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A Prospective, Observational, Comparative Study on the Relationship Between Sleep Disordered Breathing and Cardiac Disorders

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ABSTRACT

Sleep-disordered breathing (SDB) was first described in the medical literature in 1936. Obstructive sleep apnoea/hypopnoea syndrome (OSAHS) is the most common type of SDB, affecting 4% of men and 2% of women aged 30–65 years with a total population prevalence of 1–2%. There are many associations between cardiovascular diseases and sleep disordered breathing (SDB). The objective of the study is to determine the prevalence, risk factors, and severity for sleep disordered breathing in patients with cardiac disorders. A Prospective, Observational, Comparative Study on the Relationship between Sleep Disordered Breathing [SDB] and Cardiac Disorders was conducted in the Cardiology Department of a hospital in Coimbatore. The data was collected during ward rounds and severity of SDB measured with the help of two questionnaires: Epworth Sleepiness Scale and Stop-Bang questionnaire. A total of 93 cases with various cardiac disorders were analyzed. The results indicated that males (69.8%) were predominantly more than females (30.1%) in the study. The study shows that (31.1%) patients were observed with Ischemic Heart Disease condition, (31.1%) patients with Ischemic Heart Disease/Systemic Hypertension, (10.7%) patients had Systemic Hypertension as major diagnosis. Assessment using Epworth scale shows that (30.1%) patients had moderate risk, (27.9%) patients with severe risk and (24.7%) were having mild risk. Assessment using Stop- Bang shows that (49.4%) had intermediate risk, followed by (32.2%) patients with high risk and (18.2%) with low risk. The results demonstrated an increased risk for sleep disordered breathing in cardiac disorders.

Keywords: OSAHS, SDB, Stop-Bang Questionnaire, Epworth Sleepiness Scale

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INTRODUCTION

Poor sleep is among the most frequently reported symptoms among patients with cardiac disorders and is experienced by many as 75%. Factors that contribute to poor sleep in this population are multidimensional and may include demographic characteristics, (gender, aging) the pathophysiology of cardiac disorders, co-morbid health problems (pain, depression) symptoms of cardiac disorders, medication and primary sleep disorders. Sleep disordered breathing (SDB) encompasses a diverse group of disorders characterized by abnormal respiration during sleep. In patients with cardiac disorders, two types of sleep apnoea can be seen, obstructive and central sleep apnoea (OSA and CSA).SDB also complicates diseases of the neuro muscular system, chest wall, heart and lung. OSA results from upper airway collapse, whereas CSA arises from reductions in central respiratory drive. Some indicators or markers of SDB are sleep apnea, hypopnea (characterized by shallow breathing), snoring, snorting, daytime sleepiness, under sleeping, and oversleeping¹⁻⁵. There are many reasons for the growing prevalence of sleep disorder indicators, including the invention of artificial light, the rise of shift work, and 24-hour manufacturing. Some risk factors for SDB have been identified, including age, gender, and body mass index (BMI)^{6,7}.Sleep disordered breathing (SDB) has a higher prevalence in the population with cardiovascular disease, which seems to link to the pathophysiology of the disease⁸. The prevalence of SDB, defined as an apnoea-hypopnoea index (AHI) of 5 or higher, has been estimated at 24% for men and 9% for women in the general population⁹. Epidemiologic studies in random samples of subjects have estimated the prevalence of sleep apnea with functional impairment, the sleep apnea syndrome, in the general adult population to be 1 to 4%^{10,11}. A high prevalence of sleep apnea has been reported in patients with hypertension², and sleep apnea may increase cardiovascular morbidity and mortality¹²⁻¹⁴. There are many associations between cardiovascular diseases and sleep disordered breathing (SDB). In particular, the obstructive form of SDB (obstructive sleep apnoea, OSA) has been identified as an important risk factor for a variety of cardiovascular diseases such as arterial hypertension, coronary artery disease and atrial fibrillation¹⁵. On the other hand, central sleep apnoea (CSA) has mainly been associated with chronic congestive heart failure (CHF) and carries a significantly adverse prognosis¹⁶. The mechanistic link between SDB and cardiac disease is not yet fully understood. OSA is believed to be a risk factor for many cardiac diseases by inducing increases in afterload as well as elevations in systemic blood pressure secondary to hypoxia and increasing sympathetic nervous system activity during sleep disordered breathing events. These factors ultimately exert harmful effects on the cardiovascular system¹⁵.

