DEFINING NORMAL AND DISORDERED SLEEP – PRINCIPLES OF CLASSIFICATION

Defining of disordered sleep involves a clear definition of the so-called normal sleep. However, the concept of „normal sleep” represents only the most common and usual sleeping at certain age and in certain conditions. Adults sleep 6–8 hours on average, but there also are healthy individuals who sleep 3–4 hours every night (short sleepers), or 8–10 hours (long sleepers), or who sleep biphasically - in the afternoon and at night. In addition to the length, night sleep implies a certain course and structure of sleep determined by electrophysiological indicators. These indicators, however, are not sufficient to determine the effectiveness of sleep. Obviously, the real effectiveness of sleep cannot be discussed (at least not in terms of quantity) because the specific function of sleep has not been fully discovered yet. Subjective experience of „enough” or „not enough”, „bad” or „good”, „relaxing”, or „tiring”, „pleasant” or „unpleasant” sleep depends on a number of individual and psychological situations, but it gives a significant assessment of the quality of sleep (1).

Diagnostic criteria for primary insomnia (DSM-IV)

a) The predominant complaint is difficulty falling asleep (phenomenon) or disturbed continuity of sleep (course, structure – ESP) or nonrestorative sleep (subjective experience) for at least a month (duration of the phenomenon).

b) The sleep disturbance (or associated daytime fatigue) causes clinically significant distress (psychopathological phenomenon) or impairment in social, occupational or some other important area of functioning (social effectiveness).

c) The sleep disturbance does not occur exclusively during the course of narcolepsy, breathing-related sleep disorder, circadian rhythm sleep disorder or parasomnia.

d) The disturbance does not occur exclusively during the course of other mental disorders (e.g. depressive disorder, generalized anxiety disorder, delirium).

e) The disturbance is not caused by the direct effects of a substance (e.g. drug abuse, medication) or by a general medical condition (2).

SLEEP DISORDERS CLASSIFICATIONS

The classical clinical-phenomenological classification of sleep disorders is based on phenomena that deviate from the usual course and length of sleep and on subjective complaints of patients and it includes 4 types of insomnia:

1) Difficulty falling asleep (initial insomnia)
2) Oversleeping (transition disorder)
3) Early morning wakening (terminal insomnia), and
4) Mixed disorders (1,3,4).

Besides clinical observation, the assessment of these disorders, includes a whole night monitoring of sleep i.e. polysomnography (PSG).

The clinical classification given by Roth (5), who considered quantitative and qualitative characteristics of sleep, is similar and it includes 3 groups:
1) Changes in length (duration) of sleep,
2) Changes in structure (profile) of sleep, and
3) Specific quantitative disorders of sleep (e.g. sleep paralysis, etc).

Finke and Schulte (6) gave etiological classification separating:
1) Functional sleep disorders (dissomnia) from
2) Organically caused sleep disorders (hyposomnia, insomnia, agrypnia)

Functional disorders are divided into:
a) Exogenous - (physical causes) and
b) Psychoactive sleep disorders.

Organically caused disorders are divided into:
a) Specific hypersomnic syndromes (narcolepsy, Kleine-Levin syndrome, Pickwick syndrome, Rosenthal syndrome)
b) Sleep disorders caused by primary diseases CNS (infectious, toxic, traumatic brain injuries)
c) Sleep disorders caused by diseases of an organ and system (heart insufficiency, respiratory disorders, etc.)

There is a category of sleep disorders that accompany symptomatic and endogenous psychosis, as well as a „subgroup” of special forms of sleep disorders as somnambulism, pavor nocturnus that are between functional and organic disorders.

The American Sleep Disorders Association, led by H. P. Roffwarg (7) classified sleep and wakefulness disorders into 4 categories: 1. Disorders of initiating and maintaining sleep (insomnia, DIMS), 2. Disorders of excessive somnolence (hypersomnia, DOES), 3. Disorders of sleep-wake rhythm and, 4. Disorders associated with sleep, sleep stages or incomplete wakefulness (parasomnia)

Williams and Karacan (8) classified sleep disorders into 1. Primary, 2. Secondary, 3. Parasomnias and 4. Disorders caused or modified by sleep.

