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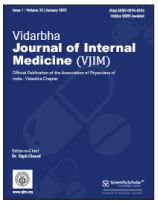

Original Article

Study of Polysomnography in Patients of Metabolic Syndrome

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ABSTRACT

Objectives: Obstructive sleep apnoea (OSA) is a condition wherein collapse of the upper airway during sleep results in decreased or complete cessation of airflow. The association of OSA with increased cardiovascular morbidity, mortality, and various cardiovascular risk factors is known for a long time. Metabolic syndrome a cluster of metabolic abnormalities, with insulin resistance as the central pathophysiological feature is 'Syndrome X' and in association with OSA is 'Syndrome Z'. The aims of this study were as follows: (1) To study the incidence of OSA in patients with metabolic syndrome, (2) to study and correlate the severity of OSA with metabolic syndrome.

Material and Methods: This is a hospital-based observational study conducted in Department of Respiratory Medicine IGGMC, Nagpur.

Results: In the present study of 'polysomnography in patients of metabolic syndrome'; 50 cases of metabolic syndrome were evaluated. 20 (55.55%) subjects were in the age group of 40–50 years. 22 (44%) subjects had moderate excessive daytime sleepiness, followed by higher normal daytime sleepiness in 14 (28%) based on Epworth sleepiness scale. Of the 50 subjects of Metabolic Syndrome, 14 (28%) had Apnoea Hypopnea Index (AHI) <5 and 36 (72%) had AHI 5 or more, of which 42% had mild sleep apnoea, 22% moderate sleep apnoea and 8% severe sleep apnoea.

Conclusion: Prevalence of Syndrome Z was found to be high in patients of metabolic syndrome .

Keywords: Obstructive sleep apnoea, Syndrome X, Syndrome Z

INTRODUCTION

Obstructive sleep apnoea syndrome (OSAS) is an increasingly prevalent chronic condition, in which there is collapse of the upper airway during sleep, as a result of which there is a decrease or complete cessation of airflow.[1-3] Its severity is usually graded according to average number of apnoeic or hypopnoea episodes per sleep hour apnoea-hypopnoea index (AHI) in sleep studies.

The criteria to identify metabolic syndrome or Syndrome X are by the presence of three or more of these risk factors: [2]

1. Central obesity: Measured by waist circumference:
   - More than 40 inches for men.
   - More than 35 inches for women.
2. Fasting blood triglycerides are 150 mg/dL or more or taking medicine for high triglycerides.
3. Low HDL cholesterol levels
   - Men – Less than 40 mg/dL
   - Women – Less than 50 mg/dL
4. Elevated blood pressure of 130/85 mm Hg or higher or taking medicine for high blood pressure.
5. Fasting glucose (blood sugar) of 100 mg/dL or more or taking medicine for high blood glucose.

OSAS may promote metabolic dysfunction through cycles of intermittent hypoxia leading to oxidative stress, sympathetic activation and inflammation. Patients with Obstructive Sleep Apnoea syndrome gave excessive day time sleepiness that can be evaluated using the STOP BANG or Epworth Sleepiness scale.[4]

Aims and objectives

The aims of this study are as follows:

- To study the prevalence of obstructive sleep apnoea (OSA) in patients of metabolic syndrome.
- To study correlation of severity of OSA with metabolic syndrome.[5]

Inclusion criteria

The following criteria were included in the study:

- All cases of metabolic syndrome as per ATPIII criteria.

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STOP BANG Scoring

STOP		
Do you often SNORE loudly (louder than talking)	Yes	No
Do you often feel TIRED, fatigued or sleepy during day	Yes	No
Has anyone OBSERVED you stop breathing during sleep	Yes	No
Do you have high blood PRESSURE	Yes	No
BANG		
BMI more than 35Kg/m2	Yes	No
AGE over 50 years	Yes	No
NECK circumference > 40cm	Yes	No
GENDER Male	Yes	No

Score 1 point for each positive response

Scoring Interpretation: 0-2 Low Risk; 3-4 Intermediate Risk; 5 or more High Risk

EPWORTH Sleepiness Scale

Likelihood to fall asleep in the following situation

1. Sitting and Reading
2. Watching TV
3. Sitting, inactive in a public place (e.g., waiting room, a theater or a meeting)
4. As a passenger in a car for an hour without a break
5. Lying down to rest in the afternoon when circumstances permit
6. Sitting and talking to someone
7. Sitting quietly after lunch without alcohol
8. In a car, while stopped for a few minutes in traffic

0- would never doze off
1- slight chance of dozing off
2- moderate chance of dozing off
3- high chance of dozing off

Exclusion criteria

The following criteria were excluded from the study:

- Patients of paediatric population <12 years
- Patients with Uncontrolled Systemic Hypertension (BP> Systolic180 mm of Hg)
- Recent Myocardial Infarction (<3 weeks)
- Patient not willing to give consent for study.

