A Case Against the Use of the Throat Culture in the Management of Streptoccocal Pharyngitis

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Acute pharyngitis is a common problem for the clinician and yet a difficult one. The throat culture appears to offer definitive diagnostic information, but this is illusory. The culture is inconvenient, subject to too many false negative and false positive results, and does not denote active streptococcal infection. Clinical assessment of the acute pharyngitis patient is shown to be the better approach.

Streptoccocal pharyngitis cannot be diagnosed by clinical methods—there must be a throat culture.

So speaks current wisdom in medicine, espoused by teachers and repeated in textbooks, and so transmitted to generations of students and practitioners. The evidence of the clinician's own senses must defer to an impersonal laboratory report, and the diagnosis of pharyngitis becomes an exercise in divination of a blood agar plate.

Although one hundred years have now passed since the discovery of streptococcus pyogenes by Louis Pasteur, in the blood of a patient with puerperal septicemia,[1] the definitive identification of pharyngitis due to this organism is still extremely difficult.

It is suggested here that the throat culture has too many problems associated with its use and interpretation, that it is of little value in supplying concrete bacteriological diagnosis, and that clinical decision making in acute pharyngitis, without a throat culture, is both rational and acceptable.

The Misleadingly Negative Throat Culture

In streptococcal pharyngitis the throat culture may be negative for the streptococcus since recovery rates for the organism are never 100 percent and are often very much less. Scarlet fever is an incontestably streptococcal disease and yet, in

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a collection of ten studies,[2] the positive throat culture rate was as low as 68 percent. In a group of patients undergoing tonsillectomy,[3] preoperative throat cultures were positive for beta hemolytic streptococcus 16.4 percent of the time, yet culture of the excised surgical tissues had a positive culture rate of 32.7 percent. It would appear that throat swabs can be a poor index of the presence of tonsillar streptococci.

Many active clinicians became influenced by the growth of laboratory medicine and wished to use the throat culture in their practices, yet the use of a reference laboratory was inconvenient and costly. Therefore the office throat culture was instituted; promoted as economical and simple to perform, it is, unfortunately, subject to considerable inaccuracy. Practitioners with a minimum of formal bacteriological training, no assistance from trained technicians, and no quality controls cannot compete for accuracy with hospital or public health facilities. In Vermont, for instance, the office laboratories of six highly motivated physicians were found to miss from 34 to 71 percent of positive throat cultures identified by a reference laboratory.[4] Two other studies of community groups of a dozen physicians each[5,6] found that 19 percent and 20 percent of positive streptococcal cultures were missed in the office.

Therefore, even under the best of conditions, perhaps 20 percent of throat cultures from patients with genuine streptococcal pharyngitis may be negative, and obviously the best conditions are not always present.

The absence of a positive throat culture in a patient with acute pharyngitis does not exclude the diagnosis of streptococcal pharyngitis.

The Misleadingly Positive Throat Culture

In nonstreptococcal or viral pharyngitis the throat culture may be positive for the streptococcus. This may happen because of overreading the culture plate, the streptococcal carrier state, or by secondary bacterial overgrowth.

Overreading

Several investigators find a high incidence of overreading of office cultures because of confusion between alpha and beta hemolysis, or between the beta hemolytic streptococcus and other beta hemolytic organisms. False positive rates[5-7] were 40 percent, 36 percent, and 21 percent. Overreading office cultures for false positive results may be as great a problem as false negative cultures.

The Carrier State

The asymptomatic general population always has an incidence of positive throat cultures which varies with the age group and the season of the year from 10 to 40 percent.[8] When a streptococcal carrier acquires a viral respiratory tract infection and sees a physician who takes a throat culture, the diagnosis will be that of a streptococcal illness. Infestation, however, is not the same as infection. The streptococcus, although a potential pathogen, is not always pathogenic. The organism can exist for months in the throats of healthy people,[9] peaceful coexistence between it and its host being the rule and disease the exception.[10] The carrier rate, which is inversely proportional to the streptococcal illness rate, is a valuable asset to the individual, who is not ill, not contagious, and not at risk for rheumatic fever. A carrier will be found to be in the process of acquiring specific M type immunity to his streptococcal strain in a natural way, and because of substrate competition, bacterial interference, and cross protection among the types of group A streptococci, he may well be less likely to acquire a new virulent epidemic strain. The carrier should be left untreated, even when he has a viral pharyngitis.

