Research Article

Surveillance of Group A Streptococcal Throat Infections among School Children in Mangalore

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ABSTRACT

Acute pharyngitis can manifest as sore throat. The primary infection is presumed to be of viral etiology, infection with bacterial pathogens commonly present in the nasopharynx can occur during viral infections. Streptococcus pyogenes is one of the commonest bacterial pathogens that cause pharyngitis among school aged children. Aim of Our Study: To study the prevalence of throat carriage of Group A betahemolytic streptococci among school children in Mangalore and to find its antimicrobial susceptibility pattern. Materials And Methods: The throat swab was collected from 300 children from the age group 5-15 years, studying in various schools in Mangalore, over a period of 1 year, and Group A betahemolytic streptococci was isolated and sensitivity pattern was noted. Results: A total of 300 students from different schools were included in the study. The prevalence of GAS was 5% among the 300 school children included in this study. The highest prevalence for GAS was noted in the >14yrs age group (8.6%) and in males (6.2%). The prevalence of GAS was both found to be higher among the socio-economic group (60% ). The isolation rates for GAS was both found to be higher during the winter (oct-jan) season (8.7%). All the isolates of GAS were found to be sensitive to penicillin. Significance of the study: it helps in the surveillance of streptococcal infection and thus helps in preventing the two non suppurative sequelae: Acute Rheumatic Fever and Acute Glomerulonephritis. These two non– suppurative sequelae are responsible for a significant number of cases of mortality and morbidity.

1. Introduction

Acute tonsillitis or pharyngitis can manifest as sore throat. Acute pharyngitis is an inflammatory condition of the pharynx caused by several different groups of micro-organisms. In most cases, the primary infection is presumed to be of viral etiology. Secondary infection with one of the potential bacterial pathogens commonly present in the nasopharynx can occur during viral infections. Even though various bacteria are incriminated in the etiology, streptococci are important worldwide [1].

Streptococcus pyogenes or Lancefield Group A beta hemolytic streptococci is one of the commonest bacterial pathogens that cause pharyngitis among school aged children living in lower socio-economic conditions. Streptococcus pyogenes can cause a wide array of infections, the most frequent of which are acute pharyngitis and impetigo. The other manifestations of the infection with Group A beta hemolytic streptococci includes sinusitis, otitis, peritonsillar abscess (quincy), pneumonia, scarlet fever, erysipelas, cellulitis, lymphangitis, puerperal sepsis, vaginitis, myositis, gangrene, perianal cellulitis [2].

The organism has been the focus of intense clinical investigative interest because of its association with two non suppurative sequelae: Acute Rheumatic Fever and Acute Glomerulonephritis, responsible for a significant number of cases of mortality.

Group A streptococci (GAS) is also responsible for post streptococcal sequelae. The other groups produce rather milder infection; possibly there are several factors other than the group of the organism contributing to the severity of the disease.
Acute Rheumatic fever and Rheumatic heart disease continue to be a major cause of cardiovascular morbidity and mortality in India. Approximately 6,00,000 children < 15 years of age are currently suffering from chronic rheumatic heart disease and approximately 1,21,000 children are newly diagnosed with acute rheumatic fever every year [3]. It has been estimated that approximately 20% of streptococcal infections of the upper respiratory tract produce symptoms. A history of upper respiratory tract infection may not be available in half the cases of acute rheumatic fever. It therefore becomes essential to identify sub clinical Group A streptococcal (GAS) throat infection so that they can be treated in order to minimize the risk of development of rheumatic fever.

It has been categorically observed that development of acute glomerulonephritis is more common following skin infections rather than throat infections. Conversely for rheumatic fever the predisposing infection is found in the throat. Recently, there are reports of streptococci belonging to Group C and Group G causing primary infection of upper respiratory tract and skin, occasionally Group C infection leading to acute glomerulonephritis[4]. Hence surveillance over streptococcal infection by means of microbiological and epidemiological surveys and follow ups are very much needed in all parts of the world.

