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**Original Article**

# Isolation of Group A β-Hemolytic Streptococci in the Tonsillopharynx of School Children in Madras City and Correlation with Their Clinical Features

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**SUMMARY**: Today, rheumatic fever is the most common cause of heart disease in children and young adults, and it accounts for about half of all cardiovascular diseases causing death in the first four decades of life, in India. In the present study, conducted during 1991-1992 at Chennai, India, a total of 666 school girls aged 5-15 years were examined clinically for one or more of the following signs and symptoms: repeated sore throat, joint pain/swelling, epistaxis, chest pain, breathlessness, palpitation, abdominal pain, etc. Out of the 666 children screened, 124 were recruited for the present study, based on their meeting one or more of the above mentioned clinical criteria. They were screened for the presence of group A β-hemolytic streptococci, and for antistreptolysin O and C-reactive protein. Thus, the aim of the present study was to reduce the load of streptococcal infection and the consequent risk of developing rheumatic fever and rheumatic heart disease. In the present study group, 89.5% of the children indicated a history of repeated sore throat. However, only 4.0% of the children in the study group were positive for group A β-hemolytic streptococci. The antistreptolysin O and C-reactive protein levels were higher in 11- to 15-year-old patients than in 5- to 10-year-old patients in the study group.

## INTRODUCTION

Streptococcal pharyngitis, caused by *Streptococcus pyogenes*, represents one of the most common bacterial infections, and is most often noted in children and young adults. Streptococcal infection has been referred to as an "occupational disease" of school children. A high prevalence and incidence of streptococcal pharyngitis, a term used for sore throat, tonsillitis, pharyngitis, and nasopharyngitis, in this vulnerable group (i.e., children of school-going age) have been recognized in most countries (1). Today, rheumatic fever (RF) is the most common cause of heart disease in children and young adults, and it accounts for about half of all cardiovascular diseases causing death in the first four decades of life in India. The pathogenic relationship of group A β-hemolytic streptococci (GABHS) to sequelae produced (e.g., acute rheumatic fever [ARF] and rheumatic heart disease [RHD]), as well as acute post streptococcal glomerulonephritis (PSGN), makes the organism unique (2). Hence, the concern of clinicians, microbiologists, and epidemiologists is to recognize streptococcal pharyngitis early and to administer treatment to prevent the sequelae. A community control program for RF and RHD should be initiated in to maintain control of the RHD through existing health service resources. Thus, the aim of the present study is to reduce the load of streptococcal infection and, consequently, the risk of developing RF and RHD in the community.

## MATERIALS AND METHODS

**Clinical investigations**: In a preliminary survey, 666 school children aged 5-15 years at a government girls' middle school, Madras, were analyzed, and children having at least one of the following signs and symptoms (repeated sore throat, abdominal pain, joint pain/swelling, epistaxis, chest pain, breathlessness, palpitation, etc.) were recruited. A detailed history was taken using a pretested open-ended questionnaire that inquired about the following: fever, previous documented history of RF, number of episodes and frequency, socioeconomic status, number of members in the family, type of housing and number of rooms, family history of RF/RHD, penicillin prophylaxis, and allergy to penicillin. A general of clinical examinations were conducted, and height and weight were noted. For the control group, 54 children who were apparently normal were used.

**Microbiological investigations**: A single throat swab for culture and a blood sample to test for antistreptolysin O (ASO) and C-reactive protein (CRP) were collected.

**Culture**: Throat swab was inoculated into sheep blood agar for isolation of β-hemolytic streptococci. Colonies were identified based on colony morphology and sensitivity to a bacitracin differentiation disc.

**Serology**: ASO and CRP levels were determined using a Behring latex agglutination kit (Hoechst India Ltd., Mumbai, India).

