International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 10; Issue 12 (A); December 2021; Page No.25597-25603
DOI: http://dx.doi.org/10.24327/ijcar.2021.25603.5110

Research Article

SCREENING FOR PATIENTS AT HIGH RISK FOR OBSTRUCTIVE SLEEP APNOEA: A COMMUNITY BASED SURVEY

Aruna Kumari Badam[1]., Narayan Mood*[1]., Surendar Reddy Katta[1]., SaiRam Challa[2] and Balakrishna Nagalla[2]

[1]ESIC Medical College & Hospital, Hyderabad, Telangana
[2]Apollo Institute of Medical Sciences and Research, Hyderabad, Telangana

A R T I C L E I N F O

Article History:
Received 10th September, 2021
Received in revised form 2nd October, 2021
Accepted 26th November, 2021
Published online 28th December, 2021

Key words:

Berlin questionnaire, Epworth Sleepiness scale, Obesity, Obstructive sleep apnoea.

A B S T R A C T

Purpose: Obstructive Sleep apnoea (OSA), is a major but under recognized clinical entity resulting from repetitive narrowing or collapse of upper airway during sleep. It may be associated with excessive daytime sleepiness(obstructive sleep Apnea syndrome).

We aimed to estimate adult population at risk for OS Ain urban and rural field practice by validated survey instruments.

Methods: In this Community based cross-sectional descriptive study, population in the three slums adjoining Urban health centre and three villages near rural health centres were screened by interns using Epworth Sleepiness scale and Berlin Questionnaire.

Results: Adults (N=308) in the age group 18-60 years were recruited. Out of 308, 239 had no risk,79 had risk of OSA according to Epworth scale and 55 according to Berlin scale.12 subjects with moderate to high scores confirmed by level 1polysomnography with Apnoea Hypopnoea Index ranging from> 5 to ≥30.Occupation, education, exercise, coexisting morbidities, Body mass Index, neck circumference and waist circumference bore statistically significant ($p<0.05$) relation with these scores.

Conclusion: Obstructive sleep apnea is prevalent in 8-25% of at-risk adult population.Established risk factors are age, snoring, high blood pressure, obesity, diabetes, hyperlipidaemia, metabolic syndrome, and hypothyroidism .Simple questionnaire-based evaluation tools can estimate the risk for OSA. It is very important to evaluate OSA at community level to increase awareness, prevent related morbidity, mortality, encourage healthy lifestyles and initiate necessary treatment in both urban and rural population. Preventive measures if initiated early in the course of disease like evaluation by survey and encouraging healthy life styles can render benefits in mild to moderate OSA.Physicians should be sensitised early so that the disease can be effectively addressed at community level.

INTRODUCTION

Obstructive sleep apnoea (OSA) is a common chronic disorder characterized by repetitive episodes of complete or partial cessation of airflow for at least 10 seconds with persistent respiratory effort during sleep (GW Pien *et al*. 2015).

These episodes result in a cyclical breathing pattern and fragmented sleep which lead to intermittent blood gas disturbances (hypercapnia and hypoxemia) and surges of sympathetic activation.

Hypoapnea is defined as more than 50 percent reduction of airflow for more than 10 seconds with or without 3% reduction in oxygen concentration.

The obstructive sleep apnea syndrome (OSAS) is defined as more than five abnormal breathing disturbances (hypopneas or apneas) per hour of sleep combined with symptoms of daytime sleepiness.

Apnea Hypopnea Index (AHI): It is a severity index derived by polysomnography, the gold standard to diagnose OSA (Berry RB *et al*. 2012), categorised as mild (AHI =5 - 15), moderate (AHI=15 to 30) and severe (AHI>30).

Obesity is the main epidemiologic risk factor. Indeed, increases in body mass index, central accumulation of adipose tissue, and neck circumference are strong predictors of disease
The prevalence of OSA, is estimated to be 2-14% (Young T *et al*. 1993), among general population, a significant proportion of patients remain undiagnosed and untreated.
The risk factors for OSA and questionnaire based studies are existent, but not emphasised to be practiced by General physicians in public health point of view.

Corresponding author:* **Narayan Mood
ESIC Medical College & Hospital, Hyderabad, Telangana

Diurnal effects of OSA are excessive sleepiness, morning headaches, mood alteration, depression, irritation, amnesia, decreased libido. Nocturnal symptoms are loud snoring, apnea, choking, nocturia, insomnia.

Physiological changes induced due to nocturnal hypoxia can result in comorbidities.

