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Frequency and Significance of Periodic Limb Movements in Patients with Obstructive Sleep Apnea: A Retrospective Study

Obstrüktif Uyku Apnesi Olan Hastalarda Periyodik Bacak Hareketlerinin Sıklığı ve Önemi: Retrospektif Bir Çalışma

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ABSTRACT Objective: The clinical importance of co-occurring periodic limb movements during sleep (PLMS) in the context of sleep-related breathing disorders remains unclear. We aimed to explore the frequency, association, and clinical significance of PLMS in patients with obstructive sleep apnea (OSA) undergoing polysomnography. **Material and Methods:** Polysomnographies conducted at our clinic were retrospectively reviewed. Patients' demographic characteristics and polysomnographic parameters were recorded. An Apnea-Hypopnea Index (AHI) ≥5 was considered indicative of OSA, and a Periodic Limb Movement Index ≥15 was considered indicative of PLMS. Those with an AHI<5 were classified as the control group. **Results:** The study involved 331 patients, with an average age of 49 and 202 (61%) being male. Among these, 275 (83.08%) had OSA (AHI≥5), with 45 (16.4%) also presenting PLMS. No significant difference in PLMS positivity was found between OSA patients and the control group (AHI<5) (p=0.47). Patients with OSA and PLMS exhibited significantly higher ages and body mass index (p=0.013 and p=0.006), shorter REM duration, lower sleep efficiency, higher sleep desaturation index, lower average oxygen saturation, and higher heart rate (p=0.013, p=0.01, p<0.001, p=0.01, and p=0.049). **Conclusion:** In OSA patients with PLMS, sleep efficiency, REM duration, and oxygen saturation levels were lower, while the sleep desaturation index and heart rate were higher. These findings suggest that PLMS negatively impacts sleep quality and may contribute to OSA severity. Considering the potential of inadequate sleep to lead to cardio-cerebrovascular diseases, the presence of PLMS alongside OSA should be carefully evaluated to improve patient outcomes.

Keywords: Obstructive sleep apnea;
periodic limb movements in sleep

ÖZET Amaç: Uyku ile ilişkili solunum bozukluklarına eşlik eden uykuda periyodik bacak hareketlerinin [periodic limb movements during sleep (PLMS)] klinik önemi net değildir. Bu çalışmada, polisomnografi yapılan hastaların; PLMS sıklığını, obstrüktif uyku apnesi [obstructive sleep apnea (OSA)] ile ilişkisini ve klinik önemini araştırmayı amaçladık. **Gereç ve Yöntemler:** Kliniğimizde gerçekleştirilen polisomnografi sonuçları retrospektif olarak incelendi. Hastaların demografik özellikleri ve polisomnografik parametreleri kaydedildi. Apne-Hipopne İndeksi (AHİ) ≥5 OSA'yı, Periyodik Bacak Hareketi İndeksi ≥15 ise PLMS'yi işaret edecek şekilde değerlendirildi. AHİ<5 olanlar kontrol grubu olarak sınıflandırıldı. **Bulgular:** Çalışmaya toplam 331 hasta dâhil edildi. Bunların 202'si (%61) erkek olup, yaş ortalaması 49'dur. Bu hastaların 275'inde (%83,08) OSA (AHİ≥5) saptandı ve bunların 45'inde (%16,4) PLMS eşlik ediyordu. OSA hastaları ile kontrol grubu (AHİ<5) arasında PLMS pozitifliği açısından anlamlı bir fark bulunmadı (p=0,47). PLMS eşlik eden OSA hastalarının yaşı ve beden kitle indeksi anlamlı derecede daha yüksekti (p=0,013 ve p=0,006), REM süresi daha kısaydı, uyku verimliliği düşüktü, uyku desaturasyon indeksi daha yüksekti, ortalama oksijen saturasyonu daha düşüktü ve kalp atım hızı daha yüksekti (p=0,013, p=0,01, p<0,001, p=0,01 ve p=0,049). **Sonuç:** PLMS'nin eşlik ettiği OSA hastalarında uyku verimliliği, REM süresi ve oksijen saturasyon seviyeleri daha düşük, uyku desaturasyon indeksi ve kalp atım hızı ise daha yüksekti. Bu bulgular, PLMS'nin uyku kalitesini olumsuz etkilediğini ve OSA'nın şiddetini artırabileceğini göstermektedir. Yetersiz uykunun kardiyo-serebrovasküler hastalıklara yol açma potansiyeli göz önünde bulundurulduğunda, OSA ile birlikte PLMS varlığı dikkatle değerlendirilmeli ve hasta sonuçlarını iyileştirmek için ele alınmalıdır.

