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The effect of treatment of obstructive sleep apnea syndrome on overactive bladder symptoms

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SUMMARY

OBJECTIVE: To evaluate the effect of the treatment of obstructive sleep apnea syndrome on overactive bladder symptoms.

METHODS: All patients who applied to the outpatient clinic with complaints of snoring and apnea were evaluated by polysomnography between years 2017 and 2019. obstructive sleep apnea syndrome severity was evaluated according to the apnea-hypopnea-index. All patients were filled with questionnaire form as overactive bladder symptoms score, international quality of life, international consultation on incontinence questionnaire short-form, and 3-day bladder diary before polysomnography and three months after continuous positive airway pressure therapy and surgical treatment.

RESULTS: A total of 125 patients, 34 (27.2%) patients with mild obstructive sleep apnea syndrome, 27 (21.6%) patients with moderate obstructive sleep apnea syndrome, and 64 (51.2) patients with severe obstructive sleep apnea syndrome were included in the study. The prevalence of overactive bladder symptoms in three obstructive sleep apnea syndrome groups were 67.6, 53.8, and 48.4%, respectively, and there was no statistical difference between the groups (p=0.190). obstructive sleep apnea syndrome treatment such as surgical treatment or continuous positive airway pressure therapy was applied to 45.5% (31 patients) patients with obstructive sleep apnea syndrome and overactive bladder. Three months after treatment, the overactive bladder symptoms score significantly decreased from 16.1±7.9–12.80±9.82, international quality of life was significantly increased from 105.0±23.2–110.4±22.2, and incontinence questionnaire short-form decreased from 11.9±4.0–10.4±5.6 (p=0.009, p=0.023, and p=0.248, respectively). There was a significant decrease between before and after treatment in terms of mean day-time frequency and mean urgency episodes of patients (p=0.007, p=0.002).

CONCLUSIONS: Both surgery and continuous positive airway pressure treatment of obstructive sleep apnea syndrome improved overactive bladder symptoms, overactive bladder symptoms score, international quality of life, day-time frequency, and urgency episodes.

KEYWORDS: Sleep apnea, obstructive. Urinary bladder, overactive. Continuous positive airway pressure.

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is defined as complete or partial obstruction of the upper respiratory tract during sleep, resulting in airflow reduction or cessation[1]. The standard method for diagnosis of OSAS is polysomnography (PSG), which measures the apnea-hypopnea index (AHI)[2]. AHI is defined as the sum of apneas and hypopneas per hour of sleep, and OSAS can be classified as mild, moderate, and severe according to AHI[3]. In the treatment of patients with OSAS, lifestyle changes, oral cavity tools, medical treatment,

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surgical treatment, and continuous positive airway pressure (CPAP) therapy are used[4].

Overactive bladder (OAB) prevalence rates range from 49.6 to 79.3% in patients with OSAS[5,6]. Despite extensive study, the etiopathogenesis of OAB has not been clearly explained, and the relationship between OSAS and OAB is still under investigation[6,7]. Some studies have explained the relationship between OSAS and OAB by urinary visceral dysfunction caused by hypoxia. However, the effect of severity and treatment of OSAS on the improvement of OAB in patients with OSAS is still unclear and the prevalence studies of OAB in OSAS patients are quite limited[5,6,8].

In this study, the prevalence of OAB in OSAS severity and the effect of disease treatment on OAB symptoms were evaluated.

METHODS

Patients who applied to the outpatient clinic with complaints of snoring and apnea were retrospectively evaluated by PSG after routine otorhinolaryngologic examinations between years 2018 and 2019. Patients diagnosed and treated with benign prostate hyperplasia, interstitial cystitis, neurogenic urinary bladder, urinary tract infection, hematuria, previous urogenital operations, neurological disorders, patients who were taking anticholinergic, α1-blockers and 5α-reductase inhibitor, patients who had inadequate and incomplete tests, and patients with AHI score below 5 were excluded from the study.

