. However, it would seem necessary a different evaluation of the pharmacological treatment in patients with MS and EDS.

**Materials and methods:** A 76-year-old female with MS (detected 32 years ago) showed from 18 years clinical features of chronic indistinguishable insomnia, EDS, fatigue, social and quality of life impairment and severe limitations in walking and home mobility. The sleep was less than 6 h and the patient snored mildly. She did not present other diseases: BMI was  $19.2 \text{ kg/m}^2$ , neck circumference was 34 cm, and was also screened for depression (neg). Nocturnal polysomnography revealed: TIB 549 min, TST 281 min, Sleep Efficiency 52.9%, WASO 138 min, StageN1 2.3%, StageN2 13.3%, StageN3 38.4%, Stage R 0.7%, Wake/Mov 45.3%. AHI was 4.3/h, ODI 2.1/h, RDI 10.2/h; PLM av 4.3/h; av O<sub>2</sub> sat.92%; Nadir O<sub>2</sub> sat.83%; ESS 23. Neuroimaging study (brain MRI) confirmed morphological evidences of MS in the corona radiata, centro semiovale, in the bilateral cerebellar hemisphere and a nuanced alteration of signal level at the midbrain, which extends caudally in the pons and in the reticular formation, in relation to the degenerative phenomena and neuronal deafferentation. The patient had been taking, for many years, benzodiazepines, non-benzodiazepine hypnotics, amitriptyline,

mirtazapine, promazine, gabapentin, without any clinical effect. So, we started the administration of the following drugs: quetiapine 25 mg, trazodone 50 mg, escitalopram 20 mg; there was no need to add melatonin receptor agonist.

**Results:** At the control, the patient showed a significant improvement in sleep efficiency and decrease of EDS; a second nocturnal polysomnography demonstrate: TIB 420 min, TST 416 min, Sleep Efficiency 99%, WASO 2 min, Stage N1 10.3%, Stage N2 45.4%, Stage N3 32.2%, Stage R 11.2%, Wake/Mov 0.9%. AHI was 2.3/h, ODI 1.6/h, RDI 3.2/h; PLM av 0.6/h; av O<sub>2</sub> sat.93%; Nadir O<sub>2</sub> sat.86%; ESS 9.

**Conclusion:** There are no specific guidelines for treatment of insomnia in MS patients; however, the CNS lesions, such as brainstem lesion and/or damage to the medullary reticular formation, are assumed to play a main role for the effectiveness or ineffectiveness of drug therapies. Finally, our data suggest to investigate the potentially reversible sleep disorders in MS patients.

**Acknowledgement:** Stefano Bastianello, MD Neuroradiologist.

<http://dx.doi.org/10.1016/j.sleep.2013.11.700>

### Sleep medicine in Japanese pre-doctoral dental curriculum

H. Yoshinori Higuchi

*Kyushu University Hospital, General Oral Care, Japan*

**Introduction:** In the sleep medicine field, dentists are increasingly required to provide important services; such as oral appliance manufacture, orthodontic approach or maxillofacial surgery for sleep disordered breathing. For the dentist, sleep bruxism is one of the important factors for oral health. However there is limited information regarding sleep medicine in pre-doctoral dental education. The aim of this survey is to reveal how sleep medicine related education has been done in Japanese dental school.

**Materials and methods:** This was an e-mail based questionnaire survey. A three-page cover letter with 10 questions was sent out to all the 29 Japanese dental schools. The main categories included: the number of hours taught in each of the 6 years, educational style such as didactic or clinical experience, which departments taught the materials, which diagnoses and therapies were reviewed, and what additional topics if any were discussed. Which department is responsible for sleep apnea patients in clinical setting was also asked.

**Results:** Twenty-six out of 29 dental schools (89.7%) responded to this survey. Of the responding dental schools, 80.8% reported some educational time in sleep medicine. Five schools (23.8%) reported no curriculum time. The average number of educational hours was 3.8 h. The majority were taught by didactic (58.5%). The most frequently covered topics included sleep-related breathing disorders (20 schools, 95.2%) and sleep bruxism (13 schools, 61.9%). More than half of dental school taught oral appliance, CPAP, ENT surgical therapy, oral surgery as treatment option for sleep apnea, but orthodontic approaches was only reviewed at 38.1% of dental schools.

**Conclusion:** Educational time for sleep medicine in Japanese pre-doctoral education is similar with that of US (3.92 h, Simmons, 2012). While sleep medicine in Japanese pre-doctoral dental education is similar to the previous US report, it is still required to expand this topic in Japan for collaborating as members of a multidisciplinary sleep medicine approaches.

**Acknowledgement:** This study is supported by Japanese association of the general dentistry.

<http://dx.doi.org/10.1016/j.sleep.2013.11.701>

### Developing and validating a questionnaire to screen commercial driver's license applicants for sleep-disordered breathing

O. Tzischinsky<sup>1</sup>, R. Epstein<sup>2</sup>, G. Pillar<sup>3</sup>

<sup>1</sup> Behavioral Science, Emek Yezreel Academic College, Israel

<sup>2</sup> Research Center for Work Safety and Human Engineering, Technion, Israel

<sup>3</sup> Sleep Clinic, Clalit Health Services, Haifa, Israel

**Introduction:** Excessive Daytime Sleepiness (EDS) is known to impair daytime performance. Sleep-Disordered Breathing (SDB), the most common EDS sleep disorder, puts sufferers at high risk of falling asleep while driving. In Israel, most commercial driver's license applicants are young (20–40 years) and are not screened for SDB. The aim of the present study was to develop and validate a short questionnaire to be used for SDB screening among healthy young applicants for a Commercial Driver's License (CDL).

**Materials and methods:** Participants included 203 CDL applicants. All applicants completed self-administered questionnaires. Their sleep was then monitored for one night by means of an ambulatory device: the Watch-PAT-200 (WP200), a four-channel unattended ambulatory device based on the peripheral arterial tone (PAT) signal with three additional channels: heart rate, pulse oximetry and actigraphy. We employed new statistical methods to identify possible predictors of clinically significant SDB among the applicants, as indicated by Respiratory Disturbance Index (RDI) > 15. These methods included Generalized Boosted Regression Modeling (GBM), Classification and Regression Trees (CART) and Stepwise Multiple Logistic Regression (SMLR).

**Results:** 153 CDL applicants successfully completed the study. The Watch-PAT-200 results demonstrated that SDB is prevalent in at least 31.4% of young CDL applicants (RDI > 15). The following parameters were identified as major predictors of clinically significant SDB: BMI (>32), age (>29), afternoon nap-taking, history of snoring father, dry mouth after awakening, snoring and feeling tired in the morning. The CART analysis method yielded a "true positive" in 85% of the participants. In 73% of the cases the analysis correctly identified those without SDB, while in 27% it resulted in a "false positive" classification error.

**Conclusion:** This study examined the probability of using a questionnaire for subjective prediction of SDB among young CDL applicants. The results were then corroborated by an objective ambulatory measure of night sleep using WP-200. A combination of questions referring both to sleep and to physiological data predicted most cases of clinically significant SDB among the young applicants. We recommend including a short questionnaire along with BMI as part of CDL screening. These tools can help the screening physicians determine whether SDB needs to be ruled out and get treatment before an applicant is granted a commercial driver's license.

**Acknowledgement:** Israel National Road Safety Authority for the support.

<http://dx.doi.org/10.1016/j.sleep.2013.11.702>

### Factors affecting the intention and decision to be treated for

O. Tzischinsky<sup>1</sup>, S. Shahrabani<sup>2</sup>, G. Givati<sup>3</sup>, Y. Dagan<sup>4</sup>

<sup>1</sup> Emek Yezreel College, Behavioral Science, Emek Yezreel Academic College, Israel

<sup>2</sup> Emek Yezreel College, Economics and Management Department, The Max Stern Yezreel Valley, Israel

<sup>3</sup> Neurology Department, Sheba Medical Center, Israel

<sup>4</sup> Sleep Medicine Department, Assuta Medical Center, Israel

**Introduction:** Obstructive Sleep Apnea (OSA) is a contemporary disorder that has a deleterious impact on health and quality of life. Using the Continuous Positive Airway Pressure (CPAP) device on a regular basis effectively lessens OSA, improves daily functioning and decreases Excessive Daytime Sleepiness (EDS). We proposed two-stage model: The first stage examines how the intention to use the CPAP device is affected by the Health Belief Model (HBM), subjective physiological factors and control variables. The second stage examines how the decision to purchase a CPAP device is affected by intention to use the device, socio-demographic variables, objective physiological factors (AHI: Apnea Hypopnea Index) and length of device trial.

**Materials and methods:** Questionnaires were distributed at three sleep laboratories in Israel among 633 participants suspected of having OSA. The questionnaire consisted of a Mini Sleep Questionnaire (MSQ), HBM variables, socio-demographic information, and intention to be treated by the CPAP device if needed. Six months later, 194 OSA patients were contacted by telephone to verify whether or not they had purchased a CPAP device.

**Results:** The results of stage 1 showed that 33% of the patients in the sample indicated that if diagnosed with OSA they intend to purchase a CPAP device. Those who have significantly higher levels of Mean MSQ than those who do not intend to purchase the device or are not sure about it ( $p < 0.04$ ), they were significantly more susceptible to OSA ( $p < 0.001$ ), perceived more benefits ( $p < 0.001$ ), had fewer barriers to treatment ( $p < 0.02$ ), and higher income level ( $p < 0.1$ ). Nevertheless, no significant difference between the two groups was found with respect to BMI and sleepiness. Stage 2 results indicated that 100 OSA patients (51.5%) purchased the CPAP (out of 194 OSA patients). The results of the logistic regression for the decision (yes vs. not) to purchase the device revealed that the decision was positively affected by the intention to use CPAP ( $p < 0.04$ ), higher AHI ( $p < 0.03$ ), number of CPAP trial days ( $p < 0.001$ ), age ( $p < 0.04$ ) and number of years in the country ( $p < 0.02$ ).

**Conclusion:** Patients' attitudes and health beliefs prior to diagnosis may predict their intention to be treated for OSA, and in turn, affect their actual decision to purchase the device. Awareness of behavioral intention can enable decision-makers developing targeted interventions to promote treatment, especially among those who a priori do not intend to get the treatment, even before they take the sleep test.

**Acknowledgements:** The financial support of the research institute of Maccabi Healthcare Services.

<http://dx.doi.org/10.1016/j.sleep.2013.11.703>

### Not all are equal: modifiers of the effect of poor sleep quality on work injuries

K. Uehli<sup>1</sup>, D. Miedinger<sup>2</sup>, E. Holsboer-Trachsler<sup>3</sup>, C. Schindler<sup>1</sup>, N. Kinzli<sup>1</sup>, J. Leuppi<sup>4</sup>

<sup>1</sup> Swiss Tropical and Public Health Institute (Swiss TPH), Switzerland

<sup>2</sup> Swiss National Accident Insurance Institution (Suva), Switzerland

<sup>3</sup> Psychiatric University Clinics, Switzerland

<sup>4</sup> Clinic of Internal Medicine, University Hospital Basel, Switzerland

**Introduction:** Sleep problems are a well known risk factor for work injuries but vulnerable populations most at risk are not clear. The aim of this study was to investigate whether potential susceptible factors modify the association between sleep quality and risk of work injury.

**Materials and methods:** A hospital-based case-control study including 180 cases and 551 controls was conducted at the University Hospital Basel, Switzerland, from December 1st 2009 and June 30th 2011. Data was collected on work injuries, sleep quality measured by the Pittsburgh sleep quality index (PSQI), and

potential confounders. Adjusted odds ratios and 95% confidence intervals for the association between sleep quality and work injury were estimated in multivariate logistic regression analyses in all participants and after stratification by age, gender, job risk, work shift, daily sleep and hours worked per week.

**Results:** Poor sleep quality is significantly associated with work injury ( $p = 0.025$ ). The association between poor sleep quality and work injury was significantly higher for workers older than 30 yrs ( $OR > 30$  0.91 vs.  $OR > 30$  1.30,  $p = 0.006$ ), sleeping more than 7 h a day ( $OR < 7$  1.19 vs.  $OR > 7$  0.82,  $p = 0.048$ ), and working 50 h or more per week ( $OR < 50$  1.10 vs.  $OR \geq 50$  1.81,  $p < 0.001$ ). Males, workers with high job risk, and workers with daytime work were at higher risk for sleep quality related injury than their counterparts but these differences were not statistically significant.

**Conclusion:** Older age, short daily sleep, and long working hours may be susceptible factors for sleep quality related work injuries.

**Acknowledgements:** We would like to thank Roland Bingisser, Selina Durrr, Sabrina Maier, Amar Mehta, Roland Muller, and Stefanie Zogg for their scientific contribution. We acknowledge support from the Swiss National Accident Insurance Institution (Suva).

<http://dx.doi.org/10.1016/j.sleep.2013.11.704>

### One night of auto-CPAP titration without pulse oximetry versus three or four nights titration

D. Bejarano Ugalde<sup>1</sup>, S. Juarros Martínez<sup>2</sup>, C. Disdier Vicente<sup>3</sup>, M. Del Olmo Chiches<sup>4</sup>, D. Vielba Dueñas<sup>5</sup>, I. Ramos Cancelo<sup>5</sup>

<sup>1</sup> Sleep-Disordered Breathing Unit, Pulmonology Department, Clinical University Hospital of Valladolid, European Respiratory Society (ERS), Spain

<sup>2</sup> Sleep-Disordered Breathing Unit, Pulmonology Department, Clinical University Hospital of Valladolid, Spanish Society of Pneumology and Thoracic Surgery (SEPAR), Spanish Sleep Society (SES), Spain

<sup>3</sup> Chief Pulmonology Department, Clinical University Hospital of Valladolid, Spanish Society of Pneumology and Thoracic Surgery (SEPAR), Spain

<sup>4</sup> Sleep-Disordered Breathing Unit, Pulmonology Department, Clinical University Hospital of Valladolid, Spanish Society of Pneumology and Thoracic Surgery (SEPAR), Spain

<sup>5</sup> Pulmonology Department, Clinical University Hospital of Valladolid, Spanish Society of Pneumology and Thoracic Surgery (SEPAR), Spain

**Introduction:** Autotitrating continuous positive airway pressure (auto-CPAP) at home have been validated against polysomnography titration in hospital. A previous study suggested that although a 1-day trial was sufficient to determine the CPAP pressure requirement, but not cost-effective and had a high rate of failure, especially because monitoring oximetry considerably increased the cost. The primary outcome was whether the autoCPAP titration parameters for the first night differed from that of following nights and trying to validate like abbreviated titration.

**Materials and methods:** We evaluated retrospectively 253 random records of auto-CPAP without pulse oximetry (REMstar Auto Series M501, Respiromics Inc.) between June, 2008 to November, 2012. Were selected those records of 3 or 4 nights with at least 4 h/day adherence. Were analyzed the mean pressure 90% (MP90%), mean pressure (MP), residual apnea-hipopnea index (residual AHI) and air leak (AL) and then compared this variables with those obtained during the first night. We used a commercial statistical package (SPSS Statistics v.17.0, SPSS Inc., Chicago, IL, USA) and considered significant a chi-squared test ( $p < 0.05$ ).

**Results:** A total of 160 studies met inclusion criteria (130 men and 30 women). The age average was 60 years old (63 for women and 60 for men). For 3 or 4 nights titration MP90% average was 11.02 (+/- 2.81) cm H<sub>2</sub>O, MP 8.24 (2.16) cm H<sub>2</sub>O, residual AHI 4.99 events/h and AL 34.79 liters per minute. During the first night MP90% average was 11.21 (+/- 3.24) cm H<sub>2</sub>O, MP 8.33 (+/- 2.43) cm H<sub>2</sub>O, residual AHI 5.23 events/h and AL 35.31 l/min. Statistically significant association was observed ( $p < 0.05$ ) for MP90%, MP and residual AHI comparing values for 3 or 4 nights titration regarding those obtained during the first night. 211 records (80.54%) of 253 had a valid titration during the first night.

**Conclusion:** There was not significant differences between auto-CPAP titration without pulse oximetry during 3 or 4 nights versus titration obtained during the first night. About 20% studies of single night auto-CPAP titration would be repeated for invalid registration, an assumable disadvantage because a shorter time study could be increase the availability of devices and resources management in Sleep-Disordered Breathing Units.

**Acknowledgements:** We thank to OXIGEN salud S.A. for invaluable technical assistance in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.705>

### EEG newborn 60 min vs. 30 min

O. Urdanibia<sup>1</sup>, H. Otsubo<sup>2</sup>, M. Diaz<sup>1</sup>, O. Ciopat<sup>1</sup>, M. Blasco<sup>3</sup>, E. Gómez<sup>3</sup>

<sup>1</sup> Hospital Universitario La Fe, Spain

<sup>2</sup> Sick Kids Hospital, Spain

<sup>3</sup> Hospital La Fe, Spain

**Introduction:** Electroencephalography (EEG) has been widely used in the neonatal intensive care units (NICU) for assessment and monitoring of brain function in preterm and term babies. The most common indications are the diagnosis of epileptic seizures or other kinds of events, assessment of brain maturity, and recovery/prognosis from hypoxic-ischemic events. EEG recording techniques have dramatically improved, but there is still a lot to understand and to do. The aim of this poster is to determine the occurrence of quiet sleep in the NICU during 1 h EEG recording. To determine the occurrence of quiet sleep in EEG in the NICU as well as the factors which influence its appearance and recognition the need of 1 h instead of half hour recording EEG.

**Materials and methods:** A prospective review was conducted of all newborn patients who were admitted or transferred to the NICU from February 2013 to April 2013 (35 patients) with an unexplained decrease in level of consciousness or no overt clinical seizures.

**Results:** Thirty out of 35 patients who met the criteria for inclusion in the study were found to have quiet sleep. A part of the group (16/35) had quiet sleep in the first half hour. Most of them (14/16) without touching or nurse assistance during the recording. The largest group of patients (18/35) did not have quiet sleep in the first half hour due to electrode problems, nurse assistance or ambient/surrounding disturbances. And 5/35 did not fall asleep in the recording. In this last group, (13/18), had quiet sleep in the half hour left, when the ambient problems stopped it. A small group of patients (5/18) had many arousals due to intrinsic reasons, such as neurological or metabolic conditions. In the smallest sample group (1/35) we were not able to tell the difference between the awake state and the quiet sleep due to prematurity of the brain/severe encephalopathy. In the remainder, the variability of do not have quiet sleep in the first 30 min included: Tech's manipulation (39%), nurses (28%), epilepsy-related seizure (5%), and others (22%).

**Conclusion:** Quiet sleep is an environment and process related. Almost half of the patients were not having quiet sleep due to extrinsic factors. This report highlights the importance of paying close attention to the tech and the timing of the recording in order to guarantee that we have quiet sleep in the NICU patients.

**Acknowledgement:** To Sick Kids Hospital and Hospital Universitarío La Fe.

<http://dx.doi.org/10.1016/j.sleep.2013.11.706>

### **Obstructive sleep apnea–hypopnea syndrome exacerbates the pulmonary hypertension?**

T. Ustyan<sup>1</sup>, G. Podosyan<sup>2</sup>, A. Matevosyan<sup>3</sup>, P. Zelveian<sup>2</sup>

<sup>1</sup>Center of Preventive Cardiology, Yerevan, Armenia

<sup>2</sup>Center of Preventive Cardiology, National Institute of Health, Yerevan, Armenia

<sup>3</sup>Sleep Research Laboratory at the Center of Preventive Cardiology, Armenia

**Introduction:** Obstructive sleep apnea–hypopnea syndrome (OSAHS) is a known cardiovascular risk factor. Previous echocardiographic studies have investigated the structural abnormalities relationship with OSAHS severity. The aim of present study has to evaluate the possible relationship between pulmonary artery acceleration time and apnea–hypopnea index (AHI).

**Materials and methods:** Twenty-two patients with known OSAHS were evaluated in “Sleep Research Laboratory” at the “Center of Preventive Cardiology”. We used overnight polysomnographic examination by “Embla N7000” and data were analysed by “Somnologica 4.0” software. Pulmonary artery acceleration time (PAAT) was measured using pulsed-wave Doppler imaging (“Sonos 5500”). Statistical comparisons of continuous data were made using a Pearson correlation test. Statistical analyses were performed by SPSS v17.0 software. Estimated values are presented as mean and standard deviation (SD).  $P < 0.05$  was considered as statistically significant.

**Results:** The patients mean age was 44.4 (13.3) years (between 18 and 71 years), their body mass index was 35.7 (7.4) kg/m<sup>2</sup>, mean systolic blood pressure – 140 (22.9) and mean diastolic blood pressure – 88.2 (13.8) mmHg. We found statistically significant negative correlations between AHI and PAAT parameters ( $R = -0.449$ ;  $p = 0.04$ ).

**Conclusion:** In our sample decreasing the pulmonary artery acceleration time has a significant inverse association with apnea–hypopnea index; we can assume that the severity of OSAHS exacerbates the pulmonary hypertension.

**Acknowledgement:** Ani Aleksanyan echocardiologist of Center of Preventive Cardiology.

<http://dx.doi.org/10.1016/j.sleep.2013.11.707>

### **Measuring attention deficit with dass test in children with obstructive sleep apnea**

H. Vaher<sup>1</sup>, R. Vaikjärv<sup>2</sup>, M. Veldi<sup>1</sup>, P. Kasenõmm<sup>2</sup>, V. Vasar<sup>3</sup>

<sup>1</sup>Ear Clinic of Tartu University, Psychiatry Clinic of Tartu University, Estonia

<sup>2</sup>Ear Clinic of Tartu University, Estonia

<sup>3</sup>Psychiatry Clinic of Tartu University, Estonia

**Introduction: Objective:** To investigate the relationship between attention deficit and obstructive sleep apnea (OSA). We hypothesized that the severity of obstructive sleep apnea (OSA) correlates positively with negative DASS (Divided Attention Steering Simulation) test scores, which is a measure of attention ability.

**Materials and methods:** Methods: DASS tests were administered to 16 children with OSA symptoms and 16 children symptom free. Both groups were similar in age, gender, and body mass index (BMI). Polysomnography testing was given to both groups. OSA measures were: apnea hypopnea index (AHI), mean oxygen desaturation (SpO<sub>2</sub>), lowest mean SpO<sub>2</sub>. Attention deficit measures were DASS test scores: mean response time, off-road events per hours, failed responses.

**Results:** Results: 18 boys and 14 girls participated in the study. The mean age of the study group and control group was 10.3 years, the mean BMI was 20.1 for the study group and 19.9 for controls. For the OSA symptom group: AHI was 2.2 (95% CI 1.9–2.5), mean lowest SpO<sub>2</sub> and lowest SpO<sub>2</sub> were 97.4% and 90.6 % (95% CI 89.5–91.7); for the DASS testing the average response time was 2.2 s, off road events per hour 75.6, failed responses 13.2. For the control group: AHI was 0.8 (95% CI 0.6–1.0); mean lowest SpO<sub>2</sub> and lowest SpO<sub>2</sub> were 98.0% and 96.4% (95% CI 96.0–96.9); for the DASS testing the average response time was 1.4 s, off-road events per hour 10.1; failed responses 1.9. AHI value increase per 1 unit produced the increase of average response time of 0.44 units ( $p < .0001$ ). The increase in AHI value was significantly related also to the number of off-road events ( $p < .0014$ ) and to failed responses ( $p < .0001$ ). Decrease in lowest mean SpO<sub>2</sub> leads to increase in average reaction time ( $p < .0002$ ;  $p < .0001$ ). There was also an increase in off road events when AHI was higher ( $p = .0014$ ), also decrease in lowest mean SpO<sub>2</sub> resulted in higher number of off-road events ( $p < .0074$ ). Higher AHI with lower mean SpO<sub>2</sub> and mean lower SpO<sub>2</sub> led to more failed responses during the DASS test ( $p < .0001$ ;  $p < .0005$ ;  $p < .0001$ ).

**Conclusion:** Conclusion: The severity of sleep disordered breathing is related to worse outcomes of DASS testing in case of OSA. DASS test can be used as a diagnostic instrument to measure OSA-related attention deficit problems in children.

**Acknowledgements:** The authors would like to thank all the participants in this study as well as Pille Kool for her work regarding analyzing the data and our dedicated Sleep Laboratory personnel of Tartu University Ear Clinic.

<http://dx.doi.org/10.1016/j.sleep.2013.11.708>

### **Chiari malformation and central sleep apnea: successful therapy with adaptive pressure support servo-ventilation**

J. Vale, E. Silva, I. Gil, A. Sanchez, C. Marques, A. Simões Torres  
Centro Hospitalar Tondela-Viseu, Portugal

**Introduction:** The Chiari malformation type I (CM-I) has been associated with sleep breathing disorders, especially central sleep apnea.

**Materials and methods:** Case report.

**Results:** A 44 years-old female with CM-I was referred to our Sleep Unit for evaluation of sleep apnea, after being submitted to decompressive surgery three years before. Arterial blood gas analysis showed mild hypercapnia. Polysomnography (PSG) showed a respiratory disturbance index (RDI) of 108/h and a CT90 of 27.6% and all events were central. The patient started treatment with adaptive

servoventilation (ASV) and the PSG after ASV showed resolution of the central events (RDI = 4.8/h; CT90 = 1.4%).

**Conclusion:** We demonstrate the effectiveness of servoventilation upon resolving central sleep apnea associated with CM-I, on a patient previously submitted to surgery.

**Acknowledgement:** Workers and managers of the Sleep Unit.

<http://dx.doi.org/10.1016/j.sleep.2013.11.709>

### The impact of obstructive sleep apnea in diabetes mellitus

J. Vale, P. Manuel, A. Oliveira, I. Gil, E. Nascimento, A. Sanchez  
Centro Hospitalar Tondela-Viseu, Portugal

**Introduction:** There is convincing evidence that obstructive sleep apnea (OSA) is highly associated with impaired glucose metabolism, independently of obesity. The effect of OSA in glucose metabolism could be exerted via intermittent hypoxia, sleep fragmentation and sleep deprivation. Our objectives were analyze the prevalence of OSA in type 1 and type 2 diabetes mellitus (DM) and evaluate the influence of OSA on glycemic control.

**Materials and methods:** The adult patients with diabetes mellitus (DM) followed in the department of internal medicine were referred to our Sleep Unit. A home respiratory polygraphy was then performed in all patients with body mass index (BMI) <40 kg/m<sup>2</sup>. The glycemic control was assessed by the value of glyated hemoglobin (HbA1c) in the previous 3 months.