There is impaired decision making and as a consequence, motor vehicle accidents are a frequent occurrence, which can result in fatal outcomes. OSA has tremendous impact on work and quality of life.

15 -20 % OSA patients belong to OHS (obesity hypoventilation syndrome) characterised by obesity, daytime sleepiness and hypercapnia. A significant proportion of patients diagnosed with OSA based on an increased AHI do not complain of daytime sleepiness.

If untreated, OSA can result in deleterious consequences impacting cardiovascular, cerebrovascular, neurocognitive, social and metabolic systems (Akintunde AA *et al*. 2012).

Polysomnography is the gold standard to confirm OSA (Fleetham J *et al*. 2011).It is an expensive test which records the events at night during sleep. It records respiratory effort, airflow, EEG, EMG, ECG, oxygen saturation and leg movements. It is available at few specialised centres. Atechnologist is required to accurately score sleep in real time. There are few questionnaire based, self-administered tests to evaluate the risk for OSA like Epworth sleepiness scale, Berlin Scale, STOP BANG and Stanford Sleepiness Scale.Epworth sleepiness scale (EPW) has 8 items(Grippi, 2015).It is 70% sensitive and 55.6% specific[6] in subjects with a history of daytime sleepiness (Table 1).

The Berlin Questionnaire (Fig 1) identified snorers with an AHI ≥ 5/hr (based on assignment to the high-risk group) with a sensitivity of86% and a specificity of 77% (Netzer N *et al*., 1999).The questionnaire consists of 3 categories scoring snoring, tiredness, sleepiness, blood pressure and body mass index. Patients can be classified into High Risk; if there are 2 or more categories where the score is positive or Low Risk if there is only 1 or no categories where the score is positive.

METHODS

A community based cross-sectional study was done by the department of Respiratory Medicine and the department of Social and preventive Medicine of a medical college between 2017 to 2018, over a period of one year, after obtaining approval from Institutional Ethics Committee, Apollo Institute of Medical Sciences & Research, Hyderabad. Patients were screened after obtaining a written informed consent to assess for OSA risk by documenting excessive daytime sleepiness and snoring respectively. We used two different survey instruments which represented the risk factors to be studied alongside a checklist with demographic details of age, gender, occupation, residence, history of snoring, hypertension, diabetes, hyperlipidaemia, hypothyroidism, personal habits like doing exercise, smoking, alcohol intake, BMI, neck and waist circumference. Recording of demographic details, vitals, EPW and Berlin questionnaire took approximately 15 to 20 minutes per person.

Patients aged 18-60 years, with history of snoring and BMI> 25 were included. Neck circumference of >16 inches for females, >17 inches for males, waist circumference of >35.4 inches in males and >31.4 inches in females was considered as risk factors.

Those with underlying chronic medical conditions such as chronic heart disease (CHD), chronic kidney disease (CKD), chronic lung disease (CLD), uncontrolled diabetes mellitus, malignancy and unstable patients, on CPAP therapy for other conditions, patients with other sleep disordered breathing were excluded.

Subjects were identified to have mild, moderate and severe risk of excessive sleepiness based on the severity scoring (Arnardottir ES *et al*. 2016) according to EPW scale and Low and High Risk for sleep disordered breathing according to Berlin scale (BS).

All the subjects were counselled and advised lifestyle modification, treatment of co morbid conditions. Mild cases were advised to have periodic assessment. Moderate to high-risk cases were further evaluated by polysomnography and managed according to standard guidelines by the department of Respiratory Medicine. Figure 2 depicts the study activities and study conduct.

Statistical Analysis

Sample size: The minimum sample size was arrived at using the Cochran formula $N = Z^2pq/d^2$. The calculated minimum sample size was 308 at 25 % prevalence and 0.05degree accuracy. All statistical analyses were done using SPSS windows version 24.0

RESULTS

Three hundred and eight (males 166, females 142),subjects who met the inclusion criteria were recruited. Subjects were categorized into ≦35 years (n=116), 36- 50 years (n=98) and 51-60 years (n=94). Urban (n=163), and rural (n=145) residency.EPW and BS categorized 229 (74.4%) and 253 (82.14%) under No risk (Table 2).

