

ORIGINAL RESEARCH

Prevalence and Patterns of Sleep Apnea in Asian Indians With Heart Failure

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ABSTRACT

Background

Sleep-disordered breathing (SDB) is common in heart failure, and is associated with increased morbidity and mortality. The aim of the study is to determine the prevalence and patterns of sleep apnea in Asian Indian patients with heart failure.

Methods

This was a prospective, observational study of consecutive 60 cases of heart failure. All these patients were clinically assessed and evaluated for sleep apnea with sleep study. Apnea-hypopnea index (AHI) was used to determine the severity of sleep apnea.

Results

In this study of 60 patients, the mean age was 62 ± 8 years, with a higher prevalence of sleep apnea observed in older age groups. There was a male predominance, but it was not statistically significant. Approximately 51.7% of patients had a co-morbidity, with diabetes and hypertension significantly associated with sleep apnea. 43 (71.7%) were found to have sleep apnea, with varying degrees of severity. Central sleep apnea was present in 60.5% of sleep apnea patients, while obstructive sleep apnea was present in 39.5% of patients. Higher NYHA class, atrial fibrillation, higher dyspnea class, and elevated heart rate were significantly associated with sleep apnea.

Conclusion

Our study identified significant rates of undiagnosed sleep apnea in patients with chronic heart failure, with a higher prevalence of central sleep apnea. Patients with more heart failure symptoms were more susceptible to developing sleep apnea. Routine screening for sleep apnea using polysomnography is crucial in chronic heart failure patients. This comprehensive approach holds promise due to the bidirectional relationship between sleep apnea and heart failure.

Introduction

The aim of the study is to determine the prevalence and patterns of sleep apnea in Asian Indian patients with heart failure. Sleep-disordered breathing (SDB) is common in heart failure, and is associated with increased morbidity and mortality. (1) The two major phenotypes of SDB are obstructive sleep apnea (OSA) and central sleep apnea (CSA). OSA is a common sleep disorder characterized by repeated episodes of complete or partial blockage of the upper airway during sleep, leading to disrupted breathing patterns and intermittent hypoxemia. The reported prevalence of OSA is nearly 30-50% in heart failure patients (2). In CSA, the underlying abnormality is in the regulation of breathing in the brainstem respiratory centres; a modest rise in PaCO₂ (Partial pressure of carbon dioxide in arterial blood) during sleep results in inappropriate hyperventilation due to increased chemosensitivity. This hyperventilation decreases PaCO₂ below the apneic threshold and the neural drive to respire becomes too low to stimulate effective inspiration, resulting in an apnea (complete pause in breathing) or hypopnea (partial reduction in airflow). PaCO₂ subsequently rises and the cycle is repeated. Central sleep apnea occurs in 30-50% patients of heart failure with reduced ejection fraction (HFrEF) and 18-30% patients of heart failure with preserved ejection fraction (HFpEF) (3). The study intends to investigate the

frequency and severity of sleep apnea in this specific population. To determine the prevalence and severity of sleep apnea, the study will utilize polysomnography, which is the gold standard diagnostic test for sleep disorders. (4) Polysomnography involves monitoring various physiological parameters during sleep, such as brain waves, heart rate, respiratory effort, and oxygen saturation levels. The primary metric used to assess the severity of OSA is the apnea-hypopnea index (AHI), which quantifies the average number of apneic and hypopneic events per hour of sleep. Overall, by assessing the prevalence and pattern of sleep apnea in Asian Indian patients with heart failure, this study aims to contribute to the understanding of the relationship between these two conditions.

