

Efficacy of Auto-PAP Titration in Obstructive Sleep Apnea: Single-center Experience

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Abstract

Background: Obstructive sleep apnea (OSA) is a sleep-associated breathing disorder, which left untreated can cause severe morbidities or even mortality. The recommended treatment strategy for moderate-to-severe OSA is continuous positive airway pressure (CPAP). The optimal pressure required for OSA can be measured by either manual CPAP titration or auto-CPAP titration study. **Objective:** To assess the efficacy of auto-PAP titration for OSA patients. **Methodology:** This was a cross-sectional study conducted on Pulmonary Medicine Sleep Lab at Amrita Institute of Medical Sciences, Kochi. Fifty patients who have undergone full-night polysomnography and followed with auto-PAP titration are included in the study. The research was approved by the institutional ethics committee. **Results:** In the study cohort, 50% showed optimal titration, 40% good titration, 10% adequate titration and none in unacceptable category. The results showed that auto-PAP usage has good result in moderate-to-severe OSA. **Conclusion:** Unattended auto-PAP titration seems to be highly effective modality which can be considered as an alternative to attended CPAP titration, thus reducing labor intensiveness and cost.

Keywords: Auto-positive airway pressure, continuous positive airway pressure, OSA

INTRODUCTION

Obstructive sleep apnea (OSA) is characterized by partial or full obstruction of the airway during sleep due to muscle relaxation causing soft-tissue collapse in the upper airway. Continuous positive airway pressure (CPAP) is the recommended treatment for OSA; it acts as a pneumatic splint in the airway and keeps it open.^[1] CPAP level required can be assessed either by manual CPAP titration or auto-titration. In manual titration, an attending clinician monitors the sleep pattern and increases or decreases CPAP level manually. In auto-PAP titration, the machine automatically adjusts for varying pressure requirement of patients. During the course of auto-PAP titration, one attending clinician should monitor the patient and minimize the chances of disconnection. Auto-PAP devices adjust treatment pressure by feedback control according to patterns of sleep and pressure requirement. Flow signals are measured during the treatment.

According to the American Academy of Sleep Medicine (AASM) guidelines, efficacy of CPAP titration is classified as follows: Optimal titration: Reduces Respiratory

Disturbance Index (RDI) <5 for at least a 15 min duration and should include supine rapid eye movement (REM: During this stage, the activity of the brain's neurons is quite similar to that during waking hours) sleep at the auto-titrated pressure that is not continually interrupted by spontaneous arousals or awakening. Good titration: Reduces RDI <10 or by 50% if the baseline RDI <15 and should include supine REM sleep that is not continually interrupted by spontaneous arousals or awakening. Adequate titration: Does not reduce RDI <10 but reduces the RDI by 75% from baseline, or one which the titration grading criteria for optimal or good are met with the exception that supine REM sleep did not occur at the auto-titrated pressure. Unacceptable titration: Titration is one that does not meet any one of the above grades.^[2]

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METHODOLOGY

The present observational study was conducted over a period of 1 year (August 2016–August 2017) at the Pulmonary Medicine Department in Amrita Institute of Medical Science and Research Center, a multispecialty teaching and tertiary care hospital, Kochi, India. The study was approved by the Institutional ethical committee. Consecutive patients aged >18 years, who were diagnosed with moderate (apnea-hypopnea index (AHI) 15-29) to severe OSA (AHI ≥30) with polysomnography (PSG) and who underwent auto-PAP titration were included in the study. Patients with overlapping conditions such as chronic lung disease or who were acutely ill (heart failure), mild OSA, already on noninvasive ventilation, and were not willing to participate from the study were excluded. Auto-PAP level ranged between 4 cmH₂O and 20 cmH₂O. The pressure was automatically titrated by the auto-PAP machine. Philips Respironics Alice PDx and Resmed AirSense 10 auto-CPAP devices were used for the study.

Outcome measures

The primary outcome assessed was the efficacy of auto-PAP titration in moderate-to-severe OSA. Secondly we also assessed association between body mass index (BMI), age distribution, neck circumference, and leak with titration efficacy groups.

RESULTS

Table 1 represents the demographic details of the patients. 50 patients were recruited in the study [Figure 1]. Of these, 45 were males. 73% of the study groups were obese (BMI ≥30). Based on age, the patients were stratified into three groups, of which 58% of the study population with OSA had age between 40 and 59 years, respectively. PSG study showed 28% of study population had moderate OSA and 72% had severe OSA. Table 2 represents the comparison of OSA severity

