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ORIGINAL RESEARCH

Comparison of Group A Streptococcus Antigen Detection and Pathogen Culture in Paediatric Infections

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Objective: To compare the clinical value of Group A Streptococcus (GAS) antigen detection and pathogen culture in the diagnosis and treatment of paediatric infections, providing a basis for the rational use of antibiotics.

Methods: This retrospective study included 310 paediatric patients with GAS infections admitted between January 2019 and January 2024. Patients were assigned to either the antigen-positive group (n = 156) or the culture-positive group (n = 154). Demographic characteristics, clinical features, treatment outcomes, and complications were compared between the two groups.

Results: There were no significant differences between the two groups in terms of demographic data (age, sex, weight) and clinical symptoms (such as fever, sore throat, and rash) ($P > 0.05$). The time to fever resolution (3.00 [3.00, 4.00] days vs 3.00 [2.00, 4.00] days, $P = 0.103$), time to sore throat resolution (3.00 [3.00, 5.00] days vs 4.00 [3.00, 5.00] days, $P = 0.405$), acute complication rates (6.41% vs 9.09%, $P = 0.377$), and late complications (none in either group) during the 3-month follow-up period showed no significant differences.

Conclusion: GAS antigen detection and pathogen culture have comparable clinical efficacy and can both effectively guide antibiotic treatment. Rapid antigen detection can be used as the preferred screening method in clinical practice, optimising early diagnosis and treatment.

Keywords: group A streptococcus, antigen detection, pathogen culture, antibiotic treatment, clinical outcomes

Introduction

Group A Streptococcus (GAS) infection is a common bacterial disease in children, often causing upper respiratory tract infections such as pharyngitis and tonsillitis, and, in severe cases, leading to complications such as rheumatic fever and acute glomerulonephritis.[1–3] The global burden remains substantial, with an estimated 18.1 million people currently affected and 1.78 million new cases annually, particularly in low- and middle-income countries and among indigenous populations in high-income countries.[4,5]

Clinical diagnosis currently relies on two methods: antigen detection and bacterial culture. The rapid antigen detection test (RADT) is easy to perform and provides results in 5–10 minutes, but has a high false negative rate and reduced sensitivity, especially at low bacterial loads. By contrast, the conventional culture method, considered the "gold standard", has high specificity (>95%) but takes 24–48 hours to obtain the results, which may delay treatment.[6–8] International guidelines, including those from the Infectious Diseases Society of America and the American Heart Association, provide recommendations for GAS diagnosis and management, yet variations exist in their approaches to testing strategies and antibiotic regimens.[9,10]

Although GAS remains universally susceptible to beta-lactam antibiotics, emerging concerns about macrolide resistance in certain regions highlight the need for ongoing surveillance and appropriate antibiotic stewardship.[11,12] Existing studies focus on the diagnostic efficacy of both methods, but those exploring their impact on clinical outcomes

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remain limited. A recent Cochrane review highlighted the need for more evidence on how rapid testing strategies affect clinical outcomes and antibiotic prescribing patterns in real-world settings.[13]

This article, therefore, compares the effectiveness of antigen detection and culture testing in anti-infection treatment, hypothesising that under standardised sampling conditions, antigen detection can achieve similar clinical outcomes (eg the time to symptom relief and incidence of complications) as culture testing. The findings aim to provide evidence-based guidance for clinical selection of optimal diagnostic strategies to streamline treatment processes and promote rational antibiotic use.

Subjects and Methods

Study Subjects

This retrospective analysis included children aged 0–18 years who visited Beijing United Family Hospital and Beijing United Family Women's & Children's Hospital between January 2019 and January 2024. Eligible patients were clinically diagnosed with acute tonsillitis, acute pharyngitis, or scarlet fever, and further confirmed with GAS infection by RADT or bacterial culture.

Inclusion criteria followed the "Chinese Expert Consensus on the Diagnosis, Treatment, and Prevention of GAS Infection-related Diseases in Children".[6] Exclusion criteria were (1) concurrent rheumatic or immunological disease, or severe immunodeficiency; (2) confirmed co-infection with other pathogens (eg influenza virus, Epstein–Barr virus, adenovirus, *Mycoplasma pneumoniae*); (3) final diagnosis of Kawasaki disease or haemophagocytic syndrome; (4) death; (5) history of severe penicillin allergy; and (6) antibiotic treatment prior to consultation.

