CLINICAL FORMS AND ELECTROENCEPHALOGRAM ASPECTS OF SLEEP DISORDERS – LITERATURE REVIEW

Réka Szabó^{1,2}, Petru Mihancea², Florica Voiță-Mekereș², Gheorghe Florin Voiță²,
Mariana Racoviță, Gabriel Mihai Mekeres

¹Department of Neurology Recovery, Municipal Clinical Hospital Dr. Gavril Curteanu,
Oradea, Romania

²Faculty of Medicine and Pharmacy, University of Oradea, Romania

Corresponding author: Florica Voiță-Mekereș, lecture; University of Oradea, Medicine and
Pharmacy Faculty; Email adress: mekeres_florina@yahoo.com

Abstract

The clinical manifestations in sleep disorders vary according to the type of hypnopathies, a heterogeneous group of conditions, characterized by the presence of any sleep-related symptoms capable of generating discomfort.

We aimed to present the diagnostic criteria and the classification of the subtypes of sleep disorders in the most recent classification published in the medical literature. I have searched in the PubMed, Medline, Google Scholar Search databases, using keywords to select the right items. We selected the articles published in English and French language, in the period of 2000-2018.

The sleep disturbances may be of quantitative order (hyper- or hyposomnia) or of qualitative order (parasomnia), respectively hypnopathies related to breathing or movement, due to the circadian rhythm and other categories, according to ICSD-3.

Conclusions. *The correct classification in the subtypes of sleep disorders is the key to their optimal treatment, but this process is complex, staged and multidisciplinary.*

Keywords: *insomnia, narcolepsy, parasomnia, apnea.*

Rezumat

Manifestările clinice în tulburările de somn variază în funcție de tipul hipnopatiilor, un grup heterogen de afecțiuni, caracterizate prin prezența oricăror simptome legate de somn care generează disconfort. Ne-am propus să prezentăm criteriile de diagnostic și clasificarea subtipurilor tulburărilor de somn conform celei mai recente clasificări publicată în literatura medicală. Am căutat în bazele de date PubMed, Medline, Google Scholar, folosind cuvinte cheie pentru a selecta articolele potrivite. Am selectat articolele publicate în limba engleză și franceză, în perioada 2000-2018.

Tulburările de somn pot fi de ordin cantitativ (hiper- sau hiposomnie) sau de ordin calitativ (parasomnie), respectiv hipnopații legate de respirație sau mișcare, cauzate de ritmul circadian și alte categorii, conform ICSD-3.

INTERNAL MEDICINE

General Reviews

Concluzii. Clasificarea corectă în subtipurile tulburărilor de somn este cheia tratamentului optim al acestora, dar acest proces este complex, etapizat și multidisciplinar.

Cuvinte cheie: insomnie, narcolepsie, parasomnie, apnee.

Abbreviations:

ICSD-3 - International Classification of Sleep Disorders, 3rd edition, REM - rapid eye movement, NREM - non rapid eye movement, RBD - REM sleep behavior disorder, SAS - sleep apnea syndrome, RLS - restless leg syndrome, PMLS - periodic limb movement disorder, PSG - polysomnography.

Introduction

The sleep is a physiological, periodic and reversible process characterized by the temporary suppression of consciousness, the slowing down of the vital functions, and the partial abolition of sensitivity. Sleep can be divided into 2 types: paradoxical or rapid eye movement sleep (REM) and slow-wave sleep (NREM). The two types alternate forming sleep cycles. During sleep, there are changes in the majority of the body's systems, which underlie the explanation of the mechanisms of the hypnic disorders.

For the purpose of a detailed analysis and diagnosis of the various sleep disorders we use polysomnography.

This is a multi-parametric test, which consists of electro-encephalography, electromyography, electrooculography,

behavioral aspects, electrocardiography, pneumographic aspects, blood pressure, pulse, body temperature, electrodermographic parameters⁽¹⁾.

In this paper, our aim is to present the diagnostic criteria and the classification of the subtypes of sleep disorders in the most recent classification published in the medical literature.

