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CLINICAL CORRELATION OF DIAMETER OF PHARYNX AND VARIOUS COMORBITIES IN PATIENTS OF OBSTRUCTIVE SLEEP APNEA

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ABSTRACT
OSA is one of the emerging disease due to changing lifestyle of people. There are many challenges in it's management like less awareness for disease in patients and multiple comorbities associated with it. We conducted a case control study on obese patients attending a tertiary care centre in North India from a peroid of July 2020 to June 2022. Out of 50 cases, mean age was 58.06 ±12.36 and that in 20 controls was 57.85±11.7. Screening with STOP BANG questionnaire showed average score of 4.72 in case group and 1.3 in control group with significant p value < 0.001. Screening with Epswoth Sleepiness scale also showed significance with p value of <0.001. Average transverse diameter of pharynx in case group was 10.06±1.75mm and that in control group was 16.19±1.75mm with significant p value of < 0.001 and r value of – 0.38. Comorbities were also assessed in patients and cor pulmonale was found to be associated significantly with OSA with p value 0.04. Other comorbidies like HTN and T2DM were also found higher in case group but there was no significant correlation. It is essential to increase awareness of OSA in population and also assess the patients for various commorbities as OSA is asscociated with various commorbidites. By assessing transverse diameter through MRI we can screen the patient for OSA as PSG is cumbersome and often is delayed due to availability of machines.

KEYWORDS: OSA, STOP BANG Questionnaire, phaynx, cor pulmonale.

INTRODUCTION
Obstructive sleep apnea (OSA) is a well recognised and commonly occurring condition in which an individual suffers frequent apneic episodes causing arousal from sleep leading to fragmented and poor quality of sleep.[1] There is increased risk of all cause mortality of those effected by severe OSA.[2]

The polysomnography (PSG) has been the gold standard for the diagnosis of OSA and the severity is graded by the apnea hypoxia index (AHI) calculated by the number of apneas or hypopneas per hour of sleep. Patients then usually undergo treatment with continuous positive airway pressure (CPAP) or other medical management such as oral appliances, myofunctional therapies, and/or nasopharyngeal airway devices if indicated.[3] However, if patients cannot tolerate medical management, or if their OSA is severe enough that medical management is ineffective, patients will often seek surgical treatment. There are many options for surgical treatments including soft tissue surgeries, as well as skeletal surgeries and hypoglossal nerve stimulator implants that have proven effective for the management of OSA.[4]

MRI used in the traditional technique has also been used in the study of OSA patients and will be reported as "static MRI". Static MRI is a useful tool for identifying anatomical differences between patients with and without OSA.[5] Volumetric data calculated from static MRI of the soft palate, tongue, lateral wall volumes, and parapharyngeal fat pads can be predictors of OSA severity.[6] On the other hand, dynamic sleep MRI has potential to be applied clinically by providing images of

the exact sites and pattern of obstruction in OSA patients while asleep.

We aimed to study MRI findings in patients with obstructive sleep apnoea (OSA) and to evaluate the radiological correlation between velopharynx diameter in patients with obstructive sleep apnea.

MATERIALS AND METHODS

Case control study was conducted in obese patients coming to Chest OPD with complaints of dysnea, daytime sleepiness & snoring. Screening was done with

1) ESS
2) STOP BANG questionnaire

An overnight level 2 PSG was conducted at Sir Sunderlal hospital BHU.

Detailed history, thorough physical examination and a battery of relevant investigations was be done.

All patients included in this study will undergo polysomnography and other clinical and radiological evaluation as per pre-standardized protocol:

1) ECG
2) 2D-ECHO
3) Chest X-Ray (digital)
4) HRCT thorax
5) MRI Pharynx

Study design	Case control study
Study Center	Sir SunderLal Hospital, BHU ,Varanasi
Study Population	Patients coming to Sir Sundarlal hospital,BHU
Sample Size	Case:50 Patients diagnosed with OSA Control:20 healthy individuals
Sample Method	Adult patients meeting the inclusion criteria
Study Period	July 2020-June 2022

Inclusion criteria

- Patients diagnosed by COPD with or without cor pulmonale.
- Both male and female.
- Newly diagnosed OSA.

