Impact of Nocturnal Continuous Positive Airway Pressure on Clinical and Spirometric Lung Functions in Obstructive Sleep Apnoea

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Abstract

Introduction: Nocturnal CPAP therapy is advised as standard treatment for OSA patients. However, in literature there exists a mixed opinion regarding its effectiveness. So to study its effectiveness objectively in Indian population, study was undertaken.

Aims and Objective: To assess compliance to nocturnal CPAP treatment; to assess changes in lung functions in terms of FEV_1 and to assess symptomatic changes in term of STOP BANG score, after 1 year of nocturnal CPAP use.

Study Design: Retrospective and Prospective, Observational

Materials and Methods: A prospective study was carried out in Dept. of pulmonary medicine of Lokamanya Tilak municipal medical college and hospital, Mumbai. 25 patients of OSA (13 Patients of OSA and 12 patients of overlap syndrome) who were previously diagnosed on level 2 polysomnography were included .Their baseline characteristics including symptoms of OSA were obtained from patients record and interview. Lung functions before the start of CPAP therapy were obtained from the records and were followed from January 2015 to November 2016. Lung functions repeated at the end on the study period at the same centre and clinical improvement was assessed through interviewing individual patient and scaling symptoms in terms of STOP BANG score.

Results: Among them, 20 were males with mean age of 55.58 years (±10.5) and 5 were females with mean age of 55.26 years (±9.7). The mean AHI was 25.7(±12.3). Among 25 patients, 19 were using regular overnight CPAP termed as compliant and 6 were not using CPAP termed as non-compliant. Repeated lung function at the end of 1 year showed statistically significant improvement (p value=0.012) in FVC among 15 compliant patients who were using overnight CPAP whereas only 1 non-compliant patient showed improvement in FVC. Similarly repeated FEV_1 at the end of 1 year also showed statistically significant improvement (p value=0.006) among compliant patients of OSA and overlap syndrome. The mean improvement in FEV_1 was 0.146(±0.23) among compliant patients whereas, there was mean decline of 0.246(±0.21) among patient non-compliant to CPAP treatment. All the compliant patients taking overnight CPAP showed improvement in STOP BANG score.

Conclusion: There was significant clinical and lung functions improvement in OSA and Overlap syndrome patients treated with CPAP over a period of 1 year. However present study has a limitation of sample size and short duration. Further study may be necessary in this context with larger sample size and for larger duration.

Introduction

Obstructive sleep apnoea (OSA) is mainly characterised by the narrowing or collapse of nasopharyngeal airway during sleep. It is defined as more than 5 respiratory disturbances (either hypopnoea or apnoea) of sleep combined with symptoms of daytime sleepiness.[1] Since the study by sullivian et al[2] concluded that continuous positive airway pressure (CPAP) is effective treatment of OSA syndrome, there has been constant debate on usefulness and effectiveness of CPAP in treatment of patients with OSA. The effectiveness of CPAP in OSA is mainly based on its effect as a pneumatic splint. Currently CPAP is widely accepted therapy for OSA and for patients with OSA and COPD (overlap syndrome). Study by O'Brien A[3] and Whitman K showed greater decline in lung function among compliant overlap syndrome patient. Whereas, study by di Miguel J et al[4] showed statistically significant improvement in lung function after 6 months of CPAP use in patients of overlap syndrome.

So, to study the effectiveness of nocturnal CPAP in patients of OSA and overlap syndrome among Indian

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population the study was undertaken.

Type of Study

Retrospective and prospective; observational study.

Material and Methods

25 patients of obstructive sleep apnoea (13 patients of OSA and 12 patients of overlap syndrome) who were presented to department of pulmonary medicine of Lokmanya Tilak Municipal medical college and hospital, Sion, Mumbai were included in this study. The study was carried out from January 2015 to November 2016. Written and informed consent was taken from each patient and relative. The diagnosis of OSA was obtained from previous records and were based on level 2 polysomnography (embletta®). The spirometric lung functions, performed in the same institute (By using Ultima™ pulmonary function with RTD) at the time of diagnosis were obtained from the records. According to titration study, CPAP machine and pressure were prescribed to the patients. Those who were using overnight CPAP were termed as compliant and non-users of CPAP were termed as non-compliant. Patients were interviewed regarding symptoms of OSA at the time of presentation in terms of STOP BANG score[5] in terms of snoring; tiredness during daytime; observed apnoeas; blood pressure; BMI> 35 Kg/m2; Age > 50 yrs; Neck circumference >40 cm and gender. STOP BANG score was recorded prior to the beginning of treatment with CPAP. The diagnosis of overlap syndrome was made in patients with FEV_1/FVC ratio less than 0.7 along with symptoms of obstructive sleep apnoea. Data were obtained in terms of smoking index; co-morbidities like diabetes mellitus; hypertension; thyroid status and alcohol consumption status.