Secondary Bacterial Overgrowth

There is a synergism between streptococci and viruses in the respiratory tract, the bacteria frequently appearing as secondary invaders in the later course of a viral illness.[11-13] In smallpox, measles, influenza, and other viral respiratory tract infections, streptococci, often nonepidemic strains of low virulence, invade the throat and grow luxuriantly. Because of this synergism it is understandable that a patient with a viral infection may have a positive throat culture for beta hemolytic streptococcus, even with heavy growth on the culture plate, and not be infected by the organism but merely infested, and in no danger of harm.

Thus, in acute pharyngitis the throat culture

may be misleadingly positive because of overreading, the carrier state, or bacterial-viral synergism.

The presence of a positive throat culture in a patient with acute pharyngitis does not exclude the diagnosis of viral pharyngitis.

The Degree of Positivity of the Culture

It has been suggested by proponents of the use of the throat culture that the number of colonies of streptococci on the culture plate is a useful indicator of the difference between a carrier and a patient with an active infection, the presence of fewer than ten colonies being considered clinically unimportant.[14]

However, in scarlet fever there may be heavy growth on the culture plate, or there may be none.[15] Of individuals in a population study,[10] having a heavy growth on culture, only 38 percent had a rise in antistreptolysin titer; subjects with strongly positive cultures were no more likely to be ill than those with lightly positive ones. In all types of nonstreptococcal respiratory illness and in concurrent viral infections, high streptococcal colony counts have been found,[11-13] and low colony counts, far from being clinically unimportant, still produce in one third of patients a significant serologic response.[16]

Therefore it is plain that the degree of growth on the culture plate cannot be of any practical use in clinical decision making.

The Syndrome of Acute Pharyngitis

Acute pharyngitis is the problem which the clinician faces and which he/she must manage on the basis of symptoms and signs, with or without the additional factor of the throat culture. Yet the cause of the illness is often obscure.[8] In one half of patients with acute pharyngitis, after full bacteriological and virological investigation, no etiological agent can be found. In the remainder, one third have positive throat cultures for beta hemolytic streptococcus and one sixth are harboring a virus: influenza and parainfluenza, adenovirus, rhinovirus, enterovirus, coxsackie virus, or herpes simplex virus.[17,18]

It is the one third of acute pharyngitis patients who do have a positive throat culture for beta hemolytic streptococcus that must now be considered. It is this group of patients who are assumed to have streptococcal pharyngitis by those who rely on the culture. Strangely enough, such an obvious assumption is incorrect.

Acute Pharyngitis with a Positive Culture

It was demonstrated in the discussion on the Misleadingly Positive Throat Culture, that a positive culture in a patient with pharyngitis may not be evidence for an active streptococcal infection. An active infection must be defined as the presence of a positive culture plus a subsequent rise in type-specific antibody. It is the magnitude of this rise in antistreptococcal antibody which relates to the risk for the subsequent development of acute rheumatic fever.

It has been found that in fewer than half (43 percent) of acute pharyngitis patients with positive cultures did serological evidence of acute streptococcal infection develop,[8,16] inhibition of antibody response by antibiotics not being a factor. In a majority of the patients (57 percent), the illness could not be related to the streptococcus present in the throat culture. Such patients were usually convalescent carriers with an already high titer of antibody to the strain that they were carrying in their throats, and who had succumbed to an intercurrent viral illness.

These individuals with acute pharyngitis and a positive culture but no serological response were neither at risk of developing complications nor of transmitting infection, and were not, in fact, suffering from streptococcal pharyngitis. Yet, such patients make up more than half of the group assumed to have streptococcal pharyngitis by those who rely on the culture.

The throat culture, with its false negatives and false positives, and its inability to demonstrate active infection, is a failure in the clinical setting.

It is consideration of the efficacy of the clinical assessment of the patient, with clinical diagnosis of streptococcal and nonstreptococcal illnesses, and then consideration of the reasons why streptococcal pharyngitis should be treated at all, that will show that clinical management without a culture is a valid course of activity.

