RESEARCH PAPER

Assessment of the Risk Factors Associated With Obstructive Sleep Apnoea- A Cross-Sectional Survey in Bangalore Population

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ABSTRACT

Background: Obstructive sleep apnoea (OSA) is common in males of 30-60 years, which often presents with symptoms of snoring, excessive tiredness and witnessed apnoea. It can cause systemic problems and changes in the oral cavity. Hence it is important to diagnose and treat OSA.

Aim of the study: To assess the symptoms of OSA by using STOP BANG questionnaire and also to assess the intraoral and extraoral risk factors associated with it.

Materials and Methods: A cross-sectional study was conducted on 160 subjects for diagnosing OSA using STOP BANG questionnaire and also to assess orofacial risk factors associated with OSA. Chi Square test and Fischer exact test was used to compare the different variables with different grades of OSA.

Results: Among 160 OSA patients, snoring, tiredness, hypertension, obesity and increased neck circumference were associated with intermediate risk of OSA in male patients of 36-60 years and it is statistically significant. More prevalent risk factors were forward head posture, tongue coating and crenations, attrition, recession and class 3 & 4 Mallampati score.

Conclusion: In our study, OSA was associated with multiple risk factors. Hence dentist can use STOP BANG questionnaire for diagnosing OSA and treating the risk factors associated with it.

Keywords: Obstructive sleep apnoea, Snoring, Sleep related breathing disorder, STOP BANG, Obesity, Mallampati score.

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INTRODUCTION

Obstructive sleep apnoea (OSA) occurs due to physical changes in the upper airway anatomy which leads to respiratory distress. It can affect at any age, including children. Data from Wisconsin cohort study, [1] shows the prevalence of OSA in 30-60 years age group is 9-24% for men and 4-9% for women.

Risk factors for OSA include males who are above 40 years with increased neck circumference > 48cm. Prevalence of obesity among men and women was 40%. It is also associated with many systemic diseases such as hypertension, type II diabetes etc.

Structural changes in the craniofacial bone anatomy can predispose the patients to pharyngeal collapse which can lead to snoring during the sleep. [2] Extra oral factors include changes in the jaw, deviated nasal septum and diminished nasal valve space. [3] Intraoral risk factors include tonsillar hypertrophy, periodontitis, changes in the morphology of hard, soft palate and uvula [3]. STOP BANG questionnaire is simple screening tool for the assessing the symptoms of OSA and its severity. It can be easily used by dentists and other specialists for early diagnosis of OSA. The main purpose of this study was to assess the intraoral and extraoral risk factors associated with OSA in Bangalore population.

MATERIALS AND METHODS

This study was performed on 160 subjects in the Department of Oral Medicine and Radiology after

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obtaining ethical clearance number: RRDCH/IEC/2024/033 which was issued from the institutional ethical committee of Raja Rajeswari Dental College & Hospital held on 19th February 2024. Ethical standards of this study follow the guidelines of Helsinki Declaration on Ethical principles for research on Human beings.

INCLUSION CRITERIA

Subjects who are

1. In the age group of 20-70 years
2. Obese and have symptoms of snoring, tiredness, obstruction in breathing

EXCLUSION CRITERIA:

Subjects who

1. Previously diagnosed and treated for OSA
2. Have a previous history of trauma and surgery for maxillofacial region
3. Have no history of sleep disturbances and obstruction in breathing

SAMPLE SIZE ESTIMATION

$n=Z^2_{(1-\alpha/2)}\, p\,(1-p)\,\delta^2$

$Z_{(1-\alpha/2)} = 1.96$, P=0.05 (Based on prevalence of OSA among Bangalore population), δ (Margin error) =0.05

n=72.99, which was rounded off to 75. Due to heterogeneity in the sample characteristics, a design effect of 2 was considered. Hence 160 sample size was calculated using the formula.

Statistical analysis: Chi Square test and Fischer exact test was used to compare the demographic variables in categorical data, various parameters like snoring & other comorbidities with different risk scores of OSA. The level of significance was set at $P<0.05$.

METHODOLOGY

Subjects who satisfied the inclusion criteria were included in the study after taking written informed consent. Diagnosis of OSA was done by using STOP BANG questionnaire.

