

## **Streptococcal pharyngitis in general practice. 1. Some unusual features of the epidemiology**

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### SUMMARY

This report is based on a study of acute infections of the upper respiratory tract in 1965 and detailed records of such infections in 1963 and 1964. A change from illnesses mainly yielding viruses to illnesses mainly yielding group A streptococci was noted around the age of 5 years. A positive culture for group A streptococci in patients over 4 years of age was highly correlated with a complaint of sore throat and with serological evidence of streptococcal infection. A bimodal age distribution curve for pharyngitis associated with a positive culture for group A streptococci was consistently noted. The incidence was highest in children aged 5–9 but a second smaller peak occurred among adults in the 30–39 age group. The evidence suggests that being female increases the risk of acquiring group A streptococci and of experiencing sore throat.

### INTRODUCTION

The work described here was carried out in a general practice over 25 years ago. Only those findings that add to existing knowledge of the epidemiology of streptococcal pharyngitis are reported.

Over 8 months from February to August 1963 and for the whole of 1964 detailed records were kept of all patients of mine whom I saw with symptoms suggesting acute upper respiratory tract infection. Swabs were taken for culture of bacteria in all cases and in some for culture of viruses also. For a period of 12 months up to mid-December 1965 all patients of mine with acute infections of the upper respiratory tract were recruited into a study of transient urinary abnormalities following acute sore throat [1]. This paper reports the epidemiological findings, supplemented by data recorded in 1963 and 1964 and the results of a study of acute sore throat in all patients of the practice in 1959 [2].

#### *Population at risk*

In December 1965 a detailed census was carried out of the 3435 patients registered with me or that I customarily looked after. The number had increased by 206 (112 males, 94 females) during that year but the age and sex distribution had not changed significantly; 40% were less than 15 years old and only 8% were over 49 years of age, 52% (54% of children aged 5–14) were female. The preponderance of young children arose because I had joined the practice just before families from outside the area began to move in to a series of new housing

developments in and around the town. In the first of these developments, an estate commissioned by the National Coal Board to house miners from decaying mining areas in other parts of the United Kingdom, lived 3500 people, half of whom I looked after. Streptococcal infections and their complications were common amongst them. In 1959 the consultation rate for sore throats of any duration associated with a positive culture for group A streptococci was 7·8/100 persons for my patients on that estate and 3·8/100 persons for my patients living elsewhere in the town, most of them also families with young children.

### *Method*

Over a period of 12 months from mid December 1964 all patients on my list or who were customarily looked after by me, whom I saw within 48 h of the onset of symptoms suggesting an upper respiratory tract infection, were admitted to the study.

Clinical details were recorded on a special form. Two swabs were taken from the nose and two from the throat. One swab from the nose and one from the throat were replaced in their tubes; the other two swabs were broken off into a bottle containing 2% Bovine Plasma Albumen in Hank's saline with 0·1% bicarbonate which was then placed in a vacuum flask containing ice for transport to the Public Health Laboratory at Stafford.

In eight patients with coryza there is no record of a second contact; none yielded group A streptococci. All other patients were seen 2 days later, clinical details were recorded and a second throat swab was taken for bacterial culture if the first had not yielded group A streptococci.

The laboratory cultured the specimens for mycoplasma, viruses, streptococci and other potentially pathogenic bacteria. Group A streptococci were typed using the slide agglutination test for T antigen. Three categories were identified for systematic follow up: all those yielding type 4 or type 12 streptococci, an equal number matched by sex and age group yielding other types and all those yielding both a virus and group A streptococci. A small proportion of cases not yielding group A streptococci were also selected for follow up. The laboratory notified me when a patient fell into one of these categories and I visited the home and arranged to collect a sample of blood and the first and second specimens of urine passed on the following day and around 21 days after the onset of the illness. It so happened that in all cases notified the first samples were collected on the seventh day after the onset of the illness.

The purpose of the study was explained to the patient or, in the case of children, to a parent. Participation was optional. A technique of painless venepuncture was devised for the children.

