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Prevalence, Risk Factors and Clinical Manifestation of Patients Suspected as having Obstructive Sleep Apnea in Songklanagarind Hospital Sleep Center

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Abstract:

Objective: To identify the prevalence and to determine both risk factors and clinical manifestation of obstructive sleep apnea (OSA).

Material and Methods: A retrospective study was conducted to review the medical records and polysomnographic data of patients from March 2006 to December 2017.

Results: A total of 929 patients was enrolled, however, only 124 patients had habitual snoring (13.4%). The prevalence of OSA and OSAS was 85.6% and 52.7% respectively. OSA was more prevalent in men than women (60.5% vs 25.1%). The presence of HT or symptoms of choking, gasping and neurocognitive impairment were significantly greater in OSA patients compared with the non-OSA group. In multivariate analysis, it was revealed that male gender, age ≥50 years, body-mass index (BMI) >25 kg/m^2, neck circumference (NC) >40 cm and waist to height ratio (WHtR) >0.6 were the significant predictors for OSA.

Conclusion: This study demonstrated that; OSA is a major health concern within the Thai population. Male gender, elderly age and those higher in BMI, NC or WHtR can be predicted as having the presence of OSA.

Keywords: obstructive sleep apnea, polysomnography, prevalence, risk factor

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Introduction

Obstructive sleep apnea (OSA) is a common sleep disorder in the middle-aged population. It is characterized by a narrowing or complete collapse of the upper airway during sleep, leading to sleep fragmentation, excessive daytime sleepiness, mood changes and neurocognitive impairment. Furthermore, it interferes with the quality of life, and increases risks of motor vehicle accidents, work problem and cardiovascular morbidity and mortality.[1-10] Subjects with OSA may complain of daytime sleepiness, choking or gasping during sleep, an unrefreshing sleep and morning headaches, while some patients may be asymptomatic. Nowadays, comprehensive sleep evaluations with various sleep questionnaires are used together for screening patients at risk. However, the standard diagnosis of OSA is still made by in-laboratory polysomnography.

Findings from most literatures have confirmed that those of a male gender, smokers, alcohol drinkers and hypertension were the significant risk factors of OSA.[11,12] Besides this, other considered factors were neck circumference (NC) >40 cm, body mass index (BMI) >30 kg/m^2, age >50 years of age. The history of excessive daytime sleepiness, using the Epworth sleepiness scale (ESS) score ≥11, witnessed apnea, as well as which, choking also plays a role in the occurrence of OSA.[13] However, these factors and their cut-off points might not be applicable in an Asian population, which had less obesity and differences in the craniofacial structure, compared with the Western population.[14,15] In regards to the published prevalence in Asian populations, this was widely varying in range of 3.7 to 97.3%, because of the variety in the criteria definition along with sleep study type used.[16] Recently, in the Central Thai population, the prevalence of OSA was 11.4%, while that of obstructive sleep apnea syndrome was 4.4%. The prevalence of OSA was 15.4% and 6.3% in men and women, respectively.[17] The aim of this present study is to identify the prevalence, and to determine the risk factors and clinical manifestation of OSA.

Material and Methods

Study population

All patients presenting with snoring, or other symptoms with suspected OSA who underwent polysomnography from March 2006 to December 2017 at Songklanagarind Hospital's sleep center, a tertiary hospital in southern Thailand, were included. For every patient, the data was recorded; including age, body mass index, gender, symptoms associated with OSA, Epworth sleepiness scale score (ESS), Friedman tongue position (FTP)[18], NC, waist circumference (WC) and polysomnographic findings. NC was measured at the cricoid level, and WC was measured at the umbilical level, at the end of expiration, while patients were standing. Patients with incomplete data were excluded from the study. Type I polysomnography studies were conducted at the sleep center. The study consisted of electroencephalography (EEG), electrooculography, chin and leg electromyography, electrocardiography, thermistors and nasal pressure transducer for oronasal airflow, thoracic and abdominal belts for respiratory efforts, pulse oximetry for oxyhemoglobin level, tracheal microphone for snoring and sensors for sleeping position. The data recordings were scored manually by use of standard criteria.[19] The EEG was scored into the five stages of sleep, including stage wakefulness (W), stage non-rapid eye movement1 (N1), stage N2, stage N3, and stage rapid eye movement (REM).[19] Apnea was scored when there was a drop in the thermistor signal by ≥90.0%, of the pre-event baseline, for ≥10 seconds. The definition of hypopnea used either a 30.0% or 50.0% drop in nasal pressure signals for 10 seconds, or greater, which was associated with ≥3.0% desaturation, or an arousal.[19] The apnea hypopnea index (AHI) was calculated by the number of apneas and hypopneas, per hour, of total sleep time. Excessive daytime sleepiness (EDS) was self-assessed by using ESS questionnaires.[20,21] A score of >10 was considered to be suggestive of EDS. OSA, this was defined as: an AHI score of >5. Obstructive sleep apnea syndrome (OSAS) was defined as: an AHI score of >5, with the presence of EDS.[22] The OSA severity was defined as: mild for AHI ≥5 and <15, moderate for AHI ≥15 and ≤30 and severe for AHI >30.[22] This retrospective study was approved by the Ethics Committee of the Faculty of Medicine, Prince of Songkla University. And, this article did not contain any studies with human participants performed by any of the authors.

