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Original Article

Impact of diagnosing and treating obstructive sleep apnea on healthcare utilization

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ABSTRACT

Purpose: Obstructive sleep apnea (OSA) contributes to an increased risk for multiple co-morbidities and decreased quality of life. As a result, OSA patients may have higher usage of healthcare resources which can be mitigated with effective treatment. This study evaluates changes in healthcare utilization (HCU) following the initiation of therapy for OSA.

Methods: We conducted a retrospective study of newly diagnosed OSA patients. To assess total HCU, we incorporated the sum total of outpatient clinic encounters, laboratory tests, and medication prescriptions into a composite HCU score. Healthcare utilization for twelve months prior to positive airway pressure (PAP) was compared with twelve months after initiation of therapy. Reductions in HCU were correlated with PAP adherence.

Results: 650 consecutive patients were included. Mean age, gender, BMI, AHI, and ESS were 47.2 ± 8.8 years, 77.2% (men), 30.7 ± 4.9 kg/m^2, 37.1 ± 30.3, and 13.1 ± 5.1, respectively. Prior to PAP, mean outpatient visits, laboratory studies, medication prescriptions, and HCU composite score were 11.6 ± 10.4, 13.7 ± 11.0, 4.7 ± 3.2, and 29.7 ± 18.6, respectively. Following initiation of treatment, a 32.8% reduction in non-sleep outpatient visits was identified ($p = 0.01$) and a 16.4% decrease in laboratory studies ($p = 0.02$) was observed. There was a 19.9% reduction ($p = 0.002$) in HCU composite score. Those who were adherent with PAP had a 25.7% reduction in HCU composite score versus a 4.9% increase in those who discontinued PAP therapy ($p < 0.001$).

Conclusions: Diagnosing OSA and initiating PAP therapy resulted in a significant decrease in healthcare resource utilization. This reduction was greatest among those with higher baseline healthcare usage and those most adherent with therapy.

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1. Introduction

Obstructive sleep apnea (OSA) is a common medical condition associated with an increased risk for respiratory, cardiovascular, neurocognitive, psychiatric, and gastrointestinal disorders [1,2]. OSA has also been shown to decrease quality of life and increase somatic complaints. Furthermore, OSA patients may demonstrate diminished therapeutic responses for many comorbid disorders [3]. Treatment of several of these conditions, particularly hypertension, headache disorders, gastrointestinal reflux, depression, and diabetes, may not produce a clinical improvement until after the concomitant OSA is identified and adequately treated [4]. Due to the presence of co-morbid conditions and diminished responses to treatment, OSA patients may require additional clinic visits, laboratory evaluations, and medications, which increase healthcare usage and financial costs while failing to successfully manage these comorbid conditions.

Previous studies have demonstrated a significant increase in healthcare utilization (HCU) in patients with OSA as compared to demographic-matched controls prior to diagnosis [5,6]. Likewise, it has been shown that healthcare costs significantly decrease following the diagnosis of OSA and initiation of positive airway pressure (PAP) therapy [7–10]. Although these findings are encouraging and thought-provoking, the aforementioned studies

Abbreviations: OSA, obstructive sleep apnea; PAP, positive airway pressure; HCU, health care utilization; AHI, apnea-hypoxia index.

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are either lacking in size or examined only changes in healthcare financial costs following the diagnosis of OSA.

We hypothesize that diagnosing and treating underlying OSA would lead to better management of comorbid disease states and somatic complaints which, in turn, may lead to an overall reduction in HCU. The primary objective of our study was to examine the impact of diagnosing and treating OSA on the utilization of healthcare within the outpatient setting. Furthermore, we sought to explore the influence of comorbid conditions and adherence with PAP therapy on changes in HCU.

2. Materials and methods

2.1. Study design

We conducted a retrospective study of all adult patients newly diagnosed with OSA and initiated on PAP therapy at our sleep disorders clinic over a six-month period. All patients received their care from a single military academic sleep disorders center. Our population is comprised of Active Duty Service Members, their dependents, and those retired from military service, representing a wide range of patient demographics (age, gender, ethnicity, educational, and socioeconomic backgrounds) which, in general, are representative of the U.S. population and populations cared for at academic civilian institutions. No records were excluded from this analysis. Data were obtained from a closed electronic medical records system. This system is shared by all military medical treatment facilities worldwide, thereby minimizing the possibility of significant data loss. The protocol was approved by our institution's Department of Clinical Investigation (Scientific Review Board, Human Use Committee, and Institutional Review Board; Protocol #404402-1). No external funding was utilized to complete this study.