### *Results*

Allowing for leaves the period of study was 47 weeks. During this time 136 episodes of illness judged to be due to infection of the upper respiratory tract were seen within 48 h of the onset of symptoms. In three episodes (all of acute sore throat) satisfactory swabs could not be taken. These episodes have been excluded.

In three episodes (seen over a weekend) swabs were taken for culture of bacteria only (all three yielded group A streptococci). In the remaining 130 episodes

Table 1. All cases: isolation by type of illness and by sex

	Episodes		Streptococcus		Isolations		Total
	No.	Positive culture	Gp A	Not ACG	Virus*	Other†	
Pharyngitis							
Male	43	33 (77)	19 (44)	10 (23)	7 (16)	2	38
Female	67	51 (76)	37 (55)	8 (12)	9 (14)	3	57
Male & female	110	84 (76)	56 (51)	18 (16)	16 (15)	5	95
URTI							
Male	12	4	0	1	3	0	4
Female	11	4	0	0	4	1	5
Male & female	23	8	0	1	7	1	9
Total	133	92 (69)	56 (42)	19 (14)	23 (17)	6 (4)	104

Figures in parentheses are percentages.

\* In three episodes of pharyngitis all in females, swabs were not taken for virus culture; percentages for virus isolations therefore are based on 64 episodes in females.

† *S. viridans* (2 episodes), pneumococci (2 episodes), *Neisseria catarrhalis* (1 episode), *Staphylococcus aureus* (1 episode): isolated together with group A streptococci or a virus in four episodes.

satisfactory swabs were taken for culture of both bacteria and viruses. These 133 episodes (in 128 individuals) are divided into two groups: acute pharyngitis and all other upper respiratory tract infections (URTI). Acute pharyngitis was defined as illness in which the patient complained of sore throat or exhibited exudate or marked redness of the throat.

The first group comprised 110 episodes, 109 in patients over 2 years of age all of whom complained of sore throat and one in a child of 18 months with a febrile illness associated with exudate in the throat.

The second group comprised 23 episodes (five in children under 2 years of age) not associated with a complaint of sore throat or exudate or marked redness of the throat.

The consultation rate for acute pharyngitis seen within 48 h of the onset of symptoms was 3.2 per 100 persons at risk for the 47 weeks of observation (3.5 per 100 persons per year).

*Isolations*

The main results are summarized in Table 1.

In 76% (84) of the 110 episodes of pharyngitis, and in a third (8) of the 23 episodes of URTI, a potentially pathogenic organism was cultured. In 10 episodes 2, and in 1 episode 3, such organisms were cultured; in all therefore there were 104 isolations.

In 56 episodes of pharyngitis group A streptococci were cultured from throat swabs, in 55 from swabs taken within 48 h of the onset of symptoms. In one episode, in a man aged 41, the first swab yielded herpes simplex virus (HSV) and streptococci not of groups A, C or G, (not investigated further) and the second swab, taken within 72 h of the onset of the illness, yielded group A streptococci

(not typed). This was the only episode in which a second swab, taken because the first was negative, yielded group A streptococci. The results of typing these 56 strains were as follows: T-type 12, 14; type 3, 13; type 11, 7; type 1, 5; type 3/13/B3264, 4; type 6, 4; type 4, 3; and one each of the following types 18, 28/28R, 13/B3264, 25/Imp 19, 5/27/44 and non-typable.

The consultation rate for pharyngitis of 48 h duration or less associated with a positive culture for group A streptococci was 1.6 per 100 persons at risk for the 47 weeks of observation (1.8 per 100 persons per year).

Group A streptococci were isolated in 51% of the episodes of acute pharyngitis. None of the 23 episodes of URTI yielded group A streptococci.

