

ORIGINAL ARTICLE

Results of Polysomnographies and Treatment Strategies in Elderly Patients with Symptoms of Obstructive Sleep Apnea Syndrome

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Abstract

OBJECTIVES: In this study, we evaluated data regarding the management of geriatric patients with symptoms of obstructive sleep apnea syndrome (age, >65 years) who were admitted to our sleep clinic.

MATERIAL AND METHODS: Symptoms and sleep data of the patients were retrospectively evaluated, and the patients were reevaluated after treatment.

RESULTS: A total of 85 patients with a median age of 69 years were included. Snoring and fatigue were the most common symptoms. Cardiovascular diseases were the most frequently listed comorbidity. The median Epworth sleepiness scale was 10, and based on Berlin sleep questionnaire findings, 63.5% of the participants were in the high-risk group. Eighty-seven percent were diagnosed with obstructive sleep apnea (2/3 of them were positional), and moderate-to-severe obstructive sleep apnea was observed more in women than in men. Only one patient was diagnosed with central sleep apnea. There were positive and linear correlations between increased age and the apnea-hypopnea index, arousal index, Epworth sleepiness scale, and being in a high-risk group according to the Berlin sleep scale; however, there was no correlation between increased age and the number of hypopnea and apnea events. There were also positive and linear correlations between the apnea-hypopnea index and the Epworth sleepiness scale, being in a high-risk group according to the Berlin sleep questionnaire, an increased number of known medical conditions, and increased body mass index. We were able to contact 72 of the 85 patients via phone calls. Patients who adjusted to treatment had positive feedbacks.

CONCLUSION: Sleep disorders are observed more in the elderly, and an increasing age is an independent factor for sleep disorders. Besides the usual signs and symptoms of sleep disorders, it should be considered in elderly who have cognitive dysfunction and dementia.

KEYWORDS: Elderly, polysomnography, obstructive sleep apnea

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INTRODUCTION

The proportion of elderly people (age, >65 years) has been increasing, particularly in developing countries. The World Health Organization has estimated that the population of people aged >65 years will be 1.5 billion by 2050 [1]. Although some people age without having any serious illnesses, some elderly might have "pathological aging" with significant comorbidities that lead to functional impairment [2]. One way or another, the elderly may complain of changes in sleep habits such as difficulty falling asleep and maintaining sleep, with frequent nocturnal awakenings and early morning awakening; thus, sleep gets more fragmented and consequently lighter [3]. Because of the changes in sleep architecture or physiological and/or pathological changes owing to aging, elderly people may report increased daytime sleepiness and fatigue as well as concentration and memory problems [4]. These symptoms can also occur because of obstructive sleep apnea syndrome (OSAS), which is characterized by nocturnal episodes of upper airway obstruction, sleep fragmentations, and hypoxemia [5]. These symptoms might be under-recognized in elderly patients because the presence of the symptoms might be accepted by patients, caregivers, or even by doctors as a "natural" occurrence of aging.

Obstructive sleep apnea defined as anapnea-hypopnea index (AHI) of >5/h is commonly observed in elderly (age >65 years), with a large range of incidence (5%-75%). Prevalence of OSAS increases with age, with a conservative estimation of double the prevalence in younger age groups [6]. There are several mechanisms associated with this age-related increase, including reduction in pharyngeal muscle function, age-related differences in pharyngeal morphology (including a decrease in the size of the upper airway lumen), increase in arousal frequency that leads to periodic breathing, and increase in the prevalence of obesity and comorbidities [including congestive heart failure and neurocognitive impairment (such as dementia and stroke)] [7].

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Symptoms of sleep disorders are similarly observed in both younger and older populations [5]. However, there might be a great variability in the level of sleepiness with the same degree of OSAS. Obesity is main risk factor of OSAS and is reported to be less important in the elderly who usually have a lower body mass index (BMI) and neck circumference than in younger OSAS patients [3]. Polysomnography (PSG) is the gold standard diagnostic tool for evaluating OSAS, but only a small percentage of people at risk for OSAS have access to PSG, and using PSG in elderly populations with multiple comorbidities may be difficult [8]. Treatment options are similar for younger and older patients, as recommended by the American Academy of Sleep Medicine (AASM) [9].

