SHORT COMMUNICATION

Sleep Science

Ambulatory positional obstructive sleep apnea syndrome

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ABSTRACT

Objective: To establish the prevalence of positional (PP) OSA patients using self-administered home-based respiratory polygraphy (RP). **Materials and Methods:** 52 month retrospective study based on RP records. **Results:** 200 PR records: 70.5% men 29.5% women. 76% were diagnosed with OSA and 54.6% with PP OSA. There were no significant differences in Epworth Sleepiness Scale, apnea hypopnea index and oxygen desaturation index. PP OSA patients were younger, had a lower BMI (30.3±0.9 vs. 35.3±1.2) (p<0.0001), and the time they spent with oxygen saturation <90% (T<90) was lower (8.8 vs. 28.7±6.7, p=0.0038). The PP OSA group spent 43% of total recording time in the supine position. **Conclusions:** The prevalence of PP OSA patients studied with RP is similar to the one described by sleep laboratories. They have lower BMI, present mostly mild OSA with less desaturation, and are less likely to receive CPAP therapy.

Keywords: Sleep Apnea Syndromes; Sleep Apnea, Obstructive; Continuous Positive Airway Pressure; Supine Position.

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INTRODUCTION

Obstructive Sleep Apnea Syndrome (OSA) is a prevalent condition characterized by repeated episodes of complete or partial airway obstruction during sleep[1]. The clinical consequences of these episodes are excessive daytime sleepiness[2], an increased risk for cardiovascular disease like hypertension, arrhythmia, ischemic coronary disease[2-4], metabolic syndrome, and insulin resistance[5].

According to prior descriptions, most OSA patients have a higher number of obstructive events in the supine sleeping position. The subgroup of OSA patients whose supine apnea hypopnea index (AHI) or respiratory disturbance index (RDI) is twice as high as their non-supine AHI or RDI are called positional (PP) OSA patients[6]. Studies have shown that these patients are younger and have lower BMI and AHI levels than patients with non-positional (NPP) OSA[7]. These findings are limited by the fact that most published studies have been conducted with polysomnography, a method that may increase the time patients spent in supine position and, therefore, may overestimate AHI severity[8]. Its kwon that respiratory poligraphy (RP) can underestimate the AHI severity because the arousals can't be detected by this method and also because AHI is calculated base on the total register time.

The purpose of this study is to determine the prevalence and characteristics of PP OSA patients studied by home RP.

MATERIALS AND METHODS

Design

This retrospective study was based on a systematically collected database of patients referred for home RP at Hospital Británico de Buenos Aires, from December 2011 to April 2016 (52 months).

The protocol was approved by the Ethics Committee and the Institutional Review Board in accordance with the Declaration of Helsinki (as amended from time to time).

Population

This study was based on data of consecutive ≥18 year old patients referred for RP for cardinal symptoms of OSA, such as snoring, sleepiness or apnea observed by others. The age range was between 18-87 years. Patients on oxygen therapy or non-invasive ventilation during RP were excluded from the study. Patients with a known diagnosis of COPD, obesity hypoventilation syndrome, chronic heart failure, neuromuscular disorders, parasomnia, periodic limp movement disorders, and narcolepsy were also excluded.

Questionnaires

Demographic data (age, sex) and anthropometric data (e.g. BMI in kg/m^2) were collected and subjective sleepiness questionnaires were completed during patients' visit to hospital to pick up the RP device. According to the definition of the World Health Organization (WHO)[9], patients were classified into the following categories: normal weight (BMI<25); overweight (BMI between 25.0 and 29.9 kg/m^2); class 1 obesity (BMI between 30 and 34.9); class 2 obesity (BMI between 35 and 39.9); and class 3 or severe obesity (BMI≥40). All patients completed validated Spanish versions of Epworth Sleepiness Scale (ESS)[10], and Berlin and STOP-BANG questionnaires[11].

Respiratory Polygraphy

Recordings were made using portable Alice PDX (Philips-Respironics® USA) and Embletta Gold® (Embla® USA) devices with sensors for nasal pressure and thoracic and abdominal effort, and oximetry (signal averaging time <1 second) measured by finger probe.

Technicians instructed patients in the use of RP devices the same day nocturnal recordings were obtained through the home self-administration technique. Pulmonologists trained in AASM standards (American Academy of Sleep Medicine[12]) edited recordings manually (*sequential manual scoring*) using specific software: Remlogic-*e*® *(Embla)* and G3® *(Philips)*. Edited recordings were considered valid when they included more than four hours of good quality signal [>4 hours of total register time (TRT)].

Apneas were described as a >90% airflow reduction and hypopneas as a >50% airflow reduction associated with ≥3% oxygen desaturation for at least 10 seconds[13] (Chicago criteria).

