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Real-World Evidence on Obstructive Sleep Apnea in Type 2 Diabetes and Impact of Continuous Positive Airway Pressure Therapy on Glycemic Control and Other Complications

Pravin Gulab Dandekar[1*], Pranay Anil Jain[2], Shefali Jain[3], Vaishali Bhalavi[1]

[1]Department of Medicine, Chirayu medical college and hospital, Bhopal, India
[2]Department of Cardiology, Ramakrishna CARE hospital, Raipur, India
[3]Department of Medicine, Ramakrishna Care hospital, Raipur, India

ABSTRACT

Introduction: Obstructive Sleep Apnea (OSA) is a chronic respiratory disorder and is recurrent comorbidity in people with type 2 diabetes (T2D) with high prevalence and morbidity. Evidence suggests that the majority of patients with T2D also have OSA. The relationship between OSA and T2D may be bidirectional in nature and untreated OSA in these patients results in poor glycemic control and complications.

Aims: To assess the prevalence and severity of OSA in people with T2D and the impact of continuous positive airway pressure (CPAP) therapy on glycemic control, and other complications.

Materials and Methods: People with T2D suspected of OSA and who underwent polysomnography (PSG) from the department of medicine, Chirayu medical college and hospital, Bhopal were recruited for this study, from September 2021 to April 2022. Thirty people with T2D were included in the study. The participants were followed up for 12 weeks and 24 weeks respectively.

Results: The mean age of the participants was 50.73± 3.60. The majority of the participants 66.7 % were male. 50% of the participants were overweight and 33% were obese. The mean fasting blood glucose at 12 weeks was 154.47 mg/dl and at 24 weeks 112.93 mg/dl, the mean postprandial (PP) blood glucose was 254.47 mg/dl at 12 weeks, and 212.93mg/dl at 24 weeks. The mean HbA1c was 8.9% at 12 weeks and at 24 weeks it was 8.3% (p=0.0301) a statistically significant drop in mean HbA1c was noted.

Conclusion: Treatment of OSA with CPAP reduces HbA1c in a significant number of patients and this also had a positive impact on blood pressure parameters.

Key words: Continuous positive airway pressure, Glycemic control, Obstructive sleep apnea, Type 2 diabetes

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Corresponding author: Pravin Gulab Dandekar

e-mail✉: pravindandekar@gmail.com

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INTRODUCTION

Obstructive sleep apnea (OSA) is a common chronic respiratory disorder characterized by sleep-induced recurrent upper airway collapse, intermittent hypoxia, and sleep fragmentation which results in sympathetic activation, systemic inflammation, and oxidative stress. These effects of OSA are important mediators of metabolic, cardiovascular, and neurocognitive risk. OSA is a common disorder that is highly prevalent in people with Type 2 diabetes (T2D) [1,2] .

A substantial proportion of people with T2D suffer from unrecognized OSA and conversely, T2D is more prevalent among OSA patients compared to those without OSA. Hence, the role of OSA in the management of T2D is important and needs further assessment. The majority of patients with T2D also have OSA, which

is a significant risk factor for cardiovascular disease and mortality. Few prospective studies have concluded that even habitual snoring may independently increase the risk of T2D [3,4]. The prevalence of OSA among obese T2D has recently been estimated at 86% in the United States [5]. Various studies currently available highlight the association between OSA and a higher risk of diabetic kidney disease (DKD) [6], the risk of progression to advanced diabetic retinopathy [7], and a strong association with hypertension [8], the evidence available to date is contradictory on continuous positive airway pressure (CPAP) treatment of OSA and improving glycemic parameters [2].

Hence, this study was conducted to find the prevalence and severity of OSA in people with T2D and the impact of CPAP therpay on glycemic and blood pressure parameters.

MATERIALS AND METHODS

People with T2D suspected of OSA and who underwent polysomnography (PSG) from the department of medicine, Chirayu medical college and hospital, Bhopal were recruited for this study, from September 2021 to April 2022. Thirty people with T2D suspected of OSA were included in the study. The participants were followed up for 12 weeks and 24 weeks respectively.

Exclusion criteria included those with a history of congestive heart failure or low ejection fraction, chronic obstructive pulmonary disease, end-stage renal disease (ESRD), severe chronic liver disease (such as cirrhosis), stroke, and permanent pacemaker placement.

Informed consent was obtained from all the participants and the study was approved by the institutional ethical committee. An overnight laboratory PSG was performed to diagnose the presence and severity of OSA. The FPG, PPG, and HbA1c test was taken at baseline and repeated at 3 and 6 months after CPAP therapy was initiated.

Statistical analysis

Analysis was done using SPSS data sheet version 22. Frequency tables and measures of central tendency (mean) and measures of dispersion (Standard Deviation) were calculated. The student's t-test was applied to compare the mean values of quantitative variables when the distribution was normal; $P \leq 0.05$ was considered statistically significant.

RESULTS

Thirty people with T2D were enrolled in the study. The mean age of the participants was 50.73± 3.60. Twenty (66.7%) study participants were male (Table 1). The majority of the participants (50%) had a body mass index between 25-29.9 kg/m^2 (Table 2).

About 27 (90%) participants had snoring, 26 (88.66%) had nocturia, 25(83.33%) had disturbed sleep and 22 (73.33%) of them witnessed apneas and daytime sleepiness (Table 3). Based on the Apnea-hypopnea index score 5 (16.66%) patients had mild, 11 (36.66%) had moderate, and 14 (46.66%) had severe OSA (Table 4).

The mean fasting blood glucose at 12 weeks was 154.47 mg/dl and at 24 weeks 112.93 mg/dl, The

Table 2: Body mass index.