Anahtar Kelimeler: Obstrüktif uyku apnesi;
uykuda periyodik bacak hareketleri

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Obstructive sleep apnea (OSA) is a common sleep disorder characterized by repeated episodes of airflow blockage during sleep, caused by upper airway obstruction. These obstructions lead to partial (hypopnea) or complete (apnea) cessation of airflow, resulting in intermittent hypoxia, sleep fragmentation, and excessive daytime sleepiness. An Apnea-Hypopnea Index (AHI) score of 5 or higher detected by polysomnography (PSG) in individuals with characteristic symptoms such as excessive daytime sleepiness, fatigue, insomnia, snoring, nocturnal breathing disorders, or observed apneas, or with associated comorbidities such as coronary artery disease, atrial fibrillation, heart failure, stroke, diabetes, hypertension or cognitive dysfunction, confirms the diagnosis of OSA. In the absence of symptoms or comorbidities, 15 or more obstructive respiratory events per hour of sleep are sufficient for diagnosing OSA.[1] OSA is linked to substantial health hazards, such as high blood pressure, heart disease, stroke, and diabetes. This highlights the importance of timely diagnosis and effective management.[2]

Periodic limb movements during sleep (PLMS) involve involuntary, repetitive movements of the legs that occur while sleeping. When they are frequent and intense, they can cause arousal and disrupt nocturnal sleep.[1] In the case of PLMS, definitive diagnosis is also made through PSG. PLMS is a prevalent condition in the general population, with an estimated prevalence of 4% to 11%.[3,4] Notably, these movements are frequently observed in individuals with various sleep disorders, including restless legs syndrome and OSA.[5,6]

The relationship between PLMS and OSA is multifaceted and complex. On one hand, PLMS may be triggered by the microarousals caused by apneic events, potentially serving as a compensatory mechanism for airway patency. On the other hand, PLMS themselves may contribute to sleep fragmentation, creating a vicious cycle of disturbed sleep and worsening clinical outcomes in OSA patients.[7,8] Furthermore, some studies have shown that PLMS are independently related to higher cardiovascular risk.[9]

Despite the frequent co-occurrence of PLMS in patients with OSA, the clinical significance of this association remains under debate. While some studies indicate that PLMS do not significantly affect the severity of OSA or its associated comorbidities, others propose that PLMS could be a marker of more severe disease or an independent risk factor for negative cardiovascular results.[10,11] This discrepancy in findings could be attributed to variations in study designs, patient cohorts, and the methodologies used to define, measure, and assess PLMS.

To better understand the clinical outcomes of the coexistence of OSA and PLMS, we planned a retrospective study. This study is intended to explore the prevalence and clinical significance of PLMS in individuals diagnosed with OSA.

MATERIAL AND METHODS

STUDY DESIGN

Patients who underwent PSG in our hospital's sleep laboratory between December 2021 and December 2023 were retrospectively analyzed. Demographic characteristics, comorbidities, Epworth Sleepiness Scale, body mass index (BMI), symptoms prior to PSG (snoring, witnessed apneas, morning headaches, etc.), and PSG findings were recorded.

The AHI was calculated by dividing the total number of apneas and hypopneas by the total hours of sleep. OSA was diagnosed in patients with an AHI of 5 or more. The severity of OSA was categorized as mild for an AHI between 5 and 15, moderate from 16 to 30, and severe for an AHI exceeding 30. Participants with an AHI below 5 were assigned to the control group. The evaluation of periodic leg movements was conducted in accordance with the guidelines established by the American Academy of Sleep Medicine. A PLM index above 15 was classified as PLMS.[1]

The research was carried out per the ethical standards set out in the International Declaration of Helsinki and the requisite approvals were obtained from the Dr. Lütfi Kırdar City Hospital Ethics Committee (date: October 30, 2023, no: 2023/514/260/ 32).