**Results:** A total of 46 patients were studied (20 men and 26 women), The mean age was 51±15 years and mean BMI was 28.7 ± 4.5 kg/m<sup>2</sup>. The mean HbA1c was 8.2 ± 1.2 and the mean ESS score was 7.8 ± 4.5. Twenty-four patients had type 2 DM and 22 patients had type 1 DM. Twenty-eight patients (60.9%) had OSA and 6.5% had severe OSA (AHI > 30/h). The mean CT90 was 5.3 ± 12.5 and the mean AHI was 13.3 ± 12.5. The mean AHI was similar between type 1 and type 2 DM (15.3 ± 5.3 vs 11.6 ± 1.8; *p* = 0.52). There was no difference in the mean AHI and CT90 between obese and non obese patients. The AHI was not correlated with the BMI. Type 2 DM patients with poorer glycemic control (HbA1c > 7.5%) have an higher mean AHI (14.5 ± 2.5 vs. 7.4 ± 1.8; *p* = 0.032).

**Conclusion:** The prevalence of OSA in type 1 DM was similar to that founded in type 2 DM. The prevalence of OSA in our small size sample seems to be independent of the presence of obesity. A poor glycemic control was associated with more severe OSA in type 2 DM.

**Acknowledgement:** Workers and managers of the Sleep Unit and of the Diabetes Unit of Hospital Center Tondela-Viseu.

<http://dx.doi.org/10.1016/j.sleep.2013.11.710>

### Stop-bang questionnaire is a good test in discriminating OSA in obese women but not in men

M. Valencia-Flores<sup>1</sup>, V. Santiago-Ayala<sup>2</sup>, M. Resendiz-García<sup>2</sup>, V. Castaño-Meneses<sup>2</sup>, A. Mendoza-Pacheco<sup>2</sup>, G. García-Ramos<sup>3</sup>

<sup>1</sup> Clínica de Trastornos del Dormir, INCMNSZ-UNAM, Mexico

<sup>2</sup> INCMNSZ, Mexico

<sup>3</sup> Departamento de Neurología, INCMNSZ, Mexico

**Introduction:** Recently, the STOP-Bang (SB) questionnaire was identified as a clinical screening tool for Obstructive Sleep Apnea (OSA) easy to use, and having a favorable diagnostic odds ratio, making it suitable for predicting severe OSA in the preoperative setting. OSA is considered a significant risk factor for perioperative morbidity and mortality. Our study explores the diagnostic test

characteristics of SB against PSG in obese subjects, as it is recognized that obese are always at higher risk for surgical complications.

**Materials and methods:** Patients were recruited from the Sleep Clinic at INCMNSZ in Mexico City. The study was approved by the local ethics committee. To be included in the study, patients had to have a BMI ≥ 30 kg/m<sup>2</sup> and to give their informed consent. Patients (*n* = 214, Women = 134, men = 80), BMI women = 49.0 ± 8.9, Men = 47.6 ± 12.5; age women = 40.0 ± 11.5, men = 38.3 ± 12.5 were studied on two PSG consecutive nights. SB questionnaire was applied the night before first PSG. An AHI ≥ 5 was considered positive diagnostic of OSA on PSG. We use Receiver operating characteristic curve (ROC) analysis to assess the diagnostic accuracy of the SB. We performed the ROC analysis by sex to see whether there were differences in accuracy.

**Results:** The diagnostic test's discriminatory power at a cutoff of ≥3 for men, and for women at ≥2 cutoff were: Men, Area under the ROC Curve = 0.755, Standard Error = 0.06, *p* = 0.003, 95% CI = 0.640–0.870; Women, Area under the ROC Curve = 0.664, Standard error = 0.06, *p* = 0.003, 95% CI = 0.556–0.772. Sensitivity for Men = 0.909, Specificity = 0.857, FPR (1-Specificity) = 0.143, FNR (1-sensitivity) = 0.091; Sensitivity for Women = 0.990, Specificity = 0.842, FPR (1-Specificity) = 0.158, FNR (1-sensitivity) = 0.01. The diagnostic odds ratio (DOR) which combines data on sensitivity and specificity to give an indication of a test's ability to rule in or rule out OSA condition were for Women = 17.9, for Men = 1.67.

**Conclusion:** Stop-Bang questionnaire in obese patients seems to be a good test in discriminating OSA in obese women but with no value in prediction in obese men, as DOR value was <2.

**Acknowledgement:** This work was supported by PAPIIT IN209109 and CONACYT-46257-H.

<http://dx.doi.org/10.1016/j.sleep.2013.11.711>

### Influence of the obstructive sleep apnea treatment in the glaucoma control

M. Moussalli<sup>1</sup>, J. Bekerman<sup>1</sup>, C. Cuello Oderiz<sup>1,2</sup>, S. Valiensi<sup>2</sup>

<sup>1</sup> Glaucoma Service Hospital Italiano, Buenos Aires <sup>2</sup> Ophthalmology Service Hospital Italiano, Hospital Italiano Buenos Aires Argentina, Argentina

<sup>2</sup> Servicio de Neurología del Hospital Italiano, Argentina

**Introduction:** The information of the relationship between the obstructive Sleep Apnea Syndrome treatment (OSAS) with glaucoma and the importance of the approach to treatment of both together, is limited. Purpose: Formulate the association of Obstructive Sleep Apnea Syndrome (OSAS) and Glaucoma, through the presentation of a clinical case.

**Materials and methods:** A retrospective study in 41 patients with Glaucoma and OSAS was held over two years in joint management with Ophthalmology and Sleep Neurology Service. The patients were controlled with applanation tonometry, Photo of the optic disc, Gonioscopy, Computerized Visual field, Optic disk OCT, in spite of the medical glaucoma treatment, there was Visual Field and RNFL defects progress. At the clinical control of the cardiovascular risk factors, OSAS was diagnosed by Polisomnography. A sample case of a male patient of 62 years of age with open angle glaucoma of 8 years of evolution under treatment with Timolol and Bimatoprost and 14 mmHg Intraocular Pressure) IOP with progression on the defects of the Visual Field and OCT will be discussed as an example. (became worse) Distant visual acuity with correction (sph + 2) was 20/20 in both eyes until December 2012 lowered to 20/25 in both eyes (macular epiretinal membrane was detected). Slit Lamp Biomicroscopy

without any peculiarities (was normal). Both eyes with open angle and some mesodermal remnants at the trabecular meshwork at the gonioscopy. A Polisomnography for OSAS was performed successfully.

**Results:** The target IOP < 11 mmHg reached in all the control with Timolol and Dorzolamide and Bimatoprost (not advised in OSAS Brimonidine and had used without good tolerance when it was referred to). The patients began treatment with an air generator (CPAP) during the night well tolerated (something very difficult to achieve), stabilizing the visual fields (until December 2012) and RNFL OCT. In our series (n 41), the average age was 62.5, 39% did not know that they suffered from glaucoma and 56% did not know they had OSAS. The 35.8% patients had glaucoma associated with Plateau Iris, the 23% Pseudoexfoliation Glaucoma, 20.5% Open-angle glaucoma, 12.8% Low tension Glaucoma and 7.7% Primary angle-closure glaucoma. The OSA Index, was mild to moderate.

**Conclusion:** In OSAS there's an alteration of the optic nerve irrigation which is of great importance for the development and progression of the glaucoma. Most of our population don't know Glaucoma-apnea Association. In a high percentage on the apnea/hypopnea Index, was mild to moderate. That is why the emphasis must be put on its treatment. In the same way, in patients with OSAS, the focus must be on detection of glaucoma, as the prevalence in this group is higher, especially associated with Plateau Iris. Our results are different from literature reviewed. We must work in an interdisciplinary team with physicians in Neurology and Pneumology to improve and/or stop the progression in these patients. Very low IOP Target is recommend for this group.

**Acknowledgement:** Carolina Cuello Ortiz.

<http://dx.doi.org/10.1016/j.sleep.2013.11.712>

### Polysomnographic characteristics of sleep in old age patients

S. Valiensi<sup>1</sup>, S. Maggi<sup>1</sup>, P. Leon<sup>1</sup>, E. Cristiano<sup>1</sup>, C. Lucero<sup>2</sup>

<sup>1</sup> Hospital Italiano de Buenos Aires, Hospital Privado de Córdoba, Argentina

<sup>2</sup> Hospital Privado de Cordoba Argentina, Argentina

**Introduction:** Sleep disorders increase and change with age. However, these are insufficiently researched and in some cases ignored. **Objective:** To describe the polysomnographic (PSG) findings in patients over 65 years old, analyzing and comparing these findings in different age groups (G) between them.

**Materials and methods:** Descriptive study analyzing the information of polysomnographic studies during a 6 h night of registry total sleep time (TTR) in the Hospital Italiano de Buenos Aires, Argentina, on a population over 65 years old between June 1, 2011 and December 30, 2012. The following variables were taken into consideration: age, BMI (body mass index), scoring on the Epworth scale, and variables related to sleep (sleep onset latency (SOL), stage REM latency, sleep efficiency, % sleep time of REM and apnea hypopnea index/h: AHI). In order to analyze it, the population was divided into: G1 (ages 65–70), G2 (ages 71–75), G3 (ages 76–80) and G4 (ages > 80) comparing the results obtained from the four groups. **Statistical Analysis:** The information from the general series and the inter-group differences were analyzed. The continuous variables were expressed with M (media), SD. The “M” difference between groups was done through ANOVA. The nominal variables were expressed as a percentage. A  $p < 0.05$  was considered to be significant. The information was analyzed with the Stat View statistic program.

**Results:** The PSG records on 551 patients over 65 years old were analyzed, 54.4% (300) were male. 45% (253) between the ages of 65–70 (G1), 25% (138) between 71–75 (G2), 17% (93) between

76–80 (G3) and 13% (67) over 80 years old (G4). The 64 had less BMI than G1 and G2. The G4 had less BMI than G1 and G2 ( $27.48 \pm 0.73$  vs.  $29.70 \pm 0.39$ ;  $p = 0.007$  and  $27.48 \pm 0.73$  vs.  $29.31 \pm 0.50$ ;  $p = 0.04$ , respectively). Regarding the PSG characteristics, G4 had more AHI than G1 ( $20.63 \pm 3.40$  vs.  $13.24 \pm 0.97$ ;  $p = 0.005$ ), not showing differences between the rest of the groups. G3 showed a higher SOL than G1 ( $36.92 \pm 4.24$  vs.  $27.88 \pm 2.39$   $p = 0.04$ ) and higher stage REM latency than G1 and G2 ( $161.76 \pm 9.17$  vs.  $140.31 \pm 5.22$ ,  $p = 0.03$  and  $161.76 \pm 9.17$  vs.  $137.87 \pm 6.45$ ;  $p = 0.03$ , respectively). Significant differences in the analyzed variables were not observed.

**Conclusion:** The information displayed that AHI increased with age, and not with BMI. As years have passed, the SOL has increased on patients over 76 years old but not on patients over 80 years old. Future studies will help confirm these findings. This is the first study in Latin America which analyses this type of variables in the elderly.

**Acknowledgement:** MD. Cecilia Lucero for statistic analysis and Andres Alvez for teacher English.

<http://dx.doi.org/10.1016/j.sleep.2013.11.713>

### Quality of life and sleep disorders in elderly

C. Ribeiro Do Valle<sup>1</sup>, E. Valle<sup>2</sup>, L. Valle<sup>2</sup>, C. Alves Fior<sup>1</sup>

<sup>1</sup> Pontific Catholic University – Poços de Caldas, Department of Psychology, Brazil

<sup>2</sup> Interclinica Ribeiro do Valle, Neurology, Brazil

**Introduction:** There has been an increase in life expectancy worldwide, followed by an improvement in technological and scientific knowledge. In this way, it is important to associate Aging with quality of life that is defined by several factors which includes good sleep condition. The aims of this study were to compare quality of life in the elderly with or without Sleep Disorders in Brazilian community.

**Materials and methods:** This is an exploratory and descriptive study with characteristics quantitative and qualitative. We evaluated 41 subjects that accepted to participate in this survey in the city of Poços de Caldas, Brazil. All participants filled out these questionnaires: World Health Organization Quality of Life (WHOQOL) (WHOQOL-OLD and WHOQOL-BREF), Epworth Somnolence Scale (ESS) and Pittsburgh Sleep Quality Index (PSQI). All data were studied by statistical analysis. All participants were fully informed about the study and informed consent was obtained from each patient. The study followed in compliance with the Declaration of Helsinki.

**Results:** The mean age was 71 years old (SD  $\pm 7.8$ ). 85% were female and 15% were male. For analysis, patients were divided in two groups: with Sleep Disorders and without Sleep Disorders. Statistical differences were founded between the groups. Sleep Disorders group reported poor quality of life, as evidenced by WHOQOL-BREF in physical, psychological, social relationship, environment and general quality of life. On the other hand, on WHOQOL-OLD the 2 groups have no statistical differences. The data demonstrated that people who have poor results in sleep quality have a worse quality of life.

**Conclusion:** The research showed an association between quality of life and quality of sleep. Sleep health is extremely important to a better quality of life. It is necessary to improve prevention and education activities about Sleep Disorders to promote a better quality of life in Aging.

**Acknowledgement:** The authors would like to thank all participants of this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.714>

### Stress and sleep disorders in teachers – A Brazilian study

L. Ribeiro Do Valle<sup>1</sup>, C. Ribeiro Do Valle<sup>2</sup>, E. Valle<sup>3</sup>, S. Malvezzi<sup>1</sup>, R. Reimão<sup>4</sup>

<sup>1</sup>University of São Paulo, Department of Work and Social Psychology, Brazil

<sup>2</sup>Interclinica Ribeiro do Valle, Psychology, Brazil

<sup>3</sup>Interclinica Ribeiro do Valle, Department of Neurology, Brazil

<sup>4</sup>Sleep Medicine Advanced Research Group, Hospital das Clinicas, University of São Paulo, Department of Neurology, Brazil

**Introduction:** Work is a resource of social integration for it favors both personal development in society and brings about other important benefits, but under intense tensions it may produce mental, somatic and social disruptions as well as stress. Stress interferes in performance, in social relationships and sleep. The balance between work daily activities and sleep is an essential condition for mental health, and as such deserves proper care chiefly when the worker is in charge of children education as it occurs with teachers. The objective of this research is to investigate the relationship between the development of symptoms of stress and the quality of teachers' sleep.

**Materials and methods:** The population here under scrutiny was the public schools teachers of Poços de Caldas. It was aimed at searching the rates of stress and the latter's correlation with Brazilian occupational standards. That aim was accomplished in a population of 165 teachers, through the means of ISS-LIPP, PSQI-BR and QFEP, in order to identify and understand the impact of stress in teachers' health and the quality of their sleep.

**Results:** The findings revealed that 59% of the teachers are stressed, being the majority at the resistance phase (39%) and a large amount of them under the prevalence of psychological stress. Moreover, they disclosed that 46.7% of the teachers sleep badly, pointing out undeniable association between sleep and both physical and psychological stress. Women, as the prevailing subgroup of the studied population (88.5%), presented more physical stress than men ( $p = 0,015$ ).

**Conclusion:** The conclusion of this study also disclosed the call for further developments in the investigation of teachers' stress as a means for the prevention of social disruptions, disturbances in teacher's mental health as well as in quality of their lives.

**Acknowledgement:** The authors thank Clara Hisae for her kind assistance in recruiting subjects for the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.715>

### Sleep disorders in children – A Brazilian study

E. Valle<sup>1</sup>, C. Ribeiro Do Valle<sup>1</sup>, L. Ribeiro Do Valle<sup>1</sup>, R. Reimão<sup>2</sup>

<sup>1</sup>Interclinica Ribeiro do Valle, Neurology, Brazil

<sup>2</sup>Sleep Medicine Advanced Research Group, Hospital das Clinicas, University of São Paulo School Medicine, Department of Neurology, Brazil

**Introduction:** Sleep is a physiological process which is very important in childrens development. It is during sleep that the proteins are synthesized to maintain or expand neural networks linked to memory and learning. Sleep Disorders (SD) affect the process of sleep and interfere with learning, neural plasticity and memory consolidation. The objective of the study was to identify sleep complaints in primary schools.

**Materials and methods:** The sleep process in children aged 6 to 9 years in this exploratory and descriptive research was derived from the Reimão-Lefrève Questionnaire (QRL), as responded to by

parents. It studied a population of 258 children in five elementary schools.

**Results:** The results indicated DS related to: movement in excess when sleeping (53%), insomnia (48.4%) somniloquy (talking when sleeping) (39.9%), teeth grinding (36.4%), sleepwalking (22%), nightmares (47.6%), snoring (24.8%), and nocturnal enuresis (6.5%). Large number of students do not awaken spontaneously (57.3%) and if it were not necessary to wake up to go to school, they would sleep later every day (37.9%).

**Conclusion:** According to the results, many children exhibit symptoms of SD observed by parents. In this sample of primary schools there was significant presence of sleep complaints suggesting a probable impairment in sleep quality. The SD should be diagnosed and treated early, in order to minimize the impact on the growth and development of this population. Research on DS in elementary school students needs to be developed as preventive care.

**Acknowledgement:** The authors would like to thank all the children and their parents who participated in this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.716>

### Blood pressure monitoring in restless legs syndrome (Willis-Ekbom disease) patients

E. Valle<sup>1</sup>, M. Valle<sup>2</sup>, L. Valle<sup>3</sup>, R. Reimão<sup>1</sup>

<sup>1</sup>Sleep Medicine Advanced Research Group, Hospital das Clinicas, University of São Paulo School Medicine, Department of Neurology, Brazil

<sup>2</sup>Interclinica Ribeiro do Valle, Cardiology, Brazil

<sup>3</sup>Sleep Medicine Advanced Research Group, Hospital das Clinicas, University of São Paulo School Medici, Psychology, Brazil

**Introduction:** Restless Legs Syndrome (RLS) patients frequently report symptoms like insomnia, fragmentation of sleep and also complain of paresthesia and pain in lower limbs that could be associated with changes in blood pressure (BP). The aim of this study was to determine possible changes in nocturnal blood pressure and risk of developing Hypertension in patients with RLS.

**Materials and methods:** Thirty patients were divided in three groups: Ten patients (age range 40–75 y, median age 65 y; 6 women) with clinical diagnostic of RLS that have full criteria for RLS by International Restless Legs Syndrome Study Group (IRLSSG) without Hypertension (G1); ten patients (age range 29–71 y, median age 58.5 y; 3 women) with Hypertension without RLS (G2) and ten healthy controls (age range 28–58 y, median age 47.5 y; 6 women) (G3). All patients were submitted to a clinical interview and neurological examination. Each subject completed the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS) and Restless Legs Syndrome Rating Scale (RLSRS). All patients were investigated by 24 h Ambulatory Blood Pressure Monitoring (ABPM). RLS patients underwent overnight Polysomnography. Informed consent of all study members was obtained after a full explanation of the survey. The study was approved by ethical committee.

**Results:** The mean age was statistically different by the groups ( $p = 0.03$ ). RLS patients were approximately 14.3 years age older than controls ( $p = 0.027$ ). The correlation of sleep scales and BP shows statistical differences in PSQI scale between the groups ( $p < 0.001$ ). RLS patients demonstrated higher values than G2 ( $p < 0.005$ ) and G3 ( $p < 0.001$ ). The blood pressure values for each group and comparative tests were nocturnal systolic blood pressure ( $109 \pm 11.2$  vs.  $127 \pm 29.5$  vs.  $108 \pm 11.3$  mmhg;  $p = 0.06$ ) and nocturnal diastolic blood pressure ( $65 \pm 4.9$  vs.  $74 \pm 16.5$  vs.  $65 \pm 9.1$  mmhg;  $p = 0.11$ ). The blood pressure values were statistically similar among the variables studied for age, gender, BMI and

quality of sleep ( $p > 0.05$ ). Possible relationship between RLSRS and BP were also investigated. There is no statistical significance between RLSRS and BP during sleep time ( $p > 0.05$ ). The mean of PLMS index was 33.8/h.

**Conclusion:** Although many studies have shown the relationship of RLS/PLMS and cardiovascular disease, no significant changes on blood pressures were evidenced in RLS patients in one night measure of 24 h blood pressure monitoring.

**Acknowledgements:** The work was performed at Interclinica Ribeiro do Valle – Poços de Caldas, Brazil. The authors would like to thank all members of Sleep Medicine Advanced Research Group.

<http://dx.doi.org/10.1016/j.sleep.2013.11.717>

### Increase in rem sleep following trauma exposure

W. Vanderheyden, L. Urpa, G. Poe

University of Michigan, Department of Anesthesiology, United States

**Introduction:** Post-Traumatic Stress Disorder (PTSD) in humans often presents with sleep abnormalities such as sleep fragmentation and increased nightmares. These sleep disturbances are generalized across populations of patients with PTSD, however, the electrophysiological properties of these disturbances are less well characterized. The mechanisms regulating the interactions of traumatic stress and sleep are poorly understood and it remains unclear if sleep is playing a role in the acquisition of PTSD. In an effort to clarify this, we have utilized the validated rodent model of PTSD called Single Prolonged Stress (SPS), to assess sleep alterations in response to stress. We hypothesize that stress exposure may induce changes in sleep physiology that enhances the acquisition of PTSD.

**Materials and methods:** Male, Sprague Dawley rats (~300 g) were implanted with hippocampal and cortical EEG leads along with neck EMG electrodes for recording sleep behavior. After 10 days of recovery, all animals were acclimated to a recording apparatus. After acclimation, 24 h of baseline EEG/EMG activity was recorded. The following day, animals underwent SPS treatment beginning at ZTO. SPS consists of 2 h of physical restraint, 20 min forced swim, and ether exposure. Subsequent EEG/EMG activity was recorded for another 24 h. Sleep changes between the baseline day and the SPS day were compared. Home cage controls were analyzed similarly to ensure the sleep phenotypes observed were due to SPS and not an outside factor.

**Results:** On the SPS treatment day, time spent in REM sleep during the quiescent phase of the day (during the light) remained unchanged between the control (13.6%) and SPS (13.2%) treated animals. However, time spent in REM sleep during the active phase (during the dark) increased from 3.7% to 9.2% following SPS treatment ( $p = 0.04$ ). Interestingly, neither waking nor slow wave sleep were altered over the combined 24 h period. Home cage controls did not exhibit any alteration in sleep between the two days of recording.

**Conclusion:** Exposure to uncontrolled stress alters electrophysiological properties of REM sleep which may account for the long term physiological and behavioral impairments that these animals display. Future study will determine how long such sleep abnormalities persist and whether manipulations that interrupt the increase in REM discussed here will protect against the long lasting alterations in PTSD.

**Acknowledgements:** We would like to thank everyone from the Liberzon lab for their support. This study was funded by NIH-MH60670 and by the Department of Anesthesiology at the University of Michigan.

<http://dx.doi.org/10.1016/j.sleep.2013.11.718>

### The sleep registry. An international online survey and cognitive test assessment tool and database for multivariate sleep and insomnia phenotyping

J. Benjamins<sup>1</sup>, F. Migliorati<sup>2</sup>, K. Dekker<sup>1</sup>, R. Wassing<sup>1</sup>, S. Moens<sup>1</sup>, E. Van Someren<sup>1</sup>, L. Hartescu<sup>1,2</sup>, J. Itzhacki<sup>1,2</sup>, T. Pinto<sup>1,2</sup>, N. Tesler<sup>1,2</sup>, J. Perrier<sup>1,2</sup>, C. Garbaza<sup>1,2</sup>, M. Jarkiewicz<sup>1,2</sup>

<sup>1</sup>Netherlands Institute for Neuroscience, Dept Sleep & Cognition, The Netherlands

<sup>2</sup>Netherlands Institute for Neuroscience, The Social Brain Lab, The Netherlands

**Introduction:** Insomnia as a complaint is a complex, heterogeneous condition. It can be a symptom of medical, psychiatric, or substance abuse disorders or it can be a condition on its own. Even in the latter case, there appears to be considerable variability in complaints and patient characteristics. This heterogeneity makes progress in our understanding of insomnia difficult. A first logical step would be to determine well-defined insomnia subtypes and subsequently unravel the brain mechanisms underlying insomnia complaints in these homogenous subtypes. The need to determine these subtypes, and obtain a large sample to be able to do so, has been recognized by several researchers before (e.g. Edinger et al., 1996; Van Someren et al., 2009; Vgontzas et al., 2012; Roenneberg, 2013).

**Materials and methods:** Internet technology has profoundly changed survey methodology and moreover makes web-based cognitive performance testing possible. Freeware implementations of these technologies have been combined in the Sleep Registry ([www.sleepregistry.org](http://www.sleepregistry.org)) to obtain multiple descriptive, subjective and performance parameters in a huge sample of individuals and families. The multidimensional variable space can be subjected to latent class analysis in order to yield homogeneous subgroups. Given the large amount of measurements that will be done in the Sleep Registry, participants are given the opportunity to fill out their set of questionnaires and computer-based tests voluntarily at their own pace. Feedback on performance is given as reward to promote adherence. The setup of the Sleep Registry site is very modular making it possible for individual labs to add questionnaires and tests, or to initiate parallel sampling using different languages.

**Results:** Currently, around 14.000 people signed up for the Sleep Registry in the Netherlands and filled out between one and 28 modules, where each module contains one or more validated questionnaires. In addition, modules are available to assess the Consensus Sleep Diary (Carney et al., 2012), as well as common tasks including overnight word pair learning, the psychomotor vigilance test (Dinges and Powell, 1985; Basner and Dinges, 2011) and the digit span. Two modules are available for extensive structured diagnosis of sleep disorders as well as somatic, psychiatric and neurological disorders and medication use. The Sleep Registry is now available in Dutch, English, Spanish, Portuguese, German, French, Italian and Polish. Labs can identify their own URL to make sure that they can own the data of their recruited participants, and are free to pool data with colleagues.

