

Clinical Profile of Obstructive Sleep Apnea Syndrome in a Tertiary Care Hospital in Western India

Ketaki Utpat¹, Sameer Bansal², Unnati Desai³, Jyotsna Joshi⁴

ABSTRACT

Background: Obstructive sleep apnea syndrome (OSAS) is an increasingly common, yet under-recognized and underreported sleep-related breathing disorder (SRBD) with momentous clinical, psychological, epidemiological, economic and healthcare implications. We conducted this study to decipher the clinical profile of patients with OSAS at the Pulmonary Medicine Department of a tertiary care center in Mumbai, India.

Methodology: Patients presenting to our outpatient department with either symptoms of OSAS or who were referred with risk factors for OSAS were evaluated with polysomnography (PSG) after a comprehensive history, detailed clinical examination, calculation of various pre-test probability scores and relevant pre-requisite workup.

Results: One hundred thirty patients were included, of these, 92 (71%) were male patients, while 38 were females (29%). Mean age of the study group was 49.5 years. Thirty-nine patients (30%) were overweight, while 35 (27%), 23 (17.7%) and 15 (11.5%) patients had mild, moderate and morbid obesity respectively. Average neck circumference in our group of patients was 40.1 (± 4) cm. Average Epworth sleepiness score (ESS) for the group was 13.8 (± 3.5). Average adjusted neck circumference score (ANCS) in our patients was 47.6 (± 5.2). Average STOP-BANG score of our group was 5.3 (± 1.4). The average APNEIC score was 4 (± 1.2), and average Berlin score was 2.4 (± 0.89). Of all the comorbidities present in these OSAS patients, hypertension was the commonest, present in 86 patients (66%), followed by GERD in 80 patients (61.5%), diabetes mellitus in 56 patients (43%), ischemic heart disease in 31 patients (24%), and hypothyroidism in 22 patients (17%). Mild pulmonary artery hypertension (PH) was present in 94 (72%), 20 patients had no PH (15.4%), while 11 patients (8.5%) had moderate PH. Seventy three patients (56%) had a normal spirometry, 36 patients (27.7%) had a restrictive, while 17 (13%) patients had an obstructive abnormality. Four patients had a spirometry suggestive of upper airway obstruction. PSG revealed 29 patients with mild OSAS (22%), 38 patients had moderate OSAS (29%), while 63 patients had severe OSAS (48.5%). Although there was a positive correlation seen between ANCS, STOP-BANG, APNEIC and ESS scores with the AHI, it was not a linear correlation.

Conclusion: Obstructive sleep apnea syndrome (OSAS) in a tertiary center in India shows a predilection towards male sex, obesity, and a frequent association with cardiovascular comorbidities such as hypertension and IHD. Pretest probability scores help predict the likelihood of OSAS.

Keywords: Apnoea-hypopnea index, Polysomnography, Sleep-related breathing disorders, Sleep scores.

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INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is a sleep-related breathing disorder (SRBD) which has been noiselessly prevalent since coons age but which has attained recognition only since a couple of decades.¹ It is hallmarked by upper airway collapsibility and obstruction leading to nocturnal hypoxia and sleep fragmentation.² This phenomenon culminates in recurrent oxyhemoglobin desaturation and arousals from sleep with day time spillover effects secondary to excessive daytime sleepiness (EDS). It presents with a constellation of nocturnal symptoms like snoring, nocturnal choking, witnessed apneas and daytime symptoms like EDS, irritability, memory lapses, lack of concentration, morning headaches, and near-missed accidents.² OSAS is associated with a myriad of co-morbidities like systemic hypertension, diabetes mellitus, ischemic heart disease, obesity, and metabolic syndrome.³ The disease is notorious from multifarious perspectives. The nocturnal hypoxia has detrimental implications on the cardiovascular, cerebrovascular and neurocognitive functions contributing to the succeeding morbidity and mortality. The sleep fragmentation and resulting EDS has a pessimistic impact on attention, vigilance, learning, mood, and memory. This starts the ball rolling for psychiatric disorders like depression.⁴ It also engenders suboptimal work productivity leading to huge economic losses and may have grave consequences like workplace or motor vehicle accidents.⁵ The consequences of this disease can be combated by early diagnosis by PSG. The criteria employed for its diagnosis are given by 2007 recommendations of the portable monitoring task force of the American Academy of Sleep