This difference is partly due to the higher proportion of children under 5 years of age in the latter group and, as will be seen, group A streptococci were seldom isolated in such children. However even if children under 5 years of age are excluded the difference is highly significant; the resulting exclusion of the child of 18 months with exudate also allows a comparison to be made between all those who complained of sore throat and all those who did not complain of a sore throat. In 52 (53%) of the 98 episodes in patients over 4 years of age who complained of sore throat swabs yielded group A streptococci; of the 13 episodes in patients over 4 years of age who did not complain of sore throat none yielded group A streptococci. The difference in proportions yielding group A streptococci, using Fisher's exact test, is significant at the 0.1% level ( $P < 0.001$ ).

Over the whole recording period from 1963-5 inclusive 55 episodes of URTI were seen within 48 h of the onset of symptoms. In only one, a child of 3 years with fever and a single painful tonsillar gland, were group A streptococci cultured from nose or throat swabs.

Four episodes of pharyngitis yielded both group A streptococci and a virus: HSV in two patients, both adults, coxsackie A9 virus in a girl 8 years old, and echovirus type 7 in a girl 18 months old.

Pathogenic mycoplasma were not cultured from any swab during the year.

#### *Consultation and isolation rates by sex*

In this study 12 of the 23 episodes of URTI were in males and 11 in females; 67 (61%) of the 110 episodes of pharyngitis and 37 (66%) of the 56 episodes yielding group A streptococci were in females. Isolation rates for group A streptococci were 55% for females and 44% for males. In 1963-4 24 of the 32 episodes of URTI seen within 48 h of the onset of symptoms were in males and 8 in females; 122 (63%) of the 194 episodes of pharyngitis seen within 48 h of the onset of symptoms and 61 (68%) of the 89 episodes yielding group A streptococci were in females. Isolation rates for group A streptococci were 50% for females and 40% for males.

Both in childhood and after childhood more of the females than of the males at risk consulted with acute pharyngitis within 48 h of the onset of symptoms and more yielded group A streptococci in 1965 and over the whole recording period, 1963-5 (Table 2).

Over the same period a total of 126 episodes of pharyngitis was seen within 3-5 days of the onset of symptoms; 50 were in males and 76 (60%) in females. Swabs yielded group A streptococci in 44 episodes; 14 in males (isolation rate 28%) and 30 in females (isolation rate 39%).

Table 2. *Pharyngitis: consultation rates\* per 100 at risk by sex and age group*

		Age group			
		1965		1963-5	
		0-14	15-44	0-14	15-44
All episodes	Male	3.4 (26)*	2.2 (17)	10.3 (68)	4.7 (47)
	Female	5.5 (39)	3.3 (28)	16.4 (115)	6.9 (74)
Episodes yielding gp A strep	Male	1.6 (12)	0.9 (7)	4.7 (31)	1.6 (16)
	Female	3.0 (21)	1.9 (16)	8.5 (60)	3.5 (38)

\* Rates are based on census in December 1965.

† Number of episodes in parentheses.

Table 3. *Episodes and isolations per 100 at risk in each age group*

	Age group							All ages
	0-4	5-9	10-19	20-29	30-39	40-49	50+	
No. at risk	480	461	702	468	596	416	272	3435
All episodes /100	22 4.6	36 7.8	36 5.1	12 2.6	19 3.2	7 1.5	1 0.4	133 3.9
Viruses /100	11 2.3	7 1.5	2 0.3	1 0.2	0 0	2 0.5	0 0	23 0.7
Group A /100	4 0.8	18 3.9	17 2.4	3 0.6	11 1.8	3 0.6	0 0	56 1.6

*Consultation rates by age*

Consultation rates per person at risk for episodes yielding a virus were highest in children under 5. Only three patients over the age of 14 yielded a virus: rhinovirus in a man with URTI and HSV in two patients with pharyngitis both of whom also yielded group A streptococci. Consultation rates per person at risk for episodes yielding group A streptococci were highest in children aged 5-9 with a possible second peak among adults aged 30-39 (Table 3).

