

Group G streptococci in healthy school-children and in patients with glomerulonephritis in Trinidad

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SUMMARY

The group G streptococcus has generally not been considered a prominent pathogen. In a 1982 study of the colonization rate by β -haemolytic streptococci in apparently healthy children, age 5–11 years, 25 of 69 isolates belonged to group G. This surprisingly high rate of group G colonization (14·3%) led to a retrospective study of school surveys in 1967 which showed that the colonization rate with this organism was 2·3% (range 1·3–3·5%). A review of bacitracin-sensitive streptococcal isolates from hospital admissions of patients with acute glomerulonephritis (AGN), rheumatic fever, and their siblings, between January 1967 and July 1980, was conducted. Of 1063 bacitracin-sensitive isolates, 63 were group G, and 52 of these were isolated from AGN patients and their siblings, i.e. 7 from skin lesions of AGN patients, 40 from the throats of siblings and only 5 from the skins of the siblings. The other 11 group G isolates were from rheumatic-fever patients and their siblings. Thus, the group G colonization rate fluctuates in the population. The isolation of only group G streptococci from skin lesions of patients with AGN suggests a possible association between group G streptococcal pyoderma and acute post-streptococcal glomerulonephritis.

INTRODUCTION

Beta haemolytic group G streptococci as a cause of human infection have been reported infrequently since their description by Lancefield & Hare (1935). Within the last decade, however, there have been publications identifying this organism

as the aetiologic agent in neonatal sepsis (Brans, 1974; Dyson & Read, 1981; Nieburg, 1979), pharyngitis (McCue, 1982), wound infection and sepsis (Duma *et al.* 1969; Norlander, Thal & Tunevall, 1975) and also in adult urinogenital carriage (Christensen *et al.* 1974). In addition, group G septicaemia has been identified in seriously debilitated patients (Armstrong *et al.* 1970). In Southern Ghana the isolation of group G streptococci from pyoderma is not an uncommon occurrence (Belcher *et al.* 1975). In Nigeria, group G streptococcus has been isolated from the throats of carriers and from patients with tonsillitis (Lawal, Angiwo & Ogunbi, 1979). However, from these African countries there is thus far no evidence of post-streptococcal sequelae as a result of infection by these streptococci.

This paper reports the increasing throat colonization by group G streptococci in apparently healthy children in Trinidad and the possible association of group G streptococcal pyoderma with acute glomerulonephritis.

MATERIALS AND METHODS

School-children. The school-children studied were apparently healthy and were aged 5–11 years. These were of three groups:

(a) One hundred children from a rural school studied on a weekly basis during the three school terms of 1967.

(b) One hundred and fourteen children from an urban school to which six weekly visits were made in 1967.

(c) One hundred and seventy-five children from two rural schools, studied in the period January to March 1982.

Patients. The patients studied were those with AGN admitted to the General Hospital, San Fernando, during the period January 1976 to July 1980.

Siblings of patients. The siblings of admitted AGN patients were investigated by the district health nurse who visited the homes.

Specimens. Swabs from the throat and from skin lesions were inoculated directly on to blood agar plates and streaked on return to the laboratory. Isolation of streptococci and bacitracin sensitivity followed. Grouping and typing of streptococci were done by the Central Public Health Laboratory, Colindale, England. Laboratory investigations on blood and urine specimens were done by the General Hospital Laboratory and by the Streptococcal Disease Unit.

Selection of strains for grouping. In the rural and urban studies of 1967 and 1982 all β -haemolytic streptococci were grouped. However, in the period 1976–80 only bacitracin-sensitive strains were typed. It is recognized that this seriously underestimates the true prevalence of group G strains in this period. Nevertheless this data is presented for comparison.

Clinical evaluation. Each AGN patient was examined and evaluated by one of us (T.P.-K.).

