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A hospital based study to assess risk of obstructive sleep apnea in a population visiting dental out patient department

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ABSTRACT

Studies focusing on subjective assessment of risk of obstructive sleep apnea in general population are sparse. The purpose of this cross- sectional study was to assess the risk of obstructive sleep apnea in a population visiting dental Out Patient Department. Three hundred consenting participants between the age group of 18-65yrs reporting to the dental OPD were enrolled in the study. Polysomnography is the gold standard of diagnosis of OSA, however, due to cost and elaborate procedure other methods of diagnosis and risk assessment were used as tools. STOP BANG questionnaire was evaluated for the participants and grouping was done into high, moderate and low-risk OSA patients. Anthropometric patient measurements, including Body Mass Index (BMI), age, neck circumference and gender, were recorded. Blood pressure was assessed by a digital blood pressure instrument to check the systolic and diastolic levels. Data was collected and statistically analyzed. The BMI for males was 24.5±3.9, and for females, it was 24.5±4.6. The mean neck circumference in males was higher (14.4±1.2) compared with females (13.1±1.4). 4.1% of males had a high risk of neck circumference, whereas 3.7% of females had a high risk. 16.1% of males reported hypertensive systole compared with 8.2% of females and 23.9% of males reported hypertensive diastole compared with 18% of females. Risk assessment of OSA based on STOP-BANG scoring revealed that 63.6% of the total study population were at low risk of developing OSA, 32% at high risk and, 4.4% of the study population at very high risk of developing OSA. Males were at higher risk than females. OSA has a high prevalence and a higher tendency to remain underdiagnosed due to a lack of awareness amongst the population as well as dental and healthcare professionals. There can be an essential role of a dentist in identifying the risk factors of OSA and referring those patients to sleep, specialists. In the long run, the dentists' early diagnosis of OSA patients may prevent OSA complications and aid in managing the condition.

1. Introduction

Obstructive sleep apnea (OSA) is characterized by repetitive episodes of airflow cessation or reduction occurring during sleep due to upper airway collapse.[1] It A strong association with hypertension, insulin resistance, type II diabetes, cardiovascular morbidity, and cerebrovascular disorders has been reported in the literature.[2–4] Clinical symptoms of OSA include excessive daytime fatigue & sleepiness, witnessed cessation of breathing by a bed-partner, choking or gasping during sleep, morning headache, dry mouth or sore throat, nocturia, and insomnia.

The Prevalence of obstructive sleep apnea in Indian population was reported to be 13.7%among adults.[5,6] The predisposing factors for OSA include excessive

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weight, male gender, ethnicity, family history, congenital malformation like retrognathia or micrognathia, nasal, retroglossal & retropalatal obstruction; supine sleep position, enlarged tonsils and diabetes. Other risk factors include hypothyroidism, acromegaly, alcohol consumption, tobacco consumption, sedatives, and post-menopause (for women).[1,7,8]

Most of the population with OSA under-report their symptoms and remain under-diagnosed due to lack of awareness.[9]

Polysomnography remains the gold standard to diagnose OSA, which is used to study sleep. Polysomnography with an apnea-hypopnea index (AHA-I $\geq$5 per hour) confirms the diagnosis of OSA.[10] Although polysomnography is the gold standard, it is time-consuming, and the treatment is expensive.[11]

Treatment options include behavior modifications, oral appliances, surgical treatment, and continuous positive airway pressure (CPAP). A mandibular advancement splint is the most commonly used oral appliance.[12] CPAP is the gold standard of treatment, however, in some cases may have lower patient compliance resulting from high pressures, air leaks leading to stomach bloating, and claustrophobia.[12] Mandibular advancement splints can be used as a treatment alternative to CPAP in situations with poor patient tolerance. Dentists not only provide routine clinical workouts, but they may also help in the management of severe and highly complicated disease conditions of sleep-breath disorders.[13]

