Obstructive Sleep Apnea:

Current Managements & Treatments

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Obstructive sleep apnea (OSA) accounts for one of over 80 varieties of sleep apnea. It is the only type which elicits physiologic obstruction of the upper airway, and happens to be the most common type found in the United States. It is estimated that almost half of the U.S. population over the age of 25 have obstructive sleep apnea (158.4 million adults). Unfortunately, over 25 million of them will remain undiagnosed. General awareness and adequate understanding of this condition is crucial in challenge to improve these statistics. More importantly, general practitioners should also begin to implement a high index of suspicion in a commitment to recognize this condition.

Obesity is undoubtedly one of the main reasons that we have such a high prevalence of OSA in America. More than one-third of U.S. adults (35.7%) are obese.[1] Specifically, the state of Florida has an obesity average of 26.6% (Georgia=28.0%, Alabama=32.0%). Although it is a major contributing factor in the pathophysiology of OSA, obesity is one of many variables in the dynamics that create physiologic obstruction of the upper airway.

In advance of exploring the various treatment modalities for OSA, we will review the basic physiology. First, in the most pragmatic sense, OSA essentially represents the obstruction of the airflow that flows into the upper airway from the mouth and nose. During its course to the trachea, it encounters resistance in a variety of ways, each contributing to the 'obstruction' in OSA. There are complex dynamics that come into play to ultimately produce the 'obstruction' and there is an evolving expansion in our understanding of these complex mechanisms involved. Aside from anatomy, these additional variables include vascular and neuromuscular tone and reflexes, central ventilatory control, sleep and arousal effects, surface tension forces, lung volume effects and expiratory collapse, all intricately involved in the maintenance of upper airway stability and dynamics.[2]

Because of the disproportionate anatomy of the upper airway and its supporting structures in adults, , there is great variability in the site(s) of obstruction that are often distinct in every patient.[3] The site-specific and highly variable obstruction can be divided into three basic anatomic (Table I).[2,4,5] They include the nasal cavity/nasopharynx , oropharynx/base of tongue and the hypopharynx.

In children, the leading cause for OSA is adeno-tonsillar hypertrophy. Additional factors that have a major role in creating upper airway obstruction in children includes skeletal and craniofacial variability and aberrations that alter airway size and resistance.[6,7] The focus of our discussion will be on adults.

Because of the numerous anatomic sites that may cause the obstruction(s) in OSA, there are multiple types of surgery available. But their effectiveness is purely based on judicious selection by the surgeon to target the sites of obstruction. In other words, each patient's unique anatomy requires a uniquely tailored surgical plan which may target multiple sites in the upper airway. This is unlike other definitive surgical options such as an appendectomy or a cholecystectomy, as the numerous available surgical options for OSA also pose a challenge in selection that may result in unpredictable outcomes. So, there is admittedly a lack of a mainstay surgery to use as the 'silver bullet'. Nonetheless, these surgical options are evolving in their technique but their selective use remains crucial in delivering best results. The past decade has been a renaissance in terms of our understanding of sleep and upper airway dynamics, allowing sleep apnea surgeons to offer more effective surgery for OSA. Now that we have the variety in the types of surgeries for OSA, the main challenge that limits surgical success lies in the methods used to match the surgery with the patient's examination findings.

In evaluating a patient for OSA surgery, there are several key factors to consider. A comprehensive overnight sleep study is necessary to ensure that each patient's sleep apnea is correctly evaluated and, in respect to OSA, it is accurately quantified and treated. The sleep study evaluation should be preferably done within one year of the visit. It is also common that such patients seeking surgical options have failed initial treatment by CPAP or BIPAP, in addition to other conservative and non-surgical treatments such as behavior modification, along with mechanical devices like oral appliances.

When evaluating patients that have 'failed a CPAP trial', it is important to know why they failed. Some patients often note their noncompliance from their inability to use a full-face mask versus a nasal mask, or they are unable to tolerate their machine at high pressures, which often leads to a feeling of claustrophobia. Other personal or social reasons may also play into their intolerance to such initial treatments.

It is very important for both surgeons and patients to have a common goal for expectations of the surgery. "Am I getting surgery to cure my OSA or reduce it because I'll be happy with a CPAP instead of a BIPAP...". For example, in patients with severe OSA with very high AHI scores, the primary goal of surgery may be to achieve improved tolerance by a reduction in pressure setting requirements or better fit and tolerance to a nasal mask or pillow instead of a full-face mask. These goals are more commonly set with patients with severe OSA who cannot tolerate the longer and more invasive surgical recommendations that may be required to achieve significant reductions in their apnea-hypopnea index (AHI) scores. For this, the most common objective measure is the comparison of the preoperative sleep study to a postoperative study. Generally, a greater decrease in the AHI (apnea hypopnea index) is equivalent to a greater reduction in the severity of OSA.

The focus of surgery for obstructive sleep apnea is to relieve the site(s) of obstruction in the upper airway. The sites of dynamic obstruction may be numerous along the path of the nasal cavity, nasopharynx, oropharynx, hypopharynx, along with many dynamic and physiologic changes taking effect in both positional and in terms of neuromuscular changes. The most important consideration that is crucial to the outcome and success of surgery is the surgeon's ability to identify these dynamic sites of obstruction in a focused objective physical examination. In addition to the data from the sleep study, a comprehensive head and neck examination should be performed in addition to fiberoptic laryngoscopy. Additionally, some surgeons perform such laryngoscopy with a fiberoptic scope upon sedation in the operating room when patient is supine in order to generate both anatomic and physiologic changes that closely mimic those when the patient is experiencing obstruction during sleep.

