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Etiology, Epidemiology and treatment of bacterial pharyngitis: a review article

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Abstract

Pharyngitis is an upper respiratory tract condition common in both general and specialist clinics. Though the majority of cases are viral, bacterial pharyngitis led by *Streptococcus pyogenes* (group A streptococcus) still forms a major percentage of infections with a risk for severe complications like rheumatic fever and peritonsillar abscesses. Knowledge of the pathogens, epidemiological trends, and treatment strategies would ensure optimal care and prevent antibiotic misuse. The purpose of this review is to describe what is currently known about the bacterial etiologies of pharyngitis while narrowing the more likely causative organisms—*Streptococcus pyogenes, Mycoplasma pneumoniae,* and *Fusobacterium necrophorum*. It then discusses global and regional epidemiological trends plus how age, seasonal timing, and socioeconomic status factor into disease prevalence. This paper reviews treatment strategies. It discusses the use of empiric antibiotics based on evidence, antimicrobial resistance, clinical scoring systems, and rapid diagnostics in guiding treatment. Antimicrobial resistance is a global problem increasingly pressing that has not left bacterial pharyngitis untouched as timely and adequate management depend on accurate diagnosis. Thus, recent evidence consolidated here offers clinicians as well as investigators an updated comprehensive insight into bacterial pharyngitis toward improved disease targeting through enhanced precision in diagnosis and appropriate therapeutic decision-making besides public health measures in transmission control and antimicrobial resistance.

Keywords

Etiology, Epidemiology, treatment, bacterial pharyngitis.

Introduction

Pharyngitis is the most common cause that brings patients to the outpatient and emergency departments all over the world, particularly children and adolescents (Shulman et al., 2012). It describes inflammation of the mucosa of the pharynx with multiple etiologies which includes viral, bacterial, fungal as well as non-infectious causes-allergic and environmental irritants. Though viruses are the most common culprits of infection, it is important to note bacterial infections give more weight because if not treated properly complications may develop. The most classic example is Streptococcus pyogenes infection or Group A Streptococcus infection (Bisno et al., 2002).

Bacterial pharyngitis is of clinical concern not only because it is very common but also due to its effects on the health of individuals and the general population. If

not treated, it may result in suppurative complications like peritonsillar abscesses and non-suppurative sequelae such as acute rheumatic fever and glomerulonephritis. From the public health point of view, Bacterial pharyngitis substantially leads to inappropriate use of antibiotics which hastens the development of resistance to antibiotics (Gerber et al., 2009).

The main bacterial pathogen of pharyngitis is *Streptococcus pyogenes*. Other clinically important pathogens include Fusobacterium necrophorum, which in incidence is increasing among teenagers and young adults, and atypical pathogens, including *Mycoplasma pneumoniae, Corynebacterium diphtheriae,* and *Cryptobacterium haemolyticum*. Clinical bacterial pharyngitis overlaps considerably with viral etiologies and does require laboratory confirmation to treat appropriately. When unclear about the diagnosis, empiric treatment results in the use of antibiotics unnecessarily.

Bacterial pharyngitis epidemiology is seasonal, geographic, and age-dependent. In temperate climates, the late winter and early spring months are when it is most prevalent. Schools provide the close contact necessary for easy spread among children of school age- the main population involved in transmission (Pfoh et al., 2008). Prevalence is higher in those regions where inadequate resources lead to more complication rates that access intervention because diagnosis and treatment cannot be provided (Carapetis et al., 2005).

Treatment of bacterial pharyngitis with antibiotics serves to reduce the duration of symptoms, and prevention of sequelae and also limits the spread of the disease. Penicillin or amoxicillin therapy is considered first-line treatment because these drugs remain highly effective against gastrointestinal serotypes (GAS) with very low resistance rates. Other agents that may be used include macrolides and cephalosporins in cases where resistance has been reported or in patients who are allergic to penicillin (Shulman et al., 2012).

