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Original research

EFFICACY OF THE STREP A RAPID ANTIGEN DETECTION TEST IN REDUCING UNNECESSARY ANTIBIOTIC PRESCRIPTIONS FOR ACUTE TONSILLOPHARYNGITIS IN PEDIATRIC PATIENTS

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ABSTRACT

Introduction: *Acute tonsillopharyngitis caused by Group A beta-hemolytic streptococcus (GABHS) is a common condition in pediatric populations, often leading to the overprescription of antibiotics. This is a pressing issue both in Vietnam and globally, where accurate diagnosis plays a crucial role in reducing antibiotic overuse and mitigating Antimicrobial Resistance. This study evaluates the effectiveness of the Strep A Rapid Antigen Detection Test (RADT) in diagnosing GABHS and reducing inappropriate antibiotic prescriptions in children at Children's Hospital 1, Ho Chi Minh City.*

Methods: *A cross-sectional study was conducted on 200 children with fever and/or sore throat, diagnosed with acute tonsillopharyngitis. Symptoms were assessed using the Modified Centor Score, and the Strep A RADT was performed to confirm GABHS infection. The study evaluated the impact of Strep A RADT on antibiotic prescription rates and its applicability in clinical practice.*

Results: *Among the 200 patients aged 1 to 15 years (mean age 6.39 ± 3.05 years), 39% tested positive for GABHS. The RADT demonstrated a sensitivity of 87.3% and specificity of 95.8%. Antibiotic prescriptions were reduced by 57.5%, from 96.5% pre-RADT to 39% post-RADT. This reduction highlights the role of Strep A RADT in minimizing unnecessary antibiotic use and improving antibiotic stewardship.*

Conclusions: *Strep A RADTs are advantageous due to their high sensitivity, specificity, ease of use, and short turnaround time. The combination of this RADT with the Modified Centor Score is beneficial in reducing unnecessary antibiotic prescriptions by up to 57.5%.*

Keywords: *Acute tonsillopharyngitis; GABHS; Rapid Strep A Test; Streptococcus Pyogenes; Modified Centor Score.*

I. BACKGROUND

Acute pharyngitis and tonsillitis are among the most prevalent infections affecting children worldwide, typically caused by viruses or bacteria. Group A beta-hemolytic streptococcus (GABHS) is the most common bacterial aetiology, responsible for 20-30% of all cases in children, particularly those aged 5-15 years [1]. It is one of main reason for antibiotic prescriptions. First-line antibiotics for GABHS include penicillin V and amoxicillin, while alternatives like cephalexin, clindamycin, or macrolides (e.g., azithromycin) are used for patients with penicillin allergy [2].However, the overlap of clinical features caused by viruses and bacteria presents a challenge for clinicians. Misdiagnosing GABHS can lead to either under-treatment of bacterial infections, resulting in serious complications like rheumatic fever and acute glomerulonephritis or unnecessary antibiotic prescriptions for viral or non-bacterial infections. This contributes to the growing global problem of Antimicrobial Resistance. This issue is more serious due to the overuse antibiotics,

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which is particularly pressing in Vietnam, where the high empirical prescription of antibiotics for acute respiratory infections is well-documented. Recent reports indicate that over 97% of pediatric patients diagnosed with acute tonsillopharyngitis are prescribed antibiotics, many of whom may not have actually required such therapy [3]. The need for accurate, rapid diagnostic tools that can differentiate between viral and bacterial infections is critical in curbing the overuse of antibiotics. Bacterial culture remains the gold standard for the accurate diagnosis of GABHS. Nevertheless, its clinical utility is limited by the 24-48-hour turnaround time required for results, which may delay timely treatment decisions. In addition, the procedure necessitates access to specialized laboratory equipment and expertise, making it less feasible for resource-limited settings. The Strep A RADT has been proposed as a potential solution to this problem. RADTs allow for the quick and reliable identification of GABHS, enabling clinicians to make informed decisions about antibiotic prescribing. Previous studies have demonstrated that RADTs have high sensitivity and specificity, making them a valuable tool in clinical settings where rapid decision-making is essential [4]. By improving diagnostic accuracy, RADT has the potential to significantly reduce unnecessary antibiotic use, thereby contributing to the broader goal of combating AMR.

