Clinical characteristics of non-sleepy obstructive sleep apnea patients: a study in a tertiary care sleep clinic in India

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Abstract

Obstructive sleep apnea (OSA) encompasses a diverse population, manifesting with or without symptoms of excessive daytime sleepiness. There is contention surrounding the significance of non-sleepy OSA within clinical contexts and whether routine treatment is warranted. This study aims to evaluate epidemiological and clinical distinctions between sleepy and non-sleepy OSA patients. A retrospective analysis was conducted on consecutive patients undergoing polysomnography for OSA assessment at tertiary care hospitals between 2018 and 2023. For 176 of 250 patients, complete polysomnography records with OSA diagnoses were available. Non-sleepy OSA was defined when a patient had an Epworth Sleepiness Scale score <10 and polysomnography demonstrated an Apnea-Hypopnea Index ≥5/hour. Non-sleepy OSA patients were matched with sleepy OSA patients in terms of age and gender distribution (mean age 51.24±13.25 years *vs*. 50.9±10.87 years, male 70.4% *vs*. 73.3%). The sensitivity of STOP-BANG (snoring, tiredness, observed apnea, high blood pressure, body mass index ≥35 kg/m^2, age >50, neck circumference >40 cm, male gender) ≥3 for the non-sleepy OSA group was 87.7%, 89.3%, and 95.2% for any OSA severity, moderate to severe OSA, and severe OSA, respectively, while the corresponding sensitivity for the sleepy OSA group was 96.5%, 98.6%, and 100% for any OSA severity, moderate to severe OSA, and severe OSA, respectively. A novel symptom scoring tool, HASSUN, demonstrated a sensitivity of over 90% for all severity categories of OSA in both non-sleepy and sleepy OSA groups. The prevalence of cardiovascular and metabolic comorbidities did not significantly differ between non-sleepy and sleepy OSA patients. The physiological parameters, including forced vital capacity (FVC), forced expiratory volume in one second (FEV1), FEV1/FVC ratio, arterial partial pressure of oxygen, and bicarbonate at baseline, were comparable between the two groups. To conclude, non-sleepy OSA patients are less obese, exhibit fewer symptoms, and have less severe OSA in comparison to sleepy OSA. Non-sleepy OSA patients display a similar likelihood of cardiovascular and metabolic comorbidities compared to sleepy OSA patients. Further investigations are warranted to elucidate the mechanisms underlying cardiovascular metabolic comorbidities in non-sleepy OSA patients. The proposed HASSUN scoring tool for non-sleepy OSA screening necessitates validation in future studies.

Introduction

Obstructive sleep apnea (OSA) represents a prevalent sleep disorder linked with significant cardiovascular and metabolic

implications. It is characterized as a sleep-related breathing disorder typified by recurrent apneas and hypopneas, objectively defined *via* polysomnography, often resulting in excessive daytime sleepiness (EDS) and potential cognitive impairment [1]. Current estimates suggest a global prevalence of 938 million adults affected by OSA [2]. Studies have indicated a mean prevalence of OSA of approximately 6% (ranging from 3% to 18%) in men and 4% (ranging from 1% to 17%) in women. Similarly, the prevalence of OSA ranges from 27.3% (9% to 86%) in men to 22.5% (3.7% to 63.7%) in women [3]. STOP-BANG (snoring, tiredness, observed apnea, high blood pressure, body mass index ≥35 kg/m^2, age >50, neck circumference >40 cm, male gender) is the most widely utilized screening tool for OSA owing to its documented sensitivity.

The Epworth Sleepiness Scale (ESS) emerges as a pivotal tool for distinguishing between patients with and without EDS, employing a questionnaire to assess the likelihood of falling asleep in everyday scenarios. Scores on the ESS scale range from 0 to 24, with an ESS score ≥10 indicative of a sleepy patient, while an ESS score <10 suggests a non-sleepy patient [4,5]. Some OSA patients experience the burden of EDS, while others remain asymptomatic during the day [2,3]. The mechanisms causing different clinical presentations in OSA patients are still unclear.

There is a paucity of data in the literature regarding how non-sleepy OSA patients differ when compared to sleepy OSA patients. Here in this retrospective study, we scrutinized the data of sleepy and non-sleepy OSA patients and explored whether the demographic and/or polysomnographic comparison could bring out meaningful findings. We also attempted to propose a novel symptom-scoring tool to screen suspected cases of OSA.