AHI was defined as the number of respiratory events (apneas + hypopneas) over TRT. According to final scoring AHI values were classified either as normal (AHI<5/h), mild (AHI between 5 and 14.9 events per hour), moderate (AHI between 15 and 29.9/hour), or severe (AHI>30/hour). Oxygen Desaturation index (ODI) was also calculated on TRT and time spend with oxygen saturation less than 90% (T<90) was measured in minutes and as a percentage of valid TRT. ODI was defined as a 3% drop from the immediately preceding baseline value.

Definition of positional apnea

Total supine and non-supine times were measured as exposure indicators.

PP OSA was defined as an AHI of ≥5 events/hour with a supine AHI/non-supine AHI ratio ≥2. As an additional requirement, supine/non-supine times analyzed were ≥30 minutes minimum of TRT.

STATISTICAL ANALYSIS

As for categorical variables, results were presented as percentages; for numerical variables, results were presented as mean or standard deviation (SD). We used Mann-Withney or Chi Square test to compare differences between two groups (for quantitative and qualitative variables), and the non-parametric Kruskall-Wallis test and Dunn's multiple comparison test to compare the results of three or more groups. Data were analyzed using Prism 5 software (Graph Pad, La Jolla, CA).

RESULTS

Population characteristics

We included 200 patients, 70.5% (n: 141) were men. Demographic characteristics are shown in Table 1.

Table 1. Demographic characteristics.

Variables	PP OSA (n 83)	SD	NPP OSA (n 69)	SD	*P* value
Age	49.7	12.16	52.5	12.44	0.1
Men (%)	80.7		66.7		0.4
BMI	30.3	8.38	35.3	9.83	<0.0001
ESS	8.6	4.91	9.6	4.97	0.49

PP OSA: Positional Obstructive Sleep Apnea Syndrome, NPP OSA: Non-Positional Obstructive Sleep Apnea Syndrome, SD: Standard Deviation, BMI: Body Mass Index (kg/m²). ESS: Epworth Sleepiness Scale.

We found that 152 patients suffered from OSA. Of these, 54.6% (n: 83) were PP OSA and supine time was 43% (% of TRT). There were more men among the PP than the NPP group, though this difference was not statistically significant (p=0.4) (Figure 1). In addition to this, we observed that PP OSA patients were younger than NPP (49.7±1.3 *vs.* 52.5±1.5; p=0.1) and had lower BMI (30.3±0.9 *vs.* 35.3±1; p<0.0001) (Figure 2A and 2B).

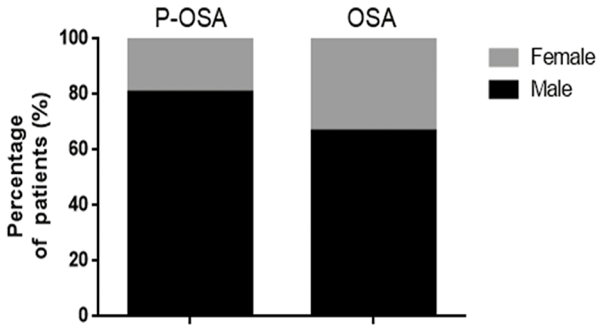

Figure 1. Study population distribution according to sex P -OSA: positional Obstructive Sleep Apnea Syndrome. OSA: Obstructive Sleep Apnea Syndrome.

In this series, we did not observe differences in initial symptoms, since mean ESS values were similar in both groups (PP: 8.6 *vs.* NPP: 9.6; p: 0.5).

As shown in Figure 2C, even though the differences in AHI and oxygen desaturation index (ODI) were not statistically significant (PP=22.3±1.6 *vs.* NPP=26.7±2.6; p=0.4 and PP=19.2±1.6 *vs.* NPP=26.9±3.1; p=0.7; respectively), PP OSA patients spent less time with oxygen saturation <90% (T<90) (8.8±1.7 *vs.* 28.7±6.7; p<0.01) Table 2. A larger proportion of these patients presented mild OSA (40.7%)-in terms of AHI-and had fewer indications of CPAP therapy. CPAP therapy was indicated for 42.35% of PP and 61.42% of NPP patients due to severe or moderate OSA associated with symptoms or comorbidities.

DISCUSSION

OSA is the most prevalent sleep disorder[14]. In 1984, Cartwright arbitrarily established that PP OSA patients should be distinguished from NPP in terms of their AHI or RDI[6,15]. However, supine time is another factor with the potential to modify respiratory indicators during sleep.

