Compliance with continuous positive airway pressure (CPAP) therapy in a dedicated sleep clinic population

by

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Abstract:

Obstructive sleep apnea syndrome (OSAS) is characterized by repeated cessations of breathing during sleep. Most patients suffering from OSAS are treated with continuous positive airway pressure (CPAP) as the first line of therapy. Overall, noncompliance to CPAP can range from 29-83%. In this study of 135 patients, we aimed to evaluate the role of sleep clinics in factors improving adherence to CPAP. Initially, patients had a compliance of 72.6%, but after one year or more overall compliance was 85.9%. Remarkably, the most significant difference was seen in the Medicaid population, whose compliance increased by 26.6%. Considering the well-established benefits of CPAP in patients with OSAS, we determined that a close follow up in a dedicated sleep clinic improves overall compliance especially in the Medicaid population. CPAP mask change was the most successful intervention that improved compliance.

Introduction

Obstructive sleep apnea syndrome (OSAS) is characterized by mechanical upper airway obstruction due to repetitive collapses of the upper airway during sleep (1). Several organizations have published clinical practice guidelines for the treatment of OSAS including the American Academy of Sleep Medicine (AASM), the American Thoracic Society (ATS), and the American College of Physicians (ACP). All of these organizations’ guidelines recommend that adult patients diagnosed with OSAS should be offered continuous positive airway pressure (CPAP) as the initial therapy (2, 3, 4). There is ample evidence that positive airway pressure therapy like CPAP reduces the frequency of respiratory events during sleep as well as improves oxygen desaturations, decreases day-time sleepiness, improves hypertension, and increases the quality of life.
and cognitive function of the patient (5, 6). In addition, CPAP is able to prevent or reverse comorbidities such as hypertension, cardiac disease, stroke, or atrial fibrillation (7).

For CPAP treatment to be effective, it must be used regularly (8). It is estimated that 20-40% of patients do not use their CPAP regularly and many others do not use it at all (9, 10). There can be multiple factors contributing to decreased adherence to CPAP which makes treatment highly variable and difficult to predict (11).

Currently, many patients suffering from OSAS are diagnosed and treated by their primary care physician (12). As the implementation of OSAS therapy may be outside the focus of a busy primary care clinic, we hypothesized that a dedicated sleep clinic may have greater experience and resources to treat OSAS, and thus, patients may have increased compliance and better success with CPAP therapy.

**Methods**

This study was given full approval by the Marshall University Institutional Review Board before research began. A retrospective chart review was performed to identify patients with obstructive sleep apnea syndrome using diagnosis code ICD-9 327.23, and isolated to be restricted to patients that visited the Cabell Huntington Hospital Sleep Disorder Center and had at least a one year follow-up visit between January 2015 and July 2015. Clinical data was obtained from the review of the patient charts. Following this, patient charts were reviewed to determine whether records included the parameters we wanted to study which were patient age, sex, BMI, insurance status, Epworth Sleepiness Score (13), AHI, and initial and final compliance data with CPAP.
therapy. Additionally, patients that were still in the process of an intervention to improve their compliance were excluded from the analysis. Based on the procedures of this sleep clinic, the patient’s initial compliance was recorded as being approximately one month after receiving the CPAP Machine. The final compliance was documented from records 1 year or more after receiving the CPAP Machine. Medicare requirements were used to determine whether a patient was compliant (14). Specifically, patients must have used the machine for more than four hours per night, for more than 70% of nights.

Patients were referred to the Cabell Huntington Hospital Sleep Disorder Center by a primary care physician. Most patients who were diagnosed with OSAS on diagnostic baseline study were referred to the Sleep Disorder Clinic for further evaluation and management. Patients went for CPAP titration and a CPAP machine was ordered. The patient was reevaluated in the Sleep Disorder Clinic after 31-90 days, as per Medicare guidelines (14). Compliant patients with successful therapy were seen in follow up in the sleep-clinic between 6 and 12 months later. Less successful therapies were augmented with an intervention after which such patients were followed at 2 month intervals, with the compliance data reviewed during each follow-up visit. In some cases, patients unable to tolerate CPAP were referred for other treatment modalities.

Results

A total of 135 patients were chosen for the study who fit our parameters and had adequate clinical information in their charts. Usage in our study was defined as nights that the machine was actually used (usage must be four hours or greater). Compliance was defined in accordance with Medicare requirements (14): the machine must be used for at least 70% of the nights for at least 4 hours per night to be considered compliant.
Initial use for all patients within the first 31-90 days averaged 76.2% of nights with a 95% confidence interval of 71.4-81.0%. Final usage after one year or longer was 81.7% of nights with a confidence interval of 78.1-85.4%. There was an overall difference of 5.53% between initial and final compliance (p < 0.01).

