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A Prospective Study on Obstructive Sleep Apnea

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ABSTRACT

The obstructive sleep apnea (OSA) is a common condition characterized by repeated episodes of upper airway obstruction during sleep and nocturnal hypoxemia and hypercapnia. OSA is one of the sleep disorders which are associated with adverse health outcome. The aim of the study was to determine whether OSA increases the risk of cerebro-vascular and cardiovascular causes and the risk of study population. This prospective study was conducted on 61 subjects, who underwent an overnight polysomnography (PSG) study. OSA diagnosed based on Apnea Hypopnea Index (AHI) 47. Based on AHI, distribution of patients as No OSA, mild OSA, moderate OSA and severe OSA was established as 22.95%, 18.03%, 16.39% and 42.62% respectively. Among 47 OSA patients 78.72% were male and 21.27% were female. The present BMI (r=0.335, p<0.05), oxygen saturation (r=0.398, p<0.01), oxygen de-saturation (r=0.514, p<0.01) and study 29.78% was obese and 59.57% were overweight. The mean body mass index (BMI), oxygen saturation, oxygen de-saturation and number of snoring were found to be 27.73±3.09 kg/m^2, 91.58±6.09%, 24.50±36.22% and 52.54±24.11 respectively. AHI correlated positively and significantly with number of snoring (r= 0.345, p<0.05). Findings suggest that sleep disordered breathing causes significant nocturnal perturbations, such as OSA which can lead to cerebro-vascular and cardiovascular disorders. An immediate treatment option like nasal continuous positive airway pressure (n- CPAP) must be weighed.

Key words: Obstructive sleep apnea, Apnea hypopnea index, Body Mass Index, Polysomnography.

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INTRODUCTION

The obstructive sleep apnea (OSA) is a common condition characterized by repeated episodes of upper airway obstruction during sleep and nocturnal hypoxemia and hypercapnia. OSA affects mostly the middle-aged work force, and exerts a negative impact on public health by increasing both morbidity and mortality [1]. OSA has been found to have an independent association with hypertension, cardiovascular disease, stroke, type 2 diabetes, metabolic syndrome, and an overall deterioration of an individual's quality of life and working capacity [2-6]. Obstructive sleep apnea with manifest clinical symptoms is estimated to be prevalent in 2-4% of the population, while the prevalence of an apnea hypopnea index (AHI) values greater than 5 is reported as 25% for men and 9% for women [7,8]. Patients with Obstructive sleep apnea have increased circulating levels of C-reactive protein, TNF- alpha, Interleukins, Intracellular adhesion molecule-I, lipoproteins, triglycerides and leptin [9]. Overnight polysomnography (PSG) is considered to be the gold standard for diagnosis of OSA. One of the studies in Japanese patients confirmed the usefulness of nasal CPAP on the quality of life with OSA [12].

METHODOLOGY

Study Design

This prospective study was conducted at Kovai Medical Centre and hospital, Coimbatore, India. Subjects of the study, selected from the patients who underwent an overnight Polysomnography and diagnosed as OSA. The study protocol was approved by the Ethics committee and written informed consent was obtained from all patients prior to enrollment.

Polysomnography

Overnight polysomnography was performed by using recording system and standard electrodes and sensors. Various parameters monitored included electroencephalogram (EEG), electro-oculogram (EOG), electrocardiogram (ECG), chin and leg electromyogram (EMG), nasal airflow, tracheal breath sounds, thoracic wall and abdominal movements, transcutaneous oxygen saturation and body position. All subjects underwent PSG for at least 6 h. The sleep data recorded by the computer were scored for sleep stages, apneas, and hypopneas. The apnea was defined as cessation of oronasal airflowfor >10 sec. Obstructive apneas were scored when airflow was absent but respiratory efforts were present. Hypopnea was defined as the reduction in respiratory airflow during a preceding period of normal breathing for >10 sec accompanied by a decrease of 4 per cent or more in oxy-haemoglobin saturation during sleep. Apnea-hypopnea index (AHI) was calculated based on the following formula: AHI = (total no. of obstructive apneas + total no. of hypopneas) / total sleep time in hours [10].

Anthropometric profile

Body weight was recorded in all patients, in erect position without shoes. Height was measured and body mass index (BMI) was calculated as body weight/height^2 (kg/m^2).

