ORIGINAL RESEARCH PAPER

Pulmonary Medicine

TO DETERMINE CORRELATION BETWEEN ANTHROPOMETRIC MEASUREMENTS WITH OBSTRUCTIVE SLEEP APNEA AND HYPOPNEA SYNDROME IN GENERAL POPULATION.

KEY WORDS:

Dr. Kshitiz Sharan 3rd year PG Resident, Department of Medicine, GMC, Bhopal

Dr. Nishant Srivastava* Associate Professor, TB Chest, GMC, Bhopal *Corresponding Author

Dr. Lokendra Dave Professor and Head,Department of TB Chest,GMC,Bhopal

Dr. T. N. Dubey Professor, Department of Medicine, GMC, Bhopal

Dr. Soniya Saxena Assistant Professor, LNMC & RC, Bhopal

ABSTRACT

Introduction: Obstructive sleep apnea and hypopnea syndrome has many ill effects on health. Anthropometric measurements like body mass index, neck circumference ,waist circumference can be used to predict the risk of obstructive sleep apnea and hypopnea syndrome in general population.

Aim and Objectives: To determine correlation between Anthropometric measurements with obstructive sleep apnea and hypopnea syndrome in general population.

Material and methods: Observational study of 100 participants, aged between 13 and 85 years; who were healthy attendants of patients presenting to Hamidia hospital from 1stDecember 2015 to 31st May 2017 They underwent full night polysomnography and anthropometric measurements. Pregnant ladies, hypothyroid participants, alcoholics and persons with enlarged tonsil and adenoids were excluded.

Results: Of the 100 participants 21 had normal AHI,32 had mild AHI,23 had moderate AHI,24 had severe AHI. 22 out 26 (84.61%) obese participants had severe AHI . Of the 29 participants who had neck circumference upto 34.9cm,12(41.37%),10(34.48%),4 (13.79%) and 3(10.34%) had normal, mild, moderate and severe apnea hypopnea index respectively. Of the total 29 male participants who had waist circumference less than 102 cm;9(31.03%),8(27.58%),8(27.58%), and 4(13.79%) had normal, mild, moderate and severe apnea hypopnea index respectively. Of the total 10 female participants who had waist circumference less than 88 cm;5(5%),3(3%),1(1%), and 1(1%) had normal, mild, moderate and severe apnea hypopnea index respectively and same values of apnea hypopnea index for participants with waist circumference greater than 88 cm(total 35) was 6(17.14%),13(37.14%),8(22.85%) and8(22.85%) respectively with a p value of 0.184.

Conclusion: Increasing body mass index and neck circumference was significantly associated with increasing severity of Obstructive sleep apnea and hypopnea syndrome. However increasing waist circumference was significantly associated with increasing severity of Obstructive sleep apnea and hypopnea syndrome only in males and not in females. Increasing body mass index was associated with increasing severity of snoring.

INTRODUCTION

Sleep appears to be an active process during which the brain is involved in a variety of activities that are as complex as those occurring during wakefulness.[1] Sleep has effect on memory consolidation and has restorative function for energy and alertness.

It is estimated that up to 26 percent of adults are at high risk for obstructive sleep Apnea[2]. An obstructive apnea occurs when airflow is absent or nearly absent for 10 seconds , but ventilatory effort persists due to complete, or near complete, upper airway obstruction . Hypopnea is a reduction of airflow to a degree that is insufficient to meet the criteria for an apnea. In Hypopnea Airflow decreases at least 30 percent from pre-event baseline for at least 10 seconds and is accompanied by at least 3 percent oxyhemoglobin desaturation from pre-event baseline, or an arousal.

Risk factors for sleep related disorders are gradually being identified.[3] Obesity is a very important risk factor. As the Indian population is being urbanized and as the life style and food habits are being changed obesity is bound to increase and so is the problem. Cervical adiposity affects upper airway anatomy because of fat deposition. Excessive abdominal fat is the major determinant of obesity-induced hypoventilation.

This study aims to find out how anthropometric measurements are related to Obstructive Sleep Apnea and Hypopnea syndrome for central Indian population. If we can quantify the risk based on simple anthropometric measurements we can actually educate the general public regarding the risks of sleep related respiratory disorders and how it can be prevented.

