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Prevalence of bacterial pathogens and its relative distribution in various chronic tonsillitis

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ABSTRACT

A prospective study was carried out to identify the possible bacterial isolates and their antibiotic sensitivity among 100 cases of chronic tonsillitis whose age group was from 4 to 30 years, where 34% and 66% were males and females respectively. The predominant symptoms of the patients in the study were sorethroat and odynophagia where majority of the patients had chronic parenchymatous tonsillitis. Enlarged adenoids were also observed as co-morbidity with chronic tonsillitis. Among the bacterial isolates, aerobes predominated with 87% whereas both aerobes and anaerobes were possible with 13%. Beta haemolytic streptococci dominated followed by *Staphylococcus aureus* and *Streptococcus pneumoniae*. Among anaerobes, *Bacteriodes* and *Fusobacterium* were isolated. Raised ASO titre was observed in majority of the cases. Maximum isolates were

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identified as sensitive to norfloxacin and ciprofloxacin whereas resistant patterns were determined to cotrimaxazole and gentamycin. Since bacterial isolates in the core play an important role in causing and sustaining chronic tonsillitis, further newer techniques are required to indentify the bacterial pathogens without the need for tonsillectomy. With the view of examining antibiotic therapy to overcome chronic tonsillitis, ampicillin, tetracycline, gentamycin and cotrimoxazole that are commonly used drugs.

Keywords: Tonsillitis, bacterial pathogens, ASO titre comparison, sensitivity patterns

1. INTRODUCTION

Tonsillitis is one of the common upper respiratory tract infections (URTI) causing ill health in children presenting to primary care physicians (Sadoh et al., 2008). Although most cases of pharyngitis/ tonsillitis are viral in origin, bacterial causes are important because of the non suppurative sequalae like rheumatic fever and rheumatic heart disease in group A β hemolytic *Streptococcus* (GABHS) infection. Rheumatic fever (RF) and its cardiac complication of rheumatic heart disease (RHD) remain major health problems in developing countries (Linder et al., 2005).

Infections of ENT such as tonsillitis are diseases that occur with high frequency (Yamanaka, 2011). During the past decades, efforts have been made to manage the infectious diseases of tonsils (Bista et al., 2006). It has been reported that the impact of tonsillar diseases may not only affect the tonsils alone but it can reach other related anatomic structures like the paranasal sinus, upper aerodigestive tract, and Eustachian tube-middle ear complex (Bista et al., 2006; Vlastarakos et al., 2007). Thus understanding the microbiology and pathophysiology of such diseases represents an important step in the management of biofilm-related infections (Kania et al., 2007).

The predominant symptom of pharyngotonsillitis is a sore throat. The infection, with subsequent inflammation, may be localized to the tonsils/pharynx alone or it may include several other locations as well (Gunnarsson et al., 2001). Treatment failure or recurrent infection is a common problem in acute pharyngotonsillitis. Several factors have been proposed to explain the failure rate, but the presence of aetiological agents other than GABHS has attracted little attention (Sadoh et al., 2008; Linder et al., 2005).

The literature does not support the idea that the clinical picture can distinguish a viral disease from a bacterial one. However, doctors do make preliminary clinical diagnoses before confirmatory laboratory tests are taken. These preliminary diagnoses of the probability of a bacterial throat infection in the patients could be estimated as unlikely, possible or likely. Patients diagnosed as having a likely bacterial throat infection are usually treated with antibiotics, and those judged as having an unlikely bacterial throat infection are not (Ahmary et al., 2012).

Some studies highlighted that streptococcal infections dominated and the introduction of this invasive bacterial strain is strongly associated with the outbreaks leads to rheumatic fever and RHD. Bacterial pathogens play a major role in chronic tonsillitis which is considered one of the most common pathologies in childhood (Palmer, 2005; Nixon and Bingham, 2006; Brook, 2002). Despite the widespread use of antibiotics, tonsillitis is often recalcitrant and tonsillectomy is mainly performed only when antibiotic therapy fails to relieve the symptoms of infection (Chole and Faddis, 2003) or when the enlarged tonsils cause functional obstruction to the air passage (Messner and Peyalo, 2000). Moreover, the increasing incidence of β-lactamase-producing bacteria recovered from tonsils may protect the causing pathogens from being eliminated by host defense and antibiotics (Jain and Agarwal, 2009) which may lead to the recurrence of tonsillar infections that are caused by microorganisms shown to be susceptible *in vitro* (Brook, 2001). These observations have led to the hypothesis that bacteria can resist eradication causing chronic inflammation and permanent changes in the tonsillar lymphoid tissue (Brook, 2001).

