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Two subtypes of positional obstructive sleep apnea: Supine-predominant and supine-isolated

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HIGHLIGHTS

- 74% of obstructive sleep apnea (OSA) patients met the criteria for positional OSA (POSA).
- Of those with POSA, 73% have supine-predominant OSA, and 27% supine-isolated OSA.
- The supine-isolated OSA patients have less arousal but poorer sleep quality, and more depression.

ABSTRACT

Objectives: The body position has a strong influence on obstructive sleep apnea (OSA). The purpose of this study is to compare the clinical features of two subtypes of positional OSA (POSA), namely supine-predominant OSA (spOSA) and supine-isolated OSA (siOSA), so as to discuss whether the two groups can be classified separately.
Methods: A total of 279 consecutive patients with OSA were enrolled. The POSA was defined as having an overall apnea-hypopnea index (AHI) $\geqslant$5 with supine AHI >2 times the non-supine AHI. Only those with $\geqslant$30 min spent in the supine and non-supine sleeping positions were included, and split night studies were excluded from the study. Patients were considered spOSA unless their non-supine AHI was negligible (<5) (siOSA). The clinical and polysomnographic characteristics of both groups were compared.
Results: Two hundred and sixteen subjects (77.4%) met the criteria for POSA, with 158 (73.1%) of them classified as spOSA, and 58 (26.9%) as siOSA. The siOSA patients had lower arousal indices, but poorer quality of sleep, and were more depressed and anxious compared with the spOSA subjects.
Conclusions: Those with siOSA and spOSA show different clinical features.
Significance: These findings suggest that a more detailed sub-classification of POSA is needed.

1. Introduction

Obstructive sleep apnea (OSA) syndrome is characterized by recurrent episodes of upper airway obstruction during sleep. It is also an independent risk factor for a variety of medical conditions including neurocognitive deficits, cardio-cerebro-vascular and metabolic diseases (Quan and Gersh, 2004; Martinez-Garcia et al., 2009; Palma et al., 2013). Several phenotypes of OSA are being increasingly recognized (e.g. positional or non-positional, with or without hypoxia, anatomic or non-anatomic) and may involve, beyond the anatomy, physiological factors (Eckert et al., 2013; Menon and Kumar, 2013; Motamedi, 2014; Palma et al., 2014). While the pathophysiology of OSA is complicated, it is posited that the body position has a strong influence on OSA with relevance to gravity. The supine sleeping position is correlated with higher incidence and severity of OSA. Nevertheless, the severity of OSA, assessed based on overall apnea-hypopnea index (AHI), may not reflect the heterogeneity of OSA as there are more apneic events in supine position. In fact, 50–60% of OSA patients have

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positional OSA (POSA) commonly defined as ⩾50% increase in AHI in supine sleep position compared to the nonsupine positions, with or without normalized AHI of <5 in nonsupine positions (Cartwright, 1984; Mador et al., 2005; Schiza et al., 2015). On the other hand, estimates of non-compliance with continuous positive airway pressure (CPAP) therapy range from 29% to 83% (Ravesloot et al., 2013). Therefore, using positional therapy (e.g. chest-worn sleep position trainers, tennis ball technique) as an efficient intervention is of increasing value in this group of patients (de Vries et al., 2015; Dieltjens et al., 2015).

However, since the description of POSA by Cartwright in 1984 (Cartwright, 1984), various definitions and classifications have been proposed to identify and classify these patients (Marklund et al., 1998; Mador et al., 2005; Bignold et al., 2011; Ravesloot et al., 2013). The inconsistency in definition criteria continues; for example, the prevalence of POSA has widely varied in different studies ranging from 23–30% to 9–60% depending on the definitions used (Cartwright et al., 1985; Mador et al., 2005; Mo et al., 2011; Gillman et al., 2012; Joosten et al., 2012; Teerapraipruk et al., 2012; Schiza et al., 2015). Therefore, more accurate characterization of subgroups of POSA may help developing a unified set of diagnostic criteria and thereby facilitating the development of optimized and targeted treatment strategies. Here we report different clinical and polysomnographic features in two subgroups of POSA i.e., patients with supine-predominant OSA (spOSA) (Cartwright, 1984; Joosten et al., 2012, 2014), and supine-isolated OSA (siOSA) (Mador et al., 2005; Joosten et al., 2014). We speculated that the siOSA patients would show comparatively milder clinical features than the spOSA patients.

2. Methods

2.1. Subjects

A total of 279 consecutive adult Korean patients with OSA [41 females (14.7%), age 45.23 ± 14.18 years (mean ± SD)] were enrolled from among those who visited a tertiary-care regional university hospital sleep center for the first time, between August 2009 and February 2014. The data included in the current study is limited to those obtained prior to starting treatment therefore, no outcome data was included in this study. The diagnosis of OSA was based on AHI ⩾5, according to the second edition of the International Classification of Sleep Disorder (ICSD-2) (American Academy of Sleep Medicine, 2005). Subjects whose supine or non-supine sleeping time was less than 30 min and those who had a split night polysomnography (PSG) study were excluded. Patients with primary insomnia, narcolepsy, parasomnia and restless legs syndrome were also excluded from the study. These patients had no history of otolaryngological procedures or current sinusitis. Body weight, height, neck and waist circumferences were measured. The study was approved by, and was conducted in compliance with the regulations set by the Institutional Review Board.

