

## INCIDENCE AND IMPORTANCE OF STREPTOCOCCI IN AN INSTITUTION FOR RHEUMATIC CHILDREN

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The association between rheumatic fever and infections with Lancefield's group A streptococci (Waksman, 1949) is well established. Because of this association it seemed likely that in an institution for rheumatic children there would be a high incidence of streptococcal infections, and that such an institution would be a suitable community for the study of the mode of spread of streptococci. The first stage of such an investigation was to determine the incidence of streptococci in the nasal and throat swabs of the children. At the end of a year, however, the incidence of group A streptococci was shown to be so low that it did not warrant any further epidemiological studies.

This communication reports a few points of interest which have arisen from the preliminary studies.

### METHOD

Swabs were taken weekly from anterior nares and from tonsils or tonsillar beds from all children. Swabs were moistened with saline before use, and since the laboratory was near no carrier medium was used.

Swabs were streaked on 'oxid' nutrient agar containing 10% horse blood and 1 in 500,000 crystal violet, and were then themselves incubated in 10% horse blood broth containing 1 in 500,000 crystal violet and 1 in 5000 sodium azide. All cultures were aerobic.

Owing to the low incidence of haemolytic streptococci, a comparative test was made for 4 weeks, using other media of proved suitability for streptococcal isolation in parallel with the 'oxid' medium. These control media did not increase the number of haemolytic streptococci isolated.

Haemolytic streptococci were grouped using Maxted's enzyme method (Maxted, 1948). All group A strains were typed by Dr R. E. O. Williams at the Streptococcal Reference Laboratory, Colindale.

### MATERIAL

The subjects consisted of all children resident at Ash House, a hospital school for rheumatic children, between 10 May 1951 and 1 May 1952. The age of the children varied from 3 to 14 years. The number of beds was 42, but during the year the hospital school was never full, the numbers varying from 22 to 36 at any one time.

There were 63 new admissions and 67 discharges. Of 52 children transferred from hospitals in which their acute rheumatic fever had been treated and 11 admitted directly from home, only three were carrying group A streptococci at the time of their first swab after admission. These three all came from a hospital. One had a negative swab before admission; from one no swab was taken prior to

admission; and the third was a light carrier of group A streptococci at the time of admission.

This low incidence of streptococci on admission is probably due in part to the selection for transfer. Of the 52 transferred from hospital, 26 had no group A streptococci in throat swabs before transfer, 21 were on penicillin or sulphadiazine prophylaxis when transferred and were not carrying group A streptococci, and only four were transferred with neither bacteriological examination nor prophylaxis. One child, because of an oversight, was transferred when known to be a light carrier of group A streptococci and without prophylactic treatment. Of the 11 children admitted directly from home, two had negative throat swabs before transfer and nine were not examined bacteriologically.

Prophylaxis after admission to Ash House consisted of either penicillin orally, 100,000 units twice daily on an empty stomach, or sulphadiazine orally, 0.5 g. daily for children below 60 lb. in weight and 1.0 g. for those over 60 lb. It can be seen in Table 1 that at any time approximately one-third of the children received some prophylaxis. There were no definite criteria for the selection of children who received prophylactic penicillin. Usually the children given oral penicillin were those who either had more frequent respiratory infections of any etiology or had already developed severe rheumatic heart disease. Sulphadiazine was given prophylactically to the children who during their stay at the Children's Hospital, Sheffield, were included in the investigation organized by the Medical Research Council on the value of hormone treatment in rheumatic fever, and who were subsequently transferred to Ash House.

The matron, five sisters and nurses and three of the domestic staff were resident. Seven of the nursing staff, four of the domestic staff and the four teachers were non-resident. In addition, the hospital school was visited by the doctor and occasionally by medical students. Parents visited once a week, children under 16 not being allowed on the premises. Visitors were requested not to visit if suffering from a respiratory infection, but it cannot be said with certainty that all the parents complied with this request. Resident children were also sent to the Out-patient Department of the Sheffield Children's Hospital for special investigations or for consultations. There were, therefore, many opportunities for the introduction of an infection from outside.

#### INCIDENCE OF STREPTOCOCCI

1644 throat swabs and 1644 nasal swabs were examined. Lancefield's group A streptococci were isolated from 20 throat swabs and two nasal swabs from 12 children. Neither of the nasal swabs gave a heavy growth. With one exception the same types were not isolated from different children. Evidence of cross-infection with streptococci was therefore conspicuously absent, as also were heavy nasal carriers.

Streptococci of Lancefield's groups C and G were isolated from 20 children. Group C streptococci were isolated from three throat swabs and group G strains from 75 throat swabs and from nine nasal swabs. Forty-five strains of streptococci other than groups A, C, or G were isolated from throat swabs and nine from nasal swabs (Table 1).

Table 1. *The incidence of streptococci in 4-weekly periods during the year of investigation and the number of children on prophylaxis*

(The numbers in brackets represent the strains isolated from nasal swabs, the other figures from throat swabs.)

