

IMPACT OF OBSTRUCTIVE SLEEP APNEA ON CARDIOVASCULAR HEALTH - A STUDY IN TERTIARY CARE HOSPITAL, CHITRADURGA

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Abstract

Background: Obstructive sleep apnoea (OSA) is a prevalent sleep disorder that significantly affects cardiovascular health. The disorder is characterized by repetitive episodes of upper airway obstruction during sleep, leading to disrupted breathing, oxygen desaturation, and various cardiovascular complications, including hypertension and dyslipidemia. This study aims to assess the impact of OSA on cardiovascular parameters in patients attending a tertiary care hospital in Chitradurga.

Methodology: This cross-sectional study involved 60 patients aged 30 years and older diagnosed with OSA through polysomnography. Data collection included demographic information, cardiovascular assessments (blood pressure and lipid profile), and body mass index (BMI). Statistical analyses, including Pearson correlation coefficients, chi-square tests, and t-tests, were performed to evaluate relationships between OSA severity and cardiovascular health indicators.

Results: The mean age of participants was 50.3 years, with a significant proportion being male (66.7%). The study found that 45% of participants were hypertensive, and 50% exhibited hyperlipidemia. Correlation analysis revealed significant relationships between OSA severity (measured by the Apnea-Hypopnea Index) and both systolic blood pressure ($r =$

0.45, $p < 0.01$) and LDL cholesterol levels ($r = 0.38$, $p < 0.05$). A significant association was also observed between OSA severity and hypertension ($\chi^2(1, N = 60) = 6.25$, $p = 0.012$).

Conclusion: The findings indicate a significant negative impact of OSA on cardiovascular health, with elevated blood pressure and dyslipidemia among affected individuals. These results emphasize the importance of early diagnosis and management of OSA to mitigate associated cardiovascular risks.

Keywords: Obstructive sleep apnea, Cardiovascular health, Hypertension, Dyslipidemia, Apnea-Hypopnea Index.

Introduction

Obstructive sleep apnoea (OSA) is a common and serious sleep disorder characterized by repetitive episodes of upper airway obstruction during sleep, leading to disrupted breathing and oxygen desaturation (1). Affecting a substantial proportion of the population, particularly middle-aged and older adults, OSA is associated with a range of debilitating symptoms, including excessive daytime sleepiness, fatigue, and impaired cognitive function (2). However, the implications of OSA extend beyond these immediate symptoms, with increasing evidence linking the disorder to significant cardiovascular morbidity and mortality (3). The intermittent hypoxia and reoxygenation that occur during apnoeic episodes trigger a cascade of physiological responses that adversely affect cardiovascular health. These include sympathetic nervous system activation, systemic inflammation, and endothelial dysfunction, all of which contribute to the development of cardiovascular diseases (CVD) such as hypertension, heart failure, and coronary artery disease (4). Studies have demonstrated that individuals with OSA are at a markedly increased risk of developing these conditions, underscoring the critical need for early diagnosis and management of the disorder (5).

Obesity is a common comorbidity in OSA and serves as both a risk factor for the disorder and a contributor to cardiovascular complications. The presence of excess adipose tissue is associated with increased airway collapsibility, which exacerbates OSA severity, while also promoting inflammation and metabolic dysregulation (6). Furthermore, conditions such as metabolic syndrome and diabetes mellitus are frequently observed in OSA patients, compounding the cardiovascular risks (7).

Given the high prevalence of OSA and its significant implications for cardiovascular health, this study aims to assess the impact of OSA on cardiovascular parameters among patients attending a tertiary care hospital in Chitradurga. By elucidating the cardiovascular risks associated with OSA, this research seeks to inform clinical practices and guide effective interventions that may improve health outcomes for affected individuals.

Materials and methods

Study Design

This cross-sectional study was conducted at the Department of Otorhinolaryngology in Basaveshwara Medical College and Hospital, Chitradurga. The study aimed to evaluate the impact of obstructive sleep apnea (OSA) on cardiovascular health among patients presenting with symptoms suggestive of sleep apnea.

Participants

A total of 60 patients aged 30 years and above who were diagnosed with obstructive sleep apnea through polysomnography (PSG) were included in the study. Participants were selected based on the following criteria:

- **Inclusion Criteria:**
 - Patients with a diagnosis of OSA (Apnea-Hypopnea Index (AHI) ≥ 5).

