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## CLINICAL FEATURES OF ADULT PATIENTS EVALUATED THROUGH POLYSOMNOGRAPHY IN A SLEEP LABORATORY IN TURKEY

### CARACTERÍSTICAS CLÍNICAS DE PACIENTES ADULTOS EVALUADOS MEDIANTE POLISOMNOGRAFÍA EN UN LABORATORIO DEL SUEÑO DE TURQUÍA

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#### ABSTRACT

**Objective.** The obstructive sleep apnea syndrome (OSAS) is the most frequent respiratory disease in society. Polysomnography (PSG) is the gold standard technique in diagnosis of sleep respiratory disorders. The aim of this study is to evaluate demographic features of patients with OSAS clinical findings, comorbid diseases and severity of symptoms. **Material and methods.** The study evaluated parameters of 514 adult patients with OSAS pre-diagnosis who went through PSG between the dates 2010-1-1 and 2013-1-1 in a sleep laboratory at Ordu State Hospital in Turkey. Parameters belonging to the patients' age, gender, body mass index (BMI), tobacco and alcohol addiction, duration of OSAS symptoms, comorbid diseases, the Epworth Sleepiness Scale and polysomnographic findings were evaluated. **Results.** Mean age of patients was  $50.15 \pm 10.94$ , and 61.8% of them ( $n = 320$ ) were female. 48.1% of patients were diagnosed with severe OSAS, 24.7%, with moderate level, and 21.8%, with mild level. 4.1% of the patients were found to have OSAS dependent on the rapid eye movement (REM). Simple snoring rate was 4.6%. **Conclusion.** In this study, clinical features and polysomnographic findings of the patients with symptoms of OSAS were evaluated.

**KEY WORDS.** Polysomnography, sleep, apnea.

#### RESUMEN

**Objetivo.** El síndrome de apnea obstructiva del sueño (SAOS) es la enfermedad respiratoria más frecuente en la sociedad. La polisomnografía (PSG) es la técnica por excelencia en el diagnóstico de trastornos respiratorios del sueño. El propósito de este estudio es evaluar las características demográficas de los pacientes con hallazgos clínicos de SAOS, enfermedades comórbidas y síntomas graves. **Material y métodos.** El estudio evaluó los parámetros de 514 pacientes adultos con un diagnóstico previo de SAOS, quienes se sometieron a una PSG entre el 1 de enero de 2010 y el 1 de enero de 2013 en un laboratorio del sueño del Hospital Público de Ordu en Turquía. Se evaluaron en los pacientes los siguientes parámetros: edad, género, índice de masa corporal (IMC), adicción al tabaco y al alcohol, duración de los síntomas del SAOS, enfermedades comórbidas, Escala de Somnolencia de Epworth y hallazgos polisomnográficos. **Resultados.** La media de edad de los pacientes fue de  $50,15 \pm 10,94$ , y el 61,8 % de ellos ( $n = 320$ ) eran mujeres. Se halló que el 48,1% de los pacientes presentaba el síndrome de apnea obstructiva del sueño ligado a los movimientos oculares rápidos (REM, por su sigla en inglés). El índice de ronquido simple fue del 4,6%. **Conclusión.** En este estudio, se evaluaron las características clínicas y los hallazgos polisomnográficos de los pacientes con síntomas de SAOS.

