



Tonsillitis & Adenoiditis

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Learning objectives:

- **By the end of this lecture, you will be able to:**

1. Identify the anatomy, Structure and Function of palatine and nasopharyngeal tonsils.
2. Understand the effects of Tonsillitis and Tonsillectomy on Immunity.
3. Understand the clinical picture of chronic inflammation.
4. List the indications, contraindications and complications of both tonsillectomy and adenoidectomy.

Reference

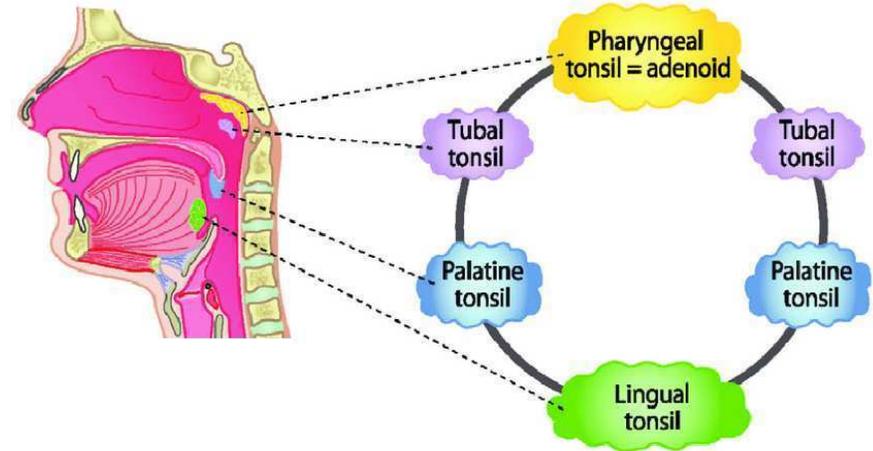
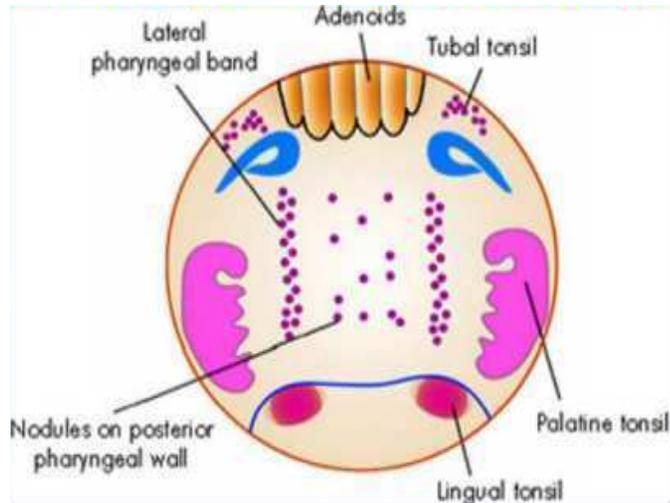
The screenshot shows the website for the American Academy of Otolaryngology-Head and Neck Surgery Foundation. The main header features the journal title "Otolaryngology-Head and Neck Surgery" in white text on a dark orange background. To the right is the foundation's logo, a colorful swirl, and the text "AMERICAN ACADEMY OF OTOLARYNGOLOGY-HEAD AND NECK SURGERY FOUNDATION". Below the header is a navigation bar with links for "Journal Home", "Browse Journal", "Journal Info", and "Stay Connected", along with a red "Submit Paper" button and the acronym "AAO-HNS". A sidebar on the left contains a "Menu" button and a "Download PDF" button. The main content area displays the title "Clinical Practice Guideline: Tonsillectomy in Children (Update)" by Ron B. Mitchell, MD, Sanford M. Archer, MD, Stacey L. Ishman, MD, MPH, and others. It includes the publication date "First Published February 5, 2019", the article type "Research Article", a "Find in PubMed" link, and a "Check for updates" button. The DOI link is provided as <https://doi.org/10.1177/0194599818801757>.

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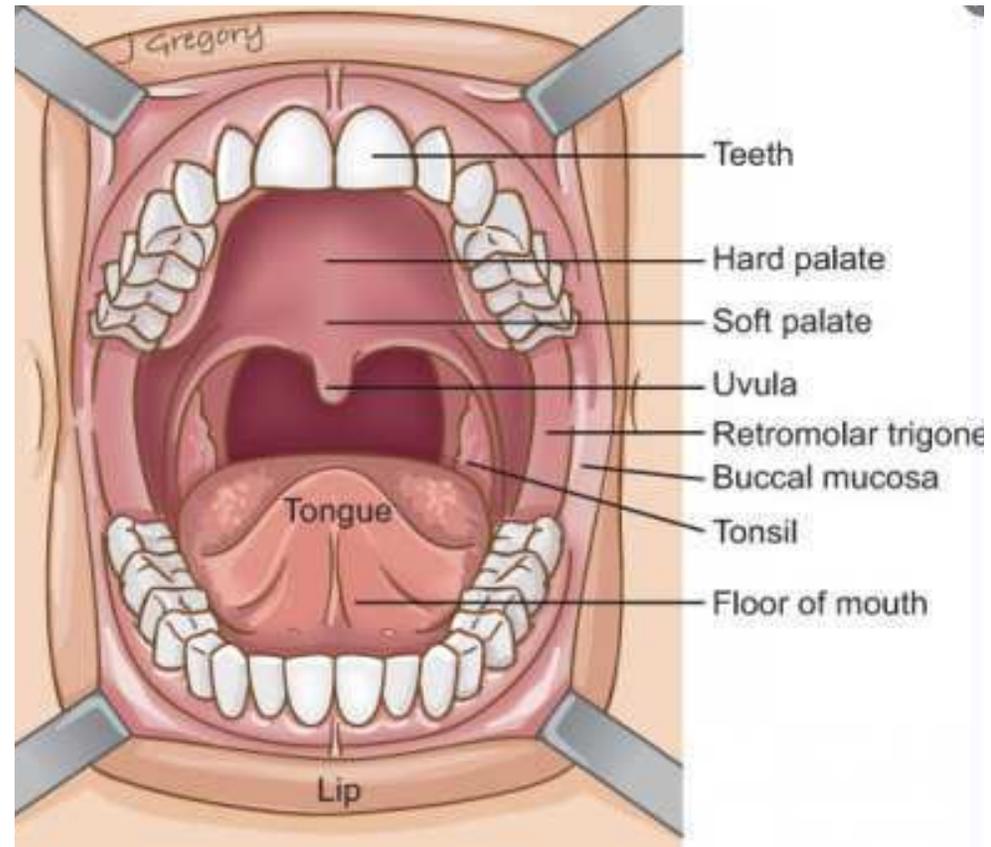
Relevant anatomy (Waldeyer's ring)

- Waldeyer's lymphatic ring, or tonsillar ring) is a **ringed** arrangement of **lymphoid organs in the pharynx**. Waldeyer's ring surrounds the naso- and oropharynx, with some of its tonsillar tissue located above and some below the soft palate (and to the back of the mouth cavity)



Relevant anatomy (Palatine Tonsils)

- The palatine tonsils are Lymphoepithelial organs located at the junction of the oral cavity and oropharynx.
- They are strategically positioned to serve as secondary lymphoid organs, initiating immune responses against antigens entering the body through the mouth or nose.
- The **greatest** immunologic **activity** of the tonsils is found between the **ages of 3 and 10 years**.
- As a result, the tonsils are most prominent during this period of childhood and subsequently demonstrate **age-dependent involution**.