Such a mechanism may also be the underlying cause of the development of calcific aortic stenosis, which shares the same risk factors with coronary artery disease. The current theory of cardiovascular pathogenesis in CSA, in brief, involves pulmonary congestion secondary to heart failure that leads to chronic hyperventilation from repeated pulmonary vagal irritant receptor stimulation. This, in turn, facilitated by enhanced chemo sensitivity to CO₂, drives the PaCO₂ below the apnoea threshold, and triggers episodes of apnoea.

Epidemiologic studies in random samples of subjects have estimated the prevalence of sleep apnea with functional impairment, the sleep apnea syndrome, in the general adult population to be 1 to 4%. A high prevalence of sleep apnea has been reported in patients with hypertension, and sleep apnea may increase cardiovascular morbidity and mortality. In an 18 year follow-up of the Wisconsin Sleep Cohort, the adjusted hazard ratio for all-cause mortality with severe versus no SDB was 3.0 and the CVD specific hazard ratio was 5.2¹⁷. Similarly, a 14 year follow-up of the Busselton Health Study found the fully adjusted hazard ratio for all-cause mortality associated with moderate to severe OSA was 6.24¹⁸. However, in both studies, confidence intervals were wide, and the precision of the estimate is uncertain. More recently, with an average follow-up duration of 8.2 years, SHHS found a fully adjusted hazard ratio for all-cause mortality of 1.46 with much narrower confidence intervals. Treatment of OSAHS with continuous positive airway pressure (CPAP) has lowered blood pressure, reduced the frequency and severity of some arrhythmias, and improved markers of endovascular inflammation. CPAP has had a mild positive effect on left ventricular function in chronic heart failure by treating co-existent SDB, but it has not improved mortality, possibly because it does not fully treat associated CSA. Clinicians need to be aware of the increasing associations of SDB, especially OSAHS, with cardiovascular dysfunction, as treatment of co-existent SDB will not only improve sleepiness, quality of life, and driving risk, but there is growing evidence that it may also reduce cardiovascular risk itself, even in non-sleepy subjects.

MATERIALS AND METHOD

The study was conducted in a 750 bedded multi-specialty hospital in the Cardiology department located at Coimbatore. A prospective observational study was conducted for six months from March 2016 to August 2016. The study was carried out after obtaining the consent from the hospital authorities and patients.

Inclusion criteria

Patients with cardiac disorders, admitted in department of Cardiology who are willing to participate in the study.

Exclusion criteria

Patients admitted for more than one week after stroke onset, with coma and those who are not willing to participate in the study and patients with insufficient data in their records. The data were collected during daily ward rounds with the help of a specially designed data entry form. Two questionnaires: stop- bang and Epworth sleepiness scale were used to assess the severity of sleep disordered breathing in cardiac patients.

RESULTS AND DISCUSSION

A total of 93 cardiac patients were enrolled in the study. Out of that, 65 (69.8%) were males and 28 (30.1%) were female population [Table1]. In the study, analysis of Stop- Bang shows that (30.1%) men and (2.1%) women with high risk. ESS analysis found that (22.5%) men and (5.3%) women at severe risk. Similar study conducted by Toru Inami (MD) *et al* (2012) also reported that the prevalence of SDB, defined as an apnea-hypopnea index (AHI) of 5 or higher, has been estimated at 24% for men and 9% for women in the general population. The major Cardiovascular Complications include IHD (28), SHT (9), CCF(1), MI/SHT(2), MI (4), IHD/SHT (28), IHD/CCF (4), IHD/MI (6), CHF/SHT (3), SHT/IHD/MI (4), SHT/CHF/IHD (4)(fig1). Out of 93 patients enrolled in the study,(30.1%) patients were having IHD, (30.1%) patients were having a combination of IHD/SHT followed by (10.7%) with SHT and (7.5%) patients were having IHD/MI [Table 2]. A similar study conducted by Toru Inami (2012) shows that the prevalence of SDB in patients with cardiovascular disease is known to be two- or three-fold greater than for populations without cardiovascular disease.