RESULTS

Group G streptococci at a rural and an urban school in north Trinidad

During 1967 weekly visits were made to a rural school during the three terms of the school year (Table 1). During the first term, cultures were taken from 1043 children. There were 236 isolates of β -haemolytic streptococci, of which group G

Table 1. *Streptococcal pharyngeal isolates from school-children*

	No. of cultures	Group A	Group C	Group G
1967				
Rural schools	2891	171 (6%)*	6 (0.2%)	32 (1%)
Urban schools	114	14 (12%)	0	4 (4%)
1982				
Rural schools	175	39 (22%)	4 (2%)	25 (14%)

* Percentage of total cultures (colonization rate).

isolates represented 6.0% of the total. The ratio of group A to group G was 17:1. The number of children swabbed during the second term was 811. There were 227 β -haemolytic isolates of which the group G strains represented 7.9% of the total number of isolates. The ratio of group A to group G was 11:1. During the third term 1037 cultures were examined, yielding 277 β -haemolytic isolates, of which group G strains represented 15% of the total. The ratio of group A to group G was 7:1. Thus for the year 1967, the isolation rate for group G was 9.1% of β -haemolytic organisms, and the colonization rate 2.3% (range 1.3–3.5%). The over-all group A to group G ratio was 10:1 (range 7:1–17:1).

During this year, six weekly visits were also made to an urban school. At this school, only children with skin lesions were swabbed. Each child also had his or her throat swabbed. There were 199 cultures taken from skin lesions and these yielded 168 isolates of β -haemolytic streptococci, of which 164 were group A and 4 were group G, two of which were in mixed culture with group A. Of the throat cultures taken, 114 in number, there were 36 streptococcal isolates, of which 14 were group A and 4 were group G. In this school, therefore, the number of group G isolates represented 4.0% of the total β -haemolytic isolates and 2.6% of the total number of cultures taken. It should be noted that these were selected children with skin lesions. The ratio of group A to group G was 22:1.

Group G streptococci at two rural schools in central Trinidad in 1982

Between January and March 1982, the throats of 175 children were swabbed, yielding 69 β -haemolytic isolates (Table 1). There were 39 belonging to group A and 25 to group G. This high rate of group G colonization (14.3%) was surprising and showed a group A to group G ratio of 1.6:1.

When broken down by age, the group G streptococcal colonization rate varied between 7% in the 8-year-olds and 31% in the 9-year-olds. There did not appear to be any particular pattern to the colonization rate at different ages.

Occurrence of group G streptococci – January 1976 to July 1980

The high rate of group G colonization of the throat (14%) prompted a review of those streptococcal isolates sent to the Central Public Health Laboratory, Colindale, England, between January 1976 and July 1980, during which time all bacitracin-sensitive strains from patients with post-streptococcal sequelae were sent for grouping and typing. Isolates, 1231 in number, were sent and 1063 were successfully grouped and typed; of these 1063 isolates, 958 belonged to group A, 18 to group B, 19 to group C, 5 to group D and 63 to group G. Table 2 shows the

Table 2. *Distribution of 1063 isolates by group/year*

	Streptococcal groups			Total*
	A	C	G	
1976	200	4	9	219
1977	238	9	32	284
1978	188	3	15	213
1979	197	2	2	202
July 1980	135	1	5	145
	958	19	63	1063

* Indicates all bacitracin-sensitive β -haemolytic streptococcal isolates.

Table 3. *Distribution of isolates from AGN patients and siblings by group and source*

	AGNs		AGN siblings		Total
	Throat	Skin	Throat	Skin	
Group A	101	156	220	232	709
Group B	1	2	5	3	11
Group C	0	0	14	1	15
Group D	2	1	0	0	3
Group G	0	7	40	5	52
	104	166	279	241	790*

* The other 273 isolates were obtained from ARF patients and their siblings.

distribution by group and year of these isolates. It can be seen that the percentage of group G organisms varied from year to year, being the highest in 1977 at 11 % of all isolates and lowest in 1979 at 1 %.

