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Hearing loss in mild OSAS and simple snoring patients

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ABSTRACT:

Introduction Obstructive sleep apnea syndrome (OSAS) is characterized by recurrent episodes of prolonged partial or complete obstruction of the upper airways. Several groups have studied the effect of snoring and OSAS on auditory function and have shown an increased incidence, earlier onset, and/or greater degree of hearing loss in apneic patients in comparison to healthy controls.

The aim of our study is to evaluate audiological performance of patients with simple snoring and mild OSAS and to investigate the impact of these conditions on auditory function, considering the significant levels of chronic noise.

Materials and Methods: Data were collected by analyzing audiometric exams of snoring patients and of non-snoring patients who served as a control group. Our study included simple snoring patients without OSAS (AHI < 5) or with low level of OSAS (5< AHI < 15). Possible hearing loss was classified on a categorical scale (A-B-C-D-E), whereby A indicated the best and E the worst auditory performance, according to the national protocol of occupational medicine for evaluation of hearing loss in patients exposed to chronic noise.

Results: We found independence between patients with simple snoring and mild OSAS snorers when compared to non-snoring patients in terms of hearing performance.

Conclusions: Our results show the distribution of hearing loss in different groups that appear to be independent from the presence or absence of snoring, either complicated or uncomplicated by mild OSAS.

KEYWORDS: hearing loss, osas, snoring, chronic noise, auditory damage

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is a common sleep-related disease that is characterized by recurrent episodes of prolonged partial (hypopnea) and/or complete (apnea) obstruction of the upper airways, which leads to a reduction in blood oxygen saturation and an increase in the concentration of carbon dioxide, with intermittent hypoxia and hypercapnia.

These cycles of hypopnea/apnea tend to be repeated several times during the night, causing disturbed sleep that is complicated by frequent awakenings ("arousal"), agitation, and snoring. Snoring is interrupted by phases of silence (apneas) in which the person cannot breathe, with the appearance of "choking" and "gasping". In turn, poor quality of sleep puts patients with OSAS at an increased risk of chronic asthenia, which may evolve to daytime sleepiness and general deterioration of social and working performance. This has consequences such as an increased risk of domestic and car accidents, lack of concentration, memory impairment, and psychological disturbances. Furthermore, OSAS has been associated with many medical conditions, such as cardiovascular diseases and chronic obstructive pulmonary disease (1).

OSAS is a common worldwide disease, affecting 3-7% of middle-aged men and 2-5% of middle-aged women (2) in Western populations, but the real prevalence of the disease is unknown, because a large number of people suffering from this disease often remain undiagnosed. It is presumed that the difference between genders is related to hormonal factors, different distribution of body fat, and anatomical differences of the upper airways.

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The recurrence of sleep apneas is very common in snorers, and often it is the presence of snoring that reveals the associated respiratory disorders. Based on the available literature, the main cause of OSAS/snoring is a reversible reduction of the tone of the pharyngeal dilator muscles, leading to a collapse of the upper airway muscles. There are three main anatomical sites of obstruction: velopharynx, tongue base, and the lateral walls of the pharynx (3).

Obesity is a causal and aggravating factor of airway obstruction. Intake of sleep-inducing drugs and alcohol consumption reduce the tone of pharyngeal muscles and lead to a backward movement of the tongue base with consequent obstruction of the upper airways.

Other predisposing factors include:

- tonsillar hypertrophy
- morphological alterations of the jaw (micrognathia) and the tongue (macroglossia and mixedema by thyroid disease)
- soft palate modifications (overdevelopment and/or laxity of velum palatinum)
- obstruction of nasal cavities in chronic allergic rhinitis and/or vasomotor rhinitis.

According to AASM's (American Academy of Sleep Medicine) 2007 criteria, *apnea* can be defined as an interruption of breathing during sleep (>90% decrease in airflow), with persistence of thoracic and/or abdominal movements, leading to a decrease in the arterial blood oxygen saturation.

The term *hypopnea* is defined either by >30% decrease of airflow that leads to a reduction in the blood oxygen saturation > 4% or by >50% reduction in the airflow that leads to >3% reduction in blood oxygen saturation. According to international standards, each of these respiratory events must last for at least 10 seconds and no longer than 3 minutes.

The number of apneas and hypopneas per hour of sleep is the index of apnea/hypopnea (AHI). An AHI < 5 is considered normal; an AHI of 5-15 defines **mild** OSAS; values between 15 and 30 refer to **moderate** OSAS, while the occurrence of more than 30 events per hour characterizes **severe** sleep apnea.

Although the main consequences of OSAS are related to cardiovascular and metabolic problems, the recent literature has focused on a possible impact that OSAS may have on the auditory function, which is reflected by a higher prevalence of hearing loss in apneic patients.

