Updated Friedman Staging System for Obstructive Sleep Apnea

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Abstract

In the practice of sleep medicine, the first step is identification of those patients at high risk for sleep apnea. Nearly every physician and every hospital has preferred methods of screening. Many patient questionnaires or surveys as well as some objective physical measurements have been suggested to predict the presence of sleep apnea. Screening is well established, and laboratory and home testing are widely available. An early assessment with a physical examination can help direct treatment planning. The Friedman tongue position, lingual tonsil hypertrophy grading, and the effects of oral positioning on the hypopharynx should be used in early assessment for treatment planning, and as screening tools to assess the sight of obstruction. Although these screening tools are not substitutes for drug-induced sleep endoscopy (DISE), they are crucial in early assessment as many patients do not require surgery or DISE early in the evaluation.

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Since the first description of uvulopalatopharyngoplasty (UPPP) by Fujita et al. [1] in 1981, surgical treatment of obstructive sleep apnea (OSA) has continued to evolve, with new techniques and modifications showing improvements in success. However, the efficacy of surgery for the treatment of sleep apnea remains controversial. Consideration of the complex relationship between different sites of obstruction is paramount to choosing the correct surgical approach to treatment. As such, the preoperative selection of patients that are likely to respond to surgery is both a necessity and priority. This requires the detailed assessment of individual patient anatomy. Correctly choosing patients who are likely to benefit from surgical treatment not only results in better outcomes, but also clarifies the need for surgery in specific populations of OSA patients.

OSA typically results from anatomic multi-level obstruction. There are many methods by

which to determine sites of obstruction in OSA patients. Imaging (CT or MRI), cephalometric studies, drug-induced sleep endoscopy (DISE), and even snoring sound analysis are all methods that have been used to determine obstruction prior to surgery. It is important to have a strategy of airway evaluation that is both efficient and noninvasive for the early detection of surgical candidates. The performance of this type of outpatient screening is critical prior to consenting a patient for an invasive airway procedure. Based on simple clinical staging systems, patients are divided into 2 groups. Those with a favorable anatomy are directed to surgery after failing continuous positive airway pressure (CPAP). However, patients with an unfavorable anatomy are warned of the limited success of multilevel surgical procedures. If patients decide to proceed with surgery, DISE is a second preoperative assessment.

When evaluating a patient preoperatively, we use a well-established surgical staging system that incorporates the Friedman tongue position (FTP), tonsil size, and BMI. Surgical staging of OSA has been shown to be an accurate predictor of surgical success with UPPP, and can also be applied to predict patients who may be candidates for other treatments. Creating a universal language also provides insight on surgical success and morbidities that are likely to be associated with varying anatomic stages. We present our anatomic staging system and a grading system for lingual tonsil hypertrophy (LTH) that has recently been tested for interexaminer reliability.

Friedman Tongue Position

FTP is a simple means by which to approximate obstruction at the hypopharyngeal level. Descriptions of hypopharyngeal obstruction, prior to the introduction of FTP, were not standardized. Similar physical findings were reported with arbitrary terms such as “crowded oropharynx,” “macro-

glossia,” and “retrognathia,” etc. This is confusing both in patient care and in reporting data.

FTP is the evaluation of the tongue’s position relative to the tonsils/pillars, uvula, soft palate, and hard palate. It is based on Mallampati stages, which are used in the field of anesthesiology in the context of difficult endotracheal intubation [2]. While the Mallampati system has 3 grades and evaluates the palate with the tongue protruded, FTP evaluates the palate with the tongue in a neutral position inside the mouth. Furthermore, FTP is assigned on a scale from I to IV, and FTP II is split into IIa and IIb.

To evaluate FTP, the clinician should ask the patient to open his/her mouth widely, a minimum of 5 times. This allows the observer to assign the most consistent position of the tongue. The patient should also be instructed to “breathe normally,” while leaving the tongue in its natural position. FTP I allows the observer to visualize the entire uvula and tonsils or pillars. FTP IIa allows visualization of the uvula but the tonsils are only partially seen. FTP IIb allows visualization of the complete soft palate down to the base of the uvula, but the uvula and the tonsils are not seen. FTP III allows visualization of some of the soft palate but the distal soft palate is eclipsed. FTP IV allows visualization of the hard palate only (Fig. 1).

