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Research Article

Prevalence and Risk Factors of Obstructive Sleep Apnea (OSA) Using Modified Berlin Questionnaire in Thai Rural Community

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Keywords

- Obstructive sleep apnea
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Abstract

Study objectives: Obstructive sleep apnea (OSA) is the most common sleep-related breathing disorder, associated with high morbid and mortal disease. Prevalence of OSA in rural areas has only been partially explored.

Methods: The aim of this study was to determine prevalence of OSA and associated factors. We surveyed in 3 agrarian villages of Chachoengsao using the Modified Berlin Questionnaire to determine OSA.

Results: The analysis was performed on 233 respondents, 84 males and 149 females. The prevalence of the high-risk group for OSA was 41.6%. The factors associated with OSA included age over 51 years (adjusted OR 1.02, 95% CI: 1.0-1.1, p=0.035), waist circumference ≥90cm in males and ≥80cm in females (adjusted OR 3.15, 95% CI: 1.7-5.9, p<0.001) and history of alcohol consumption ≥3 drinks/day (adjusted OR 11.9, 95% CI: 2.5-56, p=0.002).

Conclusions: This study showed a high prevalence of the high-risk group for OSA in a Thai rural community. The high-risk group for OSA in this population was associated with age, waist circumference and alcohol consumption.

INTRODUCTION

Obstructive sleep apnea (OSA) is the most common type of sleep apnea resulting from repetitive narrowing or collapse of the upper airway during sleep [1,2]. Prevalence of OSA among middle-age adults in USA was 9% for women and 24% for men [3]. The patients with OSA may be predisposed to increased sympathetic activity in response to hypoxia, hypercapnia, vasoconstriction, and vasculopathy [4, 5]. Many studies have shown an association between OSA and hypertension [6-12]. In addition, a bidirectional relation has been revealed between OSA and systemic hypertension [10]. The prevalence of OSA among hypertensive patients is higher than in the general population. Inversely, many patients with OSA also have hypertension. Patients with hypertension and comorbid OSA often resist antihypertensive therapy [8] and have an increased risk of hypertension-related morbidities such as stroke, heart failure, and premature death [13].

Polysomnography, a comprehensive documentation of the biophysiological changes during sleep [14], is considered to be the gold standard method to diagnose OSA. This procedure requires overnight hospital admission and is impractical in community-based studies. Thus, the prevalence of OSA was commonly underestimated in the general population. Other tools have been developed to evaluate OSA. A feasible approach to survey the prevalence of OSA in community is a questionnaire-based screening test. The Berlin Questionnaire is a simple test to identify patients at risk for the sleep apnea syndrome. This questionnaire determines the occurrence of risk factors for OSA and consists of 3 sections: 1) snoring, 2) daytime sleepiness and fatigue and 3) hypertension and obesity. High risk of OSA is defined when the subjects had ≥2 positive sections [15]. The Berlin Questionnaire

is a useful instrument for screening high-risk groups of OSA in a primary care setting with a reasonable sensitivity and specificity value [16]. A Modified Berlin Questionnaire has been developed to suit Asian populations defining obesity as BMI≥25 kg/m [2,17]. The Modified Berlin Questionnaire has a sensitivity of 85% and specificity of 95%. The positive predictive value was 96% and negative predictive value was 82% [15]. There is no information regarding to OSA in rural agricultural populations, the main communities of Thailand. The study in these communities might present different picture of OSA compared to urban community based or hospital based studies. A few aspects such as population composition, physical activity, life style and culture, which are different among communities, may influence OSA. Thus, we aimed to assess the prevalence and risk factors of a high-risk group for OSA in a Thai rural community using the Modified Berlin Questionnaire.

METHODS

Study population

This observational study was approved by the Institutional Review Board of Royal Thai Army Medical Department and appointed the number 223/2555. The study was conducted in an agricultural community in Chachoengsao, Central of Thailand. We did a total survey in this study.Villagers who were≥18 years old in this village were 344. Because most of them were farmers and worked in daytime, 233 villagers who met inclusion criteria and agreed to sign the informed consent were surveyed from 344 people (67.7%). The villagers who had a history of chronic anxiolytic or sedative drugs, neurological or psychiatric problems and history of irregular sleeping time such as shift worker were excluded because these conditions could lead to daytime sleepiness which indicated in the Modified Berlin Questionnaire.

