The prevalence of risk for Obstructive Sleep Apnea among type 2 diabetes mellitus patients

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ABSTRACT
Obstructive sleep apnea (OSA) is a common medical disorder and Type 2 Diabetes mellitus (T2DM) is an endocrine disorder where both of them commonly coexist. T2DM will disturb sleep patterns and disturbed sleep may predispose to insulin resistance resulting in T2DM. The study aim is to evaluate the prevalence of risk for Obstructive sleep apnea among T2DM patients based on patient demographic variables (age, gender and Body Mass Index (BMI)) and Berlin Questionnaire (BQ). In this cross-sectional study a total of 111 patients were included and the prevalence of risk was determined based on the BQ categories and the percentage was calculated accordingly. In BQ, Category 1 includes five questions based on snoring, category 2 includes three questions based on daytime somnolence and category 3 includes two questions based on BMI. These categories were marked as positive if the responses for snoring or daytime somnolence indicate persistent symptoms (> 3-4 times/week). Third category includes the patient’s BMI greater than 30 kg/m2 (obese) indicates positive score. In this study, the patients above 61 years (100%) and obese (94%) were at a higher risk for OSA. Based on the BQ, more positive (89.19%) responses were observed in category 1 (snoring) when compared to category 2 (40.54%) and 3 (74.77%) which concluded that T2DM patients are at a high risk (HR) for developing Obstructive Sleep Apnea.

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INTRODUCTION
OSA is a common medical disorder which is characterized by upper airway instability while sleeping which leads to recurrent episodes of airway obstruction (complete or partial). Recent studies indicated that prevalence of OSAas 17%–26% in men and 9%–28% in women (Young et al., 2002). This was recognized as an important cause of increase in both morbidity and mortality (McNicholas and Bonfigore, 2007). The major risk factor for OSA is the global obesity increase (Tahrani, 2015); (Amin et al., 2017), which in turn leads to increased diagnosis of this condition.

T2DM is an endocrine disorder affecting the beta cells in pancreas, and is commonly increasing worldwide reaching to epidemic proportion (Murray and Lopez, 1997). It was estimated that the prevalence of diabetes may increase in adults by 69% in developing countries and 20% increase in developed countries between 2010 and 2030 (Shaw et al., 2010). T2DM will disturb sleep patterns and disturbed sleep may predispose to
insulin resistance resulting in T2DM (Punjabi et al., 2002). Multiple studies have shown that increased insulin resistance and glucose intolerance are obesity independent (Aronsohn et al., 2010); (Punjabi, 2004). Various cross sectional studies have shown that T2DM and OSA commonly coexist (Tahrani, 2017); (Pamidi and Tasali, 2012). The patients with T2DM have more prevalence of sleep disturbances when compared to non-diabetic (West et al., 2006).

It is important to find the interrelation among T2DM and OSA patients as they are linked with cardiovascular diseases.

Table 1: Distribution based on Age

| Age in years | No of participants (n=111) | Percentage (%) |
|--------------|---------------------------|----------------|
| 30 – 40      | 25                        | 22.52%         |
| 41 – 50      | 38                        | 34.23%         |
| 51 – 60      | 36                        | 32.43%         |
| 61 and above | 12                        | 10.82%         |

Table 2: BMI based distribution.

| BMI (kg/m²) | No. Of participants (n=111) | Percentage (%) |
|-------------|-----------------------------|----------------|
| <18.5 kg/m² | 0                           | 0%             |
| 18.5-24.9 kg/m² | 6                        | 5.40%         |
| 25-29.9 kg/m² | 55                        | 49.55%        |
| >30 kg/m²   | 50                          | 45.05%        |

Aim

The study aim is to evaluate the prevalence of risk for Obstructive sleep apnea among T2DM patients. A total of 111 participants with T2DM were selected and BMI was obtained. The risk and symptoms of OSA were examined using BQ, and was divided into 3 categories with a total of 10 questions. Category 1 includes five questions based on snoring, category 2 includes three questions based on daytime somnolence and category 3 includes two questions based on BMI. As reported by Netzer et al., 1999, the BQ was scored. These categories (1 and 2) were marked as positive if the patient had persistent symptoms of snoring or daytime somnolence for > 3-4 times/week. Category 3 was marked as positive if the patients were Obese with BMI greater than 30 kg/m². The patient is considered to be at a high risk if any of the two or more categories shows positive. Based on the percentage, high risk (HR) and low risk (LR) of Obstructive Sleep Apnea were calculated in T2DM patients.