It is therefore important to evaluate the pattern of bacterial URTI, determine the frequency of bacterial involvement and their current susceptibility to various antibiotics therapy. This will facilitate formulation of empirical antibiotic therapy especially in clinical setting with poor microbiological facilities. A prospective study was therefore carried out to determine the pattern of bacterial isolates causing chronic tonsillitis and their antibiotic sensitivity at the Otolaryngology OPD of the teaching hospital of Annamalai University, India.

2. MATERIALS AND METHODS

A series of 100 patients with chronic tonsillitis who are attended the Otolaryngology OPD of teaching hospital of Annamalai University, India were recruited for the study. The inclusion criteria were patients with a history of sorethroat, difficulty in swallowing, fever (including a recorded temperature of >38.0°C at presentation) and/ or evidence of inflamed tonsils, exudates on the tonsils on examination of the throat and anterior cervical adenitis). Cervical adenitis was adjudged present if the anterior cervical lymph nodes were tender and palpable. Exclusion criteria included patients with a history of infection who received antimicrobial therapy within one month prior to surgery, patients with grossly asymmetrical tonsillar size as noted on preoperative clinical assessment, patients undergoing tonsillectomy for emergency conditions such as peritonsillar abscess or other deep neck space infections, and patients suspected for benign or malignant tonsillar tumors.

After obtaining institutional ethical committee clearance, the investigation was initiated and informed consent was obtained from the subjects included in this study. The detailed clinical history of the patients was obtained and the clinical features in each case were documented. Patients who had hyperaemia, exudates or ulcers on the pharyngeal wall were said to have pharyngitis thus these findings were restricted in this study and a proper diagnosis of tonsillitis was made.

Microbiology

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Specimens (throat swab) were taken from each patient using a sterile swab stick. The swab stick was introduced into a well exposed mouth with the tongue depressed by a wooden spatula where necessary and visible exudates or hyperaemic areas on the pharyngeal or tonsillar walls were swabbed (Loganathan et al., 2006; Ahmary et al., 2012). The specimen stick was aseptically transported for microbiological analysis within 1 hour or kept in Stuart medium before being analysed at the Microbiology laboratory of the same hospital. Swabs were simultaneously plated on a blood agar, MacConkey and Chocolate agar media for aerobic cultivation and neomycin blood agar and brain heart infusion agar for anaerobic cultivation. Further all the inoculated plates were incubated appropriately at 37°C for 48 hours. Growths were further sub-cultured to identify species. Cultures were considered negative if there was no significant bacterial growth after 48 hours. Growths of β haemolytic streptococci, *Streptococcus pneumoniae, Staphylococcus aureus, Enterococcus spp, Klebsiella spp, Proteus spp, Fusobacterium, Peptostreptococcus and Bacteriodes* on any of the media were identified by standard methods. β hemolytic streptococcal (BHS) colonies could not be classified further into their Lancefield groups because of non availability of this facility. The sensitivity of the isolates was tested against seven common antibiotics, using himedia antibiotic discs.

Statistical analysis

Data were analysed using SPSS 11.0 version. Simple proportions were represented in percentages. The sensitivity (The number of patients with bacteria isolates as a percentage of patients with the symptom) and specificity (The number of patient without bacterial isolate as a % of patients without the symptom) of each of the clinical symptom/ sign in predicting possible bacterial upper respiratory tract infections were determined. Two way analysis of variance was performed to determine the mean square and F value. The test of significance was performed by determining the difference between means. $p < 0.05$ and are considered statistically significant.

3. RESULTS

There were 100 patients who met the study criteria and their samples were analysed. Of which 34 (34%) were males and 66 (66%) were females, where the sex incidence was found more in case of females than males; 4 (4%) were aged between 4 and 5 years (Figure 1). Two (2%) patients were from high socioeconomic class, 11(11%) from middle class and 87(87%) from low class. The jugulodigastric nodes was palpable among 72 cases and non palpable among 28 cases. Squeeze test was positive among 22%. Most of the patients 85 (85%) had sore throat, 98 (98%) had odynophagia while dysnoea found among 12 (12%). Maximum number of cases (51%) presented with 2 to 3 years of duration of illness.

