



## CLINICAL PREDICTORS OF OBSTRUCTIVE SLEEP APNOEA IN PATIENTS WITH SNORING.

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## ABSTRACT

Obstructive Sleep Apnea (OSA) is gaining more significance in otorhinolaryngology practice now a day because of the anatomical sites involved in this pathology. This study was aimed to correlate Epworth Sleepiness Scale (ESS), neck circumference (NC), body-mass index (BMI) and Friedman's Staging with the Apnea-Hypopnea Index (AHI). This is a prospective descriptive study, where Fifty three patients with snoring were included. The ESS score, BMI, neck circumference, Friedman staging were correlated with apnea-hypopnea index (AHI) using statistical tests to assess for any statistical significance. Of the fifty three patients, forty six were diagnosed as having OSA with the proportion of 86.8%. There was a significant association of ESS, BMI, neck circumference in males and Friedman staging with the severity of OSA. Thus we concluded that, even though Polysomnogram is the gold standard in the diagnosis of OSAS, Epworth Sleepiness Score, Body Mass Index, Neck circumference and Friedman staging can be used as clinical predictors of OSA in patients with snoring.

## KEYWORDS

Obstructive sleep apnea, Epworth Sleepiness Score, Friedman staging, Polysomnography, Body Mass Index, Neck Circumference

## INTRODUCTION

Obstructive sleep apnea (OSA) syndrome was first recognized as a significant health problem only over the last half of 20th century. The exact prevalence of OSA is unknown, it ranges from 10- 17% in the US population [1]. Literature available on the prevalence of OSA in Indian population is very less. A two-stage, cross-sectional, community-based prevalence study conducted by Surendra Kumar Sharma et al in Delhi estimated the prevalence of OSA to be 13.74% and OSAS (OSA with day time symptoms) to be 3.57%[2]. OSA is a condition characterised by repetitive upper airway obstruction leading to sleep fragmentation, cardiovascular stimulation and oxygen desaturation during sleep. Abnormalities in upper airway size and muscle activity contribute to the pathogenesis of OSA. Obesity is a major risk factor and upper body obesity results in fat deposition around the airways and in the related soft tissues. Together, these lead to symptoms such as snoring, unrefreshing sleep, excessive daytime sleepiness (EDS), and the increased risk of co-morbidities such as cardiovascular disease, hypertension, insulin resistance, cerebrovascular disease and road traffic accidents.

Assessment of patients with OSA includes detailed history, ideally with the partner and evaluation with a questionnaire in view of lack of sensitivity and specificity based on history alone. BMI, neck circumference, detailed nasal, oropharyngeal assessment including Friedman's palate position, tonsillar grading and craniofacial abnormalities gives us static information about the upper airway. Polysomnography is the gold standard in the diagnosis of OSA, in which the apnea-hypopnea index (AHI) is calculated, based on which the severity of OSA is graded. Sleep MRI and Drug Induced Sleep Endoscopy (DISE) helps to find the pattern and levels of dynamic obstruction.

In this study, assessment of clinical parameters like Epworth Sleepiness Score (ESS), Neck Circumference (NC), Body Mass Index (BMI) and Friedman Staging was done, to assess their significance to serve as adjuncts in diagnosis of OSA in patients with snoring.

## MATERIALS AND METHODS

This is a prospective, descriptive study conducted in a community hospital during the period of November 2014 to December 2015. All patients who presented to our outpatient department with complaints of snoring were evaluated with Epworth's Sleepiness Score: Patients were given ESS questionnaire and graded accordingly. ESS more than 10 is considered abnormal.

Neck circumference: Neck circumference measured at the level of crico-thyroid membrane in cm. Neck circumference of more than 43.2cm in males and 42cm in females is considered significant.

Body Mass Index: The patient's weight in kg and height in meter measured and BMI calculated as follows and graded according to WHO criteria.

$$BMI = \frac{\text{Weight (in kg)}}{\text{Height}^2 \text{ (in m)}}$$

## Friedman Staging:

Patients were evaluated according to this classification and graded as in Table 1.