This study aims to evaluate the effectiveness of the RADT in reducing unnecessary antibiotic prescriptions for pediatric patients presenting with acute tonsillopharyngitis at Children's Hospital 1, Ho Chi Minh City, Vietnam. We hypothesized that by applying this RADT, antibiotic use for acute tonsillopharyngitis will be more appropriately targeted, leading to better clinical outcomes and a reduction in antibiotic misuse. The study also explores the impact of combining RADT with the Modified Centor Score, a clinical scoring system used to estimate the likelihood of GABHS infection based on patient symptoms.

II. MATERIAL AND METHODS

2.1. Study design

This cross-sectional descriptive study was conducted over a six-month period, from December 2023 to June 2024, at the department of Otolaryngology, Children's Hospital 1. The primary objective was to assess the diagnostic accuracy of the Strep A RADT in pediatric patients with symptoms of acute tonsillopharyngitis and to determine the test's impact on antibiotic prescription rates. This design was chosen as it allows for the collection of data from a defined population at a specific point in time, making it suitable for evaluating the diagnostic performance of a clinical tool like RADT and its real-world applicability in reducing antibiotic use.

2.2. Participants

Inclusion Criteria: Pediatric patients aged between 1 and 15 years presenting with symptoms suggestive of acute tonsillopharyngitis, including fever, sore throat, signs of tonsillar, and/ or tender cervical lymphadenopathy. A Modified Centor Score of 3 or higher, indicating a higher likelihood of GABHS infection. Informed consent was obtained from the parents or guardians of all participants. The inclusion of patients with a Centor Score ≥ 3 ensured that the study focused on individuals at higher risk of bacterial infection, where diagnostic testing would have the most clinical impact.

Exclusion criteria: Patients with warning signs, including complications such as peritonsillar abscess or systemic infections (e.g., sepsis). Patients were diagnosed with the specific agent identified through tests. Patients who had received antibiotics prior to enrollment were excluded to avoid interference with diagnostic accuracy. The exclusion criteria were implemented to prevent confounding factors that might affect the accuracy of the RADT or skew the interpretation of results.

2.3. Sample size calculation

The sample size was calculated based on the prevalence of GABHS in previous studies, which was estimated at 8.5% [5]. Using a confidence interval of 95% and a margin of error of 4%, a minimum sample size of 187 was determined. To ensure the study's power, a final sample of 200 patients was included.

Sampling method: A convenience sampling technique was used, with a structured recruitment process implemented for all patients attending the Otolaryngology Clinic at Children's Hospital 1. Eligible patients were those presenting with symptoms of fever or sore throat and acute

tonsillopharyngitis suspected to be caused by GABHS, who were evaluated by the researchers based on inclusion and exclusion criteria.

2.4. Data collection

Clinical Evaluation: A comprehensive clinical evaluation by an otolaryngologist. The key symptoms, including fever, sore throat, exudative tonsils, tender cervical lymphadenopathy, and the absence of cough, were assessed and scored

These symptoms were scored using the Modified Centor criteria, a validated scoring system used to estimate the likelihood of GABHS infection. The Modified Centorcore assigns points based on the following criteria (Table 1).

Table 1: The Modified Centor Score

Fever (≥ 38°C):	**1 point**
Tonsillar exudates	1 point
Tender anterior cervical lymphadenopathy	1 point
Absence of cough	1 point
Aged from 3 to 10 years	1 point

A total score of 3 or higher is associated with an increased probability of GABHS infection and is typically used to guide further diagnostic testing.

