Diagnosing streptococcal pharyngitis in the emergency department: Is a sore throat score approach better than rapid streptococcal antigen testing?

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ABSTRACT

Background: Reducing the number of unnecessary antibiotic prescriptions given for common respiratory infections has been recommended as a way to limit bacterial resistance. This study assessed the validity of a clinical sore throat score in 2 community emergency departments (EDs) and its impact on antibiotic prescribing. We also attempted to improve on this approach by using a rapid streptococcal antigen test.

Methods: A total of 126 patients with new upper respiratory tract infections accompanied by sore throat were assessed by a physician. Pharyngeal swabs were obtained for a rapid test and throat culture, and information was gathered to determine the sore throat score. The sensitivity and specificity of the score approach were compared with usual physician care based on the rapid test results.

Results: Of the 126 cases of new upper respiratory infections with sore throat, physicians who followed their usual care routine, guided by the rapid test results, prescribed antibiotics for 46 patients. Of the 46 prescriptions, 18 were given to patients with culture-negative results for group A streptococcal (GAS) pharyngitis. Use of the sore throat score would not have reduced the number of prescriptions but would have missed only 1 patient with a positive culture result ($p < 0.05$). The rapid test was not as sensitive as throat culture.

Conclusion: An explicit clinical score approach to the management of GAS pharyngitis is valid in a community ED setting and could improve the pattern of antibiotic prescribing. While the addition of a rapid streptococcal antigen test significantly decreased the sensitivity of detecting GAS infections, a combined approach consisting of the clinical score and throat culture for patients with negative results on the rapid test would decrease antibiotic prescribing and telephone follow-up without decreasing the sensitivity of detecting GAS infection.

Key words: sore throat score, pharyngitis, rapid streptococcal antigen test, group A streptococcus, emergency department

RÉSUMÉ

Contexte : Il a été recommandé de réduire le nombre d'ordonnances pour des antibiotiques inutiles dans le cadre du traitement des infections respiratoires courantes afin de limiter la résistance bactérienne. La présente étude a évalué la validité d'un système de cotation clinique des

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maux de gorge dans deux départements d'urgence communautaires et son impact sur la prescription d'antibiotiques. Nous avons également tenté d'améliorer cette approche en évaluant le recours à un test rapide de détection d'antigènes streptococciques.

Méthodes : Au total, 126 patients atteints d'une infection nouvelle des voies respiratoires supérieures accompagnée d'un mal de gorge furent évalués par un médecin. Des prélèvements pharyngés furent obtenus pour un test rapide de détection d'antigènes streptococciques et une culture de gorge et les renseignements furent réunis pour établir la cotation des maux de gorge. La sensibilité et la spécificité de l'approche par cotation furent comparées aux soins habituels donnés par le médecin fondés sur les résultats des tests rapides.

Résultats : Parmi les 126 cas d'infections nouvelles des voies respiratoires supérieures accompagnées de maux de gorge, les médecins ayant suivi leur démarche thérapeutique habituelle fondée sur les résultats des tests rapides prescrivirent des antibiotiques à 46 d'entre eux. Parmi les 56 ordonnances, 18 furent données à des patients présentant des résultats de culture négatifs pour la pharyngite à streptocoques du groupe A (SGA). Le recours à un système de cotation des maux de gorge n'aurait pas réduit le nombre d'ordonnances et aurait manqué seulement un patient présentant un résultat de culture positif ($p < 0,05$). Le test rapide n'était pas aussi sensible que la culture de gorge.

Conclusion : Une approche explicite par cotation clinique de la prise en charge de la pharyngite à SGA est valable dans un département d'urgence communautaire et pourrait contribuer à diminuer la fréquence de prescription d'antibiotiques. Alors que l'ajout d'un test rapide de dépistage des antigènes streptococciques avait réduit de façon significative la sensibilité de détection des infections à SGA, une approche combinée comprenant la cotation clinique et une culture de gorge pour les patients dont les résultats du test rapide sont négatifs permettrait de réduire le nombre d'ordonnances pour des antibiotiques et de suivis téléphoniques sans diminuer la sensibilité de détection des infections à SGA.