For this purpose, we have searched in the PubMed, Medline, Google Scholar Search databases, using keywords (insomnia, narcolepsy, parasomnia and apnea) to select the right items. The inclusion criteria were represented by the articles published in English and French language, in the period of 2000-2018. The exclusion criteria were the inaccessibility to the full article, unclear case studies and studies published in other languages. Subsequently, the relevant data

gathered were systematized in this paper⁽²⁾. Currently more than 80 sleep disorders have been described, the most recent classification being from 2014 and made by the American Academy of Sleep Medicine. Hypnopathies can be of a quantitative nature (hyper- or hyposomnia/insomnia) or of a qualitative nature (parasomnia) and in their turn each is divided into different subtypes. There are also breathing-related sleep disorders, movement-related sleep disorders, sleep disturbances due to the circadian rhythm and other categories, according to ICSD-3, the current international classification.

The sleep disturbances may be of quantitative order (hyper- or hyposomnia) or of qualitative order (parasomnia), respectively hypnopathies related to breathing or movement, due to the circadian rhythm and other categories, according to ICSD-3.

Insomnia

Insomnia is a sleep disorder characterized by difficulties in initiating and/or maintaining the sleep despite the favorable sleep conditions, which is manifested by shortening of the sleep duration and/or decreasing the depth of sleep, which alters the daytime activity.

Insomnia is subdivided into the difficulty of falling asleep (sleep onset insomnia), frequent and prolonged awakenings (sleep maintenance insomnia) or the desire to continue to fall asleep despite a sleep of adequate duration (non-restorative sleep)⁽²⁾.

According to ICSD-3, insomnia is classified into 11 categories:

1. The adjustment or adaptation insomnia is also known as transient

insomnia, short-term or acute insomnia. The adjustment insomnia occurs in response to an environmental factor (too much noise or light at night, extreme temperatures, uncomfortable bed etc.) or stress factors related to the social or familial situation. Patients may also have consecutive anxiety, irritability, lethargy and somatic symptoms (most commonly headaches). Most adults experience some episodes of this type of insomnia during their lives. Insomnia usually lasts for up to 3 months and quickly disappears with the removal of the factor that caused it^(3,4).

2. The psychophysiological insomnia or the primary insomnia begins during a prolonged period of stress and is favored by the person's predisposition for sleep disturbances. This is manifested by the fact that the habit of the sleepless night is quickly consolidated by the patient's hypersensitivity. In case of these patients there is never found the presence of drowsiness and they often complain about headaches⁽⁵⁾.

3. The paradoxical insomnia or the pseudo-insomnia is the inability of sleep perception. It is a disorder in which the patient reports the absence of sleep, but could not object to it.

There is an inconsistency between the subjective perception of sleep by the patient and the one objectively found by the examiner and the polysomnography. The patient, however, is frankly convinced of the existence of his disorder. The psychiatric history is lacking in most cases, but the anxiety-depressive disorders may occur over time^(4,5).

4. Insomnia due to a somatic pathology. Pathologies that can accompany insomnia are:

INTERNAL MEDICINE

General Reviews

- *chronic pain of any cause (arthritis, cancer);*
- *advanced chronic obstructive pulmonary pathology;*
- *cardiac ischemia;*
- *in case of men, benign prostatic hypertrophy (due to nocturnal micturition);*
- *chronic renal pathology;*
- *fibromyalgia etc⁽⁶⁾.*

5. *Insomnia due to a mental illness.* Most chronic psychiatric illnesses are associated with insomnia. Depression is the cause of early morning awakening and the inability to fall asleep again. There is also an inverse causal relationship, insomnia being the one that will cause depression if it is extended for more than a year. Schizophrenia, bipolar disorders and anxiety disorders are other psychiatric illnesses that can cause frequent insomnia. Eventually, a sleep disorder may precede a mental decompensation, thus being a valuable alarm signal for the family and the physician^(6,7).

6. *Insomnia due to drug or medication abuse.* Sleep disorders are common in case of excessive use of psychostimulant substances, alcohol or hypnotic sedatives (rebound insomnia)⁽⁸⁾.

7. *Non-organic insomnia.* It is nonspecific, not given by known physiological substances or conditions.

This category includes all those environmental conditions that can cause passive insomnia (e.g. after anesthesia, in case of persons who had no activity for a long time etc.). It is characterised by their installation and their disappearance as soon as the cause is removed^(4,5,7).

