Acute sore throat—diagnosis and treatment in general practice

A combined study by the East Scotland Faculty, Royal College of General Practitioners and the Department of Bacteriology, The University, Dundee

SUMMARY. This study tested how general practitioners diagnose streptococcal infection on clinical grounds alone, in patients who presented with sore throats.

Four hundred and fifty-two patients were admitted to the study. A clinical diagnosis, prognosis and follow-up was completed in each case and the clinical assessment was checked by throat swabbing at first contact and a week later.

The doctors were inaccurate in predicting streptococcal infection, but better than might be expected if prediction were a matter of pure guesswork. Colds and influenza implied negative prediction, tonsillitis a positive prediction, and pharyngitis was doubtful.

In this series negative prediction for pharyngitis was 85·2 per cent and positive prediction 31·5 per cent accurate. The equivalent figures for tonsillitis were 61·5 per cent and 38·9 per cent respectively. There was a general tendency to overpredict streptococcal infection which was most marked in acute follicular tonsillitis, but this led to few false negatives. The tendency to overpredict streptococci was most marked when the patient was an adolescent female.

There were differences between the urban and rural patterns. During the same period, influenza (and similar illnesses) was recorded less often in the country, whereas urban practitioners were more likely to predict streptococcal infection. Rural practitioners were more accurate in prediction because they were less prone to implicate streptococcal infection than their urban colleagues; there was a higher proportion of cases with proven streptococcal infection in the town and there is a disproportionately high number of adolescent females among the urban patients.

Introduction

Infections of the upper respiratory tract are the biggest single group of diseases with which the general practitioner has to deal (Royal College of General Practitioners, 1973). In one study of febrile sore throat in children, about 65 per cent were virus infections and the remainder were infections by *Streptococcus pyogenes* (Ross, Chisty, and Knox, 1971). In a more recent study over one third of the cases were infected with haemophilus, and 46 per cent with *Streptococcus pyogenes*. Since the streptococcal group carries the risk of non-infective sequelae their identification and specific treatment are matters for concern.

One would expect that streptococcal infection would be easy to recognise clinically, but various investigations indicate that this is not so (Bell *et al.*, 1960; Fry, 1958; Jackson *et al.*, 1966). This causes difficulty in selecting the most appropriate treatment. Because *Strep. pyogenes* is always penicillin sensitive and also because penicillin is relatively safe it is widely held to be the drug of choice in this kind of infection, but opinions are divided as to whether it is necessary as a routine or whether it should be used in selected cases only (Fry, 1958; Hodgkin, 1957; Jackson *et al.*, 1966).

Most workers stress the importance of using a throat swab in diagnosis, but difficulties with transport and access to laboratories prevent some practitioners from using this diagnostic tool. In addition there is always a time lag between taking the swab and getting the result. Doctors are under pressure from patients to treat their complaints rapidly and are also under a legal obligation to do so. Furthermore the patient may have preconceived ideas about the management appropriate for his case and may make these known to the doctor. These emotional and psychological considerations can influence the doctor's choice of diagnostic method and treatment. Because of this, action is frequently taken after a clinical rather than a laboratory diagnosis.

The Research Committee of the East Scotland Faculty, Royal College of General Practitioners mounted this study to estimate the accuracy of clinical diagnosis and the effects of therapy.

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Method

Twenty-nine doctors volunteered to take part in the study which took 18 months to complete. A terminology, approximating to that used in the Royal College of General Practitioners' classification of morbidity, was agreed. During each week of the trial the doctor admitted the first patient presenting with a sore throat. He examined the patient and noted his findings on a case sheet. He also recorded whether he thought the sore throat was streptococcal in origin or whether some other agent was responsible. He then took a throat swab, placed it in Stuart's medium, and posted it with the case sheet to the bacteriological laboratory. He went on to treat the patient in his usual manner.

The patient reported for follow-up one week later—a second case sheet was completed indicating the doctor's view of the outcome of the case. He sent this, with a follow-up swab, in transport medium to the laboratory. Thus clinical and bacteriological diagnoses were made independently in each case. It was decided to exclude all children under five years old because of difficulty in taking swabs. The criterion for cure was to be *discharge from treatment*, that is if the doctor told the patient not to return after the second swab was taken. The date of the response was to be measured from the first contact.