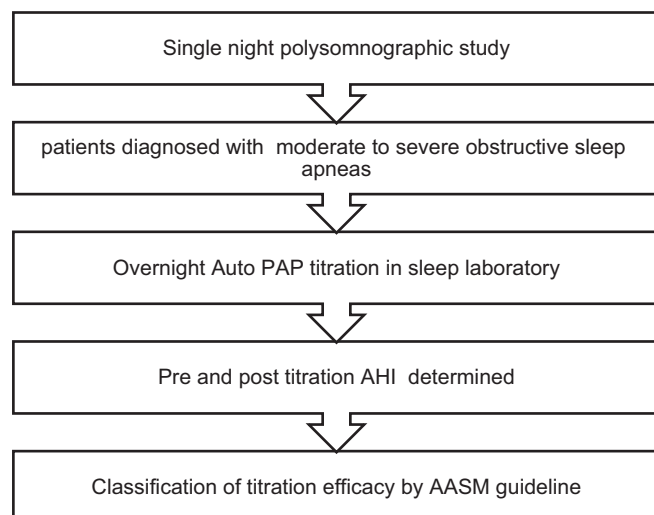


Figure 1: Schematic representation of study design

with other measured indices. The mean respiratory distress index (RDI) was 25.5 vs. 48.8 in moderate and severe OSA group. Higher percentage of both moderate and severe OSA patients had more than 4 Epworth score for daily symptoms. Average snore index in patients with moderate and severe OSA was 214 and 354, respectively. The primary outcome variable (efficacy of CPAP) assessed with AASM guideline showed 25 (50%) patients had optimal titration, 20 had good, and 5 had adequate titration. No one came under the category of unacceptable titration [Table 3]. Secondary assessments such as comparison of titration group versus the age distribution, BMI, neck circumference, and leak were measured and are reported in Tables 4 and 5.

Table 1: Demographic data

Demographics	Category	n (%)
Gender	Females	5 (10)
	Males	45 (90)
BMI	Obese	33 (73)
	Nonobese	17 (37)
Age (years)	18-39	9 (20)
	40-59	26 (58)
	>60	15 (22)
OSA severity (PSG finding)	Moderate	14 (28)
	Severe	36 (72)

BMI: Body mass index, PSG: Polysomnography, OSA: Obstructive sleep apnea

Table 2: Obstructive sleep apnea severity versus other measured data

	OSA severity	
	Moderate	Severe
Snore Index (mean)	214	354.7
Daily symptoms (Epworth scoring), n (%)	<4	3 (8)
	≥4	33 (92)
RDI (mean)	25.5	48.8

OSA: Obstructive sleep apnea, RDI: Respiratory Distress Index

Table 3: Auto-positive airway pressure titration efficacy

Titration efficacy classifications	Number of patients, n (%)
Optimal	25 (50)
Good	20 (40)
Adequate	5 (10)
Unacceptable	0

Table 4: Age distribution versus titration efficacy

Age (years)	Optimal, n (%)	Good, n (%)	Adequate, n (%)
18-39	5 (20)	4 (20)	0
40-59	13 (52)	9 (45)	4 (80)
>60	7 (28)	7 (35)	1 (20)

Table 5: Mean body mass index, neck circumference and leak in titration group

Titration group	BMI (kg/m ²), mean BMI		Neck circumference (inches)	Leak (L/min)
	Obese >30	Nonobese ≤30		
Optimal	36.04	27.40	16.69	3.05
Good	35.85	25.63	16.58	3.63
Adequate	32.85	25.73	15.54	5.54

BMI: Body mass index

DISCUSSION

OSA is a common disease condition with high prevalence in developed and developing countries. Epidemiological studies from USA showed almost 20 percent of adults have at least mild OSA and 7 percent of them have moderate-to-severe OSA with male predominance.^[3] Furthermore, data from Indian home sleep studies showed 7.5% of urban middle age men have OSA. Obesity and aging were the risk factors for OSA. Similar to these studies, the present study also observed the incidence of OSA was higher in males, aged between 40 and 59 years. One of the earliest studies on treating OSA with CPAP was done by Sullivan *et al.* in South Asian population.^[4] In their study, they observed significant difference in AHI with application of CPAP. Following this, the benefits of CPAP in OSA have been well studied and documented to be an effective strategy.^[5-9] Later, auto-PAP titration was introduced and has been studied extensively. Ortho *et al.* conducted a cohort study comparing the constant pressure with automatic pressure and found auto-PAP was as effective as constant CPAP in OSA.^[10] Ficker *et al.* conducted a study on auto-PAP versus constant CPAP and showed that auto-PAP was equally effective as manual CPAP.^[11] Another interesting finding was that the level of CPAP was higher in auto-PAP group compared to the constant CPAP. The primary objective of the present study was to assess the efficacy of auto-PAP. We found that 50% were optimally titrated, 40% showed good titration, 10% titrated adequately, hardly anyone in unacceptable efficacy category.

The secondary objective was to compare the association between BMI, age, and neck circumference and leak statistics with titration efficacy. We observed that the mean BMI, neck circumference, and leak were similar compared to the titration group. Ress *et al.*^[12] and Mayer *et al.*^[13] showed that most of the baseline parameters have significant correlation with titration efficacy.

Major limitation of our study was lack of a comparative cohort, but study findings support the use of auto-PAP titration to reduce AHI. The scarcity of manpower resource is a major limitation of delivering quality care to patients and therefore in resource-limited settings, auto-CPAP titration can be recommended over manual CPAP titration.

CONCLUSION

Unattended auto-PAP titration seems to be a highly effective modality that can be considered as an alternative to attended CPAP titration. Thus reduces labor intensiveness and cost.

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Conflicts of interest

There are no conflicts of interest.

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