Statistical methods

The prevalence was reported in percentage of proportion. Numerical data were described using mean and standard deviation (S.D.) or median and interquartile range (IQR) based on their distribution. Comparison between groups was performed with unpaired t-test for continuous variables, and chi-square test for nominal variables. Wilcoxon Mann Whitney test was used to compare ESS. The correlation was tested by Spearman correlation coefficients. Odd ratios (ORs) and 95% confidence intervals (CIs) were determined. Logistic regression was used to analyze the significant factors in relation to OSA. All statistical analysis was performed using Epidata software (version 3.1) and R software (version 3.4.2) A p-value of less than 0.05 was considered to be statistically significant.

Results

Prevalence of obstructive sleep apnea

A total of 929 patients, undergoing in-laboratory polysomnography, were enrolled in this study. Among these patients, 795 patients had OSA (85.6%), 490 patients had OSAS (52.7%) and 124 patients had habitual snoring (13.4%). The prevalence of OSA was 60.5% and 25.1% in men and women, respectively. The percentage of mild, moderate and severe OSA was 23.1%, 18.0% and 44.5%, respectively.

Ages ranged from 18 to 85 years, with a male predominance of 622 patients (67.0%). The male-to-female ratio was significant increasingly in the OSA group as 2.4:1. The mean BMI was higher in the OSA group, than in the non-OSA group (30.2±8.5 kg/m^2 vs 25.7±4.8 kg/m^2; p-value <0.001). The characteristics of age, sex, BMI, NC, WC and waist-to-height ratio (WHtR) were statistically significant different in both groups. The presence of HT was greater in OSA subjects. In the OSA group, 461 patients (58.0%) had a FTP III-IV, and a larger tonsil grading was shown more in this group. The demographic data along with risk factors of OSA and the non-OSA group are summarized in Table 1.

Clinical manifestation and PSG findings

In OSA patients, only 5 patients had no snoring (0.6%). The OSA group seemed to have higher ESS scores coupled with excessive daytime sleepiness. Also, the presence of choking, gasping and neurocognitive impairment symptoms were significantly greater in OSA patients, compared with non-OSA, as shown in Table 1. Furthermore, the symptoms of recurrent awakening during the night, and vehicle accidents were found more common in the moderate to severe OSA group. The polysomnographic data is shown in Table 2. In the OSA group, there was a significant increasing in stage N1 and a reduction in stage REM of sleep. The lowest oxygen saturation was lower and the oxygen desaturation index was higher in OSA patients.

Risk factors associated with OSA

The results of univariate analysis are shown in Table 3. Male gender, age ≥50 years, BMI >25 kg/m^2, NC >40 cm, WC >101 cm, WHtR >0.6, ESS score >10 and FTP III-IV showed significant correlation with an AHI score of ≥5. The presence of HT, and the symptoms of choking, gasping as well as neurocognitive impairment were associated with OSA. Stepwise multivariate analysis identified that male gender, age ≥50 years, BMI >25 kg/m^2, NC >40 cm and WHtR >0.6 were the significant predictors for OSA. Furthermore, the NC >40 cm was the most important predictor for severe OSA, with an odds ratio of 4.62 [95% confidence interval (CI) 3.38-6.32, p-value <0.001].

