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Insomnia and sleep misperception



Insomnie et mésestimation du sommeil

C.H. Bastien^{a,*,b}, T. Ceklic^{a,b}, P. St-Hilaire^{a,b}, F. Desmarais^{a,c}, A.D. Pérusse^{a,b},
 J. Lefrançois^{a,b}, M. Pedneault-Drolet^{a,b}

^aÉcole de psychologie, université Laval, pavillon Félix-Antoine-Savard, bureau 1012, 2325, rue des Bibliothèques, G1V 0A6 Québec, Canada

^bLaboratoire de neurosciences comportementales humaines, centre de recherche, institut universitaire en santé mentale de Québec, 2601, chemin de la Canardière, G1J 2G3 Québec, Québec, Canada

^cÉcole de service social, université Sherbrooke, 2500, boulevard de l'Université, J1K 2R1 Sherbrooke, Québec, Canada

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ABSTRACT

Sleep misperception is often observed in insomnia individuals (INS). The extent of misperception varies between different types of INS. The following paper comprised sections which will be aimed at studying the sleep EEG and compares it to subjective reports of sleep in individuals suffering from either psychophysiological insomnia or paradoxical insomnia and good sleeper controls. The EEG can be studied without any intervention (thus using the raw data) via either PSG or fine quantitative EEG analyses (power spectral analysis [PSA]), identifying EEG patterns as in the case of cyclic alternating patterns (CAPs) or by decorticating the EEG while scoring the different transient or phasic events (K-Complexes or sleep spindles). One can also act on the on-going EEG by delivering stimuli so to study their impact on cortical measures as in the case of event-related potential studies (ERPs). From the paucity of studies available using these different techniques, a general conclusion can be reached: sleep misperception is not an easy phenomenon to quantify and its clinical value is not well recognized. Still, while none of the techniques or EEG measures defined in the paper is available and/or recommended to diagnose insomnia, ERPs might be the most indicated technique to study hyperarousal and sleep quality in different types of INS. More research shall also be dedicated to EEG patterns and transient phasic events as these EEG scoring techniques can offer a unique insight of sleep misperception.

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RÉSUMÉ

La mésestimation du sommeil est souvent observée chez les individus souffrant d'insomnie (INS). Cependant, l'ampleur de cette mésestimation varie entre les types d'INS. Cet article est composé de sections dédiées à l'étude de l'EEG et sa comparaison avec les rapports subjectifs de sommeil d'individus souffrant soit d'insomnie psychophysologique ou paradoxale et bons dormeurs. L'EEG peut être étudié soit sans intervention (en utilisant les données brutes) comme dans le cas de la polysomnographie ou l'analyse spectrale, soit en identifiant des patrons d'activation comme pour les patrons cycliques alternants (*cyclic alternating pattern*) ou encore en décortiquant l'EEG en événements phasiques ou transitoires (complexes-K et fuseaux de sommeil). On peut également agir sur l'EEG en délivrant des sons et en étudiant leur impact sur les ondes de l'EEG comme dans le cas des potentiels évoqués, et surtout ceux cognitifs. Du peu d'études disponibles utilisant ces différentes techniques/mesures, une conclusion générale peut tout de même être tirée : la mésestimation du sommeil n'est pas facilement quantifiable et sa valeur clinique n'est pas adéquatement reconnue. Alors qu'aucune des techniques/mesures définies ici n'est disponible ou recommandée afin de diagnostiquer l'insomnie, la technique utilisant les potentiels évoqués cognitifs semble la plus appropriée ou juste afin de mesurer l'hypervigilance corticale

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* Corresponding author.

E-mail address: celyne.bastien@psy.ulaval.ca (C.H. Bastien).

(*hyperarousal*) et la qualité du sommeil chez les différents types d'individus souffrant d'insomnie. Finalement, plus de recherches devraient être dédiées à l'étude des patrons EEG et des événements phasiques du sommeil puisque ces techniques apportent une compréhension différemment unique de la mésestimation du sommeil.