Table 1 Epworth Scale

Situation: "Usual Way of Life In Recent Times" Chance Of Dozing Total 0–24

*0 = would NEVER doze,1 = SLIGHT chance of dozing,2 = MODERATE chance of dozing,3 = HIGH chance of dozing

S.No	Situation	Score
1	Sitting and reading	0–3
2	Watching TV	0-3
3	Sitting, inactive in a public place (e.g., a theatre or a meeting)	0-3
4	Lying down to rest in the afternoon when circumstances permit	0-3
5	As a passenger in a car for an hour without a break	0-3
6	Sitting talking to someone	0-3
7	Sitting quietly after a lunch without alcohol	0-3
8	In a car, while stopped for a few minutes in traffic	0-3

Interpretation of EPW scores: and correlation with AHI index.
0 to 10 = normal range of sleepiness in healthy adults
11 to 14 = mild sleepiness, (AHI =>5-15)
15 to 17 = moderate sleepiness (AHI = >5 to 20)
And 18 to 24 = severe sleepiness (AHI = >8-23)

Table 2 Risk categorisation as per Epsworth score and Berlin score

Total	Normal	EPW	N=79		Berlin	N=55
N=308	N=239	mild	Moderate	high	low	High
		N=68	N=9	N=2	N=39	N=16

There was a statistically significant difference in EPW score between those with normal and at risk for OSA. Mean±SD EPW and BS was 1.5±3.56, 11.3±3.7, respectively. 25.6% had risk of OSA according to Epworth scale and 17.9% according to Berlin scale which are consistent with expected sensitivity and specificity values.Occupation, education, exercise, coexisting morbidities, BMI, neck circumference and waist circumference bore statistically significant ($p<0.05$) relation with these scores (Table 3).

Multiple logistic regression was performed to study the risk factors of Epworth sleepiness scale with demographic, morbidity and nutritional variables.

Snoring in first degree relatives had 31.8 times risk (95%CI:6.9-146.8), having dyslipidaemia 7.4 times risk (95%CI:1.3-41.2), not doing exercise have 4.7 times risk (95%CI: 1.5-14.9).The risk of OSA is high among those with co morbidities, and is highest among those with dyslipidaemia (86.4%), type 2 DM (86.2%), hypertension (86.2%) and hypothyroidism (73.3%). Snoring in first degree relative (92.9%) was a risk factor for OSA in 47.1% of the patients.

Table 1 compares EPW score and Berlin scale. Table 2 compares demographic and risk factors with EPW and Berlin questionnaire. Smoking (70) Alcohol consumption (59), were significant risk factors.