Table 1 Demographic characteristics of the study population (n=929)

Characteristics	Non-OSA subjects (n=134)	OSA subjects (n=795)	p-value
Age (year)			0.005
<50	77 (57.5)	350 (44.0)	
≥50	57 (42.5)	445 (56.0)	
Gender			<0.001
Male	60 (44.8)	562 (70.7)	
Female	74 (55.2)	233 (29.3)	
BMI† (kg/m^2)	25.7 (4.8)	30.2 (8.5)	<0.001
Neck circumference† (cm)	35.3 (3.7)	39.0 (4.3)	<0.001
Waist circumference† (cm)	89.0 (12.3)	100.3 (16.0)	<0.001
WHtR†	0.5 (0.1)	0.6 (0.1)	<0.001
FTP III-IV	72 (53.7)	461 (58.0)	0.002
Tonsils grade 3-4	5 (3.7)	71 (8.9)	0.020
Retrognathia	25 (18.7)	137 (17.2)	0.250
Habitual smoking	1 (0.7)	14 (1.8)	0.202
Habitual drinking	10 (7.5)	80 (10.1)	0.464
Hypertension	20 (14.9)	248 (31.2)	<0.001
ESS score†	8.9 (3.9)	9.8 (4.5)	0.044
Excessive daytime sleepiness	38 (28.8)	293 (37.7)	0.063
Habitual snoring	124 (13.4)	734 (79.0)	0.135
Choking or gasping	56 (6.0)	357 (38.4)	0.040
Recurrent awakening	28 (3.0)	170 (18.3)	0.857
Morning headache	20 (2.2)	151 (16.3)	0.090
Unrefreshing sleep	56 (6.0)	280 (30.1)	0.333
Neurocognitive impairment	44 (4.7)	183 (19.7)	0.017
Accident or near miss accident	7 (5.2)	45 (5.7)	1.000

OSA=obstructive sleep apnea, WHtR=waist to height ratio, FTP=Friedman tongue position, ESS=Epworth sleepiness scale, †mean (S.D.)

Table 2 The polysomnographic measures of the study population (n=929)

Parameters	Non-OSA subjects (n=134)	OSA subjects (n=795)	p-value
Sleep latency† (min)	13.3 (14.9)	13.3 (15.9)	0.996
REM latency† (min)	132.9 (77.7)	120.7 (65.5)	0.060
Stage N1† (%)	17.7 (11.2)	27.6 (18.9)	<0.001
Stage N2† (%)	54.4 (11.1)	51.5 (14.6)	0.030
Stage N3† (%)	11.9 (11.2)	10.2 (11.5)	0.096
Stage REM† (%)	16.0 (6.9)	11.0 (8.3)	<0.001
Minimum oxygen saturation† (%)	89.1 (4.6)	78.2 (10.3)	<0.001
Oxygen desaturation index† (events/hrs)	1.5 (1.3)	34.5 (31.0)	<0.001

REM=rapid eye movement, N1=non rapid eye movement1, N2=non rapid eye movement2, N3=non rapid eye movement3, OSA=obstructive sleep apnea

Table 3 Risk factors associated with obstructive sleep apnea

Characteristics	Univariate analysis odd ratio (95% CI)	Stepwise multivariate analysis Adjusted odd ratio (95% CI)
Male gender	2.97 (2.05-4.32)	3.93 (2.52-6.12)
Age ≥50	1.71 (1.19-2.49)	2.55 (1.66-3.91)
BMI >25 kg/m^2	3.43 (2.35-4.99)	1.72 (1.07-2.77)
NC >40 cm	6.31 (3.16-12.61)	3.01 (1.35-6.70)
WC >101 cm	4.10 (2.38-7.06)	
WHtR >0.6	3.19 (2.01-5.05)	2.59 (1.43-4.69)
ESS score >10	1.49 (1.00-2.24)	
FTP III-IV	1.66 (1.11-2.48)	
HT	2.58 (1.57-4.25)	
Choking or gasping	1.62 (1.02-2.55)	
Neurocognitive impairment	0.86 (0.48-1.52)	

BMI=body mass index, NC=neck circumference, WC=waist circumference, WHtR=waist to height ratio, FTP=Friedman tongue position, ESS=Epworth sleepiness scale, HT=hypertension, CI=confidence interval