Rapid Antigen Detection Test (RADT): Throat swabs were collected from all patients meeting the inclusion criteria, and processed using the SD Bioline Strep A kit (Standard Diagnostics, Korea). The RADT is based on chromatographic immunoassay technology that detects GABHS antigens directly from throat swab samples. Results were available within 10-15 minutes, making it a practical tool for use in outpatient settings where rapid decision-making is essential. The RADT has been validated in previous studies, demonstrating a sensitivity of 87.3% and specificity of 95.8% [4].

Antibiotic Prescribing Practices: Data were collected on the antibiotic prescribing practices of clinicians before and after the introduction of RADT. Prior to the use of RADT, antibiotics were prescribed empirically based on clinical judgment alone. After RADT, antibiotics were only prescribed to patients with positive test results for GABHS. The primary outcome of interest was the reduction in antibiotic prescription rates following the introduction of RADT.

2.5. Statistical analysis

All data were entered and managed using Epidata and analyzed using Stata 14.0 software. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as means ± standard deviation. The Chi-square test was employed to assess the correlation between Strep A test result and the Modified Centor Score. If more than 20% of the total cells had expected value less than 5, the Fisher test is used instead of the Chi-squared test. A significance level of $p < 0.05$.

In addition, multivariate logistic regression analysis was performed to identify factors associated with positive RADT results and the likelihood of antibiotic prescription post-RADT. This analysis allowed for the adjustment of potential confounders, providing a more accurate assessment of the impact of RADT on clinical decision-making.

III. RESULTS

The study involved 200 pediatric patients with an age range from 1 to 15 years (mean age was 6.39 ± 3.05 years. The sample was predominantly male, accounting for 61.5% of the participants. The age distribution indicated the largest proportion being 5-year-olds (18%). Children between 5 and 7 years old represented the most commonly affected age group, accounting for 40% of the total study population (Table 2). The age distribution aligns with epidemiological data showing that GABHS infections are most prevalent in school-aged children.

Table 2: Age Distribution of Study Participants (n=200)

Age (years)	**Number of patients**	**Percentage (%)**
1	3	1.5
2	24	12.0
3	8	4.0
4	16	8.0
5	36	18.0
6	26	13.0

Age (years)	Number of patients	Percentage (%)
7	18	9.0
8	20	10.0
9	16	8.0
10	15	7.5
11	7	3.5
12	4	2.0
13	3	1.5
14	1	0.5
15	3	1.5
Total	200	100

The key clinical features observed in the patients included fever (97.5%) and sore throat (58%). Through clinical examination, it was noted that all patients (100%) had exudative/purulent tonsils, while 60% exhibited tender cervical lymphadenopathy. Notably, a majority of patients (78.5%) report the absence of cough, which is a key clinical indicator used to differentiate bacterial from viral pharyngitis. These finding were presented in Table 3. The high prevalence of fever, exudative tonsils, and absence of cough aligns with the classical presentation of bacterial tonsillopharyngitis, particularly GABHS infections. In this sample population, the group of patients with a Centor Score of 4 and 5 dominanted, accounting for 41.5% and 40.5%, respectively.

Table 3: Clinical Symptoms of Patients (n=200)

Symptoms	Number of patients	Percentage (%)
Sore throat	116	58.0
Fever > 38ºC	195	97.5
Absence of cough	157	78.5
Exudative tonsils	200	100
Tender Cervical Lymphadenopathy	120	60.0

Out of the 200 patients, 78 patients (39%) tested positive for GABHS using the RADT, while 122 patients (61%) tested negative (Table 4). The results, showing that GABHS (+) in the study group was 39%, are consistent with previous studies in similar pediatric populations

Table 4: Rapid Strep A test results

Strep A Test Result	Number of patients	Percentage (%)
Positive	78	39.0
Negative	122	61.0
Total	200	100

The Modified Centor Score showed association with Strep A Test Results ($p = 0.00<0.05$), with higher Centor Scores correlating with a greater likelihood of a positive RADT result. Among patients with a Centor Score of 5, 55.6% tested positive for GABHS, while only 11.1% of those with a score of 3 had positive results (Table 5).