Grading of risk of OSA using STOP BANG questionnaire is as follows:

1. High risk- Yes to 5-8 items
2. Moderate/ Intermediate risk- Yes to 3-4 items
3. Low risk- Yes to 0-2 items

By using clinical examination form, extraoral and intraoral risk factors associated with OSA were assessed. Extraoral risk factors include forward head posture, shoulder height, mandibular position, head shape, angular cheilitis, competency of lips, tenderness in the temporomandibular joint and muscles of mastication, nasal polyp, nasal valve, small nostrils, deviated nasal septum and alar rim collapse. Intraoral risk factors include macroglossia, coated tongue, tongue crenations, Mallampati score, gingival inflammation, wasting diseases, xerostomia, periodontitis, changes in the morphology of soft palate and uvula, tonsillar size, open bite and hard palate.

Assessment of Mallampati score: Position of tongue in the mouth at rest and open mouth relative to soft palate and ability to observe the oropharynx. [4]

Assessment of Tonsillar size: Based on Friedman grading system.[5]

RESULTS

In our study, OSA was diagnosed by the various symptoms included in the STOP BANG questionnaire. On assessing the distribution of various symptoms of OSA, the prevalence of tiredness (75.6%) and snoring (63.4%) was more when compared to the obstruction during the sleep (17.5%). Hypertension (47.5%) was more common when compared to diabetes mellitus (5.6%) in OSA patients. Among 160 OSA patients, the males (53.1%) were at more risk when compared to the females (46.9%) who were in the age group of 36-60 years (56.3%). Anthropometric measurements like BMI (73.6%) and neck circumference (47.5%) were increased

among OSA patients. On comparison of different grades of OSA, the patients were more at intermediate risk (56.9%) rather than high or low risk grade of OSA. **[Table 1]**

Forward head posture (43.8%), mesocephalic head shape (86.9%), even shoulder height (91.3%) were the commonly associated extraoral risk factors. In some patients there was prevalence of uneven shoulder height (8.8%), brachycephalic (11.9%) and dolicocephalic (1.3%) head shape, angular cheilitis (5%), incompetent lips (7.5%), joint sounds (13.1%) and tenderness in TMJ (4.4%), masseter (3.8%) and sternocleidomastoid muscles (1.3%). On assessing the nasal abnormalities, there was prevalence of nasal polyp (19.4%), small nostrils (3.1%) and deviated nasal septum (13.1%) in few patients. **[Table 2]**

Coated tongue (84.4%), tongue crenation (58.8%), generalized gingival recession (58.8%) and attrition (41.3%), long soft palate (76.3%) were the commonly associated intraoral risk factors. Some patients had macroglossia (20%), gingival inflammation (42.5%), xerostomia (13.1%) and high arched palate (16.3%). Uvula was elongated, enlarged and shrunken in few cases. In our study, the class 3 and class 4 Mallampati score and grade 2 tonsillar size were more prevalent among OSA patients. **[Table 3]**

Symptoms like snoring, tiredness, obstruction during sleep, hypertension and diabetes mellitus were more associated with intermediate risk of OSA and it is statistically significant. On age and gender wise comparison with different risk score of OSA, males in the age group of 36-60 years were more associated with intermediate risk of OSA and it is statistically significant.

On comparison of anthropometric measurements with different risk of OSA, increased BMI and neck circumference were more associated with intermediate risk of OSA and it is statistically significant. **[Table 4]**

Table 1: Distribution of symptoms among the obstructive sleep apnoea patients

Variable	Category	Frequency n= 160	Percentage %
Snoring	Present	102	63.4
	Absent	58	36.6
Tiredness	Present	121	75.6
	Absent	39	24.4
Obstruction during sleep	Present	28	17.5
	Absent	132	82.5
Blood pressure	Present	76	47.5
	Absent	84	52.5
Diabetes	Present	9	5.6
	Absent	151	94.4
Body mass index (kg/m2)	<18.5	2	1.3
	18.5 – 24.9	40	25
	25- 29.9	69	43.1
	>30	49	30.6
Age (years)	< 35	21	13.1
	36-60	90	56.3
	>60	49	30.6
Neck size (Inches)	<15	84	52.5
	15-20	76	47.5
Gender	Male	85	53.1
	Female	75	46.9
Risk score (based on symptoms scored)	High risk	40	25
	Intermediate risk	91	56.9
	Low risk	29	18.1

