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Research Article

PREVALENCE OF OBSTRUCTIVE SLEEP APNEA IN CASES OF METABOLIC SYNDROME: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objectives: The study aimed to find out the prevalence of obstructive sleep apnea (OSA) in individuals with metabolic syndrome (MS).

Methods: This was a cross-sectional study conducted in the department of respiratory medicine of a tertiary care medical institute. Eighty patients infected with MS diagnosed on the basis of national cholesterol education program adult treatment panel III criteria were included in this study on the basis of predefined inclusion and exclusion criteria. Demographic details such as age, gender, and socioeconomic status of all the patients were noted. A thorough general and clinical examination was conducted, including the assessment of vital signs. Polysomnography was done in all cases and the diagnosis of OSA was based on polysomnography results. SSPS 21.0 was used for statistical analysis and $p<0.05$ was taken as statistically significant.

Results: Out of 80 patients, there were 58 (72.50%) males and 22 (27.50%) females with a M: F ratio of 1: 0.37. The overall mean age of the studied cases was found to be 44.60±12.92. Mild (apnea-hypopnea index [AHI] 5–14), moderate (AHI=15–30), and severe OSA (AHI >30) was seen in 33 (41.25%), 17 (21.25%) and 9 (11.25%) patients, respectively. Overall prevalence of OSA in cases of MS was found to be 73.75% as the severity of OSA increased there was decreased in mean sleep time and the difference was found to be statistically significant ($p<0.05$). The most common presenting complaint was loud snoring, observed in 55 patients (93.22%). This was followed by daytime sleepiness in 47 patients (79.66%), waking up tired in 37 patients (62.71%), and disturbed sleep in 36 patients (61.02%).

Conclusion: The prevalence of OSA is notably high among individuals with MS. Consequently, routine assessment for OSA should be an integral component of the management strategy for patients with MS.

Keywords: Obstructive sleep apnea, Metabolic syndrome, Snoring, Daytime somnolence.

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INTRODUCTION

Metabolic syndrome (MS) is a cluster of metabolic abnormalities that significantly increase the risk of cardiovascular diseases and Type 2 diabetes mellitus. MS is characterized by the presence of three or more of the following criteria: Central obesity, hyperglycemia, dyslipidemia, and hypertension [1]. The pathogenesis of MS is multifactorial and involves genetic predisposition, sedentary lifestyle, unhealthy dietary habits, and increasing age. Insulin resistance is the cardinal feature of MS and plays an important role in its pathogenesis. Insulin resistance is marked by the body's diminished ability to respond to insulin leading to compensatory hyperinsulinemia. This hyperinsulinemia in turn exacerbates other components of MS such as hyperglycemia and dyslipidemia. Moreover, central obesity, marked by excess visceral fat, is an important contributor to MS as fat is metabolically active and secretes various adipokines and cytokines that promote insulin resistance and inflammation [2].

The incidence of MS has been rising alarmingly worldwide due to the global obesity epidemic and increasing prevalence of sedentary lifestyles. As per World Health Organization, the prevalence of obesity has significantly increased since 1975, and a substantial proportion of these individuals meet the criteria for MS. This trend poses a substantial public health challenge as MS significantly increase cardiovascular morbidity and mortality [3]. The clinical consequences of MS are profound, with a substantial impact on individual health and healthcare systems. One of the most critical outcomes of MS is an increased risk of coronary artery disease (CAD). The atherogenic dyslipidemia associated with MS promotes the development of atherosclerotic plaques. In addition, the pro-inflammatory and pro-thrombotic state induced by MS further increases risk of CAD. The interplay between hyperglycemia and other metabolic abnormalities accelerates the development of microvascular complications, such as neuropathy, retinopathy, and nephropathy as well as macrovascular complications, including CAD and peripheral arterial disease. Moreover, recent studies have identified a strong association between MS and obstructive sleep apnea (OSA) [4].

