Effect of a Standardized Pharyngitis Treatment Protocol on Use of Antibiotics in a Pediatric Emergency Department

Maria Carmen G. Diaz, MD; Nadine Symons, MD; Maria L. Ramundo, MD; Norman C. Christopher, MD

Background: Pharyngitis is a common complaint in pediatric patients. If clinical parameters are used alone, bacterial pathogens will be wrongly implicated in many cases. A nonstandardized approach to the treatment of children with pharyngitis in an emergency department setting may lead to inappropriate empirical therapy, contribute to increased bacterial resistance, and result in adverse events related to the treatment provided.

Objective: To implement evidence-based guidelines for the diagnosis and treatment of children with pharyngitis in an emergency department setting and thereby influence practices of prescribing antibiotics.

Design and Methods: An evidence-based guideline for the evaluation and treatment of patients with pharyngitis was developed and implemented in our emergency department. Preintervention and postintervention patient cohorts were identified by a search of the emergency department’s clinical repository. A medical record review was performed using a standardized data abstraction form (history and examination data, diagnostic testing, and therapy provided). Treatment decisions were judged as appropriate if the diagnosis of pharyngitis caused by group A β-hemolytic streptococci was based on confirmatory microbiological testing rather than on the history and physical examination findings alone.

Results: We included 443 patients for study (219 preintervention and 224 postintervention). In the preintervention group, 97 (44%) of 214 received appropriate treatment. In the postintervention group, 204 (91%) of 224 received appropriate treatment.

Conclusion: An evidence-based clinical guideline can influence and improve practices of prescribing antibiotics by pediatric emergency physicians in a teaching hospital setting.


SORE THROAT IS ONE OF THE most common complaints in the pediatric population. Most sore throats are caused by viral agents, and only 15% to 20% are caused by group A β-hemolytic streptococci (GABHS). Accurate diagnosis and treatment of patients with GABHS are essential in the prevention of rheumatic fever and other complications. The distinction between viral and bacterial etiologies of sore throat can be challenging because many experts agree that GABHS infection “cannot be diagnosed on clinical grounds in most patients.” Certain symptoms such as prominent rhinorrhea, cough, and hoarseness are more suggestive of a viral etiology. However, physicians may overdiagnose GABHS infection 80% of the time because physical examination findings alone do not adequately distinguish streptococcal from nonstreptococcal pharyngitis. To avoid complications associated with inappropriate use of antibiotics, various confirmatory microbiological tests for GABHS are available. Throat cultures are the gold standard; however, rapid antigen detection tests have become a useful aid. Rapid streptococcal antigen tests (RSTs) have been shown to have variable sensitivity but high specificity; therefore, negative results on these tests require culture confirmation, but positive findings allow treatment without performing a culture. Results of rapid tests or cultures for GABHS should be positive before beginning antibiotic treatment.

There has also been much discussion regarding choice of antibiotics in the treatment of GABHS; however, penicillin remains the drug of choice for the treatment of this type of infection. No GABHS organisms are resistant to penicillin, and treatment is effective for the elimination of GABHS and prevention of rheumatic fever.

Author Affiliations: Departments of Pediatrics (Drs Diaz, Symons, Ramundo, and Christopher) and Emergency Medicine (Drs Diaz, Ramundo, and Christopher), Northeastern Ohio Universities College of Medicine, and Pediatric Emergency Services, Children's Hospital Medical Center of Akron (Drs Diaz, Symons, Ramundo, and Christopher), Akron, Ohio.
Well-constructed evidence-based guidelines allow the physician to use scientifically based clinical parameters to improve patient care. They also provide a means by which physicians may enhance their own education and quality of their practice. We hypothesize that implementing evidence-based guidelines for the diagnosis and treatment of patients with pharyngitis will influence antibiotic prescribing practices.

**METHODS**

The Pediatric Emergency Department at the Children's Hospital Medical Center of Akron (Akron, Ohio) is a 32-bed department with an annual census of 65,000 patient visits. It is a teaching hospital for Northeastern Ohio Universities College of Medicine and is staffed by board-certified pediatric emergency medicine attending physicians, fellows, and general pediatricians.