Anatomic Grading System

The anatomic staging system integrates FTP, an estimation of hypopharyngeal obstruction, with tonsil size and BMI to predict surgical outcomes. This system can separate patients who will benefit from UPPP alone from those that will require multilevel surgical intervention. Tonsil size is graded from 0 to 4, where 0 is the absence of tonsillar tissue, size 1 represents tonsils contained within the pillars, size 2 tonsils extend to the pillars, size 3 tonsils extend beyond the pillars but not to the midline, and size 4 represents tonsils that extend to the midline (Fig. 2) [3, 4].

Fig. 1. Friedman tongue position (FTP). **a** FTP I visualizes the uvula and tonsils/pillar. **b** FTP IIa visualizes most of the uvula but not the tonsils/pillar. **c** FTP IIb visualizes the entire soft palate to the uvular base. **d** FTP III shows some of the soft palate with the distal end absent. **e** FTP IV visualizes only the hard palate. From Friedman [10].

Fig. 2. Tonsil grading system. **a** Size 0, absence of tonsillar tissue. **b** Size 1, within the pillars. **c** Size 2, extended to the pillars. **d** Size 3, extended past the pillars. **e** Size 4, extended to the midline. From Friedman [10].

Table 1. Friedman staging system as determined by Friedman tongue position (FTP), tonsil size, and BMI

Stage	FTP	Tonsil size	BMI
I	I, IIa, IIb	3 or 4	<40
II	I, IIa, IIb III or IV	0, 1, or 2 3 or 4	<40 <40
III	III or IV	0, 1, or 2	<40
IV ^a	I–IV	0–4	>40

^a All patients with significant craniofacial or other anatomic abnormalities.

Stage I disease is defined as patients with FTP I, IIa, or IIb, tonsil size 3 or 4, and BMI <40. Stage II disease is defined as FTP I, IIa, or IIb with tonsil size 0, 1, or 2, or FTP III or IV with tonsil size 3 or 4, and BMI <40. Stage III disease is defined as FTP III or IV, tonsil size 0, 1, or 2, and BMI <40. All patients with BMI >40 are classified as stage IV, alongside patients with skeletal deformities such as micrognathia or mid-face hypoplasia (Table 1).

Lingual Tonsil Hypertrophy Grading System

LTH is a common cause of hypopharyngeal obstruction. The degree of hypertrophy should be assessed in every patient as it reflects the degree of morbidity. Therefore, a universal language is necessary in order to compare the efficacy of removing different grades of lingual tonsils. The LTH grading system presented here may be useful in selecting patients requiring specific lingual tonsil surgery versus tongue base surgery.

To evaluate the lingual tonsils, the clinician should examine the awake patient with the tongue in multiple positions. The lingual tonsils are often best visualized with the tongue protruded, but this is not true in all patients. As multiple views of the tongue in different positions allows for a bet-

ter understanding of the individual patient's LTH, awake endoscopy is superior to DISE for grading.

The grading system consists of a scale from 0 to 4. Grade 0 denotes a complete absence of lymphoid tissue on the tongue base. Grade 1 is defined as lymphoid tissue scattered over the tongue base. Grade 2 represents lymphoid tissue covering the entirety of the tongue base with limited vertical thickness. Grade 3 consists of significantly raised lymphoid tissue covering the entirety of the tongue base, approximately 5–10 mm in thickness. Grade 4 represents lymphoid tissue 1 cm or more in thickness, rising above the tip of the epiglottis (Fig. 3). The vertical depth of the lingual tonsils is a clinical approximation that should be judged by the otolaryngologist, with grade 3 being the first stage in which the tonsils have significant vertical height.

Discussion

In 1996, Sher et al. [5] reported that UPPP achieved surgical success in only 40% of patients in a meta-analysis of unselected patients. This brought forth not only the need for modifications of procedures to increase efficacy, but also the realization that not all OSA patients are suitable candidates for surgery. It was thought that surgery should be reserved for patients with mild/moderate disease, rather than severe disease. However, studies have shown that UPPP is not more effective in treating patients with mild disease, and can even worsen objective parameters such as the apnea-hypopnea index [6, 7].

