Acute Tonsillitis

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Abstract: Acute tonsillitis is an inflammatory process of the tonsillar tissues and is usually infectious in nature. Acute infections of the palatine tonsils predominantly occur in school-aged children, but patients of any age may be affected. Tonsillitis of viral origin is usually treated with supportive care. Bacterial tonsillitis is most commonly caused by *Streptococcus pyogenes*. Polymicrobial infections and viral pathogens are also important sources of infection. Penicillins remain the treatment of choice for *S. pyogenes* tonsillitis, and augmented aminopenicillins have gained utility in concert with the increasing incidence of beta-lactamase producing bacteria. We describe the anatomic features and the immunologic function of the palatine tonsils, including a detailed discussion of history and physical examination findings, treatment recommendations, and possible complications of acute tonsillitis. Establishing an accurate diagnosis and initiating appropriate treatment are key components of managing this common pathologic process.

Keywords: Acute, infection, pediatric, tonsillitis.

INTRODUCTION

Diseases become increasingly important when they are common, treatable, and have the potential for significant long-term morbidity. As a pathologic process, acute tonsillitis demonstrates each of these characteristics. Primarily treated by pediatricians and primary care physicians, this disease process remains a common occurrence in the general population.

This discussion outlines the anatomy, immunology, variations in pathology, and common complications of acute tonsillitis. Acute tonsillitis refers to any inflammatory process involving the tonsillar tissues of the oropharynx. More commonly, and for the purposes of this discussion, this term is used specifically to describe the infection and inflammation of the palatine tonsils. Acute tonsillitis occurs in school-aged children predominantly, affecting nearly all children at least once in their lifetime. The most common etiologic pathogens are bacterial, with *Streptococcus pyogenes* contributing heavily to the incidence of this disease process. Other bacteria and viral agents are also known to produce acute tonsillar inflammation, each with its own complement of morbidities [1-3].

ANATOMY

The palatine tonsils are a component of Waldeyer's ring, a circumferential array of secondary lymphoid tissue in the oropharynx that provides immunologic surveillance and produces immunoglobulin. The lingual tonsils, adenoids, and palatine tonsils make up this ring, and the palatine tonsils are the largest of the three tissue groups [1, 4-7]. Located in the lateral aspect of the oropharynx, each palatine tonsil lies in a fossa bound by two pillars of pharyngeal muscle: the palatopharyngeus posteriorly, and the palatoglossus anteriorly. The tonsil itself is surrounded by a capsule of loose connective tissue which is intimately associated with the tonsillar parenchyma and loosely attached to the superior pharyngeal constrictor fascia on the deep surface of the tonsil.

The nerve supply to the palatine tonsil is comprised of sensory fibers from the tonsillar and pharyngeal plexuses, which are derivatives of the glossopharyngeal nerve. Another glossopharyngeal nerve branch, the tympanic branch, is indirectly associated with the tonsillar plexus, explaining the common occurrence of referred otalgia often seen during acute tonsillitis or after tonsillectomy [1, 4, 6, 8, 9].

The superior and inferior poles of the tonsil receive their blood supply from branches of the external carotid artery. The superior pole is supplied by the ascending pharyngeal and lesser palatine arteries. The inferior pole is supplied by the tonsillar branch of the dorsal lingual artery, the ascending palatine artery, and the tonsillar branch of the facial artery. Venous drainage occurs via the peritonsillar plexus, which communicates with the lingual and pharyngeal veins, and ultimately empties into the internal jugular vein [1, 4, 6, 8].

IMMUNOLOGY

The palatine tonsils are favorably located at the entrance to the upper aerodigestive tract. Here, they are exposed to various exogenous antigens, such as viruses, bacteria, and food particles. The parenchyma of the tonsil is composed of antigen sampling M-cells, B-lymphocytes, T-lymphocytes, and plasma cells. The B-lymphocyte is the most abundant of the palatine tonsil's immune complement and is actively involved in immunologic memory and antibody production [1, 3, 6]. Memory B-cells are located in a region of secondary lymphoid tissue called the germinal center. Here, B-cells that have been activated by antigen exposure proliferate and undergo specific immunologic processes designed to enhance the acquired immune response [1, 3]. Surrounding the germinal center is the mantle zone, composed of mature B-cells. Together, the region defined by the germinal center and mantle zone is termed the lymphoid follicle, and it is surrounded by T-cells in the extrafollicular area [3, 4]. Unlike lymph nodes, the palatine tonsils do not contain afferent

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lymphatic channels by which circulating antigens can be delivered. Instead, the epithelium-lined tonsillar crypts function to trap exogenous material and transfer these antigens to the immunologically active lymphocytes [1, 4, 6, 10].