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Medicine (AASM).⁶ Opportune initiation of appropriate therapies like lifestyle modification, continuous positive airway pressure (CPAP) or surgery is the crux of avoiding preventable morbidity and mortality.⁷ Nonetheless there is dismal lack of awareness amongst clinicians about this disorder and the cases which are diagnosed may just be the tip of the iceberg. Hence we conducted this study to comprehend the profile of OSAS patients with respect to various risk factors, comorbidities, pretest probability scores and severity of the disease.

METHODOLOGY

This was a retrospective observational study conducted to decipher the clinical profile of patients with OSAS at the

Pulmonary Medicine Department of a tertiary care center in Mumbai, India. The study duration was two years with a sample size of 130. Institutional ethics clearance was obtained. Patients who presented to our outpatient department with the symptoms of OSAS² were evaluated in the study. The detailed history and clinical examination were noted. Body measurements like height, weight, BMI, Mallampati score, waist, and hip circumference were taken. Pre-test probability sleep scores for OSAS were calculated. These scores included subjective scores like Epworth sleepiness score (ESS), and objective scores like STOP-BANG, ANCS, APNEIC, and BERLIN. The original SACS score consists of a normogram which has to be read in conjunction with the noted neck circumference. An easier modification has been developed, 'The ANCS' score or the adjusted neck circumference score, which gives 3 points for snoring, 3 for observed apneas, 4 for hypertension and takes the neck circumference in centimeters. The total score is then calculated for the patient by adding these 4 values. Investigations performed included complete hemogram, fasting blood sugar, blood urea nitrogen, lipid profile, thyroid profile, arterial blood gas, chest X-ray, spirometry with flow volume (FV) loop, two-dimensional echocardiography (2D ECHO) and ENT examination. Finally, a PSG level one⁸ was carried out on Philips PDx machine, and patients were diagnosed and classified as per the diagnostic criteria are given by the 2007 recommendations of the portable monitoring task force of the AASM.⁶ Apnea-hypopnea scoring was done manually by the doctor. Those patients with an AHI \geq 5/hour were included in the study. Descriptive statistics including frequencies, percentages, mean and standard deviation were calculated for the parameters taken into account. Correlation with various sleep scores and AHI was assessed by calculating Pearson's correlation coefficient. The significance of correlation was determined with *p* value <0.05 .

RESULTS

Total of 130 PSG based diagnosed OSAS patients were included in the study. Of these, 92 (71%) were male patients, while 38 were females (29%). Mean age of the study group was 49.5 years, with a standard deviation of 12.8 yrs. Youngest patient in the group was a 4-year old girl, while the oldest was a 75-year-old man. Most of the patients fell in the age group 35 to 65 years, comprising 102 patients (78%). As far as the anthropological parameters were considered, average BMI of our patients was $32.1 (\pm 7.6)$ kg/m², most of our patients

