

Streptococcus A in paediatric accident and emergency: are rapid streptococcal tests and clinical examination of any help?

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Background: Rapid streptococcal tests (RSTs) for streptococcal pharyngitis have made diagnosis at once simpler and more complicated. The American Academy of Pediatrics recommends that all RSTs be confirmed by a follow up throat culture unless local validation has proved the RST to be equally sensitive.

Aims: To evaluate (a) RST as a single diagnostic tool, compared with RST with or without throat culture; (b) clinical diagnosis and the relative contribution of different symptoms.

Methods: The study included 213 patients with clinical signs of pharyngitis. Throat swabs were analysed using Quickvue+ Strep A Test; negative RSTs were backed up by throat culture. Thirteen clinical features commonly associated with strep throat were analysed using backward stepwise logistic regression.

Results: Positive results (RST or throat culture) were obtained in 33 patients; RST correctly identified 21. Eleven samples were false negative on RST. At a strep throat prevalence of 15.9%, sensitivity of RST was 65.6% (95% CI 46.8% to 81.4%) and specificity 99.4% (96.7% to 99.9%). Sensitivity of clinical diagnosis alone was 57% (34% to 78%) and specificity 71% (61% to 80%). Clinically, only history of sore throat, rash, and pyrexia contributed to the diagnosis of strep throat ($p < 0.05$).

Conclusion: The high specificity of RST facilitates early diagnosis of strep throat. However, the low sensitivity of RST does not support its use as a single diagnostic tool. The sensitivity in the present study is markedly different from that reported by the manufacturer. Clinical examination is of limited value in the diagnosis of strep throat. It is important to audit the performance of new diagnostic tests, previously validated in different settings.

Rapid antigen detection tests for diagnosis of Group A β -haemolytic streptococcal pharyngitis (GABHS) have been available for over 20 years. Increasing sensitivity of the available test kits has made the diagnosis of GABHS more straightforward, and more contentious at the same time by questioning the need to perform a back-up throat culture. Only a few years ago, the American Academy of Pediatrics was recommending back-up throat culture for all negative rapid streptococcal tests (RSTs). However, the recent recommendation by the American Academy of Pediatrics and Infectious Disease Society of America to validate that an RST is as sensitive as throat swab culture before abandoning the back-up culture for negative rapid tests, implies clinicians set up a setting specific audit of the performance of their RST.^{1–3}

GABHS infections have suppurative and non-suppurative complications. Following a recent Cochrane Database systematic review, we now have the necessary evidence base to recommend treatment of GABHS.⁴ In the UK, use of RSTs has never been widespread. Due to the structure of the National Health Service (ensuring the possibility of patient follow-up by the general practitioner) the "wait and culture" approach is a feasible alternative to "blind" treatment of suspected GABHS in accident and emergency (A&E) departments.

We conducted the present study to evaluate the introduction of RST in a busy, tertiary paediatric A&E department as a single diagnostic tool. We also aimed to evaluate, by means of a questionnaire, clinical diagnosis of GABHS and the relative contribution of different symptoms/signs as assessed by junior doctors.

METHODS

Setting

Samples were obtained between January and March 2003 in a busy paediatric A&E department (35 000 patient contacts/year) in a tertiary children's hospital in Edinburgh, Scotland. Experienced paediatric nursing staff, who were given a refresher course on correct sampling technique by our microbiology consultant prior to the start of the study, took the throat swabs.

Patients

All children attending our paediatric A&E with clinical signs of pharyngitis were eligible for enrolment in the study. Clinical diagnosis of pharyngitis was the only inclusion criterion. We did not impose a clinical scoring system upon our participating medical staff to make this clinical diagnosis. There were no exclusion criteria.

Ethical approval was not sought as this project was a local validation of a previously validated RST, as recommended by the American Academy of Pediatrics.² Parents were given an information sheet after verbal explanation by the requesting clinician of the purpose and structure of the study.

Sample processing

Experienced nursing staff analysed the samples using Quickvue+ Strep A test (Quidel Inc., San Diego, CA). As reported by the manufacturer, sensitivity and specificity of Quickvue+ are 95% and 98%, respectively. Results of the RST

Abbreviations: A&E, accident and emergency; GABHS, Group A β -haemolytic streptococcal pharyngitis; RST, rapid streptococcal test

were reported immediately to the clinician and the patients and their parents to guide further management.

Negative RSTs had a back-up throat swab sent for culture to our local bacteriology laboratory. The specimens were processed according to standard bacteriology techniques. Laboratory staff were not blinded to the clinical data provided on the request form (including the result of the RST). Paper copy results were sent back to the A&E department for review by medical staff.

Questionnaire

Doctors were asked to complete a questionnaire before they knew the result of the RST. The questionnaire included 13 clinical features commonly associated with GABHS (history of sore throat, pyrexia >38.5 °C, drooling, red ears, red tonsils, not feeding, red pharynx, irritable, pus on tonsils, wheeze, tachycardia, rash, tachypnoea) and other (free entry). Any antibiotic use during the last seven days was also documented.

Data analysis

The RST \pm culture results and patient details were documented in a study logbook. After the end of the study period bacteriology results, patient details and questionnaire responses were entered in an Access 2000 database (Microsoft Corp.).

Sensitivity, specificity (95% confidence interval (CI)), likelihood ratios (LR), and post-test probability were calculated for the RST and clinical examination. We analysed the clinical features with backward stepwise logistic regression using SPSS Version 11.