Three major types of chronic tonsillitis were identified. Chronic parenchymatous tonsillitis, chronic follicular tonsillitis and chronic fibrotic tonsillitis were identified among 76, 22 and 2 cases respectively (Figure 2). The most commonly associated ENT conditions are adenoids and CSOM among and 9 ad 2 cases respectively.

Bacteria were isolated from all the subjects. All (100%) of the isolates were aerobes whereas 16% supported the isolation of anaerobes. The distribution of aerobic and anaerobic bacterial in surface of tonsils is β haemolytic streptococci, *Staphylococcus aureus, Klebsiella sp, Streptococcus pneumoniae* etc. The detailed distribution frequency of various bacterial isolates was depicted in table 1. The ASO titre was supported 57 cases whereas 58 β haemolytic streptococci that indicated 99.9% sensitivity.

With the view to examine the bacterial etiology of tonsillitis, the antibiotic sensitivity patterns showed sensitive to antibiotics and two way analyzing of variance has been carried out and the detailed description of the sensitivity pattern was depicted in table 2. Further there is a no significant difference in the sensitivity of different types of bacteria exposed to each of the antibiotics in the surface of tonsils since F_{cal} is less than $F_{0.05}$ at (5, 30) d.f and there is a significant difference in the sensitivity of each type of bacteria exposed to different types of antibiotics since F_{cal} is greater than $F_{0.05}$ at (6, 30) d.f (Table 3).

Figure 1 Agewise distribution of subjects included

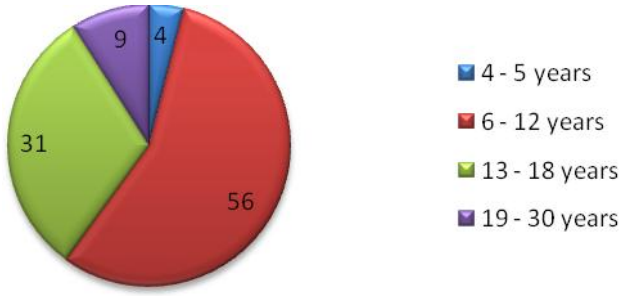

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Figure 2 Types of tonsillitis verses No. of cases

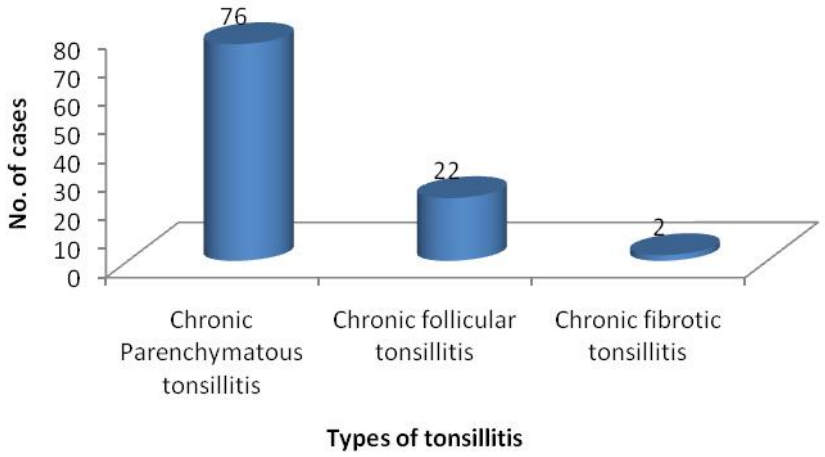

Table 1 Distribution of aerobic and anaerobic bacteria in surface of tonsils

S.No.	Bacteria	No. of samples supported
1	Beta haemolytic streptococci	40
2	*Staphylococcus aureus*	21
3	*Klebsiella* sp	19
4	*Streptococcus pneumoniae*	12
5	*Bacteriodes* sp.	7
6	*Fusobacterium* sp.	6
7	*Proteus* sp.	5
8	*Peptostreptococci* sp.	3
9	*Enterococcus* sp.	2

Table 2 Antibiotic sensitivity pattern of bacterial isolates from surface of tonsils