Patients were prospectively followed for the period of 1 year from the starting of use of nocturnal CPAP and at the end of study period of 1 year patients were re-evaluated in terms of daily hours of CPAP use and STOP BANG score. Spirometric lung functions were repeated again in accordance with ATS/ERS guideline. Statistical analysis was done with IBM® SPSS® Statistics version 20 software.

Table 1: Baseline characteristics of population

Baseline characteristics	OSA	Overlap syndrome	Total population
No. of patients	13	12	25
Age (Years)	53.5(±9.64)	57.5(±11.07)	55.6(±10.35)
Sex (No.)	M=8 ; F=5	M=12 ; F=0	M=20 ; F=5
Weight at the time of diagnosis (Kg)	88.84(±25.18)	81.5(±14.33)	85.32(±20.62)
BMI at the time of diagnosis (Kg/m²)	36.81(±8.11)	31.32(±5.87)	34.18(±7.52)
Neck circumference (Centimetre)	42.3(±3.85)	42.25(±4.71)	42.28(±4.19)
AHI	28.73(±12.94)	22.5(±11.48)	25.78(±12.34)
STOP BANG score	6.07(±1.25)	6.16(±1.02)	6.12(±1.13)
Pre CPAP use FVC (Litre)	1.83(±0.83)	1.83(±0.43)	1.83(±0.65)
Pre CPAP use FEV_1 (Litre)	1.55(±0.72)	0.91(±0.25)	1.25(±0.63)
Post CPAP use FVC (Litre)	1.74(±0.87)	1.92(±0.42)	1.82(±0.68)
Post CPAP use FEV_1 (Litre)	1.48(±0.84)	0.99(±0.32)	1.25(±0.68)

Results

Total 25 patients were included in the study. Among them, 20 were males with mean age of 55.58 years (±10.5) and 5 were females with mean age of 55.26 years (±9.7). The mean AHI was 25.7(±12.3) and advised overnight CPAP therapy.

Among 25 patients, 13 were of obstructive sleep apnoea and 12 patients had an underlying COPD (Overlap syndrome). Baseline characteristics of study population are mentioned in table-1. Among 25 patients, 19 were using regular overnight CPAP termed as compliant and 6 were not using CPAP termed as non-compliant. Repeated lung function at the end of 1 year showed statistically significant improvement (p value=0.012) in FVC among 15 compliant patients who were using overnight CPAP whereas only 1 non-compliant patient showed improvement in FVC.

Among 19 compliant patients, 15 patients showed mean improvement of 0.257 (±0.14) Litre whereas, 4 patients showed mean decline of 0.187 (±0.27) Litre in FVC. Among 6 non-compliant patients, 1 patient showed improvement of 360 ml whereas 5 patients showed mean decline of 0.32 (±0.1) Litre.

Similarly change in FEV_1 also showed statistically significant improvement (p value=0.006) among compliant patients of OSA and overlap syndrome. The mean improvement in FEV_1 was 0.146 (±0.23) among compliant patients whereas, there was mean decline of 0.246 (±0.21) among patient non-compliant to CPAP treatment.