In this study, we evaluated data regarding the management of geriatric patients with OSAS symptoms (age,>65 years) who were admitted to our sleep clinic. We assessed the correlation between age and sleep parameters, including the severity of the sleep disorder, and attempted to clarify the characteristics of sleep problems among elderly people. Moreover, the patients were re-evaluated and adherence rates to suggested treatment options were also assessed.

MATERIAL AND METHODS

Subjects

Eighty-five patients with a suspected diagnosis of OSAS and who were aged >65 years and were admitted to the sleep clinic at Baskent University Istanbul Hospital between January 2013 and December 2015 were enrolled in the study. After 6 months, these patients were contacted by telephone, and informed consent was obtained from the patients. Of 85 patients, 72 could be contacted, and their symptoms of OSAS and their adherence to treatment were assessed. The study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the ethics committee of Baskent University.

Demographic Data and Clinical Conditions

Baseline demographic characteristics, symptoms, and comorbidities were recorded on the basis of the responses given in the questionnaires filled at the outpatient clinic. The Epworth sleepiness scale (ESS) and Berlin sleep questionnaire (BSQ) scores, which predict the level of daytime somnolence and likelihood of OSAS, were recorded.

Sleep Study

All subjects underwent nocturnal PSG testing with the same polygraphic device (Grass Comet) at our sleep laboratory following the protocol of AASM [9]. Sleep studies were scored and analyzed according to the AASM recommendations by a medical doctor certified in sleep medicine. Other sleep disturbances such as central sleep apnea were excluded according to the PSG results. AHI, computed as the ratio of apneas and hypopneas per hour, was used to define the presence (i.e., AHI of $\geq 5/h$) and severity of OSAS (5-15 as mild, 15-30 as moderate, and >30 as severe) [9]. Titration studies with noninvasive ventilation (Resmed, S9, autocpap), as described by AASM, were performed in selected OSAS patients.

Statistical Analysis

IBM Statistical Package for the Social Sciences 21.0 (IBM Corp.; Armonk, NY, USA) and MedCalc statistical software were used in the statistical analysis. Descriptive statistics (frequency, percentage, mean (\pm), median [min-max]) were used to evaluate the numerical data in the study. The independent-sample *t*-test was used to compare parameters between the evaluated groups. For the analysis of difference between groups, non-parametric Mann-Whitney U tests and Kruskal-Wallis tests were used. Spearman's correlation analysis was used to evaluate the relationship between age and AHI, arousal index, and number of apneas and hypopneas. Moreover, the relation between AHI and BMI, ESS, and BSQ scores was evaluated. Results were determined with 95% confidence intervals, and a p value <0.05 was considered statistically significant.

RESULTS

A total of 85 patients with a median age of 69 years (range, 65-88 years) were enrolled. Demographic data, symptoms, and comorbidities are summarized in Table 1. Snoring and fatigue were the most common symptoms. Cardiovascular disease (including hypertension and other heart diseases) was the most frequently listed comorbidity. As expected with aging, comorbidities were quite common. Comorbidities, such as chronic obstructive pulmonary disease (COPD) and cardiovascular diseases, or symptoms, such as memory problems, were assessed using standard procedures by specialists. Our patients were sleepy during the daytime, with a median ESS score of 10 (range, 1-24). On the basis of BSQ findings, 63.5% of patients were in the high-risk group.