Table 3 Comparison of Epworth score and Berlin Score of study parameters

	EPW score				Berlin Scale		
Parameter	**Normal n(%)**	**Risk n(%)**	**Total**	**p value**	**Normal n(%)**	**Risk n(%)**	**p value**
Age							
≦35 years	74 (24.03)	25 (8.12%)	99 (32.14%)	1.00	81 (26.3%)	18 (5.84%)	1.000
≧ 36 years	155 (50.33%)	54 (17.535%)	209 (67.86%)		172 (55.84%)	37 (12.01%)	
Total	229 (74.4%)	79 (25.65%)	308		253 (82.14%)	55(17.86%)	
Gender							
Female	101 (32.79%)	41 (13.31%)	142 (46.10%)	.241	111 (36.04%)	31 (10.07%)	.102
Male	128 (41.56%)	38 (12.33%)	166 (53.90%)		142 (46.10%)	24 (7.79%)	
Total	229 (74.35%)	79 (25.65%)	308		253 (82.14%)	55 (17.86%)	
Location							
Rural	119 (38.64%)	26 (8.44%)	145 (47.08%)	.004	130 (42.21%)	15 (4.87%)	.004
Urban	110 (35.71%	53 (17.21%)	163 (52.92%)		123 (39.94%)	40 (12.99%)	
Occupation							
Unskilled	139 (45.13%)	26 (8.44%)	165 (53.57%)	.002	148 (48.05%)	17 (5.52%)	.002
Skilled	90 (29.22%)	53 (17.20%)	143 (46.43%)		105 (34.09%)	38 (12.34%	
Education							
Illiterate	118 (38.31%)	24 (7.79%)	142 (46.10%)	.002	126 (40.90%)	16 (5.20%)	.007
Literate	111 (30.04%)	55 (17.86%)	166 (53.9%)		127 (41.23%)	39 (122.66%)	
Exercise							
Yes	221(71.75%)	49 (15.91%)	270 (87.66%)	.003	234 (75.97%)	36 (11.69%)	.003
No	08 (2.60%)	30 (9.74%)	3 (0.97%)		19 (6.17%)	19 (6.17%)	
Smoking							
Yes	56 (18.18%)	14 (4.55%)	70 (22.73%)	.276	60 (19.48%)	10 (3.25%)	.478
No	173 (56.17%)	65 (21.10%)	238 (77.27%)		193 (62.66%)	45 (14.61%)	
Alcohol							
Yes	34 (11.03%)	25 (8.12%)	59 (19.16%)	.003	44 (14.29%)	15 (4.87%)	.129
No	195 (63.93%)	54 (17.53%)	249 (80.84%)		208 (67.53%)	40 (12.99%)	
Diabetes							
Yes	04 (1.3%)	25 (8.12%)	29 (9.42)	.001	10 (3.25%)	19 (6.17%)	.001
No	225 (73.05%)	54 (17.53%)	279 (90.58%)		243 (78.9%)	36 (11.69%)	
Hypertension							
Yes	13 (4.22%)	30 (9.74%)	43 (13.96%)	.001	13 (4.22%)	30 (9.74%)	.001
No	216 (70.13%)	49 (15.91%)	265 (86.04%)		240 (77.92%)	25 (8.12%)	
Dyslipidemia							
Yes	3 (0.97%)	19 (6.17%)	22 (7.14%)	.001	05 (1.62%)	17 (5.52%)	.001
No	226 (73.38%)	60 (19.48%)	286 (92.86%)		248 (80.52%)	36 (11.69%)	
Hypothyroidism							
Yes	04 (1.3%)	11 (3.57%)	15 (4.87%)	.001	04 (1.3%)	11 (3.57%)	.001
No	225 (73.05%)	68 (22.08%)	293 (95.13%)		249 (80.84%)	44 (14.29%)	
Snoring in first degree relative							
Yes	226 (73.38%)	60 (19.48%)	286 (92.86%)	.000	238 (77.27%)	48 (15.58%)	.086
No	03 (0.97%)	19 (6.17%)	22 (7.14%)		15 (4.87%)	07 (2.27)	
BMI							
Overweight	124 (40.26%)	21 (6.82%)	145 (47.08%)	.003	136 (44.16%)	09 (2.92%)	.004
Obese	97 (31.49%)	31 (10.06%)	128 (41.56%)		103 (33.44%)	25 (8.12%)	
Morbid obese	08 (2.6%)	27 (8.77%)	35 (11.36%)		14 (4.55%)	21 (6.82%)	
Neck circumference							
>16 inches in females, >17 inches in males	20 (6.49%)	52 (16.88%)	72 (23.38%)	.001	34 (11.04%)	38 (12.34%)	.001
normal	209 (67.86%)	27 (8.77%)	236 (76.62%)		219 (71.10%)	17 (5.52%)	
Waist circumference							
>35.4 inches in males > 31.4 inches in females	22 (7.14%)	66 (21.43%)	88 (28.57%)	.001	38 (12.34%)	50 (15.23%)	.001
Normal	207 (67.21%)	13 (4.22%)	220 (71.43%)		215 (69.81%)	05 (1.62%)	