Results

Four hundred and fifty-two patients were studied. The age and sex distribution of this population are shown in figure 1, which indicates that females are more likely to complain of

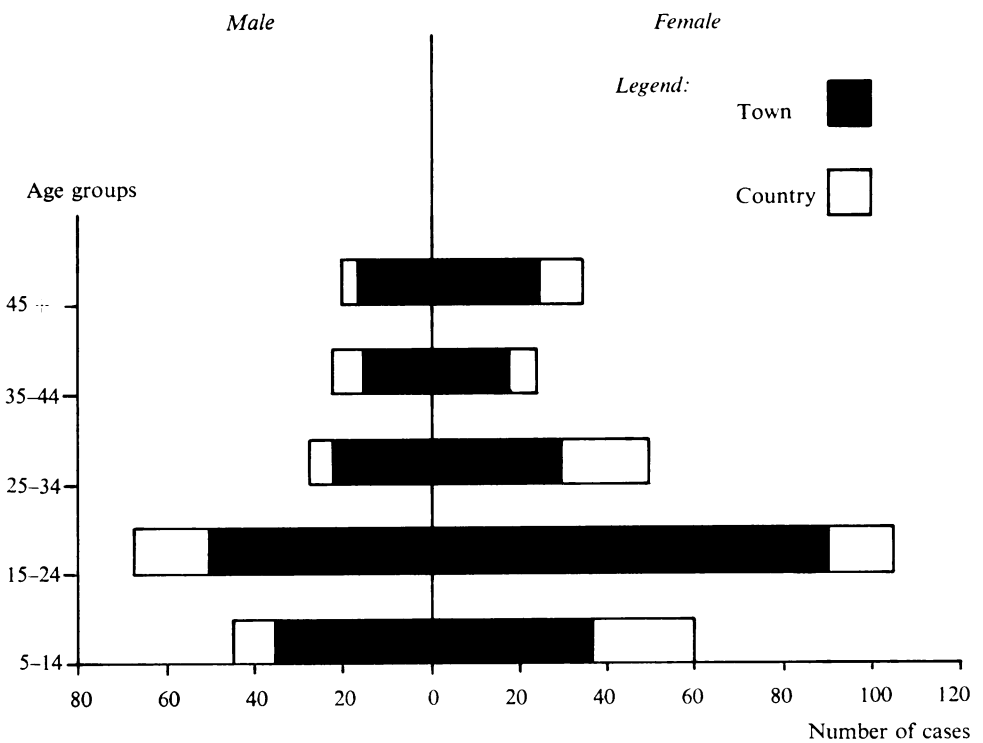

Figure 1. Age and sex distribution of the patients

sore throat than males and that sore throats are more frequent in childhood, adolescence, and young adult life. The age-sex distribution of these patients differed from that of the whole practice populations. The predictions of the general practitioners by diagnosis and their accuracy, according to laboratory tests of swabs, were recorded in the first of a series of master tables. " Colds " and " influenza " imply negative streptococcal predictions whereas " tonsillitis " implies

positive streptococcal prediction. Pharyngitis gives rise to doubt, but is more often considered to be non-streptococcal in origin. This is illustrated by extract (a) from master table 1.

MASTER TABLE 1
(*a*) PREDICTION OF *Streptococcus pyogenes* BY DIAGNOSIS

Strep. pyogenes	*Colds*	*Pharyngitis*	*Tonsillitis*	*Influenza*	*Totals*
Predicted	3	111	131	1	246
Not predicted	16	149	13	28	206
Totals	19	260	144	29	452

$\chi^2=133{\cdot}8$; degrees of freedom$=3$ $\therefore$ $P<0{\cdot}001$

The accuracy of the predictions are summarised in extract (b) from master table 1.