RESULTS AND DISCUSSION

Among 111 participants, 25 were 30-40 years, 38 were 41-50 years, 36 were 51-60 years and 12 were above age of 61 (Table 1).

Out of 111 participants, the BMI for the patients with <18.5 kg/m² (underweight) were nil, 18.5 – 24.9 kg/m² (normal) were 6 (5.40%), 25 – 29.9 kg/m² (overweight) were 55 (49.55%) and > 30 kg/m² (Obese) were 50 (45.05%) (Table 2).
Table 3: Prevalence of low and high risks based on age and gender distribution

| RISK       | AGE IN YEARS | GENDER          |
|------------|--------------|-----------------|
|            | 30-40 (n=25) | 41-50 (n=38)    | 51-60 (n=36)    | 61 and above (n=12) | Male (n=63) | Female (n=48) |
| Low risk   | 19           | 13              | 1               | 0                    | 20          | 14             |
| High risk  | 6            | 25              | 35              | 12                   | 43          | 34             |
| Low risk % | 76%          | 34.21%          | 2.78%           | 0%                   | 31.75%      | 29.17%         |
| High risk %| 24%          | 65.79%          | 97.22%          | 100%                 | 68.25%      | 70.83%         |

Table 4: Prevalence of high risk and low risk based on the BMI.

| RISK       | BMI            |
|------------|----------------|
|            | 18.5 kg/m²–24.9 kg/m² (n=6) | 25 kg/m²–29.9 kg/m² (n=55) | > 30 kg/m² (n=50) |
| Low risk   | 2              | 28              | 3               |
| High risk  | 4              | 27              | 47              |
| Low risk % | 33.33%         | 50.91%          | 6%              |
| High risk %| 66.67%         | 49.09%          | 94%             |

Table 5: Distribution based on the BQ categories

| Category - 1 | Percentage (%) | Category - 2 | Percentage (%) | Category - 3 | Percentage (%) |
|--------------|----------------|--------------|----------------|--------------|----------------|
| No. of participants (n=111) |                 | No. of participants (n=111) |                 | No. of participants (n=111) |                 |
| Positive     | 99 89.19%      | 45 40.54%     | 83 74.77%      |               |                |
| Negative     | 12 10.81%      | 66 59.46%     | 28 25.23%      |               |                |

Figure 3: Prevalence of high risk and low risk based on the BMI.

In this study “The prevalence of risk for obstructive sleep Apnea among patients with type 2 diabetes mellitus”, we found that the patients with T2DM have a HR for OSA based on BQ which was in agreement with Shim et al. and other studies (Shim et al., 2011); (Einhorn et al., 2007). For OSA, age is a contributing factor along with the diabetes and other comorbidities like hypertension and obesity which was also reported by (West et al., 2006). The prevalence of OSA is more due to a worldwide surge in

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the aged populations and obesity (Usmani et al., 2012). Few studies stated that male genders are the risk factor for OSA (Khashawneh et al., 2009), but some studies found that there was no significant difference in the genders with respect to risk for OSA (Sokwalla et al., 2017).

The major limitation of this cross-sectional study is its nature and the limited number of risk factors were examined. Moreover, no OSA tests were performed for the patients to confirm the OSA diagnosis. Hence further studies are required to address these limitations and confirm the same.

CONCLUSIONS

Our study concluded that the prevalence of high risk for Obstructive Sleep Apnea among T2DM patients were confirmed using the BQ. According to these, more positive responses were observed in category 1 (snoring) which confirmed that T2DM patients are at a high risk for developing OSA. Hence, further awareness among the health care professionals and the patients are required to prevent its prevalence and complications.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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