**PALABRAS CLAVE.** Polisomnografía, sueño, apnea.

## Introduction

Sleep respiratory disorders, which are frequent in society and cause modifications at pathologic levels in respiratory pattern during sleep, are a disease group related to characterized sympathetic activity increase that causes apparent intrathoracic pressure variation, sleep interruptions, hypoxemia, hypercapnia, and recurrent upper respiratory tract collapse (1). The clinical symptoms of this disease group appear as daytime sleepiness, severe snoring, witnessed apnea, obstruction during sleep; and during night sleep, five or more respiratory obstruction cases hourly (apnea, hypo-apnea or arousal related to respiratory effort) (1). The obstructive sleep apnea syndrome (OSAS) is the most frequently seen respiratory disorder during sleep among the population (1). The prevalence of OSAS is high in society and impacts approximately 10-17% of males and 3-9% of females (2). Repetitive occurrences of complete or partial upper airway obstruction during sleep that result in cyclic periods of hypoxemia and hypercapnia leading to neurohumoral and clinical sequels are characteristic of OSAS (3). Snoring, apnea or hypo-apnea, arousals during sleep, excessive daytime sleepiness, morning fatigue, nocturia, headache and concentration disorder are among known symptoms of OSAS (3). This disease is also a severe risk factor for cardiovascular diseases as well as for poor living conditions (3). The Apnea-hypopnea Index (AHI), which displays apnea and hypo-apnea number per hour, is used to show the severity of OSAS (3). The obstructive sleep apnea is detected when typical clinical symptoms occur simultaneously with  $AHI \geq 5/h$  or when  $AHI \geq 5/h$  (3). The severity of OSAS has been divided into three categories: mild with an  $AHI \geq 5/h$  and  $<15/h$  with accompanying typical clinical symptoms, moderate with  $AHI \geq 15/h$  and  $<30/h$  and severe with  $AHI \geq 30/h$  (3). In order to diagnose respiratory disorders during sleep, a polysomnography (PSG), an objective test, is needed as well as clinical findings (1). A PSG conducted in a laboratory is the gold standard for OSAS diagnosis, and essential in diagnosing a respiratory disorder in sleep (1). PSG is the gold standard for the diagnosis of sleep disorders and a method by which neurophysiologic, cardiorespiratory and physical parameters are recorded during sleep, generally at night and at a certain period concurrently and continuously (4). PSG provides data about stages of sleep, many physiological parameters, functions of several organ systems, interferences during sleep and wakefulness (4). During a PSG test, a variety of monitoring techniques are used, including electroencephalography (EEG), which can monitor sleep, wakefulness and sleep staging, electrooculography (EOG), submental electromyography (EMG), electrocardiogram (ECG) and air flow signals that reveal inspiratory events, belts that show thoraco-abdominal effort and oximetry signals (1).

The aim of this study is to assess demographic features of patients with cardinal symptoms of OSAS, their polysomnographic parameters, their comorbid diseases and the severity of their symptoms.

## Material and methods

After the approval by the local ethical committee, this study evaluated 514 adult patients with OSAS pre-diagnosis who underwent PSG between 2010-1-1 and 2013-1-1 in a sleep laboratory at Ordu State Hospital in Turkey. In PSG testing, spontaneous night sleep was watched through a Compumedics E series polysomnograph with 44-channel configuration and video monitoring, including a polygraphic sleep test, respiratory recordings and leg EMG (460023). Scores were registered manually. Sleep staging was done by scoring PSG recordings. Respiratory parameters were evaluated according to American Academy of Sleep Medicine (AASM) criteria. In Oranazal air flow, a complete obstruction, prolonged for more than 10 seconds, determined apnea; a 3% decrease for 10 or more seconds in oxygen saturation or, at least, a 50% decrease in air flow, together with arousal development, determined hypo-apnea. Hourly number of apnea and hypo-apnea determined Apnea-hypopnea Index (AHI). The OSAS severity was determined as: mild OSAS, when  $AHI < 5$  and simple snoring was detected in PSG; moderate OSAS when  $15 \leq AHI < 30$ , severe OSAS when  $30 \leq AHI$ . The study evaluated a) the patients' age, gender, length (meters), weight (kilograms), BMI (weight/length<sup>2</sup>), smoking habits and alcoholism; b) the patients' snoring, witnessed apnea, daytime excessive sleepiness, duration of symptoms, comorbid diseases and medication; c) the sleep questionnaire surveying OSAS (Table 1); d) The Epworth Sleepiness Scale, where daytime excessive sleepiness was evaluated through eight questions, each of which was scored with three points; e) the AHI through polysomnographic parameters, median saturation, the longest apnea duration and sleeping event.

The parameters of study were analyzed through SPSS for Windows, version 22.0. Normally distributed parameters from continuous variables were defined as mean  $\pm$  standard deviation, non-normally distributed parameters were presented as median (minimum-maximum), categorical variables were shown as number (%).

## Results

The mean age of the patients included in the study was  $50.15 \pm 10.94$  and 61.8% of them ( $n = 320$ ) were female. Tobacco-alcohol addiction and comorbid diseases of the patients who responded to sleep questionnaire are shown in Table 2.