MASTER TABLE 1
EXTRACT (*b*) ACCURACY OF GENERAL-PRACTITIONER'S PREDICTION OF *Strep. pyogenes* BY DIAGNOSIS

	Colds	*Pharyngitis*	*Tonsillitis*	*Influenza*	*Totals*
Accurate prediction	15	162	59	19	255
Inaccurate prediction	4	98	85	10	197
Totals	19	260	144	29	452

$\chi^2=22{\cdot}539$; degrees of freedom$=3$ $\therefore$ $P<0{\cdot}001$

While it is clear that the clinical criteria for predictions are inaccurate, there was significantly more inaccuracy when acute follicular tonsillitis was diagnosed than for any of the others. On the other hand, when the inaccuracies are analysed from the view of further complications, as in extract (c) from master table 1, the tonsillitis errors of prediction were seen to be very significantly less serious (c.f. pharyngitis $\chi^2=8{\cdot}659$; degrees of freedom$=1$ $\therefore$ $P<0{\cdot}01$ after Yate's correction) than in any of the others.

However, this is not simply a matter of prediction. The " totals " section of master table 2

MASTER TABLE 1
EXTRACT (*c*) ANALYSIS OF INACCURACIES OF *Strep. pyogenes* PREDICTION

	Colds	*Pharyngitis*	*Tonsillitis*	*Influenza*	*Totals*
False positives	2	76	80	1	159
False negatives	2	22	5	9	38
Totals	4	98	85	10	197

shows that *Streptococcus pyogenes* is also found proportionately more often in cases of tonsillitis than in any of the other conditions ($\chi^2=14{\cdot}856$; degrees of freedom$=3$ $\therefore$ $P<0{\cdot}01$). A comparison of the inaccuracies for each diagnosis using the matched pair technique illustrates that, despite the over-preponderance of false negatives for influenza, the difference is just significant (2·214 times the standard error); for pharyngitis and tonsillitis, on the other hand, where there is an over-preponderance of false positives, the differences are highly significant (5·4 times and eight times the standard error respectively).

Since the local clinical picture alone is not a reliable predictor of streptococcal infection, it is reasonable to investigate whether age or sex or a combination of both can make prediction more reliable. The figures indicate that females are much more likely than males to seek attention for a sore throat, whether they experience streptococcal infection or not. Positive prediction was most accurate for males in the 25–34 age group where there were no false negatives (master table 2—Extract (a)), but, for males over 35 years of age, there is a high proportion of

false negatives. In the 15–24 age group, however, streptococcal infection is predicted much more often than it is confirmed. Although this applies to both sexes, it applies more to males than to females. ($\chi^2=3\cdot76$; degrees of freedom$=1 \therefore P<0\cdot10$).

MASTER TABLE 2

EXTRACT (*a*) ANALYSIS OF INACCURACIES OF *Strep. pyogenes* IN MALES

Males in age groups	*5–14*	*15–24*	*25–34*	*35 & Over*	*Totals*
False positives	12	33	10	8	63
False negatives	4	3	0	7	14
Totals	16	36	10	10	77

$\chi^2=13\cdot251$; degrees of freedom$=3 \therefore P<0\cdot01$

In all the other age groups and between the sexes, the prediction is more random. As illustrated in master table 2—Extract (b), inaccuracy was greater in the 15–24 age group.

MASTER TABLE 2

EXTRACT (*b*) PREDICTIVE ACCURACY OF *Strep. pyogenes* BY AGE

Age groups	*5–14*	*15–24*	*25–34*	*35 & Over*	*Totals*
Accurate prediction	63	83	48	61	255
Inaccurate prediction	39	88	28	42	197
Totals	102	171	76	103	452

$\chi^2=7\cdot238$; degrees of freedom$=3 \therefore P<0\cdot10$

Complications such as otitis media and cervical adenitis, as well as pyrexia, were examined as possible indicators of streptococcal infection. These complications are rare in cases with a clinical diagnosis of colds and influenza. They are found most often among the cases of tonsillitis and in consequence do not help the prediction. Overall, streptococci were confirmed in only 35·3 per cent of cases believed to be streptococcal in origin. Against this, streptococci were found in 18·5 per cent of cases in which they were expected to be absent. These figures are much better than random. The results indicate a general pattern, but within the pattern there were several distinctions between town and country practice. For example master table 3 shows that influenza or influenza-like illness is diagnosed less often in country than in town practice.

