



## An Updated Understanding of Tonsils and Adenoids

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### Abstract

The tonsils and adenoids are lymphoid organs situated at the entrances of the digestive and respiratory systems, with the palatine tonsil as an almond like mass located in the lateral oropharynx and the adenoids as a pyramidal mass in the posterior-superior nasopharynx. Waldeyer's ring encompasses the upper pharynx, consisting of the adenoids in the superior portion, the palatine tonsils laterally, and the lingual tonsils anteriorly. These structures act as the initial defense mechanism against invading infections, strategically placed near the entrance of the gastrointestinal and upper respiratory tracts. In this article an updated and extensive review of tonsils and adenoids is done for a better understanding of this entity which still at times remains challenging for clinicians to deal with.

**Keywords:** Tonsils; Adenoids; Tonsillectomy; Adenoidectomy

### Introduction

Palatine tonsils come into action with ingested pathogens and debris, trapped within tonsillar crypts, making first immune response. The tonsils with approximately 15 crypts, offer a substantial internal surface area for immunological response involving germinal centers, mantle zones, extra follicular areas, and reticular crypt epithelium within the mucosa of this lymphoid tissue. Inhaled pathogens interact with adenoids situated in the posterior-superior nasopharynx. Initial disease processes involve inflammation in the mucosal-associated lymphoid tissue of these organs, acting as primary defense mechanisms. As a mucosa-associated lymphoid tissue, the palatine tonsils serve as the primary lymphatic tissue of the oropharynx [1].

In the process both tonsils and adenoids can be inflamed and infected. Symptoms include fever, sore throat, swollen tonsils or adenoids, predominantly affecting children and adolescents.

The chronic infection of tonsils and its systemic repercussions is recognized quite earlier but its correlation with systemic diseases is relatively recent understanding. Chronic tonsil infection has been recognized for its systemic implications, showing a correlation with systemic diseases. Tonsil infections have been linked to chronic toxemia and localized infections in joints, heart, and kidneys. Adeno-tonsillar hypertrophy, causing upper airway obstruction, has been identified as a significant contributor to sleep apnea syndrome.

Some studies suggest that chronic tonsillitis can lead to pulmonary hypertension and cor pulmonale. Cardio-pulmonary changes resulting from chronic adeno-tonsillar hypertrophy have been successfully treated through surgical removal. Fahim Ahmed Shah, *et al.* [2]. Cor pulmonale and pulmonary hypertension can occur due to CO<sub>2</sub> retention. Periodic cyanosis and apnoeic attacks can occur due to chronic adenotonsillar hypertrophy. Sdralis, *et al.* [3]. If not treated, recurrent episodes of tonsillitis can result in

the spread of harmful microorganisms and subsequent systemic illnesses, often caused by bacteria. Adenoid hypertrophy can be a presentation of HIV infection [5]. Complications can result in conditions like middle ear infection, peritonsillar abscess, sleep apnea, scarlet fever, rheumatic fever, glomerulonephritis and certain other systemic conditions. If a peritonsillar abscess is not diagnosed and treated promptly, complications such as aspiration, airway obstruction and extension into the retropharyngeal space can occur [5].

### Embryonic development

In the first 8 weeks of development, significant growth occurs in the head and neck regions of embryonic life. During this time, there are 5 sets of pharyngeal or branchial arches, each accompanied by external clefts and internal pouches. Each pouch has both a lower and upper part. The source of these arch structures is primarily the mesoderm tissue layer. The clefts are lined with ectoderm, while the pouches are lined with endoderm. By the 8th week of gestation, the upper portion of the first pharyngeal pouch and the lower portion of the second pouch contribute to the formation of the tonsil cavity and the palatine tonsils. The tonsil pillars originate from the second and third arches. Crypts develop between 3 to 6 months of gestation, the protective covering forms around the 5<sup>th</sup> month, and germinal centers develop after birth. Adenoids begin forming during the third month of fetal growth. Lymphocytes infiltrate the developing glandular tissue in the back of the throat, covered by a specialized tissue called pseudostratified ciliated epithelium, which fully forms by the 7th month. Shortly after birth, adenoids encounter bacterial colonization, grow during childhood due to exposure to foreign substances, and generally shrink by early adulthood. Enlarged tonsils in adults are less and may indicate chronic infection.

### Tonsil anatomy

Tonsils are positioned in the mouth laterally, bordered anteriorly by the palatoglossal arch and posteriorly by the palatopharyngeal arch. Both these anatomical boundaries, covered with mucous membranes, blend with the roof of the mouth and are created by the palatoglossus and palatopharyngeus muscles, respectively. They are in pairs and reside within a cavity called the tonsillar sinus. These boundaries are limited by the palatoglossal

arch at the front, the palatopharyngeal arch at the back, and the superior pharyngeal constrictor muscle on the sides. The tonsils are enclosed in a tough connective tissue capsule.