The rationale for the anatomic staging system is that the success of UPPP is highly dependent on the anatomical relationship between palatal and hypopharyngeal obstruction. Patients who have large tonsils but minimal hypoglossal obstruction are likely to benefit from a procedure such as UPPP with tonsillectomy. Patients with

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(For legend see next page.)

stage I disease have a greater than an 80% chance of success with UPPP, even if they have severe disease based on polysomnography. However, patients with stage III disease have more hypopharyngeal obstruction, and are unfavorable candidates for UPPP. Success rates for these patients, when treated with UPPP alone, are as low as 8% [8, 9] (Table 2). Treatment options for these patients would need to include plans for multilevel surgery. It is important to keep those with anatomic stage IV in mind; they are not surgical candidates and thus would also not benefit from DISE.

Among the developments in surgical treatment of OSA has been the introduction of transoral robotic surgery (TORS). It has become increasingly common to perform lingual tonsillectomy along with other TORS procedures. No studies have proven the value of lingual tonsillectomy for OSA. However, not all OSA patients have hypertrophied lingual tonsils. It is necessary to have a unified and cost-effective method of identifying patients who would benefit from lingual tonsillectomy and clarify which LTH grades

are associated with perioperative and postoperative morbidity.

Generally, anatomic staging is used for the triage of patients who are noncompliant or intolerant to CPAP therapy. Grading of LTH is done to see whether specific patients would benefit from lingual tonsillectomy. It is our belief that LTH grade 3 and 4 are clinically significant and may be indicators for surgical removal of tonsillar tissue. To date, there are no studies that have identified the specific benefit of lingual tonsillectomy in relation to the degree of hypertrophy, especially since it is often done as a combined or adjunctive procedure with glossectomy. Similarly, no studies have identified the morbidity or mortality of lingual tonsillectomy as an isolated procedure. Clearly, however, there must be morbidity associated with the procedure. If we do perform lingual tonsillectomy, we can study both the efficacy and morbidity if we have a common language to describe lingual tonsil size. While logic would dictate that lingual tonsillectomy is beneficial for patients with LTH grades 3 and 4, it is not clear that the morbidity of lingual tonsillectomy is justifiable for LTH grades 1 or 2. Thus, a grading system is necessary to compare the results of excision based on the level of hypertrophy.

As it is an efficient tool to use in an outpatient setting, staging provides the clinician with valuable initial information about a patient's prospects of being a good surgical candidate. There are certainly further methods to directly visualize the patient's airway for areas of obstruction that should be utilized prior to operating. Nevertheless, anatomic staging remains a highly useful and noninvasive tool in patient selection.

Conclusion

The results of surgical treatment are never completely predictable for any disorder, but clinical staging offers important benefits. Staging systems

Table 2. Success and failure rates of uvulopalatopharyngoplasty (*n* with percentages in parentheses) for the treatment of obstructive sleep apnea stratified by stage

Stage	Unsuccessful	Successful	Total
I	6 (19.4)	25 (80.6)	31 (100)
II	18 (62.1)	11 (37.9)	29 (100)
III	68 (91.9)	6 (8.1)	74 (100)

Fig. 3. Lingual tonsil hypertrophy (LTH) grading system. **a** LTH 0, no lymphoid tissue. **b** LTH 1, scattered lymphoid tissue. **c** LTH 2, lymphoid tissue covering the entire tongue base, limited vertical thickness. **d** LTH 3, lymphoid tissue covering the entire tongue base, significant vertical thickness of approximately 5–10 mm. **e** LTH 4, lymphoid tissue covering the entire tongue base, rising to or above the tip of the epiglottis, approximately 1 cm in height. From Friedman et al. [11].

are created to identify clinical features of the disease process that can predict whether any particular treatment option will be of value. The use of the anatomic staging system in OSA is a cost-effective,

noninvasive, reproducible method to stratify patients based on anatomic variations. This can help improve surgical success rates and outcomes in OSA.

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