8. *Insomnia caused by inappropriate hygiene of sleep.* The violation of sleep hygiene is highlighted by at least one of the following:

- *inappropriate sleep timing, consisting of frequent daytime sleep episodes, large bedtime and bed - wake up variations or excessive periods of time spent in bed*
- *frequent use of products containing alcohol, nicotine, caffeine before bedtime*
- *involvement in intellectual, physical or emotional activities immediately before bedtime*
- *frequent use of the bed for other activities (watching TV, using the phone or the computer, reading, learning, eating)*
- *the inability to create a comfortable sleeping atmosphere^(6,9)*

9. *Idiopathic insomnia* is the innate inability of the patient to achieve a physiological sleep from birth. There is a clear genetic predisposition and is more likely to be caused by the inappropriate

development of the brain structures responsible for sleeping. Characteristically, insomnia is invariable, it is not influenced by the affective state of the patient. Over time, a sense of psycho-physical exhaustion is being installed, which significantly affects the quality of life. Some patients with less severe forms adapt relatively well to their hypnic disorder, but others develop a major degree of disability that prevents them from pursuing a lucrative activity. In such clinical forms, the installment of depression and even of the autolytic attempts are common^(7,8,9).

10. Behavioral insomnia of childhood. It is mainly due to the repeated mistakes of adults who are not able to properly manage and supervise the child's upbringing, implying a bad ritual sleep. We are talking about this hypnic disorder only after the age of 2 years. The inadequate comfort, medical problems of the child or even the lack of parental affection are favorable factors. Once the sleep is initialized, its quality and duration will be normal⁽⁶⁾.

11. Organic insomnia (physiological). It has as its etiological substratum the various dysfunctional somato-psychic states, otherwise quasi-normal, due to the physiological stages of development, maturation, reproduction and aging. It installs slowly and disappears progressively with the change in the stages of life. The patient is irritable, impulsive, has communication difficulties, cognitive-intellectual disabilities, hypoprosopnea^(7,8).

EEG Aspects in insomnia

The electroencephalographic characteristics of insomnia have been objectively evaluated

by quantitative EEG methods. The sleep installation normally occurs asynchronously on the EEG, in contrast, patients with insomnia experience a hypersynchronism with anterior distribution associated with a long sleep latency. The sleep EEG records show disorganized sleep with predominant N1 sleep stages of NREM sleep and increased REM sleep periods during the first part of the night, interrupted by frequent microarousals. On the EEG monitoring is recorded a predominantly fast beta rhythm with frontal anterior distribution and some slow theta globally compared to healthy subjects, suggesting a dysfunctional awakening. It should be noted that the patient should be evaluated for EEG without hypnotic medication or other substance with has effect on the central nervous system, which influences the cortical electrical behavior and can lead to errors^(10,11).

Hypersomnia

Hypersomnia is an excess of sleep, which differs from the normal sleep through the duration, depth and brusqueness of the occurrence. This hypnopathies are characterized by recurrent episodes of excessive daytime sleepiness or an exaggerated prolongation of nighttime sleep. The duality of sleep patterns also correspond to a duality of hypersomnia, some corresponding to the slow wave sleep phase and others to the REM sleep phase⁽¹²⁾.

1. Symptomatic hypersomnia occurs in a number of organic cerebral diseases: cerebral tumors, stroke, infectious meningoencephalitis, cranial-cerebral trauma, multiple sclerosis, neuro-degenerative diseases, hepatic encephalopathy, respiratory

INTERNAL MEDICINE

General Reviews

encephalopathy, renal failure, endocrine diseases, psychiatric disorders^(12,13).

The Kleine-Levin syndrome: a particular syndrome belonging to this category, which is a neuro-hormonal hypersomnia, occurring in young men and consists of several weeks of excessive sleep, almost continuous, with no physiological changes in sleep. Hypersomnia is associated with hyperinstinctuality, namely compulsive hyperphagia and hypersexuality; between episodes, patients have normal behavior; these episodes usually disappear with age, with the trend towards decreasing the androgenic level⁽¹³⁾.