TABLE 1. SLEEP QUESTIONNAIRE

	YES	NO
What time do you go to bed at night?		
What time do you get up in the morning?		
How long does it take you going to sleep?		
How many times do you wake up at night?		
Has anyone ever told you that you snore when you are asleep?		
Do you hear yourself snore?		
Have you been told you snore because of your sleeping position?		
Have you ever been told you had stopped breathing during your sleep?		
Do you ever wake up feeling like you got choked during sleep?		
Do you feel rested when you get up in the morning?		
Do you drink alcohol before going to bed to help you sleep?		
Do you use sleeping medicine?		
Do you have chest pain at night?		
Do you have throb / palpitations?		
Have you ever had a work accident because of nodding off?		
Have you ever had an accident because of nodding off?		
Do you have a sensation of food or liquid coming up into your mouth when you lie down?		
Do you complain about experiencing forgetfulness?		
Do you have difficulty in focusing on something?		
Do you have headaches in the morning?		
Do you have dryness in the mouth in the morning?		
Do you sweat during sleep?		
Do you have lack of sexual appetite?		
Do you have potency?)		
Do you go to the toilet at night?		
Do you have restless legs?		
Does your partner complain that you have limb movements during sleep?		
Did you have any weight change before your complaints began?		
Do you walk when sleeping?		
Do you speak when sleeping?		

TABLE 2. TOBACCO-ALCOHOL ADDICTION AND COMORBID DISEASES

	n	%	Number of patients responding to the questionnaire
Tobacco	86	32.7	263
Alcohol	40	15.2	263
Diabetes mellitus	46	16.5	278
Hypertension	100	36.0	278
Coronary artery disease	23	9.3	271
Hypothyroidism	6	2.2	240
Chronic obstructive pulmonary disease (COPD)	5	1.8	278
Asthma	34	11.2	278
Hypertlipidemia	19	6.8	278
Gastro-esophageal reflux	8	2.9	278

TABLE 3. SLEEP QUESTIONNAIRE AND RESPONSES

	<i>n</i> (YES)	%	Number of patients responding to the questionnaire
Has anyone ever told you that you snore when you are asleep?	264	95	278
Do you hear yourself snore?	170	61.2	278
Have you been told that you snore because of your sleeping position?	66	23.7	278
Have you ever been told that you had stopped breathing during your sleep?	173	62.2	278
Do you ever wake up feeling like you have got choked during sleep?	151	54.3	278
Do you feel rested when you get up in the morning?	65	23.4	278
Do you drink alcohol before going to bed to help you sleep?	2	0.7	278
Do you use sleeping medicine?	14	5.1	277
Do you have chest pain at night?	75	27	278
Do you have throb / palpitations?	89	32	278
Have you ever had a work accident because of nodding off?	12	4.3	278
Have you ever had an accident because of nodding off?	6	2.2	278
Do you have a sensation of food or liquid coming up into your mouth when you lie down?	105	37.8	278
Do you complain about experiencing forgetfulness	191	68.7	278
Do have difficulty in focusing on something?	114	41	278
Do you have headaches in the morning?	132	47.5	278
Do you have dryness in the mouth in the morning?	212	76.3	278
Do you sweat during sleep?	179	64.4	278
Do you have lack of sexual appetite?	72	25.9	278
Do you have potency?	68	24.5	278
Do you go to the toilet at night?	215	77.3	278
Do you have restless legs?	155	56	277
Does your partner complain that you have limb movements during sleep?	196	70.8	277
Did you have any weight change before your complaints began?	155	55.8	278
Do you walk when sleeping?	5	1.8	278
Do you speak when sleeping?	75	27	278

