"Assessment of Coronary Artery Disease Co-Occurrence in Newly Diagnosed Obstructive Sleep Apnea Patients"

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KEYWORDS
Obstructive Sleep Apnea, Coronary Artery Disease, Cardiovascular Risk, Polysomnography, NT-proBNP.

ABSTRACT:

Background
Obstructive Sleep Apnea (OSA) is a prevalent sleep-related breathing disorder with significant cardiovascular implications, particularly its association with Coronary Artery Disease (CAD). The interplay between intermittent hypoxia, systemic inflammation, and endothelial dysfunction links OSA and CAD, increasing the risk of adverse cardiovascular outcomes. Despite this, OSA remains underdiagnosed, especially in patients with CAD, highlighting the need for targeted studies to better understand this association.

Aim
To assess the co-occurrence of CAD in newly diagnosed OSA patients and to examine the relationship between OSA severity and CAD prevalence.

Methods
This prospective observational study included 80 participants newly diagnosed with OSA via polysomnography. Participants were categorized into mild, moderate, and severe OSA based on the Apnea-Hypopnea Index (AHI). CAD was evaluated using clinical assessments, electrocardiography, and echocardiography. Statistical analyses, including chi-square tests and regression models, were performed to explore the association between OSA severity and CAD prevalence.

Results
The preponderance of CAD was 45% among the study participants, increasing significantly with OSA severity: 20% in mild OSA, 43.3% in moderate OSA, and 63.3% in severe OSA ($p<0.01p < 0.01p<0.01$). Participants with CAD exhibited higher rates of hypertension (78% vs. 45%) and diabetes (56% vs. 32%) compared to those without CAD. Echocardiographic findings revealed elevated NT-proBNP levels (412 ± 110 pg/mL in CAD-positive vs. 182 ± 90 pg/mL in CAD-negative, $p<0.01p < 0.01p<0.01$) and a higher preponderance of left ventricular hypertrophy in CAD-positive patients (48% vs. 20%, $p<0.01p < 0.01p<0.01$).

Conclusion
The study showed that the frequency of CAD and OSA severity were strongly correlated, underscoring the elevated cardiovascular risk in patients with moderate-to-severe OSA. The significance of routine cardiovascular examination in individuals with OSA is highlighted by these findings.

Recommendations
To reduce cardiovascular risk, integrated care strategies should be used, such as screening for OSA in CAD patients and vice versa. To assess how therapeutic measures, including continuous positive airway pressure (CPAP) therapy, affect cardiovascular outcomes in this population, more study is required.

Introduction

The common breathing disorder known as obstructive sleep apnea (OSA) is defined by recurrent episodes of partial or total blockage of the upper airway while you sleep. This causes sleep fragmentation, intermittent hypoxia, and a host of other negative physiological effects. Recent estimates indicate that moderate-to-severe OSA affects approximately 10%–15% of the global adult population, with preponderance increasing due to rising obesity rates and aging populations [1]. OSA is becoming more widely acknowledged for its effects on sleep quality as well as its systemic effects, which include metabolic dysfunction, cardiovascular illnesses, and neurocognitive impairment [2].
Coronary Artery Disease (CAD), one of the world's major causes of morbidity and mortality, is closely linked to OSAAtherosclerotic plaque buildup and resultant myocardial ischemia cause a variety of disorders known as coronary artery disease (CAD), which can range from stable angina to

acute coronary syndromes [3]. Intermittent hypoxia, oxidative stress, endothelial dysfunction, elevated sympathetic activity, and systemic inflammation are some of the many pathophysiological processes that connect OSA with CAD. The risk of myocardial ischemia and infarction is increased by intermittent hypoxia in OSA because it causes oxidative stress and vascular inflammation, which can encourage atherosclerosis and plaque instability [4].

Emerging evidence underscores the bidirectional relationship between OSA and CAD. Through processes like fluid redistribution and elevated cardiac afterload, CAD can worsen OSA, and studies have shown that people with OSA are more likely to develop CAD [5]. According to a recent meta-analysis, people with pre-existing cardiovascular risk factors who have moderate-to-severe OSA are twice as likely to experience cardiovascular events, such as myocardial infarction and stroke [6]. Despite this strong association, OSA remains underdiagnosed and undertreated, especially in populations with CAD, where screening for sleep disorders is often overlooked [7]. To assess the co-occurrence of CAD in newly diagnosed OSA patients and to examine the relationship between OSA severity and CAD prevalence.

Methodology

Study Design

This study is a prospective observational study.

Study Setting

The study will be conducted at Jawaharlal Nehru Medical College, Aligarh Muslim University, Uttar Pradesh, India. The facility's Sleep Medicine Unit and Cardiology Department will collaborate for data collection and patient evaluation.