OBJECTIVES

- To determine correlation between Anthropometric measurements with obstructive sleep apnea and hypopnea syndrome in general population.

MATERIAL AND METHODS

The study was an observational study to determine correlation between anthropometric measurements with obstructive sleep apnea and hypopnea syndrome in general population. 100 Participants for the study were chosen from healthy attendants of patients who presented to Hamidia Hospital either in the OPDs or Wards from a period of 1st December 2015 to 31st May 2017.

Those participants who fully understood the procedure and were willing to undergo a full night in lab polysomnography were chosen for study. ENT consultation to rule out any upper airway obstruction like Tonsilar hypertrophy or polyps was taken.

INCLUSION CRITERIA

1. Male or female aged between 13 years and 85 years
2. Those who gave signed consent for the study

EXCLUSION CRITERIA

1. Age less than 13 years or more than 85 years.
2. Known Hypothyroid
3. Alcohol consumption
4. Pregnancy
5. Enlarged tonsils or Adenoids

DATA COLLECTION

A predesigned proforma was used to obtain relevant information including name,age sex, marital status, address, anthropometric measurements like Body mass Index ,neck circumference, waist circumference, history regarding thyroid disorder etc. ENT reference was taken to rule out upper airway obstruction in form of tonsilar hypertrophy or adenoid enlargement. A full night in lab polysomnograpghy was done to record Electroencephalogram, electrocardiogram, electrooculogram, electromyogram ,respiratory movements of chest, snoring ,SPO_2. The polysomnogram Alice 5 generated data including central Apnea, obstructive apnea, mixed apnea , index of all these data, Apnea Hypopnea Index and snoring time .

For males a cut off of waist circumference was taken as 102 cm and for females it was 88 cm according to NCEP: ATP III 2001 criteria. A cut off of 34.9 cm was taken for neck circumference as no standard value was present. Body Mass Index was classified as Normal (18.5-24.9 kg/m^2),overweight (25-29.9 kg/m^2) and obese(>30 kg/m^2).

STATISTICAL ANALYSIS

Statistical analysis was done by using SPSS 19. Statistical analysis and p-value calculation was done by chi square test and z test.

OBSERVATION AND RESULTS

The following observations were made in this study. Out of the 100 participants 21 had normal AHI,32 had mild AHI,23 moderate AHI,24 severe AHI.

Table 1 shows distribution of number of persons with normal, mild, moderate and severe AHI in normal ,overweight and obese group. 18 out of 33 persons with normal BMI had no OSA(that is AHI<5).None of the person with normal BMI had severe OSA. On the other hand none of the obese patient had AHI<5 and 22 out 26 obese person had severe AHI. The p value was <0.05 for Table 1 which is statistically significant,

Table 1: BODY MASS INDEX AND APNEA HYPOPNEA INDEX

APNEA HYPOPNEA INDEX	BMI(Kg/m2)			TOTAL
	NORMAL (18.5-24.9)	OVERWEIGHT (25-29.9)	OBESE (>30)	
NORMAL	18	3	0	21
MILD	11	20	1	32
MODERATE	4	16	3	23
SEVERE	0	2	22	24
TOTAL	33	41	26	100
MEAN AHI	7.90	15.15	59.30	24.24

Hence it shows there was a significant difference in the AHI of normal ,overweight and obese persons as classified according to BMI. The AHI in normal, overweight and obese persons were 7.90,15.15,59.30 respectively. The mean AHI for whole population was 24.

Table 2: NECK CIRCUMFERENCE AND APNEA HYPOPNEA INDEX

NECK CIRCUMFERENCE	APNEA HYPOPNEA INDEX				TOTAL
	NORMAL	MILD	MODERATE	SEVERE	
UPTO 34.9 cm	12 41.37%	10 34.48%	4 13.79%	3 10.3%	29 100%
>34.9 cm	9 12.6%	22 30.9%	19 26.76%	21 29.57%	71 100%

Table 2 shows distribution of study population with respect to neck circumference less than or greater than 34.9 cm in normal, mild, moderate or severe AHI group.12 person with normal AHI have neck circumference upto 34.9 cm while 9 had neck circumference more than 34.9cm.On the other hand 3 with severe AHI had neck circumference upto 34.9cm and 21 had thicker neck with neck circumference more than 34.9 cm. The p value was <0.005 for Table 2, and hence obese persons were more likely to have a thicker neck(<34.9 cm).