Table 2: Distribution of extraoral risk factors among Obstructive Sleep Apnoea patients

Variable	Category	Frequency n= 160	Percentage %
Forward head posture	Present	70	43.8
	Absent	90	56.3
Shoulder Heights	Even	146	91.3
	Uneven	14	8.8
Mandibular position	Normal	159	99.4
	Prognathic	1	0.6
Head shape	Mesocephalic	139	86.9
	Dolicocephalic	2	1.3
	Brachycephalic	19	11.9
Angular cheilitis	Present	8	5
	Absent	152	95
Lips competency	Competent	148	92.5
	Incompetent	12	7.5
Condition of TMJ	Normal	132	82.5
	Joint sounds	21	13.1
	Tenderness	7	4.4
Range of motion	Straight	146	91.3
	S shaped	14	8.8
Masseter muscle	Tender	6	3.8
	Non tender	154	96.3
Temporalis muscle	Tender	0	0
	Non tender	160	100
Lateral Pterygoid muscle	Tender	1	0.6
	Non tender	159	99.4

Medial pterygoid muscle	Tender	1	0.6
	Non tender	159	99.4
Sternocleidomastoid muscle	Tender	2	1.3
	Non tender	158	98.8
Nasal polyp	Present	31	19.4
	Absent	129	80.6
Nasal valve space	Normal	124	77.5
	Broad	17	10.6
	Narrow	19	11.9
Small nostrils	Present	5	3.1
	Absent	155	96.9
Alar rim collapse	Present	0	0
	Absent	160	100
Deviated nasal septum	Present	21	13.1
	Absent	139	86.9

Table 3: Distribution of intraoral risk factors among Obstructive Sleep Apnoea patients

Variable	**Category**	**Frequency n= 160**	**Percentage %**
Coated tongue	Present	135	84.4
	Absent	25	15.6
Macroglossia	Present	32	20
	Absent	128	80
Tongue Crenations	Present	94	58.8
	Absent	66	41.3
Mallampati score	Class 1	28	17.5
	Class 2	10	6.3
	Class 3	66	41.3
	Class 4	56	35
Bleeding on probing	Present	68	42.5
	Absent	92	57.5
Xerostomia	Present	21	13.1
	Absent	139	86.9
Gingival recession	Localized	23	14.4
	Generalized	94	58.8
	Absent	43	26.9
Attrition	Localized	38	23.8
	Generalized	66	41.3
	Absent	56	35
Abfraction	Localized	50	31.3
	Generalized	2	1.3
	Absent	108	67.5
Long soft palate	Present	122	76.3
	Absent	38	23.8
Uvula	Normal	135	84.4
	Enlarged	5	3.1
	Elongated	19	11.9
	Shrunken	1	0.6
Red patch on pharyngeal wall	Present	41	25.6
	Absent	119	74.4
Tonsillar size	Grade 0	8	5
	Grade 1	80	50
	Grade 2	65	40.6
	Grade 3	6	3.8
	Grade 4	1	0.6
Open bite	Anterior	2	1.3
	Absent	158	98.8

Hard palate	Normal	130	81.3
	Narrow	4	2.5
	High arched	26	16.3

Table 4: Comparison of various symptoms with different risk scores of obstructive sleep apnoea using Chi square and Fischer exact test

