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Expert Opinion Article

Effect Of Continuous Positive Airway Pressure Therapy On Glycemic Control And Blood Pressure In Patients Having Obstructive Sleep Apnea

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Abstract

Introduction: OSA is a sleep disorder which causes repetitive episodes of complete or partial obstruction of upper airway during sleep which lead to Sleep fragmentation. Alterations in human body caused by untreated OSA likely contribute to development of insulin resistance and type 2 diabetes. Common treatment for obstructive sleep apnea is CPAP. CPAP eliminate OSA that help to breathe during sleep and prevent sleep fragmentation, and activation of the sympathetic nervous system. So, this study was conducted to find whether CPAP therapy in patients having OSA really improve glucose metabolism or not.

Materials and Method: First of all, written consent was taken then Polysomnography for all these subjects were done from 10 pm to 6 am at Sleep Research Centre, MGM Hospital, Kamothe Navi Mumbai. Apnea hypopnea index was obtained from polysomnogram. Subjects having AHI ≥ 5 were included in the study. After polysomnography recording is over, at around 6:30 am, fasting blood sample was collected for fasting blood glucose level and HbA1c investigation of these subjects. Then, for 2 months, subjects were made to use CPAP for 6 hours every night while sleeping. After Two months of CPAP use polysomnography recording and blood investigation of these subjects were done again. Then comparison between all parameters of subjects before CPAP use and after CPAP use were done.

Results: CPAP use increases sleep efficiency%, mean TBI SPo2%, SBP, DBP significantly. It decreases Apnea-Hypopnea Index (AHI) significantly. It also insignificantly decreases FBS, HbA1c%.

Conclusions: CPAP treatment reduces obstructive sleep apnea (OSA), increases oxygen saturation and sleep efficiency and improve glycemic control.

Keywords: Obstructive sleep apnea, Continuous positive airway pressure, Fasting blood sugar level, HbA1c, Apnea-Hypopnea Index

INTRODUCTION

Obstructive sleep apnea (OSA) is a common sleep disorder, present in about 24% of middle-aged males and 9% of middle-aged females [1]. OSA is a sleep disorder which causes repetitive episodes of complete or partial obstruction of upper airway during sleep, which lead to Sleep fragmentation.[2]

If OSA is left untreated for long time then it may cause sympathetic overdrive, cardiovascular and other metabolic alterations [3- 5]. activation of the sympathetic nervous system (SNS), systemic inflammation, oxidative stress and changes in hormonal systems (e.g. modulation of the hypothalamic– pituitary–adrenal (HPA) axis) [6].

Alterations in human body caused by untreated OSA likely contribute to derangements in glucose metabolism with development of insulin resistance and glucose intolerance, possibly promoting the development of type 2 diabetes [7,8].

Common treatment for obstructive sleep apnea is continuous positive airway pressure (CPAP). Constant and steady air pressure is delivered by this device to eliminate OSA that help to breathe during sleep and prevent sleep fragmentation, oxidative stress, intermittent hypoxia, activation of the sympathetic nervous system (SNS), systemic inflammation. It led to improve clinical symptoms of OSA, including excessive daytime sleepiness and snoring may prevent patients from developing diabetes. [9,10,11]

So, this study was conducted to find whether CPAP therapy in patients having OSA really improve glucose metabolism or not.

MATERIALS AND METHODS

This is an interventional study. This study was carried out in the Sleep Research Centre, MGM Hospital, Kamothe Navi Mumbai. 35 subjects participated in this study. Age range of subjects participated in this study was 30 to 70 years. First of all, written consent was taken then Polysomnography for all these subjects were done from 10 pm to 6 am at Sleep Research Centre, MGM Hospital, Kamothe Navi Mumbai. Apnea hypopnea index was obtained from polysomnogram. Subjects having AHI ≥ 5 were included in the study. After polysomnography recording is over, at around 6:30 am, fasting blood sample was collected for fasting blood glucose level and HbA1c investigation of these subjects. Then, for 2 months, subjects were made to use CPAP for 6 hours every night while sleeping. After Two months of CPAP use polysomnography recording and blood investigation of these subjects were done again. Then comparison between all parameters of subjects before CPAP use and after CPAP use were done.