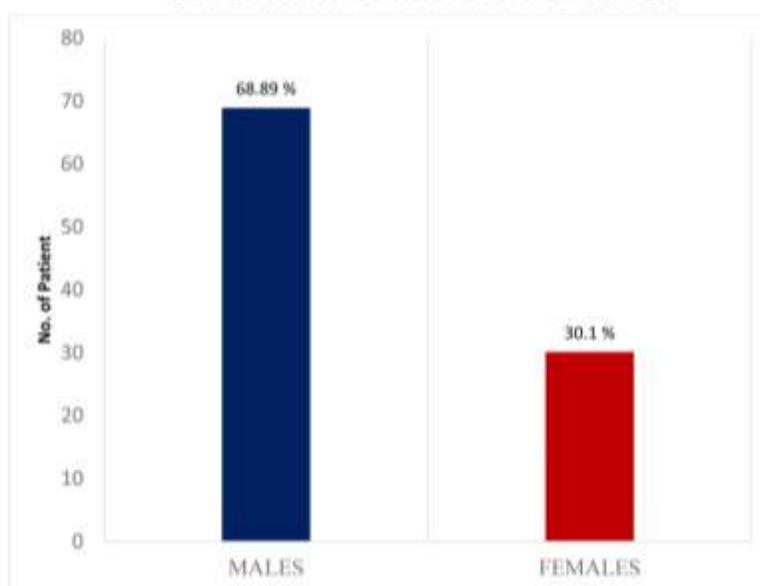


Figure 1: Classification of cases based on gender

Table 1 Classification of cases based on gender (n=93)

Gender	No. of patients	Percentage
Male	65	69.89%
Female	28	30%

Table 2: Prevalence of diseases (n=93)

Cardiovascular disorders	Occurrence	Percentage
IHD	28	29
SHT	9	10
CHF	1	5
MI	4	1
MI/SHT	2	2
IHD/SHT	28	29
IHD/CCF	4	5
IHD/MI	6	7
CHF/SHT	3	3
SHT/IHD/MI	4	5
SHT/CHF/IHD	4	4

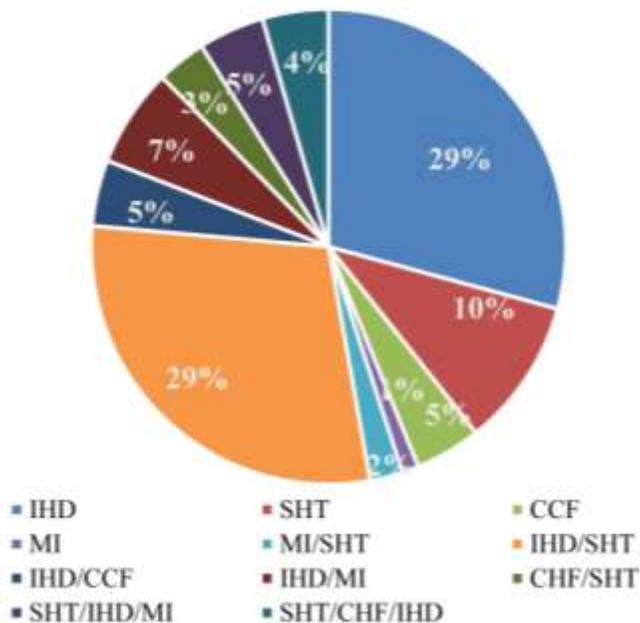


Figure 2: Prevalence of diseases

Assessment using ESS shows that 30.1% patients having moderate risk, 27.9% patients with severe risk, 24.7% patients with mild risk and 17.2% were normal [Table 3]. Assessment using Stop-Bang shows that 49.4% patients were with intermediate risk, 32.2% were having high risk and 18.2% patients with low risk [Table 4]. A similar study conducted by Toru Inami *et al* (2012) shows that the prevalence of AHI less than 5 was 9%, \leq AHI < 15 was 45%, $15 \leq$ AHI < 30 was 27%, and greater than or equal to 30 was 19% of the patients. Another study conducted by Terry

