Clinical Profile and Diagnosis of Obstructive Sleep Apnea Syndrome using Overnight Polysomnography in a Tertiary Care Hospital
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ABSTRACT

Background
Obstructive sleep apnea is a highly prevalent yet largely under-diagnosed disease that poses a significant burden on the healthcare system.

Objective
To determine the role of predictors for Obstructive sleep apnea syndrome and its severity in Nepalese population.

Method
Prospective and analytical study conducted in the Department of Otorhinolaryngology and Head and Neck surgery at Kathmandu University Hospital between March 2018 and June 2020. A total of 85 adult patients with Obstructive sleep apnea with an Epworth sleepiness score greater than 10 were included. Overnight polysomnography was done and scoring of sleep associated events were done according to the American Academy of Sleep Medicine criteria. Participants were classified as simple snoring and mild, moderate or severe Obstructive sleep apnea syndrome groups depending on the Apnea Hypopnea Index values. Relationship of Apnea hypopnea index was analyzed with age, neck circumference, body mass index and Epworth Sleepiness score.

Result
Simple snoring was seen in 18(21.17%) patients, 14(16.47%) had mild Obstructive sleep apnea, 13(15.29%) had moderate Obstructive sleep apnea, whereas the severe group consisted of 40(47.05%) patients. The minimum Epworth Sleepiness Score was 10 and the maximum was 25. The Apnea hypopnea index correlated positively with Body mass index (p=.010) and Epworth sleepiness score (p<.001). However, Apnea hypopnea index had no association with age (p=.437) and neck circumference (p=.118).

Conclusion
Health professionals need to be extremely vigilant while examining patients presenting with Obstructive Sleep Apnea. Polysomnography is the investigation of choice in the early identification of this treatable disease.

KEY WORDS
Apnea hypopnea index, Obstructive sleep apnea, Polysomnography
INTRODUCTION

Obstructive sleep apnea syndrome (OSA) represents a global health problem and is increasing in prevalence. There is profound morbidity, impairment of quality of life and costs related to this highly prevalent yet largely under-diagnosed disease. The prevalence of OSA has been estimated to be 14% in men and 5% in women.\(^1\)

If undiagnosed and untreated, it has deleterious consequences such as atrial fibrillation, resistant hypertension, insulin resistance and stroke.\(^2,3\) Other associated features are hypersomnolence, declines in daytime function leading to higher rates of job-related and motor vehicle accidents, depression, sexual impotence, gasping, nocturia and morning headaches. Bed partner may report snoring or witnessed apneas, work-place errors and death.\(^4,8\)

OSA poses a significant burden on the healthcare system, with increased healthcare utilization. Hence, it is very crucial to assess it timely and rigorously. Polysomnography (PSG) is the gold standard investigation which aids in its early identification.\(^9\) Despite the rapidly growing prevalence, OSA remains a very scarcely researched topic in Nepal.

Our study aims to determine the role of predictors for OSA and severity in Nepalese population with the help of PSG.

METHODS

We conducted a single center, prospective, analytical study in the Department of Otorhinolaryngology and Head and Neck surgery at the Kathmandu University Dhulikhel Hospital between March 2018 and June 2020. Ethical approval was obtained from Kathmandu University School of Medical Sciences Institutional Review Committee.

A total of 85 patients who were more than or equal to 18 years of age with clinically diagnosed OSA with an Epworth sleepiness score greater than 10 undergoing diagnostic evaluation by PSG were included in our study. Exclusion criteria were patients under the age of 18 years, pregnancy, a sleep disorder other than OSA and subjects under treatment with continuous positive airway pressure. Patients with a recent history of airway surgery, airway cancer, decompensated cardiopulmonary disease were also excluded. Similarly, patients with overlap syndrome, chronic kidney disease, neuromuscular disease with repercussion on ventilator mechanics, neuropsychiatric illness that could compromise the validity of questionnaire and patients on medications known to affect sleep or neurocognitive function were not enrolled.

A detailed history and clinical examination was performed. With the help of a study questionnaire the demographic data, presenting symptoms, symptoms of co-morbidities, general medical history, medication use, alcohol use, smoking habits and sleep hygiene were recorded.

