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Research Article

Patient versus Domestic Partner Epworth Sleepiness Scale and Polysomnography Results

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ABSTRACT

Obstructive Sleep Apnea (OSA) is a disorder that affects 2% to 4% of the adult population. Excessive daytime sleepiness is considered a cardinal manifestation of OSA. The Epworth Sleepiness Scale (ESS) is a commonly used instrument to assess subjective daytime sleepiness. It has been found that patients with higher ESS scores should be suspected of having obstructive sleep apnea. It was hypothesized that the results of the Epworth Sleepiness Scale completed by a domestic partner would be at least or possibly more accurate in predicting which patients truly have underlying obstructive sleep apnea. This study found that the results of patient self-reported ESS were well correlated with their domestic partners assessment. In addition, ESS scores were found to be correlated with several key PSG measures of OSA, including measures of disease severity. The results of the current study provide support for use of both a patient's and domestic proxy's Epworth Sleepiness Scale in the evaluation of suspected obstructive sleep apnea.

Keywords: Epworth; Sleepiness scale; Obstructive sleep apnea

INTRODUCTION

Obstructive Sleep Apnea (OSA) is a disorder that affects 2% to 4% of the adult population. It is even more prevalent in the elderly population, affecting up to 20% of those individuals greater than 60 years of age. OSA remains an underdiagnosed condition, in part, due to a variable clinical presentation. Obstructive sleep apnea is caused by narrowing of the upper airways during sleep resulting in apnea or hypopnea. Apnea is defined as a >90% decrement in airflow through the upper airways for ten seconds or more while hypopnea is usually defined as a >30% decrease in airflow for ten seconds or more with an associated 4% O_2 desaturation or Electroencephalography (EEG) arousal. The severity of sleep apnea can be quantified as the Respiratory Disturbance Index (RDI), the sum of the number of apneas, hypopneas, and Respiratory Effort Related Arousal (RERA) events per hour of sleep and the Apnea Hypopnea Index (AHI), the sum of the number of apneas and hypopneas per hour of sleep. The RDI is an objective, sensitive and specific measure of OSA severity. Less than five respiratory events per hour is considered within the normal range for adults. Mild, moderate, and severe sleep apnea are defined as an RDI of 5 ≤ 15, 15 ≤ 30 and >30, respectively. Obstructive sleep apnea is often associated with both oxyhemoglobin desaturations and frequent arousals resulting in disruption of normal sleep architecture. These abnormalities during sleep lead to poor sleep continuity and excessive daytime somnolence [1]. Nocturnal hypoxemia has been shown to be a significant determinant of excessive daytime sleepiness on patients with OSA [2]. Excessive daytime sleepiness is considered a cardinal manifestation of OSA [3-5]. In addition, sleep apnea has been associated with many medical conditions including hypertension, neurocognitive difficulties including impaired memory and concentration, increased risk of myocardial infarction, cerebrovascular accident, nocturnal cardiac arrhythmias, angina as well as an increased risk of motor vehicle accidents, making it both a significant medical and societal problem.

The standard for diagnosing obstructive sleep apnea is full night attended Polysomnography (PSG). Polysomnography is performed by having the patient sleep in a laboratory while measuring multiple physiologic parameters. The parameters

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measured include eye movements Electrooculogram (EOG), Electroencephalography (EEG), nasal and oral airflow, Electrocardiography (ECG), Electromyography (EMG), chest wall and abdominal movements, Oxygen Saturation (SpO_2) and sometimes End-Tidal Carbon Dioxide ($ETCO_2$). Using these measurements, obstructive events can be observed and quantified. Diagnostic polysomnography is both expensive and time consuming. Although Home Sleep Testing (HST) has been introduced as an alternative to in-lab polysomnography, it has a well-known tendency to underestimate the severity of OSA since it does not monitor EEG activity and cannot differentiate between sleep and wakefulness and cannot detect respiratory related arousals.

Currently, there are a limited number of sleep laboratories in the United States of America. Since there is a backlog of patients awaiting polysomnography due to limited resources at most medical centres, any screening instrument that may help select patients at high risk for obstructive sleep apnea may be beneficial in helping to prioritize patients for testing. The Epworth Sleepiness Scale (ESS) is the most commonly used instrument to assess subjective daytime sleepiness or propensity for sleep in adults [6,7]. First introduced in 1991, the Epworth Sleepiness Scale is a simple, self-administered questionnaire in which the responder quantifies the likelihood of falling asleep in eight different situations: Sitting and reading, watching television, sitting inactive in a public place (e.g., a theater or a meeting), as a passenger in a car for an hour without a break, lying down to rest in the afternoon when circumstances permit, sitting and talking to someone, sitting quietly after lunch without alcohol, and in a car while stopped for a few minutes in traffic. For each situation, the patient assigns a score of 0-3, where 0=would never doze, 1=slight chance of dozing, 2=moderate chance of dozing, and 3=high chance of dozing 18. The ESS was designed to measure a wide range of activities, some of which are more soporific than others. Perhaps, not surprisingly "lying down in the afternoon" was found to be the most soporific of the survey items, whereas "sitting and talking with someone" and "in a car, while stopped for a few minutes" was the least likely to induce sleep. Previous studies have shown that the ESS was found to be a simple and reliable method of measuring daytime sleepiness in adults [8]. In fact, it was determined to be the most discriminating test for evaluating daytime sleepiness when compared to other methods [9]. An ESS score of 0-10 is indicative of normal daytime sleepiness, 11-12 is considered mild excessive daytime sleepiness, 13-15 moderate, and 16-24 severe excessive daytime sleepiness. It has been found that patients with ESS scores of 10 or greater should be suspected of having obstructive sleep apnea [10]. In his original study, Johns reported a mean ESS score of 6 in normal healthy controls versus 12 in patients with OSA [6]. Because of this, the ESS has frequently been used to help select a subset of patients with a history of excessive daytime somnolence to undergo formal polysomnography for definitive diagnosis. Previous reports have shown a variable relationship between the results of this screening questionnaire and the severity of OSA [11-14]. Some studies have shown a high number of false negative results [15-19]. In one report, the sensitivity and specificity ranges of the ESS to detect OSA using a cut-off of 5 respiratory events per hour was found to be 0.27-0.72 and 0.5-0.76, respectively [20].