2. **The functional hypersomnia** include hypersomnias where no organic cause of excess sleep can be highlighted. With the individualization of the two forms of sleep, were created premises for the differentiation of functional hypersomnia, corresponding to slow sleep, to others that correspond to paradoxical sleep (narcolepsy).

There are described some simple "essential" hypersomnia (diurnal or nocturnal) in which sleep, although it lasts a long time, is not accompanied by other clinical manifestations or bio-electric anomalies.

Functional hypersomnia may take several hours, days, even weeks, and may occur

at intervals of one month to several years^(12,14).

Narcolepsy

Narcolepsy is defined as a syndrome of unknown origin with chronic evolution characterized by sleep abnormalities, including excessive daytime sleepiness, with paroxysmal sleep apnea, nocturnal pathological sleep and abnormal REM sleep manifestations; the latter occur in the form of sudden onset of REM sleep and correlation of characteristic inhibitory processes, cataplexy and sleep paralysis; cataplexy and, more rarely, sleep paralysis and hypnosis hallucinations are the major symptoms of the disease, representing the **classical narcoleptic tetrad**^(13,14,15).

- **Excessive diurnal sleepiness**

The main feature of narcolepsy is the overwhelming sleepiness which leads to the uncontrollable need to sleep during the daytime. Patients fall asleep without warning, anywhere and at anytime. Episodes can take a few minutes or even a half an hour, after which the awakening occurs, followed by a new episode of paroxysmal sleep. In addition, may occur drowsiness between the narcoleptic episodes, which affects the ability to concentrate, resulting in the decreasing of performances.

- **Sudden decrease in muscle tone**

It is called **cataplexy**. The episode can last a few seconds to a few minutes. Cataplexy is uncontrollable and is often triggered by intense emotions, either positive (laughter, joy) or negative (fear, anger). Patients may experience rare cataplexy episodes (1-2/year) or more episodes on a daily basis. Approximately 70% of narcoleptics experience life-long manifestations of the disease.

- **Sleep paralysis**

It is the failure to make movements or talk while waking up or falling asleep. These episodes had a duration of 1-2 minutes. There is also the possibility to forget this aspect immediately after awakening. Sleep paralysis mimics the temporary paralysis during the REM sleep period, when dreams also occur.

- **Hallucinations**

A particular type of hallucinations, called hypnagogic hallucinations, may occur when a person with narcolepsy enters quickly in a REM sleep period. Thought when the dream begins, the person can be half awakened; the dream is confused with the reality.

- **Other clinical features**

Include the restless night-time sleep and various automated behaviors which appear occasionally⁽¹⁶⁾.

EEG aspects in hypersomnia

It is known the fact that, in the case of healthy individuals, the different stages of sleep appear in a regular sequence. In the case of narcoleptics, however, sleep apnea generally begins in the REM sleep phase with minimal sleep latency. The organization of night sleep is clearly altered, but the results of various studies are contradictory about

the predominance of slow delta rhythms occurring in the deep sleep stages. The EEG correspondent of cataplexy attacks are paroxysmal theta oscillations with fronto-temporal distribution – this is the most recently confirmed hypothesis^(13,17).

Parasomnia

Parasomnias are disorders characterized by verbal, motor or unwanted sensitive phenomena that occur in association with sleep, specific stages of sleep or sleep transition phases. They are considered to be "parasitic" somatopsychic phenomena, overlapping the different phases of sleep. They can be divided into NREM- and REM parasomnia.

The NREM parasomnias are disorders that occur during the third phase of slow wave sleep. They are caused by a psychological activation in which the patient's brain comes out of the NREM and it is caught between sleep and wakefulness. These disorders involve the activation of the autonomic nervous system, motor system or cognitive processes during sleep or sleep-wake transitions. Some parasomnias are common in childhood, but decrease as frequency with aging. They may be triggered in some individuals by alcohol, sleep deprivation, physical activity, emotional stress, depression, medication or infectious diseases.

The REM parasomnias allow the individual to act in a dream and can end up with injuries. 90% of these patients are men over 50 years of age.

These disorders most commonly occur as a result of adverse effects of antidepressant medication. There are also frequent associations with neurodegenerative diseases^(18,19).