Young *et al* (2008) shows that the prevalence of moderate or severe SDB is estimated to be at least 6% for US adults; moreover, 17% of adults are estimated to have mild or worse SDB.

Table 3: Assessment using Epworth Sleepiness Scale (n=93)

Severity	No. of patients	Percentage
Normal (0-10)	16	17.2%
Mild (11-14)	23	24.7%
Moderate (15-18)	28	30.1%
Severe (19-24)	26	27.9%

Table 4: Assessment using Stop-Bang Questionnaire

Severity	No, of patients	Percentage
Low	17	18.2
Intermediate	46	49.4
High	30	32.2

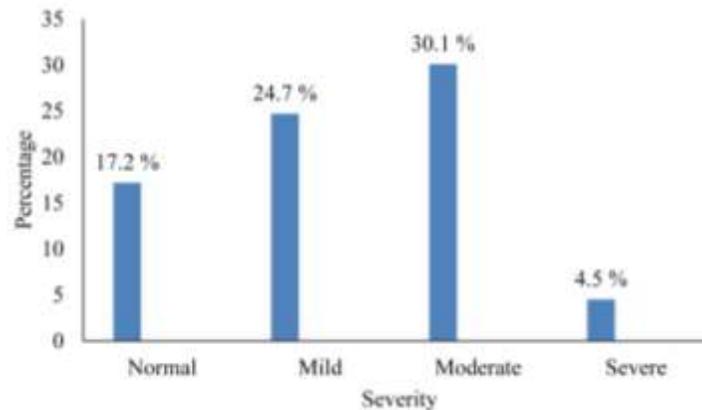


Figure 3: Assessment using Epworth Sleepiness Scale

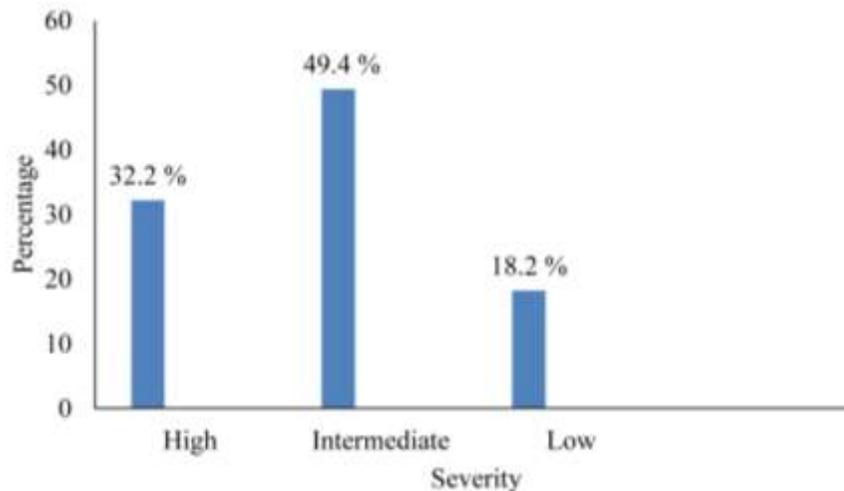


Figure 4: Assessment using Stop Bang Questionnaire

In our study, 39.7% patients were having diabetes mellitus [Table5]. This shows a strong association of diabetes with SDB and cardiac disorders. In a similar study conducted by Kamran

Mahmood et al, it was examined that the prevalence of type 2 DM was 30.1% in the group with OSA compared in those without OSA.