RESULTS

The study sample consisted of a total of 213 children (110 boys, 103 girls; mean (SD) age 3.85 (3.15) years. Of these, 201 patients were included in the analysis (12 patients did not have follow up throat culture sent). Positive results (RST or throat culture) were obtained in 33 patients, and RST was positive in 21 patients (table 1). Eleven samples were negative on RST but positive on follow up throat culture. One weakly positive RST was negative at follow up throat culture. At a streptococcal pharyngitis prevalence of 15.9% (32/201) in our study population, sensitivity of RST was 21/32 or 65.6% (95% CI 46.8% to 81.4%) and specificity was 168/169 or 99.4% (95% CI 96.7% to 99.9%). Positive LR was 109.3 and negative LR 0.346. Post-test probability was 95.4%.

Follow up was complete and questionnaires were available for 115/213 (54%) patients. A&E medical staff did not complete the questionnaire in 86 patients and 12 patients did not have a follow up throat culture sent. Twenty one patients were positive for strep throat (21/115, 18.3%). Sensitivity of clinical diagnosis alone was 12/21 or 57% (95% CI 34% to 78%) and specificity 67/94 or 71% (95% CI: 61% to 80%) (table 2). Positive LR was 1.96 and negative LR 0.60. Post-test probability of clinical diagnosis was 30%.

In the backward stepwise logistic regression of the surveyed clinical features only history of sore throat, rash

Table 2 Results of clinical diagnosis of Group A β -haemolytic streptococcus pharyngitis (GABHS)

Clinical diagnosis	GABHS		Total
	Positive	Negative	
Positive	12	27	39
Negative	9	67	76
Total	21	94	115

and pyrexia contributed significantly to the diagnosis of strep throat ($p < 0.05$). "Red tonsils" was still a variable in the final equation but without reaching statistical significance ($p = 0.095$).

Eight patients had received antibiotics during the previous seven days. Only one had a positive RST (after amoxicillin); seven had negative RST and throat swab culture.

DISCUSSION

A recent Cochrane review of 26 studies covering 12 669 cases of sore throat concluded that suppurative complications (acute otitis media, acute sinusitis, and quinsy) were significantly reduced by the use of antibiotics. Their use in non-suppurative complications such as acute glomerulonephritis and rheumatic fever led respectively to some protection against and significant reduction in its occurrence.⁴ With the evidence at hand to treat GABHS, clinicians want to be certain about the microbiological aetiology of the pharyngitis they have diagnosed. Haemolytic streptococci are responsible for 5–36% of cases of pharyngitis.⁵ The prevalence of GABHS in our study was 15.9%. Although asymptomatic carrier rates are reported between to be 2% and 21% depending on age, the finding of a positive throat culture or rapid antigen test, in the presence of clinical findings, is accepted to be sufficient to establish the diagnosis of streptococcal pharyngitis.^{6,7}

We know that a single throat culture is not the gold standard.^{8,9} Size of the inoculum is of major influence on the sensitivity of any test, rapid test or culture.¹⁰ For this study, we decided not to change our current practice of sending one swab for culture. Because of the reported high specificity of RST, we did not send a back-up culture for positive RSTs.^{11,12} In our study the sensitivity of the RST compared with single throat culture was only 65.6%. This is much lower than the sensitivity reported by the manufacturer (95%) and from office based reports of RST sensitivity.⁷ Pitetti *et al* have previously reported on the low sensitivity of RST (still 79.5%) in the setting of a paediatric emergency department.¹¹ The specificity of RST in our study was 99.4%. One weakly positive RST was negative at follow up throat culture. This is partly due to the study design of sending a back-up culture only for a negative RST.

Avoidable drug reactions, penicillin allergy, and induction of antibiotic resistance are the main reasons for treating GABHS only in patients with proved pharyngitis. In a healthcare system like that in the UK, where all patients are registered with a general practitioner (GP) and care is free at the site of delivery, follow up of patients is virtually 100%. In our department, all culture results are reviewed by the on-call medical staff. Positive cultures results are conveyed by phone to the parents and to the GP so that an antibiotic prescription can be arranged. Lieu *et al* conducted a cost-effectiveness analysis of different diagnostic and treatment strategies for streptococcal pharyngitis. They found the throat culture alone strategy to be sensitive to the probability of follow up. Only at follow up rates of $>98\%$ does culture alone

Table 1 Results of the rapid streptococcal test (RST) and throat culture

RST	Throat culture		Total
	Positive	Negative	
Positive	21	1	22
Negative	11	168	179
Total	32	169	201

become the most cost effective strategy.¹³ We believe it to be a matter of good clinical governance that mechanisms are set up to ensure close follow up of all test results. After this study we have decided not to change our current practice of culture alone while ensuring adequate follow up of all culture results.

The clinical diagnosis of GABHS pharyngitis is a troublesome exercise. Various scoring systems and reviews have been dedicated to solving this problem.^{14 15} We asked the clinicians to complete a questionnaire before they knew the result of the RST. The questionnaire assessed 13 clinical features commonly associated with GABHS (see Methods above for details). Any antibiotic use during the last seven days was also documented. Backward stepwise logistic regression of all the surveyed features showed that only history of sore throat, rash, and pyrexia were contributing significantly to the diagnosis of strep throat ($p < 0.05$). The feature "red tonsils" was still a variable of the final equation without reaching statistical significance ($p = 0.095$).

The unimpressive positive LR of 1.96 and the negative LR of 0.6 for clinical diagnosis of GABHS are similar to previous reports.^{16 17}

SUMMARY

The high specificity of RST in our study increases the post-test probability, facilitating early diagnosis of streptococcal pharyngitis. However, the low sensitivity of RST does not support its use as a single diagnostic tool. The obtained sensitivity in our department is markedly different from the sensitivity reported by the manufacturer or in previous office based reports of RST. Clinical examination by junior doctors is of limited value in the diagnosis of streptococcal pharyngitis. Our research shows the importance of auditing the performance of new diagnostic tests, previously validated in different settings.

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