

TITLE: Special Situations in the Management of Tonsil and Adenoid Disorders
SOURCE: Grand Rounds Presentation
UTMB, Dept. of Otolaryngology
DATE: January 11, 2006
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Introduction

Tonsillectomies and adenoidectomies are 2 of the most common surgical procedures performed. In 1996, there were 274,000 adenotonsillectomies (T&As), 144,000 tonsillectomies (without adenoidectomy), and 136 000 adenoidectomies (without tonsillectomies) performed in the United States. The surgical treatments to remove pharyngeal lymphoid tissue are often performed for symptoms of upper airway obstruction, recurrent infection, refractory tonsillar bleeding and possible malignancy.

Anatomy

The lateral palatine tonsils, adenoids and anterior portion of the lingual tonsils form the ring of lymphoid tissue in upper part of the pharynx called Waldeyer's Ring. The palatine tonsils are an encapsulated body of lymphoid tissue covered with a cryptic surface lined with stratified squamous epithelium. The capsule is continuous with the pharyngobasilar fascia that is closely adherent to the tonsillar tissue but loosely associated with the three muscles of the tonsillar fossa. The fossa is composed of the palatoglossus (anterior pillar), superior constrictor (most of the tonsillar bed) and the palatopharyngeal muscle (posterior pillar). For the arterial blood supply for the tonsils, there are typically three arteries at the lower pole: the dorsal lingual artery anteriorly, the ascending palatine artery (a branch of the facial artery) posteriorly, and the tonsillar branch of the facial artery. At the upper pole of the tonsil the ascending pharyngeal artery enters posteriorly, and the lesser palatine artery enters on the anterior surface. The tonsillar branch of the facial artery is the largest.

The nerve supply is the tonsillar branches of the glossopharyngeal nerve at the lower pole of the tonsil and through the descending branches of the lesser palatine nerves, which go through the pterygopalatine ganglion. The cause of referred otalgia with tonsillitis is through the tympanic branch of the glossopharyngeal nerve.

Grading of tonsils and tonsil positions

Visual inspection without tongue blade can be adequate for examining the tonsils in most cases but sometimes in children with prominent tongues, long soft palates or small oropharynx a tongue blade can be helpful. The size of the tonsils are usually measured based on the enlargement of the tonsils as they extend toward the midline. Brodksy, Moore, and Stanievich described an assessment scale for tonsillar hypertrophy. This scale often used for measurement is based on percent obstruction and can be categorized by values ranging from 0 to 4+, or as a corresponding percentage based on the distance from the anterior pillars and the medial edge of the tonsils.

Tonsil variation can also be encountered based on positioning of the tonsils and relative shape. The tonsils can be bi-lobed, have asymmetric enlargement when comparing the upper vs. the lower poles which can result in either hypopharynx or rarely nasopharynx obstruction.

Peritonsillar Abscess

Peritonsillar Abscess (PTA) can arise near the superior pole of the palatine tonsil, or from infection in the tonsillar fossa due to adjacent acute tonsillitis. There is also some evidence that the infection can arise from obstruction of Weber glands near the superior pole of the tonsil. The exact incidence of PTA is estimated at 30 cases per 100,000 people per year in the United States. The controversies surrounding PTA include proper diagnosis, the best method of management, and indications for tonsillectomy, either urgent or elective. Management issues can be further complicated in pediatric patients who are too young to tolerate bedside drainage under local anesthesia.

Diagnosis is historically by physical exam but as new diagnostic techniques have become available, other imaging such as ultrasound (US) and computed tomography (CT) have been used. Studies using intra-oral US by Lyon *et al.* and Blavias *et al.* have shown good results with finding abscesses and treatment with needle aspiration in these patients have been shown to be more successful by ER physicians. However, CT scans remain the imaging of choice in uncooperative children unable to tolerate examination by intra-oral US.

Management centers on either aspiration or incision and drainage (I&D) at the bedside with local anesthesia or under general anesthesia in the operating room with possible tonsillectomy (Quinsy Tonsillectomy). Other options include treatment with antibiotics alone or interval tonsillectomy after infection has resolved. The controversy of the best treatment from the selected above is what has caused so much debate surrounding treatment for PTAs. Johnson *et al.* performed an EBM review of the effectiveness of tonsillectomy on PTA and what is the best method for acute management. Their findings showed that I&D had a slightly higher success rate vs. needle aspiration (94% vs. 92%), with I&D being more painful, with the NNT was 48 patients for I&D. Thus, the authors concluded that needle aspiration was the better initial treatment and then I&D if aspiration failed. The use of steroids was also looked at by Ozbek *et al.* which showed IM steroids were beneficial for several outcomes of patients concurrently treated for PTA by either needle aspiration or I&D. Some of these outcomes listed were less post-op fever after 24h and quicker ability to swallow water than placebo group.