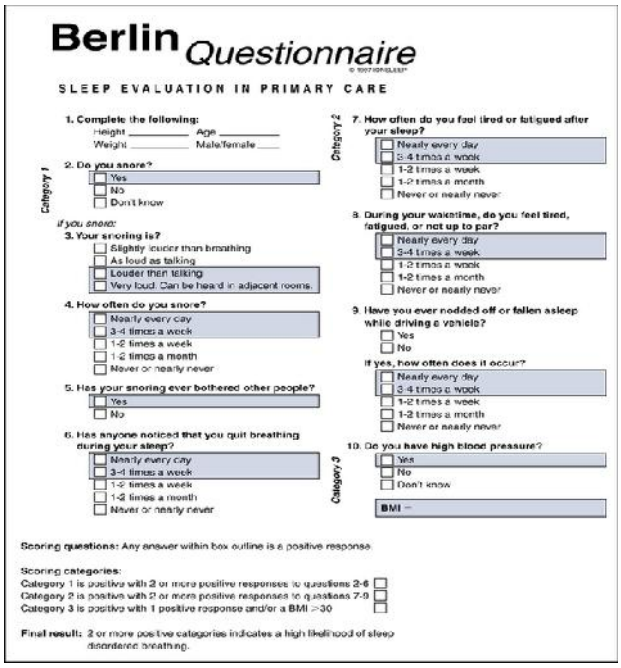

Figure 1 Berlin Questionnaire

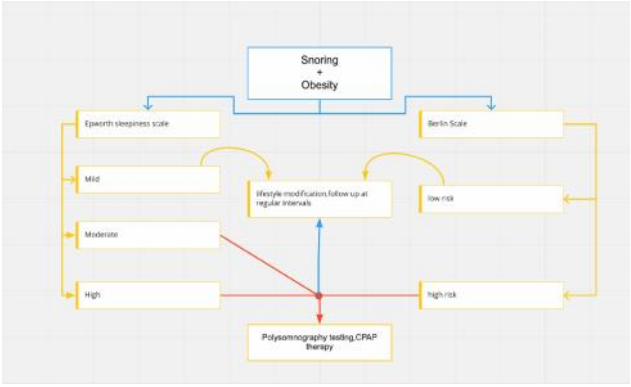

Figure 2 Study activities and study conduct

DISCUSSION

OSA is highly prevalent condition but is under reported due to minimal symptoms without adverse outcomes.

Pathophysiology

Repeated episodes of hypoxemia and normoxemia lead to various pathophysiological conditions, such as intermittent hypoxia, sleep restriction and sleep fragmentation, resulting in sympathetic neural activation, systemic inflammation, oxidative stress loading and changes in hormonal systems. These include the activation of the hypothalamic–pituitary adrenal axis and changes in adipokine profiles, both of which usually lead to fat accumulation and obesity (Desalu O *et al*. 2016).

Risk factors

Ethnicity

Apart from the well-established risk factors (old age, smoking, obesity) ethnicity (Indian or Chinese) is also the predictor of OSA. Reported risk factors in Indian patients are similar to that reported from their counterparts globally (Sharma SK *et al*. 2006).

Obesity

In developing countries like India, prevalence of overweight and obesity are increasing leading to lifestyle-related diseases (IIPS, 2015).The prevalence of obesity was 6.4% among women and 3.2% among men in 1975, it had risen to 14.9% and 10.8%, respectively by 2014.

Reports on global trends estimated that 27.8% of all Indians would be overweight, and 5.0% obese, by 2030 (WHO, 2006). Deposition of fat around the pharyngeal airway is likely to increase the collapsibility of the pharyngeal airway (Shelton KE *et al*., 1993; Horner RL *et al*., 1989). Neck circumference more than the cut-off was recorded in our study in 54 subjects (females 21, males 33). Obesity has been associated with functional impairment in upper airway muscles (Carrera M *et al*., 2004).

Men have increased fat deposition around the pharyngeal airway as compared with women and an increased length of the pharyngeal airway as compared with women (Whittle AT *et al*., 1999; Malhotra A *et al*., 2002), hence easy collapsibility. Deposition of fat around the pharynx increases with aging, independent of systemic fat (Malhotra A *et al*., 2006; Martin SE *et al*., 1997). Similar to many upper airway reflexes (Erskine RJ *et al*., 1993), the genioglossus negative pressure reflex appears to deteriorate with aging (Marcus CL *et al*., 2004).

Fat deposition around the abdomen leads to reductions in functional residual capacity (Ray CS *et al*., 1983), Higher waist circumference than the standard was noted in 79 subjects in our study (females 38, males 41).Our study had subjects with central obesity at 49.2 times high risk (95%CI: 13.5-177.9).

Age

Our study revealed OSA prevalence of 5-9 percent in subjects less than 35 years and12- 18 percent in older subjects. In Young *et al* study the prevalence among 30–39 years of age, is 5% in females and 12% in males ((Marcus CL *et al*., 2004). In older people (>65 years), the prevalence of sleep apnoea is at least two-fold greater, with estimates ranging between 13 and 32% (Ray CS *et al*., 1983; Hoch CC *et al*., 1990).

Snoring

Our study revealed 15-18% risk. Higher BMI, hypertension and high blood sugar levels were noted in snorers, thus posing higher cardiovascular risk (Hoch CC *et al*., 1990).Our study too supports these observation; hypertension (14%), type 2 DM (9.4%) and dyslipidaemia (7.1%) and hypothyroidism were the comorbidities observed in our subjects with history of snoring.

Diabetes

Sleep-disordered breathing and type 2 diabetes are associated, independent of aging and obesity. Our study revealed a 3-5% risk of OSA in diabetics. Both diabetes and OSA together are a risk for future cardiovascular disease, such as stroke, in which thrombosis is a crucial factor in pathogenesis (India State-Level Disease Burden Initiative Diabetes Collaborators, 2018).

Hypertension

Our study revealed 5-9% risk of OSA on hypertensive subjects. Loss of diurnal rhythm of BP is reported in those

with OSA (Hader C *et al*., 2005). Martin *et al*. demonstrated that OSA, independent of obesity and other known OSA risk factors, increased the risk of HTN development.