2. Materials And Methods

The study was a cross-sectional study carried out at the Department of Microbiology, K.M.C., Mangalore. The study included 300 children from the age group 5-15 years, studying in various schools in Mangalore, over a period of 1 year.

Inclusion Criteria: - All school going children aged between 5-15 years. The children were selected at random from various schools in Mangalore.

Exclusion Criteria: - All children who were taking or had received antibiotics in the past 2 weeks of collection of throat swab.

Three swabs were collected from each child. One was used for culture on to 5% sheep blood agar and crystal violet blood agar and the third for inoculation on to Robertson’s Cooked Meat (RCM) broth. The culture plates were stabbed 3-4 times to enhance hemolysis. The culture plates and RCM broth were incubated at 37°C & 10% carbon dioxide. All β- hemolytic colonies were subjected to Gram’s staining and catalase test. The β-hemolytic colonies, which showed Gram positive cocci in chains and which were catalase negative, were identified based on susceptibility to Bacitracin & Bacitracin & Trimethoprim- suphamethoxazole. Streptococcal grouping was carried out using Streptex kit for isolates which were sensitive for Bacitracin and resistant for resistant for Trimethoprim-suphamethoxazole were tested with Group A latex suspension (SXT) were tested with Group A latex suspension.

Susceptibility of all the isolates of Group A streptococci to the following antibiotics was tested by the disc diffusion methods of Kirby Bauer. The antibiotic discs were obtained from Hi Media Laboratories Private Limited Mumbai. After 18-24 hours incubation, the diameter of the inhibitory zone was measured. The zone size around each antimicrobial disc was interpreted as sensitive, intermediate or resistant according to CLSI criteria.

3. Results:

A total of 300 students from different schools were included in the study

Table 1: Age wise distribution

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 – 7</td>
<td>61</td>
<td>20.3</td>
</tr>
<tr>
<td>8 – 10</td>
<td>112</td>
<td>37.3</td>
</tr>
<tr>
<td>11 – 13</td>
<td>92</td>
<td>30.7</td>
</tr>
<tr>
<td>&gt;14</td>
<td>35</td>
<td>11.7</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 1 shows the age group pattern of the participants in the study. Of the 300 children 61(20.3%) were in the age group of 5-7 years; 112 (37.3%) in the age group of 8-10 years; 92(30.7%) in the age group of 11-13 years; 35(11.7%) greater than 14 years.

Table 2: GAS in different age groups

<table>
<thead>
<tr>
<th>Age group</th>
<th>Result Group A</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 – 7</td>
<td>59(96.7%)</td>
<td>61(100.0%)</td>
</tr>
<tr>
<td>8 – 10</td>
<td>105(93.7%)</td>
<td>112(100.0%)</td>
</tr>
<tr>
<td>11 – 13</td>
<td>89(96.7%)</td>
<td>92(100.0%)</td>
</tr>
<tr>
<td>&gt;14</td>
<td>32(91.4%)</td>
<td>35(100.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>285(95.0%)</td>
<td>300(100.0%)</td>
</tr>
</tbody>
</table>

Table 2 show the incidence of Group A Streptococci (GAS) in the throat cultures of the children of different age groups. For GAS, the incidence was 3.3% in the 5-7 years age group; 6.3% in the 8-10 years age group; 3.3% in the 11-13 years age group and 8.6% in >14 years age group.

Table 3: Sex distribution of children

Table 3 shows the sex distribution of children included in the study. Of the 300 children 59.3% were boys and 40.7% were girls.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>178</td>
<td>59.3</td>
</tr>
<tr>
<td>Female</td>
<td>122</td>
<td>40.7</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4: Isolation GAS in male and female

Table 4 also shows the incidence of GAS among the children. The carrier state of GAS male children was 6.2% and among female children was 3.3%.
The prevalence of GAS in throat swabs of asymptomatic children was 5% This is in consistence with the various studies conducted in South India, which have also reported predominance of GAS [5,6,7]. A report from Delhi however was different [8] where GAS was the predominant group isolated. Prevalence rates of GABHS in other countries vary widely from as low as 2.5% to as high as 15.8% from children [9,10]. This difference could be attributed to differences in socioeconomic and climatic conditions.