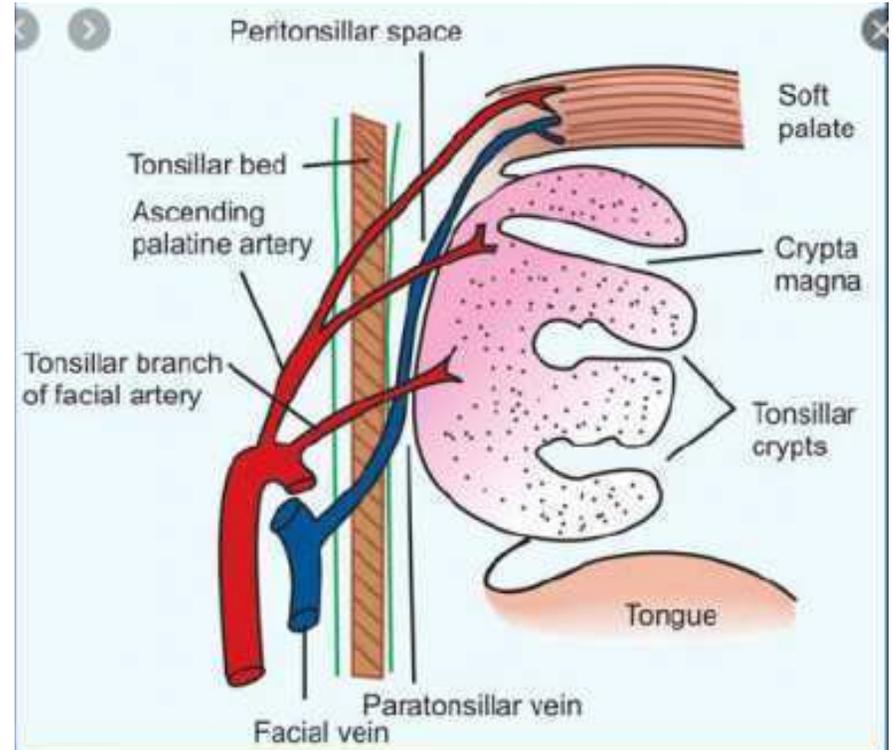
Relevant anatomy (Palatine Tonsils)

- **Blood supply :**

- Main blood supply :
 - ❑ **The tonsillar branch of the facial artery**
- other contributors
 - ❑ The ascending pharyngeal
 - ❑ descending palatine
 - ❑ the dorsal lingual branch of the lingual artery also contribute.

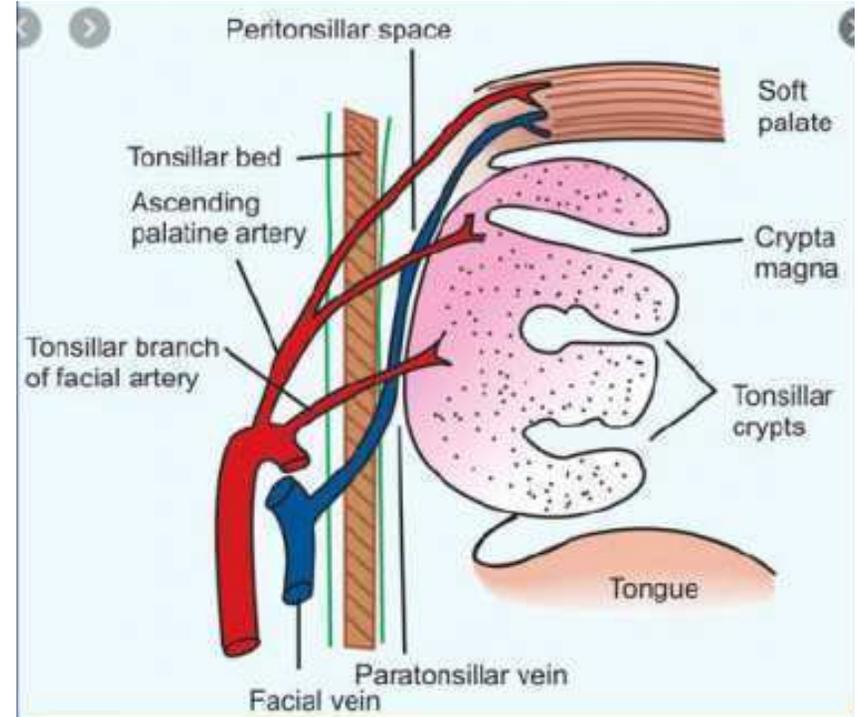
- **The nerve supply**

- Mainly from **CN IX**
- Some branches of **lesser palatine nerve** via the sphenopalatine ganglion.



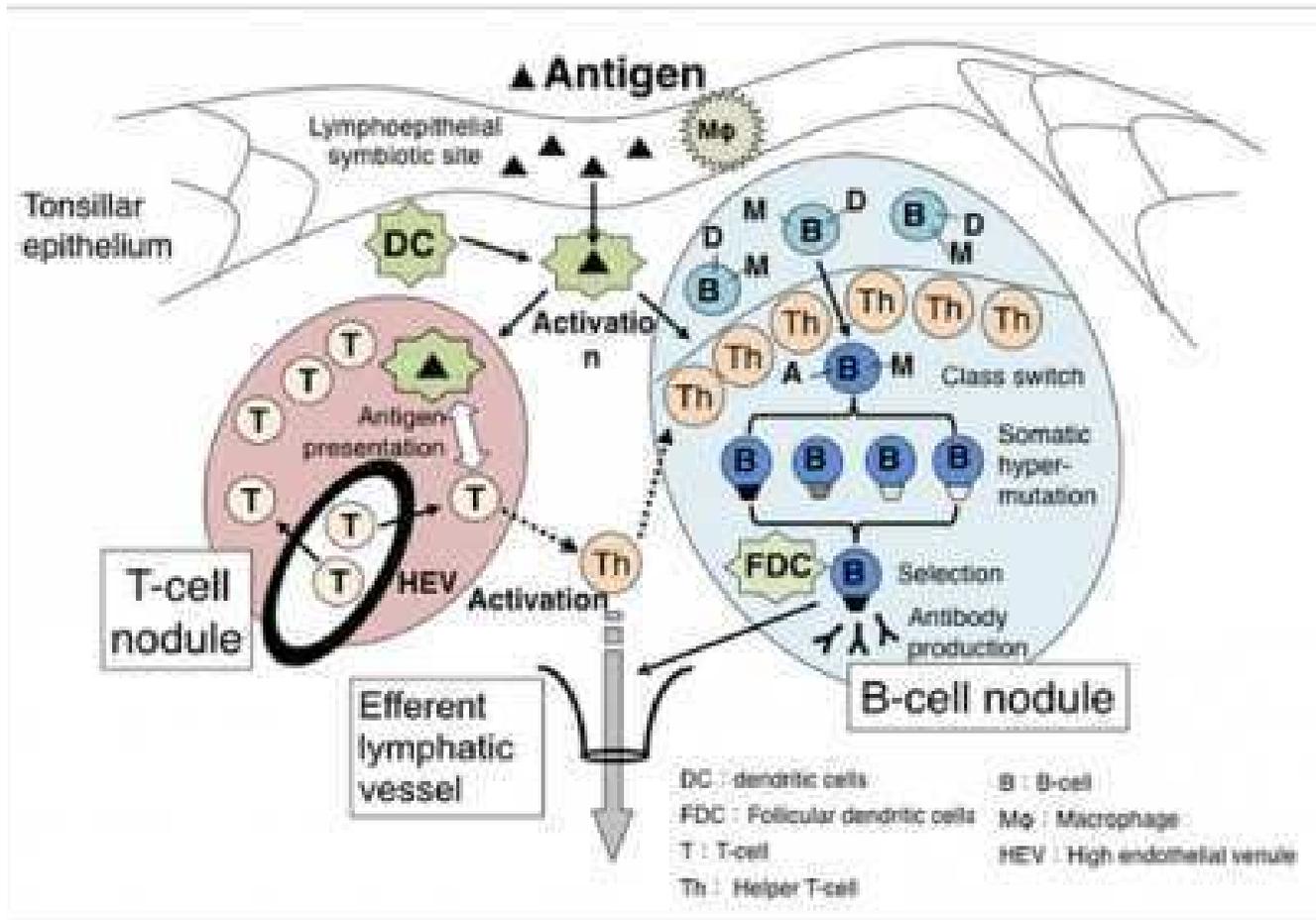
Relevant anatomy (Palatine Tonsils)

- The luminal surface of the tonsil is covered by deeply invaginated **stratified squamous epithelium**.
- In most people, the **internal carotid** artery lies **two centimeters posterolateral** to the deep surface of the tonsil; however in 1% of the population, it is found just deep to the **superior constrictor muscle**.
- The base of the tonsil is separated from the underlying muscle by a dense collagenous hemi-capsule.
- The parenchyma consists of numerous lymphoid follicles dispersed just beneath the epithelium of the crypts.



