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Prevalence and Characteristic of Obstructive Sleep Apnea Syndrome in Subjects with High Blood Pressure: A Pilot Study in Vietnam

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Abstract

Background: The prevalence of obstructive sleep apnea (OSA) is high in patients with high blood pressure (HBP), increasing the risk of mortality and morbidity due to cardiovascular events. Therefore, early diagnosis of OSA, especially severe OSA, in patients with HBP is optimal.

Objectives: This study was planned to evaluate the prevalence of OSA in Vietmanese subjects with newly diagnosed HBP, and to describe its clinical, biological, and polysomnography (PSG) characteristics.

Method: This was a cross-sectional study including subjects with newly diagnosed HPB without other associated severe diseases. PSG with Alice PDx device had been performed for each study subject. All anthropological, clinical, biochemical characteristics and apnea-hypopnea index (AHI) had been recorded for analyzing.

Results: 186 subjects with HBP had been enrolled and studied with PSG. The results were 34 subjects were without OSA (18%; 56 ± 7 years), 28 had mild OSA (15%; 58 ± 12 years), 79 had moderate OSA (43%; 59 ± 14), and 45 had severe OSA (24%; 61 ± 13 years). Suggested findings of OSA patients were snoring at night, hypertriglyceridemia, and large abdominal perimeter. There were significant correlations between these findings and AHI in OSA patients ($p<0.05$, $p<0.01$, $p<0.001$).

Conclusion: The prevalence of OSA in subjects with systemic HBP is high. The findings of snoring at night, large abdominal girth and hypertriglyceridemia suggest that PSG is warranted. Early diagnosis of OSA in patients with HBP may decrease morbidity and mortality.

Keywords: Sleep apnea; High blood pressure; Apnea-hypopnea; Snoring

Introduction

Obstructive Sleep Apnea (OSA) is a common disease in adults, which increases by age with the estimated frequency of 4-7% [1]. The disease is characterized by snoring, daytime sleepiness and night-time sleep disturbance often noted by their relatives. People with OSA syndrome have an increase risk of morbidity and mortality due to cardiovascular diseases.

Previous studies showed that OSA might be associated with systemic arterial hypertension (high blood pressure: HBP) in approximately 50% of cases, and vice versa, over 50% of cases with HBP developed OSA [2,3]. These studies concluded that there was a correlation between HBP and OSA diagnosed by polysomnography (PSG), and the apnea-hypopnea index (AHI) was also correlated with systolic and diastolic blood pressure values at rest. The subjects with HBP and OSA had a higher risk of stroke than those without OSA [4-6]. In addition, there was a correlation between OSA patients' mortality due to stroke and the severity of AHI [6]. Thus, appropriate diagnosis and treatment of OSA in patients with HBP may decrease the morbidity and mortality related to cardiovascular events [7]. Our study was planed to evaluate the prevalence of OSA in subjects with HBP and to determine features of Vietnamese patients with HBP that may be used to predict who would most likely benefit from early screening.

Study Subjects and Methods

Study subjects

The subjects with diagnosed HBP living in Dalat City, Lamdong Province, Vietnam, were included in the present study after signing an informed consent approved by the Local Ethical Review Board. All study subjects met the inclusion criteria, which included non-treated HBP with blood pressure at rest ≥ 140/90 mmHg recorded in 3 consecutive measurements. Exclusions included severe chronic or acute diseases such as diabetes, renal failure, coronary diseases, cerebral vascular accident, asthma and chronic obstructive pulmonary disease and insomnia.

Study methods

This is a descriptive and cross-sectional study. The anthropolometric parameters, clinical and funtional characteristics, and PSG parameters were recorded for analysis. All study subjects underwent clinical examination, blood pressure measurement at rest, electrocardiography (ECG), and biochemical blood tests.