Though the association was not statistically significant, there was

Table 2: FVC changes among compliant and non-compliant patients

Patients		Improvement in FVC (in litre)	Decline in FVC (in litre)	Overall change in FVC
Compliant patients	No of patients	15	4	19
	Mean FVC	0.257 (±0.14)	0.187 (±0.27)	+0.163 (±0.25)
Non-compliant patients	No of patients	1	5	6
	Mean FVC	0.36	0.32 (±0.1)	-0.206 (±0.29)
Total		16	9	25

Table 3: FEV_1 changes among compliant and non-compliant patients

Patients		Improvement in FEV (in litre)	Decline in FEV_1 (in litre)	Overall change in FEV_1
Compliant patients	Number	16	3	19
	Mean FEV_1	0.215 (±0.17)	0.22 (±0.08)	0.146(±0.23)
Non-compliant patients	Number	1	5	6
	Mean FEV_1	0.08	0.314 (±0.15)	-0.246 (±0.21)
Total		17	8	25

Table 4: Lung function change in OSA and overlap syndrome

	Changes in FVC		Changes in FEV_1	
	Improvement	Decline	Improvement	Decline
Obstructive sleep apnoea	7	6	8	5
Overlap syndrome	9	3	9	3
Total	16	9	17	8

Table 5: STOP BANG Score among compliant and non-compliant patients

Patients	Worsening of STOP BANG score	Improvement of STOP BANG score	Total
Compliant patients	0	19	19
Non-compliant patients	6	0	6
Total	6	19	25

Table 6: Changes in STOP BANG Score among OSA and overlap syndrome patients

Nature of patient	No. of pts.	Improvement in STOP BANG score
Compliant		
OSA	9	3;2.9
Overlap syndrome	8	5;4.7
Noncompliant		
OSA	2	0
Overlap syndrome	4	0

improvement of FVC among 9 patients of overlap syndrome whereas 3 patient showed decline in FVC at the end of 1 year of CPAP treatment. Among 13 patients of OSA, 7 patients showed improvement in FVC whereas 6 patients showed decline in FVC.

There is statistically significant improvement was seen in terms of FEV_1 among OSA patients (p value =0.035) showed improvement among 8 patients and decline among 5 patients.

All the compliant patients taking overnight CPAP showed mean improvement in STOP BANG score.

The mean improvement in compliant OSA patient is by 3 and among compliant overlap syndrome patients by 5. All non-compliant patients reported worsening in terms of STOP BANG score.

Discussion

The present retrospective and prospective observational study on 12 patients of overlap syndrome and 13 patients of OSA showed statistically significant improvement among compliant patient over the period of 1 year. Overall among 19 compliant patients who were using daily nocturnal CPAP for the duration of atleast 1 year showed improvement of 163 ml in FVC. In literature there exists a mixed opinion regarding the impact of nocturnal CPAP on lung function. In Mansfield and Naughton's [6] study on effect of CPAP on COPD with sleep disordered breathing patients the observed statistically significant improvement of 50 ml in FEV_1 among compliant patients. They also showed similar improvement of 140 ml in FVC .Whereas, in the study conducted by Sforza et al [7] showed decline of FEV_1 by 84 ml over the period of 1 year among OSA patients. In the present study the improvement of 163 ml in FVC and 146 ml in FEV_1 over the period of 1 year can be explained by the fact that 9 patients of 19 had underlying COPD (overlap syndrome) and were also compliant to their COPD treatment by means of bronchodilators so both CPAP as well as adequate optimisation of underlying COPD might had contributed to so much improvement in lung function moreover nocturnal CPAP also improves lung function by means of increasing lung volumes and decreasing the resistance in upper airway and intrathoracic airways.[8-10]

The similar improvement was observed among compliant patients in terms of STOP BANG score. In present study all compliant patients showed improvement in score whereas, none of non-compliant showed improvement. The STOP BANG score improved by 5 among patients with overlap syndrome whereas, by 3 among OSA patients. This is in accordance with the literature mentioning CPAP eliminates snoring and apnoea experienced by the patient as well as also improves daytime somnolence by improving quality of nocturnal sleep.[11,12]

Thus, current study showed beneficial effect of overnight CPAP among compliant patients in terms of lung function and clinical symptoms in Indian population. However, the major limitation of this study was lower sample size and limited duration of follow up for the period of one year. So, further studies in future are required to establish firm beneficial effect of nocturnal CPAP in patients of OSA and overlap syndrome.

Abbreviations

OSA: Obstructive sleep apnoea; CPAP: Continuous positive airway pressure; COPD: Chronic obstructive pulmonary disease; FVC: Forced vital capacity; FEV_1: Forced expiratory volume in 1 second

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