


Original Article

The prevalence of sleep paralysis in medical students in Buenos Aires, Argentina

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Sleep paralysis (SP) is an unpleasant disorder that occurs when falling asleep (hypnagogic) or waking up (hypnopompic). The American Association of Sleep Medicine defines it as the impossibility of moving the trunk or extremities at the beginning of the dream or when waking up, from a few seconds to minutes of duration, that cause significant distress and cannot be explained by other medical or psychiatric causes^[1] [Table 1]. The primary SP corresponds to the isolated SP, which can be recurrent. However, it can be part of the symptom complex in patients with narcolepsy.^[2]

This disorder is related to rapid eye movement (REM) sleep due to the dissociation between this period of sleep and awakening.^[3] Its prevalence in the general population is 7.6%, with higher percentages in university students, patients with panic disorders, and other psychiatric illnesses. This disorder most frequently begins between the ages of 13 and 18, although it can be found at an earlier or later age.^[4]

Sometimes, patients with SP do not consult a doctor for fear of public opinion.^[5] Furthermore, it is common for general practitioners to be unaware of the entity, which leads to erroneous diagnoses such as psychosis.^[6]

The result of an assessment carried out in 2016, where 58% of a sample of medical students from the University of Buenos Aires (UBA) had poor sleep quality.^[7] paved the way to the objective of this work, that determines the prevalence of SP in a sample of medical students from the UBA.

MATERIALS AND METHODS

An *ad hoc* questionnaire based on the diagnostic criteria of SP was electronically sent, along with a questionnaire considering demographic data (age, gender, and self-perception of sleep quality). Questions were asked about symptoms, sleep habits, the presence and type of hallucinations during the episodes (including the incubus phenomenon), triggers, and associated cultural beliefs. This questionnaire was sent to students of

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Internal Medicine of the School of Medicine of the UBA, who answered it through the Google Forms® platform after signing an informed consent form.

This study was carried out under the ethical standards that govern research on human beings, under Law 25326 of the Argentine Republic and the Helsinki Declaration in its latest version (Fortaleza, 2013). The ethics committee of the Hospital de Clínicas “José de San Martín” approved this research project.

The statistical analysis was bivariate, using percentages and their 95% confidence intervals (95% CI) to determine prevalence and frequency; χ^2 tests or Fisher’s exact test were used to search for the association of nominal variables. Age was compared using the parametric ANOVA test. SPSS® version 24 was used for statistical analysis.

RESULTS

The survey was sent to 190 students, but 182 participants (95.80%) responded: 42 males, 138 females, and two who defined themselves as “another gender.” The mean age of the participants was 25.39 ± 4.379 years, with no significant differences between the female, male, and other genders.

The prevalence of SP in the analyzed sample was 40.7% ($n = 74$), with no significant differences in gender. Results showed that a high percentage of participants reported suffering from SP-related anxiety (76.5%, $n = 56$).

Another relevant finding was the association found between self-perceived quality of sleep quality (good vs. fair or poor sleep quality) and the incidence of SP (χ^2 : 12.712, $P = 0.002$).

The highest prevalence of SP was hypnopompic (55%, $n = 40$). The highest frequency of symptoms was less than once every 6 months, or only once in life (55.4%, $n = 41$), followed by two or more times in 6 months. Only one respondent (1.4%) reported having symptoms more than once per night.

The highest percentage of participants reported having started SP symptoms after the age of 18 (59.5%, $n = 44$); the lowest percentage reported having had PS symptoms before the age of 13 (9.5%, $n = 7$).

A total of 97.3% ($n = 72$) reported not having seen a doctor for these episodes, and 66.2% ($n = 49$) informed that symptoms were exacerbated when they were at university. About 55% ($n = 41$) did not report a family history of sleep disorders.

Most respondents (62.2%, $n = 46$) reported having bad self-perceived sleep habits, while total of 54.1% ($n = 40$) did not report the presence of SP triggers.

Regarding hallucinations, 50% ($n = 37$) reported auditory hallucinations during episodes of PS, followed by visual hallucinations (47.3%, $n = 35$), whereas 10.8% ($n = 8$)

reported no symptoms accompanying PS. The highest percentage (25%) reported having only one accompanying symptom; 2.8% ($n = 2$) reported having eight accompanying symptoms: visual and auditory hallucinations, feeling of a presence, shortness of breath, feeling of the mattress sinking, feeling observed, terror, and Incubus phenomenon. The frequency of the Incubus phenomenon in those with SP was 14.9% ($n = 11$) [Table 2].

Most respondents (70.8%, $n = 52$) denied the association of the symptoms with any religious or paranormal beliefs. Only 6.8% ($n = 5$) associated SP symptoms with a paranormal phenomenon, and 14.9% believed that they were going crazy due to the symptoms of SP.

Related to gender, there was no significant difference to be reported.

DISCUSSION

The prevalence of SP in the analyzed sample was 40.8%, which was higher than that reported in the general population. This percentage was lower than that found in a study of medical students from Lima (49.7%),^[8] but higher than that reported in other published studies.^[9-11] In addition, the prevalence found in this study was higher than that reported in other studies evaluating university students in general.^[12-15]

In this study, poor sleep quality was associated with SP. This finding was consistent with what has been published in other studies.^[7,8,15,16] In addition, the majority of those surveyed

Table 1: Diagnostic criteria of sleep paralysis according to the International Classification of Sleep Disorders, 3rd edition.^[11]

- Inability to move the trunk or the limbs at sleep onset or upon awakening
- Each episode lasts from a few seconds to a few minutes
- Each episode causes significant distress: bedtime anxiety or fear of sleep
- Not explained by another sleep disorder (narcolepsy), mental disorder, medical condition, medication or substance use

Table 2: Frequency of associated symptoms in respondents with sleep paralysis.