TABLE 4. EVALUATION OF POLYSOMNOGRAPHIC PARAMETERS

	Median [min-max]		Median [min-max]
BMI (weight/length <sup>2</sup> )	32 (23-58)	Obstructive AHI	8,95 (0-141)
Duration of snoring (year)	10 (0-30)	Mix AHI	0 (0-4.30)
Duration of witnessed apnea (year)	1 (0-20)	Central AHI	0 (0-20.10)
Duration of daytime excessive sleepiness (year)	2 (0-25)	Mean duration of obstructive apnea (second)	20.70 (0-56.20)
Duration of going to sleep (minute)	10 (1-10)	Mean duration of mix apnea (second)	0 (0-43.40)
Total Epworth Score	7 (0-21)	Mean duration of central apnea (second)	0 (0-45.90)
Total recording duration (minute)	484 (192-638)	Mean duration of apnea (second)	20.70 (0-56.20)
Sleep efficiency (%)	83.95	Mean duration of hypo-apnea (second)	23.90 (0-43.00)
Total sleep duration (minute)	481.25 (192-638)	Number of obstructive apnea in non-REM	39 (0-668)
Net sleep duration (minute)	392.25 (64-581)	Number of mix apnea in non-REM	0 (0-29)
REM latency (minute)	99.50 (0-466)	Number of central apnea in non-REM	0 (0-139)
Wakefulness duration (minute)	48 (0-466)	Total number of apnea in non-REM	42 (0-668)
REM duration (minute)	63 (0-194)	Total number of hypo-apnea in non-REM	65 (0-484)
REM duration (%)	16.50 (0-41)	Number of obstructive apnea in REM	11 (0-146)
Non-REM, stage 1, duration (minute)	17 (1-156)	Number of mix apnea in REM	0 (0-8)
Non-REM, stage 1, duration (%)	4.30 (0-39)	Number of central apnea in REM	0 (0-47)
Non-REM, stage 2, duration (minute)	211.50 (23-436)	Total number of central apnea in REM	11 (0-146)
Non-REM, stage 2, duration (%)	55.30 (14-92)	Total number of hypo-apnea in REM	14 (0-111)
Non-REM, stage 3, duration (minute)	85 (0-291)	AHI in REM	36.2 (0-123.5)
Non-REM, stage 3, duration (%)	22.10 (0-65)	AHI in non-REM	27.05 (0-119.0)
Wakefulness saturation (%)	95 (80-98)	AHI in recumbency position	33.85 (0-336.50)
The lowest saturation (%)	84 (0-96)	AHI in left-side sleeping position	6.60 (0-123.10)
Mean saturation (%)	93 (41-98)	AHI in right-side sleeping position	20.70 (0-119.60)
Mean desaturation (%)	4 (0-23)	AHI in face-down sleeping position	0 (0-180)
Obstructive apnea number	59 (0-690)	Mean heart rate	65 (44-112)
Number of mix apnea	0 (0-29)	Total obstructive apnea	59 (0-690)
Number of central apnea	0 (0-148)	Total mix apnea	0 (0-29)
Number of total apnea	62 (0-690)	Total central apnea	0 (0-148)
Total number of hypo-apnea	85.5 (0-564)	The longest duration of hypo-apnea	44.15 (0-112.40)
AHI	29.4 (0-118.8)	The longest duration of apnea	38.60 (0-138.20)

TABLE 5. THE EPWORTH SLEEPINESS SCALE (10)

Situation	n	%	Number of respondents
<b>Sitting or reading</b>			277
Would never doze	142	51.3	
Slight chance of dozing	68	24.5	
Moderate chance of dozing	36	13.0	
High chance of dozing	31	11.2	
<b>Watching TV</b>			275
Would never doze	67	24.4	
Slight chance of dozing	91	33.1	
Moderate chance of dozing	55	20.0	
High chance of dozing	62	22.5	
<b>Sitting still in a public place (e.g., theater, cinema or meeting)</b>			278
Would never doze	135	48.6	
Slight chance of dozing	68	24.5	
Moderate chance of dozing	43	15.5	
High chance of dozing	32	11.5	
<b>As a passenger in a car for an hour without a break</b>			278
Would never doze	112	40.3	
Slight chance of dozing	52	18.7	
Moderate chance of dozing	41	14.7	
High chance of dozing	73	26.3	
<b>Lying down to rest in the afternoon when circumstances permit</b>			278
Would never doze	54	19.4	
Slight chance of dozing	93	33.5	
Moderate chance of dozing	63	22.7	
High chance of dozing	68	24.5	
<b>Sitting and talking to someone</b>			278
Would never doze	194	69.8	
Slight chance of dozing	61	21.9	
Moderate chance of dozing	13	4.7	
High chance of dozing	10	3.6	
<b>Sitting quietly after a lunch without having drunk alcohol</b>			278
Would never doze	73	26.3	
Slight chance of dozing	91	32.7	
Moderate chance of dozing	63	22.7	
High chance of dozing	51	18.3	
<b>In a car or bus while stopped for a few minutes in the traffic</b>			276
Would never doze	267	96.7	
Slight chance of dozing	8	2.9	
Moderate chance of dozing	1	0.4	
High chance of dozing	-	-	