It is thought that the immunologic surveillance and activity of the tonsils peaks in early childhood, commonly before age 10. After this period, involution of the tonsil takes place, and a fluctuation in the ratio of T and B cells ensues. As a result, much debate has existed historically regarding the consequence of tonsillectomy and adenoidectomy in the pediatric population [1]. Histologically, regression of the tonsils is associated with a decline in lymphatic tissue as it is replaced by fibrinous tissue [11, 12].

PHYSICAL EXAMINATION

The characteristics of the physical examination are not specific or unique to the patient with acute tonsillar disease. The palatine tonsils are often easily visualized in the pediatric patient using a tongue depressor to steadily depress the posterior oral tongue. In contrast, the palatine tonsil may be less evident in the adult patient secondary to involution; however, the tonsillar pillars should remain visible. A grading system exists that allows the physician to document tonsil size with some degree of objectivity by quantifying the percentage of the tonsil that lies outside the tonsillar fossa [1, 8] Fig (**1**).

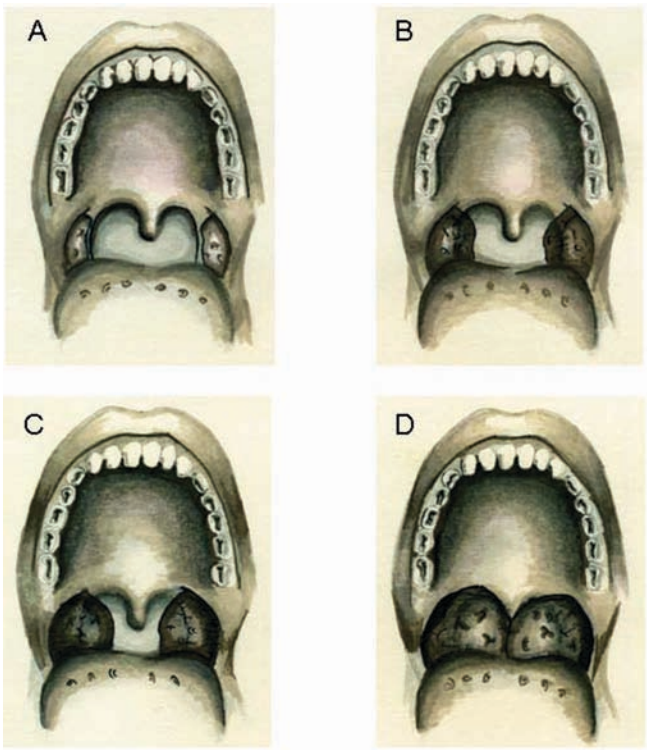

Fig (1). Tonsillar grading system. **A**) 0-25%; 1+. **B**) 25-50%; 2+. **C**) 50-75%, 3+. **D**) 75-100%, 4+. (Adapted from Brodsky, L. Modern assessment of tonsils and adenoids. *Pediatr. Clin. N. Am*., **1989**, *36*(6), 1551-1569).

The clinical presentation of acute tonsillitis varies based on etiology, most commonly presenting with fever, odynophagia, dysphagia, and tonsillar erythema. Physical examination characteristics specific to each disease process are reviewed in the following sections.

ACUTE BACTERIAL TONSILLITIS

The human oropharynx is host to myriad resident bacteria, including *Streptococcus pneumonia, Haemophilus influenzae*, and *Moraxella catarrhalis*, in addition to *Propionibacterium*, *Nocardia*, and *Fusobacterium* [1, 6, 13]. The prevalence of oropharyngeal bacterial colonization is thought to fluctuate with the onset of an acute viral infection, and varies among individuals [1, 2]. The natural history of an acute bacterial infection usually involves the obstruction or inflammation of tonsillar crypts. Subsequent accumulation of crypt debris allows bacterial flora to multiply, causing leukocytic exudates, inflammation, and erythema.

