Sleep Science

ORIGINAL ARTICLE

Clinical and polysomnographic differences among the obstructive sleep apnea syndrome patients from different ages

Diferenças no perfil clínico e polissonográfico de pacientes com síndrome da apneia obstrutiva do sono entre diferentes faixas etárias

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ABSTRACT

Introduction: Obstructive Sleep Apnea Syndrome (OSAS) has cardiovascular and cognitive repercussions that differ according to age. The aim of the present study was to demonstrate clinical and polysomnographic differences among three different age groups of patients with OSAS. **Methods:** We studied 130 adult patients with OSAS. The study protocol consisted on questionnaires, a physical examination, and polysomnography. Patients were distributed into three age groups: below 35 years-old (Group A), 35 to 65 years-old (Group B), and above 65 years-old (Group C). **Results:** Group A had 22 (16.9%) patients, B had 92 (70.7%), and C had 16 (12.3%). Systemic arterial hypertension (p=0.01) and cardiopathy (p=0.02) were significantly more frequent in Group C, while smoking (p=0.04) was more frequent in Group A. There were no differences between groups on polysomnography measures or Epworth Sleepiness Scale scores. Upon physical examination, there were significantly more posterior soft palate (p=0.004) and a greater use of dental prosthesis in Group C (p=0.03), along with a greater number of hypertrofic palatine tonsils in Group A (p=0.01). **Conclusion:** Most OSAS patients were in the 35 to 65 years-old age range. Clinical findings show that the disease may have different aggravating factors depending on the patient's age.

Keywords: sleep apnea, obstructive; snoring; physical examination; polysomnography; aged.

RESUMO

Introdução: A Síndrome da Apneia Obstrutiva do Sono (SAOS) apresenta repercussões cardiovasculares e cognitivas e tem sido relacionada ao envelhecimento. Desta forma, o objetivo deste estudo foi demonstrar as possíveis diferenças clínicas e polissonográficas entre as diferentes faixas etárias de pacientes com SAOS. **Métodos:** Foram inclusos 130 pacientes adultos com SAOS. O protocolo de avaliação consistiu em questionários, exame físico e polissonografia. Os pacientes foram distribuídos em três grupos: até 35 anos (Grupo A), 35 a 65 anos (Grupo B) e acima de 65 anos (Grupo C). **Resultados:** Vinte e dois (16,9%) pertenciam ao Grupo A, 92 (70,7%) ao B e 16 (12,3%) ao C. Dentre os achados clínicos que apresentaram diferença estatisticamente significante, a presença da hipertensão arterial sistêmica (p=0,01) e da cardiopatia (p=0,02) foi mais frequente no Grupo C, e o tabagismo (p=0,04) mais frequente no Grupo A. Os achados polissonográficos e a escala de sonolência de Epworth não apresentaram diferença significativa entre os grupos. Os achados significantes no exame físico foram maior frequência de palato mole posteriorizado (p=0,004) e uso de prótese dentária n Grupo C (p=0,03), e maior frequência de tonsilas palatinas hiperplásicas no Grupo A (p=0,01). **Conclusão:** A maior parte dos pacientes com SAOS se encontrou entre a faixa etária de 35 a 65 anos. Os achados clínicos mostram que a doença pode apresentar diferentes agravantes, dependendo da faixa etária acometida.

Descritores: apnéia do sono tipo obstrutiva; ronco; exame físico; polissonografia; idoso.

INTRODUCTION

Obstructive Sleep Apnea Syndrome (OSAS) is characterized by recurrent episodes of a partial or total obstruction of the upper airway (UA) during sleep, it is usually associated with sleep fragmentation and decreased oxyhemoglobin saturation[1]. The prevalence of OSAS is of 2% in women and 4% in men[2], but a recent epidemiological study of the adult population of São Paulo, in Brazil, showed a much higher prevalence of 32.9%[3]. OSAS is clinically important because it has high morbidity due to its effects on cardiovascular and cognitive function[1].

The physiopathology of OSAS is not fully understood, but it seems to be multifactorial, and functional and structural alterations of the pharynx seem to be involved[1]. The main clinical predictors of the disease are: cervical circum-

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ference, body mass index (BMI), craniofacial profile, and anatomical changes in the UA[1].

Numerous studies have correlated clinical measures with the presence of OSAS. For example, Friedman et al.[4] showed a relationship between the presence of OSAS and the Mallampati Modified Index (MMI), size of tonsils, and BMI. Additionally, Zonato et al.[5] have demonstrated a relationship between both the presence and severity of OSAS and MMI, BMI, and anatomical abnormalities of the pharynx, whereas Mayer et al. have related imaging measures of the UA and age (along with BMI) to snore and apnea patients. They showed a higher prevalence of the UA narrowing in younger patients, which positively correlated with the apnea-hypopnea index (AHI)[6].

