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Original Research Article

Prevalence of obstructive sleep apnea risk in patients with type 2 diabetes mellitus in an urban field practice area of a Government Medical College, Nagpur: a cross-sectional study

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ABSTRACT

Background: Obstructive sleep apnea (OSA) is a common but frequently undiagnosed sleep disorder characterized by recurrent upper airway obstruction during sleep. Patients with type 2 diabetes mellitus (T2DM) are at increased risk of OSA because of shared risk factors such as obesity and metabolic abnormalities. This study assessed the prevalence of OSA risk among patients with T2DM using a validated screening tool.
Methods: A cross-sectional study was conducted among 110 patients with T2DM attending the urban health training centre of Government Medical College, Nagpur. OSA risk was assessed using the STOP-Bang questionnaire. Demographic and clinical data, including body mass index (BMI) and comorbidities, were collected. Participants were categorized as having low, intermediate, or high risk of OSA based on STOP-Bang scores. Descriptive statistics and univariate analysis were used for data analysis.
Results: Of the 110 participants, 59.1% were male and 60.9% were aged ≥60 years. Based on STOP-Bang scores, 29% were at low risk, 36% at intermediate risk, and 35% at high risk of OSA. High OSA risk was significantly associated with age ≥60 years ($p<0.001$) and hypertension ($p<0.0001$).
Conclusions: More than one-third of patients with T2DM were at high risk of OSA. Increasing age and hypertension were significantly associated with higher OSA risk. Routine OSA screening among patients with T2DM may facilitate early identification and timely management of this potentially underdiagnosed condition.

Keywords: Obstructive sleep apnea, Prevalence, Risk factors, STOP-Bang, Type 2 diabetes mellitus

INTRODUCTION

Obstructive sleep apnea (OSA) is a common sleep-related breathing disorder characterized by recurrent episodes of partial or complete upper airway obstruction during sleep, leading to intermittent hypoxia, sleep fragmentation, and reduced sleep quality.[1] OSA is increasingly recognized as a major public health problem because of its association with cardiovascular diseases, metabolic disorders, impaired cognitive function, reduced quality of life, and increased mortality. The disorder often remains underdiagnosed due to lack of awareness and limited screening in routine clinical practice.[2]

Type 2 diabetes mellitus (T2DM) is one of the most prevalent non-communicable diseases worldwide and poses a significant burden on healthcare systems. India has witnessed a rapid rise in diabetes prevalence due to urbanization, sedentary lifestyle, obesity, and dietary transitions.[3] Patients with T2DM are particularly

vulnerable to OSA because both conditions share common risk factors such as obesity, advancing age, hypertension, and metabolic dysregulation.[4]

Several studies have demonstrated a bidirectional relationship between OSA and T2DM. Recurrent hypoxia and sleep fragmentation associated with OSA contribute to insulin resistance, systemic inflammation, oxidative stress, and sympathetic nervous system activation, thereby worsening glycemic control.[5] Conversely, obesity and metabolic abnormalities in diabetic patients may predispose them to upper airway collapse during sleep. This coexistence increases the risk of cardiovascular complications, poor metabolic control, and overall morbidity among affected individuals.[6]

Despite growing evidence regarding the association between OSA and diabetes, OSA remains underdiagnosed among diabetic patients, particularly in primary care and community settings. Polysomnography is considered the gold standard for diagnosis of OSA; however, it is expensive, time-consuming, and not readily accessible in many resource-limited settings. Therefore, validated screening tools such as the STOP-BANG questionnaire are useful for identifying individuals at high risk of OSA in clinical and epidemiological studies.[7]

The STOP-Bang questionnaire is a simple and validated screening instrument that evaluates important risk factors including snoring, tiredness, observed apnea, hypertension, body mass index, age, neck circumference, and gender. It has been widely used for early identification and risk stratification of OSA in both hospital and community settings.[7] Early screening and timely intervention among diabetic patients may help improve glycemic control, reduce complications, and enhance quality of life.

Considering the limited data available from central India regarding OSA risk among patients with T2DM, the present study was undertaken to assess the prevalence of obstructive sleep apnea risk among patients with type 2 diabetes mellitus attending an urban field practice area of Government Medical College, Nagpur, using the STOP-Bang questionnaire.[7]

METHODS

Study design and setting

A cross-sectional study was carried out at urban health training centre (UHTC) under the department of community medicine, Government Medical College, Nagpur.

Study duration

The study was conducted from September to December 2024.

Study participants

The study included adults aged 18 years and above who attended the out-patient department of the urban health training centre during the study period. Individuals with documented evidence of diagnosis and treatment for T2DM prescribed by medical doctors were included in the study. Patients with type 1 diabetes mellitus, secondary diabetes, or gestational diabetes; pregnant women; individuals with substance dependence or neurological disorders affecting sleep; and persons who had undergone neurosurgical procedures within the past three years were excluded from the study.