Acute bacterial tonsillitis is often preceded by a viral infection and is commonly polymicrobial, composed of exogenous and resident flora [1-3, 13]. *Streptococcus pyogenes* is considered to be the most common single organism associated with bacterial pharyngitis and tonsillitis [1-3, 6, 11, 12]. This organism is a known precursor to rheumatic fever, which occurs secondary to an autoimmune response. Recognition of this association has led to a dramatic decline in the incidence of rheumatic fever in the United States [1, 14, 15]. It has been suggested that all previously-infected tonsils have some amount of *S. pyogenes* present at the time of tonsillectomy despite the presence or absence of signs of acute infection. This is possibly due in part to a decreased clearance of bacteria from the tonsillar stroma. Surface proteins on *S. pyogenes*, which resist tonsillar clearance, have been demonstrated on an animal model. Accordingly, approximately 20-40% of 5- to 12-year-old patients have positive cultures without exhibiting evidence of active disease [3].

Despite the probability of low-grade colonization by *S. pyogenes*, active infection of the tonsils is a separate and distinct clinical process that warrants appropriate treatment. Common signs and symptoms on presentation include exudative inflamed tonsils in conjunction with fever, dysphagia, odynophagia, and tender cervical lymphadenopathy [1, 4, 6] Fig (**2**). Current primary care literature supports the treatment of presumed group A beta-hemolytic streptococcal (GABHS) tonsillitis based on the presence of these criteria alone [16]. Common practice, however, often includes throat culture with or without rapid streptococcal antigen testing, regardless of the presence or absence of these clinical criteria [17]. Although results of pharyngeal cultures can take up to 48 hours to obtain, the tests are highly sensitive. In contrast, rapid streptococcal detection kits are available, which provide an acceptable level of specificity, although sensitivity is sub-optimal. When used appropriately, however, these tests serve as a useful adjunct by which *S. pyogenes* tonsillitis can be diagnosed in some patients. A negative test in the presence of clinical suspicion can be followed by a culture, withholding antibiotics until results are obtained. Physical examination findings consistent with acute bacterial tonsillitis are a necessary component of the diagnosis, as the presence

Fig (2). Acute bacterial tonsillitis. **A**) acute tonsillar enlargement. **B**) bilateral tonsillar erythema and edema.

of chronic infection or resident flora can not be delineated by pharyngeal culture [1-4, 6, 8, 13].

Histologically, acute bacterial tonsillitis is heralded by necrotic crypt epithelium, leukocytes within the crypts (empyema), and abundant bacterial colonies. In contrast, chronic inflammation is characterized by enlarged and activated germinal centers, with a marked increase in IgG production. Crypts are distended, often containing debris, bacteria and occasionally calcification (tonsillithiasis) [1, 11].

Penicillin is the treatment of choice for *S. pyogenes* tonsillitis; however, the increased incidence of beta-lactamase producing bacteria may warrant a change of antibiotic coverage in the face of persistent symptoms. An antibiotic such as amoxicillin with clavulanic acid is appropriate under these circumstances. Penicillin-allergic patients may be treated with clindamycin. Those patients who, despite appropriate treatment, continue to have recurrent infection, may benefit from tonsillectomy.

ACUTE VIRAL TONSILLITIS

Viral tonsillitis is similar to its bacterial counterpart. Dysphagia, fever, odynophagia, and tonsillar erythema are common upon presentation [1, 6, 8]. Viral pathogens frequently contributing to acute tonsillitis include the Epstein-Barr virus (EBV), *rhinovirus*, *enterovirus*, *influenza*, and *adenovirus* [1, 6, 10, 18-20]. Many viruses implicated in acute tonsillitis are normal oropharyngeal flora. In contrast to bacterial tonsillitis, rarely do viral pathogens result in an exudative tonsillitis [1, 6, 8, 21].