STATISTICAL EVALUATION

The analytical procedures were executed using the Statistical Package for the Social Sciences (SPSS)

version 24.0 (IBM Corp., Armonk, NY, USA). To determine if the data followed a normal distribution, we used histogram plots and the Kolmogorov-Smirnov test. When presenting descriptive analysis, we included measures such as the average (mean), standard deviation (a measure of variability), and the median (the middle value). For comparing groups, we used the chi-square test, which is ideal for analyzing categorical variables to see if there are significant differences between groups. For variables that didn't fit into a normal distribution (referred to as nonparametric variables), we applied different tests based on the number of groups being compared. If comparing two groups, we used the Mann-Whitney U Test. For comparisons involving more than two groups, we utilized the Kruskal-Wallis Test. We considered results to be statistically significant if the p-value, which indicates the likelihood of observing the data if there was no actual effect, was less than 0.05.

RESULTS

GENERAL CHARACTERISTICS AND FINDINGS OF PATIENTS

The study involved 331 subjects, with an age distribution ranging from 18 to 80 years. Of these, 202 (61%) were male. Comorbid conditions were present in 173 patients (52.3%). The mean BMI value was 31.36±6.1, while the average Epworth Sleepiness Scale score was 7.97±5.93. Among the participants, 322 (97.3%) reported snoring, 267 (80.7%) had witnessed apneas, 229 (69.2%) complained of daytime sleepiness, 153 (46.2%) experienced unsatisfactory sleep, 84 (25.4%) suffered from morning headaches, and 33 (10.0%) reported night sweats. The average AHI throughout the night was calculated as 27.23±26.32. Mild OSA was found in 95 patients (34.5%), moderate OSA in 71 patients (25.8%), and severe OSA in 109 patients (39.6%). There were 52 patients (15.7%) with a PLMS index of 15 or higher (Table 1).

TABLE 1: General characteristics and findings of patients undergoing polysomnography.

		n / Mean ± SD n=331	%/Median (Minimum-Maximum)
Age/years		48.62±10.96	49 (18-80)
Gender	Male	202	(61.03)
	Female	129	(38.97)
Comorbidty		173	(52.27)
Body mass index		31.36±6.1	30.35 (18.65-55.1)
Epworth Sleepiness Scale		7.97±5.93	6 (0-24)
Snore		322	(97.28)
Witnessed apnea		267	(80.66)
Daytime napping		229	(69.18)
Unsatisfied sleep		153	(46.22)
Morning headache		84	(25.38)
Night sweating		33	(9.97)
Total time in bed		406.04±67.49	422 (116-521.5)
Sleep duration		318.4±85.04	335.5 (38-477)
Sleep efficiency (%)		78.55±14.15	81.35 (10.7-98.1)
Sleep latency (min)		31.88±32.05	22 (0.5-198)
N1		6.86±6.86	5.1 (1-80)
N2		59.07±12.39	58.8 (4-94)
N3		18.9±9.75	18.9 (0-74.6)
REM		15.36±7.52	16 (0-52)
Apnea-Hypopnea Index		27.23±26.32	17.6 (0.1-118)
Groups	Control	56	(16.92)
	OSA	275	(83.08)
OSA	Mild	95	(34.55)
	Moderate	71	(25.82)
	Severe	109	(39.64)
Apnoea index		16.25±22.25	6.6 (0-101.6)
SpO_2 <T90 (%)*		16.4±26.81	3.9 (0-100)
Nocturnal Oxygen Desaturation Index		21.96±22.83	13.3 (0-98.9)
Minimum SpO_2, %		81.52±10.36	84 (40-95)
Average SpO_2, %		92.68±3.55	93.2 (66-98)
Average heart rate		67.6±10.07	67 (37-101)
PLM index		8.18±17.68	0.8 (0-109.1)
PLMS≥15		52	(15.71)

*Percentage of time spent with saturation below 90%; SD: Standard deviation; OSA: Obstructive sleep apnea; PLMS: Periodic limb movement in sleep.

