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Original Article

Clinical and polysomnographic characteristics and response to continuous positive airway pressure therapy in obstructive sleep apnea patients with nightmares

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ABSTRACT

Objective: To assess the characteristics of obstructive sleep apnea (OSA) patients with nightmares and the effects of continuous positive airway pressure (CPAP) therapy on nightmares.
Methods: Consecutive patients referred with a clinical suspicion of OSA underwent attended overnight sleep studies. OSA and nightmares were diagnosed according to the American Academy of Sleep Medicine (AASM) criteria, and CPAP titration was performed in accordance with the AASM guidelines. A follow-up visit was performed 3 months later, and the patients with nightmares were divided into two groups: group 1 used CPAP with good compliance, whereas group 2 refused CPAP treatment and did not use other alternative treatments for OSA.
Results: The study included 99 patients who had been diagnosed with OSA with nightmares. Their mean age was 47.2 ± 11.2 years, and they had a mean apnea–hypopnea index (AHI) of 36.5 ± 34.3/h. Also included were 124 patients with OSA without nightmares. The mean age of these patients was 45.4 ± 13.9 years, and they had a mean AHI of 40.2 ± 35/h. The patients with nightmares had a significantly higher AHI during rapid eye movement sleep (REM) compared with the patients without nightmares (51.7 ± 28.1 vs 39.8 ± 31.9/h). Logistic regression analysis revealed that the REM-AHI and interrupted sleep at night were independent predictors of nightmares in the OSA patients. Nightmares disappeared in 91% of the patients who used CPAP compared with 36% of patients who refused to use CPAP ($p < 0.001$).
Conclusion: Nightmares in OSA patients are associated with a higher REM-AHI. CPAP therapy results in a significant improvement in nightmare occurrence.

1. Introduction

Fragmentation of sleep caused by recurrent episodes of upper airway obstruction and episodic desaturations in patients with obstructive sleep apnea (OSA) may provoke parasomnias [1,2]. Researchers have hypothesized that a shortage of oxygen during sleep may provoke nightmares [3]. In a unique study, Boerner reported that blocking the nose and mouth with a cloth induced nightmares [4]. Because OSA is a common cause of intermittent hypoxemia, the effect of OSA on dreaming has become a topic of research interest. Most of the previous studies that have examined the effect of OSA on dream recall have been retrospective in nature and have reported contradictory results. Although some investigators have reported less dream recall in OSA patients and normalization of dream recall occurred following continuous positive airway pressure (CPAP) therapy, others have reported that OSA patients have more dreams with emotional content, particularly violent and aggressive content [5–8]. Only a limited number of studies have assessed nightmares in OSA patients, and the results have been contradictory [7,9–11].

The prior studies on nightmares in OSA patients have several limitations. For example, several studies included patients with post-traumatic stress disorder (PTSD) [7,9], whereas others were conducted on students who snored, which does not represent typical OSA patients [10,11] and limits the generalizability of the results. Possible explanations for the discrepancies between studies include the fact that most of the previous studies did not use a standard definition for nightmares; the use of different patient groups; and the use of a retrospective method of dream data collection after patient diagnosis, which may have impacted patients' dream perceptions. Carrasco et al. proposed two theories to explain the contradictory results in dreams and nightmares in OSA patients [6]. They proposed that the increased arousal in OSA patients might

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increase dream recall, whereas hypoxia might cause cognitive impairments in OSA patients that might impair dream recall [6].

Previous studies that have addressed the effect of CPAP treatment on dreaming have primarily focused on dream recall. Gross and Lavie demonstrated that withdrawal of CPAP therapy for one night resulted in an increased apnea–hypopnea index (AHI) and increased dream recall. However, Gross and Lavie did not study dream recall before the initiation of CPAP [12]. Another study in a group of patients with severe OSA demonstrated that treatment with CPAP decreased dream recall acutely and after 3 months despite an increase in rapid eye movement (REM) density [6]. The effects of CPAP treatment on nightmares in OSA patients have not been well explored. OSA patients with nightmares are frequently seen in our practice. However, the clinical and polysomnographic (PSG) characteristics of OSA patients with nightmares have not been properly assessed. Although nightmares are an REM-associated parasomnia, the association between REM-related OSA and nightmares has not been explored. Therefore, we designed this study to assess the characteristics of PSG-diagnosed OSA patients with nightmares, to compare the results with those of OSA patients without nightmares and to prospectively study the effects of CPAP therapy on nightmares.