Materials & Methods

This study was a prospective, observational study conducted over a period of 12 months. 60 patients completed the study. It aimed to assess the prevalence and patterns of sleep apnea patients with heart failure. The study was conducted after obtaining institutional, departmental, and ethics committee clearances. The study included patients of either gender who presented with symptoms of CHF. The age of the enrolled patients was ≥ 18 years, and their body mass index (BMI) was less than 30 kg/m². Patients with a history of cerebrovascular accident (CVA), known OSA and patients on sedatives were excluded from the study. Patients enrolled were clinically assessed and evaluated. The baseline characteristics of the enrolled patients were recorded at the time of recruitment. Measurements of pulse and blood pressure were taken just prior to the polysomnography sleep study. Routine blood testing, electrocardiogram (ECG), chest X-ray, and echocardiography were performed to gather relevant data. The polysomnography, was conducted for all study participants. Polysomnography is the gold standard diagnostic test for sleep disorders. It involves monitoring various physiological parameters during sleep, such as brain waves, heart rate, respiratory effort, and oxygen saturation levels. These measurements help in determining the severity using the apnea-hypopnea index (AHI).

Statistical analysis

The study was statistically analyzed using the Statistical Package for the Social Sciences (SPSS) software version 22 (IBM Corp., Armonk, NY). The qualitative variables were analyzed by the chi-square or Fisher's exact test and quantitative variables by expressing as mean or median and comparisons with a student's test.

Results

The observations were captured and analyzed for sixty patients. The mean age of the study population was 62 ± 8 years. The majority of patients in the study belonged to the age group of 60-69 years, followed by 50-59 years, 70-79 years, and <50 years. Age was found to be significantly associated with sleep apnea, with a higher prevalence in older age groups. There was a male predominance in the study, but was not statistically significant. 65% of patients were males and 35% were females. The male-to-female ratio was 1.85:1. Approximately 51.7% of patients had a co-morbidity, while 48.3% had no co-morbidity. Diabetes and hypertension were significantly associated with sleep apnea and was seen in 35% and 41.67% of patients, respectively.

Out of 60 patients, 43 patients (71.7%) were found to have sleep apnea. (Table 1) The mean Apnea-Hypopnea Index (AHI) was 13.48 ± 11.12 , ranging from 1.02 to 57.30. Among patients with sleep apnea, 48.8% had mild sleep apnea, 41.9% had moderate sleep apnea, and 9.3% had severe sleep apnea. (Table 2) Central sleep apnea was present in 60.5% of sleep apnea patients, while obstructive sleep apnea was present in 39.5% of patients. (Table 3) Additionally, CSA patients had a higher AHI compared to OSA patients.

Various features associated with heart failure, such as dyspnea history, elevated heart rate, signs of right and left heart failure, and chest X-ray changes, were analyzed.

The study found that all patients had a history of dyspnea, with varying severity. All patients were in NYHA Class 2 or higher. 65% of patients were in NYHA Class 2, and 35% were in NYHA Class 3. The majority of patients (76.7%) had a normal sinus rhythm, while 23.3% had atrial fibrillation. Higher NYHA class, atrial fibrillation, higher dyspnea class, and elevated heart rate were also significantly associated with sleep apnea.

In conclusion, this study demonstrated significant associations between sleep apnea and various factors in patients with heart failure. Age, comorbidities such as diabetes and hypertension, NYHA class, atrial fibrillation, dyspnea severity, and elevated heart rate were identified as important factors associated with sleep apnea in this population. These findings emphasize the need for screening and managing sleep apnea in patients with heart failure, considering its potential impact on cardiovascular outcomes.

Table 1

Proportion of sleep apnea found in study population

Sleep Apnea	No. of cases	Percentage
Absent	17	28.3%
Present	43	71.7%
Total	60	100.0%

Table 2

Distribution of severity of sleep apnea among patients having sleep apnea

Severity of sleep apnea	No. of cases	Percentage
Mild	21	48.8%
Moderate	18	41.9%
Severe	4	9.3%

Table 3

Distribution of type of sleep apnea among patients of sleep apnea

Predominant type of sleep apnea	No. of cases	Percentage
CSA	26	60.5%
OSA	17	39.5%

Discussion

In our study, we enrolled patients with heart failure, regardless of whether they had symptoms of sleep apnea or sleep-disordered breathing. We aimed to diagnose latent or previously unrecognized sleep apnea in these patients. Similar studies by R. Schulz et al. and Arzt et al. also enrolled heart failure patients without sleep apnea symptoms to determine the prevalence of sleep apnea in this population. (5,6)