Position of maxilla and mandible including retrognathia and micrognathia, and presence or absence of any abnormality in facial characteristics were noted. Assessment of nose was done for any external nasal deformity, nasal valve adequacy, position of nasal septum, turbinate size, condition of nasal mucosa, presence or absence of nasal polyps, rhinorrhea or purulence. In oral cavity, size of tongue and tonsil, position and elongation of palate and uvula, modified Mallampati score, dentition and crowding of oropharynx was noted. In the neck, neck circumference (NC), redundant cervical adipose tissue and hyoid position was noted. Weight was measured with light clothing and after removal of shoes. NC was measured using a measuring tape at the level of middle of the neck through cervical spine process and superior line of the cricothyroid membrane with the patients awake and in the standing upright position and stated in centimeters. Patients were asked to look straight ahead, with shoulders down, but not hunched during the measurement. All the anthropometric measurements were done twice and averaged to get a more precise value. Body Mass Index (BMI) was calculated as measured weight (in kilograms) divided by height (in meters) squared. Blood pressure was measured in sitting and supine position after resting for five minutes. The left arm of the patient was placed at the level of the right atrium in each position during measurement.

Laryngeal examination was done by fiberoptic nasopharyngolaryngoscopy to rule out any laryngeal tumours. Epworth sleepiness score (ESS) was used to evaluate the subjective level of daytime sleepiness.\(^10\)

Written informed consent was obtained from each patient following a detailed explanation of the objectives and protocol of the study. A clinical data proforma was filled up.

Overnight PSG was conducted at Kathmandu University Hospital in the sleep laboratory. All the PSG studies were supervised and attended by an experienced sleep technician. Participants arrived in early evening. A 48-channel PSG recording system (Miniscreen pro device) was used to assess sleep state and respiratory and cardiac parameters. PSG was performed by the same sleep technician during the whole period of study. Data was analysed by using software. The parameters monitored were electroencephalography, electrocuculography, chin and anterior tibialis electromyography, electrocardiography, inductance plethysmography (to detect abdominal and thoracic movements), pulse oximetry, nasal pressure monitoring using nasal pressure transducer, snoring intensity using acoustic sensor (microphone), oronasal thermal airflow using thermistor, blood pressure, pulse and body position. The various events of PSG record were inspected visually for abnormal breathing episodes. All the PSG records were scored and read by the same sleep technician and verified by the same otorhinolaryngologist trained in sleep medicine over the entire period of study in order to avoid inter observer bias. All tests lasted for a minimum of six hours. The scoring of sleep and associated
events was done according to American Academy of Sleep Medicine criteria.\textsuperscript{11,12}

Apnea was identified as reduction in airflow greater than \( \geq 90\% \) as recorded by oronasal thermistors or nasal pressure cannulas lasting for \( \geq 10 \) seconds. Hypopnea was identified when reduction in airflow \( \geq 30\% \) as recorded by nasal pressure cannulas lasting \( \geq 10 \) sec with reduction in saturation at least \( \geq 4\% \) from baseline SpO\textsubscript{2} % prior to event. Apnea-hypopnea index (AHI) was defined as the number of apneas and hypopneas per hour of sleep, confirmed by electroencephalogram (EEG). Arousal was defined as a sudden change in the electroencephalography frequency, with alpha and theta activity or 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 an increased respiratory effort or flattening of nasal pressure waveform, followed by arousal from sleep, which does not meet the criteria for an apnea or hypopnea event.\textsuperscript{12,13}

Sleep stage scoring was done in 30 seconds epochs and respiratory events scoring was done in 2 minute epochs. Participants were classified into four groups on the basis of Apnea Hypopnea Index (AHI) determined from the PSG records as simple snoring group (AHI < 5 events/hour), mild OSA group (AHI-5 to 15 events/hour), moderate OSA group (AHI-16 to 30 events/hour) and severe OSA group (AHI- \( \geq 30 \) events/hour).

The statistical analyses was carried out by using the Statistical Package for Social Science software (IBM SPSS Statistics 21, Chicago, USA). The relationship between age and AHI, AHI and neck circumference, AHI and BMI, AHI and ESS was done by using Pearson correlation coefficient. The relationship between severity of OSA in between groups and age was analysed by the help of One-way ANOVA test. A \( p \)-value < 0.05 was considered to be statistically significant.