Exclusion criteria

- Pregnant female
- Patient taking treatment for OSA.
- Any chronic pulmonary condition
- Any neuromuscular disorder

Total 50 cases with AHI>= 5/hr were taken and 20 controls with AHI <5/hr were taken

STASTISTICAL ANALYSIS

Data were recorded on a predesigned proforma and managed on an Excel spreadsheet. Descriptive statistics was done and mean and standard deviation was calculated. Correlation was assessed using Spearman rank coefficient and statistical significance was accepted at p value <0.05. Statistical analysis was done using the Microsoft Excel and IBM statistical package for the social sciences (SPSS), for Windows, version 23.0(IBM corp, ARMONK, NY).N

RESULTS

Table 1: Distribution of patients according to age.

Age distribution	Case group		Control group	
	No. of patients	%	No. of patients	%
28-50	12	24	5	25
51-70	30	60	12	60
>70	8	16	3	15
Total	50	100	20	100
Mean +- SD	58.06+-12.36		57.85+-11.71	

Here we found that mean age for case group was 58.06 years and for control group was 57.85 years.

Table 2: Distribution according to gender.

Gender distribution	Case group		Control group	
	No. of patients	%	No. of patients	%
Female	17	34	9	45
Male	33	66	11	55
Total	50	100	20	100

The study was male dominant as 66 % males were in case group & 55% males in control group.

Table 3: Distribution according to BMI.

Parameter	Case group		Control group	
	Mean	SD	Mean	SD
BMI(kg/m^2)	32.03	5.34	31.1	4.04

Table 4: Distribution according to STOP BANG, ESS & AHI.

Parameter	Case group		Control group	
	Mean	SD	Mean	SD
STOP BANG	4.72	0.75	1.3	0.73
ESS	16.1	2.51	4.2	1.67
AHI(Events/hr)	46.28	23.71	2.75	1.11

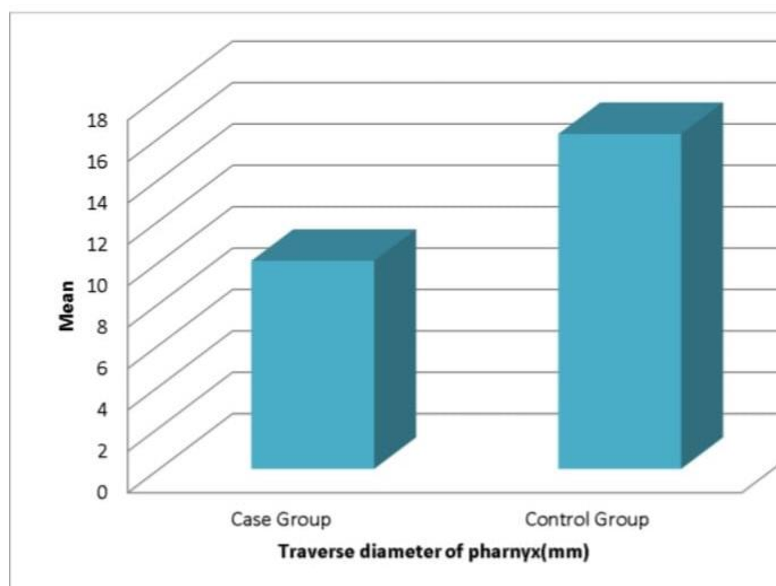
Table 5: Distribution according to comorbidities.

