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Original Contribution

Prediction of obstructive sleep apnea using visual photographic analysis☆,☆☆

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Abstract

Study Objectives: Obstructive sleep apnea (OSA) has been historically underdiagnosed and may be associated with grave perioperative complications. The ASA and American Academy of Sleep Medicine recommend OSA screening prior to surgery; however, only a minority of patients are screened. The objective of this study was to determine the proficiency of anesthesiologists, otolaryngologists, and internists at predicting the presence of OSA by visual photographic analysis without the use of a computer program to assist, and determine if prediction accuracy varies by provider type.

Design: Prospective case series.

Setting: Tertiary care hospital–based academic center.

Patients: Fifty-six consecutive patients presenting to the sleep laboratory undergoing polysomnography had frontal and lateral photographs of the face and torso taken.

Interventions: Not applicable.

Measurements: Polysomnography outcomes and physician ratings. An obstructive apnea hypopnea index (oAHI) ≥ 15 was considered "positive." Twenty anesthesiologists, 10 otolaryngologists, and 11 internists viewed patient photographs and scored them as OSA "positive" or "negative" before and after being informed of patient comorbidities.

Main Results: Nineteen patients had an oAHI <15, 18 were ≥ 15 but <30, and 19 were ≥ 30. The mean oAHI was 28.7 ± 26.7 events/h (range, 0-125.7), and the mean body mass index was 34.1 ± 9.7 kg/m^2 (range, 17.4-63.7). Overall, providers predicted the correct answer with 61.8% accuracy without knowledge of comorbidities and 62.6% with knowledge ($P < .0001$). There was no difference between

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provider groups (P = .307). Prediction accuracy was unrelated to patient age (P = .067), gender (P = .306), or race (P = .087), but was related to body mass index (P = .0002).

Conclusion: The ability to predict OSA based on visual inspection of frontal and lateral photographs is marginally superior to chance and did not differ by provider type. Knowledge of comorbidities did not improve prediction accuracy.

1. Introduction

Obstructive sleep apnea (OSA) is a common sleep disorder characterized by partial or complete airway obstruction which occurs when the upper airway collapses during sleep, and can lead to episodic desaturation, hypercarbia, and cardiovascular disturbances [1]. Multiple comorbidities are associated with OSA including hypertension, heart failure, arrhythmias, myocardial infarction, cerebrovascular disease, metabolic syndrome, obesity, and gastroesophageal reflux [2–6]. Although the incidence of OSA in the general population is estimated at 2% to 4%, up to 80% to 90% of people with the disorder may remain undiagnosed [7,8]. A diagnosis of OSA has been associated with increased postoperative complications and is thought to be an independent risk factor for increased morbidity and mortality [9–12].

An overnight, in laboratory, polysomnogram (PSG) is the gold standard used to diagnose the presence and severity of OSA and the obstructive apnea hypopnea index (oAHI) is the primary indicator for OSA severity [13]. However, PSGs are expensive and time-consuming, and can be somewhat uncomfortable. Moreover, current standard of care does not require clinicians to acquire a screening PSG prior to ambulatory surgery.

The American Society of Anesthesiologists (ASA) [1] recommends routine screening for OSA prior to surgery; however, a 2010 study found that only 20% of anesthesiologists included OSA assessment questions in their preoperative interview [14]. The infrequency of screening may be partially explained by the study from Stierer et al [15] which showed that although undiagnosed OSA is relatively common in ambulatory surgery patients, and these patients require increased anesthetic management due to more frequent perioperative events, unplanned hospital admissions are not commonly required for these patients. Although there are several questionnaires that have been developed as screening tools, they have moderately low specificity and are frequently not used in the perioperative period. In order to identify which patients are most likely to have OSA, many seasoned health care providers, especially anesthesiologists, otolaryngologists, and internal medicine specialists, rely upon a nonverbal, informal, and frequently undocumented assessment including visual analysis to diagnose a propensity for OSA during preoperative patient examinations. Identification of likely OSA is increasingly important, as the risk for postoperative respiratory complications has led many surgical centers to recommend prolonged observation or admission after surgery for patients with OSA.

There are several physical characteristics associated with OSA including obesity, increased neck circumference, limited neck extension, a high modified Mallampati score, enlarged tongue or tonsils, decreased thyromental distance, and male gender. In 2008 and 2009, Lee et al [16,17] found craniofacial photographic analysis of facial anatomical measurements useful when predicting the presence of OSA. Although computer programs have been used to assist in identifying anatomic measurements associated with upper airway obstruction, little further research has been published to analyze the ability of clinicians to identify OSA in patients by visual facial analysis. We hypothesized that health care providers, especially anesthesia providers, would be able to predict the presence of OSA through facial analysis gleaned from tacit learning and experience. The purpose of this study is to determine the proficiency of anesthesiologists, otolaryngologists, and internists at predicting the presence of OSA by visual photographic analysis and to determine if accuracy of prediction differs by provider type.

2. Materials and methods

Fifty-six consecutive individuals between the ages of 17 and 84 years who were undergoing an in-laboratory, overnight PSG were recruited from the Johns Hopkins Hospital Sleep Center. A standard PSG montage was used and all studies were scored by a registered polysomnographic technologist using the criteria as outlined in the American Academy of Sleep Medicine (AASM) scoring manual [13]. All studies were interpreted by board-certified sleep medicine physicians. Standardized frontal and lateral photographs, which included the face and torso (waist up), were taken of the study participants immediately prior to the start of the study. In order to standardize the facial photographs, patients were asked to pose in a standing position and pictures were taken from both the anterior and lateral positions. The first 56 consecutive patients with adequate photographs and clinical information (gender, age, race, and comorbidities) were analyzed. One patient was excluded due to inadequate lateral photographs as assessed by 2 board-certified otolaryngologists with training in facial plastic surgery. The oAHI was calculated as the number of respiratory events (apneas or hypopneas) divided by the