OSA is a common sleep disorder characterized by recurrent episodes of partial or complete airway obstruction at the time of sleep, leading to intermittent hypoxia and sleep fragmentation. Emerging evidence suggests a bidirectional relationship between MS and OSA, with each condition potentially exacerbating the other [5]. Central obesity is a well-established risk factor for both MS and OSA. Excess adipose tissue in the neck and upper airway can lead to increased airway collapsibility, predisposing individuals to OSA. Second, the systemic inflammation and oxidative stress caused by MS may contribute to upper airway inflammation and edema. Moreover, insulin resistance and dyslipidemia, common in MS, have been linked to alterations in neuromuscular control of the upper airway, enhancing the susceptibility to OSA [6].

Conversely, the intermittent hypoxia and sleep fragmentation characteristic of OSA can exacerbate metabolic abnormalities, creating a vicious cycle. Hypoxia-induced sympathetic nervous system activation and oxidative stress can worsen insulin resistance, hypertension, and dyslipidemia, thereby aggravating the components of MS [7]. This relationship underscores the importance of recognizing and managing these patients comprehensively [8].

Despite the well-documented association between MS and OSA, significant knowledge gaps remain regarding the precise prevalence of

OSA in individuals with MS. This study aims to address these knowledge gaps by determining the prevalence of OSA in persons with MS.

METHODS

This was a prospective study in which 80 patients with MS were included on the basis of a predefined inclusion and exclusion criteria. The study was conducted in the department of respiratory medicine of a tertiary care medical college. Informed consent was obtained from patients. The sample size was calculated as per pilot study done on the topic of OSA in cases of MS. Assuming 90% power and 95% confidence interval, the sample size required was 72 patients; therefore, we included 80 patients in our study. The MS was diagnosed on the basis of National Cholesterol Education Program (NCEP) adult treatment panel III (ATP III) criteria in which the presence of any three of the five of following factors were considered to be diagnostic of MS [9].

1. Fasting glucose ≥100 mg/dL
2. Blood pressure ≥130/85 mmHg
3. Triglycerides ≥150 mg/dL
4. High-density lipoprotein-cholesterol <40 mg/dL in men or <50 mg/dL in women
5. Waist circumference ≥102 cm (40 in) in men or ≥88 cm (35 in) in women.

Demographic information such as age, gender, weight, and body mass index was documented in all cases. In addition, the occupation and socioeconomic status of each patient were recorded. A detailed history was obtained, focusing on symptoms including significant snoring, daytime sleepiness, waking up feeling tired, night sweats, waking up due to a choking sensation, morning headaches, and symptoms of irritability, anxiety, and depression. The presence of daytime somnolence was also enquired. A thorough general and clinical examination was conducted, including the assessment of vital signs. Polysomnography was done in all cases and the diagnosis of OSA was based on polysomnography results, with an apnea-hypopnea index (AHI) of 5 or more per hour, coupled with daytime symptoms such as excessive sleepiness, fatigue, or cognitive impairment, serving as the criteria for OSA. The prevalence of OSA in patients was MS was assessed. Moreover, the severity of OSA was also assessed in each patient. The OSA was classified into being mild (AHI 6–14), moderate (AHI=15–30) or severe (AHI >30) on the basis of AHI [10].

Statistical analysis was done using software SPSS 24.0 version. Mean and standard deviations were used for various parameters. The correlation of MS with severity of AHI was assessed using Pearson's correlation. $p<0.05$ was taken as statistically significant.

Inclusion criteria

1. Patients having MS as per the NCEP ATP III criteria
2. Age of the patients 18–60 years
3. Ready to give informed and written consent to be part of study.

Exclusion criteria

1. Age <18 years at the time of enrollment
2. Those who refused written consent to be part of study
3. Patients with psychiatric illness
4. Patients on drugs known to predispose an individual for OSA such as opioids, benzodiazepines, and muscle relaxants
5. Patients with parasomnias such as night terror, somnambulism, and sleep paralysis as well as confusional arousals.

RESULTS

In this study of OSA in individuals with MS out of 80 patients, there were 58 (72.50%) males and 22 (27.50%) females with an M: F ratio of 1: 0.37 (Fig. 1).