PSG tests of patients were performed at the sleep laboratory of Çukurova University, School of Medicine, Department of Chest. The severity of OSAS was determined AHI (mean number of apnea+hypopnea per hour of sleep). In this study, AHI was classified as mild (5–15), moderate (16–30), and severe (>30)[9]. Patients were offered CPAP therapy or surgery according to OSAS severity and patients' clinic.

All patients who applied to the Sleep Disorders Center were filled with a 3-day bladder diary and before PSG was performed and 3 months after CPAP therapy and surgery treatment, all patients were filled with questionnaire form as Overactive Bladder Symptoms Score (OAB-V8), International Consultation on Incontinence Questionnaire Short-Form (ICIQ-SF), and International Quality of Life (I-QOL).

An overactive bladder questionnaire (OAB-q) consists of 33 questions is the first questionnaire form specific to OAB disease and can be used in both wet and dry OAB patients[10]. OAB-V8 consists of the first 8 questions of OAB-q evaluating the daytime frequency, nighttime frequency, urgency, and emergency incontinence and recommended as OAB screening and awareness test[11]. OAB-V8 is preferred for its ease of use in clinical practice. Patients with a total OAB-V8 score ≥8 were considered to be OAB patients[12]. In our study, OAB was defined as ≥8 points on the OAB-V8.

I-QOL is a 22-item questionnaire form into 3 subscales: Avoidance and Limiting Behavior (eight items), Psychosocial Impacts (nine items), and Social Embarrassment (five items). The total I-QOL is calculated by summing the unweighted item score and transforming them to a 100 point scale where 0=most severe, and 100=no problem.

The ICIQ-SF is formed of six items in the past 4 weeks that evaluate urinary continence. Scores range from 0 to 21 points. Only it was filled by patients with urge incontinence.

In this study, OAB-V8, I-QOL, ICIQ-SF, and nocturia of the patients were compared according to OSAS severity, whose parameters were compared before and 3 months after treatment of OSAS.

Statistical analysis

All analyses were performed using IBM SPSS Statistics statistical software package, Version 20.0. χ^2 test was used to compare categorical variables between the groups. For comparison of continuous variables between two groups, the Mann-Whitney U test was used. To compare two related continuous variables, Wilcoxon Signed Rank test or the Repeated Measurements Analysis were used, where appropriate. For comparison of more than two groups, Oneway ANOVA or Kruskal Wallis test was used. The statistical level of significance for all tests was considered to be 0.05.

RESULTS

A total of 125 patients with the mean age of 49.9±11.6 years (range 25–81 years) were included in the study. Of them, 98 (78.4%) were male and 27 (21.6%) were females (p=0.013). Patients were classified according to AHI; 34 (27.2%) patients had mild OSAS, 27 (21.6%) had moderate, and 64 (51.2%) had severe OSAS. The mean AHI of mild, moderate, and severe OSAS groups were 8.1±2.9, 24.0±9.3, and 55.8±19.6, respectively (p<0.001). A comparison of demographic and clinical characteristics between the OSAS groups are presented in Table 1. Gender, age, diabetes mellitus (DM), hypertension (HT), smoking, and alcohol do not differ statistically between the OSAS groups (p>0.05).

Overactive bladder was observed in 68 patients (54.4%). Urge urinary incontinence was present in 22 (32.3%) of patients with OAB. The mean AHI value of 68 patients with OAB was 34.9±27.2. The prevalence of OAB in three groups of OSAS were 67.6, 53.8, and 48.4%, respectively (p=0.190). The mean OAB-V8 of patients with OAB was 16.9±8.3 and no significant difference in patients' OAB-V8 scores was found between

Table 1. Baseline characteristics of the study population.

