Original Research Paper

Medicine



Association of Severity of Obstructive sleep apnea syndrome with Body mass index and Neck circumference

Dr. Rakesh D. Waghmare	kesh D.(Assistant Professor) Department of Pulmonary Medicine, Byramjee Jeejeebh Government Medical College and Sassoon General Hospital, Jai Prakash Narayan Road, Near Pune Railway Station, Pune-411001	
Dr. Nisha S. Nair	(Resident Doctor) Department of Pulmonary Medicine, Byramjee Jeejeebhoy Government Medical College and Sassoon General Hospital, Jai Prakash Narayan Road, Near Pune Railway Station, Pune-411001	
Dr. Rahul M. Lokhande	(Associate Professor) Department of Pulmonary Medicine, Byramjee Jeejeebhoy Government Medical College and Sassoon General Hospital, Jai Prakash Narayan Road, Near Pune Railway Station, Pune-411001	
Dr. Sushant H. Meshram	(Professor) Department of Pulmonary Medicine, Byramjee Jeejeebhoy Government Medical College and Sassoon General Hospital, Jai Prakash Narayan Road, Near Pune Railway Station, Pune-411001	

Introduction: Many patients with OSA are obese. Obesity is believed to predispose to OSA becausemass loading of the upper airway by adipose tissue in the neck. We in this study examined the relationship between indices of general obesity like BMI & neck circumference with severity of OSA.

Methods: 50 obese persons of age more than 18 years whose body habitus were measured by standard anthropometric methods were subjected for online sleep study in hospital under supervision.

Results: Out of 50 subjects 37 have found to have OSA.11, 7 and 19 subjects had mild, moderate and severe OSA respectively. There is significant correlation between BMI and Neck circumference with severity of OSA.

Conclusion: Neck Circumference has been suggested to be more predictive of obstructive sleep apneas than general obesity. Increased NC may be a greater risk factor for severe OSAS in obese patients.

Obstructive Sleep Apnea Syndrome, Body mass index, Neck Circumference

INTRODUCTION

KEYWORDS

Obesity is considered a major risk factor for the development and progression of Obstructive Sleep Apnea Syndrome(OSAS)^{1,2,3}. In the adult population, the prevalence of OSAS is estimated to be ~25%, and as high as 45% in obese subjects^{1,4,5,6,7,8}. Obesity predisposes to and potentiates OSAS. The prevalence of OSAS and its consequences are likely to increase in the light of the current obesity epidemic.

Obesity is believed to predispose to OSAS because of mass loading of the upper airway by adipose tissue in the neck⁹.

An increased neck circumference (corrected for height) has beensuggested as a better sign of obstructive sleep apnea than other clinical indices^{10,11}, and may be up to 77% sensitive and 82% specific for obstructive sleep apnea in patients referred to a sleep clinic¹⁰.

This study examined association between BMI and NC with the severity of OSAS.

MATERIALS AND METHOD

The study was conducted over the period of 24 months & carried out in 50 obese persons with BMI more than 25 or more than 20% of ideal body weight and age more than 18 years who attended chest OPD.Measures of body habitus were recorded by standard anthropometric methods.The study was conducted by the polysomnography machine "The Embla S7000" which is used to perform online sleep studies in hospital under our supervision.

RESULTS

The demographic characteristics of the study population and the results of clinical assessment are summarized in the Table no. 1.

TABLE No. 1: Demographic characteristics

Sr.No	VARIABLE		NUMBER OF PATIENTS	PERCENT AGE(%)
1	MALE		27	54 %
2	FEMALE		23	46 %
3	AGE	<40 YRS	11	22 %
		>=40 YRS	39	78 %
4	BMI	25-29.9KG/M2	10	20 %
		30-30.99KG/M2	33	66 %
		>=40KG/M2	7	14 %
5	NECK CIRCUMFERE NCE	<15 CM	10	20 %
		<17CM	12	24 %
		>15CM	15	30 %
		>17CM	13	26 %
6	OSA	MILD	11	22%
		MODERATE	7	14%
		SEVERE	19	38%
		TOTAL	37	74%

Table no. 2 shows association between BMI and AHI.It shows that 37 patients with BMI ≥25 have AHI ≥5i.e.OSAS.There is significant correlation between BMI and AHI.