Unilateral Tonsillar Enlargement

Most often due to asymmetric tonsil position rather than a unilateral enlarged tonsil. The nature of the enlargement can be due to uncommon infections such as atypical mycobacteria, fungi and actinomycosis. Other etiologies such as neoplastic processes are also possible, especially lymphoma and for this reason “true” unilateral tonsil enlargement must be ruled-out by excisional biopsy of the tonsil.

Clinical presentation can be slow and progressive, with voice changes and new-onset snoring. Diagnosis is by excisional biopsy and accompanying CT scans can be helpful for recognizing any extracapsular extension. For suspected neoplasm a preoperative consultation with a pediatric oncologist for concurrent bone marrow biopsy can also be helpful while the child is already under general anesthesia.

Hemorrhagic Tonsillitis

Seen infrequently, but can result from both acute and chronic tonsillitis. In chronic or recurrent acute tonsillitis, dilated blood vessels on the surface of the tonsil can rupture and bleed. The bleeding can also arise from the tonsillar parenchymal tissue, or from previously unrecognized bleeding disorders. Treatment is hemostasis of the bleeding or tonsillectomy if the patient is young and uncooperative with local control and the bleeding is recurrent.

Lingual Tonsil

The lingual tonsils are non-encapsulated lymphoid tissue and extend from the tongue base to the vallecula. Recurrent infection and laryngopharyngeal reflux are often causes for hyperplasia of this tissue may lead to respiratory problems and, rarely, OSA. Although the lymphoid tissue in Waldeyer's ring tends to decrease with advancing age, the lingual tonsil may increase in size as a compensatory response to previous adenotonsillectomy. Clinical presentation of lingual tonsil hyperplasia can be heralded by sore throat, globus sensation, speech change, dysphagia, obstructive sleep apnea in adults and pediatric airway obstruction. Lingual tonsil enlargement is usually discovered incidentally during difficult intubations, often for non-ENT related surgical procedures. Surgical treatment is indicated when a patient is refractory to medical therapy. Surgical treatment can include direct laryngoscopy and removal of the tonsil tissue with CO2 laser, sharp dissection or bovie cautery.

Down's Syndrome

Down's syndrome most often results from trisomy of chromosome 21 (95%) with the other 3-4% of cases having an unbalanced translocation. The syndrome is can be characterized by: mental retardation, microbrachycephaly, flat occiput, short neck, oblique palpebral fissures, epicanthal folds, flat nasal dorsum, small low-set auricles, stenotic ear canals, prominent furrowed tongue & microdontia with fused teeth.

Predisposing factors for OSA are: midfacial hypoplasia; micrognathia; narrow nasopharynx; small oral cavity; macroglossia; relative tonsil and adenoid hyperplasia; increased secretions; hypotonia of the palatal, lingual, and pharyngeal muscles; laryngotracheal

abnormalities; and obesity. There is an increased incidence of chronic rhinosinusitis and tonsillitis in children with Down syndrome.

Tonsillectomy and adenoidectomy (T&A) may be required in children with Down syndrome for treatment of upper-airway obstruction, OSAS, recurrent or chronic tonsillitis, recurrent peritonsillar abscesses, dentofacial abnormalities, and, rarely, for malignant neoplasms, spontaneous tonsil hemorrhage, and refractory halitosis.

In a study by Goldstein et al. they looked at length of hospitalization and postoperative outcomes of children who had tonsillectomy with comparison of patients with and without Down's syndrome. They concluded that the rate of postoperative respiratory complications is higher and the duration until adequate oral intake is resumed is longer in children with Down's syndrome. They also recommend that children with Down syndrome be admitted to the hospital overnight after undergoing tonsillectomy and adenoidectomy.

Cleft Palate

Submucous cleft palate has an appearance of a bifid uvula, a midline lucency of the soft palate and notching of the hard palate. The palatal hypofunction that results from the associated muscular abnormalities is known to carry a risk of VPI should an adenoidectomy be performed.

An occult submucous cleft is a less well-recognized anatomical anomaly. It too involves abnormality of the structure and function of the palatal musculature, but is not detectable on oral examination. On endoscopic examination of the nasopharynx, there is loss of the midline convexity of the superior surface of the soft palate with either flattening or a midline groove, consistent with the absence of musculus uvulae. This is sometimes known as the 'seagull sign'.