Determination of the prevalence and risk factors for a high-risk group of OSA using Modified Berlin Questionnaire

Demography and health information such as age, sex, underlying diseases, smoking, drinking and exercise were collected by standardized questionnaire. Because a few previous studies showed an association between OSA and gastro-esophageal reflux disease (GERD) [18] and tonsillitis [19], clinical presentations of these diseases were included in the standardized questionnaire. Well-trained researchers measured height, weight, neck circumference, upper arm circumference, waist circumference and blood pressure. BMI was calculated and a BMI>25 kg/m^2 was used as a cut-off for obesity [17]. The participants were asked with The Modified Berlin Questionnaire by well-trained researchers.

Statistical analysis

Statistical analysis was performed with STATA/MP for Windows, version 12 (Stata Corp LP, TX). The association between variables and the high-risk group of OSA was assessed by Chi-square or Fisher's exact test with a 95% confidence interval (CI). Univariate and multivariate analysis using binary logistic regression was performed to determine the independent risk factors of the high-risk group of OSA. The statistical significance level was determined as p<0.05.

RESULTS

The characteristics of the participants are shown in Table 1. A total of 149 of 233 were female (64.0%). Two thirds of the participants were over 40 years old. Approximately half the participants were overweight or obese. Most subjects were nonsmokers (66.5%) and nondrinkers (65.2%). The most common underlying disease detected by questionnaire was hypertension (18%). Moreover, measurement of blood pressure showed 30% for hypertension and 27.9% prehypertension in this study population.

The prevalence of a high risk for OSA was 41.6% in this population using the Modified Berlin Questionnaire. In addition, the prevalence of snoring was 56.7%. The prevalence of a high risk for OSA differed among age groups (p = 0.016). The prevalence of high risk factors of OSA in the group of 18-29 years old was lower than other age groups. The prevalence of a high risk for OSA increased with age; however, without statistical significance (p=0.104). The prevalence of a high risk for OSA differed among nutritional statuses as determined by BMI. Approximately 70% of the high risk for OSA was in the obese I and obese II groups. The prevalence of a high risk for OSA increased in subjects with higher BMI (Chi-square test for trend, p<0.001). The participants who had symptoms of GERD showed a higher prevalence high risk for OSA than those without symptoms (p=0.014). A higher prevalence was also shown in the participants with a history of hypertension and diabetes mellitus (p< 0.001and p=0.018, respectively). Accordingly, the prevalence a high risk for OSA was approximately twice among those who had SBP >140 or DBP >90 mmHg.

Univariate and multivariate analysis for the risk factors of a high risk for OSA is shown in Table 2. Multivariate analysis identified the independent risk factors of high-risk group of OSA included waist circumference and alcohol consumption. Men who had a waist circumference >90 cm and women who had a waist circumference >80 cm had a 6.9 times higher risk of having a high risk for OSA (p<0.001). In addition, the participants who drank ≥ 3standard drinks/day had an 11.9 times higher risk compared with those who drank less (p= 0.002).

DISCUSSION

The present study is the first report that determined the risk of OSA using the Modified Berlin Questionnaire in a Thai rural community. The prevalence was 41.6%, which was rather high compared with a previous study [20]. These previous studies showed approximately one fourth of the surveyed populations had a high risk for OSA. Our study was conducted in an agricultural community, which might be similar to the majority of Thai rural population. Most Thai rural community members usually consisted of all ages with a fewer number of young working age group, who might temporarily migrate for work. Thus, the higher risk for OSA in this population may be due to the distribution of age groups. Of the participants, the prevalence of obesity was 36.4%, similar to the general population in Thailand (34.7%) surveyed by the Thai Health Promotion Foundation. The prevalence of obesity was 28.4% among males and 40.7% among females. While in rural communities, the prevalence of obesity was 25.1% among males and 38.8% among females [21].