The Clinical Diagnosis of Streptococcal Pharyngitis

Symptoms suggestive of streptococcal pharyngitis are sudden onset of sore throat, pain on swallowing, headache, fever, and sometimes abdominal pain, nausea, and vomiting. Signs are toxemia, a thick speech, a beefy red or fiery red throat, swelling of the pharynx, exudate, petechiae on the soft palate, white or red strawberry tongue, tender lymphadenitis, and a scarlatinal rash. Rhinitis and cough are features which, if present, make the diagnosis less likely. In the child under the age of three years, the streptococcic syndrome is associated with chronic nasal discharge, excoriated nares, and lymphadenopathy.

These clinical symptoms and signs are associated with a high incidence of positive throat culture for the group A beta hemolytic streptococcus.

It was first established over 20 years ago that in 75 percent of clinically diagnosed streptococcal pharyngitis patients there was a positive throat culture.[19] Later workers[20,21] found a 78 percent and 88 percent clinico-bacteriological correlation. It was also found that clusters of symptoms and signs were better indicators than single clues; the more positive features found, the more likely was the diagnosis of streptococcal pharyngitis.

More recently,[22-24] clinical symptoms and signs have been assigned numerical scoring values to quantify the clinical features and develop score card probability profiles. On high scoring symptom-sign combinations, 78 percent, 87 percent, and 89 percent correlations with a positive throat culture were obtained.

No matter which system was used, all of the six investigations[19-24] found a uniformly high incidence of agreement (75 to 89 percent) between highly suggestive clinical pictures and positive throat cultures. This correlation rate parallels that obtained in scarlet fever and, considering the uncertainty of diagnosis in acute pharyngitis, is unlikely to be improved upon. Clinical diagnosis is confirmed to be a valid procedure.

So why culture?

In a clinically diagnosed case of streptococcal pharyngitis, the culture has been shown to be highly likely to be positive, and, even if negative, should not prevent treatment because of the possibility of laboratory error. Moffett[21] says that because of the possibility of error in a single throat culture, all children with febrile exudative pharyngitis should probably be treated with full therapeutic courses of penicillin because of the very high frequency of positive cultures for Group A hemolytic streptococci in this group. Breese, too,[22] suggests that when a scoring system produces a result of high clinical significance, and the culture is negative, then there is a possibility of laboratory error.

Logically then, a patient with clinical streptococcal pharyngitis can be treated as such without resorting to the time, trouble, and expense of a throat culture. Such a patient should be treated whatever the result of the throat culture.

Of course, this does mean that some viral pharyngitis will be treated as if it were streptococcal, particularly adenoviral infections in the preschool child and mononucleosis in the adolescent, which most closely mimic the clinical features of streptococcal pharyngitis. However, in the present state of the art, this is inevitable and it is difficult to see how it can ever be avoided. The degree of unnecessary treatment actually will be less than if the culture is relied upon, for more than half of positive cultures in acute pharyngitis have already been shown not to signify a streptococcal infection.

The prompt institution of treatment in clinical cases has the added advantage of clearing the organism from the throat in about two days and thereby preventing epidemic spread.

The Clinical Diagnosis of Non-streptococcal Pharyngitis

The clinician dealing with an acute respiratory tract illness and finding little evidence for streptococcal disease can make a definite decision that he is not dealing with bacterial pharyngitis but with a viral syndrome. In such patients, when throat cultures were taken, six separate studies[19-24] found positive culture rates of 4, 12, 14, 18, 23, and 36 percent. These rates are within the range of frequency of carriers of the streptococcus in the general population. Workers on the numerical score card systems[22-24] suggest that this group of patients with clinical viral pharyngitis need not be cultured at all because of the cost and volume of unnecessary cultures.

So, the patient with a clinical viral pharyngitis

need not be treated, whatever the result of his throat culture. Logically here too, as with the patient with clinical streptococcal pharyngitis already discussed, the result of the culture does not influence clinical decision making, and therefore it can be omitted.

Why Treat Streptococcal Pharyngitis?

Streptococcal pharyngitis is treated with antibiotics to provide symptomatic relief, and to prevent suppurative and nonsuppurative complications. Consideration, in turn, of these three indications for treatment provides further supportive evidence for the primacy of the use of clinical criteria over a reliance on throat culture.