TABLE No. 2:ASSOCIATION BETWEEN BODY MASS INDEX AND APNOEA HYPOPNEA INDEX

BMI IN KG/M2	NEGATIVE (AHI <5)	POSITIVE (AHI >=5)
25-29.9	6(12%)	4(8%)

30-39.9	6(12%)	27(54%)		
MORE THAN 40	1(2%)	6(12%)		
X2(df=1)= 5.464, p=0.019, significant (<30Vs >=30)				

From Table no. 3, we can say that there is significant number of patients with increased neck circumference falls in the category of AHI \geq 5 and shows higher significant correlation between neck circumference and OSA.Therefore, neck circumference is a major risk factor for the development of OSA in obesity.

TABLE No. 3: ASSOCIATION BETWEEN NECK CIRCUMFRENCE AND AHI

NECK CIRCUMFERENCE	NEGATIVE(AHI <5)	POSITIVE (AHI >=5)		
MALE <17	5 (10%)	7(14%)		
FEMALE<15	8(16%)	2(4%)		
MALE >=17	0(0%)	13(26%)		
FEMALE>=15	0(0%)	15(30%)		
X2(DF=1) = 19.393 ,P < 0.001.HIGHLY SIGNIFICANT				

DISCUSSION

Obesity is probably the most important among the risk factors for Obstructive sleep apnea syndrome. It has been recognized that not only increased body weight but also the type of regional fat distribution plays an important role in development of OSAS.

The neck circumference was the most powerful predictor of OSAS among all anthropometric variables. This fact suggested that upper body or central obesity may be important for the development of OSAS. The fat deposition in the neck region, especially in the parapharyngeal region plays an important role in the development of OSAS. Fat deposits in the upper airway and pharyngeal walls of obese patients can lead to narrowing in pharyngeal space. Fat infiltration of upper airway and parapharyngeal region may soften the soft palate, tongue, epiglottis and pharyngeal wall, predisposing to upper airway narrowing or obstruction during sleep.

We carried out a sleep clinic based study in 50 obese patients.Out of that,27(54%) were male and 23(46%) were female and diagnosed to have sleep apnea or sleep disordered breathing were studied for their clinical features and to assess the relationship between the severity of the disease.

Out of 50 subjects, 37(74%) patients had obstructive sleep apnea, of these 11(22%), 7(14%) and 19(38%) subjects had mild, moderate and severe sleep apnea respectively and 13 patients were found with normal AHI (<5). Among 37 patients, 21(42%) were males as compared to 16(32%) females had obstructive sleep apnea syndrome.

Compared to this, Young et al¹² investigated the association of sex, age, race, snoring and obesity with SDB in community dwelling adults, using data from 6119 participants in the sleep heart health study (SHHS), a multicenter cohort study of SDB and cardiovascular disease, and found prevalence of mild, moderate and severe disease among the patients of Sleep Disordered Breathing as 53%, 29% and 18% respectively.

In the study conducted by Sharma and colleagues⁸, male gender was associated with a 10-fold higher risk of having OSA.Zammarron et al¹³ chose a sample of 76 subjects, 50 to 70 years of age, from the electoral census ina small study in 1999. It was found that 28.9% of those surveyed had an AHI \ge 5 and there were no difference between men (28%) and women(30%).

The WHO recommended BMI cut off points for overweight and obesity as; $\geq 25 \text{ kg/m}^2$ and $\geq 30 \text{ kg/m}^2$, respectively14. Recently, increasing evidence has suggested that the relationship between BMI and body fat percentage (BF%) differs among various ethnic groups. Well known examples for this situation are Asians, Blacks and Polynesians. It has been shown that Asians have a higher BF%

in lower BMI values compared to Caucasians15.

A committee co-sponsored by the Regional Office for the Western Pacific, WHO,International Association for The Study ofObesity (IASO) and International Obesity Task Force (IOTF) considered this issue and proposed new BMI cut off values for adult Asians,which suggested normal ranges 18.5-22.9kg/m².

In our study BMI showed a statistical significant (Table no. 2) with sleep apnea.33 (66%) patients had BMI \geq 30kg/m2 of these10(20%),6(12%)and 17 (34%) patients had mild,moderate and severe sleep apnea respectively.4 patients had BMI of \geq 25-25.9 kg/m2,of these 1(2%),1(2%) and 2(4%) had mild,moderate and severe sleep apnea respectively.These results are particularly important if it'staken onto account that OSAS is a risk factor for Hypertension, Cardiovascular diseases,asthma andimpairment of carbohydrate metabolism and endocrine function and it is possible that the effect of weight loss in reducing the cardiovascular risk associated with severe obesity might be due,at least in part to a simultaneous reduction of sleep breathing disorders in these patients.