**Conclusion:** The Sleep Registry thus provides a useful tool for efficiently and flexibly acquiring large samples of descriptive, subjective and performance measurements to facilitate sleep research and truly start a cooperative Human Sleep Project (Roenneberg, 2013). Labs interested to run their own Sleep Registry and cooperate are welcome: [e.van.someren@nin.knaw.nl](mailto:e.van.someren@nin.knaw.nl) Dinges DF and Powell JW (1985) Microcomputer analyses of performance on a portable, simple visual RT task during sustained attention. *Behav Res Meth Instr Comp* 17:652–655. Edinger JD, Fins AI, Goeke JM, McMillan DK, Gersh TL, Krystal AD and McCall WV (1996) The empirical identification of insomnia subtypes: a cluster analytic approach. *Sleep* 19:398–411. Van Someren EJW, Pollmächer T, Leger D, Espie C, Bassetti C and Riemann D (2009) The European Insomnia Network. *Front Neurosci* 3:436. Basner M and Dinges

DF (2011) Maximizing Sensitivity of the Psychomotor Vigilance Test (PVT) to Sleep Loss. *Sleep* 34:581–591. Carney CE, Buysse DJ, Ancoli-Israel S, Edinger JD, Krystal AD, Lichstein KL and Morin CM (2012) The consensus sleep diary: standardizing prospective sleep self-monitoring. *Sleep* 35:287–302. Vgontzas AN, Fernandez-Mendoza J, Bixler EO, Singareddy R, Shaffer ML, Calhoun SL, Liao D, Basta M and Chrousos GP (2012) Persistent insomnia: the role of objective short sleep duration and mental health. *Sleep* 35:61–68. Roenneberg T (2013) Chronobiology: the human sleep project. *Nature* 498:427–428.

**Acknowledgements:** Supported by the VICI Innovation Grant 453-07-001 of the Netherlands Organization of Scientific Research (NWO); The Hague, the Netherlands; co-funding of the Polish translation by an ENSRL travel grant of the ESRS to Michal Jarkiewicz; co-funding of the English translation by Kevin Morgan, Sleep Research Centre, School of Sport, Exercise and Health Sciences, Loughborough University, Leicestershire LE11 3TU, UK.

<http://dx.doi.org/10.1016/j.sleep.2013.11.719>

### Differential brain structural correlates of insomnia in depression vs. anxiety

D. Stoffers<sup>1</sup>, M. Van Tol<sup>2</sup>, B. Penninx<sup>3</sup>, D. Veltman<sup>4</sup>, N. Van Der Wee<sup>5</sup>, E. Van Someren<sup>6</sup>

<sup>1</sup> Netherlands Institute for Neuroscience, Dept of Sleep & Cognition, The Netherlands

<sup>2</sup> Otto von Guericke University, Leibniz Institute for Neurobiology, The Netherlands

<sup>3</sup> VU University & Medical Center, Dept of Health and Care Sciences, The Netherlands

<sup>4</sup> VU University & Medical Center, Dept of Psychiatry, The Netherlands

<sup>5</sup> Leiden University Medical Center, Dept of Psychiatry, The Netherlands

<sup>6</sup> Netherlands Institute for Neuroscience, Dept of Sleep & Cognition, The Netherlands

**Introduction:** Insomnia is common in many psychiatric disorders (1), especially so in affective disorders like major depressive disorder (MDD) (2) and anxiety disorder (2,3). Insomnia is moreover a cardinal risk factor for the development of MDD (4). Nevertheless, the neural correlates of insomnia complaints in psychiatric patients have hardly been investigated, hampering the development of rational treatment and prevention of these disabling symptoms.

**Materials and methods:** Fifty-nine patients with MDD as well as 61 patients with anxiety disorder filled out the Women's Health Initiative Insomnia Rating Scale (WHIIRS) (5) and underwent structural magnetic resonance imaging of the brain. The WHIIRS is a brief, five-item scale evaluating insomnia symptoms, which yields a summary score that reflects complaints on sleep quality. Whole-brain voxel-based morphometry was used to investigate the association of the WHIIRS summary score with gray matter density.

**Results:** In patients with MDD, the WHIIRS insomnia severity score showed a strong negative correlation with gray matter density in the pulvinar of the thalamus. Gray matter in this area showed no association at all with insomnia severity in patients with anxiety disorder. In contrast, anxiety disorder patients more severe insomnia showed lower frontopolar GM density, an association not found in MDD patients.

**Conclusion:** This is the first study to directly compare structural brain correlates of insomnia severity between MDD and anxiety disorder. Unlike previous voxel-based morphometry findings that indicated particularly orbitofrontal involvement in sleep complaints in both well-sleeping (6) and poorly-sleeping (7) people without

psychiatric disorder, we here found differential involvement of the pulvinar and frontopolar cortex. These triple dissociations have strong implications for our understanding of insomnia; depending on the psychiatric phenotype, remarkably different cerebral mechanisms can underlie seemingly similar subjective sleep complaints. References: 1. Benca RM, Obermeyer WH, Thisted RA, Gillin JC. Sleep and psychiatric disorders. A meta-analysis. *Arch Gen Psychiatry* 1992;49:651–668; discussion 669–670. 2. Tsuno N, Besset A, Ritchie K. Sleep and depression. *J Clin Psychiatry* 2005;66:1254–1269. 3. Soehner AM, Harvey AG. Prevalence and functional consequences of severe insomnia symptoms in mood and anxiety disorders: results from a nationally representative sample. *Sleep* 2012;35:1367–1375. 4. Baglioni C, Battagliese G, Feige B, et al. Insomnia as a predictor of depression: a meta-analytic evaluation of longitudinal epidemiological studies. *J Affect Disord* 2011;135:10–19. 5. Levine DW, Kaplan RM, Kripke DF, Bowen DJ, Naughton MJ, Shumaker SA. Factor structure and measurement invariance of the Women's Health Initiative Insomnia Rating Scale. *Psychol Assess* 2003;15:123–136. 6. Stoffers D, Moens S, Benjamins J, et al. Orbitofrontal gray matter relates to early morning awakening: a neural correlate of insomnia complaints? *Front Neurol* 2012;3:105. 7. Altena E, Vrenken H, Van Der Werf YD, van den Heuvel OA, Van Someren EJ. Reduced orbitofrontal and parietal gray matter in chronic insomnia: a voxel-based morphometric study. *Biol Psychiatry* 2010;67:182–185.

**Acknowledgements:** Supported by the VICI Innovation Grant 453-07-001 of the Netherlands Organization of Scientific Research (NWO); The Hague, The Netherlands.

<http://dx.doi.org/10.1016/j.sleep.2013.11.720>

### Affordable sleep estimates using micro-electro-mechanical-systems (MEMS) accelerometry

B. Te Lindert, E. Van Someren

Netherlands Institute for Neuroscience, Dept of Sleep & Cognition, The Netherlands

**Introduction:** Although more affordable than polysomnography, actigraphic sleep estimates have disadvantages. Brand-specific differences in data reduction impede pooling of data for consortia to create large-scale cohorts, as for genome-wide-association-studies (GWAS). Secondly, online data reduction may not fully exploit movement information. Thirdly, sleep estimate reliability might improve by advanced analyses of tri-axial, linear accelerometry data sampled at a high rate. Such recordings are now feasible using affordable micro-electro-mechanical-systems (MEMS). However, it might take a while before advanced analyses are validated and available. PURPOSE: To provide lab-databases and ongoing studies with backward compatibility when switching from actigraphy to MEMS accelerometry, we designed and validated a method to transform accelerometry data into the traditional actigraphic 'movement counts', thus allowing for the use of validated algorithms to estimate sleep parameters.

**Materials and methods:** Simultaneous duplicate actigraphy and duplicate MEMS-accelerometry was recorded in fifteen healthy adults (23–36 years, 10 M, 5F) during one night spent at home. Actigraphy was recorded as 'movement counts 15-s epoch with two Actiwatches (Cambridge Neurotechnology Ltd., Cambridge, UK and Mini Mitter, Respironics Inc., Bend, OR, USA). MEMS-accelerometry was digitized at 50 Hz with two Geneactivs (ActivInsights Ltd., Kimbolton, UK). Passing-Bablok regression was used to optimize the transformation of MEMS-accelerometry signals to 'movement counts'. Actigraphic 'movement counts' and their MEMS-accelerometry estimates were used to calculate

common sleep parameters. Reliability was evaluated both between and within the traditional actigraphs and MEMS-accelerometers using Bland–Altman plots.

**Results:** Movement counts could be estimated from MEMS-accelerometry with high precision. MEMS-accelerometry had a better reliability than actigraphy; sleep parameter estimate agreement between two MEMS-accelerometers or a MEMS-accelerometer and an actigraph was better than agreement between two actigraphs.

**Conclusion:** The algorithm allows for continuity of outcome parameters in ongoing actigraphy studies that consider switching to the new generation of MEMS-accelerometers. Their affordability and the algorithm with graphical-user-interface we here provide, makes objective sleep estimates in large-scale twin-sibling and GWAS cohort designs feasible. Detailed results as well as instructions to get the free stand-alone Matlab-based interface to convert 3D signal to movement counts and obtain actigraphic sleep estimates are given in: te Lindert BHW and Van Someren EJW (2013) Affordable sleep estimates using micro electro-mechanical systems (MEMS) accelerometry. *Sleep* 36:781–789.

**Acknowledgements:** Supported by: Project NeuroSIPE 10 738, of the Dutch Technology Foundation STW, which is part of the Netherlands Organization for Scientific Research (NWO) and partly funded by the Ministry of Economic Affairs, Agriculture and Innovation; and by the VICI Innovation Grant 453-07-001 of the Netherlands Organization of Scientific Research (NWO); The Hague, the Netherlands.

<http://dx.doi.org/10.1016/j.sleep.2013.11.721>

### The role of central sleep apnea in assessing infants with apparent life-threatening event

K. Escajadillo-Vargas, N. Cuéllar-Ramos, A. Pedera-Mazarro, R. Buenache-Espartosa, M. Villadóniga-Zambrano, A. Lamas-Ferreiro  
*Hospital Ramón y Cajal, Spain*

**Introduction:** Apparent life-threatening event (ALTE) is not a specific diagnosis characterized by a combination of central or obstructive apnea, color change, marked change in muscle tone and choking or gagging; which frightens and requires an intervention from the observer. Gastroesophageal reflux, metabolic abnormalities, arrhythmia and seizures must be studied as a possible underlying condition that explains the ALTE. The aim of this study is to show our experience with video-polysomnography (VPSG) in children with ALTE.

**Materials and methods:** Descriptive study, enrolling all children with ALTE attended at our hospital during the last 4 years. A complete study was performed including VPSG.

**Results:** 27 children were hospitalized from 5 days to 23 months of age. They presented medical history of: premature birth (7), gastroesophageal reflux (1), and idiopathic hypercalcemia (1), malformative syndrome (2), apnea of prematurity (1), and previous ALTE (1). The cardiological study showed patent foramen ovale in 13 patients, with normal cardiological study in the rest of children. In 10 infants (37%) gastroesophageal reflux was confirmed by upper gastrointestinal series, none of them had regurgitation previous history; they received treatment with domperidone and ranitidine. In 20 patients the brain neuroimaging had not significant abnormalities. VPSG was performed in 25 patients, with apnea-hypopnea index (AHI) altered in 21 (84%) cases (AHI:1,2 –70). All patients suffered predominantly central apneas in REM sleep associated with oxygen desaturation. These were not any cases of obstructive apnea or EEG alteration. 19 cases received treatment with caffeine citrate

and 21 required home monitor, which was retired when they normalized VPSG. In evolution, all children improved AHI, except 3 cases that developed a transitory deterioration with eventual normal studies.

**Conclusion:** The VPSG is a useful method for assessing the characteristic, frequency and evolution of infant apnea with ALTE. In our series, central sleep apnea was the main cause of ALTE, probably related with a neuro-maturative process. This technique allows the detection of cardio-respiratory events, pathological disturbance in sleep architecture and abnormal EEG paroxysm. We consider that VPSG must be included in the routine etiological study of ALTE.

**Acknowledgement:** Dres. Quintana, Sáez, Paradinas, Lorenzo y Morillo.

<http://dx.doi.org/10.1016/j.sleep.2013.11.722>

### Prevalence of the upper airway resistance syndrome in the general population

S. Vat<sup>1</sup>, J. Haba-Rubio<sup>1</sup>, D. Andries<sup>1</sup>, N. Tobback<sup>1</sup>, M. Tafti<sup>2</sup>, R. Heinzer<sup>3</sup>

<sup>1</sup>University Hospital (CHUV), Center for Investigation and Research in Sleep (CIRS), Lausanne, Switzerland

<sup>2</sup>University Hospital (CHUV), Center for Investigation and Research in Sleep (CIRS) and Center for Integrative Genomics (CIG), Lausanne, Switzerland

<sup>3</sup>University Hospital (CHUV), Center for Investigation and Research in Sleep (CIRS) and Pulmonary Department, Lausanne, Switzerland

**Introduction: Background:** Upper airway resistance syndrome (UARS) shares common clinical features with obstructive sleep apnea and hypopnea (OSAH). It is characterized by repetitive respiratory effort-related arousal (RERA), which may lead to daytime sleepiness and functional impairment. Little is known about the prevalence of UARS in the general population. **Objectives:** To determine the prevalence of UARS in the general population and to compare its characteristics to matched control subjects without UARS.

**Materials and methods:** 2020 subjects (50.0% women, 57.3 ± 10.7 years old, BMI 25.5 ± 4.3 kg/m<sup>2</sup>) participating in an ongoing population-based sleep cohort study (HypnoLaus, Lausanne, Switzerland) underwent complete polysomnographic recordings at home. Respiratory events were scored according to the AASM Chicago criteria. UARS was present if the RERA index was ≥5/h and accounted for more than 50% of the respiratory disturbance index (RDI), which is defined by the sum of the apnea-hypopnea index (AHI) and RERA index. Characteristics of each subject with confirmed UARS were compared with 5 age and sex matched control subjects with similar AHI but no RERA.

**Results:** The prevalence of UARS was 0.84% of this general population sample. Median AHI and RDI were respectively 4.4/h (IQ range 3.5–6.8/h) and 10.7/h (IQ range 9.1–15.6/h). Mean Epworth Sleepiness Score was 6.6 ± 3.2; male-to-female ratio was 0.7. There were no significant differences between UARS subjects and the control subjects regarding BMI (24.7 ± 3.1 vs. 24.0 ± 3.3, *p* = 0.46) and the Epworth Sleepiness Score (6.6 ± 3.2 vs. 7.4 ± 2.5, *p* = 0.15). Also, the same prevalence of hypertension (29.4 ± 47.0% vs. 25.9 ± 19.7%, *p* = 0.77), diabetes (5.9 ± 24.2% vs. 5.9 ± 11.8%, *p* = 1.0) and metabolic syndrome (29.4 ± 47.0% vs. 12.9 ± 12.1%, *p* = 0.16) were found in UARS and control subjects.

**Conclusion:** In our middle-aged population-based cohort, the prevalence of UARS is lower than previously reported. There was no significant difference between UARS and control subjects in terms of BMI, daytime sleepiness, hypertension, diabetes and metabolic syndrome.

*Acknowledgement:* Funding: Ligue pulmonaire vaudoise, Fondation Leenaards, Fond national Suisse and GSK.

<http://dx.doi.org/10.1016/j.sleep.2013.11.723>

### Screening for sleep-disordered breathing in the general population: predictive performance of four questionnaires

S. Vat<sup>1</sup>, J. Haba-Rubio<sup>1</sup>, D. Andries<sup>1</sup>, N. Tobback<sup>1</sup>, M. Tafti<sup>2</sup>, R. Heinzer<sup>3</sup>

<sup>1</sup> University Hospital (CHUV), Center for Investigation and Research in Sleep (CIRS), Lausanne, Switzerland

<sup>2</sup> University Hospital (CHUV), Center for Investigation and Research in Sleep (CIRS) and Center for Integrative Genomics (CIG), Lausanne, Switzerland

<sup>3</sup> University Hospital (CHUV), Center for Investigation and Research in Sleep (CIRS) and Pulmonary Department, Lausanne, Switzerland

*Introduction: Background:* Several questionnaires have been used to screen for sleep-disordered breathing (SDB). Most of them have been validated in selected clinical populations, and little is known about their predictive performance in the general population.

*Objectives:* To investigate the accuracy of four questionnaires used for SDB screening in the general population: the Berlin Questionnaire (BQ), the Epworth Sleepiness Scale (ESS), the STOP-Bang (SB) and the adjusted-neck circumference (neck+).

*Materials and methods:* 2115 subjects (50.4% women, 58.4 ± 11.0 years old, BMI 26.2 ± 4.4 kg/m<sup>2</sup>) participating in an ongoing population-based sleep cohort study (HypnoLaus, Lausanne, Switzerland) underwent complete polysomnographic recordings at home. Respiratory events were scored according to the AASM 2013 criteria. Prevalence of SDB was determined for apnea-hypopnea index (AHI) thresholds of ≥15 and ≥30. Interviewers administered the BQ and the ESS and calculated SB and neck+. SB includes the following items: snoring, daytime Tiredness, Observed apnea, high blood Pressure, Body-mass index ≥35 kg/m<sup>2</sup>, Age ≥50 yr, Neck girth ≥40 cm, and male Gender. Neck+ is obtained by measuring the neck girth in cm and adding 3 cm for the presence of snoring, 3 cm for observed apnea and 4 cm for high blood pressure. Subjects were considered at increased risk for SDB if BQ is positive in ≥2 categories, ESS score ≥11, SB score ≥3 and neck+ ≥43 cm. Assessment of questionnaire included their sensitivity, specificity, positive-predicted value (PPV) and negative-predicted value (NPV).

*Results:* Prevalence of SDB with AHI thresholds of ≥15 and ≥30 were respectively 36.4% and 15.0%. Percentages of positive BQ was 25.3%, ESS:13.4%, SB: 41.3% and neck+:29.0%. For an AHI ≥ 15, sensitivity, specificity, PPV and NPV were respectively: BQ (39.4%, 82.7%, 56.6% and 70.5%), ESS (13.5%, 86.7%, 35.8% and 64.5%), SB (67.3%, 72.8%, 57.3% and 80.4%) and neck+ (52.3%, 83.8%, 64.0% and 76.1%). For an AHI ≥ 30, sensitivity, specificity, PPV and NPV were respectively: BQ (48.7%, 78.8%, 28.8% and 89.7%), ESS (13.1, 86.6%, 14.2% and 85.4%), SB (81.7%, 65.6%, 28.7% and 95.5%) and neck+ (69.8%, 77.9%, 34.6% and 93.9%).

*Conclusion:* Our population-based study suggests that questionnaires such as BQ, ESS, SB and neck+ could be used to rule out severe SDB considering their strong NPV. However they do not seem suitable to screen for moderate to severe SDB in the general population.

*Acknowledgements:* Funding : Ligue pulmonaire vaudoise, Fondation Leenaards, Fond national Suisse and GSK.

<http://dx.doi.org/10.1016/j.sleep.2013.11.724>

### Melatonin in patients with delayed sleep phase disorder

A. Viegas<sup>1</sup>, S. Rebocho<sup>1</sup>, T. Paiva<sup>2</sup>

<sup>1</sup> CENC – Sleep Medicine Center, Portugal

<sup>2</sup> CENC – Center of Sleep Medicine, Portugal

*Introduction:* Delayed sleep phase disorder (DSPD) is common mainly in adolescents and young adults and has a complex treatment that involves behavioral techniques, phototherapy and melatonin administration. Therapeutic failures and relapses are frequent. Considering the characteristics of circadian rhythms and the fact that their reactivity to a specific therapy depends on the phase that it is administered, it is essential to determine with accuracy the nadir of temperature rhythm or the initiation of melatonin production – DLMO (dim light melatonin onset).

*Materials and methods:* 69 patients aged from 18 to 85 years (41.9 ± 14.8), with DSPD according to AASM 2005 were selected. The measurement of melatonin in saliva samples occurred at 5 consecutive hours (last collection occurred one hour after the usual sleep onset). Melatonin concentration was measured with a radioimmunoassay and DLMO was defined as the time at which the melatonin concentration in saliva reaches 4 pg/ml. All patients underwent polysomnography (PSG) after the saliva collections.

*Results:* DLMO could be determined in 39 patients (56.5%). Failure of DLMO determination was mainly due to profiles with low melatonin values – between 0.5 and 3 pg/mL (26.9%) or profiles where melatonin levels were already above the threshold of 4 pg/mL (17%). In these cases patients may have a wrong perception of sleep onset, or are persistent low melatonin secretors. There were no age differences in the DLMO measurements. The PSG showed a subgroup of patients with polygraphic characteristics of insomnia.

*Conclusion:* DLMO allowed the confirmation of DSPD in 56.5% of patients. It also enabled the identification of patients with behavioral DSPD. Insomnia was present in a patient subgroup.

<http://dx.doi.org/10.1016/j.sleep.2013.11.725>

### Low HLA DQB1 0602 in portuguese narcoleptics

A. Viegas<sup>1</sup>, S. Rebocho<sup>1</sup>, T. Paiva<sup>2</sup>, A. David<sup>3</sup>

<sup>1</sup> CENC – Sleep Medicine Center, Portugal

<sup>2</sup> CENC – Center of Sleep Medicine, Portugal

<sup>3</sup> Centro Hospitalar de Coimbra, Portugal

*Introduction:* Narcolepsy is a rare sleep disorder characterized by episodes of excessive sleepiness. Symptoms such as cataplexy sleep paralysis, REM sleep onset and hypnopompic or hypnagogic hallucinations can also occur. The ICSD-2 classifies this sleep disturbance in several subtypes, namely: Narcolepsy with Cataplexy, Narcolepsy without cataplexy, Narcolepsy due to medical condition and Narcolepsy non-specific. The diagnosis implies the existence of excessive sleepiness with or without cataplexy, and the recording of two SOR-EM's (Sleep Onset Rapid Eye Movement) in the Multiple Sleep Latency Test (MSLT). The symptoms described above should also be considered. In Brazil HLA DQB1\*0602 allele is prevalent in 95% of patients with cataplexy, and has been highlighted in less than 50% of patients without cataplexy (Coelho F., et al., 2010); these data are in line with other international data. In Portugal there are about 47 in every 100 000 inhabitants with Narcolepsy (Ohayon et al., 2002), i.e., similar to other European countries, however HLA DQB1\*0602 prevalence has been found around 60% in Narcolepsy with cataplexy (Viegas et al. 2013). OBJECTIVES The aim of this study was to enlarge the database to other regions of the country in order to better determine the prevalence of HLA DQB1 0602 and HLA DRB1 1501 in cases of Narcolepsy with (NC) and without cataplexy (NnoC).

**Materials and methods:** 183 patients were selected; 117 with cataplexy and 66 without cataplexy. All patients were diagnosed according to standard criteria (ICSD2), using a clinical interview, a cataplexy questionnaire and Type 1 PSG followed by MSLT. HLA typing was performed in officially recognized laboratories. Data were obtained in Center and South Portuguese regions.

**Results:** 54% of the NC are males against 42% of the NnoC. The statistical differences between the 2 groups were: average age of the symptoms onset (24.46 years for NC and 26.81 for NnoC; diagnostic delay took a mean of 16 years for NC while for NnoC it was only 8.29 years. Prevalence of sleep paralysis and hallucinations are statistically different among groups: 44% of the narcoleptic with cataplexy have sleep paralysis against 24.5 of the narcoleptic without cataplexy; 60% of the narcoleptic with cataplexy have hallucinations when compared to 28% of the patients without cataplexy. The mean latency in the MSLT is low for both groups:  $4.11 \pm 2.52$  min for NC and  $4.32 \pm 2.06$  min for NnoC. The patients with cataplexy had an average of  $1.98 \pm 1.51$  SOREMS and those without cataplexy have about  $2.16 \pm 1.057$  SOREMS. The HLA DQB1 0602 was more prevalent in NC: 51% for the NC have HLA DQB10602, while only 31% of the NnoC have this allele. The HLA DRB11501 is prevalent in 42% of the subjects with cataplexy and 25% of those without cataplexy.

**Conclusion:** The low HLA prevalence of DQB1 0602 in NC in our population has so far no clear explanation. It is tempting to assume that the high miscegenation started many centuries ago - it's a possible explanation. In a National study of HLA prevalence clear differences in allele frequency do exist between North, Center and South regions, in spite of the relatively short differences in KM (Spinola et al. 2005). Furthermore these authors propose a marked influence of African and European genes, with African genes more prevalent in South regions. The high prevalence of HLA DQB1 0602 in NC detected in a São Paulo, Brazilian study renders this explanation eventually difficult, taking into account many similarities between both countries. However 2 aspects may be open for discussion: the reduced number of brazilian cases and the possibility that in Brazil there are strong territorial differences. The questions raised by this study deserve further research.

**Acknowledgements:** (1) Ohayon, M.M., Priest R.G., Zulle J., Smirne S., Paiva T. (2002). Prevalence of narcolepsy symptomatology and diagnosis in the European general population. *Neurology*, 58: 1826–1833. (2) Morrish E., King M.A., Smith I.E., Shneerson J.M. (2004). Factors associated with a delay in the diagnosis of narcolepsy. *Sleep Medicine*, 5: 37–41. (3) David A, Constantino F, Santos JM, Paiva T. Health-related quality of life in Portuguese patients with narcolepsy. *Sleep Med*. 2012 Jan 24. (4) Coelho F.M.S, Pradella-Hallinan M., Pedrazzoli M., Soares C.A.S., Fernandes G.B.P., Gonçalves A.L., Tufik S. & Bittencourt L.R.A. (2010). Traditional biomarkers in narcolepsy – experience of a brazilian sleep centre. *Arq Neuropsiquiatr*, 68 (5): 712 – 715. (5) Spínola H, Middleton D, Brehm A. (2005). HLA genes in Portugal inferred from sequence-based typing: in the cross-road between Europe and Africa. *Tissue Antigens*. 66(1):26–36.

<http://dx.doi.org/10.1016/j.sleep.2013.11.726>

### **Partial resection of the base of the tongue with harmonic scalpel: A promising surgical approach for sleep apnea**

J. Vila

Hospital Vall d'Hebron, Multidisciplinary Sleep Unit/Otolaryngology Department, Spain

**Introduction:** The base of the tongue (BT) component of Obstructive Sleep Apnea (OSA) may be one of the reasons why surgery on

the tonsils and soft palate alone does not always work. Transoral Robotic Surgery (TORS) acting at the level of the BT, has emerged as a powerful new tool in OSA surgery. Several studies have proven the safety and efficacy of the technique. Its benefits seem clear, but it is very expensive. We sought an alternative that would allow us to perform BT resection for OSA patients without using robotic surgery.

**Materials and methods:** Under general anesthesia, an elective temporal tracheostomy is performed at the beginning of the procedure (usually closed after 2–4 days). By combining the ablative and hemostatic actions of harmonic scalpel, and using a few simple surgical techniques with rigid 4 mm diameter 30° endoscopic guidance, we have designed a procedure in which we can visualize and resect the of BT safely and effectively. Depending on the patient's anatomical characteristics, soft palate surgery and tonsillectomy were performed during or before BT surgery. The midline of the tongue and the circumvallate papillae are identified and marked. Using the harmonic scalpel, a symmetric wedge in the midline of the posterior third of the tongue is excised. We applied the technique in 13 patients with tongue hypertrophy.