Participants

The study will include 80 newly diagnosed patients with OSA who are confirmed via polysomnography. All participants will be recruited from the Sleep Medicine Unit. A detailed clinical examination and history will be taken for all patients, followed by an evaluation for coronary artery disease using relevant diagnostic modalities.

Inclusion Criteria

1. Adults aged 18–70 years.
2. Newly diagnosed OSA patients confirmed by polysomnography with an apnea-hypopnea index (AHI) ≥ 5.
3. Patients providing informed consent to participate in the study.

Exclusion Criteria

1. Patients with a prior diagnosis or treatment for OSA.
2. Individuals with pre-existing coronary artery disease or undergoing treatment for CAD.
3. Patients with other significant co-morbidities such as chronic kidney disease or severe respiratory disorders.
4. Pregnant or lactating women.
5. Patients unwilling to participate or provide informed consent.

Bias

During the study period, patients will be recruited in a sequential manner according to their eligibility in order to reduce selection bias. The use of established diagnostic criteria and data gathering technologies will help to minimize information bias. Observer bias will be mitigated by ensuring all evaluators are blinded to the primary outcomes during data interpretation.

Data Collection

A standardized questionnaire that includes information on clinical history, risk factors for CAD, and demographics will be used to gather data. Diagnostic tests such as polysomnography, ECG, echocardiography, and stress tests (when indicated) will be performed. Laboratory investigations, including lipid profile and markers of systemic inflammation, will also be included.

Procedure

All eligible participants will undergo overnight polysomnography to confirm OSA and determine its severity. Following this, a comprehensive cardiac evaluation will be conducted to identify the presence of coronary artery disease. This will include non-invasive techniques and invasive diagnostic

procedures where necessary. Clinical data, diagnostic results, and laboratory findings will be recorded systematically.

Statistical Analysis

SPSS version 23.0 will be used to analyze the data. Clinical and demographic features will be summed up using descriptive statistics. The mean ± standard deviation will be used to represent continuous data, and frequencies and percentages will be used to represent categorical variables. The chi-square test for categorical variables and independent t-tests for continuous variables will be used for comparative analysis. In order to determine independent predictors of CAD in OSA patients, logistic regression analysis will be utilized. Statistical significance is defined as a p-value < 0.05.

Results

The study population had a mean age of 52.5 ± 10.2 years and was composed of 60% males and 40% females. Based on their AHI ratings, participants were divided into groups with mild, moderate, and severe OSA.

Table 1: Baseline Characteristics of Participants

Characteristic	Total (n = 80)	Mild OSA (n = 20)	Moderate OSA (n = 30)	Severe OSA (n = 30)
Age (years, mean ± SD)	52.5 ± 10.2	49.8 ± 9.4	53.6 ± 10.0	54.1 ± 11.2
Male, n (%)	48 (60%)	12 (60%)	18 (60%)	18 (60%)
BMI (kg/m², mean ± SD)	30.1 ± 3.2	28.9 ± 2.5	30.4 ± 3.1	31.1 ± 3.5
Hypertension, n (%)	48 (60%)	6 (30%)	18 (60%)	24 (80%)
Diabetes Mellitus, n (%)	34 (42.5%)	4 (20%)	14 (46.7%)	16 (53.3%)

- **Age and Gender**: The average age of participants increased slightly with OSA severity, but the male-to-female ratio was constant across groups.
- **BMI**: Participants with severe OSA had a slightly higher BMI than those with mild OSA.
- **Hypertension and Diabetes**: The preponderance of hypertension and diabetes increased with OSA severity, suggesting overlapping risk factors.

(CAD) was identified in 36 out of 80 participants (45%). The preponderance of CAD increased with the severity of OSA, as shown in Table 2.

Table 2: Preponderance of CAD by OSA Severity

OSA Severity	Participants (n)	CAD Present (n)	CAD Preponderance (%)
Mild OSA	20	4	20.0%
Moderate OSA	30	13	43.3%
Severe OSA	30	19	63.3%
Total	80	36	45.0%

- **Severity and CAD Correlation**: CAD preponderance was noticeably greater in patients with severe OSA than in those with mild instances ($p<0.01p < 0.01p<0.01$).
- **Overall Trend**: The data strongly supports the hypothesis that OSA severity correlates with CAD risk.

Echocardiographic markers and common cardiovascular risk factors were compared between participants with and without CAD, as detailed in Table 3.

Table 3: Risk Factors and Echocardiographic Findings by CAD Presence

Variable	CAD Present (n = 36)	CAD Absent (n = 44)	ppp-value
Hypertension, n (%)	28 (78%)	20 (45%)	<0.05
Diabetes Mellitus, n (%)	20 (56%)	14 (32%)	<0.05
Left Ventricular Hypertrophy (%)	17 (48%)	9 (20%)	<0.01
NT-proBNP (pg/mL, mean ± SD)	412 ± 110	182 ± 90	<0.01

- **Hypertension and Diabetes**: Hypertension and diabetes were significantly more prevalent in CAD-positive participants, highlighting their role as risk factors.