AGN patients and their siblings

During the period January 1976 to July 1980, 642 patients with AGN were admitted to the General Hospital, San Fernando, the second largest town situated in South Trinidad. For each AGN admission, the district health nurse visited the family and took cultures of the throat and of any skin lesions present on the siblings. Urine and blood samples from each were brought back to the laboratory for testing. In this way, an additional 66 AGN cases (subclinical) were revealed and were hospitalized. The total number of siblings examined during that period was 2525, of whom 587 yielded streptococcal isolates on culture.

Source and group distribution of isolates from AGN patients and siblings

Table 3 shows the streptococcal groups and the source of the isolates from AGN patients and their siblings. In general, post-streptococcal AGN followed infection with group A streptococci; 257 (95 %) of the 270 isolates from the AGN patients were group A strains. However, of particular interest are the streptococcus group G isolates, 7 (3 %) being isolated from skin lesions and none from the throat. On the other hand, of the 520 isolates from the siblings, 452 (87 %) were group A strains while of the 45 (9 %) group G strains, 40 were from the throat and only 5 from skin lesions.

Table 4. Group G associated AGN cases

Series no.	Age	Sex	Race*	Siblings	Laboratory			Bacteriology†	
					ASOT	C3	BUN	TS	SS
2201200	12	M	I	2	240	25	94	M60	Grp. G
2207600	5	M	I	1	240	34	13	—	Grp. G
2209200	3	M	N	2	480	21	29	—	Grp. G
2217700	14	M	O	5	480	37	21	M60	Grp. G
2219400	9	M	N	4	640	27	27	—	Grp. G
2200800	5	M	I	8	100	23	26	—	Grp. G
2213000	16	F	I	5	240	89	NA ⁶	—	Grp. G

NA = Not available.

* I = East Indian, N = negro, O = other.

† TS = Throat swab, SS = skin swab.

AGN patients with skin lesions infected with only group G streptococci

There were seven AGN patients from whose skin lesions streptococcus group G was isolated (Table 4). The patients ranged in age from 3 years to 16 years, the 16-year-old being the only female affected. Six of the seven cases occurred in 1977, the other occurred in late 1976. Four of the patients were of East Indian origin, two of African origin and one of mixed ethnic origin classified as 'other'. All patients came from rural areas, five from areas of sugar-cane cultivation and two from areas of cocoa and coffee cultivation. The seven patients came from good homes with a central water supply to six of the homes. In one house there was no water supply and the occupants depended on rainwater or an infrequent truck-borne supply. In each of two homes there were two siblings, each of whom yielded streptococcus group A isolates from the throat. All other siblings were negative on culture. The clinical features of the seven patients with group G associated AGN were the same as those for AGN following group A infection. All patients presented with oedema of the face, arms and/or legs and all had skin lesions. All patients had haematuria and proteinuria. Blood pressure was elevated in all but one patient. The laboratory results showed that five of the seven patients had elevated blood urea nitrogen (BUN) levels, one patient was within the normal range and one was not recorded. The antistreptolysin O titre was elevated in six of the seven patients. One was within normal limits but his anti-hyaluronidase titre (AHT) was 1496 units, confirming recent streptococcal infection. The serum complement C₃ was depressed in all patients. Two of the patients had isolates of group A streptococcus (M type 60) from the throat as well as group G from the skin lesions.

DISCUSSION

In order to determine the colonization rate of group G streptococci in a group of normal children aged 5–11 years, the throats of apparently healthy children from two rural schools were swabbed in 1982. Of the 175 children swabbed, 69 produced isolates of streptococci, of which 25 (14%) were group G. There was no difference in streptococcal colonization rate between the boys and the girls. It was found from the records of one of us (D.C.J.B.) that a study done in 1967 showed that the rate

of group G colonization at a rural school varied from term to term (1.3–3.5 %) or 2.3 % colonization over the period of a year.