In accordance with our clinical pathway, patients with positive RADT results were diagnosed with GAS infection and commenced antibiotic treatment immediately. Consequently, bacterial culture was not routinely performed for these patients. As a result, the study design does not permit a direct head-to-head comparison of the diagnostic performance (eg sensitivity, specificity) of RADT and culture, since the reference standard (culture) was not applied to all participants. The primary aim was rather to compare the clinical outcomes of patients diagnosed using these two distinct strategies.

Laboratory Diagnostic Methods

All throat swabs were collected by trained nursing staff using a standardised protocol. Patients were asked to tilt their heads back and open their mouths wide. Using a tongue depressor to ensure good visualisation of the posterior pharynx and tonsillar areas, the nurses rotated a sterile polyester-fibre tipped swab (Copan Diagnostics, Cat. No. 155C) vigorously over both tonsils (or tonsillar fossae if tonsillectomised) and the posterior pharynx, avoiding contact with the tongue, buccal mucosa, or teeth. Immediately after collection, the swab was placed into a sterile transport tube containing Amies medium (Copan Diagnostics, Cat. No. 108C) to maintain bacterial viability. The specimens were transported to the laboratory at room temperature and processed within 2 hours of collection.

Group A Streptococcus was cultured on Columbia blood agar (Thermo Fisher Scientific, Cat. No. PB0123A) and incubated at 35–37°C in a 5% CO2 incubator (Thermo Fisher Scientific, Model HERACELL 240i) for 24–48 hours. The criteria for positive cultures were the formation of round colonies >0.5 mm in diameter, greyish-white, with a smooth, moist surface, and a β-haemolytic ring with a diameter 2–4 times that of the colony. After confirming the colonies as Gram-positive cocci in chains through Gram staining, identification tests were further conducted using antibiotic susceptibility paper (Taikang Bio Co., Ltd., Cat. No. Z21059).

The RADT was performed using Abbott's Strep A kit (Cat. No. 45FK12), based on latex immunochromatography, strictly following the product instructions. Polymerase chain reaction testing was not used as a confirmatory method in this study, as the clinical diagnosis relied on antigen detection and culture, the routine diagnostic methods in our clinical setting. All tests were performed by trained laboratory personnel, with positive and negative controls set to ensure testing quality.

The time to result for each method was recorded based on the clinical workflow. The RADT results were available within 1 hour of specimen arrival at the laboratory, often during the same clinical encounter. The bacterial culture results were available after 24–48 hours of incubation. Consequently, antibiotic treatment was initiated on the day of

consultation for the antigen-positive group, but delayed until receipt of the culture result (~48 hours) for the culture-positive group. This difference in diagnostic latency is a key characteristic of the two diagnostic strategies compared in this study.

Antimicrobial susceptibility testing (AST) was not routinely performed on the cultured *Streptococcus pyogenes* isolates in this study, consistent with the current global and national microbiological guidelines (eg CLSI, EUCAST), which do not recommend routine AST for *S. pyogenes* against beta-lactam antibiotics (such as penicillin and amoxicillin) due to the persistently high susceptibility rates reported worldwide. To date, no clinical resistance to beta-lactams in *S. pyogenes* has been reported. Therefore, bacterial culture results in this cohort were used primarily for definitive diagnosis rather than antibiotic selection, as empirical beta-lactam use is considered highly reliable.

Treatment Methods

This study strictly followed the treatment regimen outlined in the "Chinese Expert Consensus on the Diagnosis, Treatment, and Prevention of GAS Infection-related Diseases in Children".[6] All diagnosed children received standardised anti-infection treatment: amoxicillin clavulanate potassium was preferred and administered at an amoxicillin dose of 50 mg/(kg·d) (maximum daily dose 1000 mg) for 10 days. Those allergic to beta-lactams were switched to azithromycin at 12 mg/(kg·d) for 5 days.

During the treatment, medication compliance was ensured through regular reviews of electronic medical records and phone follow-up, with treatment responses and adverse reactions recorded.

Observation Indicators

The primary observation indicator was the time to fever relief, defined as axillary temperature remaining below 37.3°C for 24 consecutive hours. Secondary observation indicators included the time to sore throat relief and the occurrence of complications. The diagnostic criteria for acute complications were as follows: otitis media required otoscopic evidence of tympanic membrane distension and related clinical symptoms, and peritonsillar abscess required confirmation by contrast-enhanced CT. Delayed complications were followed up for 3 months, with rheumatic fever diagnosed using the Jones criteria, and acute glomerulonephritis requiring laboratory evidence of haematuria, proteinuria, and hypocomplementaemia.