In the present study, the highest prevalence of GAS was more in > 14 yrs age group (8.6%) followed by 6.3% in 8-10 yrs age group, 3.3% both in 5-7 yrs and 11-13 yrs age group. Age has been reported to be an important factor in the microbiological etiology of pharyngitis. The peak incidence of GAS pharyngitis occurring in children aged 5-10 yrs. In our study the incidence of GAS was slightly higher in > 14 yrs age group. This finding was also observed in a previous study [11,12].

In our study higher carriage rates were found among males for GAS 6.2%. The corresponding carriage rate for females was 3.3%, for GAS. This is consistent with previous study [13] where the isolation rates were 31.4% and 25.5% respectively among males and females. But other workers did not observe any sex differences [12].

In the present study an attempt was made to assess the role of socio-economic status in the prevalence of streptococcal throat carriage. Furthermore the carrier rate was higher among children from the lower socio-economic group 60% of GAS. This could be due to overcrowding which is usually present in the lower socio-economic group. These results indicate that religious habits and socio-economic status of the individual probably influence throat carriage of streptococci.

We attempted to determine seasonal variation in the incidence of streptococcal throat carriage among the children. The isolation of GAS showed a bimodal peak, with higher incidence in the monsoon (June-Sept) and during the winter season (Oct-Jan) with isolation rates 4.3% and 8.7% for Group A. This finding co-relates with the previous reports [14] did not show any significant seasonal variation.

Antimicrobial susceptibility: We tested the susceptibility of our isolates of GAS and GGS to the following antibiotics Amoxicillin (A) [100%], Ciprofloxacin (Cf) [80%], Ceftoxime (Ce) [100%], Cotrimoxazole (Co) [6.7%] Cephalexin (Cp) [80%), Erythromycin (E) [100%], Penicillin (P) [100%] and Tetracycline (T) [86.7%]

4. Discussion

There is evidence that asymptomatic throat infection caused by GAS may lead to acute rheumatic fever. Asymptomatic infections with subsequent rise in streptococcal antibody titters have also been reported in patients with previously diagnosed rheumatic fever. In this study, we evaluated throat swabs from 300 school children aged 5-15 years.

The 15 GABHS isolates was found to be sensitive to Amoxicillin (A) [100%], Ciprofloxacin (Cf) [80%], Ceftoxime (Ce) [100%], Cotrimoxazole (Co) [6.7%] Cephalexin (Cp) [80%), Erythromycin (E) [100%], Penicillin (P) [100%] and Tetracycline (T) [86.7%]

Table 5: Seasonal variation for GAS isolation

<table>
<thead>
<tr>
<th>Seasons</th>
<th>Result</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nil</td>
<td>Group A</td>
</tr>
<tr>
<td>Feb-May</td>
<td>81(100.0%)</td>
<td>0(0.0%)</td>
</tr>
<tr>
<td>June-September</td>
<td>89(95.7%)</td>
<td>4(4.3%)</td>
</tr>
<tr>
<td>October-January</td>
<td>115(91.3%)</td>
<td>11(8.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>285(95%)</td>
<td>15(5.0%)</td>
</tr>
</tbody>
</table>

Table 6: GAS in different socioeconomic groups.

<table>
<thead>
<tr>
<th>Socio-economic status</th>
<th>Result</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nil</td>
<td>Group A</td>
</tr>
<tr>
<td>Low</td>
<td>13(45.6%)</td>
<td>9(60.0%)</td>
</tr>
<tr>
<td>High</td>
<td>15(53.4%)</td>
<td>6(40.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>285(100.0%)</td>
<td>15(100.0%)</td>
</tr>
</tbody>
</table>