Immunological role and histology of palatine tonsils

- The tonsils and adenoids are important in the production of antigen-specific secretory IgA.
- A system of **clefts** covered by **specialized epithelium** allows intimate contact between antigens and immune competent cells.
- **Antigens are transported by M cells** in the specialized squamous epithelium to a tubovesicular system where they are **captured by APC** (antigen processing cells) and transported to the next layer, the extra follicular area.
- The extra **follicular area is rich in T-cells** , contains abundant vasculature allowing circulating lymphocytes to gain access to the tonsils. The lymphoid follicle is encased by the mantle zone where mature lymphocytes reside.
- At the core of the lymphoid follicle is the **germinal center** where immunoglobulin production takes place by **B cells** .



Effects of Tonsillitis and Tonsillectomy on Immunity

- With **recurrent tonsillitis**, the controlled process of **antigen transport and presentation is altered** due to shedding of the M cells from the tonsil epithelium.
- The **direct influx of antigens** disproportionately expands the population of mature B-cell clones, and as a result, **fewer early memory B cells** go on to become J chain–positive **IgA immunocytes**.
- In addition, the tonsillar lymphocytes can become so overwhelmed with persistent antigenic stimulation that they may be unable to respond to other antigens.
- Once this immunologic impairment occurs, the tonsil is no longer able to function adequately in local protection, nor can it appropriately reinforce the secretory immune system of the upper respiratory tract. There would therefore appear to be a therapeutic advantage to removing recurrently diseased tonsils. However, some studies demonstrated minor alterations of Ig concentrations in the serum and adjacent tissues following tonsillectomy.
- Nevertheless, there are no studies to date that demonstrate a significant clinical impact of tonsillectomy on the immune system

Microbiology

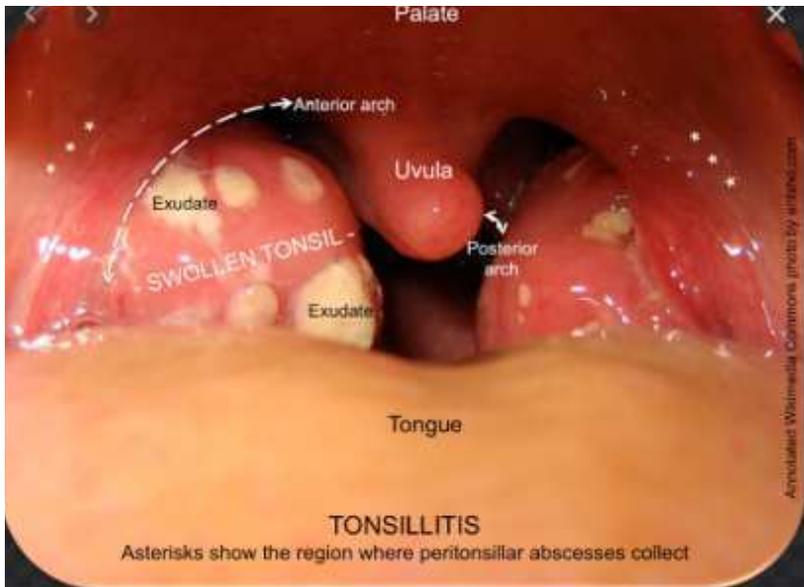
- Tonsillopharyngitis may be caused by a number of pathogens
- Studies have shown that the **majority of acute infections are incited by viruses** and may lead to secondary bacterial infection.
- Approximately **5 to 30% of acute infections are bacterial** ,the most frequently cultured bacteria from patients with recurrent acute tonsillitis and tonsil hypertrophy are :
 - H. influenza
 - S. aureus
 - Strept pneumo
 - Strept pyogenes (group A beta-hemolytic streptococci or GABHS)
- **GABHS is the most important bacterial pathogen due to its potential sequelae** , rheumatic fever and glomerulonephritis. Although the incidence of rheumatic fever is decreasing in the US, many developing countries show it as the etiology of 30-40% of all heart disease.
- The prevalence of Staph aureus increased from 6 to 40%. Also more commonly seen now are anaerobic (particularly Bacteroides) and polymicrobial infections.

Tonsillitis

- **Tonsillar disease can also be divided into four categories:**
 - 1. Acute tonsillitis**
 - 2. Recurrent acute tonsillitis**
 - 3. Chronic tonsillitis**
 - 4. Obstructive tonsillar hyperplasia .**

Acute tonsillitis

- Patients with acute tonsillitis may have
 - a sore throat
 - fever
 - dysphagia
 - tender cervical lymphadenopathy
 - and erythematous/exudative tonsils
- a throat culture should be obtained to test for GABHS.
- The incidence of GABHS pharyngitis is lowest in the infant and peaks from 6-12 years of age.
- Another common cause of a sore throat is acute pharyngitis.
- A patient with acute **pharyngitis will have diffuse erythema of the soft palate** and pharyngeal wall **but no involvement of the tonsils** or lymph nodes.

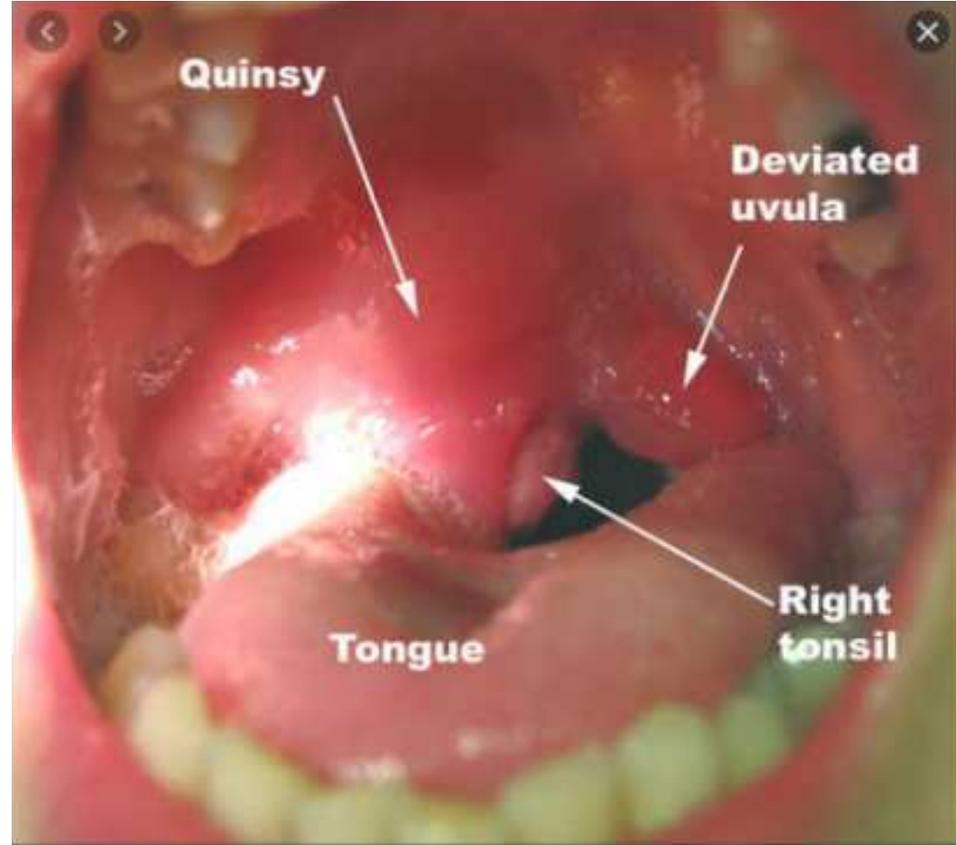


Complications of Acute tonsillitis

- Cervical adenitis.
- Retropharyngeal abscess.
- Parapharyngeal abscess.
- Peritonsillar abscess.
- Intratonsillar abscess.
- Inflammatory torticollis.
- Hemorrhagic tonsillitis.

Peritonsillar abscess (Quinsy)

- It is caused by infection of crypts in the supratonsillar fossa and can result in infection of the Parapharyngeal space if the superior constrictor muscle is penetrated.
- The condition is preceded by acute tonsillitis and is characterized by:
 - low grade fever
 - trismus (pain when opening the mouth)
 - difficulty swallowing secretions.



Chronic tonsillitis

- The physician should consider the diagnosis of chronic tonsillitis when the patient has a **sore throat or pain with swallowing** that last **longer than 4 weeks**.
- Associated symptoms include
 - tonsillitis
 - halitosis
 - excessive tonsillar debris
 - Peritonsillar erythema
 - persistent tender cervical lymphadenopathy.



