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The spectrum of sleep-related breathing disorders in idiopathic pulmonary fibrosis

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Abstract:

BACKGROUND AND AIM: The prevalence of sleep-related breathing disorders (SRBD) is higher in patients with idiopathic pulmonary fibrosis (IPF) compared to the healthy population. On the other hand, comprehensive and comparative assessment of the diagnostic characteristics in IPF patients with and without SRBD is highly needed. The purpose of this study is to analyze the prevalence and types of SRBD in IPF patients, and to investigate and compare the laboratory characteristics of IPF patients with and without SRBD.

METHODS: In this prospective study, demographic, respiratory function, and diffusion test data, polysomnography data, 6-minute walk test score, and the scores of quality of life questionnaires of 55 patients were recorded. Additionally, patients were divided into two groups as patients with and without SRBD, and all obtained data were compared between these groups.

RESULTS: The mean age was 67.5±7.9 years. Forty patients (72.7%) were male and 15 (27.3%) were female. The prevalence of SRBD in IPF patients was 78.2%. The mean values of apnea-hypopnea index (AHI) 19.2±19.3 vs 6.7±10.5, supine AHI 27.5±26.9 vs 5.3±12.9, non-rapid eye movement (non-REM) AHI 18.9±20.5 vs 6.1±10.3, and oxygen desaturation index 17.4±22.6 vs 3.4±3.7 were found to be significantly higher in IPF patients with SRBD compared to IPF patients without SRBD. Mean Stop-Bang scores differed significantly between the two groups, with patients having SRBD scoring 4.2±1.4 compared to 3.2±1.1 for those without SRBD (p=0.032). Additionally, there were significant differences in the symptom spectrum between the groups (p=0.04).

CONCLUSIONS: SRBDs are common in patients with IPF. We concluded that questioning symptoms and performing a Stop-Bang questionnaire in these patients is effective in the decision for performing polysomnography for IPF patients.

Keywords:

Idiopathic pulmonary fibrosis, interstitial lung diseases, sleep disorders, sleep related disorders

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Introduction

Idiopathic Pulmonary Fibrosis (IPF) is an interstitial lung disease (ILD) characterized by a progressive clinical course and poor prognosis, the cause of which remains unknown today.[1] Sleep-related breathing disorders (SRBDs) are clinical conditions that can develop due to pathological changes in breathing during sleep, leading to increased mortality and morbidity in patients by creating conditions such as hypoxemia and hypercapnia.[2] Effective management of these pathologies increases the quality of life of patients.[3]

The coexistence of IPF and SRBDs has been a topic of investigation in recent decades. Decreased sleep quality due to night coughs, hypoxia, and obstructive apnea in patients with IPF also adversely affects their quality of life. The most frequent SRBD among IPF patients is obstructive sleep apnea syndrome (OSAS). Previous studies have reported that 59–88% of IPF patients suffer from OSAS.[4,5] Due to its high prevalence, it is suggested that SRBDs should be investigated in all IPF patients.[4] The presence of SRBDs significantly increases the mortality and morbidity rates and reduces the quality of life in IPF patients, hence research on the association between these two conditions has increasingly gained importance.[6] Current studies emphasize that the investigation and treatment of comorbidities accompanying IPF have a remarkable effect on the survival of patients with IPF.[6,7]

The primary aim of this study was to investigate the prevalence and clinical characteristics of SRBDs in patients with IPF, and the secondary aim was to compare chracteristics of IPF patients with and without SRBD.

Materials and Methods

This study was conducted as a prospective, observational, cross-sectional study at a tertiary center, following the approval of the Institutional Research Ethics Committee (Approval number: 2018/14-6). All participants in the study provided informed consent.

Study design

The patients who had been registered and followed in the ILD outpatient clinic of our center between September 2019 and 2021 were evaluated, and those who met the inclusion criteria were enrolled in the study. None of the participants were newly diagnosed with IPF; all were already under follow-up. On the other hand, the data from the evaluation tools applied in this study were obtained prospectively.

The inclusion criteria were as follows:

1. Diagnosis of IPF (The patients were diagnosed according to American Thoracic Society/European Respiratory Society Clinical Practice Guideline[7]).
2. Ages between 35–80 years.
3. Being in the stable period of IPF.

