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# Lingual tonsillectomy and midline posterior glossectomy in children with obstructive sleep apnea

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Lingual tonsillectomy and midline posterior glossectomy are useful in children with persistent obstructive sleep apnea following tonsillectomy and adenoidectomy who do not tolerate positive airway pressure ventilation. These techniques involve removing tissue from the surface (lingual tonsil) or base (midline posterior glossectomy) of the tongue to decrease bulk in the oropharynx. The aim of this review is to delineate the preoperative evaluation and intraoperative considerations of lingual tonsillectomy and midline posterior glossectomy in children.


## Introduction

Tonsillectomy and adenoidectomy (TA) successfully treat obstructive sleep apnea (OSA) in approximately 75% of children.[1,2] Unfortunately, this rate is much lower (25%-45%) in children who are obese, older than 7 years of age, or have asthma, more severe sleep apnea, craniofacial anomalies, or chromosomal abnormalities such as Down syndrome.[2-5] Persistent OSA following TA, however, is difficult to investigate and treat. Long-term adherence to positive airway pressure (PAP; continuous PAP or bilevel PAP) ventilation in children, especially those who are syndromic, is poor.[6] Uvulopalatopharyngoplasty alone has not proven to be successful in children.[7] Tracheotomy, which has historically been the gold standard treatment for persistent severe OSA following TA, carries the inherent risks of mucous plugging, accidental decannulation, bleeding, and

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poor quality of life for patients and their families, making it an operation of last resort.

Recently, a few otolaryngologists—head and neck surgeons have begun tailoring surgery for each patient with OSA by searching for anatomically abnormal areas that would most likely be the cause of their obstruction. This usually takes the form of sleep endoscopy or sleep or cine magnetic resonance imaging (cine MRI). Examples of anatomical sources of obstruction that have been targeted include lingual tonsil hypertrophy, macroglossia (large tongue), and glossoptosis (posterior prolapse of the tongue).[8,9] Shott[7] has published a detailed review on the evaluation and management of pediatric OSA beyond TA.

## Preoperative planning

Patients who have already undergone TA, continue to have severe OSA, and cannot tolerate PAP ventilation are candidates for further surgery at our institution. A full history and physical examination is performed.

### Physical examination

General inspection for syndromic features that could contribute to airway narrowing such as midface hypoplasia, steep mandibular plane (obtuse gonial angle), long facial height (adenoid facies), and retrognathia is important. Inspection of the nose for a deviated septum, large inferior turbinates, pyriform aperture stenosis, nasal polyps, cysts, tumors, or choanal atresia is paramount. The mouth should be examined for retrognathia, macroglossia, narrow high-arched palate, and dental wear secondary to bruxism. Flexible nasopharyngoscopy can detect adenoid regrowth, nasopharyngeal cysts and tumors, lateral pharyngeal wall collapse, lingual tonsil hypertrophy, glossoptosis, abnormalities in the shape and position of the epiglottis, arytenoid edema due to acid reflux, and impaired vocal cord movement. Sleep endoscopy under general anesthesia can be performed to better identify areas of collapse during relaxation. However, care must be taken not to overestimate the degree of collapse under general anesthetic owing to muscle relaxation induced by the agent itself.[7] Anecdotal evidence suggests that alternatives such as dexmedetomidine (alpha-2 agonist that parallels non–rapid-eye-movement sleep without significant respiratory depression) may cause less airway collapse than propofol; however, this has not been demonstrated using upper airway measurements on cine MRI.[7,10,11]

### Imaging

Lateral neck x-ray can detect adenoid regrowth and lingual tonsil hypertrophy but carries the risks of radiation and overestimation of adenoid size if the patient is swallowing and the soft palate is in contact with the adenoid tissue. For these reasons, the author prefers flexible nasopharyngoscopy over lateral neck x-ray for evaluation of adenoid and lingual tonsil tissue. Cine MRI allows for analysis of the airway during episodes of airway obstruction. Donnelly[12] has described in detail how to perform and interpret cine MRI studies in children with OSA. In brief, multiple anatomical sites can be examined on midsagittal and axial sections simultaneously. T2-weighted images are helpful for identifying the adenoids and differentiating lingual tonsil tissue from the base of tongue. Adenoids are considered large if they are thicker than 12 mm on sagittal section with intermittent obstruction of the posterior nasopharynx. Lingual tonsils are considered large if they are thicker than 10 mm and abut both the tongue and the posterior pharyngeal wall.[12] An added benefit of cine MRI over sleep endoscopy is that cine MRI can detect a Chiari malformation. Chiari malformations involve herniation of the cerebellar tonsils with or without the brainstem into the foramen magnum or spinal cord or both, which can cause obstructive or central sleep apnea.[13] Cine computed tomography has been described but is not recommended owing to high levels of ionizing radiation.

## Lingual tonsillectomy

### Rationale

Lingual tonsil hypertrophy has been described as a cause of persistent OSA following TA.[8] Approximately 54% of patients with lingual tonsil hypertrophy as a cause of persistent OSA have another disorder such as Down syndrome, Beckwith-Wiedemann syndrome, or velocardiofacial syndrome.[8] Approximately 30% of patients with Down syndrome who have persistent OSA following TA have enlarged lingual tonsils.[9] Lin and Koltai[8] first described lingual tonsillectomy for persistent pediatric OSA and demonstrated significant reductions in respiratory disturbance index and mean number of apneas per hour following this procedure. The surgical technique described herein builds on previous authors' descriptions and adds this author's personal preferences.

### Patient positioning

Patient positioning is demonstrated in Figure 1. The patient is nasotracheally intubated through the left nasal cavity, and the endotracheal tube (ETT) is taped to a square piece of foam padding that is taped to the forehead. The eyes are taped shut for protection but are left undraped. A shoulder roll is not used because many of these children have Down syndrome and neck extension can lead to atlantoaxial subluxation. This can occur even if preoperative flexion–extension x-ray results are normal, rendering preoperative acquisition of such x-rays unnecessary.[14]

### The procedure

A tooth guard is trimmed to fit the patient's mouth, and a 2-0 silk suture is placed through the anterior aspect of the