The severity of sleepiness and daytime fatigue were assessed by Epworth (0-24 points) and Pichot (0-32 points) scores. The diagnosis

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of metabolic syndrome was based on 3/5 of standard criteria from the International Diabetes Association: waist circumference >90 cm in men or >80 cm in women, blood pressure ≥135/85 mmHg, triglyceride ≥1.5 g/L, HDL-cholesterol <0.40 g/L in men or <0.50 g/L in women and fasting glucose >1.1 g /L.

All study subjects completed a screening questionnaire about symptoms of OSA, sleep habits, sleep quality, and snoring. Epworth and Pichot scores was calculated for each patient. Subjects with OSA were defined by apnea-hyponea index (AHI) ≥5/hour and classified as mild (AHI=5-15), moderate (AHI=16-30), and severe (AHI >30) OSA.

Polysomnography

In-laboratory overnight PSG was performed for each study subject using Alice PSG (Philippes, USA) in Sleep Lab Center of Lamdong Medical College as previously published [8,9]. The recording time from 10 pm to 6 am of the day after. The minimum recording time for PSG was 6 hours with sleep time of at least 3 hours. Sleep G3 software (Philippes, USA) was used to analyze PSG results. The recorded parameters were electroencephalography (EEG) with 4 channels: C4-A1, C3-A2, O2-A1, and O1-A2; chin electromyography (EMG); electrocardiography (ECG); nasal and buccal air flows; thorax and abdomen mouvements; sleeping posture; apnea-hyponea index (times/hour); type of apnea (central apnea, obstructive apnea or mixed); oxygen saturation (SpO2) and minimum SpO2 (Nadir SpO2); arousal index (times/hour); snoring (> 56 dB); and sleep efficiency (%).

Statistical analysis

The recorded parameters were analysed using IBM-SPSS 22.0 software (Chicago, Illinois, USA). Values were expressed as mean ± standard deviation (SD) and 95% confidence interval (CI) for quantitative variables, and percentage for qualitative variables. The comparison of quantitative parameters was done by Student's T test. The statistical significance was p<0.05.

Results

Anthropometric characteristics of study subjects

From January 2015 to February 2016, there were a total of 186 eligible subjects with HBP included in the study. The anthropometric characteristics of study subjects are shown in Table 1.

The number of HBP subjects with OSA was 152/186 (82%). The average age of OSA subjects (AHI ≥5) was higher than that of subjects without OSA (p<0.01). The waist and neck circumferences of subjects with OSA were significantly higher than those of subjects without OSA (p <0.05 and p <0.01). There was no difference in BMI between subjects with and without OSA (p> 0.05).

Clinical characteristics of the study subjects

The clinical characteristics of study subjects are shown in Table 2. A significantly higher percentage of HBP subjects with OSA had snoring compared to subjects without OSA. There were no significant differences for nocturia, headache or day-time fatigue score of Pichot (Table 2) between subjects with and without OSA. Epworth scores in severe OSA group were significantly higher than those of the group without OSA (p <0.05).

Biological and PSG characteristics of study subjects

The biological and PSG characteristics of study subjects are shown in Table 3. The level of fasting glucose in subjects with severe OSA was significantly higher than that of subjects with mild OSA or without OSA (p<0.05). The increase of triglyceride and decrease of SpO_2 were significantly different in subjects with OSA compared with those of subjects without OSA (p<0.05 and p<0.01; respectively). There was no significant difference for HDL-cholesterol level between study subjects (p>0.05; Table 3).

Correlation between AHI, clinical symptoms of OSA, and metabolic syndrome

The correlations between OSA severity assessed by AHI with clinical symptoms of OSA and metabolic syndrome are presented in Table 4. There were significant correlations between AHI with snoring, triglyceride level, and waist circumference in subjects with OSA. For subjects with severe OSA (AHI ≥30 times/hour), there were the significant correlations between AHI, Epworth score, and fasting glucose (Table 4).