Body mass index	n	%
<18.5 kg/m²	0	0%
18.5–24.9 kg/m²	5	16.67%
25–29.9 kg/m²	15	50%
≥30 kg/m²	10	33.33%
Total	30	100%

Table 3: Presentation of diabetic patients with obstructive sleep apnea.

		OSA (%)
Snoring	Yes	27 (90)
	No	3
Witnessed apneas	Yes	22 (73.33)
	No	8
Disturbed sleep	Yes	25 (83.33)
	No	5
Daytime sleepiness	Yes	22 (73.33)
	No	8
Nocturia	Yes	26 (86.66)
	No	4

Table 1: Baseline characteristics.

Parameters		Study group(n=30)
		Mean ± SD
Age (years)		50.73 ± 3.60
Gender	Male (%)	20(66.7%)
	Female (%)	10 (33.3%)

Table 4: Severity of OSA based on apnea-hypopnea index.

	Participants (%)
No OSA	1 (3.33)
Mild	4 (13.33)
Moderate	11 (36.66)
Severity	14 (46.66)

Table 5: Various parameters at 12 and 24 weeks in the study participants.

Parameters	12 weeks (Mean±SD)	24 weeks (Mean±SD)	p-value
Fasting blood sugar (mg/dl)	154.47± 40.01	112.93± 26.12	0.0221
PP blood sugar (mg/dl)	254.47± 50.01	212.93± 36.82	0.04101
HbA1c (%)	8.9± 1.01	8.3± 0.92	0.0301
BMI (kg/m2)	28.9± 3.01	28.9± 3.01	0.0475
Systolic blood pressure (mmHg)	141.53± 8.87	133.13± 7.02	0.0071
Diastolic blood pressure (mmHg)	86.13± 8.62	81.10± 8.62	0.0201

mean postprandial (PP) blood glucose was 254.47 mg/dl at 12 weeks, and at 24 weeks the PP blood glucose level was 212.93mg/dl. The mean HbA1c was 8.9% at 12 weeks and at 24 weeks the mean HbA1c level was 8.3% (p=0.0301) a statistically significant drop in mean HbA1c was noted (Table 5).

DISCUSSION

The International Diabetes Federation (IDF) 2019 Atlas estimates that India has a burden of 77 million adults with diabetes and is projected to increase by 74% in 2045. 1 in 6 adults with diabetes in the world comes from India. The prevalence of diabetes has increased significantly in India in the last few decades, and it reached 8.9% in 2019 [9]. With the emergence of India as being diabetes capital of the world, the main focus is to get the people with diabetes to their glycemic goal. There is a high prevalence of OSA among people with T2D and an association between OSA and insulin resistance and glucose intolerance emerge as a greater threat [1,2]. The mechanisms that contribute to this association include intermittent hypoxia, sleep fragmentation, and immune activation [10-12].

A total of 30 people with T2D were included and followed up for 12 weeks and 24 weeks. In our study, the mean age was 50.73 years. This also gives information on the prevalence of metabolic syndrome in the middle age group. There was a 66.7 % male population in our study.

For the BMI parameters, 50% of the participants were overweight (25–29.9 kg/m2) and 33.33% were obese. The main presenting symptoms of were snoring 27 (90%), daytime sleepiness 22 (73.33%), disturbed nocturnal sleep 25 (83.33%), nocturia 26 (86.7%), and witnessed apneas 22 (73.33%).

In the present study, 96.66% of patients with T2D had OSA indicating that OSA is highly prevalent comorbidity in our diabetic population. Regarding the prevalence of OSA in patients with T2D our findings are consistent with, the sleep AHEAD (Action for Health in Diabetes) study, reported OSA prevalence of 86% in diabetics [5]. CPAP a non-pharmacological intervention that is the gold standard treatment of OSA is highly effective in relieving the symptoms of OSA [2].

The mean fasting blood glucose at 12 weeks was 154.47 mg/dl and at 24 weeks 112.93 mg/dl. At the end of the 24 weeks, the study group had a statistically significant drop in mean fasting blood glucose. The mean PP blood glucose was 254.47 mg/dl at 12 weeks, and at 24 weeks the postprandial (PP) blood glucose level was 212.93mg/dl. At the end of the 24 weeks, the study group had a statistically significant drop in mean PP blood glucose. The mean HbA1c was 8.9% at 12 weeks and at 24 weeks the mean HbA1c level was 8.3% a statistically significant drop in mean HbA1c was noted.

The mean blood pressure was above average to some degree at baseline. In our study as per our protocol mean systolic blood pressure at 12 and 24 weeks were recorded. In the study group we observed the systolic blood pressure of 141.53mmHg at 12 weeks and 133.13 mmHg at 24 weeks which was also statically significant (p=0.0071). For the diastolic blood pressure, we observed 86.13mmHg at 12 weeks and 81.13mmHg at 24 weeks which was also statically significant (p=0.0201).

Two studies reported earlier have also demonstrated improvements in nocturnal glucose levels in diabetics after CPAP treatment of their OSA. In contrast, earlier studies [13-15] showed no change in HbA1c levels but reported improvements in insulin sensitivity after 3–4 months of CPAP therapy. The results of studies on the effect of CPAP on glycemic control remain conflicting. However, other favorable effects of CPAP support its use in people with diabetes and OSA, particularly in symptomatic patients. Increasing evidence suggests that people with T2D and severe OSA who are highly adherent to CPAP therapy may have greater glycemic benefits [2].

CONCLUSION

The present study demonstrates that treatment of OSA with CPAP reduces HbA1c in a significant number of patients with T2D. The CPAP therapy has also had a good response in reducing hypertension in these populations. Thus, the role of OSA in the management of T2D is in urgent need of further assessment, and current practice approaches should be modified to include systematic evaluation and treatment of OSA.

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