COMPARISON OF PSG FINDINGS BETWEEN CONTROL AND OSAS GROUPS

When comparing the control group (AHI<5) with the OSA group, there was a significant increase in the incidence of morning headaches and night sweats in the control group (p=0.001, p=0.002). Although the presence of PLMS was more common in the OSA group, this difference was not statistically significant. No statistically significant differences were found in the other parameters (Table 2).

In the comparison between mild, moderate, and severe OSA groups, in the mild OSA group, snoring was found to be lower compared to the other groups, while the rate of daytime sleepiness was higher. In

TABLE 2: Comparison of polysomnography findings between control and OSAS groups.

	Control group (AHI<5)	OSA group (AHI≥5)	p value
Gender/male	32 (57.1%)	170 (61.8%)	0.51
Age/years	48 (18-71)	49 (18-80)	0.23
Body mass index kg/m^2	30.66 (18.65-50.18)	30.12 (19.47-55.1)	0.692
Comorbidity	24 (42.9%)	134 (48.7%)	0.42
Snore	54 (96.4%)	268 (97.5%)	0.66
Witnessed apnea	45 (80.4%)	222 (80.7%)	0.94
Daytime napping	38 (67.9%)	191 (69.5%)	0.81
Unsatisfied sleep	32 (57.1%)	121 (44%)	0.07
Morning headache	25 (44.6%)	59 (21.5%)	**<0.001**
Night sweating	12 (21.4%)	21 (7.6%)	**0.002**
Epworth Sleepiness Scale	6 (2-24)	7 (0-24)	0.572
Total time in bed	423.35 (116-480.5)	422 (117-521.5)	0.819
Sleep duration	325.75 (66-431.5)	337 (38-477)	0.267
Sleep efficiency (%)	78 (45.9-95.4)	82.2 (10.7-98.1)	0.130
Sleep latency (min)	15.5 (1-124.5)	22.5 (0.5-198)	0.053
N1	5.1 (1-31)	5.2 (1-80)	0.461
N2	58.6 (17-88)	59 (4-94)	0.551
N3	19.95 (0-40.3)	18.6 (0-74.6)	0.325
REM	16.55 (0-52)	15.8 (0-42)	0.907
SpO_2 < T90 (%)**	6.9 (0-99.4)	3 (0-100)	0.093
Nocturnal Oxygen Desaturation Index	12.25 (0.3-98.9)	13.65 (0-98.3)	0.786
Minimum SpO_2, %	83.5 (56-95)	85 (40-95)	0.258
Average SpO_2, %	92.9 (82-98)	93.4 (66-98)	0.082
Average heart rate	68 (51-100)	67 (37-101)	0.260
PLM index	1.25 (0-108.9)	0.7 (0-109.1)	0.881
PLM≥15	7 (12.5%)	45 (16.4%)	0.46

**Percentage of time spent with saturation below 90%; OSAS: Obstructive sleep apnea syndrome; AHI: Apnea-Hypopnea Index; PLM: Periodic limb movement.

the severe OSA group, unsatisfactory sleep and morning headaches were found to be lower compared to the other groups, whereas night sweating was higher. The presence of PLMS was similar across all three groups (Table 3).

In the comparison among groups with mild, moderate, and severe OSA, it was observed that the BMI value was higher in the mild OSA group than in the severe OSA group, with a statistically significant difference (p=0.014). Furthermore, the percentage of time spent with oxygen saturation levels below 90% was found to be lower in the severe OSA group compared to the other groups (p<0.001). Both minimum and mean saturation values were higher in the severe OSA group than in the mild obstructive sleep apnea syndrome (OSAS) group (p=0.008, p=0.001) (Table 4).

