

## Clinical Predictors of Streptococcal Pharyngitis in Adults

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### Abstract

**Background:** Acute pharyngitis in children is one of the most frequent illnesses for which primary care physicians are consulted. It is caused more frequently by viruses than by bacteria, but it is difficult to differentiate the causative agent by clinical signs alone. Group A *Streptococcus* accounts for 30% of children with a sore throat, and only in these cases is antibiotic therapy definitely indicated. However, the frequency and symptomatology of streptococcal pharyngitis in adults is not well established.

**Objectives:** To examine the clinical features that could distinguish sore throat caused by  $\beta$ -hemolytic group A *Streptococcus* in adults.

**Methods:** Patients aged over 16 years old (n=207) who presented with a sore throat to community clinics were examined and throat cultures were taken. The microbiologic confirmation of Group A *Streptococcus* was correlated with symptoms and clinical signs by univariate analysis.

**Results:** About 24% of the patients with positive cultures were younger individuals. Chills, absence of cough, pain in swallowing, absence of rhinitis, headache, vomiting, tonsillar exudate, oral malodor, fever >38°C and sweats had high sensitivity but low specificity for streptococcal pharyngitis. Univariate analysis suggested that chills and pharyngeal exudate had the greatest predictive value for streptococcal pharyngitis ( $P = 0.044$ , odds ratio 2.45;  $P = 0.001$ , OR 5.49, respectively). When compared with a published scoring method (Centor criteria), large inconsistencies were found.

**Conclusion:** Our adult population had a relatively high prevalence of group A *Streptococcus*, and their presentation differed from that of pediatric patients. In primary care, a throat swab culture is not necessary in adults with a low score (0–1 points).

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Acute pharyngitis is one of the most frequent illnesses for which pediatricians and other primary care physicians are consulted [1]. Although group A *Streptococcus* is the most common bacterial etiology of acute pharyngitis, only 30% of the children and 10% of the adults with sore throat are infected by GAS [2,3]. Moreover, GAS pharyngitis is the only acute pharyngitis for which antibiotic therapy is definitely indicated, as it could prevent rheumatic fever, shorten the period of fever, toxicity and infection [4], and minimize local complications such as peritonsillar abscess, mastoiditis and sinusitis.

Acute pharyngitis is caused more frequently by viruses than by bacteria [4], but it is difficult to differentiate the causative agent by

clinical signs alone, because they overlap broadly. Thus, a laboratory confirmation of streptococcal infection by throat swab culture, or immunologically by the rapid antigen detection test, for example, is recommended [1,4,5]. While throat culture is the gold standard for diagnosing streptococcal pharyngitis, this practice is frequently not available, especially in developing countries. Therefore, simple clinical guidelines for the diagnosis of streptococcal pharyngitis are needed [4].

The World Health Organization Global Acute Respiratory Infection Treatment Program [6,7] suggested that for children under 5 years of age, acute streptococcal pharyngitis should be suspected when pharyngeal exudate plus tender and anterior cervical lymphadenopathy are present. Efforts have been made, most of them in the pediatric population, to create a clinical scoring system to predict the probability that a sore throat is caused by a  $\beta$ -hemolytic GAS [8,9]. It is intriguing that the clinical signs and symptoms of streptococcal pharyngitis vary with age [10]. Specific clinical guidelines for acute pharyngitis in adults have recently been published [1–3].

The ability of experienced physicians to predict positive throat cultures is moderate, with estimated sensitivity ranging from 55% to 74% and estimated specificity from 58 to 76% [3]. One clinical tool for prediction of GAS pharyngitis is the Centor criteria, a model of positive cultures consisting of four variables (tonsillar exudate, swollen tender anterior cervical nodes, lack of cough, and a history of fever). The probability of a positive culture was found to be 56% in patients with all four variables, 32% in those with three variables, 15% in those with two variables, 6.5% in those with one variable, and 2.5% in patients with zero variables [3–11]. The positive and negative predictive value will vary depending on the prevalence of GAS in the population; according to the investigators, the presence of three or four criteria has a positive predictive value of 40–60%, and the absence of three or four criteria has a negative predictive value of approximately 80% [3].

Mclsaac et al. [12] proposed a scoring method for assigning patients with sore throat into three treatment groups – based on the patient's age, temperature >38°C, tender anterior cervical adenopathy, tonsillar swelling or exudate, and absence of cough. They found that for adults, this scoring protocol in a community-based practice had a sensitivity of 76% and specificity of 97%, and was significantly more precise than the judgment of physicians regarding prescription or withholding of antibiotics and performance of throat swabs [13].

OR = odds ratio

GAS = group A *Streptococcus*

The objective of the present study was to investigate the signs and symptoms of streptococcal pharyngitis in adults and to elucidate simple clinical predictors of streptococcal pharyngitis, and to compare them with the Centor scoring protocol.

