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Demographic, Anthropometric and Clinical Profile of Obstructive Sleep Apnea Patients at a Tertiary Care Centre in Eastern India: A Cross-Sectional Study

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ABSTRACT

Background: Obstructive Sleep Apnea (OSA) is a prevalent sleep disorder with significant public health implications, including cardiovascular diseases, hypertension, metabolic syndrome, and neurocognitive impairments. Despite its high prevalence, OSA remains underdiagnosed, often requiring clinical assessment and anthropometric measurements as effective screening tools. This study aims to investigate the profile of OSA patients attending a sleep clinic in a tertiary care center in eastern India.

Methods: This cross-sectional study with interventional component was conducted between January 2016 and December 2017 at the Department of Physiology, Rajendra Institute of Medical Sciences (RIMS), Ranchi, and the Department of Sleep Medicine, Tata Mains Hospital, Jamshedpur. One hundred consecutive patients (aged 25–70 years) with clinical symptoms suggestive of OSA underwent overnight PSG. Demographic, anthropometric (BMI, neck circumference, waist circumference), and clinical data were collected. Daytime sleepiness was assessed using the Epworth Sleepiness Scale (ESS). OSA was classified based on Apnea Hypopnea Index (AHI). For patients with moderate-to-severe OSA, continuous positive airway pressure (CPAP) therapy was evaluated using a split-night protocol.

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Results: The mean age was 46.1 ± 8.8 years; 67% were male. Comorbidities included Type 2 diabetes (49%), hypertension (21%), and hypothyroidism (19%). Snoring (75%), witnessed apneas (58%), and excessive daytime sleepiness (ESS ≥10: 83%) were common. Anthropometric indices (BMI, neck and waist circumference) showed significant positive correlation with AHI severity ($p<0.001$). CPAP therapy in 68 moderate-to-severe patients significantly improved mean oxygen saturation (78.6% → 93.0%, $p<0.001$) and reduced apnea episodes (25.7 → 5.4, $p<0.001$). Severe OSA was present in 23% of the cohort.

Conclusion: OSA is highly prevalent in patients with comorbidities like Type 2 diabetes, hypertension, and hypothyroidism. Anthropometric measurements such as BMI, waist, and neck circumference are useful predictors of OSA severity. CPAP therapy was highly effective in improving oxygen saturation and reducing apnea episodes. Early diagnosis and intervention are critical to managing the condition and preventing associated complications.

KEYWORDS

• Obstructive Sleep Apnoea • Polysomnography • Anthropometry • CPAP • Comorbidities • Eastern India

INTRODUCTION

Sleep apnea is a prevalent sleep disorder characterized by repeated episodes of paused or shallow breathing during sleep, with a diagnosis requiring more than five episodes per hour. The condition is classified into obstructive sleep apnea (OSA), central sleep apnea, and mixed sleep apnea.[1] OSA, the most common type, affects 4-7% of the general adult population and is three times more prevalent in men than women. It is associated with significant public health concerns, including cardiovascular diseases, hypertension, metabolic syndrome, and neurocognitive impairments such as attention deficits and increased reaction time due to restricted sleep.[2,3]

Key risk factors for OSA include obesity, advancing age, and male gender. Despite its high prevalence, OSA remains underdiagnosed, often requiring input from family members or clinical assessment of symptoms like loud snoring, daytime fatigue, and disrupted sleep. Cephalometric and anthropometric measurements such as BMI, neck circumference, and waist circumference serve as affordable screening tools, reducing the need for costly polysomnography in high-risk patients.[4]

Untreated OSA is linked to severe complications, including hypertension, diabetes, stroke, heart failure, and increased accident risks. Effective management involves lifestyle changes, CPAP therapy, oral appliances, or surgery. Early diagnosis and intervention can significantly reduce health risks and healthcare costs, emphasizing the need to address the large undiagnosed population.[5] There is limited published literature on the clinical and anthropometric profile of OSA patients from eastern India, where lifestyle and ethnic factors may influence risk. This study, therefore aimed to describe the demographic, anthropometric, and clinical characteristics of OSA patients in tertiary care sleep clinic of Jharkhand and to evaluate the short-term efficacy of CPAP therapy.

MATERIAL AND METHODS

Study Design, Setting, and Participants

A cross-sectional study with an interventional component was conducted from January 2016 to December 2017 at the Sleep Laboratory of Tata Main Hospital, Jamshedpur. The research was conceived and overseen by the Department of Physiology at the Rajendra Institute of Medical Sciences (RIMS) in Ranchi, which also provided ethical governance for the project. The study involved one hundred consecutive patients, aged 25–70 years, referred for suspected sleep-disordered breathing. Participants were included based on clinical symptoms of OSA, specifically excessive daytime sleepiness (Epworth Sleepiness Scale score ≥10) and/or a history of loud snoring,

witnessed apneas, or nocturnal gasping. (6) Exclusion criteria included significant craniofacial abnormalities, major cardiac disease, pacemakers, cognitive impairment, or previous OSA diagnosis.