Several groups have studied the effect of snoring and OSAS on auditory function and have shown an increased incidence, earlier onset, and/or greater degree of hearing loss in apneic patients in comparison to healthy controls.

Tab I. Correction of presbycusis related to age at 4.000 Hz(dB).

AGE	FEMALE	MALE
25	0	0
30	2	3
35	3	7
40	5	11
45	8	15
50	12	20
55	15	26
60	17	32
65	18	38

Tab. II. ELI scale of classification of hearing performance.

HEARING LOSS (AFTER CORRECTION)	ELI GRADE	CLASSIFICATION
<8	A	Normal-Excellent
8–14	B	Normal-Good
15–22	C	Normal
23–29	D	Suspicion of deafness
>30	E	Certainty of deafness

Based on these premises, the aim of our study is to evaluate audiological performance of simple-snoring patients with simple OSAS in the Siena area and to investigate the impact of these conditions on auditory function, considering the significant levels of chronic noise caused by them.

MATERIALS AND METHODS

Data were collected by analyzing audiometric exams of snoring patients in the Otolaryngologist Clinic of Policlinico Santa Maria alle Scotte in Siena between September 2015 and April 2016. We also enrolled non-snoring patients who served as a control group.

Our study included snoring subjects who, based on polysomnography performed according to international guidelines, had simple snoring without OSAS (AHI < 5) or mild OSAS

(5 < AHI < 15). Subjects affected by mild OSAS (low AHI) were selected to exclude problems relating to hypoxia (typical in severe forms). We identified mild OSAS as a possible cause of acoustic suffering.

The study population was compared to age-matched non-snoring patients who served as a control group.

Subjects with acute inflammation of the external or middle ear during hospitalization were excluded, together with subjects affected by other pathologies of the middle/internal ear, as reported by the patients during medical history. We also excluded patients previously exposed to acoustic trauma or chronic noise.

Moreover, we excluded patients older than 65 years, as older age might be a confounding factor.

Our final sample was composed of 80 subjects, aged between 45 and 65 years. Thirty non-snoring patients served as a control group (mean age: 57.3 years), and the experimental group included 50 snorers (mean age: 58.9 years) - 15 simple snorers and 35 patients with mild OSAS.

All subjects underwent a general ENT medical examination, including an evaluation of the nasal cavities on anterior rhinoscopy, external examination of the mouth, and an otoscopic evaluation of the external auditory canal and tympanic membrane. Since not all subjects reported for OSAS assessment, only a part of the sample underwent rhinofibrolaryngoscopy.

Then, subjects underwent a standard tonal audiometric examination (250-8000 Hz).

Subjects were ranked according to age, and ELI (Early Loss Index) was calculated according to the national protocol of occupational medicine for the evaluation of hearing loss in patients exposed to chronic noise. ELI was calculated by subtracting a corresponding correction number for presbycusis from the 4000 Hz frequency and by evaluating the loss related to age and sex (see Table I). Possible hearing loss was classified on a categorical scale (A-B-C-D-E), with A indicating the best and E the worst auditory performance (see Table II), as indicated by the protocol.

It is important to specify that the related correction indices for presbycusis should only be used in patients younger than 65 years, as evaluation tables for acoustic damage should be used in active workers only. Over that range, a correction index is the same for all ages and therefore patients over 65 years were excluded.

Tab. III. Audiometric outcomes

	A	B	C	D	E	TOTAL
Simple snorers (AHI < 5) (X)	2	4	5	3	1	15
Mild OSAS (5 < AHI < 15) (Y)	5	9	10	8	3	35
Control group (z)	4	10	9	5	2	30
TOT	11	23	24	16	6	80

Tab. IV. Distribution of theoretical absolute frequencies in simple snorers, mild OSAS snorers, and non-snoring patients.

	A	B	C	D	E	TOT
Simple snorers (AHI < 5) (X)	2,0625	4,3125	4,5	3	1,125	15
Mild OSAS (5 < AHI < 15) (Y)	4,8125	10,0625	10,5	7	2,625	35
Control group (z)	4,125	8,625	9	6	2,25	30
TOTAL	11	23	24	16	6	80

RESULTS

After data gathering has been completed, the patients distribution has been reported in a contingency table according to each category (see Table III). Consequently, the potential dependence/independence between the considered groups and the degree of hearing loss has been evaluated. Thus, in Table IV the distribution of theoretical absolute frequencies in the case of independence has been computed, and the groups of simple snorers, mild OSAS snorers, and non-snoring patients have been compared. As a result, the Cramer's V measure has been used to test for independence. The Cramer's V index varies from 0 to 1 and can reach 0 only when there is perfect independence. In this study the resulting value of the test amounted to 0,073, implying therefore a clear independence between the group of patients with simple snoring, patients with mild-OSAS, non-snoring patients and the hearing performance classification.