## Patients and Methods

During four winter months (December 1999 to March 2000) we conducted a prospective study at the primary care clinics of the Clalit Health Services in Nazareth, Israel. Enrolled were 207 consecutive adult patients who presented with sore throat. The inclusion criteria were age above 16 years and a history of acute sore throat. The patients were referred to a physician who obtained their informed consent, recorded demographic and clinical data, and took a throat swab culture.

The clinical symptoms registered were presence or absence of chills, pain on swallowing, headache, vomiting, throat or ear pain, conjunctivitis, and abdominal pain. The presentation or absence of the following clinical signs was also recorded: oral fever  $>38^{\circ}\text{C}$ , white-yellow pharyngeal exudate, cough, rhinitis, oral malodor, sweating, enlarged or tender cervical anterior lymph node ( $>1.5$  cm), pharyngeal erythema, pharyngeal swelling and skin rash.

Throat swab cultures were taken by a standard method and delivered to the microbiology laboratory within 4 hours. Samples sent to the laboratory were plated on Streptococci Selective Agar (HyLaboratories, Rehovot, Israel). Beta hemolytic streptococci colonies were first screened using the 0.04 u bacitracin test (Mast Group, Mersyside, UK). Bacitracin-sensitive beta hemolytic streptococci were identified as belonging to Group A using Strepex (Murex Biotech, Dartford Kent, UK). Positive samples were qualified into two categories: those presenting predominant growth of GAS (reported as positive) and those that grew less than 10 colonies of GAS (reported as negative).

Sensitivity (percentage of true positive of all positive cultures) and positive predictive value were calculated for symptoms and clinical signs. The chi-square test was used to analyze the association between throat culture status and the dichotomous variables, and the *t*-test was used to analyze age. A logistic stepwise regression model was applied to identify the factors that could predict positive GAS throat cultures. The Centor scoring criteria were used for comparison [3,11].

## Results

During the study period, 207 patients aged 16–80 years were enrolled (mean  $\pm$  SD  $32.6 \pm 12.8$  years, median 29 years). Forty-

**Table 1.** Frequency of symptoms and clinical signs, and univariate analysis of their association with positive throat cultures

	Negative cultures (%) (n=157)	Positive cultures (%) (n=50)	P	OR	95% CI	PPV (%)
<b>Symptoms</b>						
Chills	96 (61.1)	42 (84.0)	0.003	3.34	1.47–7.59	30.4
Pain on swallowing	132 (84.1)	49 (98.0)	0.007	9.28	1.22–70.34	27.1
Headache	106 (67.5)	43 (86.0)	0.011	2.96	1.24–7.03	28.9
Vomiting	26 (16.6)	14 (28.0)	0.099	1.96	0.93–4.14	35.0
Ear pain	68 (43.3)	25 (50.0)	0.419	1.31	0.69–2.48	26.9
Conjunctivitis	17 (10.8)	4 (8.0)	0.789	0.72	0.23–2.24	19.0
Abdominal pain	42 (26.8)	12 (24.0)	0.853	0.87	0.41–1.81	22.2
<b>Clinical signs</b>						
Tonsillar exudate	74 (47.1)	43 (86.0)	0.0001	6.89	2.92–16.25	36.8
Oral malodor	78 (49.7)	36 (72.0)	0.006	2.6	1.30–5.20	31.6
Absence of cough	90 (57.3)	40 (80.0)	0.004	2.98	1.39–6.38	30.8
Absence of rhinitis	120 (76.4)	47 (94.0)	0.007	4.83	1.42–16.42	28.1
Temp $>38^{\circ}\text{C}$	106 (67.5)	43 (86.0)	0.011	2.96	1.24–7.03	28.9
Sweat	77 (49.0)	33 (66.0)	0.05	2.02	1.04–3.92	30.0
Enlarged or tender anterior cervical lymph node	24 (15.3)	4 (8.0)	0.239	0.48	0.16–1.46	14.3
Pharyngeal erythema	156 (99.4)	49 (98.0)	0.426	0.31	0.02–5.12	23.9
Pharyngeal swelling	119 (75.8)	40 (80.0)	0.442	1.42	0.63–3.19	25.2
Skin rash	1 0.6	0 0.0	1			

nine percent were females and 53.1% were males. Three patients were excluded because the throat cultures were missing. Overall, 50 patients (24%) had a throat culture positive for group A  $\beta$ -hemolytic streptococci, a rather high rate for an adult population. There was no significant gender bias in the rate of positive cultures.

Patients with positive cultures were significantly younger: the mean age of patients with positive cultures was  $29.4 \pm 11.04$  vs.  $33.6 \pm 13.9$  years for patients with negative cultures respectively ( $P = 0.04$ ).