Many screening questionnaires[14,15] have been used to diagnose and assess OSA probability, including STOP, Berlin, Epworth Sleepiness Scale, and STOP-BANG questionnaire. Among all questionnaires, the STOP questionnaire has a sensitivity of 72%, 16 whereas the STOP questionnaire has a sensitivity of 72%, 16 whereas the STOP-BANG questionnaire has a sensitivity of 83.6% to detect OSA.[16] Recently, an important community based indian study predicted that 23% of male driving license applicants are in risk of OSA.[17] Specific biomarkers including serum leptin and leptin receptor gene polymorphism have also been investigated for establishing its association with existence and severity of the OSA.[18–21] Screening questionnaires and patient history remains the most time-efficient, cost-friendly, chairside methods not relying on technique sensitivity for diagnosis and assessing probability of OSA.

OSA is not at all a single sleep disorder that we may encounter in dental OPDs; dentists remain involved in diagnosing and treating sleep ailments.[22] Comparative evaluation of craniofacial measurements may play a significant role in predicting disease occurrence.[23]

As dentists are the ones that first examines the mouth, oral cavity, observes airway and neck thoroughly, they can play a crucial role in identifying the potential risk of obstructive sleep apnea or any sleep breathing disorders using screening questionnaires and further refer the OSA patient to physician to confirm final diagnosis of OSA, thus promoting the interdisciplinary and collaborative approach in early diagnosing of OSA. Evaluation of maxillo-mandibular relations may aid in predicting probability of OSA, with retruded mandibular relations showing higher probability. Lateral cephalometric radiographic evaluation of posterior airway space can also help in probability assessment and treatment efficacy in OSA.

In context to the above reasons, it is necessary to identify risk factors associated with obstructive sleep apnoea to assist clinicians in early diagnosis and identification of obstructive sleep apnoea for subsequent referral to a sleep specialist for a sleep study. This study aims to determine the risk factors associated with obstructive sleep apnoea and use it to diagnose patients at risk OSA in tertiary hospitals.

2. Materials and Methods

This cross-sectional study was conducted in 300 patients between the age group of 18-65yrs reporting to Out Patient Department (OPD) of Prosthodontics and Crown & Bridge department. Ethical approval was obtained from the Institutional Ethics Committee of the university prior to the study (531/Ethics/ R.Cell-17- 26/05/17).

The study was conducted by first screening the patients using the STOP BANG questionnaire and then grouping them into high, moderate, and low-risk OSA patients. The questionnaire consists of eight dichotomous (yes/no) items in relation to the clinical features of sleep apnea (snoring, tiredness, observed apnea, high blood pressure, BMI, age, neck circumference and male gender). Answers with a "yes" scores 1, a "no" scores 0, with a total score ranging from 0 to 8. These respective scores can classify the patients for OSA risk.[24] A STOP-Bang score of 0 to 2 can be classified as being at low risk for moderate to severe OSA.[24] Those with a STOP-Bang score of 5 to 8 can be classified as being at high risk for moderate to severe OSA.

The general examination included screening the patient using STOP-BANG questionnaire, and then recording patients' anthropometric measurements, including Body Mass Index (BMI) which is calculated by dividing a person's weight in kilograms (or pounds) by the square of height in meters (or feet), age, neck circumference, and gender. Blood Pressure was assessed by a digital blood pressure instrument to check the systolic and diastolic levels. Data was collected and statistically analyzed using SPSS software version 24.

3. Results

In our study, 300 patients were enrolled and the characteristics of subjects as described in Table 1 illustrated the total mean age was 47.9±14.9 years, for males

49.6±15.5 years, and for females, mean age was 45.7±13.8 years. The BMI for males was found to be 24.5±3.9 and for females it was 24.5±4.6. The mean height for males (164.4±8.1) was higher than for females (155.9±5.9). The mean weight of males was more (66.3±11.9) as compared to the mean weight of females (59.3±10.5). The mean value of neck circumference of male was found to be 14.4±1.2 and for females it was near about 13.1±1.4. The mean systolic blood pressure recorded for males was 131.3±13.9 mmHg whereas it was 128.8±9.0 mmHg for females. The mean diastolic blood pressure was slightly higher for males (86.8±11.4 mmHg) compared with females (85.4±9.1 mmHg).