Comorbidities	Case group		Control group		P value
	No. of patients	%	No. of patients	%	
ACO	2	4	0	0	0.3
Asthma	3	6	2	10	0.5
CAD	7	14	2	10	0.6
COPD	18	36	4	20	0.19
T2DM	6	12	4	20	0.3
HTN	19	38	3	15	0.06
ILD	1	2	0	0	0.5
Cor Pulmonale	**17**	**34**	**2**	**10**	**0.04**

Here we found, most common comorbidity associated with OSA was cor pulmonale with significant p value of 0.04, followed by Hypertension whose correlation was not significant.

Table 6: Distribution according to transverse diameter of pharynx.

Paramseter	Case group		Control group		P value
	Mean	SD	Mean	SD	
Transverse diameter of pharynx(mm)	10.06	1.75	16.19	0.75	<0.001

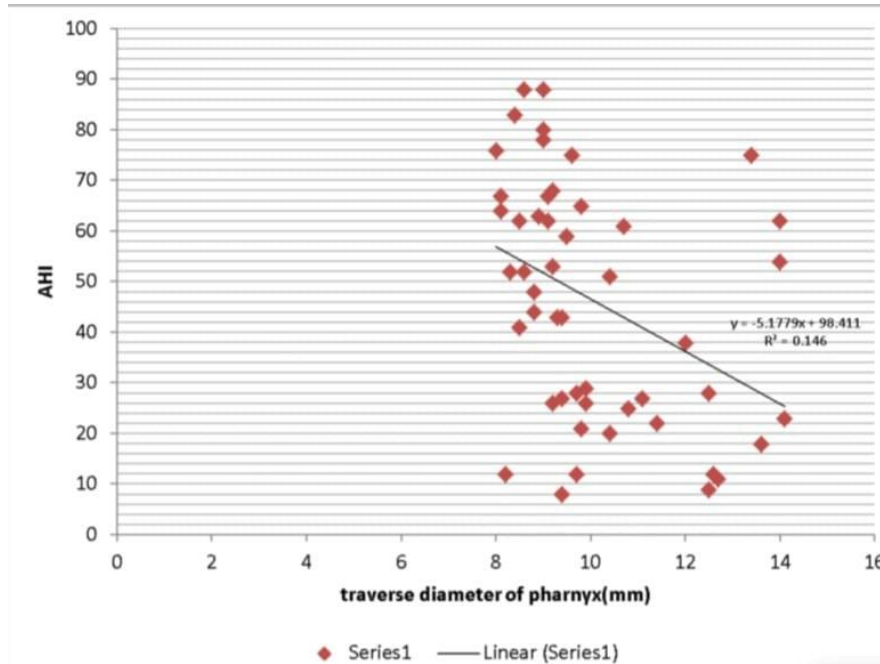


Graph 1: showing relation between transverse diameter of phayrnx (mm) and OSA.

In above table 6 & graph1, we found that mean transverse diameter of pharynx for case group was 10.06mm and for control group, it was 16.19mm with significant difference in p value <0.05.

Table 7: Pearson's correlation between transverse diameter of pharynx and AHI.

Pearson's correlation	r- value	p- value
	-0.38	0.006



Graph 2: showing distribution of AHI with transverse diameter of pharanx.

From above tables & graphs, we found that AHI is related to transverse diameter of pharynx, though there is no linear relationship, but transverse diameter can be used to predict OSA in patients.

DISCUSSION

OSA is a pervasive problem with many different treatment options both surgical and non-surgical. While PSG remains the gold standard for diagnosis of OSA, it is limited in providing information regarding the area of obstruction and a long waiting period for it in developing countries like India possess an issue. CPAP remains the gold standard for initial treatment; however, for those patients with severe cases, or those patients who otherwise opt for surgical intervention, it is important to determine a targeted therapy. Considering that there are numerous surgical interventions targeting different areas in the upper airway, determining the specific area of obstruction will be key in surgical planning. For that we need an MRI of pharynx.

Baseline characteristics

We found that mean age for case group was 58.06 years and for control group it was 57.85years. This study was male dominant as in case group 66% and in control group 55% male were seen. The mean BMI for case group was 32.03 kg m^2 and for control group it was 31.1 kg m^2.