RESULT

SPSS 19.0 software were used to analyse all collected data. Descriptive statistics such as mean, and standard deviation (SD) were used to preset the data. Further comparison of the all parameters of the subjects before CPAP use and after CPAP use was done using paired t test. The recorded values were expressed as Mean±SD. The level of significance was set at 5%. All p–values less than 0.05 were considered to be significant.

Table 1. comparison of mean± standard deviation of all parameters of subjects before CPAP use and after CPAP use.

	Before CPAP	After CPAP	p-value
AHI	38.28 ± 32.24	10.16 ± 5.16	0.000003
sleep efficiency%	81.45± 11.28	92.83± 2.96	0.0000001
mean TBI SPo2%	93.78 ± 3.64	96.07 ± 1.10	0.00006
BMI	31.24 ± 5.99	31.09 ± 6.05	0.1
HbA1c%	5.98 ± 0.54	5.92 ± 0.39	0.092
Fasting blood sugar level (FBS) mg/dl	90.76 ± 13.78	89.63 ± 11.57	0.089
Systolic blood pressure (SBP)	130.74±12.93	125.60 ± 8.73	0.0002
Diastolic blood pressure (DBP)	83.77 ± 7.09	82.40 ± 4.16	0.088

AHI before CPAP use is 38.28 ± 32.24 after CPAP use is 10.16 ± 5.16 and the difference is statistically significant (p-value 0.000003).

Sleep efficiency% before CPAP use is 81.45± 11.28 after CPAP use is 92.83± 2.96 and the difference is statistically significant (p-value 0.0000001).

Mean TBI SPo2% before CPAP use is 93.78 ± 3.64 after CPAP use is 96.07 ± 1.10 and the difference is statistically significant (p-value 0.00006).

BMI before CPAP use is 31.24 ± 5.99 after CPAP use is 31.09 ± 6.05 and the difference is not statistically significant (p-value 0.1).

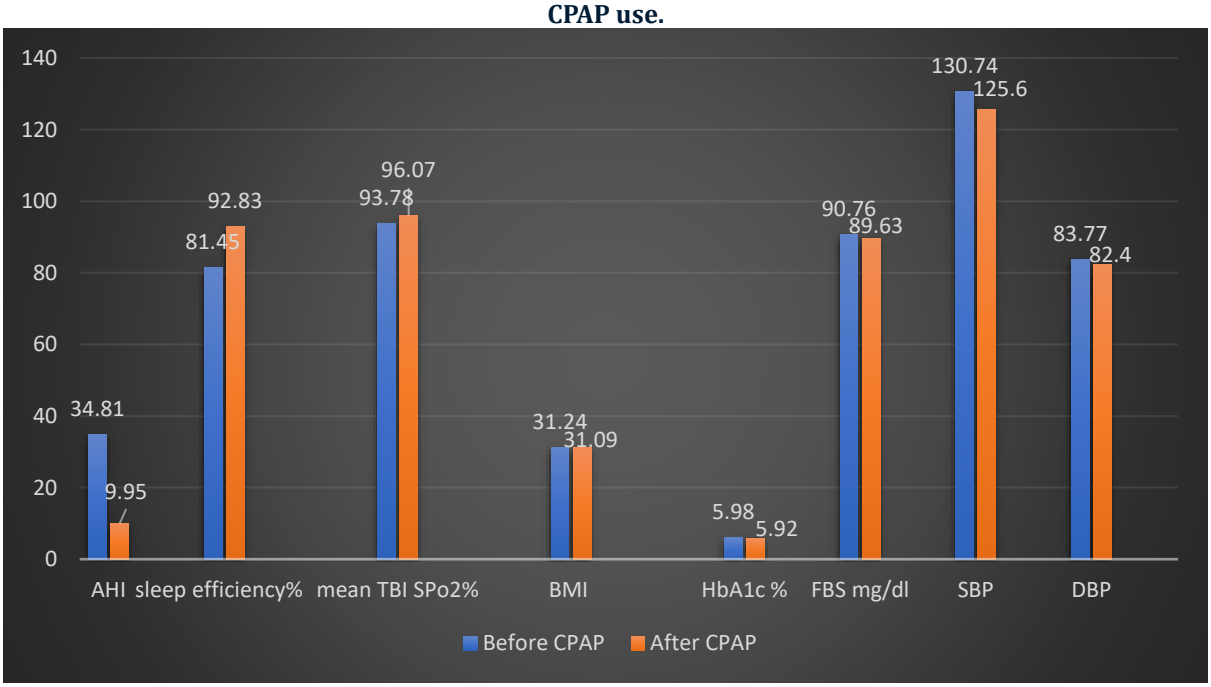
HbA1c before CPAP use is 5.98 ± 0.54 after CPAP use is 5.92 ± 0.39 and the difference is not statistically significant (p-value 0.092).