## RESULTS

Out of the 666 children screened, 124 were recruited for the present study, based on their meeting one or more of the clinical criteria: repeated sore throat, abdominal pain, joint pain, epistaxis, chest pain, breathlessness, etc. Among the study group, 89.5% had repeated sore throat; 57.2% had abdominal pain; 42.0% had joint pain; 8.1% had epistaxis; 21.0% had chest pain; 25.0% had breathlessness; etc. Additionally, 54 normal children were used as a control group. Seventy-one children (57.2%) had a history of passing worms

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Table 1. History analysis

| Serial no. | History | Study group ($n$=124) | % |
|---|---|---|---|
| 1. | Repeated sore throat+Abdominal pain+Chest pain +Breathlessness+Joint pain | 5 | 4.0 |
| 2. | Repeated sore throat+Abdominal pain+Chest pain+Joint pain | 10 | 8.0 |
| 3. | Repeated sore throat+Abdominal pain+Joint pain | 32 | 25.8 |
| 4. | Repeated sore throat | 111 | 89.5 |
| 5. | Abdominal pain | 71 | 57.2 |
| 6. | Chest pain | 26 | 21.0 |
| 7. | Joint pain | 52 | 42.0 |
| 8. | Breathlessness | 31 | 25.0 |
| 9. | Palpitation | 17 | 13.7 |
| 10. | Epistaxis | 10 | 8.1 |
| 11. | Cervical lymphadenitis | 17 | 13.7 |
| 12. | Family history of RHD | 11 | 8.9 |

Table 2. Distribution of pathogenic and normal commensal in the throat swab of study and control groups

| Serial no. | Throat swab culture | Study group $n$=124 | Control group $n$=54 | $P$ value |
|---|---|---|---|---|
| 1. | Normal flora (*Neisseria* spp., $\alpha$-hemolytic streptococci, diphtheroids) | 110 | 50 | 0.60 |
| 2. | Group A $\beta$-hemolytic streptococci | 5 | 2 | 0.63 |
| 3. | *Klebsiella* spp. | 3 | 2 | 0.47 |
| 4. | *Proteus* spp. | 2 | 0 | 0 |
| 5. | *Staphylococcus aureus* | 4 | 0 | 0 |

in stools. Eleven children (9.0%) had a family history of RHD, though none had definite evidence of RF. The other commonly elicited complaints are shown in Table 1.

Though 89.5% of the children recruited gave a history of repeated sore throat, examination of tonsils gave varying results. Among the study group 56.0% had unduly enlarged tonsils, 21.0% had infected tonsils, and 22.0% had normal tonsils. One child did not have any tonsils; they had been removed.

Distribution of pathogens and commensal in the throat swab of the study and control groups are presented in Table 2. Distribution of pathogenic and normal commensal in the throat showed that 88.7% and 92.6% yielded only normal flora in the study and control groups, respectively. Throat cultures were positive for GABHS in 4.0% and 3.7% of the study and control groups, respectively. Other organisms grown were *Klebsiella* spp. (2.4% in the study group, and 3.7% in the control group). In the study group, two strains of *Proteus* spp. were isolated in two children and one strain of *Staphylococcus aureus* in four children. Of the children in the study group, 28 were available for repeat throat cultures, all of which yielded normal flora. The first throat culture of the same 28 children had also yielded normal commensals. All five children who had a throat culture positive for GABHS in the study group were above 6 years of age.

The ASO antibodies are transmitted to the fetus through the placenta and fall to minimal levels during the first year of life. Thereafter, they build up rapidly, reaching peak levels in the young school-aged population. Therefore, titers of 400 IU/ml-300 IU/ml are common in healthy children aged 6-14 years (3). CRP titers of 6 mg/l and above were taken as positive. The significant ASO titers were obtained in 46.0% of the study group and 11.0% of the control group (Tables 3 and 4). As also shown in Tables 3 and 4, 40.3% of the study group and 26.0% of the control group had a positive CRP titer.

Table 3. Pattern of distribution of antistreptolysin O (ASO) and C-reactive protein (CRP) titers in study group

| | Study group $n$=124 | | |
|---|---|---|---|
| ASO (IU/ml) | 5-10 years (67) | 11-15 years (57) | Total |
| <200 | 12 | 8 | 20 |
| 200 | 28 | 19 | 47 |
| 400 | 23 | 20 | 43 |
| 800 | 4 | 8 | 12 |
| 1600 | 0 | 2 | 2 |
| 3200 | 0 | 0 | 0 |
| CRP (mg/l) | 5-10 years (67) | 11-15 years (57) | Total |
| <6 | 41 | 33 | 74 |
| 6 | 20 | 13 | 33 |
| 12 | 3 | 6 | 9 |
| 24 | 2 | 4 | 6 |
| 48 | 1 | 1 | 2 |
| 96 | 0 | 0 | 0 |

The significant ASO and CRP titers obtained were 46.0% and 40.3%, respectively in the study group.

