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The present study investigates the feasibility of the clinical differentiation between patients with beta-haemolytic streptococcal pharyngitis from those with pharyngitis caused by other agents, based on the patients' symptoms, symptom duration, and the clinical findings. Twenty-four general practitioners recruited 225 patients for the study. Fifty-six patients had positive and 169 patients negative group A beta-haemolytic streptococcal throat cultures. Twenty-two patients in the streptococcal group and 76 patients in the non-streptococcal group were initially correctly diagnosed based on an overall clinical assessment (sensitivity 0.39, specificity 0.55 and accuracy 0.51). This is as accurate as "flipping a coin". Similar figures were found with regard to the individual symptoms (accuracy 0.38–0.68) and clinical findings (accuracy 0.36–0.65). Taking the duration of symptoms into account and applying discriminant function analysis did not significantly improve these figures. In order to obtain a sufficiently accurate diagnosis in general practice, the use of the new rapid agglutination test for streptococcal identification is recommended.

Key words: streptococcal pharyngitis, symptoms, signs, symptom duration, accuracy, discrimination analysis.

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Throat infection is a common and important problem in primary health care. Beta-haemolytic streptococci are found in about one-third of cases of acute pharyngitis (1, 2). Clinical studies have confirmed that early treatment with penicillin significantly reduces the duration of symptoms and the incidence of suppurative complications in these cases (3, 4). Treatment may also limit spread of the disease in the family and community (5). The non-specific nature of the signs and symptoms of streptococcal pharyngitis makes the differential diagnosis difficult. Several studies have shown that it is virtually impossible to distinguish clinically between throat infections caused by streptococcal infection and those caused by other bacteria or viruses (1, 2, 6, 7). To our knowledge, however, no studies have explored the predictive value of *symptom duration* as a discriminating factor between these two groups of pharyngitis.

The aim of the present study was to see whether it was possible to predict streptococcal pharyngitis on the basis of selected symptoms and signs and symptom duration. A further aim was to try to establish a more accurate diagnosis by using discrimination analysis.

PATIENTS AND METHODS

The study was performed between November 1985 and March 1986 by 24 general practitioners (including the first author) at seven health centres in the city of Oslo. Patients were included in the study if they presented with symptoms or signs indicating acute throat infection of five days duration or less. Exclusion criteria were use of antibiotics during the previous seven days, antiseptic mouth wash or throat lozenges during the past 12 hours, or difficulties in obtaining throat swabs according to protocol.

The patients were first examined by one of the

Table I. *Symptoms in 56 patients with streptococcal pharyngitis (group I) and 169 with non-streptococcal pharyngitis (group II)*

As "don't know" was a response alternative, the answers do not all add up to 225. For each symptom the ratio between present and not-present, sensitivity, specificity, and accuracy are given. The p-values (chi-square test) refer to differences in numbers in group I and group II

	With/without symptoms			Sensi-tivity	Speci-ficity	Accu-racy
	Group I	Group II	p-Value			
Globulus	36/16	84/67	0.2	0.66	0.44	0.51
Discomfort in swallowing saliva/fluid	48/4	125/41	0.01**	0.92	0.25	0.41
Discomfort in swallowing food	50/5	131/36	0.1	0.90	0.22	0.39
Halitosis	17/34	35/129	0.08	0.33	0.79	0.68
Hoarseness	18/38	79/88	0.1	0.32	0.53	0.48
Cough	13/43	85/84	0.0001***	0.23	0.48	0.43
General malaise	42/12	122/42	0.8	0.77	0.27	0.38
Pain in muscles/joint	15/34	43/109	0.9	0.25	0.72	0.62
Headache	30/23	69/82	0.2	0.57	0.54	0.55
Otalgia	23/31	40/122	0.04*	0.43	0.75	0.67
Stuffy nose/rhinorrhoea	15/41	78/91	0.01**	0.27	0.54	0.47
Temperature $\geqslant$38.5°C	13/8	62/41	0.4	0.62	0.65	0.44

