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Obstructive Sleep Apnea in Patients with Heart Failure and Atrial Fibrillation

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ABSTRACT

Background: Obstructive sleep apnea (OSA) is an independent risk factor for heart failure and atrial fibrillation. Therefore, effective detection and management of OSA are essential. **Objective:** The study aimed to determine how common obstructive sleep apnea is among patients with heart failure and atrial fibrillation. **Methods:** We performed a cross-sectional study assessing the prevalence of OSA in hospitalized patients with both conditions, following the latest European Society of Cardiology Guidelines for heart failure assessment and using polysomnography to evaluate OSA. **Results:** The study included 30 subjects; 22 (73.3%) were men, and 18 (60%) were over 60 years old. Polysomnography revealed that 23 (80.0%) had OSA, with 4 (23.5%) in the severe category and an average AHI of 18.3 ± 14.7. Among participants, 11 (65%) with ejection fraction ≤ 40%, 12 (40%) had obesity, 11 (36.7%) had Type 2 diabetes, 19 (63.6%) had hypertension, 20 (66.7%) had coronary artery disease, and 3 (10%) had a history of stroke. Most participants (60%) had a history of smoking. **Conclusion:** This study shows a high prevalence of OSA among patients with heart failure and atrial fibrillation, especially in men and those with reduced ejection fraction.

Keywords: atrial fibrillation, heart failure, obstructive sleep apnea

1. Introduction

Obstructive sleep apnea (OSA) is a widespread breathing disorder impacting nearly one billion people globally, with a prevalence between 9% and 38%. It serves as an independent risk factor for conditions such as hypertension, arrhythmia, heart failure, coronary artery disease, and stroke, and can also exacerbate heart failure and atrial fibrillation. Proper detection and treatment of OSA are vital to lowering the risk of cardiovascular complications in patients suffering from heart failure and AF [1-4].

In patients with heart failure, the prevalence of OSA ranges from approximately 11% to 45%, while in those with atrial fibrillation (AF), it is about 49% [5]. Several polysomnographic studies on heart failure patients have shown a variable incidence of OSA, between 12% and 53%, which is higher than in the general population [6]. However, the exact prevalence of OSA in heart failure patients with atrial fibrillation remains uncertain, especially since many previous studies relied only on patient history or questionnaires rather than polysomnography [7]. This study employed polysomnography to determine the prevalence of OSA among patients with heart failure and atrial fibrillation.

2. Methods

This descriptive study used a cross-sectional approach to collect data from patients admitted with heart failure and atrial fibrillation between March and June 2023. A total sampling method was applied due to the small sample size. The inclusion criteria included: (1) heart failure (regardless of left ventricular ejection fraction), (2) atrial fibrillation (AF), and (3) age over 18 years and willingness to participate. Heart failure diagnosis followed European Society of Cardiology (ESC) guidelines [8,9]. AF diagnosis was confirmed through ECG findings, including both paroxysmal and persistent AF cases. Obstructive sleep apnea (OSA) was evaluated and categorized using the Apnea-Hypopnea Index (AHI) based on polysomnography conducted after the acute phase stabilized, showing clinical improvement and no requirement for oxygen therapy. y).

3. Results

The baseline demographics of the subjects in this study are shown in Table 1, including 30 participants, of whom 22 were male and eight were female. Most participants were over 60 years old. The most common comorbidities were type 2 diabetes and hypertension, and many subjects had a history of smoking. According to their body mass index, only nine individuals had a normal weight. Echocardiography indicated that 53.3% of subjects had an ejection fraction of 40 or less, 13.3% had an ejection fraction between 41-50%, and 33.3% had an ejection fraction of 50 or higher. The average ejection fraction was 41.4 ± 2.7. Most subjects showed an increased left atrial volume index (LAVI), with 19 (63.3%) presenting a mean value of 38.1 ± 2.5.

