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Original research

EVALUATION OF OBSTRUCTIVE SLEEP APNEA IN PATIENTS WITH METABOLIC SYNDROME

Hoang Anh Tien[1], Tran Nguyen Hien Luong[1], Pham Thi Minh Hang[1], Nguyen Thi Tra Giang[1], Truong Thi Thu Uyen[1], Nguyen Hong Duyen[1], Doan Chi Thang[2]

[1]Department of Internal Medicine, Hue University of Medicine and Pharmacy, Hue, Viet Nam

[2]Department of Cardiology, Cardiovascular Center, Hue Central Hospital, Hue, Viet Nam

ABSTRACT

Background: *Obstructive sleep apnea syndrome (OSAS) is a common sleep breathing disorder that negatively affects health and quality of life. Assessing the relationship between sleep apnea syndrome and metabolic syndrome promises to bring new approaches, early screening, and appropriate prognosis to groups of patients with high-risk factors. This study aims to investigate the clinical and paraclinical characteristics of Obstructive Sleep Apnea Syndrome in patients with Metabolic Syndrome and to examine the correlation between the Apnea-Hypopnea Index (AHI) and lipid profile indices, blood sugar, waist circumference, blood pressure, and body mass index (BMI).*

Methods: *A cross-sectional descriptive study was conducted by interviewing 36 people aged 18 years and older who were diagnosed with metabolic syndrome according to criteria based on the consensus statement of IDF (international diabetes federation), AHA (American Heart Association)/NHLBI (Association (AHA) /National), WHF (World Federation of Hemophilia), IAS (International Antiviral), and IASO (Indian Association of Surgical Oncolog) in 2009 at the Department of Cardiology and the Department of General Internal Medicine, Hue University of Medicine and Pharmacy Hospital from February 2023 to December 2023.*

Results: *Among 36 patients with metabolic syndrome, 30 had OSAS (83.3%), with mild severity accounting for the majority (52.8%). The mean age of the group with OSAS was 64.1 ± 13.4 years. The BMI and Epworth scores were significantly higher in the OSAS group. Symptoms of snoring, morning headaches, decreased alertness, and memory concentration were significantly higher in the OSAS group.*

Conclusion: *Metabolic syndrome and obstructive sleep apnea syndrome are associated with many factors. Metabolic syndrome has the risk of worsening sleep apnea and vice versa.*

Keywords: *Obstructive sleep apnea syndrome, metabolic syndrome.*

I. INTRODUCTION

MS (Metabolic syndrome) is a major medical problem worldwide. In Europe, America, and Australia, along with an increase in the number of people with overweight, obesity, and diabetes, the number of people with MS is also constantly increasing. In Asia, although BMI is often lower than that in Europeans, this does not mean that the incidence of MS is low. In Vietnam, the incidence of MS varies from 12% to 39%, depending on the region, diagnostic criteria, and research subjects. The incidence of OSAS worldwide is increasing at all ages, related to the increase in overweight, obesity, cardiovascular diseases, and metabolic disorders. Studies have shown that the rate of MS in people with OSAS is quite high (43 - 78%) [1, 2] and in the opposite direction, the rate of OSAS in people with MS is 60.5 - 95% [3, 4]. Although the cause-and-effect relationship between OSAS and dyslipidemia remains unclear, there is much evidence

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Corresponding author: Doan Chi Thang. Email: thangdoanchi1981@gmail.com. Phone: +84 905469595

that OSAS affects glucose metabolism disorders, insulin resistance, hypertension, and dyslipidemia. blood lipid metabolism. Intermittent hypoxia in OSAS can promote activation of the sympathetic nervous system, activation of the hypothalamic-pituitary-adrenal axis, reduction of adiponectin, and inflammation, which are sources of cardiovascular and metabolic disorders for patients [5]. OSAS and MS have many interrelated pathogeneses that form a potential pathological spiral. Comorbidity with OSAS and MS increases the concentration of biomarkers, directly contributing to or increasing the likelihood of cardiovascular complications or events occurring in the body [6]. Starting from this situation (Comorbidity with OSAS and MS), we conducted research to describe the clinical and paraclinical characteristics of Obstructive Sleep Apnea Syndrome in patients with Metabolic Syndrome and investigated the correlation between the AHI number and waist circumference, blood pressure, body mass index, lipid profile, and blood sugar.