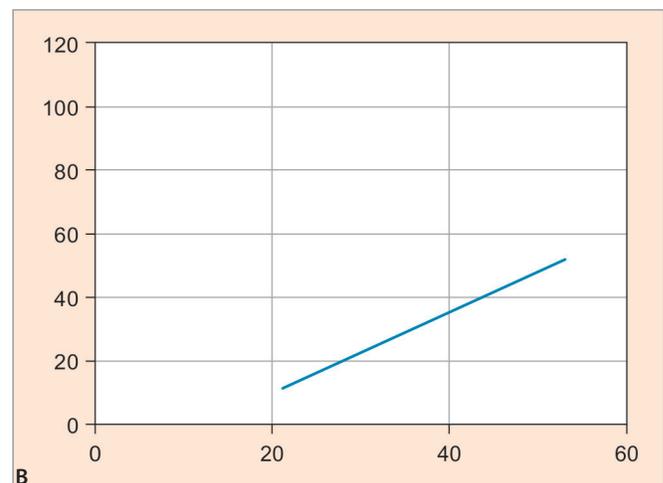
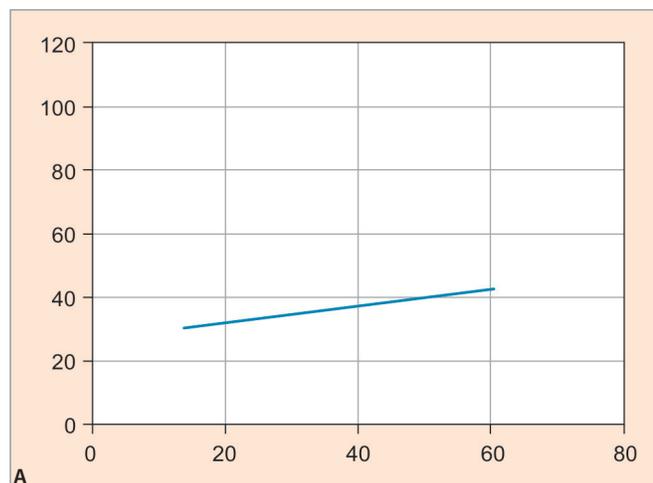
were overweight or obese, with just 18 patients (13.8%) having a normal or low body mass index (BMI). Thirty-nine patients (30%) were overweight, while 35 (27%), 23 (17.7%) and 15 (11.5%) patients had mild, moderate and morbid obesity, respectively. Average neck circumference in our group of patients was $40.1 (\pm 4)$ cm. Only 14 patients (10.7%) had a neck circumference less than 37 cm, 60 patients had a neck circumference ranging from 37 to 40 (46%), while 56 (43%) had neck circumference more than 40 cm circumference. Mallampati classification (MPC) was grade I in 7 patients (5.4%), grade II in 36 (27.7%), grade III in 65 patients (50%), and grade IV in 22 patients (17%). Table 1 summarizes all the baseline characteristics of our study group. Graph 1 shows the correlation of AHI with various anthropologic measurements like BMI and neck circumference. Both have a positive correlation, albeit this is not linear, with Pearson's correlation coefficient being 0.08 and 0.21, respectively.

Epworth sleepiness score (ESS), which is the most commonly used subjective assessment score for sleepiness, was less than 8 in only 3 patients, signifying normal sleepiness, while 23 (17.7%) patients had ESS between 8 and 10, 58 (44.6%) between 10 and 16, and 46 (35.4%) had ESS more than 16. Average ESS for the group was $13.8 (\pm 3.5)$. Average ANCS score in our patients was $47.6 (\pm 5.2)$. Thirty-six patients had ANCS score of less than 46 (27.7%), suggesting a low probability of OSAS, while 94 patients (72.2%) had an ANCS score of more than 46. Average STOP-BANG score of our group was $5.3 (\pm 1.4)$. Only 5 patients had a score of less than 3, which suggests a low probability of OSAS. Remaining 125 patients had high scores. The average APNEIC score was $4 (\pm 1.2)$, and average BERLIN score was $2.4 (\pm 0.89)$. Table 2 demonstrates the number of patients with significant sleep scores on each of the 4 parameters, i.e., ANCS, STOP-BANG, APNEIC, and ESS.

Of all the comorbidities present in these OSAS patients,

Table 1: Baseline demographic details

Total number of patients	130
Male:Female	7:3
Mean age	$49.5 (\pm 12.8)$
Mean BMI	$32.1 (\pm 7.6)$
Mean neck circumference	$40.1 (\pm 4)$
Mean malampatti grade	$3.2 (\pm 0.4)$
Mean AHI	$36.2 (\pm 13.1)$



Graphs 1A and B: Correlation between AHI and anthropometric measurements (BMI with AHI $\rightarrow r = 0.08$, neck circumference with AHI $\rightarrow r = 0.21$)

Table 2: Sleep scores

Scoring parameter	No. of patients
Epworth Sleepiness Scale (ESS) > 10	104 (80%)
ANCS ≥ 46	94 (72%)
STOP-BANG ≥ 3	125 (96%)
APNEIC ≥ 2	113 (87%)
BERLIN ≥ 1	122 (94%)