INTERNAL MEDICINE

General Reviews

1. NREM parasomnia

- **Pavor nocturnus** (nocturnal anxieties or nocturnal fears).

It is a parasomnia characterized by extreme terror and the temporary impossibility to regain total consciousness. The subject suddenly wakes up from sleeping with slow waves, sighing, screaming or groaning, and with agitated behavior because of the fear. The person in question cannot be completely awake from sleep and after this episode he continues to fall asleep. It cannot be remembered later by the subject. The terrors in sleep are obligatory accompanied by a vegetative anger: tachycardia, tachypnea, skin congestion, diaphoresis, mydriasis, hypertonia. Children between the ages of 2 and 6 years are most prone to night terrors, affecting 15% of them. The episodes may return a few weeks away and suddenly disappear. There are evidences that suggest a genetic predisposition for these disorders, but there are multiple triggering factors: emotional stress, fever, constipation. Pavor nocturnus in the case of adults are more likely uncommon, more related to mental trauma than genetic trauma^(18,19).

- **Enuresis nocturnus**

It is the involuntary urination during sleep, especially in the case of children, at

an age to which they should anticipate this need. Among the adults, it is a 0.5% rate - up to 2.3% of cases of enuresis. It is important to find the cause (it can be urological, psychiatric, hormonal etc.). More recently, it appears that this disorder may also occur in other phases of sleep⁽¹⁹⁾.

- **Sleep walking**

Patients wake up from sleep and enter a stage of superficial consciousness and perform activities that are usually performed during the day. These activities can be benign simple or complex activities but also violent gestures, throwing with different objects or even crime (murdering). People do not remember the events. Although their eyes are open, their expression is frozen. The episode can take from 30 seconds to 30 minutes.

The patient is hard to awaken from this state and if he wakes up, he will be confused. The amnesia of the episode is usually the rule. Nocturnal breakouts occur more frequently after sleep deprivation. Some researchers state that the development of childhood disorder is due to a delay in the maturation of the central nervous system. The condition is found in families, and the percentage of children sleep walking increases to 45% if a parent is affected and 60% if both

parents are affected. Other risk factors include sleep deprivation, fever, excessive fatigue, hypnotic or neuroleptic drugs^(18,19).

- **Bruxism**

It is characterized by the screech of teeth and is typically accompanied by jaw clenching. It is a parafunctional oral activity that occurs to most people at some point in their life. At the majority of people, bruxism is moderate without being a health problem. It is one of the most common sleep disorders. Its etiology is not known, although some conditions are known to be related to bruxism: diet and anxiety. Most patients are unaware of the bruxism and only 5% develop symptoms such as jaw ache and headache. In most cases, the sleep partner notices the phenomenon before the affected individual. Over time, teeth trauma may occur⁽¹⁹⁾.

- **Somnilocvia**

It can be loud talking, ranging from simple sounds to lengthy speeches and can occur several times during the same sleep period. It occurs either in the NREM stage when it is unintelligible, or in the REM stage, when words from dreams are said out loud. Sometimes the "somnolitics" can be contacted and are of absolute sincerity, lacking censorship. It may appear as a single sleep disorder or associated with other parasomnias. It is very common and reported in 50% of children, especially in puberty. It seems to be familial⁽¹⁹⁾.

- **EEG aspects in NREM parasomnia**

The EEG changes begin in the N3 stage of NREM sleep. Hypersynchronism in the predominantly anterior delta band predominates frequently but it is considered to be a rather unspecific

electrical manifestation. With the help of the video-EEG recordings, we can observe the pathological motor- and the emotional behaviors specific to each type of NREM parasomnia, which also helps to make differential diagnosis with nocturnal epileptic seizures⁽²⁰⁾.

2. REM parasomnia

- **REM sleep behavioral disorder (RBD)**

It is characterized by the intermittent loss of muscle tone in REM sleep and the development of elaborate motor activities (beating, jumping and running) associated with a dream-like state. If the person is awakened during an episode, he can tell the dream content according to an observed behavior. It occurs in the case of elderly people, more frequently in the case of men; it is progressive and consists of agitation, sometimes violence, with the potential of self-harming. It may occur after sleep deprivation or as a rebound after discontinuation of benzodiazepines. It also occurs in neurodegenerative diseases or it could be idiopathic^(18,19).