Table 3: NECK CIRCUMFERENCE AND APNEA HYPOPNEA INDEX

APNEA HYPOPNEA INDEX	MEAN OF NECK CIRCUMFERENCE(in cm)
NORMAL	33.45
MILD	36.65
MODERATE	37.08
SEVERE	38.85

Table 3 shows the mean neck circumference of person having normal, mild, moderate and Severe AHI in study population .Mean neck circumference increase as severity of AHI increase. In normal AHI persons mean neck circumference was 33.45 cm whereas in persons having severe AHI it was 38.85 cm.

Table 4 shows distribution of study population with respect to waist circumference upto 102 cm and greater than 102 cm in different AHI groups for males. Out of 29 males who had waist circumference upto 102 cm 9 had Normal AHI whereas only 4 had severe AHI. On the other hand out of 26 males who had waist circumference greater than 102 cm only 1 had normal AHI whereas 11 had severe AHI.

TABLE 4: WAIST CIRCUMFERENCE AND APNEA HYPOPNEA INDEX FOR MALES

APNEA HYPOPNEA INDEX	WAIST CIRCUMFERENCE		TOTAL
	Upto 102 cm	>102 cm	
NORMAL	9	1	10
MILD	8	8	16
MODERATE	8	6	14
SEVERE	4	11	15
TOTAL	29	26	55

As calculated from Table 4 the p value comes out to be 0.021 which is statistically significant and hence persons who have severe AHI are more likely to have a thicker waist (waist circumference greater than 102 cm).

Table 5 shows distribution of study population with respect to waist circumference upto 88 cm and greater than 88 cm in different AHI groups for females. Out of 10 females who had waist circumference upto 88 cm 5 had normal AHI whereas only 1 had severe AHI. On the other hand out of 35 females who had waist circumference greater than 88 cm only 6 had normal AHI, 13 had mild AHI, 8 had moderate AHI and 8 had severe AHI.

TABLE 5: WAIST CIRCUMFERENCE AND APNEA HYPOPNEA INDEX FOR FEMALES

APNEA HYPOPNEA INDEX	WAIST CIRCUMFERENCE		TOTAL
	Upto 88 cm	>88 cm	
NORMAL	5	6	11
MILD	3	13	16
MODERATE	1	8	9
SEVERE	1	8	9
TOTAL	10	35	45

As calculated from Table 5, the p value comes out to be 0.184 which was not statistically significant and hence in females higher waist circumference was not statistically related to increase in AHI in this study.

Table 6 shows distribution of study population with respect to percentage of sleep time spent as snoring in different BMI groups. Out of 34 normal BMI study participants 28 had spent less than 5% of sleep, snoring and only 3 had spent more than 20% sleep time snoring. On the other hand out of 26 obese individuals 6 had spent less than 5% of sleep snoring and 3 had spent more than 20% sleep snoring.

TABLE 6: BODY MASS INDEX AND SNORING

BODY MASS INDEX(kg/m^2)	SNORING				
	Upto 5% of sleep	5.1-10% of sleep	10.1-15% of sleep	15.1-20% of sleep	>20% of sleep
Normal	28	1	1	1	3
Overweight	25	8	2	1	4

Obese	6	5	5	7	3
Total	59	14	8	9	10

The p value for Table 6 comes out to be <0.000128 which is less than 0.05.This means that correlation between higher BMI and higher snoring during sleep is statistically related.

DISCUSSION

Awareness about sleep and sleep related disorders have largely been neglected despite the fact that it has grave consequences on health.

In this present study an attempt has been made to study the correlation between Anthropometric measurements and Obstructive sleep Apnea and Hypopnea syndrome in the general population.

