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Original article:

Study of determination of effects of continuous positive airway pressure therapy on lipid profile in patients with obstructive sleep apnea

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ABSTRACT

Background: Obstructive sleep apnea (OSA) is a common sleep related breathing disorder with significant adverse health consequences.

Aim: To determine the effect of continuous positive airway pressure therapy on lipid profile in patients of OSA using CPAP.

Methods: The study was hospital based observational study conducted on 50 newly diagnosed obstructive sleep apnea patients by level 1 polysomnography were selected according to inclusion and exclusion criteria by simple random sampling, in the department of Pulmonary, Critical care and Sleep medicine Safdarjung hospital from January 2019 to June 2019.

Results: Out of 50 patients 37 (74%) were males, mean age 51.28±10.98 yr, 78% patients had used CPAP for 4-6 hrs. After 1 month of therapy there was non significant changes in lipid profile. Conclusion: CPAP/B PAP had no effect on lipid profile in OSA in short term and most of these patients require specific therapies for improvement in specific metabolic parameter.

INTRODUCTION

Obstructive sleep apnea (OSA) is a common sleep related breathing disorder with significant adverse health consequences. Obstructive sleep apnea is a highly prevalent but under recognized clinical problem. OSA is characterized by recurrent, functional collapse during sleep of the velopharyngeal and/or oropharyngeal airway, causing substantially reduced or complete cessation of airflow despite ongoing breathing efforts. This leads to intermittent disturbances in gas exchange (e.g., hypercapnia and hypoxemia) and arousal from sleep, usually at the termination of the apnoeic episode, resulting in sleep fragmentation and changes in sympathetic neural activity: all of which are potential mechanisms for derangement in metabolic parameters that occur in OSA.[1]

In an urban setting in northern India, The overall prevalence of Sleep disordered breathing (SDB) of 4.3%.[2] Among patients with a body mass index (calculated as the weight in kilograms divided by height in meters squared) greater than 28, OSA is present in 41%.[3] In middle and older age population with symptoms suggestive of sleep apnea up to 93% of women and 82% of men may have undiagnosed moderate to severe OSA.[4]

Continuous Positive Airway Pressure (CPAP) is the treatment of choice for OSA. It is proven to be efficacious in eliminating obstructive respiratory events during sleep, improving sleep architecture, improving daytime sleepiness and quality of life but the effect of CPAP on the improvement on metabolic parameters such as lipid profile are still unclear. Most studies have shown a decrease in blood pressure with the use of CPAP, with a few exceptions.[5, 6] Overall the effect of CPAP on the lipid profile have disparate results.[7, 8]

The impact of continuous positive airway pressure therapy on various metabolic parameters are not much known, except for reduction in blood pressure and there are conflicting results in various studies and in many of these studies the main pitfall was compliance with CPAP therapy, In the present study, we intend to observe the patients on a routine basis for evaluation of CPAP adherence.

AIM

To determine the effect of continuous positive airway pressure therapy on lipid profile in patients of OSA using CPAP.

MATERIALS AND METHODS

The study was hospital based observational study conducted on 50 newly diagnosed obstructive sleep apnea patients by level 1 polysomnography were selected according to inclusion and exclusion criteria by consecutive sampling, in the department of Pulmonary, Critical care and Sleep medicine Safdarjung hospital from January 2019 to June 2019.

Patients attending the sleep clinic in department of Pulmonary, Critical care and Sleep medicine with history suggestive of excessive daytime sleepiness, snoring, early morning headache, lethargy and fatigue were taken according to inclusion (>18 yr, no history of use of CPAP, AHI>15) and exclusion criteria (any evidence of end organ damage, already diagnosed with diabetes mellitus, haemodynamically unstable, does not give consent) and the following information was collected from all study subjects: age, sex, History of diabetes, hypertension, hypothyroidism, dyslipidemia and smoking.

