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ASSOCIATION OF OBSTRUCTIVE SLEEP APNEA AND BLOOD PRESSURE ON HYPERTENSIVE PATIENT IN DEPOK INDONESIA

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Abstract

Over the past few years, the number hypertensive patients in Indonesia have increased rapidly. Previous studies have investigated that OSA independently is important risk factor of hypertension. In Indonesia, there were still lacks of study between OSA and blood pressure on population-based or clinical-population. The objective of this study was to know the relation of OSA to blood pressure on hypertensive patients. This study design was descriptive correlation with cross-sectional approach on 96 hypertensive patients at one of the community health center in Depok city, who were selected with consecutive sampling technique. The OSA was assessed by using the Berlin questionnaire, blood pressure was assessed by aneroid sphygmomanometer, and

anthropometric measurements was assessed by weight scale and stature meter. This study showed that 57,3% subjects had the high risk for OSA. The result of analysis by using the Mann-Whitney test showed that OSA related to systolic blood pressure ($p= 0.028$; $CI95\%= 0.000-0.066$) but was not related to diastolic blood pressure ($p= 0.231$; $CI95\%=0.229-0.416$), although there was difference of 10 mmHg, higher on hypertensive patient with high risk OSA. This study showed that OSA related to increasing morbidity of hypertension because its effect on elevated blood pressure. The assessment and management of OSA needs to be implemented in providing health care, in order to increase the quality of life for patients especially on hypertensive patients.

Keywords

Berlin questionnaire, Hypertension, Obstructive Sleep Apnea, Sleep

1. Introduction

Hypertension is one of the non-communicable diseases that play a role as one of the primary risk factors for cardiovascular disease and stroke-as the leading cause of death in the world. In Indonesia, the prevalence of hypertension is still high, reached 25,8% in 2013 (Agency for Health Research and Development, 2013). The case of hypertension in the one of community health center in Depok city has increased three-fold higher in 2014 compared with the previous year (Department of Health, 2014), from 839 case to 2.468 case in 2014. A lack of awareness of hypertension can be a factor that influence this condition. Kim et al. (2001) showed that the awareness of hypertension in Asia is much lower than in Western countries. Hypertension can be influenced by lifestyle such as unhealthy diet, stress and low of physical activity. The Obstructive Sleep Apnea (OSA) is also contribute to increase blood pressure. OSA is characterized by recurrent episodes of cessation of respiratory airflow caused by upper airway inspiratory collapse during sleep, with a consequent decrease in oxygen saturation (Pensuksan, Chen, Lohsoonthorn, Lertmaharit, Gelaye & Williams, 2014). According to the Wisconsin Sleep Cohort Study, moderate-severe OSA is associated with an increase in the incidence of hypertension by 80% (Dudenbostel & Calhoun, 2012). Beside of that, OSA can decrease the quality of sleep that significantly can cause hypertension. The study showed that the people with severe OSA with a short sleep duration can increase the incidence of hypertension 4-fold higher than a people with OSA and sleep duration 7-8 hours per days. Priou et al. (2014) reported that

OSA significantly can increase blood pressure. The cohort study in Korea proved that OSA was independent factor in development of hypertension (Kim et al., 2007).

OSA is one of hypertension risk factor that still lack of attention. A recent systematic review has highlighted the lack of data on the OSA prevalence in Asia (Pensuksan, Chen, Lohsoonthorn, Lertmaharit, Gelaye & Williams, 2014). Actually in Indonesia, there was still lack of research about OSA and hypertension. The objective of this study was to know the relationship of OSA and blood pressure on hypertensive patients in Indonesia.

2. Research Method

Study Population. This cross-sectional study used analytical numeric unpaired. The study was conducted between April-Juni 2016 at one of community health center in Depok city. The subjects who had a history of hypertension or had suffered of hypertension when blood pressure was measured and willing to become respondents in this research, through consecutive sampling, were obtained (n=110). The subjects from the outside of sub-district, suffered from severe pain that can not be in a sitting position and incomplete questionnaires were excluded from the study. A total of 96 hypertensive patients (n= 22 men and n =74 women) with complete information about demographic, lifestyle factors, risk for OSA, BP and anthropometric measurements, were analysed.