II. MATERIALS AND METHODS

2.1. Subjects

We interviewed 36 people aged 18 years and over who were diagnosed with metabolic syndrome according to criteria based on the consensus statement of IDF, AHA/NHLBI, WHF, IAS, and IASO in 2009 at the Department of Cardiology and the Department of General Internal Medicine, Hue University of Medicine and Pharmacy Hospital from February 2023 to December 2023.

2.2. Method

Cross-sectional descriptive study

Research protocol: All patients were explained and signed to participate in the study. The patient underwent blood pressure and blood tests. All patients underwent respiratory polygraphy overnight at the Department of Cardiology and the Department of General Internal Medicine of Hue University of Medicine and Pharmacy Hospital, including sensors such as nasal flow sensors, abdominal movement, oxygen saturation, and heart rate. The recorded parameters of the respiratory polygraphy results, including apnea-hypopnea index (AHI), SpO2 were classify to the standard recommendations of AASM (American Academy of Sleep Medicine) 2012. The apnea-hypopnea Index (AHI) was used to assess OSA severity, including non-OSA with AHI < 5 times/hour, 5 - 15 times/hour: mild; 16 - 30 times/hour: moderate OSA, and > 30 times/h: severe OSA. The Epworth scale is calculated based on the level of drowsiness in situations with a total score from to 0 - 24 points. Statistical analyses using SPSS 22.0 software.

III. RESULTS

We conducted a study of 36 hospitalized patients diagnosed with MS based on the consensus statement of IDF, AHA/NHLBI, WHF, IAS, and IASO in 2009 and found evidence of obstructive sleep apnea syndrome. blockage. Patients were divided into two groups based on the results of the respiratory polygraph: 30 patients with OSAS (OSAS (+) group). Group of patients without OSAS (OSAS(-) group): 6 patients. Thus, the proportion of patients with MS with OSAS in our study was 83,33%.

Men with OSAS accounted for a low rate of 20%. The BMI was significantly higher in patients with OSAS. Epworth scores were higher in the OSAS group ($p < 0.002$) (Table 1).

Table 1: Patient characteristics

Characteristic	OSAS (+) (n = 30)		OSAS (-) (n = 6)		Total		p
	n	%	n	%	n	%	
Age	64.1 ± 13.4		64.67 ± 14.4		64.2 ± 13.4		> 0.05
Sex (% male)	6	20.0	4	67.8	10	27.8	< 0.05
BMI (kg/m^2)	24.3 ± 3.3		20.7 ± 3.0		23.7 ± 3.5		< 0.05
Neck circumference (cm)	35.5 ± 3.0		34.17 ± 3.3		35.2 ± 3.1		> 0.05
Waist circumference (cm)	92.5 ± 7.3		86.5 ± 6.0		91.5 ± 7.4		> 0.05

Characteristic	OSAS (+) (n = 30)		OSAS (-) (n = 6)		Total		p
	n	%	n	%	n	%	
Systolic blood pressure (mmHg)	139.3 ± 14.6		138.3 ± 7.5		139.2 ± 13.6		> 0.05
Diastolic blood pressure (mmHg)	81.0 ± 7.1		80 ± 0.0		80.8 ± 6.5		> 0.05
Diabetes	18	60.0	3	50.0	21	58.3	> 0.05
Hypertension	29	96.7	5	83.3	34	94.4	> 0.05
Dyslipidemia	9	30.0	1	16.7	10	27.8	> 0.05
Epworth score	10.5 ± 3.8		5.2 ± 2.3		9.6 ± 4.1		< 0.002

Nocturia accounted for the majority of 30/35 patients. The rates of snoring, morning headaches, decreased alertness, concentration, and memory in the OSAS (+) group were significantly higher than those in the OSAS (-) group (p < 0,05) (Table 2). In the OSAS (+) group, mild OSAS accounted for the majority (52.8%), and severe OSAS accounted for a high percentage (23.3%) (Table 3). The average AHI of the OSAS (+) group was 18.89 ± 14.5 (times/hour), equivalent to the average obstructive sleep apnea threshold, which was significantly higher than that of the OSAS (-) group (Table 4).

