Snoring Sound and Sleep Analysis in an Obese Patient Group

Obez Hasta Grubunda Uyku ve Horlama Sesi Analizi

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ABSTRACT

Objectives: Snoring is the most common symptom of obstructive sleep apnea syndrom (OSAS). In this study, snoring percentage and severity were determined in a group of obese patients (with a BMI ⩾30 kg/m2) and the relationship between OSAS severity and snoring intensity were investigated.
Methods: A total of 60 obese patients were retrospectively included in the study with a complete polysomnography (PSG) examination and snoring sound analysis which was performed simultaneously with the sleep study. The participants were divided into three groups according to AHI scores. The percentages of snoring sounds above 65 and 85 dB, determined during sleep were compared between groups. The demographic data, PSG record and snoring percentage of the patients were compared statistically.
Results: The intensity of snoring sound and the percentages of snoring sound above 65 and 85 dB were found to be significantly related with the disease severity of OSAS in the obese patients (P<0.05).
Conclusion: In this study, the significant relationship between OSAS severity and snoring sounds percentages over 65 and 85 Db in obese patients was demonstrated. These findings are promising for further studies and clinical use.

Key Words: Obesity, OSAS, snoring

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ÖZET

Amaç: Horlama Obstruktif Sleep Apne Sendromu'nda sık görülen bir semptomdur.Bu çalışmada obezitesi olan hasta grubunda (BMI ⩾30 kg/m2 olan) horlama seviyesi ve horlama oranı tespit edilmiş ve horlama seviye ve oranı ile OSAS seviyesi arasındaki ilişki araştırılmıştır.
Yöntem: Bu çalışmada, total 60 obez hasta prospektif olarak değerlendirildi ve komple Polisomnografik (PSG) ve aynı anda horlama sesi analizi yapıldı.Hastalar AHI'e göre 3 gruba ayrıldı. 65 dB ve 85dB ve üzeri horlama oranları kayıt edilerek gruplar ile karşılaştırıldı. Hastaların demografik verileri, PSG kayıtları ve horlama oranları istatistiksel olarak karşılaştırıldı.
Bulgular: Obez hastalarda horlama sesinin şiddeti ve 65dB ve 85 dB lik horlamaoranları ile OSAS şiddeti arasında önemli bir ilişki tespit edildi.
Sonuç: Bu çalışmada elde edilen obez hasta grubunda horlama sesinin şiddeti, 65 ve 85 dB üzeri horlama oranları ile OSAS şiddeti arasındaki önemli ilişki gelecek çalışmalar ve klinik uygulamalar için önemlidir.

Anahtar Sözcükler: Obezite, OSAS, horlama

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INTRODUCTION

Risk factors for obstructive sleep apnea syndrome (OSAS) are; age, male sex, obesity, family history, smoking and alcohol use, and craniofacial anomalies. Obesity is a major risk factor. Increased central fat tissue may cause pharyngeal collapse due to mechanical effect of lung and pharyngeal soft tissue(1,2,3). Snoring is the most common symptom in OSAS which is found in 70-90 % of the affected subjekts. OSAS incidence is found to be 3.2 times more in people who snore than those who do not snore (4,5).

Many studies have been performed to demostrate the difference between habitual snoring patients without OSAS and OSAS patients who are also snoring (6,7). Many automatic snoring analysis programs have been developed for this purpose (8,9).

There isn't any study like the relationship between the severity of the OSAS and snoring sound in obese patients (obesity a BMI ⩾30 kg / m2) in the literature. In this study, the severity and percentage of snoring that was measured with automatic recorder during polysomnography test were compared with OSAS grade in obese patients.

METHODS

The study included 60 obese patients (BMI≥30) who was performed PSG test in the Gazi University Otorhinolaryngology Department. A complete ENT examination, Muller test and Epworth Sleepiness Scale (ESS) questionnaire were performed before the PSG test. Patients with significant septonasal deformities and maxillofacial anomalies were excluded from the study. Snoring sound analysis was performed on the system simultaneously with PSG record.