Introduction

Pharyngitis is a common reason for primary care visits, and emergency departments (EDs) are often the site of care. Despite many recommendations, physician management remains inconsistent, with most physicians using clinical suspicion as a reason to prescribe antibiotics.[1–4] Reliance on throat cultures is associated with difficulty in communicating test results to patients once they have left the ED.[5]

The sore throat score,[6] a clinical approach to the evaluation of patients who present with sore throats, has been developed for use in community-based family practice (see Fig. 1, page 182). The goal of this approach is to identify and treat group A streptococcal (GAS) infections in order to prevent the sequelae of these infections: rheumatic fever and peritonsilar abscess. This clinical approach has the potential to achieve a 48% reduction in antibiotic use in the family practice setting and to reduce the need for throat cultures,[6] and patients are spared the expense and side effects of unnecessary treatment. Validation of this prediction rule is required when applying it in new clinical settings such as the ED.[7] Because this approach was originally investigated in an ED for use in adults,[8] it is appealing to apply it in this setting as well. However, the sore throat score approach recommends throat culture if the patient has a total score of 2 or 3. As a result, telephone follow-up is necessary (to convey culture results and recommendation for therapy). In contrast, rapid test results are available within minutes and could eliminate the need for follow-up. The purpose of this study was first to evaluate the performance of the score approach in the ED and to examine the accuracy and impact of incorporating rapid testing. We hoped to devise a strategy to further decrease antibiotic use without missing more than an additional 10% of GAS infections, thereby eliminating the need for throat culture and the associated follow-up problems.[2]

Methods

Approval for this study was obtained from the ethics committees of the Etobicoke General and Credit Valley hospitals, where the study was conducted. Between January 1999 and February 2000, patients presenting to the ED with sore throat who were older than 3 years and not already receiving antibiotics were enrolled in the study when 1 of 6 participating physicians was on duty and had the time to enter the patient in the study (convenience sample). Informed consent was obtained prior to enrollment.

Patients were examined and assessed by means of a standardized encounter form listing the factors constituting the clinical score approach: patient's age, as well as presence of cough, fever, tender anterior cervical nodes, and tonsil-

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lar swelling or exudate. The physician also recorded a clinical impression as to whether the patient had GAS pharyngitis and indicated whether he would prescribe an antibiotic. The sore throat score for each patient was calculated after the emergency visit.

For all patients, pharyngeal swabs were taken for both culture and rapid streptococcal antigen assay. The prescription of antibiotics was withheld until the physician had received the result of the rapid test. On occasion, a nurse who had been instructed in the test procedure through demonstration and written materials performed the rapid test.

Culture specimens were plated on 5% sheep blood agar plates and incubated anaerobically for 48 hours. Group A Streptococcus was identified by means of standard techniques.[9] The rapid assay was performed with the Abbott Testpack+Plus (Abbott Laboratories Ltd., Mississauga, Ont.) according to the manufacturer's instructions. The method consists of placing a throat swab into a reagent tube, adding 3 reagents in turn and pouring the mixture onto a reaction disc; a plus symbol (+) appears within 10 minutes if the result is positive.

Data analysis was performed with Microsoft Excel and Stata programs. The sensitivity and specificity of the rapid test and the sore throat score were determined and 95% confidence intervals (CIs) were compared. A positive culture result was the gold standard indicating infection. To determine the antibiotic prescribing rates had the score approach been used, previously published management recommendations were used.[6] Patients with a score of –1, 0 or 1 were classed as not requiring culture or antibiotic; those with a score of 2 or 3 were considered to require throat culture, and those with a score of 4 or 5 were considered to require an antibiotic without culture. Antibiotic use, unnecessary prescriptions and use of throat culture were also determined and compared for the 3 approaches: 1) making a decision on the basis of the rapid strep antigen test result, 2) following the recommendations of the score approach, and 3) substituting rapid testing for throat culture for patients with a sore throat score of 2 or 3. The sensitivity and specificity and the proportion of antibiotic prescriptions and throat cultures under each approach were compared by means of a chi-square test or the Fisher's exact test where *n* was less than 5.