Table 1. Baseline Characteristics

Variable	n = 30 (%)
Sex	
Female	8 (26.7)
Male	22(73.3)
Age (years)	
41-50	3 (10.0)
51-60	9 (30.0)
>60	18 (60.0)
BMI (kg/m^2)	
Normal (18.5-24.9)	9 (30)
Overweight (25.0-29.9)	9 (30)
Obesity class I (30.0-34.9)	9 (30)
Obesity class II (≥35.0)	3 (10)
LVEF (%)	
≥ 50	10 (33.3)
41-49	4 (13.3)
≤ 40	16 (53.3)
LAVi (ml/m2)	
<34	11 (36.7)
≥34	19 (63.3)
Comorbidities	
Type 2 DM	11 (36.7)
Hypertension	19 (63.3)
Coronary Artery Disease	20 (66.7)
Stroke	3 (10)
Smoker	
Yes	18 (60)
No	12 (40)

BMI: Body Mass Index; LVEF: Left Ventricle Ejection Fraction; LAVi: Left Atrial Volume Index; Type 2 DM: Type 2 Diabetes Mellitus.

Polysomnography examination showed that 80% of the subjects had OSA, with 11 (36.7%), 6 (20%), and 7 (23.3%) in the mild, moderate, and severe categories, respectively. The mean AHI was 17.8 ± 2.8, and the highest prevalence of OSA was found in males, namely 18 (60%). The subjects with an ejection fraction of 40 or lower had the highest prevalence of OSA, with 13 of them (43.3%).

Table 2. Polysomnography Result

Polysomnography	Number (%)
Non OSA (<5 events/hour of sleep)	6 (20)
Mild (5-14.9 events/hour of sleep)	11 (36.7)
Moderate (15-29.9 events/hour of sleep)	6 (20)
Severe (≥30 events/hour of sleep)	7 (23.3)

4. Discussion

OSA is a common type of sleep-disordered breathing that affects around 2-4% of middle-aged adults. When it occurs in patients with heart failure, OSA can lead to poor prognosis and a decrease in cardiac function progression. Nearly 50% of heart failure patients have OSA. Additionally, patients with AF have a higher prevalence of sleep apnea compared to those without AF. The prevalence of sleep apnea in AF patients can be 21%-74%, which is 10 times higher than in the normal population.[10] This study has revealed that the prevalence of OSA in patients with heart failure and atrial fibrillation is as high as 80%.

OSA severity, as recommended by the American Academy of Sleep Medicine, is determined by calculating the AHI, which is the average number of apneas and hypopneas per hour during sleep. The AHI value is used to classify OSA into three groups: Mild (AHI value 5-15), Moderate (AHI value >15-30), and Severe (AHI value >30).[9][11] According to this classification, our study revealed that 11 (36.7%) subjects had mild OSA, while 13 (43.3%) patients had moderate to severe OSA.

Research indicates that OSA can lead to the development and progression of cardiovascular diseases by impacting the heart's structural and functional remodeling. During sleep, OSA is characterized by repeated hemodynamic, hypoxemic, hypercapnic, and autonomic disturbances caused by intermittent collapse of the pharyngeal airway and significant changes in intrathoracic pressure as the body tries to reopen the airway. This cycle can worsen conditions like AF and HF by triggering parasympathetic activation, followed by surges in sympathetic activity and microarousals [12].

The importance of OSA has grown because of its connection to both fatal and nonfatal cardiovascular events, particularly in untreated cases [1,5,13]. Interestingly, the study found that over 40% of patients with heart failure and atrial fibrillation had moderate to severe OSA. However, this research did not assess how OSA affects clinical outcomes.

5. Conclusion

This study revealed a high rate of OSA among patients with heart failure and atrial fibrillation, indicating that the true prevalence in everyday clinical practice is probably underestimated. This highlights the critical need for accurate diagnosis to ensure proper treatment. However, the study has limitations, including a small sample size, being conducted at a single center, not having a control group, and assessing OSA only in hospitalized patients.

6. Data Availability Statement

The datasets generated and analyzed during this study are not publicly available due to privacy and ethical considerations, but can be accessed from the corresponding author upon reasonable request.

7. Ethical Statement

This study received approval from the Research Ethics Committee of the Faculty of Medicine, USU (No.871/KEPK/USU/2024).

8. Author Contributions

All authors participated in designing and implementing the research, analyzing data, and finalizing the manuscript.

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11. Conflict of Interest
The authors declare that there is no conflict of interest regarding the publication of this paper.

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