Measures. This study used a Berlin Questionnaires that had been modified in India because India's country was inside Asia region and the items questionnaire of this had a similiar characteristics with Indonesian people, compared with Berlin Questionnaire that was used in the Western country. Beside that, the researcher collected information about demographic and life style factors such as smoking and alcohol consumption. All the completed questionnaires were anonymous. Researchers used interviewing techniques to fill the questionnaires. Blood pressure measurement include systolic and diastolic pressure was performed by using aneroid sphygmomanometer in a sitting position and feet touching the floor, the position of the arm at a heart level (right atrium), did not speak and hold urination during the measurement. Body Mass Index (BMI) was calculated by measuring height and body weight of participants. Height and body wight were measured by using stature meter and weight scale that had been calibrated, while the subjects were wearing light clothes without footwear or brought anything in the

pockets. Measurement of blood pressure and anthropometric (height and body weight) were taken once.

Risk factor for OSA. The Berlin Questionnaire was used to assess the risk for OSA. The Berlin Questionnaire has been validated and is widely used to assess OSA (Sharma et al., 2006; Drager et al., 2010 in Pensuksan, Chen, Lohsoonthorn, Lertmaharit, Gelaye & Williams, 2014). According to Sharma et al. (2006), Berlin questionnaire has a sensitivity of 86% and a specificity of 95%. The questionnaire was divided into 3 categories, behavioral snoring (category 1), wake-time sleepiness and fatigue (category 2), which was positive if there were at least two symptoms of persistent (> 3 -4kali / week), while the third category were positive if there is a history of hypertension or obesity (≥ 25 kg / m²). In this study, the third category was removed to avoid the bias in the study result because all of the subjects that recruited were hypertensive patients. High risk of OSA is established if there was ≥ 1 positive category. Based on validity and reliability test on hypertensive patients in this study, *Cronbach alpha* values is obtained at 0,756, which shows the questionnaire was acceptable and reliable enough to be used in this study.

Covariables. Demographic information was collected such as age, gender and BMI. Age was classified into three groups: 18-29 years old for young adult, 30-59 years old for middle adults and ≥ 60 for older adults. BMI was calculated and not classified. Lifestyle factors such as smoking and alcohol consumption were collected. Smoking status was classified into five groups; nonsmoker, light smoker (1-4 cigarettes/day), moderate smoker (5-14 cigarettes/day), heavy smoker (> 14 cigarettes/day) and former smoker. Alcohol consumption was assessed by question on drinking behavior during the month before the interview and was classified into four groups; nondrinkers (< 1 g alcohol/day), light drinkers (1-30 g alcohol/day), heavy drinkers (≥ 30 g alcohol/day) and former drinkers.

Statistical analysis. Univariate analysis was used to describe the characteristics of each variables. *Mann-Whitney* tests was conducted to evaluate the relation between OSA and blood pressure. The significance level that was used in this study was set at $p < 0.05$ for 2-sided analyses.

3. RESULT

Table 1: Characteristics of Respondents based on Gender, OSA, Cigarettes Consumption and Alcohol Consumption (n=96)

Characteristics of Respondents	Frequency(n)	Percentage(%)
Age		
Middle-aged adult	64	66,7
Late-aged adult	32	33,3
Gender		
Man	22	22,9
Women	74	77,1
OSA		
High risk of OSA	55	57,3
Low risk of OSA	41	42,7
Smoking		
Non smokers	77	80,2
Light smokers	5	5,2
Moderate smokers	6	6,2
Heavy smokers	1	1,0
Former smokers	7	7,3
Alcohol Consumption		
Non-drinkers	92	95,8
Light drinkers	0	0
Heavy drinker	0	0
Former drinkers	4	4,2

Table 2: Characteristics of Respondents based on Age, BMI and Blood Pressure (n= 96)

Characteristics of respondents	Mean	95% CI
Age	55 (39-76)	55,09-58,50
BMI	25,91 (4,84)*	24,93-26,89
Blood Pressure		
- Systolic	140 (100-210)	140,66-149,34
- Diastolic	90 (70-120)	84,66-89,71

*distribution of data was normal, using SD value

Table 3: The Relationship between OSA and Blood Pressure

Variables	Blood Pressure	
	mean	p
OSA	<i>systolic</i>	
High risk	150 (100-190)	0,028*
Low risk	140 (100-210)	
OSA	<i>diastolic</i>	
	mean	p
High risk	90 (70-110)	0,231
Low risk	80 (70-120)	