Table 1. Description of 126 patients and their clinical findings

Characteristic	No. (and %) of patients
Age, years	
3–14	59 (46.8)
15–44	63 (50.0)
45+	4 (3.2)
Clinical findings	
Temperature >38°C	57 (45.2)
Cough	53 (42.1)
Tender anterior nodes	69 (54.8)
Tonsil swelling or exudate	72 (57.1)
Positive result	
Culture	32 (25.4)
Rapid streptococcal antigen test	25 (19.8)
Antibiotic prescribed	46 (36.5)

Results

A total of 130 subjects were enrolled in this study. Incomplete data for 4 of the subjects resulted in their exclusion from the analysis. The majority of the encounters (83.3%) occurred in one ED, where most of the patients in the study were evaluated by one of the investigators (P.R.). A large proportion of study patients were children (59 [46.8%]), and very few (4 [3.2%]) were aged 45 or older (Table 1). Fifty-seven (45.2%) of the patients reported a temperature greater than 38°C, and 72 (57.1%) had tonsillar swelling or exudate. Culture results were positive for 32 patients (25.4%), and the rapid test was positive for 25 (19.8%). Physicians prescribed antibiotics to 46 patients (36.5%) after obtaining the results of the rapid test. Of

Table 2. Correlation of culture results with rapid streptococcal antigen test, clinical score and a combined strategy*

Strategy, result	Culture result; no. (and %) of patients: Negative *n* = 94	Positive *n* = 32
Rapid test result		
Negative	93 (99)	8 (25)
Positive	1 (1)	24 (75)
Sore throat score		
–1, 0 or 1	29 (31)	1 (3)
2 or 3	44 (47)	15 (47)
4 or 5	21 (22)	16 (50)
Combined strategy		
–1, 0 or 1	29 (31)	1 (3)
Score 2 or 3, do rapid test		
Negative	44 (47)	3 (9)
Positive	0 (0)	12 (38)
Score 4 or 5	21 (22)	16 (50)

*Perform rapid streptococcal antigen test if sore throat score is 2 or 3; treat on the basis of rapid test results only. Follow score recommendations if sore throat score is less than 2 or greater than 3.

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these, 18 (39%) were prescriptions for patients with negative throat culture results. One (3%) of the 30 patients with a sore throat score of less than 2 had a positive throat culture result, whereas 16 (43%) of the 37 patients with a score of more than 3 had a positive culture result. Table 2 outlines the accuracy of each approach in identifying cases of culture-proven GAS. If physicians had treated all patients on the basis of the rapid test results alone, then 24 of the 32 culture-proven cases would have been treated (sensitivity 75%, 95% CI 56.6%–88.5%). The false-positive rate for the rapid test was low, with a specificity of 99% (95% CI 94.2%–99.9%). The sore throat score recommends throat culture for patients with a score of 2 or 3 and treatment or culture for patients with a score of 4 or more. Thus, all patients with a positive culture result and a score of 2 or more would have been identified, for a sensitivity of 97% (95% CI 83.8%–99.9%, $p = 0.03$ compared with the rapid test; Fisher's exact test) and a specificity of 78% (95% CI 67.9%–85.6%, $p < 0.001$ compared with the rapid test). The combined strategy, substituting a rapid test for throat culture in patients with a score of 2 or 3 would have missed an additional 3 patients with a positive throat culture result, for an overall sensitivity of 88% (28/32). This was not statistically different from the sensitivity of the rapid test or the score approach. The specificity of the combined strategy was the same as for the score approach (78%).

The impact of each of these approaches on throat culture use, antibiotic prescriptions and unnecessary antibiotic use is shown in Table 3. Throat culture was not assessed as a component of observed physician care because a throat swab was obtained for all patients as part of the study, and physicians were not asked if they would have normally ordered throat culture. The rapid test and combined strategy would have eliminated the need for throat cultures, whereas the score approach would have recommended throat culture for 59 (47%) of encounters. Of these, 15 results (25%) would have been positive; therefore, the score approach would require a subsequent phone call to 15 (11.9%) of the 126 patients to inform them of results and ensure appropriate treatment. This is a 53% reduction in telephone follow-up compared with a strategy involving throat culture for all patients (32 [25.4%] positive cultures requiring telephone follow-up; $p = 0.06$), but still represents significantly more follow-up than with the strategy incorporating rapid testing.