Obstructive tonsillar hyperplasia

- general symptoms
 - loud snoring
 - dysphagia
 - voice changes.
- In **adults**, **excessive daytime sleepiness** is the most common presenting symptom of OSA.
- In **children**
 - **snoring is the most common presenting symptom**
 - Nocturnal enuresis
 - Lower mental activity ,decreased attention span and poor scholastic performance,could be diffued with attention deficit.



Does it matter ???

Clinical presentation

- Each episode of tonsillitis had to have one or more of the following:
 - oral temperature of at least 38.C
 - Enlarged (>2cm)
 - tender cervical adenopathy
 - tonsillar or pharyngeal exudate
 - positive culture for GABHS.
- Attention should be made to symptoms of failure to thrive and cor pulmonale from chronic tonsillar hypertrophy.
- Complications of GABHS such as post streptococcal glomerulonephritis and rheumatic fever should be considered.

Physical examination

- the **size of the tonsils** should be documented. The following grading system was developed by Brodsky et al. using the ratio of the width of the tonsils to the width of the oropharynx (next slide)
- The **surface of the tonsils** should be examined for **erythema or exudate**.
- Patients should be examined for craniofacial, neuromuscular, or CNS anomalies as these conditions put patients at greater risk for airway obstruction and postoperative complications.

Tonsil Grades

the Tonsils are graded by the percentage they Occupy of the lateral dimension of the oropharynx

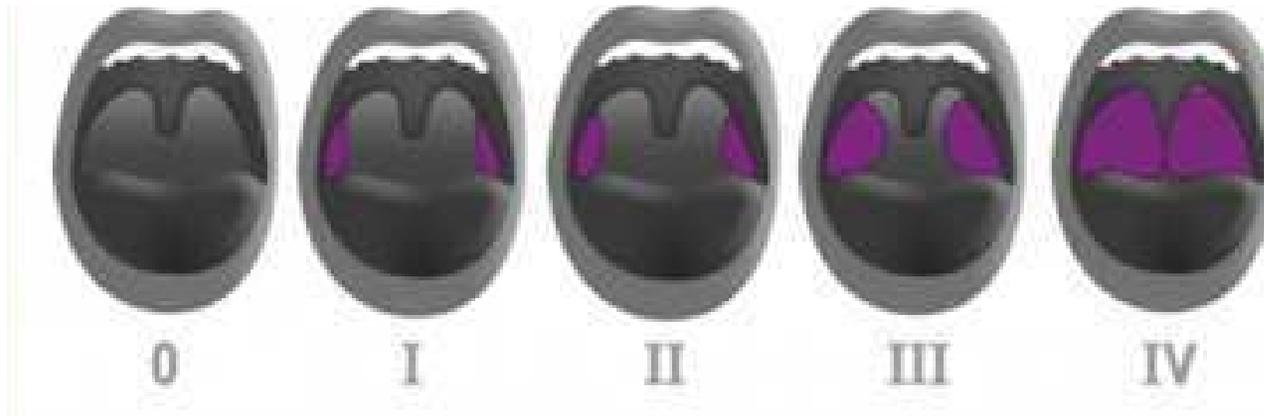
0 — Tonsils are **entirely within the tonsillar pillar** (removed by surgery)

1+ — Occupy **less than 25 percent**

2+ — Occupy **26 to 50 percent**

3+ — Occupy **51 to 75 percent**

4+ — Occupy **more than 75 percent** (Kissing tonsils)



OBSTRUCTIVE SLEEP APNEA (OSA)

- Many physicians use subjective criteria to diagnose sleep disordered breathing in children.
 - A number of clinical studies have shown no correlation of the patient's history to the sleep study findings.
 - The best objective method to diagnose OSA is by multichannel polysomnography (PSG),
 - The most common pattern in children is continuous partial obstructive hypoventilation. Therefore, PSG is only ordered if the history and physical exam are not in agreement or in children who are at unusually high risk for perioperative complications.
-
- PSG records the oxygen level in your blood, heart rate and breathing and other metrics during the study

Medical Management

- Brodsky reports that adenotonsillar hyperplasia may respond to one month of antibiotics (Augmentin, clindamycin).
- Penicillin is still the 1st line agent for acute adenotonsillitis, and in the face of a negative throat culture for GABHS, should still be used if clinical suspicion is high.

Tonsillectomy

Historic Background

TONSILLECTOMY

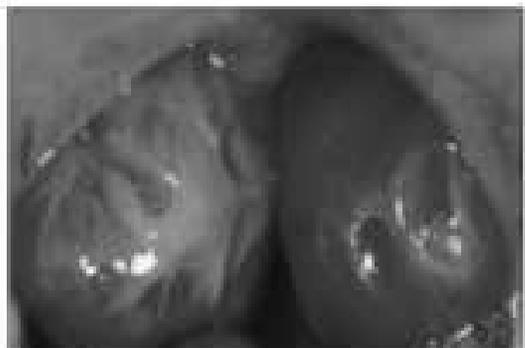
10 A.D.	Celsus first to report removal of tonsils
6 th century	Aetius of Amida on the Tigris described a technique for tonsillectomy
625	Paul of Aegina described tonsillar forceps
1757	Caque of Rheims first tonsillectomy
1827	Physick described the first tonsillar guillotine
19 th century	Mackenzie popularized the surgery

INDICATIONS FOR POLYSOMNOGRAPHY

- Before performing tonsillectomy, the clinician should refer children with obstructive sleep-disordered breathing (oSDB) for polysomnography (PSG) if they are
 - <2 years of age
 - Exhibit any of the following :
 - Obese
 - Down syndrome
 - Craniofacial abnormalities
 - Neuromuscular disorders
 - Sickle cell disease
 - Mucopolysaccharidoses.
- Without any of the comorbidities listed above for whom the need for tonsillectomy is uncertain or when there is discordance between the physical examination and the reported severity of oSDB.



Who Needs a Sleep Study Before Surgery?



Tonsillectomy Indications for Recurrent Tonsillitis

Minimum Frequency of Sore Throat Episodes	At least : 7 episodes in the previous year 5 episodes in each of the 2 previous years 3 episodes in each of the previous 3 year
Clinical features	Sore throat plus at least 1 of the following features qualifies as a counting episode: <ul style="list-style-type: none">•Temperature greater than 100.9 (38.3)•Cervical adenopathy (tender lymph nodes or lymph node size greater than 2 cm)•Tonsillar exudate•Culture positive for group A β--hemolytic streptococcus
Treatment	Antibiotics administered in the conventional dosage for proved or suspected streptococcal episode
Documentation	Each episode of throat infection and its qualifying features substantiated by contemporaneous notation in a medical record If the episodes are not fully documented, subsequent observance by the physician of 2 episodes of throat infection with patterns of frequency and clinical features consistent with the initial hist

Other Absolute indications

- **Pediatric OSA**
 - Most common cause of upper airway obstruction remains adenoid & tonsil hypertrophy
 - If hypertrophic tonsil & adenoid tissue are present—adenotonsillectomy(T&A) first line treatment
- **Multiple antibiotic allergy/intolerance**
- **PFAPA –Periodic fever, aphthous stomatitis, pharyngitis, adenitis**
- **History of peritonsillar abscess**
- **PANDAS--Pediatric Autoimmune Neuropsychiatric Disorders Associated with Streptococcal infections**
- **Poorly validated clinical indications –halitosis, febrile seizures, malocclusion of teeth**

Tonsillectomy as part of another procedure

1. Excision of elongated styloid process (Eagle syndrome) – Nagging throat pain and a palpatory finding in the tonsillar fossa.
2. Glossopharyngeal neuralgia
3. UPPP (Uvulopalatopharyngoplasty) or LAUP (Laser-assisted uvulopalatoplasty) or CAUP (Coblation assisted uvulopalatoplasty)