The positive predictive value of a Centor Score of 5 was significantly higher than that of a score of 3, indicating that the clinical scoring system remains a valuable tool in predicting GABHS infection, particularly when combined with RADT.

Table 5: Association Between Modified Centor Score and Strep A RADT Results

Modified Centor Score	Positive RADT Result (%)	Negative RADT Result (%)	Total
3	11.1	88.9	36
4	34.9	65.1	83
5	55.6	44.4	81

Impact of Strep A RADT on Antibiotic Prescriptions. Before the implementation of RADT, antibiotics were empirically prescribed to 96.5% of patients based on clinical assessment alone, most commonly including amoxicillin, amoxicillin-clavulanate, and macrolides. Following the application of the Strep A test, antibiotics were only prescribed to patients who tested positive, reducing the prescription rate to 39%. This significant reduction highlights the effectiveness of RADT in avoiding unnecessary antibiotic use in children with negative test results.

Time Efficiency. The average time to complete RADT was 14 + 0.65 minutes, with minimum of 13 minutes. The short time frame further enhances the test's practicality in a clinical setting, enabling prompt treatment decisions.

Adverse Events. No significant adverse events were reported in relation to the use of RADT. A small number of patients (n = 7, 3.5%) experienced transient discomfort, such as gagging or coughing during the throat swab collection, but these symptoms resolved spontaneously without requiring further intervention.

IV. DISCUSSION

The study sample consisted of 200 patients aged 1 to 15 ages, with a mean age of 6.39 ± 3.05 years and a male predominance (61.5%). These results are consistent with many national and international studies on this condition in children. Authors have reported a higher incidence of GABHS infection in patients aged around 5-7 years, with most studies indicating a male predominance in their sample populations, though the reasons behind this remain unclear. In Vietnam, this pattern is similar to the Trần Thiện Ngọc Thảo's study conducted at Children's Hospital 1 in 2019, reinforcing the consistency of disease models in the local context [5].

The clinical data showed that fever (97.5%) and sore throat (58%) were chief complaints, while exudative/purulent tonsils (100%) and cervical lymphadenopathy (60%) were the most common physical symptoms in the study group. Additionally, the absence of cough in 78.5% of patients further supports the bacterial origin of the condition, aligning with diagnostic guidelines that emphasize the importance of symptomatology in differentiating between viral and bacterial causes. The clinical symptoms observed in the study sample are commonly associated with acute tonsillopharyngitis caused by GABHS. This finding is consistent with several similar studies, such as Tran Thien Ngoc Thao, Shaikh et al., which reported fever and sore throat as the primary reasons for pediatric consultation [2, 5]. Kose, et al.'s study of 223 samples noted exudative/purulent tonsils in 95.5% of cases [6].

The Modified Centor Score is a clinical assessment tool. According to the score guidelines and our study results, a higher Modified Centor Score is associated with an increased likelihood of GABHS infection. Studies by Fine et al and Anne W. Rimoin et al in Brazil and Croatia have reported similar findings, further demonstrating the score's diagnostic value [7, 8]. However, the clinical utility of the Centor Score alone is limited by its inability to definitively distinguish between bacterial and viral infections. In this study, the combination of the Modified Centor Score with RADT significantly improved diagnostic accuracy.

Patients with higher Centor Scores (4 or 5) were much more likely to test positive for GABHS on RADT, confirming the predictive value of the Centor Score when used in conjunction with rapid diagnostic testing. This finding is consistent with previous research, which has demonstrated that combining clinical scoring systems with RADT increases the specificity of the diagnosis and reduces the risk of unnecessary antibiotic use [3]. The use of both tools in tandem allows clinicians to more accurately identify patients who would benefit from antibiotics, while avoiding the overuse of these drugs in patients with viral infections.