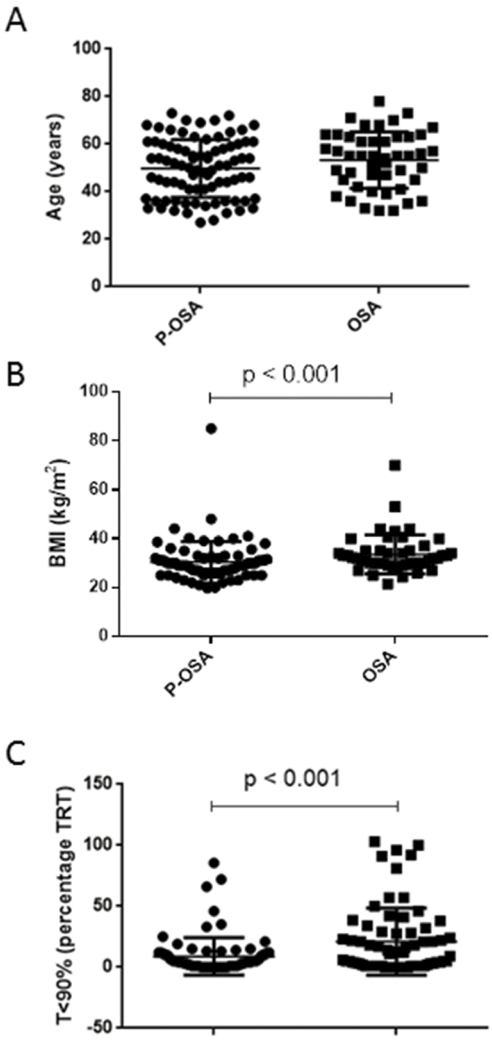

Figure 2. A) Comparison of mean age between PP and NPP OSA. B) Differences in BMI between PP and NPP OSA C) Percentage of oxygen saturation time <90% (T P -OSA: positional Obstructive Sleep Apnea Syndrome. OSA: Obstructive Sleep Apnea Syndrome. BMI: Body Mass Index. T

Table 2. Poligraphy indicators.

Variables	PP OSA (n 83)	SD	NPP OSA (n 69)	SD	*P* value
AHI*	22.3	22.3	26.7	21.18	0.36
ODI*	19.2	19.2	26.9	24.15	0.69
T<90**	8.8	8.8	28.7	81.74	0.004

PP OSA: Positional Obstructive Sleep Apnea Syndrome, NPP OSA: Non-Positional Obstructive Sleep Apnea Syndrome, SD: Standard Deviation, AHI: Apnea Hypopnea Index, ODI: Oxygen Desaturation index, T<90: time they spent with oxygen saturation <90%

* Events/hour base on total register time (TRT). ** Saturation below 90% as % of TRT

PP OSA has high prevalence (>50% of OSA) and most series have been described using polysomnography[14] (PSG), which increases the time patients spend in the supine position and, therefore, has an influence in the classification of severity for most subjects. In our series, we found that the prevalence of

PP OSA among OSA patients studied with RP is similar to the one described by sleep laboratories[7,16] (50-60%) and, therefore, we conclude that the diagnostic method is not a determining factor in the prevalence of this condition.

The analysis of demographic data revealed similar findings to those described by similar works using PSG; PP OSA patients are younger and have lower BMI[7]. Joosten et al.[17] described differences of 30.4[17]±1.2 kg/m^2 *vs.* 34.9±3.1 kg/m^2 between PPs and NPPs, respectively and described a mean age of 51.2±1.7 years for PPs and 57±2.1 years for NPPs[17]. In our series BMI was also lower in the PP group (30.3±0.9 kg/m^2 *vs.* 35.3±1.2 kg/m^2, p<0.0001), with a mean age of 49.7±1.3 *vs.* 52.5±1.5 (p<0.5), respectively.

Previous studies have proposed that PP OSA usually present more subjective daytime sleepiness than other OSA patients[18]. In our analysis, ESS was similar in both groups. Other authors have described less sleepiness among PP OSA patients through objective multiple sleep latency tests (MSLT)[7].

We also measured the percentage of TRT in the supine position (TRT_S). According to some hypotheses, patients spend more time in the supine position during sleep laboratory tests because these tests restrict their movement[17]. By using portable monitors, we found a TRT_S of 43%, which is similar to reported PSG findings at sleep laboratories[8,19,20].

PP OSA patients had slightly lower AHI and ODI values than NPP OSA, though the biggest differences in the oximetry profile were observed in T<90%, which was higher in the NPP group with lower oxygen saturation levels at night. Considering this finding was not observed in the other measured indicator (ODI), this might not be related to airway obstruction events.

Finally, when we analyzed severity in terms of AHI we found more severe OSA patients in the NPP group (35.8% *vs.* 25.8%) and, therefore, the indication of CPAP was more frequent for this group.

CONCLUSIONS

The use of portable home devices allowed us to find that the prevalence of PP OSA and TRT_S is similar to the one described in sleep laboratories. PP OSA patients have lower BMIs, present mostly mild OSA with lower desaturation indexes, and are less likely to receive an indication for CPAP therapy.

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