Diagnostic Criteria and Measurements

OSA diagnosis and severity classification were based on the Apnea-Hypopnea Index (AHI) from overnight polysomnography (PSG). Severity was defined as: Mild (AHI 5-15), Moderate (AHI 15-30), and Severe (AHI >30). (7) All participants underwent comprehensive PSG monitoring, including electroencephalography, electrooculography, electromyography, respiratory effort, airflow, electrocardiography, and pulse oximetry. Anthropometric measurements (BMI, waist circumference, neck circumference) were recorded using standardized protocols.

Intervention and Ethical Considerations

Patients diagnosed with moderate-to-severe OSA during the first half of the night underwent a split-night protocol with automatic CPAP titration (5-20 cm H_2O) to determine optimal therapeutic pressure. The study received ethical approval from the Institutional Ethics Committee of RIMS, Ranchi, and all participants provided written informed consent.

Statistical Analysis

Data were analyzed using SPSS version 20.0. Normally distributed continuous variables are presented as mean ± standard deviation, and categorical variables as counts and percentages. Group comparisons were made using ANOVA with post-hoc Tukey test, and pre-post CPAP changes were assessed with paired t-tests. A p-value <0.05 was considered statistically significant.

OBSERVATIONS AND RESULTS

Table 1: Demographic, Clinical Characteristics, and Sleep Symptoms of Participants (N = 100)

Variable	Category	n (%) / Mean ± SD
Age (years)	Mean ± SD	46.1 ± 8.8
	25–34	8 (8%)
	35–44	31 (31%)
	45–54	38 (38%)
	55–64	20 (20%)
	≥65	3 (3%)
Gender	Male	67 (67%)
	Female	33 (33%)
Comorbidities	Type 2 diabetes	49 (49%)
	Hypertension	21 (21%)
	Hypothyroidism	19 (19%)
	Hyperthyroidism	2 (2%)
Personal habits	Tobacco/alcohol use	40 (40%)
Clinical symptoms	Snoring	75 (75%)
	Witnessed apneas	58 (58%)
	Limb movements	61 (61%)
Epworth Sleepiness Scale (ESS)	Mild daytime sleepiness	60 (60%)
	Moderate daytime sleepiness	17 (17%)
	Severe daytime sleepiness	23 (23%)

Table 2: Anthropometric Indices by OSA Severity

Parameter	Mild (n=32)	Moderate (n=45)	Severe (n=23)	p-value
BMI (kg/m²)	23.8 ± 2.1	25.6 ± 2.4*	27.9 ± 2.8*†	<0.001
Neck circumference (cm)	33.5 ± 1.5	36.2 ± 1.8*	38.3 ± 2.1*†	<0.001
Waist circumference (cm)	82.5 ± 5.2	87.2 ± 6.1*	91.7 ± 7.3*†	<0.001

*Post-hoc Tukey: p<0.05 vs. mild; †p<0.05 vs. moderate.

Table 3: CPAP Efficacy (n=68)

Parameter	Pre-CPAP	Post-CPAP	p-value
Oxygen saturation (%)	78.6 ± 4.5	93.0 ± 3.1	<0.001
Apnea episodes (n)	25.7 ± 9.0	5.4 ± 3.2	<0.001
Arousals (n/hour)	20.8 ± 10.9	4.5 ± 2.2	<0.001

RESULTS

Most participants were middle-aged, and men predominated in the cohort. Metabolic and endocrine disorders such as type 2 diabetes, hypertension, and hypothyroidism were frequently observed. Nearly two-

fifths of the participants reported tobacco or alcohol use. Snoring, witnessed apneas, limb movements, and excessive daytime sleepiness were common clinical features. (Table 1)

Anthropometric indices including body mass index, neck circumference, and waist circumference showed a progressive increase with higher OSA severity and were significantly different across mild, moderate, and severe groups. (Table 2)

Continuous positive airway pressure (CPAP) therapy in patients with moderate-to-severe OSA produced marked improvements in nocturnal oxygenation and substantial reductions in apnea events and arousals during sleep. (Table 3)

DISCUSSION

This study analyzed 100 cases of sleep apnea reported at Tata Main Hospital, Jamshedpur, providing insights into demographic, lifestyle, anthropometric, and clinical factors associated with the condition. The findings align with existing research and emphasize critical aspects that influence the prevalence and severity of sleep apnea.