MASTER TABLE 3

DIAGNOSTIC PATTERN IN CITY AND COUNTRY PRACTICE

Location	*Cold*	*Pharyngitis*	*Tonsillitis*	*Influenza*	*Totals*
City	12	191	109	27	339
Country	7	69	35	2	113
Totals	19	260	144	29	452

$\chi^2=6\cdot86$; degrees of freedom$=3 \therefore P<0\cdot10$

A second difference is that city practitioners are much more likely to predict streptococcal infection than their rural counterparts.

Further analysis of the figures indicate that predictive accuracy is greater in the country than in the town, but this may follow from the greater proportion of urban practitioners who predict streptococcal infection as shown in master table 4. Despite this, there is a higher proportion of cases in the city with proven streptococcal infection which seems to imply a real epidemiological difference.

Another pointer in this direction is that, although the age and sex structure of the urban and rural patients in this study is similar, there is one significant difference between the two. This is

MASTER TABLE 4

PREDICTION OF STREPTOCOCCI IN CITY AND COUNTRY PRACTICE

	City	*Country*	*Totals*
Streptococcus pyogenes predicted	197	49	246
No *Streptococcus pyogenes* predicted	142	64	206
Total	339	113	452

$\chi^2=6{\cdot}85$; degrees of freedom$=1 \therefore P<0{\cdot}01$

that there is an excess, proportionately of females in the age cohort 15–24 among the urban patients. It is in this particular group of patients that the urban doctors were found most likely to predict, wrongly, the presence of streptococci.

The practitioners' choice of treatment was largely governed by whether they predicted streptococcal infection or not. They gave an antibiotic, usually oral penicillin, to 87·7 per cent of all the patients whom they believed to be infected by streptoccoci. There is nothing in the data which might explain why penicillin was not used in the remainder. However, prediction was not the only determinant. A sizeable minority (41·2 per cent) of those who were believed to be suffering from other infections were treated with penicillin. There was no significant difference in habit between town and country in this respect. As expected, laboratory confirmation that an antibiotic was necessary was found in only 30 per cent of cases, but on the other hand, in 70 per cent of cases the negative decision was shown to be appropriate.

Fortunately, sore throat is a self-limiting condition so that, despite diagnostic inaccuracy, most cases had a favourable outcome, both clinically and bacteriologically. Only 11 of the patients who had been treated with antibiotic and who had a positive first swab had a second swab positive for streptococci; a further 20 who had not been given antibiotics had a positive second swab as well as a positive first swab. When the first swab was negative the outcome was determined by factors other than the choice of antibiotic (master table 5—extracts (a) and (b)).

EXTRACT (*a*) MASTER TABLE 5

PATIENTS TREATED WITH ANTIBIOTICS BUT NOT BACTERIOLOGICALLY CURED

	Colds	*Pharyngitis*	*Tonsillitis*	*Influenza*	*Totals*
Both swabs positive	0	1	9	1	11
Only second swab pos.	0	5	2	0	7
Totals	0	6	11	1	18

EXTRACT (*b*) MASTER TABLE 5

PATIENTS NOT TREATED WITH ANTIBIOTICS AND NOT BACTERIOLOGICALLY CURED

	Colds	*Pharyngitis*	*Tonsillitis*	*Influenza*	*Totals*
Both swabs positive	1	7	5	7	20
Only second swab pos.	1	3	0	0	4
Totals	2	10	5	7	24

The relationship between the general practitioners' clinical assessment of cure or improvement and the corresponding laboratory findings is interesting. In order to make a valid comparison, only cases from which *Streptococcus pyogenes* was isolated and which were also treated with penicillin at the *original* consultation, can be used (master table 6).