Symptomatic Relief

It is strange that there survives to this day a school of thought (Wannamaker and Ferrieri 1975[25]) that maintains that antibiotics have little effect on the acute course of uncomplicated streptococcal pharyngitis; that somehow in this one bacterial illness the eminently susceptible streptococcus is not influenced as other disease-producing bacteria are in other illnesses. However, most investigators[7,9,19,24] do find a prompt and dramatic response to penicillin after 24 hours of treatment, with improvement in symptoms and reduction or disappearance of fever. This prompt response to penicillin is of diagnostic value in differentiating viral and streptococcal sore throat. Wannamaker and his co-workers' own study[26] showed that 24 hours after penicillin treatment, fewer than 20 percent of patients were still febrile, while in a placebo group just fewer than 60 percent were still febrile. Most recently,[27] symptoms and signs have been found to persist for two to three days in treated patients, and six to seven days in untreated patients.

Assuming therefore that penicillin does provide symptomatic relief, it is clear that it is the patient with an overt clinical picture of streptococcal pharyngitis who requires it. He has fiery redness or edema of the throat, exudate, and high fever, while the patient with clinical viral pharyngitis has merely a "scratchy" throat and streaky redness on the fauces. This applies whatever the result of the throat culture.

Prevention of Suppurative Complications

Streptococcal pharyngitis may be complicated by sinusitis, otitis media, peritonsillar or retropharyngeal abscess, or suppurative cervical lymph glands. It is the acutely ill patient with clinically advanced illness, the patient with the clinical picture of streptococcal pharyngitis, who is in danger of these complications and who therefore can be treated to prevent them. This applies whatever the result of the throat culture.

Prevention of Nonsuppurative Complications

Prompt, adequate treatment of streptococcal pharyngitis prevents the development of acute rheumatic fever (although it probably does not prevent acute glomerulonephritis). For the clinician, total accuracy in diagnosis of streptococcal pharyngitis is unfortunately impossible, with or without the throat culture. "It is impossible to distinguish who needs treatment with an acceptable degree of precision."[8]

Consideration of the epidemiology of rheumatic fever helps resolution of the dilemma. Rheumatic fever has, in fact, been more a social ailment of the ghetto than a medical problem. As with many other significant diseases it is associated with poverty, poor levels of education, overcrowding, and substandard housing. Continuing improvement in these social conditions in this century has been the major reason for a steady fall in the incidence of rheumatic fever which cannot be attributed to the well-meaning efforts of the clinician culturing the throats of suburban families. Furthermore, individual effort to reduce the incidence of rheumatic fever by culturing throats is hampered by the fact that two thirds of rheumatic fever patients either have no symptoms of a preceding respiratory tract infection, or else ignore them.

Hence, the activities most likely to be fruitful in further diminishing the frequency of rheumatic fever are political progress in improving the conditions of lower socioeconomic groups and intensive public health community projects in high incidence areas.

Another aspect of the problem is the relative cost and efficiency of the alternate methods of management. A cost effectiveness analysis[28] has shown that early penicillin treatment in clinical streptococcal pharyngitis is superior to the treatment of only those acute pharyngitis patients with

positive throat cultures. The clinical strategy, in addition to its other advantages of simplicity, minimization of epidemic spread, reduction of morbidity and of illness duration, and prevention of rheumatic fever, is also less costly in patient time and money and more efficient in use of medical resources.

Conclusions

The throat culture can miss or overread the streptococcus, and a positive culture may merely reveal a carrier, or secondary overgrowth in a viral infection. The degree of growth on the culture plate is not helpful and less than half of positive cultures denote an active streptococcal infection.

Conversely, clinical syndromes of streptococcal and of viral illness correlate well with positive and negative cultures. Since it is irrational to act on the basis of a culture report when it conflicts with the clinical picture, the culture can be omitted. The possibility of laboratory error confirms the primacy of clinical judgment.

Whatever the result of a throat culture, it is those patients with the clinical features of streptococcal pharyngitis who need antibiotic therapy both for symptomatic relief and for prevention of suppurative complications.

Rheumatic fever is a disease to be attacked by political, social, or public health measures in high-risk areas, not by adding throat culturing to clinical management in an individual practice which can have negligible impact.

"Streptococcal pharyngitis cannot be diagnosed by clinical methods–there must be a throat culture."

Can this still be said to be true?