Discussion

The present study represents the high-risk population, based on the survey of OSA in a tertiary care hospital in southern Thailand. We found that the burden of disease was quite high. The prevalence of OSA and OSAS in this study was 85.6% and 52.7%, respectively. In the past, Young and colleagues[2] reported the prevalence of OSA in middle-aged men and women as 24.0% and 9.0%, respectively.[2] Moreover, the published prevalence in the Asian population is widely varying in range from 3.7 to 97.3%, due to the difference in the criteria definition, and sleep study type used.[16] One study, conducted with the central Thai population, reported the prevalence of OSA as: 11.4%, and that of OSAS as: 4.4%.[17] Moreover, the prevalence was higher in high-risk populations, such as morbid obesity undergoing bariatric surgery, and was estimated to be 77.0-88.0%.[23,24] Musman and colleagues[25], studied patients, who submitted for polysomnography, and reported the prevalence of sleep apnea as 71.2%. In this study, the majority of patients were referred for a sleep study when the presence of highly suspicion sleep apnea was indicated, including morbid obese patients.

The clinical symptoms alone were quite difficult to obtain the definite diagnosis, because of the non-specificity of symptoms as well as the lacking of patient's awareness. Although the OSA screening questionnaires were widely popular, the excessive daytime sleepiness, evaluated by ESS score, might not be used alone in OSA screening because the sleepiness could present in a normal population. This may simply be caused by sleep deprivation, medical effects or psychiatric conditions. Additionally, the STOP-Bang questionnaire was another popular screening tool for identifying OSA in surgical patients. A score of 3 out of 8, had been considered highly sensitive for detecting OSA. However, its specificity was reported to be as low as 36.0%, resulting in a high false-positive rate.[26] Moreover, its BMI cut-off point was not applicable for an Asian population, whereas in this study the author focused on a more suitable BMI cut-off point for Thai people. Additionally, the symptoms of choking, gasping or neurocognitive impairment might be used to co-evaluate patients suspected for OSA. However, a sleep study was still needed, so as to make a standard diagnosis of OSA for these patients.

Male gender was the strongest risk factor of having OSA. The previous studies have shown that men have a higher rate of OSA, than those of women, varying as 9.0-52.1%, in regards to the differences in upper airway shape and genioglossal muscle activity during the awake state, craniofacial morphology, and pattern of fat deposition.[1-3,16,17] In this study, the male-to-female ratio was 2.4:1, relevant to previous studies, which reported approximately 2:1 to 3:1.[1,3] An elderly age was also another risk for OSA. The prevalence of OSA in the population aged 50-70 years, was strikingly high, and was estimated to be at: 43.2% in men and 27.8% in women.[27] This study also found that the prevalence of OSA in ≥50 years of age was higher (47.9%) than the age <50 years (37.7%), and had approximately a 2.5-fold risk for developing OSA. Obesity was an important risk factor for OSA in Western populations with several studies having demonstrated an increase in the prevalence of OSA being correlated with increasing BMI.[27] WHtR was the another anthropometric index. It was widely used as the assessment of obesity, as an early health warning measurement, which is associated with cardio-metabolic risk.[28,29] NC, a marker of upper body adipose tissue distribution, has recently been published from many studies as an important measure to detect patients at risk of OSA, as it was much easier to measure in routine clinical practice, than waist circumference.[30,31] Moreover, the measurement of waist and hip circumferences was quite difficult in patients with severe obesity, whom had excessive fat at the abdominal wall. As the World Health Organization's recommendation of using the lower BMI cut-off point in an Asian population[32], we confirmed that the measures of body habitus including BMI >25 mg/m^2, NC >40 cm, WHtR >0.6 as being the significant predictors of OSA in our study.

The strength of this study was that our sample size was very large and it was performed in a university-based hospital where demographic data, clinical features and standard in-laboratory polysomnographic data were available for all patients. Additionally, we used the gold standard test, overnight in-laboratory polysomnography study, for determination of OSA. A potential weakness of the present study was referral bias resulting from the high risk population not being a representative of the community.

Conclusion

In conclusion, this study demonstrated that: OSA is one of the major health concerns for the adult, Thai population. The risk factors, which significantly predicted the presence of OSA, included male gender, age>50 years, and obesity assessed by BMI of >25 kg/m^2, NC >40 cm or WHtR >0.6.

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Conflict of interest

The authors declare that there are no conflict of interest regarding the publication of this paper.

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