An Epidemic Infection of Group-A Beta-hemolytic Streptococci in a Small Community

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Following epidemic upper respiratory infection, carriers of Type 4 strains of group-A β-hemolytic streptococci were observed in high incidence among the children of a religious organization in Kyoto City.

Serum antistreptococcal antibodies (antistreptolysin 0, antideoxyribonuclease B and antistreptococcal polysaccharide) were analyzed and the interrelations among these antibody titers were studied.

From August to October, 1980, a large number of children of a religious organization in Kyoto City were absent from school due to epidemic upper respiratory infection, and an epidemic infection of β-hemolytic streptococci was strongly suggested by serological and bacteriological examinations. The results of the throat cultures for β-hemolytic streptococci and of streptococcal antibody tests on these children are reported in this paper.

MATERIALS AND METHODS

In this religious organization, there were 19 children in preschool, 32 in primary school and 17 in middle school in 1980. Total number of children studied was 64 when the first throat culture was taken on October 21, 1980 and 67 when the second culture was taken on December 15, 1980.

Throat cultures were performed by the method using quinoline medium, and isolated β-hemolytic streptococci were grouped serologically. All group-A strains were typed according to the T-protein agglutination technique using anti-T-protein specific sera.

Blood samples were taken from 52 children out of the 64 children of this school in November, 1980, and serum streptococcal antibodies of these samples were determined as follows: 1) Antistreptolysin 0 (ASO) titer was determined according to Rantz and Randall's method. 2) Antideoxyribonuclease B (ADN-B) titer was determined using Streptonase-B kit (Wampole Laboratories). 3) Antistreptococcal polysaccharide (ASP) titer was measured according to the hemoagglutination method using sheep erythrocytes, which were sensitized with polysaccharide extracted from a group-A streptococcal cell wall.

RESULTS

Absence Records of the Children from School

Eight of 19 children could not attend their preschool for 3 to 8 days in August. They were suffering from upper respiratory infection. Seven children did not attend for one to 5 days in September, and 2 were absent for 5 to 8 days in October. There was only one child who could attend preschool throughout these periods.

Key Words:
- Group A streptococcal infection
- Antistreptolysin O (ASO)
- Antideoxyribonuclease B (ADN-B)
- Antistreptococcal polysaccharide (ASP)

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TABLE I  ISOLATION OF BET'A-HEMOLYTIC STREPTOCOCCI BY THROAT CULTURES

<table>
<thead>
<tr>
<th>Date of culture</th>
<th>Number of children</th>
<th>Group of beta-hemol. strept.</th>
<th>T-type of group-A streptococci</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st culture</td>
<td>October 21, 1980</td>
<td>64</td>
<td>45 (70.3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2nd culture</td>
<td>December 15, 1980</td>
<td>67</td>
<td>53 (79.1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Fig.1. Interrelation between serum ASO and ADNase B titers.

- = positive throat culture for group-A streptococci, o = negative throat culture for group-A streptococci

<table>
<thead>
<tr>
<th>ASP (titer)</th>
<th>number of children</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>o</td>
<td>1.7 %</td>
</tr>
<tr>
<td>4</td>
<td>oooooooooo</td>
<td>21.6</td>
</tr>
<tr>
<td>8</td>
<td>ooooooooooooooo</td>
<td>30.0</td>
</tr>
<tr>
<td>16</td>
<td>ooooooooooo</td>
<td>20.0</td>
</tr>
<tr>
<td>32</td>
<td>ooooooo</td>
<td>11.7</td>
</tr>
<tr>
<td>64</td>
<td>ooooooo</td>
<td>10.0</td>
</tr>
<tr>
<td>128</td>
<td>oooooo</td>
<td>5.0</td>
</tr>
<tr>
<td>256</td>
<td>ooo</td>
<td></td>
</tr>
</tbody>
</table>

Fig.2. Distribution of serum ASP titers obtained from 60 healthy children of a primary school in Otsu City. Throat cultures from these children were negative for beta-hemolytic streptococci.

ASP = antistreptococcal polysaccharide

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Eighteen of 32 children in primary school were absent from school for one to 10 days in September, and 7 could not attend in October. The number of children who could attend regularly was 7.

Four of 17 students in middle school were absent from school in September and 2 could not attend in October.

Prevalence of β-hemolytic Streptococci
The results of throat cultures are shown in Table I.

The recovery rate of β-hemolytic streptococci was 75.0% when the first throat culture was taken and 82.1% when the second throat culture was taken. Furthermore, 70.3% of β-hemolytic streptococci isolated from the children in the first culture belonged to group-A and 79.1% of streptococci isolated in the second culture belonged to group A.

Among the group-A streptococci isolated during this study period, the most dominant strain was Type 4: 84.4% of group-A streptococci in the first culture and 88.7% in the second culture.

Determination of Antibodies
Sera from 52 children were used for the determination of streptococcal antibodies.

Serum ASO titers were determined in 52 children. Forty-one children (78.8%) showed an elevated serum ASO titers of 333 U/ml or more, and 11 showed a level of 250 U/ml or less.

Relation between ASO and ADN-B titers (Fig. 1): Serum ADN-B titers were 1:480 or more in 38 out of 41 children showed elevated serum ASO titers, and in 3 of these 41 ADN-B titers were 1:340 or less. In 3 of 11 children who showed normal serum ASO titers, ADN-B titers were 1:480 or more.

Relation between ASO and ASP titers (Fig. 2): ASP titers obtained from 60 healthy children of another school are shown in Fig. 3. They were 1:16 or less in 73.3% of these children and 1:32 or less in 85.0%.

Among the 41 children with high serum ASO titers of 333 U/ml or more, serum ASP titers were 1:64 or more in 17 and 1:32 or less in 24.

Among the 11 children with normal serum ASO titers of 250 U/ml or less, serum ASP titers were 1:64 or more in 3 and 1:16 or less in 8.

DISCUSSION
In the religious organization at the foot of a mountain, approximately 300 people have lived together, forming a relatively isolated community. They have had their own schools of a small scale, where the children of this organization have been educated.

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From the fact that a large number of children were absent from school due to upper respiratory infection during the period from August to October, 1980, and that a high isolation rate of group-A streptococci and high serum antibody titers to streptococcal antigens were observed, an epidemic infection of β-hemolytic streptococci was considered to exist among these children. Type-4 strain of group-A streptococci was thought to be the cause for this epidemic infection.

The usefulness of serum ASO and ADN-B tests for the diagnosis of β-hemolytic streptococcal infection has been well known. Up to now, the upper limit of the normal range of serum ASP titers has not yet been determined. In the present study on 41 children who showed increased serum ASO titers, high serum ADN-B titers (1:480 or more) were seen in 92.7% of the children, but serum ASP titers of 1:64 or more were seen in 41.5% and those of 1:32 or more were observed in 65.9%. From these results, it is considered that the simultaneous determination of these three antibodies may be helpful for the diagnosis of streptococcal infection, although the clinical usefulness of serum ASP tests must be investigated further.

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