Table 4: Spirometry findings

Spirometry findings	No. of patients	Percentage (%)
Normal	73	56
Obstructive	17	13
Restrictive	36	27.7
UAO	4	3

hypertension was the commonest, present in 86 patients (66%), followed by GERD in 80 (61.5%), diabetes mellitus in 56 (43%), ischemic heart disease (IHD) in 31 (24%), and hypothyroidism in 22 (17%) (Table 3). All the patients were assessed with spirometry. Seventy-three patients (56%) had normal spirometry; with a normal FV loop. Thirty-six patients (27.7%) had a restrictive abnormality, while 17 (13%) patients had an obstructive abnormality on the spirometry. Further, four patients had a spirometry suggestive of upper airway obstruction (UAO), as indicated by the FV loop, and the Empey's index (Table 4).

An overnight PSG was finally done to assess the severity of OSAS. Severity was classified based on the apnea-hypopnea index (AHI). AHI between 5 and 15/hour suggests mild OSAS, between 15–30 moderate, and more than 30 is severe.⁶ PSG revealed a total of 29 patients with mild OSAS (22%), 38 patients with moderate OSAS (29%), while 63 patients had severe OSAS (48.5%). Further, the pre-test probability scores were correlated with the severity of OSAS. Although there was a positive correlation seen between ANCS, STOP-BANG, APNEIC and ESS scores with the AHI, it was not a linear correlation, i.e., it does not suggest that as ANCS, STOP-BANG, APNEIC or ESS increases, AHI also increases. Pearson's correlation coefficient was 0.25, 0.23, 0.45, and 0.34, respectively for ANCS score, STOP-BANG, APNEIC, and ESS score, when correlating with the AHI. This was, however, statistically significant ($p < 0.05$) (Graph 2). Correlation analysis was not possible with BERLIN score, as most of the patients had a score of 2 or 3.

A two-dimensional (2D) ECHO was done to assess the patients for PH. Majority of the patients demonstrated mild PH (72%), i.e., pulmonary artery systolic pressure (PASP) between 25 to 45 mm Hg, 20 patients had no PH (15.4%), while 11 patients (8.5%) had moderate PH, with PASP between 45 to 60 mm Hg, and 5 patients (3.8%) had severe pulmonary hypertension, with PASP more than 60 mm Hg.

