

# An epidemiological study of rheumatic fever and rheumatic heart disease in Lagos

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**SUMMARY** In Lagos 12 755 schoolchildren aged between six and 12 years were screened for evidence of rheumatic heart disease and showed a prevalence rate of 0.03%. Group C (27.7%) and group G (47.3%) predominated in the throat and in cases of pharyngitis, while group A predominated on the skin. Two hundred and sixty-six cases of pharyngitis were recorded, 70 (26.4%) were positive for  $\beta$ -haemolytic streptococci. Half of the cases of streptococci were caused by group A  $\beta$ -haemolytic streptococci while 28.2% and 21.1% were caused by groups C and G respectively. A diversity of serotypes of group A streptococci, which included types 49 and 55, and C and G streptococci were isolated from impetiginous skin lesions. The main point of interest is the association of group C and G streptococci with sore throat and skin infections. The pathogenicity of C and G in such circumstances merits further investigation. The present study also showed that prophylactic benzathine penicillin (Penadur) given to patients with rheumatic heart disease or rheumatic fever had been effective with no recurrent attack of acute rheumatic fever.

Until recently it was generally thought that streptococcal infections and their sequelae occurred rarely in tropical and subtropical areas and were not therefore a major problem (Von Bormann quoted by Rotta and Schleifer, 1974). Trowell (1960) indicated that little was known about the natural history of rheumatic fever in Africa. However, Shaper (1972) stated that there was now abundant evidence from studies on hospital inpatients that rheumatic heart disease was today the commonest form of heart disease in children and young adults in most tropical or developing countries and was one of the most common cardiovascular diseases in adults.

Thus, rheumatic fever and rheumatic heart diseases are serious health problems in developing countries and appear to be increasing (Antia *et al.*, 1971). Poor environmental hygiene, low socio-economic standards, and the lack of a comprehensive prophylactic programme against streptococcal infections are among the contributing factors resulting in this increase.

Classical studies of the streptococcus showed that the throat was the main site of infection, but recently attention has been drawn to the skin as a common site of invasion by streptococci (Dudding *et al.*, 1970; Sharrett *et al.*, 1971; Dillon, 1972).

In a recent study Ogunbi (1971) and Taplin *et al.* (1973) found that streptococcal pyoderma was very common in a number of tropical countries, with

group A streptococci responsible for over 90% of the infections.

Simon *et al.* (1965) first drew attention to post-streptococcal epidemic nephritis in Trinidad which often followed a primary streptococcal skin lesion.

In view of this evidence of high rates of streptococcal infections in the tropics it was decided:

To determine the prevalence of streptococci in the nose, throat, and skin in the Lagos area

To identify the serotype of streptococci associated with streptococcal infections

To determine the prevalence of rheumatic fever and rheumatic heart disease in the study population

To evaluate the measures aimed at preventing the non-suppurative sequelae of streptococcal infection, particularly rheumatic fever and rheumatic heart disease, in the community.

## Materials and methods

Interest in streptococcal infections began in 1970 when a research team started to survey a general population in Lagos for prevalence of streptococci. The team comprised a medical microbiologist, a paediatric cardiologist, a community physician, some junior doctors, health sisters, laboratory technicians, and interview laboratory attendants. The study began by surveying a random sample of

metropolitan Lagos.

In 1972 there was a second survey (1/10 sample) covering 12 755 children aged between six and 12 years from the primary school in Lagos. The schoolchildren were screened for evidence of rheumatic heart disease by medical students in their final year and by resident medical staff working with the team.

The surveillance for rheumatic fever and rheumatic heart disease began in 1973 and effectively covered children attending Massey Street Children's Hospital, Lagos University Teaching Hospital, Lagos City Council Welfare Centres, and School Health Clinics. It continued throughout 1973 and 1974.

The study included an evaluation of secondary prophylactic measures using benzathine penicillin (Penadur) injection for identified cases of rheumatic fever and rheumatic heart disease. These patients were seen regularly on Wednesday afternoons.

There were detailed bacteriological, serological, and clinical follow-up visits of some 380 children randomly selected from the 1972 survey and of 70 cases of pharyngitis from the school population under study for a period of three years.

Biological studies of a few strains of serogroups C and G streptococci isolated from our study population were undertaken by assessing the production of (deoxyribonuclease) DNase B, hyaluronidase, streptolysin O, and M-associated protein (MAP) (Widdowson *et al.*, 1971); bactericidal tests (Maxted, 1956) were carried out with human donors.