This will allow the surgeon to choose among the numerous types of surgeries that are available targeting the various potential sites of obstruction.

The specific surgical procedures for OSA are grouped by their target anatomic region (see table 1). In general, there are two categories of OSA surgery that are distinguished based on their cumulative complexity, operative time and postoperative recovery requirements. They can be considered as primary and secondary surgery. The secondary surgery may be composed of multiple multi-level procedures such as a hyoid suspension with midline glossectomy and maxillomandibular advancement. Mild to moderate OSA is often treated with the more conservative primary procedures such as a septoplasty, uvulopalatopharyngoplasty (UPPP), palatine or lingual tonsillectomy among others. Patients that do not achieve adequate reduction in their OSA severity from primary surgery, or patients who have severe to profound OSA (AHI>80), may then undergo the more extensive secondary types of surgery. Overall, the best outcomes are available to patients with mild to moderate OSA.

The goal of the surgeon is to elucidate the sites of obstruction. There is ongoing controversy in the accuracy of various methods used to assess the possible sites of obstruction as there are a variety of methods that are used in this evaluation. This includes cephalometric analysis, in-office fiberoptic nasopharyngoscopy and Mallampati classification.[8] However, these assessments have inherent issues with reliability and various biases such as inter-observer differences. There are significant soft tissue changes that dynamically alters the upper airway with changes in position and sleep-awake states that alter muscle tone. Therefore, it is believed that the best evaluation of the upper airway is in supine position. This thought has led to the use of the Muller maneuver, sleep endoscopy and others.[9-11]

The goal of ridding the need for CPAP is not always achievable when considering surgery. Therefore, it is crucial that a surgical consultation details specific goal and end-points. If patients are able to tolerate their CPAP machine after the surgery, and this was a treatment goal established prior to surgery, then surgery was successful. If surgery failed to provide a previously established goal of total relief in mild OSA, then the patient will continue to live with OSA, albeit mild, which may go untreated. This group of patients may have been noncompliant with CPAP therapy, but may show improved compliance if they undergo a new CPAP trial.

The successful surgical treatment of OSA is highly dependent on the availability of a multi-disciplinary approach to ensure congruency throughout the path of each patient's journey from evaluation to treatment end-point, being surgical or non-surgical modalities. This interdisciplinary team approach maximizes treatment efficiency and outcomes by capitalizing on the unique expertise of each subspecialty member. These members may include a board-certified sleep specialist, an otolaryngologist and an oral & maxillofacial surgeon.

There are a number of surgeries available for the treatment of OSA. To achieve the best improvement, the surgeries need to be tailored to each patient based on the level or location of their obstruction sites leading to their OSA. The most common combination of surgeries for OSA includes septoplasty and turbinate reduction in addition to UPPP/tonsillectomy. This often results in some improvement in the overall AHI in their OSA evaluation. However, those with severe OSA do not get much improvement with such a combination, as most may have their main obstruction at area behind the tongue base/root.

In patients who have a chief complaint of snoring without the presence of OSA, there are multiple nonsurgical options available which can be performed in an office/clinic setting. These include Pillar procedure, injection somnoplasty, radiofrequency ablation of the inferior turbinates, soft palate or base of tongue reduction. These procedures have also been shown to improve mild to moderate OSA.[12]

As the use of current surgical options become more focused in their selection and application, the outcomes will gradually improve for OSA patients undergoing surgery. However, future conservative and surgical therapies on the horizon may well serve to supplement the success of the current options. These future therapies will likely involve less invasive modalities with the use of robotics, hypoglossal nerve stimulation, and the use of nasal expiratory positive airway pressure (EPAP) as an alternative to CPAP therapy.[13-19]

The treatment of OSA is an evolving specialty practice which is best performed via a multidisciplinary approach. Surgical therapy requires an understanding of the intricate dynamics of the upper airway and the variety of available surgical options and techniques. Multi-level surgery is often required to tailor the most effective surgical plan for each patient. Future options for OSA treatment will span medical and surgical management options including the use of robotic technology to improve access and postoperative recovery.

Table I.

Surgical Procedures Grouped by Location of Obstruction	
Septoplasty	Nasal cavity and/or nasopharyngeal
Turbinate reduction	
Internal/external nasal valve repair	
Adenoidectomy	
Maxillary advancement (Lefort I)	
Tonsillectomy	Retropalatal and/or oropharynx *(behind soft palate and tonsil area)*
Uvulopalatopharyngoplasty (UPPP)	
*Midline/partial glossectomy	
Genial tubercle advancement	
Genioglossus advancement	
Mandibular advancement	
Supraglottoplasty/epiglottopexy	Hypopharyngeal *(behind tongue root near the voicebox)*
Hyoid myotomy/hyoid suspension – Airlift® procedure	
Radiofrequency ablation of soft palate/tongue base	
Inspire® procedure	
**Tracheostomy	

* Currently may be performed via robotic technique, Trans-Oral Robotic Surgery (TORS)

**Tracheostomy is not categorized as it may satisfy one or more of the location groups listed above.

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