MATERIAL AND METHODS

Study Design: Present study was conducted prospective observational study.

Sample Size: 50 cases were included in the present study.

The patients were subjected to the STOP BANG Score (4), EPWORTH Sleepiness Scale (5) and Polysomnography studies.

Table 1: Age distribution of the study subjects.

Age group	Frequency	Percentage
30–40	4	8.00
41–50	27	54.00
51–60	16	32.00
>60	3	6.00
Total	50	100.00
Mean	47.84	
SD	6.12	
Range	36–62	

Table 2: Anthropometric measurements in the study subjects.

Anthropometric parameters	Female		Male	
	Mean	SD	Mean	SD
Height	152.12	9.84	157.68	11.01
Weight	89.84	18.85	86.48	14.29
Body mass index	38.60	8.19	35.24	7.18
Waist circumference	90.09	4.74	91.60	4.01
Waist: Hip ratio	1.22	0.24	1.12	0.20

RESULTS

The mean age of the cases was 47.84 ± 6.12 years (25 M/25 F) with minimum of 36 years and maximum of 62 years. Majority of the cases were in the age group of 40–50 years followed by 50–60 years [Table 1].

The mean height of the males and females was 152.12 cm and 157.68 cm, respectively. The mean weight of the males and females was 89.84 kg and 86.48 kg, respectively. The mean body mass index (BMI) of the males and females was 38.60 and 35.24, respectively. The mean waist circumference of the males and females was 90.09 cm and 91.60 cm, respectively. The mean waist: hip ratio of the males and females was 1.22 and 1.12, respectively [Table 2].

The mean systolic blood pressure of the males and females was 128.80 and 132.80, respectively. The mean diastolic blood pressure of the males and females was 85.60 and 87.84, respectively.

Table 3: Clinical and biochemical parameters in the study subjects.

Investigations	Female		Male	
	Mean	SD	Mean	SD
Systolic blood pressure	128.80	8.81	132.80	8.43
Diastolic blood pressure	85.60	5.07	87.84	4.08
Fasting blood sugars	114.60	11.37	111.32	10.44
HDL	36.52	6.11	34.52	5.07
LDL	134.28	8.59	130.08	6.49
TG	149.88	7.50	148.96	6.85

Table 4: Distribution of the study subjects based on the risk assessment using STOP BANG questionnaire.

STOP BANG	Frequency	Percentage
<3 (Low risk)	0	0
≥3 (High risk)	50	100.00
Total	50	100.00
Median	6	

Table 5: Distribution of the study subjects based on the risk assessment using Epworth sleepiness scale.

Epworth sleepiness scale	Frequency	Percentage
0–5 (Lower normal daytime sleepiness)	0	0
6–10 (Higher normal daytime sleepiness)	14	28.00
11–12 (Mild excessive daytime sleepiness)	3	6.00
13–15 (Moderate excessive daytime sleepiness)	22	44.00
16–24 (Severe excessive daytime sleepiness)	11	22.00
Total	50	100.00
Mean	12.96	
SD	4.12	
Range	6–21	

Table 6: Obstructive sleep apnoea prevalence on polysomnography in the study subjects.

AHI	Frequency	Percentage
Normal	14	28.00
Mild (5–15)	21	42.00
Moderate (15–30)	11	22.00
Severe (>30)	4	8.00
Total	50	100.00
Mean	12.95	
SD	10.89	
Range	1.30–50.70	

Table 7: Gender distribution of study subjects with OSA.

Gender	Number of cases with OSA	Number of cases normal AHI
Male (25)	19 (38.0%)	6 (12%)
Female (25)	17 (34.0%)	8 (16%)

OSA: Obstructive sleep apnoea

Table 8: Age distribution of study subjects with obstructive sleep apnoea.

Age group	Frequency	Percentage
30–40	4	11.11
41–50	20	55.55
51–60	12	33.33
>60	0	0
Total	36	

The mean fasting blood sugars of the males and females were 114.60 and 111.32, respectively. The mean HDL of the males and females was 36.52 and 34.52, respectively. The mean LDL of the males and females was 134.28 and 130.08, respectively. The mean TG of the males and females was 149.88 and 148.96, respectively [Table 3].