[Study subjects (n=186, 100%)	Age (years)	Male/ Female	Waist circumference (cm)	Neck circumference (cm)	BMI (kg/m²)
(1) AHI < 5 (n=34, 18%)	56 ± 7	4/6	83 ± 9	35 ± 7	24 ± 4
(2) 15 > AHI ≥ 5 (n=28, 15%)	58 ± 12**	2/4	88 ± 10*	37 ± 6*	24 ± 3¶
(3) 30 > AHI ≥ 15 (n=79, 43%)	59 ± 14**	16/14	87 ± 9*	38 ± 7*	23 ± 5¶
(4) AHI ≥ 30 (n=45, 24%)	61 ± 13**	12/4	91 ± 8**	39 ± 5**	25 ± 4¶

Table 1: Anthropometric characteristics of study subjects classified by AHI. OSA: Obstructive Sleep Apnea; AHI: Apnea-Hypopnea Index, BMI: Body Mass Index; (1): without OSA; (2): mild OSA; (3): moderate OSA; (4): severe OSA; *,**: p<0,05 and p<0,01 compared to (1); ¶: p>0,05 compared to (1).

Study subjects (n=186)	Snoring (%)	Nocturia (%)	Headache (%)	Pichot Score (0-32)	Epworth Score (0-24)
(1) AHI < 5 (n=34)	27%	34%	58%	14 ± 7¶	8 ± 4
(2) 15 > AHI ≥ 5 (n=28)	66%**	36%¶	60%¶	15 ± 9¶	9 ± 5¶
(3) 30 > AHI ≥ 15 (n=79)	77%***	42%¶	59%¶	17 ± 8¶	10 ± 5¶
(4) AHI ≥ 30 (n=45)	88%***	43%¶	57%¶	16 ± 8¶	12 ± 6*

Table 2: Clinical characteristics of study subjects classified by AHI. OSA: Obstructive Sleep Apnea, AHI: Apnea-Hypopnea Index, Pichot: Fatigue score (0-32 point); Epworth: Daytime Sleepiness Score (0-24 points); (1): without OSA; (2): mild OSA; (3): moderate OSA; (4): severe OSA; *,**,***: p<0,05, p<0,01 and p<0,001 compared to (1); ¶: p>0,05 compared to (1).

Study subjects (n=186)	Glucose (g/L)	TG (g/L)	HDL (g/L)	AHI (times/hour)	Nadir SpO_2 (%)
(1) AHI < 5 (n=34)	1.1 ± 0.2	1.5 ± 0.5	0.5 ± 0.1	4 ± 1	89 ± 4
(2) 15 > AHI ≥ 5 (n=28)	1.2 ± 0.2¶	1.9 ± 0.6*	0.4 ± 0.1¶	12 ± 5	84 ± 4**
(3) 30 > AHI ≥ 15 (n=79)	1.2 ± 0.2¶	1.9 ± 0.8*	0.5 ± 0.1¶	23 ± 8	81 ± 6**
(4) AHI ≥ 30 (n=45)	1.4 ± 0.3*,#	2.4 ± 0.9**,#	0.4 ± 0.1¶	32 ± 7	79 ± 7**

Table 3: Biological and PSG characteristics of study subjects. OSA: Obstructive Sleep Apnea; AHI: Apnea-Hypopnea Index; Nadir SpO_2: The lowest SpO_2; Glucose: Fasting Glucose; TG: Triglyceride; HDL: HDL-Cholesterol; (1): without OSA; (2): mild OSA; (3): moderate OSA; (4): severe OSA ;*,**: p<0.05, p<0.01 compared with (1); #: p<0.5 compared with (2) and (3); ¶: p>0.05 compared with (1).