COMPARISON OF OSA PATIENTS WITH PLMS AND WITHOUT PLMS

Patients diagnosed with OSA were categorized into two groups: those with PLMS and those without. The PLMS group exhibited a markedly elevated mean age and BMI in comparison to the non-PLMS group (p=0.013 and p=0.006, respectively). Additionally, sleep efficiency was lower, and the duration of REM sleep was shorter in the PLMS group (p=0.013). Regarding sleep quality, both the percentage of total sleep time with oxygen saturation below 90% and the Oxygen Desaturation Index (ODI) were elevated in patients with PLMS (p=0.011 and p<0.001, respectively). Minimum and average oxygen saturation levels recorded during PSG were also lower in the PLMS group (p=0.002 and p=0.01, respectively). Moreover, patients with PLMS exhibited a higher average heart rate (p=0.049) (Table 5).

DISCUSSION

Our study reveals that in patients diagnosed with OSA, the presence of PLMS affects sleep quality compared to those without PLMS. In OSA patients with accompanying PLMS, we found reduced sleep efficiency, shortened REM sleep stages, increased duration of oxygen saturation below 90% throughout the night, and increased ODI. The findings suggest that PLMS may be a significant factor in the management of OSA.

In our analysis, it was determined that the average heart rate in OSA patients with accompanying PLMS was statistically significantly higher compared to OSA patients without PLMS. This suggests that PLMS may additionally burden the cardiovascular system in patients with OSA. Therefore, the presence of PLMS in the treatment of OSA should be considered in terms of potential cardiovascular risks.

In a study conducted by Zinchuk et al., although a direct synergistic relationship between PLMS and OSA was not found, it was demonstrated that PLMS could be an independent risk factor for cardiovascular diseases or mortality risk in patients with mild to moderate OSA.[12]

TABLE 3: Comparison of gender, comorbidities and symptoms of OSA groups.

		OSA severity						
		Mild		Moderate		Severe		
		n	%	n	%	n	%	p value
Gender	Male	55	(57.9)	49	(69)	66	(60.55)	0.324
	Female	40	(42.1)	22	(30.99)	43	(39.45)	
Comorbidity	None	42	(44.21)	37	(52.11)	55	(50.46)	0.540
	Present	53	(55.79)	34	(47.89)	54	(49.54)	
Snoring	None	6	(6.32)	0	(0.00)	1	(0.92)	**0.015**
	Present	89	(93.68)	71	(100.00)	108	(99.08)	
Witnessed apnea	None	22	(23.16)	15	(21.13)	16	(14.68)	0.278
	Present	73	(76.84)	56	(78.87)	93	(85.32)	
Daytime napping	None	18	(18.95)	25	(35.21)	41	(37.61)	**0.009**
	Present	77	(81.05)	46	(64.79)	68	(62.39)	
Unsatisfied sleep	None	51	(53.68)	32	(45.07)	71	(65.14)	**0.025**
	Present	44	(46.32)	39	(54.93)	38	(34.86)	
Morning headache	None	66	(69.47)	49	(69.01)	101	(92.66)	**<0.001**
	Present	29	(30.53)	22	(30.99)	8	(7.34)	
Night sweating	None	91	(95.79)	70	(98.59)	93	(85.32)	**0.001**
	Present	4	(4.21)	1	(1.41)	16	(14.68)	
PLM≥15	None	77	(81.05)	59	(83.10)	94	(86.24)	0.601
	Present	18	(18.95)	12	(16.90)	15	(13.76)	

OSA: Obstructive sleep apnea; PLM: Periodic limb movement.

TABLE 4: Comparison of polysomnography findings in OSA groups.