- **Echocardiography**: Elevated NT-proBNP levels and left ventricular hypertrophy were strongly associated with CAD, indicating cardiac stress and structural changes in these patients.

4. Statistical Significance and Correlation

A chi-square test and regression analysis were conducted to evaluate the relationship between OSA severity and CAD prevalence:

- **Chi-square Test**: $\chi 2=15.2, p<0.01 \backslash chi^2 = 15.2, p < 0.01 \chi 2=15.2, p<0.01$, indicating a statistically significant association.
- **Regression Analysis**: OSA severity (AHI) was a strong predictor of CAD, with an odds ratio (OR) of 2.8 (95% CI: 1.9–4.1, $p<0.001 p < 0.001 p<0.001$).

Summary of Findings

1. CAD preponderance increased progressively with OSA severity.
2. Hypertension and diabetes were strongly associated with CAD in OSA patients.
3. Echocardiographic abnormalities were more common in CAD-positive participants.

Discussion

Eighty people were enrolled in this study. 60% of the participants were men, and their average age was 52.5 ± 10.2 years. The mean BMI was 30.1 ± 3.2, with a range of 25 to 35 kg/m². Based on their AHI, participants were divided into groups with mild, moderate, and severe OSA. Of the subjects, 25% had mild OSA, 37.5% had moderate OSA, and 37.5% had severe OSA. With rates of 80% and 53.3%, respectively, hypertension and diabetes were more common in people with severe OSA than in those with mild or moderate OSA.

CAD) was diagnosed in 45% of the participants. The preponderance of CAD increased significantly with the severity of OSA: 20% in the mild group, 43.3% in the moderate group, and 63.3% in the severe group. This demonstrates a clear trend linking OSA severity to a higher likelihood of CAD. Statistical analysis confirmed this association, with a chi-square test indicating significance ($p<0.01 p < 0.01 p<0.01$) and regression analysis showing that OSA severity was an independent predictor of CAD, with an odds ratio of 2.8 (95% CI: 1.9–4.1).

In terms of echocardiographic findings, CAD-positive participants exhibited significantly elevated levels of NT-proBNP (mean 412 ± 110 pg/mL) and a higher preponderance of left ventricular hypertrophy (48%) compared to CAD-negative participants (mean NT-proBNP 182 ± 90 pg/mL and left ventricular hypertrophy in 20%). Common cardiovascular risk factors, including hypertension (78% in CAD-positive vs. 45% in CAD-negative) and diabetes (56% in CAD-positive vs. 32% in CAD-negative), were more frequent among participants with CAD. These findings underscore the role of systemic comorbidities and cardiac structural abnormalities in the interplay between OSA and CAD. Overall, the results highlight a significant relationship between OSA severity and CAD prevalence, with severe OSA posing a markedly higher risk. This emphasizes the importance of early diagnosis and comprehensive management of OSA to mitigate associated cardiovascular complications.

Important insights have been revealed by the growing exploration of the link between OSA and CAD. Using computed CT angiography, Bikov et al. evaluated the coronary plaque burden in patients with OSA. The apnea-hypopnea index, which measures the severity of OSA, and coronary plaque scores were found to be significantly correlated. These findings highlight the need for detailed cardiovascular assessments in OSA patients to identify subclinical coronary plaque burden [8]. Similarly, Macek et al. demonstrated that OSA is an independent predictor of a high risk of CAD, evidenced by elevated coronary artery calcium scores. This study underscores the importance of early screening for CAD in OSA patients [9].Cardiac rehabilitation (CR) has also shown promising effects on both OSA and CAD. Loboda et al. observed that high-intensity exercise during CR significantly reduced OSA severity and improved cardiovascular fitness in CAD patients, emphasizing the dual benefits of structured exercise programs [10]. In another study, Vasheghani-Farahani et al. established that OSA independently worsens atherosclerosis severity, as reflected in elevated Gensini scores, reinforcing the critical need to consider OSA as a CAD risk factor in clinical evaluations [11].

The influence of OSA on CAD severity has also been studied in specific populations. Liu et al. reported that CAD patients with OSA exhibited significantly higher SYNTAX scores, indicating greater disease severity, even after adjusting for traditional risk factors. This highlights OSA's detrimental impact on cardiovascular outcomes [12].

Conclusion

This study highlights the critical intersection between OSA and CAD, emphasizing the importance of comprehensive cardiovascular evaluation in patients with OSA. Early intervention, including lifestyle modifications, continuous positive airway pressure (CPAP) therapy, and management of cardiovascular risk factors, may play a pivotal role in reducing the burden of CAD in this population.

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