All patients who require a rapid test for GABHS or a throat culture undergo 2 simultaneous throat swabs in the emergency department (ED). These swabs may be performed by medical students, residents, fellows, or attending physicians. The obtained specimens are then processed by our laboratory technicians. One of the swabs is used for an RST; the other is held for culture only if ordered by the physician and if the result of the rapid test is negative. The STREP A OIA MAX assay (Thermo BioStar, Louisville, Colo) is used as the means of rapid identification of GABHS. Throat swabs are plated for culture undergo 2 simultaneous throat swabs in the emergency department (ED). These swabs may be performed by medical students, residents, fellows, or attending physicians. The obtained specimens are then processed by our laboratory technicians. One of the swabs is used for an RST; the other is held for culture only if ordered by the physician and if the result of the rapid test is negative. The STREP A OIA MAX assay (Thermo BioStar, Louisville, Colo) is used as the means of rapid identification of GABHS. Throat swabs are plated for culture undergo 2 simultaneous throat swabs in the emergency department (ED). These swabs may be performed by medical students, residents, fellows, or attending physicians. The obtained specimens are then processed by our laboratory technicians. One of the swabs is used for an RST; the other is held for culture only if ordered by the physician and if the result of the rapid test is negative. The STREP A OIA MAX assay (Thermo BioStar, Louisville, Colo) is used as the means of rapid identification of GABHS. Throat swabs are plated for culture undergo 2 simultaneous throat swabs in the emergency department (ED). These swabs may be performed by medical students, residents, fellows, or attending physicians. The obtained specimens are then processed by our laboratory technicians. One of the swabs is used for an RST; the other is held for culture only if ordered by the physician and if the result of the rapid test is negative. The STREP A OIA MAX assay (Thermo BioStar, Louisville, Colo) is used as the means of rapid identification of GABHS. Throat swabs are plated for culture undergo 2 simultaneous throat swabs in the emergency department (ED). These swabs may be performed by medical students, residents, fellows, or attending physicians. The obtained specimens are then processed by our laboratory technicians. One of the swabs is used for an RST; the other is held for culture only if ordered by the physician and if the result of the rapid test is negative. The STREP A OIA MAX assay (Thermo BioStar, Louisville, Colo) is used as the means of rapid identification of GABHS. Throat swabs are plated for culture undergo 2 simultaneous throat swabs in the emergency department (ED). These swabs may be performed by medical students, residents, fellows, or attending physicians. The obtained specimens are then processed by our laboratory technicians. One of the swabs is used for an RST; the other is held for culture only if ordered by the physician and if the result of the rapid test is negative. The STREP A OIA MAX assay (Thermo BioStar, Louisville, Colo) is used as the means of rapid identification of GABHS. Throat swabs are plated for
Table 1. Preintervention Data: Numbers of Patients With a Complaint of Sore Throat, Types of Tests Performed, and Therapy

<table>
<thead>
<tr>
<th></th>
<th>Antibiotics Given in the ED</th>
<th>Antibiotics Withheld</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive RST result (throat culture not done)</td>
<td>47 (21 appropriate, 26 inappropriate)</td>
<td>0</td>
</tr>
<tr>
<td>Negative RST result</td>
<td>1</td>
<td>2*</td>
</tr>
<tr>
<td>Positive throat culture result</td>
<td>21</td>
<td>43*</td>
</tr>
<tr>
<td>Negative throat culture result</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>RST not done</td>
<td>28</td>
<td>4*</td>
</tr>
<tr>
<td>Throat culture not done</td>
<td>36</td>
<td>16*</td>
</tr>
</tbody>
</table>

Abbreviations: ED, emergency department; RST, rapid streptococcal antigen test.
*Indicates patients who received appropriate treatment.

Table 2. Postintervention Data: Numbers of Patients With a Complaint of Sore Throat, Types of Tests Performed, and Therapy

<table>
<thead>
<tr>
<th></th>
<th>Antibiotics Given in the ED</th>
<th>Antibiotics Withheld</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive RST result (throat culture not done)</td>
<td>48 (42 appropriate, 6 inappropriate)</td>
<td>1</td>
</tr>
<tr>
<td>Negative RST result</td>
<td>3</td>
<td>16*</td>
</tr>
<tr>
<td>Positive throat culture result</td>
<td>3</td>
<td>133*</td>
</tr>
<tr>
<td>Negative throat culture result</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>RST not done</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Throat culture not done</td>
<td>0</td>
<td>10*</td>
</tr>
</tbody>
</table>

Abbreviations: ED, emergency department; RST, rapid streptococcal antigen test.
*Indicates patients who received appropriate treatment.

