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Rapid Antigen Testing for Acute Pharyngitis in a Tertiary Hospital in Chad: A Prospective Cross-Sectional Study

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Abstract

Background: Acute pharyngitis is a common reason for consultation in otorhinolaryngology. Distinguishing viral from bacterial etiologies, particularly group A streptococcal (GAS) infection, is essential to reduce inappropriate antibiotic prescribing, especially in low-resource settings where rapid antigen detection testing (RADT) is not widely implemented. **Objective:** To assess the value of RADT in the management of acute pharyngitis at the Renaissance University Hospital Center in N'Djamena, Chad. **Methods:** We conducted a descriptive cross-sectional study with prospective data collection over 18 months. Patients aged ≥3 years presenting with acute pharyngitis were included. All underwent clinical examination with McIsaac score calculation. RADT was performed systematically in children aged 3 - 15 years and in adolescents/adults (≥16 years) when the McIsaac score was ≥3. Data were analyzed using SPSS version 26.0. **Results:** A total of 136 patients were included (mean age 19.8 ± 13.2 years; male-to-female ratio 0.92). RADT was performed in 91/136 patients (66.9%), including all children and only adolescents/adults with a McIsaac score ≥ 3. Among this selected subgroup, RADT was positive in 65/91 cases (71.4%). RADT positivity was significantly associated with the McIsaac score ($p < 0.05$). All RADT-positive patients received antibiotics, whereas most RADT-negative patients did not; RADT result was strongly associated with antibiotic prescribing (Fisher's exact test, $p < 0.001$). **Conclusion:** Rapid antigen testing appears to be a useful tool for guiding antibiotic prescription in acute pharyngitis, particularly in resource-limited settings, by reducing unnecessary antibiotic use.

Keywords

Acute Pharyngitis, Rapid Antigen Detection Test, Group A Streptococcus, Antibiotic Prescribing

1. Introduction

Acute pharyngitis is one of the most common reasons for consultation in general practice and otorhinolaryngology, particularly among children and young adults [1] [2]. Although most cases are of viral origin, a substantial proportion of acute pharyngitis is caused by *Streptococcus pyogenes* (group A streptococcus), for which antibiotic therapy is indicated in order to prevent potentially serious complications such as acute rheumatic fever and post-streptococcal renal disease [3] [4].

In daily clinical practice, the diagnosis of acute pharyngitis still relies largely on clinical assessment. Several clinical scoring systems, including the McIsaac score, have been developed to estimate the likelihood of streptococcal infection [5]. However, these tools have limited predictive value and do not always allow reliable differentiation between bacterial and viral pharyngitis [6]. This diagnostic uncertainty often leads to excessive and sometimes inappropriate antibiotic prescribing, contributing to the emergence of antimicrobial resistance, which is now recognized as a major global public health concern [7].

Rapid antigen detection testing (RADT) for group A streptococcal pharyngitis represents a simple, rapid, and recommended approach to improve diagnostic accuracy and guide therapeutic decision-making [8] [9]. Its benefit has been well established in high-income countries, where its use has been shown to significantly reduce unnecessary antibiotic prescriptions [8]. In contrast, in low-resource settings, the integration of RADT into routine clinical practice remains insufficiently documented, particularly in hospital settings, due to constraints related to accessibility, healthcare worker training, and health system organization [10] [11].

In Chad, the hospital-based management of acute pharyngitis still relies predominantly on clinical evaluation, as RADT for group A streptococcal pharyngitis is not routinely used in everyday practice. This situation occurs in a context characterized by a high patient burden, limited access to conventional microbiological investigations, and frequent reliance on empirical antibiotic therapy, making the evaluation of RADT under real-world clinical conditions particularly relevant.

This study therefore provides original data from a tertiary university hospital, contributing to the documentation of the role of RADT in the diagnostic and therapeutic management of acute pharyngitis in a low-resource setting.

The objective of this study was to assess the value of rapid antigen detection testing in the diagnosis and management of acute pharyngitis at the Renaissance University Hospital Center in N'Djamena, Chad.

2. Materials and Methods

2.1. Study Design

This was a prospective cross-sectional descriptive study including both descriptive and analytical components.

