Comparison of Throat Culture and Latex Agglutination Test for Streptococcal Pharyngitis

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Numerous reports have recently appeared in the clinical microbiology literature that describe agglutination tests for identifying patients with group A streptococcal pharyngitis. These studies have indicated a close correlation between the results of the agglutination tests and traditional throat culturing. This paper describes a comparison study of 100 consecutive throat swab specimens using a commercially available agglutination test and routine throat culturing. The cultures were interpreted by an individual who was blinded to the agglutination test results. All agglutination testing was done by two laboratory members of a family practice office staff. The agglutination procedure was easy to perform and clear to interpret. The test sensitivity and specificity compared well with that reported in the literature from microbiology laboratories. The new agglutination tests are useful in the office laboratory for the identification of group A streptococci. Their primary advantage compared with throat culturing is the rapid availability of test results.

Most clinicians recognize the need to differentiate group A streptococcal pharyngitis from other infectious causes of pharyngitis because of the reduction in suppurative sequelae and rheumatic fever when streptococcal pharyngitis is treated with antibiotics.[1] New evidence has also supported the intuitive feeling of some clinicians that early antibiotic treatment will decrease the severity and length of time of pharyngitis symptoms.[2]

Throat culturing has been the standard office laboratory test to identify group A streptococcal pharyngitis.[3] Throat culturing is associated with high rates of both false-positive and false-negative tests, even in the best hands. Several studies have demonstrated the difficulty of performing throat cultures in the office or clinic setting.[4-6] Throat culture interpretation is complicated and requires both specialized training and regular practice.

An additional problem with throat culturing has been that clinicians are uncomfortable with the 24- to 48-hour test time. Inconsistent patterns of clinical practice have therefore developed, including waiting for the culture results before treating, prescribing penicillin to all patients until the results are available, or treating all patients without confirming the diagnosis by culture. The variety of these conflicting clinical approaches has been confusing to both the public and individual patients.

A rapid test for identifying streptococcal pharyngitis with an easy end point has clearly been needed. Latex agglutination tests have recently been introduced and seem to meet these requirements. This paper reports the predictive value of one such test compared with office throat culturing and discusses the impact of this new test on the management of patients with pharyngitis.

METHODS

Testing was done on 100 consecutive throat swab specimens sent for throat culturing from a

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TABLE 1. AGGLUTINATION TEST PERFORMANCE COMPARED WITH THROAT CULTURING IN A FAMILY MEDICINE OFFICE SETTING

Agglutination Test	Throat Culture		
	Positive	Negative	Total
Positive	20	3	23
Negative	2	75	77
Total	22	78	100

Sensitivity (20/22) 91%, specificity (75/78) 96%, positive predictive value (20/23) 87%, negative predictive value (75/77) 97%

family medicine office. The specimens were collected during a four-month period. The requesting physicians were faculty and residents in a family medicine residency program. Patient specimens were collected by clinicians (faculty and residents) and nursing staff (registered nurses, licensed practical nurses, and medical assistants) using Culturette* swabs. All specimens were collected from both the tonsillar and posterior pharyngeal area. Plating and agglutination testing were done on the same swab immediately after the specimen collection. A single swab technique has previously been found to be reliable for both tests.[7] The specimen was first plated onto a 5 percent sheep blood agar plate by swabbing one third of the plate and then streaking it with an inoculating loop. Three stabs were made with the inoculating loop in an unstreaked portion of the plate. An A disc for differentiation of group A streptococcus was placed over the inoculum. An N disc was placed near the A disc in order to create a zone of staphylococcus inhibition.[3] The plates were incubated at 37°C in a candle jar for 24 hours and then interpreted by one of the authors who was blinded to the results of the agglutination test.

The specimen swab was then processed for the presence of group A streptococci using a commercially available test and its recommended procedure.[8] In a microtube, one drop of extraction reagent No. 1 and one drop of extraction reagent No. 2 were added. The swab was placed in the microtube and ground into the bottom and the sides of the tube to assure a homogenous mixing of the reagents. After five minutes of incubation at room temperature, two drops of extraction reagent No. 3 were added to the microtube. Again the swab was rolled against the sides of the tube pressing the reagent mixture out of the swab fibers. One drop of the test mixture was then placed onto the test slide. A second drop of the extracted reagent was used for a negative control. One drop of latex group A detection reagent was added to the test area. A drop of negative latex control reagent was added to the control. The slide was hand-rocked at a rate of about 100 rpm for three minutes and then examined for agglutination under a high-intensity light. Positive controls were done on a daily basis to assure reagent reactivity. All agglutination testing was performed by medical laboratory technicians on the staff of the family practice center laboratory.

Culturette 10-Minute Group A Strep ID, Marion Scientific, Kansas City, Missouri

RESULTS

Testing was done on 100 consecutive specimens sent for throat culturing. Group A streptococci were isolated by throat culture in 22 of these patients. Twenty of those had positive throat cultures and positive agglutination tests, resulting in a test sensitivity of 91 percent. Of the 78 patients with negative throat cultures, all but three had negative agglutination tests. These results determine a test specificity of 96 percent (Table 1). The three patients with false-positive agglutination tests were contacted after their culture results became available. One of the three admitted to antibiotic use prior to the office visit. Antibiotics can inhibit culture growth without interfering with the agglutination test. This one patient, therefore, may not represent a false-positive test result.