Assessment of BMI revealed that out of the total study population 4.7%(n=8) of males were found to be underweight, whereas more of females (9.0%(n=12)) were found to be underweight. 53.8% of males had normal BMI whereas only 48.1% of females had normal BMI. 29.9% of males were found to be pre obese and 30.0% of females were pre-obese. Females (10.5%) were more obese under the Class I category than 10.1% of males. Underclass II obese category, only 1.1% were males and 1.5% were females. Only 0.7% of females were found to be under the obese Class III category, whereas no males were class III obese (Table 2).

Assessment of risk based on neck circumference revealed that 90.4% of males and 94.7% of females had average neck circumference. 8.3% of males were under intermediate risk, and only 1.5% of females had intermediate risk. 4.1% males had high risk of neck circumference, whereas 3.7% of females had an increased risk (Table 3).

Blood pressure assessment revealed that only 2.9% of males had normal systolic pressure compared to 7.5% of females, whereas more males (18.5%) had normal diastolic pressure than females (15.7%.) In our study, males (n=107) were more prehypertensive than females (n=98), out of which 81.4% of males and 84.2% of females had prehypertensive systolic pressures. Prehypertensive diastolic pressure was reported more in females (66.1%) compared with males (56.8%). About 26 males and only 12 females were found to be hypertensive, of which 16.1% of males had hypertensive systole more than 8.2% of females and only 23.9% of males reported hypertensive diastole more than 18% of females (Table 4).

Participants' assessment of the STOP-BANG questionnaire revealed that 6.7% of females and 5.3% of males snore loudly. More of females (32.3%) feel tired, fatigue or sleepy during the daytime compared with males (26.9%). Our study also found that about 34.5% of females and 32.3% of males observed breathing stopped during sleep. More of males (20.3%) were being treated for high blood pressure than females (15.0%). Females (1.5%) had higher BMI than males (1.1%). More of males (50.8%) were above the age of 50yrs than females (44.3%). Females (7.5%) had lower neck circumference than males (16.7%). Out of 300 participants,167 were males (Table 5).

The score assessment of the STOP-BANG questionnaire revealed that, for low-risk OSA population, 14.6% of the total study population were underscore 0, 26% were under score 1and 21.6% were underscore 2. For intermediate-risk OSA population, 18.3% were under score 3, and 13% were underscore 4. For high-risk OSA population, 2.6% were under score 5, 1% were under score 6, and only 0.6% were under score 7 (Table 6). Risk assessment of OSA revealed that 63.6% of the study population were at low risk of developing OSA, 32% at high risk, and 4.4% of the study population were at very high risk of developing OSA. Males were at higher risk than females (Table 7).

4. Discussion

In the present study, 60 males & 32 females were identified in high-risk group for OSA, and 13 males & 4 females were placed in very high risk group of OSA. These results were similar to that reported by previous studies.[26–28] It wasfound that participants over 65 years were associated with the highest risk for OSA and over 65 years were associated with the highest risk for OSA and the middle-aged population were at high risk of OSA. These results correlate with other studies reporting higher risk and prevalence of OSA with advancing age.[26,29–32] This may be attributed to anatomic changes around the pharyngeal region, lengthening of the soft palate and increased fat deposition in the pharyngeal area.[33,34]

In the current study, neck circumference in males was found to be greater compared with females, which was similar to a study by Tufik et al.[35] Flemons et al. showed that increased neck circumference can be a marker for localized obesity which in turn may increase the risk of OSA.[36] Higher neck circumference in OSA patients may be correlated with patient's aerobic capacity, less physical activity, and excess body fluid.[37] Neck circumference is an influential factor in determining the risk of OSA.[38] In a study by Onat et al., neck circumference was found to be a marker of central obesity, which in turn is a factor responsible for OSA.[39]