Table 1. Demographic data, symptoms, and comorbidities of patients

Variables	n
Age (IQR), years	69.0 (67-74)
Sex (male/female)	52/33
BMI (IQR)	29.1 (25.7-36.9)
Symptoms (n, %)	
Snoring	81 (95.3)
Fatigue	75 (88.2)
Apnea	55 (64.7)
Daytime sleepiness	51 (60.0)
Waking up with a feeling of being drowned	41 (48.2)
Memory problems	37 (43.5)
Headache	21 (24.7)
Comorbidities (n, %)	
Hypertension	65 (76.4)
Heart disease*	37 (43.5)
Diabetes	36 (42.3)
COPD, asthma, and other lung diseases	14 (16.4)
Others	29 (34.1)
Number of comorbidities (IQR)	2.52 (1.25-3.0)

IQR: interquartile range; COPD: chronic obstructive pulmonary disease

*Coronary arterial disease, congestive heart failure, arrhythmias

Seven patients were administered alprozalam because of difficulty in falling asleep. Sleep efficiency and other PSG data are shown in Table 2. Twelve percent of patients ($n=10$) were diagnosed with simple snoring. Eighty-seven percent of the enrolled patients ($n=74$) were diagnosed with OSAS, with 16.4% ($n=14$) being mild, 30.5% ($n=26$) being moderate, and 40% ($n=34$) being severe OSAS. Nearly two-thirds of them were positional (in supine position $AHI > 5$, and in non-supine $AHI < 5$) ($n=46$). Moderate-to-severe OSAS was observed more in women than in men [39 women vs. 21 men ($p<0.05$)]. Only one patient was diagnosed with central sleep apnea.

Rhinolaryngeal examination, positional therapy, and PAP treatment were the treatment options planned for the patients. Positional therapy and rhinolaryngeal examination were planned for 17 mild OSAS patients, and based on the rhinolaryngological examination findings, the severity of OSAS, and patients' preferences, two patients underwent a nasalseptum operation and one was treated with an oral appliance. For 61 patients, PAP treatment was planned; one of them had central sleep apnea and 60 patients had moderate-to-severe OSAS. Nine of the 60 patients with moderate-to-severe OSAS refused to undergo titration. Finally, PAP treatment was initiated for the one central apnea patient and other 51 moderate-to-severe OSAS patients. Treatment options are summarized in Table 3. After 6 months were evaluated the patients via phone calls, and their adherence to treatment, outcomes, and symptoms were assessed. We were able to contact 72 of 85 patients via phone calls. We could not reach three of nine patients who refused to undergo titration, and among the remaining six patients, only one got better with lifestyle modifications (BMI decreased from 33 to 24), whereas the other five patients continued to have sleep disturbances. Forty-five patients who regularly used their devices (6.2 ± 1.8 h/day for 6.3 ± 0.7 days/week) had positive feedbacks, and most of their symptoms got better and their sleep disturbances reduced. We recommended all patients to change the mask each year, but only 37.8% of them renewed their mask yearly. Besides PAP treatment, 30 patients were recommended for other treatment options. We were able to contact 90% of the patients in this group, and 81% of them had positive feedbacks. People whose symptoms did not improve were the ones who did not comply with our suggestions.

We also performed a correlation analysis and evaluated if there was an association between age and the number of apnea-hypopnea events, AHI, arousal index, BSQ score, ESS score, and periodic limb movement index (PLMI). We observed a positive and linear correlation between increased age and AHI, arousal index, being in a high-risk group according to BSQ scores, and ESS scores; however, there was no correlation between increased age and the number of apnea-hypopnea events or PLMI (Figure 1, Table 4). We also performed a correlation analysis between AHI and ESS scores, being in a high-risk group according to BSQ scores, increased number of known medical condition, and increased BMI value, and there was a positive and linear correlation between AHI and all these parameters (Table 4).

Table 2. Polysomnography results

Variables (IQR)	
Sleep efficiency, % of TRT	77.9 (68.8-88.6)
Arousal index, /h	31.8 (18.5-49.4)
Total number of hypopnea events	63.0 (26.0-123.0)
Total number of apnea events	35.0 (8.5-79.5)
AHI, /h	24.2 (11.7-43.1)
Minimum oxygen saturation, %	82.0 (76.0-86.75)
Duration of oxygen desaturation (<88%), % of TST	2.7 (0.15-19.5)
PLMI	2.45 (0-14.1)