The presence of an irregular mass of residual adenoid tissue can lead to VPI if it prevents the soft palate from moving to close against the posterior pharyngeal wall and there is space for air to escape around the residual tissue. Careful visualization of the postnasal space during or after adenoidectomy should minimize this problem. The precise effect of any remaining tissue depends on the pre-existing pattern of velopharyngeal closure (coronal, circular or sagittal).

Indications

Tonsillectomy - The current clinical indicators for tonsillectomy as recommended by the AAO-HNS in 2000 are:

- Patient with 3 or more infections per year despite adequate medical therapy.
- Hypertrophy causing dental malocclusion or adversely affecting orofacial growth documented by orthodontist.
- Hypertrophy causing upper airway obstruction, severe dysphagia, sleep disorders, or cardiopulmonary complications.
- Peritonsillar abscess unresponsive to medical management and drainage documented by surgeon, unless surgery performed during acute stage.
- Persistent foul taste or breath due to chronic tonsillitis not responsive to medical therapy.
- Chronic or recurrent tonsillitis associated with the streptococcal carrier state and not

- responding to beta-lactamase resistant antibiotics.
- Unilateral tonsil hypertrophy presumed neoplastic.

Adenoidectomy - The current clinical indicators for adenoidectomy as recommended by the AAO-HNS in 2000 are:

- Four or more episodes of recurrent purulent rhinorrhea in prior 12 months in a child <12. One episode documented by intranasal examination or diagnostic imaging.
- Persisting symptoms of adenoiditis after 2 courses of antibiotic therapy. One course of antibiotics should be with a beta-lactamase stable antibiotic for at least 2 weeks.
- Sleep disturbance with nasal airway obstruction persisting for at least 3 months. d) Hyponasal or nasal speech
- Otitis media with effusion >3 months or second set of tubes
- Dental malocclusion or orofacial growth disturbance documented by orthodontist.
- Cardiopulmonary complications including cor pulmonale, pulmonary hypertension, right ventricular hypertrophy associated with upper airway obstruction.
- Otitis media with effusion over age 4.

Contraindications

As described in Bluestone's Pediatric Otolaryngology, contraindications can be divided into 4 categories; velopharyngeal, hematologic, immunologic and infectious.

- Velopharyngeal insufficiency are usually a contraindication for adenoidectomy. These are for cleft palate patients and those with neuromuscular and neurological disorders.
- Hematologic contraindications to tonsil or adenoid surgery are anemia or any disorder of hemostasis. Surgical intervention in this population can still be undertaken provided the proper work-up and pre- and post-operative management is in place for this patient group.
- Respiratory allergy untreated can represent a relative contraindication for some physicians. A trial of anti-allergy medicine such as a nasal steroid can be first line management before surgical intervention in some patients.
- Active infection is another relative contraindication unless the urgent removal is necessary. In interval of 3 months or more is recommended between tonsil infections to reduce risk of operative hemorrhage.

Complications

Hemorrhage is the most common complication. An estimated 2-3% of patients have hemorrhage, and 1 of 40,000 patients die from bleeding.

Pressure can be applied to a bleeding tonsil fossa by using a sponge and a long clamp. Options to stop the bleeding are electrocautery of the tonsil bed, use of further topical hemostatics, or ligation of the ipsilateral carotid artery as the last resort. Diathermy is thought to be superior to ligation because of the risk of perforating large vessels with the needle. In severe situations, a sponge may be fixed in place by using sutures. Another last resort is ligation of

other large vessels, such as the external carotid artery.

Bleeding may be classified as intraoperative, primary (occurring within the first 24 hours), or secondary (occurring between 24 hours and 10 days).

Other complications include the following:

- Pain (eg, sore throat, otalgia)
- Dehydration (common in children who do not eat because of pain)
- Weight loss (common in children who do not eat because of pain)
- Fever (not common, usually related to local infection)
- Postoperative airway obstruction (because of uvular edema, hematoma, aspirated material)
- Pulmonary edema (occurs in people with true airway obstruction caused by tonsils)
- Local trauma to oral tissues
- Tonsillar remnants
- Vocal changes (If the tonsils are large, the patient's voice may be muffled.)
- Psychological trauma, night terrors, or depression
- Death (uncommon, usually related to bleeding or anesthetic complications)

Late complications are nasopharyngeal stenosis and velopharyngeal incompetence. These complications are most likely to occur if adenoidectomy or uvulopalatopharyngoplasty is undertaken at the same time as tonsillectomy.

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