Friedman Stage	Friedman Palate Position	Tonsil size	BMI
Stage 1	1	3,4	<40
	2	3,4	<40
Stage 2	1,2	1,2	<40
	3,4	3,4	<40
Stage 3	3	0,1,2	<40
	4	0,1,2	<40
Stage 4	1,2,3,4	0,1,2,3,4	>40

Table 1: Friedman Staging

Polysomnography: All patients were referred for polysomnography. Level 3 home sleep study, which includes oxygen saturation, heart rate, airflow, and chest movements was done. The report was interpreted by pulmonologist and patients were graded as Mild, Moderate and Severe OSA with AHI of 5-15, 15-30 and more than 30 respectively. AHI of less than 5 with snoring has been denoted as simple snoring without OSA.

The ESS, Neck circumference, BMI and Friedman's classification of each patient was compared with the AHI and statistically analyzed.

## STATISTICS AND RESULTS

Out of 53 patients in the study group with snoring, 7 were simple snorers and 46 had AHI more than 5. Among them, 22 patients had severe OSA. (Table: 2). The mean AHI value was 30.4 with standard deviation of  $\pm 23$ .

AHI	No. of patients
<5	7
5 to 15	11
15 to 30	13
>30	22
Total	53

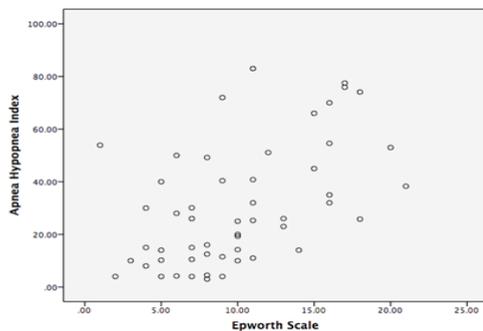
**Table 2: AHI Distribution**

Patients included in this study were from 20 to 80 years, with maximum patients in the age group of 40-50. Males were predominant and there were 12 females. Snoring, excessive daytime sleepiness, dryness of mouth, choking and body & leg movements during sleeping was the common symptoms. (Table 3) Dyslipidemia and hypertension were the most common comorbidities seen in our study group. Diabetes mellitus and hypothyroidism was also present.

Symptoms	No. of patients
Snoring	53
Excessive day time sleepiness	41
Choking	36
Body & leg movements	34
Morning fatigue	33
Dryness	33
Nocturnal enuresis	18
Morning headache	17
Nocturnal sweating	8

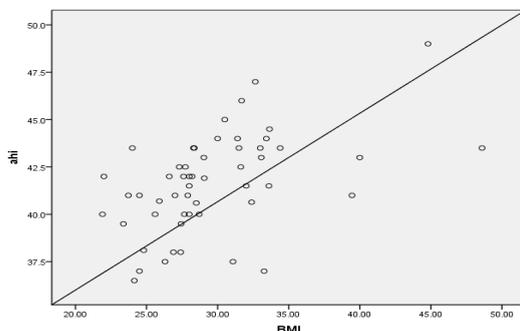
**Table 3: Symptom Distribution**

21 patients had an Epworth sleepiness score of more than 10. The mean ESS was 10 with standard deviation of ±5. There was strong correlation between Epworth Sleepiness scale and Apnea Hypopnea Index, Pearson correlation  $r=0.51$ , which was highly significant,  $p<0.001$  (fig: 1).



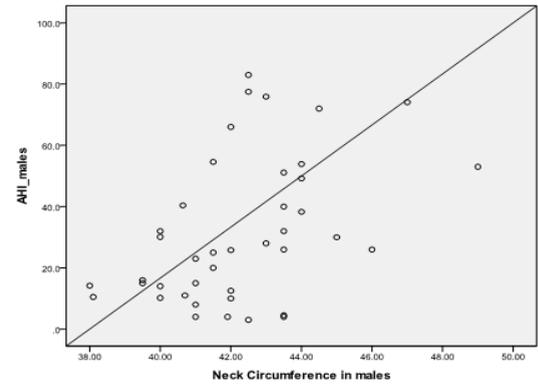
**Fig1: ESS v/s AHI**

In this study, BMI was categorised according to WHO classification. 21 patients were obese and 23 were over-weight. Mean BMI was 30 with standard deviation of ±5.1. There was strong correlation between Body Mass Index and Apnea Hypopnea Index, Pearson correlation  $r=0.498$ , which was highly significant,  $p<0.000$  (fig: 2).