participating physicians, who made a clinical diagnosis of either streptococcal or non-streptococcal throat infection. The presence of the following symptoms and the time from their first occurrence to a perceived maximum were recorded: globulus, discomfort in swallowing saliva or fluid, pain on swallowing food, halitosis, hoarseness, cough, pain in muscles or joints, general malaise, headache, earache, rhinorrhoea or stuffy nose and fever. The degree of malaise and pharyngeal pain was registered using visual analogue scales. The presence of moderate to marked swelling, redness or membranous exudation of the tonsils, prominent papillae of the tongue, and swollen cervical lymph nodes was registered. The diagnosis of group A beta-haemolytic streptococcal throat infection was based on conventional throat culture, performed at the Microbiological Laboratory, Ullevaal University Hospital, Oslo (8).

Statistical analysis

Comparison of groups was performed using Wilcoxon mid rank sum test and t-test. A level of significance of 5% was chosen. Discrimination analysis was performed according to the method of Fischer (9). Sensitivity, specificity, accuracy, negative and positive predictive values were calculated as described by Sackett et al. (10).

RESULTS

225 consecutive patients with throat infection were included in the study. In 56 (mean age 20.2 years; range 2–52), the presence of group A beta-haemolytic streptococcal throat infection was verified (group I), whereas 169 patients (mean age 22.4 years; range 1–70), showed no streptococcal growth (group II). In group I the diagnosis of streptococcal pharyngitis was predicted clinically in 22 of the 56 patients with positive beta-haemolytic streptococci culture (sensitivity 0.39). In group II, 93 of 169 patients were clinically correctly identified as not having streptococcal throat infection (specificity 0.55). The average accuracy

$$\left(\frac{N_{\text{true positive}} + N_{\text{true negative}}}{N_{\text{total}}} \right)$$

of the prediction of streptococcal pharyngitis in patients with acute throat infection was 0.51, which shows that an incorrect clinical diagnosis was made in about half the patients. The individual recorded symptoms had predictive values between 0.38 and 0.68.

Table I shows the distribution of symptoms in groups I and II. There were statistically significant differences in the two groups regarding discomfort caused by swallowing saliva or fluid, cough, earache, and stuffy nose. Each of these symptoms, however, as well as the other recorded symptoms,

Table II. *Mean symptom duration in days from the first occurrence to a perceived maximum in 56 patients with streptococcal (group I) and 169 patients with non-streptococcal (group II) pharyngitis*

The four symptoms with greatest differences are given

	Group I	Group II	p-Value (t-test)
Pain in muscles/joints	1.5 (SD 0.5)	2.4 (SD 1.1)	0.001**
Earache	2.1 (SD 1.0)	2.7 (SD 1.4)	0.14
Cough	1.7 (SD 0.8)	2.3 (SD 1.1)	0.016*
Pharyngeal pain/irritation	2.0 (SD 1.0)	2.4 (SD 1.3)	0.13

showed either low sensitivity or specificity, or both, in diagnosing streptococcal pharyngitis. There were no significant changes in the accuracy when various symptoms were combined. The positive or negative predictive values are not presented here because they did not show any relevant clinical differences between the two groups. The mean duration from the occurrence of the first symptom to a perceived maximum for that symptom was 60 hours (SD 4.5 hours) in group I and 75 hours (SD 2.6 hours) in group II (p = 0.004).

Table II gives the duration in days of the four symptoms which showed the greatest differences between the groups. Only muscle/joint pain and cough had significant differences. The mean degree of patient malaise was 5.5 (SD 2.1) in group I and 4.7 (SD 2.0) in group II (p = 0.01), using a visual analogue scale ranging from 0 (no malaise) to 10 (very severe malaise). The corresponding values for pharyngeal pain and irritation were 6.1 (SD 2.6) in group I and 5.3 (SD 2.5) in group II (p = 0.06).

Differences in clinical findings between the two

groups are shown in Table III. Swelling, exudate and redness of the tonsils and enlargement of cervical lymph nodes were significantly more frequent in group I. None of the specified clinical findings, however, showed a satisfactory level of sensitivity or specificity.