Fasting blood sugar level (FBS) before CPAP use is 90.76 ± 13.78 mg/dl after CPAP use is 89.63 ± 11.57 mg/dl and the difference is not statistically significant (p-value 0.089).

Systolic blood pressure (SBP)before CPAP use is 130.74±12.93 after CPAP use is 125.60 ± 8.73 and the difference is statistically significant (p-value 0.0002).

Diastolic blood pressure (DBP) before CPAP use is 83.77 ± 7.09 after CPAP use is 82.40 ± 4.16 and the difference is not statistically significant (p-value 0.088).

Figure 1. comparison of mean± standard deviation of all parameters of subjects before CPAP use and after CPAP use.



DISCUSSION

OSA is associated with hyperglycaemia and increased sympathetic activity. However, the effects of CPAP therapy on Glycemic control and sympathetic activity are unclear. The purpose of a study was to investigate whether CPAP therapy in patients having OSA really improve blood glucose level and sympathetic activity.

Dorkova Z et al in 2008 found that CPAP use for ≥ 4 hour/ night by patients (n = 16), causes reduction in systolic BP and diastolic BP (p = 0.001 and p = 0.006, respectively), HOMA-IR (p = 0.031). Patients who used CPAP for < 4 h/night Showed no significant changes in parameters. (12) our study shows similar finding about SBP and DBP.

Coughlin SR et al in 2007 found that CPAP therapy for 6 weeks causes significant reduction in subjective sleepiness, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and fasting blood glucose level. (13) our study shows similar finding except insignificant decrease in fasting blood glucose level.

Lam JC et al in 2010 found that CPAP treatment for a week causes significant decrease in systolic and diastolic blood pressure. (14) Kakkar RK et al in 2007 found that CPAP therapy for OSA causes improvement in sleep quality, daytime sleepiness and quality of life, and also reduce blood pressure [15]. Bratton DJ et al in 2015 found that CPAP therapy in OSA patients were associated with reductions in blood pressure. (16) our study shows similar finding.

Chasens ER et al in 2022 found that CPAP adherence was associated with greater improvements in glycemic control. (17) our study shows insignificant improvements in glycemic control.

Zhao X et al in 2022 found that CPAP therapy reduces fasting blood glucose (FBG), postprandial blood glucose (PBG), and HbA1c levels in the intervention group significantly ($P < 0.05$). (18) our study shows similar but insignificant finding.

Banghøj AM et al in 2020 found that CPAP therapy for 12 weeks does not significantly change in glucose level and HbA1 in patients with type 2 diabetes and OSA. (19) Lam JCM et al in 2017 found that CPAP therapy for 3 months in patients with type 2 DM and moderate to severe OSA, did not decrease HbA1c but but lowered systolic and diastolic blood pressures. (20) our study shows similar finding.

Gharsalli H et al in 2019 found that CPAP therapy for `2 months causes significant decrease in the mean HbA1c level. (21) our study shows similar but insignificant finding.

Yang D et al in 2012 found that CPAP therapy in non-diabetic patients with moderate to severe OSA showed no significant change in body mass index. No change in glycemic control with CPAP therapy found compared with baseline fasting blood glucose. (22) our study shows similar finding.

Yang D et al in 2013 found that CPAP therapy causes significant reduction in plasma ghrelin levels and insulin resistance (IR) but not body fat. (23) in our

study also, BMI did not change significantly after CPAP use.

CONCLUSIONS

CPAP treatment reduces obstructive sleep apnea (OSA) significantly, increases oxygen saturation and sleep efficiency significantly but improve glycemic control insignificantly.

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