**Results:** Thirteen patients with OSAS were treated with the technique. Seven of them have already their postoperative sleep studies. The mean age was 43 (range 36–55). Mean AHI pre and postoperatively was: 46.99 (range 10.4–14.10) versus 15.64 (range 40.2–3.80, with a relative gain (RG) of 66.7%. In 6 of them we analyzed separately lateral (22.37 vs. 9.54: RG of 57.36%) and supine AHI (43.07 vs. 25.94: RG of 39.88%). Their BMI did not change at the time of the postoperative sleep study (26.6 vs. 26.37). None of the 13 patients had a fatal complication or important long lasting secondary effect after surgery: 4 had subcutaneous emphysema after tracheostomy closure (one of them required reopening for 3 more days), 3 had postoperative bleeding (from the 3rd to the 9th day after surgery) that resolved with conservative measures. Important temporary pain after surgery was the main complaint.

**Conclusion:** We conclude that this is a safe, effective and relatively cheap technique, which can make it easier for more hospitals to offer it to some patients with OSA.

**Acknowledgements:** Dr. Perelló, for his support and encouragement. He, with Dr. Quesada were world pyoneers on OSA surgery.

<http://dx.doi.org/10.1016/j.sleep.2013.11.727>

### **Personality and severity of primary insomnia**

M. Bravo-Ortiz<sup>1</sup>, C. Valverde<sup>1</sup>, E. Herrero<sup>1</sup>, J. Melero<sup>1</sup>, M. Naranjo<sup>2</sup>, R. Del Rio<sup>2</sup>

<sup>1</sup>Hospital Universitario la Paz, Psychiatry and Mental Health Service, Spain

<sup>2</sup>Hospital Universitario la Paz, Neurology Service, Spain

**Introduction:** Primary Insomnia is difficulty in initiating, or maintaining sleep, waking up too early, or sleep that is chronically nonrestorative or of poor quality (AASM, 2005) that can not be explained by another mental disorder, medical illness or substance abuse disorder. Psychological factors, such as depression, anxiety and excessive worry, can strongly influence insomnia (Kales and Vgontzas, 1992). Moreover, the personality profiles of insomniacs may differ from those of normal controls (de Saint Hilaire et al., 2005), suggesting that personality traits may also influence the severity of insomnia. Both depression and anxiety have been suggested to be the underlying link between personality and insomnia (Harvey and Greenall, 2003; Ongur et al., 2005; Carney et al., 2010), though the precise mechanism of this influence is unclear at the moment. Traditional studies using the MMPI and found higher scores in patients insomniacs: Traits of neuroticism, anxiety, worry (Freedman and Sattler, 1982), Personality styles aimed at internalizing the concerns and

increased psychological and physiological activation (Kales, Caldwell, Preston, Healey and Kales, 1976). According to these results, it is found more anxiety, both psychic and somatic, in patients suffering from insomnia (Lundh, Broman and Hetta, 1995). Studies applying the Temperament and Character Inventory (TCI-R) Cloninger consistently show higher Harm Avoidance in insomniac patients than in control and less self-direction (De Saint Hilaire, Straub & Pelissolo, 2005). Severity of insomnia correlates (Park, An, Jang and Chung, 2012): Positively with Harm Avoidance; Negatively with Novelty Seeking, Cooperation and Reward Dependence Objectives: Analyze temperamental and characterological features of a group of patients diagnosed with primary insomnia To study the relationship between the severity of insomnia and anxiety and depression symptoms.

**Materials and methods:** Sample: 25 patients diagnosed with primary insomnia Instruments: Beck Depression Inventory (BDI), Hamilton Anxiety Scale, Temperament and Character Inventory- Revised (TCI-R), Insomnia Severity Index (ISI), the Pittsburgh Sleep Quality Index, the Epworth Sleepiness Scale, the Horne and Ostberg morning/evening questionnaire (MEQ), and actigraphy. Statistical Analysis: Raw scores on TCI-R were standardized and transformed into Z scores following normative data (Gutiérrez-Zotes et al., 2003), compared with population mean using a Student t test for one sample (comparison value = 0). We used Pearson correlation between BDI, Hamilton and ISI.

**Results:** The scores on the Harm Avoidance scale are significantly above average in patients with primary insomnia ( $t = 4.51$ ,  $p < 0.001$ ) On the scale Self-Direction scores observed significantly lower the average ( $t = -2.51$ ,  $p = 0.02$ ) The measures of anxiety and depression correlated with each other ( $r = 0.71$ ,  $p < 0.001$ ) but not with the severity of insomnia ( $r = 0.22$  and  $r = 0.02$ , respectively).

**Conclusion:** The results are consistent with the literature reviewed in a greater tendency to harm avoidance and lower self-direction in patients with insomnia The present study found no relationship between the severity of insomnia and anxiety and depression symptoms In light of the results are proposed therapeutic interventions aimed at increasing active coping and improving emotional regulation.

**Acknowledgement:** Sara Izquierdo and Ana Alcon, clinical psychological trainees, who also collaborated in the studio and of course patients.

<http://dx.doi.org/10.1016/j.sleep.2013.11.728>

### Effects of treatment with lithium in a case of Kleine-Levin without compulsive eating

R. Del Río<sup>1</sup>, M. Bravo-Ortiz<sup>2</sup>

<sup>1</sup> Hospital Universitario, Servicio de Neurología, Spain

<sup>2</sup> Hospital Universitario, Servicio de Psiquiatría, Spain

**Introduction:** Kleine-Levin syndrome without compulsive eating (KLS WOCE) is characterized by recurrent hypersomnia with cognitive abnormalities but not compulsive eating. The disease is typically described in adolescents. Here, we present a 2 year follow-up case of KLS WOCE in a middle age woman with extreme hypersomnia documented by actigraphy and the effects of treatment with lithium carbonate.

**Materials and methods:** This is a 58-year-old woman with no personal or familial psychiatric past history. She reported normal sleep habits. She started experiencing strong episodes of recurrent hypersomnia one year before this study. No trigger was identified. A video-polysomnography followed by MSLT implemented before, showed no significant findings. MRI, TAC and EEG were normal. A history of 5 years of little sleepiness which began just after menopause was reported. A video-polysomnography and a complete neuropsychological examination was conducted

between episodes. Sleep logs for 15 consecutive months and two actigraphy studies of one month of duration each, before and after lithium carbonate treatment, monitored episodes of hypersomnia and inter-crisis.

**Results:** At the moment of the first visit she presented episodes of 3 to 7 days of extreme hypersomnia followed by several days of insomnia or normal sleep for 15 to 30 days. During episodes she presented impaired speech and concentration, inability to make a decision and impairment of memory. Some symptoms of depression and anxiety were also observed. She also reported some dysautonomic features such as nauseating body or hypotension. Interepisodic, neuropsychological studies showed little problems in executive functions and attention and memory functions. She also showed some difficulties in verbal recognition. Video polysomnography was completely normal: Efficacy: 87%. No respiratory or movement events occurred. Actigraphy and sleep logs documented a short cycle length before treatment. Lithium carbonate dramatically reduced the frequency, duration and intensity of episodes. Significant reduction began one month after the beginning of treatment even when secondary effects were observed much earlier. The improvement was maintained for the next 12 months. At the time of this writing episodes of hypersomnia rarely occur once a month for 4 to 6 h and their intensity is much lower.

**Conclusion:** We present the efficacy of treatment with lithium in a middle-age woman with KLS WOCE as documented by actigraphy. Even when some symptoms decrease in severity and duration with repeated episodes, the efficacy of treatment is clear in this follow-up in order to the temporal relationship and intensity of reduction of the symptoms.

<http://dx.doi.org/10.1016/j.sleep.2013.11.729>

### Maxillary transverse distraction osteogenesis for the treatment of OSAS

P. Vinha<sup>1</sup>, F. Mello-Filho<sup>1</sup>, A. Faria<sup>1</sup>, S. Xavier<sup>2</sup>, A. Eckeli<sup>3</sup>

<sup>1</sup> Faculty of Medicine of Ribeirao Preto, University of São Paulo, Department of Ophthalmology, Otorhinolaryngology and Head and Neck Surgery, Brazil

<sup>2</sup> Faculty of Dentistry of Ribeirão Preto, University of São Paulo, Surgery Department, Brazil

<sup>3</sup> Faculty of Medicine of Ribeirao Preto, University of São Paulo, Neurology Department, Brazil

**Introduction:** Obstructive Sleep Apnea Syndrome (OSAS) is a progressive disease with numerous associated comorbidities. Because of its multifactorial etiology, several treatments have been proposed, not always achieving ideal results. The objective of the present study was to present a new form of treatment for OSAS based on maxillary transverse distraction osteogenesis (MTDO).

**Materials and methods:** A prospective study was conducted on 15 individuals with OSAS and with posterior crossbite. Because of atresia of the upper dental arch, the patients were submitted to MTDO, commonly called surgically assisted rapid maxillary expansion (SARME), with osteotomy of the pterygomaxillary suture. After removal of the intraoral distractor, a new polysomnography exam was performed nine months after surgery for the assessment of respiratory sleep disorders.

**Results:** Partial results demonstrated a significant reduction of the respiratory disturbance index (RDI) from 27.85 to 12.84, SD 6.46 ( $p = 0.003$ ). The apnea-hypopnea index (AHI) was also significantly reduced and oxymetry values showed important improvement.

**Conclusion:** MTDO was efficient in reducing or even eliminating OSAS in individuals with atresia of the upper dental arch, thus rep-

resenting a valid therapy for the treatment of this group of patients, alone or in combination with other surgical techniques such as bimaxillary advancement.

*Acknowledgements:* FAPESP.

<http://dx.doi.org/10.1016/j.sleep.2013.11.730>

### **Is there a relationship between the extent of maxillary transverse distraction and expansion of the upper airway?**

P. Vinha, F. Mello-Filho, A. Faria

*Introduction:* Obstructive Sleep Apnea Syndrome (OSAS) is a progressive disease with numerous associated comorbidities. Because of its multifactorial etiology, several treatments have been proposed, not always achieving ideal results. The objective of the present study was to present a new form of treatment for OSAS based on maxillary transverse distraction osteogenesis (MTDO).

*Materials and methods:* A prospective study was conducted on 15 individuals with OSAS and with posterior crossbite. Because of atresia of the upper dental arch, the patients were submitted to MTDO, commonly called surgically assisted rapid maxillary expansion (SARME), with osteotomy of the pterygomaxillary suture. After removal of the intraoral distractor, a new polysomnography exam was performed nine months after surgery for the assessment of respiratory sleep disorders.

*Results:* Partial results demonstrated a significant reduction of the respiratory disturbance index (RDI) from 27.85 to 12.84, SD 6.46 ( $p = 0.003$ ). The apnea–hypopnea index (AHI) was also significantly reduced and oxymetry values showed important improvement.

*Conclusion:* MTDO was efficient in reducing or even eliminating OSAS in individuals with atresia of the upper dental arch, thus representing a valid therapy for the treatment of this group of patients, alone or in combination with other surgical techniques such as bimaxillary advancement.

*Acknowledgements:* FAPESP.

<http://dx.doi.org/10.1016/j.sleep.2013.11.731>

### **Restless Legs Syndrome – prevalence and associated factors among university students in Estonia**

S. Virolainen

*Department of Psychiatry, University of Tartu, Estonia*

*Introduction:* Restless Legs Syndrome (RLS) is described as uncomfortable sensation in legs which gets worse in the evening or bedtime and may at least partially be relieved by movement. The prevalence in general population is reported in most studies 10–12% and may differ quite largely by countries. RLS has been associated with dopaminergic dysregulation, several health conditions and lifestyle factors like consumption of coffee, alcohol, cigarettes and some drugs. RLS is considered to be more prevalent among women and older people. As being chronic and undertreated condition RLS could have a serious impact on sleep quality and emotional status. Very little is known about RLS prevalence among otherwise healthy young people. This was the reason, we decided to concentrate on sample of university students. RLS in Estonia is underestimated as a disease and underdiagnosed, so the real prevalence in general population is now unknown. The aim of this study was to specify the prevalence and associated factors of RLS in the group of Estonian students presenting the epidemiologic situation among young healthy adults.

*Materials and methods:* All the participants were students of University of Tartu, Estonia who attended lectures in 2005. 757 questionnaires which included personal data, questions about sleep and daytime habits, lifestyle factors and Emotional State Questionnaire (EST-Q), were delivered to the students. The response rate was 98.8% and the final study sample consisted of 747 students. The participants were from age 18–35 (mean 20.6). 522 (69.8%) of the respondents were female and 226 (30.2%) male. The existence and severity of RLS was evaluated by question: “During bedtime, do you have disturbing unpleasant sensation in legs, so that you have to move the legs to get rid of it?” According to the answers we divided participants into 3 categories: healthy, intermittent RLS group and persistent RLS group.

*Results:* The overall prevalence of RLS was 23% and the prevalence of persistent RLS (symptoms at least 1–2 times a week) was 6%. In our study we did not find statistically relevant associations between RLS and gender, age, sleep duration, coffee, alcohol or tobacco consumption. RLS was associated with BMI ( $p = 0.0153$ ), daytime sleepiness ( $p = 0.0342$ ), subjective quality of sleep ( $p = 0.00006$ ) and use of medication (besides sleeping pills) ( $p = 0.0188$ ). We found strong associations between RLS and depression ( $p = 0.0000015$ ), generalized anxiety disorder ( $p = 0.00000176$ ), panic disorder ( $p = 0.0037$ ), asthenia (0.0015) and insomnia ( $p = 0.00015$ ).

*Conclusion:* RLS is more prevalent among young adults than could be predicted on the ground of general population studies. RLS has serious impact on sleep quality and emotional status. Therefore it is important to diagnose and treat RLS to avoid and cure accompanying conditions.

*Acknowledgements:* This study was funded by Estonian Research Council, by Grant SF0180125s08 Neurbiological, genetic and psychosocial factors associated with onset, pathogenesis and treatment outcome of schizophrenia, major depression and panic disorders.

<http://dx.doi.org/10.1016/j.sleep.2013.11.732>

### **A new respiratory disturbance variable (RDV) based on the envelope analysis of the airflow signal and its relationship to AHI**

J. Díaz, J. Arancibia, A. Bassi, E. Vivaldi

*University of Chile, Laboratory of Sleep and Chronobiology, Faculty of Medicine, Chile*

*Introduction:* A method was developed to quantify Sleep-Disordered Breathing (SDB) by extracting a continuous Respiratory Disturbance Variable (RDV) based on the normalized coefficient of variation of the envelope of the nasal-cannula signal routinely recorded in polysomnographic (PSG) studies. Higher values of RDV reflect increasing departure from normal sinusoidal breathing, with the threshold for conventionally abnormal breathing being around 1.0. Here we report the relationship between a given level of RDV and its corresponding AHI.

*Materials and methods:* In 24 PSG studies (6 from each group of subjects with none, mild, moderate and severe OSA) the RDV was calculated for each 30-s epoch. The full length of PSG studies was segmented according to RDV values. The RDV range 0.50–4.00 was subdivided into 14 categories using 0.25 unit grouping intervals. For each RDV category its specific AHI was calculated as events per hour (just as it is routinely done for subsets such as sleep stage, body position or CPAP pressure). Besides AHI, a time-in-event fraction was calculated as the fraction occupied by hypopneas or apneas of the total time spent in a given RDV category. Only groups of at least 10 epochs were kept for further analysis, a criterion that resulted in 197 validated data points. Simple linear regression models were calculated with RDV as the regressor and either AHI or time-in-event

fraction as the regressand. The coefficient of determination ( $R^2$ ) assessed the goodness-of-fit of the regressions.

**Results:** In the two RDV categories below 1.0 the AHI was always near zero. Simple linear models using as regressor RDV in the range 1.0–4.0 were highly significant for both AHI and time-in-event ratio, the adjusted  $R^2$  being 0.777 and 0.812, respectively ( $p < .001$  in both cases).

**Conclusion:** RDV, a measurement that can be automatically computed and that does not require previous definitions of events, is highly correlated with AHI. It additionally offers a gradient at the lower end of the spectrum ( $AHI < 5$ ) that might be useful to recognize patterns of airflow limitation regimes, such as UARS.

**Acknowledgements:** Supported by Fonis (Conicyt) Grant SA10I20034.

<http://dx.doi.org/10.1016/j.sleep.2013.11.733>

### Quality of life is impaired among older adults with obstructive sleep apnea hypopnea syndrome despite disease severity

F. Barbagelata-Aguero<sup>1</sup>, D. Vizcarra-Escobar<sup>1,2</sup>

<sup>1</sup> Hypnos Instituto del Sueño, Clínica San Felipe, Lima, Peru

<sup>2</sup> Universidad Peruana Cayetano Heredia, Peru

**Introduction:** It has been studied that Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS) increases with age but physicians face a problem in diagnosis because symptoms can be different in older populations. There is still a controversy about treating OSAHS in the elderly since the impact isn't very clear. The main objective of the present study was to evaluate the effect in the QoL of older adults with OSAHS diagnosis compared to normal population.

**Materials and methods:** A total of 798 medical records and polysomnography (PSG) of consecutive patients from 2007–2012 were reviewed, 159 corresponded to older adults ( $\geq 60$  yo) with OSAHS. Diagnosis was made following ICSD-2 criteria and severity was set using BDI cutoff as: 5–15 events/hour as mild, 15–30 events/hour as moderate and  $>30$  events/hour as severe. QoL was evaluated using the SF-36 questionnaire validated for language and country. Excessive Daytime Sleepiness (EDS) was assessed by Epworth Scale, a score of  $>10$  points was considered abnormal. Other data was obtained from records.

**Results:** 159 records corresponded to older adults, age  $67.93 \pm 6.95$  yo, 73.6% were males, BMI  $28.18 \pm 4.70$  kg/mt<sup>2</sup>, neck circumference  $41.16 \pm 4.71$  cm ( $16.1 \pm 1.8$  inches), Epworth Scale  $9.16 \pm 5.23$  points and EDS present in 32.1%. PSG showed IAH  $24.67 \pm 20.35$ , BDI  $40.47 \pm 20.94$ , minimum saturation  $81.48 \pm 7.89\%O_2$ . Other comorbidities were hypertension (42.1%), diabetes mellitus (13.2%), history of stroke (4.4%), and depressive symptoms (37.1%). OSAHS severity was mild in 6.9%, moderate in 27% and severe in 66%. All of the SF36 components showed worst scores in the OSAHS older adult patients compared to general population scores. No differences were found between the SF36 scores between severity groups in our patients.

**Conclusion:** In our patients, the QoL is equally affected in all severity groups of OSAHS and worsened compared to general population scores. This information supports the idea to treat OSAHS in every patient with diagnosis, regardless their age, since their quality of life is impaired. Limitations of this study are the possible influence of other comorbidities in the QoL scores and should be taken in account for future studies on this matter.

**Acknowledgements:** Hypnos Instituto del Sueño, Lima, Perú.

<http://dx.doi.org/10.1016/j.sleep.2013.11.734>

### Quality of life impairment. A reason for rethink the importance of upper airway resistance syndrome

D. Vizcarra-Escobar<sup>1</sup>, F. Barbagelata-Aguero<sup>2</sup>

<sup>1</sup> Hypnos Instituto del Sueño, Clínica San Felipe, Lima, Peru

<sup>2</sup> Universidad Peruana Cayetano Heredia, Peru

**Introduction:** The Upper Airway Resistance Syndrome (UARS) was described by Guilleminault in 1993 to report patients that didn't meet criteria for Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS) but presented with similar symptoms, specially Excessive Daytime Sleepiness (ESS) and an abnormal breathing pattern during sleep. The diagnosis of UARS is controversial and in many cases patients are left untreated or misdiagnosed. The impact of UARS in the quality of life (QoL) haven't been studied before in contrast with OSAHS patients in whom QoL have been reported to be decreased. Our objectives were to assess the difference in QoL measured by SF36 questionnaire between UARS and OSAS patients and to evaluate the clinical differences between both groups.

**Materials and methods:** A total of 711 consecutive patients from 2007–2012 were retrospectively evaluated using their medical records and Polysomnography (PSG). Diagnosis of UARS was made following Guilleminault definition ( $AHI < 5 + RDI > 10$ ), diagnosis of OSAHS was made according to ICSD-2 criteria ( $AHI > 5 +$  symptoms or  $AHI > 15$ ) and the recommended definitions for respiratory events of the Manual for Scoring of Sleep and Associated Events of the AASM v2007. Quality of Life was evaluated by the SF36 questionnaire, previously validated in our country.

**Results:** Of the 711 consecutive records, 632 were classified as UARS (23.5%) or OSAHS (65.4%) patients, 79 (11.1%) didn't meet any of the syndrome's diagnosis criteria. No differences were found in SF 36 QoL domains, but in the Physical Factor component with worse score in the OSAHS group. Regarding clinical features, the OSAHS group presented with older patients ( $52.81 \pm 13.56$ yo vs  $44.11 \pm 13.17$ yo  $p < 0.001$ ), a higher BMI ( $29.25 \pm 4.65$  kg/mt<sup>2</sup> vs  $25.58 \pm 3.57$  kg/mt<sup>2</sup>  $p < 0.001$ ) and more common diagnosis of hypertension (29.46% vs 16.17%  $p < 0.001$ ). Female/male proportion was found to be 1:8 in OSAHS and 1:2 in UARS ( $p < 0.001$ ). No differences were found in somnolence measured by Epworth Scale, medical history of Diabetes Mellitus, Stroke, depressive symptoms, or insomnia symptoms.

**Conclusion:** The impact in QoL, secondary to UARS or OSAHS in our patients, is pretty similar, giving a strong reason for an exhausting diagnosis protocol and an early treatment in symptomatic patients, especially since UARS represents a significant proportion of our sleep clinic consultations. Special attention should be paid to clinical features such as younger age, female gender and lower BMI, where PSG must be consider as gold standard for a correct diagnosis.

**Acknowledgements:** Hypnos Instituto del Sueño, Lima, Perú.

<http://dx.doi.org/10.1016/j.sleep.2013.11.735>

### Restless Legs Syndrome (Willis Ekbohm Disease) and growing pains, are they the same thing?: a side by side comparison of the diagnostic criteria for both and recommendations for future research

A. Walters<sup>1</sup>, D. Gabelia<sup>2</sup>, B. Frauscher<sup>2</sup>

<sup>1</sup> Vanderbilt University School of Medicine, Dept of Neurology, USA

<sup>2</sup> Innsbruck Medical University, Dep. of Neurology, Austria

**Introduction:** There has been no previous side by side comparison of the diagnostic criteria for Restless Legs Syndrome/Willis Ekbohm Disease (RLS/WED) and Growing Pains. In this study we do this

comparison emphasizing overlaps and disconnects, summarize recent literature exploring the relationship between the two and make suggestions for future research.

**Materials and methods:** A literature search was done looking at articles over the last 10 years exploring the relationship between RLS and Growing Pains.

**Results:** There is considerable overlap in the diagnostic criteria for childhood RLS and Growing Pains. The literature also indicates that RLS and Growing Pains occur more commonly together than one would expect based upon chance alone and the family histories of RLS and Growing Pains are often overlapping. Leg rubbing to obtain relief from leg discomfort is common to both disorders although walking to obtain relief seems unique to RLS. Childhood RLS has also been reported to be painful in up to 45% of cases.

**Conclusion:** The development of standard diagnostic criteria for Growing Pains is necessary to move the field of Growing Pains research forward. A quantitative and validated rating scale for Growing Pains severity already exists. Because of the clinical and genetic similarity between RLS and Growing Pains, studies that parallel those previously done in RLS is recommended for Growing Pain patients. For example a Genome Wide Association study in Growing Pains patients of all possible genes with particular attention to those identified as related to RLS and a therapeutic trial of medications known to be effective in RLS would be welcome. Abnormalities in Vitamin D metabolism may be common to both disorders.

**Acknowledgements:** Arthur S. Walters gratefully acknowledges the time spent in the laboratory of Dr. Birgit Hogl at the Medical University of Innsbruck while on sabbatical.

<http://dx.doi.org/10.1016/j.sleep.2013.11.736>

### Sleep disturbances and emotional/behavioral problems among Chinese school-aged children: prevalence and association

G. Wang<sup>1</sup>, G. Xu<sup>1</sup>, N. Lu<sup>2</sup>, F. Ren<sup>3</sup>, L. Geng<sup>4</sup>, Y. Sun<sup>5</sup>

<sup>1</sup>School of Psychology and Cognitive Science, East China Normal University, China

<sup>2</sup>Research and Counseling Centre of Applied Psychology, Shenzhen University, China

<sup>3</sup>Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, and Graduate, China

<sup>4</sup>Shijiazhuang Preschool Teachers College, China

<sup>5</sup>School of Psychology, Nanjing University of Chinese Medicine, China

**Introduction:** Sleep disturbances and emotional/behavioral problems are highly prevalent in childhood across all societies, and they frequently present with other co-morbidities. However, little is known about these issues among Chinese school-aged children. Therefore, the objectives were to investigate the prevalence of sleep disturbances and emotional/behavioral problems, and their associations.

**Materials and methods:** The sample comprises 886 children (6–12 years old) recruited from normal elementary schools in Shenzhen, China, with a cluster stratified sampling procedure. Their parents completed the Children Sleep Habits Questionnaire (CSHQ), Strengths and Difficulties Questionnaire (SDQ), and some socio-demographic questions to assess the domains involved.

**Results:** Based on clinical cut-offs, 69.5% of parents perceived their children had global sleep disturbances, the prevalence of specific sleep disturbances ranged from 5.2% (night waking) to 23.1% (bed-time resistance); 11.5% of parents perceive their children had global emotional/behavioral problems, the prevalence of specific emotional/behavioral problems ranged from 8.5% (emotional symptoms) to 26.6% (peer problems). The correlations between most sleep disturbances and emotional/behavioral problems domains were

statistically significant ( $|r| = 0.01 \sim 0.39, p < 0.05$  or  $0.01$ ). After controlling the effects of age, gender, parental education level, housing income, and co-sleeping, emotional symptoms ( $\Delta R^2 = 0.26, p < 0.01$ ), conduct problems ( $\Delta R^2 = 0.09, p < 0.05$ ) and hyperactivity ( $\Delta R^2 = 0.17, p < 0.01$ ) account for 16% variance in sleep disturbances.

