

## Left Ventricular Systolic Dysfunction in Patients of Obstructive Sleep Apnea Syndrome

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### ABSTRACT

**Objective:** To determine the left ventricular systolic dysfunction and the association of various factors with this dysfunction in patients with obstructive sleep apnea syndrome.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Pak Emirates Military Hospital, Rawalpindi Pakistan, from Dec 2020 to May 2021.

**Methodology:** We included the patients diagnosed with sleep apnea syndrome by a consultant pulmonologist based on a sleep study. Patients were labelled as having left ventricular systolic dysfunction if the ejection fraction was less than 40% on echocardiography.

**Results:** Eighty patients diagnosed with sleep apnea syndrome were included in the study. The mean age of the study participants was 48.551±9.971 years. Out of 80 patients, 19(23.75%) had left ventricular systolic dysfunction on echocardiography, while 61(76.25%) had no evidence of left ventricular systolic dysfunction. With the application of relevant statistical tests, we found that patients with high body mass index and the presence of comorbid illnesses had a statistically significant relationship ( $p$ -value<0.05) with the presence of left ventricular systolic dysfunction among patients with sleep apnea syndrome.

**Conclusion:** Considerable number of patients suffering from obstructive sleep apnea syndrome showed the presence of left ventricular systolic dysfunction on echocardiography. High Body mass index and comorbid illnesses emerged as risk factors for left ventricular systolic dysfunction in our study population.

**Keywords:** Body mass index (BMI), Left ventricular systolic dysfunction, Obstructive sleep apnea syndrome (OSAS).

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## INTRODUCTION

Cardiac diseases have been highly prevalent globally, and heart failure is one of the leading causes of mortality and morbidity among patients of all age groups.<sup>1</sup> A lot of non-cardiac clinical conditions may be cause or consequence of heart failure among the patients suffering from this condition.<sup>2,3</sup> Sleep apnea syndrome is a relatively common diagnosis now a day's due to widely available sleep studies.<sup>4</sup> This syndrome is not limited to the disturbance in sleep architecture but affects almost all the systems of the human body, making overall quality of life compromised. Respiratory and cardiovascular systems are the most affected systems in patients sleep apnea syndrome.<sup>5,6</sup>

Cardiac problems and sleep apnea syndrome have an established relationship. A meta-analysis concluded that patients with sleep apnea syndrome are more prone to develop cardiac abnormalities, including left ventricular systolic dysfunction.<sup>7</sup>

An increase in the availability of sleep studies has

enabled clinicians to diagnose obstructive sleep apnea with more precision and confidence.<sup>8,9</sup> A recent study concluded that obstructive sleep apnea had been a common condition in our set up and clinicians that are more expert are required to deal with the disease burden efficiently.<sup>10</sup> Limited local data has been available regarding relationship of left ventricular function and obstructive sleep apnea syndrome. Therefore, we planned this study to look for left ventricular systolic dysfunction and the association of various factors with this dysfunction in patients with obstructive sleep apnea syndrome.

## METHODOLOGY

The cross-sectional study was conducted at the Pulmonology Department of Pak Emirates Military Hospital, Rawalpindi Pakistan, from December 2020 to May 2021. Ethical approval for the study was obtained from the Ethical Review Board Committee (IREB No. A/28/EC/305/2021) of the concerned hospital. The sample size was calculated using the WHO sample size calculator taking the population proportion of left ventricular involvement in obstructive sleep apnea as 75%.<sup>5</sup> Non-probability consecutive sampling technique was used to gather the sample.

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**Inclusion Criteria:** All the patients diagnosed with sleep apnea syndrome based on a sleep study by a consultant respiratory physician were included in the study. Left ventricular systolic dysfunction was diagnosed by a consultant cardiologist based on an ejection fraction of less than 40% on an echocardiogram.

**Exclusion Criteria:** Patients less than 18 years or more than 65 years of age or those who were already diagnosed with ischemic heart disease or any cardiac abnormality and taking any medications for that cardiac ailment were excluded from the study. Patients with heart failure with more than 40% ejection fraction were also excluded from the study. Patients on any medications which could interfere with cardiac function were also not included in the study. Patients diagnosed with any cardiac condition before the diagnosis of obstructive sleep apnea syndrome were also not included in the study.

Subjects were provided with a detailed description of the study and were inducted into the study after written informed consent. After confirmation of the diagnosis of obstructive sleep apnea syndrome, echocardiography was performed on the patients in the cardiology unit of our hospital.

Comorbid illnesses included in the analysis were type 2 diabetes mellitus and hypertension. The diagnosis was confirmed by looking in old charts or contacting their treating physician. In addition, body mass index (BMI) was calculated as part of routine physical examination on all the patients included in the study. Interpretation of findings of BMI was made as BMI<25 as normal, BMI>25 overweight or obese.<sup>11,12</sup> All these relevant socio-demographic variables were recorded in the proforma designed for this study.

All statistical analysis was performed using Statistics Package for Social Sciences version 23.0 (SPSS-23.0). Characteristics of participants and the distribution of the left ventricular systolic dysfunction among the study participants were described by using descriptive statistics. In addition, Chi-square was done to evaluate the relationship of age, gender, presence of comorbid illness and body mass index with the left ventricular systolic dysfunction among the study participants. Differences between groups were considered significant if *p*-values were less than or equal to 0.05.