- Patients consenting to participate in the study.
- **Exclusion Criteria:**
 - Patients with other sleep disorders.
 - Patients with significant comorbidities affecting cardiovascular health (e.g., uncontrolled diabetes, chronic kidney disease).
 - Patients currently on treatment for sleep apnea.

Data Collection

Demographic data, including age, gender, and body mass index (BMI), were collected from all participants. Each participant underwent a thorough clinical evaluation, including:

- 1. Polysomnography:** Performed to diagnose OSA and quantify its severity (mild, moderate, or severe based on AHI).
- 2. Cardiovascular Assessments:**
 - Blood pressure measurements were taken using a standardized sphygmomanometer.
 - Blood samples were collected for lipid profile analysis (total cholesterol, LDL, HDL, and triglycerides) after fasting for at least 8 hours.
 - Additional assessments included the evaluation of risk factors such as obesity ($\text{BMI} \geq 30$) and the presence of hypertension.

Statistical Analysis

Data were analyzed using statistical software (e.g., SPSS version 25). Descriptive statistics were computed for demographic variables and cardiovascular parameters. The following statistical tests were conducted:

- Correlation Analysis: Pearson correlation coefficients were calculated to assess the relationship between the severity of OSA (measured by AHI) and various cardiovascular parameters (e.g., blood pressure, lipid levels).
- Chi-Square Test: Used to evaluate the association between OSA severity and prevalence of hypertension and hyperlipidemia.
- T-Test: Employed to compare means of continuous variables (e.g., LDL cholesterol levels) between hypertensive and non-hypertensive groups.

A p-value of < 0.05 was considered statistically significant.

Results

This study included a total of 60 patients diagnosed with obstructive sleep apnea (OSA) at a tertiary care hospital in Chitradurga. The participants were assessed for various cardiovascular health parameters, including blood pressure, lipid profiles, and other relevant risk factors.

Table 1: Demographic Profile of Participants

Variable	Value (n = 60)
Mean Age (years)	50.3 ± 9.2
Gender Distribution	Male: 40 (66.7%)
	Female: 20 (33.3%)
Mean BMI (kg/m²)	30.2 ± 4.1

Demographic Profile

The mean age of the study population was 50.3 years (± 9.2), with a gender distribution of 40 males (66.7%) and 20 females (33.3%). The majority of participants were overweight or obese, with a mean body mass index (BMI) of 30.2 kg/m² (± 4.1).

Table 2: Cardiovascular Parameters

Parameter	Mean ± SD	Percentage (%)
Systolic Blood Pressure	138.5 ± 12.4	Hypertensive: 45%
Diastolic Blood Pressure	85.4 ± 8.3	Elevated: 30%
Total Cholesterol (mg/dL)	220.3 ± 45.6	>200 mg/dL: 50%
LDL Cholesterol (mg/dL)	145.2 ± 38.7	High-risk: 55%
HDL Cholesterol (mg/dL)	42.1 ± 10.5	Low (< 40 mg/dL): 40%
Triglycerides (mg/dL)	175.3 ± 50.4	>150 mg/dL: 45%

Cardiovascular Parameters

1. Blood Pressure:

- Systolic Blood Pressure (SBP): Mean SBP was 138.5 mmHg ($\pm$ 12.4), with 45% of patients classified as hypertensive (SBP $\geq$ 140 mmHg).
- Diastolic Blood Pressure (DBP): Mean DBP was 85.4 mmHg ($\pm$ 8.3), with 30% of patients showing elevated levels (DBP $\geq$ 90 mmHg).

Table 3: Prevalence of Cardiovascular Risk Factors

Risk Factor	n (%)
Hypertension	27 (45%)
Hyperlipidemia	30 (50%)
Diabetes Mellitus	12 (20%)
Obesity (BMI $\geq$ 30)	36 (60%)

1. Lipid Profile:

- Total Cholesterol: Mean total cholesterol was 220.3 mg/dL ($\pm$ 45.6), with 50% of participants exceeding the recommended level of 200 mg/dL.
- LDL Cholesterol: Mean LDL cholesterol was 145.2 mg/dL ($\pm$ 38.7), with a significant proportion (55%) classified as high-risk (LDL $\geq$ 130 mg/dL).

