ECRONICON OPEN ACCESS
EC ENDOCRINOLOGY AND METABOLIC RESEARCH
Research Article

Diagnostics of OSA in Patients with Type 2 Diabetes Mellitus

Muminova SU[1]*, Daminova LT[2] and Esimova DM[3]

[1]*Tashkent Medical Pediatric Institute, Tashkent, Uzbekistan*

[2]*Tashkent State Dental Institute, Tashkent, Uzbekistan*

[3]*The Republican Specialized Scientific and Practical Medical Center for Endocrinology, Tashkent, Uzbekistan*

***Corresponding Author:** Muminova SU, Department of Endocrinology, Tashkent Medical Pediatric Institute, Tashkent, Uzbekistan.

Received: July 31, 2018; **Published:** September 19, 2018

Abstract

Objective: Comparative evaluation of OSA diagnostic methods in patients with type 2 diabetes mellitus.

Material and Methods: Total of 300 patients with type 2 diabetes were examined (mean age was 59.4 ± 6.66 years). All examined by questionnaire Stop-bang were divided to male and female. 150 female patients mean age 57.4 ± 7.6 years, mean body mass index (BMI) 31.2 ± 5.0 kg/mI, neck circumference, (mean 38.04 ± 2 cm). 150 male patients, mean age 54 ± 8.3 years, mean BMI - 28.9 ± 7.2 kg/mI, neck circumference 41.8 cm ± 3 cm. Examined women patients by polysomnography: average of age 52.7; IAG 56.4; BMI-32.4; Hb1C - 7.9%; Desaturation -80.

Results: According to the results of the questionnaire, it was noted that 45.4% of men and 75.7% of women had snore in dream. In each group, 87% of the patients complained of weakness during the day. In 25.7% of women and 10.6% of men, periodic respiratory arrest in a dream was detected. A direct correlation between T2DM, BMI and sleep apnea ($p < 0.01$). Results of polysomnography, low degree of OSA-11 (27%) in women, an average severity of OSA-12 (30%), a severe degree of 17 (42.5%) in patients with type 2 diabetes.

Conclusions: The decision to test any individual is reached on the basis of the clinical context and a determination of the severity of sleep disordered breathing. The severity of sleep apnea with a range of probabilities may enable one to make more appropriate decisions for an individual regarding the need for testing with polysomnography. Using the STOP-Bang or some other equivalent questionnaire to provide sets of probabilities may provide greater guidance to clinical decision. This concept needs to be verified in a larger prospective clinical trial. High incidence of OSA noted among the women participants in the Uzbek nationality. The Stop Bang questionnaire is one of the promising methods for detecting OSA and may directs patients for polysomnography. Given that the quality of life indicator is an indicator of the state of health, any violation of them dictates the need for timely detection and correction of OSA.

Keywords: *Type 2 Diabetes Mellitus; Obstructive Sleep Apnea; Stop-Bang Questionnaire; Polysomnography*

Abbreviations

T2DM: Type 2 Diabetes Mellitus; OSA: Obstructive Sleep Apnea; BMI: Body Mass Index; HLS: Health Life Style

Introduction

Over the past decades, diabetes mellitus (diabetes), along with cardiovascular and oncological diseases, is becoming an increasingly common pathology and by the current moment has become a «non-communicable epidemic». In Uzbekistan for 2017, 182,865 patients with diabetes mellitus were registered. The actual number of patients is more than 10 times registered, for the last 18 years the number of patients with diabetes on appeal in Uzbekistan has increased by 2.4 times (Ministry of Health of the Republic of Uzbekistan).

Type 2 diabetes mellitus (T2DM) and obstructive sleep apnea (OSA) are two common, chronic conditions that are associated with both prevalent and incident cardiac disease. Although T2DM and OSA share a common risk factor, i.e. obesity, accruing evidence over the last two decades has demonstrated that there is an independent association between OSA and T2DM. Epidemiological evidence has demonstrated a high prevalence of OSA in patients with Type 2 DM. Estimates on the prevalence of OSA in type 2 diabetics are indeed staggering with studies showing that well over 50% of type 2 diabetics have OSA. In a cross-sectional study, up to 23% of a diabetic population were found to have OSA [1-3].

Conversely, studies have also indicated a high prevalence of DM or insulin resistance in OSA patients. In a large clinic-based cross-sectional study, 30.1% of OSA patients had Type 2 DM, while 20% had impaired glucose tolerance [4].

Additionally, a recent meta-analysis of prospective studies has found that moderate-to-severe OSA was associated with an increased incidence of Type 2 DM [5].

The mechanisms of insulin resistance and pancreatic β-cell dysfunction explain the epidemiological observations that the prevalence of prediabetes and type 2 diabetes are increased in OSA. Most studies have used quantitative and validated measures for diabetes and OSA, such as fasting glucose or GTT and polysomnography, respectively. Interestingly, there is evidence to suggest that type 2 diabetes independently increases the likelihood of sleep-disordered breathing [6], possibly through the effects of diabetes on the autonomic and central nervous system. The prevalence of OSA in people with type 2 diabetes is variable, and estimates range from 18% in primary care to 58% in an older cohort, and as high as 86% in obese populations with type 2 diabetes [2,6,7].

However, there is heterogeneity in the findings of these longitudinal studies when adjusted for confounders, including age, sex, and BMI. This suggests that shared risk factors are important moderators of the association between OSA and type 2 diabetes and should be considered in the clinical evaluation and management decisions pertaining to individual patients. In this regard, emerging data suggest that OSA expression in rapid eye movement (REM) sleep (in which more frequent respiratory events and more severe oxygen desaturation may be observed) has significant effects on insulin resistance and glycemic control [5,8]. The most typical clinical signs for OSA are daytime sleepiness, memory and concentration dysfunction, sexual dysfunction, gastroesophageal reflux, headaches, snoring and the presence of hypertension [9-11]. Hypopnea is a condition when there is no stopping the breathing of snoring, and apnea - when the breath stops for 5 seconds. Currently, the standard for assessing the severity of respiratory disturbances during sleep is the so-called apnea/hypopnea index (AHI), which provides a quantitative assessment of episodes of apnea and hypopnea per 1 hour of sleep during a polysomnographic study. About the syndrome speak in the case when 5 [9]. However, the polysomnography requires serious material costs, and for the preliminary assessment of the risks of OSA, it is possible to use the methods of questioning. The diagnostic significance of the STOP-Bang questionnaire was evaluated in the Sleep Heart Health Study. The STOP-BANG is a shorter and more straight-forward instrument. It includes a subjective 4-item questionnaire (STOP) and a 4-item portion informed by demographics and measures (BANG) [12]. The sensitivities of the STOP-BANG for detection of OSA at an apnea/hypopnea index (AHI, number of events per hour sleep) > 5, > 15, and > 30 were 83.6, 92.9, and 100% respectively. Previous investigators did evaluate the STOP-BANG in a sleep laboratory setting retrospectively, by deriving the equivalent of STOP responses from other questionnaires patients completed, and adding BANG information from medical records [13]. They found that the STOP-BANG had a sensitivity of 81.5% for detecting AHI ≥ 5.

Material and Methods

STOP-BANG Questionnaire

The STOP-BANG questionnaire used in this study included four yes/no questions:

- S- "Do you Snore loudly (louder than talking or loud enough to be heard through closed doors)",
- T-"Do you often feel Tired, fatigued, or sleepy during daytime?"
- O- "Has anyone Observed you stop breathing during your sleep?"
- P- "Do you have or are you being treated for high blood Pressure?" [12].

The BANG portion of the questionnaire asked patients to report their height and weight (from which BMI was calculated), Age, Neck circumference or collar size, and Gender [12].

Patients received an additional point toward their STOP-BANG scores for the presence of each of the following clinical characteristics: BMI > 35, age > 50, neck circumference > 40 cm, and male gender. Patients were classified as having high risk for OSA if they had a total STOP-BANG score ≥ 3 points, out of a possible 8 points [12]. As both self-reported and measured or observed values for BMI, age, neck circumference, and gender were collected, two sets of scores were calculated.

Polysomnography

- Neuron-Spectrum-5 (Russia)
- 32-channel Upgradeable EEG and Long-Term Monitoring System

Main Features:

- 32 EEG channels + 9 channels to record any physiological signals
- 11 types of EEG analysis
- Impedance measurement button on EEG unit
- 12 options to expand the device functions including video monitoring, polysomnography, etc.
- License for unlimited number of workstations

The purpose Comparative evaluation of OSA diagnostic method in patients with type 2 diabetes mellitus.

We examined 300 patients with type 2 diabetes (mean age was 59.4 ± 6.66 years). All examined were divided into 2 groups: Men - 150 patients and women 150 patients with type 2 diabetes.

All the examinees signed informed consent to participate in the study, were questioned: «Questionnaire for the screening of sleep apnea -Stop-Bang» Patients gave answers to questions about snoring in sleep, stopping breathing in sleep, and blood pressure (BP). When assessing the completed questionnaire, the total score was calculated. When more than 3 positive responses were recruited, it was regarded as a possible breathing disorder in a dream. Also, 40 women were diagnosed by polysomnography. average of age 52.7; IAG 56.4; BMI-32.4; Hb1C - 7.9%; Desaturation -80. All patients underwent general clinical examination, calculated BMI, measured the circumference of the neck. Statistical processing was carried out using the Microsoft Excel program. The results are presented as the mean (Mean) and the mean error (Sem). Groups was checked using by Statistica 6.0.

Results

It was found that in the first group of patients from 150 women with diabetes 2, the mean age was 57.4 ± 7.6 years, the average body mass index (BMI) was 31.2 ± 5.0 kg/m^2, the neck circumference - 38.04 ± 2 cm. In the second group of patients from 150 men with type 2 diabetes, the mean age was 54 ± 8.3 years, the average BMI was 28.9 ± 7.2 kg/m^2, the neck circumference was 41.8 cm ± 3 cm. Recorded hereditary predisposition of T2DM was aggravated in 59% of patients with diabetes, men patients with obesity was 57.8%, and women patients - 60.6%. Physical activity in both groups did not differ significantly. In the group of patients with T2DM, the presence of autonomic neuropathy was taken into account, which was diagnosed in 164 patients (78 women, 86 men), which corresponds to 47,5 and 52.4%. The presence of arterial hypertension (AH) was found in men with T2DM in 19.6%, in obese people in 12.8% of cases.

According to the results of the questionnaire (see table 1), it was noted that snoring occurred in 45.4% of men, in women it was 75.7% among patients suffering from T2DM. In each group, complaints of weakness during the day were reported in 87% of patients, 25.7% of women and 10.6% of men had periodic respiratory arrest in sleep.

	All examined patients (n = 300)	Male (n = 150)	Female (n = 150)
Snore	181 (60,3%)	68 (37,5%)	113 (62,4%)
Observed	54 (18%)	16 (29,6%)	38 (12,6%)
Tired	129 (43 %)	76 (58,9 %)	53 (41%)
Blood pressure	251 (83%)	97 (47,5%)	145 (52,4%)
BMI 35kg/m	181 (60,3%)	86 (47,5 %)	95 (52,4 %)
Age up to 50	240 (80 %)	111 (46,2%)	129 (43%)
Neck circumference M > 40 F > 37	274 (91%)	164 (59,8%)	110 (40,1%)

Table 1: *Clinical characteristics of the patients examined in the group.*

High blood pressure, mainly in the morning, was observed in patients with T2DM, women 52,4% more often than men 47,5%, men's BMI was 47,5%, women's' 52,4%. A high risk of developing sleep apnea was 37.5% of men with T2DM and 40.9% of a woman with T2DM. The results of the screening of sleep apnea syndrome showed that a direct correlation between BMI and sleep apnea in T2DM patients ($p < 0.01$).

Indicators of the questionnaire shows that 62 women get high risk development of OSA. Additionally, out of 62 women, only 40 women agreed to be examined by polysomnography.

According to the results, low degree of OSA-11 (27%) in women, an average severity of OSA-12 (30%), a severe degree of 17 (42.5%) in patients with type 2 diabetes. 42,2% women patients with T2DM and OSA revealed obesity of grade 3 and a high level of Hb1C (8.1%).

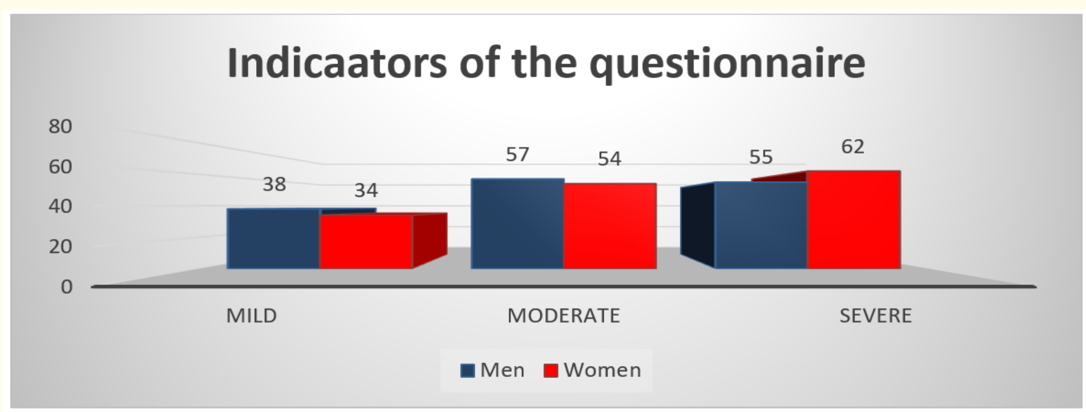

Figure 1

Discussion

A total of 300 diabetic patients participated in our study aiming at assessing the risk of OSA in the diabetic patients in Tashkent city. The measurement tool used in this study was the STOP-BANG questionnaire. The score of STOP-BANG questionnaire was calculated for all the patients. According to the scores of the patients, 24% of patients had mild risk, 37% had moderate risk and 39% had severe risk for OSA.

The results of this study can be compared to those of a study published in 2006 studying the prevalence of OSA in men with type 2 diabetes [3].

The authors found that 57% were scored as "high" and 39% as "low" risk for OSA; 4% were already known to have OSA. The method used in this study is a questionnaire different from the STOP-BANG questionnaire. There was no significant difference in HbA1c levels between the "high" and "low" risk groups, which is the same result we reached in our study.

Another study focused on OSA among obese patients with type 2 diabetes. It showed that over 86% of participants had OSA with an apnea-hypopnea index (AHI) ≥ 5 events/h. The mean AHI was 20.5 ± 16.8 events/h. A total of 30.5% of the participants had moderate OSA (15 ≤ AHI < 30), and 22.6% had severe OSA (AHI ≥ 30) [7]. A population-based study performed in 1,387 participants of the Wisconsin Sleep Cohort found a significant association between sleep apnea and type 2 diabetes, and this relationship was independent from other risk factors [14]. STOP-BANG Questionnaire Score in Diabetic Patients Hospitalized from June to August 2017 at King Abdul-Aziz Specialist Hospital. A total of 197 diabetic patients participated in our study aiming at assessing the risk of OSA in the diabetic patients in Taif city. The measurement tool used in this study was the STOP-BANG questionnaire. The score of STOP-BANG questionnaire was calculated for all the patients, the mean was 2.6 and the standard deviation was 1.7. According to the scores of the patients, 57.9% of patients had mild risk, 26.9% had moderate risk and 15.2% had severe risk for OSA. A significant correlation was found between the score and the age and the correlation coefficient was 0.35, meaning that there is a moderate positive relationship between age and the score. There was no significant correlation between the score and FBS's level and between the score and the HbA1c's value.

To the extent that the AHI is a valid parameter for defining this complex syndrome, the composite STOP-Bang model score provides a method for stratifying patients into categories of sleep apnea. For example, if the SBM score is 6 - 8, then the corresponding probability of having severe OSA is quite high (53.3%, 74.1%, and 81.9%, respectively), and further evaluation is relatively urgent. The physician can weigh a 53% chance of severe sleep apnea with other factors to decide on the appropriate clinical course of action, but would likely balance this differently for someone with a 90% or 10% probability [13].

Conclusion

The decision to test any individual is reached on the basis of the clinical context and a determination of the severity of sleep disordered breathing. Being able to estimate the severity of sleep apnea with a range of probabilities may enable one to make more appropriate decisions for an individual regarding the need for testing with polysomnography. In clinical practice, these decisions are based on consideration of numerous factors and the probabilities of various conditions that may be contributing to symptoms. Although there are limitations, the STOP-Bang model provides a simple method for screening, estimating the AHI severity, and triaging patients for testing. Using the STOP-Bang or some other equivalent questionnaire to provide sets of probabilities may provide greater guidance to clinical decision. This concept needs to be verified in a larger prospective clinical trial. Additionally, high incidence of OSA noted among the women participants in the Uzbek nationality. The Stop Bang questionnaire is one of the promising methods for detecting OSA and may directs patients for polysomnography. Given that the quality of life indicator is an indicator of the state of health, any violation of them dictates the need for timely detection and correction of OSA.

Bibliography

1. Einhorn D., *et al*. "Prevalence of sleep apnea in a population of adults with type 2 diabetes mellitus". *Endocrine Practice* 13.4 (2007): 355-362.

2. Heffner JE., *et al*. "Prevalence of diagnosed sleep apnea among patients with type 2 diabetes in primary care". *Chest* 141.6 (2012): 1414-1421.

3. West SD., *et al*. "Prevalence of obstructive sleep apnoea in men with type 2 diabetes". *Thorax* 61.11 (2006): 945-950.

4. Meslier N., *et al*. "Impaired glucose-insulin metabolism in males with obstructive sleep apnoea syndrome". *European Respiratory Journal* 22.1 (2003): 156-160.

5. Wang X., *et al*. "Obstructive sleep apnoea and the risk of type 2 diabetes: a meta-analysis of prospective cohort studies". *Respirology* 18.1 (2013): 140-146.

6. Resnick HE., *et al*. "Diabetes and sleep disturbances: findings from the Sleep Heart Health Study". *Diabetes Care* 26.3 (2003): 702-709.

7. Foster GD., *et al*. "Obstructive sleep apnea among obese patients with type 2 diabetes". *Diabetes Care* 32.6 (2009): 1017-1019.

8. Celen YT., *et al*. "Impact of gender on incident diabetes mellitus in obstructive sleep apnea: a 16-year follow-up". *Journal of Clinical Sleep Medicine* 6.3 (2010): 244-250.

9. Martнnez-Ceryn E., *et al*. "Effect of Continuous Positive Airway Pressure on Glycemic Control in Patients with Obstructive Sleep Apnea and Type 2 Diabetes. A Randomized Clinical Trial". *American Journal of Respiratory and Critical Care Medicine* 194.4 (2016): 476-485.

10. Mok Y., *et al*. "Obstructive sleep apnoea and Type 2 diabetes mellitus: are they connected?" *Singapore Medical Journal* 58.4 (2017): 179-183.

11. Nakata K., *et al*. "Distinct impacts of sleep-disordered breathing on glycemic variability in patients with and without diabetes mellitus". *PLoS One* 12.12 (2017): e0188689.

12. Chung F., *et al*. "STOP questionnaire: a tool to screen patients for obstructive sleep apnea". *Anesthesiology* 108.5 (2008): 812-821.

13. Farney RJ., *et al*. "The STOP-Bang equivalent model and prediction of severity of obstructive sleep apnea relation to polysomnographic measurements of the apnea/hypopnea index". *Journal of Clinical Sleep Medicine* 7.5 (2011): 459-65B.

14. Reichmuth KJ., *et al*. "Association of sleep apnea and type II diabetes: a population-based study". *American Journal of Respiratory and Critical Care Medicine* 172.12 (2005): 1590-1595.

Volume 3 Issue 5 October 2018
©All rights reserved by Muminova SU*., et al.*