The mean age of our study population was 62 ± 8 years, which is consistent with the mean age reported in other studies by Sajit Kishan et al. and Ali Vazir et al. that evaluated sleep apnea in chronic heart failure patients. (7,8) However, the age in our study was lower than the mean age reported by Archana Rao and Mary Macdonald in their studies on the prevalence of sleep apnea in heart failure patients. (9,10)

Our study found a significant association between older age and sleep apnea (p-value=0.001) as well as its types (p-value < 0.05 for both obstructive and central sleep apnea). This finding is supported by studies conducted by Dai Yumino et al., Alexandra Paulino et al., and Michael Arzt et al., which also found that older age was a risk factor for sleep apnea in heart failure patients. (6,11,12) However, a study by R. Schulz et al. did not find a significant association between age and sleep apnea in their heart failure patients. (5)

In our study, there was a male preponderance, with 65% of patients being male and 35% being female. This is consistent with the findings of studies by Olaf Oldenburg et al. and Thomas Bitter et al., which also observed a high proportion of sleep apnea in male heart failure patients. (13,14) However, Shahrokh Javaheri et al. enrolled only male heart failure patients, while J Chan et al. found a female preponderance in their study. (15)

Interestingly, our study did not find a significant association between sleep apnea and gender (p-value=0.218), which is consistent with the findings of studies by Katherine Ferrier et al. and Mary MacDonald et al. (10,16) On the other hand, DD Sin et al. reported that male gender was a significant risk factor for sleep apnea in heart failure patients. (17)

All patients in our study had New York Heart Association (NYHA) class II or III heart failure, with the majority being in stable NYHA class II. This is consistent with the findings of studies by R. Schulz et al. and J Chan et al., which also included heart failure patients in NYHA class II or III. (5,18)

In our study, higher NYHA class was significantly associated with sleep apnea (p-value=0.019) and its types (p-value < 0.045 for none vs. CSA, p-value < 0.024 for none vs. OSA). This finding is consistent with studies conducted by Mary MacDonald et al. and Olaf Oldenburg et al., which found a significant association between higher NYHA class and sleep apnea in heart failure patients. (10,13) However, R. Schulz et al. did not find a significant association between NYHA class and sleep apnea in their study. (5)

The proportion of sleep apnea in our study population was 71.7%, with 43 out of 60 heart failure patients having latent and undiagnosed sleep apnea. Similar proportions were reported in studies by Thomas Bitter et al. and Katherine Ferrier et al., which found that approximately 69-68% of heart failure patients had sleep apnea. (14,16) However, there are studies reporting higher or lower proportions of sleep apnea in heart failure patients. (6,11)

There are some potential limitations to our study. It was a single centred study and sample size was small. Another limitation may be the fact that the prevalence of SDB in our hospital, which is a tertiary academic cardiac care unit, may be higher than community hospitals. The impact of sleep apnea on morbidity and mortality was not studied. Also, effect of CPAP treatment on such patients outcomes was not studied.

Conclusion

Our study findings reveal significant rates of undiagnosed sleep apnea among patients with chronic heart failure, with the central type of sleep apnea being the most prevalent. Furthermore, we observed that the severity of sleep apnea tends to be higher in cases of central sleep apnea. Several risk factors were identified, including increasing age, higher NYHA class, and comorbidities such as diabetes and hypertension. Notably, atrial fibrillation was found to be associated with an increased risk of central sleep apnea. Additionally, patients

exhibiting more symptoms and signs of heart failure demonstrated a higher susceptibility to developing sleep apnea.

Consequently, it is crucial to implement routine screening for sleep apnea in patients with chronic heart failure using polysomnography, the gold standard test. Such screening would facilitate appropriate treatment interventions, potentially influencing the progression and trajectory of both sleep apnea and heart failure. Given the bidirectional relationship between these conditions, this comprehensive approach has the potential to yield significant benefits.

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