The study reported a GABHS positive rate of 39% through RADT, consitent with numerous studies on pediatric populations. For example, Anne W. Rimoin et al. and Ayanrouh et al. found that the prevalence of GABHS in children with tonsillopharyngitis ranged from 25% to 35%, depending on the population studied [8, 9]. Our study result, conducted at Children's Hospital 1, aligns with these international figures, further emphasizing the importance of using Strep A RADT in clinical practice to confirm GABHS infections.

Impact on Antibiotic Prescription: The primary finding of this study is the substantial reduction in antibiotic prescriptions following the implementation of RADT. Prior to the use of RADT, 96.5% of pediatric patients with acute tonsillopharyngitis were prescribed antibiotics empirically, based on clinical symptoms alone. After RADT was introduced, the rate of antibiotic prescriptions dropped to 39%, representing a 57.5% reduction. This result is consistent with findings from other studies that have demonstrated similar reductions in antibiotic use following the introduction of RADTs

for GABHS. For instance, Kose et al. and Steve Ayanruoh reported a decrease of approximately 42.6 to 50% in antibiotic prescriptions after using Strep A RADTs in the diagnosis of acute tonsillopharyngitis caused by GABHS [6, 9]. These significant reduction highlights the impact of the test on improving antibiotic stewardship.

The results of this study suggest that RADT could play an important role in mitigating this problem by providing a rapid and accurate diagnosis of GABHS, enabling clinicians to make more informed decisions about antibiotic use.

The study also found that the average time to complete a Strep A RADT was 14 + 0.65 minutes, including both sample collection and result interpretation. This quick turnaround time is an essential advantage in busy clinical settings, particularly in pediatric outpatient clinics, the ability to quickly diagnose GABHS allows for timely treatment. This is especially important in managing high patient volumes, where delays in diagnosis can lead to prolonged waiting times and increased pressure on healthcare resources. Compared to throat cultures, which can take at least 24 to 48 hours to produce results, the Strep A test allows for immediate diagnosis and treatment decisions. Therefore, RADT not only improves patient management, but also enhances patient satisfaction.

Moreover, the safety profile of RADT was excellent, with no serious adverse events reported in this study. The few cases of transient discomfort during throat swab collection were mild and resolved spontaneously, suggesting that RADT is well-tolerated in pediatric populations. These findings further support the feasibility of incorporating RADT into routine clinical practice [10].

Limitations

While this study provides valuable insights into the efficacy of RADT in reducing antibiotic prescriptions, several limitations should be acknowledged. First, the study was conducted at a single pediatric hospital in Ho Chi Minh City, which may limit the generalizability of the findings to other regions in Vietnam, particularly rural areas with different healthcare infrastructures. Second, the study did not assess the cost-effectiveness of RADT compared to traditional diagnostic methods, such as throat cultures. Future research should explore the economic implications of RADT implementation, particularly in terms of cost savings from reduced antibiotic use and shorter treatment times.

Another important limitation is the absence of confirmatory bacterial culture, which limits the ability to fully validate RADT performance, especially in cases of potential false negatives. While RADT demonstrated high sensitivity in this study, clinicians should interpret negative results with caution in patients presenting a high Modified Centor Score. In such cases, follow-up testing or empirical antibiotic therapy may be justified if clinical suspicion remains strong [4].

V. CONCLUSION

The Strep A RADT significantly reduces unnecessary antibiotic prescriptions in pediatric tonsillopharyngitis. Combined with the Modified Centor Score, it enhances diagnostic accuracy, improving antibiotic stewardship and mitigating AMR risks

Competing interests

No potential conflict of interest relevant to this article was reported.

Ethical statement

This study was approved by the Institutional Review Board (IRB) of Children's Hospital 1 in Ho Chi Minh City (No:60/GCN-BVND1), dated 08/04/2024.

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