The pattern of distribution of the ASO titer in different age groups revealed that the group of 11- to 15-year-olds showed higher titer values than the group of 5- to 10-year-olds. However, the titer of the control groups for all ages did not exceed 400 IU/ml (Table 4).

The CRP levels in this study showed that the group of 11- to 15-year-olds had a higher titer of CRP than the group of 5- to 10-year-olds. However, only two children (5-10 years old) in the control group showed a CRP titer as high as 12 mg/l (Table 4).

Table 4. Pattern of distribution of antistreptolysin O (ASO) and C-reactive protein (CRP) titers in control group

| Control group $n$=54 | | | |
|---|---|---|---|
| ASO (IU/ml) | 5-10 years (22) | 11-15 years (32) | Total |
| <200 | 11 | 8 | 19 |
| 200 | 8 | 21 | 29 |
| 400 | 3 | 3 | 6 |
| 800 | 0 | 0 | 0 |
| 1600 | 0 | 0 | 0 |
| 3200 | 0 | 0 | 0 |
| CRP (mg/l) | 5-10 years (22) | 11-15 years (32) | Total |
| <6 | 14 | 26 | 40 |
| 6 | 6 | 6 | 12 |
| 12 | 2 | 0 | 2 |
| 24 | 0 | 0 | 0 |
| 48 | 0 | 0 | 0 |
| 96 | 0 | 0 | 0 |

The significant ASO and CRP titers obtained were 11.0% and 26.0%, respectively in the control group.

## DISCUSSION

In developing countries, most cases of RF and RHD present with severe heart disease by the time secondary prophylaxis can be initiated. Early case detection is therefore crucial to the success of any community control program based on secondary prophylaxis. Since RF has been termed an "occupational disease of school children" (4), it is appropriate that pupils play an important role in its control. The control of RF and RHD is a priority in India, where it affects 5.4 to 6.0 per thousand children in whom the presence of GABHS is a cause of acute pharyngitis. It is important to study the burden of this illness so that appropriate antibiotics can be given in a timely fashion, and RF can be prevented (primary prophylaxis). In the present study, oral penicillin V (250 mg) 3 times daily was given for 10 days as primary prophylaxis.

In the present study, data included the medical history of 124 school children, and the symptoms and signs recorded included repeated sore throat, breathlessness, abdominal pain, anterior cervical lymphadenitis, joint pain, chest pain, epistaxis, enlarged tonsils, etc. In 1977, Koshi and Benjamin (5) conducted a similar study at Vellore among rural children. They reported that in 287 children who had clinical pharyngitis, 81% had enlarged tonsils, 73% had dysphagia, 58% had cervical lymphadenitis, 66% had cough, and 78% had congested throat. In our study, throat cultures were positive for GABHS only in 4.0%, and 88.7% had normal flora, and the remaining cultures grew various organisms, such as *Klebsiella* spp., *S. aureus*, and *Proteus* spp. The low percentage of positive throat culture in this study may be due to antibiotics received prior to screening. Notably, our findings are comparable with those in studies made by Koshi and Mammen (6) and Padmavathi (7). In 1961, Myers and Koshi (8) could isolate GABHS only in 5% of subjects who gave a history of upper respiratory tract infection. Hence, our results were also in accordance with those of Myers and Koshi. In the present study, 77.0% of subjects had enlarged tonsils, 21.0% of which were infected. In our study, 46.0% of the study group and 11.0% of the normal control group showed significant ASO titer (>400 IU/ml). The CRP levels noted were 40.3% and 26.0% of the study and control groups, respectively. Among the children GABHS-positive by throat swab culture in this study, three had significant ASO titer (>400 IU/ml) and two had CRP of more than 6 mg/l, which findings were strong evidence of recent streptococcal infection (9-11).

Unless a community-based survey is undertaken in both rural and urban areas, many patients with RHD go undetected; figures derived by other methods (e.g., hospital surveys) may be grossly misleading. Useful information can often be obtained when RF prevention programs are implemented on a local or regional basis. The screening of school-aged children for RHD and the creation of a registry for the cases detected are essential features of such a program.

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