Materials and Methods

A retrospective analysis encompassed all patients presenting to our sleep clinic at a tertiary care center between 2018 and 2023 for OSA evaluation. Patient records were retrieved from our existing database and scrutinized for demographic parameters, symptoms, comorbidities at presentation, ESS, STOP-BANG score, Berlin score, and Charlson Comorbidities Index. Additionally, physiological parameters including forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), FEV1/FVC ratio, arterial blood gas (ABG) analysis including partial pressure of oxygen, and bicarbonate were evaluated. In the final data analysis, patients with incomplete polysomnography data and those with an Apnea-Hypopnea Index (AHI) <5/hour were excluded. OSA was defined as an AHI of ≥5/hour of sleep with symptoms or an AHI of ≥15/hour without symptoms. Mild OSA was defined as those with AHI≥5<15/hour, moderate OSA (AHI≥15-30/hour), and severe OSA (AHI>30/hour) [1]. The patient population was divided into non-sleepy OSA and sleepy OSA groups, with non-sleepy OSA being ESS<10 and sleepy OSA being ESS≥10. Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Variables with normal distribution were presented as mean ± standard deviation and subjected to an independent sample *t*-test to analyze differences between non-sleepy and sleepy OSA groups. Categorical variables were presented as numbers (percentage) and analyzed using the Chi-square test for statistical significance. All significance tests were two-sided. Sensitivity analysis of STOP-BANG, based on two different cutoffs (STOP-BANG≥3, ≥4) as described in various studies [6-8], was conducted for the overall cohort and for non-sleepy *vs.* sleepy OSA groups. A screening tool (HASSUN) was developed for non-sleepy OSA patient detection based on symptom analysis in the non-sleepy OSA group. The HASSUN score consisted of hypertension, apnea, snoring, sleep disturbance, unrefreshing sleep, and nocturia, with each parameter constituting one point, the total maximum score being 6 and the minimum score being 0. Sensitivity of the HASSUN score was assessed for OSA detection in the non-sleepy OSA population at two different cutoffs, namely HASSUN≥2 and HASSUN≥3.

Results

Sample size and exclusion criteria

A total of 250 subjects were initially screened for analysis, with complete polysomnographic data available for 184 patients. Following exclusion criteria, eight patients with AHI<5/hour on polysomnography were removed from the analysis, resulting in a final sample size of 176 patients. Among the included patients, 71 were classified into the non-sleepy group (ESS≤10), while 105 were categorized into the sleepy group (ESS>10).

Non-sleepy OSA and sleepy OSA groups had a comparable age and gender distribution. The prevalence of cardiovascular and metabolic comorbidities, the Charlson Comorbidity Index, spirometry, and ABG parameters did not significantly differ between the two groups. (Table 1 and *Supplementary Table 1*). The non-sleepy OSA group demonstrated a significantly lower body mass index (BMI) compared to the sleepy OSA group. The non-sleepy OSA group exhibited significantly lower mean AHI and a lower prevalence of severe OSA compared to the sleepy OSA group (Tables 1 and 2).

Scores and sensitivity

Sensitivity of STOP-BANG for the overall cohort with a cutoff of ≥3 was 93%, 95% and 98.7% for any OSA, moderate-severe OSA, and severe OSA, respectively. The sensitivity for STOP-BANG≥4 was 82.5%, 86% and 90.9% for any OSA, moderate-severe OSA, and severe OSA, respectively.

Sensitivity of STOP-BANG≥3 for non-sleepy OSA group was 87.7%, 89.3% and 95.2% for any OSA severity, moderate to severe OSA, and severe OSA, respectively, while corresponding sensitivity for sleepy OSA group was 96.5%, 98.6% and 100% any OSA severity, moderate to severe OSA, and severe OSA, respectively.

Sensitivity of STOP-BANG≥4, again, was lower for the non-sleepy OSA group as compared to the sleepy OSA group. Sensitivity for the non-sleepy OSA group was 71.9%, 74.4% and 80.9% for any OSA severity, moderate to severe OSA, and severe OSA, respectively, while corresponding sensitivity for the sleepy OSA group was 89.5%, 93.3% and 94.5% any OSA severity, moderate to severe OSA, and severe OSA, respectively.