EBV tonsillitis is a frequently discussed etiologic agent associated with viral tonsillitis. EBV is known to colonize the tonsils of healthy individuals, with a 28% detection rate in one study [18, 22, 23]. EBV is thought to remain latent in the B-lymphocytes of germinal centers, interacting to produce the infected M-cells found in the extrafollicular area [20]. Part of the syndrome known as mononucleosis, EBV is also known to produce enlarged tonsils with a gray discoloration in association with palatal petechia, fever, posterior cervical lymphadenopathy, hepatosplenomegaly, and fatigue [1, 6, 10, 18, 20, 22]. In conjunction with physical exam findings, a diagnosis is made via serology, which includes the heterophile antibody test and complete blood count with manual differential. A differential representing 50% lymphocytes with 10% atypical lymphocytes (activated T-cells) is supportive of a diagnosis. Fewer than 60% of patients have a positive test within the first two weeks of illness [1, 8, 10, 18]. Appropriate clinical suspicion and accurate diagnosis are crucial. Due to the association of hepatosplenomegaly with the mononucleosis syndrome, patients must be cautioned to avoid contact sports during their illness, as they have the potential to sustain a splenic rupture. Treatment is largely supportive, consisting of precautionary guidance, fluid resuscitation, and rest. Tonsillar enlargement may be significant and has the potential to cause acute airway obstruction requiring systemic steroids, and placement of a nasopharyngeal or surgical airway (see "Airway obstruction").

Lastly, amoxicillin-related antibiotics are known to cause an immune-mediated rash when given to patients with mononucleosis. Antibiotics are therefore avoided in patients with an established or suspected diagnosis of EBV tonsillitis [1, 6, 8].

OTHER ETIOLOGIC AGENTS

Less commonly, acute tonsillitis may arise secondary to other etiologic agents, including the coxsackievirus; *Corynebacterium diphtheria*; and sexually transmitted diseases such as *Neisseria gonorrhoeae*, and *Chlamydia trachomatis*.

Coxsackievirus

Acute tonsillitis secondary to the coxsackievirus results in vesicular lesions on the tonsillar surface, posterior pharyngeal wall, and the soft palate. Given the term *herpangina*, coxsackievirus tonsillitis is associated with dysphagia, odynophagia, and high fevers. It may also represent a component of hand, foot, and mouth syndrome, with associated vesicles on the palms and soles. Treatment is generally supportive with hydration, antipyretics, and analgesics [1, 2, 4, 8].

Corynebacterium Diphtheriae (Diphtheria)

With the advent of diphtheria toxin vaccination, the incidence of diphtheria tonsillitis has declined significantly. Today, approximately 200-300 cases per year are documented in the United States, and a high level of suspicion is therefore required for diagnosis [1, 8, 24]. The organism is readily identifiable on culture, and Klebs-Loffler bacilli are identifiable by gram stain [1, 25]. On physical examination a thick, gray exudative membrane is classically visualized. The membrane is friable and historically has been considered to pose a risk of dislodgement and airway obstruction if intubation is required. For this reason, tracheotomy is the recommended means to secure an airway if justified by the clinical presentation. Treatment is required, as distant end-organ injury may occur secondary to diphtheria exotoxin if not managed appropriately [26]. Treatment consists of penicillin as well as Diphtheria antitoxin, preferably within 48 hours of symptom onset.

Neisseria Gonorrhoeae and Chlamydia Trachomatis

Gonorrhea is one of the most frequent sexually transmitted bacterial infections reported in the United States. While oral-genital infections are predominantly transmitted via sexual contact, maternal-fetal transmission during birth may result in systemic or ophthalmic infections. As a result, both *N. gonorrhoeae* and *C. trachomatis* are rarely identified in the pediatric patient. Diagnosis of either etiologic agent therefore mandates the consideration of underlying sexual abuse in this patient population.

Symptoms localized to the pharynx include mild pharyngeal discomfort and dysphagia. Other symptoms incude headache, myalgias, arthralgias, dysgeusia, cervical lymphadenopathy, and nasal discharge. Diagnosis is often established clinically, based on patient history and risk factor stratification. Risk factors include recent known exposure to gonorrhea and multiple sexual partners. Pharyngeal culture aimed specifically at detecting gonorrhea is routinely performed despite the initiation of empiric antibiotic treatment. Importantly, the gram-negative intracellular organism *C. trachomatis* is thought to have the ability to produce a similar pharyngeal infection and frequently coexists in the patient with pharyngeal gonorrhea. In contrast to gonorrhea, chlamydial infections are rarely detected on pharyngeal culture, despite evidence of systemic disease. As a result, treatment for both *N. gonorrhoeae* and *C. trachomatis* is recommended. The treatment of choice therefore includes intramuscular ceftriaxone in addition to either azithromycin or doxycycline [27, 28].