Obesity and age, along with gender[2,3], are also the main risk factors for OSAS. Snoring, which is one of the most common clinical signs of sleep apnea, sharply increases with age and has been found to be more prevalent in men (45%) than women (30%) over 65 years-old[7]. Moreover, several studies have associated the severity of OSAS with age[2,3,7]. The aim of this study was to demonstrate differences in clinical and polysomnographic measures among three age groups, in patients with OSAS.

METHODS

We randomly sampled 130 adult (older than 18 years-old) patients with OSAS, of both genders, from referrals to a sleep-disordered breathing (SDB) outpatient clinic in the Department of Otolaryngology at the Faculdade de Medicina do ABC from Hospital Estadual Mário Covas, Santo André, São Paulo, in Brazil, between April 2007 and August 2008. The Ethics Committee of the institution approved the project and all patients signed an informed consent form.

OSAS diagnosis was based on clinical and polysomnographic criteria proposed by the International Classification of Sleep Disorders, second edition (ICSD-2, 2005)[8].

All patients were assessed with questionnaires and a physical examination of the UA and craniofacial features was performed, during their first visit to the clinic; at a later visit, they underwent polysomnography.

For the analysis, patients were distributed into three groups: below 35 years-old (Group A), 35 to 65 years-old (Group B), and above 65 years-old (Group C). We compared the groups in all clinical and polysomnographic measures.

Questionnaires

Patients were asked about the presence of associated diseases, such as systemic arterial hypertension, diabetes mellitus, cardiopathy, and others, as well as tobacco and alcohol consumption.

Patients who reported snoring almost every day or every day of the week were considered to have habitual snoring. Patients were assessed with the Epworth Sleepiness Scale[9] and the one that scored higher than 9 were considered to have excessive daytime sleepiness.

UA and craniofacial physical examination

The physical examination of the UA was performed as recommended by Zonato et al.[5]. Specifically, we evaluated the nose, soft palate, uvula, tonsillar pillars, tongue, palatine tonsils, and MMI.

For the nasal cavity examination, obstructive septal deviations were noted. We considered obstructive deviations of grades II and III, defined as touching the inferior nasal concha (grade II) or the lateral wall (grade III).

The soft palate was considered thick when it co-occurred with edema; posterior when it leaned to the posterior oropharyngeal wall; and web, when the insertion of the posterior pillar in the uvula was lowered. The tonsillar pillars were considered medialized when the insertion of the posterior pillar in the tongue was toward the midline of the pharynx and obstructed at least 50% of it.

The tonsils were divided into four grades, with grade I referring to the tonsils that occupied up to 25% of the oropharyngeal space and grade IV to those that occupied more than 75%. Hypertrofic tonsils were considered as grades III and IV, i.e., employing more than 50% of the oropharyngeal space. The tongue was considered voluminous when demarked by teeth, which shows a disparity between oral cavity and tongue volume.

The MMI was performed according to Friedman et al.[4], and patients were classified into one of four classes. Class I occurred when the entire oropharynx was seen, including the lower pole of the tonsil. Class IV occurred when only the hard palate and part of the soft palate could be seen, and the posterior oropharyngeal wall and the insertion of the uvula were not seen. Patients were class III or IV when the base of the tongue and oropharynx was disproportionate.

The craniofacial exam evaluated the facial profile, hard palate, and type of dental occlusion, as recommended by Zonato et al.[5].

First, we positioned the patient sideways in the Frankfurt position. Then, we drew a virtual line perpendicular to the ground through the white and red edges of the inferior lip. A distance greater than 0.2 mm from the chin was considered as retrognathic. The hard palate was considered ogival when it was narrow and deep. The dental occlusion was assessed according to Angle[10], and patients were considered class I if they had a normal occlusion, class II if the lower arcade was retro-positioned as compared to the upper arcade, and class

III if the upper arcade was retro-positioned as compared to the lower arcade. Patients who had some missing teeth or who were edentulous could not be assessed and placed in the dental prosthetic group.

Polysomnography

An all-night polysomnography was performed by trained professionals using the "EMBLA" (EMBLA® S7000, EMBLA systems, Inc, Broomfield, CO, USA). The biological variables were measured by electroencephalography (C3/A2, C4/A1, O1/A2, O2/A1), bilateral electro-oculography, submentonian and anterior tibial electromyography, and electrocardiography (V2 modified). The oral and nasal flows were measured through a thermistor and nasal cannula with pressure transducer, respectively. Thoracic and abdominal movement were monitored by noncalibrated inductance plethysmography, snoring was recorded using a microphone, oxyhemoglobin was measured by pulse oximetry, and body position was monitored by a sensor. Sleep staging followed the criteria of Rechtschaffen and Kales[11] and the arousal followed the ones from the American Sleep Disorders Association (ASDA)[12]. The staging of respiratory events was performed according to the criteria proposed by the American Academy of Sleep Medicine (AASM)[13].