Recent advances in diagnostic techniques at the point of care include rapid antigen tests and polymerase chain reaction that assist in differentiating bacterial from viral infections. This enables more accurate treatment with antibiotics, hence enabling responsible use of antibiotics. This brings to light the multifactored nature of bacterial pharyngitis. It also focuses on the need to understand its etiology, epidemiological pattern, and appropriate options for treatment. Therefore, this article attempts to bring together previously conducted research findings that would assist clinicians in making evidence-based decisions, reducing inappropriate antibiotic prescribing, and improving treatment outcomes. This article stresses such a requirement for an integrated approach between clinical expertise and diagnostic support as well as public health awareness, particularly when antibiotic resistance is rising (Magdefrau et al., 2025).

Bacterial Etiology of Pharyngitis

Pharyngitis is defined as the infection of the pharyngeal mucosa by pathogenic organisms, in which bacteria, though not the usual etiological agents, are important. Even though viruses are the major causative agents of pharyngitis, bacterial pathogens, particularly *Streptococcus pyogenes* have clinical importance because inadequate diagnosis and treatment may lead to severe complications. Knowledge of bacterial etiologies that cause pharyngitis is very significant in applying appropriate plans of antimicrobial treatments and reducing complications such as rheumatic fever and peritonsillar abscesses (StatPearls, 2024).

***Streptococcus pyogenes* (Group A Streptococcus)**

Streptococcus pyogenes (GAS) is the most frequent bacterial etiology of pharyngitis. Children between 5 and 15 years of age are more commonly affected. GAS accounts for about 20 to 30 percent of cases of pharyngitis in children and 5-15% in adults. Sudden onset sore throat, fever, headache, tonsillar exudate, and tender cervical lymph nodes with no respiratory symptoms such as a cough or catarrhal inflammation are clinical features that can be used to suggest a diagnosis wherein the organism has any importance. The same organism is responsible for both suppurative complications like peritonsillar abscess on one hand and non-suppurative ones like acute rheumatic fever and glomerulonephritis on the other side. Disease control is complicated by carrier states; asymptomatic carriers provide reservoirs from which secondary household contacts may acquire infection through droplet spread. Virulence determinants include M protein, streptolysin, and superantigen toxins with roles in immune evasion plus host tissue damage. (Cunningham, 2000).

Group C and Group G Streptococci

Though GAS is the usual etiology, other beta-hemolytic streptococci — especially Streptococcus dysgalactiae and group G streptococci — have been isolated from cases of pharyngitis in older children and adults (Brink et al., 2008). The infection by these pathogens clinically mimics that of GAS and cannot be differentiated symptomatically. Group C and G streptococci are infrequently associated with such complications as rheumatic fever; however, they have been found to be the causative agents of bacteremia and endocarditis in immunocompromised patients. (Turner et al., 2012).

Fusobacterium necrophorum

The anaerobic, Gram-negative *Fusobacterium necrophorum* has recently begun to be recognized as the etiology of clinically significant pharyngitis in adolescents and young adults with Lemière's syndrome, a dramatic disorder that results in septic thrombophlebitis among internal jugular veins (Centor et al., 2015). Some studies have shown that it may be a very common reason for bacterial pharyngitis in this age group where *Fusobacterium necrophorum* was believed to be an infrequent pathogen and their clinical picture resembles that of gastroesophageal reflux disease (Eilbert & Singla, 2013), specific anaerobic cultures or PCR-based methods are required to diagnose infections. Early recognition and antibiotic coverage are critical due to the severity of associated complications. (Fine et al., 2010).