Antibiotic	β HS	SA	SP	K	E	P
Penicillin	62.5	71.4	100	84.2	0	80
Norfloxacin	97.5	90.4	92.3	100	100	80
Ciprofloxacin	95	85.7	100	94.7	50	60
Amoxycillin	55	76.2	50	68.4	0	75
Tetracycline	47.5	61.9	23.1	63.2	100	25
Gentamycin	37.5	28.6	30.1	88.9	0	40
Cotrimaxazole	25	45	30.8	46.2	0	60

[βHS – Beta haemolytic streptococci; SA – *Staphylococcus aureus*; SP – *Streptococcus pneumoniae*; K – *Klebsiella*; E – *Enterococci*; P – *Proteus*]

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Table 3 Two way analysis of variance among the bacterial isolates

Source of variation	Sum of sp.	DF	Mean square	F
Between bacteria	6607.3555	5	1321.4711	2.4044
Between antibiotic	16943.5495	6	2823.9249	5.1380
Residual	16400.4162	30	549.6139	-
Total	40039.3212	41	976.5600	-

4. DISCUSSION

Most of the patients having the incidence of tonsillitis in this study were in the age group of 6 to 12 years of age. This is in keeping with previous reports. The fact that these young children are still in the process of developing immunity to pathogens in their environment may explain this finding. That majority of the subjects may reflect the likelihood that people from upper social class are more likely to seek medical attention for an upper respiratory tract infection. Although, sorethroat and difficulty in swallowing are major symptoms in tonsillitis, there are less than a third of the patients in this study who presented with these complaints. This is because children seldom complain of sorethroat or difficulty in swallowing. Since almost a third of the studied patients were infants, complaint of sorethroat or difficulty with swallowing would obviously be less. The use of individual clinical features as predictors of possible bacteria URTIs were poor as shown by their low sensitivity and specificity. This is consistent with other studies that showed the unreliability of using individual sign to predict possible bacteria tonsillitis.

The occurrence of chronic tonsillitis with respect to population distribution was found to vary differently. Among the reported age groups, maximum tonsillitis cases were observed in the preteen age group (6-12 years) with 56% followed by teen age groups (12-18 years) 31%, children (4-5 years) 4% and the least incidence of 9% in youth (19-30 years). Similar observations were also reported in some studies where the predominant affected age group belong to 6-12 years (Sadoh et al., 2008; Vijayashree et al., 2014). The distribution of tonsillitis was more in female patients (66%) compared to male patients (34%) probably because number of patients admitted were more than male patients. This data was slightly non-correlated with other studies (Vijayashree et al., 2014). As for as socioeconomic condition concerned, 87% of cases were observed in low income group, 11% in middle income group and a lowest occurrence of 2% in high income group. The highest cases reported for low income group is perhaps due to their poverty, poor nourishment, unhygienic condition, illiteracy and improper medical care. Several factors have been proposed to explain the failure rate, but the presence of aetiological agents other than group A beta-haemolytic streptococci has attracted little attention (Gunnarsson et al., 2001). Increased prevalence of antimicrobial resistance among respiratory tract pathogens isolated from children and adults is evident worldwide. Treatment of infections caused by *S. pneumoniae* and *S. aureus* with older agents or ineffective dosing regimens may not eradicate infections and may contribute to the spread of resistance (Jacobs, 2003). These observations confirm the need for appropriate antimicrobial use to halt or at least limit the spread of resistance.

The susceptibility profile showed that ciprofloxacin and gentamicin should be the treatment of choice for the recurrent tonsillitis in this area of study, as previously observed by workers where gram negative bacilli and other etiologic agents were highly sensitive to gentamicin and ciprofloxacin (Adedeji et al., 2007; Babiwa et al., 2013). The use of ciprofloxacin in children should be seldom encouraged since this is contraindicated in such group of patients. The use of amoxicillin or amoxicillin - clavulanic acid combination as first choice drugs in recurrent tonsillitis should be discouraged as our data have shown increasing resistance of the etiologic agents in recurrent tonsillitis in our setting.

5. CONCLUSION

Our study has shown the imperative of continuous surveillance of antimicrobial susceptibility generally and in particular of tonsillar materials for early detection of emerging resistance trends and adjustment and usage of appropriate therapeutic interventions. Efforts would be made to evaluate possible anaerobic infectious agents associated with tonsillar materials in our future investigations. The possible role of fungi and viruses was not within the purview of this study.

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