Obstructive Sleep Apnea Severity and PAP Compliance in Atrial Fibrillation Patients

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Abstract

Obstructive Sleep Apnea (OSA) is highly prevalent in patients with atrial fibrillation and successful treatment has been shown to reduce morbidity in this high-risk group. This study evaluates the effect of OSA severity on treatment compliance.

Methods: Electronic medical records were reviewed for sleep study variables (Apnea-hypopnea index - AHI), the prescribed positive airway pressure device, and PAP compliance. The OSA diagnoses were categorized into 3 categories based on the patients’ AHI. An AHI of >5-<15 was considered “Mild”. An AHI of 15-<30 was considered “Moderate”. An AHI of 30 or more was considered “Severe”. At 3 months, compliance was reviewed. PAP usage of 4 or more hours for 70 % or more of the nights was considered compliant. Chi-square test was performed to compare the three OSA groups for compliance.

Results: A total of 222 patients met inclusion criteria and 192 patients had OSA. Mild OSA was observed in 35 patients, moderate OSA in 52 patients and severe OSA in 105 patients. Among patients who were started on therapy, 95% were on CPAP and 10 % were on BIPAP. There was a statistically significant difference in PAP compliance across OSA severity groups (Mild 45% vs Moderate 61 % vs Severe 67%, P-value 0.03).

Conclusion: Severe OSA patients were more compliant with PAP as compared to mild OSA patients; there is a significant upward trend in compliance with increasing OSA severity. As even mild OSA can affect atrial fibrillation outcomes, barriers to treatment compliance in this group need to be evaluated.

INTRODUCTION

Obstructive Sleep Apnea (OSA) is a disorder that involves intermittent upper airway obstruction during sleep resulting in poor sleep quality and nocturnal hypoxemia [1]. This disorder can result in an increased risk of cardiac and metabolic syndrome comorbidity [2]. OSA is one of the leading risk factors for stroke [3]. Along with obesity and diabetes, the prevalence of OSA in America has risen steadily over the last two decades and as much as 55% in certain subgroups such as patients with atrial fibrillation [4]. OSA treatment in patients with atrial fibrillation has been shown to significantly decrease morbidity and mortality underscoring the need for treatment compliance.

Among treatment options for OSA, positive airway pressure (PAP) is the most widely accepted and has been shown to be highly effective [5]. However, the national average for PAP compliance is currently as low as 30-60% in even the most severe cases [6]. A meta-analysis of the current literature regarding adult OSA patients found that there was a significant difference in sleep apnea severity between non-compliant and compliant patients [7]. Thus severity of OSA has been shown to be a factor in compliance among the general sleep apnea patient population. Whether this applies to groups at risk for OSA, such as those with cardiac comorbidity, remains to be seen. This study aims to further explore how OSA severity affects compliance in a cohort of atrial fibrillation patients.

METHODS

An electronic medical record (EMR) search was performed in the local cardiology group database for patients with a diagnosis of both atrial fibrillation and obstructive sleep apnea, identified with ICD-9 diagnosis codes (327.23 and 427.31). We then retrospectively reviewed patients’ medical history regarding the following variables: Polysomnogram results, echocardiogram
results, ECG, body mass index (BMI), hypertension, diabetes, ejection fraction, and the use of PAP therapy. Board certified cardiologists established the diagnosis of atrial fibrillation. All sleep studies were interpreted by the same board certified sleep physician to reduce inter-observer bias.

PAP therapy compliance data at 3 months was reviewed. Compliance was described as PAP device usage for 4 or more hours 70% or more of the nights.

Sleep Studies

Polysomnograms were performed in the sleep laboratory at the Cardiology Sleep Center using a computerized system (Somnomedics). The following standardized parameters were recorded during the study: Electroencephalogram (C3-A2, C4-A1, O1-A2 and O2-A1), right and left electrocorticogram (EOG), submental, tibial and intercostal electromyogram (EMG), electrocardiography (ECG), nasal/oral airflow through nasal pressure sensor, oxygen saturation by pulse oximeter (Nelcor N1000), oximeter pulse waveform, video monitoring using an infrared video camera, and finally rib cage and abdominal volume changes recorded with a computer-assisted respiratory inductance plethysmograph (Somnometrics; Noninvasive Monitoring System Inc, Miami Beach, FL). Obstructive apnea (OA) was defined as the presence of chest/abdominal wall motion in the absence or decrease of airflow by more than 90% of the preceding breath. Obstructive hypopnea (OH) was defined as a 30% reduction in airflow, associated with oxygen desaturation ≥ 4%. All obstructive events ≥ 10 seconds duration were counted. Sleep staging was performed according to the American Academy of Sleep Medicine 2007 criteria. Obstructive Sleep Apnea (OSA) was defined by overnight PSG for this study as an AHI index score of more than 5 events per hour of sleep. Mild OSA was defined as AHI ≥ 15 and <30 per hour of sleep, and Severe OSA as AHI ≥ 30 per hour of sleep.

