Original Article

Prevalence of erectile dysfunction among obstructive sleep apnea patients

Piyapong Wongjittraporn[1], Visasiri Tantrakul[2], Worakot Suwansathit[2], Suthep Patcharatrakul[1], Wisoot Khongcharoensombat[1], Wachira Kochakarn[1], Premsant Sangkum[1]

[1]Division of Urology, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

[2]Division of Pulmonary and Critical Care Medicine, Department of Medicine, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Keywords:
Obstructive sleep apnea, erectile dysfunction, aging

Abstract

Objective: The purpose of this study was to evaluate the prevalence of ED among OSA patients in Ramathibodi Hospital.

Material and Method: A cross-sectional study was conducted of 299 male patients who underwent diagnostic polysomnography for suspected OSA between November 2016 and April 2017. Every patient gave informed consent and completed the Thai Hospital Anxiety and Depression Scale, Epworth sleepiness scale, STOP-BANG Sleep Apnea Questionnaire, and the validated Thai version of the IIEF-5 questionnaire before undergoing polysomnography.

Result: Two hundred ninety-nine patients who underwent sleep lab polysomnography were included in the analysis. OSA was diagnosed in 93% of the patients. The overall prevalence of ED in men diagnosed by impaired IIEF-5 score was 178 patients (59.53%). Aging, diabetes, hypertension, body mass index and sleep lap parameters including apnea hypopnea index, respiratory disturbance index and arousal index were significantly increased in the ED group compared with the non-ED group ($p<0.005$). Multivariate logistic regression analysis showed aging and apnea hypopnea index were independent risk factors for ED (OR of 1.04 (95%CI 1.01-1.07) and 1.02 (95%CI 1.00-1.03), respectively).

Conclusion: These data indicate that OSA and the related intermittent hypoxia during sleep were associated with impaired erectile function. OSA can be used as a risk factor for ED.

Corresponding author: Premsant Sangkum

Address: Division of Urology, Department of Surgery, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

E-mail: premsanti@gmail.com

Received: March 19, 2019

Revision received: October 1, 2019

Accepted after revision: October 1, 2019

Introduction

Erectile dysfunction (ED) occurs when patients cannot achieve and maintain an erection sufficient to engage in sexual activity. This may lead to stress, low self-confidence, and relationship problems[1]. There are many risk factors for ED, including aging, stroke, depression, anxiety, hypertension (HT), Peyronie's disease, dyslipidemia, diabetes mellitus (DM), peripheral vascular disease, and relationship problems[2]. The prevalence is estimated at 49.69% globally[3] and 37.5% in the Thai population[4].

Obstructive sleep apnea (OSA) is a breathing disorder in which the airway is obstructed due to upper airway collapse during sleep[5]. A diagnosis of OSA requires overnight polysomnography to detect the frequency of airway obstruction events during sleep. The apnea-hypopnea index (AHI) measures the number of apnea or hypopnea events per hour. An AHI score of 5 or greater with symptoms or an AHI score of 15 or greater without symptoms denotes OSA[6]. Research has suggested that OSA may be a risk factor for stroke, DM, heart failure, and myocardial infarction[7]. It induces oxidative stress through repetitive hypoxia, which decreases nitric oxide levels[8]. Nitric oxide plays an important role in erectile function, so low nitric oxide levels may cause ED[9]. Oxidative stress can damage the microvasculature of the entire body, including that of the penis. Impaired vascular supply to the penis may also cause ED[10]. In addition, OSA can cause fatigue and depression, which may both involve ED[11]. Common comorbidities that cause both ED and OSA include DM and HT[12]. The purpose of this study was to evaluate the prevalence of ED among obstructive sleep apnea patients at Ramathibodi Hospital.

Material and Method

Subjects

All men admitted to the sleep lab of Ramathibodi Hospital at Mahidol University for polysomnography between November 2016 and April 2017 were invited to take part in this cross-sectional study. Patients received an informed consent form, the International Index of Erectile Function (IIEF-5) questionnaire, the Thai hospital anxiety and depression scale, the Epworth sleepiness scale (ESS), and STOP-BANG sleep apnea questionnaire. The Thai version of the IIEF-5 questionnaire has been validated and published, showing good reliability[13]. Demographic data recorded include age, body mass index (BMI), and neck, waist, and hip circumference; comorbidities recorded include DM, HT, history of stroke, chronic kidney disease, dyslipidemia, cardiovascular disease, and benign prostatic hyperplasia. This study was approved by the Ethics Committee at Ramathibodi Hospital before enrollment.