References

1. Pasteur L: De l'extension de la théorie des germes à l'etiologie de quelques maladies communes. Comptes Rendus Hebdomadaires de Seances de l'Academie des Sciences (Paris) 90:1033, 1880
2. Mortimer EA: Letter. Pediatrics 48:843, 1971
3. Rantz LA: The hemolytic streptococci. J Infect Dis 69:248, 1941
4. Mondzac AM: Throat culture processing in the office: A warning, letter. JAMA 200:208, 1967
5. Rosenstein BJ, Markowitz M, Gordis L: Accuracy of throat cultures processed in physicians' offices. J Pediatrics 76:606, 1970
6. Battle CU, Glasgow LA: Reliability of bacteriologic identification of B-hemolytic streptococci in private offices. Am J Dis Child 122:134, 1971
7. Merenstein JH, Rogers KD: Streptococcal pharyngitis: Early treatment and management by nurse practitioners. JAMA 227:1278, 1974
8. Wannamaker LW: Perplexity and precision in the diagnosis of streptococcal pharyngitis. Am J Dis Child 124:352, 1972
9. Dunlap MB, Harvey HS: The carrier state and type-specific immunity in streptococcal disease. Am J Dis Child 114:229, 1967
10. Meyer RJ, Haggerty RJ: Streptococcal infections in families: Factors altering individual susceptibility. Pediatrics 29:539, 1962
11. Cumming JG: The alliance between streptococci and virus infections. Med Ann DC 37:644, 1968
12. Nichol KP, Cherry JD: Bacterial-viral interrelations in respiratory infections of children. N Engl J Med 277:667, 1967
13. Mogabgab WJ: Beta-hemolytic streptococcal and concurrent infections in adults and children with respiratory disease, 1958-1969. Am Rev Respir Dis 102:23, 1970
14. Breese BB: Culturing beta-hemolytic streptococci in pediatric practice:Observation after twenty years. J Pediatrics 75:164, 1969
15. Zanen HC, Ganor S, Van Toorn MJ: A continuous study of hemolytic streptococci in the throats of normal children, adults and aged men. Am J Hyg 69:265, 1959
16. Kaplan EL, Top FH Jr, Dudding BA, et al: Diagnosis of streptococcal pharyngitis: Differentiation of active infection from the carrier state in the symptomatic child. J Infect Dis 123:490, 1971
17. Glezen WP, Clyde WA Jr, Senior RJ, et al: Group A streptococci, mycoplasmas, and viruses associated with acute pharyngitis. JAMA 202:455, 1967
18. Baker LH, Hodges GR: Examination of pharyngeal secretions to determine the etiology of pharyngitis. Am J Med Sci 272:89, 1976
19. Breese BB, Disney FA: The accuracy of diagnosis of beta streptococcal infections on clinical grounds. J Pediatrics 44:670, 1954
20. Stillerman M, Bernstein SH: Streptococcal pharyngitis: Evaluation of clinical syndromes in diagnosis. Am J Dis Child 101:476, 1961
21. Moffet HL, Cramblett HG, Smith A: Group A streptococcal infections in a children's home: Part 2: Clinical and epidemiologic patterns of illness. Pediatrics 33:11, 1964
22. Breese BB: A simple scorecard for the tentative diagnosis of streptococcal pharyngitis. Am J Dis Child 131:514, 1977
23. Walsh T, Bookheim WW, Johnson RC, et al: Recognition of streptococcal pharyngitis in adults. Arch Intern Med 135:1493, 1975
24. Randolph MF, Redys JJ, Hibbard EW: Streptococcal pharyngitis: Part 1: Correlation of cultures with clinical criteria. Del Med J 42:29-34, 43, 1970
25. Wannamaker LW, Ferrieri P: Streptococcal infections—Updated. DM: October 1975
26. Denny FW, Wannamaker LW, Hahn EO: Comparative effects of penicillin, aureomycin and terramycin on streptococcal tonsillitis and pharyngitis. Pediatrics 11:7, 1953
27. Bass JW, Crast FW, Knowles CR, et al: Streptococcal pharyngitis in children: A comparison of four treatment schedules with intramuscular penicillin G benzathine. JAMA 235:1112, 1976
28. Tompkins RK, Burnes DC, Cable WE: An analysis of the cost-effectiveness of pharyngitis management and acute rheumatic fever prevention. Ann Intern Med 86:481, 1977