Table 2: Symptoms of OSAS in patients

Symptoms	OSAS (+) (n = 30)		OSAS (-) (n = 6)		Total	p
	n	%	n	%		
Snoring	26	96.3	1	3.7	27	< 0.05
Breathing cessation while sleeping	9	90	1	10	10	> 0.05
Insomnia	27	81.8	6	18.2	33	> 0.05
Nocturia	30	85.7	5	14.3	35	> 0.05
Excessive daytime sleepiness	12	85.7	2	14.3	14	> 0.05
Morning headaches	19	95	1	5	20	< 0.05
decreased alertness, concentration, and memory	24	92.3	2	7.7	26	< 0.05

Table 3: Proportion of OSA severity groups

Severity	n	%
Mild (5 - 15 times/hour)	19	52.8
Moderate (16 - 30 times/hour)	4	13.3
Severe (> 30 times/hour)	7	23.3
Total	30	100

Table 4: Paraclinical characteristics of the study subjects

Variables	OSAS (+) (n = 30)	OSAS (-) (n = 6)	p
AHI (times/hour)	18.89 ±14.5	1.83 ± 1.53	< 0.05
Average SpO2 (%)	93.67 ± 2.8	94.17 ± 3.13	> 0.05
Lowest SpO2 (%)	77.9 ± 1.53	79 ± 10.7	> 0.05
Glucose (mmol/l)	11.65 ± 7.5	8.95 ± 3.66	> 0.05
LDL-Cholesterol (mmol/l)	3.99 ± 1.84	4 ± 1.28	> 0.05
Triglyceride (mmol/l)	3.25 ± 1.63	2.3 ± 0.79	> 0.05

IV. DISCUSSION

4.1. General, clinical and paraclinical characteristics of study subjects

The increased incidence of MS and OSAS in postmenopausal women is thought to be related to a decrease in estrogen levels (a hormone that plays an important role in metabolic regulation and energy balance), leading to an increased incidence of overweight, obesity, and increased incidence of type 2 diabetes [7]. Postmenopausal women have a higher risk of OSAS than premenopausal women; therefore, hormone replacement therapy may reduce this risk [8, 9].

In our study, OSAS (+) predominated with OSAS (-) and the difference between the two patient groups was statistically significant. This rate is different from the rates often mentioned in the medical literature, possibly because the research group had many women of menopausal age, so the rate of OSAS in women also increased compared to that in men.

BMI is also an important indicator that helps to predict the possibility of OSAS. In European and American countries, it is found that - 60 - 70% of OSAS cases are related to obesity; however, this relationship is not clear in Asians. In our study, the average BMI of the study group was 24.3 ± 3.3 kg/m2, and BMI was higher in the OSAS patients with metabolic syndrome ($p < 0.05$). The relationship between BMI and the risk of OSAS can be explained as follows: overweight and obesity, especially in subjects with type 2 diabetes, and increased fat deposition in the oropharynx, leading to an increased risk of airway collapse. At the same time, overweight and obesity increase fat deposition in visceral organs, reduce lung volume, and indirectly reduce respiratory gas capacity [10].

In our study, the rate of hypertension in the OSAS (+) patient group was higher than that in the OSAS (-) patient group, but this difference was not statistically significant ($p > 0.05$). In our study, 21/36 patients had diabetes, of which 85.7% were in the OSAS (+) group; there was no statistically significant difference between the two groups of patients. Our results showed that the proportion of patients with dyslipidemia in the OSAS (+) group was higher than that in the OSAS (-) group, but this difference was not statistically significant ($p > 0.05$).