		Risk score						
Variable	**Category**	**High risk N, %**	**Intermediate risk N, %**	**Low risk N, %**	**Total N=160 %=100**	**χ^2 Value**	**Fischer exact value**	**P value**
Snoring	Present	18(17.6)	64(62.7)	20(19.6)	102(63.7)	8.131	-	0.017*
	Absent	22(37.9)	27(46.6)	09(15.5)	58(36.3)			
Tiredness	Present	37(30.6)	66(54.5)	18(14.9)	121(75.6)	-	0.240	0.002*
	Absent	03(7.7)	25 (64.1)	11(28.2)	39 (24.4)			
Obstruction during sleep	Present	13(46.4)	13(46.4)	02(7.1)	28(17.5)	-	8.298	0.010*
	Absent	27(20.5)	78(59.1)	27(20.5)	132(82.5)			
Blood pressure	Present	30(39.5)	41(53.9)	05(6.6)	76(47.5)	23.701	-	0.000*
	Absent	10(11.9)	50(59.5)	24(28.6)	84(52.5)			
Diabetes	Present	01(11.1)	07(77.8)	01(11.1)	9(5.6)	-	1.254	0.422
	Absent	39(25.8)	84(55.6)	28(18.5)	151(94.4)			
Body mass index	<18.5	01(50)	01(50)	0(0)	2(1.3)	-	25.029	0.001*
	18.5-24.9	02(05)	25(62.5)	13(32.5)	40(25)			
	25-29.9	17(24.6)	38(55.1)	14(20.3)	69(43.1)			
	>30	20(40.8)	27(55.1)	02(4.1)	49(30.6)			
Age (years)	<35	03(14.3)	12(57.1)	06(28.6)	21(13.1)	-	15.915	0.004*
	36-60	17(18.9)	52(57.8)	21(23.3)	90(56.3)			
	>60	20(40.8)	27(55.1)	02(4.1)	49(30.6)			
Neck size (inches)	<15	14(16.7)	48(57.1)	22(26.2)	84(52.5)	11.261	-	0.004*
	15-20	26(34.2)	43(56.6)	07(9.2)	76(47.5)			
Gender	Male	27(31.8)	50(58.8)	08(9.4)	85(53.1)	11.036	-	0.004*
	Female	13(17.3)	41(54.7)	21(28)	75(46.9)			

*Statistically significant

DISCUSSION

Obstructive sleep apnoea is a pattern of apnoea, in which there is absence of airflow due to closure of upper airway despite of continuous respiratory effort. The aetiology is multifactorial and can be associated with various anatomical and neuromuscular factors.[6] Obesity with increased neck circumference (> 17 inch), upper airway abnormality (nose, tongue, jaw, pharynx, larynx) and endocrine disorders like acromegaly, type II diabetes mellitus, hypothyroidism, cardiovascular disease, especially hypertension and postmenopausal state are the risk factors for the development of OSA. Medical complications impacted by OSA are cardiac arrythmias, myocardial infarction, pulmonary hypertension, stroke, gastroesophageal reflux disease and metabolic disorders.[7]

The prevalence of OSA was more common among males and also increases with aging process due to natural alterations in the upper airway and respiratory muscles, [7,8] which occurs in individuals above the age group of 40 years. In the current study, the prevalence of OSA was more common among males of 36-60 years age group. Similar results were found in studies done by Devaraj et al and Zhou et al. [9,10]

Anthropometric measurements like BMI and neck circumference will aid the diagnosis of OSA as these factors were related to obesity. Obesity is considered as one of the potential risk factors for OSA, as excess weight can lead to narrowing of the upper airway. In our study, there was an increased BMI (>25 Kg/m^2) in about 74 % of the individuals. Similarly, the BMI greater than 25kg/m^2 was observed in studies done by Devaraj et al and Zhou et al. [9,10] A study by Devaraj et al,[9] showed that the neck circumference associated with OSA was below 15 inches. Similar result was found in our study with a prevalence of 52.5%.

Snoring is considered as a marker of pharyngeal narrowing and it is one of the common symptoms associated with OSA. Increased upper airway resistance causes fluttering of the soft palate because of turbulent flow and it is responsible for the acoustic phenomenon known as snoring and its prevalence among the general population ranges from 2 to 85%. [11] In our study, snoring was observed in 63.4% of individuals with OSA whereas in a study by Devaraj et al,[9] showed the prevalence rate of 52%.

Majority of the patients with OSA experience excessive tiredness during day time and obstruction in breathing during sleep. Tiredness (75.6%) was more prevalent in our study when compared to obstruction in breathing during sleep (17.5%). In a study by Thompson et al,[12] tiredness and obstruction during sleep were high in patients with OSA.

