BJHS
Birat Journal of Health Sciences

ISSN:

2542-2758 (Print) 2542-2804 (Online)

ARTICLE INFO:

Received Date: 5 January, 2025
Accepted Date: 5 August, 2025
Published Date: 31 August, 2025

KEYWORDS:

Obstructive sleep apnea, polysomnography

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Access the article online

DOI: 10.62065/bjhs660

CITATION:

Sapkota B, Pokharel M , Pangeni RP. Clinical Profile and Prevalence of Obstructive Sleep Apnea Syndrome in a Tertiary Care Hospital. 2025; 10 (2): 41-46.

Clinical Profile and Prevalence of Obstructive Sleep Apnea Syndrome in a Tertiary Care Hospital

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ABSTRACT

Introduction: Obstructive sleep apnea syndrome is characterized by recurrent collapse of the upper airway during sleep associated with recurrent oxygen desaturation and sleep arousal . It is an undiagnosed public health problem with harmful implications.

Objectives: To find the relationship between risk factors and severity of obstructive sleep apnea.

Methodology: Prospective and analytical study conducted among 61 participants in the Department of Otorhinolaryngology and Head and Neck Surgery, Dhulikhel Hospital. A detailed history and evaluation of the nose, oral cavity, oropharynx and larynx was performed. The epworth sleepiness score was filled .The body mass index was calculated. Overnight polysomnography was performed. Participants were classified as primary snoring, mild, moderate or severe obstructive sleep apnea groups. The relationship of the apnea hypopnea index was analyzed with the body mass index and the epworth sleepiness score.

Results: Of the 61 participants, all had excessive daytime sleepiness .Sixty (98.4%) complained of snoring and 46 (75.4%) complained of frequent awakening. Primary snoring was observed in 11(18.03%) patients, 9(14.75%) had mild, 16(26.22%) had moderate, while 25(40.98%) patients had severe obstructive sleep apnea .Significant relationship (p <.001) was observed between apnea hypopnea index and body mass index and epworth sleepiness score and severity in different groups.

Conclusion: Obstructive sleep apnea is often neglected as primary snoring. Patients with excessive daytime sleepiness, multiple apneic spells, high body mass index and epworth sleepiness score should undergo an overnight polysomnography for diagnosis and early intervention.

Introduction

Obstructive sleep apnea syndrome (OSAS) is characterized by recurrent obstruction of the upper airways during sleep associated with recurrent oxygen desaturation and arousal from sleep.

It is a public health problem that has substantial harmful implications. It is estimated that about 80% of cases are not diagnosed.[1] The prevalence of OSAS is estimated to be 1%-5%.[2,3] The consequences of undiagnosed and untreated OSAS are medically serious and economically costly.[4]

OSAS has associations with many diseases such as hypertension, Type II diabetes,

stroke, congestive cardiac failure, coronary artery disease, cardiac arrhythmias, decreased cognitive function and road traffic accidents and even mortality. Therefore, it is extremely important to rigorously assess it.[5, 6]

Understanding differences between OSAS and simple snoring is important to explain the mechanisms responsible for upper airway obstruction. [7]

We aim to find the prevalence of OSAS and to find the correlation between risk factors and severity of OSAS.

Methodology

It was a cross-sectional ,observational ,qualitative and analytical study conducted in the Department of Otorhinolaryngology and Head and Neck Surgery, Dhulikhel Hospital between July 2021 and January 2023.Participants aged 18 years or above with ESS ≥10 with snoring or daytime sleepiness were asked to undergo full-night polysomnography .Patients under 18 years, pregnancy, recent history of the aero digestive tract surgery, benign and malignant masses of aero digestive tract, decompensated cardiopulmonary disease were excluded. Patients with cognitive impairment or neurological diseases and patient receiving drugs with an impact on cognitive function were also not taken for the study.

Ethical clearance was obtained from the Institutional review Committee (IRC-KUSMS Approval no.-226/2021).All the patients were informed of the study in detail. Verbal and written informed consent was taken. Respondents voluntarily participated in the study and were given the option to withdraw from the study whenever they wanted .The identity of the respondents was kept confidential and data was used for research purposes only.

Convenient non -probability sampling technique was used. Convenience sampling was done and the sample size was calculated using the Cochrane formula,

$$n = Z^2 \times p \times q / e2$$

$$= \frac{(1.96)^2 \times 0.05 \times (1-0.05)}{(0.055)^2}$$

$$= \frac{3.8416 \times 0.05 \times 0.95}{0.003}$$

$$= \frac{0.1825}{0.003}$$

$$= 60.83 = 61$$

Where n= required sample size, Z= 1.96 at 95% Confidence Interval (CI), p= prevalence of OSAS, for maximum sample size, 5% = 5/100=0.05, q= 1-p, and e= margin of error, 5%.