In Asian populations, the BMI for obesity is above 25 kg/m^2.[40]In the present study, more the population were recorded as pre-obese, especially males, accounting for 50 males and 40 females. Recent research suggests that about 60% of the adult population is overweight (BMI $\geq$ 25 kg/m^2) and about 30% are obese (BMI $\geq$ 30 kg/m^2) in industrialized countries.[41] It has been reported that risk of OSA in males is two-fold higher than in females.[42] This increased risk of OSA may be due to the differences in the distribution of adipose tissue in men,[43–45] as men exhibit central fat tissue deposition associated with decreased lung volume, specifically around the neck, trunk, and abdominal viscera compared with women.[46,47]

Table 1: Subject characteristics: variables of OSA

S.No.	Character	Mean±SD (Total)	Mean±SD (Male)	Mean±SD (Female)
1.	Age	47.9±14.9	49.6±15.5	45.7±13.8
2.	BMI	24.5±4.2	24.5± 3.9	24.5±4.6
3.	Height	160.6±8.4	164.4±8.1	155.9±5.9
4.	Weight	63.2±11.8	66.3±11.9	59.3±10.5
5.	Neck Circumference	13.9±1.5	14.4±1.2	13.1±1.4
6.	Systolic	130.3±11.9	131.3±13.9	128.8±9.0
7.	Diastolic	86.2±10.4	86.8±11.4	85.4±9.1

Table 2: Body Mass Index (kg/m^2): a determinant of risk for obstructive sleep apnea according to WHO

S.No.	BMI (kg/m^2)	Total	Male (n) %	Female (n) %
1.	Underweight (<18.50)	(20)6.6	(8) 4.7	(12) 9.0
2.	Normal (18.50-24.99)	(154)51	(90) 53.8	(64) 48.1
3.	Overweight (>25.00)			
	a)Pre-Obese (25.00-29.99)	(90)30.3	(50) 29.9	(40) 30.0
	b)Obese Class I (30.00-34.99)	(31)10.3	(17) 10.1	(14) 10.5
	c)Obese Class II (35.00-39.99)	(4)1.3	(2) 1.1	(2) 1.5
	d)Obese Class III (>40.00)	(1)	(0) 0	(1) 0.7

Table 3: Neck circumference[23] - A determinant of risk for obstructive sleep apnea (cm)

S.No.	Neck circumference	Total (n)%	Male (n) %	Female (n)%
1.	**Normal Neck**		**≤ 15.7**	**≤ 15.7**
		(277)92.3	(151)96.4	(126)94.7
2.	**Intermediate Risk**		**(15.8-17)**	**15.8-16**
		(13)4.3	(9)5.3	(2)1.5
3.	**High Risk**		**> 17**	**>16**
		(10)3.3	(7)4.1	(5)3.7

Table 4: Blood Pressure (mm Hg)[25] - a determinant of risk for obstructive sleep apnea

S.No.	Blood pressure (mm Hg)	Male (n)%	Female (n)%	Total %
1.	**Normal (n)** <120/80	**(34)**	**(23)**	**19**
a.	Systolic<120	2.9	7.5	
b.	Diastolic<80	18.5	15.7	
2.	**Prehypertensive (n)** 120-139/80-89	**(107)**	**(98)**	**68.3**
a.	Systolic 120-139	81.4	84.2	
b.	Diastolic 80-89	56.8	66.1	
3.	**Hyperyensive (n)** >140/90	**(26)**	**(12)**	**12.6**
a.	Systolic =>140	16.1	8.2	
b.	Diastolic ≥ 90	23.9	18.0	

Table 5: Stop Bang- Questionnaire characteristics[24]