The DSM-IV classification of psychiatric disorders (2) divides sleep disorders into: 1. Primary (Dissomnias – primary insomnia, primary hypersomnia, narcolepsy, breathing-related sleep disorder, circadian rhythm sleep disorder, non-specific sleep disorders; and Parasomnias – nightmares, night terrors, sleepwalking), 2. Disorders related to other mental disorders (insomnias, hypersomnias) and 3. Other sleep disorders (insomnia, hypersomnia, parasomnia, mixed disorder – related to a general medical condition). Sleep disorders caused by psychoactive substances are classified as drug abuse.

The International Disease Classification (IDC-10) in the chapter on Mental Disorders states only inorganic sleep disorders – inorganic insomnia, hypersomnia, circadian rhythm sleep disorder, sleepwalking, night terror, nightmares, and other non-specified inorganic sleep disorders. Organically caused disorders are described in the section with organic systems disorders (sleep apnoea in respiratory diseases, nocturnal urination in diseases of urogenital system, etc) (9).

DIAGNOSTICS OF SLEEP DISORDERS

Complex and often interdisciplinary diagnostics of sleep disorders has two main goals:
1) To establish if the sleep disorder is an acute (transient, reactive) disturbance, or a chronic (repeated, permanent state); and
2) To determine the extent to which psychogenic i.e. somatogenic factors have the effect upon etiopathogenesis of the sleep disorder. Therefore, it is necessary to:

1) Study sleep habits in details, starting from childhood,
2) Obtain data on frequency, duration, extent and consistency of the sleep disorder.
3) Consider precipitating, causal psycho-social and biological factors that contribute to disorder genesis
4) Consider both objective data and subjective assessment of the quality and quantity of sleep.
5) Analyze symbolic or existential importance of the disorder for the individual and his or her social environment
6) Find out chronology and content of daily activities
7) Give psychiatric evaluation of an emotional or mental disorder
8) Perform a complete physical examination and necessary consultative examinations – neurological, internistic, ORL, ophthalmological, gynaecological, rheumatological etc.
9) Perform laboratory analyses and functional investigations of organic systems (respiratory, cardiovascular, CNS, endocrine, locomotor) in accordance with the present disturbances and physical findings.
10) Perform a special clinical and neuropsychological diagnostics of the sleep disorder i.e. circadian rhythm disorder (polysomnography– PSG, ACPSG).

Diagnostic methods

Clinical exploration is based on: 1. Standard psychiatric interview directed towards the stated diagnostic goals; 2. Standardized clinical scales for assessment of mental functioning (BPRS, HAMA, HAMD, etc.); 3. Special questionnaires for assessment of the sleep quality; 4. General somatic, neurological and psychiatric examination; 5. Consultative examinations (internistic, ORL, etc.); and 6. Psychological examination.

Laboratory exploration starts with standard (but very important) biochemical examinations of blood and urine, and continues with biochemical analyses and functional investigations of organic systems (especially hepatorenal, respiratory, cardiovascular, cerebrovascular, etc.). Complementary diagnostics can also be performed – ra-
diagnostic methods (native and contrast-enhanced scans, CT, NMR etc.), toxicological analyses, microbiological examinations, etc.

Clinical neurophysiological diagnostics is based on standardized polygraphic recording of nocturnal sleep – polysomnography (PSG = EEG EOG EMG), or on the 24-hour monitoring of the circadian and ultradian rhythm of the sleep-awake cycle by means of Ambulatory Cassette polysomnography – ACPSG method (known as Holter-EEG). Visual or automatic (computerized) analysis of polysomnogram gives sleep (and wake) parameters that make the so-called Electrophysiological Sleep Profile (EPS) (10, 11).

Characteristic alterations of sleep profiles, special phenomena during sleep (frequent nocturnal awakenings, incomplete awakenings, discharges) and mathematically derived diagnostic models are of great importance in diagnostics of sleep disorders, as well as in diagnostics of other psychological and organic disorders (12).

SLEEP DISORDER TREATMENT

A properly performed diagnostic procedure is a good starting point for a successful therapeutic treatment plan of the sleep disorder (insomnia, hypersomnia).