IQR: interquartile range; AHI: apnea-hypopnea index; NREM: non-rapid eye movement; TST: total sleep time; TRT: total recording time; PLMI: periodic limb movement index

Table 3. Treatment choices planned for the sleep apnea patients

Treatment option	n/%
PAP treatment	52 (69.3)
CPAP	35 (46.6)
BIPAP	10 (13.3)
BIPAP-ST	4 (5.0)
AUTO-CPAP	2 (2.6)
ASV	1 (1.3)
Nasal septum operation	2 (2.6)
Oral appliance	1 (1.4)
Positional therapy	14 (16.4)

PAP: positive airway pressure; CPAP: continuous positive airway pressure; BIPAP-ST: bilevel positive airway pressure; ASV: adaptive servoventilation

Table 4. Results of correlation analyses between evaluated parameters

	Variables	Correlation coefficient	p
	AHI	0.223	0.038
AGE	ESS score	0.253	0.022
	Arousal index	0.246	0.038
	High risk in BSQ score	0.329	0.016
AHI	ESS score	0.457	0.001
	High risk in BSQ score	0.620	0.001
	Number of medical conditions	0.215	0.031
	BMI	0.351	0.019

AHI: apnea-hypopnea index; ESS: Epworth sleepiness scale; BSQ: Berlin sleep quality; BMI: body mass index

DISCUSSION

This study was a summary of the data of an elderly population who were admitted to our sleep clinic. Snoring was the