- HDL Cholesterol: Mean HDL cholesterol was 42.1 mg/dL (± 10.5), with 40% of patients having low levels (HDL < 40 mg/dL).
- Triglycerides: Mean triglycerides were 175.3 mg/dL (± 50.4), with 45% of patients exceeding 150 mg/dL.

2. Prevalence of Cardiovascular Risk Factors:

- Hypertension: Observed in 27 patients (45%).
- Hyperlipidemia: Present in 30 patients (50%).
- Diabetes Mellitus: Diagnosed in 12 patients (20%).
- Obesity (BMI ≥ 30): Found in 36 patients (60%).

Table 4: Statistical Analysis

Analysis Type	Findings
Correlation Analysis	AHI vs. SBP: $r = 0.45$, $p < 0.01$
	AHI vs. LDL: $r = 0.38$, $p < 0.05$
Chi-Square Test	OSA Severity & Hypertension: $\chi^2(1, N = 60) = 6.25$, $p = 0.012$
T-Test	LDL Cholesterol (Hypertensive): 160.5 ± 40.2 vs. Non-Hypertensive: 130.2 ± 30.1 , $p = 0.005$

Statistical Analysis

1. Correlation Analysis:

- A Pearson correlation coefficient was calculated to evaluate the relationship between OSA severity (measured by the Apnea-Hypopnea Index, AHI) and cardiovascular parameters.
- A significant positive correlation was found between AHI and SBP ($r = 0.45$, $p < 0.01$) and LDL cholesterol levels ($r = 0.38$, $p < 0.05$).

2. Chi-Square Test:

- A chi-square test was conducted to assess the association between OSA severity and the prevalence of hypertension.
- Results showed a significant association ($\chi^2(1, N = 60) = 6.25$, $p = 0.012$), indicating that patients with severe OSA were more likely to have hypertension compared to those with mild to moderate OSA.

3. T-Test:

- An independent samples t-test was performed to compare the mean LDL cholesterol levels between patients with and without hypertension.
- Patients with hypertension had significantly higher LDL cholesterol levels (Mean = $160.5 \text{ mg/dL} \pm 40.2$) compared to those without hypertension (Mean = $130.2 \text{ mg/dL} \pm 30.1$), with a p-value of 0.005.

Discussion

This study highlights the significant impact of obstructive sleep apnea (OSA) on cardiovascular health, demonstrating elevated blood pressure and dyslipidemia among affected individuals. The mean systolic blood pressure of 138.5 mmHg in our cohort, with 45% of participants classified as hypertensive, aligns with previous research

indicating a strong association between OSA and hypertension (8). The intermittent hypoxia characteristic of OSA is believed to activate the sympathetic nervous system, leading to sustained increases in blood pressure (9). Furthermore, the findings that 50% of participants exhibited hyperlipidemia underscore the broader metabolic implications of OSA, as dyslipidemia is a well-recognized risk factor for cardiovascular disease (10). The correlation analysis revealed a significant positive relationship between the severity of OSA, as indicated by the Apnea-Hypopnea Index (AHI), and both systolic blood pressure ($r = 0.45$, $p < 0.01$) and LDL cholesterol levels ($r = 0.38$, $p < 0.05$). These results are consistent with earlier studies that reported worsening cardiovascular parameters with increasing severity of OSA (11). Additionally, the chi-square analysis demonstrated a significant association between OSA severity and the prevalence of hypertension ($\chi^2(1, N = 60) = 6.25$, $p = 0.012$), reinforcing the need for careful monitoring of blood pressure in this population. The presence of other cardiovascular risk factors, such as obesity (60% of participants with $BMI \geq 30$) and diabetes mellitus (20%), further complicates the clinical picture. Obesity is not only a common comorbidity of OSA but also a known contributor to the pathophysiology of cardiovascular disease (12). The interaction between OSA and metabolic syndrome highlights the necessity of an integrated approach to managing patients with sleep-disordered breathing to mitigate cardiovascular risks (13).

Conclusion

This study reinforces the need for healthcare providers to recognize the cardiovascular implications of obstructive sleep apnoea. Effective screening and management strategies, including lifestyle modifications and possibly continuous positive airway pressure (CPAP) therapy, could be essential in reducing cardiovascular morbidity and

mortality in patients with OSA. Future longitudinal studies are warranted to elucidate the long-term cardiovascular outcomes in this high-risk population.

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