The majority of patients in our clinic-based sample were middle-aged and severity increased with increasing age. This trend is consistent with earlier findings suggesting that anatomical changes, reduced muscle tone, and increased comorbidities associated with aging contribute to the condition.[8] The study highlighted a significant gender disparity, with males comprising 67% of the cases. This aligns with studies indicating a male-to-female ratio of 3:1 to 5:1 due to differences in fat distribution, airway anatomy, and protective effects of estrogen in premenopausal women.[9]

Lifestyle habits such as addiction to alcohol and smoking were prevalent among 40% of cases and were noted to exacerbate sleep apnea severity. These substances are known to decrease pharyngeal muscle tone and impair lung ventilation, worsening apnea symptoms.[10] Occupationally, 80% of the participants were either sedentary or moderately active, suggesting a correlation between reduced physical activity and increased apnea severity. Weight loss and lifestyle modifications remain pivotal in mitigating the risk and severity of sleep apnea.[11]

The high prevalence of comorbid conditions such as type 2 diabetes (49%) and hypertension (21%) underscores their association with sleep apnea. Chronic intermittent hypoxia and sleep fragmentation associated with apnea can lead to insulin resistance, elevated blood pressure, and cardiac autonomic imbalance.[19] Conversely, effective treatment of sleep apnea has been shown to improve glycemic control and reduce hypertension by lowering stress hormone levels, enhancing vascular function, and restoring autonomic balance.[12-14]

Nineteen cases (16 females) were hypothyroid, supporting its etiologic role in sleep apnea. Hypothyroidism contributes to apnea through mechanisms such as mucoprotein deposition in the upper airway and increased risk of obesity, both of which compromise airway patency.[15] Regular screening for thyroid dysfunction is therefore recommended in patients with unexplained sleep apnea.

Snoring (75%), limb movements (61%), and frequent arousals were the most commonly reported symptoms. These findings underscore the importance of recognizing such symptoms in the early diagnosis of sleep apnea. The study also highlighted predictors of apnea severity, including ESS scores, anthropometric parameters, and nocturnal oxygen saturation. Higher ESS scores were strongly associated with greater severity, validating their diagnostic utility.[16] Anthropometric measures like BMI, waist circumference, and neck circumference correlated significantly with apnea severity, although their predictive value diminished in severe cases when combined.[17, 18] Reduced nocturnal oxygen saturation emerged as a critical risk factor for adverse outcomes, which was significantly improved with CPAP therapy.[19]

CPAP therapy proved highly effective in reducing apnea episodes, nocturnal desaturation, and arousals. It also enhanced overall sleep quality and reduced the risk of complications such as sudden cardiac death and pulmonary hypertension.[19] By preventing the recurrent sleep restriction and fragmentation caused by apneas, CPAP mitigates the associated rise in blood pressure[14] and helps stabilize the autonomic nervous system,[13] which are key pathways to cardiovascular improvement. Despite initial compliance challenges, patient education and adherence strategies are crucial to maximizing

CPAP benefits. These findings align with prior research emphasizing CPAP as the cornerstone of moderate-to-severe sleep apnea management.[20]

This study has certain limitations. First, it was hospital-based and may not reflect the true community prevalence. Second, the modest sample size (n=100) limits subgroup analysis, particularly gender-based comparisons. Third, the cross-sectional design prevents causal inference. Finally, long-term outcomes of CPAP adherence were not studied.

CONCLUSION

Sleep apnea was found to be significantly associated with higher BMI, snoring, limb movements, and arousals during sleep. CPAP therapy emerged as a highly effective intervention, significantly improving oxygen saturation and reducing the number of apnea episodes. Anthropometric parameters such as BMI, waist circumference, and neck circumference were useful predictors for identifying mild to moderate cases of apnea; however, their reliability decreased in cases of severe apnea. The study also highlighted the prevalence of comorbidities such as Type 2 Diabetes Mellitus, hypertension, and hypothyroidism among patients with sleep apnea, emphasizing the need for an integrated approach to manage these conditions alongside apnea treatment.

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Conflict of interest

Authors declared no conflict of interest.

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Ethical considerations

The study protocol was approved by the Institutional Ethics Committee of RIMS, Ranchi.

Code of Ethics

All subjects gave their informed consent for inclusion before they participated in the study. We confirm that the clinical research was done in accordance of the Ethical Principles for Medical Research Involving Human Subjects, outlined in the Helsinki Declaration of 1975.

Authors' contributions

All authors contributed to the conception, design, data collection, analysis, interpretation, drafting, critical revision, and final approval of the manuscript.

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