Basic principles of insomnia treatment

1) Take into serious consideration all patients’ complaints concerning sleep disturbances (and subjective assessment!).
2) Evaluate what the patient will gain or lose by the treatment.
3) Treat the basic disorder/disease because insomnia or hypersomnia is very often only a symptom (hypersomnia should be taken as a symptomatic disorder).
4) Sleep disorder should be treated during the day, complete wakefulness should be restored by means of natural, psychological, physical and biological interventions (the better the wakefulness - the better the sleep).
5) Sleep is an automatic, vegetative phenomenon – one does not sleep voluntarily, but by itself.
6) All therapeutic procedures should have restoration of the sleep-wake cycle as their goal i.e., they should enable natural sleep and a pleasant awakening.
7) In the course of diagnostic and therapeutic procedures, a special attention should be paid to specific sleep disorders – narcolepsy, parasomnia, insomnia in depressive disorder (masked depression) and disorders of sleep caused by the so-called „chronic pain syndrome“.
8) Treatment of sleep disorders has to be performed interdisciplinary and systematically – it should include a whole family, especially in children patients.
9) Medicamentous treatment has to be directed towards the basic physical or mental disorder. Treatment of this disorder will indirectly lead to harmonization of sleep-wake cycle.
10) Some sleep disorders do not have to be (and cannot be) treated, e.g. sleep talking, teeth grinding. Some kinds of insomnia should not be treated (at least not directly) because they have a role in maintenance of intraphysical balance in an individual (e.g., compensations for a guilt conscience), but they have to be understood and accepted.

Therapeutic procedures

General therapeutic measures

General therapeutic measures refer to advice and instructions in the elements of sleep hygiene, and they include:

• Providing satisfactory conditions and comfort for sleep – ventilation, temperature, bed;
• Natural and physiotherapeutic procedures necessary to establish and maintain wakefulness during the daytime – getting up immediately upon awakening, morning shower, gymnastics, walk, avoidance of daytime naps;
• Relaxation procedures and rituals in the afternoon and evening in order to get ready for sleep (afternoon and evening walks, relaxation techniques, avoidance of excitement, not taking stimulation drinks – coffee, Coca-Cola, Indian tea);
• Application of the so-called „conditioning ritual“ before the bedtime (personal hygiene, cup of warm milk, mild tea, etc.).

All these procedures should be directed towards restoration of the sleep-wake cycle. An important therapeutic measure lies in abstinence (or at least reduction) from the so-called „vegetative poisons“ like nicotine and caffeine, and maintenance of a healthy diet (avoidance of strong, spicy and canned food and alcohol).

Psychotherapeutic procedures

In addition to psychotherapeutic interventions directed towards solving the daily conflicts (especially in acute conditions i.e., acute posttraumatic stress disorders) psychotherapy of the basic emotional or structural disorder is performed.

In treatment of insomnia (as with other psychosomatic syndromes), nonverbal, indirect psychotherapeutic procedures have a significant role in removal of emotional arrest and harmonization of emotional and vegetative functioning. Autogenous training and medical hypnosis are primarily used, but relaxation techniques, movement therapy, musical therapy, creative therapy, sensitive training, meditation and yoga can also be recommended. Psychotherapy is also performed systemically – it includes all family members, especially with children and adolescent patients.

Specific therapeutic procedures

Both medicamentous and specific therapeutic procedures are used only if natural and psychotherapeutic procedures are not sufficient to synchronize the circadian sleep-wake rhythm.

Sleep deprivation is used when the sleep/wakefulness cycle is considerably disrupted, which is the case when wakefulness is shifted into the night and with total in-
version of circadian sleep-wake rhythm. In addition to a total sleep deprivation, partial sleep deprivation (deprivation of REM) is also performed and it is called the „sleep phase advance“ (as in treatment of endogenous depression).

**Paradoxical intention** is a procedure during which a patient is suggested to stay awake (or not to fall asleep). It can be useful in chronic insomnias, structural disorders, negativism that accompanies some mental disorder.

**Sleep** - either spontaneous, medicamentous, or „electro-sleep“, gives certain results in frequent narcoleptic crisis, psychotic syndromes, insomnia as an isolated symptom (psychosomatic syndrome), and organically caused sleep disorders.

**Sleep restriction** implies a strict restriction of the time patients spend in bed, which results in increased sleep efficiency and better subjective assessment of the night (13).

**Medicamentous treatment**

Medicamentous treatment is always directed towards treatment of the primary mental or somatic disease whose symptom is sleep disorder. The primary disease can be respiratory, cardiovascular, cerebrovascular or hepatorenal insufficiency, a pain condition, osteomuscular disturbance, affective disease, psychotic disorder, psycho-organic syndrome, etc.

**Time distribution of a medication** is very important. Medications with stimulative properties are primarily administrated in the morning and afternoon, while sedatives are given in the afternoon and in the evening (highest doses).