Table 5: Association with diabetes (n=93)

Association	No. of patients	Percentage
Without DM	56	60.2%
DM	37	39.7%

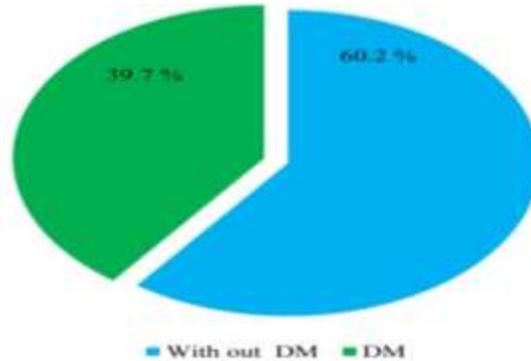


Figure 5: Association with diabetes

Examination of other comorbidities showed that 8.6% were having BA/COPD disease, 6.4% patients with CVA and 5.3% patients with hypothyroidism [Table6]. A study conducted by Mihaela Teodorescu et al found that asthma was associated with an increased risk of new onset OSA.

Table 6: Association with other diseases

Diseases	Occurrence
BA/COPD	8
CVA	6
Hypothyroidism	5
Anaemia	5
Pulmonary Edema	4

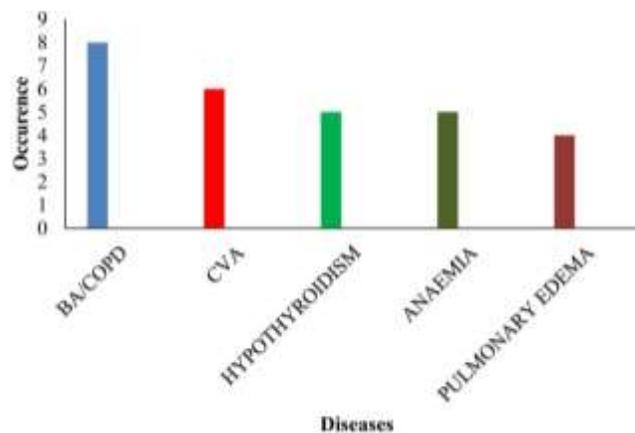


Figure 6: Association with other diseases

Examination of the risk factors revealed that 31.1% patients were having chest pain as the major complaint followed by 27.9% patients with complaint of dyspnoea [Table7]. A study conducted by Hagman M et al shows that dyspnoea was reported in 21% of the total population and in 70% of the angina population.

Table 7: Comparison between risk factors (n=93)

Risk Factors	No. of patients	Percentage
Dyspnoea	26	27.9%
Chest Pain	29	31.1%
Both chest pain &Dyspnoea	15	16.1%
Others	23	24.7%