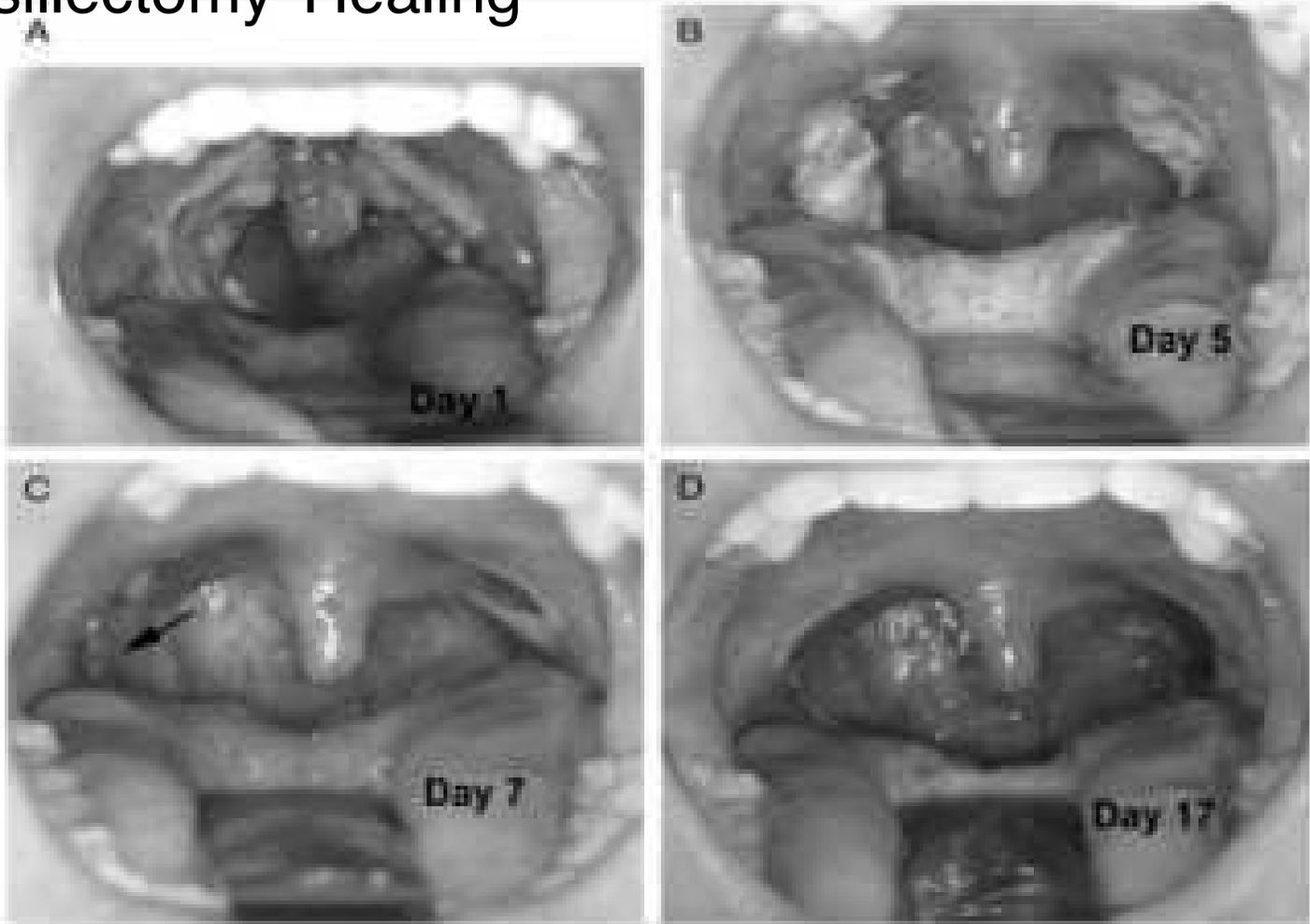
Contraindications

1. **Bleeding disorders**
2. Cleft palate or sub mucous cleft palate Velopharyngeal insufficiency
3. Acute infection
4. Uncontrolled systemic disease
5. Anemia
6. Extremes of age

The surgery



Post--tonsillectomy Healing

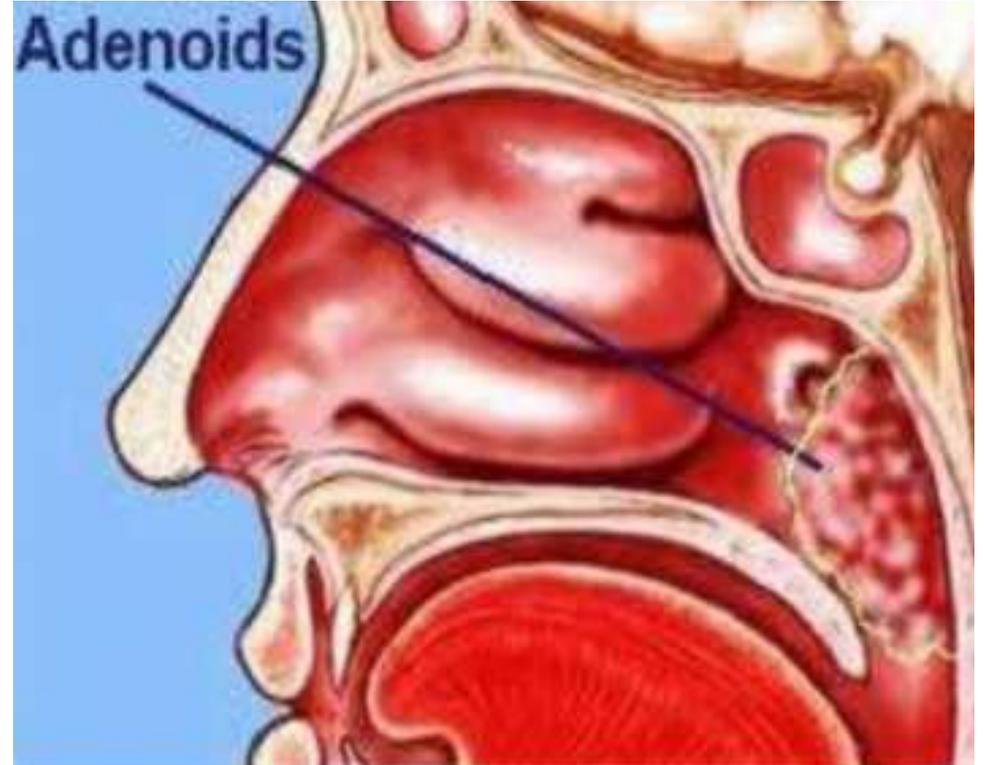


Complications of tonsillectomy

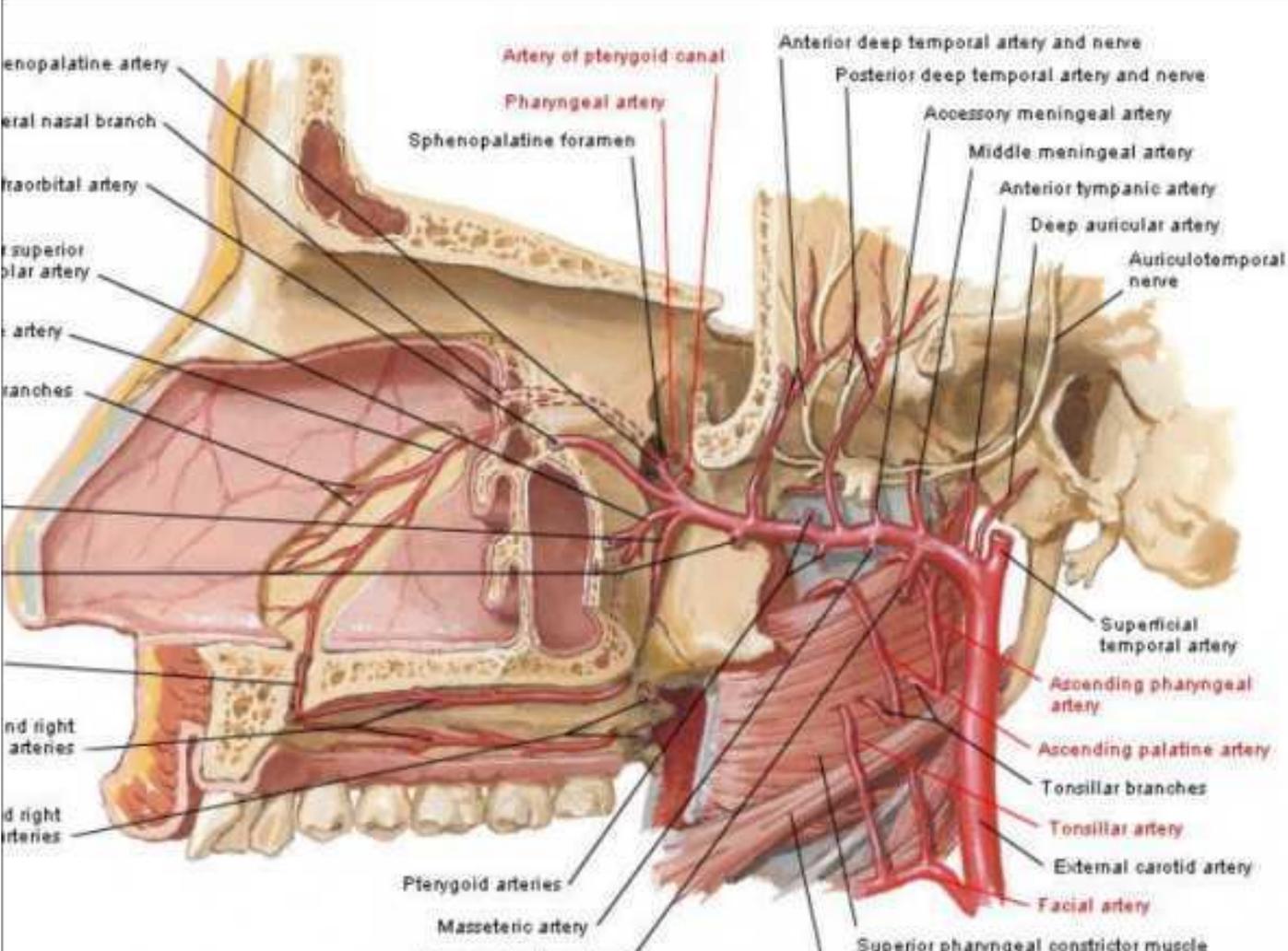
Intraoperative	<ul style="list-style-type: none">- Laryngospasm and/or bronchospasm- Aspiration- Trauma: tooth fracture, perioral burns, Grisel syndrome, subcutaneous emphysema, subcondylar mandible fracture- Uncontrollable hemorrhage
Early postoperative (<24 h)	<ul style="list-style-type: none">- Nausea and vomiting- Pain- Bleeding- Edema of the uvula- Airway obstruction- Postobstructive pulmonary edema
Delayed postoperative (2-21 days)	<ul style="list-style-type: none">- Pain- Dehydration- Bleeding- Tonsillectomy bed infection- Neck infections: neck abscess, necrotizing fasciitis, cervical osteomyelitis
Long-term	<ul style="list-style-type: none">- Velopharyngeal insufficiency- Pharyngeal stenosis- Tonsillar remnants- Subacute endocarditis- Cranial nerve lesions- Taste disturbances