The International Index of Erectile Function (IIEF-5), Thai version

The IIEF-5 is a questionnaire used for screening ED patients. It is composed of 5 questions regarding erectile function and sexual satisfaction. A score of 22-25 points represents the absence of ED, 17-21 represents mild ED, 12-16 points represents mild to moderate ED, 8-11 represents moderate ED, and 5-7 points represents severe ED. It has been validated for use in the Thai language[13].

Polysomnography (PSG)

Polysomnography is used for the diagnosis of OSA[14]. Overnight polysomnography was performed on all patients. According to established criteria, mild, moderate, and severe OSA were defined by an AHI of 5-15, 16-29, and greater than or equal to 30, respectively[14].

Statistical Analysis

Statistical Package for the Social Sciences was used to analyze statistical data. We used the median to describe general measurements. Then, we used the Chi-square test to evaluate the association between non-continuous variables and the Mann Whitney U test to evaluate the association between continuous variables. To adjust for possible confounding factors, we used multivariable logistic regression analysis. Results were considered statistically significant at $p<0.05$.

Result

Patient demographic data were analyzed. The median age was 46 years and the median BMI was 28.76. Of the 299 patients, 92 (30.77%) had dyslipidemia, 95 (31.77%) had HT, 41 (13.71%) had DM, and 3 (1.00%) had cardiovascular disease. A history of stroke and/or cerebrovascular accident was identified in 5 (1.67%). In total, 19 (6.99%) patients did not fit the criteria for OSA, while 38 (13.97%) fit the criteria for mild OSA, 57 (20.96%) for moderate OSA, and 158 (58.09%) for severe OSA. The prevalence of ED was 59.53%. Of these patients, 98 (32.78%) had mild ED, 56 (18.73%) had mild to moderate ED, 15 (5.02%) had moderate ED, and 9 (3.01%) had severe ED.

Polysomnographic parameter analysis is described in Table 1. Results showed that AHI, respiratory disturbance index, and arousal index were significantly higher in the ED group than the non-ED group ($p<0.005$). Time of desaturation below 90% of oxygen saturation was also significantly higher in the ED group than the non-ED group ($p<0.005$). The median lowest desaturation was 83% and 85% in the ED group and non-ED group, respectively, and this difference was statistically significant. Participant AHI scores during non-REM sleep were significantly higher in the ED group than in the non-ED group, but this was not the case during REM sleep. The median continuous positive airway pressure (CPAP) titration was 9 cmH_2O in the ED group compared with 8 cmH_2O in the non-ED group.

Results of univariate analysis are shown in Table 2. Aging was significant and directly related to the presence of ED (OR (CI 95%) of 1.03 (1.01-1.05) at a p-value of 0.003). In addition, DM and HT were associated with ED (OR (CI 95%) of 2.34 (1.10-4.98) at a p-value of 0.027 and OR (CI 95%) of 1.74 (1.04-2.91) at a p-value 0.034, respectively). Finally, BMI and waist circumference were significantly associated with ED (OR 1.07 (1.02-1.21) and 1.03 (1.01-1.05), respectively). There was no association between dyslipidemia (p=0.569), cardiovascular disease (p>0.99), stroke and cardiovascular event (p=0.398), benign prostatic hyperplasia (p=0.06), and chronic kidney disease (p=0.65). Past smoking habits also showed no association (p=0.67). The Thai hospital anxiety and depression scale, ESS, and STOP-BANG sleep apnea questionnaire also showed no associations.

Multivariate analysis results are shown in Table 2. Age and AHI were independent risk factors for ED (OR of 1.04 (95%CI 1.01-1.07) and 1.02 (95%CI 1.00-1.03), respectively). In contrast, DM (p=0.977), HT (p=0.778), BMI (p=0.406), waist circumference (p=0.876), and lowest oxygen saturation (p=0.935) were not considered independent risk factors for ED.

Discussion

From the literature review, several studies confirmed that the prevalence of ED was higher in OSA patients than in those without OSA. Schmidt and Wise were the first to suggest a relationship between these 2 conditions[15]. Next, Guilleminault et al. suggested that 48% of men with OSA had low libido and ejaculatory dysfunction[16]. Hirshkowitz et al. and Seftel et al. also suggested this relationship[17,18.] In the present study, we found that 59.53% of OSA patients had ED, supporting most prior publications.

We found that the higher the age, the higher the prevalence of ED, and this relationship was statistically significant. Therefore, we considered this an independent risk factor, which supported previous literature. Moreover, the present data confirmed that AHI score was an independent risk factor for ED. Higher AHI scores were associated with a higher degree of OSA. Therefore, this was considered an independent risk factor for ED. In addition, ED risk increased with increasing severity of OSA, which induced more oxidative stress[19].