Epworth Sleepiness Scale: The Epworth Sleepiness Scale, revised in 1997, was used to assess patients with OSA. Patients with scores ≥11 and experiencing sleepiness during work or driving were suspected to be having OSA.[9]

Polysomnography was done using alice 6 LDX (Philips respironics, USA). In polysomnography, many body functions including brain (EEG), eye movements (EOG), muscle activity or skeletal muscle activation (EMG) and heart rhythm (ECG) during sleep were recorded. Diagnostic PSG was done followed by PAP titration on the next day of diagnostic study.

PAP titration was done following AASM guidelines. The recommended minimum starting CPAP is 4 cm H2O for adult patients, and the recommended minimum starting IPAP and EPAP is 8 cm H2O and 4 cm H2O, respectively, for adult patients on BPAP. The recommended maximum CPAP is 20 cm H2O. The recommended minimum IPAP-EPAP differential is 4 cm H2O and the recommended maximum IPAP-EPAP differential is 10 cm H2O. CPAP was increased by at least 1 cm H2O with an interval no shorter than 5 min, with the goal of eliminating obstructive respiratory events. CPAP was increased from any CPAP level if at least 2 obstructive apneas were observed, if at least 3 hypopneas were observed, if at least 5 RERAs were observed. CPAP was increased from any CPAP level if at least 3 min of loud or unambiguous snoring were observed. If the patient were uncomfortable or intolerant of high

pressures on CPAP, the patient were tried on BPAP. If there were continued obstructive respiratory events at 15 cm H2O of CPAP during the titration study, the patient was switched to BPAP.[10]

Waist (WC), hip (HC), and neck circumferences (NC) were measured using measuring tape. NC was measured at the level of the cricothyroid membrane, and Waist circumference (WC) measured midway between the lower rib and the iliac crest on the mid axillary line, and hip circumference at the level of the widest circumference over the great trochanters. Both circumferences were measured on standing subjects at the end of a gentle expiration. Height was measured to the nearest 0.1 cm using a stadiometer. Weight was measured to the nearest 0.1 kg, without shoes and wearing light clothes, using an electronic digital weighing machine

After overnight diagnostic sleep study morning fasting sample for serum Triglyceride, high-density lipoprotein (HDL C) cholesterol, total cholesterol (T CHO) and low-density lipoprotein (LDL C) cholesterol were taken with appropriate technique of blood sampling with precautions and sent within 30 minutes to the Department of Biochemistry VMMC and Safdarjung hospital and measured within 2 hours of sample collection and reports were collected on same day. Blood Triglyceride was measured by enzymatic end point method with TRIG 2 (Seimens Advia) Total cholesterol (T CHO) levels were measured by CHOD-Esterase peroxidase method. The low-density lipoprotein (LDL C) cholesterol level was calculated with the use of the Fried Ewald equation. HDL cholesterol was measured by direct method.

All measurements and blood tests were done on baseline and 1 month of study.

Follow up Assessment: After initial assessment patients were sent home and prescribed therapeutic CPAP. Improvements in parameters were made by reassessment of patients after the end of 1 month for lipid profile and anthropometric indices.

All data collected was entered using Microsoft Excel and statistical analysis was carried out using appropriate statistical software. Results was considered as significant when $p < 0.05$.

OBSERVATION

Out of 50 patients 37 (74%) were males and 13 (26%) were females. Mean height (SD) was 163.36±7.52, mean weight (SD) in kilogram was 87.98±12.82, mean (SD) ESS was 14.78±5.04, (52%) patients had hypertension, hypothyroidism 8(16%) and 24% were smoker. In the study at presentation patients with metabolic syndrome were 33 (66%) which were same at 1 month of CPAP treatment.