**Conclusion:** As in other societies, both sleep disturbances and emotional/behavioral problems among school-aged children frequently occurred in China, and sleep disturbances are associated with emotional/behavioral problems, especially emotional symptoms, conduct problems and hyperactivity. Our study suggests a need to prevent, detect, and invent sleep disturbances and emotional/behavioral problems among Chinese children, and provides reference data to researchers and professionals.

**Acknowledgements:** The authors thank the lovely children and their parents and teachers. We acknowledge Rui Ma (Nanshan Xuefu Primary School) for her help with data collection. We also appreciate the efforts of Lin Lin and her three classmates (Shenzhen University, China) in data entry.

<http://dx.doi.org/10.1016/j.sleep.2013.11.737>

### Endogenous opiates in the parabrachial nucleus mediate the electroacupuncture – induce sleep activities in rats

T. Wang

National Taiwan University, Graduate Institute of Veterinary Medicine, Taiwan

**Introduction:** Previous studies indicate that electroacupuncture (EA) of Anmian acupoint (EX 17) enhances vagal activity and changes the synaptic morphology in the nucleus tractus solitarius (NTS) by different EA stimulus frequencies. The goal of this study is to investigate the role of parabrachial nucleus (PBN), which receives afferents from NTS, in the EA-induced sleep alterations.

**Materials and methods:** Total of six male Sprague–Dawley rats, weighted 250–300 g, was used. We microinjected naloxone, an opioid receptor antagonist, into the PBN before the EA stimulation. A 30-min EA stimulation was performed at the beginning of the dark period in a 12:12 h light:dark cycle. The frequency of EA used in this experiment was 10 Hz, and the EEGs were recorded after EA stimulation and lasted for 24 h.

**Results:** Our preliminary results indicated that EA significantly enhanced non-rapid eye movement (NREM) sleep between the 6th and the 9th hour after the 30-min EA stimuli. The percentage of NREM sleep between 6- and 9-h of the dark period increased from 19.2 +/- 2.9% obtained after control to 43 +/- 3.6% (one-way ANOVA,  $p < 0.05$ ). Microinjection of naloxone (broad-spectrum opioid receptor antagonist) into the PBN 30 min prior to the EA stimulation reduced the percentage of NREM sleep to 30.3 +/- 3.7 % (one-way ANOVA,  $p < 0.05$  vs. the effect of EA).

**Conclusion:** Our results indicated that 10 Hz EA stimulation of Anmian acupoints increased spontaneous NREM sleep during the dark period, suggesting the sleep improvement for EA stimuli of Anmian acupoints. Microinjection of naloxone directly into the PBN blocked EA-induced enhancement of NREM sleep, indicating the role of endogenous opioids in the PBN. This observation further demonstrated endogenous opioids in the PBN, the relay nucleus of NTS, mediate EA-induced sleep alterations.

**Acknowledgements:** This study is supported by National Science Council grant (NSC 101-2321-B-002-065).

<http://dx.doi.org/10.1016/j.sleep.2013.11.738>

### Clinical study on sleep-regulating technique (TIP3–2) combined with medication of treating primary

W. Wang, L. Hong, Y. Lin, F. Wang, T. Li, W. Wang, G. Li  
Psychology and Sleep Department in Guang-anmen Hospital, China  
Academy of Chinese Medical Sciences, China

**Introduction:** Cognitive behavioral therapy (CBT) and hypnotic medications are efficacious for short-term treatment of insomnia, but few patients achieve complete remission with any single treatment. In patients with persistent insomnia, the addition of medication to CBT produced added benefits during acute therapy. Sleep-regulating Technique (TIP3–2) is a Symptomatic treatment method of Low Resistance Thought Induction Psychotherapy (TIP). TIP is a psychotherapy of treating insomnia or other mental disorders accompanying with insomnia. TIP is a therapy developed based on low resistance theory and thought induction theory. It combines the eastern Guidance (Dao Yin) and Qigong with western suggestion and hypnotherapy. It is supposed that this can create a low resistance background. Then to treat the patients use some psychotherapy in this condition. Sleep-regulating Technique (TIP3–2) has standard operating procedures and induction word for different symptoms of the patients. The objective of this study is to observe the curative effect of primary insomnia using Sleep-regulating Technique (TIP3–2) combined with medication.

**Materials and methods:** 70 primary insomnia patients were randomly divided into two groups, TIP combined with medication and only medication, and 35 cases Each group. The patients in medication group were given 1–2 mg Estazolam half an hour before going to bed. On the basis of taking Estazolam, the patients in TIP combined with medication group were given Sleep-regulating Technique treatment twice a week. Observed the changes of Pittsburgh sleep quality index (PSQI) before and after treatment, and the period is 4 weeks.

**Results:** Comparison in group: In TIP combined with medication group, there are improvement in total score of PSQI, subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, daytime dysfunction in statistical significance ( $P < 0.05$ ). In medication group, the total score of PSQI, Subjective sleep quality, sleep duration have statistical significance improvement ( $P < 0.05$ ); Comparison between groups: Comparing the data after treatment, There were significant differences in the total score of PSQI, subjective sleep quality, medication use and daytime dysfunction ( $P < 0.05$ ). TIP combined with medication is better than only medication. Comparing the difference of PSQI values before and after treatment, there are significant difference between two groups in the total score of PSQI, subjective sleep quality, sleep latency, medication use and daytime dysfunction ( $P < 0.05$ ). TIP combined with medication is better than only medication.

**Conclusion:** The two methods have different degrees of improvement in primary insomnia. TIP combined with medication is better than only medication. It is suggested that psychological therapy combined with medication therapy is a more effective treatment of insomnia.

**Acknowledgements:** Research was funded by the following project: Prevention and treatment study of Chinese Traditional Medicine on psychological diseases: Project supported by the National Key Technology Research and Development Program of the Ministry of Science and Technology of China (Grant No. 2009BAI77B09). And thanks to all the members cooperation and the participants who help us accomplish the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.739>

### Study on clinical efficacy of treating primary insomnia by wen dan ning xin grain

W. Wang, Y. Liu, L. Hong, Y. Lin, F. Wang, W. Wang, G. Li  
Psychology and Sleep Department of Guang'an men Hospital, China  
Academy of Chinese Medical Sciences, China

**Introduction:** Wen Dan Ning Xin grain is a preparation which can only be prescribed in Guang'an men Hospital in China. Its basic components comes from an ancient Chinese medical book called Zheng Zhi Zhun Sheng. It is developed by a Chinese famous doctor Rong-lin Gao, and has been used in clinical for about 10 years. It is said that this is an effective method of treating insomnia. This study is to observe the clinical efficacy of treating primary insomnia.

**Materials and methods:** 70 primary insomnia patients were randomly divided into two groups, Wen Dan Ning Xin Grain group and Estazolam group, and 35 cases each group. Patients in Wen Dan Ning Xin Grain group were given Wen Dan Ning Xin Grain, 6 g every time and 3 times a day. The patients in Estazolam group were given 1–2 mg Estazolam half an hour before going to bed. Observed the changes of Pittsburgh sleep quality index (PSQI) before and after treatment, and the observation period is 4 weeks.

**Results:** Wen Dan Ning Xin grain increased sleep duration, improved subjective sleep quality, reduced sleep disturbances and generally improved insomnia ( $P < 0.05$ ); Estazolam only improved subjective sleep quality ( $P < 0.05$ ). Comparison between groups, in terms of daytime dysfunction and total scores of PSQI, Wen Dan Ning Xin grain is better than Estazolam ( $P < 0.05$ ). Additionally, effective rate of Wen Dan Ning Xin grain is higher than Estazolam.

**Conclusion:** Although there is selection bias in this study, it is inevitable in Traditional Chinese Medicine hospital in China. The data in this paper is suggested that Wen Dan Ning Xin grain is better than Estazolam for primary insomnia in Traditional Chinese medicine hospital, and further study is needed.

**Acknowledgements:** Research was funded by the following project: Prevention and treatment study of Chinese Traditional Medicine on psychological diseases: Project supported by the National Key Technology Research and Development Program of the Ministry of Science and Technology of China (Grant No. 2009BAI77B09). And thanks to all the members cooperation and the participants who help us accomplish the study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.740>

### Evaluation of drug–drug interactions of sodium oxybate with divalproex: Results from a pharmacokinetic/pharmacodynamic study

M. Eller<sup>1</sup>, Y. Wang<sup>1</sup>, K. Wesnes<sup>2</sup>, S. Alvarez-Horine<sup>1</sup>, B. Benson<sup>1</sup>, J. Black<sup>1</sup>

<sup>1</sup>Jazz Pharmaceuticals, Inc., United States

<sup>2</sup>Bracket, United States

**Introduction:** To evaluate drug–drug interactions of sodium oxybate (SXB) and divalproex sodium ER (DVP) with regard to PK, PD, and safety. SXB is the sodium salt of gamma-hydroxybutyrate (GHB), a substrate for monocarboxylate transporter and GHB dehydrogenase; both are inhibited by valproic acid.

**Materials and methods:** Healthy volunteers were randomized to one of 4 treatment sequences in a 5-period, double-blind, crossover design with washout between periods. During Periods 1 and 2, subjects received two 3g doses of SXB or placebo 4h apart in a crossover fashion (days 1 and 3). In Period 3 (days 5–14), subjects

received DVP 1250 mg, and continued DVP during Periods 4 and 5 (days 15–18), with two 3 g doses of SXB or placebo administered 4h apart in a crossover fashion on Days 15 and 18. Blood and urine samples were taken at predefined times for PK analysis. PD testing, performed during SXB treatment, included the Karolinska Sleepiness Scale, and several automated tests from CDR System (www.bracketglobal.com) including Simple Reaction Time, Digit Vigilance, Choice Reaction Time, Tracking, and Numeric Working Memory tasks. Safety was assessed throughout the study.

**Results:** 20 subjects enrolled and completed the study (all male, 65% white, mean age  $33.9 \pm 6.6$  y). Geometric LS means of SXB with SXB + DVP relative to SXB alone were significantly higher for plasma AUC<sub>0-inf</sub> ( $349.7$  vs.  $275.6 \mu\text{g} \cdot \text{h/mL}$ ;  $P < 0.0001$ ) and renal clearance ( $606.0$  vs.  $480.5 \text{ mL/h}$ ;  $P < 0.001$ ), and upper bounds of the 90% CIs of the percent mean ratios exceeded the equivalence range of 80–125%. No changes in DVP PK were observed with SXB+DVP. SXB induced sleepiness and cognitive impairments. SXB + DVP produced significantly greater deficits ( $P < 0.05$ ) at several time points than SXB alone in numeric working memory mean reaction time, simple reaction time mean, digit vigilance accuracy, choice reaction time accuracy, continuity of attention, and tracking distance from target. The most common adverse events (AEs) were consistent with the drug profiles. AEs in  $\geq 2$  subjects with SXB + DVP were somnolence,  $n = 18$ ; euphoric mood,  $n = 10$ ; dizziness,  $n = 7$ ; and nausea,  $n = 4$ .

**Conclusion:** SXB + DVP showed changes in SXB PK and renal clearance consistent with GHB dehydrogenase and monocarboxylate transporter inhibition. SXB produced sleepiness and cognitive impairments; some cognitive domains showed greater impairment with DVP co-administration, consistent with SXB PK changes. AEs with SXB + DVP reflect a combined drug effect.

**Acknowledgement:** This study was sponsored by Jazz Pharmaceuticals, Inc.

<http://dx.doi.org/10.1016/j.sleep.2013.11.741>

### What is known about the experience of CPAP for OSA from the users' perspective? A systematic integrative literature review

K. Ward<sup>1,2</sup>, M. Gott<sup>1,2</sup>

<sup>1</sup>The University of Auckland, Faculty of Medical & Health Sciences: School of Nursing, New Zealand

<sup>2</sup>The University of Auckland, Faculty of Medical & Health Sciences: School of Nursing & School of Popu, New Zealand

**Introduction:** The estimated economic, social and personal cost of untreated obstructive sleep apnoea (OSA) is high. Night time continuous positive airway pressure (CPAP) is a recommended, cost effective and popular treatment. The predicted global increase in obesity will lead to increasing prevalence of OSA. Exploring management of CPAP from the user perspective is crucial to successful administration of this therapy. The objective was synthesis of the international evidence base regarding users' experience of night time continuous positive airway pressure therapy for obstructive sleep apnoea.

**Materials and methods:** A systematic integrative literature review was conducted and quality assessment criteria applied.

**Results:** From 538 identified papers, 22 met inclusion criteria. Thematic analysis identified four themes: (1) evidence regarding experience of CPAP and issues of research design; (2) CPAP influenced by users' views and beliefs; (3) CPAP investigated using a language of difficulty; and (4) spouse and family impact on CPAP use. Overall, research relating to user experience of CPAP is limited. Understanding is incomplete because of problems of study

design, for example the use of pre-determined checklists and survey questions. The problem oriented terminology adopted by most studies is also likely to set up the expectation that users will encounter difficulties with CPAP. There is evidence that personality and attitude impact expectations about CPAP prior to and during use, whilst engagement of spouse, family and colleagues also influence experience.

**Conclusion:** This comprehensive integrative review identified limited evidence about experiencing CPAP from the users' perspective. Current research is constrained by researchers' concern with non-compliance. Typically experiences of CPAP are not defined by the user, but from an 'expert' healthcare perspective, using language that defines CPAP as problematic. Family and social support is a significant, but underexplored, element of experiencing CPAP and warrants further investigation. Research that more comprehensively involves CPAP users is required to determine how patients manage this therapy successfully.

**Acknowledgement:** Acknowledgements go to both supervisors Merryn Gott and Karen Hoare.

<http://dx.doi.org/10.1016/j.sleep.2013.11.742>

### Repetitive transcranial magnetic stimulation enhances sleep quality of patients with comorbid major depressive disorder and insomnia

T. Li, W. Wang, L. Hong, Y. Lin, F. Wang

Sleep Medicine Committee of World Federation of Chinese Medicine Societies, Department of Sleep and Psychology, Guanganmen Hospital, China Academy of Chinese Medical Sciences, Beijing, PR China

**Introduction:** Insomnia impacts the course of major depressive disorder (MDD), obstructs response to treatment, and raises risk of depression relapse. This study approached how repetitive transcranial magnetic stimulation (rTMS) relieves depression and enhances sleep quality of patients with comorbid major depressive disorder and insomnia.

**Materials and methods:** A randomized, controlled, pilot study was conducted in our hospital. The study was approved by local Ethics Committee. All subjects signed informed consents. 30 patients, conforming to meet the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) criteria for MDD, and Montgomery-Asberg Depression Scale (MADRS) score between 12 and 29 were randomly chosen as the MDD group. Another 30 patients, meeting the DSM-IV-TR criteria for MDD and insomnia, MADRS score between 12 and 29, and Pitts-burgh Sleep Quality Index (PSQI) scores  $>7$ , were randomly selected as the MDD and insomnia group. Both groups received rTMS (10 Hz for 4 weeks) once per day. After treatment, patients' depression was assessed with MADRS, and their sleep quality was evaluated by PSQI. Raters were masked to treatment assignment.

**Results:** There were 30 subjects in MDD group (60% female, mean age  $38.56 \pm 12.13$  s.d. mean course of disease  $11.35 \pm 7.53$  months). MDD and insomnia group consisted of 30 subjects (66.67% female, mean age  $32.72 \pm 14.69$  s.d. mean course of disease  $9.23 \pm 4.81$  months). Although the rate of depression remission in MDD and insomnia group (59.36%) was higher than MDD group (57.21%), this difference was not significant. After 4 weeks treatment, both MDD group ( $12.56 \pm 6.73$ ) and MDD insomnia group ( $11.38 \pm 7.16$  s.d.) were significantly improved in MADRS scores ( $P < 0.05$ ). MDD and insomnia group was significantly improved ( $P < 0.05$ ) in PSQI sleep quality ( $1.40 \pm 0.41$ ), time for falling asleep ( $1.73 \pm 1.21$ ), sleep time ( $1.90 \pm 1.28$ ), sleep efficiency ( $0.90 \pm 1.52$ ), Function during the day-time ( $1.87 \pm 0.84$ ), total score ( $8.57 \pm 3.74$ ).

**Conclusion:** This pilot study offers the evidence that rTMS improves depression and sleep quality of patients with comorbid major depressive disorder and insomnia.

**Acknowledgements:** This research was supported by Fund Projects of International Cooperation and Exchanges of Ministry of Science and Technology of China. Grant No. 2011DFA30960.

<http://dx.doi.org/10.1016/j.sleep.2013.11.743>

### The sleep-improving effect of an chinese indigenous psychotherapy on depression associated with insomnia

W. Wang, X. Lu, L. Hong, Y. Lin, F. Wang  
Guangánmen Hospital, China Academy of Chinese Medical Sciences, China

**Introduction:** Insomnia has a high prevalence among Chinese population. Insomnia patients in China often doubt about the side effects of hypnotic medicine. They prefer complementary and alternative medical treatment. In Chinese medical hospital, insomnia patients receive acupuncture, herbs as well as qigong practice to cope with insomnia. In our department, we use the Sleep regulation Technique of Low Resistance State Thought Induction Psychotherapy (TIP) to treat patients. The objective of the study is to study the effect of sleep regulation technique of TIP treating insomnia accompanied by depression.

**Materials and methods:** 30 patients were included at Psychology Department of Guangánmen Hospital between October 2008 and December 2010. We referred to DSM-[fx]<sup>o</sup> to make the diagnosis of depression and insomnia. Treatment lasted for 24 weeks. The treatment frequency was 2 times per week at the beginning. 12 weeks later, the frequency reduced to 1 times per week. Pittsburgh Sleep Quality Index (PSQI) and polysomnography (PSG) were tested prior and post treatment.

**Results:** 24 patients completed the study in the end. Data from PSQI and PSG indicates the effect of treatment. Scores of PSQI in sleep quality, initiating sleep time, sleep time, sleep efficiency, sleep disorder, daytime function and the total score all decreased significantly ( $P < 0.05$  or  $0.01$ ); Data of PSG in sleep efficiency stage 3 percentage increased significantly ( $P < 0.05$ ); number of wake, stage 1 percentage and REM sleep percentage decreased significantly  $P < 0.05$  or  $0.01$ .

**Conclusion:** Sleep regulation technique of TIP can improve patients' sleep quality in depression patients. It may has strong potential for application in China.

**Acknowledgement:** National Natural Science Foundation of China.

<http://dx.doi.org/10.1016/j.sleep.2013.11.744>

### Creating a sleep-permissive condition using bed warming

T. Weysen, E. Møst, R. Raymann  
Philips Group Innovation Research, The Netherlands

**Introduction:** Recent studies showed that mild skin warming, without hampering core body temperature decline, improved sleep onset and promoted slow wave sleep and sleep maintenance [1,2]. We were challenged to translate these findings, originating from fully controlled laboratory studies, into a prototype for a home-applicable, sleep promoting solution. As a suitable solution, a multi-zoned low power feedback controlled electric heating blanket was developed. It was hypothesized that mild bed warming will increase skin temperature – without affecting core body temperature – and subsequently affect sleep.

**Materials and methods:** 8 healthy sleepers (4 males) were studied in the sleep experience laboratory for two nights. Participants slept one night in a bed warmed to 34°C (W) and one night in a non-warmed bed (N). Bed temperature was controlled via a multi-zoned low power feedback controlled electric heating blanket developed at our technical department. Skin temperature was calculated by means of temperature sensors placed on 9 standard body positions. Sleep was measured using PSG and questionnaires.

**Results:** Relative amount of Wake (N:  $2.5 \pm 0.6\%$  vs. W:  $0.9 \pm 0.2\%$ ;  $p = 0.023$ ) and S1 (N:  $3.7 \pm 0.7\%$  vs. W:  $2.4 \pm 0.3\%$ ;  $p = 0.043$ ) was suppressed whilst sleeping in the warmed bed. Furthermore, SOL was shorter (N:  $16.8 \pm 4.4$  min vs. W:  $10.4 \pm 4.1$  min;  $p = 0.009$ ) and the sleep efficiency (N:  $94.5 \pm 0.9\%$  vs. W:  $97.0 \pm 0.8\%$ ;  $p = 0.004$ ) was higher in the bed warming condition. The reduction in the relative amount of Wake was also reflected in the subjective reports on wakefulness (N:  $16.8 \pm 7.6$  min vs. W:  $6.3 \pm 3.6$  min;  $p = 0.034$ ). Surprisingly, no significant differences in skin temperature were observed between the bed warming condition and the control condition.

**Conclusion:** In the present study, we showed that feedback-controlled bed warming improved sleep, even without observing an overall higher mean skin temperature. Since we did not replicate warming effects on SWS sleep [2], we concluded that mild bed warming (without affecting skin temperature) is creating a sleep-permissive condition rather than a sleep promoting condition. These findings show that the use of temperature manipulations to affect sleep go beyond well-controlled laboratory settings; bed warming is an affordable and easy to apply sleep aid that might be of use in a clinical/therapeutic setting as well. [1] Raymann RJ et al., *AJP*, 2005;1589–97. [2] Raymann RJ et al., *Brain*, 2008;500–13.

<http://dx.doi.org/10.1016/j.sleep.2013.11.745>

### The effect of rotigotine on nocturnal blood pressure changes and periodic limb movements of sleep in patients with idiopathic RLS: The encore study

F. Grieger<sup>1</sup>, E. Schollmayer<sup>1</sup>, K. Moran<sup>1</sup>, C. Trenkwalder<sup>2</sup>

<sup>1</sup>UCB Pharma, United States

<sup>2</sup>University of Göttingen and Paracelsus-Elena-Klinik, United States

**Introduction:** Rotigotine transdermal system reduces periodic leg movements (PLM) during sleep in patients with restless legs syndrome (RLS). Episodic nocturnal blood pressure (BP) excursions coincide with PLM, possibly increasing the risk of hypertension and cardiovascular disease. We examined the effect of rotigotine on PLM-associated and total nocturnal systolic BP (NSBP) elevations in patients with moderate-to-severe RLS (IRLS  $\geq 15$ ).

**Materials and methods:** This double-blind, placebo-controlled study (SP0977 ENCORE [NCT01455012]) randomized patients (1:1) to optimal dose rotigotine (1–3 mg/24 h) or placebo. Continuous beat-by-beat BP and heart rate assessments were performed at baseline and end of 4-week maintenance (EoM). Primary outcome was change from baseline to EoM in PLM-associated NSBP elevations (defined: a slope of linear regression  $\geq 2.5$  over 5 consecutive heartbeats [equivalent to  $\geq 10$  mmHg]). Change in total NSBP elevations and PLM index (PLMI) were also assessed. Efficacy data are reported for the full analysis set (FAS).

**Results:** 81 patients (mean  $\pm$  SD age:  $57.2 \pm 10.5$  years; 63% female) were randomized (rotigotine: 40; placebo: 41); 66 (rotigotine: 37; placebo: 29) comprised the FAS. Mean ( $\pm$ SD) baseline PLMI was similar between rotigotine ( $72.9 \pm 55.6$ ) and placebo ( $69.9 \pm 47.9$ ). Reductions from baseline ( $\sim 300$  elevations) in PLM-

associated NSBP elevations were greater with rotigotine vs. placebo (LS mean [95% CI]:  $-239.95$  [ $-275.34, -204.56$ ] vs  $-79.61$  [ $119.25, -39.97$ ]; treatment difference:  $-160.34$  [ $-213.23, -107.45$ ];  $p < 0.0001$ ). Greater decreases from baseline ( $\sim 785$  elevations) to EoM in total NSBP elevations also were observed for rotigotine vs placebo (treatment difference:  $-161.13$  [ $-264.47, -57.79$ ];  $p = 0.0028$ ). Greater decreases from baseline to EoM in PLMI were observed for rotigotine ( $-49.4$  [ $-57.4, -41.4$ ] vs. placebo ( $-16.6$  [ $-25.6, -7.7$ ]) ( $-32.8$  [ $-44.7, -20.8$ ];  $p < 0.0001$ ). Adverse events were consistent with dopaminergic stimulation and transdermal application. 15 patients (rotigotine: 4/40; placebo: 11/41) discontinued prematurely.

**Conclusion:** Rotigotine reduced PLM-associated and total NSBP elevations in patients with RLS. Further investigation is required to determine whether decreases in PLMI-related and total nocturnal BP translate into reductions in cardiovascular risk in patients with RLS.

**Acknowledgement:** This study was supported by UCB Pharma, Monheim am Rhein, Germany.

<http://dx.doi.org/10.1016/j.sleep.2013.11.746>

### Examination of polysomnography in hospitalized patients with acute moderate-severe traumatic brain injury

C. Wiseman-Hakes<sup>1</sup>, P. Gaudreault<sup>1</sup>, C. Duclos<sup>1</sup>, F. Bernard<sup>2</sup>, J. Carrier<sup>1</sup>, N. Gosselin<sup>1</sup>

<sup>1</sup>Centre d'études avancées en médecine du sommeil, Canada

<sup>2</sup>Department of Critical Care Medicine, Intensiviste, Canada

**Introduction:** Traumatic brain injury (TBI) is a commonly occurring condition and a significant public health issue, as it is one of the leading causes of disability worldwide. Complaints of disturbed sleep, excessive daytime sleepiness and disorders of arousal have been well established as being among the most pervasive, enduring and common sequelae, and have been shown to compromise the recovery process if left untreated. Current evidence suggests that sleep wake disorders begin in the acute stage with altered rest-activity cycles as evidenced from actigraphy findings. For those in the chronic stage, studies involving polysomnography have identified a number of changes in sleep architecture including reductions in total sleep time, sleep efficiency, and N3 sleep, and increased stage N1 sleep. For those with severe TBI, hypersomnia and increased sleep need have been identified as being the most common sleep complaint. To date however, there has not yet been an examination of sleep architecture in the acute stage of TBI. The objective of this study was to examine the sleep architecture of adults with acute moderate-severe traumatic brain injury, and to compare these findings with the sleep architecture of age- and sex-matched healthy controls.

**Materials and methods:** Six adults (4 males;  $25 \pm 11.3$  yrs), with moderate-severe TBI underwent 24-h polysomnography (PSG) on average 21 days (range 7–38 days) during their acute hospital stay. Results were compared with those of 11 healthy controls (7 males;  $25 \pm 10.5$  yrs); who underwent in-laboratory PSG. Groups were compared for sleep architecture variables for the night period, determined as the longest 'visually observable consecutive sleep period' identified on the PSG recording in TBI patients. A Mann-Whitney test for non-parametric data was carried out in order to compare PSG parameters between TBI patients and controls.