The exclusion criteria were:

1. Age below 35 and over 80 years.
2. Presence of chronic nasal obstructive pathology.
3. Comorbidities that may cause sleep disorders such as chronic heart failure, chronic renal failure, other lung pathologies, endocrinological diseases, psychiatric diseases.
4. Patients with acute IPF attacks.
5. Regular use of corticosteroids or psychiatric drugs (due to their side effects causing SRBDs).

Outcome measures

Age, gender, tobacco consumption, body mass index, respiratory symptoms, and sleep-related symptoms of the patients were recorded. Pulmonary function tests, diffusing capacity of the lungs for carbon monoxide (DLCO), and the 6-minute walk test (6MWT) were applied to the patients. The Short Form (36) Health Survey (SF-36) Quality of Life Scale, Epworth Sleepiness Scale, and Stop-Bang questionnaires were administered to each patient. In the pulmonary function test, the following parameters were evaluated: Forced Expiratory Volume in one second (FEV_1) (Liters and %), Forced Vital Capacity (FVC) (Liters and %), FEV_1/FVC, Forced Expiratory Flow at 25–75% of pulmonary volume (FEF 25–75), Transfer Factor of the Lung for Carbon Monoxide adjusted for Hemoglobin (DLCO [Hb]), DLCO (%), Carbon Monoxide Transfer Coefficient (KCO) (Liters), and KCO (%). The use of antifibrotic medications and long-term oxygen therapy was recorded. The gender-age-physiology (GAP) index scores and stages, which help to determine mortality in patients with IPF, were calculated for all patients. Polysomnography (PSG) was performed on all included patients.

The patients were also divided into two groups according to the presence of SRBD following the obtained PSG data. All data were compared between these two groups.

Polysomnography

All participants underwent full overnight in-laboratory PSG (Comet™ Grass-Telefactor version 4.5.3, West Warwick, RI, USA). The electroencephalography electrodes were positioned according to the international 10–20 system. In PSG, all patients were monitored with electroencephalography, electrooculography, electrocardiography, anterior tibialis electromyography, a digital microphone for snoring detection, airflow, respiratory muscle effort, and blood oxygen saturation through a transcutaneous finger pulse oximeter. Thoraco-abdominal plethysmography, oro-nasal temperature thermistor, and nasal-cannula-pressure transducer system were used to identify apneas and hypopneas. The Apnea-Hypopnea Index (AHI) was the sum of the number of apneas and hypopneas per hour of sleep. PSG recordings were analyzed by the authors, who are experienced in sleep disorders, using TWin® Electroencephalography/Polysomnography (EEG/PSG) Software. Patients with a mean AHI value of 5 and above were diagnosed with OSAS. AHI between 5–15 was evaluated as mild, 15–30 as moderate, and 30 and above as severe OSAS. Patients' total sleep duration (minutes), sleep efficiency (%), duration of sleep stages and their proportions to total sleep time, counts of obstructive apnea, central apnea, total apnea, hypopnea, AHI, REM AHI, non-REM AHI, supine AHI, non-supine AHI, minimum oxygen saturation, mean oxygen saturation, percentage of time spent below 90% saturation, oxygen desaturation index (ODI), and mean oxygen saturation values during the sleep were recorded.

Statistical analysis

The Statistical Package for the Social Sciences (SPSS) (version 25; SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Levene's test was used to evaluate the homogeneity of the data, and the Kolmogorov-Smirnov test was used to analyze the distribution pattern. The independent samples t-test was used for the comparison of parametric variables, while the Kruskal-Wallis or Mann-Whitney U tests were used for the analysis of non-parametric variables according to the distribution pattern. The Chi-Square Test was used for the analysis of categorical variables. The data were expressed as "mean ± standard deviation (SD)", percent (%), minimum-maximum where appropriate. A p-value below 0.05 was considered to be statistically significant.

Results

Sixty patients were enrolled in this study; however, five patients were excluded due to low sleep efficiency during polysomnography (PSG). Thus, the remaining 55 patients were included in the study. Out of the total 55 patients, 40 (72.7%) were male and 15 (27.3%) were female. The mean age of all patients was 67.5±7.9 years. According to the PSG evaluation, out of 55 patients, 43 (78.1%) were diagnosed with SRBD, of which 40 (72.7%) were diagnosed with OSAS. Twelve patients (21.9%) had no SRBDs. The mean average score of the SF-36 scale was 78.9±15.6. The average score of the Epworth Sleepiness Scale was 5.9±4.6. The mean total score of the Stop-Bang questionnaire was 4±1.4 (min-max: 2–7), and all patients were found to be at high risk for sleep apnea. Using the GAP index to predict mortality in IPF patients, 20 (36.4%) patients were Stage 1, 28 (50.9%) were Stage 2, and 7 (12.7%) were Stage 3. The characteristics and demographic data of all individuals are shown in Table 1.