## Results

Table 1 shows that out of the 12 755 schoolchildren in Lagos examined in 1972, 1679 (13.3%) were positive throat carriers of streptococci. Of the serogroups identified almost half (47.3%) were serogroup G, about one-quarter of the cases were serogroup A (22.8%), and one-quarter serogroup C (27.7%).

The number of positive skin carriers identified in this population was much lower. Among 154 children who were positive skin carriers there were 58 (37.7%) with identified organisms from the ankle, 35 (22.7%) from the back, and 61 (39.6%)

from the wrist. The pattern of serotypes identified from these skin carriers, however, was very different from that of the throat carriers; of the 154 organisms identified from the skin 117 (76%) were serotype A, 26 (17%) were type G, and 11 (7%) were type C. The details are shown in Table 2.

Table 2 *Skin streptococci carriers in 12 755 schoolchildren in Lagos, 1972*

	Site of positive swabs			
	Ankle	Back	Wrist	Total
No. of strains	58	35	61	154
Prevalence ratio (%)	0.45	0.27	0.48	1.21
Serogroups				
A	42	26	49	117
C	4	4	3	11
G	12	5	9	26

Table 3 shows that in the study of schoolchildren in Lagos 5300 were examined for skin infections and 724 cases of pyoderma were identified, giving a prevalence ratio of 13.7%. Out of these 724 cases, 402 (55.5%) yielded  $\beta$ -haemolytic strains of streptococci. The serogroups were A (89.5%), G (6.4%), C (2.9%), and D (0.9%).

Table 3 *Skin infections in schoolchildren in Lagos, 1972*

No. of children examined	5300	
No. of children with pyoderma	724	
Prevalence ratio of pyoderma (%)	13.7	
Total $\beta$ -haemolytic streptococcal strains	402	
Percentage of pyoderma caused by $\beta$ -haemolytic streptococci	55.5	
Serogroups (%)		
A	360	89.5%
C	12	2.9%
G	26	6.4%
D	4	0.9%

In the total population of 12 755 schoolchildren in Lagos examined in 1972, four (0.03%) were found to have previously undetected rheumatic heart disease. Seven cases were already known and identified in the hospital, giving a true prevalence of 0.08%.

In the continuing surveillance study of patients with rheumatic fever or rheumatic heart disease, 53 cases (21 males and 32 females) were admitted to the study including the four cases identified in the 1972 survey of schoolchildren. Six (11%) were between the age of three and five years, 35 (66%) were between the age of six and 10 years, seven (13%) were between 11 and 15, and five (10%) were over the age of 15 years. Of the 53 cases, 42 had clinical signs of valvular lesions, 37 had evidence of acute rheumatic fever, and 22 had congestive

Table 1 *Throat streptococci carriers in schoolchildren in Lagos, 1972*

No. of children examined	12 755				
No. of positive throat carriers	1 679				
Prevalence ratio (%)	13.3				
Serogroups (%)	G	C	A	B	D
	47.3	27.7	22.8	0.1	0.9

heart failure. The types of valvular lesions are shown in Table 4.

Table 4 Cases of valvular heart disease seen in surveillance clinics 1973-74

Mitral incompetence and mitral stenosis	9
Mitral incompetence	26
Mitral stenosis	1
Mitral incompetence and aortic stenosis	1
Mitral incompetence and aortic incompetence	4
Mitral incompetence, aortic stenosis, and aortic incompetence	1
	42

Of these 53 cases a definite history of previous streptococcal throat infection was obtained in only two cases, while such an infection was suspected or probable in 10 cases, and in the remainder it was not possible to obtain a history of such an infection.

Thirty-five patients (14 males and 21 females) attended the clinic for secondary prophylactic benzathine penicillin injections for a period of three years. The dose given was 600 000 units every three weeks for children and 1 200 000 units three weekly for adults. Of these 35 patients, 17 (48%) attended the clinic on every occasion, 10 (29%) attended at least 80% of the time or needed some home visits to encourage attendance, and eight (23%) attended less than 80% of the time despite home visits by the health sister.

In the study of cases of pharyngitis detected at school health clinics in 1973-74, there were 266 cases identified. Seventy-one (26%) of these were positive for  $\beta$ -haemolytic streptococci and half of these, 35 (49%), were serogroup A, about one-quarter 20 (28%) were serogroup C, and one-fifth 15 (21%) group G. Eleven of these patients were bled so that ASO titres might be estimated, and the results are shown in Table 5.

In the Lagos University Teaching Hospital 31 cases of active rheumatic fever and 38 cases of rheumatic heart disease were admitted between 1965 and 1974. The distribution of these cases by sex and age is shown in Tables 6 and 7.