**Results:** Our results indicated that the TBI group (TBI) tended to have longer total sleep duration (TBI:  $8.1 \pm 2.1$  h; Controls:  $6.6 \pm 1.7$  h  $p = 0.12$ ), greater total wake duration (TBI:  $159 \pm 104.7$  min; Controls:  $53.6 \pm 47$  min,  $p = 0.04$ ), higher number

of arousals and micro-arousals per hour of sleep ( $p = 0.009$ ), and greater number of sleep cycles ( $p = 0.02$ ). No group difference was found for the percentage of each sleep stage (N1: TBI:  $46.1 \pm 11.8$  %, Controls  $42.6 \pm 16.2$ %; N2; TBI:  $20.6 \pm 11.4$ %, Controls  $28.5 \pm 11.5$ ; N3; TBI:  $29.8 \pm 17.0$ %, Controls:  $28.3 \pm 11.0$ ; REM: TBI:  $17.2 \pm 6.0$ %, Controls  $16.8 \pm 4.6$ %).

**Conclusion:** Although our sample size was small, these preliminary findings indicate that even in this very early stage, hospitalized patients with acute severe TBI experience a longer sleep duration, however with greater sleep fragmentation in comparison to control subjects. Additional research is needed to further elucidate and determine the course of these disturbances, and their relationship with clinical, neurological and functional outcomes.

**Acknowledgements:** We gratefully acknowledge the assistance of Ms. H el ene Blais for her assistance with the data for this project.

<http://dx.doi.org/10.1016/j.sleep.2013.11.747>

### Mechanisms underlying declarative memory consolidation are changing with age – Insight from healthy and disturbed sleep

M. Wislowska, D. Heib, K. Hoedlmoser, H. Griessenberger, M. Schabus

University of Salzburg, Department of Physiological Psychology, Laboratory for Sleep, Cognition and Consciousness Research, Austria

**Introduction:** Today there are little doubts about the role of sleep for memory consolidation. Yet, (i) study samples are not always well controlled for age and (ii) data appears inconsistent when it comes to patients groups. Our current studies explore whether age influences sleep-dependent declarative memory consolidation in a population of insomnia patients, as well as healthy sleeper controls.

**Materials and methods:** Firstly, 24 insomnia subjects were divided in two age groups: younger ( $25.75 \pm 6.34$ ) and older ( $43.92 \pm 3.85$ ). Participants learned a list of 80 word-pairs in the evening. Afterwards, they underwent two cued recall sessions, one before and one after 8 h of nocturnal sleep (with full polysomnography). In a follow-up study we extended the previous experiment (investigating two age groups with 34 controls and 25 patients) and also added an interference learning condition in the morning.

**Results:** Data revealed that overnight memory change [OMC] was associated with percent of N3 sleep in older patients ( $r = .540$ ,  $p = .070$ ). Moreover, OMC correlated (i) in younger patients with slow sleep spindle [SS] activity during N3 ( $r = .545$ ,  $p = .067$ ), but (ii) in older patients with slow NREM oscillations (density:  $r = .681$ ,  $p < .05$ ; slope:  $r = .578$ ,  $p < .05$ ). Preliminary analysis of the follow-up study on the other hand revealed that in older controls OMC was associated with REM sleep ( $\rho = .478$ ,  $p < .05$ ). Lastly, resistance to interference correlated with (i) SS in older controls and (ii) older patients (slow SS in N3) and (iii) with fast N2 SS in younger patients.

**Conclusion:** Our findings highlight the potential modulating effect of age for mechanisms of "offline" memory consolidation.

**Acknowledgements:** Research was supported by the Austrian Science Foundation (FWF: P-21154-B18 and I-934). Additionally, D.P.J. Heib is associated and supported by the FWF Doctoral College "Imaging the Mind" at the University of Salzburg (FWF-W1233).

<http://dx.doi.org/10.1016/j.sleep.2013.11.748>

### CPAP adherence as a mediator between co-morbid insomnia, OSA and subjective daytime sleepiness

W. Wohlgenuth, D. Wallace, P. Tetali  
Miami VA Sleep Center, United States

**Introduction:** CPAP effectively treats obstructive sleep apnea (OSA), but as is widely recognized, adherence with the treatment remains a significantly less than desirable in the population. Recent work has begun to explore the association between insomnia and CPAP adherence and indicates that those with co-morbid OSA and insomnia are less likely to adhere to PAP therapy. Less is known the mediational link of CPAP adherence between nighttime symptoms (i.e., insomnia, OSA) and subjective daytime sleepiness in co-morbid insomnia/OSA. We hypothesized that OSA would be positively associated with adherence, insomnia would be negatively associated with adherence and the relationship between nighttime symptoms and daytime sleepiness would be fully mediated by adherence to CPAP.

**Materials and methods:** Participants were 237 veterans who attended follow-up CPAP Clinic at the Miami VA. At that visit, participants had a CPAP download, completed a battery of questionnaires including the Epworth Sleepiness Scale, and the Insomnia Severity Index. Information regarding medical/psychiatric conditions as well as PSG results was extracted from the medical record. A structural equation model with latent variables was constructed and a full mediational model was tested in mPlus. The model hypothesized that the nighttime symptoms (i.e., insomnia, OSA) effect on subjective daytime sleepiness were fully mediated by adherence to CPAP.

**Results:** Adequate statistical support was provided for the hypothesized model (ChiSq = 270.44, df = 143; RMSEA = 0.061; CFI = 0.93, SRMR = 0.075). However, improvement in overall model fit could be made. A second model was hypothesized in which partial mediation was tested and direct paths from nighttime symptoms to daytime sleepiness were added. This model showed a significant improvement in fit (ChiSq change = 15.17, df = 2,  $p < .001$ ). Overall model fit parameters are: ChiSq = 255.27, df = 141; RMSEA = 0.058; CFI = 0.94, SRMR = 0.056. Path coefficients in the final model indicated that CPAP adherence, counter to our hypothesis, was not a significant mediator between nighttime symptoms and daytime sleepiness. Only nighttime insomnia symptoms were related to daytime sleepiness.

**Conclusion:** Insomnia appears to be a particularly troublesome symptom in those with OSA. First, it is negatively associated with adherence, and second, it is positively associated with subjective daytime sleepiness. These results indicated that neither the AHI or adherence were related to daytime sleepiness. More attention should be given to insomnia symptoms in those with OSA.

**Acknowledgements:** No Acknowledgements.

<http://dx.doi.org/10.1016/j.sleep.2013.11.749>

### Reversing decline of higher order cognitive functions during the day with a Nap

M. Wong, K. Lau, E. Lau

Sleep Laboratory, The University of Hong Kong, China

**Introduction:** Apart from memory and attention, the role of sleep on higher order cognitive functions have recently become an important research area. However, the relationship between a nap and these higher order cognitive functions is poorly understood.

**Materials and methods:** Seventy-five university students (Mean age = 20.38, SD = 1.39, 63.5% male) participated in the study and

completed the measures on vigilance, Psychomotor Vigilance Task (PVT), working memory, Spatial N-back test with 2-backs condition (2-back test), and planning, Tower of London Test (TOL), in a pre- and post-condition session and they were randomly assigned to either the Nap group or the Wake group for 90 min between the sessions. The groups were matched in age, sex, body mass index, habitual sleep duration and sleep quality and a mixed ANOVA with Condition (Nap & Wake) as between-subjects factor and Time (Pre & Post) as within-subjects factor was used to test if daytime napping benefits each higher order cognitive function.

**Results:** For PVT, there was no main effect of Condition or Time. A significant Condition \* Time Interaction was found,  $[F(1,65) = 30.587, p < .001]$ . The Nap group had faster, but the Wake group had slower reaction time in the Post-test than the Pre-test respectively. For 2-back test, main effect of time was significant, with subjects having higher accuracy in the post-test than the pre-test,  $[F(1,67) = 15.955, p < .001]$ . No main effect of Condition was found ( $p > .05$ ). There was significant Condition \* Time Interaction  $[F(1,67) = 4.58, p = .036]$ . Improvement in accuracy in the Nap group was larger than that in the Wake group. For TOL, there was no main effect of Condition or Time ( $p > .05$ ). Condition \* Time interaction was found significant,  $[F(1,74) = 4.803, p = .032]$ . The Nap group used fewer but the Wake group used more steps in the Post-test than the Pre-test.

**Conclusion:** Our findings support the role of sleep in higher order cognitive functions that while performance of vigilance, planning and problem solving deteriorates in the Wake group, a 90-min daytime nap is shown to reverse the impaired function, as well as benefits spatial working memory.

**Acknowledgement:** This work was supported by HKU Seed Funding Program for Basic Research.

<http://dx.doi.org/10.1016/j.sleep.2013.11.750>

### Efficacy of auto-trilevel positive airway ventilation on patients with both obesity hypoventilation and moderate to severe obstructive sleep apnea syndromes

Z. Zhang

The First Affiliated Hospital of Nanjing Medical University, China

**Introduction:** To observe the efficacy of auto-trilevel positive airway pressure (Auto-trilevel PAP) ventilation on patients with both obesity hypoventilation syndrome (OHS) and moderate to severe obstructive sleep apnea syndromes (OSAS) by comparison of fixed bilevel positive airway pressure (BiPAP) ventilation.

**Materials and methods:** 17 patients with both OHS and moderate to severe OSAS were recruited. Three different positive airway pressure (PAP) modes issued by the ventilators (SOMNOvent auto-S, Weinmann Inc, Germany) were used for 8 h per night with each mode at each night and two nights' interval without any treatment among different modes. In mode one, the EPAP issued by BiPAP was titrated as the minimal positive pressure for disappearance of snoring. The same inspiratory positive airway pressure (IPAP) titrated by PaCO<sub>2</sub> in mode 1 was used in modes 2 and 3 as well. However, the EPAP issued by BiPAP in mode 2 was 3 cm H<sub>2</sub>O higher than that in mode 1. In mode 3 with autotrilevel PAP, the beginning of EPAP was set the same as that in mode 1 while the end of EPAP (EEPAP) was automatically adjusted to elevate based on upper airway patency condition. Comparisons were made for parameters before and after treatment as well as among different ventilation modes. The following parameters were compared such as nocturnal apnea hypopnea index (AHI), minimal SpO<sub>2</sub> (miniSpO<sub>2</sub>), arousal index, sleep efficiency, morning PaCO<sub>2</sub> and daytime ESS.

**Results:** Compared with the parameters before ventilation therapies, there was a significant decrease in nocturnal AHI, arousal index, morning PaCO<sub>2</sub> and daytime ESS, but a significant increase in nocturnal miniSpO<sub>2</sub> and sleep efficiency caused by all three modes of ventilation (all  $P < 0.01$ ). Comparison among three modes demonstrated that with the same IPAP, the mode 3 could result in the lowest arousal index, daytime ESS and the highest sleep efficiency. Comparison between modes 1 and 2 revealed there was a statistically lower AHI but higher miniSpO<sub>2</sub> and morning PaCO<sub>2</sub> in mode 2 (all  $P < 0.01$ ). Compared with mode 1, in mode 3 there was a lower AHI, higher miniSpO<sub>2</sub> (all  $P < 0.01$ ), but no significant difference in PaCO<sub>2</sub> at the end of therapy. Compared with mode 2, in mode 3 there was a significant lower PaCO<sub>2</sub> ( $P < 0.01$ ), but no significant difference in AHI and miniSpO<sub>2</sub>.

**Conclusion:** Auto-trilevel PAP ventilation is superior over fixed BiPAP ventilation for treatment of OHS with coexisting moderate to severe OSAS, since this novel PAP mode can achieve a higher efficacy in simultaneous removal of residual apnea hypopnea events and correction of hypercapnia as well as in achieving a higher sleep quality and lower daytime sleepiness.

**Acknowledgement:** Thanks to the Weinmann Inc, Germany which provided our research with Auto-trilevel PAP ventilators for clinical study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.751>

### Adiponectin may inhibit chronic intermittent hypoxia-induced endoplasmic reticulum stress and cell apoptosis in genioglossus

Z. Zhang, H. Hanpeng

The First Affiliated Hospital of Nanjing Medical University, Nanjing Medical University

**Introduction:** Adiponectin may inhibit chronic intermittent hypoxia-induced endoplasmic reticulum stress and cell apoptosis in genioglossus. Background Adiponectin is a potent protective molecule against injury caused by chronic intermittent hypoxia (CIH). However, the protective mechanism is not well elucidated. Cell apoptosis was remarkable in genioglossus of rats undergoing CIH. Enhanced endoplasmic reticulum (ER) stress has been recognized as the precursor of acceleration of cell apoptosis. Objective The present study aims to investigate the effects of CIH and adiponectin supplement on ER stress and cell apoptosis in genioglossus of rats.

**Materials and methods:** 30 male Wistar rats were randomly divided into three groups: normal control group (group A), CIH group (group B) and CIH+Ad group (group C) with 10 rats in each. Rats in group A were kept breathing normal air, while rats in both group B and group C received same CIH environment (CIH 8 hr/day for successive 5 weeks). However, rats in group C was given intravenous Ad supplement at the dosage of 100 μg/kg, twice a week for successive 5 weeks. At the end of experiment (day 35), the expression of glucose-regulated protein 78 (GRP78), P38, c-Jun NH-terminal kinase (JNK) and C/EBP homologous protein (CHOP) proteins of genioglossus were tested with western blot assay. In addition, the cell apoptosis of genioglossus in each group was measured through TUNEL and Annexin V/PI staining.

**Results:** Compared with control group, in CIH group the P38 was significantly activated, the expression of GRP78 and CHOP proteins of genioglossus were significantly upregulated, and the rate of cell apoptosis was significantly elevated (all  $P < 0.01$ ). However, compared with CIH group, in group C the activation of P38 was partially inhibited, the expression of GRP78 and CHOP proteins was significantly weakened, and the rate of cell apoptosis was remarkably lower (all  $P < 0.05$ ). There was no significant difference of JNK expression of genioglossus among three groups ( $P > 0.05$ ).

**Conclusion:** Conclusions CIH could induce ER stress and significantly elevate the rate of cell apoptosis through activation of P38-CHOP pathway in genioglossus of rats submitted to CIH. Supplement of extrinsic adiponectin could attenuate excessive ER stress, inhibit activation of P38-CHOP pathway, and thus further reduce the rate of cell apoptosis induced by CIH in genioglossus.

**Acknowledgements:** Thanks to the support from the Department of pathophysiology, Nanjing Medical University for providing this study with CIH instrument.

<http://dx.doi.org/10.1016/j.sleep.2013.11.752>

### The relationships between sleep disturbance among elementary school children and lifestyles of their family

R. Yamamoto<sup>1</sup>, M. Maruyama<sup>2</sup>, R. Hojo<sup>3</sup>, M. Inaga<sup>4</sup>, Y. Nagashima<sup>4</sup>, N. Sugimori<sup>4</sup>

<sup>1</sup> Division of Clinical Psychology, Health Care and Special Support, Graduate School of Education, Joetsu University of Education, Japan

<sup>2</sup> Niigata Prefectural Bureau of Education, Joetsu Education Office, Japan

<sup>3</sup> Division of Humanities and Social Education, Graduate School of Education, Joetsu University of Education, Japan

<sup>4</sup> Specialized Subject Fields of Education, School of Education, Graduate School of Education, Joetsu University of Education, Japan

**Introduction:** This study was designed to examine the relationships between sleep problems among elementary school children and lifestyles of their family.

**Materials and methods:** We conducted a cross-sectional survey at the Elementary School attached to Joetsu University of Education from February to March 2013. The questionnaire for children consists of the Child and Adolescent Sleep Checklist (CASC: Oka, et al., 2009). The questionnaire for caregivers consists of items about lifestyles and sleep problems among their family members. Three hundred eighty-nine elementary school children (and their caregiver) completed and returned the questionnaire (collection rate: 84.74%). The analyzed sample was composed of 378 valid data (168 boys and 210 girls).

**Results:** Ninety-three children (24.6%) were classified into the sleep disturbances group, as defined by a CASC total score  $\geq 18$ . Based on the results of unpaired *t*-test, sleep disturbances among elementary school children was significantly associated with (a) the discrepancy of average time in bed between weekday and a day before a holiday among family members ( $t(368) = 2.13, p = .03$ ), (b) delayed average wake time on the weekend morning of family members ( $t(368) = 2.63, p = .01$ ), (c) the discrepancy of average wake time between weekday and weekend among family members ( $t(358) = 2.61, p = .01$ ), and (d) the percentage of family members with sleep problems ( $t(368) = 2.52, p = .01$ ), and marginally significantly associated with (e) delayed average time in bed on a day before a holiday among family members ( $t(368) = 1.69, p = .09$ ) and (f) the discrepancy of average total sleep time between weekday and weekend among family members ( $t(359) = 1.81, p = .07$ ).

**Conclusion:** Sleep disturbance among elementary school children is associated with the lifestyles of their family members. For the children's sleep health, this study suggests that all family members should try to keep a regular sleep-wake schedule and especially try not to catch up on sleep on their days off.

**Acknowledgements:** This study was approved by the Ethics Committee of Joetsu University of Education. This study was granted by Research Project of Joetsu University of Education (General Research 2012–2013).

<http://dx.doi.org/10.1016/j.sleep.2013.11.753>

### Influence of application of the new rule for hypopnea in cardiac patients

A. Yanai

Kyushu University Hospital, Sleep Apnea Center, Japan

**Introduction:** In 2012, American Academy of Sleep Medicine (AASM) proposed a new rule for hypopnea in adults (Version 2), where hypopnea is scored when the flow signal excursions drop by  $\geq 30\%$  of pre-event baseline accompanied by  $\geq 3\%$  desaturation or arousal. The phase or the temporal shape of oxygen saturation of central hypopnea or mixed hypopnea is very different from those of obstructive hypopnea. Many patients with heart disease have more central apnea including Cheyne Stokes respiration (CSR) and mixed apnea and, therefore, application of the new rule may bring about a significant change in the judgment of sleep disordered breathing, especially in patients with heart disease. Thus, we analyzed and compared the respiratory events using both version 1 (AASM 2007, alternative rule) and version 2 rules.

**Materials and methods:** The subject comprised of 75 patients who underwent Full PSG at our sleep laboratory. Patients were classified into those without heart disease ( $n = 20$ , age  $52 \pm 15$  years, male 85%), with heart disease ( $n = 55$ , age  $62 \pm 15$  years, male 76.2%). The patients with heart disease were further divided into those who mainly had CSA ( $CSA_i \geq 50\%$  and  $AHI_i \geq 5/h$ ,  $n = 13$ , age  $63 \pm 18$  years, male 85%) and those without CSA dominance. Data were analyzed using both version 1 and 2 rules and compared between them.

**Results:** The mean apnea-hypopnea indices (AHI) of the group without heart disease by version 1 and 2 were  $29 \pm 20/h$  vs  $30 \pm 20/h$  respectively ( $P = ns$ ). Correlation coefficient between both analysis was  $y = 1.03x$ ,  $R^2 = 0.996$ . The mean AHI of the group with heart disease was  $35 \pm 20/h$  and  $36 \pm 20/h$  respectively ( $P = ns$ ). Correlation coefficient between both was  $y = 0.98x + 2.29$  and  $R^2 = 0.995$ . The mean AHI of the group with CSA dominance was  $44 \pm 18/h$  vs  $45 \pm 17/h$  respectively ( $P = ns$ ). Correlation coefficient between both was  $y = 1.02x$  and  $R^2 = 0.994$ .

**Conclusion:** Though there may be a substantial difference between the AHI results when analyzed using both versions of criteria in the cardiac or non-cardiac patients especially with low AHI, there was no significant difference among the groups as a whole. Thus, there may not be any serious problem by the analysis with the new version rule in these populations.

**Acknowledgement:** There is no COI in all authors.

<http://dx.doi.org/10.1016/j.sleep.2013.11.754>

### Assessing the knowledge and attitude general physician about sleep medicine in Qazvin, Iran

Z. Yazdi<sup>1</sup>, S. Jalilolghadr<sup>2</sup>, S. Rezaiean<sup>1</sup>

<sup>1</sup>Qazvin University of Medical Sciences, Iran

<sup>2</sup>Metabolic Disease Research Center, Qazvin University of Medical Sciences, Iran

**Introduction:** Although sleep disorders are common, these are under-recognized and under-estimated by many physicians due to lack of physician's education in sleep and sleep disorders. Insomnia and sleep apnea are two of the most common sleep disorders. We conducted this survey to assess the general knowledge and attitude of primary health care physicians in Qazvin toward sleep disorders.

**Materials and methods:** A questionnaire including self report measures of the frequency and routines of treatment and assessment of sleep problems was distributed to 243 general physicians in Qazvin.

**Results:** 49.3% of physicians were male and 50.6% were female. Only 45.7% agreed that sleep disorders are a distinct medical specialty and 71.2% felt that sleep disorders are common medical problems based on their practice. The recognition of some of the serious consequences of obstructive sleep apnea syndrome was poor that were shown below; motor vehicle accidents (82.7%), ischemic heart disease (65.8%), hypertension (70.8%), depression (94.2%), pulmonary hypertension (51%) and metabolic disorders (60.5%).

**Conclusion:** We concluded that general physicians in Qazvin do not recognize the importance and impact of obstructive sleep apnea syndrome and other sleep disorders. Education of general physicians about sleep disorders may increase detection of sleep disorders; and the number of referrals, the provision of proper treatment and the prevention of complications.

**Acknowledgement:** We thanks all the participants of the survey for their kind cooperation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.755>

### Amygdala opioid receptors mediate the electroacupuncture-induced deterioration of sleep disruptions in epilepsy rats

P. Yi<sup>1</sup>, F. Chang<sup>2</sup>

<sup>1</sup>Aletheia University, Department of Sports, Health & Leisure, Taiwan

<sup>2</sup>National Taiwan University, School of Veterinary Medicine, Taiwan

**Introduction:** Clinical and experimental evidence demonstrates that sleep and epilepsy reciprocally affect each other. The effects of acupuncture of Feng-Chi (GB20) acupoints on epilepsy suppression and insomnia treatment have been documented in the ancient Chinese literature, Lingshu Jing. However, the action of electroacupuncture (EA) stimulation of bilateral Feng-Chi acupoints on epilepsy-induced sleep disruptions has not been investigated. This current study was designed to elucidate the effect of EA stimulation of bilateral Feng-Chi acupoints in the epilepsy-induced sleep disruptions.

**Materials and methods:** Administration of pilocarpine into the left central nucleus of amygdala (CeA) induced the focal epilepsy in rats. Rats received a 30-min 100 Hz EA stimulation of bilateral Feng-Chi acupoints per day, beginning at 30 min before the dark period and performing in three consecutive days. Electroencephalogram (EEG) and sleep-wake activity were recorded and lasted for 24-h. These recording were acquired before and after the manipulations. The broad-spectrum opioid receptor antagonist (naloxone), mu-receptor antagonist (naloxonazine), delta-receptor antagonist (naltrindole) and kappa-receptor antagonist (nor-binaltorphimine) were administered directly into the CeA to elucidate the involvement of CeA opioid receptors in the EA effect.

**Results:** Administration of pilocarpine into the CeA induced focal epilepsy and decreased both rapid eye movement (REM) sleep and non-REM (NREM) sleep. High-frequency (100 Hz) EA stimulation of bilateral Feng-Chi acupoints further deteriorated epilepsy-induced sleep disruptions. The EA-induced exacerbation of sleep disruptions was blocked by microinjection of naloxone, naloxonazine, nor-binaltorphimine or naltrindole into the CeA.

**Conclusion:** This study suggests that high-frequency (100 Hz) EA stimulation of bilateral Feng-Chi acupoints exhibits no benefit of improving epilepsy-induced sleep disruptions; in contrast, EA further deteriorated the sleep disturbances. In addition, the opioid receptors in the CeA mediated EA-induced exacerbation of sleep disruptions in rats with focal epilepsy.

**Acknowledgements:** This work was supported by National Science Council grant NSC99–2320-B-002-026-MY3. We thank Mr. Yi-Fong Tsai's technical assistance in this project.

<http://dx.doi.org/10.1016/j.sleep.2013.11.756>

### Dislipidemia with obstructive sleep apnea (OSAS) in patients over sixty years old

M. Yildiz<sup>1</sup>, G. Keskin<sup>2</sup>, B. Karaalioglu<sup>2</sup>, B. Tekgul<sup>3</sup>

<sup>1</sup> Ankara Diskapi Yildirim Beyazit Education and Research Hospital, Turkey

<sup>2</sup> Ankara Yildirim Beyazit Education and Research Hospital, Turkey

<sup>3</sup> Ankara Diskapi Education and Research Hospital, Turkey

**Introduction:** OSAS (obstructive sleep apnea) is a frequent condition characterized by recurrent episodes of upper airway obstruction during sleep, daytime sleepiness and nocturnal hypoxemia. Increased sympathetic nerve activity and metabolic abnormalities are frequent in OSAS. Most of the symptoms, risk factors and predisposition factors are similar both in OSAS and cardiovascular disease. Hypoxia lead to endothelial dysfunction and oxidation of LDL cholesterol as a result of oxidative stress in OSAS. A large number of studies demonstrated that plasma lipid and apolipoprotein levels were similar both in OSAS and control groups however in OSAS dysfunction of HDL cholesterol and increased oxidized LDL cholesterol levels were found. AHI index is considered to be responsible for the disorder of HDL and LDL cholesterol levels.

**Materials and methods:** 40 patients age of 60 and over referred to the sleep clinic suffering from OSAS symptoms and undergone to the diagnostic polysomnography procedure were included in the study. The patients were divided into four subgroups based on the severity.

**Results:** 440 patients age of 60 and over referred to the sleep clinic suffering from OSAS symptoms and undergone to the diagnostic polysomnography procedure were included in the study. The patients were divided into four subgroups based on the severity of OSAS.

**Conclusion:** In this study, gender was found not to be significantly related with severe OSAS in addition a significant relation of BMI and OSAS was demonstrated ( $p < 0.05$ ). Percentage of being obese or morbid obese was indicated higher in patients with severe OSAS. A significant relation between OSAS and cigarette was not determined meanwhile neck circumference and visceral obesity was found obviously increased in severe OSAS. Dyslipidemia one of the most important factor contributes to the cardiovascular mortality and morbidity was not associated directly with degree of OSAS ( $p > 0.05$ ). Whether the patients with dyslipidemia classified according to degree of OSAS and gender received drugs or not did not create a significant difference ( $p < 0.05$ ). However, in patients with dyslipidemia and using drug, in moderate OSAS, cholesterol levels in male patients than female patients were found to be significantly regulated ( $p < 0.05$ ).