Symptoms	n	%	95% CI
Visual hallucinations	37	50	39.2–62.2
Auditory hallucinations	35	47.3	41.9–63.5
Fear	35	47.3	41.9–63.5
Feeling of a presence	32	43.2	32.4–54.1
Feeling breathless	25	35.1	24.3–45.9
Feeling of a sagging mattress	19	25.7	16.2–35.1
Feeling of being observed	18	24.3	14.9–35.1
Incubus phenomenon	11	14.9	6.8–23
None of the above	8	10.8	4.1–17.6

with PS reported poor sleep habits. Poor sleep quality is an independent predictor of SP and is mainly associated with prolonged sleep latency, daytime dysfunction due to poor sleep, and insomnia that occurs five or more times per month. In addition, it has been found that the variation of the PER2 gene (circadian rhythm regulator) influences the appearance of SP and poor sleep quality. Finally, going to sleep after midnight increases the odds of SP.^[17]

About 89.2% reported having hallucinatory symptoms: the majority, in the form of visual hallucinations, followed by auditory hallucinations, terror, and the sensation of a presence. Smaller percentages reported feeling of sinking in the mattress and the feeling of being observed. These values were similar to those found in the San Marcos University study regarding visual and auditory hallucinations. However, the prevalence of hallucinations among medical students from Ecuador was much lower, predominately visual ones.^[8] Hallucinatory phenomena are vivid, elaborate, multimodal and terrifying. These phenomena are related to the abnormal state of REM sleep caused by exogenous and endogenous inputs from oculomotor or middle ear activity. Signals from the brainstem to the thalamus project to the cerebral cortex, amygdala, and cingulate cortex.^[18] Concomitantly, paralysis occurs due to GABAergic and glycinergic projections originating in the pontine reticular formation and ventromedial region of the medulla on the interneurons of the spinal cord. During SP, wakefulness occurs at the same time as muscle atony. There is desynchronization between motor performance and sensory input. Sensorceptive phenomena occur due to the activation of the temporoparietal junction and the parietal lobe on the right side: these two structures are necessary for the neural representation of the human body. This activation is mediated by serotonin through its 5-HT_{2A} receptors: thus, meaningless stimuli acquire meaning.^[19] In SP, the appropriate medical term for these phenomena should be hallucinosis.

The Incubus phenomenon is a hallucinosis that consists of a creature sitting or lying on the thorax, which can carry out violent or sexual activity during the SP episode. Vegetative symptoms and, sometimes, sexual arousal occur during this phenomenon. In this case, the SP ends abruptly when that deluded creature falls. This phenomenon can lead to insomnia, comorbid anxiety, or comorbid delusional disorder but should not be confused with schizophrenia. The prevalence of this phenomenon in the general population is 19%,^[20] slightly higher than that found in this study (14.9%). According to mythological beliefs, an Incubus is a demon that lies down on women engaging in sexual activity with them. This phenomenon was first described in the 17th century by Isbrand van Diemerbroeck.^[21]

A few respondents related the episodes of SP with a paranormal belief. A study conducted at the University of

Manchester found a weak association between paranormal beliefs and SP.^[22]

SP is a form of parasomnia associated with REM sleep. Under physiological conditions, this stage of sleep is triggered by the cholinergic activity of the neurons of the lateral dorsal tegmental nuclei (REM-on neurons) and the inhibition of the serotonergic and noradrenergic activity of the pontine neurons and the floor of the IV ventricle (REM-off neurons). The REM-on neurons facilitate the activity of the reticularis-pontis-oralis region and, from there, ascending signals (such as the desynchronization of the electroencephalogram, eye movements and ponto-geniculo-occipital waves), and descending ones (causing muscle atony) are emitted.^[23] According to the activation-input-modulation framework, there is significant activation, external and internal inputs, and mixed neuromodulation: cholinergic and serotonergic in SP. Polysomnographic recordings show mixed electroencephalographic activity (with alpha waves and REM activity), and an absence of electromyographic activity due to muscle atony.^[17]

A systematic review with meta-analysis did not show a predilection for age, sex or ethnicity.^[16] In this study, no differences were found in relation to any of the variables explored in terms of gender. The highest percentage reported having symptoms that started after the age of 18, and the majority reported that the attacks of SP were exacerbated by university studies. Finally, the highest percentage reported feeling anxiety during the episodes. Medical students have high academic demands and poor sleep quality.

The presence of an underlying psychiatric condition cannot be ruled out, and it cannot be determined whether episodes of PS are isolated or associated with narcolepsy. PS has been associated with dissociative experiences, panic attacks, post-traumatic stress disorder, history of childhood sexual abuse,^[4,16] mood disorders, and bipolar disorder.^[24] A passive-aggressive personality has been associated with the occurrence of SP;^[25] however, some authors did not find a connection between personality traits and this parasomnia.^[26]

CONCLUSION

SP is highly prevalent in medical students and is associated with poor sleep habits and poor self-perceived sleep quality. Most of the accompanying hallucinations were visual and auditory, and the prevalence of the Incubus phenomenon was lower than that previously reported. General practitioners need to consider this parasomnia through questioning and polysomnography to avoid misdiagnosis of a psychotic episode and to reduce the anguish of those who suffer from it. Informing them of the nature of the condition, its characteristics, control measures, and knowledge of its benign nature improves the quality of life of the person who suffers from SP.

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Declaration of patient consent

The authors certify that they have obtained all appropriate consent.

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Conflicts of interest

There are no conflicts of interest.

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