**Fig2: BMI v/s AHI**

Out of 41 males 14 had neck circumference more than 17inches (43.2cms) minimum was 38.1 and maximum was 46 cms. Of the 12 females 4 had neck circumference more than 16inches (41cms), minimum was 36 and maximum 43 cms. The mean neck circumference was 42 with standard deviation of ±3. There was correlation between Neck circumference in males and AHI, Pearson correlation  $r=0.302$ , which was significant,  $p<0.05$  (fig: 3). In females there was no significant correlation as the sample size was small.



**Fig 3: Neck Circumference v/s AHI**

In the study group, 23 patients were in Friedman palate position 3 and 22 patients in position 4. Out of 53 patients 32 had Friedman staging III. 2 patients had a BMI more than 40, thus 2 patients were in Friedman stage 4. So higher Friedman stage was associated with severe OSA. Chi square test P- value of 0.02 that was statistically significant (table: 4)

Friedman staging	AHI				Total	P value
	<5	5 to 15	15 to 30	>30		
I	0	1	0	0	1	0.02
II	6	4	2	5	17	
III	1	6	11	15	33	
IV	0	0	0	2	2	
Total	0	11	13	22	53	

**Table 4: Friedman Staging v/s AHI**

**DISCUSSION**

Early diagnosis of OSA will prevent the development of comorbidities associated with it. Even though polysomnography is the gold standard investigation in the diagnosis of OSA, our aim was to assess whether these clinical variables like Epworth Sleepiness Score, Body Mass Index, Neck circumference and Friedman's staging will predict OSA in patients so that they can be used as an outpatient screening tool.

A total of 53 patients who presented with snoring were included in the study. Based on the polysomnography, 7 patients were diagnosed as simple snorers and the remaining 46 patients as OSA. Thus, the proportion of patients with OSA in the study was 86.8%. In this study patients were between 20 to 80 years of age. Maximum patients were in the age group of 40-50, (22 patients) with male preponderance. According to the study done by S K Sharma et al, in Indian population OSA is twice more common in men and common in age group of 40 to 60 years[2].

We have taken 10 as the cut off value for ESS, which is the most accepted and widely used one. Pearson correlation co-efficient was taken to assess the statistical significance of ESS and AHI. There was strong correlation between ESS and AHI. In the study done by A M Bhandarkar et al, high ESS was found to be a clinical indicator of OSA in patients with snoring and excessive day time sleepiness [3]. Mean BMI in our study was 30 and increasing BMI was found to be significantly associated with severity of OSA in this study. A M Bhandarkar et al, also concluded in their study that high BMI is an clinical indicator of OSA[3]. Kang HH et al in their study found out that a BMI more than 24.95 is significantly associated with presence and severity of OSA [4].

A cut-off value of 43.2cm in males and 41cm in females was used for neck circumference as per the guidelines of American Academy of Sleep Medicine in this study [5]. There was strong correlation between Neck circumference in males and AHI. In the study of Ricardo LMD et al also, they concluded that neck circumference of more than 42cm is an independent predictor of OSA [6]. Hari Lekshmanan et al also found out that neck circumference was an independent predictor of OSA with cut-off value of 15.5 inches [7]. There is significant association of Friedman staging III and IV with severity of OSA in this study and thus it can predict OSA in a patient with snoring. In the studies done by M Friedman et al and M M Rodrigues et al, there was a significant association of stage III and IV with severe OSA [8, 9]

## CONCLUSION

In our study we found most of the patients with OSA had excessive day time sleepiness and snoring, were overweight, and had a mean neck circumference of 42 and a Friedman stage of III or IV. So to conclude, ESS, neck circumference, BMI and Friedman Staging can be used as clinical predictors in the diagnosis and severity of OSA in patients with snoring.

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