We found that 98 out of 135 patients were initially compliant according to Medicare guidelines, giving us a compliance rate of 72.6%. 116 out of 135 patients were compliant after one year or more of having received the CPAP Machine, giving us a final compliance rate of 85.9%.

![Percent of Nights Used vs Insurance Type](image)

**Figure 1:** The percentage of nights the CPAP Machine was used on average for each type of insurance, both initial and final. The error bars represent standard error.

Among all the parameters studied, the biggest difference was based on patients’ insurance status. In terms of “total usage”, the Sleep Clinic had the most dramatic effect
on Medicaid patients, where the difference in nights used increased by 11.8%. The Sleep Clinic had a similar effect on Commercial and Medicare patients, with the difference in average nights used +4.4% and +2.6%, respectively (Figure 1). These increases were not statistically significant.

Figure 2: Percent Compliance vs Insurance Type examined. Medicaid has the lowest CPAP compliance, but their final compliance is on par with Commercial and Medicare insurances after one year (or more).

In terms of “compliance”, all insurances had a positive change in compliance, with the greatest difference being in Medicaid patients, with a 26.6% increase in compliance. Commercial insurance patients and Medicare insurance patients had a 12.2% increase and 8.8% increase respectively (Figure 2). Combining the Commercial and Medicare patient populations, and comparing it against the Medicaid population, we found that there was a statistical difference for the initial CPAP compliance between Medicaid patients and Medicare/Commercial patients. Medicaid patients are less likely
to be initially compliant in comparison with patients who have Medicare or Commercial insurances by approximately 19\% \ (p \ <0.008).

The demographics and full results of the compliance data are shown in Table 1 and Table 2 respectively.

<table>
<thead>
<tr>
<th>Patient Demographics</th>
<th>Commercial (n=68)</th>
<th>Medicaid (n=30)</th>
<th>Medicare (n=37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age- years mean (SD)</td>
<td>56.9 (12.1)</td>
<td>44.9 (8.7)</td>
<td>63.5 (10.6)</td>
</tr>
<tr>
<td>BMI mean (SD)</td>
<td>37.6 (6.8)</td>
<td>41.0 (8.7)</td>
<td>38 (9.3)</td>
</tr>
<tr>
<td>% Male (n)</td>
<td>64.1 (43)</td>
<td>53.3 (16)</td>
<td>51.3 (19)</td>
</tr>
<tr>
<td>% Smoker (n)</td>
<td>44.8 (30)</td>
<td>46.7 (14)</td>
<td>59.5 (22)</td>
</tr>
</tbody>
</table>

Table 1: Patient demographics organized by insurance type.

<table>
<thead>
<tr>
<th>Compliance Data</th>
<th>Commercial (n=68)</th>
<th>Medicaid (n=30)</th>
<th>Medicare (n=37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Compliance % (n)</td>
<td>76.4 (52)</td>
<td>56.7 (17)</td>
<td>73.0 (27)</td>
</tr>
<tr>
<td>Final Compliance % (n)</td>
<td>86.8 (59)</td>
<td>83.3 (25)</td>
<td>81.1 (30)</td>
</tr>
</tbody>
</table>

Table 2: Compliance data organized by insurance type.

We also studied the compliance by comparing three groups: mild OSAS (AHI 14 or below), moderate OSAS (AHI 15-30), and severe OSAS (AHI >31) \ (1). We had 63 patients with severe OSAS, 39 patients with moderate OSAS and 33 patients with mild OSAS. We determined that patients with severe OSAS used the CPAP machine slightly more than patients with moderate or low OSAS (this was statistically significant; \ p<0.0356).
Discussion

In order to effectively treat OSAS, a CPAP or BiPAP machine must be worn during sleep. Although the machine may show an optimal therapy during titration in the sleep disorder center, its short-term and long-term acceptability at home has been variable with an overall long-term non-compliance around 29-83% (15).

Factors influencing adherence to CPAP include adherence during the first week of therapy (16), subjective sleepiness (1), and severity of oxygen desaturation (17). Severity of OSAS as indicated by AHI has shown to be a weak predictor of CPAP compliance (18). Other predictors of successful CPAP compliance include patient demographics, disease severity, treatment titration procedures, technological factors, side effects, psychological, and social factors (19, 20). Age, race and socioeconomics are other predictors to CPAP adherence (21). A study by Billings et al. (22) concluded that African Americans and lower socioeconomic residential areas are associated with poor adherence to CPAP. The Medicaid population has been typically associated with low socioeconomic status (23), and our results showed that they had a lesser compliance than patients with better socioeconomic statuses.