Data Analyses

Descriptive statistical analyses were performed to calculate the mean and standard deviation for baseline characteristics of all subjects. Comparisons of categorical variables between groups were made using a 3x2 Chi-square test. P-values less than 0.05 were considered to indicate statistical significance.

RESULTS

A total of 192 patients met inclusion criteria. The mean age was 69.9 years with a standard deviation of 10.6 years. The mean BMI was 35.15 with a standard deviation of 8.5 (Table 1). Hypertension was reported in 87% of patients, diabetes was reported in 23% of patients, and heart failure was reported in 8% of patients (Table 2).

Mild OSA was observed in 35 patients, moderate OSA in 52 patients and severe OSA in 105 patients. Among patients who were started on therapy, 95% were on CPAP and 10% were on BIPAP. The average minimum Oxygen saturation in the PAP compliant group was 81% (range 55-92) and in the non-compliant group was 78% (range 68-85).

Table 1: Patient Characteristics.

<table>
<thead>
<tr>
<th>Category</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>69.9</td>
<td>10.6</td>
</tr>
<tr>
<td>BMI</td>
<td>35.15</td>
<td>8.5</td>
</tr>
<tr>
<td>Diabetes</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>87%</td>
<td></td>
</tr>
<tr>
<td>Heart Failure</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>LA dilatation</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>Permanent Atrial Fibrillation</td>
<td>8%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: PAP Compliance across OSA severity.

<table>
<thead>
<tr>
<th>OSA Severity</th>
<th>PAP-Compliant No. Of patients (%)</th>
<th>PAP-Non-Compliant No. Of patients (%)</th>
<th>P-value Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild OSA</td>
<td>16</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Mod OSA</td>
<td>32</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Severe OSA</td>
<td>73</td>
<td>32</td>
<td>0.03</td>
</tr>
</tbody>
</table>

DISCUSSION

Our study has shown that the severity of OSA does have an independent association with compliance rates in sleep apnea patients with co-morbid atrial fibrillation. The compliance rate was approximately 69.5% in patients with severe OSA compared to 61.5% and 45.7% in the moderate and mild condition, respectively. It is important to note that both the moderate and severe compliance rates are far above the national average of 50%, and additionally the overall compliance rate was 67%.

Threshold for PAP compliance is based on data showing PAP to be effective in the majority of the population at 4 hours or more compliance per night [8]. A study of eighty patients diagnosed with OSA found that only 54% were still using the CPAP machine while 15% had abandoned therapy and 31% never even began treatment after initial diagnosis [9]. This rate of compliance is unacceptable and further justifies the widely held belief that PAP compliance is the single most important limiting factor in OSA treatment. As mentioned earlier, the PAP compliance can be as low as 30% in even the most severe cases [6]. While discomfort is an issue, the advent of modern PAP machines has ameliorated the problem. Extant research suggests that the long-term PAP compliance has many independent predictors and the alarmingly low rates are a product of a multi-factorial and complex issue [10].

While our results indicate a clear relationship between severity and compliance, there is considerable debate in the literature regarding the issue. Certain studies have shown no statistically significant relationship between OSA severity and PAP compliance. For example, an overnight study of 135 Pakistani patients diagnosed with sleep apnea from 1998 to 2003 determined that while certain factors such as obesity and improvements in symptoms such as daytime fatigue were independent predictors of compliance, severity itself was not [11]. On the other hand, there is significant evidence supporting our conclusions as well. A study from the American Journal of Therapeutics conducted a meta-analysis of the PubMed and
Cochrane libraries to determine that there was a statistically significantly higher AHI in the group of CPAP compliant patients compared to non-compliant patients. They concluded that the mean difference in AHI between the groups was 5.9, and that patients with Mild OSA are significantly less likely to be compliant [7].

From a clinical perspective, mild OSA can have detrimental effects on the overall health outcomes in patients with atrial fibrillation. Mild sleep apnea defined as 5-15 AHI has been linked to adverse affects including poorer cardiovascular health, decreased metabolic efficiency, and hypertension [12,13]. Additionally, the linear relationship between hypertension and sleep apnea begins at the very mildest of OSA cases; further strengthening the case that mild OSA should be aggressively treated, particularly among individuals with compromised cardiovascular health such as the cohort studied here.

Limitations of this study include the fact that it is a retrospective review of atrial fibrillation patients that were managed at the local sleep center. In that vein, the study could not investigate confounding factors such as education, marital status and insurance status. As such, prospective studies should include analyses of these factors in conjunction with severity.

REFERENCES