Statistical Methods

Data analysis was performed using SPSS 26.0 statistical software (IBM, USA). As this was a retrospective study, an a priori sample size calculation was not performed; instead, the sample size was determined by the number of eligible cases meeting the inclusion criteria during the study period. A post-hoc power analysis was conducted to assess the statistical power of the observed results.

For the primary outcome of time to fever relief, the observed median was 3.00 days in both groups, with a common standard deviation of approximately 1.0 day (estimated from the interquartile range [IQR]). A sample size of 310 (155 per group) provides over 90% power at a two-sided alpha level of 0.05 to detect a clinically meaningful difference of 0.5 days (12 hours) in fever resolution time, using the Mann–Whitney *U*-test. This effect size is considered clinically relevant in paediatric febrile illnesses.

For acute complication rates (6.41% vs 9.09%), the same sample size provides approximately 80% power to detect an absolute difference of 7% between groups, which is also considered a clinically important threshold. Therefore, the final cohort size of 310 patients was deemed sufficient to support the study's conclusions with statistical validity.

Normality tests for all continuous variables were conducted using the Shapiro–Wilk test. Normally distributed data were expressed as mean ± standard deviation ($\bar{x}\pm s$), with inter-group comparisons performed using independent-samples t-tests. Non-normally distributed data were expressed as median (IQR) [M(P25, P75)] and compared using the Mann–Whitney *U*-test. Categorical variables were expressed as numbers (percentages) (n [%]) and compared between groups using the χ^2-test or Fisher's exact test. All statistical analyses were two-sided, with a significance level of $\alpha = 0.05$.

Results

Comparison of Baseline Characteristics

Of 409 children screened for this study, 310 were included after applying exclusion criteria: 156 in the antigen-positive group (males: n = 89, 57.05%) and 154 in the culture-positive group (males: n = 97, 62.99%). No statistically significant differences were found between the 2 groups in baseline characteristics, including age (6.00 [5.75, 7.00] years vs 6.00 [6.00, 8.00] years, $P = 0.805$), gender distribution ($P = 0.286$), and weight (24.00 [21.00, 31.00] kg vs 24.50 [20.00, 29.88] kg, $P = 0.703$). In terms of clinical symptoms, the 2 groups exhibited a similar incidence of fever (98.72% vs 95.45%, $P = 0.170$), sore throat (99.36% vs 96.75%, $P = 0.210$), and rash (33.33% vs 38.96%, $P = 0.302$) (Table 1).

Comparison of Clinical Efficacy

As anticipated, there was a significant difference in the time from specimen collection to the availability of the diagnostic result between the two groups. The median time to result for the RADT group was 1.0 hour (IQR: 1.0, 2.0) compared with 48.0 hours (IQR: 44.0, 52.0) for the culture group ($P < 0.001$). This directly influenced the timing of antibiotic initiation, which occurred on the day of presentation for patients with positive antigen results, but was delayed by approximately two days for patients with positive culture results.

Despite this marked difference in diagnostic and treatment initiation latency, the two groups showed comparable performance in terms of the primary outcome indicators: the time to fever relief was 3.00 (3.00, 4.00) vs 3.00 (2.00, 4.00) days ($P = 0.103$), and time to sore throat relief was 3.00 (3.00, 5.00) vs 4.00 (3.00, 5.00) days (P=0.405) in the antigen-positive and culture-positive groups, respectively. In terms of safety, the incidence of acute complications was 6.41% (10/156) vs 9.09% (14/154) ($P = 0.377$) in the antigen-positive and culture-positive groups, respectively. No delayed complications were observed in either group during the follow-up period. Recurrence rates were 1.92% (3/156) vs 1.30% (2/154) ($P > 0.999$) in the antigen-positive and culture-positive groups, respectively (Table 2).