A comprehensive history and clinical examination was performed and demographic data was recorded with the help of a study questionnaire, presenting symptoms, symptoms of co morbidities, general medical history, medication use, alcohol use, smoking habits and sleep hygiene were recorded. The position of the maxilla and mandible including retrognathia and micrognathia, and presence or absence of any abnormalities in facial characteristics were noted. Symptoms suggestive of nasal, nasopharyngeal, oropharyngeal and hypopharyngeal obstruction were also observed. A history of comorbid diseases such as hypertension and diabetes mellitus was also evaluated.

The converted Nepali version of Epworth sleepiness score (ESS) [8] was filled. ESS was assessed to assess the degree of excessive daytime sleepiness and to determine the functional status of the individual. A score of less than 10 was considered normal. Body mass index (BMI) was calculated as kilogram/metre^2. A BMI of 18.5 to 24.9 was considered normal, 25 to 29.9 considered overweight, 30 to 34.9 considered class I obesity, 35 to 39.9 considered class II obesity and 40 or more considered class III obesity.[9]

The nose was evaluated for any external nasal deformity, position of the nasal septum, size of the turbinate, condition of the nasal mucosa, presence or absence of nasal mass.

The oral cavity and oropharynx were evaluated for tonsillar enlargement, elongated and edematous uvula, edematous soft palate, large tongue. Tonsillar size was graded from 0 to 4.

Measurement of neck circumference was made. Complete systemic evaluation, particularly cardiovascular and respiratory evaluation, was carried out.

Full night polysomnography (PSG) was performed at Dhulikhel Hospital in a room resembling a typical bedroom. Participants arrived in the early evening. A 48 channel polysomnography recording system (Miniscreen pro device) was used to assess the state of sleep and respiratory and cardiac parameters. The PSG was performed by the same sleep technician throughout the study period. Data were analyzed by using software. The monitored parameters were electroencephalography, electrooculography, chin and anterior tibialis electromyography, electrocardiography, inductance plethysmography (to detect abdominal and thoracic movements), pulse oximetry, nasal pressure monitoring using the nasal pressure transducer, snoring intensity using acoustic sensor(microphone), oronasal thermal airflow using the thermistor, blood pressure, pulse and body position. The various events of the PSG record were visually inspected for abnormal breathing episodes. All PSG records were scored and read by the same observer to avoid interobserver bias. The scoring of sleep and associated events was performed according to the American Academy of Sleep Medicine (AASM) guidelines.[10]

Apnea is defined as a reduction in airflow greater than ≥90% as recorded by the oronasal thermistor or nasal pressure cannula lasting for ≥10 seconds. Hypopnea is defined as airflow reduction ≥30% as recorded by nasal pressure cannulas lasting ≥10 sec with a saturation reduction of at least ≥4% from baseline SpO2 % prior to the event. The Apnea-hypopnea index (AHI) is defined

as the number of apneas and hypopneas per hour of sleep.[10] Body position detection: Changes in body position lasting less than 5 seconds were not considered valid. Desaturation analysis: An oxygen desaturation event was described as a reduction in the oxygen saturation by at least 4 %. All saturation values below 50% were excluded as artifact values and were not counted as a part of desaturation events.

Arousal was defined as a sudden change in the frequency of electroencephalography, with the activity of the alpha and theta waveforms having frequency >16 Hertz and a duration of 3-15 seconds.

Respiratory effort- related arousals (RERA) were identified as a sequence of breaths lasting for at least 10 seconds, characterized by increased respiratory effort or flattening of the nasal pressure waveform, followed by arousal from sleep, which does not meet the criteria for an apnea or hypopnea event. Respiratory distress index (RDI) is defined as the sum of AHI and RERA.

The Oxygen desaturation index (ODI) is the average number of episodes of desaturation per hour of recording. ODI is typically recorded as the number of 4% desaturation. Sleep scoring was done in 30 seconds epochs and respiratory events scoring was done in 2 minute epochs.

Participants were classified into four groups[11] on AHI determined from the PSG records as: primary snoring: AHI < 5 per hour, mild OSAS: AHI ≥ 5, but < 15 per hour, moderate OSAS: AHI ≥ 15, but < 30 per hour and severe OSAS: AHI ≥ 30 per hour.

All statistical analyses were performed using International Business Machine (IBM) Statistical Package for the Social Science 25.0 version (SPSS 25, Chicago, IL, USA). The relationship between AHI and ESS, AHI and BMI was done using Pearson correlation coefficient. A p-value < 0.05 was considered statistically significant.