The analyzed measures were AHI, minimal oxygen saturation of oxyhemoglobin (SpO_2 min.), arousal index per hour of sleep (AI), percentage of sleep stages [REM and non-REM (NREM)], and sleep efficiency (SE).

Descriptive statistics were calculated for all of the aforementioned measures. Specifically, the mean, range, and standard deviation were calculated for quantitative variables, and proportions were calculated for categorical variables. Group means and frequencies were compared using an analysis of variance (ANOVA) for quantitative variables and Pearson's chi-square test for the categorical ones.

All tests were performed using SPSS 16.0 for Windows, and the significance level was set to $p \leq 0.05$.

RESULTS

Of the 130 patients, 77 were female and 53 were male, with a mean age of 49.3 years-old. The mean BMI of the whole sample was 29.2 kg/m^2.

Group A had 22 (16.9%) patients, Group B had 92 (70.7%), and Group C had 16 (12.3%).

We found no statistically significant differences between the proportion of patients that were female *versus* male (Table 1). There was a significantly higher frequency of smoking in Group A (p=0.04), and systemic arterial hypertension and cardiopathy in Group C (p=0.01 and p=0.02, respectively), as it can be seen in Table 2. Table 3 shows the polysomnography findings. There were no statistically significant differences between groups on these measures. BMI also was not statistically different (Table 1).

Regarding the UA and craniofacial evaluation, there was a significantly higher frequency of posterior soft palate (p=0.004) and dental prosthetics (p=0.03) in Group C, and hypertrofic tonsils of grades III and IV (p=0.01) in Group A (Table 4).

Table 1. Distribution of patients according to sex, as well as the body mass index and Epworth Sleepiness Scale scores for each age group.

Clinical parameter	Group A n=22	Group B n=92	Group C n=16	p-value
Females*	6 (27%)	41 (45%)	9 (59%)	0.32
Males*	16 (73%)	51 (55%)	6 (35%)	0.32
BMI (kg/m^2)**	27.6±5.18	29.4±5.62	30.0±5.55	0.93
ESS**	11.3±3.8	10.5±5.5	12.0±4.4	0.69

Group A: ≤35 years; Group B: 35-65; Group C: >65 years. BMI: body mass index; ESS: Epworth Sleepiness Scale; p: statistical value. Pearson x^2 test* and ANOVA**.

Table 2. Clinical features of patients with OSAS across three age groups (Groups A, B and C).

Clinical feature	Group A n=22	Group B n=92	Group C n=16	p-value
Habitual snoring	17 (77.3%)	85 (92.4%)	15 (93.8%)	0.91
Smoking	7 (31.8%)	17 (18.5%)	1 (5.9%)	0.04
Alcoholism	2 (9.1%)	3 (3.3%)	1 (5.9%)	0.3
Systemic arterial hypertension	3 (13.6%)	35 (38%)	12 (75%)	0.01
DM	0	9 (9.8%)	2 (12.5%)	0.27
Cardiopathy	0	4 (4.3%)	3 (17.6%)	0.02

Group A: ≤35 years; Group B: 35-65; Group C: >65 years; DM: Diabetes Mellitus; p: statistical value. Pearson x^2 test.

Table 3. Polysomnographic findings across three age groups (Groups A, B and C).

Polysomnography measure	Group A n=22	Group B n=92	Group C n=16	p-value
AHI (hours)	30.0±33.1	29.7±26.4	44.2±28.9	0.15
Sleep 1 (%)	6.1±3.7	6.3±5.9	9.6±8.4	0.07
Sleep 2 (%)	58.6±17.2	60.9±13.3	63.8±14.5	0.53
Sleep 3+4 (%)	15.9±10.3	16.7±9.3	9.7±8.4	0.26
REM (%)	16.9±6.2	15.8±7.3	15.3±9.2	0.81
SpO_2min (%)	86.8±7.7	80.2±7.3	75.3±18.2	0.20

Group A: ≤35 years; Group B: 35-65; Group C >65. AHI: apnea and hypopnea per hour of sleep; REM (%): percentage of rapid eye movement sleep; SpO_2 min. (%): minimal oxygen saturation in pulse oximetry; p: statistical value; ANOVA.

Table 4. Upper airway and craniofacial evaluation across three age groups (Groups A, B and C).