The concept that a domestic partner may be able to assess a patient's sleepiness more accurately has received limited evaluation. It has been previously documented that patients and their domestic partner assess sleepiness differently. In a study performed by Garcia, et al. domestic partners were found to assess the patient's sleepiness as statistically more severe than the subject [21].There has yet to be a study determining whether the ESS completed domestic partners is equally or more predictive of obstructive sleep apnea than the response of patients themselves. The rationale for a domestic partner to assess sleepiness more accurately, and possible be more predictive of the presence of sleep apnea, is the known effect of obstructive sleep apnea on cognitive and memory which may impact the results of the self-reported ESS questionnaire. The purpose of this study is to have patients already referred for a sleep study and their domestic partners complete the ESS. The results of the Epworth Sleepiness Scales will then be compared to each other as well as to the results of diagnostic polysomnography. It is hypothesized that the domestic partner's response to the Epworth Sleepiness Scale will be at least as or possibly even more accurate in predicting which patients truly have underlying obstructive sleep apnea.

MATERIALS AND METHODS

Over a period of three months, all patients entering a university-based sleep centre were assessed using the Epworth Sleepiness Scale. In addition, household partners accompanying the patient to their visit were also asked to independently complete the same questionnaire during the appointment. Household partners of patients who came to their appointment alone were interviewed by telephone at a later time. Exclusion criteria included subjects that had no domestic partner, domestic partners of the patient unavailable to complete the ESS questionnaire and any subject who had a domestic partner for less than one year. Additional exclusion criteria included any patient whose PSG was performed greater than three months following survey completion. Two groups of respondents were defined: (1) Patient-only ESS (PtESS) and (2) Patient-Partner Pair (PtESS-PnrESS). Polysomnogram measures were defined using Medicare criteria for apnea (>90% decrease in flow >10 seconds), hypopnea (>30% in flow>10 seconds with ≥ 4% O_2 desaturation, and RERA (<30% decrease in flow >10 seconds with associated EEG arousal). The Student's T test was used to compare the mean score for the PtESS and PnrESS. In addition, Spearman correlation was used to compare PSG results between groups (1) PtESS and (2) PtESS with PnrESS. Specific PSG parameters evaluated include the RDI, AHI, SpO_2 minimum, % of time with SpO_2<90%, $ETCO_2$ maximum, sleep efficiency and wake/arousal index.

RESULTS

Questionnaires were collected from 171 patients. Fifteen percent of patients had a household partner who accompanied them to their appointment, sixty seven percent of patients had a household partner but came alone to their appointment, and

eighteen percent lived alone. Of the 171 patients surveyed, 37 patients and partners satisfied the patient-partner criteria while 88 patients satisfied the patient only criteria. PtESS was correlated with RDI (+0.303, p=0.0045), AHI (+0.323, p=0.0024), and O_2 minimum (-0.313, p=0.003). PtESS was not correlated with sleep efficiency %, wake/arousal index, % time with SaO_2<90% or $ETCO_2$ maximum. PtESS was correlated to PnrESS (+0.371, p=0.0237). The mean PtESS (12.5, SD: 6.28) and mean PnrESS (9.283, SD: 5.414) were not found to be statistically different by student's T test.

DISCUSSION

In this patient population, the patients ESS was found to be correlated with several key PSG measures of OSA, including measures of disease severity and SpO_2 nadir. Since patient ESS scores were found to be correlated with their domestic partners ESS scores, both PtESS and PnrESS may be useful in prioritizing patients to undergo PSG. As there is currently a backlog of patients awaiting polysomnography due to limited resources at most medical centers, a screening instrument such as the ESS may help select patients at high risk for obstructive sleep apnea.

Measuring and identifying excessive daytime sleepiness appears to be useful in predicting the presence and severity of OSA. It has also been shown to have prognostic implications for patients with OSA. In the large prospective cohort Sleep Heart Health study, patients with OSA and severe excessive sleepiness were found to have an increased risk of cardiovascular disease, including a threefold increase in heart failure versus patients with lesser degree of sleepiness [22]. Similarly, the presence of excessive daytime sleepiness in patients diagnosed with OSA may also impact the effect of treatment as evidenced by a greater reduction in diastolic blood pressure following initiation of Positive Airway Pressure (PAP) in this subset of patients [22]. The results of the current study provide support for the use of both a patient's and domestic proxy's Epworth Sleepiness Scale in the evaluation of suspected obstructive sleep apnea and may also have therapeutic implications.

CONCLUSION

Limitations of this study include that the study population was composed exclusively of patients seeking care at large academic centre. As such, the results of this study may not be applicable to those patients seeking care at smaller community medical centres. Another limitation of this study is the inherent subjective nature of the Epworth Sleepiness Scale itself. However, the accuracy of the self-reported ESS is bolstered by the current study's findings which demonstrated a good correlation between outside observers, the domestic partners, and patients own assessment of their degree of sleepiness. Another limitation is the relatively sample size in this study. It is possible that if a larger patient population had been studied, other PSG parameters associated with ESS scores may have been identified as significant. Finally, other factors beyond AHI which may contribute to daytime sleepiness and therefore affect the ESS score, including typical sleep duration, medication use, and other sleep disorders, were not evaluated in this study.

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