

Mixed Method Model to Assess CPAP Adherence Among Patients with Moderate to Severe OSA

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Abstract

Background. Continuous positive airway pressure (CPAP) is an effective therapy for obstructive sleep apnoea (OSA). Despite proven benefits of CPAP in OSA, adherence has been sub-optimal. The present study was designed to evaluate the compliance of CPAP therapy and factors affecting it in patients with moderate to severe OSA.

Methods. Patients diagnosed to have moderate/severe OSA (apnoea-hypopnoea index [AHI] >15) during the period April to December 2015 were evaluated using a pre-defined questionnaire on the number of hours of usage, number of nights per week usage and challenges faced in using CPAP; Epworth Sleepiness Score was recorded. CPAP usage was documented from the downloaded data from their CPAP machines.

Results. Forty patients (mean age 50.6±11.4 years; 29 men) were studied. Their average body mass index (BMI) was 33.2 Kg/m². Of these, 31 had severe OSA (mean AHI 47.8 per hour). The objective usage of CPAP among patients with OSA was less by 89 minutes when compared with perceived duration (p=0.001). Twenty patients had used the device for less than four hours per night. Patients reported social factors, dryness of mouth, not reapplying machine after nocturia, power shut down and reduced motivation as reasons for non-adherence to use CPAP.

Conclusions. Despite the recognised benefits of CPAP, the acceptance and adherence with therapy remains a considerable barrier. Objective assessment of CPAP compliance should be a part of routine follow-up in patients with OSA. [Indian J Chest Dis Allied Sci 2019;61:119-122]

Key words: Obstructive sleep apnoea, CPAP, Compliance, Adherence.

Introduction

Obstructive sleep apnoea (OSA) is a disorder that is portrayed by abnormal collapse of the pharyngeal airway during sleep leading to apnoeic episodes and repetitive arousals from sleep.¹ Apnoea-hypopnoea index (AHI) is the measure of total number of apnoea and hypopnoea events per hour of sleep.² An AHI of five or greater in combination with self-reported hyper-somnolence is indicative of clinically symptomatic sleep apnoea syndrome. Sleep apnoea syndrome is associated with cardiovascular diseases, such as hypertension, angina, arrhythmias, coronary heart disease and congestive heart failure.³ In community-based studies even mild occult sleep apnoea is associated with hypertension, excessive day-time somnolence, morning headaches, mental and cognitive impairments, erectile dysfunction, fibromyalgia and higher rates of automobile and work related accidents.⁴

Continuous positive airway pressure (CPAP) is an effective therapy for OSA.⁵ CPAP use reduces day-time sleepiness, enhances daily function, elevates mood, reduces automobile accidents and decreases blood pressure and

other cardiovascular events.⁶ Despite proven benefits of CPAP in OSA syndrome, and an initial acceptance rate of 70% to 80%,⁷ the adherence has been shown to be sub-optimal.⁸ It is estimated that 29% to 83% of patients are non-adherent to CPAP therapy (CPAP use ≤4 hours of use per night).⁹ In a recent study,¹⁰ CPAP adherence was evaluated to be 30.3% and inability to buy the CPAP device was quoted as the main barrier to adherence. Sparse data is available on the causative factors leading to non-adherence to CPAP. Hence, we designed this study to evaluate the compliance to CPAP therapy and factors affecting CPAP compliance.

Material and Methods

Adult patients above the age of 18 years, diagnosed to have moderate/ severe OSA (AHI >15) from April 2015 to December 2015 were contacted through telephone. The study was initiated after Institutional Ethics Committee approval. Patients who gave history of CPAP use for a duration of a month or more were invited to participate in the study. The subjects were recently diagnosed and were using the CPAP for a duration of 3-10 months. The

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subjects were enquired about the compliance of CPAP therapy, and were invited to visit the sleep clinic. A written informed consent was taken and subjects' identity was coded, ensuring confidentiality and anonymisation of data. During this visit the subjects received a brief explanation of OSA and the use of CPAP regularly, by the sleep physician. Demographic details, like age, gender, body-mass index (BMI) and presence of comorbid conditions were noted. A pre-defined questionnaire which included questions on number of hours of use of CPAP, CPAP used for number of nights per week, the challenges in using CPAP (each parameter was rated on a 5 point Likert scale) and Epworth Sleepiness Score (ESS) was administered. The use of CPAP machine was noted from the downloaded data from their CPAP machines.