In the pulmonary function test, the mean FEV_1 was 1.99±0.57 liters, and FEV_1% was 78.3±17.3%; the mean FVC was 2.32±0.72 liters, and the mean FVC% was 70.91±16.7%. The mean FEV_1/FVC ratio was 87.29±6.75%. The mean value of the 6MWT was 358.13±104.1 meters (min-max: 180–570 meters). Pulmonary function test parameters, DLCO, and 6MWT data of all patients are presented in Table 2.

The mean total sleep time was 314.3±86.5 minutes, and the mean sleep efficiency percentage was found to be 66.8±15.2%. The mean AHI was 15.1±17.3. An AHI value above 5 was observed in 43 patients. PSG evaluation revealed obstructive sleep apnea in 40 patients, sleep-related hypoxia in 1 patient, severe central sleep apnea in 1 patient, and mild central sleep apnea in 1 patient. For the patients diagnosed with obstructive sleep apnea, the AHI scores between 5-15, 15-30 and above 30 were observed in 25, 9 and 6 patients, respectively. The PSG parameters are shown in Table 3.

In the comparative analysis between patients with and without SRBDs, there were no statistically significant differences in age, gender, and smoking status ($p>0.05$). However, there was a statistically significant difference in the distribution of idiopathic pulmonary fibrosis symptoms ($p=0.04$). A statistically significant difference was also observed in the comparison of mean Stop-

Table 1: The characteristics and demographic data of the patients

Parameter	n	Mean±SD	%
Age (year)		67.5±7.9	
Gender			
Male	40		72.7
Female	15		27.3
Body mass index (kg/m^2)		26.4±2.5	
Smoking			
Non-smoker	20		36.4
Active smoker	9		16.4
Ex-smoker	26		47.3
IPF symptoms			
Dyspnea	19		34.5
Cough	6		10.9
Dyspnea+Cough	24		41.8
Cough+Phlegm	2		3.6
Dyspnea+Cough+Phlegm	5		9.1
OSA symptoms			
None	5		9.1
Snoring	10		18.2
Apnea	3		5.5
Daytime sleepiness	14		25.5
Two or more symptoms	23		41.8
SF-36 score		78.9±15.6	
Epworth sleepiness scale		5.9±4.6	
Stop-bang score		4.0±1.4	
GAP stage			
Stage 1	20		36.4
Stage 2	28		50.9
Stage 3	7		12.7

SD: Standard deviation, IPF: Idiopathic pulmonary fibrosis, OSA: Obstructive sleep apnea, SF-36: Short Form 36, GAP: Gender-age-physiology

Table 2: The pulmonary function test, DLCO, and 6MWT data of the patients

Parameter	Mean±SD
FEV_1 (Liter)	1.99±0.57
FEV_1 (%)	78.3±17.3
FVC (Liter)	2.32±0.72
FVC (%)	70.91±16.7
FEV_1/FVC	87.29±6.75
FEF 25-75	94.61±32.87
DLCO (Hb)	3.52±1.42
DLCO (%)	44.32±15.44
KCO (Liter)	0.94±0.41
KCO (%)	69.70±28.47
6MWT (Meter)	358.13±104.1

DLCO: Diffusing capacity of the lungs for carbon monoxide, 6MWT: 6-Minute Walk Test, FEV_1: Forced expiratory volume in the first second, FVC: Forced vital capacity, FEF 25–75: Forced expiratory flow between 25% and 75% of vital capacity, KCO: Carbon monoxide transfer coefficient

Bang scores between the groups (p=0.032). Among the PSG parameters, there were statistically significant differences only in the mean values of total apnea number, total hypopnea number, obstructive apnea (OA), central apnea (CA), AHI, supine AHI, non-REM AHI, and ODI between the two groups (p<0.05) (Table 4). No statistically significant differences were observed in the comparisons of GAP index scores and stages between IPF patients without sleep-related breathing disorders and IPF patients with OSAS (Table 5).