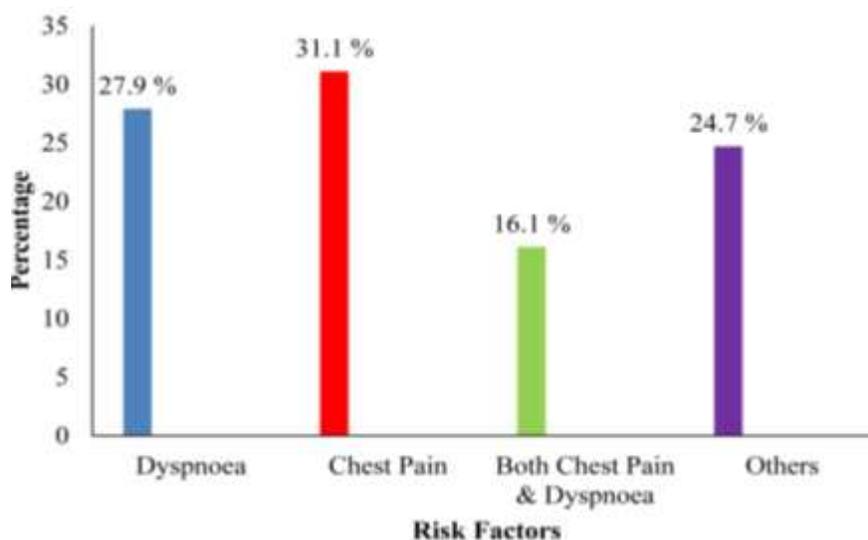


Figure 7: Comparison between risk factors

Analysis of BMI showed that 56.9% patients with normal weight (BMI:18.5-24.9),25.8% patients were overweight, 6.4% were obese and 6.4% patients were underweight [Table 8]. In a study conducted by Kohler MJ et al reported that there is an increased risk for OSAHS in association with overweight and obesity in adults.

Table 8: Categorization based on BMI

BMI	No. of patients	Percentage
<18.5	6	6.4%
18.5-24.9	53	56.9%
25-29.9	24	25.8%
>30	6	6.4%
Unable to stand	4	4.3%

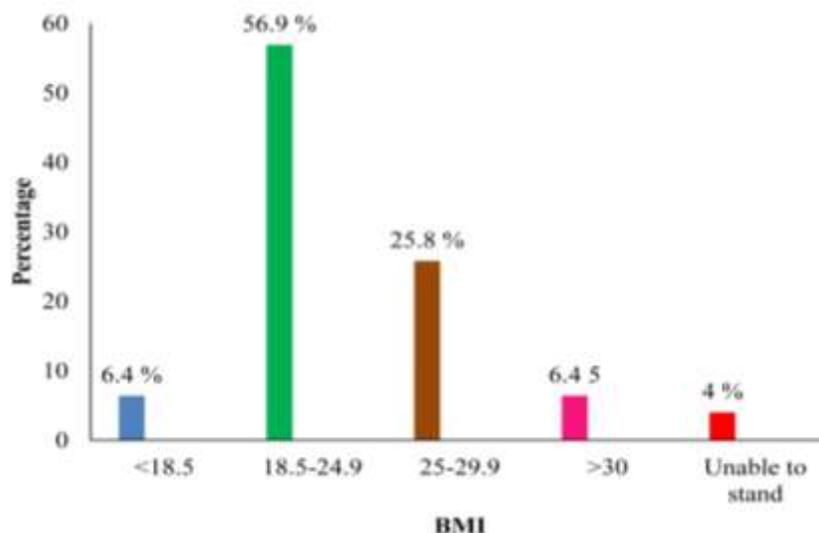


Figure 8 Categorization based on BMI

CONCLUSION

The outcome of this study revealed a positive association between Sleep Disordered Breathing and various cardiac disorders. A total of 93 cases with various cardiac disorders were analyzed and the results indicated that males (69.8%) were predominantly more than females (30.1%) in the study. The study shows that (31.1%) patients were observed with IHD condition, (31.1%) patients with IHD/SHT, (10.7%) patients had SHT as major diagnosis. Assessment using ESS shows that (30.1%) patients had moderate risk, (27.9%) patients with severe risk and (24.7%) were having mild risk. Assessment using Stop- Bang shows that (49.4%) had intermediate risk, followed by (32.2%) patients with high risk and (18.2%) patients with low risk. The study results revealed that (39.78%) observed were affected with diabetes mellitus and thus diabetes has a strong association with cardiovascular disorders. Further analysis shows that (31.1%) patients had chest pain as major reason for admission followed by (27.9%) patients with dyspnoea. This reveals an association between SDB and cardiac disorders.

The results demonstrated an increased risk for SDB in cardiac disorders. It is necessary to make aware of the cardiac patients about the SDB condition in them as early recognition will improve the quality of life. Awareness of the association of cardiovascular disease and SDB will prompt the general practitioner to look for both illnesses when presented with one of them. There is no doubt that CPAP and other treatments for SDB will make symptomatic patients who happen to have a cardiac disease feel better. Future research must be directed to improve cardiovascular outcomes by treating SDB more effectively in non-sleepy patients.

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