**RESULTS**

A total of 80 patients were included in the study. Out of 80 patients diagnosed with sleep apnea syndrome, 19(23.75%) had left ventricular systolic

dysfunction on echocardiography, while 61(76.25%) had no evidence of left ventricular systolic dysfunction. The mean age of the study participants was 48.551±9.971 years. In addition, 43(53.75%) were male, while 37(46.25%) were female (Table-I). Using the Pearson chi-square analysis, we found that patients with high body mass index (*p*-value-0.001) and the presence of comorbid illnesses (*p*-value-0.004) had a statistically significant relationship with the presence of left ventricular systolic dysfunction among the patients of sleep apnea syndrome (Table- II).

**Table-I: Characteristics of Study Participants (n=80)**

Parameters	n(%)
<b>Age (years)</b>	
Mean±SD	48.551±9.971 years
Range (Min-Max)	24 years-59 years
<b>Gender</b>	
Female	37(46.25%)
Male	43(53.75%)
<b>Left Ventricular Systolic Dysfunction</b>	
No	61(76.25%)
Yes	19(23.75%)
<b>Body Mass Index</b>	
Normal	39(48.75%)
Overweight or obese	41(51.25%)

**Table-II: Characteristics of the Study Group and Left Ventricular Systolic Dysfunction Among the Patients of Sleep Apnea Syndrome (n=80)**

	Normal Left Ventricular Systolic Function (n=61)	Left Ventricular Systolic Dysfunction (n=19)	<i>p</i> -value
<b>Age</b>			
40 year or less	31(50.8%)	08(42.1%)	0.506
>40 years	30(49.2%)	11 (57.9%)	
<b>Gender</b>			
Male	33(54.1%)	10(52.6%)	0.911
Female	28(45.9%)	09(47.4%)	
<b>Presence of Comorbid Diseases</b>			
No	42(68.8%)	06(31.6%)	0.004
Yes	19(31.2%)	13(68.4%)	
<b>Body Mass Index</b>			
Normal	36(59.1%)	03(15.8%)	0.001
over weight	25(40.9%)	16(84.2%)s	

**DISCUSSION**

Obstructive sleep apnea syndrome is a syndrome because of the involvement of multiple body systems, and recent epidemiological data confirms the increasing magnitude of this problem.<sup>13,14</sup> It becomes important for the treating team to identify all the health-related problems the patient faces and identify the high-risk patients for serious health consequences.

We conducted this study to look for left ventricular systolic dysfunction and the association of various factors with this dysfunction in patients with obstructive sleep apnea syndrome.

Hanlon *et al.* investigated the association of obstructive sleep apnea and left ventricular hypertrophy in obese and overweight children with a history of elevated blood pressure. They concluded that obstructive sleep apnea is significantly associated with left ventricular hypertrophy and dysfunction among young patients. They also concluded that the more severe the sleep apnea, the more the chances of having left ventricular hypertrophy.<sup>15</sup> Our findings supported their results as a considerable number of our study participants had left ventricular systolic dysfunction.

Myslinski *et al.*<sup>16</sup> studied a similar phenomenon from another angle and compared polygraphic parameters and selected laboratory parameters in patients with obstructive sleep apnea (OSA) who develop various types of left ventricular (LV) geometry. Their findings were that left ventricular eccentric hypertrophy was the commonest type of left ventricular geometry in patients with obstructive sleep apnea syndrome. Patients with severe sleep-disordered breathing were more likely to develop concentric hypertrophy than those with mild or moderate problems. A meta-analysis of echocardiographic studies targeted the association between obstructive sleep apnea (OSA) and left ventricular hypertrophy.<sup>17</sup> They included nine studies in their meta-analysis with 1,760 patients and 1,284 controls. They concluded that concentric left ventricular hypertrophy was the commonest finding on echocardiography among patients with obstructive sleep apnea, and they recommended routine echocardiography evaluations in these patients.

Deng *et al.*<sup>18</sup> from China, concluded that male gender, high body mass index, systolic and diastolic blood pressure and use of antihypertensive drugs were associated with compromised left ventricular function. We generated similar results as our data also showed that comorbid Type-2 DM, Hypertension and high BMI had a statistically significant relationship with left ventricular systolic dysfunction among patients suffering from sleep apnea syndrome.

### LIMITATIONS OF STUDY

We had no baseline knowledge of the left ventricular function of the patients before the diagnosis of obstructive sleep apnea syndrome. The study design, therefore, does not establish the cause-effect relationship between sleep apnea syndrome and left ventricular systolic dysfunction.

### CONCLUSION

A considerable number of patients suffering from obstructive sleep apnea syndrome showed the presence of left ventricular systolic dysfunction on echocardiography. In addition, high Body mass index and comorbid illnesses emerged as risk factors for left ventricular systolic dysfunction in our study population.

**Conflict of Interest:** None.

### Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

ZAS & MZHM: Conception, study design, drafting the manuscript, approval of the final version to be published.

RA & IZG: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

AMS & SKA: Critical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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