	OSA			
	Mild	Moderate	Severe	
	Median (Minimum-Maximum)	Median (Minimum-Maximum)	Median (Minimum-Maximum)	p value
Age/years	49 (26-80)	52 (26-73)	49 (18-74)	0.333
Body mass index kg/m^2	31.25 (21.15-49.59)	30.86 (19.47-55.1)	29.14 (19.61-47.05)	**0.014**
Epworth Sleepiness Scale	6 (1-24)	6 (1-24)	8 (0-24)	0.659
Total time in bed	418 (117-505)	422 (120.5-521.5)	424.5 (172-487)	0.715
Sleep duration	341 (42.5-477)	336.5 (76.5-456)	337 (38-459)	0.435
Sleep efficiency (%)	81.9 (10.7-96)	83.1 (41.6-98.1)	82.35 (32.6-97.1)	0.781
Sleep latency (min)	20.5 (0.5-110)	23 (3-145)	24 (1.5-198)	0.181
N1	5.4 (1-80)	6 (1-64)	5 (1-17)	0.205
N2	56.3 (20-94)	59 (4-87.4)	59 (6-88)	0.624
N3	19.2 (0-74.6)	17.5 (2.3-50)	18.5 (0-61)	0.794
REM	16 (0-29)	16 (0-42)	15.1 (0-27)	0.741
SpO_2 < T90 (%)	5 (0-100)	5 (0-100)	1 (0-97)	**<0.001**
Nocturnal Oxygen Desaturation Index	14.9 (0-85.9)	15.65 (0.2-77)	10.2 (0-98.3)	0.142
Minimum SpO_2, %	84 (42-93)	84 (40-93)	87 (50-95)	**0.008**
Average SpO_2, %	93 (66-97)	93 (83-97)	94 (79-98)	**0.001**
Average heart rate	67 (47-101)	68.5 (37-98)	66 (41-101)	0.229
PLM index	2.5 (0-95.7)	2.8 (0-109.1)	0 (0-96.4)	0.087

Kruskal Wallis Test; OSA: Obstructive sleep apnea; PLM: Periodic limb movement.

TABLE 5: Comparison of OSA patients with PLMS and OSA patients without PLMS.

	OSA		
	PLM<15	PLM≥15	p value
Age[a]	49 (18-80)	52 (40-71)	**0.013**
Gender/male n %	144 (62.6%)	26 (57.8%)	0.54
Body mass index[a]	29.7 (19.61-49.59)	32.28 (19.47-55.1)	**0.006**
Epworth Sleepiness Scale[a]	6 (0-24)	8 (0-24)	0.710
Comorbidity	117 (50.9%)	24 (53.3%)	0.76
Snoring	224 (97.4%)	44 (97.8%)	0.88
Witnessed apnea	188 (91.7%)	34 (%75.6)	0.33
Daytime napping	155 (67.4%)	36 (80%)	0.09
Unsatisfied sleep	98 (42.6%)	23 (51.1%)	0.29
Morning headache	46 (20%)	13 (28.9%)	0.18
Night sweating	19 (8.26)	2 (4.4%)	0.378
Total time in bed[a]	422 (117-521.5)	420.9 (120.1-505)	0.535
Sleep duration[a]	342.25 (38-477)	320.5 (73.5-426.5)	0.067
Sleep efficiency (%)[a]	83.05 (10.7-98.1)	76.15 (19.9-93.5)	**0.010**
Sleep latency (min)[a]	22 (0.5-198)	32.5 (2-173)	0.120
N1[a]	5 (1-80)	6.4 (1-35)	**0.029**
N2[a]	58 (4-94)	65 (33.4-88)	**0.006**
N3[a]	19 (0-61)	16 (0-74.6)	0.079
REM[a]	16 (0-30.8)	12 (0-42)	**0.013**
Apnea hypopnea index[a]	24.25 (5-118)	21.6 (5.7-92.2)	0.284
Apnea index	5.5 (0-101.6)	10.1 (0-99.5)	0.070
SpO_2 <T90 (%)**	2.7 (0-100)	7.35 (0-97.8)	**0.011**
Nocturnal Oxygen Desaturation Index[a]	11.3 (0-98.3)	28.1 (0.3-85.9)	**<0.001**
Minimum saturation[a]	85 (42-95)	82 (40-95)	**0.002**
Average saturation[a]	93.9 (66-97)	92.7 (79-98)	**0.010**
Average heart rate[a]	66 (37-101)	69 (55-92)	**0.049**

[a]Median (minimum-maximum); OSA: Obstructive sleep apnea; PLMS: Periodic limb movement in sleep. **Percentage of sleep time with oxygen saturation below 90%.