Table 3: The polysomnography data of the patients

Parameter	Mean±SD
TST	314.3±86.5
SE	66.8±15.2
REM	11.3±7.4
Non-REM 1	3.0±2.1
Non-REM 2	66.4±28.2
Non-REM 3	21.7±11.1
OA	17±47.8
MA	3.3±14.3
CA	7.2±25.2
Total Apnea	27.5±74.2
Total Hypopnea	55.3±60.6
AHI	15.1±17.3
Supine AHI	22.4±26
Non-supine AHI	8.3±13.3
REM AHI	17.4±19.8
Non-REM AHI	15.9±19.3
Minimum O_2 saturation (%)	82.7±5.4
Average O_2 saturation (%)	92.5±2.7
O_2 saturation Over 90% (%)	14.9±21.4
ODI	14.1±20.7
Average O_2 saturation during wakefulness (%)	92.7±2.8

TST: Total sleep time, SE: Sleep efficiency, REM: Rapid eye movement, OA: Obstructive apnea, MA: Mixed apnea, CA: Central apnea, AHI: Apnea-hypopnea index, ODI: Oxygen desaturation index

Among the 40 patients who were diagnosed with OSAS, 20 were recommended positive airway pressure (PAP) therapy. The appropriate PAP settings were established for all 20 patients during in-laboratory PAP titration with full PSG. All patients received education before the PAP titration. Six patients could not tolerate the use of the device during titration. Finally, seven patients were initiated on continuous positive airway pressure (CPAP) therapy, and seven patients were initiated on bilevel positive airway pressure (BPAP) (5 patients) or BPAP with spontaneous/timed mode (BPAP/ST) (2 patients) therapy. Application of PAP therapy for an average of four hours a night for at least 70% of the nights was considered sufficient PAP adherence. The PAP adherence rate in this study was 70%. The average PAP device pressure levels (as expiratory and inspiratory positive airway pressure levels) during the follow-up of 14 patients are presented in Table 6.

Table 4: The comparisons of all data between two groups

Parameter	Mean±SD		p
	IPF patients with sleep-related breathing disorders (n=43)	IPF patients without sleep-related breathing disorders (n=12)	
The characteristics and demographic data			
Gender, %			>0.05
Female	30.2	84.6	
Male	69.8	15.4	
Age (year)	68.3±7.6	65.0±8.2	>0.05
Smoking, %			>0.05
Non-smoker	34.9	38.5	
Active smoker	11.6	30.8	
Ex-smoker	53.5	30.8	
IPF symptoms, %			**0.04**
Dyspnea	30.2	46.2	
Cough	11.6	7.7	
Dyspnea+Cough	46.5	30.8	
Cough+Phlegm	–	15.4	
Dyspnea+Cough+Phlegm	11.6	–	
OSA symptoms, %			>0.05
None	11.6	7.7	
Snoring	14	30.8	
Apnea	4.7	7.7	
Daytime sleepiness	23.3	30.8	
Two or more symptoms	46.5	23.1	
Body mass index (kg/m^2)	26.7±2.4	25.3±3	>0.05
SF-36 score	81.2±12.9	70.1±20.7	>0.05
GAP index score	4.0±1.2	3.7±1.4	>0.05
GAP stage, %			>0.05
Stage 1	32.6	46.2	
Stage 2	53.5	46.2	
Stage 3	14	7.7	
Epworth sleepiness scale	5.8±4.6	5.6±5	>0.05
Stop-bang score	4.2±1.4	3.2±1.1	**0.032**
Pulmonary function test and 6MWT data			
FEV_1 (Liter)	1.9±0.6	2.0±0.4	>0.05
FEV_1 (%)	79.4±18.2	74.1±13.2	>0.05
FVC (Liter)	2.3±0.7	2.4±0.5	>0.05
FVC (%)	71.8±17.8	68.8±12.4	>0.05
FEV_1/FVC	87.2±6.4	85.6±9.9	>0.05
FEF 25–75	94.9±29.9	93.5±42.6	>0.05
DLCO (Hb)	3.4±1.5	3.6±1.1	>0.05
DLCO (%)	44.2±16.3	44.4±12.6	>0.05
KCO (Liter)	0.9±0.4	0.9±0.3	>0.05
KCO (%)	69.2±30.3	71±21.9	>0.05
6MWT (meter)	347.3±105.3	383.1±100.3	>0.05
Polysomnography data			
TST	320.7±90.2	262±115.3	>0.05
SE	68.9±15.4	55.1±19.2	**0.01**
REM	11.5±7.7	10.9±6.3	>0.05
Non-REM 1	2.8±1.7	3.7±2.9	>0.05
Non-REM 2	68.6±30.5	59±17.8	>0.05
Non-REM 3	21.5±11.3	22.2±10.7	>0.05

Table 4: Cont.