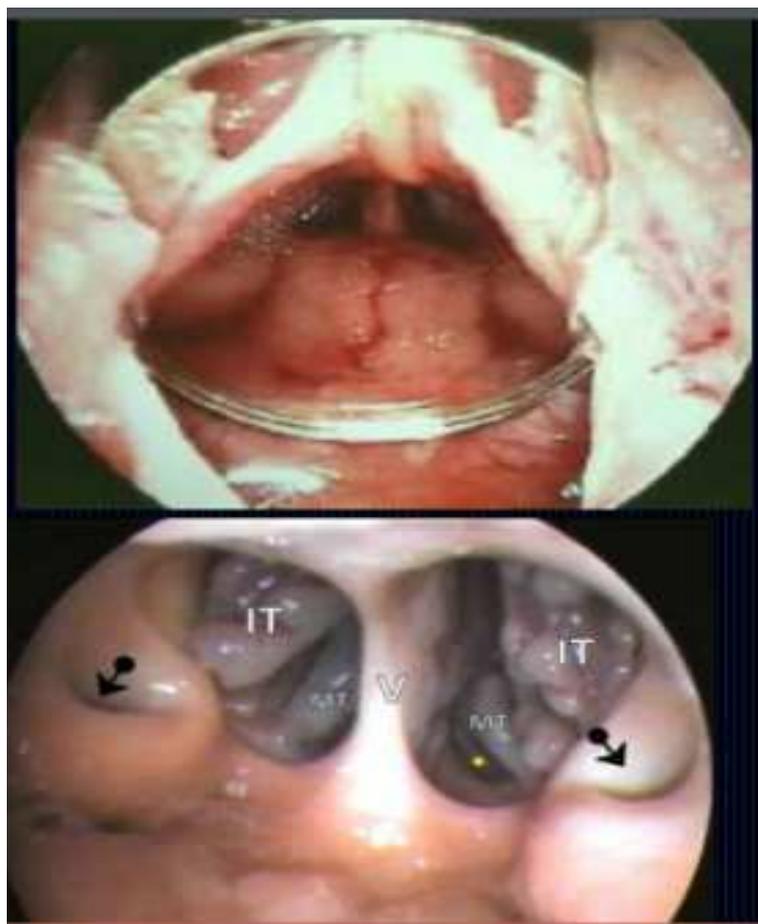
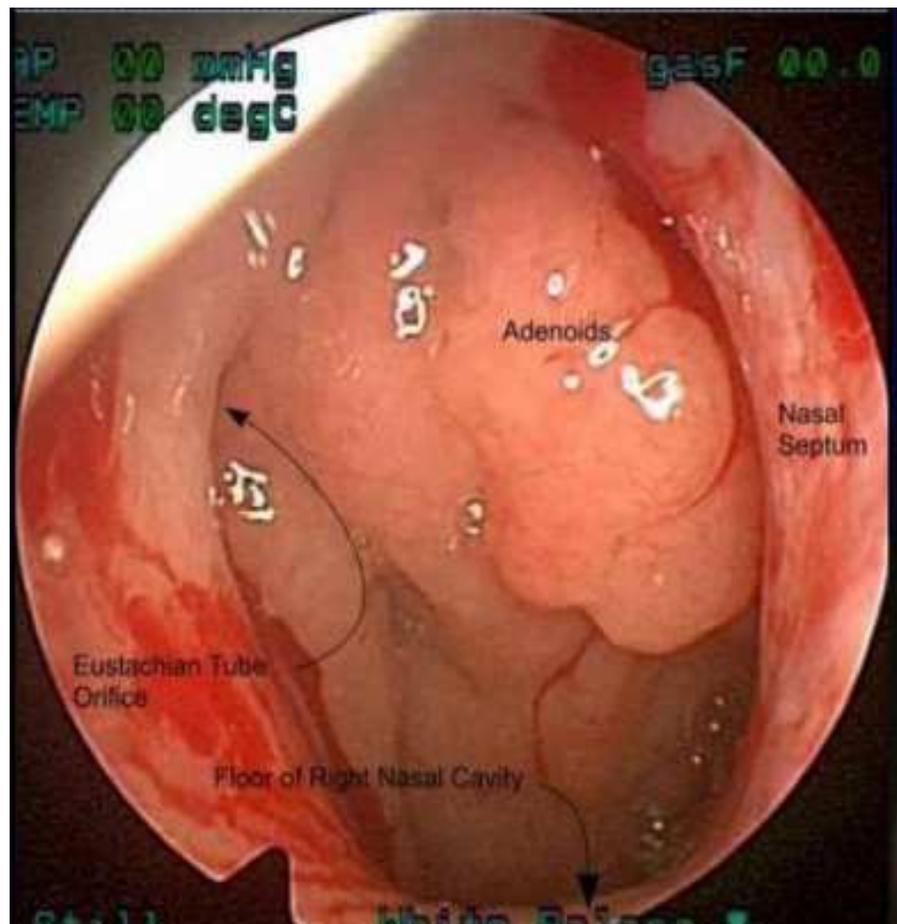
Adenoids

- The adenoid tissue is positioned in the midline of the posterior nasopharyngeal wall immediately inferior to the rostrum of the sphenoid.
- It makes up the most rostral portion of the pharyngeal lymphoid tissue termed Waldeyer's ring.