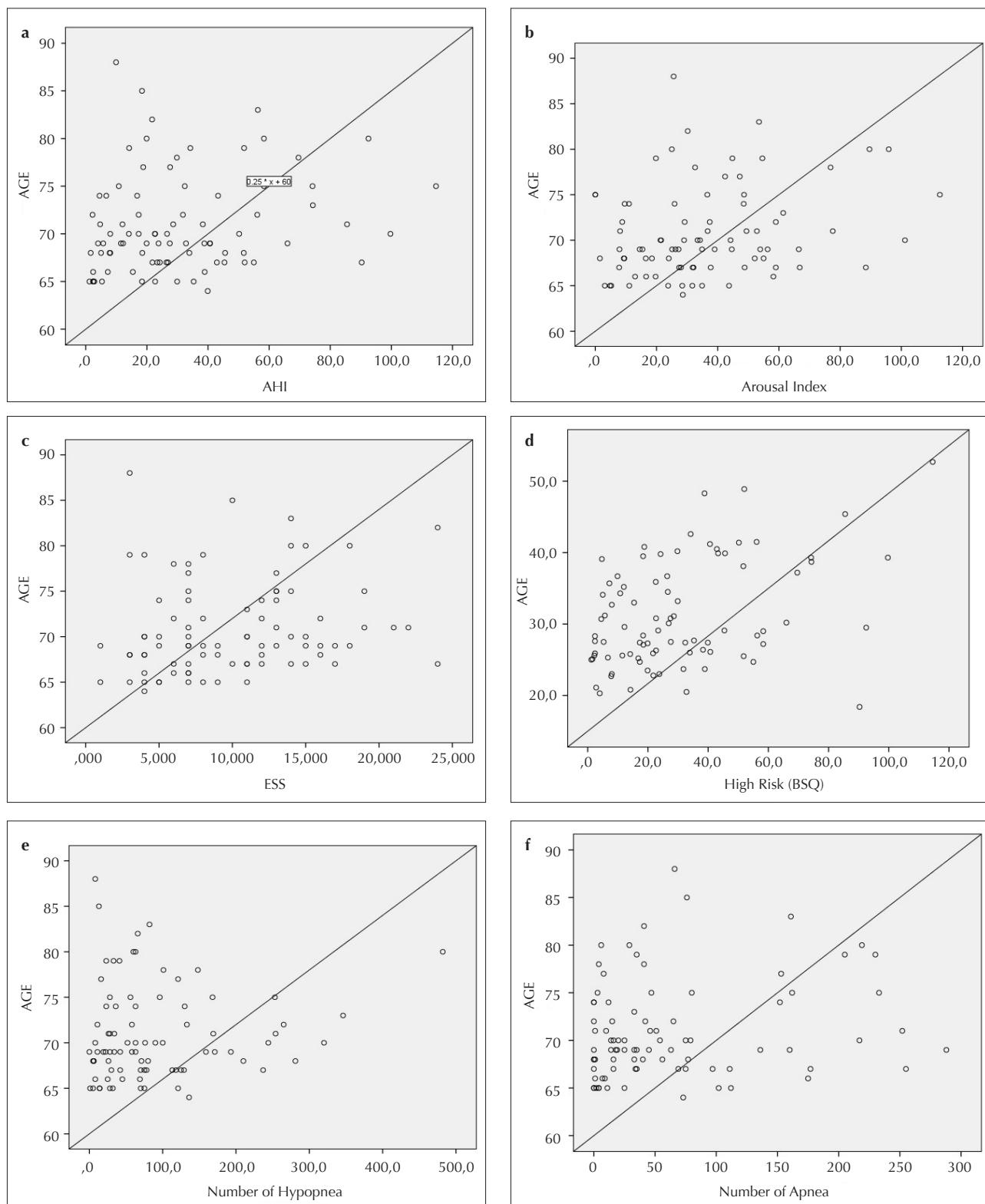


Figure 1. a-f. Correlation between age and sleep parameters. (a) Correlation between age and AHI. (b) Correlation between age and arousal index. (c) Correlation between age and ESS scores. (d) Correlation between age and being high risk in BSQ scores. (e) Correlation between age and the number of hypopnea events. (f) Correlation between age and the number of apnea events.

AHI: Apnea-hypopnea index; BSQ: Berlin sleep questionnaire; ESS: Epworth sleep scale

most observed symptom, and the patients mostly complained of fatigue. Most patients (60%) had moderate-to-severe OSAS, and we preferred PAP (mostly CPAP) treatment for such patients. No treatment was offered to people with AHI of <5. We first planned rhinolaryngological examination for

people with AHI of 5-15, and if necessary, surgery was offered. The main aim of the study was to determine the risk of increasing age on sleep parameters, and we observed that increased age was a risk factor for increased AHI, arousal index, ESS score, and being in a high-risk group according to

BSQ scores. There was a positive and linear association between AHI and BMI, increased ESS scores, being in a high-risk group according to BSQ scores, and an increased number of known medical conditions. Most patients who adjusted to the PAP treatment and tried other treatment options had positive feedbacks.

Increased age, polypharmacy, and obesity are known risk factors for sleep disturbances [10]. In our study, the probability of observing OSAS was more in elderly people with more medical conditions and whose BMI was high. There was no difference in OSAS between men and women in our population (87% of men and 86% of women had AHI of >5); however, moderate-to-severe OSAS was observed more in women. Duran et al. [11] suggested similar results (80% of women and 81% of men had AHI of >5). The prevalence of OSAS is 2-3-fold lower in pre-menopausal women than in males, and with respect to post-menopausal women, the prevalence is equal [12]. Protective function of estrogen is lost in elderly in women because of menopause. At younger ages the prevalence of OSAS is more in men, however in elderly the prevalence of OSAS is more in women, and it may be related to loss of protective function of estrogen at that age group. Therefore hormone replacement therapy has been suggested as a therapeutic intervention for elderly women with OSAS [13]. In our study group, the most important risk factor for OSAS was obesity, and the probability of having OSAS was 35.5% greater among obese patients than among those with normal BMI. In the current literature, it is estimated that overall, 50%-60% of obese people have OSAS [14], and obesity is a major risk factor for OSAS. Obesity promotes the enlargement of soft tissue structures within and surrounding the airway, contributing to pharyngeal airway narrowing. In contrast, impaired glucose metabolism in OSAS might be the reason for metabolic syndrome and obesity [15].

