Surgical Approaches to Obstructive Sleep Apnea

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KEYWORDS

• OSA surgery • OSA • CPAP failure • Multilevel surgery • Effectiveness • Evidence

KEY POINTS

- Contemporary obstructive sleep apnea (OSA) surgery is a key salvage treatment option for patients who have failed device use (ie, continuous positive airway pressure [CPAP] or mandibular advancement splint [MAS]).
- Nasal surgery should be considered a prephase option to facilitate subsequent CPAP or MAS or airway surgery.
- Newer variants of modified palatal and tongue surgeries are increasingly supported for their ability to achieve improved outcomes with less sacrifice of functional tissue.
- New modalities such as cranial nerve stimulation show significant promise.
- The current status of high-level literature supports a role for contemporary airway surgery in OSA, but ongoing level I and level II studies are still necessary.

INTRODUCTION

Surgery in adult obstructive sleep apnea (OSA) has undergone significant advancement in recent years and continues to evolve. It is a modality of treatment used in the context of failed device use, specifically, failed continuous positive airway pressure (CPAP) or mandibular advancement splint (MAS). In this context, the role of surgery is as salvage therapy to improve outcomes[1–3] or to facilitate better tolerance of device use. Other treatments such as weight loss, adjuvant nasal therapy (medical ± prephase nasal surgery), and positional devices may be combined with airway surgery. Both pediatric OSA, being a separate entity to adult OSA, and bariatric surgery are discussed and are considered elsewhere. In general, patients with OSA are managed with in-hospital monitoring perioperatively, but where ambulatory considerations are realistic, they are highlighted in this article.

DEFINITION OF OBSTRUCTIVE SLEEP APNEA SURGERY

Adult OSA surgery includes an array of operative procedures to open or stabilize the upper airway and is outlined in **Box 1**. It is much more than just uvulopalatopharyngoplasty (UPPP) or maxillomandibular surgery as a fall back. Procedures are rarely isolated or directed to a single level of the airway and are often concurrent or staged. Prephase nasal surgery is used to facilitate return to device use with better adherence, or before multilevel surgery.

PHILOSOPHY OF SURGERY

In real clinical context, patients who fail primary device use therapy would remain otherwise untreated without salvage options such as upper airway OSA surgery.[4] Many such patients are usually desperate for an alternative, at least to reduce

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Box 1
Sample of procedures used in obstructive sleep apnea surgery

Traditional Procedures

- Tonsillectomy
- Adenoidectomy
- UPPP
- Geniotubercle advancement
- Hyoid suspension
- Epiglottoplexy
- Maxillomandibular advancement

More Contemporary Procedures

- Modified or variant UPPP
- Expansion sphincteroplasty
- Uvulopalatal flap
- Lateral palatoplexy
- Transpalatal advancement
- Radiofrequency systems
- Coblation channeling
- Midline glossectomy
- Submucosal lingualplasty
- Lingual tonsillar reduction

symptom burden and improve quality of life, and to mitigate cardiovascular risk.

Contemporary ethos and summation of available evidence recognizes that OSA surgery allows at least partial treatment applied all the time, as opposed to CPAP, which although a complete treatment modality, may only be applied part of the time.[5] What constitutes effective CPAP use to ameliorate complications of OSA is still yet to be clarified.[6]

CLINICAL ASSESSMENT IN OBSTRUCTIVE SLEEP APNEA SURGERY, INCLUDING DYNAMIC AIRWAY ASSESSMENT

A comprehensive sleep history with focus on snoring, partner-witnessed apnea, disrupted sleep, sleep hygiene, sleep position, tiredness, sleepiness, nasal symptoms, weight, and its progression should be taken. Symptoms indicating other treatable diseases such as thyroid disorders, inflammatory conditions, and depression must be explored. This history needs to be put in the context of patient concerns, such as daytime somnolence, reduced executive function, or social and marital disruption, as well as clinician concerns for cardiovascular, motor vehicle, and industrial accident risk.

Examination includes documentation of body mass index (height and weight), neck circumference, and blood pressure. Maxillofacial assessment for significant maxillary hypoplasia, retrognathia, and unfavorable soft tissue anatomy is made. Nasal examination includes dynamic evaluation of nasal valve, anterior rhinoscopy, and nasendoscopy. The oral cavity and oropharynx are examined, and the Friedman tonsil and tongue-relative-to-palate grade is recorded.[7] Flexible nasendoscopy is performed in the erect and supine positions, combined with the modified Mueller maneuver and Woodson hypotonic method.[8–10] The airway is examined at multiple levels both in the natural position and with a jaw thrust maneuver, used to assess the magnitude of change in the airway. Sedation endoscopy may be used either in certain select cases, or in some clinician's practices, routinely.[11]

Clinical questionnaires generally include a measure of snoring (eg, Snoring Severity Scale[12]), a measure of sleepiness (eg, Epworth Sleepiness Scale [ESS][13]), a quality-of-life yardstick (eg, Functional Outcomes of Sleep Questionnaire-30 [FOSQ-30][14]), and in some practices predictive tools (eg, Berlin[15] or STOP-BANG[16]).

Formal in-laboratory polysomnography is preferred, but if unavailable, a sleep physician–requested and reviewed level II ambulatory study are performed preoperatively and after definitive surgical intervention.

PREPHASE NASAL SURGERY

Nasal obstruction affects 25% to 40% of CPAP users,[21] and the need for nasal airway patency in the treatment of OSA is well established. Depending on the underlying disorder, this may be achieved via medical therapies, surgery, immunotherapy, or a combination. Anatomic obstructions can be addressed with prephase nasal surgery with the intention of facilitating frontline OSA therapies.[22] Nasal surgery also significantly decreases pressure requirements and improves compliance in CPAP use.[17] In isolation, it may improve apnea hypopnea index (AHI) and the symptoms of OSA, and on the rare occasion, may even obviate further treatment.[20,23,24] However, it must be emphasized that these are not the objectives of nasal surgery, and the need for further treatment is usually required.

Surgical reduction of inferior turbinate size, usually with concomitant correction of septal deviations, remains the mainstays of improving nasal airway patency and has been shown to result in the greatest decrease in CPAP pressures.[17] Other procedures include dynamic nasal valve surgery, rhinoplasty, functional endoscopic sinus surgery,