Oral orders were excluded if the patient was immunocompromised, was receiving penicillin prophylaxis, had prior rheumatic heart disease, had been taking antibiotics in the past 48 hours, was admitted to the hospital, or had a final discharge diagnosis other than pharyngitis, GABHS pharyngitis or tonsillitis, scarlet fever, or viral illness.

Our primary outcome measure is compliance with the evidence-based guidelines and appropriate prescribing practices. In addition, characteristics of the RST as used in our ED are identified as well as choice of antibiotics. We have defined appropriate treatment of GABHS pharyngitis as the initiation of antibiotic treatment for a complaint of sore throat based on a positive RST result or withholding empirical therapy based on a negative result. Proper antibiotic therapy requires the use of penicillin. Erythromycin should be prescribed for patients who are allergic to penicillin; however, macrolides such as azithromycin are acceptable alternatives. In our pathway, we recommend clindamycin for those who are allergic to both penicillin and macrolides. Withholding antibiotic therapy and not obtaining an RST or throat culture in patients with clear viral etiologies of sore throat were also deemed appropriate. In all cases, supportive and symptomatic therapy were recommended. This study protocol was reviewed and approved by our institutional review board.

RESULTS

The age range in our study population was 1.5 to 19 years with a median of 9 years (interquartile range, 6-13 years). The male-to-female ratio was 1:1.7 (185:238).

PREINTERVENTION DATA

From August 1, 2002, through November 30, 2002, 603 patients were evaluated in our ED with a triage complaint of sore throat (Table 1). A random sample of 300 patients was generated from this dataset. Of these, 219 patients met our study inclusion criteria and comprise the preintervention database. In the preintervention group, 97 (44%) of 219 patients received appropriate treatment; 21 of these 97 were given appropriate antibiotic therapy based on a positive RST result. Therapy was withheld in 45 of 97 cases in which the rapid test results were negative and throat cultures were pending. In addition, 20 of 97 patients did not have an RST, but antibiotic therapy was withheld pending throat culture results. Finally, 11 of the 97 patients did not have an RST or a throat culture and were not given antibiotics.

Of the remaining 122 (of 219) patients in the preintervention group, 88 were treated empirically based on clinical examination; 29 (33%) of these 88 had positive throat culture results. In addition, 26 of the 122 were given antibiotics other than penicillin, a macrolide, or clindamycin in response to a positive RST result. The remaining 8 (of 122) patients did not receive appropriate treatment because they had a negative RST result but no follow-up throat culture was performed. In the preintervention group, 3 patients with a negative RST result were later found to have a positive throat culture result, giving a false-negative rate of 4.4% (3/67).

POSTINTERVENTION DATA

From August 1, 2003, through November 30, 2003, 546 patients were evaluated in our ED with a triage complaint of sore throat (Table 2). From this data, a random sample of 300 patients was generated; 224 of the 300 patients met our study inclusion criteria. These 224 patients seen in 2003 comprise the postintervention data.

In the postintervention database, 204 (91%) of 224 patients received appropriate treatment based on our parameters; 42 of 204 were given appropriate antibiotic therapy based on a positive RST result. Therapy was withheld in 149 of 204 cases in which the RST results were negative and throat culture results were pending. In addition, 3 of the 204 did not have an RST but antibiotic therapy was withheld pending throat culture results. Finally, 10 of the 204 did not have an RST or a throat culture and were not given antibiotics.

Of the remaining 20 (of 224) patients not included in the appropriate treatment subset, 9 were empirically treated based on a clinical examination; 6 (66%) of these 9 had positive throat culture results. Of the 20 patients, 6 did not receive appropriate treatment because they were given antibiotics other than penicillin, a macrolide, or clindamycin in response to a positive RST result. In addition, 4...
of 20 had a negative rapid test result but no follow-up throat culture; 1 of 20 had a positive rapid test result but was not given antibiotics in the ED. In the postintervention group, 19 patients with a negative rapid test result were later found to have a positive culture result, giving a false-negative rate of 12.2% (19/155).