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1. Abbreviations

CAPs	Cyclic alternating patterns
DSM-5	Diagnostic and Statistical Manual of Mental Disorders – Version 5
EEG	Electroencephalogram or electroencephalography
EKC	Evoked K-Complex
EOG	Electrooculography
EMG	Electromyography
ERPs	Event-related potentials
FFT	Fast Fourier Transformations
fMRI	functional Magnetic Resonance Imagery (MRI)
GS	Good sleepers
ICSD	International Classification of Sleep Disorders
INS	Individuals suffering from insomnia
KC	K-Complex
NCAP	Non-CAP
NREM	Non-rapid eye movement
N1	Negative wave appearing about 100 milliseconds after stimulus onset
N350	Negative wave appearing about 350 milliseconds after stimulus onset
PARA-I	Paradoxical insomnia sufferers
PSA	Power spectral analysis
PSG	Polysomnography
PSY-I	Psychophysiological insomnia sufferers
P2	Positive wave appearing about 200 milliseconds after stimulus onset
P3	Positive wave appearing about 300 milliseconds after stimulus onset
REM	Rapid eye movement
SE	Sleep efficiency
SKC	Spontaneous K-Complex
SOL	Sleep onset-latency
SWS	Slow wave sleep
S2	Stage 2 sleep
TST	Total sleep time
WASO	Wake after sleep onset

2. Introduction

Insomnia is among the most common health complaints in medical practice. Approximately 30% of the general population experiences some insomnia symptoms occasionally and 10% suffer from chronic and persistent insomnia [1,2]. Frequently reported consequences related to insomnia include fatigue, sleepiness, mood disruption [3], impaired attention and memory deficits [4], consequences being infrequently objectively confirmed [5].

3. Definition and types of insomnia

An insomnia disorder is defined as a complaint of prolonged sleep latency (labeled “sleep-onset insomnia”), difficulties in

maintaining sleep (labeled “sleep-maintenance insomnia”), waking up too early in the morning (labeled “terminal insomnia”), and a mix of different sleep complaints (labeled “mixed insomnia”). In addition, the DSM-5 [6] specifies that to be considered a disorder, insomnia or its perceived consequences cause clinically marked distress or significant impairment of occupational or social functioning. Although insomnia can be acute, the current definition of insomnia specifies that it must be present for at least three months.

While the International Classification of Sleep Disorders (ICSD) [7] was previously distinguishing among different types of insomnia (Box 1), its new revised version [8] does not recommend a sub-classification of different types for clinical purposes as it mainly argues that empirical evidence is lacking to retain them. As researchers though, it is still strongly believed that at least two types of chronic insomnia (insomnia presenting itself without any other comorbid disorder) warrant attention as they are the most prevalent insomnia types and puzzling [9] and have seemingly different underlying pathophysiology [10–14]. As such, research shall still devote time to their study. These two types are psychophysiological and paradoxical (or sleep-state misperception) insomnia. In some cases, complaints of sleep difficulties are objectively observable, in other cases, they are not. Thus, a patient may either complain of sleep difficulties while objective polysomnographic recordings appear normal, or there may be constant and important gap between objective and subjective measures (for example, polysomnography [PSG] vs sleep diaries) of sleep [9]. As much as 50% of individuals suffering from insomnia could be poor estimators (displaying gross misperception) and classified as paradoxical insomnia sufferers [10,11,15]. While paradoxical INS (PARA-I) and good sleepers (GS) display similar results on measures of sleep macroarchitecture (for example the observed percentage in different sleep stages), there may be subtle differences in their microarchitecture [12]. On the other hand, typically, INS accurately estimating their sleep are those suffering from psychophysiological insomnia (PSY-I). Finally, these two types of INS are not mutually exclusive. Thus, an individual can show objective sleep-onset, sleep-maintenance or mixed objective sleep difficulties once his/her sleep has been recorded in the sleep laboratory but also present important discrepancies between his/her reports and laboratory sleep observations. As such, an individual might be complaining of mixed sleep difficulties over a long period of time, without showing any signs of depression or anxiety and at the same time, be of the paradoxical type [15]. Unfortunately, it is difficult to estimate the percentage of those

Box 1. Types of insomnia according to the ICSD.

Psychophysiological insomnia
 Paradoxical insomnia
 Idiopathic insomnia
 Inadequate sleep hygiene
 Behavioral insomnia of childhood
 Insomnia due to (another) mental disorder
 Insomnia due to (a) medical condition
 Insomnia due to drug or substance

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