Addition of the 89 episodes recorded in 1963-4 would make the second peak more evident, given that the age distribution of the population did not change significantly over those years. The age distribution for isolations of group A streptococci among my patients seen with sore throats of 48 h duration or less during those years and among all patients (14 411) of the practice with sore throats of any duration in 1959 follows the same pattern (Fig. 1).

*Antistreptolysin titres*

Twenty-seven patients with pharyngitis yielding group A streptococci were identified by the laboratory for follow up: 11 yielding type 12 alone, 3 yielding type 4 alone, 10 yielding other types alone and 3 yielding both a virus and group A streptococci: type 12 plus echovirus type 7 in a girl 18 months old, type 12 plus HSV in her mother, type 11 plus coxsackie virus A9 in a girl 8 years old.

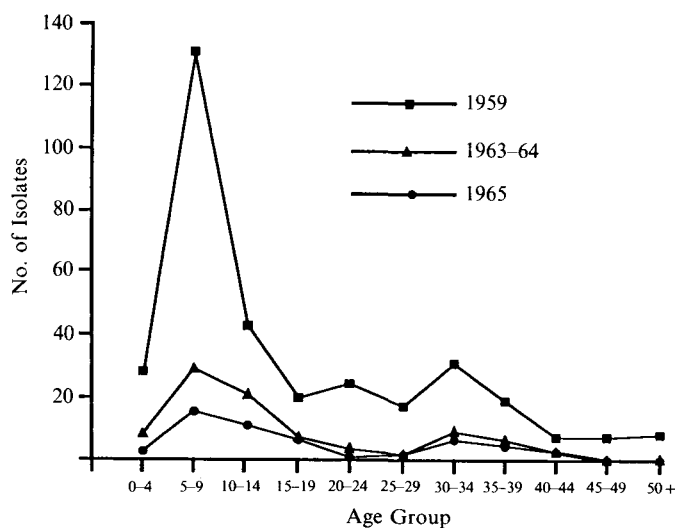


Fig. 1.

Four of these patients were not submitted to venepuncture. A second specimen of blood could not be obtained from five children. The first specimen could not be obtained from one child but at 21 days her anti-streptolysin (ASL) titre was over 800 U/ml.

Thus for 17 of the 27 patients yielding group A streptococci who were identified for follow-up ASL titres during the first week (in all cases on the seventh day) and around 21 days are known and for another the titre in convalescence.

One patient, yielding type 11 streptococci, who was not among the group identified for follow-up, was found on routine testing on the twelfth day to be excreting protein and granular casts; at 21 days the ASL titre was over 800 U/ml.

In nine patients the initial titres did not exceed 210 U/ml and there was a rise in titre of at least two dilution increments over 2 weeks. These nine patients and the two with titres over 800 U/ml in convalescence are considered to have had a streptococcal infection occurring contemporaneously with the onset of pharyngitis (Table 4:I). Five of these 11 patients yielded type 12 streptococci and 6 types other than 12 or 4.

In 5 patients (4 yielding type 12 and 1 type 4) the initial titre was 300 U/ml or more and there was little change over 2 weeks. These patients are considered to have had a streptococcal infection that began before the stated time of onset of symptoms for which they consulted and which continued after that time (Table 4:II).

Thus in five-sixths (15/18) of the patients identified for follow-up and followed up there was serological evidence of streptococcal infection.

In 3 patients (1 yielding type 12 and 2 types other than 12 or 4) both titres were less than 100 U/ml (Table 4:III).