Anatomical change	Group A n=22	Group B n=92	Group C n=16	p-value
Retrognathia	6 (27.3%)	20 (21.7%)	4 (25%)	0.891
Soft palate web	16 (72.7%)	62 (67.4%)	13 (81%)	0.512
Posterior soft palate	1 (4.5%)	35 (38%)	8 (50%)	0.004
Thick soft palate	9 (40.9%)	39 (42.4%)	8 (50%)	0.830
Palatine tonsils grades III and IV	8 (36.4%)	7 (7.6%)	1 (6.2%)	0.01
MMI III and IV	15 (68.2%)	77 (83.7%)	15 (93.8%)	0.102
Occlusion Class II and III	9 (9.8%)	16 (17.4%)	1(1.1%)	0.03
Dental prosthesis	2 (9.1%)	51 (55.4%)	12 (75%)	
Tonsillar pillars gutters	12 (54.5%)	1 (1.1%)	7 (43.8%)	0.951
Voluminous tongue	12 (54.5%)	38 (41.3%)	5 (31.3%)	0.335
Thick uvula	9 (40.9%)	48 (52.2%)	6 (37.5%)	0.411
Long uvula	12 (54.5%)	32 (34.8%)	8 (50%)	0.161
Obstructive septal deviation	4 (18.2%)	34 (37%)	5 (31.3%)	0.240

Group A: ≤35 years; Group B: 35-65; Group C: >65 years. MMI: Modified Mallampati Index; p: statistical value; Pearson x^2 test.

DISCUSSION

The systemic arterial hypertension was most frequently associated with OSAS in patients over 65 years of age. Anatomically, Hypertrofic tonsils were more common in patients younger than 35 years-old and a posterior soft palate was more common in patients older than 65 years-old, suggesting that OSAS has a different profile in patients of different age groups.

When this sample of OSAS patients was categorized by age and gender, the largest sub-group consisted on males who were 35 to 65 years-old (n=51), which is consistent with the literature[2,3,6].

Importantly, we found a slightly larger number of females among patients older than 65 years, although this difference was not statistically significant. There are additional data that can help to explain this finding, including a longer life span among women and the fact that menopause is a risk factor for OSAS[14]. Resta et al. have noted that a higher prevalence and severity of OSAS in men disappears in patients older than 55 years-old, and menopause may lead to an increased incidence and severity of OSAS in women[15].

The vast majority of patients across all groups presented with a snoring complaint. Snoring is one of the most common clinical signs of sleep apnea and increases considerably with age. Bresnitz et al. showed that 45% of men and 30% of women over 65 years-old snore[7]. Smoking was significantly more frequent in young patients.

The frequency of systemic arterial hypertension and cardiopathy was significantly greater in individuals older than 65 years-old. However, this is due to their increased incidence with age independent of OSAS. The following fact is important and should always be discussed with patients: Systemic arterial hypertension is twice as common in those who snore, even after excluding confounding factors, such as age and obesity[16].

As for the anthropometric evaluation, all groups showed a high rate of obesity (i.e., the mean BMI was high in all groups). As was found here, obesity has consistently been reported to be a predictor of OSAS[3,4,6].

No polysomnography measures were significantly different across groups, the explanation of which is highly speculative. Several studies have demonstrated that the incidence of OSAS increases with age, independent of weight gain[4,7]. However, there is a consensus that age should also be a predictor of disease severity. In the present study, which included only patients diagnosed with OSA, there was no increase in severity with increasing age. Therefore, we can conclude that age is a factor in the development of OSAS physiopathology, but not in determining its severity, which leads us to question whether the disease is progressive. Future studies with larger patient samples will be able to clarify the effect of age on disease severity.

A difference in the patients' anatomical profiles was seen as a result of specific anatomical changes. The most important difference, which was statistically significant, is in the size of the palatine tonsils. Patients younger than 35 years-old had a higher prevalence of hypertrofic tonsils (grade III and IV) compared to both older groups. Therefore, we conclude that the anatomical profile of patients with OSAS differs especially with respect to tonsil size (an important contributor to the physiopathology of the disease), varies with age, and should be evaluated in young subjects, which is consistent with previous studies[6].

A posterior palate was significantly more common in adults over 65 years-old. This difference may be explained by changes in the muscle tone and collagen deposits, which happens as you get older.

The type of dental occlusion was also different among the groups. This difference was due to the large number of patients over the age of 65 years, who use dental prosthetics. Although it does not represent a real difference in the patient's skeletal profile, this is an important factor for choosing the patient's treatment, as edentulous individuals cannot receive oral mandibular-advancement devices.

In conclusion, OSAS was more prevalent in patients between 35 and 65 years of age, but there were some features that were specific to an age group, especially the youngest (below 35 years-old) and oldest (over 65 years) groups. Further studies may help us gain a better understanding of the physiopathology of this disease, as well as the reason why the disease onsets in different stages of life.

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