Snoring Sound Analyses

Analyses were performed in Noxturnal A1 system, versions 2.0 (Nox Medical ehf Katrinartuni2 IS - 105 Reykjavík, Iceland). The sound signal was amplified and filtered using a second order Butterworth pass-band filter between 70 Hz and 2,000 Hz and then digitized with a sampling frequency of 5,000 Hz and a 12-bit digital converter. The position of the patient was simultaneously captured and digitized using an abdominal sensor. The snoring episodes were then identified by a previously trained and validated automatic detector and analyzer. The snoring detector was designed to identify snoring episodes from simple snorers and OSAS patients, and to reject respiratory sounds from regular inspiration and exhalation, cough, voice, and other artifacts. This pattern allows the distinction between snoring sound and the remaining respiratory sounds. Single Snore events form so called Snore Trains which stand for periods with multiple Single Snores meeting certain time conditions. Snore Train analysis can be performed by the customizable Noxturnal detector (10).

In our study, the snoring sound at 65dB which peaked at least 3 times with 0.2-2 second time duration, was supposed as a snore train on the system. The records were analyzed again for 85 dB sound in the same way. We also recorded the total number of snore trains during the sleep. In this way, the percentages of 65 and 85 dB sound snoring sounds were determined in sleeping period.

Polysomnography

Full-night polysomnography (Nox A1 system, version 2.0, Nox Medical ehf Katrinartuni2 IS - 105 Reykjavík, Iceland) was performed according to standard methods. The PSG was performed by recording EEG, EOG, ECG, EMG, thoracic and abdominal respiratory excursion, oronasal airflow by a thermistor, and blood oxygen saturation by an oximeter. The apnea-hypopnea index (AHI) was calculated as the sum of the apneas and hypopneas divided by the total sleep time.

Snoring subjects were assigned to three groups according to their AHI results as being mild, moderate and severe OSAS , respectively. Group 1 (mild); snorers with an AHI > 5 and <15; group 2(modorate); snorers with an AHI between 15-30 and group 3 (severe); snorers with an AHI ≥ 30.

Statistical Analysis

All analyses were performed using version 20 of the Statistical Pack age for the Social Sciences (SPSS) software. Sutudent's T test, Mann-Whitney U test, chi-square test, and Spearman's correlation efficient test were used. A P value < 0.05 was considered to reflect statistical significance.

RESULTS

Sixty patients with a mean age of 47.8 ± 10.8 years were included in the study. Nineteen subjects were female and 41 were male. The mean BMI was 33.2 ± 3.2. Epworth sleepiness questionnaire was performed for all patients and the mean score was found to be 24.6 ± 12.6.

Demographic data and PSG results were compared. AHI and apnea index in particular were found to be significantly higher in male gender (P < 0.05). Otherwise, there was no significant difference in terms of age, BMI, and ESS questionnaire results between two genders (P>0.05) (Table 1). Considering snoring sound analysis; there was a significant increase in the rate of snoring over 85 dB in the female obese group compared to the male obese group (Table 2). No significant difference revelaed between afore mentioned groups in terms of BMI and age. Statitistically significant differenece revealed between mild and severe OSAS groups in terms of snornig sound severity (dB) and rates of snoring above 65 and 85 dB during sleep (P < 0.05). There was no statistically significant difference between 65 dB sound and the snoring rates when compared with moderate and severe OSAS group. But we found significant difference for 85 dB snoring sound between the two groups (P< 0.05) (Table 3).

Table 1. Demographic data and polysomnography findings with statistical comparison between the sex groups

	Total		Males		Females		P value
	Mean	**+/-SD**	**Mean**	**+/-SD**	**Mean**	**+/-SD**	
Age (years)	47.8	± 10.8	47.7	± 11.2	48.1	± 10.05	ns*
BMI	29.93	± 4.4	32.7	± 2.5	34.3	± 4.7	ns*
Tr-ESS	22.53	± 12.44	24.6	± 12.3	24.4	± 13.5	ns**
AHI	31.4	± 25.6	32.5	± 26.3	26.1	± 18.8	***< 0,01***
AI	18.05	± 22.6	33.95	± 29.1	23.05	± 24.1	***< 0,01***
HI	12.4	± 11.1	31.4	± 24.8	28.5	± 22.1	ns**

ns: nonsignificant meaning p> 0.05, * Student- t test; ** Mann-Whitney U test

Table 2. Distribution rate of snoring according to the sex groups

	Total		Males		Females		P value
	Mean	**+/-SD**	**Mean**	**+/-SD**	**Mean**	**+/-SD**	
dB	72.03	± 17.3	71.7	± 20.9	72.5	± 3.1	ns**
r65 (%)	24.78	± 19.9	25.70	± 19.82	22.61	± 20.19	ns**
r85 (%)	1.4	± 4.1	1.94	± 4.79	0.139	± 0.59	**< 0.01****

ns: nonsignificant meaning p> 0.05, * Student- t test; ** Mann-Whitney U test

Table 3. Age, BMI, ESS results, AHI and snoring sound analyses comparison between groups