We devised a score for screening of non-sleepy OSA patients, termed as HASSUN score, consisting of hypertension, apnea, snoring, sleep disturbance, unrefreshing sleep, and nocturia. Sensitivity of this score for predicting OSA in the non-sleepy group was 98.5%, 98.3% and 96.7% at cutoff of ≥2 for any OSA, moderate to severe OSA, and severe OSA, respectively, and 95.5%, 94.9% and 96.7% at the cutoff of ≥3 for any OSA, moderate to severe OSA, and severe OSA, respectively (Table 3).

Discussion

EDS in OSA patients presents a complex pathogenesis. EDS has been linked to sleep fragmentation or alterations in oxygenation, independent contributions of nocturnal hypoxemia, and sleep fragmentation [9-15]. However, the relationship between EDS and the risk of cardiovascular and metabolic comorbidities in OSA patients remains unclear.

The current study aimed to investigate differences in demographic parameters, symptoms, polysomnographic variables, and comorbidities between OSA patients with and without EDS. We found no significant disparities in age or gender distribution. However, patients without EDS (non-sleepy OSA patients) tended

Table 1. Demographic profile of the study cohort (n=176).

Parameter	Non-sleepy OSA (n=71)	Sleepy OSA (n=105)	p
Age	51.4±13.25	50.9±10.87	0.851
Sex, n (%)			
Male			
Female	50 (70.4)21 (29.6)	77 (73.3)28 (26.7)	0.673
Height (cm)	165.78±11.2	165.02±8.95	0.685
Weight (kg)	80.69±16.08	90.01±17.99	0.005
BMI (kg/m^2)	29.64±5.88	32.73±7.54	0.022
Symptoms, n (%)			
Sleep disturbance	56 (78.9)	99 (94.3)	0.002
Breathing difficulty at night	39 (54.9)	90 (86.5)	0.000
Snoring	67 (94.4)	105 (100)	0.015
Prolonged apneas in sleep	45 (65.2)	87 (84.5)	0.003
Unrefreshing sleep	52 (73.2)	100 (95.2)	0.000
Headache and neck pain in morning	36 (52.9)	62 (59.0)	0.429
Hypertension	42 (60)	61 (58.7)	0.859
Chest pain	23 (32.4)	41 (39)	0.368
Nocturia	57 (81.4)	88 (84.6)	0.580
Anxiety	13 (29.5)	24 (29.3)	0.974
Depression	8 (17.4)	13 (16.7)	0.917
Comorbidities, n (%)			
Diabetes	17/60 (28.3)	31/91 (34.1)	0.459
Hypertension	32/64 (50)	54/97 (55.7)	0.480
Hyperlipidemia	10/46 (21.7)	25/79 (31.6)	0.234
CAD	6/58 (10.3)	11/91 (12.1)	0.744
Heart Failure	2/47 (4.3)	1/82 (1.2)	0.271
Stroke/CVA/TIA	4/59 (6.8)	4/91 (4.4)	0.526
Charlson Comorbidity Index	0.41±0.72	0.45±0.65	0.709
STOP-BANG	4.33±1.61 (n=57)	5.31±1.47 (n=86)	0.000
Berlin score	5.49±2.01 (n=57)	6.81±1.79 (n=86)	0.000

BMI, body mass index; CAD, coronary artery disease; CVA, cerebrovascular accident; STOP-BANG, snoring, tiredness, observed apnea, high blood pressure, body mass index 35 kg/m^2, age>50, neck circumference>40 cm, male gender; TIA, transient ischemic attack.

Table 2. Polysomnography parameters of the study cohort.

Parameter	Non-sleepy OSA (n=71)	Sleepy OSA (n=105)	p
AHI	32.95±20.62	47.79±28.72	0.000
Mild OSA, n (%)	10 (14.3)	14 (13.3)	0.025
Moderate OSA, n (%)	28 (40)	23 (21.9)	
Severe OSA, n (%)	32 (45.7)	68 (64.8)	

AHI, apnea hypopnea index; OSA, obstructive sleep apnea.

Table 3. Hypertension, apnea, snoring, sleep disturbance, unrefreshing sleep, nocturia score analysis.

HASSUN score cutoff	Sensitivity in non-sleepy OSA group (%)		
	Any OSA	Moderate to severe OSA	Severe OSA
≥2	98.5	98.3	96.7
≥3	95.5	94.9	96.7

HASSUN, hypertension, apnea, snoring, sleep disturbance, unrefreshing sleep, nocturia; OSA, obstructive sleep apnea.

to be less obese, reported fewer symptoms. They also exhibited lower STOP-BANG and Berlin scores. Additionally, non-sleepy OSA patients had a significantly lower mean AHI and were less likely to have severe OSA compared to sleepy OSA patients. However, the proportion of patients with moderate to severe OSA did not significantly differ between the groups.

