



The role of anaerobic bacteria in tonsillitis

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Summary This review summarizes the information that supports the potential importance of anaerobic bacteria in tonsillitis. Some anaerobic bacteria possess interfering capability with Group A beta-hemolytic streptococci (GABHS) and other pathogens. The possible role of anaerobes in the acute inflammatory process in the tonsils is supported by several observations: anaerobes have been isolated from the cores of tonsils of patients with recurrent GABHS and non-GABHS tonsillitis (NST); the recovery of anaerobes as predominant pathogens in abscesses of tonsils, in many cases without any aerobic bacteria; their recovery as pathogens in well-established anaerobic infections of the tonsils (Vincent's angina); the increased recovery rate of encapsulated pigmented *Prevotella* and *Porphyromonas* spp. in acutely inflamed tonsils; their isolation from the cores of recurrently inflamed NST; and the response to antibiotics in patients with NST. Furthermore, immune response against *Prevotella intermedia* is present in patients with recurrent NST, and an immune response can also be detected against *P. intermedia* and *Fusobacterium nucleatum* in patients who recovered from peritonsillar cellulitis or abscesses, infectious mononucleosis and acute non-streptococcal and GABHS tonsillitis. Although more studies are needed, these findings support the possible pathogenicity of Gram-negative anaerobic bacilli in tonsillitis.

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1. Introduction

Tonsillitis is a common disease especially of children and young adults. The diagnosis of tonsillitis generally requires the consideration of Group A beta-hemolytic streptococci (GABHS) infection. However, numerous other bacteria alone or in combination (including *Staphylococcus aureus* and *Haemophilus influenzae*), viruses and other infectious and non-

infectious causes should also be considered. Recognition of the microbial cause(s) can affect the choice of appropriate therapy and is therefore of great importance in assuring rapid recovery and prevention of complications.

The role of anaerobic bacteria in tonsillitis is hard to elucidate because these organisms are normally prevalent on the surface of the tonsils and pharynx as well as in the core of tonsils and adenoids, so that cultures taken directly, from these areas are difficult to interpret. Anaerobic bacteria are part of the normal on pharyngeal flora and are capable of

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interfering with the in vitro growth of GABHS as well as other potential pathogens.

The pathogenic potential of anaerobes is realized in a variety of localized clinical infections proximal to the tonsils which include: dental [1], peritonsillar [2] and retropharyngeal [3] abscesses, cervical adenitis [4], chronic otitis media and sinusitis [5], and mastoiditis [6].

Many of the Gram-negative anaerobic bacilli (GNAB) that are isolated from the tonsillar core can produce the enzyme beta-lactamase. Beta-lactamase-producing strains of *Bacteroides fragilis* group, *Fusobacterium* spp., *H. influenzae* and *S. aureus* were isolated from the tonsils of 73–80% of children with GABHS recurrent tonsillitis [7–11] and from 40% of children of non-GABHS tonsillitis (NST) [12]. The production of beta-lactamase has important implications for antimicrobial therapy. These organisms could degrade penicillin in the area of the infection, thereby protecting not only themselves but also penicillin-sensitive associated pathogens. Thus, penicillin therapy directed against a susceptible pathogen might be rendered ineffective by the presence of beta-lactamase-producing bacteria (BLPB). This phenomenon may explain the growing failure of penicillin in eradicating GABHS tonsillitis [13]. The possibility that penicillin-resistant anaerobic bacteria may protect pathogenic organisms has been extensively studied [7–11].

The anaerobic species that have been implicated in tonsillitis are pigmented *Prevotella* and *Porphyromonas*, *Fusobacterium* and *Actinomyces* spp. The possible role of anaerobes in the acute inflammatory process in the tonsils is supported by several clinical and scientific observations: anaerobes have been isolated from the cores of tonsils of children and adults with recurrent GABHS [7] and NST [12, 14] and peritonsillar [2] and retropharyngeal [3] abscesses in many cases without any aerobic bacteria, their recovery as pathogens in well-established anaerobic infections of the tonsils (Vincent's angina) [15], the increased recovery rate of encapsulated pigmented *Prevotella* and *Porphyromonas* spp. in acutely inflamed tonsils [16], and the response to antibiotics in patients with NST [17–22].

Additional support for the role of anaerobic bacteria in tonsillitis is the demonstration of an immune response against *Prevotella intermedia* in patients with recurrent NST; [23] and an immune response against *P. intermedia* and *Fusobacterium nucleatum* in patients who recovered from peritonsillar cellulitis or abscesses [24] and infectious mononucleosis [25] and acute NST and GABHS tonsillitis [26].

This review summarizes the information that supports the potential importance of anaerobic bacteria in tonsillitis.

2. Anaerobes as interfering bacteria

Bacterial interference can play a major role in the maintenance the normal mucous membranes flora, by preventing colonization and subsequent invasion by potential pathogenic bacteria [27]. This phenomenon is most important in preventing certain bacterial infections. Anaerobic bacteria with interfering capabilities with the in vitro growth of GABHS, are part of the normal oropharyngeal flora.

We compared [28] the frequency of recovery of aerobic and anaerobic bacteria with interfering capability for GABHS from the tonsils of children with and without the history of recurrent GABHS pharyngotonsillitis. Tonsillar cultures were taken from 20 children with and 20 without the history of recurrent GABHS pharyngo-ton-sillitis. Eleven aerobic and anaerobic isolates with interfering capability for GABHS were recovered from 6 of the 20 (30%) children with recurrent GABHS tonsillitis, and 40 such organisms were isolated from 17 of the 20 (85%) without recurrences ($p < 0.01$). The interfering organisms included aerobic (alpha and non-hemolytic streptococci), and anaerobic organisms (*Prevotella* and *Peptostreptococcus* spp.). The study illustrates that the tonsils of children with the history of recurrent GABHS infection contain less aerobic and anaerobic bacteria with interfering capability of GABHS than those without that history. It also suggests that the presence of these interfering bacteria may play a role in preventing GABHS infection.

3. Recovery of anaerobes in peritonsillar abscesses

Most peritonsillar abscesses (PA) are polymicrobial; the average number of isolates is five (range: 1–10) [2, 8, 29–33]. The predominant anaerobic organisms isolated in peritonsillar abscesses are *Prevotella*, *Porphyromonas*, *Fusobacterium* and *Peptostreptococcus* spp.; aerobic organisms are GABHS (*Streptococcus pyogenes*), *S. aureus* and *H. influenzae*. Anaerobes can be isolated from most abscesses whenever appropriate techniques for their cultivation have been employed, [29] while GABHS is isolated in only about one-third of cases [2, 31].

Hansen [34] studied 153 aspirates from PA and isolated 151 strains of GNAB, including, *Bacteroides funduliformis*, fusiform bacilli, and *B. fragilis*. Hallander et al. [35] recovered anaerobic bacteria from 26 of 30 patients. These included *Bacteroides* spp., *Fusobacterium* spp., *Peptostreptococcus* spp., microaerophilic streptococci, veillonellae, and bifidobacteria. Sprinkle, et al. [36] isolated anaerobes from four of six patients with peritonsillar abscess.

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