Small elevations in AHI (< 5) are associated with a 42% increased odds of HTN over four years. They also demonstrated that treatment of OSA with continuous positive airway pressure (CPAP) resulted in a long term reduction in this risk.

Occurrence of cardiovascular events in OSA is due to intermittent hypoxia leading to increased oxidative stress, systemic inflammation, and sympathetic activity; intrathoracic pressure changes leading to excessive mechanical stress on the heart and large artery walls; and arousal-induced reflex sympathetic activation with resultant repetitive blood-pressure rises. Screening for OSA in cardiovascular patients is more cost-effective (Dincer HE *et al*., 2006).

Hyperlipidaemia

Desaturation index, a surrogate marker for hypoxia, was found to be an independent factor contributing to hypercholesterolemia and hypertriglyceridemia (Chou YT *et al*., 2010).OSA may lead to increase in LDL and decrease in HDL via the stimulation of *α* adrenergic receptors. Our study revealed 5-8% risk for OSA.

Hypothyroidism

The incidence of thyroid disorders in India is high (11%), with hypothyroidism a particular problem that is not adequately controlled in the country at present. Iodine deficiency, unregulated use of pesticides and exposure to endocrine disruptors, unclean drinking water and exposure to industrial pollutants like resorcinol and phthalic acid have been suggested as causes."(Bagcchi S, 2014)

Hypothyroidism cause OSA due to mucoprotein deposition in the upper airway, decreased neural output to the upper airway musculature, obesity, and abnormalities in ventilatory control (Lin CC *et al*., 1992)

Obesity a modifiable risk factor, hence the treatment objective must include weight management. These patients need to reduce a significant percentage of weight for better outcomes (Peppard PE *et al*, 2013) hence, rigorous weight loss training is required. Peppard and co-workers followed the effects of weight change on AHI. A 10% weight gain predicted an approximate 32% increase in the AHI. A 10% weight loss predicted a 26% reduction in the AHI.
Among the participants, there were current smokers (16.6%); and 20% consumed alcohol.

Sleep hygiene and changes in lifestyle habits, including weight loss, discontinuation or replacement of drugs that directly interfere with upper airway muscle function (benzodiazepines, barbiturates, and narcotics), reducing alcohol consumption (especially during the evening), smoking cessation, regular physical activity, and changing body position during sleep (avoiding the supine position) should always be encouraged in the treatment of OSA (Papandreou C *et al*., 2013).

Our study supports male preponderance (53.6%) in OSA, which is well documented; Morrish E *et al*. (2008) reported 82% were men in their study.

The prevalence of OSA was 25% (mild 25%; moderate 13%; severe 03%).

Snoring (90%), day time sleepiness (77%) and respiratory pauses are the chief complaints. Similar complaints but at less prevalence were reported by a Nigerian study that reported snoring (33.4%), excessive daytime sleepiness (16.3%), daytime fatigue (10%), feeling drowsy during driving (8%) as the chief complaints.

Low awareness among general population resulted in under-reporting. Similar clinical presentations were reported by Akintunde AA *et al* (2012); the prevalence of OSA is two to three times greater in men than in women and in older individuals (≥65 yr) compared with middle-aged individuals (30–64 years). Other established risk factors are snoring, high blood pressure, metabolic syndrome, and hypothyroidism.

Community testing by Interns sensitises them to the problem of OSA. There is a need of new pedagogic curriculum in sleep medicine for medical students to enable them to practice as primary care physicians. It can be taught as an elective subject for undergraduate medical students[33]under new competency based medical education guidelines.EPW and Berlin questionnaires are useful assessment tools for screening OSA in the community.OSA has to be recognized as a disease of public health importance .Proper management of OSA will not only benefit the patient but also improves many aspects of society.

Limitation

Our study was done on small, local, mostly migrant population and lack uniform confirmation by gold standard testing by Polysomnography. The survey questionnaires for Indian population are lacking.

CONCLUSION

Obstructive sleep apnea is prevalent in 8-25 percent of at risk adult population.Established risk factors are age, snoring, high blood pressure,obesity,diabetes,hyperlipidaemia,metabolic syndrome, and hypothyroidism .Simple questionnaire-based evaluation tools can estimate the risk for OSA.It is very important to evaluate OSA at community level to increase awareness, prevent related morbidity, mortality, encourage healthy lifestyles and initiate necessary treatment in both urban and rural population.Preventive measures if initiated early in the course of disease like evaluation by survey and encouraging healthy life styles can render benefits in mild to moderate OSA. Physicians should be sensitised early so that the disease can be effectively addressed at community level.