Snoring, fatigue, daytime sleepiness, and cessation of breath during sleep were the most common signs and symptoms we observed, and these symptoms can be observed in both young and elderly people with sleep disorders [5]. We also observed dementia and headache in our population. Dementia observed more in elderly people, and it may be directly related to OSAS. Day-time somnolence and sleep fragmentations may be the reason of cognitive dysfunction and also dementia. Therefore all the symptoms of dementia should not be associated with natural mechanism of getting older, moreover OSAS should also be considered in patients with symptoms of dementia. [16]. Such findings could simply occur because of the comorbidities in elderly people, but chronic hypoxia during sleep can cause neural injury, and this may be another reason for cognitive dysfunction and headache [17]. The overexpression of the apolipoprotein E (APOE) gene is observed in both Alzheimer disease and OSAS, and this may be another reason for the observed dementia in people with sleep disorders [18].

In elderly populations, age-related differences in pharyngeal morphology and reduction in pharyngeal muscle function are observed [19], and these are the basic mechanisms of OSAS in elderly people. In our study group, there was a positive and a linear association between age and AHI. As

the age of our patients increased, the probability of a high arousal index increased, and it was previously shown that arousal frequency increases with age [20]. Our clinic is a sleep center in an university hospital, and most of our patients were referred from other clinics such as cardiology, endocrine and metabolism, and nephrology; therefore, these patients tended to have multiple comorbidities. We observed that the diagnosis of OSAS was more probable as the number of medical conditions increased. An increased number of comorbidities or polypharmacy can be the reason for sleep disturbances in elderly populations [21]. Diuretic therapy or diseases such as benign prostate hyperplasia might cause nocturia, or people with chronic renal or heart failure may have orthopnea or PND; and all of these may affect the sleep quality [22]. Being high risk in BSQ and having high ESS scores are positively and linearly correlated with both increased age and high AHI score, similar to that reported in previous studies [5,7,23]. In contrast, there have been studies in which ESS and BSQ scores had low accuracies for discriminating subjects with or without OSAS. Sforza et al. [8] showed that the third item of BSQ hypertension is not appropriate for discriminating OSAS because many people in this age group have hypertension; therefore, this item should only comprise obesity. Because of the decrease in symptom awareness in elderly people, ESS and BSQ scores might have limited use as indicators of sleep disorders [8,24]. Higher values of PLMI have been observed in elderly populations [25,26]; however, the median value of PLMI in our study group was 2.45, and there was no association between PLMI values and increased age.

Treatment options depend on the severity of sleep disease and the patient's symptoms. All patients were encouraged to pursue lifestyle modifications, including weight loss, cessation of smoking, increased exercise, and reduced consumption of alcohol and caffeine. Oral appliances and positional measures were preferred for people with symptomatic mild and moderate sleep disorders. PAP treatment is the mainstay therapy choice for moderate-to-severe sleep disorders [27]. Nearly 70% of our patients who followed our suggested treatment option got better, and 80% of them had positive feedbacks about symptom-related outcomes and quality of life. There have been a few prospective cohort studies in which outcomes of symptoms of sleep apnea patients were observed after CPAP treatment. Similar to our results, in these studies, improvement in sleep quality, cognitive functions, and quality of life were observed [28,29]. It was observed both in our study and previous studies that people who use PAP treatment regularly have perfect outcomes [30,31].

This study has some limitations. We could have had more exact results if the study was prospectively designed, and the measurements of the records of sleep data in the PAP devices would have been better than phone calls.

In conclusion, sleep disorders are observed more in the elderly, and increasing age is an independent risk factor for sleep disorders. Besides the usual signs and symptoms of SDB such as snoring, daytime somnolence, and fatigue, OSAS should be considered in the elderly who have cognitive dysfunction or dementia.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Başkent University School of Medicine.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - A.O.U.; Design - B.B., A.Ö.U.; Supervision - A.Ö.U.; Resources - B.B., A.Ö.U.; Materials - A.Ö.U.; Data Collection and/or Processing - B.B.; Analysis and/or Interpretation - A.Ö.U.; Literature Search - B.B.; Writing Manuscript - B.B.; Critical Review - A.Ö.U.

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