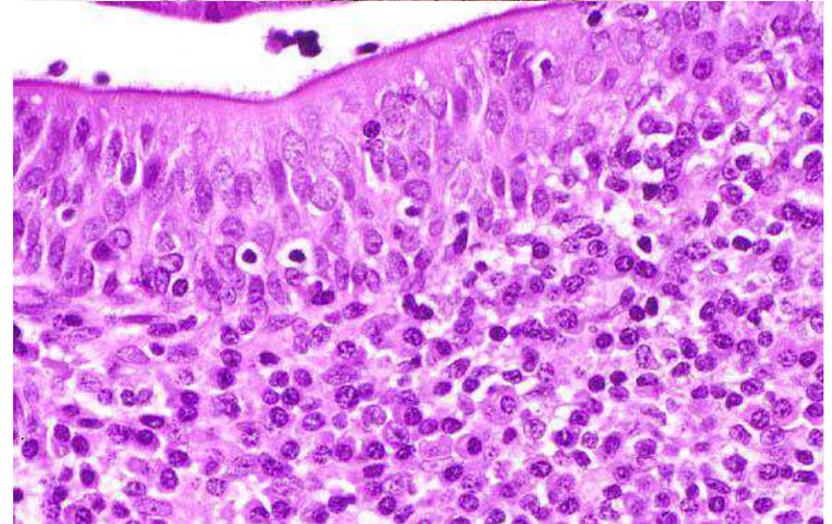
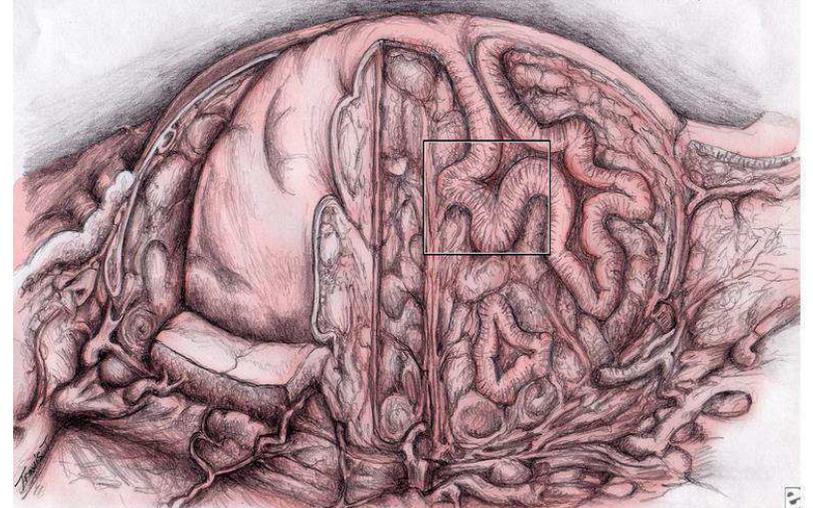
Adenoids





Microscopic Anatomy

- Covered by respiratory epithelium (pseudostratified ciliated columnar epithelium).
- Non-encapsulated (harder to remove).
- Lymphatic parenchyma is organized into follicles. Seromucous glands lie within the connective tissue.
- Germinal centers produce antibodies.



Adenoid Function - Adenoid through out life

- 50 – 65% of its lymphocytes are B-cells.
- Involved in secretory immunity (immunoglobulins).
- Produces IgA, IgG, IgM, IgD
- Although it contributes to the mucosal immunity of the upper aero digestive tract, no major immunodeficiency results from adenoidectomy.
- Can be identified at 4 – 6 weeks of gestation
- They are present at birth and start growing rapidly, usually become symptomatic by 18 – 24 months
- Snoring
- Nasal airway obstruction
- They usually stop growing by age 5 – 7
- Involution and atrophy at age of 8 – 10 years and by the teenage years they become asymptomatic
- They are rarely seen in adults.

Chronic adenoid hypertrophy

- Infectious and inflammatory processes probably induce a hypertrophy/hyperplasia of the lymphatic tissue.
- Exposure to smoke/pollution has been implicated.
- Associated with:
 - ❑ Snoring/sleep apnea
 - ❑ Mouth breathing
 - ❑ Rhinorrhea
 - ❑ Craniofacial growth abnormalities
 - ❑ Recurrent otitis media
 - ❑ Chronic rhinosinusitis



Clinical symptoms

SYMPTOMS :

LOCAL

- B/L nasal obstruction
- Snoring
- Mouth breathing
- Rhinolalia clausa
- Frequent rhinorrhoea
- Epistaxis
- Feeding problems in children
- Conductive deafness due to ET block
- Cervical lymphadenopathy
- Otitis media
- Adenoids facies
- Bronchitis

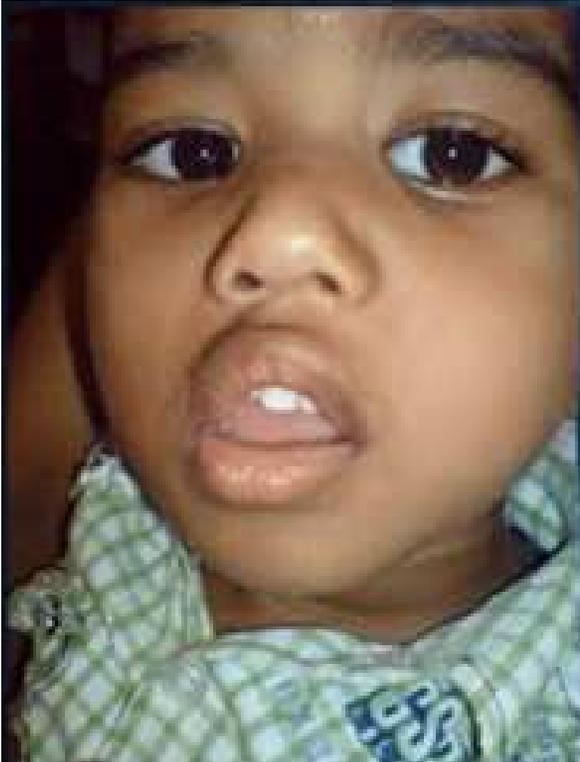
GENERAL

- Anorexia
- Lethargy
- Poor physical & mental development
- Bed-wetting
- Pigeon chest
- Protuberent abdomen

Aural manifestations in Adenoids

- Otagia
- Secretory otitis media
- Acute otitis media
- Atelectasis of TM
- ET block
- Chonic otitis media

Adenoid face



Adenoids Facies

- Sunken eyes
- Narrow pinched nostrils
- Open mouth
- High-arched palate
- Crowded teeth
- Dull mask-like face
- Protruding teeth
- Drooling saliva
- Everted upper lip
- Rhinorrhoea
- Loss of nasolabial fold



Dental malocclusion



Diagnosis

Nasopharyngoscopy

- **Gold standard**

- ▣ Adenoid size can be grading:

- ▣ 1+, 2+, 3+, or 4+ (25%, 50%, 75%, 100% of choanal obs)

- ▣ High correlation with obstructive symptoms

- ▣ Dynamic assessment



Diagnosis

Imaging

Lateral X-ray of the skull isn't necessary in all patients.

? The history and symptoms are more important than the imaging studies.

? Those with significant tonsillar hypertrophy most likely require surgical intervention

? If needed, nasopharyngoscopy should be the initial method used to evaluate adenoid hypertrophy.

? Intolerance to nasopharyngoscopy + obstructive symptoms + NO evident physical findings ? X-ray

? CT scan / MRI if there is another indication



Adenoidectomy

- ❑ Usually associated with other surgical procedures like tonsillectomy or tympanostomy tube placement.
- ❑ Tonsillectomy & adenoidectomy is the most common major surgical procedure in the United States.
- ❑ When performed alone, it's usually done as an outpatient procedure.
- ❑ Outpatient T&A when older than 3 years of age.
- ❑ Infrequently done in teenagers or older individuals.

Indications of adenoidectomy

Adenoid hypertrophy/ airway obstruction

- ☐ Moderate to severe nasal obstruction/ including sleep apneas
- ☐ Chronic mouth breathing/hypo nasal speech/impaired olfaction (quality of life).

- ☐ ***If obstruction persists despite conservative treatment with intranasal glucocorticoids.



Review Article

Systematic review and meta-analysis of randomized controlled trials on the role of mometasone in adenoid hypertrophy in children

Alisha Chohan^a, Avtar Lal^b, Karan Chohan^c, Arunabha Chakravarti^d, Sunil Gumber^e

- Mometasone caused improvements in outcomes of nasal obstruction, snoring, total nasal symptoms, pure tone audiometry, otitis media with effusion, adenoid size, and quality of life. The data is based on meta-analysis of RCTs of poor methodological quality.
- A high methodological quality, placebo controlled RCT of different doses and duration of administration of mometasone is required to evaluate its clear efficacy and safety in children with adenoid hypertrophy.

Indications of adenoidectomy

Obstructive Sleep apnea

- Almost always associated with hypertrophy of the tonsils and adenoids.
- Worse when in supine and asleep due to gravity and the relaxation of the surrounding tissues.
- Most children have a history of significant snoring.
- Daytime sleepiness, morning headache, dry mouth, halitosis, swallowing difficulty, hyponasal speech.
- **Obstructive sleep apnea is the most common indication for Adenotonsillectomy.**
- In children, Adenotonsillectomy is usually indicated with AHI greater than 5; polysomnography isn't needed as a routine.