2.2. Study Setting and Period

The study was conducted at the Renaissance University Hospital Center in N'Djamena, Chad, a tertiary referral hospital with a dedicated otorhinolaryngology department. Data collection was carried out over an 18-month period, from July 1, 2022 to December 31, 2023.

2.3. Study Population

The study population consisted of patients aged 3 years and older who presented with acute pharyngitis to the otorhinolaryngology department of the Renaissance University Hospital Center during the study period.

2.4. Inclusion and Non-Inclusion Criteria

Patients aged 3 years and older presenting with acute pharyngitis were included after receiving information about the study and providing consent.

Patients with complicated pharyngitis, those who had received prior antibiotic therapy, and patients or legal guardians who declined participation were not included.

2.5. Clinical Assessment and McIsaac Score

All included patients underwent a systematic clinical examination performed by the consulting clinician. The McIsaac score, validated for patients aged 3 years and older, was calculated during the consultation. The score is based on five clinical criteria (fever >38˚C, absence of cough, tender anterior cervical lymphadenopathy, tonsillar hypertrophy or exudate, and age) and ranges from −1 to 5, with higher scores indicating a greater probability of group A streptococcal infection.

2.6. Rapid Antigen Detection Test: Characteristics and Indications

The rapid antigen detection test (RADT) for group A streptococcal pharyngitis was continuously available throughout the study period. It was an immunochromatographic qualitative test detecting group A streptococcal antigen from a pharyngeal swab.

RADT was performed systematically in children aged 3 to 15 years. In adolescents and adults (≥16 years), RADT was recommended when the McIsaac score was ≥3; however, due to a high clinical workload and organizational constraints related to patient flow, the test could not be performed systematically in all eligible patients. RADT was not performed in patients with a McIsaac score <3. Each test included an internal control band and was used in accordance with the manufac-

turer's recommendations.

During the study period, rapid antigen detection tests were provided free of charge to patients as part of routine hospital care, ensuring that economic barriers did not influence test utilization.

2.7. Sampling Procedure and Interpretation of RADT

Pharyngeal sampling was performed using a sterile swab rubbed over both tonsils and the posterior pharyngeal wall, avoiding contact with adjacent oral structures. Results were obtained after an approximate reading time of 5 minutes and interpreted by the clinician based on the presence of test and control bands.

RADT sampling and interpretation were performed by the attending physicians of the otorhinolaryngology department, all of whom received standardized training on RADT procedures prior to the start of the study.

2.8. Data Collection

Data were collected prospectively using a standardized data collection form completed by the consulting clinician. Collected variables included sociodemographic characteristics, clinical findings, McIsaac score, performance and result of RADT, and antibiotic prescription.

2.9. Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0. Descriptive and analytical analyses were performed to assess the association between the McIsaac score and RADT results, as well as between RADT results and antibiotic prescription. Pearson's chi-square test or Fisher's exact test was used as appropriate, with statistical significance set at $p < 0.05$.

2.10. Ethical Considerations

The study was conducted in accordance with ethical principles for health research. Participation was voluntary after appropriate information. For patients under 18 years of age, parental or guardian consent was required. Anonymity and confidentiality of data were strictly ensured.

3. Results

3.1. Sociodemographic Characteristics of Patients

A total of 136 patients aged between 3 and 67 years were included in the study. The mean age was 19.8 ± 13.2 years. The 3 - 15-year age group was the most represented, with 69 patients (50.7%), followed by the 16 - 28-year group (33 patients; 24.3%) and the 29 - 41-year group (24 patients; 17.6%).

There were 71 females (52.2%) and 65 males (47.8%), yielding a male-to-female ratio of 0.92.

The distribution of patients according to age and sex is presented in **Table 1**.

Table 1. Distribution of patients by age group and sex (n = 136).

Age group (years)	Total n (%)	Male n (%)	Female n (%)
3 - 15	69 (50.7)	36 (52.2)	33 (47.8)
16 - 28	33 (24.3)	13 (39.4)	20 (60.6)
29 - 41	24 (17.6)	11 (45.8)	13 (54.2)
42 - 54	8 (5.9)	4 (50.0)	4 (50.0)
55 - 67	2 (1.5)	1 (50.0)	1 (50.0)
Total	136 (100)	65 (47.8)	71 (52.2)

Percentages by sex were calculated within each age group.