Statistical Analysis

The quantitative distribution of questionnaires, individual patient variables and results of sleep study monitoring are expressed by descriptive statistics (mean ± SD).The Pearson correlation test was performed. SPSS version 16.0 for windows was used for the statistical analysis. The values of $p<0.05$ and $p<0.01$ were statistically significant.

RESULTS

Out of 61 subjects, 47 were diagnosed with obstructive sleep apnea (77.05%) and 14 were No OSA. Based on AHI, distribution of patients as No OSA, mild OSA, moderate OSA and severe OSA was established as 22.95%, 18.03%, 16.39% and 42.62% respectively.

Among 47 obstructive sleep apnea patients 37 (78.72%) were male and 10 were female (21.27%). In the study male were comparatively higher than female. Approximately 9% of female and 24% of male experience sleep apnea. Based on the BMI, distribution of patients considered as normal, overweight and obese was established as 10.67%, 59.57% 29.78% respectively. Obesity (BMI), gender and age are important risk factors for OSA. Not only increased body weight but also the fat distribution plays a major role in OSA.

Among 47 OSA patients the mean BMI, AHI, oxygen desaturation, oxygen saturation were found to be 27.73 ± 3.09 kg/m^2, 36.17 ± 22.79 events / hour, 24.50 ± 36.22 %, 91.58 ± 6.09 events / hour respectively. Average BMI of male 27.55 ±3.16 kg/m^2 and female were 28.38 ±2.89 kg/m^2, average AHI of male 40.25 ± 22.51events / hour and female 21.08 ±17.48 events / hour, mean oxygen desaturation of male 27.87 ± 39.90 events / hour and female 12.48 ± 11.59 events / hour, mean oxygen saturation of male 93.2± 2.94% and female 85.43 ± 10.9 % (Table 1).

In order to analyze correlation among variables, Pearson correlation test was used. Out of 47 OSA patients correlation value of AHI with each variable shows significance for BMI ($r=0.335$, $p<0.05$), Oxygen saturation ($r=0.398$, $p<0.01$), Oxygen desaturation ($r=0.514$, $p<0.01$) and number of snoring ($r= 0.345$, $p<0.05$). Then AHI with variables sleep efficiency and sleep onset doesnot show significance (Table 2 : Figure 1 and 2).

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Table 1. Polysomnographic variables of obstructive sleep apnea patients

Variables	Total OSA Patients (n=47)	Male (n=37)	Female (n=10)
Age	51.25±13.06	51.0 ± 13.82	52.2 ± 10.36
BMI (kg/m^2)	27.73 ±3.09	27.55 ± 3.16	28.38 ± 2.89
Sleep Efficiency	49.74 ±28.58	49.08 ±28.12	52.2 ± 31.67
AHI (events/hour)	36.17 ±22.79	40.25 ± 22.51	21.08 ± 17.48
Sleep Onset (minutes)	24.91 ±22.41	25.43 ±23.70	23.0 ± 17.7
Total Sleep Time (minutes)	226.1 ±121.5	221 ± 118.85	245.4 ±135.77
Oxygen Desaturation (events/hour)	24.50 ±36.22	27.875 ± 39.90	12.48 ± 11.59
Oxygen Saturation %	91.58 ±6.09	93.2 ± 2.94	85.43 ± 10.09
No. of Snores	52.46 ±24.11	53.67 ± 23.02	48.0 ± 28.68

Table 2. Correlation of Apnea Hypopnea Index with Polysomnographic Variables

Variables	r value	p value
AHI	-	-
BMI	0.335*	0.021
Sleep Efficiency	0.050	0.572
Sleep Onset	0.030	0.840
Oxygen Saturation	0.398**	0.006
Oxygen De-saturation	0.514**	0.000
No. of Snoring	0.345*	0.018