TABLE 6. DISTRIBUTION OF NUMBER OF MIX APNEA

	Number of mix apnea in REM		Number of central apnea in REM		Total mix apnea number	
	n	%	N	%	n	%
0	440	89.6	468	95.3	365	70.7
1-5	31	6.3	17	3.5	120	23.3
6-10	49	10.0	4	0.8	25	4.8
>10		0.4	2	0.4	6	1.2

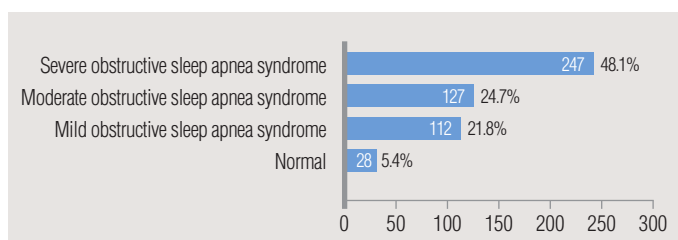


Figure 1. Diagnosis distribution in patients.

4.1% ( $n = 21$ ) of patients were determined to have obstructive apnea dependent on the rapid eye movement (REM). Positive sleeping apnea was determined in 5.8% ( $n = 30$ ) of the patients.

Four patients did not receive any treatment, 71.5% ( $n = 153$ ) were administered continuous positive airway pressure (CPAP), 20.6% ( $n = 44$ ) were administered bilevel positive airway pressure (BIPAP), and 6.1% ( $n = 13$ ) were administered an auto-CPAP.

The periodic limb movement syndrome was found in 2.9% ( $n = 15$ ) of the patients. Nocturnal cardiac arrhythmia was observed in 1.4% ( $n = 7$ ) of them. Insomnia was present in only one patient. Cheyne-Stokes respiration was observed in 0.8% ( $n = 4$ ) of subjects. Simple snoring was found in 4.6% ( $n = 24$ ) of them.

## Discussion

OSAS is a treatable disease where respiration is recurrently obstructed during sleep together with the collapse of the upper airway and that leads to cardiovascular diseases and strokes (5). The general prevalence of this disease in society varies between 1-5% and it is also seen most frequently in 40 to 65 aged males (5). The OSAS risk factors are old age, male gender, short-thick neck, craniofacial abnormalities, obesity, smoking, alcohol and use of medicine for cutaneous diseases that leads to a blocking in the upper airway (5).

In the study, the mean age of the patients was  $50.15 \pm 10.94$  and 61.8 % were female. The median was 32 for BMI (min-max: 23-58). In the study of Arisoy et al., the mean age of the patients with moderate and severe OSAS was 51.3, 55.5% were male and the mean BMI was 33.38 (5). In the study of Kicinski et al., the mean age of patients with moderate and severe OSAS was  $54.6 \pm 11.1$ , 85% were male and the BMI was  $33.5 \pm 5.2$  (3). In the same study, the mean age of the patients with mild OSAS, and whose PSG parameters were normal, was  $49.5 \pm 13.8$ ; 64% were male and BMI was  $30.4 \pm 4.9$  (3). In the study of Eroğlu et al., mean age of the patients with OSAS was  $48.93 \pm 9.66$ ; 75% were male and BMI was  $31.28 \pm 5.38$  (6).

In this study, 32.7% of the patients who responded the questionnaire had been seen smoking. Smoking is a known risk factor in the occurrence of apnea for it leads to nasal congestion (6). In the study of Eroğlu et al., 39.3% of the group with OSAS and 32% of the control group smoked, and there were no statistical significant differences between those groups (6). OSAS is also a dependent risk factor for cardiovascular diseases and quite frequent among patients with arterial hypertension (7). Hypertension, as a comorbid disease, was present in 36% of the patients who responded the questionnaire. In the study of Wang et al., hypertension was present in 59% of the patients with symptoms of OSAS who had not been diagnosed with OSAS (7). In the study of Kicinski et al., the frequency of hypertension in patients with moderate and severe OSAS was 78.9% and the

smoking rate was 15.8% (3). In that study, the frequency of hypertension in patients with mild OSAS and normal PSG parameters was 70.5%, and the smoking rate was 11.2 % (3). In the study of Vinnikov et al., the rate of current tobacco smoking was 12.6% (8). In the essay of Ayik et al., hypertension was present in 24.9% of the

patients diagnosed with OSAS, 7.5% of the patients with simple snoring and 24.9% of all the patients included in the study (9).

The limitation of the essay is that 54.8% of the patients responded the questionnaire present in the sleep laboratory. [RAM](#)

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