Regarding the association between OSA and cardiovascular and metabolic comorbidities, our findings were consistent with previous studies reporting similar prevalence rates of hypertension, coronary artery disease, heart failure, and stroke between OSA patients with and without EDS [16-24]. Despite conflicting findings in previous studies, the current study did not observe a statistically significant difference in hypertension prevalence between the two groups [19-24].

Among various screening tools for identifying OSA, STOP-BANG is the most widely utilized owing to its documented sensitivity in predicting OSA. Chung *et al*., focusing on preoperative OSA assessment, demonstrated STOP-BANG≥3 sensitivities of 83.6%, 92.9%, and 100% for AHI thresholds of >5, >15, and >30, respectively [6]. Similarly, Ong *et al*. reported sensitivities of 86.1%, 92.8%, and 95.6% for STOP-BANG with a cutoff of ≥3 for the same AHI thresholds in patients presenting to sleep clinics [7]. Meta-analysis by Pivetta *et al*. reported a pooled sensitivity of STOP-BANG ≥3 to be 91.4%, 95%, and 97% for any OSA, moderate to severe OSA, and severe OSA, respectively, with slightly lower figures for the South Asian/Southeast Asian population [25]. In the current study, the overall sensitivity of STOP-BANG ≥3 was 93%, 95%, and 98.7% for any OSA, moderate-severe OSA, and severe OSA, respectively. Notably, the sensitivity of STOP-BANG ≥3 for moderate-severe OSA was 89.3% for non-sleepy OSA patients compared to 98.6% for sleepy OSA patients, indicating a significantly lower sensitivity for the non-sleepy group. Rida Waseem *et al*. reported that the sensitivity of the STOP-BANG≥4 (with a BMI cutoff of ≥27.5) for predicting moderate-to-severe OSA was 73.9% in Indian ethnic origin [8]. In the present study, STOP-BANG≥4 exhibited an overall sensitivity of 86% for moderate to severe OSA, with sensitivity values of 74.4% for non-sleepy OSA patients and 93.3% for sleepy OSA patients, again suggesting a notably lower sensitivity of STOP-BANG for predicting moderate to severe OSA in the non-sleepy group.

In the present study, we developed a screening tool based specifically on symptoms observed in the non-sleepy group, acknowledging the lower sensitivity of STOP-BANG for detecting non-sleepy OSA. This tool, termed the HASSUN score, comprises six parameters: hypertension, apnea, snoring, sleep disturbance, unrefreshing sleep, and nocturia. Evaluating the sensitivity of the HASSUN score for the non-sleepy group at two cutoffs (≥2 and ≥3), we observed sensitivities of 98.5%, 98.3%, and 96.7% for any OSA, moderate to severe OSA, and severe OSA, respectively, for HASSUN≥2, and 95.5%, 94.9%, and 96.7% for HASSUN≥3. Consequently, the sensitivity of HASSUN as a screening tool outperformed STOP-BANG for the non-sleepy group. However, further validation through prospective studies is warranted.

In conclusion, the current study adds to the existing literature by demonstrating that the prevalence of cardiovascular and metabolic comorbidities does not significantly differ between OSA patients with and without EDS. This finding suggests that the presence of EDS may not independently predict the risk of these comorbidities in OSA patients. Consequently, when managing OSA, clinicians should consider individual patient characteristics beyond EDS to determine the appropriate treatment approach.

Despite the insights provided by the current study, it is essential to acknowledge its limitations, including its retrospective design and cross-sectional nature. Future prospective studies are needed to explore the longitudinal impact of EDS on the development of cardiovascular and metabolic comorbidities in OSA patients.

Conclusions

Non-sleepy OSA patients are as likely to suffer from cardiovascular and metabolic comorbidities as sleepy OSA patients. STOP-BANG, a commonly used screening tool, performs worse at screening non-sleepy OSA patients compared to sleepy OSA patients. Future studies are needed to characterize any differences in future risk of the same between the two groups and to validate the new proposed tool for screening non-sleepy and sleepy OSA patients.

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Online supplementary material:

Supplementary Table 1. Respiratory physiological parameters.