The REM sleep stage is important for cognitive functions such as learning and memory. In a study conducted by Zhou et al., it was found that patients with OSA who also had PLMS experienced a significantly shorter duration of REM sleep compared to OSA patients without PLMS.[13] Our study has found similar results.

Our study found that the minimum and mean saturation values were higher in the severe OSA group compared to the mild OSA group. Additionally, the percentage of time spent with oxygen saturation levels below 90% was lower in the severe OSA group compared to the other groups. Severe OSA patients may develop advanced compensatory mechanisms to adapt to more severe and frequent hypoxemic episodes. These mechanisms can improve oxygen transport and distribution during sleep, resulting in higher minimum and mean oxygen saturation levels. Additionally, severe OSA patients experience more frequent sleep fragmentation and microarousals. This can shorten the duration of hypoxemic episodes, leading to generally higher oxygen saturation levels.

The prevalence of PLMS increases with age.[14] Our research shows that, among patients with OSA, those with PLMS had a significantly higher mean age and BMI compared to those without PLMS. Similar findings are present in the literature, indicating that in patients with OSA, PLMS may be more prevalent among individuals of advanced age and those with a higher BMI.[15]

The relationship between PLMS and gender is not clear; while some studies have found no significant difference between genders, others have reported a higher prevalence in either men or women.[16,17] In the literature, a study by Ren et al. showed that among OSA patients, the frequency of PLMS was significantly higher in young women compared to young men. However, they found no difference in the prevalence of PLMS between older men and women.[16] In our study, no gender difference was detected in OSA patients with PLMS compared to those without PLMS.

The frequency of PLMS can vary depending on the population, age, and accompanying sleep disorders. Within the adult population, its prevalence is estimated to range between approximately 4% to 11%.[3,4] It is known that the frequency of PLMS increases with age. In a study conducted by Leary et al. on 1,084 cases over the age of 40, the frequency of PLMS was shown to be 28.8%.[18] In our study, the frequency of PLMS was 15.7%.

A study conducted by Budhiraja et al. demonstrated that PLMS is prevalent in patients with OSA and that the severity of PLMS is not affected by Continuous Positive Airway Pressure (CPAP) therapy.[19] In contrast to this study, our study did not include patients receiving CPAP therapy.

This study has several limitations. First, its retrospective nature. Second, the fact that the data was collected from a single center could restrict the generalisability of the findings to the wider population. Finally, not examining other factors that could potentially influence the results (for example, iron deficiency anemia, use of antidepressants or other sleep disorders) can be considered among the study's limitations. While PSG is the gold standard for evaluating sleep disorders, a more comprehensive understanding of the clinical significance of PLMS requires larger, prospective studies.

CONCLUSION

Our study has demonstrated that in OSA patients with concurrent PLMS, sleep efficiency, REM duration, and oxygen saturation are lower, while the sleep desaturation index and heart rate are higher. These findings suggest that PLMS may have adverse effects on sleep quality and cardiovascular health in patients with OSA. We recommend evaluating both OSA and PLMS in patients presenting with sleep disorder complaints.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Berrin Zinnet Eraslan, Seda Beyhan Sağmen, Sevda Şener Cömert;* ***Design:*** *Berrin Zinnet Eraslan, Seda Beyhan Sağmen;* ***Control/Supervision:*** *Berrin Zinnet Eraslan, Seda Beyhan Sağmen;* ***Data Collection and/or Processing:*** *Berrin Zinnet Eraslan, Seda Beyhan Sağmen;* ***Analysis and/or Interpretation:*** *Sevda Şener Cömert, Seda Beyhan Sağmen, Berrin Zinnet Eraslan;* ***Literature Review:*** *Sevda Şener Cömert, Seda Beyhan Sağmen, Berrin Zinnet Eraslan;* ***Writing the Article:*** *Berrin Zinnet Eraslan, Seda Beyhan Sağmen;* ***Critical Review:*** *Seda Beyhan Sağmen, Sevda Şener Cömert.*

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