CHOICE OF ANTIBIOTICS

Of the 47 patients in the preintervention group given antibiotics for a positive RST result, 18 (37.5%) were given penicillin (16 orally and 2 intramuscularly), 26 (55%) were given amoxicillin, and 3 (6%) were given azithromycin. All 3 patients given azithromycin were allergic to penicillin.

In the postintervention group, 48 patients were given antibiotics for a positive RST result: 34 (70.8%) were given penicillin (30 orally and 4 intramuscularly), 5 (10%) were given amoxicillin, and 8 (16%) received either a macrolide or clindamycin owing to a penicillin allergy. One patient was given a combination of amoxicillin and clavulanate.

Our preintervention data confirm prior studies that have shown that GABHS is often erroneously implicated as the cause of sore throat.\textsuperscript{5,10,13} Our physicians offered an incorrect clinical diagnosis in 59 (67%) of the 88 patients given antibiotics in this dataset. After the implementation of our pathway, the error rate in prescribing antibiotics for sore throat based purely on clinical examination decreased. More important, we were able to increase our appropriate treatment rate from 44% to 91%.

In our evaluation of patients with a complaint of sore throat, 24 (6 preintervention and 18 postintervention) were excluded because of an alternate diagnosis requiring specific antibiotic therapy (eg, urinary tract infection, otitis media, or pneumonia). Although we believe that appropriate treatment was rendered in all of these cases, the analysis of data from these patients was not included because their alternate diagnoses required that antibiotic therapy be initiated regardless of the presence of GABHS.

Penicillin is the drug of choice for the treatment of GABHS.\textsuperscript{13} Prior studies have shown that many physicians are hesitant to use penicillin because of the risk of adverse reactions and poor compliance.\textsuperscript{12,20} However, a 10-day course of penicillin therapy results in a bacteriologic and clinical cure in approximately 90% of children with GABHS.\textsuperscript{14} This efficacy combined with its narrow spectrum and low cost makes penicillin the drug of choice for patients with confirmed GABHS pharyngitis.

In our study, we were able to increase our penicillin prescribing rate from 37.5% to 70.8% in cases in which antibiotic therapy was indicated. Many of our physicians prescribe amoxicillin for GABHS infection. Although some studies have shown its efficacy,\textsuperscript{15} amoxicillin’s broader antibiotic spectrum may contribute to greater resistance.

There has been some focus on the efficacy of cephalosporins in the eradication of GABHS.\textsuperscript{21,23} However, the current recommendation by the American Academy of Pediatrics Committee on Infectious Diseases regarding first-generation oral cephalosporins is that they be used only in patients allergic to penicillin; their cost and wider range of antibiotic activity preclude their use in those who are not allergic to penicillin.\textsuperscript{19} Cephalosporins were not listed in our clinical pathway as an alternative in patients allergic to penicillin because of concerns of allergic cross-reactivity.

The reported specificity of the Thermo BioStar assay is 95% with a sensitivity of 85%.\textsuperscript{24} In the analysis of our RST characteristics, we did not include calculations for sensitivity or specificity because it is our institutional policy that positive test results do not receive culture confirmation. We chose to focus our calculations on the test’s false-negative rates. However, as a retrospective medical record review, our study was limited by a lack of patient follow-up. We were therefore unable to determine the costs associated with delays in the treatment of patients with false-negative rapid test results or the costs associated with follow-up or repeated visits. As an additional limitation, we were also unaware of the adverse reaction rate to penicillin in our study population. Perhaps a better awareness of patient compliance and adverse reactions could have a stronger effect on prescribing practices among ED physicians.

This study shows that physician practice can be influenced by the implementation of evidence-based guidelines. We concur with the recommendations from prior studies that patients should be treated for pharyngitis caused by Streptococcus infection only if there is a documented positive RST or culture result.\textsuperscript{22} Many studies have argued the cost-effectiveness of various tests used in the treatment of sore throats.\textsuperscript{7,26} Although we did not quantify costs in this study, we believe that those associated with making an accurate diagnosis far outweigh the implications of inappropriate antibiotic prescribing practices. The potential effect of increased antibiotic resistance should make physicians more aware of their prescribing practices. These guidelines need to be applied to general pediatric practices throughout the community.

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Correspondence: Maria Carmen G. Diaz, MD, Division of Emergency Medicine, A.I. duPont Hospital for Children, 1600 Rockland Rd, Wilmington, DE 19899 (mcdiaz@NEMOURS.org).
REFERENCES