2.2. PSG and classification

A standard overnight PSG was performed in every case using the 32-channel Grass-Telefactor Comet digital recording polysomnographic system. The PSG data were manually scored according to the American Academy of Sleep Medicine guidelines and OSA severity was classified as mild (5 ⩽ AHI < 15), moderate (15 ⩽ AHI < 30), or severe (AHI ⩾30) (Silber et al., 2007; Berry et al., 2012). Arousal index was measured as total as well as in categories including apnea-related, snore-related, and spontaneous. Patients with OSA were classified into POSA and non-positional OSA (NPOSA). Those classified as POSA had an AHI ⩾5 with a >50% reduction in the AHI between the supine and nonsupine sleep positions (Cartwright, 1984). Patients with POSA were further classified into two subgroups: spOSA and siOSA defined as proposed by Joosten et al. i.e., (1) overall AHI ⩾5 for both groups, (2) supine AHI ⩾2 times the non-supine AHI for both groups, and (3) non-supine AHI <5 only for those classified as siOSA (Joosten et al., 2014) (Fig. 1). For the ODI (oxygen desaturation index), Mean SaO_2 desaturation peaks, Time of TST (total sleep time) spent with SaO_2 <90%, Time of TST spent with SaO_2 <80% were recorded if available.

2.3. Psychometric tests

In order to fully characterize POSA and its subtypes, all subjects were asked to complete a series of standardized sleep related and psychometric tests including the Korean version of the Insomnia Severity Index (ISI-K) (Cho et al., 2014), the Pittsburgh Sleep Quality Index (PSQI-K) (Sohn et al., 2012), the Epworth Sleepiness Scale (ESS-K) (Cho et al., 2011), the Beck Depression Inventory-2 (BDI-2-K) (Sung et al., 2008), the Hospital Anxiety and Depression Scale (HADS) (Zigmond and Snaith, 1983), and the Korean version of the Short-Form 36-Item Health Survey (SF-36-K) (Han et al., 2004).

2.4. Statistics

The data analysis was performed using the SPSS version 18.0, and $p < 0.05$ was considered statistically significant. A Chi-square test was used to analyze qualitative data (gender, alcohol, smoking, diseases, and severity of OSA), and the independent *t*-test was used for analyzing quantitative data between the two groups (age, BMI, PSG data). The analysis of covariance (ANCOVA) was used for analyzing the polysomnographic data between POSA and non-POSA.

3. Results

Of the whole 279 OSA patients, 216 patients (77.4%) had POSA with 91 (42.1%) of them classified as mild, 57 (26.4%) as moderate, and 68 (31.5%) as severe sleep apnea. The POSA group showed lower neck and waist circumferences in supine position, and lower BMI. The PSG data indicated that the AHI was significantly lower in the POSA group than the NPOSA group (23.50 ± 18.83 vs. 50.52 ± 29.58; $p < 0.001$), and the POSA group showed less sleep time in N1 and N2 (63.22 ± 11.48 vs. 73.49 ± 13.74; $p < 0.001$), more N3 and rapid eye movement (REM) sleep (19.22 ± 18.64 vs. 10.37 ± 9.69%N3, $p < 0.001$; 18.18 ± 6.50 vs. 15.45 ± 6.64%REM, $p = 0.005$), lower oxygen desaturation index (ODI) (51.10 ± 36.94 vs. 20.95 ± 16.48, $p < 0.001$), less total sleep time (TST) spent at SaO_2 < 90% (88.06 ± 127.98 vs. 16.12 ± 26.04, $p < 0.001$), less TST

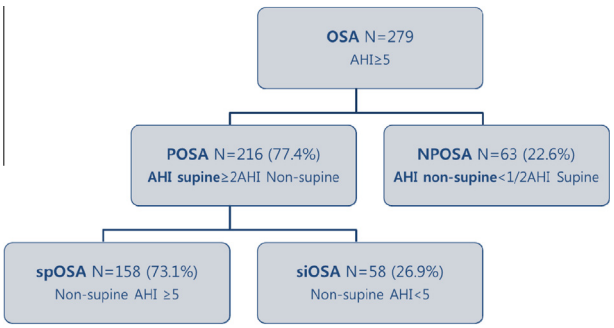

Fig. 1. Distributions of phenotype obstructive sleep apnea (OSA). POSA, positional obstructive sleep apnea; NPOSA, non-positional obstructive sleep apnea; spOSA, supine-predominant obstructive sleep apnea; siOSA, supine-isolated obstructive sleep apnea; AHI, apnea-hypopnea index.