TONSILLECTOMY

Surgical excision of the palatine tonsils remains one of the most common procedures performed in the United States. Recently-revised guidelines have been established so as to supplement clinician judgment in the decision-making process prior to tonsillectomy. These recommendations can be summarized to include: documented recurrent pharyngeal infections at a frequency of 7 episodes in one year, five episodes per year for two years, three episodes per year for three years, or recurrent infections with modifying factors. Modifying factors include a history of peritonsillar abscess, multiple antibiotic allergies, or the presence of periodic fever, aphthous stomatitis, pharyngitis, and adenitis (PFAPA) syndrome [29]. Previously described absolute indications for tonsillectomy include tonsillar enlargement resulting in severe dysphagia, cardiopulmonary strain, febrile convulsions, or concern for neoplasia.

COMPLICATIONS OF TONSILLITIS

The identification and appropriate treatment of acute tonsillitis are essential due to the multitude of sequelae that may arise in the untreated or unrecognized patient.

Rheumatic Fever and Glomerulonephritis

GABHS tonsillitis has the potential to cause both rheumatic fever as well as acute post-streptococcal glomerulonephritis (PSGN). While the risk for rheumatic fever approaches zero with adequate treatment, PSGN is an unfortunate possibility despite treatment and should be recognized in the appropriate setting [30].

Pediatric Autoimmune Neuropsychiatric Disorder Associated With Streptococcal Infections

Obsessive-compulsive traits, anxiety disorders, and pathologic compulsive tics associated with streptococcal tonsillitis and pharyngitis are increasingly being recognized as a unified entity. The abrupt onset of symptoms generally occurs within weeks of the pharyngeal or tonsillar infection, and, by definition, is confined to the pediatric population. Tonsillectomy is considered a treatment option [30, 31].

Periodic Fever, Aphthous Stomatitis, Pharyngitis, and Adenopathy Syndrome

Similar to cyclic hematopoiesis, PFAPA is a periodic fever syndrome predominantly diagnosed in children between two and six years of age, with a slight male predilection. The disease is characterized by sporadic inflammatory reactions without known provocation. Febrile events (frequently reaching or exceeding 40'C) are accompanied by one of the three cardinal symptoms, including pharyngitis, cervical lymphadenitis, and oral aphthous ulcers. Abdominal pain is also frequently present [32, 33]. Diagnosis is made based on clinical criteria. Although studies exist that suggest a genetic origin, specific gene abnormalities have not been identified to date. Initial management requires a workup for fever of unknown origin and the exclusion of alternative diagnoses, including cyclic neutropenia, malignancy, and infection. Corticosteroids are the therapeutic mainstay, but adenotonisllectomy has likewise been demonstrated to induce remission and/or reduce the severity of episodes [33]. Although sporadic reported cases occurring in adults exist, inflammatory episodes become infrequent after ten years of age [33, 34].

Airway Obstruction

Acute tonsillar enlargement has the potential to cause life-threatening airway obstruction and should be treated emergently. Non-surgical treatment options include intravenous steroids, nasopharyngeal airway placement, heliox, and

racemic epinephrine; however, these options are generally considered temporizing until a definitive airway is placed. Depending on the availability of clinical staff and resources, both fiberoptic nasotracheal intubation and tracheotomy are acceptable methods by which an airway may be secured.

Other consequences of bacterial tonsillitis include peritonsillar abscess and deep neck-space infection [1, 4, 6, 8].

CONCLUSION

Acute tonsillitis is a common disease process affecting both the pediatric and adult population. Numerous etiologies exist and commonly include bacterial or viral agents. Each pathologic process carries a unique complement of symptoms, physical exam findings, and treatment options. Depending on the cause of tonsillar inflammation and infection, morbidity can be significant and can involve both local tissues and distant organs. A thorough approach to the patient with acute tonsillitis involves an equally thorough understanding of tonsillar anatomy, immunologic function, and susceptibility to infection. Accurate diagnosis and appropriate treatment are key components of managing this common pathologic process.

CONFLICT OF INTEREST

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