RESULTS

Of the 85 patients evaluated, 72(84.7%) were males and 13(15.3%) were females. The minimum age was 20 and maximum was 68 years. Table 1 shows the socio demographic characteristics of patients. Simple snoring group consisted of 18(21.17%) patients, mild OSA group consisted of 14(16.47%) patients, moderate OSA group comprised of 13(15.29%) patients whereas severe OSA group consisted of 40(47.05%) patients. The minimum ESS was 10 and maximum was 25. The predominant sleep position encountered with OSA was supine in 46(54.1%) patients, followed by left lateral position in 22(25.9%) and right lateral in 17(20%) patients respectively. There were 21(24.7%) patients with Diabetes mellitus and 31(36.5%) were hypertensive. The mean \( \pm \) SD of age, BMI AHI, NC, ESS are presented in table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>72</td>
<td>84.70</td>
</tr>
<tr>
<td>Female</td>
<td>13</td>
<td>15.30</td>
</tr>
<tr>
<td>Age group (years)</td>
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<td></td>
</tr>
<tr>
<td>20-30</td>
<td>12</td>
<td>14.11</td>
</tr>
<tr>
<td>31-40</td>
<td>35</td>
<td>41.17</td>
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<td>41-50</td>
<td>16</td>
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<td>51-60</td>
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<td>22.35</td>
</tr>
<tr>
<td>61-70</td>
<td>3</td>
<td>3.52</td>
</tr>
<tr>
<td>Profession</td>
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<td></td>
</tr>
<tr>
<td>Driver</td>
<td>19</td>
<td>22.35</td>
</tr>
<tr>
<td>Engineer</td>
<td>15</td>
<td>17.64</td>
</tr>
<tr>
<td>Housewife</td>
<td>12</td>
<td>14.11</td>
</tr>
<tr>
<td>Restaurant worker</td>
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<td>9.41</td>
</tr>
<tr>
<td>Student</td>
<td>7</td>
<td>8.23</td>
</tr>
<tr>
<td>Teacher</td>
<td>6</td>
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</tr>
<tr>
<td>Farmer</td>
<td>5</td>
<td>5.88</td>
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<tr>
<td>Politician</td>
<td>4</td>
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</tr>
<tr>
<td>Receptionist</td>
<td>3</td>
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<tr>
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<tr>
<td>Chartered accountant</td>
<td>2</td>
<td>2.35</td>
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<tr>
<td>Doctor</td>
<td>2</td>
<td>2.35</td>
</tr>
</tbody>
</table>

AHI correlated positively with BMI (\( p = .010 \)) (fig. 1). Likewise, there was a significant interaction between AHI and ESS (\( p < .001 \)). However, when age was correlated AHI (\( p = .437 \)), no statistical significance was achieved. Similarly, no association was observed between AHI and NC (\( p = .118 \)). The mean plot between age and severity of OSA has been presented in figure 2.

DISCUSSION

We found that the most frequently affected age group was between 31-40 years. In the current study we did not observe any relationship between age and prevalence of OSA. Our results are similar to the findings of a study done in African Americans.\textsuperscript{14} Our observation contradicts those of some of the formerly published literature.\textsuperscript{15-17} These differences may be attributable to socio demographic and geographic differences between the study populations.
There was a predominance of male population in our study which is consistent to previous studies and contrary to another study where the authors found that the prevalence of OSA was more in females. This may be due to the variable pattern of distribution of adipose tissue in men, who exhibit a predominantly central fat deposition pattern around the neck, trunk, and abdominal viscera compared with women.

In approximately 56% to 75% of patients with OSA, the frequency and duration of apneas are influenced by body position. In the present study, the most frequently observed sleep position that was associated with OSA was supine. This is in accordance with study by Ravesloot et al.

Apnea-hypopnea index (AHI) has been used as the main parameter to stratify the severity of the disease. We observed a strong association between AHI and BMI (p = .010). Our findings are in accordance to previous studies in literature.

The Epworth sleepiness scale (ESS) is a widely used screening tool in the clinical evaluation of obstructive sleep apnea. It has eight items on a 3-point Likert scale, with the total score ranging from 0-24 that rate a person’s likelihood of dozing off in daily situations. A score greater than 10 suggests excessive daytime sleepiness. In a study performed at the Mayo Clinic Center for Sleep Medicine, the authors found that ESS is less associated with the presence of sleep disordered breathing in women compared with men which is in contrast to our study.

Some authors found that a large neck circumference was predictive of OSA in the general population. Likewise, Guilleminault et al. in their research stated that increases in visceral fat with age may also account for an increase in sleep apnea prevalence in middle-aged and older men and in postmenopausal women. However, in our study, no association was observed between AHI and neck circumference (p = .118). No convincing reasons have been mentioned in previous literature to support our finding.

We would also like to mention some strengths of our study. We included only the patients who underwent an attended in-laboratory PSG. To the best of our knowledge this is the only study highlighting the importance of Polysomnography in diagnosis of OSA and determining the role of predictors like age, BMI, NC, AHI in OSA in Nepali population.

Our study also has some limitations. This was a single center study. We hope that in future much large scaled community based studies will be conducted to further substantiate the observations of this study.

**CONCLUSION**

The public health burden posed by OSA is substantial. There is very high prevalence of OSA in Nepali population. However, it remains largely undiagnosed due to lack of awareness in general population. There is apparent lack of available resources for diagnosis and treatment of OSA in Nepal which is inadequate in meeting the growing demands. Health professionals need to be extremely vigilant while examining patients who present with multitude of symptoms suggesting OSA. Polysomnography is a useful investigation which helps in diagnosis of this treatable disease.
REFERENCES