Univariate analysis showed that HT and diabetes were associated with ED. However, an association between these parameters was not confirmed with multivariate analysis. Aging may have been a confounding factor that caused this situation[2]. We could not find any association between dyslipidemia and ED. It is possible that the incidence

Table 1. Characteristics and sleep parameters of patients with normal and impaired erectile function.

Variables parameter	Normal IIEF = 22-25 (N = 121)	Impair IIEF = 5-21 (N = 178)	P-value
General measures (dimension): median (min, max)			
Age (years)	43 (22, 74)	49 (23, 73)	0.002*
Body mass index (BMI) (kg/m^2)	25.9 (17.7, 52.1)	27.8 (19.1, 79.7)	0.001*
Neck (cm.)	39 (34, 48)	40 (31, 109)	0.013*
Waist (cm.)	92 (77, 144)	98 (71, 183)	0.001*
Hip (cm.)	100 (82, 144)	103 (78, 194)	0.023*
HADS	6 (2, 16)	5 (2, 18)	0.7425
Sleep efficiency: median (min, max)			
AHI	29 (0.4, 102)	50 (1.1, 143)	<0.001*
RDI	37 (1.3, 102)	53 (1.1, 143)	0.001*
$\%O_2$ saturation<90	0.5 (0, 41.1)	2.1 (0, 47)	<0.000*
lowest O_2 saturation	85 (25, 96)	83 (34, 96)	0.005*
AHI rem sleep	22 (0, 80)	24 (0, 122)	0.5394
AHI non-rem sleep	26 (0, 110)	50 (0, 143)	0.001*
PLM index	0 (0, 67)	0 (0, 52)	0.5557
Arousal index	35.5 (3.4, 103)	51 (0, 128)	0.011*
CPAP	8 (0, 16)	9 (0, 18)	0.009*
General measures (dimension): mean ± standard deviation			
ESS (score)	10.8 + 4.7	11.6 + 4.8	0.241
STOP-Bang score	2.5 + 1.0	2.5 + 1.0	0.649
Smoking history: n (%)			
Nonsmokers	104 (39.4)	160 (60.6)	0.391
Current smokers (roll/day)	7.4 + 4.8	8.2 + 6.0	0.678
Comorbidities: n (%)			
Diabetes	10 (24.4)	31 (75.6)	0.024**
Dyslipidemia	35 (38.0)	57 (62.0)	0.569
Hyperetnsion	30 (31.6)	65 (68.4)	0.033**
Cardiovascular disease	1 (33.3)	2 (66.7)	>0.999
Stroke, Cerebrovascular Accident	3 (60.0)	2 (40.0)	0.398
Benign Prostatic Hyperplasia	2 (15.4)	11 (84.6)	0.060
Chronic kidney Disease	1 (25.0)	3 (75.0)	0.650

HADS: Hospital Anxiety and Depression Scale, AHI: Apnea hypopnea index, RDI: respiratory disturbance index, PLM: periodic leg movements, CPAP: Continuous Positive Airway Pressure, ESS: Epworth Sleepiness Scale.

Table 2. Result of univariate and multivariate logistic regression analyses for characteristics and sleep parameters of erectile function.

Dependent variable	Independent variable	Univariate analyses		Mult variate analyses	
		Odds ratio (95% CI)	P-value	Odds ratio (95% CI)	P-value
Age	EF	1.03 (1.01-1.05)	0.003*	1.04 (1.01-1.07)	0.006*
AHI	EF	1.02 (1.01-1.03)	0.001*	1.02 (1.00-1.03)	0.011*
Diabetes	EF	2.34 (1.10-4.98)	0.027	1.01 (0.40-2.55)	0.977
Hypertension	EF	1.74 (1.04-2.91)	0.034	1.10 (0.56-2.15)	0.778
Body mass index	EF	1.07 (1.02-1.21)	0.002*	1.04 (0.95-1.14)	0.406
Lowest sat	EF	0.97 (0.95-0.99)	0.007	1.00 (0.97-1.03)	0.935
Waist circumference	EF	1.03 (1.01-1.05)	0.003*	1.00 (0.96-1.04)	0.876

AHI: Apnea hypopnea index, EF: erectile function

* p-value denotes statistical significance ($p<0.05$).

of dyslipidemia was underestimated in our study, because we relied on patient reports rather than blood tests. We found significant associations between polysomnographic parameters, showing that an increase in AHI increased the prevalence or severity of ED. Multivariate logistic regression analysis showed that the severity of OSA increased the prevalence of ED.