**Acknowledgements:** 1-A report of National Commission on Sleep Disorders Research. Washington, DC U.S. Government Printing Office, 1995. 2-Ancoli-Israel S, Kripke DF, Klauber MR, et al. Sleep-disordered breathing in community-dwelling elderly. *Sleep* 1991; 14:486–95 Monograph 1998;10: 75–105. 3- Bixler EO, Vgontzas AN, Ten Have T, et al. Effect of age on sleep apnea in men I: Prevalence and severity. *Am J Respir Crit Care Med* 1998;157–148.

<http://dx.doi.org/10.1016/j.sleep.2013.11.757>

### The effect of caffeine nap on declarative and procedural memory in elderly

J. Wan<sup>1</sup>, E. Lau<sup>1</sup>, T. Lee<sup>2</sup>

<sup>1</sup> The University of Hong Kong, Sleep Laboratory, Hong Kong

<sup>2</sup> The University of Hong Kong, Laboratory of Neuropsychology, Hong Kong

**Introduction:** Previous studies demonstrated that daytime nap contributed to sleep-dependent memory consolidation, and some studies suggested that nap combined with the use of caffeine have additional benefit on cognitive functioning. However, such effect has not been examined in the elderly population. The present study aimed to examine the effect of nap, combined with the use of different dosages of caffeine, on memory processing in elderly.

**Materials and methods:** The present study recruited twenty-four healthy elderly aged between 61 and 80 years ( $70.58 \pm 5.24$  years), who were habitual nappers and non- to moderate- caffeine consumers. We adopted a randomized, double-blind, placebo-controlled within-subject design. Each participant completed 4 experimental sessions, including Wake (W), Nap only (Nap0), Nap with 100 mg caffeine (Nap100), and Nap with 200 mg caffeine (Nap200), with intervals of one-week. Participants were required to stay awake in W condition, and were required to take nap in a 1-h window in the remaining 3 conditions. Placebo or caffeine-containing solutions were administered before rest/nap. Electrophysiological activities were monitored by polysomnography (PSG). A declarative memory task and a procedural memory task were administered before and after the rest/nap.

**Results:** Two-way repeated measures ANOVA revealed no main effect of condition on declarative or procedural memory. Correlation analysis on the relationship between sleep oscillation (spindle (Sp) density and slow wave activity (SWA) density) and post-nap changes in declarative and procedural memory showed that in Nap0 condition, Sp density was associated with improvement on procedural and declarative memory; and SWA density was associated with improvement on declarative memory. In Nap100 condition, Sp density showed association with improved declarative memory, and SWA density showed association with improvement on both procedural and declarative memory. In Nap200 condition, only SWA density showed correlation with improvement on procedural and declarative memory.

**Conclusion:** The benefit of nap on memory consolidation was not found in elderly based on the behavioural measurement. Analysis on sleep oscillation showed that Sp density and SWA density were associated with post-nap improvement on declarative and procedural memory, which was similar to the pattern reported in young adults. Association between Sp and post-nap memory improvement was absent in conditions involved use of caffeine. The underlying mechanism remained to be addressed.

**Acknowledgement:** Current study was supported by the Seed Grant of The University of Hong Kong.

<http://dx.doi.org/10.1016/j.sleep.2013.11.758>

### Parasomnias in Parkinson's disease

A. Ylikoski<sup>1</sup>, K. Martikainen<sup>2</sup>, M. Partinen<sup>1</sup>

<sup>1</sup> Vitalmed Research Center, Helsinki Sleep Clinic, Finland

<sup>2</sup> The Finnish Parkinson Association, Finland

**Introduction:** Sleep disturbances in patients with Parkinson's disease (PD) are common. PD patients complain of insomnia and fragmented nocturnal sleep. Occurrence of different parasomnias have been largely overlooked and we have not found previous systematic studies on parasomnias.

**Materials and methods:** We studied occurrence of parasomnias and their association with other symptoms in PD patients. A structured questionnaire was sent to 1447 patients who were randomly selected from the registry of the Finnish Parkinson Association. The response rate of 59.0%. The questionnaire covered demographic items, and it included questions derived from the Basic Nordic Sleep Questionnaire and items about different parasomnias.

**Results:** The most common parasomnias occurring at least weekly were sleep talking (21.4%), nightmares (17.0%), hallucinations (11.2%), and bruxism (4.6%). At least monthly occurring parasomnias included night terrors (8.3%) and sleep walking (3.1%). Among other sleep related phenomena nocturnal sweating occurred weekly in 28.8%, nocturia (>3 times nightly) in 15.8% and bedwetting monthly in 28.5%. The prevalence of REM sleep behavior disorder (RBD) evaluated by the Marburg RBDSQ  $\geq 6$  was 36.7%. Association of RBD with NREM sleep parasomnia (parasomnia overlap disorder) was found in 18.2% of all participants. Adjusted logistic regression analysis showed weekly nightmares (OR 7.1; 95% CI 3.2–15.5) and weekly sleep talking (OR 7.1; 95% CI 3.8–13.4) predicting the presence of RBD.

**Conclusion:** In Parkinson's disease the prevalence of RBD is over-represented and it is often associated with other parasomnias. More attention should be paid to the detection and treatment of parasomnias.

**Acknowledgement:** This study was supported by the Finnish Parkinson Foundation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.759>

### Continuous positive airway pressure therapy decreases plasma glucose levels after the glucose load even in non-diabetic patients with obstructive sleep apnea

C. Yoshimura<sup>1</sup>, A. Tamura<sup>2</sup>, Y. Kawano<sup>2</sup>, T. Watanabe<sup>3</sup>, S. Ando<sup>1</sup>

<sup>1</sup> Kyushu University Hospital, Sleep Apnea Center, Japan

<sup>2</sup> Oita University, Department of Cardiology and Clinical Examination, Japan

<sup>3</sup> Oita Nakamura Hospital, Division of Cardiovascular Medicine, Japan

**Introduction:** Although much attention has been paid to a positive association between obstructive sleep apnea (OSA) and impaired glucose metabolism, no information is available on the effect of continuous positive airway pressure (CPAP) on plasma glucose levels in oral 75-g glucose tolerance tests (75-g OGTTs) in patients with OSA.

**Materials and methods:** A total of 47 non-diabetic patients who underwent full polysomnography for suspected OSA and who were newly diagnosed as having OSA with an apnea-hypopnea index (AHI)  $\geq 20$  were prospectively enrolled in this study. The patients were divided into the following 2 groups: 29 patients in whom CPAP could be introduced (CPAP group) and 18 patients in whom CPAP could not be introduced (non-CPAP group). All patients underwent 75-g OGTTs at baseline and after 6 months.

**Results:** There were no significant differences in age, body mass index, prevalence of men, hypertension, dyslipidemia or current smokers, medications and polysomnographic parameters between the 2 groups. In the CPAP group, AHI decreased significantly ( $51.8 \pm 15.7$ – $5.6 \pm 5.5$ ,  $p < 0.001$ ). Plasma glucose levels at 2 h after glucose load decreased significantly after 6 months in the CPAP group ( $149.0 \pm 27.8$  mg/dl to  $132.9 \pm 27.1$  mg/dl,  $p = 0.009$ ), whereas the levels did not change significantly in the non-CPAP group ( $141.7 \pm 28.9$ – $151.8 \pm 46.9$  mg/dl,  $p = 0.33$ ). The body mass index, fasting plasma glucose level and homeostasis model assessment for insulin resistance did not change in the both groups.

**Conclusion:** This study indicates that CPAP therapy can decrease the plasma glucose level after glucose load in non-diabetic patients with OSA, suggesting that CPAP therapy has a favorable effect on glucose metabolism even in non-diabetic patients with OSA.

<http://dx.doi.org/10.1016/j.sleep.2013.11.760>

### Anatomical analysis of nasal cavity in stuffy patient with snoring

D. Lee<sup>1</sup>, B. Yu<sup>2</sup>, J. Kim<sup>2</sup>, S. Yun<sup>2</sup>, G. Lee<sup>2</sup>

<sup>1</sup> Daejeon St. Mary's Hospital, Otolaryngology, Catholic University of Korea, Republic of Korea

<sup>2</sup> Yeouido St. Mary's hospital, Otolaryngology, Catholic University of Korea, Republic of Korea

**Introduction:** The stuffy patient with snoring is common. After septal surgery, snoring symptom is improved often. So when evaluating patients with snoring for septoplasty, it is important to assess for nasal airway obstruction. In this study, we evaluated the relationship between subjective nasal obstruction and the corresponding anatomic nasal parameters in patients with nasal obstruction and snoring using PNS CT so as to acquire better result.

**Materials and methods:** Between March 2009 and February 2012, A total of 90 patients who underwent PNS CT imaging for preoperative evaluation were divided into 2 groups; 50 patients with nasal septal deviation who underwent septoplasty with nasal obstruction and snoring were enrolled in the study group and 40 patients without nasal septal deviation who underwent transsphenoid pituitary tumor operation without nasal obstruction were enrolled in the control group. The subjective nasal obstruction was measured by NOSE scale and NO-VAS. A preoperative coronal CT image was used for calculation of both nasal cavity cross-sectional areas at the three level of the internal nasal valve, ostiomeatal unit (OMU) and choana and used for calculation of septal deviation angle at the two level of internal nasal valve and OMU in both the study and control groups. We compared cross-sectional areas and septal deviation angles derived from both groups and evaluated the relationship between subjective nasal obstruction and the anatomic nasal parameters in the study group.

**Results:** In the study group, there was correlation between subjective nasal obstruction and the septal deviation angle, the sum of both nasal cavity cross-sectional areas and the larger area of both nasal cavity cross-sectional areas respectively at the OMU level. And in the same group, there was correlation between subjective nasal obstruction and the sum of both nasal cavity cross-sectional areas, the larger area and the smaller area of both nasal cavity cross-sectional areas respectively at the choana level. There was a difference between the study group and the control group in all anatomical nasal parameters (septal deviation angle, the sum of both nasal cavity cross-sectional areas and the area gap between both nasal cavity cross-sectional areas) at the three level of internal nasal valve, OMU and choana.

**Conclusion:** This study indicated that the septal deviation angle and nasal cavity cross-sectional areas at the level of OMU and choana are related to subjective nasal obstruction. So when we evaluate nasal obstruction in patients with snoring, the middle and posterior part patency of nasal cavity is also important along with anterior nasal valve part.

**Acknowledgement:** The authors have no financial interest to declare in relation to the content of this paper. No outside funding was received.

<http://dx.doi.org/10.1016/j.sleep.2013.11.761>

### Sleep disorders among children in China: a review of published studies in Chinese language

X. Yu, G. Wang, G. Xu

School of Psychology and Cognitive Science, East China Normal University, China

**Introduction:** Sleep problems can harmfully affect every aspect of a child's physical and psychological health, which has been recognized as a public issue in the whole world. While several studies in English shed some light on sleep problems among Chinese children, there exist similar studies in Chinese. These may be unavailable to non-Chinese practitioners and researchers due to the language barrier. The current study is to make a comprehensive review of these studies to bridge the gap.

**Materials and methods:** Electronic searches of the Chinese National Knowledge Infrastructure (CNKI), the most comprehensive search engine in China, were conducted by two authors. The time period for the searches was 1974 to June 2013. Keywords included "sleep", "sleep disorder", "sleep problems", "sleep disturbances", "infant", "child", "nursling", "preschool-aged children", "pupil", "school-aged children" and extensions of these terms. A total of 553 potential studies were initially identified, but only 98 studies met the criteria for this review: the child's age was from 0 to 18; studies published in Chinese language.

**Results:** The selected studies can be organized into four major categories: Review of the current studies abroad ( $n = 10$ ). Survey research ( $n = 62$ ) subdivided into three subcategories: survey among general participants ( $n = 47$ ), survey aimed at the special group who were fat, poor or suffering from diseases ( $n = 15$ ), correlation analysis between sleep disorder and other characteristics ( $n = 13$ ). Studies of some sleep disorders ( $n = 13$ ) and 2 case studies. In general, the majority are based on studies abroad and lack empirical research. Except for questionnaires, only 4 of them have applied other methods such as EEG. While there is no uniform conclusion on the characteristics, influencing factors, and incidence rate of sleep problems in different areas of China, some common results do exist: sleep problems and short sleep patterns are common in Chinese children. Different ages and stages indicated different developmental features. The main influencing factors were family environment, pregnancy state, sleep habits, biological factors, parental pattern, and so forth.

**Conclusion:** Although studies in the Chinese language regarding pediatric sleep problems are relatively limited, they definitely contribute to research and clinical settings of sleep medicine. Further endeavors should include making existing studies in Chinese language available to non-Chinese researchers and practitioners, and publishing new studies in Chinese, English and other languages.

**Acknowledgement:** We thank the previous researchers whose studies made our review possible.

<http://dx.doi.org/10.1016/j.sleep.2013.11.762>

### Analysis of eeg functional connectivity prior to somnambulism

M. Desjardins, J. Godbout, J. Montplaisir, J. Carrier, A. Zadra  
Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, Canada

**Introduction:** There has been increased interest in examining sleep EEG data in terms of functional brain connectivity. These new investigative tools, however, remain practically unexplored in relation to sleep disorders. We studied the EEG coherence and interdependencies between brain areas before the onset of somnambulistic episodes recorded in the sleep laboratory.

**Materials and methods:** 13 adult sleepwalkers were investigated with polysomnography. Patients were selected on the basis of having

experienced a somnambulistic episode in the sleep laboratory during their first period slow-wave sleep (SWS). The 20 s immediately preceding the onset of each of the 13 episodes was compared to the 20 s occurring two minutes prior to these episodes' onset. Data from the Fp1, Fp2, F3, F4, C3, C4, P3, P4, O1, O2 leads were investigated using two complimentary measures of brain connectivity: standard coherence and imaginary coherence (the latter addressing the problem of spurious correlations due to common sources).

**Results:** The largest observed difference between the 20 s periods occurring immediately prior to episode onset versus the 20 s segments occurring 2 min before episode onset was for the imaginary coherence with greater connectivity taking place immediately preceding sleepwalking episodes. Furthermore, increased connectivity was strongest between frontal and occipital brain areas.

**Conclusion:** These pilot findings suggest that episodes of somnambulism are preceded by temporal changes in brain connectivity and that a direct interdependence between frontal and occipital brain regions may be implicated. The study of EEG connectivity in relation to NREM parasomnias may help elucidate brain processes underlying episode occurrence.

**Acknowledgements:** This research was supported by research grants from the Fonds de la recherche en sante du Quebec (FRSQ) and from the Canadian Institutes of Health Research (CIHR).

<http://dx.doi.org/10.1016/j.sleep.2013.11.763>

### Sleep disorders in a sample of Egyptian high risk pregnant females

N. Zaki<sup>1</sup>, Y. Mesbah<sup>2</sup>, M. Shams<sup>2</sup>

<sup>1</sup> Mansoura University, Dept of Psychiatry, Faculty of Medicine, Egypt

<sup>2</sup> Mansoura University, Department of Obstetric and Gynecology, Egypt

**Introduction:** Sleep problems in pregnancy are common, with most pregnant women reporting decreasing sleep quality and increased night awakening especially when they approach labor. Studies have found that 82–98% of women in late pregnancy report waking at night, and 64–86% report problems with sleep quality during pregnancy. Furthermore, a number of studies have shown an increased frequency of snoring and sleep disordered breathing as pregnancy progresses. **Aims:** This study aimed to assess sleep practices and sleep quality in high risk pregnancy women, and to document self-reported changes that occurred between the pre-pregnancy period and the time of inclusion in the study. Also to correlate the sleep findings with other sample data like parity and pre-pregnant sleep and family history of medical illness.

**Materials and methods:** High risk pregnant females ( $N = 59$ ) were recruited from Antenatal care Unit at Mansoura University Hospital. Questions included information about maternal demographics, perceived sleep quality, sleep difficulties, night awakening, snoring, daytime tiredness, and daytime napping in addition to medical conditions in the women and their families, pre-pregnant sleep duration and complaints of current sleep problems were reviewed. Questions relating to sleep quality were based on the Pittsburgh Sleep Quality Index (PSQI), a 9-question self-rated test intended to measure sleep disturbances and quality of sleep. Participants also completed the Epworth Sleepiness Scale (ESS) to assess daytime sleepiness. The ESS asks people to rate, on a 4-point scale (0–3), their usual chances of dozing off or falling asleep in eight different situations or activities that most people engage in as part of their daily lives. The Insomnia Severity Index was also used. It has seven questions. The seven answers are added up to get a total score and categorize the degree of insomnia. Statistical analysis was conducted using the SPSS v20 statistical package.

**Results:** Respondents numbered ( $N = 59$ ). The Mean age of participating women was (28.9,  $SD \pm 6.7$ ), 38.9% were illiterate while 47.7% were educated and 15.2% could only read and write. The mean gestational age was (30.26 week,  $SD \pm 7.02$ ). They were all high risk pregnancies. 79.6% were hypertensive, and pregnant women with other medical complications were around 50.8% of the sample. Mean number of sleeping hours before pregnancy was 7.8 h ( $SD \pm 2.16$ ). The Mean score on PSQI was 7.12 ( $SD \pm 3$ ), the higher the candidates age the lower PSQI they got ( $r = -0.05$ ), while the Mean on ESS was 8.68 ( $SD \pm 4.79$ .) Insomnia and snoring was a frequent complaint. Candidates with Hypertension and other medical complications tended to have sleep problems prior to their pregnancy with excessive daytime sleepiness and poorer sleep quality.

**Conclusion:** Sleep problems were common in this group of women in late pregnancy, and these disturbances were increased comparative to their pre-pregnancy experience. Improving sleep in pregnant ladies in general and those with high risk pregnancy specifically might lessen the impact of their medical condition on their health and fetal outcomes. Screening for sleep disorders during pregnancy with defined standards of good sleep hygiene for pregnant ladies should be a core item in antenatal care units.

**Acknowledgements:** We would like to acknowledge the efforts of nurses and staff members at Antenatal care units of Mansoura University Hospital and all the participating candidates.

<http://dx.doi.org/10.1016/j.sleep.2013.11.764>

### The silence of sleep disorders. High prevalence of insomnia and obstructive sleep apnea symptoms in chronic hepatitis C infection

D. Zalai<sup>1</sup>, K. Mcshane<sup>1</sup>, M. Sherman<sup>2</sup>, K. Fornadi<sup>2</sup>, C. Shapiro<sup>2</sup>, C. Carney<sup>1</sup>

<sup>1</sup>Ryerson University, Canada

<sup>2</sup>University Health Network, Canada

**Introduction:** Fatigue is the leading patient reported symptom in chronic hepatitis C infection. Although the fatigue is recognized as an important patient reported outcome measure in hepatitis C research trials, it is rarely addressed in clinical settings. Sleep disorders are commonly associated with fatigue, yet the prevalence of specific sleep disorders and their contribution to fatigue in hepatitis C infection is unknown. The objective of this study was to determine the prevalence of clinical insomnia and obstructive sleep apnea and their association with fatigue in patients with hepatitis C infection treated at a tertiary liver clinic.

**Materials and methods:** Treatment seeking participants with chronic hepatitis C infection ( $N = 115$ ; 36% females; mean age = 56) were enrolled in a mixed design study on fatigue. Participants completed questionnaires on their fatigue, sleep, fatigue specific cognitions, depression and anxiety. Medical data were retrieved from hospital charts. Fatigue was assessed with the Fatigue Severity Scale (FSS), insomnia was assessed with the Insomnia Severity Index (ISI), excessive daytime sleepiness was measured with the Epworth Sleepiness Scale (ESS) and the risk for obstructive sleep apnea was determined with the STOP-BANG questionnaire.

**Results:** Almost 60% of the total sample (56.9% of males and 64.3% of females) obtained a score indicating severe fatigue C related functional impairment (FSS  $\geq 4$ ). The median FSS score was 4.67 (interquartile range = 2.92). More than one third of the sample (30.1% of males and 43% of females) scored above the ISI cut-off indicating moderate or severe clinical insomnia. Seventy-one percent of the sample (80.9% of males and 54.8% of females) scored at or above the cut-off score of 3 on the STOP-BANG questionnaire indicating a

70%–86% likelihood of obstructive sleep apnea. Only 7% of the total sample had been diagnosed with sleep apnea. A one way ANOVA and post hoc tests indicated that participants with clinical insomnia only and those with a combination of clinical insomnia and potentially moderate/severe sleep apnea reported significantly higher fatigue than those without a clinically significant sleep problem or with a possible sleep apnea only. The mean ESS was above the cut-off for excessive daytime sleepiness only in the group with a combination of clinical insomnia and obstructive sleep apnea.

**Conclusion:** Clinically significant insomnia and obstructive sleep apnea Cseparately and in combination – may affect 50% of patients with chronic hepatitis C infection treated in tertiary liver centers. Obstructive sleep apnea is severely underdiagnosed and treated in this group. Patients with insomnia or a combination of insomnia and obstructive sleep apnea report the most severe fatigue related functional impairment. Excessive daytime sleepiness is not a sensitive marker of sleep disorders in this group, as only those with comorbid sleep disorders reported abnormal level of sleepiness. Screening for insomnia and obstructive sleep apnea and effective treatment of these disorders may alleviate the burden of fatigue of a significant proportion of patients with chronic hepatitis C infection.

<http://dx.doi.org/10.1016/j.sleep.2013.11.765>

### Are you concerned about your fatigue? Fatigue perceptions mediate the relationship between insomnia and fatigue related functional impairment in chronic hepatitis C infection

D. Zalai<sup>1</sup>, K. Mcshane<sup>1</sup>, M. Sherman<sup>2</sup>, K. Fornadi<sup>2</sup>, C. Shapiro<sup>2</sup>, C. Carney<sup>1</sup>

<sup>1</sup>Ryerson University, Canada

<sup>2</sup>University Health Network, Canada

**Introduction:** Insomnia affects about one third of patients with chronic hepatitis C infection. Fatigue is the cardinal daytime symptom of insomnia. Those with comorbid insomnia are the most fatigued patients at liver clinics. Although we have successful treatments for insomnia, fatigue is a frequent residual complaint. This is especially concerning since chronic fatigue is associated with significant functional impairment in this group. Understanding the psychological mechanisms that maintain fatigue and fatigue related functional impairment in those with a history of co-morbid insomnia may facilitate the development of CBT-I treatments enhanced with a fatigue treatment component in the medically ill.

**Materials and methods:** Treatment seeking participants with chronic hepatitis C infection ( $N = 115$ ; 36% females; mean age = 56) were enrolled in a mixed design study on fatigue. Participants completed questionnaires on their fatigue, sleep, fatigue specific cognitions, depression and anxiety. Medical data were retrieved from hospital charts. Fatigue was assessed with the Fatigue Severity Scale (FSS), insomnia was assessed with the Insomnia Severity Index (ISI). The Brief Illness Perception Questionnaire, the Chronic Fatigue Acceptance Questionnaire and the Daytime Insomnia Symptom Response Scale were used for measuring fatigue specific cognitive factors.

**Results:** A bootstrapping mediation analysis (confidence level: 5000 resamples) revealed that the effect of insomnia on fatigue was fully mediated by two domains of fatigue perception: concern about fatigue (standardized effect = .3759, bias corrected accelerated confidence interval = .2444 to .5127) and control over fatigue (standardized effect = .0891, bias corrected accelerated confidence interval = .0290 to .1968).

**Conclusion:** Patients' concern about their fatigue and their perceived degree of control over their fatigue provided the link between

insomnia (ISI) and fatigue related functional impairment (FSS). Future research should test this theoretical model in other medically ill populations with comorbid insomnia and significant fatigue. The model implies that a fatigue-focused component targeting fatigue perceptions and fatigue management may become an important addition to the insomnia treatment in the medically ill.

<http://dx.doi.org/10.1016/j.sleep.2013.11.766>

### Study of thermal properties, toxicity emissions and rebreathing avoidance as exogenous stressors of sudden infant death syndrome in baby mattresses. Design recommendations

T. Zamora<sup>1</sup>, G. Pin<sup>2</sup>, V. Barberá<sup>3</sup>, M. Morell<sup>2</sup>, M. Aznar<sup>4</sup>, P. Huertas<sup>5</sup>

<sup>1</sup> ESCI, European Sleep Care Institute, Spain

<sup>2</sup> Pin arboledas, Unidad Valencia del Sueño H Quirón Valencia, Spain

<sup>3</sup> Elastic Confort, Spain

<sup>4</sup> Oekotex, Spain

<sup>5</sup> UPV, Spain

**Introduction:** Sudden Infant Death Syndrome (SIDS) is the highest cause of death in the post- neonatal period. According to the Triple Risk Model (Kinney et al., 2009), SIDS results when three factors simultaneously influence the infant: (a) an underlying vulnerability in the infant, (b) a critical developmental period, and (c) an exogenous stressor. Considering exogenous stressor evidences, the objectives were: to determine the thermal behavior of current baby mattresses, to test improvements reached by new materials, to confirm the viability to design harmfulness mattresses according to Oeko-tex, to confirm that rebreathing of exhaled air is above the safety threshold concluding with a design criteria including the properties mentioned above.

**Materials and methods:** Thermal test It was used a thermal mannequin ST-2 made by Measurement Technology Northwest. Test specimens were: (1) spring mat.-foam-textile cover sewed. (2) Fiber mat.-foam 3d textile. (3) PU mat. core low density PU-PVC cover. (4) PU Mat. core with low density PU. (5) Babykeeper® mat. core. (6) Babykeeper® mat. core-3D foam textile. (7) Babykeeper® mat. core-Smart textile. Toxicity and Rebreathing test Oekotex test was performed by AITEX following label standards. To study rebreathing avoidance an infant mannequin was simulated as a head box which was placed with its open face on the mattress and connected with tubing to a gas reservoir filled with 5% CO<sub>2</sub>. Also it was used 50 cc syringe with two one-way valves which simulates infant breathing. Finally a CO<sub>2</sub> analyzer was placed in the head box (tested by Bar-Yishay Phd). Both tests were executed to confirm liability of new materials: spec. 2 and 7.

**Results:** Thermal Test Results (Test Specimen (Temperature average last 30 min, Thermal Resistance Rt (C m<sup>2</sup>/W)): 1: (38.4°C, 3.2) 2: (40.1°C, 3.34) 3: (38.4°C, 3.2) 4: (38.1°C, 3.17) 5: (37.2°C, 3.1) 6: (38.5°C, 3.20) 7: (38.3°C, 3.19) Oekotex: Not toxic class1; and Rebreathing results (specimen (Max CO<sub>2</sub>(%), Time to reach plateau (sec)): Fiber core with 3D Foam (4.36 ± 0.11, 324 ± 1.4) Babykeeper® mat. (3.35 ± 0.14, 298 ± 19) In this sense both systems had a significantly faster rate of CO<sub>2</sub> elimination (4–5 min) compared to 15–18.7 min. for other mattresses (*P* < 0.001) (Bar-Yishay et al., 2011).