	15> AHI ≥5 (n=28)	30> AHI ≥15 (n=79)	AHI ≥30 (n=45)
Clinical symptoms of OSA			
BMI	r=0.134 p=0.068	r=0.446 p=0.058	r=0.482 p=0.075
Snoring	*r=0.632* *p=0.024*	*r=0.689* *p=0.003*	*r=0.798* *p=0.001*
Nocturia	r=0.344 p=0.223	r=0.386 p=0.098	r=0.388 p=0.225
Headache in the morning	r=0.228 p=0.127	r=0.344 p=0.115	r=0.392 p=0.091
Pichot	r=0.255 p=0.072	r=0.211 p=0.116	r=0.287 p=0.129
Epworth	r=0.227 p=0.099	r=0.218 p=0.105	r=0.411 p=0.028
Metabolic syndrome:			
Glucose	r=0.461 p=0.052	r=0.432 p=0.061	*r=0.614* *p=0.024*
Triglyceride	*r=0.321* *p=0.042*	*r=0.526* *p=0.003*	*r=0.629* *p=0.002*
HDL	r=0.211 p=0.076	r=0.128 p=0.132	r=0.225 p=0.089
Waist circumference	*r=0.423* *p=0.016*	*r=0.328* *p=0.024*	*r=0.621* *p=0.039*

Table 4: Correlation between AHI, clinical symptoms of OSA, and metabolic syndrome.

Discussion

The results of the present study demonstrated that: 1) The prevalence of obstructive sleep apnea (OSA) in subjects with high blood pressure (HBP) was 82%; 2) Clinical and biological symptoms commonly seen in HBP subjects with OSA were snoring, increased waist circumference and triglyceride level; 3) In HBP subjects with severe OSA there was a significant correlation between AHI, Epworth score and increase of fasting blood glucose.

The high prevalence of OSA in subjects with HBP suggested that there was a cause and effect between these two pathologies. A previous study had been conducted to observe the variability of systolic and diastolic arterial blood pressure during a 24 hour period in subjects with OSA, which showed that blood pressure increased from midnight to waking time at 09:00 [3]. During this period systolic blood pressure was increased to a higher level than that of the diastolic blood pressure. In contrary, diastolic blood pressure was increased significantly more from 14:00 to 19:00 in OSA subjects. Pepard and colleagues also found that there was a high risk of HBP in subjects having AHI >15 times/hour [10]. Moreover, similarly to our study others have demonstrated that the prevalence of OSA is increased in over 50% of HBP patients [11,12]. Although the mechanism of HBP in subjects with OSA has been well understood is it thought to be secondary to intermittent hypoxemia at night [13,14]. The cause of high prevalence of OSA in subjects with HBP has also not been fully explained.. May be that both HBP and OSA have common risk factors.

In terms of clinical symptoms, snoring at night and daytime sleepiness are regarded as the suggested symptoms of OSA. In our study, snoring was common in HBP subjects with OSA (Table 2). The frequency of snoring was higher in subjects with severe OSA and was present in 88% of subjects with AHI ≥30 times/hour. For this reason snoring appears to be an important symptom in HBP patients and suggests the need to order PSG. Moreover, the results of our study showed that there was a significant correlation between snoring and AHI (Table 4). However, daytime sleepiness as assessed by the Epworth Sleepiness Scale score showed no significant correlation with AHI in mild to moderate OSA subjects, but there was a weak correlation with severe OSA. Interestingly, there were no significant correlations between AHI and common clinical findings of OSA (Table 4) such as morning headaches, daytime fatigue and nocturia (Table 2). However, there was a significant correlation between AHI and waist circumference.

In our study, most HBP patients had Metabolic Syndrome according to diagnostic criteria as noted in the method section. In the present study, two criteria of metabolic syndrome that significantly associated with AHI were increase of waist circumference and high level of triglyceridemia (Table 4). Thus, these two biomarkers, combined with snoring, when found in HBP patients, are suggestive for OSA and predict that PSG was of benefit. In addition, daytime sleepiness and fasting blood glucose predict that HBP subjects had severe OSA. None the less, the present study had been done in a limit number of Vietnamese subjects and may not be applicable to other ethnicities.

Conclusion

OSA is a common disorder in patients with high blood pressure (HBP). OSA contributes to increased risk of morbidity and mortality for

cardiovascular events in this population. Our data suggest that patients with HBP and associated snoring, excessive wrist circumference and high serum triglycerides should be assessed by PSG. This intervention may lead to improved care of the patient and a reduced risk of morbidity and mortality associated with cardiovascular diseases.

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