Unnecessary antibiotic prescriptions would have been similar with the score approach, the combined strategy and observed physician care. Unnecessary prescriptions would have been significantly reduced with a strategy of rapid testing for all patients (94% reduction, $p < 0.001$).

Discussion

In this study we found that the sore throat score accurately predicted the likelihood of GAS-positive throat culture in community hospital ED patients. Infection was unlikely with a score less than 2 and occurred in 43% of patients with a score greater than 3. Previously published management recommendations to not treat the former group and to prescribe antibiotics for the latter group seem reasonable. For patients with a score of 2 or 3, the rapid test is not sufficiently sensitive to completely replace culture: a positive result with the rapid test warrants antibiotic treatment, whereas a negative result requires culture confirmation. This strategy would result in maintenance of the sensitivity for detecting GAS infection and would reduce the number of patients requiring follow-up.

Rapid testing in the ED of all patients presenting with a sore throat would result in a significantly lower sensitivity

Table 3. Comparison of outcomes with sore throat score approach, rapid streptococcal antigen test or combined strategy

	Strategy; no. (and %) of patients			
	Sore throat score	Rapid test	Combined strategy*	Physician's care†
Sensitivity	31/32 (97)‡	24/32 (75)	28/32 (88)	28/32 (88)
Specificity	73/94 (78)‡	93/94 (99)	73/94 (78)‡	76/94 (81)‡
Throat cultures	59/126 (47)	0/126 (0)	0/126 (0)	NA
Initial antibiotics	37/126 (29)	25/126 (20)	49/126 (39)	46/126 (37)
Unnecessary antibiotics	21/126 (17)‡	1/126 (1)	21/126 (17)‡	18/126 (14)‡

NA = not applicable.
* Perform rapid streptococcal antigen test if sore throat score is 2 or 3; treat on the basis of rapid test results only. Follow score recommendations if sore throat score is less than 2 or greater than 3.
† Outcome with physician's usual care, guided by rapid test results.
‡ p = <0.05, Fisher's exact test (compared with rapid test).

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for identifying infection than with the sore throat score approach. Suboptimal sensitivity of rapid testing has been noted in other studies as well.[10] A combined strategy of using the sore throat score but incorporating a rapid test for patients with a score of 2 or 3 was suggested in a recent review of sore throat decision rules[11] and was also proposed in a family practice setting.[12] This strategy had a somewhat higher sensitivity than rapid testing of all patients but lower sensitivity than the score approach alone. An unresolved question is whether or not such differences are clinically important, considering that most patients do not seek medical care for sore throats.

In this patient group, a combined strategy not using any throat cultures would have eliminated the need for any telephone follow-up. However, for confirmation by throat culture of all negative rapid test results, 44 patients (34.9%) would still have needed throat culture. Of these, 3 results (representing 2.4% of all visits) would have been positive and would have required telephone follow-up. In contrast, 15 patients (11.9%) would have required telephone follow-up if only the score approach had been used.

There were no differences in overall antibiotic use and unnecessary antibiotic prescriptions for any of the strategies except universal rapid testing. Unnecessary antibiotic use would be substantially reduced with rapid testing of all patients. However, a substantial number of cases of GAS infection would be missed. If rapid testing were performed for all patients with a score of 2 or more, in an effort to reduce unnecessary antibiotic use, the sensitivity of the combined approach would be reduced further (to 75%).

Rapid tests have been available for almost 2 decades and have undergone considerable modification over that period.[13] All rapid assay kits include reagents to extract streptococcal antigens from the swab. Most assays are based on antibody recognition of specific group carbohydrate antigens of GAS. The major differences between the tests are the techniques for visualizing the bound GAS antigens.