Parameter	Mean±SD		p
	IPF patients with sleep-related breathing disorders (n=43)	IPF patients without sleep-related breathing disorders (n=13)	
OA	22±53.7	0.3±0.8	**0.011**
CA	9.2±28.5	0.3±0.6	**0.012**
MA	4.3±16.3	0	–
Total Apnea	35.6±83.1	0.8±1.3	**0.009**
Total Hipopnea	66.6±63.6	17.7±26.3	**<0.001**
AHI	19.2±19.3	6.7±10.5	**0.005**
Supine AHI	27.5±26.9	5.3±12.9	**<0.001**
Non-supine AHI	8.9±14.	6.5±11	>0.05
REM AHI	18.6±19.5	13.5±21.2	>0.05
Non-REM AHI	18.9±20.5	6.1±10.3	**0.004**
Minimum O_2 saturation (%)	83±5.4	81.6±5.2	>0.05
Average O_2 saturation (%)	92.4±2.7	92.9±2.7	>0.05
Average O_2 saturation over 90% (%)	14.3±20.7	17.1±24.4	>0.05
ODI	17.4±22.6	3.4±3.7	**<0.001**
Average O_2 saturation during wakefulness (%)	92.6±2.9	93.2±2.5	>0.05
Treatment modality			
Medical treatment, %			>0.05
None	4.7	7.7	
Pirfenidone	39.5	46.2	
Nintedanib	51.2	46.2	
Refusal of treatment	4.7	–	
O_2 treatment			>0.05
None	65.1	69.2	
Present	34.9	30.8	

SD: Standard deviation, IPF: Idiopathic pulmonary fibrosis, OSA: Obstructive sleep apnea, SF-36: Short Form 36, GAP: Gender-age-physiology, FEV_1: Forced expiratory volume in the first second, FVC: Forced vital capacity, FEF 25–75: Forced expiratory flow between 25% and 75% of vital capacity, DLCO: Diffusing capacity of the lungs for carbon monoxide, KCO: Carbon monoxide transfer coefficient, 6MWT: 6-Minute Walk Test, TST: Total sleep time, SE: Sleep efficiency, REM: Rapid eye movement, OA: Obstructive apnea, MA: Mixed apnea, CA: Central apnea, AHI: Apnea-hypopnea index, ODI: Oxygen desaturation index

Four patients out of the 43 with a SRBD died before any treatment was initiated. Among the 18 patients who refused any treatment modality, 12 did not agree to use a PAP device. An alternative treatment option, such as positional therapy or an intraoral apparatus, was recommended to seven patients.

Discussion

IPF is a chronic and progressive lung disease that significantly decreases the quality of life. The management of IPF aims to maintain control with a stable clinical course. However, comorbidities such as SRBD can worsen quality of life and decrease survival time. Therefore, early diagnosis of diseases within the SRBD spectrum, particularly OSAS, is crucial for providing a better, more stable clinical course and longer survival time. The major findings of this study include the high prevalence of SRBDs in the IPF population and the significantly high scores on the Stop-Bang questionnaire, which may play an important role in investigating SRBDs, primarily OSAS, in IPF patients.