S.No.	Female(n)%	Male(n)%	Total(n)%
S	(9)6.7	(9)5.3	(18)6
T	(43)32.3	(45)26.9	(89)29.6
O	(46)34.5	(54)32.3	(100)33.3
P	(20)15.0	(34)20.3	(54)18
B	(2)1.5	(2)1.1	(4)1.3
A	(59)44.3	(85)50.8	(144)48.1
N	(10)7.5	(28)16.7	(38)12.6
G	(0)0	(167)100	(167)55.6

Table 6: Scoreassement of stop bang questionnaire

Score	Total		Males		Females	
	n	%	n	%	n	%
0	44	14.6	2	1.1	42	31.5
1	78	26	44	26.3	34	25.5
2	71	21.6	48	28.7	22	16.5
3	55	18.3	32	19.1	19	14.2
4	38	13	28	16.7	12	1.5
5	8	2.6	8	4.7	04	3.0
6	3	1	3	1.7	0	0
7	2	0.6	2	1.1	0	0

Table 7: Risk assessment of OSA: OSA Severity distribution in males and females.

S.No.	Risk	Total% (n)	Females % (n)	Males % (n)
1.	Low risk	63.6 (191)	72.9 (97)	56.3 (94)
2.	High risk	32 (92)	27 (32)	35.9 (60)
3.	Very high risk	4.4 (17)	0.1 (4)	7.8 (13)

In this study, the higher prevalence of hypertension was reported in males than females. 68.3% of the population was prehypertensive and 12% of the total population was hypertensive. Kearney at el. also found that hypertension is a highly prevalent disease, affecting 26.4% of all adults.[48] Similar result was illustrated in various observational studies stating that the prevalence of OSA is over 30% among hypertension patients.[49,50]

On assessing STOP-BANG questionnaire, 14% were found to be snoring, 26% of the participants reported tiredness and daytime sleepiness, and 21% observed apnea. Risk of OSA based on STOP-BANG scoring revealed that 63.6% of the total study population were at low risk of developing OSA, 32% at high risk, and 4.4% at very high risk. Therefore, awareness of this condition amongst the general population is of utmost importance to prevent associated consequences.[2–4] Also, males were reported to be at higher risk than females as reported in other studies.[42]

Our findings corroborate the increased risk and Prevalence of OSA with advancing age[8–11]. We found that age above 65 years was associated with the highest risk for OSA (Odds ratio 6.96) implying a further increase in risk of adverse cardiovascular outcomes in the elderly who often have other comorbid conditions. The mechanisms for the age related increase in the Prevalence of OSA include increased deposition of fat in the pharyngeal area, lengthening of the soft palate, and changes in body structure surrounding the pharynx Our findings corroborate the increased risk and Prevalence of OSA with advancing age.[8–11] We found that age above 65 years was associated with the highest risk for OSA (Odds ratio 6.96) implying a further increase in risk of adverse cardiovascular outcomes in the elderly who often have other comorbid conditions. The mechanisms for the age related increase in the Prevalence of OSA include increased deposition of fat in the pharyngeal area, lengthening of the soft palate, and changes in body structure surrounding the pharynx However, the study has few limitations. Instead of gold standard i.e. polysomnography (PSG), STOP BANG questionnaire was used to assess OSA risk. For a community-based study, PSG is not possible every time with large sample size due to its high cost and technique sensitivity. Other alternatives to PSG can be home sleep test (HST) or portable sleep monitors.

5. Conclusion

OSA has a high prevalence and a higher tendency to remain underdiagnosed. In our study, Increased awareness of OSA among patients and health care providers may help in early diagnosis, thus improving management and prognosis, and will ultimately reduce morbidity and mortality.

This study highlights the critical role of a dentist in identifying the risk factors of OSA and referring those patients to sleep, specialists. In the long run, dentists' early diagnosis may prevent OSA complications.

6. Conflict of Interest

There are no conflicts of interest in this article.

7. Source of Funding

None.

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