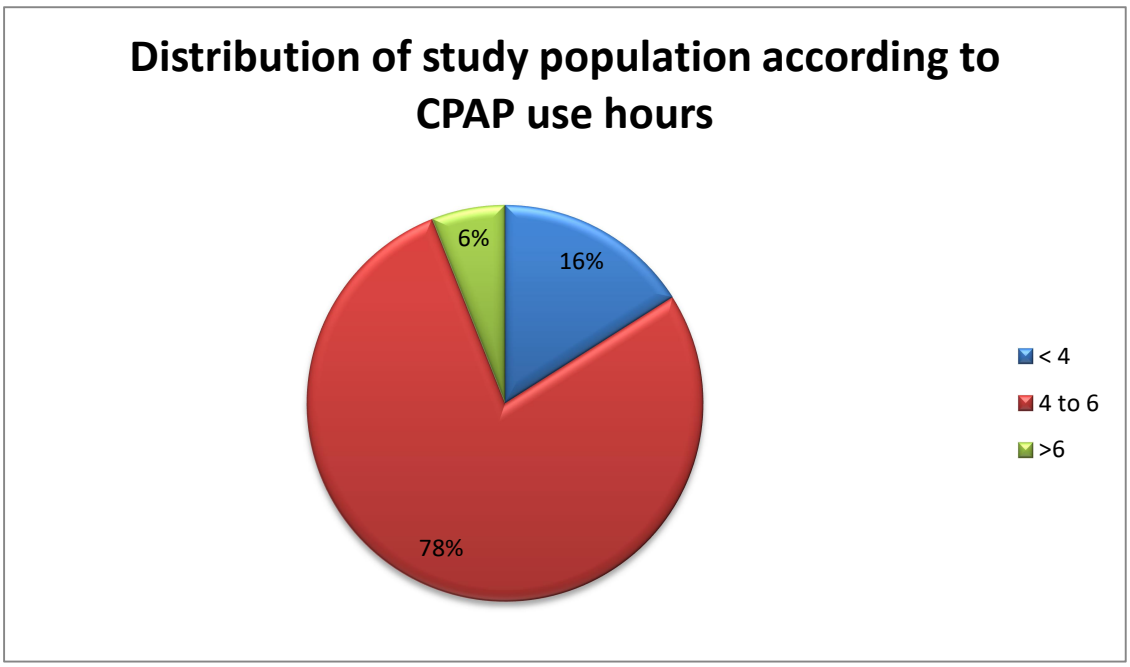
Table 1 Demographic profile of study population

Age	**No**	**%**
26-35	5	10
36-45	11	22
46-55	18	36
56- 65	10	20
66 – 75	6	12
Gender		
Male	37	74

Female	13	26
Hypertension	26	52
Hypothyroidism	8	16
Smoking	12	24
Mean Height	163.36±7.52	
Mean weight	87.98±12.82	
Mean ESS	14.78±5.04	
Baseline AHI	55.74±34.66	

Maximum were in 46-55 yr age group whereas minimum were in 26 – 35 yr age group with mean age 51.28±10.98 yr and age range 26-75 yr.

Fig.1 Distribution of study population according to CPAP use hours



Maximum 78% patients had used CPAP for 4-6 hrs and mean (SD) CPAP use in hours was 5.09±.85.

Table: 2 Anthropometric variables at 1 month of therapy

SN	Characteristic	Baseline	1 month	Statistical significance
1	BMI	33.01±4.73	33.11±4.65	.114
2	Waist circumference	105.80±9.01	105.85±8.91	.389
3	Neck circumference	43.41±1.5	43.49±1.47	.118
4	Hip circumference	108.28+9.30	108.31±9.20	.595

Mean BMI (SD) was 33.11±4.65 which was not statistically significant from baseline (p=.114). Mean Waist circumference (SD) was 105.85±8.91 which was not statistically significant from baseline (p=.389). Mean Neck circumference (SD) was 43.49±1.47 which was not statistically significant from baseline (p=.118). Mean Hip circumference (SD) was 108.31±9.20 which was not statistically significant from baseline (p=.595).