Results

Of the total 61 patients with OSAS, 44 (72.1%) patients were men and 17(27.9%) were women. The calculated mean (±SD) of age was 44.08(±9.91) years. The youngest patient in our study was 19 years old while the oldest patient was 67 years old. Table 1 shows sociodemographic variables in patients with OSAS.

Table 1: Age and gender distribution of patients with OSAS

Variables		Percentage (No. of patients)
Age(years)	≤18-20	1.63(1)
	21-30	6.55(4)
	31-40	21.31(13)
	41-50	40.98(25)
	51-60	27.86(17)
	61-70	1.63(1)
Gender	Male	72.1(44)
	Female	27.9(17)
	Total	100(61)

Forty six patients (75.4%) complained of frequent awakening, 39 (63.9%) had apneic episodes. Thirty two (52.5%) complained of headache in the early morning. Thirty patients (49.2%) complained of nasal obstruction. Twenty patients (32.8%) complained of choking, 20 patients (32.8%) complained of difficulty in concentration, 18 patients (29.5%) had personality change and 14 patients (23%) complained of mouth breathing. Few patients had periodic limb movement and throat pain.

The minimum ESS was 10, the maximum was 21, mean (±SD) was 13.13(±3.20). Primary snoring was observed in eleven (18.03%) participants, nine (14.75%) had mild OSAS, sixteen (26.22%) had moderate OSAS, while the severe group consisted of 25 (40.98%) patients as shown in Table 2. Severity of OSAS in different study groups has been shown in Table 2.

Table 2: Severity of OSAS in study population

Severity of OSA	N	Mean	Std. deviation	Std. error	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper bound		
Primary snoring	11	10.2909	4.93628	1.48835	6.9747	13.6072	3.60	19.80
Mild OSAS	9	14.0333	3.74900	1.24967	11.1516	16.9151	8.50	22.20
Moderate OSAS	16	21.9813	4.39230	1.09807	19.6408	24.3217	16.30	29.00
Severe OSAS	25	55.0560	21.76381	4.35276	46.0723	64.0397	15.30	95.90
Total	61	32.2557	24.15031	3.09213	26.0706	38.4409	3.60	95.90

Mean(±SD) of BMI was 30.25(±4.39) kg/m2 overall. The minimum BMI was 21, maximum was 45. Of the total number of cases studied 3 (4.91 %) had a normal BMI, 28 (45.90%) were overweight and 30 (49.18) % were obese. Seventeen (27.86%) had class I obesity, 12 (19.67%) had class II obesity whereas 1 (1.63%) had class III obesity. There was a statistically significant correlation between AHI and BMI (p<0.001). The predominant sleep position encountered with OSA was supine in 43 (70.5%) patients, followed by the right lateral position in 10(16.4%), left lateral in 7(11.5%) and prone in 1(1.6%) patients respectively. The various characteristics of the polysomnogram of the study population are shown in Table 3.

Table 3: Polysomnogram parameters in patients with OSAS

Variable	Range	Mean(±SD)
AHI	3.60-95.90	32.25(±24.15)
RDI	3.60-95.90	32.76(±24.04)
ODI	4.00-97.60	43.03(±28.38)
Number of desaturations	8-700	275.43(±191.77)
Number of apneas	3-711	218.90(±182.73)

A correlation was observed between AHI and BMI (p <.001) on performing Pearson's correlation analysis. When One way ANOVA test was used to see the relationship between ESS and OSA severity in different OSA groups as determined by AHI, a significant association was observed with a p value of <0.001.

The mean plot between the mean of ESS and severity of OSAS is shown in Figure 1.

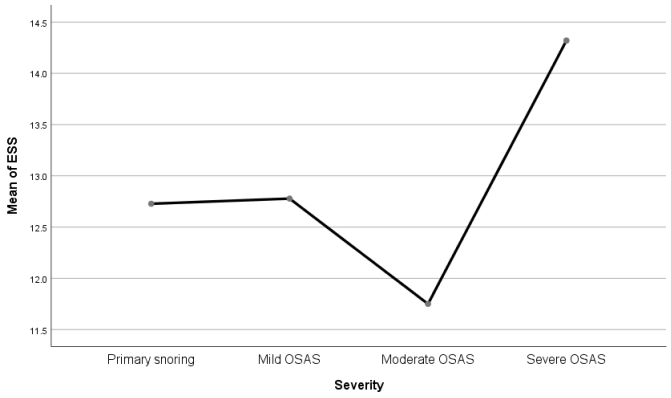

Figure 1: Mean plot between severity of OSAS and Mean of ESS

Discussion

Of the total of 61 patients with OSAS, 44 (72.1%) were men and 17(27.9%) women. There was a predominance of the male population in our study. Our findings are similar to the literature review by Franklin KA et al who found that overall, 22% of men and 17% of women had OSA and another population-based study, where the prevalence of OSA in men was 12% higher than in women While there is some evidence suggesting an increased susceptibility of the male pharynx to collapse during sleep, most of the studies investigating the effect of gender on upper airway resistance were conducted in small samples of subjects without sleep apnea.