Body mass Index has been strongly linked to Apnea hypopnea index and Snoring. Weight loss even helps in reducing the severity of OSA.[8] It is possible that obesity deposits fat in specific sites. It may narrow the upper airway or in the thorax where it reduce the chest compliance.

In this study mean AHI in normal BMI person, overweight person, obese person was 7.90/hr, 15.15 / hr and 59.30 / hr respectively. This study also showed a strong co-relation between increasing BMI and increasing severity of OSA (P<0.05) .While none of the patient with normal BMI had severe obstructive sleep apnea, 91.7% of the obese persons had obstructive sleep Apnea.

The relationship between neck circumference and obstructive sleep apnea is not as strong as BMI. In studies by Lovin et al[9], Akin et al[10], Hoffastien et al[11] they had found significant correlation between increasing neck circumference and increasing severity of obstructive sleep apnea. However in study by Subramanian et al[12] no such association was found. In our study, however the relationship between neck circumference and increasing AHI was found to be statistically significant when a cutoff value of 34.9 cm was used for neck circumference. P value was <0.005. The mean neck circumference in person with mild, moderate and severe OSA was 36.65 cm, 37.08 cm, 38.85 cm respectively. In normal AHI (i.e. no OSA) person, it was 33.45 cm.

Waist circumference is a better predictor for sleep apnea than neck circumference or BMI[13] suggesting that the link between obesity and sleep apnea cannot be explained solely by neck fat deposition. Correlation of increasing AHI with increasing BMI was seen in many studies.[10,14]

In this study different cut offs were chosen in males and females for waist circumference . It was 102 cm for males and 88 cm for females. For males waist circumference was statistically significantly related to increasing severity of OSA with the p value of 0.021. 31.03% persons with waist circumference ≤102 cm had normal AHI and only 13.79% (4 of 29) had severe OSA. In waist circumference more than 102 cm only 1 person has normal AHI. 42.30% (11 out of 26) persons had severe OSA.

The result for above mentioned parameter was not found to be statistically significant in females with P value 0.184 . 5 females with waist circumference of ≤ 88 cm had normal AHI where as only one had severe OSA. The value for waist circumference > 88 cm was 6(17.14%) and 8(22.85%) respectively.

Increasing BMI is a risk factor for Snoring. Obesity leads to increased pharyngeal fat deposition and narrows the upper airway lumen. Horner et al[15] in their study concluded that even in weight matched individuals, persons with more snoring and OSA had significantly more fat deposition in their upper airway. Other studies[16,17,18] had concluded the same. In this study also similar results were found.28 out of 34(i.e. 82.23%) normal BMI persons had less than 5% time of their sleep in snoring and only 3(8.8%) had a snoring time greater than 20 % of their sleep time. In overweight group 62.5% persons had a snoring time of less than 5% where as 20% had snoring time of 5-10% of sleep, and 10% had snoring time of greater than 20% of sleep time.In obese group only 23% had snoring time of less than 5% ,31% had snoring time of 15-20% of sleep and 34.61% had snoring time of >20% of their sleep time. The p value was 0.000128 and hence it shows that this observation of increased snoring with increased BMI is statistically significant.

LIMITATIONS

This study was done at a single center and that too with only 100 participants. Sleep is a very complex process and to support and confirm the findings in this study, multicenter trial with more study participants will be required.

CONCLUSION

The present cross sectional observation study was carried out in 100 persons (healthy attendants of patients presenting to Hamidia Hospital) to study the correlation between anthropometric measurements and obstructive sleep apnea and hypopnea syndrome in general population.

It was found in the study that significantly higher level of AHI was found in persons with higher BMI (p value< 0.05) and thicker neck (NC>34.9cm, p = 0.005), suggesting BMI and NC as risk factors for OSA .

In males increasing WC was significantly associated with increasing AHI (p value 0.021; cut of value for waist circumference in males = 102cm) but in females such statistical significance was not found (p value 0.184; cut of value for waist circumference in females = 88 cm).

Significantly more snoring (expressed as total percent of sleep time spent as snoring) was found in persons with higher BMI (p value 0.000128). It suggests increasing BMI as risk factor for snoring.
In conclusion present study supports the hypothesis that certain anthropometric measurements as discussed above are risk factors for sleep related respiratory disorders.