The median STOP BANG score was 6 and all the subjects were high-risk based on this questionnaire [Table 4].[6]

Majority of the cases were having moderate excessive daytime sleepiness (44%) followed by higher normal daytime sleepiness (28%) based on Epworth sleepiness scale. The average Epworth score was 12.96 with minimum of 6 and maximum of 21 in the present study [Table 5].[7]

On polysomnography of the 50 study subjects, 14 have AHI<5 and 36 had AHI 5 or more.

About 28% had no sleep apnoea, 42% had mild sleep apnoea, 22% moderate sleep apnoea and 8% severe sleep apnoea [Table 6].[8]

Male: female for OSA cases was 1.11:1 [Table 7].

Majority of the OSA cases were in the age group of 40–50 years followed by 50–60 years [Table 8].

DISCUSSION

Age distribution of the study subjects

Fifty cases of metabolic syndrome were included and evaluated in this study. All cases underwent overnight polysomnography studies and those diagnosed with OSA also underwent CPAP titration.

Mean age of cases was 47.84 ± 6.12 years which was similar to that reported by Herningtyas[9] (54.48 ± 10.92), Singh *et al.*[3] (53.3 ± 13.3) and Tyagi *et al.*[2] (45 ± 0); however, the mean age in the present study was higher than that reported by Kuk and Ardern[10] (40.3 ± 0.3). This difference in mean age as compared to that in by Kuk and Ardern may be due to inclusion of two different population groups in his study younger and older age groups.

Gender distribution of the study subjects

In the present study out of 50 cases, 25 (50.0%) were male and 25 (50.0%) were female. M: F ratio was 1:1. This study was similar to that reported by Kuk and Ardern.[10] and Dubey *et al.*[11] who reported it to be 1:1 and 1.2:1, respectively.

However, in study by Tyagi *et al.*,[2] M: F ratio was more 1.7:1 and in study by Singh *et al.*,[3] it was 1:3 that there were more females than males.

Anthropometric measurements of the study subjects

In the present study, the BMI for male was 35.24 ± 7.18 and female, it was 38.60 ± 8.19 which was higher than that reported by Singh *et al.*,[3] Kuk and Ardern,[10] and Herningtyas *et al.*, which was M = 23.9 ± 4.0, F = 24.2 ± 4.6, M = 27.1 ± 0.2, F = 26.8 ± 0.3 and 26.71 ± 4.001, respectively.

The waist hip ratio for male was 1.12 ± 0.2 and for female, it was 1.22 ± 0.24 higher than that reported by Singh *et al.*[3] M = 0.94 ± 0.07 and F = 0.91 ± 0.07.

Risk assessment using STOP BANG questionnaire of the study subjects

Of the 50 patients of metabolic syndrome, the risk of OSA with high STOP BANG score is 72% higher than Chung *et al*.,[4] 2012, is 68.4%, and Popevic *et al*., 2016, is 57.0%. In Pearson *et al*., only patients of BMI > 40 kg/m^2 is taken.

AHI on PSG

In the present study, polysomnography reports showed that AHI of 14 cases (28%) had AHI of <5 which was considered as normal, whereas 36(72%) had AHI o5 which suggests OSA.

This finding of OSA was almost similar to that reported by Moideen *et al*.[12] (73.3%) and more than that reported by Lam *et al*. and Popević *et al*., which was 37% and 57%, respectively, and less than that reported by Dubey *et al*.[11] who reported it 94%.

Correlation of AHI with waist circumference

In the present study, the waist circumference and AHI were correlated (r = 0.137) and (*P* = 0.0.341); however, it was not statistical significant.

In study conducted by Lam *et al*.,[13] *P* < 0.001.

Correlation of fasting blood sugar with AHI

In the present study, the mean fasting blood sugar and AHI were correlated (r = 0.014) and the p value for the present study was 0.923; however, it was not statistical significant.

Correlation of AHI with HDL

In the present study, HDL and AHI were correlated (r = 0.238) and *P* = 0.097; however, it was not statistical significant.

The study conducted by Moideen *et al*.,[12] in 2015, was also not statistical significant and *P* = 0.41.

Correlation of AHI with LDL

In the present study, the AHI and LDL were correlated (r = 0.243) and *P* = 0.089; however, it was not statistical significant.

Correlation of AHI with TG

In the present study, TG and AHI were correlated (r = 0.435) and *P* = 0.002 which was statistically significant. Increase in the level of Triglycerides, increases the risk of OSA.