Table 1: Characteristics of the enrolled subjects (n=233).

Characteristic			High-risk of OSA		
	n	%	n	(%)	p-value
Sex					0.776
Male	84	36.1	36	42.9	
Female	149	64.0	61	40.9	
Age (years)†	48.0±15.4(18-83)				0.016
18-29	30	12.9	6	20.0	
30-39	49	21.1	17	34.7	
40-49	51	21.9	25	49.0	
50-59	43	18.5	21	48.8	
60-69	41	17.6	18	43.9	
≥ 70	19	8.2	0	52.6	
BMI					<0.001
BMI<18.5 (Underweight)	21	9.0	4	19.1	
BMI 18.5-22.9 (Normal range)	90	38.6	20	22.2	
BMI 23.0-24.9 (Overweight)	37	15.9	13	35.1	
BMI 25.0-29.9(Obese I)	56	24.0	40	71.4	
BMI>30.0 (Obese II)	29	12.4	20	69.0	
Feeling of burning sensation, abdominal					0.014
discomfort and reflux					
No	144	61.8	51	35.4	
Yes	89	38.2	46	51.7	
Sore throat					0.118
No	180	77.3	70	38.9	
Yes	53	22.8	27	50.9	
Smoking					0.406
Non-smoker	155	66.5	68	43.9	
Ex-smoker	15	6.4	4	26.7	
Smoker	63	27.0	25	39.7	
Drinking					0.742
Non-drinker	152	65.2	65	42.8	
Ex-drinker	18	7.7	6	33.3	
Drinker	63	27.0	26	41.3	
Exercise					0.569
Never	188	80.7	77	41.0	
1-2 day/week	18	7.7	6	33.3	
3-4 day/week	11	4.7	5	45.5	
>5 day/week	16	6.9	9	56.3	
Hypertension‡					<0.001
Normal (SBP≤120, DBP≤80 mmHg)	98	42.1	30	30.6	
Prehypertension (SBP 120-139 or DBP 80-89 mmHg)	65	27.9	23	35.4	
Hypertension (SBP>140 or DBP>90 mmHg)	70	30.0	44	62.9	
Underlying diseases					
Hypertension	42	18.0	31	73.8	<0.001
Dyslipidemia	13	5.6	7	53.9	0.358
Nasal allergy	11	4.7	6	54.6	0.553¥
Diabetes mellitus	10	4.3	8	80.0	0.018¥
† mean±SD(min-max)					
‡ Measurement					
¥ Fisher's exact test					

Table 2: Univariate and multivariate analysis of risk factors for high-risk group of obstructive sleep apnea (n=233)

Characteristic	Total	High-risk for OSA		Crude odds ratio	p-value	Adjusted odds ratio	p-value
		N	%	(95%CI)		(95%CI)	
Age (year) ; Mean±SD	97	50.9±14.2		1.0(1.00-1.04)		1.1(0.99-1.10)	0.016
Sex							
Male	84	36	42.9	1.1(0.63-1.89)			
Female	149	61	40.9	1			
History of Diabetic Mellitus							
Yes	10	8	80.0	6.0(1.25-29.02)	0.018		
No	223	89	39.9	1			
Symptoms of GERD							
Yes	89	46	51.7	2.0(1.14-3.34)	0.014		
No	144	51	35.4	1			
Sore throat							
Yes	53	27	50.9	1.6(0.88-3.02)	0.118		
No	180	70	38.9	1			
Waist circumference (cm)							
Male > 90, Female > 80	100	59	59.0	3.6(2.08-6.22)		6.9(1.45-32.63)	<0.001
Male ≤ 90, Female ≤ 80	133	38	28.6	1		1	
Arm circumference (cm)							
Male > 25.5, Female > 23.0	205	91	44.4	2.9(1.14-7.52)	0.026		
Male ≤ 25.5, Female ≤ 23.0	28	6	21.4	1			
Amount of alcohol consumption							
≥ 3 drinks/day	21	14	66.7	6.0(1.89-19.05)		11.9(2.52-55.98)	0.002
< 3 drinks/day	40	10	25.0	1		1	

Multiple logistic regression; Backward(Wald)
After adjusted for sex, Diabetes mellitus, feeling of burning sensation, abdominal discomfort and reflux, off and on sore throat and arm circumference.