Majority of the patients were between 51 and 60 years (40.00%) followed by 41–50 years of age (22.50%) and 31–40 years (27.50%). Only 8 (10%) patients were below 30 years of age. The overall mean age of the studied cases was found to be 44.60±12.92 (Table 1).

OSA, as determined by AHI, was found to be mild, moderate, and severe in 33 (41.25%), 17 (21.25%), and 9 (11.25%) patients, respectively. There were 21 (26.25%) patients with no OSA (AHI <5) (Table 2).

The analysis of total sleep time showed that the mean sleep time in patients having mild, moderate, and severe AHI was 292.4±78.2, 270.6±68.8, and 222.6±56.4 min, respectively. As the severity of OSA increased, there was decreased in mean sleep time and the difference was found to be statistically significant ($p<0.05$) (Table 3).

Among the 59 patients diagnosed with OSA, the most common presenting complaint was loud snoring, observed in 55 patients (93.22%). This was followed by daytime sleepiness in 47 patients (79.66%), waking up tired in 37 patients (62.71%), and disturbed sleep in 36 patients (61.02%). Other notable symptoms included choking or gasping during sleep (29 patients, 49.15%), morning headaches (28 patients, 47.46%), difficulty concentrating (25 patients, 42.37%),

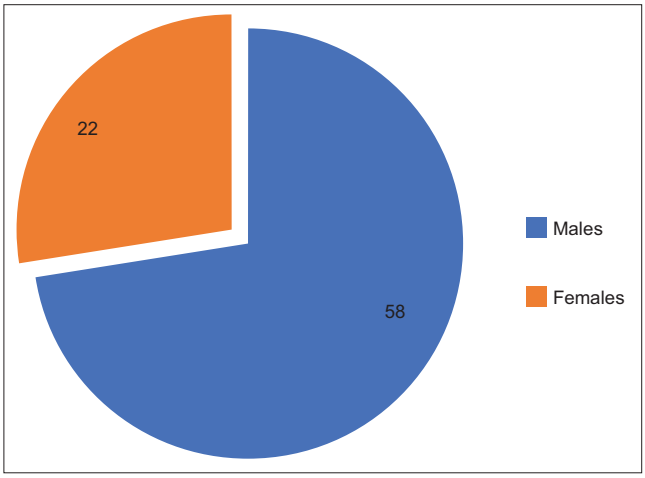

Fig. 1: Gender distribution of the studied cases

Table 1: Gender-wise distribution of age groups

Age group	No of patients	Percentage
18–30 years	8	10.00
31–40 years	22	27.50
41–50 years	18	22.50
51–60 years	32	40.00
Total	80	100.00
	Mean age: 44.60±12.92	

Table 2: Severity of obstructive sleep apnea

Sleep apnea severity	No of patients	Percentage
No OSA (AHI <5)	21	26.25
Mild (AHI 5–14)	33	41.25
moderate (AHI=15–30),	17	21.25
severe (AHI >30)	9	11.25
Total	80	100.00

OSA: Obstructive sleep apnea, AHI: Apnea–hypopnea index

Table 3: Comparison of mean sleep time in different grades of AHI

Sleep apnea severity	Mean sleep time (in minutes)
Mild (AHI 5–14)	292.4±78.2
moderate (AHI=15–30)	270.6±68.8
severe (AHI >30)	222.6±56.4
p<0.05 (significant)	

AHI: Apnea–hypopnea index

mood changes such as irritability and anxiety (24 patients, 40.68%), night sweats (19 patients, 32.20%), insomnia (17 patients, 28.81%), nocturia (12 patients, 20.34%), and dry mouth or sore throat upon waking (9 patients, 15.25%). It is important to note that most patients experienced more than one presenting complaint (Table 4).