Rodenstein D O *et al.*,[7] found that seven patients were classified as simple snorers and 10 as apnoeic patients. The latter were heavier (in terms both of weight and of body mass index), the mean (SD) values being 78 1 (16- 1) kg and 25-9 (4-3) kg m^2 for snorers v 92-2 (16-3) kg and 31-4 (5 3) kg m^2 for apnoeic patients (p < 0-05). When compared with the healthy subjects, both groups of patients were older and heavier (mean age 27 (6), 40 (17), and 52 (10) years in normal, snoring, and apnoeic subjects; mean weight and body mass index of normal subjects 71-6 (8-5) kg and 21-8 (2-2) kg/ m^2; p < 005).

Ciscar M **A ct nl,'**[8] found that in the group of 17 patients with OSA, there were 14 males and 3 females with an age of 46.9 years. Apneic patients had a BMI of 29.8 kg/ m^2. A similar study by **Zacharias** H U **ct nl,**[9]**'** found that out of 529 study participants (mean [SD] age, 52.15 [13.58] years; 282 female [53%]). **Molnar** V **ct nl,'**[10] found that out of 100 adult patients (74 men and 26 women, aged 42.15 11.7 years). **Gamaleldin** O **ct nl,**[11] found that 15 patients (5 females and 10 males) were diagnosed as having OSA. Overall mean age was 40.2 years (d7.01 years).

AHI and it's correlation with transverse diameter of pharynx

We found that mean traverse diameter of pharynx for case group was 10.06 and for control group it was 16.19. There was significant difference seen between these group as p value was <0.05.

A study by **Ciscar** M **A ct nl,'**[8] found that there was no significant differences in maximum area of the VP

among healthy subjects, awake apnoeic patients and sleep apnoeic patients, whereas minimum area of VP among healthy subjects, awake apnoeic patients and asleep apnoeic patients was significantly different between the groups. It was significantly larger in control than in both awake and asleep apnoeic patients.

In this sense, **Stauffer ct nl,**[12] assessed pharyngeal cross-sectional area at functional residual capacity during wakefulness by CT and no measure differed significantly between patients with OSA and controls. This suggested that a functional impairment of the pharynx, namely the inability to dilate on inspiration, may be present during wakefulness and even more pronounced during sleep. The decrease in VP area from the maximum to r the minimum values varied form 12% in control subjects to 57% in awake apnoeic patients and 85% in apnoeic patient during sleep. This probably indicates increased effective compliance of pharyngeal walls in apnoeic patients principally during sleep and an increase in upper airway residence associate with nasal obstruction and abnormal mandibular positioning and tongue hypertrophy. This phenomenon is produced, in part, because compliance of the pharynx increases during sleep due to reduced activity of pharyngeal dilator muscles. Similar result were obtained by **Horner ct nl,**[13] and **Shelton ct nl.**[14]

Rodenstein D O *et a/.,*[7] found that the sagittal pharyngeal area on the magnetic resonance image was larger in apnoeic patients than in simple snorers, whereas the soft palate area was significantly larger in apnoeic patients than in normal subjects.

LIMITATIONS

1) It excluded the patients in whom MRI was not feasible like who have metallic implants, who had pacemaker and who are claustrophobic
2) Our study excluded patients who were taking treatment for OSA
3) Our study had limited sample size & was conducted only on patients of limited demography

CONCLUSION

1) For patients with almost same BMI & age, AHI of patients with OSA is inversely related to transverse diameter of Pharynx (r = -0.38) at the level of velopharynx.
2) STOP BANG & Epworth Sleepiness scale can be used as a good screening test for OSA.
3) People with Cor pulmonale (p= 0.04) are more likely to have OSA compared with other comorbidities followed by HTN (p 0.06) but none other comorbidity alone has significant correlation with OSA.
4) MRI neck assessing diameter of pharynx can be used as a good diagnostic tool for OSA if PSG is not possible.

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