- **Nightmares**

It consists of terrifying dreams that trigger fear, agitation, tachycardia, tachypnea, sweating. They lead to sudden awakening, with vigilance and rapid orientation. They appear mostly in the morning, when the REM sleep dominates and can be further detailed by the patient. Favorable factors: stress, alcohol, tricyclic antidepressants, antihistamines, benzodiazepine withdrawal etc. They have a sporadic frequency; we meet them more frequently under the age of 20 years⁽¹⁸⁾.

- **Sleep paralysis**

It may occur in the case of normal

INTERNAL MEDICINE

General Reviews

subjects or may be associated with narcolepsy. Sometimes it may be a symptom of migraines. Sleep paralysis occurs when the brain wakes up from the REM sleep phase, but the body stays atone. Thus, the patient is conscious, but without being able to move. Paralysis can last for a few seconds or minutes, in which the individual can accuse panic^(18,19).

- **Catathrenia**

It consists of breathlessness and expiratory moans during sleep. It must be differentiated from somnolence and obstructive sleep apnea. The sounds are produced during the expiration phase, opposite to snoring, which appears in the inspiration phase. It is not observed by the individual, but can be extremely disturbing for the sleep partner. It is a parasomnia that does not affect the quality of sleep⁽¹⁹⁾

- **EEG aspects in REM parasomnia**

In the RBD there is observed a diffuse slowing on the EEG in the REM sleep stage, with the domination of theta rhythm anteriorly and less rapid beta rhythm, but without significant alteration of the sleep architecture. This diffuse slowing in the theta band is more obvious on the dominant hemisphere. We mention that the evaluated patients were selected in such a way that those with a cognitive impairment were excluded

(with physiological slowing of the electric background). With the help of the PSG channels, additional data can be obtained about the changes that occurred and their effect on other systems in the body: for example the EMG channel may prove the absence of the muscle tone that would be characteristic for the physiological REM sleep⁽²¹⁾.

Sleep apnea syndrome

Apnea is a temporary interruption of breathing. People who suffer from sleep apnea stop breathing repeatedly during sleep for periods ranging from a few seconds to a minute or more.

SAS was classified in 3 types: obstructive apnea (the most common), central apnea and mixed apnea. We will refer in the following to the obstructive sleep apnea or simple sleep apnea.

Obstructive apnea is caused by occlusions of the upper airways.

If within a time interval of one hour the patient has at least ten breathing interruptions of at least 10 seconds each, the amount of oxygen that reaches the brain is insufficient. This triggers a partial awakening (microarousal), accompanied by a strong snoring and a sudden inspiration. These microarousals remain unobserved by the patient, but they produce superficiality in

sleep. This superficial sleep leads to insufficient restoration of the body during the night and to daytime sleepiness and fatigue, decreases their ability to concentrate and the daytime performance drastically suffers. In the long run, repeated desaturation seriously damages the vital organs. The apnea in untreated sleep leads to complications such as high blood pressure, heart disease or stroke^(22,23,24,25,26).

EEG aspects in SAS

In the SAS cases, PSG is used for paraclinical assessment, which also includes the selected EEG channels. We can make correlations between the sleep stage, the microarousals and the number of apnea episodes.

During the NREM sleep, thus during the periods of hypopnea, the delta rhythm amplitude generally increases at 10-13 seconds after the breathing disorder occurs. In the REM phase, however, no similar changes were recorded, suggesting that the occurrence of this phenomenon is rather a wake-up mechanism and not a result of cerebral hypoxemia⁽²⁶⁾.

Sleep related movement disorders

1. Restless legs syndrome (RLS or Wittmaack-Ekbom syndrome)

It is a neurological condition characterized by the irresistible, urgent need to move the inferior limbs (occasionally the superior limbs, too) to stop uncomfortable or strange sensations. The movement of the affected part of the body modulates the sensations, bringing temporary relief. The sensations experienced by the patient can be compared to pruritus or

tickling in the muscles and begin or intensify during conscious relaxation before falling asleep. Most affected individuals experience muscle spasms during sleep, an objective physiological marker of the condition, being associated with sleep disorders^(27,28).