Statistical Analysis

Categorical variables were described by frequencies and proportions; continuous variables were compared by "student t" test or Wilcoxon rank sum where appropriate, and for comparing proportions Chi-square or Fisher's exact test was used. Multivariable logistic regression, with dependent variable as number of minutes of CPAP use per night and the independent variables being age, gender, BMI, AHI and co-morbidities, was done to observe the effect of variable factors on CPAP compliance. Analysis was done using statistical software Statistical Package for the Social Sciences (SPSS) (Version 17, Chicago, IL). A two-tailed p value of <0.05 was considered statistically significant.

Results

A total of 121 patients were contacted through telephone. Forty patients had consented to participate in the study. Their mean age was 50.6±11.4 years; there were 29 men (Table 1). Ischaemic heart disease and hypothyroidism were present in three patients each. The mean duration of usage as reported by the patients was 322.5 minutes. On analysing the download data of the CPAP machine, the mean duration of usage was 233 minutes. There was a

Table 1. Patient's characteristics

Characteristics	Result (N=40)
Age (years)	50.6±11.4
Male: Female	29:11
Mean BMI (Kg/m ²)	33.2
Severe OSA	31
Mean AHI (per hour)	47.8
Smokers	14
Alcohol use	10
Diabetes	23
Hypertension	32

Definition of abbreviations: BMI=Body mass index; OSA=Obstructive sleep apnoea; AHI=Apnoea-hypopnoea index

difference of 89 minutes between the perceived duration and the actual usage of CPAP machine among patients studied for OSA (p=0.001, 95% confidence intervals [CI], -96.71 to -37.73). Of the 40 patients studied, 20 had used the device for less than four hours per night and three patients reported using CPAP for four or less number of days per week. Thus, only 17 of the 40 (42.5%) patients studied were compliant with CPAP therapy. Thirteen patients did not reconnect CPAP in the night if there was awakening (for micturition).

Median use of CPAP was 230 minutes in women as compared to 270 minutes in men. Women were 2.16 (95% CI, 0.7-6.62) times more likely to be non-adherent than men. None of the factors, such as age, BMI, AHI and co-morbidities show any significant effect on CPAP compliance in the subjects.

There was no difference in compliance when considering the mask interface (nasal [n=23] *versus* full-face mask [n=17]); rental device (n=5) *versus* own CPAP device (n=35). Manual (n=23) *versus* auto CPAP (n=17) also did not determine the adherence to CPAP in these patients.

The challenges in using CPAP (each parameter was rated on a 5 point Likert scale) are given in table 2.

Table 2. Factors for non-compliance

Factor	Yes	No
Ill-fitting mask	14	26
Leak	14	26
Nasal stuffiness	18	22
Headache	7	33
Noise	7	34
Dryness of mouth	29	11
Gastric distension	8	32
anxiety	3	27
Interruption of power	3	27
Social inhibition	20	20
Skin Changes	1	39

Discussion

Obstructive sleep apnoea is a non-communicable disease with considerable prevalence rate of 13.4%.¹¹ It is well known that CPAP therapy is effective only when the device is applied and there are no long lasting effects. Hence, adherence to CPAP is vital for the treatment to be effective. Adherence to CPAP therapy has been appalling at 50%⁸ to 70%,¹² also considering a 25% drop-out rate in the long term.¹³ A vast difference between subjective adherence (85.1%) and objective adherence (64.5%) has been reported.¹⁴ They have also noted a poor follow-up rate of 38.3%, which might have contributed to the observed adherence levels.