Table 7: Anti- Microbial Sensitivity pattern of GAS

<table>
<thead>
<tr>
<th>A</th>
<th>Cf</th>
<th>Ce</th>
<th>Co</th>
<th>Cp</th>
<th>E</th>
<th>P</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>R</td>
</tr>
<tr>
<td>n</td>
<td>15</td>
<td>0</td>
<td>12</td>
<td>3</td>
<td>15</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>%</td>
<td>100</td>
<td>0.0%</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

The prevalence of GAS in throat swabs of asymptomatic children was 5% This is in consistence with the various studies conducted in South India, which have also reported predominance of GAS [5,6,7]. A report from Delhi however was different [8] where GAS was the predominant group isolated. Prevalence rates of GABHS in other countries vary widely from as low as 2.5% to as high as 15.8% from children [9,10]. This difference could be attributed to differences in socioeconomic and climatic conditions.
significant change in the in-vitro susceptibility of GAS to penicillin. So far there has never been a well documented report of a penicillin resistant strain of GAS isolated from a patient [20]. In fact, its MIC to penicillin has not changed in the past 70 years.

Penicillin remains the drug of choice for the treatment of GAS infections. The most proven efficacy in treating Group A streptococcal pharyngitis and preventing rheumatic fever. The low cost of penicillin, its relatively narrow spectrum and its excellent safety record in individuals who are not penicillin allergic are added bonuses. For penicillin-allergic individuals, the alternative therapies include macrolides, first generation cephalosporins and clindamycin.

In our study, 100% of GAS isolates were sensitive to erythromycin. In 1958, Lowbury[21] reported the first GAS resistance to erythromycin. From the 1970’s onwards resistance to erythromycin is being widely reported among isolates of GAS. In some parts of Europe, resistance rates of >30% have been reported [20]. The resistance rates in the U.S. is considered to be low (<3%) [20]. Reports from India suggest erythromycin resistance rates among GAS strains vary between 1% and 17.9% [22].

In our study 80% of GAS were sensitive to Cephalexin (Cp). Little information is available about cephalosporin resistance in GAS and resistance to any of the commonly used oral cephalosporins has not been reported so far.

86.7% of GAS were sensitive to Tetracyclines. Reports on resistance to Tetracycline vary widely from 5% to 90% [15]. Tetracyclines are considered inappropriate for treatment of GAS infections.

Sensitivity to ciprofloxacin was 80% for GAS isolates.

Despite the use of penicillin for more than 40 years in treating GABHS infections, there has been no significant change in the in-vitro susceptibility of GABHS to penicillin. Reported failures to eradicate GABHS from the upper respiratory tracts of patients with pharyngitis and the apparent resurgence of serious Group A streptococcal infections and their sequelae probably are not related to the emergence of penicillin resistance.

Keeping in mind the variability in reports to erythromycin resistance it would be reasonable to periodically monitor isolates of GAS for erythromycin resistance. There is no reason based on the in-vitro susceptibilities of GABHS to change the current recommendations for treating GABHS infections with penicillin and for using erythromycin for patients who are allergic to penicillin.

The lack of Group A streptococcal penicillin resistance should not be allowed to lull clinicians into a sense of complacency, instead one must keep in mind the lesion learnt from other organisms. A prime example is Streptococcus pneumoniae, which had remained exquisitely sensitive to penicillin for decades until 1970s when the organism rapidly acquired resistance, and currently up to 30% pneumococcal strains are penicillin – resistant [3].

5. Conclusion

300 Throat swabs from school children were screened for Group A beta hemolytic streptococci for over a period of one year.

The following observations were noted.

- The prevalence of GAS was 5% among the 300 school children included in this study.
- The highest prevalence was noted in the >14yrs age group (8.6%) for GAS.
- The highest prevalence was seen in male for GAS (6.2%).
- The prevalence of GAS was both found to be higher among the lower socio-economic group 60% and 77.8% respectively.
- The isolation rates for GAS was both found to be higher during the winter (oct-jan) season 8.7% and 10.3% respectively.
- All the isolates of GAS were found to be sensitive to penicillin. Hence penicillin is still the drug of choice for streptococcal infections.

6. Reference


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