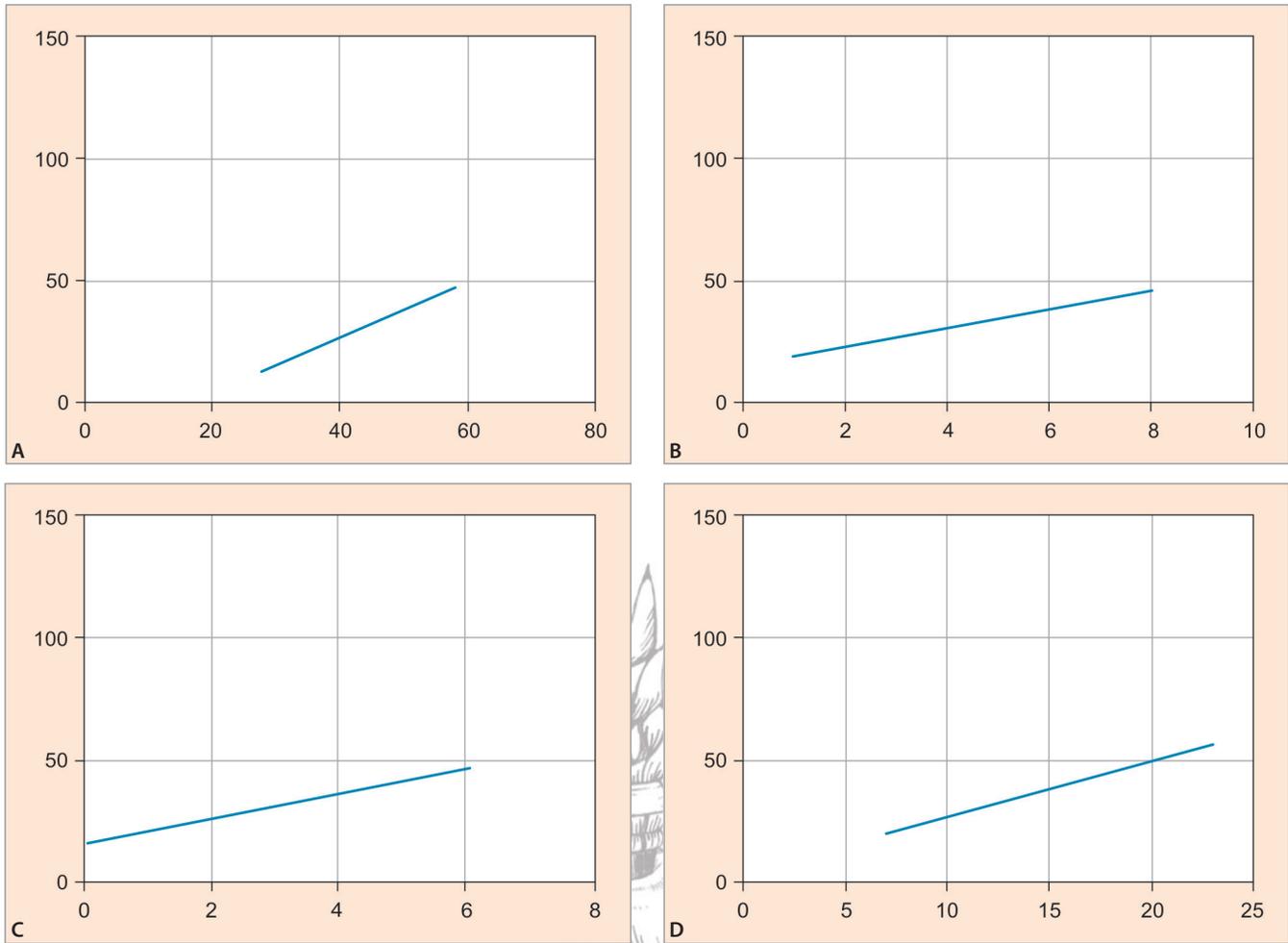
DISCUSSION

Obstructive sleep apnea syndrome a commonplace but an under-recognized disorder which consists of decreased airflow due to repetitive complete or partial obstruction of the upper airway. These obstructive events are associated with cortical micro-arousals and oxygen desaturation, which in turn lead to sleep fragmentation and increased sympathetic neural activity.⁹ Our study which aimed to study the clinical profile of OSAS was conducted in the pulmonary medicine department of a tertiary care center. Mean age of OSAS

Table 3: Comorbidities

Comorbidities	Number of patients	Percentage (%)
HTN	86	66
DM	56	43
IHD	31	24
Hypothyroidism	22	17
GERD	80	61.5