**Conclusion:** As a conclusion design recommendation are: RT < 3.2 °Cm<sup>2</sup>/W Oekotex label class 1 for product and components Rebreathing test simulation (fixing CO<sub>2</sub>: concentration at 5%): CO<sub>2</sub> < 4% (steady state situation non-toxic) and CO<sub>2</sub> elimination rate < 400 s. (Bar-Yishay et al., 2011).

**Acknowledgements:** Authors give thanks to IBV and AITEX for collaboration during laboratory test.

<http://dx.doi.org/10.1016/j.sleep.2013.11.767>

### Effects of the interaction between zolpidem and sleep deprivation on memory in mice

K. Zanin<sup>1</sup>, C. Patti<sup>1</sup>, L. Ceccon<sup>2</sup>, L. Lopes-Silva<sup>1</sup>, D. Poyares<sup>2</sup>, R. Frussa-Filho<sup>1</sup>

<sup>1</sup> Universidade Federal de São Paulo, Psychobiology and Pharmacology, Brazil

<sup>2</sup> Universidade Federal de São Paulo, Psychobiology, Brazil

**Introduction:** Zolpidem (Zolp), a hypnotic drug prescribed to treat insomnia, may have negative effects on memory. Considering the clinical context, Zolp is usually prescribed as a repeated treatment for insomnia. However, as far as we know no studies have characterized the cognitive effects of Zolp neither as repeated administration nor in animal models of insomnia. Thus, the aim of this study was to evaluate the effects of the repeated administration of Zolp (or its abstinence) on learning and memory of mice submitted to total sleep deprivation (TSD) and evaluated in the plus-maze discriminative avoidance task (PM-DAT).

**Materials and methods:** Three-month-old Swiss male mice were subjected to control condition (CTRL) or to TSD by gentle handling for 3 h per day during 10 days. Every day, after the TSD period, mice were treated with saline (Sal) or 5 mg/kg Zolp. On the 10th day, half of animals treated with Sal received an acute Zolp injection while the others received Sal. Still, half of the animals treated with Zolp received one more Zolp injection while the others receive Sal. Thirty min after the last injection, mice were trained in the PM-DAT and tested 12 days later.

**Results:** In the training, there were no differences among groups on learning. Regarding locomotion, all animals that received Zolp before training – irrespective of sleep condition or previous treatment – had motor activity decreased when compared to their respective controls. Still, mice subjected to TSD, which had acutely received Zolp, explored more the apparatus when compared to their CTRL group. In the testing, both the acute and repeated administrations of Zolp promoted amnesia on CTRL groups. The abstinence had no effects either on CTRL or on TSD groups. Concerning TSD, it induced memory deficits per se, which were counteracted by the acute administration of Zolp, but not by the repeated one.

**Conclusion:** Our data revealed that acute treatment with Zolp abolished TSD-induced memory impairment. Additionally, the repeated treatment of Zolp did not promote tolerance to the amnesic effect induced by its acute administration. Our findings demonstrate the importance of a systematic evaluation of the interactions between sleep restriction periods and Zolp on memory.

**Acknowledgement:** FAPESP, AFIP, CNPq, CAPES.

<http://dx.doi.org/10.1016/j.sleep.2013.11.768>

### Effects of anticipation of a significant event on sleep during long-term isolation

I. Zavalco<sup>1</sup>, E. Rasskazova<sup>2</sup>, G. Kovrov<sup>3</sup>

<sup>1</sup> Institute for Bio-Medical Problems, RAS, Russian Federation

<sup>2</sup> Lomonosov Moscow State University, Russian Federation

<sup>3</sup> Sechenov First Moscow State Medical University, Russian Federation

**Introduction:** Modern theories suggest that chronic and acute stress is one of the predisposing factors of insomnia. Anticipation of a significant event also may cause sleep problems.

**Materials and methods:** "Mars-520" is an international project for simulating aspects of an interplanetary manned flight, organized by

Institute for Bio-Medical Problems, RAS. Six healthy men from 27 to 38 years were isolated in the model of a spaceship for 520 days. Polysomnography during two consecutive nights were recorded 2 months before, during (4 times) and 2 weeks after the isolation. During confinement we studied sleep 40 days after the beginning of the experiment, 2 weeks before and after simulation of Mars landing and 50 weeks before the end of the experiment. Statistics. First we transformed (log10 transformation) variables with significant deviation from a normal distribution. For comparison sleep parameters we used multiple regression with period of experiment as a dependent variable, subject and sequence of night as co-variances. If statistically significant difference was found, Tukey post hoc test was used for pair-wise comparison.

**Results:** During the isolation sleep efficiency and delta-latency decreased, while sleep latency increased mainly one and a half months before the end of the isolation. Pairwise comparison revealed significant differences between background and the last measure during isolation. Frequency of nights with low sleep efficiency significantly increased before important events for cosmonauts like simulation of Mars landing and the end of the confinement. Two weeks after landing simulation the amount of the nights with low sleep efficiency significantly decreased.

**Conclusion:** Anticipation of a significant event during long-term isolation might be a factor for sleep worsening and might result in sleep initiation problems in healthy men.

**Acknowledgement:** This research was supported by a grant from the RFH project – 110601052D°.

<http://dx.doi.org/10.1016/j.sleep.2013.11.769>

### Polysomnographic evaluation of augmentation in patients with restless legs syndrome

I. Zavalko<sup>1</sup>, M. Maestri<sup>2</sup>, L. Ferini-Strambi<sup>3</sup>, S. Marelli<sup>3</sup>, M. Zucconi<sup>3</sup>, M. Manconi<sup>2</sup>

<sup>1</sup> Institute for Bio-Medical Problems, RAS, Moscow, Russia

<sup>2</sup> Sleep and Epilepsy Center, Neurocenter of the Southern Switzerland, Civic Hospital of Lugano, Switzerland

<sup>3</sup> Sleep Disorders Center, Division of Neuroscience and Università Vita-Salute San Raffaele, Milan, Italy

**Introduction:** Augmentation represents nowadays one of the most important issues in the long term treatment of restless legs syndrome. To the best of our knowledge, no polysomnographic study has been performed in this clinical condition.

**Materials and methods:** Twenty-one consecutive RLS outpatients (8M, 13F, mean age 68.4 ± 8 yrs) treated with dopamine agonists for a mean period of 6.7 ± 5 yrs and diagnosed as affected by severe, clinically relevant augmentation underwent a complete clinical evaluation and video PSG. We compared polysomnographic and clinical characteristics of patients with periodic limb movements during sleep during augmentation (PLMS+) and without (PLMS-) using a PLMS index >15 as cut-off.

**Results:** During augmentation, sleep efficiency was reduced (mean 63.13 ± 21.7%, range 15–95), with values <80% in 14 subjects (67%) and <50% in 7 (33%). Total sleep time (TST) was also reduced (mean 319.7 ± 102.6 min, range) and 10 patients (47.6%) slept less than 5 h. Twelve patients (57%) presented a PLMS index higher than 15, while three a PLMS index between 5 and 15 and six below 5. PLMS+ patients presented a longer sleep latency and a shorter TST than PLMS- subjects and a tendency toward a shorter sleep efficiency. As concerns clinical variables, PLMS+ patients were significantly younger, with an earlier age of onset of RLS and were treated with higher equivalent dosage of dopamine agonists.

**Conclusion:** Our observation showed that more than half of the patients with augmentation showed an increased motor activity during sleep that could be related to an imbalance of the expression of dopamine D1-like and D2-like receptors during DA treatment. Moreover, we confirm the clinical observation of reduction of sleep duration during augmentation. That should not be undervalued since it has been hypothesized that sleep deprivation can worsen or elicit augmentation and possibly enhance PLMS in a kind of vicious circle.

**Acknowledgement:** The authors thankfully acknowledge Stephany Fulda for their valuable help in conducting this study.

<http://dx.doi.org/10.1016/j.sleep.2013.11.770>

### Influence of nocturnal hypoxaemia on renal impairment in patients with obstructive sleep apnea-hypopnea syndrome and arterial hypertension

P. Zelveian<sup>1</sup>, L. Dheryan<sup>2</sup>, A. Matevosyan<sup>3</sup>, G. Podosyan<sup>4</sup>

<sup>1</sup> Center of Preventive Cardiology, National Institute of Health, Yerevan, Armenia

<sup>2</sup> Yerevan State Medical University

<sup>3</sup> Sleep Research Laboratory at the Center of Preventive Cardiology

<sup>4</sup> Center of Preventive Cardiology, National Institute of Health, Yerevan, Armenia

**Introduction:** The aim of the study is an investigation of the relationship between nocturnal hypoxaemia and microalbuminuria (MAU) in patients with obstructive sleep apnea-hypopnea syndrome (OSAHS) and arterial hypertension (AH).

**Materials and methods:** Forty patients (35 male, 5 female, mean age 43.3 ± 12.5 year) with OSAHS (apnea-hypopnea index (AHI) >5 episode/h) have been included in the study. These patients were divided into the two groups: patients having only OSAHS (group I) and patients having OSAHS and AH (group II). MAU has been detected in the morning urine samples, in a range of 20–199 mg/l. Nocturnal hypoxaemia was estimated by oxygen desaturation index (ODI) and oxygen desaturation time (ODT). ODI and ODT were investigated in quartiles for the statistical analysis, which was conducted using Pearson  $\chi^2$  and Fisher exact test.

**Results:** A statistically significant relationship between MAU and AH among ODI quartiles was detected in ODI fourth quartile group (ODI > 77.98 episode/h) for the patients group II. In the same time mentioned a relationship was also detected for the ODI second quartile group (ODI = 14.85–60.25 episode/h) but in the group I ( $p = 0.04$ ). A relationship between MAU and AH was also revealed in ODI fourth quartile group (ODT > 209.30 s.) for the patients in group II, while in the first, second and third quartile groups of ODI any statistically significant relationship has not been detected.

**Conclusion:** An influence of oxygen desaturation index and time in a relationship of arterial hypertension and microalbuminuria is revealed only in the fourth quartile groups of oxygen saturation measurements.

**Acknowledgement:** Zoya Hakobyan specialist of laboratory.

<http://dx.doi.org/10.1016/j.sleep.2013.11.771>

### A review of the relationship between social, emotional and behavioural difficulties (SEBD) and the sleep disturbance

J. Zhang<sup>1</sup>, N. Lu<sup>2</sup>, J. Zhang<sup>3</sup>

<sup>1</sup> Shenzhen Institute of Technology

<sup>2</sup> The Research and Counseling Center of Applied Psychology in Shenzhen University, China

<sup>3</sup> Peizheng Middle School, China

**Introduction:** The review aims to reveal the relationship between social, emotional and behavioural difficulties (SEBD) and the sleep disturbance.

**materials and methods:** Literature analysis were used to explore the relationship between SEBD and the sleep disturbance.

**Results:** Social, Emotional and Behavioural Difficulties (SEBD) can be defined as behaviours or emotions that deviate so much from the norm that they interfere with the child's own growth and development and/or the lives of others. There was about 10–20% of school aged children in UK experience a significant level of SEBD, whilst in China, an investigation indicated that 459 of 2558 (17.9%) children were sorted out that had behavioral problems, and the first four behavioral problems of boys were aggressive (7.8%), depressed (5.9%), delinquent (5.4%) and withdrawal (2.6%), while those of girls were schizoidia (6.3%), withdrawal (5.4%), depressed (4.8%) and aggressive (3.5%). Evidence shows that social, emotional and behavioural difficulties were highly associated with poor sleep patterns in children and adolescents. In a 635 children (aged of 6–8 years) investigation, results illustrated that 15% of children with behaviour problems had global reports of sleep problems. Moreover, there were associations between specific sleeping features and different aspects of behaviour and emotions. Specifically, hyperactivity was associated with tossing and turning during sleep, and with sleep walking; conduct problems were related to bedtime resistance; and emotional symptoms were associated with night terrors, difficulty falling asleep and daytime somnolence. Peer problems were associated with somewhat shorter total sleep time. Sleep disturbance can adversely affect family functioning, parental relationship and child development, school achievement. A study referring to the association between sleep problems and bipolar disorder (BPD) with onset in children and adolescents highlighted that sleep problems may be an early marker for BPD, a distinguishing feature of BPD, and a contributor to relapse. Moreover, sleep problems are associated with a range of serious adverse consequences, including difficulty in regulating affect in the daytime and difficulties with cognitive functions, such as memory, learning, attention, and concentration in addition of possible contributing to weight gain, comorbid substance use, and impulsivity.

**Conclusion:** Interventions should be done in the SEBDs with sleep disturbance in children and adolescents.

<http://dx.doi.org/10.1016/j.sleep.2013.11.772>

### The relationship between personality disorder and sleep quality in university students in China

J. Zhang<sup>1</sup>, N. Lu<sup>2</sup>

<sup>1</sup>Shenzhen Institute of Technology, China

<sup>2</sup>The Research and Counseling Center of Applied Psychology in Shenzhen University, China

**Introduction:** Personality disorders formerly referred to as a class of personality types which deviate from the contemporary expectations of a society. Such a person has stable behavior models, which affect a range of significant functions in behavioral and psychological aspects. We aimed to evaluate the association between the personality disorder and the sleep and waking among university students in order to enhance undergraduates sleep quality as well as all around personality development.

**Materials and methods:** 615 freshmen aged 17–22 with a mean age of 19.69 ± 1.182 (including 43.1% male and 56.6% female) were recruited from universities in Guangdong China, using stratified cluster sampling method. Two questionnaires were used: Personality Disorder Questionnaire for Chinese Classification of Mental Disorders C2-R (PDQC-CCMD C2-R) and Self-made Sleep Status Survey,

which contained 3 items selecting from the Symptom Checklist 90(SCL-90), namely 1.Trouble falling asleep; 2.Awakening in the early morning; 3. Sleep that is restless or disturbed. Pearson correlation analysis and independent-sample test were used for analysis.

**Results:** A modest but statistically significant correlation was reformed between item scores of 1.Trouble falling asleep; 2. Awakening in the early morning; 3.Sleep that is restless or disturbed and subtype scores of Paranoid personality disorder (PPD), Schizoid personality disorder (SPD), Antisocial personality disorder (ASPD), Conduct disorder (CD), Histrionic personality disorder (HPD), Impulsive personality disorder (IPD), Anxious personality disorder (APD), Obsessive-compulsive personality disorder (OCPD), Dependent personality disorder (DPD)( $p=0.000-0.042$ ). The *T*-test revealed that there were significantly more trouble falling asleep, more awakening in the early morning and more restless or disturbed sleep in the group that had tendency of PPD ( $t_1 = 3.746, p_1 = .000; t_2 = 3.015, p_2 = .004; t_3 = 4.212, p_3 = .000$ ), SPD ( $t_1 = 4.120, p_1 = .000; t_2 = 1.014, p_2 = .319; t_3 = 4.005, p_3 = .000$ ), HPD ( $t_1 = 3.265, p_1 = .001; t_2 = 2.093, p_2 = .038; t_3 = 3.755, p_3 = .000$ ), IPD ( $t_1 = 3.765, p_1 = .000; t_2 = 2.141, p_2 = .035; t_3 = 4.243, p_3 = .000$ ), APD ( $t_1 = 2.977, p_1 = .003; t_2 = 2.918, p_2 = .004; t_3 = 3.769, p_3 = .000$ ) and DPD ( $t_1 = 2.030, p_1 = .043; t_2 = 1.665, p_2 = .098; t_3 = 2.119, p_3 = .035$ ). Furthermore, there were significantly more trouble falling asleep and more restless or disturbed sleep in those who had tendency of OCPD ( $t_1 = 2.173, p_1 = .03; t_3 = 2.806, p_3 = .005$ ) and more trouble falling asleep in those who had tendency of ASPD ( $t_1 = 3.242, p_1 = .001$ ).

**Conclusion:** Personality disorder has significant correlation with sleep quality. The more severe the tendency of personality disorder, the poorer the sleep quality. We should pay more attention to the sleep quality in the process of helping students who have a tendency toward personality disorders.

**Acknowledgements:** This research was supported by Prof. Cao, Yiwei of Department of Psychology, Shenzhen University and a research partner Liu Ding.

<http://dx.doi.org/10.1016/j.sleep.2013.11.773>

### Restless legs symptoms in adolescents: epidemiology, heritability, and pubertal effects

J. Zhang<sup>1</sup>, S. Lam<sup>2</sup>, S. Li<sup>2</sup>, Y. Wing<sup>2</sup>

<sup>1</sup>The Chinese University of Hong Kong, China

<sup>2</sup>The Chinese University of Hong Kong, Department of Psychiatry, Shatin hospital, China

**Introduction:** The onset of sex differences in restless legs syndrome (RLS) is poorly understood. In addition, the epidemiology and heritability of RLS need further clarification in Chinese population. We aimed to determine the prevalence, pubertal effect, familial aggregation, and heritability of restless legs (RLS) symptoms in Chinese adolescents. In addition, the correlates and consequences of RLS symptoms were examined.

**Materials and methods:** This was a population-based family study recruiting 1549 adolescents (probands), their parents and siblings. RLS symptoms were assessed by a single question measuring the core features of RLS. Subjects with RLS symptoms for at least once per week were considered as abnormal. Daytime functioning impairments, behavioural problems, health conditions, and lifestyle practices were also documented.

**Results:** The prevalence of RLS symptoms was 2.7% in adolescents and 7.4% in their parents with female preponderance. The sex difference of RLS symptoms emerged in mid-puberty adolescents (Tanner

stage 3 or above). RLS symptoms were closely associated with various sleep problems (range of ORs = 2.24–32.5,  $p < 0.05$ ), except for habitual snoring. RLS symptoms were independently associated with daytime functioning impairments and self-perceived poor general health but not behavioural problems, mental health, or lifestyle practices after adjustment for age, sex, and other comorbid sleep problems. RLS symptoms presented with a modest familial aggregation and heritability ( $h^2$   $\pm$  SE = 0.17  $\pm$  0.04,  $p < 0.001$ ).

**Conclusion:** RLS symptoms are not uncommon in Chinese adolescents and their parents. Puberty plays a critical role in the emergence of sex difference of RLS symptoms. RLS symptoms are accounted for by both genetic and environmental factors.

**Acknowledgements:** This study was part of the epidemiological study funded by Health and Health Services Research Fund (HHSRF) grant (reference number 08090011) from Food and Health Bureau of Hong Kong SAR, China.

<http://dx.doi.org/10.1016/j.sleep.2013.11.774>

### Increased motor activity during rem sleep is linked with dopamine function in idiopathic rem sleep behaviour disorder and Parkinson's disease

M. Zoetmulder<sup>1</sup>, M. Nikolic<sup>2</sup>, H. Biernat<sup>3</sup>, L. Korbo<sup>3</sup>, L. Friberg<sup>4</sup>, P. Jennum<sup>1</sup>

<sup>1</sup> Glostrup Hospital, Danish Center for Sleep Medicine, Denmark

<sup>2</sup> Glostrup Hospital, Department of Clinical Neurophysiology, Denmark

<sup>3</sup> Bispebjerg Hospital, Department of Neurology, Denmark

<sup>4</sup> Department of Clinical Physiology and Nuclear Medicine, Denmark

**Introduction:** Increased motor activity during rapid eye movement (REM) sleep is associated with neurodegenerative disorders such as Parkinson's disease, Dementia with Lewy bodies, Multiple system atrophy and idiopathic REM sleep behavior disorder (iRBD). Although studies have shown a reduced density of striatal dopamine transporters in idiopathic RBD, it is unclear if the nigrostriatal dopamine system is related to the increased motor activity during sleep in these patients. Therefore, the objective was to investigate if the nigrostriatal dopaminergic system is related to muscle activity during sleep in patients with idiopathic RBD and Parkinson's disease.

**Materials and methods:** 10 patients with iRBD, 20 patients with PD (10 PD + RBD and 10 PD-RBD), and 10 healthy controls were included in the study. All participants were assessed with 123I-FP-CIT single-photon emission computed tomography, neurological examination, and polysomnography.

**Results:** Higher EMG-activity rates were seen in patients with iRBD, PD + RBD and PD-RBD compared with healthy controls. 123I-FP-CIT uptake in striatum was highest in controls, followed by iRBD, and lowest in patients with PD (contralateral to the affected body side). In iRBD patients EMG-activity in submental muscle was correlated to 123I-FP-CIT uptake in striatum. In PD EMG-activity in PD + RBD/PD-RBD was partly associated with dopaminergic treatment.

**Conclusion:** Nigrostriatal dopaminergic function may be related to the pathogenesis of increased muscular activity during REM and NREM in iRBD and PD.

**Acknowledgements:** This work was supported by the Lundbeck Foundation; the National Foundation for Parkinson's Disease; Toyota Foundation.

<http://dx.doi.org/10.1016/j.sleep.2013.11.775>

### Association of $\alpha$ -adrenergic receptor polymorphisms and nocturnal cardiopulmonary coupling in the skara sleep cohort

D. Zou<sup>1</sup>, L. Grote<sup>1</sup>, K. Bengtsson Boström<sup>2</sup>, D. Eder<sup>1</sup>, U. Lindblad<sup>3</sup>, J. Hedener<sup>1</sup>

<sup>1</sup> Center for Sleep and Vigilance Disorders, Institute of Medicine

<sup>2</sup> R&D Centre Skaraborg Primary Care, Sweden

<sup>3</sup> Skaraborg Institute, Sweden

**Introduction:** Electrocardiogram (ECG) based cardiopulmonary coupling (CPC) analysis has been used for assessment of fragmented sleep and sleep disordered breathing. We investigated the relationships between  $\alpha$ 1- and  $\alpha$ 2- adrenergic receptor (AR) gene polymorphisms and CPC in a gender-balanced community-dwelling cohort of hypertensive patients and normotensive controls (Skara Sleep Cohort).

**Materials and methods:** 280 subjects (137 males, 126 hypertensive patients, age  $61.3 \pm 6.5$  years, BMI  $28.5 \pm 4.7$  kg/m<sup>2</sup>, AHI  $24.6 \pm 22.1$  events/hour) underwent home polysomnography recording. The ECG signal was used to calculate the coupling between heart-rate variability oscillations and ECG-derived respiration. The percentage time spent with high-frequency coupling (HFC, 0.1–0.4 Hz), low-frequency coupling (LFC, 0.01–0.1 Hz) and very low-frequency coupling (VLFC, 0.0039–0.01 Hz) during the sleep period was quantified in subjects with various AR genotypes ( $\alpha$ 1-[Ser49Gly, Gly389Arg] and  $\alpha$ 2-[Gly16Arg, Gln27Glu]).

**Results:** The  $\alpha$ 2-AR Arg16 homozygous group had a higher HFC and lower LFC than the Gly16 group independent of gender, total apnea/hypopnea count and sleep efficiency ( $p = 0.026$  and  $0.011$ , respectively). The  $\alpha$ 1-AR Arg389 and Gly389 homozygous groups differed in terms of time spent with HFC and VLFC ( $p = 0.067$  and  $0.003$ , respectively). There was a significant interaction between  $\alpha$ 2-AR Arg16Gly and  $\alpha$ 1-AR Arg389Gly polymorphisms such that  $\alpha$ 2-AR Arg16 homozygotes had further increased HFC and reduced LFC when  $\alpha$ 1-AR Gly389 allele was present. The  $\alpha$ 1-AR Ser49Gly and  $\alpha$ 2-AR Gln27Glu genotypes did not associate with CPC indices.

**Conclusion:** The  $\alpha$ 2-AR Arg16Gly polymorphism influences CPC during sleep. Difference in the  $\alpha$ -AR genotype may explain variations in cardiac autonomic modulation during sleep.

**Acknowledgements:** The study was supported by the Swedish Heart and Lung Foundation, the Swedish Society of Medicine and the Göteborg Medical Society.

<http://dx.doi.org/10.1016/j.sleep.2013.11.776>

### Effects of three modes of respironics auto CPAP machines in patients with OSAHS

T. Al Zuheibi, M. Al Abri

Sultan Qaboos University Hospital, Sultan Qaboos University, Oman

**Introduction:** The effective treatment of obstructive sleep apnea (OSA) is continuous positive airway pressure (CPAP). It is considered to be the gold standard treatment for moderate and severe OSA. However, compliance is the main challenge in CPAP usage because of lack of comfort. New technology has been tried to look for different modes to improve comfort ability of CPAP usage. Philips Respironics has designed productive algorithms that maintain effective therapy at minimal pressures. These modes are C-Flex and A-Flex: A-Flex makes each breath more comfortable at inhalation and exhalation. It provides flow-based pressure relief at the beginning of the exhalation. C-Flex makes sleep therapy more comfortable by reducing pressure at the beginning exhalation and returning to

therapeutic pressure just before inhalation. **OBJECTIVE:** we aimed to differentiate the effects of three modes (A-Flex, C-Flex and 0-Flex) on CPAP compliance and comfort ability for randomized OSA patients.

**Materials and methods:** Randomized patients men and women who applied full-night Polysomnography in sleep lab, Clinical physiology Department, Sultan Qaboos University Hospital were diagnosed as moderate to severe obstructive sleep apneas. Auto CPAP Respiroics machine was prescribed to these patients. This machine has two different pressure relief technologies (modes). These modes were breathing cycles (A-Flex and C-Flex). Comfort ability of CPAP was assessed using Visual Analogue Scale (VAS), AHI pre and post CPAP titration, O<sub>2</sub> desaturation pre and post CPAP titration, average leak and Epworth Sleepiness scale (ESS) to evaluate sleep pre and post of CPAP use. And compliance was assessed by usage (hours).

**Results:** Data were collected from 100 (60 males & 40 females) with average age of 30–60 years old and diagnosed as moderate to severe OSA with mean AHI of 52/h & SD of 33.2. Patients who had treated with A-flex showed more comfort ( $P = 0.02$ ) using VAS compared to patients who had treated with C-flex and 0-flex modes. There was no difference in AHI and CPAP pressure among all modes.

**Conclusion:** The study showed that A-flex is more comfortable to patients compared to other modes of auto CPAP treatment.

**Acknowledgements:** department of clinical physiology, Sultan Qaboos University Hospital.

<http://dx.doi.org/10.1016/j.sleep.2013.11.777>

---