Nearly two thirds of our study population was female, of which 46.3% were obese while only 19.1% of enrolled male were obese (data not shown). Thus, the number of obese participants might influence the prevalence of the high-risk group for OSA.

Indeed, this study identifiedwaist circumference and alcohol consumption ≥3 standard drinks per day as the high risk factors for OSA. In India, the high risk factors for OSA wereage and gender. High risk for OSA was significantly higher among males [20]. Several explanations for the difference between male and female include obesity and the distribution of adipose tissue, upper-airway anatomy, the effect of sex hormones and leptin [22]. In contrast to previous studies, age and gender were not the significant risk factor for the high risk of OSA in this study. This might be a result of different study population and anthropologic variation in different race such as airway anatomy.

Higher prevalence was found among the participants aged 40 years old and over. Using Univariate and multivariate analysis, age was also determined as a high risk factor forOSA. The correlation between age and OSAwas identified in several previous studies [20,23-25]. Increase in age was significantly associated with a higher risk for OSA. Obesity is a modifiable risk factor for OSA [2, 26-28]. As BMI is included in the Berlin Questionnaire, we did not analyze the BMI. Other parameters for obesity were used in this study including neck, upper arm and waist circumference. Only waist circumference was identified as a high risk factor for OSA. Waist circumference of >90cm. among men and >80 cm among women posed a 6.9 times higher risk for OSA.

Alcohol consumption was associated withhigh risk forOSA. Moderate consumption of alcohol (<1 gm. alcohol/kg bodyweight per day) within 30 minutes aggravated OSA among healthy males [29]. We analyzed different numbers of drinks daily to identify risk and found that ≥3 standard drinks per day was associated with a high risk for OSA with an odds ratio of 11.9. A recent report from the Korean Genome Epidemiology Study identified a molecular mechanism for the linkage between alcoholic consumption and OSA [30].

One of the clinical presentations of OSA is hypertension. A total of 73.8% who gave a history of hypertension and 62.9% who showed a high blood pressure (SBP >140 or DBP >90 mmHg) measured during the study were high risk factors of OSA. OSA could cause hypertension and may be uncontrollable. Because both conditions might be under diagnosed, severe consequences would occur.

Our information could raise the awareness of OSA among healthcare providers and also policy makers at the community level. Important screening measures for OSA that are practical

and effective for Thais living in rural communities should be available.

Although the Modified Berlin Questionnaire cannot replace the use of polysomnography, the gold standard, the Modified Berlin Questionnairecan be used for screening and might facilitate early referral to health care services for definite diagnosis and proper treatmentfor OSA.

In further studies will have to confirm the usefulness of the Modified Berlin Questionnaire as a screening tool for OSA in this population versus gold standard: EEG monitoring for more detailed estimates of sleep structure and respiratory patterns (AHI). Level of diagnostic sensitivity and specificity of the Modified Berlin Questionnaire should be discriminate OSA in this specific population in the unique way to determine the usefulness of this screening tool.

This study focuses on the prevalence of symptoms and risk factors for obstructive sleep apnea persons, studying in 233 from only small rural community. The equipment in this study is limited to screening people who have risk for obstructive sleep apnea only, not the definite diagnosis. Hypertension in Modified Berlin questionnaire asked about underlying diseases but this study probe for underlying disease and high blood pressure.

In conclusion, the present study showed a high prevalence of high risk factors for OSA in a Thai rural community using the Modified Berlin Questionnaire. Waist circumference and alcohol consumption ≥30 grams alcohol per day were high risk factors for OSA in this population. This test is practical and available making it is useful for screening OSA in Thai rural communities.

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