patients in our group was 49.5 ± 12.8 years. Majority of the patients (60%), fell between the age of 45 to 65. This is in concordance with most of the international and Indian studies which suggest that aging predisposes to OSAS, which remains highly prevalent in the elderly and the gender differences diminish significantly after menopause. Various studies using different methodologies have reported that among the elderly, the prevalence of at least moderate OSAS (AHI ≥ 15) varies widely from as low as 7% to as high as 44%.^{10,11} Normal aging is associated with a significant decline in slow wave sleep, particularly in the older men.^{12,13} An increase in respiratory events and periodic breathing in the elderly may be in part related to the significant reduction in slow wave sleep and an increase in sleep state instability or an increase in upper airway resistance.¹⁴ Another important risk factor associated with OSAS is male gender. Although clinic-based studies had previously reported a significant gender gap in the prevalence of OSAS, more recent large population-based studies have demonstrated that the prevalence of OSAS is only 1.5–3 times higher in men than women and this gender gap narrows even further after menopause.¹⁵ Women may not present with the "classic" symptoms of OSAS and therefore may less likely be referred for a formal evaluation.^{16,17} Our study, however, clearly shows male predisposition as far as OSAS is concerned. Seventy one percent of our OSAS patients were males, as compared to only 29% of females, suggesting an odds ratio of 2.44. Clinical symptoms suggestive of OSAS include loud snoring, witnessed breathing pauses by a bed-partner, choking or gasping during sleep, morning headaches, insomnia, and daytime sleepiness in various studies done by Duran¹⁰ and Sharma et al.¹⁵ The major symptoms present in our patients were loud snoring (100%), nocturnal choking (63%), witnessed apneas (60%), excessive daytime sleepiness (84%), early morning headache (50%), excessive irritability (72%), and decreased concentration (68%). Several risk factors have been identified in the development of OSAS including aging, male gender, menopause, craniofacial abnormalities, upper airway anatomy, smoking, alcohol, and genetic predisposition. But undoubtedly, the strongest risk factor is obesity reflected by several markers including BMI, neck circumference, and waist-to-hip ratio.^{18,19} Multiple population-based studies have documented a direct relationship between the OSAS epidemic and the obesity epidemic.²⁰ Moreover, more than half of the prevalence of OSAS is attributable to excess body weight.²¹ In fact, per each unit increase in BMI the adjusted odds ratio for developing OSAS is 1.14. In our group also, 87% of the patients with OSAS had a BMI of more than 24.9 kg/m^2 . Mean BMI in our group of patients was $32.17 \text{ kg/m}^2 (\pm 7.65)$. Also, neck circumference was more than 37cm in most of these patients with AHI more than 5/hour. Neck circumference was used as a measure of central obesity with a mean value of $40.10 \pm 4.08 \text{ cm}$, and results were similar as reported by Sharma et al.¹⁵ Assessment of oropharynx by using Mallampatti score has higher likelihood predicting the OSAS. In our study, it was found that 67% patients were in class III or IV, and the majority (84%) of these had severe OSAS, suggesting an increase in the severity with an increase



Graphs 2A to D: Correlation between sleep scores and AHI ($r = 0.23, 0.25, 0.43, 0.34$, respectively for ANCS, STOP-BANG, APNEIC and ESS with AHI)

in the score. In a study performed by Uzma, higher Mallampati score was observed in patients with severe OSAS than in moderate and mild OSAS patients.²²

Various medical conditions are associated and may also lead to OSAS. Daytime hypertension is reported in 40% in OSAS, while the prevalence of OSAS in hypertension is about 20–30%.²³ As suggested in our study, 86 patients (66%) of the patients had hypertension. Some of these patients were already on combination therapy with 2 or more anti hypertensives. Further, coronary artery disease (CAD), defined as angina pectoris and/or myocardial infarction, has been independently associated with OSAS in both population-based²⁴ and clinic-based studies.²⁵ The sleep heart health study, a large population-based study, documented a modest association between OSAS and CAD. In subjects with the highest quartile of AHI (AHI >11), an adjusted odds ratio of 1.27 was observed relative to subjects with no OSAS.²⁴ Similarly, in a clinic-based study, OSAS was a significant and independent predictor of incident CAD²⁵ (relative risk 4.60). In patients with documented CAD, the prevalence of OSAS has ranged from 30 to 57%.²⁶⁻²⁸ Our study group reveals that 24% of OSAS patients had associated IHD. Another common comorbidity noted in our group of patients was diabetes mellitus. It was estimated that approximately 43% of our patients were diagnosed cases of type 2 diabetes mellitus (T2DM). Moreover, many of these patients had poor glycemic control and were on 2 or more oral hypoglycemic agents for proper control.

Several population-based studies from various geographical regions have reported an independent association between OSAS and altered glucose metabolism, insulin resistance, metabolic syndrome, and T2DM.²⁹⁻³¹ These associations have been established independently of the degree of obesity and adiposity which are major determinants of glucose metabolism dysregulation. In addition, OSAS is highly prevalent among patients with type 2 diabetes mellitus.³² These remarkable associations raise the possibility that OSAS may be a novel risk factor for type 2 diabetes mellitus or alternatively, chronic hyperglycemia may promote OSAS.