A retrospective examination of the streptococcal isolates from patients with post-streptococcal sequelae, with special reference to patients with AGN, was undertaken. During the period January 1976 to July 1980, all bacitracin-sensitive isolates from patients with post-streptococcal sequelae were sent to the Central Public Health Laboratory, Colindale, England, for grouping and typing. The colonial morphology of groups A and G are quite similar; they are typically β -haemolytic and most group A and some group G are bacitracin-sensitive. The group G strains which have been isolated from human sources mimic closely group A streptococcal strains and produce many of the same extracellular products, such as streptolysin O (Baker, 1974).

Of the 1231 specimens sent to Colindale, 1063 were successfully grouped and typed. It was shown that 63 of these belonged to group G. Of these isolates, 52 were from AGN patients or their siblings. The other 11 group G isolates came from one case of acute rheumatic fever and 10 rheumatic siblings. Investigations as to the source of these group G strains showed that in 7 AGN patients the isolates were obtained from skin lesions. When the siblings were investigated it was seen that 40 group G strains were obtained from the throat and only 5 from skin infections. In contrast, however, Potter *et al.* (1977) showed that of 354 family members of AGN patients examined during the first 6 months of 1971, only 7 group G strains were isolated, 3 from the throat and 4 from the skin. Thus the isolation rate of group G at that time was 2.8 %, much lower than our findings of 14.3 % in 1982.

Since group G streptococci are typically bacitracin-resistant on blood agar plates (Baker, 1974), the number of AGN patients with isolates resistant to bacitracin was determined to ascertain whether many more group G strains were missed. There were 23 AGN patients with bacitracin-resistant strains. However, only one of these was isolated from a skin lesion, thus suggesting that possibly only one AGN patient with group G skin lesions was missed. In the siblings, however, there were 236 with bacitracin resistant strains but only 8 of these were isolated from skin infections.

In Trinidad, acute glomerulonephritis is more often a sequel to streptococcal pyoderma than it is to streptococcal pharyngitis (Bassett, 1972; Potter *et al.* 1972), as is commonly the case in colder climates (Bassett, 1972; Potter *et al.* 1972; Taplin *et al.* 1973). In a report of the epidemics of 1964/5 and 1967/8 (Parker, 1969), the evidence for the nephritogenicity of the group A serotypes 49, 55 and 57 was their frequent association with AGN and their relative infrequency in uncomplicated pyoderma. It was not assumed that the isolation of a strain from the skin of a patient with AGN was evidence for nephritogenicity, because 18 % of children from whom streptococci were recovered from more than one site were found to be carrying two distinct strains (Parker, 1969), and serial cultures of uncomplicated pyoderma showed changes in streptococcal type between weekly culture on 28 % of occasions. Infection of single lesions with more than one group of streptococcus was reported in children in an urban school (Bassett, 1972) but mixtures of serotypes of group A in a single lesion were rare (1 %). Because of an ongoing streptococcal disease control program put into effect soon after the epidemic of AGN in 1971/2, the incidence of skin lesions on both school children and AGN

patients have decreased (unpublished data). Thus by 1976/7 patients presenting with AGN did not possess the multiplicity of skin lesions seen in the past.

The isolation of a group G streptococcus from the throat of a patient with AGN in Trinidad in March 1965 has been the subject of two previous publications (Maxted & Potter, 1967; Potter *et al.* 1971). This group G strain was found to cross-react with the M-protein antiserum of the group A (M-type 12) strain. The same patient, however, had skin lesions which yielded group A (M-type 55) streptococcus, which was the aetiologic agent of the AGN outbreak at the time of isolation. No M-type 12 strains have been found in Trinidad since 1965. However, three of the seven group G strains isolated from the AGN patients in our series cross-reacted with M-type 2 antiserum. Studies must be conducted to determine whether group G streptococci from AGN patients and carriers show cross-reactivity with group A M-types and whether there is a specific antibody response in the population to the group G specific carbohydrate.

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