2. Mioclonus nocturn (Periodic Limb Movement Disorder)

It represents the involuntary periodic movement of the lower limbs during sleep. They are unconscious, although they give frequent awakening, affecting the quality of sleep. It occurs more frequently in the case of elderly men⁽²⁸⁾.

EEG aspects in RLS/PMLS

The episodes of nocturnal movements of the legs fragmentizes the sleep, deteriorating both the NREM sleep phases and also the REM sleep phases, although some studies in the literature do not confirm significant global alteration between the limb movement episodes.²⁹

Disturbances of the circadian rhythm

The persistent disturbances of the circadian rhythm are caused by a reduced ability of the patient to reset his nictemeral cycle according to the temporal clues given by the environment.

1. Delayed Sleep Phase Syndrome.

These patients fail to sleep early in the evening and thus cannot wake up in the morning at the right time.

2. Advanced Sleep Phase Syndrome.

Contrary to the previous syndrome, in this case the affected one falls asleep too early in the evening and wakes up in the middle of the night.

INTERNAL MEDICINE

General Reviews

3. Circadian arrhythmia (Non-24 Syndrome). The affected patients fall asleep every evening later and later and get up early in the morning, as if the day would be over 24 hours for them.

4. Deregulation caused by the time zone affects travelers crossing more time zones.

5. Work done in the night shift. these people often have sleep problems during the day after^(30,4).

EEG aspects in circadian rhythm disturbances

The electrical evaluation confirms the increased (or decreased) latency of sleep, respectively compensatory increase in the duration of the REM sleep phase in the patients with sleep deprivation⁽¹¹⁾.

Conclusion

The current review of the clinical forms of hypnopathies leads to a deeper understanding of the approach to sleep disorders associated with neurological diseases, as well as the framing into sleep patterns helps to understand how they can be best influenced by a targeted treatment. The optimal management is performed according to the subtype and gravity of the type of sleep disturbance, the associated

comorbidities in each case, the access to the video-EEG and the polysomnographic evaluation. In conclusion, the pathology of sleep is a complex subject, not yet fully elucidated in detail, but having a major impact on the individual's health and requires the expansion of the current knowledge.

Bibliografie

1. Lam, Calvin, et al. Text mining of journal articles for sleep disorder terminologies. *PloS one* 2016; 11(5): e0156031
2. Sateia M.J. International classification of sleep disorders-third edition highlights and modifications. *Chest*. 2014; 146(5): 1387-1394
3. Edinger, Jack D., et al. Derivation of research diagnostic criteria for insomnia: report of an American Academy of Sleep Medicine Work Group. *Sleep* 2004; 27(8): 1567-1596
4. Doghramji, Karl. Assessment of excessive sleepiness and insomnia as they relate to circadian rhythm sleep disorders. *The Journal of clinical psychiatry*. 2004; 65:17-22
5. Bonnet, Michael H., and Donna L. Arand. Situational insomnia: consistency, predictors, and outcomes. *Sleep*. 2003; 26 (8): 1029-1036
6. Bastien, C. H., et al. Insomnia and sleep misperception. *Pathologie Biologie* 2014; 62 (5): 241-251
7. Perlis, Michael L., Charles B. Corbitt, and Jacqueline D. Kloss. *Insomnia research: 3Ps and beyond*. *Sleep medicine reviews*. 2014; 18 (3): 191-193
8. López-Torres Hidalgo, Jesús, et al. Understanding insomnia in older adults. *International journal of geriatric psychiatry*. 2012; 27 (10): 1086-1093
9. Lichstein, Kenneth L., et al. Co-occurring insomnia and obstructive sleep apnea. *Sleep medicine*. 2013; 14 (9): 824-829
10. Marzano C, Ferrara M, Sforza E and De Gennaro L.