In this study, the prevalence rates of SRBDs and OSAS were found to be 78.1% and 72.7%, respectively, in a group of 55 IPF patients. Previous reports have indicated that the prevalence of OSAS in IPF patients is higher, ranging from 77–91%.[8–11] Similarly, a recent meta-analysis encompassing 18 studies investigated the prevalence of OSAS in patients with IPF and reported a prevalence rate of 75.7%.[12] In a study conducted in Türkiye, which included 17 patients with IPF, 82.3% were found to have OSAS after PSG assessment.[13]

Table 5: Comparisons of GAP index scores and stages between IPF patients without sleep-related breathing disorders and IPF patients with OSAS

	IPF patients without sleep-related breathing disorders (n=12)		Mild OSAS (n=25)		Moderate OSAS (n=9)		Severe OSAS (n=6)		p value
	n	%	n	%	n	%	n	%	
GAP index score (mean±SD)	3.7±1.4		4.0±1.2		4.2±1.2		4.3±0.8		0.760
GAP stage									0.562
Stage 1	6	50	9	36	3	33.3	0	0	
Stage 2	5	41.7	13	52	4	44.5	5	83.3	
Stage 3	1	8.3	3	12	2	22.2	1	16.7	

	IPF patients without sleep-related breathing disorders (n=12)	IPF Patients with OSAS (n=40)	p value
GAP index score (mean±SD)	3.7±1.4	4.1±1.1	0.510

OSAS: Obstructive sleep apnea syndrome

It is suggested that the coexistence of OSAS and IPF leads to a deterioration in quality of life and an increase in mortality. However, the association between these conditions and the underlying mechanism remains unclear. It has not been definitely established whether IPF causes SRBDs or vice versa.[9] A decrease in lung volume in IPF patients reduces caudal traction, compromising upper airway patency and resulting in increased collapse of the upper airway. This, combined with the increased respiratory load due to fibrosis and nocturnal desaturation secondary to alveolar hypoventilation, may explain the development of SRBDs during the course of IPF. Conversely, OSAS causes conditions such as intermittent hypoxia, sleep disruption, endothelial dysfunction, systemic inflammation, and oxidative stress due to pharyngeal collapse during nighttime sleep.[14] Repetitive traction damage, epithelial-mesenchymal damage, and an increase in collagen production due to inspiratory effort against a closed glottis and collapsed airway can lead to increased collagen production. The increase in transdiaphragmatic pressure resulting from OSAS may facilitate the development of Gastroesophageal Reflux Disease (GERD). Microaspirations secondary to GERD cause epithelial cell damage. Through this mechanism, OSAS is thought to contribute to fibrosis related to GERD.

Obesity and male gender are well-known prominent risk factors for OSAS. In a study by Mermigkis et al.,[15] the incidence of OSAS was found to be 61% in patients with IPF, and it was diagnosed only in moderately or severely obese patients. In our study, the mean Body Mass Index (BMI) was 26.5±2.4, which falls within the overweight classification. In this study, the mean age of IPF patients with SRBDs was 68.3 years, and this outcome of the present study was compatible with previous studies.[9,16,17] FVC% predicted value in spirometry can provide information for IPF severity. The mean FVC% predicted of IPF patients with SRBDs was 71.8% in this present study, nevertheless, there was no significant difference between two groups (71.8±17.8 vs. 68.8±12.4 p>0.05). Besides, recent previous papers reported similar FVC% predicted outcomes, ranging 71.3–72.8%, in IPF patients with obstructive sleep apnea.[9,18,19]

Table 6: Mean pressure levels of positive airway pressure devices

	Patients using CPAP (n=7)	Patients using BPAP – BPAP/ST (n=7)
IPAP (mean±SD)	–	10.5±3.2
EPAP (mean±SD)	5.2±1.1	5±2

CPAP: Continuous Positive Airway Pressure, BPAP: Bilevel Positive Airway Pressure, ST: Spontaneous Timed, IPAP: Inspiratory Positive Airway Pressure, EPAP: Expiratory Positive Airway Pressure

In a recent study, the sensitivity and specificity of the Stop-Bang questionnaire for the diagnostic evaluation of OSAS in the ILD spectrum were reported to be significantly high.[20] Similarly, in this study, the Stop-Bang questionnaire scores was high in IPF patients with a

SRBD, and moreover there was a statistically significant difference between the two groups (with/without SRBDs). Similar to the finding of a previous report, no significant difference was found between the groups in the comparison of Epworth sleepiness scale scores.[8] Additionally, in this present study, the categorical analysis of IPF symptoms revealed a significant difference between the two study groups, emphasizing the importance of a comprehensive assessment of the symptom spectrum in the IPF population. Notably, the co-occurrence of dyspnea and cough symptoms emerged as a salient indicator for investigating SRBDs in this patient population and highlights the necessity of PSG evaluation.