Confirmation of OSAS requires an overnight PSG, a time-consuming and expensive test of limited availability. The increasing recognition of OSAS as a prevalent and high-mortality disease has increased PSG demand. Even in developed countries, there are long waiting periods for sleep studies.^{33,34} Hence to strike a golden balance between demand and availability, triaging patients as per the estimated severity and the need for urgency of sleep study becomes vital. Various pretest probability scores have been developed to screen patients for a PSG and assessing risk for OSAS during pre-anesthesia check-up. The sleep apnea clinical score (SACS)³⁵ and the BERLIN questionnaire (BQ)³⁶, are examples of such models, while the Epworth sleepiness scale (ESS) is used to assess daytime sleepiness.³⁷ STOP-BANG score is routinely used by the anesthetists to assess the probability of OSAS in patients to be taken up for surgeries. However, the AASM does not define which

one is the best model to estimate OSAS probability.⁶ Our patients had a mean ESS of 13.8 ± 3.5 , which suggests a high likelihood of falling asleep during the daytime. Other studies such as those done by Cao et al. suggest that ESS is consistent with clinical diagnosis and could be used as a primary diagnostic method in patients with OSAS, especially in primary-care hospitals. Another study done by El-Sayed et al.³⁸ reported 90% and 95% sensitivity for BERLIN and STOP-BANG scores to predict OSAS. This was in concordance with our group of patients, in whom 96% patients had a high probability of OSAS using the STOP-BANG score and 88% patients had a high risk of OSAS as determined by the BERLIN score. Sleep apnea clinical score (SACS) has been one of the most widely used pretest probability scores to assess OSAS. Different studies, such as those by Grover et al.,³⁹ and Jansari et al.,⁴⁰ validate the usefulness of SACS to predict OSAS. In our group of patients, SACS was more than 46 in more than 70% of the patients. However, it is important to note, that although these scores predict the likelihood of OSAS, higher scores do not correlate well with the severity of OSAS. Conversely, higher the AHI more is the likelihood of these scores to be positive, as demonstrated by El-Sayed.³⁸ Our patients also demonstrated a low positive correlation between SACS and STOP-BANG and AHI, with Pearson's correlation coefficient (*r*) being 0.25 and 0.23 respectively.

Pulmonary vascular changes in OSAS are due to both hypoxic vasoconstriction and vascular remodeling. This PH tends to improve with the treatment of OSAS, and the more severe the PH, the greater the response to CPAP. Some studies demonstrate that PH is present in 12–34% of patients with OSAS.⁴¹ However, the role of OSAS in the development of PH and its mechanisms, independent of left ventricular failure, is not entirely clear. Majority of our patients had mild PH. However, the major limitation was measurement using a 2D ECHO which allows an error of ± 10 mm Hg.⁴² Various spirometry abnormalities may also be seen with OSAS. However, studies suggest that spirometry abnormalities are not a predictor of OSAS. Sanders et al.⁴³ demonstrated saw-tooth sign in 85% of the patients with OSAS and none of the subjects without OSAS with a sensitivity of 85% and specificity of 100% for OSAS. Haponik et al.⁴⁴ reported a forced expiratory flow (FEF) 50/ forced inspiratory flow (FIF) 50 > 1 in 44% of patients with OSAS and only 8% of the patients without OSAS. In our study, the prevalence of spirometry abnormalities and FV loop was low, with as many as 56% of patients having normal spirometry with normal FV loop. Other patients who had some form of obstruction or restriction, or upper airway obstruction; had associated respiratory conditions, such as asthma, chronic obstructive pulmonary disease, interstitial lung disease, pulmonary vocal cord movement disorder or vocal cord dysfunction which could act as confounders. *Vis-à-vis* the severity of OSAS, 78% of our patients had moderate to severe OSAS, with the majority of these patients having AHI > 30/hour. This finding was similar to the study by Uzma with the majority of patients (56%) with severe OSAS.²²

To conclude, OSAS in a tertiary center in India shows a predilection towards male sex, obesity, and frequent association with cardiovascular comorbidities such as hypertension and IHD. Pretest probability scores can help predict the likelihood of OSAS. The study is limited by the fact that it represents only one hospital experience. However, this preliminary data may serve to raise the awareness of physicians and the public of OSAS and its repercussions.

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