2.2. Measured variables

For each subject, all medical records were examined for the 12 months preceding and 12 months following the diagnosis of OSA and initiation of PAP therapy. The number of outpatient clinic encounters, unique medication prescriptions, and laboratory tests were documented. Sleep clinic encounters were recorded in order to account for its specific impact on HCU. Age, gender, body mass index (BMI), apnea-hypopnea index (AHI), and Epworth Sleepiness Scale (ESS) were also recorded in each subject.

The presence of numerous comorbid conditions known to have an association with OSA were documented for each individual. Specifically, these included coronary artery disease, diabetes, heart failure, hypertension, hyperlipidemia, chronic headache syndromes, asthma, gastroesophageal reflux, chronic rhinitis, erectile dysfunction, hypothyroidism, atrial fibrillation, depression, and chronic pain syndromes. Appropriate documentation of diagnostic testing and treatment for these associated diseases was verified in each patient.

In all subjects, the diagnosis of OSA was established by an attended, overnight level 1 polysomnogram (PSG) in accordance with the 2005 American Academy of Sleep Medicine (AASM) guidelines. Hypopneas were defined utilizing the 4% desaturation criteria. Patients undergoing either full-night diagnostic polysomnograms followed by PAP titrations or split-night studies were eligible for inclusion. All polysomnographic studies were manually scored and interpreted by board certified sleep physicians in accordance with published guidelines [11]. All patients cared for in our clinic had a comprehensive sleep evaluation by one of our sleep medicine physicians prior to undergoing any polysomnographic studies. All individuals received a telephone follow-up during the first two weeks of treatment to ensure proper mask fit and to identify any potential barriers to PAP adherence. All patients had access to a 24 h support line for problems arising from PAP therapy. Additionally, all patients were automatically scheduled to undergo a clinical evaluation after the first month of therapy to optimize care. All patients received the same model of PAP (Phillips Respironics, Murrysville, PA).

Objective measures of PAP use were recorded for each subject at all sleep clinic follow-up appointments during the observation period using downloadable compliance monitoring. Specifically, we recorded the percentage of nights PAP was used, the mean hours of PAP use per night for all nights and the mean hours of PAP use per night during nights used. Those patients who did not follow-up at their sleep clinic appointment were assumed to have discontinued therapy and considered to have no PAP usage.

2.3. End points

We compared markers for HCU in the 12 months prior to the diagnosis of OSA and initiation of therapy with PAP with the 12 months after initiation of treatment. To assess total healthcare allocation, we incorporated the sum total of all outpatient clinic encounters, laboratory tests, and unique medication prescriptions into a composite healthcare utilization (HCU) score. Absolute changes and the percent change from baseline for each variable and in the composite HCU score were calculated. Our primary end point was the difference in overall HCU within the outpatient setting between the year prior to and following the diagnosis of OSA and initiation of PAP therapy.

2.4. Statistical analysis

All data are presented as the mean ± one standard deviation. Comparisons between categorical variables were performed using Chi-square or Fisher's exact tests as appropriate. For continuous variables, differences between means were assessed using two-sample *t*-tests. For analysis of disease severity, our cohort was divided into quartiles based upon AHI and the lowest and highest quartiles were compared. PAP adherence was monitored and correlated with HCU to determine its effect. Adherence to PAP was defined as greater than 4 h of use for greater than 70% of nights and subjects were classified as either adherent or non-adherent with therapy. Subjects who failed to follow-up in the 12 months following initiation of PAP therapy were assumed to have discontinued treatment and were included within the non-adherent group for statistical analysis. Data were analyzed using PASW 17.0 (SPSS Inc, Chicago, IL).

3. Results

We included 650 consecutive patients in this analysis. All patients were verified to have outcome data for the 12 months prior to and following the diagnosis of OSA and the initiation of PAP therapy. The majority of the cohort (77.2%) was men, with a mean age of 47.2 ± 8.8 years and a mean BMI of 30.7 ± 4.9 kg/m^2. Most subjects had moderate to severe OSA, with a mean AHI of 37.1 ± 30.3. The mean ESS was 13.1 ± 5.1 among the cohort (Table 1). Most patients had comorbid diseases of interest. On average, subjects had 2.7 ± 1.8 conditions of interest documented for this analysis (Table 2). The most common conditions were hyperlipidemia (53.6%), hypertension (50.1%), allergic rhinitis (46.6%), gastroesophageal reflux (39.1%), chronic headache syndromes (30.1%), erectile dysfunction (29.4% of men), and depression (20.3%). Within our cohort, age, gender, or the presence of individual specific comorbidities did not influence overall baseline HCU.