Diagnostic Performance Analysis

As outlined in the Methods section, bacterial culture was not performed after a positive RADT result per clinical protocol. Therefore, it was not feasible to calculate the standard diagnostic performance metrics (sensitivity, specificity,

Table 1 Comparison of Baseline Characteristics Between Children with *Group A Streptococcus* (GAS) Infection Identified by Antigen Detection or Pathogen Culture

Variable	GAS Antigen Positive (n=156)	GAS Culture Positive (n=154)	Z/χ2 value	*P* value
Age (Years)	6.00(5.75, 7.00)	6.00(6.00, 8.00)	−0.247	0.805
Gender			1.138	0.286
Male (n)	89(57.05)	97(62.99)		
Female (n)	67(42.95)	57(37.01)		
Weight (kg)	24.00(21.00, 31.00)	24.50(20.00, 29.88)	0.381	0.703
Fever			1.885	0.170
Yes (n)	154(98.72)	147(95.45)		
No (n)	2(1.28)	7(4.55)		
Sore Throat			1.569	0.210
Yes (n)	155(99.36)	149(96.75)		
No (n)	1(0.64)	5(3.25)		
Rash			1.064	0.302
Yes (n)	52(33.33)	60(38.96)		
No (n)	104(66.67)	94(61.04)		

Notes: Data are presented as median (interquartile range) for continuous variables and number (%) for categorical variables. P values in italics. Z values correspond to the Mann–Whitney *U*-test for non-normally distributed continuous variables (Age, Weight). χ^2 values correspond to the Pearson chi-square test for categorical variables (Gender, Fever, Sore Throat, Rash). Fisher's exact test was used when expected cell counts were <5 (applicable to "No" categories in Fever, Sore Throat, and Rash comparisons). No results reached statistical significance at α=0.05.

Abbreviation: GAS, Group A Streptococcus.

Table 2 Comparison of Clinical Efficacy Between Children with *Group A Streptococcus* (GAS) Infection Identified by Antigen Detection or Pathogen Culture

Variable	GAS Antigen Positive (n=156)	GAS Culture Positive (n=154)	Z/χ2 value	P value
Time to result (hours)	1.0 (1.0, 2.0)	48.0 (44.0, 52.0)	–	<0.001
Time to fever relief (days)	3.00(3.00, 4.00)	3.00(2.00, 4.00)	1.632	0.103
Time to sore throat relief (days)	3.00(3.00, 5.00)	4.00(3.00, 5.00)	−0.833	0.405
Recurrence			0.000	>0.999
Yes	3(1.92)	2(1.30)		
No	153(98.08)	152(98.70)		
Acute complications			0.780	0.377
Yes	10(6.41)	14(9.09)		
No	146(93.59)	140(90.91)		
Delayed complications	0	0	–	–

Notes: Data are presented as median (interquartile range) for continuous variables and number (%) for categorical variables. P values in italics. Bold indicates statistical significance (P<0.05). Z values correspond to the Mann–Whitney *U*-test for non-normally distributed continuous variables. χ^2 values correspond to the Pearson chi-square test for categorical variables. Fisher's exact test was used for Recurrence comparison due to low expected frequencies. χ^2 value reported as 0.000 due to extremely small observed difference; actual P value >0.999 indicates no significant difference. "-" indicates not applicable for statistical testing.

Abbreviation: GAS, Group A Streptococcus.

PPV, NPV) of RADT using culture as the reference standard within this study cohort, as this would require all patients to undergo both tests.

However, considering the 154 patients with positive cultures as a subset of true positives (despite some potential false negatives missed by culture itself), and acknowledging that the 156 patients with positive RADT results represent a group diagnosed by an alternative but clinically validated pathway, the study population structure itself reflects a high pre-test probability scenario. In such a setting, both positive RADT and positive culture results are used to definitively diagnose GAS infection and initiate treatment. The key finding of this study is that the clinical outcomes following treatment were equivalent regardless of whether the diagnosis was based on a positive RADT or a positive culture result.

Discussion

In this study of 310 children with GAS infections, treatment plans guided by RADT and conventional culture methods were highly consistent in key efficacy indicators, demonstrating clinical equivalence despite a substantial difference in diagnostic and treatment initiation times.

A pivotal finding is that the markedly faster diagnosis afforded by RADT (median 1 hour vs 48 hours for culture) did not translate into a detectable superiority in clinical outcomes such as time to symptom resolution or complication rates. This has critical implications for clinical decision-making. In our cohort, a positive RADT result led to immediate, same-day antibiotic prescription, adhering to the principle of early treatment to prevent complications and reduce transmission.[6,11] In contrast, the management of patients awaiting culture results often involved a period of clinical watchful waiting. Unless the clinical presentation was severe enough to warrant immediate empirical therapy, antibiotic initiation was deferred pending the culture result. Our data demonstrate that this delayed strategy did not lead to worse clinical outcomes. This supports the safety of a strategy that relies on culture confirmation in settings where rapid testing is unavailable and also validates the efficiency of the RADT-based pathway, which eliminates the diagnostic delay and provides prompt reassurance and treatment for patients and clinicians alike.