DISCUSSION

Our study examined individuals with MS for the presence of OSA. In our study, patients were predominantly males (72.50%) with a male-to-female ratio of 1: 0.37. The age distribution revealed a majority of patients (40%) were between 51 and 60 years, with an overall mean age of 44.60±12.92 years. This demographic trend aligns with previous research indicating a higher prevalence of OSA in middle-aged and older adults, as well as a male predominance due to anatomical and hormonal differences influencing airway patency. Gabbay and Lavie conducted a study to characterize the phenotype of men and women of different ages with a laboratory diagnosis of OSA [11]. For this purpose, the authors retrospectively analyzed whole-night polysomnography data from 23,806 patients. The study found that out of studied cases, 70.7% had AHI >10, and men had consistently higher AHI than women. OSA severity rose linearly with age in normal-weight and obese women and in normal-weight men. Similar male preponderance was also reported by the authors such as Geer and Hilbert [12] and Lin *et al*. [13].

In our study, the severity of OSA, categorized by the AHI, showed that 41.25% of patients had mild OSA, 21.25% had moderate OSA, and 11.25% had severe OSA, while 26.25% had no OSA. The overall incidence of OSA in individuals with MS was found to be 73.75%. Dubey *et al*. conducted a study to analyze the clinical prevalence of obstructive sleep apnea (OSA) in MS and to find risk factors associated with OSA [14] For this study, 50 patients diagnosed with MS based on NCEP criteria were selected. These patients underwent overnight polysomnography, during which parameters such as the AHI, respiratory effort-related arousals, minimum SpO_2, pulse rate, blood pressure, and electrocardiography were continuously monitored. Out of 50 patients, 2 (4.00%) were found to have AHI <5 whereas mild (AHI 5–14), moderate (AHI 15–30), and severe OSA (AHI >30) was seen in 5 (10.00%), 21 (42.00%), and 22 (44.00%) individuals. Similar to this study, we also found that the majority of patients with MS had OSA. Similar high incidence of OSA in cases of MS was also reported by the authors such as Giampá *et al*. [15] and Gaines *et al*. [16].

In our study, presenting complaints among the 59 patients with diagnosed OSA included loud snoring (93.22%), daytime sleepiness (79.66%), waking up tired (62.71%), and disturbed sleep (61.02%), among other symptoms like choking or gasping during sleep (49.15%), morning headaches (47.46%), and difficulty concentrating (42.37%). These symptoms are characteristic of OSA and reflect the physiological disruptions caused by repeated airway obstruction while sleeping, which leads to intermittent hypoxia and sleep fragmentation. Loud snoring, the most common complaint, is often the earliest and most noticeable symptom, prompting clinical evaluation and subsequent diagnosis. Khazaie *et al*. conducted a study to assess the prevalence of symptoms and risk of OSA in the general population. Out of 527 participants, 261 (49.5%) experienced snoring, with a higher prevalence among women (51.5%). Among those who reported frequent snoring, 51 individuals (10%) mentioned experiencing a breathing pause more than once a week [17]. Whereas the authors such as Gottlieb and Punjabi reported excessive sleepiness to be the most common presenting complaint of OSA [18]. Similar presenting complaints were also reported by the authors such as Sharma *et al*. [19] and Goyal *et al*. [20].

Table 4: Presenting complaints in cases having OSA

Presenting complaints	Number of cases	Percentage
Loud snoring	55	93.22
Daytime sleepiness	47	79.66
Disturbed sleep	36	61.02
Waking up tired	37	62.71
Choking or gasping during sleep	29	49.15
Morning headaches	28	47.46
Difficulty concentrating	25	42.37
Mood changes (irritability, anxiety)	24	40.68
Night sweats	19	32.20
Insomnia	17	28.81
Nocturia	12	20.34
Dry mouth or sore throat upon waking	9	15.25

*More than 1 presenting complaints was seen in majority of the patients, OSA: Obstructive sleep apnea

CONCLUSION

The high prevalence of OSA in patients having MS highlights a significant overlap between metabolic abnormalities and sleep-disordered breathing. Given the profound impact OSA can have on cardiovascular health, glucose metabolism, and quality of life, it is important for health-care providers to consider OSA as a potential comorbidity in MS. Integrating OSA screening into the standard care protocol for patients with MS could enhance patient outcomes.

CONFLICTS OF INTEREST

None.

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