Acknowledgement

Authors express their gratitude to Dr. M.V Raghavendra Rao, Scientist – Emeritus, Director of Research Central Laboratory, AIMSR, for his guidance in shaping this study and publication.

References

1. Akintunde AA, Okunola OO, Oluyombo R, Oladosu YO, Opadijo OG (2012) Snoring and obstructive sleep apnoea syndrome among hypertensive Nigerians: prevalence and clinical correlates. Pan Afr Med J 11:75.
2. Arnardottir ES, Bjornsdottir E, Olafsdottir KA, Benediktsdottir B, Gislason T (2016) Obstructive sleep apnoea in the general population: highly prevalent but minimal symptoms. Eur Respir J 47:194-202. doi:10.1183/13993003.01148-2015

3. Bagcchi S (2014) Hypothyroidism in India: more to be done. Lancet Diabetes Endocrinol 2:778. doi: 10.1016/S2213-8587(14)70208-6. PMID: 25282085.
4. Berry RB, Budhiraja R, Gottlieb DJ, Gozal D, Iber C, Kapur VK, et al (2012) Rules for scoring respiratory events in sleep: update of the 2007 AASM Manual for the Scoring of Sleep and Associated Events. Deliberations of the Sleep Apnea Definitions Task Force of the American Academy of Sleep Medicine. J Clin Sleep Med 8:597-619. doi: 10.5664/jcsm.2172.
5. Carrera M, Barbe F, Sauleda J, Tomas M, Gomez C, Santos C, Agusti AG (2004) Effects of obesity upon genioglossus structure and function in obstructive sleep apnoea. Eur Respir J 23:425–429. doi: 10.1183/09031936.04.00099404.
6. Chou YT, Chuang LP, Li HY, Fu JY, Lin SW, Yang CT, et al (2010) Hyperlipidemia in patients with sleep-related breathing disorders: prevalence & risk factors. Indian J Med Res 131:121–125.
7. Desalu O, Onyedum C, Sanya E, Fadare J, Adeoti A, Salawu F, Oluyombo R, Olamoyegun M, Fawale M, Gbadegesin B, Bello H (2016) Prevalence, Awareness and Reporting of Symptoms of Obstructive Sleep Apnoea among Hospitalized Adult Patients in Nigeria: A Multicenter Study. Ethiop J Health Sci 26(4):321-330. doi: 10.4314/ejhs.v26i4.4.
8. Dincer HE, O'Neill W (2006) Deleterious effects of sleep-disordered breathing on the heart and vascular system. Respiration 73:124-130. doi: 10.1159/000089814.
9. Erskine RJ, Murphy PJ, Langton JA, Smith G (1993) Effect of age on the sensitivity of upper airway reflexes. Br J Anaesth 70:574–575. doi: 10.1093/bja/70.5.574.
10. Grippi, M. (2015). *Fishman's pulmonary diseases and disorders* (p. 1517). New York: McGraw Hill Medical.
11. Fleetham J, Ayas N, Bradley D, Fitzpatrick M, Oliver TK, Morrison D, Ryan F, Series F, Skomro R, Tsai W; Canadian Thoracic Society Sleep Disordered Breathing Committee (2011) Canadian Thoracic Society 2011 guideline update: diagnosis and treatment of sleep disordered breathing. Can Respir J 18:25-47. doi: 10.1155/2011/506189.
12. Hader C, Schroeder A, Hinz M, Micklefield GH, Rasche K (2005) Sleep disordered breathing in the elderly: comparison of women and men. J Physiol Pharmacol 56 (Suppl 4):85-91.
13. Hoch CC, Reynolds CF 3rd, Monk TH, Buysse DJ, Yeager AL, Houck PR, Kupfer DJ (1990) Comparison of sleep-disordered breathing among healthy elderly in the seventh, eighth, and ninth decades of life. Sleep 6: 502–511.doi: 10.1093/sleep/13.6.502.
14. Horner RL, Mohiaddin RH, Lowell DG, Shea SA, Burman ED, Longmore DB, Guz A (1989) Sites and sizes of fat deposits around the pharynx in obese patients with obstructive sleep apnoea and weight matched controls. Eur Respir J 2:613–622.
15. India State-Level Disease Burden Initiative Diabetes Collaborators (2018) The increasing burden of diabetes and variations among the states of India: the Global Burden of Disease Study 1990-2016. Lancet Glob Health 6:e1352-e1362. DOI:https://doi.org/10.1016/S2214-109X(18)30387-5 .