DISCUSSION

Throat cultures have been used for over 30 years to identify patients with group A streptococcal pharyngitis. Despite its wide acceptance, this test has proven awkward as a tool for clinical care because the test results are not

TABLE 2. AGGLUTINATION TEST PERFORMANCE REPORTED IN THE LITERATURE

	No.	Sensitivity (%)	Specificity (%)	Incidence (%)
Chang and Mohla[10]	435	90	99.2	16
Miceika et al[7]	817	92.4	92.8	11.3
Slifkin and Gil[11]	557	95.1	100	15
Gerber et al[12]	263	83	99	41
Fischer and Mentrup	100	91	96	22

available to the clinician for 24 to 48 hours. This delay is expensive to the office practice because the patient's chart must be pulled, a new notation made, the patient must be contacted, and a prescription must be called to the pharmacy. This entire process has been calculated to require 14 minutes of clinician or staff time.[9] The delay is also frustrating to patients, many of whom are free of symptoms by the time the culture results are available. Recent evidence has also supported the widely held view that early treatment may shorten the course of the streptococcal pharyngitis illness.[2]

Finally, office laboratories have performed poorly in studies that have evaluated their performance to read throat cultures.[4,6] The throat culture is a complex test to interpret. Many offices do not have staff who are formally trained in microbiology techniques, and this lack of trained staff increases the chance of inaccurate culture interpretation.

A test is needed that reliably identifies patients with group A streptococcal pharyngitis and for which the results can be available while the patient is in the office. Furthermore, the test should be easy to perform and should have an unambiguous end point. Such testing is now available.

The test sensitivity and specificity calculated in this study compare well with those previously reported in the literature (Table 2).[7,10-12] The variation in incidence among these studies is likely to be due to differences in patient age mix. Children have higher rates of streptococcal pharyngitis than do adults. The study by Gerber et al[12] included only children and adolescents.

The negative predictive value for the agglutination test is 97 percent when compared with throat culturing in this study's population with a 22 percent incidence of streptococcal pharyngitis. Patients with negative tests are therefore very unlikely to have group A streptococcal pharyngitis. The positive predictive value calculated from this study for the agglutination test is 87 percent.

There are problems with using the throat culture as a "gold standard" with which to compare the results of the agglutination test. Throat cultures are known to have a 10 percent false-negative rate even when properly performed.[1] These false-negative results can be due to overgrowth on the plate by other organisms, to mutant nonhemolytic strains of group A streptococci, or to the patient's use of antibiotics prior to the specimen collection. The latter was found to be the case for one of the three patients in this study in whom the agglutination test was positive but the culture was negative.

False-positive throat cultures are primarily due to the presence of group A streptococci in patients who are carriers not actively infected with the organism. Some microbiologists have suggested that these patients can be identified by the low colony count on the culture plate, but there continues to be debate about this point.[12] The agglutination test, like the throat culture, will be positive both for patients who are carriers and for those patients with an acute streptococcal infection. The agglutination test should therefore be viewed as giving comparable information as a throat culture.

The end point for the agglutination test is sharp and rarely ambiguous. The test interpretation is therefore much easier than reading culture plates. The test procedure is technically straightforward and should be easy to learn for any office laboratory staff person who is familiar with agglutination reactions, such as slide pregnancy tests.

The performance of quality control procedures is essential to assure that accurate test results are

achieved. The manufacturers of the latex agglutination test used in this study recommend that a daily positive control and a negative control with each patient sample be done. A bottle of killed group A streptococcus cells in suspension is included as a positive control. A negative control is performed by reacting the extracted patient sample with nonspecific antibody-coated latex suspension. If the office laboratory performs three tests per day, there are sufficient reagents to complete 40 patient samples and the recommended quality controls for each kit of 55 tests. Offices performing only one test per day would obviously have much greater costs for their quality control testing. The current reagent cost for the described agglutination test is about $2.50 per test. The average reagent expiration period is 12 months. Throat cultures usually cost less than $1 per test for reagents. The agglutination costs per test are therefore considerably higher than for throat culturing. The "hands-on" technician time is also greater than for throat cultures. The total office costs are likely to be less, however, because the rapid test turnaround time greatly improves the office efficiency of managing the patient who presents with a sore throat.

There are presently 11 manufacturers of rapid diagnostic tests for streptococcal pharyngitis.[13] Ten of these have recently been evaluated for technical difficulty and end point quality.[14] None was found to be distinctly superior. Furthermore, all are similar in their reported sensitivity and specificity. The test time, costs per test, and inclusion of quality control reagents should therefore guide the clinician in his or her product choice.

SUMMARY

This study demonstrates the ease with which one new latex agglutination test for streptococcal pharyngitis can be performed in an office laboratory. The test results provide the clinician with data that are nearly equivalent to that of a throat culture, but in a more timely fashion. The ease of the test procedure and the quality of the test end point should result in more accurate testing than has been traditionally obtained by throat culturing in the office laboratory. Agglutination tests are likely to replace throat cultures in most family medicine and pediatric office settings.

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