In our study neck circumference was shown (Table no. 3) to be statistically highly significant (p < 0.001) predictor of the severity of the disease.Suggestingthat upper body fat accumulation is more important than total amount of body fat for the risk of sleep apnea. Neck circumference ≥ 17 inches for male and ≥ 15 inches for female were considered as risk factors and there were 28(56%) patients with sleep apnea. Of these 15(30%) females had neck circumference ≥ 17 inches and 13 (26%) males had neck circumference ≥ 17 inches which was considered as risk factor for sleep apnea.Neck circumference is one of the most powerful predictor of OSA among all anthropometric variables studied. There were no other obvious significant anthropometric abnormalities on clinical examination.

In a study by Katz et al¹⁶reported that mean neck circumference was 47.7cm ± 4.5 in subjects with OSAS and 39.6 cm without OSAS and there was a better correlation between neck circumference and the severity of OSAS.

Neck circumference has been suggested to be more predictive of obstructive sleep apnea than general obesity,but the statistical validity of this conclusion has been questioned. Combining neck circumference with other signs and symptoms may allow the clinical diagnosis or exclusion of sleep apnea to be made with reasonable confidence.

CONCLUSION

In conclusion Neck Circumference and Body Mass Index measurements were higher in severe OSAS patients compared to non-severe patients. Neck Circumference has been suggested to be more predictive of obstructive sleep apnea than general obesity. Increased Neck Circumference may be a greater risk factor for severe OSAS in obese patients.

REFERENCES

- Durán J , Esnaola S , Rubio R , Iztueta A . Obstructive sleep apnea-hypopnea and related clinical features in a populationbased sample of subjects aged 30 to 70 yr . Am J Respir Crit Care Med . 2001 ; 163 (3 Pt 1): 685 - 689 .
- Resta O, Foschino- Barbaro MP, Legari G et al. Sleep related breathing disorders, loud snoring and excessive daytime sleepiness in obese subjects. Int J Obese Relat Metab Disord. 2001;25(5):669-675.
- Peppard PE, Young T, Palta M, Dempsey J, Skatrud J. Longitudinal study of moderate weight change and sleep disordered breathing. JAMA 2000;284(23):3015-3021.
 Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of
- Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle aged adults. N Engl J Med . 1993; 328 (17): 1230 - 1235.
- Bixler EO, Vgontzas AN, Ten Have T, Tyson K, Kales A. Effects of age on sleep apnea in men: I. Prevalence and severity. Am J Respir Crit Care Med. 1998; 157 (1): 144 - 148.
- Bixler EO, Vgontzas AN, Lin HM, et al. Prevalence of sleep disordered breathing in women: effects of gender. Am J Respir Crit Care Med. 2001; 163 (3 Pt 1): 608 -613
- Kim J, In K, Kim J, et al. Prevalence of sleep-disordered breathing in middle-aged Korean men and women. Am J Description and Amountary (10): 1109–1112.
- Respir CritCare Med. 2004; 170(10): 1108-1113.
 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(1): 149-156.

- Shelton, K. E., H. Woodson, S. Gay, and P. M. Suratt. 1993. Pharyngeal fat in obstructive sleep apnea. Am. Rev. Respir. Dis. 148:462–466.
 Davies RJO, Stradling JR. The relationship between neck circumference,
- Davies RJO, Stradling JR. The relationship between neck circumference, radiographic pharyngeal anatomy, and theobstructive sleep apnoea syndrome. Eur Respir J 1990;3:509-14.
- Katz I, Stradling JR, Slutsky AS, Zamel N, Hoffstein V. Do patients with obstructive sleep apnoea have a thick neck? Am Rev Respir Dis 1990;141:1228-31.
- Young T, Shahar E, Nieto FJ, et al. predictors of Sleep-disordered Breathing in community-dwelling adults; The sleep Heart Health Study; Arch Intern Med; 2002; 162(8): 893-900.
- Zamarron C, Gude F, Otero Y, et al; Prevalence of Sleep disordered breathing and sleep apnea in 50 to 70 year old individuals. A survey; Respiration; International review of thoracic diseases 1999; 66(4): 317-322.
- World health organization obesity and overweight .Fact sheet no: 311(accessed 2010 may 15).available from :updated Sep 2006.
- Schwab RJ, Wasserstein M, Pierson R et al. Identification of upper airway anatomic risk factors for obstructive sleep apnea with volumetric magnetic resonance imaging. Am J Respir Crit Care Med 2003;168(5):522-530.
- Katzl, Stradling J, Sultsky AS, Zamel N, Hoffstein V. Do Patients with obstructive sleep apnea have thick necks?; Am Rev Respir Dis 1990; 141:1228-31.