Operative Techniques in Otolaryngology (2015) 26, 59–65

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Operative Techniques in
Otolaryngology

Airway evaluation in obstructive sleep apnea

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KEYWORDS
airway evaluation;
airway classification;
Müller maneuver;
pharyngometry

The prevalence of obstructive sleep apnea (OSA) in the general adult population is approximately 3%-7% for men and 2%-5% for women; however, variability in definitions may lead to underestimation of the true burden of the disease and postponing of the treatment. Thus, the first step in the management of OSA is the accurate evaluation of the severity of the problem and also the level of obstruction. Different modalities such as clinical examination and videoendoscopy have been used to detect OSA and its severity. However, the importance of these diagnostic tests is based on the specificity and the sensitivity of tests and their positive and negative predictive values. These tests are discussed in detail in this article.

Introduction

The evaluation of the patient with obstructive sleep apnea (OSA) syndrome has become increasingly complex as more modalities become available. The prevalence of OSA in the general adult population is approximately 3%-7% for men and 2%-5% for women; however, variability in definitions may lead to underestimation of true disease burden.[1] Clinical examination, videoendoscopy, and imaging—both static and dynamic—provide the clinician with a multifaceted approach for diagnosis and treatment. The importance of these modalities lies in their potential ability to positively or negatively predict success with different treatments. These methods are further detailed in the following sections to aid the clinician in his or her airway evaluation of the patient with OSA.

In office evaluation

Nasal anatomy

A detailed head and neck examination is crucial in the diagnosis and treatment planning of OSA. Nasal anatomy plays a complex, but somewhat poorly understood, role in sleep and sleep-disordered breathing. The nasal valve, which is made up of the anterior septum, caudal border of the upper lateral cartilages, and anterior tip of the inferior turbinates, as well as other contributions from the nasal floor and the pyriform aperture, accounts for two-thirds of the *total airway resistance*, thus emphasizing the importance of nasal anatomy in the evaluation of the airway. Nasal anatomy can be easily assessed in the office via anterior rhinoscopy or nasal endoscopy. Though no grading system exists for evaluation, attention should be directed to turbinate hypertrophy, internal and external nasal valve apertures, and septal deviation, as well as other factors such as allergic rhinitis.

Though a recent study looking at nasal anatomy did not show a correlation of the aforementioned nasal findings to the apnea-hypopnea index (AHI) on polysomnography,

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http://dx.doi.org/10.1016/j.otot.2015.03.003
1043-1810/

other studies do show nasal congestion to be an independent risk factor of snoring, as well as OSA.[2-4] Studies examining effects of surgical treatment, however, show that nasal surgery has minimal effect on the AHI, though it may decrease snoring and improve sleep quality.[5,6]

Oral cavity and pharyngeal examination

The oral cavity should be examined for retrognathia and dental overjet, which is the forward extrusion of the upper incisors beyond the lower incisions. Analyzing the position of the teeth can help classify subjects with a prognathic, orthognathic, or retrognathic mandible position. Overlapping teeth and dental malocclusion may indicate a small oral cavity leading to tongue malposition. Many of these bony features have been shown to be important factors in predicting soft tissue surgery outcomes.[7]

The velopharynx is generally considered to be the primary area of snoring and collapse by some, and many surgeries have been developed to correct this area. There are no specified “normal” dimensions of the velopharynx, though it can be evaluated for webbing, length, uvula size, distance to the posterior pharyngeal wall, and anterior or posterior arch narrowing. The relationship of the velopharynx to the tonsils is also usually described as part of the evaluation.[8]

Tonsils are generally graded from I to IV based on the relationship to the tonsillar fossa and how much volume of the pharyngeal space they occupy. In grade I, the tonsils are hidden in the tonsillar fossa and are barely visible behind the anterior pillars. In grade II, the tonsils are visible and take up 50% of the pharyngeal space. In grade III, the tonsils occupy between 50% and 75% of the pharyngeal space. In grade IV, the tonsils take up more than 75% of the pharyngeal space and may be touching. Subjective grade of tonsillar hypertrophy on oropharyngeal inspection correlates well with actual tonsil volume and is strongly associated with AHI, with grade IV tonsils correlating with severe OSA.[9]

The retropalatal and retroglossal areas will be discussed under the section on endoscopy.

Classification systems

To integrate some of these findings on examination, the Mallampati and Fujita scores as well as the Friedman classification system have been developed. The modified Mallampati index is a means of evaluating the oropharynx to determine the ease of intubation, but it can also be used for assessing likelihood of OSA. The scale is used to evaluate visualization of the tonsillar pillars, pharynx, uvula, and soft palate based on non-protruded tongue positioning and varies from 1 (total visualization) to 4 (no visualization) (Figure 1). The scale has been shown to be highly useful to predict the severity of OSA.[10]

The Friedman staging system is similar to the modified Mallampati index; however, it combines the palate-tongue position, as well as tonsil size and body mass index (BMI), to predict the success of uvulopalatopharyngoplasty (UPPP). In stage 1, the palate is grade 1 or 2 with tonsil grade III or IV. Stage 2 corresponds to palate grade 1 or 2 with a tonsil grade I or II, or a palate grade 3 or 4 with a tonsil grade III or IV. Stage 3 corresponds to palate grade 3 or 4 with tonsil grade I or II. Stage 4 corresponds to cases with a BMI that is larger than 40 kg/m^2 or with gross craniofacial abnormalities.

A Freidman stage 1 correlates with surgical success and is one of the few positive predictive factors in sleep surgery. Success ranges decrease as stage increases, and patients who are in stage 4 are generally not considered to be candidates for surgery.[11] Woodson et al[12] have shown improved surgical success with UPPP in Friedman stage 2 and 3 patients using modified techniques for UPPP.[13]

The Fujita classification is based on the level of obstruction: type 1—upper pharyngeal obstruction (including abnormalities of palate, tonsils, nasopharynx, or oropharynx), type 2—oropharyngeal and hypopharyngeal obstruction, or type 3—hypopharyngeal obstruction. The Fujita classification requires videoendoscopy.[11]

Videoendoscopy and the Müeller maneuver

Videoendoscopy provides a way of visually evaluating the naso- and oropharyngeal airways in real time. Endoscopy is particularly important for evaluating the retroglossal and retropalatal areas, as well as the hypopharynx. This may be performed under sedation to more closely mimic the physiology of the sleep state. It is thought that sedated videoendoscopy can aid more effectively with surgical planning compared with the awake state.[14] For office evaluation, though, awake endoscopy can still provide an ample amount of information and typically achieves equivalent surgical outcomes.

The retropalatal area can easily be visualized by endoscopy in the clinic, though there are many other ways its size and shape can be evaluated. Though it is a complex structure, authors have simplified the description of its shape on examination into 3 basic patterns: the vertical pattern, circular or oblique pattern, and the mixed pattern. In the vertical pattern, the lateral pharyngeal walls are relatively small, and the palatopharyngeus muscle is oriented parallel to the posterior pharyngeal wall. In the circular pattern, the palatopharyngeus muscles are more parallel to the hard palate and more acutely angulated to the posterior pharyngeal wall. The palatopharyngeus muscle may also be hypertrophic or associated with tonsil enlargement. The intermediate or mixed type has a circular pattern above the palatal genu and vertical segment below the genu. These basic types are often used to determine the appropriate uvulopalatopharyngoplasty technique.[15]

The retroglossal area can be classified into 3 basic types using the Moore Classification system. This system may better stratify patients for tongue base and hypopharyngeal procedures, though no correlation with success rates is