Weeks of investigation	No. of children in Ash House	No. of $\beta$ -haemolytic streptococci isolated						Prophylaxis			
		Group A	Group C	Group G	Others	No. of children	Streptococci isolated	No. of children	Streptococci isolated		
1-4	34-36	3+(1)	—	3	3	9-10	2A+(1A)	—	—		
5-8	35-36	3	2	—	2	7-9	—	—	—		
9-12	28-32	—	1	—	2	7-9	1 other	—	—		
13-16	22-27	—	—	—	1	6-7	—	—	—		
17-20	23-24	—	—	—	7+(2)	6-7	—	2	—		
21-24	23-29	—	—	—	3+(1)	5-6	—	2-5	—		
25-28	31-33	—	—	—	4	4-8	—	5-6	—		
29-32	33-34	1	—	16+(2)	3	6-7	—	6	—		
33-36	33-35	1	—	5+(1)	2	4-5	—	6-10	—		
37-40	34-36	2	—	17+(3)	2	3-4	—	9-10	—		
41-44	33-36	—	—	6+(1)	2	4-6	—	9-10	1G		
45-48	33-35	4+(1)	—	13+(1)	3+(1)	4-5	—	9-11	2G		
49-52	32-35	6	—	11+(1)	10+(4)	3-6	—	9-10	3G+(3 others)		
Total numbers isolated		20+(2)	3	75+(9)	45+(9)						

## ASSOCIATION OF STREPTOCOCCI WITH RHEUMATIC ACTIVITY

In two children the group A streptococcal infection was associated with an exacerbation of their rheumatic activity.

In the remaining children at the time of the positive swabs there was either no rheumatic activity or the only remaining sign was a raised sedimentation rate. The presence of group A streptococci in their throats had no apparent effect on their condition. In two children the sedimentation rate was normal before and after the positive swabs, and in the rest it was high and remained at the same level or it was falling and the rate of the fall was unaffected. Over the same period of time, there was no definite exacerbation of rheumatic activity without any preceding streptococcal infection.

Records of the sedimentation rates were studied in the 20 children who carried C or G streptococci. In 15 children the sedimentation rate was entirely unaffected by the presence of C or G streptococci in the throat and nose, in nine of them being normal and in six raised at the same level before and after the positive swab. In three children the effect on the sedimentation rate was unknown, either because they were discharged immediately afterwards or because of the presence at the time of a non-streptococcal infection. Finally, in two children there was a slight rise in the sedimentation rate. In one the rise was from 14 to 21 mm./hr. but it fell to 13 mm./hr. while the swab was still positive. In the other there was within 4 weeks a rise from 13 to 19 and then to 26 mm./hr. followed by a fall to 8 mm./hr.

## DISCUSSION

The most interesting point in the present study was the surprisingly low incidence of group A streptococcal infections. This was lower than the overall incidence in other investigations in which a higher proportion of children were on chemoprophylaxis (Pitt-Evans, 1949). It should be remembered, however, that in the present series the children receiving penicillin or sulphadiazine were not chosen at random, and this does not allow any strict comparison with the results of previous workers. The reason for the low incidence of group A infections was difficult to define. As far as we could ascertain, it was not due to unsatisfactory culture methods. It may have been due to a yearly variation (Taran & Jablon, 1951). On the other hand, various factors might have contributed to it. The opportunities for introduction of the infection from outside by visitors and staff were not lacking. An attempt had been made, however, to reduce the number of new patients who might be carriers on admission by insisting that before they were transferred from another hospital the children should either have negative throat swabs or be on chemoprophylaxis. One, or both, of these conditions was fulfilled by 47 of the 52 children transferred from a hospital. It is of interest to note that two of the three children who had positive swabs immediately after admission were from the five who escaped this screening, and only one child was from the 47 who fulfilled one or both of the conditions mentioned above. Another factor probably contributing to the low incidence was the absence of heavy nasal carriers (Hamburger, Green & Hamburger, 1945). During the year of study, on only one occasion was

the same Griffith's type of streptococcus isolated from different children, i.e. there was no evidence of cross-infection. This is probably due to the factors mentioned above, which also contributed to the low general incidence.

The higher incidence of streptococci of groups C and G is noticeable. This type of infection may be of practical importance for two reasons. First, in the absence of adequate laboratory facilities for the Lancefield's grouping of  $\beta$ -haemolytic streptococci, a false impression may be gained of the presence of pathogenic streptococci, and many children may be treated unnecessarily. Secondly, any effect of non-pathogenic streptococci on the sedimentation rate might be misleading. The experience of the present series suggests, however, that non-pathogenic streptococcal infections do not usually affect the sedimentation rate and if they cause a rise this is slight and of short duration.

#### SUMMARY

1. The incidence of haemolytic streptococci in the patients of a Hospital School for rheumatic children was determined over a period of 1 year.

2. In the total of 1644 throat and 1644 nasal swabs, group A strains were isolated from 20 throat and two nasal swabs. Eighty-seven strains of Lancefield's groups C and G and 54 strains of groups other than A, C, or G were isolated.

3. There was no evidence of cross-infection.

4. Factors contributing to the low incidence of group A strains and the absence of cross-infection are discussed.

5. The carriage of groups C and G strains did not appreciably affect the erythrocyte sedimentation rate.

6. Although no direct evidence is available, the experience of the present study suggests that the incidence of streptococci in an institution for rheumatic children may be reduced by: (a) bacteriological screening before admission; (b) regular swabbing and Lancefield's grouping of streptococci isolated for the early detection of group A strains; and (c) administration of penicillin or sulphadiazine prophylactically to even a limited number of children.

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