Although a formal cost-effectiveness analysis was beyond the scope of this retrospective study, the clinical findings strongly suggest potential economic and operational advantages for the RADT-based strategy in the outpatient paediatric setting. All patients were managed as outpatients with oral antibiotics, which frames the cost considerations. The principal cost components include the direct cost of the diagnostic test and the indirect costs associated with healthcare utilisation and productivity loss. Although the unit cost of an RADT kit exceeds that of a single culture plate, this must be weighed against the broader economic impact. The rapid turnaround time of RADT (approximately 1 hour) enables definitive diagnosis and treatment initiation within a single clinical encounter, eliminating the need for a second visit to

communicate culture results and prescribe antibiotics. This saves consultation costs and reduces the burden on families (eg missed work or school, transportation expenses). Earlier treatment may also reduce disease transmission within households and communities, potentially averting indirect costs associated with secondary cases. In contrast, the culture-based strategy, though having a lower direct test cost, incurs hidden costs through additional visits and delayed treatment that may prolong contagion. Therefore, despite the lack of a formal economic evaluation in this study, the substantial gain in diagnostic efficiency provided by RADT is likely to translate into overall cost savings for the healthcare system and society, especially when considering the high volume of paediatric GAS infections encountered in primary care. Future prospective studies should incorporate resource use data to enable robust cost-effectiveness analysis.

Laboratory diagnosis of GAS infection mainly relies on the RADT and conventional culture methods. The culture method provides higher accuracy, detects low concentrations of bacteria, and, in theory, can offer information on antibiotic resistance. However, it typically takes 24–48 hours to obtain the results.[12–14] For *S. pyogenes*, the utility of culture in guiding antibiotic choice (as opposed to confirmation of diagnosis) is limited in most settings. This is because of the organism's unwavering susceptibility to first-line beta-lactam antibiotics (eg penicillin, amoxicillin), making routine susceptibility testing unnecessary according to major guidelines.[6,12] Therefore, in our context, the primary clinical value of both RADT and culture was to confirm the diagnosis and justify the completion of a full course of empirical, yet highly effective, antibiotic therapy. This contextualises our finding of equivalent clinical outcomes: since antibiotic resistance is not a confounding factor in the treatment of GAS pharyngitis with beta-lactams, the key variable influencing outcome is the timing and adherence to therapy, not the selection of a specific agent based on susceptibility profiles.

The clinical equivalence observed in outcomes, even with the 48-hour treatment delay in the culture group, suggests that uncomplicated GAS pharyngitis/tonsillitis may allow a treatment window where culture-based confirmation remains effective. This is particularly relevant in resource-limited settings or clinical scenarios where rapid testing is not readily available. It provides evidence that a wait-and-see approach, supported by culture confirmation, does not necessarily compromise patient recovery. Conversely, RADT offers the distinct advantage of immediate decision-making, reducing uncertainty, minimising unnecessary antibiotic exposure in negative cases, and potentially improving patient satisfaction and compliance.

Research has indicated that appropriate use of RADT can effectively reduce unnecessary antibiotic prescription without increasing the risk of treatment failure. For example, Cohen et al found that patients without typical clinical symptoms do not require immediate antibiotic administration when the RADT is negative.[14] Similarly, Little et al concluded that in acute lower respiratory infections, patients with negative RADT results who were treated with placebo had outcomes comparable to those treated with antibiotics.[15] However, clinical studies have highlighted that children with negative RADTs with severe symptoms or high-risk factors still require a comprehensive assessment of their medical history, clinical presentation, and potential risk factors to determine the necessity of antibiotic treatment.[16–19] Therefore, a tiered treatment strategy is recommended in clinical decision-making: RADT-guided treatment should be prioritised for typical cases, and culture testing or empirical treatment should be considered for patients with negative RADT results with high clinical suspicion, especially those who are immunocompromised or have histories of close contact.[16–19] Even though waiting for culture results may delay treatment, standardised RADT screening can still provide timely and effective treatment without increasing the risk of complications.[16,20] Individualised treatment decisions should therefore integrate clinical circumstances, epidemiological data, and guidelines for antibiotic use to ensure precise treatment and reduce the occurrence of antibiotic resistance.