Indications of adenoidectomy

Recurrent or persistent otitis media

- ❑ Eustachian tube function is improved and fluid collection prevented following adenoidectomy, independent of the size of the adenoids.
- ❑ Improvement achieved even if patients don't present with obstructive symptoms.
- ❑ Indicated in those who have previously undergone tympanostomy tube placement without improvement and are being considered for a repeat procedure.
- ❑ Not recommended in those who have not undergone tympanostomy tube insertion.

Indications of adenoidectomy

Recurrent and/or chronic sinusitis

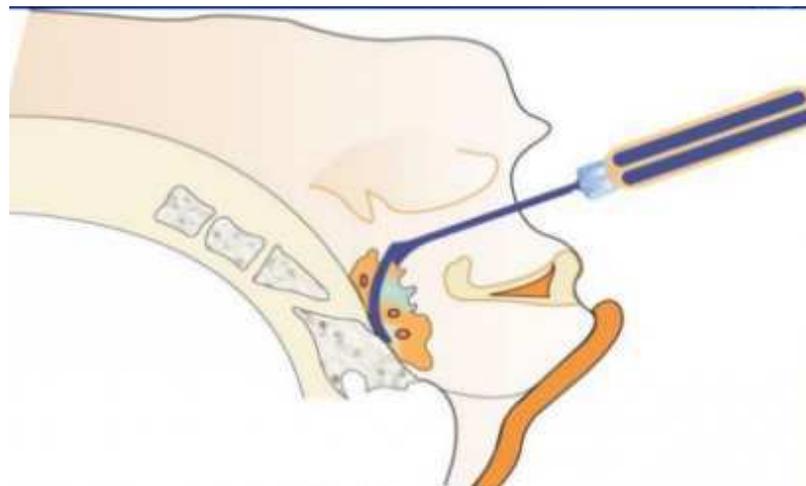
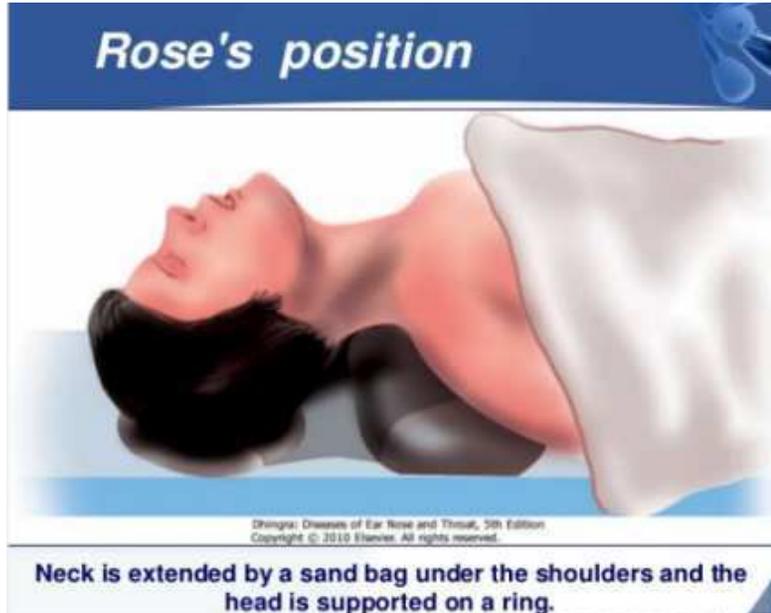
- ❑ Adenoidectomy improves sinusitis symptoms with independence of the weight of adenoids.
- ❑ Possibly attributed to biofilms in adenoid tissue.
- ❑ The European Position Paper on Rhinosinusitis and Nasal Polyps recommends adenoidectomy with possible antral irrigation or balloon dilation of the maxillary sinuses as a the first surgical treatment to be offered.
- ❑ Adenoidectomy + Balloon sinuplasty was found to be more effective than adenoidectomy alone.

Contraindications of Surgery

- Conditions in which general anesthesia cannot be performed.
- Child at risk of VPI (short palate, submucous cleft palate, cleft palate, muscle weakness or hypotonia associated with a neurological disease, velocardiofacial syndrome, etc.)
- Atlantoaxial joint laxity > neutral position.
- Coagulation disorders.



The surgery



The surgery

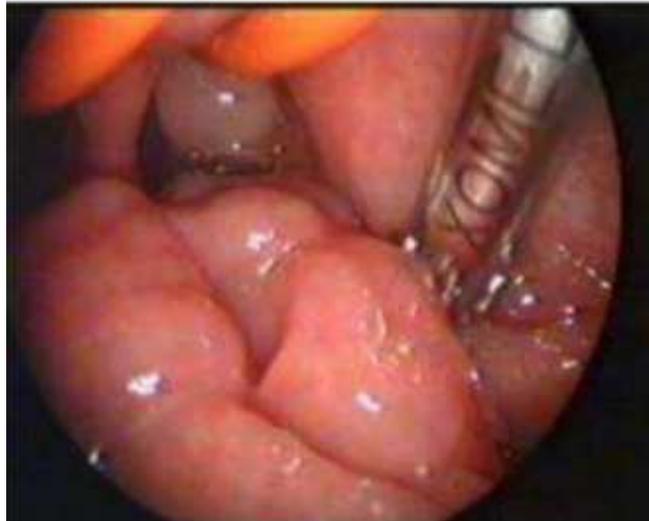


TABLE II.

Advantages and Disadvantages of Adenoidectomy Techniques.

Technique	Advantages	Disadvantages
Curettage	Inexpensive	Transmittal of blood-borne diseases, inefficient removal of adenoid tissue, trauma to adjacent structures, possible risk of nasopharyngeal stenosis, complications of electrocautery
Electrocautery	Good visualization, precision, ease, decreased operating time, decreased blood loss, inexpensive	Complications of electrocautery, possible risk of nasopharyngeal stenosis, trauma to adjacent structures
Power-assisted	Good visualization, transoral/transnasal access to adenoids, precision, decreased operating time, decreased blood loss	Difficulty accessing adenoids if nasopharynx is narrow, trauma to adjacent structures, possible risk of nasopharyngeal stenosis, complications of electrocautery, expensive, requires experience

Postoperative care

- ❑ Pain isn't a common problem.
- ❑ A sore throat can appear with swallowing or speaking.
- ❑ A normal diet can be allowed after recovery from the general anesthesia.
- ❑ Nasal congestion can result after the surgery or from a concomitant allergic rhinitis. Both can be improved with intranasal steroids.

Follow up

☐ Follow-up 1 – 4 weeks after surgery.

☐ Hyper nasal speech is observed in at least 50% of the patients following the procedure, but usually reverts to normal in 2-4 weeks.

Complications

Rare

- ? Immediate bleeding occurs in 0.4% of cases. Can be controlled with a local vasoconstrictive agent
- ? Delayed bleeding is rare
- ? Mandibular condyle fracture: very rare
- ? Eustachian tube injury
- ? Griesel syndrome (atlantoaxial subluxation)
- ? Vertebral body decalcification and laxity of the anterior transverse ligament between the axis and atlas
- ? Subluxation is usually seen 1 week after surgery

Complications

? **Nasopharyngeal stenosis**

- ? More common in T&A than in adenoidectomy alone
- ? Presents as nasal obstruction or hyponasal speech
- ? Repair involves palatal/pharyngeal flaps

? ? **Neck spasm and pain** can appear due to inflammation of the superior constrictor muscle

? **Velopharyngeal insufficiency**

- ? Persistent VPI (>3 months) occurs in 1 in 1500-3000 adenoidectomies)
- ? More often in children w/ decreased muscle tone or palatal abnormality
- ? Initial treatment involves speech therapy.
- ? Surgery

Conclusions

- ❑ Adenotonsillectomy is the most commonly performed major surgery in children.
- ❑ Obstructive sleep apnea is the most common indication.
- ❑ Other indications include nasal obstructive symptoms, recurrent or chronic ear/sinus infections, changes in facial growth.
- ❑ A complete ENT exam should be performed to rule out other causes.
- ❑ The main diagnostic method for hypertrophy is nasopharyngoscopy
- ❑ Medical treatment should be offered to patients

Thank you !