Mycoplasma pneumoniae

Bacteria of atypical pathogens also cause pharyngitis. *Mycoplasma pneumoniae* is known to commonly cause pharyngitis among adolescents and young adults. *Mycoplasma pneumoniae* belongs to the group of cell wall-deficient bacteria and can cause pharyngitis, bronchitis, and pneumonia. Pharyngitis caused by this organism is usually less severe and accompanied by malaise, headache, and dry cough presenting as systemic symptoms. It is transmitted by droplets and more cases are seen during an outbreak in crowded places like schools and military camps. Laboratory confirmation is mostly done by PCR or serological tests. Since Mycoplasma pneumoniae does not contain a cell wall, beta-lactam antibiotics are useless against this organism; treatment includes macrolides, tetracyclines, or fluoroquinolones (Atkinson et al., 2008).

Corynebacterium diphtheriae

Corynebacterium diphtheriae is a rare, though extremely serious, causative agent of bacterial pharyngitis. A thick pseudomembrane over the tonsils, throat, or nasal cavity manifests diphtheria mostly and can lead to airway obstruction. Although vaccination has primarily controlled the disease in many parts of the world, a household outbreak does take place where the vaccination rate is low (Wagner et al., 2010). The diagnosis has to be made through culture and confirmed by toxin testing. Treatment involves the use of diphtheria-antitoxin plus antibiotics that may include erythromycin or penicillin.

Cryptobacterium haemolyticum

Another emerging bacterial pathogen of pharyngitis, particularly in adolescents, is *Cryptobacterium haemolyticum*. It manifests as exudative tonsillitis and can be associated with a scarlet fever-like rash giving an appearance of streptococcal infection. It is rarely diagnosed because it takes time to grow and cannot be easily differentiated from other streptococci on culture. Macrolides treatment has mostly been effective (Lind, 1992).

Epidemiology of Pharyngitis

Pharyngitis is among the most frequent clinical syndromes at the global level in primary care. It occurs across all age groups, most commonly in children and adolescents. It is a leading cause of outpatient visits and the prescription of antibiotics (Shulman et al., 2012). Its epidemiology varies by pathogen, geographic region, season, and socioecological factors. The burden at a global scale is large: hundreds of millions of cases per year. According to the Global Burden of Disease Study, more than 17 billion cases are attributable acutely to upper respiratory tract infections (Vos et al., 2020). Most cases are due to viruses and resolve spontaneously; however, an important minority is due to bacterial pathogens— especially Streptococcus pyogenes — that can cause severe sequelae if not treated promptly.

Children between the ages of 5 to 15 years are much more likely to acquire Group A Streptococcus pharyngitis. In this age group, it is responsible for about 30% of cases while in adults it represents approximately 5-15% of cases (Gerber & Shulman, 2004). Close contact increases the transmission of GAS. Schools, daycare centers, and homes facilitate its spread. Without access to healthcare and where vaccination rates are low in the

tropics and resource-poor settings, there is an increased burden with increased complications like rheumatic fever (Carapetis et al., 2005). Pharyngitis has a very specific seasonality in most climatic zones with peaks reported late fall, winter, and early spring (Shulman et al., 2012). Indoor occupancy is higher during colder months with less ventilation promoting easier spread for all respiratory pathogens; however, seasonality may be less marked elsewhere in the tropics or perhaps more aligned with rainy months.

Pharyngitis is extremely heterogeneous by incidence and etiology around the world. In high-income countries, viral etiologies predominate-most commonly rhinoviruses, adenoviruses, and coronaviruses. In low and middle-income countries bacterial infections are clinically more significant-mostly gastroesophageal aspergillosis (GAS). This is because non-suppurative sequelae such as acute rheumatic fever and rheumatic heart disease can result from these infections (Seckeler & Hoke, 2011). High rates of rheumatic fever continue to be reported from sub-Saharan African countries besides South Asian nations and Oceania islands; hence there is a need for enhanced surveillance plus early treatment strategies emphasized here. Besides other bacterial pathogens being increasingly recognized in recent epidemiological studies with pharyngitis, *Fusobacterium necrophorum* comes clear as a significant pathogen of pharyngitis among adolescents plus young adults with prevalence akin to that of gastroesophageal angioedema (GAS) (Centor et al., 2015). Also, unusual germs like Mycoplasma pneumoniae and *Arcanobacterium haemolyticum* are seen more often, mainly during outbreaks in close contact situations. One rising epidemiologic issue linked with pharyngitis is the overuse and wrong use of antibiotics — mainly in viral cases where antibiotics do not work. This has caused antibiotic resistance to build up against strains and has weakened public health efforts on infectious disease control (Linder et al., 2005). Surveillance programs and following clinical guidelines are key for disease burden and resistance pattern control (WHO, 2021).