Sample size estimation

Sample size was estimated based on the study done Kalakattawi et al on risk of obstructive sleep apnea assessment among patients with type 2 diabetes in Taif, Saudi Arabia.[9] The sample size was estimated using the formula for single proportion:

$$n = Z^2 \times p \times (1 - p) / d^2$$

Where: n = required sample size; p = expected prevalence (0.152); d = absolute precision (0.07); Z = 1.96 at 95% confidence level.

The calculated sample size was 102, which was rounded up to 110 participants.

Sampling technique

Convenience sampling was used. All eligible individuals attending the UHTC during the study period were recruited until the required sample size was achieved.

Data collection

Data were collected using a predesigned and pretested questionnaire. Sociodemographic variables and clinical details including duration of diabetes, hypertension status, family history of diabetes, body mass index, and random blood sugar levels were recorded.

OSA risk was assessed using the STOP-Bang questionnaire, which classifies participants into low, intermediate, and high-risk categories.

Socioeconomic status was assessed using the modified Kuppuswamy scale 2024, which classifies families into five categories based on per capita monthly income.

Study tool

The risk of OSA was assessed using the STOP-Bang questionnaire, developed by the Dr. Frances Chung and her colleagues at the University Health Network and the University of Toronto. The STOP-Bang questionnaire was used as a standardized study tool for screening the

risk of obstructive sleep apnea (OSA) among the study participants. It is a simple, validated, and widely accepted screening instrument commonly used in epidemiological and clinical studies. The questionnaire consists of eight components represented by the acronym STOP-Bang. The "STOP" section includes four questions related to snoring, tiredness during daytime, observed apnea, and high blood pressure. The "BANG" section includes four demographic and anthropometric parameters namely body mass index (BMI), age, neck circumference, and gender.

Each positive response in the questionnaire was assigned a score of one, while a negative response is assigned zero. Thus, the total score ranges from 0 to 8. Participants scoring 0-2 were categorized as low risk for OSA, scores of 3-4 were considered intermediate risk, and scores of 5-8 were categorized as high risk for OSA. Higher scores indicate a greater probability of having obstructive sleep apnea.

Data analysis

Data were entered into Microsoft Excel and analysed using Jamovi statistical software (version 2.6.44). Categorical variables were expressed as frequencies and percentages. Descriptive statistics were used to calculate prevalence and chi square test was used to assess the relation between risk of OSA against the recorded variables. A p value <0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee prior to the commencement of the study. Written informed consent was obtained from all participants.

RESULTS

A total of 110 individuals diagnosed with type 2 diabetes mellitus (T2DM) were included in the study. Most participants were above 60 years of age (60.91%), showing that the study population mainly comprised elderly diabetic patients.

Males accounted for 59.10% of the participants, while females constituted 40.90%. The majority were married (92.72%) and belonged to socioeconomic class IV (57.27%), indicating that a large proportion of the study population came from lower socioeconomic strata.

Table 1: Sociodemographic and morbidity profile of the study participants (n=110).

Socio-demographic factors	Numbers (n=110)	Percentage
Age in years		
≤60	43	39.09
>60	67	60.91
Gender		
Male	65	59.10
Female	45	49.90
Marital status		
Married	102	92.72
Windowed/separated/unmarried	08	7.28
Socio-economic Status		
Class I	2	1.81
Class II	5	4.54
Class III	20	18.18
Class IV	63	57.27
Class V	20	18.18
Duration of diabetes		
<7 years	68	61.81
≥7 years	42	38.19
Medication status for diabetes		
On medication	101	91.81
Not on medication	09	8.19
Family history of diabetes		
Present	55	50
Absent	55	50

Table 2: Responses to the various components of the STOP-Bang questionnaire (n=110).

STOP-Bang	Numbers (n=110)	Percentage
Loud snoring		
Yes	52	47.27
no	58	52.73
Tiredness during daytime		
Yes	74	67.27
No	36	32.73
Stoppage of breathing while asleep		
Yes	20	18.18
No	90	81.82
Diagnosed/treated for hypertension		
Yes	74	67.27
No	36	32.73
Body mass index >35 kg/m^2		
Yes	17	15.45
No	93	84.55
Neck circumference >40 cm		
Yes	38	34.54
No	72	65.46
Male gender		
Yes	65	59.10
No	45	40.90

Screening for obstructive sleep apnea (OSA) risk was carried out using the STOP-Bang questionnaire. Based on the obtained scores, 34.54% of participants were categorized as having high risk for OSA, 36.36% had intermediate risk, and 29.09% were classified as low risk. These findings suggest that a considerable proportion of diabetic patients were vulnerable to developing OSA.