Though India has a huge burden of OSA, and patients diagnosed as OSA are initiated on treatment, there is sparse data on how many patients actually use the CPAP therapy as recommended. *To the best of our knowledge*, this is the first study to explore the subjective and objective assessment of CPAP compliance in India.

In the present study, 42.5% of the patients studied showed adherence to CPAP therapy. Some distinctive factors emerged as obstacles to CPAP adherence. Dryness of mouth, nasal stuffiness, ill-fitting mask and leak from the mask end were cited as common reasons for the non-compliance. Twenty-nine and 18 subjects attributed their non-compliance to dryness of mouth and nasal stuffiness, respectively. Subjects reported CPAP non-compliance when relatives or friends came to visit them, or when they were travelling. Surprisingly, embarrassment to use the CPAP due to social inhibition reported by 50% of the subjects. So far there are no previous reports which have looked into the social aspects of CPAP therapy.

Previous systematic review by Andrade *et al*¹⁵ have concluded lower adherence and higher CPAP abandonment with oro-nasal masks than the nasal masks. On the contrary, our patients did not show a difference in adherence when comparing those using nasal mask *versus* oro-nasal mask. This is probably due to the small number of subjects in the present study.

Headache, excessive noise and gastric distension are the other frequently cited reasons for non-compliance; these have been quoted as causes for non-compliance to a similar extent in previous studies.^{1,2} CPAP usage has been linked to reduction of headaches in 30% of patients.¹⁶ However, seven reported reduced compliance due to headache. Many patients had related headache to the pressure on the face due to the mask interface.

Three subjects each related power shut down and reduced motivation as the main reason for non-adherence. Thus far, power shut down as a reason for non-compliance has not been reported, signifying the unique situation where a sophisticated machine is available as therapy but the power supply to operate the same is sometimes lacking.

Regular CPAP use is known to reduce the mean number of nocturia incidents by 2.3.¹⁷ Not only the frequency of urination but volume of urination is also reduced with CPAP use. In our subjects, though many commenced sleep with CPAP machine, some reported of not reapplying the machine after getting up for urination. In elderly men, concomitant benign prostatic hypertrophy (BPH) should be appropriately considered, investigated and treated as a cause of nocturnal polyuria.

None of our subjects reported claustrophobia as a reason for CPAP non-compliance which was unforeseen, whereas Edmond *et al*¹⁸ have noted claustrophobia in 63% of their subjects. Claustrophobic subjects were twice likely to be non-adherent to CPAP as compared to those without claustrophobia. Targeted interventions after identification

of subjects with claustrophobia tendencies may improve CPAP adherence.^{18,19}

A standardised assessment for insomnia, which is a known factor that impacts adherence, was not performed. The number of subjects in this study was small, hence excludes any risk factor stratification between compliant and non-compliant subjects. Along with this, medications of interest, especially non-benzodiazepine receptor agonist, which can improve adherence were not reported, which are the limitations of this study.

Conclusions

Salient features evident from this study are that minor factors, such as nasal stuffiness, dryness of mouth, travelling/social factors are major hurdles for adherence to CPAP therapy. With advancement in device designs, modes of CPAP delivery and better and comfortable mask interface, CPAP compliance can be improved. Regular counselling about the disease, impact of consistent CPAP use will improve the motivation for CPAP adherence. There is a significant difference in the perceived duration of usage and the actual usage of CPAP among patients with OSA. Objective assessment of CPAP compliance should be a part of routine follow-up in patient with OSA. A roadmap comprising solutions to the commonly faced challenges, such as nasal stuffiness, mask leak should be devised to improve the compliance. *Hitherto* unexplored factors, such as social inhibition and power disruptions have emerged as a cause of non-compliance. Further studies are required to assess the factors affecting CPAP compliance among patients with OSA.

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