The frequencies of symptoms and clinical signs and their association with the presence of GAS are listed in Table 1. Some of the symptoms, such as chills, pain in swallowing and headache, had a high sensitivity (84%, 98% and 86% respectively) but a low specificity (PPV 30.4%, 27.1% and 28.9% respectively) for streptococcal pharyngitis. The presence of tonsillar exudate, oral malodor, fever  $>38^{\circ}\text{C}$ , absence of cough and absence of rhinitis also had high sensitivity (86%, 72%, 86%, 80% and 94% respectively) but low specificity (PPV 36.8%, 31.6%, 28.9%, 30.8% and 28.1%).

Univariate analysis suggested that of all the symptoms, a history of chills had the greatest predictive value for a positive throat culture ( $P = 0.044$ , OR 2.45, 95% confidence interval 1.03–5.87), while among the clinical signs the presence of pharyngeal exudate was highly predictive ( $P = 0.001$ , OR 5.49, 95%CI 1.97–15.3). By multivariate analysis, the only significant factor predictive for a positive throat culture was the presence of pharyngeal exudate ( $P > 0.001$ , OR 4.54, 95%CI 1.84–11.20).

All other factors had no statistical significance when calculated together with pharyngeal exudate in the multivariate analysis.

PPV = positive predictive value

CI = confidence interval

**Table 2.** Sore throat score

Score (points)	Total	Positive cultures (%)	Negative cultures (%)
0–1	78	4 (5%)	74 (95%)
2–3	112	44 (39%)	68 (61%)
4	14	2 (14%)	12 (86%)

Moreover, when pharyngeal exudate was excluded in the multivariate model, chills ( $P = 0.006$ , OR 3.314, 95%CI 1.42–7.74), absence of rhinitis ( $P = 0.025$ , OR 4.286, 95%CI 1.20–15.29) and absence of cough ( $P = 0.058$ , OR 2.185, 95%CI 1.0–4.9) were significantly associated with streptococcal pharyngitis.

Scoring the patients according to the Centor criteria is detailed in Table 2. Only 5% of patients with 0–1 points had a positive throat culture, but in those with 2–3 points only 39% had positive cultures. In the group of adults with four points, we noted that only 2 of 14 (14%) had a positive culture.

## Discussion

Pharyngitis and tonsillitis may be due to a variety of infections other than those caused by *S. pyogenes* [4]. However, because GAS pharyngitis is the common form of acute pharyngitis for which antibiotic therapy is definitely indicated, the clinical decision that has to be made is whether the pharyngitis is attributable to  $\beta$ -hemolytic GAS [1].

Approximately 30% of children and 10% of adults with sore throat have throat cultures positive for group A *Streptococcus* [2,4,5,7–10,14]. In our series the proportion of adults with a positive throat culture was 24%, similar to the prevalence reported in pediatric patients and higher than expected for an adult population. Streptococcal pharyngitis is known to be more frequent in younger patients, as observed in our patients.

Several studies have tested the precision with which physicians may differentiate between streptococcal and non-streptococcal sore throats by clinical criteria alone [4]. Certain clinical findings – particularly pharyngeal exudate, lymphadenitis [15] and temperature  $>38^{\circ}\text{C}$  [5] – had a statistically significant correlation with the presence of positive throat cultures. When antigen detection was used, sensitivity was more than 80% and was highly specific for GAS pharyngitis. However, all these studies were carried out in children.

In our study we evaluated the clinical signs and symptoms of pharyngitis specifically in adults. We found several clinical symptoms (chills, pain on swallowing, and headache) and signs (tonsillar exudate, oral malodor, fever  $>38^{\circ}\text{C}$ , absence of cough and absence of rhinitis) with a high sensitivity for positive throat cultures, but all had low specificity. Only chills and pharyngeal exudate were predictive of streptococcal pharyngitis.

The Centor scoring (tonsillar exudate, swollen tender anterior cervical nodes, lack of cough, and a history of fever) was only partially effective in our study group, as observed when 0–1 points were present. Since 95% of the patients had a negative culture, a throat culture was unnecessary. However, patients with 2–3 points presented a positive culture in 39% of cases, and a throat culture is recommended in accordance with the Centers for Disease Control

and the American College of Physicians guidelines [3]. Since we enrolled a small number of patients with four points, no conclusions can be drawn. Perhaps the elucidation of all other etiologic agents responsible for acute pharyngitis in these communities could help to explain the inconsistency observed in this particular scoring method.

We conclude that in our adult population there was a high prevalence of GAS among patients with sore throats, and that their clinical presentation differed from that of pediatric patients. Therefore, we recommend screening for GAS only in adults who present with two or more Centor criteria. On the other hand, patients with none or less than two Centor criteria do not require investigation or treatment [3].

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