Analysis of individual STOP-Bang components showed that excessive daytime tiredness and history of hypertension were the most frequently reported factors, each observed in 67.27% of participants. Loud snoring was present in 47.27% of cases, whereas 18.18% reported witnessed episodes of breathing interruption during sleep. Increased neck circumference (>40 cm) was noted among 34.54% participants, and obesity with body mass index greater than 35 kg/m^2 was identified in 15.45% of the study population.

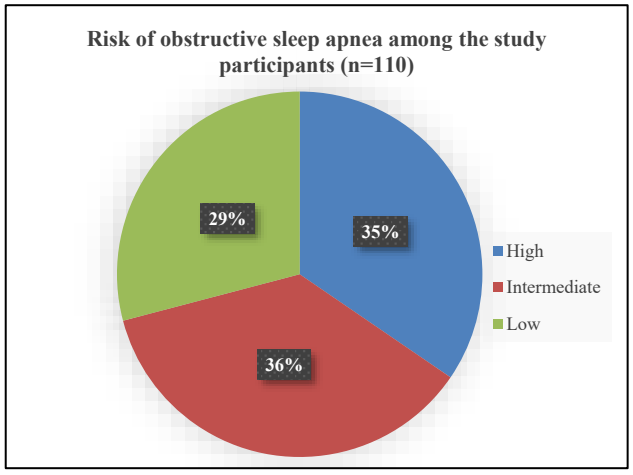

Figure 1: Risk of obstructive sleep apnea among the study participants (n=110).

Table 3: Factors associated with obstructive sleep apnea risk among the study participants.

Study variables	Intermediate + high OSA risk (n=78) (%)	low risk of OSA (n=32) (%)	Total	χ^2	df	P value
Age in years						
≤60	19 (44.18)	24 (55.81)	43	24.43	1	<0.001
>60	59 (88.05)	08 (11.94)	67			
Gender						
Female	28 (62.22)	17 (37.77)	45	2.78	1	0.09
Male	50 (76.92)	15 (23.07)	65			
Duration of T2DM						
<7 years	44 (64.70)	24 (35.29)	68	3.32	1	0.06
≥7 years	34 (80.95)	08 (19.04)	42			
Family history of T2DM						
Present	38 (69.09)	17 (30.90)	55	0.17	1	0.67
Absent	40 (72.72)	15 (27.27)	55			
Hypertension						
Present	67 (90.55)	7 (9.45)	74	42.24	1	<0.0001
Absent	11 (30.56)	25 (69.44)	36			
Random blood sugar						
Controlled	27 (69.24)	12 (30.76)	39	0.08	1	0.77
Uncontrolled	51 (71.84)	20 (28.16)	71			

Further analysis demonstrated a statistically significant association between age above 60 years and increased OSA risk. Participants in the older age group were more likely to fall into the intermediate or high-risk categories compared to younger individuals (χ^2=24.40, p<0.001). Hypertension also showed a strong association with elevated OSA risk (χ^2=42.24, p<0.0001), indicating that hypertensive diabetic patients were more likely to have symptoms suggestive of OSA.

No statistically significant relationship was observed between OSA risk and variables such as gender, duration of diabetes, family history of diabetes, or random blood sugar status. Although higher proportions of intermediate/high OSA risk were observed among males and individuals with longer duration of diabetes, these associations were not statistically meaningful.

Overall, the study findings indicate that intermediate and high risk of OSA is common among individuals with T2DM, especially among elderly and hypertensive patients. The results highlight the need for regular screening for sleep-related disorders in diabetic patients to facilitate early detection and appropriate management.

DISCUSSION

The present cross-sectional study assessed the risk of obstructive sleep apnea (OSA) among patients with type 2 diabetes mellitus (T2DM) attending an urban health training centre of Government Medical College, Nagpur. Screening using the STOP-Bang questionnaire revealed that 34.54% of participants were at high risk and 36.36% were at intermediate risk for OSA, indicating that a substantial proportion of diabetic patients may have undiagnosed sleep-disordered breathing.

The prevalence of high-risk OSA observed in the present study is comparable to that reported by Narayan and Raghuveer, who found that 38.3% of diabetic patients were at high risk for OSA in an urban primary care setting in Mangalore.[2] The similarity in findings may be attributed to the use of the STOP-Bang questionnaire and the inclusion of patients with T2DM in community-based healthcare settings. Both studies highlight the substantial burden of OSA among diabetic patients and emphasize the importance of routine screening in primary care.