The earliest tests were based on latex agglutination. After extraction of GAS antigen from a throat swab, the solution was mixed on a slide with latex reagent containing bound GAS antibodies. After gentle rocking, the presence of the antigen would cause a grainy precipitate to form, demonstrating the presence of GAS. Sensitivity was about 76%.[10,14–17] The next generation of rapid assays were enzyme-linked immunosorbent assays (ELISAs). In ELISA one GAS antibody, called the "capture" antibody, is attached to a solid plate. A second "detection" antibody is conjugated to a reporter label. When extracted GAS antigen is added to the plate, it becomes sandwiched between the 2 antibodies, which allows it to be visualized. Most trials have found that the variants of this technique have a sensitivity of about 80%.[18,19] In this study we used an ELISA assay.

Optical immunoassays (OIAs) were developed in the early 1990s and are thought to be more sensitive than older assay techniques.[20] OIA systems use polyclonal anti-GAS antibody attached to thin silicon wafers.[21] Light reflected from the surface of the wafers is normally golden. GAS antigen binds to the wafer, and when a second solution is added, containing a substrate that selectively binds to the antigen–antibody complex, the changed thickness of the film causes the colour of the reflected light to change. In clinical trials, this technique has had a sensitivity of about 90%.[22–26] Some studies have found that OIAs have higher sensitivity than traditional throat culture.[23,27]

The early rapid assays were not thought to be sufficiently sensitive to replace throat culture, a belief reflected in current pharyngitis guidelines. The American Heart Asso-

The sore throat score approach

Step 1. Determine the sore throat score:

Criteria	Points
Temperature >38°C	1
No cough	1
Tender, anterior cervical nodes	1
Tonsil swelling or exudate	1
Age <15	1
Age 45 or older	−1

Total score is determined by summing the points for the criteria.

Step 2. Suggested management strategy based on total sore throat score:

Total score	Likelihood of GAS infection (%)*	Suggested management
−1 or 0	2–3	No culture or antibiotic required
1	4–6	No culture or antibiotic required
2	10–12	Culture all; treat patients with positive result
3	27–28	Culture all; treat patients with positive result
4 or 5	38–63	Treat (penicillin or erythromycin)

Fig. 1. Steps 1 and 2 for the sore throat score approach. GAS = group A streptococcal. *Likelihood of streptococcal infection derived from a general practice setting. Adapted from McIsaac and colleagues.[6] Used with permission of the publisher.

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ciation (AHA), the Canadian Paediatric Society and the Infectious Disease Society of America all recommend that a positive result on rapid assay is sufficient evidence to treat pharyngitis with antibiotics.[2,3,28] However, they all recommend that a negative result be confirmed with throat culture. Most of these guidelines were published before OIAs had been tested. The AHA recognized these newer tests, yet felt that further evaluation was needed before recommendations for their clinical use could be made.

The relatively small number of cases of sore throat in the present study dictates caution in interpreting the results. In addition, one physician did most of the assessments, and all physicians were aware of the rapid test results before they made any decision about prescribing antibiotics. It would be prudent to replicate this study in another ED with larger numbers of patients. In addition, the prevalence of positive throat culture results in our study (25.4%) was somewhat higher than in the original study in an ED by Centor and associates[8] (17%). This difference suggests that the current study population may have been a somewhat selected group of patients with sore throat. The relatively high sensitivity of the score approach in this study was similar to that observed for children.[29,30] Almost half of the patients presenting with sore throat in this study were children.

The use of the sore throat score approach in the ED is valid and would result in 50% fewer telephone follow-up calls for positive results than would be the case if throat culture was performed for all patients. Rapid testing of all patients would eliminate the need for follow-up but would also result in a substantial number of cases of GAS infection being missed. A combined strategy of rapid testing for patients with a sore throat who have a score of 2 or 3 would further reduce the need for telephone follow-up, even if negative results of the rapid test were confirmed by culture. Further research using newer rapid tests may confirm that culture is unnecessary for patients with negative results.

Competing interests: None declared.

Contributors: Dr. Rosenberg was the principal author and was involved in all aspects of the study. Dr. McIsaac was involved in the study design, data analysis, and in the editing of the paper. Dr. MacIntosh wrote the first draft of the paper. Dr. Kroll was involved in the study design and data collection.

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