3.2. Distribution of Patients According to McIsaac Score

The McIsaac score ranged from 1 to 5. Score 4 was the most frequently observed, recorded in 52 patients (38.2%), followed by score 3 in 28 patients (20.6%). The detailed distribution of McIsaac scores is shown in Table 2.

Table 2. Distribution of patients according to McIsaac score (n = 136).

McIsaac score	n	%
1	10	7.4
2	19	14.0
3	28	20.6
4	52	38.2
5	27	19.9
Total	136	100

3.3. Performance of the Rapid Antigen Detection Test

The rapid antigen detection test (RADT) was performed in 91 patients, representing 66.9% of the total study population (91/136).

All patients aged 3 - 15 years underwent RADT (69/69). Among patients aged 16 years and older (n = 67), RADT was performed in 22 patients (32.4%), while 45 patients (67.6%) were not tested. This included 16 adults with a McIsaac score of 3 who were eligible for testing but did not undergo RADT due to logistical and organizational constraints.

The distribution of RADT performance according to age group is presented in Table 3.

Table 3. Performance of RADT according to age group (n = 136).

Age group (years)	Total n (%)	RADT performed n (%)	RADT not performed n (%)
3 - 15	69 (50.7)	69 (100)	0 (0)
≥16	67 (49.3)	22 (32.4)	45 (67.6)
Total	136 (100)	91 (66.9)	45 (33.1)

Percentages were calculated by row.

3.4. Results of the Rapid Antigen Detection Test

Among the 91 patients who underwent RADT, the test was positive in 65 patients (71.4%) and negative in 26 patients (28.6%).

Most RADT-positive results were observed in children aged 3 - 15 years, accounting for 56 cases.

The distribution of RADT results by age group is presented in Table 4.

RADT positivity was significantly more frequent in patients aged 3 - 15 years compared with those aged 16 years and older (Fisher's exact test, $p < 0.01$) (Table 5).

Table 4. RADT results according to age group (n = 91).

Age group (years)	RADT performed n (%) of 136	RADT positive n (%) within tested group	RADT negative n (%) within tested group
3 - 15	69 (50.7)	56 (81.2)	13 (18.8)
16 - 28	13 (9.6)	5 (38.5)	8 (61.5)
29 - 41	8 (5.9)	3 (37.5)	5 (62.5)
42 - 54	1 (0.7)	1 (100)	0 (0)
55 - 67	0 (0.0)	—	—
Total	91 (66.9)	65 (71.4)	26 (28.6)

Table 5. Association between age group and RADT result (n = 91).

Age group (years)	RADT positive n (%)	RADT negative n (%)	Total tested n (%)
3 - 15	56 (81.2)	13 (18.8)	69 (75.8)
≥16	9 (40.9)	13 (59.1)	22 (24.2)
Total	65 (71.4)	26 (28.6)	91 (100)

Statistical test: Fisher's exact test; $p < 0.01$. Percentages were calculated by row.

3.5. Association between McIsaac Score and RADT Result

Among the 91 tested patients, RADT positivity increased with higher McIsaac scores. RADT was positive in 25.0% of patients with a score of 3, 75.0% with a score of 4, and 85.2% with a score of 5.

Table 6. Association between McIsaac score and RADT result among tested patients (n = 91).

McIsaac score	RADT positive n (%)	RADT negative n (%)	Total n (%)
3	3 (25.0)	9 (75.0)	12 (13.2)
4	39 (75.0)	13 (25.0)	52 (57.1)
5	23 (85.2)	4 (14.8)	27 (29.7)
Total	65 (71.4)	26 (28.6)	91 (100)

Statistical test: Fisher's exact test; $p < 0.05$. RADT positive and negative percentages were calculated by row. Percentages in the "Total" column were calculated based on tested patients (n = 91).

Statistical analysis showed a significant association between McIsaac score and RADT result (Fisher's exact test, $p < 0.05$). Detailed results are shown in Table 6.

3.6. Antibiotic Prescription

Among the 91 patients who underwent RADT, antibiotic therapy was prescribed in 69 patients (75.8%).

All patients with a positive RADT result (65/65) received antibiotic treatment. Among patients with a negative RADT result, antibiotics were prescribed in 4 cases (15.4%), while 22 patients (84.6%) did not receive antibiotic therapy. Among the RADT-negative patients who received antibiotics, severe clinical signs were observed, including persistent high fever, marked tonsillar inflammation, or significant cervical lymphadenopathy.