REFERENCES

1 Carskadon MA, Dement WC. Normal human sleep: an overview. Principles and practice of sleep medicine. 2005;4:13-23.
2 Punjabi NM, Sorkin JD, Katzel LI, Goldberg AP, Schwartz AR, Smith PL. Sleep-disordered breathing and insulin resistance in middle-aged and overweight men. American journal of respiratory and critical care medicine. 2002 Mar 1;165(5):677-82.
3 Sin DD, Fitzgerald F, Parker JD, Newton G, Floras JS, Bradley TD. Risk factors for central and obstructive sleep apnea in 450 men and women with congestive heart failure. American journal of respiratory and critical care medicine. 1999 Oct 1;160(4):1101-6.
4 Wallace A, Bucks RS. Memory and obstructive sleep apnea: a meta-analysis. Sleep. 2013 Feb 1;36(2):203-20.
5 Young T, Peppard PE, Gottlieb DJ. Epidemiology of obstructive sleep apnea: a population health perspective. American journal of respiratory and critical care medicine. 2002 May 1;165(9):1217-39.
6 Punjabi NM. The epidemiology of adult obstructive sleep apnea. Proceedings of the American Thoracic Society. 2008 Feb 15;5(2):136-43.
7 Ware JC, Mcbrayer RH, Scott JA. Influence of sex and age on duration and frequency of sleep apnea events. Sleep. 2000 Mar;23(2):165-70.
8 Romero-Corral A, Caples SM, Lopez-Jimenez F, Somers VK. Interactions between obesity and obstructive sleep apnea: implications for treatment. CHEST Journal. 2010 Mar 1;137(3):711-9.
9 Lovin S, Bercea R, Cojocaru C, Rusu G, Mihăescu T. Body composition in obstructive sleep apneahypopnea syndrome bio-impedance reflects the severity of sleep apnea. Multidisciplinary respiratory medicine. 2010 Feb 28;5(1):44.
10 Soylu AC, Levent E, Sarıman N, Yurtlu Ş, Alparslan S, Saygı A. Obstructive sleep apnea syndrome and anthropometric obesity indexes. Sleep and Breathing. 2012 Dec 1;16(4):1151-8.
11 Hoffstein V, Mateika S. Differences in abdominal and neck circumferences in patients with and without obstructive sleep apnoea. European Respiratory Journal. 1992 Apr 1;5(4):377-81.
12 Subramanian S, Jayaraman G, Majid H, Aguilar R, Surani S. Influence of gender and anthropometric measures on severity of obstructive sleep apnea. Sleep and Breathing. 2012 Dec 1;16(4):1091-5.
13 Grunstein R, Wilcox I, Yang TS, Gould Y, Hedner J. Snoring and sleep apnoea in men: association with central obesity and hypertension. International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity. 1993 Sep;17(9):533-40.
14 Kim JH, Koo YC, Cho HJ, Kang JW. Relationship between various anthropometric measures and apnea-hypopnea index in Korean men. Auris Nasus Larynx. 2017 May 22.
15 Horner RL, Mohiaddin RH, Lowell DG, Shea SA, Burman ED, Longmore DB, Guz A. Sites and sizes of fat deposits around the pharynx in obese patients with obstructive sleep apnoea and weight matched controls. European Respiratory Journal. 1989 Jul 1;2(7):613-22.
16 Bloom JW, Kaltenborn WT, Quan SF. Risk factors in a general population for snoring: importance of cigarette smoking and obesity. Chest. 1988 Apr 30;93(4):678-83.
17 Schmidt-Nowara WW, Coultas DB, Wiggins C, Skipper BE, Samet JM. Snoring in a Hispanic-American population: risk factors and association with hypertension and other morbidity. Archives of internal medicine. 1990 Mar 1;150(3):597-601.
18 Norton PG, Dunn EV. Snoring as a risk factor for disease: an epidemiological survey. Br Med J (Clin Res Ed). 1985 Sep 7;291(6496):630-2.