Both groups of children experienced a certain degree of recurrence in this study, consistent with the recurrent nature of GAS infections reported in international studies.[20–24] The mechanisms of recurrence may involve multiple factors: non-standardised antibiotic treatment (eg insufficient duration or improper dosage) may lead to incomplete bacterial clearance, the emergence of specific antibiotic-resistant strains increases treatment difficulty, and asymptomatic carriers among family members may become potential sources of persistent infection. Despite the standardised pathogen culture confirmation for recurrent cases conducted in this study, the exploration of host-specific factors remains limited.[23,24] Future research should include the in-depth investigation of genetic predispositions (eg HLA genotype), immune profile

(eg characteristics of innate immune responses), and microbiome features, as these factors may collectively influence recurrence risk and clinical outcomes.

Regarding the observation of long-term complications, our findings differ from studies in high-risk areas such as Australia.[7,25–27] Even though international literature extensively reports that GAS infections can lead to severe sequelae such as rheumatic fever and acute glomerulonephritis, no such cases were observed in this cohort during short-term follow-up. This discrepancy may be due to several factors: (1) differences in sample characteristics, including ethnic genetic backgrounds and regional epidemiological features; (2) the relatively limited sample size, which may impact the detection of rare complications; or (3) early standardised diagnostic and therapeutic interventions may have effectively prevented the occurrence of severe complications. Therefore, future research should include (1) multi-centre, large-sample prospective cohorts that include more representative populations; (2) the development of more precise biomarker detection systems to improve the predictive ability for complications; and (3) long-term follow-up (at least 6–12 months) to assess the impact of different treatment strategies on long-term prognosis. These in-depth explorations will provide critical evidence-based references for improving the diagnostic and therapeutic guidelines for GAS infections.

The primary objective of this study was to compare the clinical consequences of using RADT versus culture for diagnosis, rather than to re-validate the analytical sensitivity and specificity of the RADT kit itself, which has been well-established in prior studies.[12–14,19] Our results demonstrate that when RADT is implemented according to the guidelines in symptomatic patients, the clinical outcomes are excellent and comparable to those achieved by waiting for culture results. This reinforces the value of RADT as a practical and effective tool for point-of-care decision-making.

This study has several limitations inherent to its retrospective, single-centre design. First, the sample size was determined by the available eligible cases rather than a priori power calculation, though a post-hoc analysis confirmed sufficient power for the primary outcome. Second, and most importantly, the real-world study design did not permit a direct head-to-head comparison of the diagnostic accuracy (sensitivity/specificity) of RADT against culture, as patients with a positive RADT were not routinely cultured. This was a necessary consequence of the clinical protocol to initiate immediate treatment upon a positive RADT. Third, antimicrobial susceptibility testing was not performed, consistent with global guidelines given the presumed universal susceptibility of GAS to beta-lactams; however, this precludes formal confirmation of susceptibility in our local isolates. Fourth, the sample size, while adequate for comparing primary outcomes, may be underpowered to detect very small differences or rare complications. Fifth, while the potential economic advantages of RADT were discussed based on workflow efficiency, no formal cost-benefit analysis was conducted due to concerns regarding patient and family privacy. Therefore, our economic discussion remains grounded in reasonable clinical workflow projections rather than precise calculations. Finally, the 3-month follow-up period, while sufficient for capturing most acute sequelae, might be too short to detect very late-onset complications such as rheumatic fever.

In conclusion, although the RADT and pathogen culture differ markedly in their time to result, this study demonstrates that both diagnostic strategies lead to equivalent clinical outcomes in paediatric GAS infections. The RADT-based pathway enables immediate treatment initiation, optimising efficiency and potentially reducing disease transmission, whereas the culture-based pathway, despite involving a treatment delay of approximately 48 hours, remains a safe and effective alternative, particularly in settings where rapid testing is not feasible. These findings reinforce the value of RADT as a first-line screening tool and provide reassurance regarding the safety of culture-guided treatment when necessary.

Data Sharing Statement

All data generated or analyzed during this study are included in this published article.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from Beijing United Family Hospital (BJUEC2025-03-005-K05). Written informed consent was obtained from all parents/local guardians.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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