Quantitative Electroencephalogram (EEG) in Insomnia: A New Window on Pathophysiological Mechanisms. Current Pharmaceutical Design. 2008; 14: 3446

11. Wołyńczyk-Gmaj, Dorota, and Szelenberger W. Waking EEG in primary insomnia. *Acta Neurobiol. Exp* 71. 2011; 387-392

12. Ohayon, M. M., et al. Prevalence of narcolepsy symptomatology and diagnosis in the European general population. *Neurology. 2002; 58 (12): 1826-1833*

13. Billiard, Michel. Polysomnographic features of narcolepsy types 1 and 2, and of idiopathic hypersomnia: Strengths and limitations. *Clinical Neurophysiology* 2017; 128 (9): 212

14. Scammell, Thomas E. Narcolepsy. *New England Journal of Medicine. 2015;373 (27): 2654-2662*

15. Ruoff Ch, Rye D. The ICSD-3 and DSM-5 guidelines for diagnosing narcolepsy: clinical relevance and practicality. *Current Medical Research and Opinion, 2016; 32:10: 1611-1622*

16. Ferri, Raffaele, et al. NREM sleep alterations in narcolepsy/cataplexy. *Clinical neurophysiology* 116.11 ; 2005; 2675-2684

17. Drakatos, Panagis, et al. Sleep stage sequence analysis of sleep onset REM periods in the hypersomnias. *J Neurol Neurosurg Psychiatry* 84.2 . 2013; 223-227

18. Pressman, Mark R., and Michel Cramer Bornemann. The ICSD-3 NREM parasomnia section is evidence based resulting from international collaboration, consensus and best practices. *Journal of Clinical Sleep Medicine* 2015; 11(2): 187-188

19. Lee-Chiong, Jr TL. Parasomnias and other sleep-related movement disorders. *Primary care* 2005; 32(2): 415-434

20. Derry CP, Harvey AS, Walker MC, Duncan JS, Berkovic SF. NREM arousal parasomnias and their distinction from nocturnal frontal lobe epilepsy: a video EEG analysis. *SLEEP* 2009; 32(12):1637-1644

21. Inoue Y, Sasai T, Hirata K: *Electroencephalographic*

Finding in Idiopathic REM Sleep Behavior Disorder. Neuropsychobiology. 2015; 71:25-33

22. Malhotra, Atul, and David P. White. Obstructive sleep apnoea. *The Lancet. 2002;360 9328):237-245*

23. Ferini-Strambi, Luigi, et al. Daytime sleepiness: more than just Obstructive Sleep Apnea (OSA). *La Medicina del lavoro* 2017; 108 (4): 260-266

24. Masami Nakajima, Mutsuko Hara, Akane Numakura, Yasuhiro Kase, Changes in the diagnosis of obstructive sleep apnea using the ICSD-3. *Stomato-pharyngology. 2016; 29:2: 201-206*

25. Jordan, Amy S., David G. McSharry, and Atul Malhotra. Adult obstructive sleep apnoea. *The Lancet. 2014; 383 (9918): 736-747*

26. Karakis, Ioannis, et al. The utility of routine EEG in the diagnosis of sleep disordered breathing. *Journal of Clinical Neurophysiology* 29.4, 2012; 333-338

27. Allen, R. P., Picchietti, D. L., Garcia-Borreguero, D. et al. Restless legs syndrome/W-Ekbom disease diagnostic criteria: updated International Restless Legs Syndrome Study Group (IRLSSG) consensus criteria—history, rationale, description, and significance. *Sleep Med., 2014; 15: 860*

28. Manconi, M., Ferri, R., Zucconi, M. et al. Dissociation of periodic leg movements from arousals in restless legs syndrome. *Ann. Neurol. 2012, 71: 834-844*

29. Hornyak, Magdolna, et al. Spectral analysis of sleep EEG in patients with restless legs syndrome. *Clinical neurophysiology* 116.6, 2005; 1265-1272.

30. Drake CL, Roehrs T, Richardson G, Walsh JK, Roth T. Shift work sleep disorder: prevalence and consequences beyond that of symptomatic day workers. *Sleep. 2004; 27: 1453-1462.*

31. Mekereş, F., & Buhaş, C. L. (2016). Spontaneous human combustion, homicide, suicide or household accident. *Rom J Leg Med*, 24(1), 11-13.

32. Mekereş, F., Voiţă, G. F., Mekereş, G. M., & Bodog, F. D. (2017). Psychosocial impact of scars in evaluation of aesthetic prejudice. *Rom J Leg Med*, 25, 435-438.