The study conducted by Barreiro *et al*.[14] and Jamie C.M. Lam *et al*. also found statistically significant correlation of OSA with TG (*P* = 0.04 and <0.001, respectively.

Correlation of AHI with systolic blood pressure

In the present study, the systolic blood pressure and AHI were correlated (r = 0.150) and *P* = 0.299; however, it was not statistically significant.

The study conducted by Moideen *et al*. and Lam *et al*. was statistically significant with *P* value 0.04 and <0.001, respectively.

Correlation of AHI with STOP-BANG score

In the present study, AHI and STOPBANG were correlated (r = 0.143) and *P* = 0.320; however, it was not statistically significant.

Correlation of AHI with Epworth scale

In the present study, AHI and Epworth Scale was correlated (r = 0.582) and *P* = 0.001 which was statistically significant with the increase in the score increases the risk of OSA.

Correlation of AHI with diastolic blood pressure

In the present study, the diastolic blood pressure and AHI were correlated (r = 0.344) and *P* = 0.014 which was statistically significant with the increase in the diastolic pressure the risk of OSA increases.

The study conducted by Lam *et al*. had *P* < 0.001 which was also statistically significant.

CONCLUSION

1. In the present study of 'Polysomnography in Patients of Metabolic Syndrome, 50 cases of metabolic syndrome were studied and majority of cases (55.55%) were in age group 40–50 years that was 20 (55.55%).'
2. M: F ratio was 1.11:1.
3. Majority of the cases had moderate excessive daytime sleepiness 22 (44%) followed by higher normal daytime sleepiness 14 (28%) based on Epworth sleepiness scale.
4. In the present study, risk assessment using STOP BANG questionnaire of all the 50 cases of Metabolic Syndrome was done which was more than 3 suggestive of higher risk of OSA.
5. In the present study, the mean BMI for male was 35.24 ± 7.18 and for female, it was 38.60 ± 8.19.
6. The mean waist hip ratio for male was 1.12 ± 0.2 and for female, it was 1.22 ±0.24.
7. Out of 50 cases, 8 (16%) were pre obese, 13 (26%) were in grade 1 obesity, 14 (28%) in grade 2 obesity and 14 (28%) were grade 3 obesity.
8. Of the 50 cases of metabolic syndrome, 14 (28%) had AHI <5 and 36 (72%) had AHI 5 or more. Thus, 28% had no sleep apnoea, 42% had mild sleep apnoea, 22% moderate sleep apnoea and 8% severe sleep apnoea.
9. The waist circumference and AHI were correlated (*r* = 0.137) and *P* = 0.0.341; however, it was not statistical significant.

10. The mean fasting blood sugar and AHI were correlated (r = 0.014) and p value for the present study was 0.923; however, it was not statistical significant.
11. The mean HDL and AHI were correlated (r = 0.238) and *P* = 0.097; however, it was not statistical significant.
12. AHI and LDL were correlated (r = 0.243) and *P* = 0.089; however, it was not statistical significant.
13. In the present study, the systolic blood pressure and AHI were correlated (r = 0.150) and *P* = 0.299; however, it was not statistically significant.
14. In the present study, AHI and STOPBANG were correlated (r = 0.143) and *P* = 0.320; however, it was not statistically significant.
15. In the present study, AHI and Epworth Scale were correlated (r = 0.582) and *P* = 0.001 which was statistically significant.
16. In the present study, the diastolic blood pressure and AHI were correlated (r = 0.344) and *P* = 0.014 which was statistically significant.
17. In the present study, TG and AHI were correlated (r = 0.435) and *P* = 0.002 which was statistically significant with increase in the level of TG increases the risk of OSA.

To conclude, the prevalence of OSA in patients of metabolic syndrome was 72 % and this occurrence correlated with higher scores on Epworth Sleepiness Scale, higher diastolic blood pressure and raised triglycerides.

Limitations

As 50 patients of metabolic syndrome were studied, the small sample size may be the limitation. Effect of long-term use of adherence to treatment by Continuous Positive Airway Pressure or BiPositive Airway Pressure not only on OSA but also on various components of metabolic syndrome was also not studied; hence, its effectiveness in addressing components of metabolic syndrome cannot be commented on.

Recommendations

With global epidemic of non-communicable disease on rise, OSA adds to the morbidity. Each patient of metabolic syndrome must be evaluated by polysomnography for OSA and treated accordingly.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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