Table: 3 Lipid profile at 1 month of therapy

SN	Characteristic	Baseline	1 month	Statistical significance
1	Total Cholesterol	218.20±73.71	217.40±72.34	.173
2	HDL	40.10±7.81	40.08±7.80	.932
3	LDL	129.46±32.30	129.58±30.74	.871
4	Triglycerides	190.54±69.36	189.84±68.13	.205

Mean Total Cholesterol (SD) was 217.40±72.34 which was not statistically significant from baseline (p=.173). Mean HDL C (SD) was 40.08±7.80 which was not statistically significant from baseline (p=.932). Mean LDL C (SD) was 129.58±30.74 which was not statistically significant from baseline (p=.871). Mean Triglycerides (SD) was 189.84±68.13 which was not statistically significant from baseline (p=.205).

DISCUSSION

Most studies show that patients of OSA have derangement in lipid profile. Many experimental and clinical studies tried to understand the possible underlying interaction between OSA. Also the impact of CPAP in improving lipid profile and insulin resistance is not established. This study was done to study the role of CPAP / BPAP with good adherence on lipid profile in OSA patients.

The underlying sociodemographic profile of the patients was suggestive of a predominant male and middle aged population. This is similar to previous studies in India which showed that 84% of patients were males[11]. The mean (S.D.) age of our study population was 51.28 which is comparable to other studies conducted in OSA patients in India and elsewhere[11]. This can be explained by multiple aetiologies like increased BMI, comorbidities like hypertension, congestive heart failure, dyslipidaemia and generalized decreased neural drive which can lead to a

variety of SDB like OSA, CSA and CSB of which OSA is most common. In our study patients with hypertension (52%), hypothyroidism (16%) and smoking (24%) were also comparable to other studies conducted.[12]

In our study the average duration of uses of CPAP/B PAP was 5.09 hours. Our data on compliance with therapy is much better than many older studies which show average compliance of less than 5 hours and only very few studies achieved more than 5 hours compliance till now.[11]

In our study the average baseline BMI was (33.01) and in our study most of the patients were in obese category 70%. At the end of 1 month of therapy BMI was again measured which showed no improvement ($p = 0.114$). This is comparable to other studies conducted in India.[11] Weight can increase due to increases in anabolism because of increase of slow wave sleep with CPAP and increase in craving for energy dense food. Weight loss can be due to favourable effects on leptin levels, increased physical activity due to less day time somnolence.

In our study baseline neck circumference was 43.41cm which were comparable to other studies for OSA and metabolic syndrome[13] and there was no significant improvement in neck circumference at the end of 1 month. It can be explained by the fact that in our study there was no significant improvement in BMI and weight and in any case CPAP is not supposed to alter neck soft tissue mass or upper airway anatomy exclusively.

In our study waist and hip circumference was comparable to other studies. At the end of 1 month there was no statistically significant improvement seen. It was in accordance to other studies where CPAP did not change waist to hip ratio.[14]

In our study at presentation patients with metabolic syndrome were 33 (66%). Patients with metabolic syndrome were same at 1 month of CPAP treatment. A randomized crossover trial by Coughlin and colleagues[15] of a previously studied population did not show a significant reduction in the prevalence of the metabolic syndrome after 6 weeks of CPAP therapy.

Baseline T CHO was about 218 which was comparable to the study conducted by Robinson and colleagues.[16] Baseline mean HDL C was 40 which was comparable to study done by Comondor and colleagues.[17] Mean baseline LDL C was 129 comparable to studied done by Craig and colleague[18] and mean baseline TG was 190 was comparable to study conducted by Philips and colleague.[19] After 1 month of therapy there was no statistically significant improvement seen in any group. This could be explained by the fact that most studies which showed improvement in dyslipidaemia were more than 8 weeks duration. Simon B and colleague were showed that at least 2 months of therapy were needed for any improvement in lipid profile.[20]

CONCLUSION

Dyslipidaemia and metabolic syndrome are quite common in OSA patients and require timely diagnosis and appropriate treatment to reduce cardiovascular and cerebrovascular morbidity and mortality. CPAP/B PAP had no effect on lipid profile in OSA and most of these patients require specific therapies for improvement in specific metabolic parameter. Large scale, multi centric studies with better CPAP/B PAP adherence and long term follow up is needed to demonstrate clinically significant improvement in various metabolic parameters.

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