The upper pole receives blood from the descending palatine artery, the middle part from the ascending pharyngeal artery, and the lower pole from the tonsillar branch of the lingual artery. In rare cases, the tonsillar artery may have an abnormal course and lies just beneath the superior constrictor muscle. Venous drainage from the palatine tonsils is through the peritonsillar plexus of veins, which drain into the pharyngeal and lingual veins, eventually draining into the internal jugular vein. The crypts are innervated by the sphenopalatine ganglion through the lesser palatine and glossopharyngeal nerves. There are no afferent lymphatics, efferent lymphatics drain to the upper deep cervical lymph nodes especially to the jugulodigastric node, a node of the deep cervical lymph nodes, which is placed inferior to the angle of the mandible.

### Adenoid anatomy

Anatomy of adenoids form a single pyramid-shaped mass located in the upper back part of the nasal cavity. True crypts are not present but their surface has folds. Blood supply to the adenoids comes from the ascending palatine branch of the facial artery and from ascending pharyngeal artery, (external carotid) and pharyngeal branch of the maxillary artery. The venous drainage of the adenoids takes place through the pharyngeal plexus of veins, which communicates with the pterygoid plexus and ultimately drains into the facial veins and internal jugular veins. The lymphatic drainage into the retropharyngeal and upper deep cervical lymph nodes. The innervation of adenoids is through the glossopharyngeal and vagus nerves.

### Pathophysiology

Adenotonsillitis disease can be infective, inflammatory, obstructive or rarely neoplastic. Various bacteria and viruses can cause infection of both tonsils and adenoids but the most common organisms cultured from patients with chronic tonsillar disease is *Streptococcus pyogenes* (Group A beta-hemolytic streptococcus) which is 39% of all cultured organisms, other bacterial infection are from *Staphylococcus aureus*, *Haemophilus Influenzae*, *Moraxella catarrhalis* and *Streptococcus pneumoniae*. Viral infection usually from adenoviruses and Epstein-Barr virus, only 30% of throat

cultures yield bacterial growth, in which 39% of these being beta-lactamase-producing organisms. Additional contributing factors are inadequate treatment compliance, new infections from close contacts, consumption of spicy and pungent foods leading to inflammation and subsequent infections of tonsils. Close contact with infected individuals is the primary mode of transmission, where droplets from coughing or sneezing spread the infection. Pathogens on skin or objects that contact mucous membranes can also cause infection, with symptoms emerging 2 to 5 days after exposure.

The onset of acute tonsillitis is marked by a sore throat, fever, swollen and congested tonsils, and enlarged painful lymph nodes. Symptoms such as dysphagia, malaise, fatigue, and occasional ear pain may also occur, potentially leading to ear infections. General symptoms like headaches, abdominal pain (commonly in children), nausea, and vomiting may also be present. Clinical examination reveals swollen tonsils often touching at the midline, with yellow or white spots or follicles. Typically self-limited, acute tonsillitis resolves within 3-4 days. Recurrent tonsillitis, however, requires antimicrobial treatment or tonsillectomy when necessary. Complications stem from persistent or spreading pathogens, usually bacteria, in cases of recurrent or unresponsive infections, beta-lactamase resistant antibiotics are needed.

Chronic tonsillitis arises from unresolved inflammation despite aggressive antibiotic therapy. Enlarged tonsils can obstruct the airway, leading to breathing difficulties, snoring, or sleep apnea. Untreated bacterial infections result in recurrent tonsillitis episodes and may lead to abscesses, posing emergencies. Speech difficulties, swallowing problems, and respiratory issues can also be associated with chronic tonsillitis causing significant discomfort and disruption of daily activities. Untreated chronic tonsillitis results in complications demanding surgical intervention.

### Tonsillectomy and adenoidectomy

In cases of tonsils that are too large or repeatedly infected, surgery to remove them may be necessary. Tonsillectomy is a surgical procedures in which tonsils are completely removed including the capsule by dissecting the peritonsillar space between the tonsil capsule and the muscular wall. Tonsillectomy and adenoidectomy are two of the most frequently performed surgeries in childhood. Indications for tonsillectomy are having three or

more infections annually despite sufficient medical treatment, enlarged size leading to dental misalignment, enlargement causing obstruction of the upper airway, severe difficulty in swallowing, sleep disturbances, or complications related to heart and lungs. However, nowadays, airway blockage and obstructive sleep apnea have become more frequent reasons these include an increase in the size of adenotonsillar tissue linked to obstructive sleep apnea. Due to more tonsillectomies related health issues, and numerous randomized clinical trials evaluating this commonly performed surgery, there is a significant need for evidence-based evaluation. Various surgical methods are employed to remove tonsils and adenoids such as dissection, monopolar electrocautery and more recently coblation but postoperative pain and bleeding stand out as two important challenging situations demanding more innovative techniques to look for in near future because all said and done it is ultimately the patient safety and human care that dictates the last word and the search is tireless.

### Conclusion

History of recurrent throat infections should be very proper and precise about recurrent tonsils infection before performing tonsillectomy using the selection criteria and excluding other throat infections. Therefore, treatment should be individualized, taking into consideration all possible innovative surgical options with preference to accessibility of health-care services and nature of available surgical facilities.

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