Between 50 and 60% of the patients in both groups were correctly classified, using a discrimination analysis, as having or not having streptococcal pharyngitis. In this analysis the recorded symptoms and their duration were used as the discriminant function.

DISCUSSION

The finding that about 30% of the patients had beta-haemolytic streptococcal cultures agrees with other studies (1, 2). We find it reasonable to assume that the patients in this study constitute a representative sample of patients with acute pharyngitis in general practice.

There is general agreement that a conventional

Table III. *Clinical findings in 56 patients with streptococcal pharyngitis (group I) and 169 with non-streptococcal pharyngitis (group II)*

As "don't know" was a response alternative, the answers do not add up to 225. For each clinical finding the ratio between present and not-present, sensitivity, specificity, and accuracy are given. The p-values (chi-square test) refer to differences in numbers in group I and group II

	With/without clinical finding		p-Value	Sensitivity	Specificity	Accuracy
	Group I	Group II				
Moderate to marked swollen tonsils	45/11	84/85	0.0001***	0.80	0.50	0.57
Marked redness of the tonsils	46/10	103/66	0.004**	0.82	0.39	0.50
Marked redness of the pharyngeal wall	43/10	131/38	0.9	0.81	0.22	0.36
Exudate/membranes on the tonsils	26/30	40/129	0.002**	0.46	0.76	0.61
Hypertrophic papillae of the tongue	4/52	6/163	0.3	0.07	0.96	0.65
Swollen cervical lymphatic nodes	40/16	92/77	0.02*	0.71	0.46	0.49

throat culture should serve as the "gold standard" when evaluating the accuracy of diagnosing streptococcal throat infections (1, 2, 8), although this method also has its shortcomings (11, 12). In the present study statistically significant differences were found between the prevalence of some symptoms (Table I) and clinical findings (Table III) in the streptococcal and non-streptococcal groups. These findings, however, were not associated with a sufficiently high validity (sensitivity and specificity) or accuracy (0.85 or above) to discriminate between the two conditions. Using the duration of symptoms from their first occurrence to a perceived maximum, did not contribute substantially to a better prediction. Even though the difference between the streptococcal and non-streptococcal groups with reference to pain in muscles and joints was highly significant statistically, it cannot be considered as clinically significant. This result, like the rest, might also have been confounded by inaccurate memory of the patient and the fact that not all symptoms had achieved maximum intensity at the time of registration. About 80% of the patients with streptococcal throat infection had marked enlargement and redness of the tonsils and swollen lymph nodes, while about 50% of the patients with non-streptococcal pharyngitis had the same findings. All of these factors, however, had a diagnostic accuracy below 0.61, and were of little help in establishing the clinical diagnosis.

A discrimination analysis has, to our knowledge, not previously been carried out in similar studies. In the discrimination function, those initial variables or patient factors which yielded a maximum contribution to the correct diagnosis of the two groups, were combined linearly into one new variable (9). The positive or negative value of this new variable was then used as the discrimination criterion for each patient. A correct classification of 90% or more of the patients is considered to be a good result (9). The achieved outcomes of the present study, however, did not meet these standards.

In view of the present and the great number of previous studies (1, 6, 7, 8), we do not find it warranted to carry out further studies on the accuracy of clinical assessment of streptococcal throat infection. Furthermore we find it difficult in general practice to discriminate between streptococcal and non-streptococcal pharyngitis by clinical assessment alone. The differential diagnosis of acute throat infection should be based, at least partly, on

the newly developed latex agglutination test for rapid identification of group A streptococci (8). The sensitivity of this test has in general been above 0.80 and the specificity 0.95 or higher (8, 13, 14). The latex test procedure is rapid, the answer available within 10 min, it is simple to perform, safe to handle, and economically acceptable (8, 13). Compared to a clinical assessment alone, this test appears to represent a significant practical and clinical improvement in the daily management of patients with acute throat infection.

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