Studies have shown variable results of short-term compliance predicting long-term compliance. Budhiraja et al. (24) demonstrated that 86% of their patients who used their machine for greater than 4 hours a night on day 3 were still using their machine at day 30. Another study looked at a 1-4 month interval as being a predictor for long-term usage, and found that only 24% were noted to be adherent to CPAP at one year (25).
Our study is aimed to examine the factors influencing both short (1 month) and long term (> 1 year) CPAP compliance when the patients are followed in a dedicated sleep clinic. The study is not designed to compare CPAP compliance in a dedicated sleep clinic to a primary care physician (PCP) office, but was designed to assess compliance after one year of usage, as other studies indicate that three month usage (or more) indicates long-term compliance (17).

In our study, surprisingly our initial compliance within the first 31-90 days of use was almost 73% which appears to be much higher than that reported in the literature. We attribute this initial success to the CPAP titration procedures and proper mask fit (26). A positive initial experience with CPAP in a facility based CPAP titration is a significant predictor of future CPAP adherence (27, 28). Our technicians strictly follow the American Academy of Sleep Medicine guidelines for CPAP titration (29). It has been shown that the first night successful experience predicts future adherence (26).

A dedicated sleep clinic can help identify side effects. Most of these can be simple to treat if identified early and correctly. Multiple studies have looked at different modalities affecting compliance. Changing mask size or interface may help alleviate many complaints including air leaks, or pressure on the skin (30, 31, 32). In our study, a CPAP mask change was the most successful intervention that improved compliance. Other interventions may include addition of heated humidification to help alleviate nasal stuffiness (33), or adding a chin strap to reduce air leaks or air ingestion (34). More complex interventions including switching patients from fixed CPAP to auto bi-level may also improve compliance but studies have shown inconsistent results (35, 36, 37).
Dedicated sleep clinics also provide a unique opportunity to educate patients on the disease process as well as the proper usage of the CPAP machine. Patient education is recognized as a standard of care in the treatment of sleep apnea patients’ management (38). Our study indicated lower initial compliance in the Medicaid population, who may be less educated on the disease process. In this population, long-term compliance after one year was similar to patients with other insurances. This improvement in compliance may be attributable to patient education during sleep clinic visits.

We also looked at the impact of severity of OSA as indicted by the AHI and overall compliance. In our patient population, the compliance was highest among patients with severe sleep apnea. There were similar findings as reported by other studies (25, 39).

The strengths of our study are that although it is a retrospective study but all patients included in the study had full compliance data, follow up visits, and the interventions performed were fully documented in the patient charts. Secondly, since this is a retrospective study, there is no bias of insurance status in relation to treatment that could be a consideration if the study was conducted prospectively. The insurance companies (including Medicare and Medicaid) assumes long-term compliance if the patient has been compliant in the first 90 days of usage; so for our purposes, one-year compliance would be a good measurement of long-term compliance.

Our study also had weaknesses. First, we don’t have other socioeconomic demographics including the income status, social support or partner involvement that has been shown in some studies to improve adherence (21, 22). Secondly, 107 patients
were excluded from our study because of a lack of CPAP compliance data given to us by the Durable Medical Equipment (DME) companies. Thirdly, our study was focused only on patients in the Huntington, WV area, and hence there could be other factors that might have resulted in the high compliance rate.

**Conclusion:**

In summary, this study demonstrates that dedicated sleep clinics can be an integral part of a multidisciplinary approach towards effective treatment of OSAS as well as improving compliance. Scharf et al. (12) showed that patients treated by a sleep specialist had better awareness of the disease process and their treatment was timelier than those treated by primary care physicians. Primary care physicians should encourage their patients to continue use of the CPAP as well as keep regular follow-up appointments with the dedicated sleep clinics to improve compliance. Our study also showed that the sleep clinic also had the biggest impact in the lower socioeconomic group as indicated by the Medicaid population where the treatment of side-effects as well as education improved their compliance similar to patients in the Commercial and Medicare populations.

**Figure Legend**

**Table 1:** Patient demographics organized by insurance type.

**Table 2:** Compliance data organized by insurance type.

**Figure 1:** The percentage of nights the CPAP Machine was used on average for each type of insurance, both initial and final. The error bars represent standard error.
Figure 2: Commercial and Medicare patients combined into one group, compared against Medicaid patients for percentage of nights the CPAP machine was used. The error bars represent standard error.

References:


   doi:10.5664/jcsm.3074.


Please contact the authors for the complete list of references.