The average sleep time and sleep efficiency values were 314.3±86.5 minutes and 66.8%, respectively, in the study population. However, the average expected sleep time and sleep efficiency in the normal population are 480–600 minutes and above 85%, respectively. The remarkable decrease in these parameters was found to be compatible with the literature.[11,21] Previous reports on the PSG assessment of IPF patients revealed that the number of hypopnea episodes is higher than that of apnea. Canora et al.[11] found that the number of hypopneas was significantly higher than apnea in IPF patients. Pıhtılı et al.[13] reported significantly increased hypopnea episodes in patients with ILD and OSAS, with no apnea in the majority of them. They suggested that the low number of apneas is due to increased respiratory stimulation in ILD. In our study, both apnea and hypopnea numbers were found to be significantly higher in the group with SRBDs compared to the group without. Moreover, it was also attention-grabbing to note that the average number of hypopneas was higher than the average number of apneas in the group of IPF patients with an SRBD.

PAP devices are the primary treatment for SRBDs, especially in patients with moderate to severe OSAS. A meta-analysis emphasized that nocturnal hypoxemia in OSAS can trigger the development of pulmonary hypertension in IPF patients and increase mortality. It has also been suggested that CPAP treatment can improve IPF prognosis by reducing nocturnal desaturation.[12] Mermigkis et al.[22] reported that 37 newly diagnosed IPF patients with OSAS, who were treated with CPAP and had good adherence, showed improved quality of life at the end of a 1-year follow-up. However, no significant improvement in quality of life was observed in 18 patients with poor CPAP adherence. These findings are considered remarkable in supporting the idea that PAP treatment for OSAS in IPF reduces mortality, suggesting that effective CPAP treatment significantly improves daily activities, sleep quality, and overall quality of life. In this study, the adherence with the PAP device was 70% (14 of 20 patients). Similarly, Mermigkis et al.[22] reported a good compliance rate of 67.2% with PAP device use after 1 year of follow-up in the IPF population with obstructive sleep apnea.Papadogiannis et al.[23] reported that good adherence to PAP treatment, for more than six hours a day, resulted in higher survival rates in IPF patients with OSAS. They also noted that patients adhering to PAP treatment for more than four hours a day showed significant improvement in self-assessment tools such as the Epworth Sleepiness Scale, SF-36 questionnaire, Fatigue Severity Scale, and Pittsburgh Sleep Quality Index.

Additionally, in this study, the respiratory functions of all patients were evaluated with a spirometer, carbon monoxide diffusion test, and 6MWT. When comparing the parameters of these tests between the two study groups (patients with and without SRBDs), statistically significant differences were not observed.

One of the major limitations of this study is that the included IPF patients were already under antifibrotic treatment when they were enrolled in the study; there were no patients newly diagnosed with IPF before any treatment. Another limitation is the asymmetric distribution of SRBDs among the study groups.

Conclusion

The findings of this study confirm that the prevalence of SRBDs is considerably high in IPF patients. The Stop-Bang questionnaire can be considered an effective tool for screening SRBDs in IPF patients, thereby facilitating the planning of PSG for those patients. Furthermore, the authors concluded that a comprehensive evaluation of the symptom spectrum, particularly the predominance of dyspnea and cough coexistence, emerged as crucial data for investigating SRBDs in IPF patients. However, respiratory function test parameters showed no remarkable changes in IPF patients with SRBD, regardless of undergoing PAP treatment. Further prospective studies with larger patient series investigating the effect of treatment modalities on survival are warranted.

Ethics Committee Approval

The study was approved by the University of Health Sciences İzmir Tepecik Health Application Research Center Non-Interventional Ethics Committee (No: 2018/14-6, Date: 22/11/2018).

Authorship Contributions

Concept – G.V.Ş., E.Y.; Design – G.V.Ş., E.Y., G.P.; Supervision – E.Y., Ö.Y., F.D.Ü.; Funding – G.P., F.D.Ü.; Materials – F.D.Ü., Z.Z.U.; Data collection &/or processing – G.V.Ş., G.P.; Analysis and/or interpretation – G.V.Ş., Ö.Y.; Literature search – G.V.Ş., Ö.Y., Z.Z.U.; Writing – G.V.Ş., E.Y.; Critical review – F.D.Ü., Z.Z.U.

Conflicts of Interest

There are no conflicts of interest.

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