Four patients among those not yielding group A streptococci were identified for follow up; two others had blood taken during convalescence and one other during the first week. For 5 of these patients, 4 with pharyngitis (2 yielding coxsackie viruses) and 1 with a febrile upper respiratory tract infection (yielding influenza

Table 4. *Antistreptolysin titres (ASL, U/ml)*

Positive culture for GpA								Negative culture for GpA			
I*				II†				IV‡			
Sex	Age	Serum		Sex	Age	Serum		Sex	Age	Serum	
		1	2			1	2			1	2
M	9	210	> 800	M	4	300	350	F**	5	85	< 50
F	7	100	> 800	F	28	320	310	M**	7	< 50	100
F	12	90	360	F	14	320	350	M**	9		< 50
F	32	50	470	F	9	400	510	F	6		< 50
M	12	70	625	F	10	630	580	M	4		< 50
F	9	< 50	360					M	14	160	
M	7	200	360			III‡		F*	27	350	
F	8	165	315	F	5	< 50	< 50				
M	42	125	250	F	7	< 50	< 50				
F	8		> 800	F	6	70	50				
F	8		> 800								

\* I, considered to have contemporaneous streptococcal infection.  
 † II, considered to have streptococcal infection antedating stated onset of symptoms.  
 ‡ III, no serological evidence of streptococcal infection.  
 § IV, episodes not yielding group A streptococci; \*\*, identified for follow up.

A virus) ASL titres 3 weeks after the onset of symptoms are known; in none was the titre over 100 U/ml. For two others only the titre in the first week is known; in one the titre was over 200 U/ml (Table 4:IV).

Complement fixation tests were carried out on all specimens taken on the seventh day and around 21 days. An immunological response to infection with influenza A, B, C, adenovirus, respiratory syncytial virus, Sendai viruses or *Mycoplasma pneumoniae* was not found in any case.

DISCUSSION

The incidence of pharyngitis associated with a positive culture for group A streptococci was lower in this study than in previous studies in the same population. Restriction of cases to those seen early in their course and the exclusion of all episodes that could not be timed with reasonable certainty probably accounts for this.

In the 1965 study all such infections of the upper respiratory tract in all age groups could be related to the population at risk. It is possible therefore to show the marked change from illnesses mainly yielding viruses to illnesses mainly yielding group A streptococci that occurred around the age of 5 and the bimodal age distribution curve for consulting rates per person at risk for pharyngitis yielding group A streptococci. The second peak in those aged 30–39 is small but isolation rates for group A streptococci per person consulting with pharyngitis in previous years follow the same age distribution. This finding has not hitherto been described though higher reporting rates for all acute respiratory illnesses have been noted in adults aged 20–29 as compared with older age groups [3]. The greater exposure to infection of parents at the start of family life was the suggested

cause. In this population increased exposure to streptococcal infection of parents with a child attending primary school as compared with other parents was the probable explanation.

Episodes of pharyngitis can also be compared with other infections of the upper respiratory tract. Among those over 4 years of age presenting with an acute infection of the upper respiratory tract, the presence of group A streptococci in the throat was highly associated with a complaint of sore throat and with serological evidence of streptococcal infection in those tested, though in a third the infection probably preceded the onset of the symptoms for which they consulted. There is no reason to suppose that the sample for which the results of ASL titres are known was not representative of the whole. In this population therefore the isolation of group A streptococci from individuals consulting with sore throat was more indicative of a streptococcal infection than studies of sore throat in soldiers or of children attending hospitals [4–7] or of apparently well children [8–10] would suggest.

Females report having more episodes of acute respiratory disease than do males [3]; more females than males present with acute sore throat to doctors [11, 12] and more yield group A streptococci [13, 14].

An excess of women among those consulting general practitioners is well documented and is generally attributed to a lower threshold for consulting or to higher rates of psychiatric morbidity as compared with men. The findings in this report, based upon a known population, strongly suggest a genuine excess of females with sore throats due to group A streptococci. The excess of females was found in those with sore throat but not in those with other illnesses affecting the upper respiratory tract. Among those with pharyngitis the excess of females was not evenly distributed but was concentrated in the episodes yielding group A streptococci. Isolation rates for group A streptococci per person consulting were consistently higher in females. The excess was not due to women consulting at an earlier stage of the illness than did men and it was found in children as well as in adults, affecting equally therefore those who made the decision to consult and those for whom that decision was made. The evidence suggests that being female increases the risk of acquiring group A streptococci and of experiencing sore throat as a result.

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