Treatment of Pharyngitis

Treatment of pharyngitis depends on its viral or bacterial etiology. While most cases of pharyngitis are caused by viruses and do not require treatment, cases due to bacterial pathogens—most importantly *Streptococcus pyogenes*, Group A Streptococcus (GAS)—require antibiotic therapy. Antibiotics will prevent the post-streptococcal disease acute rheumatic fever and suppurative infections, reduce symptom duration, and interrupt transmission. They also reduce the duration of symptoms as well as the route of transmission. Supportive care is the mainstay of therapy for adults who have 70–85% and children who have 20–40% of cases from viral pharyngitis (Bisno et al., 2002). This includes treatment with analgesics such as paracetamol or ibuprofen for the relief of throat pain and fever, adequate fluid intake, rest—which may decrease mucosal inflammation through lozenges or saline gargles—and use of lozenges or saline gargles (Shulman et al., 2012). Antiviral treatment is not generally implemented unless an identified virus, such as influenza viruses, causes the disease; in that case, when identified early neuraminidase inhibitors may be prescribed (Uyeki et al., 2019).

Pencillin & Amoxicillin remain first line, because they are narrow spectrum antibiotics, effective, and cheap. Standard treatment should continue for ten days to ensure killing the bacteria and prevention of rheumatic fever (Gerber & Shulman, 2004). Alternatives in the case of allergy to pencillin include Cephalexin, Clindamycin or a macrolide like Azithromycin; however, resistance against macrolides is increasing (Shulman et al., 2012). Dosage for tablets and suspension forms should be prescribed according to age and tolerance of an individual patient. Azithromycin is preferred many times for shorter courses (usually three-five days) because compliance is higher with it; however, resistance as well as QT prolongation is a disadvantage (Linder et al., 2005).

Besides the bacteria of gastroesophageal syndrome, there can be other bacterial pathogens including *Fusobacterium necrophorum, Mycoplasma pneumoniae,* and *Cryptococcus haemolyticus* that may also lead to infection of pharyngitis-in adolescents and young adults-considerably. There are no standard treatment guidelines for these atypical pathogens. However, treatment empirically using β-lactam or macrolide antibiotics in some cases can be considered when the clinical suspicion is high as well as in scenarios where patients do not respond to treatment (Centor et al., 2015).

Corticosteroids have been studied for the treatment of severe sore throat. In cases that are very severe, medication at low dose for a short period may reduce the

duration and intensity of symptoms, but generally should not be recommended because of possible side effects. The other big problem in treating pharyngitis is misprescribing antibiotics for viral infections. This greatly enhances resistance to antibiotics (WHO, 2021). Thus, it is highly advocated to confirm gastrointestinal infections (GAS) through either rapid antigen tests (RADTs) or cultures from a throat swab before instituting antibiotic therapy. Adherence to clinical guidelines and increased awareness among patients and healthcare providers are essential factors in the responsible use of antibiotics (Shulman et al., 2012).

Conclusion

Bacterial pharyngitis remains a common and important disease mainly because of its complications and, in the public health view, due to antibiotic resistance. Accurate diagnosis between bacterial and viral causes is essential for proper treatment. Group A Streptococcus is the most common bacterial pathogen that needs immediate antibiotic treatment to prevent sequels. However, with an increased awareness of other causative pathogens, a comprehensive diagnostic approach is needed.

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