	OSAS severity			
	Mild (n=34)	Moderate (n=27)	Severe (n=64)	p-value
AHI value[a]	8.1±2.9 7.0 (5.0–15.0)	24.0±9.3 22.0 (12.0–61.0)	55.8±19.6 52.5 (23.0–135.0)	<0.001
Age (years)[a]	49.5±10.7 48.5 (31.0–73.0)	52.3±13.0 51.0 (29.0–78.0)	49.2±11.5 49.0 (25.0–81.0)	0.512
Gender[b]				0.013
Male	21 (61.8)	21 (77.8)	56 (87.5)	
Female	13 (38.2)	6 (22.2)	8 (12.5)	
HT[b]	15 (44.1)	12 (44.4)	28 (43.8)	0.998
DM[b]	10 (29.4)	7 (25.9)	21 (32.8)	0.800
Smoking[b]	20 (58.8)	19 (70.4)	37 (57.8)	0.514
Alcohol[b]	4 (11.8)	3 (11.1)	9 (14.1)	0.908
Treatment[b]				<0.001
Follow up	23 (67.6)	11 (40.7)	24 (37.5)	
Surgery	9 (26.5)	8 (29.6)	10 (15.6)	
CPAP	2 (5.9)	8 (29.6)	30 (46.9)	

OSAS: obstructive sleep apnea syndrome; AHI: apnea-hypopnea index; HT: hypertension; DM: diabetes mellitus; CPAP: continuous positive airway pressure. [a]Data are expressed as mean±standart deviation, median (min–max). [b]Data are expressed as n (%). Note: bold values indicate statistical significance (p<0.05).

the groups (p=0.281). The mean I-QOL of these patients was 104.7±22.1 and was similar between the groups (p=0.539). The mean ICIQ-SF of patients with urge incontinence was 11.3±5.2 and was similar between the groups (p=0.320). The mean voided volume (MVV), mean day-time frequency, mean urgency episodes, and mean frequency of nocturia of patients with OAB were 262.0±123.5, 8.2±2.7, 4.2±4.7, and 2.7±1.5, respectively, and there was no significant difference between OSAS groups in terms of these parameters (p=0.965, p=0.120, p=0.210, and p=0.524) (Table 2).

Surgical treatment or CPAP therapy was applied to 45.5% (31 patients) of patients with OAB; (11 patients had surgery, 20 patients with CPAP). There were no significant differences between surgical treatment or CPAP therapy in terms of variables in Table 3 except for the mean voided volume in the 3rd month. The mean voided volume was found to be significantly lower in the surgical treatment group than in the CPAP therapy group (p<0.003). Hence, due to the insufficient sample size of each treatment group, the patients gathered in one group and comparisons of before and after treatment were applied to this sample (n=31). Three months after treatment, the OAB-V8 score significantly decreased from 16.1±7.9–12.80±9.82 (p=0.009). Also, in 9 of 31 patients, the OAB-V8 score decreased below 8, 3 months after treatment. After treatment, the I-QOL significantly increased from 105.0±23.2–110.4±22.2 (p=0.023). There was a significant decrease between before and after treatment in terms of mean day-time frequency and mean urgency episodes of patients with OAB (p=0.007, p=0.002). There was no significant difference between before and after treatment in terms of the MVV and mean frequency of nocturia of patients with OAB (p=0.356, p=0.205). In patients with urgent urinary incontinence, ICIQ-SF decreased from 11.9±4.0–10.4±5.6 after treatment (p=0.248). Although ICIQ-SF decrease after treatment, the difference was not statistically significant although there was a trend toward significance, which may become significant with larger group sizes (Table 3).

DISCUSSION

OSAS is causing urologic pathologies, such as erectile dysfunction (ED), nocturia, and OAB[10,13-15]. Although the pathogenesis of ED and nocturia is clearly demonstrated in patients with OSAS, the mechanism between OAB symptoms and OSAS is still uncertain[6,10,13]. Pathogenesis of OAB is thought to be morphologic changes of the detrusor (e.g., patchy denervation of detrusor muscle bundles), metabolic causes (e.g., disturbed

Table 2. Comparison of questionnaire form and bladder diary of patients with overactive bladder between obstructive sleep apnea syndrome groups.