This shows that the general practitioner is more likely to consider cases with bacteriological evidence of cure as still being ill than to decide that a cure had been effected when it was not confirmed by swab culture. Analysis of the differences between the clinical and bacteriological

assessments showed that they were highly significant for females generally, but not for males. On the other hand, they were significant in the city but not in the country. Thus the phenomenon is found to exist predominantly among city females and further analysis showed that these were mainly under 25 years of age. This was the category of patients in which the urban doctors found streptococcal infection most difficult to predict. However, there is also considerable agreement between laboratory and practitioner assessments.

MASTER TABLE 6

Streptococcus pyogenes FOUND AND TREATED WITH ANTIBIOTICS—ANALYSIS OF AGREEMENT AND DISAGREEMENT

Clinical assessment compared with laboratory assessment after treatment (matched pairs)		*City*			*Country*			*Total*		
		M	*F*	*T*	*M*	*F*	*T*	*M*	*F*	*T*
Unconfirmed Cure	Clinically	5	17	22	2	5	7	7	22	29
	Bacteriologically	6	3	9	1	1	2	7	4	11
	Totals	11	20	31	3	6	9	14	26	40
Number of times standard error		0	2·9	2·2	0	1·2	1·3	–0	3·3	2·7
Confirmed	No cure	3	1	4	1	2	3	4	3	7
	Cure	16	25	41	5	8	13	21	33	54

Discussion

These results indicate that a fair quantity of antibiotics is being used in throat infections when on purely bacteriological grounds they are not indicated. This is not a reflection of the doctor's attitude to their use, but an indication of the difficulties in making an accurate clinical diagnosis.

Although clinical indicators (appearance of the throat, pyrexia, and complications) are not infallible, the figures confirm that they have a limited validity. There is, however, an additional indication; this is that patient and doctor behaviour may have more than a peripheral bearing on the problem. For example, it was shown that the young women in the town were more likely to seek medical attention for sore throat than their rural counterparts. This was confirmed by a study of the populations from which the patients came. This could be due to a genuine increase in incidence of beta haemolytic streptococcal and other infections among city dwellers with some form of selective mechanism picking out the young women.

Another explanation could be differences in thresholds in seeking medical care: itself the resultant of such factors as habits of self-medication and accessibility of the doctor (psychological as well as geographical).

There is also the curious phenomenon that the urban doctors use the diagnostic labels of influenza or influenza-like illness more often than their rural counterparts. Again, this may be because urban patients find it easier to travel to their doctors, but it would be unwise to disregard the possibility that the more crowded conditions of the city could result in easier spread of respiratory infection.

The tendency for the urban practitioners to overpredict streptococcal infection seems, on the other hand, less likely to be explained satisfactorily by doctor availability. In so far as this depends on how the doctor evaluates the presentation of the case, one might expect urban practitioners to under-predict streptococcal infection, since there are relatively more complications in the rural areas. The lower incidence of complications among urban patients suggests that as a group they have less serious illness. Again, this points to a diagnosis of virus infection rather than streptococcal infection, since as a rule, the respiratory virus infections are undramatic illnesses. It seems that unknown extraneous factors are at work in the urban setting. For example it may be that rheumatic heart disease is commoner in the town than in the country so that alarm about possible sequelae may be a factor which influences the urban practitioners. It could also be that, in former years, streptococcal infection was commoner than it is today and the tendency to over-diagnose is a legacy of this.

There was no evidence, using the negative binomial distribution, to suggest that certain

doctors in the urban setting were more likely to diagnose streptococci than others so that the factors at work must be taken as applying to all doctors in an urban setting.

With the exception of a clear urban-rural distinction, this study confirms many of the observations made by Howie and others (1971) in a more comprehensive review of respiratory infection. Both studies clearly show the complexity of the diagnostic process. Nevertheless some patients believed to be suffering from an influenzal type illness were shown to harbour *Streptococcus pyogenes*. On the assumption that *Streptococcus pyogenes* ought to be treated with penicillin, general practitioners might use it with more freedom when they diagnose influenza.

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Addendum

A copy of the case sheet and master tables can be obtained from Dr A. Jacob, Department of General Practice, University of Dundee. Some tables have been omitted to save space.

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