If the sleep disorder is treated with basic medications (especially drugs which affect psychic functions), administration should start after lunch and intensified after dinner. Taking a medication should not be associated with going to bed.

With affective disorders, especially depression, a combination of anxiolytics and antidepressant (and sedative neuroleptics) should be administered in such a way as to enable restoration of the disturbed circadian rhythm and to ensure pleasant morning awakenings.

It is necessary to have knowledge of pharmacokinetics of sedatives and hypnotics in order to prevent a possible accumulation of active metabolites because their elimination half-times can be quite long (e. g. elimination half-time for diazepam is 32 hours and for active metabolites it is up to 210 hours!) (table 1).

**Rational use of hypnotics**

If the sleep disorder is treated with psychopharmacs (anxiolytics, antidepressants, neuroleptics) due to the basic psychotic disorder, the right combination and adequate time distribution should enable the patient to sleep. Any a priori usage of hypnotics should be avoided.

If systematic application of general therapeutic measures (sleep hygiene), psychotherapeutic interventions, specific therapeutic procedures and basic medicamentous treatment are not successful, a rational use of hypnotics can be recommended (today usually benzodiazepine with short – midazolam, triazolam, and intermediate acting effects – brotizolam). Hypnotics should be used in the following cases and in the following way:

1) With severe psychiatric disorders
2) With existential crisis that cannot be solved
3) With chronic insomnia intermittently and with an appropriate therapeutic plan
4) The chosen benzodiazepine hypnotics should have a quick initial effect and short- or intermediate-acting effects (without active metabolites)

**Caution in administration of hypnotics in the treatment of sleep disorders** is needed in the following cases:

1) Caution is necessary in administration of hypnotics to elderly, obese people, and people prone to addictions and/or consuming alcohol or other CNS depressors,
2) Caution and adequate dosage are necessary in patients with cardiovascular diseases, liver and kidney damages,
3) The lowest effective doses should be prescribed and only for a limited time,
4) Diagnosis should be regularly questioned and the treatment regime should be adjusted (14–24).

**Table 1. Pharmacokinetics of benzodiazepine hypnotics.**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Protein binding</th>
<th>Time before the effects</th>
<th>Elimination half-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flunitrazepam</td>
<td>77–80%</td>
<td>&lt; 3 h</td>
<td>9–31 h</td>
</tr>
<tr>
<td>Flurazepam</td>
<td>98%</td>
<td>3–6 h</td>
<td>47–100 h</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>85%</td>
<td>&lt; 1 h&lt;sub&gt;a&lt;/sub&gt;, 2–3 h&lt;sub&gt;b&lt;/sub&gt;</td>
<td>10 h</td>
</tr>
<tr>
<td>Midazolam</td>
<td>96%</td>
<td>0.5–1 h</td>
<td>2 h</td>
</tr>
<tr>
<td>Nitrazepam</td>
<td>85–88%</td>
<td>0.5–5 h</td>
<td>24–28 h</td>
</tr>
<tr>
<td>Temazepam</td>
<td>96%</td>
<td>0.5–0.7</td>
<td>10 h</td>
</tr>
<tr>
<td>Triazolam</td>
<td>89–94%</td>
<td>1.3 h</td>
<td>2.3 h</td>
</tr>
<tr>
<td>Brotizolam&lt;sup&gt;*&lt;/sup&gt;</td>
<td>n.a.</td>
<td>0.3 h</td>
<td>6–8 h</td>
</tr>
</tbody>
</table>

<sup>*</sup> based on Promedica Comm. Inc; 1988; supplemented by N. Ilankovic, 1995, <sup>a</sup>capsules, <sup>b</sup>tablets
SLEEP DISORDER TREATMENT CENTERS

An interdisciplinary approach in diagnostics and treatment of sleep disorders and complex clinical and neurophysiological examinations of patients require formation of highly specialized health units - centres, with adequate equipment and well-trained staff. Investigations in the field of chronomedicine, conducted in these centres, will improve and advance diagnostics and treatment procedures of the circadian sleep/wake rhythm disorder. They will also contribute to research in other medical disciplines (Urgent Medicine, Cardiology, Neurology, Endocrinology, Urology, Clinical Pharmacology, etc.) which try to explain and clarify physiological and pathological phenomena related to biological rhythms (25).

REFERENCES