16. International Institute for Population Sciences (IIPS). National Family Health Survey (NFHS-4), India, Mumbai: IIPS. 2015-16; pp. 01.
17. Lin CC, Tsan KW, Chen PJ (1992) The relationship between sleep apnea syndrome and hypothyroidism. Chest. 102(6):1663-1667. doi: 10.1378/chest.102.6.1663.
18. Malhotra A, Huang Y, Fogel R, Lazic S, Pillar G, Jakab M, Kikinis R, White DP. Aging influences on pharyngeal anatomy and physiology: the predisposition to pharyngeal collapse. Am J Med 2006;119:72.e9–72.e14.doi: 10.1016/j.amjmed.2005.01.077
19. Malhotra A, Huang Y, Fogel RB, Pillar G, Edwards JK, Kikinis R, Loring SH, White DP (2002) The male predisposition to pharyngeal collapse: importance of airway length. Am J Respir Crit Care Med 166:1388–1395.doi: 10.1164/rccm.2112072.
20. Marcus CL, Fernandes Do Prado LB, Lutz J, Katz ES, Black CA, Galster P, Carson KA (2004) Developmental changes in upper airway dynamics. J Appl Physiol 97:98–108.doi: 10.1152/japplphysiol.00462.2003.
21. Martin SE, Mathur R, Marshall I, Douglas NJ (1997) The effect of age, sex, obesity and posture on upper airway size. Eur Respir J 10:2087–2090. doi: 10.1183/09031936.97.10092087.
22. Morrish E, Shneerson JM, Smith IE (2008) Why does gender influence survival in obstructive sleep apnoea?. Respir Med 102:1231-1236. doi:10.1016/j.rmed.2008.04.014
23. Netzer, N., Stoohs, R., Netzer, C., Clark, K., & Strohl, K. (1999). Using the Berlin Questionnaire To Identify Patients at Risk for the Sleep Apnea Syndrome. Annof Intern Med, *131*(7), 485. doi: 10.7326/0003-4819-131-7-199910050-00002
24. Papandreou C, Hatzis CM, Fragkiadakis GA (2013) Effects of different weight loss percentages on moderate to severe obstructive sleep apnoea syndrome. Chron Respir Dis 12:276-8. doi: 10.1177/1479972315587516.
25. Peppard PE, Young T, Barnet JH, Palta M, Hagen EW, Hla KM (2013) Increased prevalence of sleep-disordered breathing in adults. Am J Epidemiol177:1006-1014. doi: 10.1093/aje/kws342.
26. Pien GW, Rosen IM, Fields BG (2015). Sleep apnea syndromes:central and obstructive.Fishmans Pulmonary Diseases and Disorders. In: Michael A. Grippi, Jack A. Elias, Jay A. Fishman, Robert M. Kotloff, Allan I. Pack, Robert M. Senior, Mark D. Siegel (Eds) 5th edition. McGraw-Hill Medical, New York, pp1510.
27. Ray CS, Sue DY, Bray G, Hansen JE, Wasserman K (1983) Effects of obesity on respiratory function. Am Rev Respir Dis 128:501–506. doi: 10.1164/arrd.1983.128.3.501.
28. Sharma SK, Kumpawat S, Banga A, Goel A. Prevalence and risk factors of obstructive sleep apnea syndrome in a population of Delhi, India. Chest. 2006;130:149–56. doi: 10.1378/chest.130.1.149.
29. Shelton KE, Woodson H, Gay S, Suratt PM (1993) Pharyngeal fat in obstructive sleep apnea. Am Rev Respir Dis 148:462–466.doi: 10.1164/ajrccm/148.2.462.
30. Whittle AT, Marshall I, Mortimore IL, Wraith PK, Sellar RJ, Douglas NJ (1999) Neck soft tissue and fat distribution: comparison between normal men and

women by magnetic resonance imaging. Thorax 54:323–328. doi:10.1136/thx.54.4.323
31. World Health Organization, Obesity and Overweight. Report of WHO Consultation on Obesity, WHO Geneva, 2006; pp.01.
32. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S (1993) The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med 328:1230–1235. doi: 10.1056/NEJM199304293281704.

How to cite this article:

Aruna Kumari Badam *et al* (2021) 'Screening For Patients At High Risk For Obstructive Sleep Apnoea: A Community Based Survey', *International Journal of Current Advanced Research*, 10(12), pp. 25597-25603.
DOI: http://dx.doi.org/10.24327/ijcar.2021. 25603.5110

******