	OSAS severity			
	Mild n=23	Moderate n=14	Severe n=31	p-value
AHI value[a]	8.5±2.8 7.0 (5.0–15.0)	25.0±11.3 22.0 (15.0–61.0)	57.3±23.4 49.0 (23.0–135.0)	<0.001
OAB[b]	23 (67.6)	14 (53.8)	31 (48.4)	0.190
OAB-V8[a]	18.7±8.6 17.0 (8.0–35.0)	17.9±9.2 16.0 (8.0–32.0)	15.1±7.5 12.0 (8.0–32.0)	0.281
I-QOL[a]	104.1±23.5 115.0 (62.0–132.0)	99.6±24.5 106.0 (65.0–126.0)	107.5±20.1 109.0 (64.0–132.0)	0.539
ICIQ-SF[a]	13.7±5.0 14.0 (5.0–21.0)	11.2±3.3 11.0 (8.0–15.0)	9.7±5.7 10.0 (0.0–20.0)	0.320
Day-time frequency[a]	8.9±2.5 8.0 (6.0–15.0)	8.7±3.7 7.0 (5.0–18.0)	7.5±2.2 7.0 (4.0–13.0)	0.120
Urgency episodes[a]	4.7±4.2 3.0 (0.0–17.0)	5.7±6.7 2.0 (0.0–21.0)	3.2±3.7 2.0 (0.0–16.0)	0.210
Frequency of nocturia[a]	2.5±1.3 3.0 (0.0–5.0)	2.6±1.8 2.0 (1.0–7.0)	2.9±1.4 3.0 (0.0–7.0)	0.524
The mean volume voided[a]	256.1±113.7 214.0 (80.0–571.0)	259.9±136.4 268.0 (67.0–600.0)	267.4±128.2 250.0 (108.0–625.0)	0.965
Total daily urine volume (mL)[a]	2,160.8±856.9 1,800.0 (1,200.0–4,000.0)	1,950.0±646.5 2,000.0 (1,000.0–3,000.0)	1,890.3±893.4 1,700.0 (1,000.0–5,000.0)	0.436
Total Night-time urine volume (mL)[a]	439.1±231.0 400.0 (0.0–1,000.0)	450.0±250.3 400.0 (200.0–1,000.0)	570.9±440.6 500.0 (0.0–2,000.0)	0.608

OSAS: obstructive sleep apnea syndrome; AHI: apnea-hypopnea index; OAB: overactive bladder; OAB-V8: overactive bladder symptoms scores; I-QOL: international quality of life; ICIQ-SF: international consultation on incontinence questionnaire short form. [a]Data are expressed as mean±standard deviation, median (min–max). Note: bold values indicate statistical significance (p<0.05).

Table 3. Comparison of questionnaire form and bladder diary of patients with overactive bladder between before and after obstructive sleep apnea syndrome treatment.

	Before treatment	After treatment	p-value
OAB-V8[a]	16.1±7.9 13.0 (8.0–32.0)	12.8±9.8 9.0 (1.0–36.0)	0.009
I-QOL[a]	105.0±23.2 109.0 (64.0–132.0)	110.4±22.2 120.0 (52.0–132.0)	0.023
ICIQ-SF[a]	11.9±4.0 12.0 (6.0–20.0)	10.4±5.6 11.5 (0.0–17.0)	0.248
Day-time frequency[a]	8.4±3.0 8.0 (4.0–18.0)	7.7±3.3 7.0 (4.0–18.0)	0.007
Urgency episodes[a]	4.3±5.2 2.0 (0.0–21.0)	3.4±5.8 1.0 (0.0–22.0)	0.002
Frequency of nocturia[a]	2.6±1.7 3.0 (0.0–7.0)	2.4±2.7 1.0 (0.0–10.0)	0.205
The mean volume voided (mL)[a]	230.6±131.2 214.3 (66.7–625.0)	235.2±177.0 250.0 (75.0–625.0)	0.356
Total daily urine volume (mL)[a]	1,748.4±860.2 1,500.0 (1,000.0–5,000.0)	1,924.0±830.8 1,800.0 (1,000.0–5,000.0)	0.001
Total Night-time urine volume (mL)[a]	567.7±468.6 500.0 (0.0–2,000.0)	380.0±329.5 200.0 (0.0–1,200.0)	0.013