In contrast, Saxena et al reported a much higher prevalence of OSA (73.8%) among patients with T2DM in a tertiary care teaching hospital.[8] This difference may be explained by the use of polysomnography, the gold standard diagnostic test for OSA, rather than a screening questionnaire. Furthermore, tertiary care centers often manage patients with more severe disease and multiple comorbidities, which may contribute to the higher prevalence observed in their study.

The prevalence of high-risk OSA in the present study was considerably higher than that reported by Kalakattawi et al, who observed severe OSA risk in only 15.2% of diabetic patients in Saudi Arabia.[9] Differences in ethnicity, lifestyle factors, obesity patterns, healthcare-seeking behaviour, and study settings may account for this variation. Nevertheless, both studies identified advancing age as an important factor associated with increased OSA risk.

Age greater than 60 years was significantly associated with intermediate and high OSA risk in the present study (p<0.001). Similar findings were reported by Narayan and Raghuveer, who found age greater than 50 years to be significantly associated with OSA risk, and by Kalakattawi et al, who demonstrated a positive correlation between advancing age and OSA risk.[2,9] Age-related reductions in upper airway muscle tone, increased airway collapsibility, and alterations in sleep architecture may contribute to the increased prevalence of OSA among older adults.

Hypertension emerged as another significant predictor of OSA risk in the current study (p<0.0001). Participants with hypertension were substantially more likely to belong to the intermediate or high-risk OSA category compared to normotensive individuals. Recurrent nocturnal hypoxia and sympathetic nervous system activation associated with OSA may contribute to the development and persistence of hypertension. The coexistence of diabetes, hypertension, and OSA may further increase cardiovascular morbidity and mortality.

Although male participants showed a higher prevalence of intermediate and high OSA risk than females, the association was not statistically significant (p=0.09). This finding differs from the study by Narayan and Raghuveer, where male gender was significantly associated with OSA risk.[2] It is also contrary to the findings of Yilmam and Karlikaya, who reported female gender as a significant predictor of T2DM among OSA patients.[10] Such variations may be due to differences in study populations, sample size, age distribution, hormonal influences, and obesity profiles across different settings.

The duration of diabetes was not significantly associated with OSA risk in the present study (p=0.06), although a greater proportion of participants with diabetes duration of seven years or more belonged to the intermediate and high-risk categories. Narayan and Raghuveer reported a significant association between longer duration of diabetes and OSA risk, whereas Afzal et al similarly found no significant relationship between duration of diabetes and OSA.[2,11] These inconsistencies may be attributable to differences in study design, sample size, glycemic control, and population characteristics.

Similarly, no significant association was observed between OSA risk and family history of diabetes or random blood sugar status in the present study. Afzal et al also reported that age, gender, duration of disease, and BMI were not significantly associated with OSA among

diabetic patients.[11] These findings suggest that the relationship between diabetes and OSA is multifactorial and may be influenced by several demographic, metabolic, and cardiovascular factors.

Overall, the findings of the present study are consistent with growing evidence demonstrating a high burden of OSA among patients with T2DM. The significant association of advanced age and hypertension with OSA risk underscores the need for targeted screening among high-risk diabetic individuals. Since polysomnography is often unavailable in resource-limited settings, the STOP-Bang questionnaire can serve as a practical, inexpensive, and effective screening tool for early identification and referral of patients at risk of OSA. Early detection and management may improve glycemic control, reduce cardiovascular complications, and enhance the quality of life among diabetic patients.

The current study used the STOP-Bang a scientifically proven and relatively simple tool that can be implemented in a community setting. Collection of detailed socio-demographic and clinical information allowed assessment of various factors associated with OSA risk, including age, hypertension, duration of diabetes, and anthropometric characteristics.

Since the study was cross-sectional in design, causal relationships could not be established. The diagnosis of OSA was based on a screening questionnaire rather than polysomnography, which is considered the gold standard investigation. In addition, the relatively small sample size and single-center setting may limit the generalizability of the findings. Despite these limitations, the study provides important insight into the burden of OSA risk among patients with T2DM in an urban healthcare setting.

CONCLUSION

The present study demonstrated that a considerable proportion of individuals with type 2 diabetes mellitus were at risk of developing obstructive sleep apnea (OSA). Screening with the STOP-Bang questionnaire revealed that more than one-third of the participants were categorized as having a high risk of OSA, while another large proportion had intermediate risk. Advanced age and coexisting hypertension were found to be significantly associated with increased OSA risk. These findings indicate that OSA may remain unrecognized in many diabetic patients attending primary healthcare facilities. Early identification through routine screening can support prompt diagnosis and appropriate management, thereby improve overall diabetic care and reducing associated complications.

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