* significant at $\alpha=0,05$ of Mann-Whitney test

4. DISCUSSION

Independently, OSA contribute to develop hypertension through activated the sympathetic nerves and caused endothelial dysfunction. The cohort study in Korea with exclude respondent who had blood pressure $\geq 140/90$ and BMI $\geq 27,5$ kg/m², proved that OSA significantly can cause hypertension (Kim et al., 2007). The result of this cross-sectional study indicate that there was a significant relationship between the mean systolic blood pressure in hypertensive patients were classified as high risk of OSA and hypertensive patients were classified as low risk of OSA (p= 0.028; 95%CI= 0,000-0,066) and there was a difference of 20 mmHg (higher in hypertensive patients with high-risk of OSA). While, the relationship between OSA and mean diastolic blood pressure was not statistically significant (p= 0.231; 95%CI= 0,229-0,416) although there were differences between the mean diastolic pressure was higher in hypertensive patients that classified as high risk of OSA compared with hypertensive patients classified as low risk of OSA. The previous cross sectional study was conducted on 1,499 hypertensive patients who had been investigated using polysomnograph from 2007-2013 at the Institut de Recherche en Sante 'Respiratoire des Pays de la Loire sleep cohort (IRSR) and blood pressure measurement using mercury sphygmomanometer and resting the patient for 5 minutes prior before the measurement (Priou et al., 2014). OSA identification was performed by using polysomnograph. Beside that, the study was also identified the sleep duration of respondents. The people with severe OSA with a short sleep duration can increase the incidence of hypertension 4-fold higher than a people with OSA and sleep duration 7-8 hours per days (Priou et al., 2014).

This study showed that prevalence of hypertensive patients who have high risk of OSA was more than those with low risk of OSA, it was 57,3%. The OSA was higher on hypertensive patient than normotensive patient, its related with higher levels of inflammation and insulin resistance on hypertensive patients (Qian et al., 2012). OSA can cause intermittent hypoxemia which triggers an excessive sympathetic nerves and decreases bioavailability of Nitric Oxide (NO) which can increase blood pressure or hypertension (Priou et al, 2014). Increased sympathetic activity in patients with OSA linked to increased chemoreflex drive is also thought to be one of the contributory causes for hypertension (Walia et al., 2014). During hypoxia, chemoreceptor activation promotes hyperventilation to enhance oxygen delivery to blood and increase of sympathetic activity that cause vasoconstriction in order to redistribute oxygenated blood flow to vital organs. At the same time, parasympathetic nervous is activated with consequent bradycardia, in order to reduce myocardial oxygen demand. At the result, if this condition happens continuously, the physiologic response become pathological, as we called hypertension. OSA can also decrease the effectiveness of anti-hypertensive drugs so that it can lead to hypertensive patients resistant to treatment (Walia, et al., 2014).

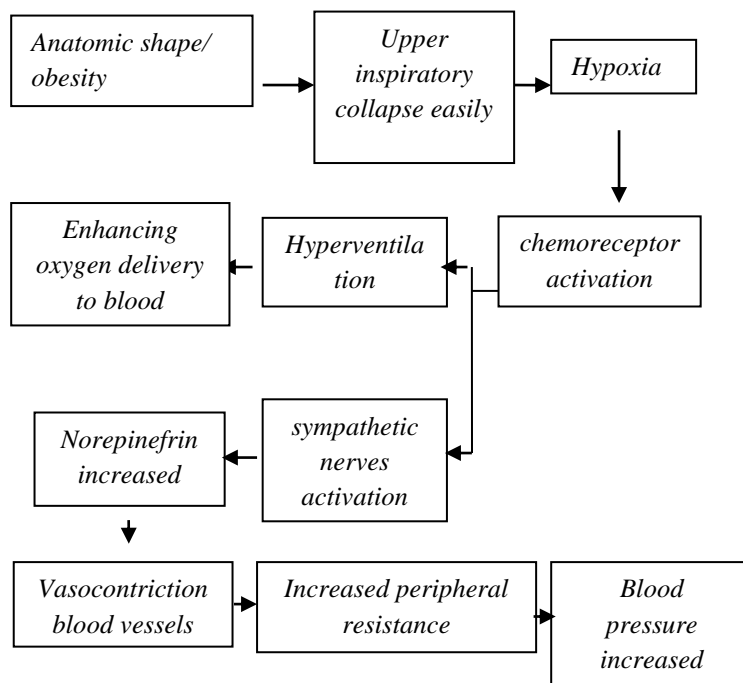


Figure 1: Pathogenesis of OSA cause Hypertension

OSA can be classified into 4 categories depends on score Apnea Hypopnea Index (AHI) that is measured by polysomnograph; none or minimal (AHI <5 per hours), mild (AHI <15 per hours), moderate (AHI \geq 15 hours dan <30 per hours), and severe (AHI \geq 30 per hours) (Division of Sleep Medicine at Harvard Medical School, 2011). This study used Berlin questionnaire-good screening tools to identify OSA, it had been validated and extensively used in previous studies such as Brazil, India, Thailand. The study in India reported that 55 people who identified as having a high risk of OSA by a Berlin questionnaire, 53 of which were positively indicated on examination by polysomnography as evidenced by AHI values >10 per hour (Sharma et al., 2006). Severe OSA may cause endothelial dysfunction, which is primarily driven by OSA-associated intermittent hypoxia and also aldosterone excess. According to Walia's (2014) study, untreated OSA can reduce the effectiveness of antihypertensive medications through pharmacokinetic, lead to resistant to drugs. So that, treat OSA in management hypertension was needed in order to keep blood pressure within normal range. According to study of Dudenbostel and Calhoun (2012), CPAP is one of therapy that can be considered as a treatment for OSA by suppressing the sympathetic activation.

Various factors contributed to cause OSA events such as age, gender and lifestyle. According to previous studies OSA often occurs in the middle-aged than in elderly due to physiologic cardioprotective adaptation to chronic intermittent hypoxia in elderly (Garvey, Pengo, Drakatos, & Kent, 2015). Similarly, male have a more risk to develop OSA than women due to anatomic shape. The male anatomy has a larger tongue and soft palate and a greater absolute volume of fat in the anterior segment in the mandible and subcutaneous to the neck (Lin, Davidson, & Ancoli-Israel, 2008). According to the result of MRI, proportion fat around on pharinx and soft tissue volume around neck of men with obesity was more than women had (Mohsenin, 2003).

Lifestyle factor had an important role to develop OSA such as obesity, smoking and alcohol consumption. Obesity leads to increase distribution of fat around the neck and airways which narrows the airway, leads the incidence of OSA (Sacchetti, Lisandro, Mangiardi & Priscilla, 2012). According to a longitudinal analysis of 2,470 participants from the Sleep Heart Health Study showed that OSA and hypertension were associated with obesity (Pensuksan, Chen, Lohsoonthorn, Lertmaharit, Gelaye & Williams, 2014). The previous study with a



retrospective cohort study design, showed that there was a significant relationship between BMI with the incidence of OSA (Soylu, Levent, Sariman, Yurtlu, Alparslan & Saygi, 2012). It indicates that weight control is one of way to prevent development of OSA. Reducing of cigarettes and alcohol consumption can decrease incidents of OSA. Cigarettes contains nicotin which can increase airway resistance when a sleep. (Kashyap, Hock, & Bowman, 2001). The study of Iochimescu and Ocatavian (2011) showed that alcohol consumption significantly with OSA because decreased signal to brain for respiratory muscle movement. The prevalence of smoking and consumption in this study was low. It can be caused by the most respondents in this study were women. In culture perspective at Indonesia, considered that smoking and alcohol consumption were bad culture in women (Ng, Weinehall & Ohman, 2007). So, it influenced the result of this study.

Body position also plays an important role to reduce the incidents of OSA. OSA is most common when the subjects sleep in supine position due to increase the tendency for the tongue and soft palate to fall back into throat that cause narrowing of the airway. Supine sleep posture is consistently associated with more severe of OSA in adult (Menon & Kumar, 2013). According to that study, lateral positioning can decrease the incident of OSA effectively.

5. Conclusion

In conclusion, the prevalence of OSA was significantly high among hypertensive patient. The implication of this incident was increasing the bad impact to their health status because there was relationship between OSA and blood pressure. This study showed that there was significant correlation between OSA and systolic blood pressure ($p= 0,028$; $\alpha = 5\%$) and correlation of OSA with diastolic blood pressure was not significant ($p= 0,231$; $\alpha = 5\%$). Clinically, this study showed that blood pressure of hypertensive patients with high risk of OSA classified as stage 1 hypertension. While, blood pressure with low risk of OSA classified as isolated systolic hypertension. This condition showed that the OSA on subjects who had hypertension were more susceptible to get worst condition-an adverse condition of hypertension. So that, the assessment and management of OSA needs to be implemented in providing health care in order to increase the quality of life for patients especially on hypertensive patients. Modification of lifestyle such as reducing of smoking and alcohol consumption and preventing obesity can be effective ways to

suppress the incidents of OSA. Beside that, giving education about positioning while sleeping or using CPAP to treat OSA properly are also the ways to decrease the incidents of OSA.

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