This study had some limitations. This was a cross-sectional study and thus we do not know whether erectile function may improve after the treatment of OSA. However, we are working to follow up these participants in order to evaluate their erectile function after treatment with CPAP.

Conclusion

The prevalence of ED in OSA patients was 59.53%. Determinants of ED included age and degree of OSA, which constituted independent risk factors for ED. In addition, DM, HT, and BMI had statistically significant associations with ED. Avoiding OSA risk factors and treatment of OSA might improve ED. However, future prospective studies are still needed to confirm our results.

Acknowledgement

We are grateful to Mrs. Yada Phengsalae for her assistance with the statistical analyses.

Conflict of interest

The authors declare no conflict of interest.

References

1. Yafi FA, Jenkins L, Albersen M, Corona G, Isidori AM, Goldfarb S, et al. Erectile dysfunction. Nature reviews Disease primers 2016;2:16003. doi:10.1038/nrdp.2016.3
2. Chaudhary RK, Shamsi BH, Chen HM, Tan T, Tang KF, Xing JP. Risk factors for erectile dysfunction in patients with cardiovascular disease. The Journal of international medical research 2016;44:718-727.
3. Wang W FJ, Huang G, et al. Meta-Analysis of Prevalence of Erectile Dysfunction in Mainland China: Evidence Based on Epidemiological Surveys. Sex Med 2016;5:e19-e30.
4. A. K. Prevalence of erectile dysfunction in Thailand. Thai Erectile Dysfunction Epidemiological Study Group. Int J Androl 2000;23:77-80.

5. Ho ML BS. Obstructive sleep apnea. Neurol Int 2011;3:e15.
6. Park JG RK, Olson EJ. Updates on definition, consequences, and management of obstructive sleep apnea. Mayo Clin Proc 2011;86:549-554; quiz 554-5.
7. Jean-Louis G, Zizi F, Clark LT, Brown CD, McFarlane SI. Obstructive sleep apnea and cardiovascular disease: role of the metabolic syndrome and its components. J Clin Sleep Med 2008;4:261-272.
8. Badran M, Golbidi S, Ayas N, Laher I. Nitric Oxide Bioavailability in Obstructive Sleep Apnea: Interplay of Asymmetric Dimethylarginine and Free Radicals. Sleep Disord 2015;2015:387801. doi:10.1155/2015/387801.
9. Burnett AL. The role of nitric oxide in erectile dysfunction: implications for medical therapy. Journal of clinical hypertension (Greenwich, Conn) 2006;8(12 Suppl 4):53-62.
10. Verri V, Brandão AA, Tibirica E. Penile microvascular endothelial function in hypertensive patients: effects of acute type 5 phosphodiesterase inhibition. Brazilian journal of medical and biological research = Revistabrasileira de pes-quisasmedicas e biologicas 2018;51: e6601.
11. Husnu T, Ersoz A, Bulent E, Tacettin O, Remzi A, Bulent A, et al. Obstructive sleep apnea syndrome and erectile dysfunction: does long term continuous positive airway pressure therapy improve erections? African health sciences 2015;15:171-179.
12. A AT. Obstructive Sleep Apnoea and Vascular Disease in Patients with Type 2 Diabetes. European endocrinology 2015;11:81-89.
13. Sangkum P SC, Viseshsindh W, Kochakarn W, Patcharatrakul S, Khongcharoensombat W. Validation and Reliability of a Thai Version of the International Index of Erectile Dysfunction (IIEF) for Thai Population. J Med Assoc Thai 2017;100(suppl 9):S73-S79.
14. Polysomnography in patients with obstructive sleep apnea: an evidence-based analysis. Ontario health technology assessment series 2006;6:1-38.
15. Schmidt HS WHn. Significance of impaired penile tumescence and associated polysomnographic abnormalities in the impotent patient. J Urol 1981;126:348-352.
16. Guilleminault C EF, Tilkian A, Simmons FB, Dement WC. Sleep apnea syndrome due to upper airway obstruction: a review of 25 cases. Arch Intern Med 1977;137:296-300.
17. Hirshkowitz M KI, Arcasoy MO, Acik G, Narter EM, Williams RL Prevalence of sleep apnea in men with erectile dysfunction. Urology 1990;36: 232-234.
18. Seftel AD SK, Loye TL, Bayard D, Kress J, Netzer NC Erectile dysfunction and symptoms of sleep disorders. Sleep 2002;25:643-647.
19. Campos-Juanatey F, Fernandez-Barriales M, Gonzalez M, Portillo-Martin JA. Effects of obstructive sleep apnea and its treatment over the erectile function: a systematic review. Asian journal of andrology 2017;19:303-310.