Statistical analysis using Fisher's exact test demonstrated a highly significant association between RADT result and antibiotic prescription ($p < 0.001$). The relationship between RADT result and antibiotic prescription is presented in Table 7.

Table 7. Association between RADT result and antibiotic prescription (n = 91).

RADT result	Antibiotics prescribed n (%)	Antibiotics not prescribed n (%)	Total n (%)
Positive	65 (100)	0 (0)	65 (71.4)
Negative	4 (15.4)	22 (84.6)	26 (28.6)
Total	69 (75.8)	22 (24.2)	91 (100)

Statistical test: Fisher's exact test; $p < 0.001$. Percentages were calculated by row.

4. Discussion

The present study provides original data on the diagnostic and therapeutic management of acute pharyngitis in a tertiary hospital in sub-Saharan Africa. It highlights the value of the rapid antigen detection test (RADT) as a clinical decision-support tool, both for diagnostic orientation and for the rationalization of antibiotic prescribing, in a resource-limited setting.

4.1. Patient Profile and Distribution of Acute Pharyngitis

The study population was predominantly young, with a majority of patients aged 3 - 15 years, accounting for more than half of the included cases. This age distribution is consistent with international data showing that acute pharyngitis, particularly streptococcal pharyngitis, primarily affects school-aged children and adolescents [4] [12].

The near-equal sex ratio observed in our series is also comparable to that reported in other clinical and epidemiological studies, suggesting no marked sex-related difference in the occurrence of acute pharyngitis [1] [8].

4.2. Contribution of the McIsaac Score to Diagnostic Orientation

The McIsaac score is a validated clinical tool used to estimate the probability of

streptococcal pharyngitis and to guide diagnostic strategies [5] [6]. In our study, high scores (4 and 5) were frequently observed, reflecting a strong initial clinical suspicion of bacterial infection.

However, the association between the McIsaac score and RADT results showed that, despite a statistically significant correlation, some patients with high clinical scores had negative RADT results. This finding is consistent with previous studies indicating that clinical scores, while useful for triage, are insufficient on their own to reliably confirm group A streptococcal infection [2] [6] [13]. The McIsaac score should therefore be regarded as a tool for clinical orientation rather than a definitive diagnostic test.

4.3. Utility of RADT in Our Setting

In our series, RADT was positive in 71.4% of tested patients. This relatively high positivity rate should be interpreted with caution. It is largely explained by the targeted testing strategy adopted, based on strict clinical criteria, particularly among adolescents and adults, in whom RADT was performed only when the McIsaac score was ≥3.

This approach introduces a selection bias, as RADT was not performed in all patients presenting with acute pharyngitis, especially among those aged 16 years and older with low clinical scores. Consequently, the proportion of RADT-positive results among tested patients does not reflect the true prevalence of streptococcal pharyngitis in the overall study population.

Moreover, in the absence of microbiological culture as a reference standard, our study does not allow assessment of the sensitivity or specificity of RADT. Rather, it primarily evaluates the practical usefulness of RADT in clinical decision-making, rather than its intrinsic diagnostic performance, as emphasized in previous methodological studies [9] [14] [15].

4.4. Impact of RADT on Antibiotic Prescribing

One of the major findings of this study is the highly significant association between RADT results and antibiotic prescription. All patients with a positive RADT received antibiotic therapy, whereas most patients with a negative RADT did not.

These results indicate that RADT contributed to better alignment between therapeutic decisions and objective diagnostic evidence, thereby limiting unnecessary antibiotic prescriptions. This observation is consistent with numerous studies demonstrating that integrating RADT into the management of acute pharyngitis significantly reduces inappropriate antibiotic use [3] [8] [14].

In a context marked by the growing burden of antimicrobial resistance, particularly in sub-Saharan Africa, this impact represents an important public health benefit [7] [16].

4.5. Relevance of RADT in African and Resource-Limited Settings

In sub-Saharan Africa, the management of acute pharyngitis often relies solely on

clinical assessment, due to limited access to microbiological investigations and organizational constraints within health systems [10] [11]. Several African studies have reported a tendency toward antibiotic overprescription for upper respiratory tract infections, contributing to the emergence of bacterial resistance [16]-[18].

