Kaohsiung Journal of Medical Sciences (2015) 31, 83–89

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.kjms-online.com

ORIGINAL ARTICLE

Polysomnographic predictors of persistent continuous positive airway pressure adherence in patients with moderate and severe obstructive sleep apnea

Yung-Fu Chen [a], Liang-Wen Hang [b], Chun-Sen Huang [b], Shinn-Jye Liang [b], Wei-Sheng Chung [c,*]

[a] *Department of Healthcare Administration, Central Taiwan University of Science and Technology, Taichung, Taiwan*
[b] *Sleep Medicine Center, Department of Internal Medicine, China Medical University Hospital, Taichung, Taiwan*
[c] *Department of Internal Medicine, Taichung Hospital, Ministry of Health and Welfare, Taichung, Taiwan*

Received 7 April 2014; accepted 15 September 2014
Available online 18 December 2014

KEYWORDS
Adherence;
Continuous positive airway pressure (CPAP);
Obstructive sleep apnea (OSA);
Polysomnographic parameters

Abstract Extensive use of continuous positive airway pressure (CPAP) has positive clinical benefits for most patients with obstructive sleep apnea (OSA). However, patient adherence is a major limiting factor to the effectiveness of CPAP treatment. This study determined the potential and quantifiable factors affecting the willingness of patients with OSA to undertake CPAP treatment by comparing the polysomnographic parameters recorded during diagnosis and titration. Patients with moderate and severe OSA who attended diagnostic polysomnography (PSG) and CPAP titration at the sleep center of China Medical University Hospital (CMUH) were included in the study. A total of 312 patients were divided into persistent users and nonusers of CPAP according to their use of in-home CPAP following titration and a 7-day CPAP trial. Multivariate logistic regression analyses were used to define the potential polysomnographic predictors of persistent CPAP adherence, and odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. Most patients were men older than 50 years who were overweight or obese. Among the patients, 146 (46.8%) became persistent CPAP users. A 10% improvement of oxygen desaturation index (ODI) and a 10% increment in deep sleep percentage increased the chance of persistent CPAP use 1.18-fold and 1.07-fold, respectively. In addition, the improved ODI and

Conflicts of interest: All authors declare no conflicts of interest.

* Corresponding author. Department of Internal Medicine, Taichung Hospital, Department of Health, Executive Yuan 199, Section 1, San-Min Road, Taichung Taiwan.
E-mail address: chung.w53@msa.hinet.net (W.-S. Chung).

http://dx.doi.org/10.1016/j.kjms.2014.11.004

deep sleep during CPAP titration increased the chance of persistent CPAP user. The polysomnographic parameters obtained from diagnosis and during titration can facilitate the prediction of persistent CPAP use.

Introduction

Obstructive sleep apnea (OSA), a prevalent sleep disorder characterized by recurrent airway obstruction during sleep that causes hypoxemia and sleep fragmentation, can result in excessive daytime sleepiness [1], mood disturbance [2], deficits in neurobehavioral performance [3], deteriorated functional status and quality of life, increased risk of hypertension and cardiovascular disease, metabolic dysfunction, and traffic accidents [4—8]. Overweight and obesity are common predisposing factors for OSA [9], which frequently causes daytime sleepiness associated with impaired daytime performance and affects approximately 3—7% of middle-aged men and 2—5% of middle-aged women [10].

Two nights of polysomnography (PSG) is the typical length of time required to diagnose OSA and titrate continuous positive airway pressure (CPAP) [11] because breathing and CPAP responses during all sleep stages can adequately be observed. The use of CPAP is well established to effectively treat daytime manifestations of severe OSA. Extensive CPAP use affords substantial clinical benefits, such as reduced daytime sleepiness, systolic and diastolic blood pressure, insulin resistance, cardiovascular risk, oxidative stress, total cholesterol, and inflammation [12]. Evidence suggests that using CPAP for longer than 6 hours decreases sleepiness, improves daily functioning, and restores memory to normal levels [13].

However, poor CPAP compliance was observed in approximately 30% of patients with OSA in Taiwan [14], which is substantially lower than the poor CPAP compliance identified in Western countries (60—70%) [15]. Several studies have reported that complaints pertaining to CPAP use, such as inconvenience, poor mask fit, discomfort, skin irritation, mask leaks, sore eyes, dry airway, nasal complications, frequent awakening, claustrophobia, and aversion to CPAP treatment, might affect CPAP compliance [16,17]. Although several psychological and clinical parameters have been used to predict CPAP adherence, inconsistent results have been determined [17,18]. Various clinical predictors, including female sex, increased age, and reduced Epworth Sleepiness Scale (ESS) scores, have a considerable correlation with increased CPAP use [19,20]. In addition, the symptomatic severity of apnea is a critical predictor of long-term adherence [20].

Investigating the predictors of long-term CPAP adherence is crucial to treating OSA and lowering comorbidity risk. However, few identified variables can be used to reliably predict CPAP adherence. In this study, we determined the potential factors affecting the adherence of patients with OSA who had been advised to undergo CPAP treatment by using PSG parameters recorded during OSA diagnosis and CPAP titration.

Methods

Patients

We retrospectively reviewed the consecutive PSG records of patients with OSA who were treated at the sleep center of China Medical University Hospital (CMUH), Taichung, Taiwan between January 2007 and December 2009. The study was approved by the CMUH Medical Research Ethics Committee (DMR98-IRB-292). Fig. 1 shows that a total of 661 patients with OSA were assessed for eligibility in this study. After a 7-day trial, 349 patients were excluded because of poor compliance as a result of severe skin allergies, nasal congestion, sinusitis, stomach bloating, uncontrolled or severe bullous lung disease, pathologically low blood pressure, severe cardiac arrhythmia, uncontrolled coronary artery disease, stroke, seizure, or economic problems. The remaining 312 patients diagnosed with moderate [15/h $\leq$ apnea/hypopnea index (AHI) $<$ 30/h] and severe OSA (AHI $\geq$ 30/h) according to the American Academy of Sleep Medicine (AASM) guidelines [21] and age $\geq$21 years [22,23] who underwent complete in-laboratory diagnostic PSG and CPAP titration were recruited for this study. CPAP titration was performed 1 month after the PSG diagnosis. Because the age range of pediatric patients began at the fetal stage and terminated at 21 years of age [22], only patients $\geq$21 years old were included in our investigation [23].

Patients were treated with CPAP using a fixed pressure determined by titration during a 7-day product trial at home prior to committing to purchase a CPAP device. To reduce bias, the CPAP devices (Type S8; Resmed, Martinsried, Germany) utilized during the titration and the home trial were manufactured by the same company. Patients were trained to use the CPAP and fitted for a mask by a certified sleep technician from the Taiwan Society of Sleep Medicine.

We assumed that patients who purchased a CPAP device were persistent users. Participants were categorized into persistent users and nonusers according to their use of in-home CPAP treatment. The economic status of patients substantially affected their willingness to purchase a CPAP device for OSA treatment; therefore, nonusers who did not purchase a device for economic reasons were excluded from further study. Demographic characteristics including sex, age, body mass index (BMI, kg/m^2), neck and waist circumferences (cm), and sleepiness index measured according to ESS scores graded on a 5-point Likert scale [24,25] were collected for analysis. CPAP titration was conducted by a certified sleep technician. An effective (optimal) CPAP pressure was determined during the one-night CPAP titration using the following procedure: