Original Article

Obstructive Sleep Apnea Among People with Type 2 Diabetes in Saudi Arabia: A Cross-Sectional Study

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Abstract

Objectives: Obstructive sleep apnea syndrome or obstructive sleep apnea (OSA) is a health condition commonly associated with glucose intolerance. The limited literature on this subject in Saudi Arabia prompted the conduct of this study, which aimed to determine the people diagnosed with type 2 diabetes mellitus (T2DM) in Saudi Arabia with at risk of OSA, and to determine its associated factors.

Methodology: A total of 201 adults, ages 25 or more with T2DM were examined from May 2015 to March 2016. Data was collected using the patients' demographic profile, medical history and clinical data, including results of their most recent glucose blood tests and HbA1C. The Berlin Questionnaire was used to determine the risk associated with OSA. All relevant risk factors were analyzed.

Results: The estimated risk of OSA determined from the samples was 44.3%. The risk of OSA was significantly more common in people who are obese than those who were overweight or normal. Furthermore, body mass index (BMI) and the duration of diabetes were independent predictors for OSA in a logistic regression model. On the other hand, factors such as age, gender, occupation, hemoglobin A1C, FBG, comorbidities, and the type of diabetes treatment were not found to be significant predictors for OSA.

Conclusions: Almost half of Saudi people with T2DM are associated with the risk of OSA, which may or may not be diagnosed. The risk of OSA was significantly correlated with increased BMI, neck and waist circumference, and duration of diabetes.

Key words: Apnea, T2DM, OSA, Saudi and sleep.

الملخص

الأهداف: متلازمة توقف التنفس الإنسدادي اثناء النوم (OSA) هي حالة مرضية عادة ما تسبب اضطراب في جلوكوز الدم. وبسبب قلة الدراسات في هذا المجال في المملكة العربية السعودية، عزمنا في هذه الدراسة الى تحديد مدى خطورة الإصابة بمتلازمة توقف التنفس الإنسدادي اثناء النوم (OSA) لدى مرضى السكري من النوع الثاني في المملكة العربية السعودية ومعرفة العوامل المصاحبة لذلك.

الطريقة: تم فحص ٢٠١ مريض سكري من النوع الثاني ممن أعمارهم فوق ٢٥ عام خلال الفترة بين مايو ٢٠١٥ و مارس ٢٠١٦. تم استخلاص البيانات الشخصية والسريرية والتاريخ المرضي ونتائج اخر تحليل لسكر الدم والسكر التراكمي (التجسسي). تم استخدام استبيان برلين لتحديد خطر الإصابة بمتلازمة توقف التنفس الإنسدادي اثناء النوم (OSA). تم عمل تحليل احصائي لمعرفة عوامل الخطورة المصاحبة لذلك.

النتائج: ان مستوى خطورة الإصابة بمتلازمة توقف التنفس الإنسدادي اثناء النوم لدى السعوديين المصابين بالسكري من النوع الثاني يعادل ٤٤.٣٪. ويزداد الخطر شيوعاً بشكل ملحوظ لدى البدناء. بالإضافة، تبين من خلال التحليل الاحصائي ان كتلة الجسم ومدة الإصابة بالسكري تشكلان عامل مهم في رفع معدل الخطورة.

الخلاصة: تبين من خلال الدراسة أن نصف السعوديين المصابين بالسكري من النوع الثاني لديهم نسبة خطورة عالية للإصابة بمتلازمة توقف التنفس الإنسدادي اثناء النوم (OSA).

Introduction

The growing prevalence of obesity among populations in the world brings with it a range of other health conditions, such as diabetes mellitus. Reports have shown that prevalence rate of diabetes in Saudi Arabia is very high and is continuously increasing.[1,2]A common form of diabetes is type 2 diabetes mellitus (T2DM) which is strongly associated with central obesity. Moreover, in addition to obesity, T2DM was also found to be related to obstructive sleep apnea syndrome (OSA), a condition where a patient experiences recurrent and intermittent episodes of hypoxia or a deficiency in oxygen during sleep. This is due to the failure of the upper airways which results in disturbance of sleep and more drowsiness during the day. [3] Number of studies including epidemiological, cross-sectional performed on large-scale have shown that OSA is risk independent with the onset of T2DM.[4] However, many others studies have shown that 15-30% cases of OSA patients are seen in patients with T2DM . [4] Furthermore, it is also well reported that risk for the onset of OSA increases in people with T2DM[5]

Over the past 10-15 years, interest on cardiometabolic derangements in OSA has been shown by number of investigators. [6,7] People with T2DM have shown a strong association with central obesity.[8] Several studies reported that OSA is associated with T2DM, insulin resistance and glucose intolerance but not associated with obesity.[9] Investigations on OSA and T2DM in Arab populations, however, are limited, and this is one of the first known studies to assess the risk of OSA in T2DM among Saudi population.

With this in mind, this study sought to assess the prevalence of people with T2DM at risk for obstructive sleep apnea and their associated risk factors using the Berlin Questionnaire (BQ). [10]

Methods

The study was a cross-sectional investigation that involved Saudi Arabian people with T2DM ages 25 years and older. Data was collected from May 2015 to March 2016 at the Diabetes Center, King Fahad Specialist Hospital, Buraidah, Saudi Arabia. The study was approved by the Institutional Review Board, College of Medicine, Qassim University. All participants provided their consent to participate in the study. Trained medical students interviewed the patients in order to complete the demographic data and the Berlin Questionnaire, the primary instrument used to assess the risk for OSA. The patients' medical history covered the following information: disease duration, current treatment, smoking history, comorbidities, recent fasting blood glucose (FBG), and HbA1c levels. Height (cm), weight (cm), neck and waist circumference (cm/inch) and blood pressure (mmHg) were likewise recorded, and the body mass index (BMI) was calculated as weight (kg)/ height (m2).

In the present study, the Berlin Questionnaire was used to determine the risk of OSA as described previously. [10] Eleven items were identified, covering three domains related to the risk of obstructive sleep apnea.

These were as follows: snoring and sleep-related symptoms (category 1); awake-time sleepiness and drowsiness (category 2); and hypertension and/or BMI greater than 30 (category 3). The responses for each category were coded accordingly as present or absent, and the final scores ranging from 0 to 3 were determined. Subjects who registered positive scores in two out of the three categories were identified as having high risk of OSA. Patients did not meet the above criteria were scored low risk for OSA. The scale registered good reliability and validity was used as previously described for detecting Respiratory Disturbance Index, considered an indicator of obstructive sleep apnea. [11,12]

Data were analyzed using Statistical Package of Social Studies (SPSS, Windows Version 18.0) and expressed as means (SD). Furthermore, a statistician was commissioned to perform the analysis to ensure a blind assessment of the results. Categorical variables were described using frequency distributions and presented as frequency (%). In order to recognize the potential risk of OSA, quantitative variables were also subjected to a two-sample T-test. The x2 Test and/or Fisher's Exact Test were used to analyzed the qualitative variables, whereas high risk for OSA was predicted by logistic regression model. The same test was also used to assess the effect of risk of OSA on other study factors, including age, gender, occupation, smoking habit, race/ethnicity, disease duration, T2DM treatment, and BMI.

Results

In this study, the data were collected from 201 patients and their clinical characteristics of the patients are presented in Table 1. Mostly there were mostly middle-aged patients with average age of 53 years and were obese with average BMI of 31.2. About 50.3 percent of them were male, and almost half has dyslipidemia or hypertension. The average T2DM duration (±SD) was calculated to be 8.6 (±5.5) years. More than half (62.2%) was treated with oral hypoglycemic agents, while several (34.8%) used insulin, either alone or in combination with other oral agents. The average (±SD) hemoglobin count was 8.7 (±1.7).

Screening results using the Berlin Questionnaire revealed that 44.3% of the Saudi people with T2DM has high risk of OSA, which means nearly half of Saudi type 2 diabetics are at risk of having OSA and are needed for proper evaluation (Figure 1). The detailed characteristics of both studied groups are summarized in Table 2. Of those who are at risk, snoring was identified in 93.2% of the patients, and breathing pauses more than once a week were noticed in 18.6% of the patients. Noteworthy is the high percentage of drowsiness or the tendency to fall asleep during driving among 33.9% of the high-risk group. Furthermore, OSA was also significantly more common among obese patients (73%) than those classified to be overweight and normal (20.2% and 6.7%, respectively); $p \leq 0.001$ (Figure 2). The condition was also higher among people with very high HbA1c

than among people with only high and controlled HbA1c (46.1% and 37.1%, 16.9%; p=0.362). However, neither groups showed statistical significance.

A logistic regression model was applied for the prediction of OSA risk and plotted the correlation with factors, including age, gender, occupation, smoking habit, duration of diabetes, FBG, HbA1c, BMI and the type of diabetes treatment. The model was significant at p =0.002. Of the factors investigated, a BMI of more than 30 was well correlated with an increased risk of OSA (OR=3.9; 95% CI=1.4, 7.8), and Diabetes of more than five years was classified as high risk (OR=3.1; 95% CI =1.3, 7.8). On the other hand, age, gender, occupation, HbA1c, FBG, comorbidities, smoking habit, and type of diabetes treatment were not identified as significant predictors of risk of obstructive sleep apnea.

Table 1: Clinical characteristics of the study population.

Variable	mean (SD)
Age (years)	53.3(9)
BMI (kg/m2)	31.2(5.8)
BP systolic (mmHg)	148.3(77.3)
BP diastolic (mmHg)	78(12)
Neck circumference (cm)	39.4(3.2)
Waist circumference (inches)	107.7(11.2)
Duration of Diabetes (years)	8.6(5.5)
Gender (%Male)	50.3
Smoker (%)	7.5
Education: (%)	
Illiterate	35.3
Primary	18.9
Intermediate	14.9
Secondary	16.9
Undergraduate	13.9
Occupation: (%)	
Unemployed	46.8
Employer	19.9
Business man	11.9
Retired	21.4
Co-morbid: (%)	
Hypertension	42.8
Dyslipidemia	57.2
Bronchial Asthma	9
IHD	5.5

SD, Standard Deviation; BP, blood pressure; BMI, body mass index; IHD, ischemic heart disease

Table 2. Baseline characteristics of people with or without obstructive sleep apnea (OSA).

Variable	High Risk (n=89)	Low Risk (n=112)	*P* Value
Age (mean (SD))	53.9(8.1)	52.8(9.7)	0.404
Gender (%Male)	51.7	49.1	0.716
BMI (mean (SD))	32.9(5.8)	29.8(5.4)	<0.001
Hypertension (%)	50.6	36.6	0.047
Dyslipidemia (%)	59.6	55.4	0.55
Bronchial Asthma (%)	11.2	7.1	0.315
IHD (%)	5.6	5.4	0.935
Duration of Diabetes(%)			
5< year	9	24.9	0.837
5-10 year	12.9	33.3	
10> year	7.5	12.4	
Type of treatment: (%)			
OHA	80.9	75.9	0.058
Insulin	37.1	33	
FBG (mean (SD))	10.3(3.9)	9.6(4.1)	
Level of control (%)			0.240
Normal (130<)	22.5	33	
High (130>)	76.4	63.4	
HbA1c (mean (SD))	8.8(1.7)	8.6(1.7)	
Level of control (%)			
Controlled (7.0<)	16.9	22.3	0.362
High (7.0-9.0)	37.1	33	
Very high (9>)	46.1	44.6	

SD, Standard Deviation; BMI, body mass index; IHD, ischemic heart disease; OHA, oral hypoglycemic agents; FBG, fasting blood glucose

Figure 2: The Risk of OSA in different diabetic BMI subgroups.

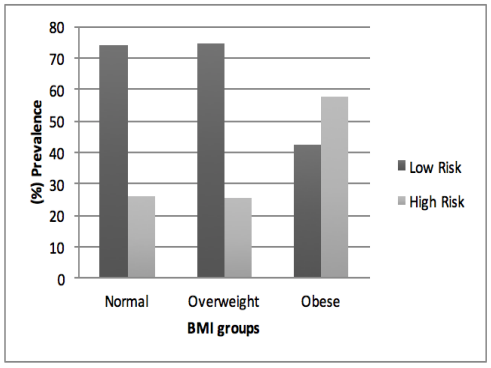
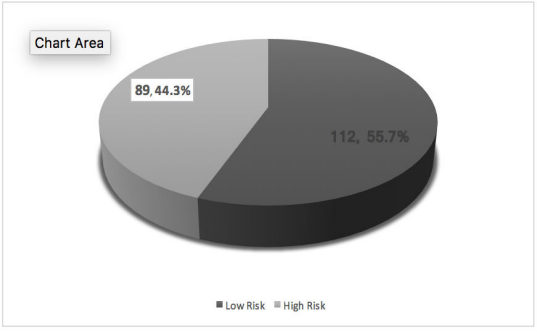


Figure 1: Risk of Obstructive Sleep Apnea among study population using the Berlin questionnaire (n = 201).



Discussion

Outcomes of the study indicate that the prevalence of OSA among type 2 diabetes mellitus was markedly higher than non-diabetic individuals in the general population of Saudi Arabia. Data gathered from the Berlin Questionnaire showed that 44.28 percent of the Saudi Arabia people examined were at "high" risk of OSA compared to the 33 – 39 percent of the general Saudi population. [13,14] Cass AR. et al, found a similar risk of OSA (48.6%) using Berlin Questionnaire in a family medicine center in USA.[15] Another data by Ioja et al used Berlin Questionnaire have reported 35% of people with type 1 diabetes mellitus and 31% of people with T2DM at high risk of OSA.[16] Kalaktawi et al, using the STOP-BANG Questionnaire in a hospitalized patient at King Abdul-Aziz Specialist Hospital in Taif have reported that 57.9% were at mild risk, 26.9% were at moderate risk and 15.2% patients at severe risk for OSA. [17]

This corroborates the findings of other international studies that show that people with T2DM are more likely to also be at risk of OSA [18,19] The occurrence of OSA in people with T2DM has been documented to be as high as 59 percent, compared to 5 – 15 percent of the general population, underscoring the important association between these two conditions. However, methodological limitations in available studies did not allow for inferences to be made on the cause and effect, and therefore, limited the generalizability of the available data. Such issues notwithstanding, researchers from the Sleep Heart Health Study have found that even after adjusting confounders such as obesity and prevalent cardiovascular disease, middle-aged and older adults with a long case of T2DM have shown periodic breathing problems while sleep. While several epidemiologic studies have also reported an association between sleep-disordered breathing and the risk of OSA onset with age of the patients. [20,21] Other studies reported a highest occurrence of OSA in 60 year old patients and have reported to decline thereafter, a similar pattern found in the study. [22,23]

Furthermore, in contrast with the findings of other investigations, have shown insignificant correlation between OSA with gen-

der. Other investigations have found that men are more likely than women to have OSA with 2-3 times. [21,24] It is also important to point out that studies are performed in previous decade which may indicated that the study was conducted on less obese population.[24] The risk of OSA was also found to increase with the duration of diabetes. Data indicated that obstructive sleep apnea was significantly higher among people with more than five years of T2DM. Which is previously confirmed by similar study.[25] In terms of lifestyle habits, other studies have shown that smoking may increase the risk of OSA. [26] This, however, was not confirmed in the study due to the relatively small sample size.

Present study fully supported to the view that T2DM has correlation with increased risk of OSA. It is worthy to note that not all people with T2DM showed a typical risk OSA profile, therefore further studies are recommended that will show more screening for OSA among people with T2DM. Moreover, we also suggested to include clinicians in the recommended study as they are more aware of the risk of prevalence of OSA in the people with T2DM. It is also important to point out that lack of awareness among clinicians of the risk and prevalence of OSA in people with T2DM directly or indirectly caused improper diagnosis of OSA that also effects on inappropriate treatment of OSA. Improved recognition and treatment of OSA among people with T2DM is an important step to improve the patient health outcome. In conclusions, the present study shows that prevalence rate of obstructive sleep apnea is very high in men with type 2 diabetes as compared with the non-diabetic men in the general population of Saudi Arabia. Given the strong association between these two conditions, screening for OSA among Saudi Arabian with T2DM is important as an effective treatment of OSA, as well as to address sleep apnea-related symptoms and to improve diabetes control and management.

Declaration of interest

Authors declare no conflicts of interest.

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