** p< 0.01, * p< 0.05

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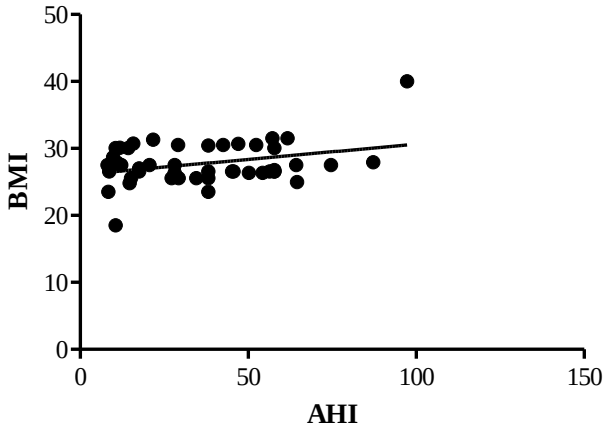
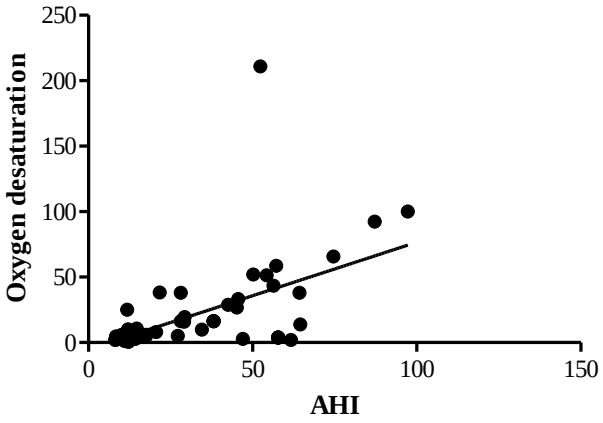
Figure 1. Correlation of AHI and BMI



r=0.335* p<0.021

Figure 2. Correlation of AHI and Oxygen desaturation



r=0.514**p<0.000

DISCUSSION

A number of epidemiological studies have been performed all over the world in various ethnic and racial groups to determine the prevalence of OSA. In the present study we examine the AHI through polysomnography. Here is strong association between the AHI and presence of symptoms. The risk of Obstructive sleep apnea is increased in people with obesity, hypertension and abnormalities in craniofacial anatomy [13]. Previous investigations have observed that apnea hypopnea index was significant determinant of C-reactive protein. In predicting cardiovascular risks of Obstructive sleep apnea syndrome, both hypoxia and obesity should be considered in middle aged group whereas nocturnal respiratory disturbance are important in elderly group [14].

Based on the BMI, distribution of patients considered as normal, overweight and obese. Obesity is strongly associated with sleep apnea [8]. In obese patients fatty cells clogs the throat tissue, which indicates that they narrow the airways. The more obese a person with sleep apnea is, the higher the pressure on the airway and therefore greater the obstruction of the airway. Sleep and weight gain are closely related, and weight gain is one of the common effects of lack of sleep. Obesity and sleep apnea occur together frequently, lack of sleep has multiple effects that can result in excess weight. Lack of sleep lowers the level of leptin, a protein that regulates and controls appetite. Low leptin levels may increase appetite, leading to weight gain. Although leptin is a circulating signal that reduces appetite, in general, obese people have an unusually high circulating concentration of leptin. These people are resistant to the effect of leptin. The present study also showed that oxygen saturation decreases in OSA patients. OSA is a sleep disorder characterized by intermittent complete and partial airway collapse, resulting in frequent episodes of apnea and hypopnea. The breathing pauses cause adverse effects, including oxy-hemoglobin desaturation, fluctuations in blood pressure and heart, increased sympathetic activity, cortical arousal and sleep fragmentation [15].

CONCLUSION

In the present study 29.78% are obese and 59.57% are overweight that means obesity is one of the main risk factor for obstructive sleep apnea. Obstructive sleep apnea is a sleep disorder associated with the repetitive reduction (hypopnoea) or cessation (apnoea) of airflow due to upper airway instability and closure. OSA patients have increased cardiovascular morbidity and mortality rate. Therefore, identifying the disease and possible risk factors involved in obstructive sleep apnea is of great clinical importance. Obstructive sleep apnea is commonly seen in male with age of 40-60 years. Obesity plays a major role in sleep disordered breathing. OSA is characterized by repeated oxygen desaturation. The frequent drops in oxygen levels and increased number of snoring trigger the release of stress hormones. These compounds raise the heart rate and increase the risk for high blood pressure, heart attack, and stroke. The more obese person with sleep apnea, is the higher the pressure on the airway and therefore greater the obstruction of the airway. In addition, population based studies are necessary in order to elucidate the interaction between obstructive sleep apnea and metabolic consequences so that these individuals are properly treated. The study concluded that sleep disordered breathing is the main cause for nocturnal perturbations, such as OSA which can lead to cerebro-vascular and cardiovascular disorders. An immediate treatment option like nasal continuous positive airway pressure (n- CPAP) must be weighed.

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