OAB-V8: overactive bladder symptoms scores; I-QOL: international quality of life; ICIQ-SF: international consultation on incontinence questionnaire short form. [a]Data are expressed as mean±standard deviation; median (min–max). Note: bold values indicate statistical significance (p<0.05).

serotonin metabolism), age-related causes of urinary dysfunction, and neurologic changes (e.g., ischemic nerve damage)[13]. Considering these mechanisms that can cause OAB, the relationship between OSAS and OAB is thought to be related to nerve damage caused by hypoxia due to OSAS, as in erectile dysfunction[6,13]. The other possibility is that malfunction of the central nervous system leads to dysregulation of sleep and voiding. The hypothalamus is responsible for the regulation of sleep and arousal, as well as for sending afferent signals directly to the pontine micturition center. Continuous activation of the hypothalamus, which might induce urgency, might fail in its regulation of sleep and arousal[16]. Our study showed that the prevalence of OAB is quite high in patients with OSAS; however, there is no difference according to prevalence between OSAS severity and it was demonstrated that the treatment of OSAS, regardless of surgery or CPAP therapy, improved OAB symptoms. It was also found that OSAS treatment not only improved the OAB-V8 score but also improved quality of life. In addition, an improvement in day-time frequency and urgency episodes were found.

Ipekci et al. assessed 140 female patients diagnosed with OSAS and reported that OAB symptoms were observed in 79.3% of patients, but unlike our study, they defined OAB as OAB symptoms score of ≥4. They found no statistically significant differences between OSAS severity with the prevalence of OAB[6]. Similarly, Tuncer et al. evaluated the 194 patients diagnosed with OSAS and found no significant difference between OSAS severity in terms of OAB symptoms urgency urinary incontinence[5]. However, Kemmer et al. argued that patients with moderate and severe OSAS had a significantly higher prevalence of OAB than patients with mild OSAS and control group patients[13]. In this cohort, it had been shown that the prevalence of OAB, urgency urinary incontinence, parameters of bladder diary were similar between OSAS severity.

In the study, Ipekci et al. investigated whether CPAP therapy administered in OSAS patients improves OAB and they concluded that the OAB, OABSS, and ICIQ-SF scores improved in women with severe and moderate OSAS 3 months after treatment[6]. Similarly, in another study consisted of 73 patients, Dinç et al. concluded that CPAP therapy improved OAB symptoms[8]. The present study evaluated the effect of surgery as well as CPAP on OAB symptoms and concluded that both surgery and CPAP improved OAB symptoms, I-QOL, day-time frequency, and urgency episodes.

Limitations of the study

The limitations of this study are the low number of patients with OSAS and OAB receiving treatment and the small number of women included in the study. Another limitation is that urodynamic studies were not used for the diagnosis of OAB, only questionnaire forms and bladder diary were made.

CONCLUSIONS

The prevalence of OAB was higher in OSAS patient; however, there was no difference in the prevalence of OAB between OSAS severity. Both surgery and CPAP therapy of OSAS improved OAB symptoms, I-QOL, day-time frequency, and urgency episodes.

AUTHORS' CONTRIBUTION

MD: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – original draft. **OS:** Data curation, Investigation, Methodology, Project administration, Supervision. **SK:** Data curation, Writing – review & editing. **IT:** Data curation. **NA:** Formal analysis, Visualization. **SPY:** Formal analysis. **VI:** Project administration, Supervision, Writing – review & editing. **MD:** Validation, Visualization.

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