Table 5 Patients from the school health clinics who were bled and had ASO titres determined

Case No.	ASO	Isolates
1	564	Group A > 50 colonies
2	564	C > 50 colonies
3	141	C > 2 colonies
4	141	G 11 colonies
5	564	A > 50 colonies
6	282	C > 50 colonies
7	141	C > 50 colonies
8	282	colonies not known
9	141	A 7 colonies
10	282	Negative for $\beta$ -haemolytic streptococci
11	181	Negative for $\beta$ -haemolytic streptococci

Table 6 Rheumatic fever in Lagos University Teaching Hospital, 1965-74. Distribution in relation to age and sex

Age (years)	Sex		Total
	Male	Female	
1-4	2	1	3
5-9	3	9	12
10-14	7	7	14
15-24	0	2	2
25-34	—	—	—
All ages	12	19	31

Table 7 Rheumatic heart diseases in Lagos University Teaching Hospital, 1965-74. Distribution in relation to age and sex

Age (years)	Sex		Total
	Male	Female	
1-4	2	1	3
5-9	2	5	7
10-14	2	4	6
15-24	3	5	8
25-34	3	4	7
35-44	1	3	4
45+	—	3	3
All ages	13	25	38

## Discussion

We have identified and followed-up 53 cases of rheumatic heart disease since 1973 at our special Streptococcal Disease Clinic. The following clinical features were present in order of magnitude: apical systolic murmur, carditis, fever, and polyarthrititis. A history of streptococcal throat infection was not common; rheumatic nodules were rare, erythema marginatum was difficult to see in dark skins; skin infections were not uncommon.

The diagnosis of rheumatic heart disease was easily made at the various clinics and hospitals. The same however cannot be said of rheumatic fever. We presume most of these cases are missed and treated for some other conditions.

Our survey of 12 755 children aged between six and 12 years found only four (0.03%) cases of previously undetected rheumatic heart disease, but the true prevalence in this population includes not only these four cases but also all those cases drawn from this population who were already known to have been diagnosed as rheumatic heart disease. In Algeria, in a pilot study of an area with a general population of 45 000 inhabitants, 0.3% sought medical care for rheumatic fever and rheumatic heart disease, while in Egypt in a field study of schoolchildren aged between six and 12 years, a prevalence rate of 1% was found (Strasser and Rotta, 1973).

The low prevalence of a past history of rheumatic fever in Nigeria may be owing to many factors among which are customs, ignorance, traditional beliefs, and low socioeconomic status of most of the population (Antia *et al.*, 1971).

It is interesting to note that rheumatic fever was seen at ages under five years in our study while the peak incidence of rheumatic heart disease in our community is between five and 10 years. This observation is similar to a Ugandan study in which rheumatic fever and rheumatic heart disease had a peak incidence at between six and 12 years (D'Arbela *et al.*, 1974). However, these peak data differ slightly from the review on the Lagos University Teaching Hospital, as shown in Tables 5 and 6. Benzathine penicillin (Penadur) given to patients with rheumatic heart disease or rheumatic fever was effective (World Health Organisation, 1966) and there has been no recurrent attack of acute rheumatic fever. These findings agree with those of a study at Ibadan, Nigeria (Antia *et al.*, 1971).

We continue to see a preponderance of groups C and G  $\beta$ -haemolytic streptococci among the throat carriers and in cases of pharyngitis, while group A predominates on the skin.

In a five-year study in Czechoslovakia, Rotta *et al.* (1966) found group A strains accounted for 86.2% of the streptococci isolated from patients suffering from streptococcal disease and 62.3% of the strains from normal carriers.

Christie (1969) stated that 95% of haemolytic streptococci infections in man are caused by some group A streptococci. The preponderance of groups C and G in our community requires further study to elucidate their possible pathogenic roles. Evidence of infection as shown by rise in ASO titre, and primary isolates of over 50 colonies incriminated both serogroups C and G as primary pathogens responsible for many cases of pharyngitis in our study. Ninety per cent of streptococcal pyoderms were caused by group A while groups C and G accounted for only 7.3%. This finding agrees with that of Taplin *et al.* (1973) in which over 90% of cases of streptococcal pyoderma was found to belong to group A.

In our studies we found no evidence of an association of streptococcal pyoderma with rheumatic fever or rheumatic heart disease. Although we have relatively high primary streptococcal infection of the pharynx by groups C and G streptococcal, we have yet to associate either of the two with rheumatic fever or rheumatic heart disease. But this study shows that in a tropical population there is an association between carditis and skin infections from Serogroup A. Continued surveillance to clarify the above situation is necessary.

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