Seventh Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure stated that hypertension is a risk factor of OSA. Angiotensin II, which is a potent arteriole vasoconstrictor and active product of renin angiotensin pathway, triggers the release of aldosterone that can lead to fluid accumulation in the airway which in turn leads to airway resistance.[7] Prevalence of hypertension in our study was about 47.5% whereas in a study by Devaraj et al,[9] the prevalence was about 16% among Bangalore population. Another study by Thompson et al, [12] showed the prevalence rate of 78% among females and 71.9% among males.

Obstructive sleep apnoea has been associated with insulin resistance, glucose intolerance and type II diabetes mellitus. Intermittent hypoxia and recurrent arousals from the sleep play an important role in pathophysiologic mechanisms that can lead to altered glucose homeostasis in patients with OSA. Other mechanisms involved in the pathogenesis, are due to the activation of sympathetic nervous system, which can cause upregulation of regulatory factors that have anti insulin activities and dysfunction of the hypothalamic-hypophyseal-adrenal axis, which can increase cortisol levels that can lead to insulin resistance. [13] Our study showed the prevalence of diabetes to be 5.6% among OSA. Studies by Devaraj et al, [9] and Al Qattan et al, [14] showed the prevalence of about 12% and 22.6 % respectively. Among 160 patients of OSA, hypertension was preceded by type II diabetes mellitus.

On comparison of various symptoms, anthropometric measurements like BMI and neck circumference, systemic condition like hypertension with different risk scores of OSA, there was a statistical significance results with intermediate risk followed by high risk OSA. As the individuals with diabetes mellitus were less compared to hypertension, the results were not statistically significant with risk score of OSA.

The current study showed more prevalence of forward head posture, even shoulder heights, mesocephalic head shape, competent lips. The least prevalent risk factors were nasal polyps, deviated nasal septum, narrow nasal valve space, angular cheilitis. In a study by Bailey et al,[3] the prevalent extraoral risk factors were forward head posture, mandibular retrognathia, dolichocephalic head shape, incompetent lips, alar rim collapse, small nostrils and angular cheilitis.

Individuals with OSA has an association with TMJ disorders (TMD), as repetitive reflexive jaw clenching during apnoeic episodes can lead to an unconscious attempt to prevent airway collapse in OSA. Individuals who suffer from TMD and OSA also experience symptoms like headaches, jaw pain and joint noises. [15] TMJ joint sounds (13.1%) and tenderness (4.4%) was noted in our patients with OSA.

In our study, coated tongue, tongue crenations, class 3 and 4 Mallampati score, attrition, long soft palate, grade 1 and 2 tonsillar size were the more prevalent intraoral risk factors associated with OSA. The least prevalent risk factors were macroglossia, xerostomia, abfraction, elongated uvula, red patches on the pharyngeal wall and high arched palate. In a study by Bailey et al,[3] the prevalent intraoral risk factors were coated tongue, macroglossia, tongue crenations, class 3 and 4 Mallampati score, xerostomia, attrition, abfraction, long slopping soft palate, enlarged or elongated uvula and red patches on pharyngeal wall.

Patients with OSA had a higher prevalence of periodontal disease, which results from sleep fragmentation and intermittent hypoxia which in turn increase the load of inflammation throughout the body. On the other hand, inflammatory cytokines generated during periodontal disease, such as TNF-alpha and interleukins (IL-1, IL-6) could penetrate systemic circulation and exacerbate the inflammatory condition linked to OSA.[15] In our study, gingival recession (72%) was more prevalent when compared to gingival inflammation (42.5%). Similar result was found in a study by Bailey et al. [3]

Limitations of the study: Diagnosis of OSA was done based on the STOP BANG questionnaire and it is not based on PSG study. After diagnosing and assessing the risk factors of OSA, patient was educated about the condition, but further follow up and treatment was not performed.

Future prospects of the study: There is a scope for performing a cohort study on patients diagnosed with OSA to treat the possible risk factors associated with it and to avoid further medical consequences.

CONCLUSION

Dental professionals should determine whether the patient is at risk for sleep apnoea through the use of STOP BANG questionnaire and also by reviewing the health history of the patient. As OSA causes many medical and dental consequences which affects the overall health of the patient, hence risk factors of sleep disorders should be

assessed in the routine case history proforma for the early diagnosis and treatment of OSA.

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