

Association between Depression and Severity of Obstructive Sleep Apnea Syndrome

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Abstract

Background and Objective: Depression is commonly reported in patients with Obstructive Sleep Apnea/Hypopnea Syndrome (OSAS). We aimed to assess the association between OSAS severity and depressive symptoms in patients with OSAS.

Materials and Methods: A total of 337 patients with symptoms of OSAS were visited for psychological testing prior to beginning diagnosis for the syndrome between 2012 -2014 in Baharloo Hospital. Participants completed the Beck Depression Inventory-II (BDI-II) and Epworth Sleepiness Scale (ESS) questionnaires. Respiratory Disturbance Index (RDI), mean of arterial oxygen saturation, sleep efficiency, and number of awakenings were measured by polysomnography (PSG).

Results: Correlation between RDI index and ESS score was statistically significant ($r: 0.215, P<0.001$), but correlation between RDI and BDI-II score was not statistically significant ($P= 0.59$). Also mean of BDI-II score between male and female was statistically different (male: 12.08 ± 10.6 , female: $17.26 \pm 12.56, P<0.001$).

Conclusions: OSAS severity was not related to symptoms of depression measured by BDI-II questionnaire. It seems that the method of scoring for depression severity may affect the association between obstructive sleep apnea and depression.

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Keywords: Daytime sleepiness, Depression, Obstructive sleep apnea

Introduction

Obstructive sleep apnea (OSA) is the most common subtype of breathing disorders during sleep (1). OSA increases the risk of poor neurocognitive performance and organ system dysfunction, due to repeated arousals and/or intermittent hypoxemia during sleep over several months to years. OSA and depression are common co-morbid disorders with serious health consequences. The prevalence of depression is higher in patients with OSA compared to general population (2).

The reported prevalence of depression in patients with OSA ranges from 5-63% (2). The severity and duration of OSA necessary for development of these outcomes likely varies among patients. The published literature from 2000-2011 is not conclusive because of methodological differences, such as variability of diagnostic tools for depression and OSA (2). However, studies show a higher rate of depression in patients with OSA as compared to the general population. An exact pathophysiological association between OSA and depression is not fully understood (2). In this study, we investigated the prevalence and association between depression and obstructive sleep

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apnea syndrome (OSAS) in patients with OSA symptoms.

Materials and Methods

In this cross-sectional study, 337 out of 400 patients completed Beck Depression Inventory-II (BDI-II) prior to beginning diagnostic procedure during 2012 -2014 in Baharloo Hospital. OSAS was diagnosed with a full night standard polysomnography (PSG) evaluating physiological and respiratory variables. Apneas and hypopneas were scored using AASM manual for the scoring of sleep and associated events (3). Apnea severity measures included the Respiratory Disturbance Index (RDI); an index of apnea and hypopnea spells per hour of sleep, and mean blood oxygen saturation during overnight PSG. An RDI of less than 5 is considered as normal, 5-14 as mild OSA, 15- 29 as moderate OSA, and ≥ 30 as severe OSA. Measurements of height, weight and neck circumference were recorded and body mass index (BMI) was calculated (kg/m^2). Subjective sleepiness was measured using the Epworth Sleepiness Scale (ESS) (4). ESS is psychometrically sound with ade-

quate reliability (5). Depressive symptoms were assessed using the BDI-II; a 21-item self-report scale that evaluates symptoms of depression over the past week. Participants rated the severity of each symptom on a 0 (absent) to 3 (most severe) scales. Total scores range from 0-63. The BDI-II is shown to be a reliable and valid tool for assessing the construct of depression (6). The BDI-II could be separated into two factors based on the factor analysis presented in the published manual: a somatic factor and a cognitive factor (7). Severity of depression could be categorized based on the scores; 0-13: minimal, 14-19: mild, 20-28: moderate, and 29-63: severe (7).

Data were analyzed using IBM SPSS Statistics for Windows version 19.0. Significance level was set at 0.05 for all analyses. Pearson correlation coefficients were used to examine the associations between apnea severity, obesity, subjective sleepiness, and depression.

Results

In this study, 337 adults with OSAS completed BDI questionnaire. The mean (\pm SD) age of participants was 47.54 (\pm 12.58) years. About 72.8% ($n= 291$) of participants were male. The mean (\pm SD) of RDI and BDI were 34.14 (\pm 28.40) and 13.68 (\pm 11.11), respectively. Table 1 shows demographic and baseline characteristics of the patients.

A total of 140 patients (41.5%) had BDI-II scores above 13 (the cutoff point of BDI score indicating some degree of depression) and 58.5% of them had normal BDI-II score. Most of the participants with abnormal BDI-II score had mild depression. Various levels of depression, according to BDI-II cutoffs are shown in Table 2.