2. Methods

2.1. Subjects

In the present prospective observational study, consecutive patients who were referred to the University Sleep Disorders Center between January 2008 and December 2011 with a clinical suspicion of OSA based on typical symptoms (e.g. snoring, choking attacks during sleep, witnessed apnea or excessive daytime sleepiness) were considered for inclusion if they were diagnosed with OSA based on PSG, fulfilled the American Academy of Sleep Medicine (AASM) diagnostic criteria for recurrent nightmares and agreed to participate in this study. We also selected a group of OSA patients who did not have nightmares who were matched with OSA patients with nightmares for age, body mass index (BMI) and gender to compare the clinical and PSG features of the two groups.

Patient histories were obtained, physical examinations were conducted by a sleep medicine specialist upon the initial assessment and psychiatric assessments were performed by a rotating psychiatrist. Assessment for psychiatric disorders including depression and anxiety were done according to the results of the Mini-International Neuropsychiatric Interview (MINI) [13]. The Epworth Sleepiness Scale (ESS) was used to obtain a subjective assessment of daytime sleepiness [14]. The bed partner of each patient or another household member was also interviewed. Patients with other sleep-related breathing disorders, non-invasive ventilation or home oxygen, a daytime $PaO_2 < 70$ mmHg or a $PaCO_2 > 45$ - mmHg, congestive heart failure, and psychiatric disorders (e.g. anxiety, depression or PTSD) [15] and who used psychoactive drugs or medications that may influence nightmares were excluded [16]. Patients with hypertension who were on beta-blockers were also excluded. None of the patients in this study consumed alcohol. Hypertension was defined as one or more of the following symptoms: resting systolic blood pressure $\geqslant$140 mmHg, resting diastolic blood pressure $\geqslant$90 mmHg, and treatment with antihypertensive medication [17]. A diagnosis of diabetes mellitus was recorded on the clinical history, and the use of diabetes medications was either revealed by the patient or determined by a review of the patient's medical file. This study was approved by the Institutional Review Board of the College of Medicine at King Saud University, and an informed consent was obtained from all of the participants.

2.2. Study protocol

Nightmares were diagnosed according to the International Classification of Sleep Disorders (ICSD 2005), which includes recurrent episodes of awakening from sleep with recall of intensely disturbing dream mentations (with full alertness on awakening and good recall of sleep mentation) and one of the following features: delayed return to sleep after the episode or occurrence of the episode in the second half of sleep [18]. The diagnosis of nightmares was made by a team member before the PSG was performed. In addition, the assessment of nightmares was performed before the patients knew the clinical diagnosis of their sleep disorder. The patients were labeled as having OSA with nightmares if nightmares occurred at least once per week, whereas patients were labeled as OSA patients without nightmares if they had no history of nightmares.

Per our sleep disorders center protocol, CPAP therapy is recommended to all patients who are diagnosed with OSA. Patients who refuse CPAP treatment receive conservative advice about weight loss and are referred to otolaryngology for further assessment.

Reassessments of the patients' nightmares were performed 3 months after the initiation of CPAP therapy, and patients with nightmares were divided into two groups: group 1 contained the patients who used CPAP with good compliance, and group 2 contained the patients who refused CPAP treatment and did not use other alternative treatments for OSA, such as surgery, weight change by $\geqslant$5% or oral appliances during the follow-up period. The patients who started medications that could influence nightmares during the follow-up period were excluded [16]. The CPAP compliance data were downloaded from built-in smartcards in the CPAP devices, and good compliance was defined as using CPAP for >4 h/night for >70% of the recorded period [19]. An improvement in nightmares was defined as a maximum nightmare occurrence frequency of once per month.

2.3. Sleep studies

The nocturnal PSG recordings included electroencephalography (taken at C3M2, C4M1, O1M2, O2M1, F3M2, and F4M1), electrooculography, muscle tone (electromyography of the chin and both legs), electrocardiography, continuous finger pulse oximetry, chest and abdominal wall movements (thoracic and abdominal belts), airflow (thermistor and nasal prong pressure transducer), and snoring (microphone). PSG recording was performed using Alice 5 diagnostic equipment (Respironics, Inc., Murrysville, PA, USA). Manual scoring of the electronic raw data (i.e. sleep stages and respiratory events) was manually performed in accordance with the AASM criteria [20]. The scorer was blind to the clinical findings. OSA was defined according to the International Classification of Sleep Disorders (ICSD 2005) [18].

CPAP titration was performed during a therapeutic night in accordance with the AASM guidelines, and CPAP was offered to all of the patients [21]. The patients had three training sessions on the use of CPAP during the first 2 weeks following diagnosis (day 1, day 7 and day 14). A follow-up session in the CPAP clinic was performed 12 weeks after the start of CPAP therapy. All of the patients were provided with the sleep disorders center phone number to answer their queries and help troubleshoot CPAP therapy-related issues.

2.4. Statistical analysis

All of the data in the text and tables are reported as the mean ± SD or the percentage (%). Comparisons between OSA patients with and without nightmares were performed using the two-tailed Student's *t*-test for continuous variables and the