The main symptom and also the most common reason why patients with sleep-disordered breathing visit the doctor is loud snoring while sleeping and excessive drowsiness during the day [11-13]. According to community research, the rate of snoring increases with age. At ages 41 - 65, the rate of snoring is 60% in men and 40% in women [11]. Our research results in Table 2 show that the majority of patients had symptoms of loud snoring during sleep (27/36 patients) and 96.3% of patients with this symptom belonged to the OSAS (+) group. Differences were considered statistically significant at $p < 0.05$. Sleep apnea can be described by the patient as a feeling of suffocation at night, or by the sleeper and the patient experiencing an apnea episode. This is also a common symptom in OSAS patients, in addition to loud snoring during sleep and excessive daytime sleepiness [14, 15]. Our results showed that 9/10 patients with symptoms of apnea and suffocation at night belonged to the OSAS (+)

group; however, the difference was not statistically significant ($p > 0.05$). Excessive daytime sleepiness is an important and common symptom of OSAS. Daytime sleepiness may manifest as loss of alertness or falling asleep in inappropriate situations. The cause of this symptom is nighttime sleep quality combined with snoring symptoms (a consequence of the patient often waking up many times during the night). An individual is considered excessively sleepy when he or she cannot stay alert enough to complete daily activities. [16]. Excessive sleepiness affects approximately 15% of the general population and one-third of adults, with no difference between the sexes [11]. In our study, 12/14 patients with symptoms of daytime sleepiness (accounting for 85.7%) belonged to the OSAS group; however, the difference was not statistically significant ($p > 0.05$).

Patients with OSAS often complain of waking up many times during the night and have difficulty returning to sleep after waking up. Patients may not sleep well or sometimes have to urinate frequently at night. This is also one of the common reasons patients visit doctors for sleep disorders. Our study showed that the majority of patients with this symptom were in the OSAS (+) group (27/33), but the difference was not statistically significant.

Although many studies have suggested that headache symptoms, especially morning headaches, are more common in patients with OSAS than in normal individuals, there is still no firm consensus. Some hypotheses help explain the association between OSAS and morning headaches, such as increased blood CO2 concentration, decreased pulse, increased intracranial pressure, and poor sleep quality [16].

According to our research results (Table 2), the majority of patients with morning headaches were in the OSAS (+) group, with a rate of 95%, which is higher than that of patients in the OSAS (-) group who also had this symptom. The difference between the two groups was statistically significant ($p < 0.05$).

Reduced alertness, concentration, and memory are the consequences of excessive daytime sleepiness. Patients with OSAS may experience many difficulties in daily activities and work because of reduced concentration, memory, and quality of life [16]. Our study showed that 14/36 patients had this symptom and the majority were in the OSAS (+) group (85.7%); however, this difference was not statistically significant.

The Epworth Scale is used clinically to screen for daytime symptoms of OSAS. In the US, a study evaluated 268 patients diagnosed with OSAS at a sleep clinic and continuously monitored their Epworth scores. The results of this study demonstrate the potential of Epworth discrimination as a clinical screening tool for OSAS [17].

We evaluated patients' Epworth scores. In the study group, we found that the Epworth score of the OSAS (+) group (10.5 ± 3.8) was higher than the OSAS (-) group (5.2 ± 2.3) there is a statistically significant difference between the two groups of patients with OSAS (+) and OSAS (-) in the mean value of the Epworth scale (Table 1) with $p < 0.002$. Our study results are consistent with the study of author Hamid Reza Javadi and colleagues (2013) showing that the average Epworth score in patients with OSAS (+) and OSAS (-) is 12.2 ± 2.6 and 9.2 ± 2.7, this difference is statistically significant ($p < 0.001$) [18].

Our study evaluated the severity of OSAS according to the apnea-hypopnea index (AHI) and divided it into three groups: mild (5 - 15 events/h) and moderate (16 - 30 events/h). events/h), and severity (>30 events/h). Our study results (Table 3) showed that the frequencies of mild, moderate, and severe OSAS were 19/30 (52.8%), 4/30 (13.3%), and 7/30 (23.3%), respectively. The distribution of OSAS levels in patients with MS fluctuates widely.