Table 1. Demographic characteristics of study participants

Characteristic	Mean	SD
Age (years)	47.54	12.58
Neck circumference (cm)	41.32	4.85
BMI (kg/m^2)	31.50	8.74
RDI (number/h)	34.14	28.40
BDI (/63)	13.68	11.11
ESS (/24)	9.86	7.55
Mean SaO ₂ (%)	90.92	5.60

BMI: Body Mass Index, RDI: Respiratory Disturbance Index
ESS: Epworth Sleepiness Scale, BDI: Beck Depression Inventory, SaO₂: O₂ Saturation

Table 2. Prevalence of different levels of depression of study participants in terms of BDI-II score

Level of depression	Number	Percent
Minimal (0-13)	197	58.5
Mild (14-19)	58	17.2
Moderate (20-28)	45	13.4
Severe (≥ 29)	37	11

Table 3. Pearson correlation between BDI-II score, RDI, ESS score, BMI, Mean SaO₂, sleep efficiency, and number of awakenings

	RDI	BDI score	ESS score	BMI	Mean SaO ₂	Sleep efficiency	Number of awakenings
RDI	–	0.029	0.215***	0.176**	-0.523***	0.079	-0.005
BDI score	–	–	0.130*	0.040	-0.043	-0.106	-0.031
ESS score	–	–	–	0.030	-0.189***	0.114*	-0.044
BMI (kg/m ²)	–	–	–	–	-0.173**	-0.026	0.020
Mean SaO ₂ ^a	–	–	–	–	–	0.039	0.044
Sleep efficiency	–	–	–	–	–	–	-0.135**

P*<0.05, *P*<0.01, ****P*<0.001a: O₂ saturation

Present results showed that women had significantly higher BDI-II scores than men (mean ± SD: male: 12.08 ± 10.6, female: 17.26 ± 12.56, *P*<0.001).

Table 3 shows associations between BDI –II score, PSG parameters and ESS scores (RDI, mean SaO₂, sleep efficiency and number of awakening). The BDI-II score was not correlated with PSG parameters. The BDI-II score was significantly correlated with ESS score. BMI was correlated with RDI and mean of SaO₂ but no significant correlation was observed between BMI and BDI-II score.

Discussion

In this study, the prevalence of depression in patients with OSA was estimated 41.5% based on cutoff point of BDI score. According to the subject literature, the prevalence of depression in patients with OSA ranges from 5- 63% (2).

In this study, we found no statistically significant association between BDI-II and OSA measures. Although some associations between RDI and depression have been reported in the literature (8-10), some studies have reported findings in line with current study (11).

In the current study, there might be several reasons for showing no association between OSA severity and depression. First of all the mean of BDI-II questionnaire score (mean: 13.68) was in

normal range. Secondly, we did not evaluate confounding factors such as genetic susceptibility, hypertension, diabetes, and cardiovascular disease (12,13). Thus, it seems that BDI-II questionnaire is not a suitable instrument for diagnosing depression in patients with OSA. Physician's clinical diagnosis and history of prescription of antidepressant medications might be better measurement of depression other than questionnaire in these patients.

In this study, BDI-II questionnaire score was not related to obesity as well. However, the association between RDI and obesity, RDI and depression, obesity and depression have all been reported in the literature (14-16). Some studies have showed a reciprocal link between depression and obesity where obesity was found to increase the risk of depression (16).

In present study, the mean of BDI-II score was in normal range. Thus, this could be why we did not find any association.

Current study showed that significant association presents between ESS score and BDI-II. Excessive daytime sleepiness was assessed by ESS questionnaire. This finding is consistent with other studies. Insomnia and daytime sleepiness are often associated with depression (17, 18). Sleep fragmentation and hypoxia are reported as a cause of depression in patients with OSA (19). More recently,

studies have reported that disturbance of the sleep/wake cycle is often observed in OSA and depression (20).

Present findings showed significant difference in BDI-II score between men and women. These findings are consistent with previous studies. According to presented hypothesis, prevalence of depression in women is 1.5-3 times more than men (21,22). This difference may be due to hormonal differences, effect of parturition or the difference of psychosocial stress between men and women (21,22).

Some confounding factors such as hypertension, diabetes mellitus, and other co-morbidities were not included in the analysis of current findings and this could be considered as one limitation of this study. Moreover, authors assessed depression and its severity based on BDI-II questionnaire rather than clinical diagnosis.

In conclusion, we did not find a significant association between OSAS severity and depression based on BDI-II score. Thus, further randomized controlled studies utilizing established diagnostic criteria for OSA and depression are needed.

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