	Group-I	Group-II	Group-III	P value*		
	AHI <15 (n:22)	AHI Between 15 -30 (n: 35)	AHI≥30 (n:3)	Group I vs-II	Group II vs-III	Group I vs-III
Age (years)	48.6 ± 11.3	50.1 ± 11.1	46.3 ± 10.7	ns	ns	ns
BMI	32.9 ± 3.1	32.7 ± 2.9	30 ± 3.84	ns	ns	ns
Tr-ESS	16.8 ± 9.6	25.2 ± 8.5	29.8 ± 13.9	**0.01**	ns	**0.00**
dB	69.1 ± 17.0	71.1 ± 19.8	74.7 ± 16.2	ns	ns	**0.03**
r65 (%)	15.2 ± 29.0	20.3 ± 30.0	24.9 ± 30.8	ns	ns	**0.01**
r85 (%)	17.2 ± 32.0	17.7 ± 26	26.2 ± 28.1	ns	**0.02**	**0.01**

Tr-ESS: Turkish version of Epworth sleepiness scale ns: nonsignificant meaning p> 0.05, *: Mann-Whitney U test

DISCUSSION

Obesity is a chronic disease that has became epidemic in the worldwide. It is also a major risk factor for various disorders, including OSAS. As the prevalence of obesity continues to increase, the prevelance of OSAS increases in turn. Therefore, over the last several decades, the criteria used in order to determine the prevalence of OSAS have been redefined. (11,12,13).

Ursavas and collegues investigated obesity and caridovascular disease prevelance in 119 OSAS patients (105 males and 14 females). In this study 44 patients (36.9 %) were found to be overweight and 48 patients (40.5%) were found to be obese among 119 OSAS patients(14). The BMI is known to be higher in men compared to women. In addition OSAS severity is also lesser in women compared to men with the same BMI, presumably as a result of different fat distrubition between two genders (15).

In adult patients, the acoustic character of snoring is little known. Some researchers have pointed out some snoring analyzes with spectral analysis focused on the snoring intensity and the pitch-related analyzes (16). In the literature, acoustic analysis has been performed to determine the diagnostic features of the snoring screening, such as pick, format frequencies, peak frequencies, sound intensities and frequency spectrum in various studies (17,18).

No standard method has yet been established for determined the snoring sound. In addition, no optimal recording tool or recording time has yet been defined (19). Many studies have shown that patients with OSA exhibit more severe anatomical and functional changes to the upper airway than do simple snorers (20). Snoring analysis is not likely to replace the conventional diagnosis procedure of OSAS through a polysomnographic study and a complete clinical evaluation, but it can significantly improve the management of this pathology. Automatic snoring analysis could also be helpful for the follow-up of snorers without OSAS before and after application of medical and surgical therapies (21).

Increasing demand for individualized treatment and objective outcome control generated a lot of interest to receive additional information about snoring, in particular about its occurrence in different frequency bands, all based on the full audio signal recorded in ambulatory studies with Nox A1 systems. Arnardottir et al showed that; The chest audio was capable of detecting snore events with lower volume and higher fundamental frequency than the other sensors. (10).

In our study, all patients were subjected to snoring analysis using the Chest audio sensor during the PSG test. At 65 dB and above, snorers were recorded as snoring simultaneously with PSG analysis during sleep. The average snoring sound intensity and the percentage of snoring of all patients was recorded during the night sleep period. Likewise snoring analysis was repeated at the same level for snoring severity of 85 dB. Clinical data of the patients, Epworht Sleepiness Scales and snoring analysis were compared with OSAS severity. As a result, the severity of snoring and the percentage of snoring increased consistently with OSAS severity. It was shown that snoring sound recordings of 85 dB; high severity snoring pointed directly to severe OSAS (Table 3).

As a conclusion, this is the first study comparing snoring sound analysis of an OSAS group with obese patients. In particular, the snoring severity and the snoring percentage in the obese patient group was found to be correleated with OSAS severity. We believe that similar studies that is conducted the specific groups will reveal the relationship between OSAS and snoring sound severity.

Conflict of interest

No conflict of interest was declared by the authors.

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