Our study diagnosed OSAS based on clinical symptoms and PSG results during sleep. The AHI is determined by the number of apneas and hypopneas per hour of sleep. AHI was the most important evaluation parameter in our study, both for diagnosing and assessing the severity of OSAS, and was the goal of this study. The study results showed that the average AHI was 18.89 ± 14.5 (times/hour) in the OSAS (+) group and 1.83 ± 1.53 (times/hour) in the OSAS (-) group. Therefore, the AHI in the OSAS (+) group was significantly higher than that in the group without OSAS ($p < 0.05$).

In addition to AHI, other indicators of blood oxygen saturation also help to evaluate the severity of OSAS. Research results (Table 4) show that the

average value of the mean and lowest blood oxygen saturation in the two groups OSAS (+) and OSAS (-) does not have a statistically significant difference with $p > 0.05$. This difference can be explained by the small sample size of our study ($n = 36$); spirometry is not the gold standard for diagnosing OSAS as well as errors during the measurement process.

4.2. Correlation between AHI and lipid bilan index, blood sugar, waist circumference, blood pressure, body mass index

The relationship between obstructive sleep apnea and lipid disorders, according to the NCEP criteria, is inconsistent [19]. Additionally, other studies that measured continuous variables for lipid disorders instead of the NCEP criteria have shown a relationship between OSAS and hyperlipidemia, such as increased triglycerides and decreased HDL [20]. In this study, the results were similar, possibly because the patients had been diagnosed and were being treated with lipid-modifying drugs; therefore, the indices did not reflect the level of metabolic disorders. This is the same as that for any blood glucose level.

Simple obesity differs from central obesity - obesity due to visceral fat - expressed through waist circumference. Central obesity is mainly caused by increased levels of the subperitoneal adipose tissue. Visceral fat is a metabolically active tissue in which large amounts of inflammatory and vasoactive substances are produced, which can cause metabolic disorders and atherogenesis [21]. When studying the correlation between AHI and waist circumference index, our research results show that there is a statistically significant positive correlation between these two indices. The regression equation was $y = 0.7502x - 52.643$ with a correlation coefficient of $R = 0.374$ and $p = 0.025$.

Being overweight and obese are considered the most important risk factors for OSAS. The role of obesity in the pathogenesis of OSAS has been clearly demonstrated; at least half of adults with OSAS are overweight [22]. When studying the correlation between AHI and BMI, our results showed a statistically significant positive correlation between AHI index. The regression equation was $y = 2.2677x - 37.788$, with a correlation coefficient of $R = 0.533$ and $p = 0.001$.

In patients with OSAS, the symptoms of excessive daytime sleepiness may be masked by daily work activities. The Epworth scale is a simple questionnaire and a quick screening tool to detect patients' symptoms of daytime sleepiness. Eight situations are described in a questionnaire scored from 0 to 3, with a total score ranging from 0 to 24, with higher scores related to increasing sleep levels [12]. When studying the correlation between the Epworth index, our research results show a statistically significant positive correlation. Regression equation $y = 2.3786x - 6.8862$ with a correlation coefficient of $R = 0.66$ and $p < 0.001$.

V. CONCLUSION

MS and OSAS are correlated with each other in many ways. MS increases the risk of worsening sleep apnea, and vice versa. Therefore, it is necessary to propose solutions, such as increasing education and awareness of OSAS, for the medical community as well as the public. Provide simple and effective methods for assessing and screening OSAS in the community, especially for high-risk groups, such as those with metabolic syndrome. Strengthen cooperation between medical professionals, build multidisciplinary and synchronized care processes, and accurately diagnose and choose appropriate treatment methods. Collaboration between specialists, such as cardiologists, sleep specialists, and respiratory specialists, will facilitate early diagnosis and comprehensive treatment.

Disclosure

The authors report no other conflicts of interest in this work.

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