In our study, 60(98.4%) had complaints of snoring. Contrary to our study, Gondim et al[14] found that the majority of participants (83.2%) had snoring while 52.8% had excessive daytime sleepiness. They had conducted their study in 125 participants with clinical suspicion of OSAS regardless of the degree of daytime ESS based sleepiness. They concluded that only history and clinical findings are not sufficient tools for diagnosis of OSAS and patients have to undergo polysomnography.

ESS correlated with AHI ($p < .001$) suggesting that the scale is a reliable indicator to assess the functional state of the patient and to determine the severity of obstructive sleep apnea along with the amount of daytime sleepiness. Similarly in a study by Guo et al, [15] authors found that ESS was positively correlated with AHI and concluded that ESS is valid to assess OSAS can be used as a screening tool. Our study findings are contrary to the study by Pang et al16 who did not find a strong correlation between ESS and AHI($p = 0.06$). In the current study, the mean BMI was 30.25 kg/m^2 overall. Minimum BMI was 21 kg/m^2, maximum was 45 kg/m^2. Most of the participants fell into the overweight-obese category, the highest being Class I obesity (27.26%). There was a statistically significant correlation between AHI and BMI ($p < 0.001$) suggesting that BMI is a reliable clinical indicator of OSAS.

Obesity is a key risk factor for the development of OSA, the physiological mechanisms however, remain less than certain. Deposition of fat around the pharyngeal airway is likely to increase the collapsibility of the pharyngeal airway. Fat deposition around the abdomen leads to reductions in functional residual capacity, which would be predicted to reduce lung volume tethering effects on the upper airway.[17] The lifestyle and food habits also encourage people in Nepal to develop obesity leading to short and stout necks and therefore a high BMI that predisposes to OSAS.

Similarly, Pang et al[16] in their study found that the mean BMI was 32.9 kg/m^2, and the mean AHI is 37.9 events/hour. They also reported a significant correlation between BMI and AHI. They reported that the risk of severe OSAS was higher in patients with BMI ≥31.7 kg/ m^2.

In the current study, the majority of participants (40.98%) had severe OSAS. This could be explained by the fact that the majority of patients who come to our hospital belong to lower to middle class families who do not have insurance coverage for performing diagnostic procedures such as polysomnography. People can afford to seek medical care only when it is highly necessary and when they are severely symptomatic. In addition, we included participants who had high ESS scores ≥10. Also, most of our patients had a high BMI which may be contributing factors to the high severity of OSAS. In addition, our study population had participants with high grades of tonsils, elongated uvula, bulky tongue, short neck which are considered a risk factor and can contribute to severe OSAS.

This study has several strengths and limitations that deserve discussion. There have been very few studies on OSAS in the Nepali population and ours is one of them. [18, 19, 20]

PSG records were scored and read by the same observer to avoid interobserver bias. However, a limitation of the study is that pediatric patients were not included due to the lack of pediatric-sized instruments on the polysomnography machine. Additionally, the study may not be representative of the general population. Another limitation of the study was that we did not perform drug-induced sleep endoscopy (DISE) which would have provided information on the level and degree of upper airway collapse that is needed for surgical intervention.

We recommend that a multi centric study with a larger sample size would be more representative of the general population and provide more reliable results. Inclusion of a health insurance policy for costly investigations would also help ensure that all participants have access to the care they need.

Conclusion

OSAS is an under diagnosed disease in a country like ours because patients often neglect it as snoring. Patients with excessive daytime sleepiness, multiple apneic spells, high body mass index and a high Epworth sleepiness score should raise clinical suspicion of obstructive sleep apnea. In our study, primary snoring was observed in 11(18.03%) patients, 9(14.75%) had mild, 16(26.22%) had moderate, while 25(40.98%) patients had severe obstructive sleep apnea . A multidisciplinary approach is

necessary for its diagnosis and patients should undergo overnight sleep study for diagnosis and early intervention. Finally, snoring should not be considered a feature of sound sleep. Rather, it should be considered a ticking time bomb waiting to explode.

Acknowledgements

The authors express their sincere gratitude to our sleep technician Mr.Dipak Raj Karki from the Department of ENT and Head and Neck Surgery, Dhulikhel Hospital for his valuable support.

Conflict of Interest: None

Financial Disclosure: None

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