DISCUSSION

In the literature, several studies have shown a higher prevalence of hearing loss in apneic and snoring patients.

The mechanisms underlying this relationship are still to be fully clarified. For instance, recurring ischemic injury due to

apneic crisis may damage cochlear cells (4, 5). On the other hand, hearing impairment could be attributable to chronic noise to which snoring patients are exposed (acoustic trauma) (6). These hypotheses are still to be proven, and studies have not yet shown definite clinical and auxiliary evidence.

Studies performed by Hoffestein et al. (7), which analyzed the correlation between snoring and presbycusis, based on an analysis of audiometry tests in snoring patients, have not demonstrated a significant impact on hearing and have shown that snoring is not a factor that influences hearing.

However, Chopra et al. (8) demonstrated a decrease in auditory performance for both low and high frequencies in patients with OSAS (9).

Only an electrophysiological analysis of auditory pathways through evoked potentials could demonstrate slowed nerve conduction and an increase in the latency of the waves I, III, and V and intervals I-III and I-V; however, the results are equivocal (10, 11, 12, 13).

CONCLUSIONS

Our results show distribution of hearing loss in different groups that appear to be independent from the presence or absence of snoring, either complicated or uncomplicated by mild OSAS. No correlation between auditory performance in snoring patients with particular alterations or audiological pattern was detected.

Based on the data obtained in our study, chronic exposure to noise in simple snoring patients and patients with mild OSAS does not seem to be a predisposing or causative factor of hearing loss. Therefore, it is plausible that hypoxia may cause a lower auditory performance that other studies have shown in the snoring population.

REFERENCES

1. Karkoulias K., Lykouras D., Sampsonas F., Karaivazoglou K., Sargianou M., Drakatos P. et al.: The impact of obstructive sleep apnea syndrome severity on physical performance and mental health. The use of SF-36 questionnaire in sleep apnea. Eur. Rev. Med. Pharmacol. Sci. 2013; 17: 531–536.
2. Lurie A.: Obstructive sleep apnea in adults: epidemiology, clinical presentation, and treatment options. Adv. Cardiol. 2011; 46: 1–42.
3. Schwartz R.N., Payne R.V, Hier M.P., Fanous A., Vallée-Gravel C.: The relationship between upper airway collapse and the severity of obstructive sleep apnea syndrome: a chart review. Otolaryngol. Head Neck Surg. 2015; 44: 32.
4. Martines F., Ballacchino A., Sireci F., Mucia M., La Mattina E., Rizzo S. et al.: Audiologic profile of OSAS and simple snoring patients: the effect of chronic nocturnal intermittent hypoxia on auditory function. Eur. Arch. Otorhinolaryngol. 2015; 12.
5. Casale M., Vesperini E., Potena M., Pappacena M., Bressi F., Baptista P.J. et al.: Is obstructive sleep apnea syndrome a risk factor for auditory pathway? Sleep Breath. 2012; 16: 413–417.
6. Sardesai M.G., Tan A.K., Fitzpatrick M.: Noise-induced hearing loss in snorers and their bed partners. J. Otolaryngol. 2003; 32: 141–145.
7. Hoffstein V., Haight J., Cole P., Zamel N.: Does snoring contribute to presbycusis? Am J Respir. Crit. Care Med. 1999; 159: 1351–1354.
8. Chopra A et al.Sleep Apnea Tied to Hearing Loss in Large Study. American Thoracic Society International Conference 2014; San Diego.
9. Chopra A., Jung M., Kaplan R.C., Appel D.W., Dinces E.A., Dhar S. et al.: Sleep Apnea Is Associated with Hearing Impairment: The Hispanic Community Health Study/Study of Latinos. J. Clin. Sleep Med. 2016.
10. Wetmore S.J., Henderson C., Doshier N.W., Milligan L.B.: Auditory brainstem response in obstructive sleep apnea. Laryngoscope. 1988; 98: 499–501.
11. Ni D.: Auditory brainstem response in obstructive sleep apnea syndrome. Zhonghua Er Bi Yan HouKeZaZhi 1991; 26: 284–286; 317.
12. Paquereau J., Meurice J.C., Neau J.P., Ingrand P., Patte F.: Auditory brainstem responses (ABRs) in sleep respiratory disorders. Eur. J. Clin. Invest. 1994; 24: 156–160.
13. Muchnik C., Rubel Y., Zohar Y., Hildesheimer M.: Auditory brainstem response in obstructive sleep apnea patients. J. Basic Clin. Physiol. Pharmacol. 1995; 6: 139–148.

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