Our study demonstrates that the rational use of RADT is feasible in an African tertiary hospital and may contribute to improving the quality of care for patients with acute pharyngitis. These local data support international recommendations advocating for simple, accessible diagnostic strategies to combat antimicrobial resistance [7] [9] [19].

4.6. Study Limitations

This study has several limitations. Its single-center design may limit the generalizability of the findings to other healthcare settings. In addition, the lack of microbiological confirmation by culture prevents assessment of the diagnostic accuracy of RADT in our context.

Furthermore, in children, asymptomatic carriage of group A streptococcus—well documented in the literature—may lead to a positive RADT result in the absence of active infection, representing a recognized limitation of rapid antigen tests [12] [20]. Nevertheless, the prospective nature of data collection, the use of standardized clinical criteria, and appropriate statistical analyses strengthen the validity of the observed results.

5. Conclusions

This study highlights the value of rapid antigen detection testing in the management of acute pharyngitis at the Renaissance University Hospital Center in N'Djamena. The significant association between the McIsaac score and RADT positivity confirms the usefulness of the clinical score as a tool for diagnostic orientation, while RADT appears to be a relevant aid for confirming group A streptococcal pharyngitis.

The use of RADT contributed to better alignment between therapeutic decision-making and the probability of streptococcal infection, in line with principles of appropriate antibiotic use. In an African context characterized by a high infectious disease burden and a concerning rise in antimicrobial resistance, the rational and expanded integration of RADT into the management of acute pharyngitis represents a promising strategy to improve quality of care and support antimicrobial stewardship policies.

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Conflicts of Interest

The authors declare that they have no conflicts of interest related to this study.

References

[1] Bisno, A.L. (2001) Acute Pharyngitis. *New England Journal of Medicine*, **344**, 205-211. https://doi.org/10.1056/nejm200101183440308

[2] Ebell, M.H., Smith, M.A., Barry, H.C., Ives, K. and Carey, M. (2000) Does This Patient Have Strep Throat? *JAMA*, **284**, 2912-2918. https://doi.org/10.1001/jama.284.22.2912

[3] Shulman, S.T., Bisno, A.L., Clegg, H.W., Gerber, M.A., Kaplan, E.L., Lee, G., *et al.* (2012) Clinical Practice Guideline for the Diagnosis and Management of Group a Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America. *Clinical Infectious Diseases*, **55**, e86-e102. https://doi.org/10.1093/cid/cis629

[4] Carapetis, J.R., Steer, A.C., Mulholland, E.K. and Weber, M. (2005) The Global Burden of Group a Streptococcal Diseases. *The Lancet Infectious Diseases*, **5**, 685-694. https://doi.org/10.1016/s1473-3099(05)70267-x

[5] McIsaac, W.J., White, D., Tannenbaum, D. and Low, D.E. (1998) A Clinical Score to Reduce Unnecessary Antibiotic Use in Patients with Sore Throat. *Canadian Medical Association Journal*, **158**, 75-83.

[6] Fine, A.M., Nizet, V. and Mandl, K.D. (2012) Large-Scale Validation of the Centor and Mcisaac Scores to Predict Group a Streptococcal Pharyngitis. *Archives of Internal Medicine*, **172**, 847-852. https://doi.org/10.1001/archinternmed.2012.950

[7] World Health Organization (2014) Antimicrobial Resistance: Global Report on Surveillance 2014. World Health Organization.

[8] Linder, J.A., Bates, D.W., Lee, G.M. and Finkelstein, J.A. (2005) Antibiotic Treatment of Children with Sore Throat. *JAMA*, **294**, 2315-2322. https://doi.org/10.1001/jama.294.18.2315

[9] Stewart, E.H., Davis, B., Clemans-Taylor, B.L., Littenberg, B., Estrada, C.A. and Centor, R.M. (2014) Rapid Antigen Group a Streptococcus Test to Diagnose Pharyngitis: A Systematic Review and Meta-Analysis. *PLOS ONE*, **9**, e111727. https://doi.org/10.1371/journal.pone.0111727

[10] Lukama, L., Aldous, C., Kuhn, W., Michelo, C. and Kalinda, C. (2024) Ten Years of Ear, Nose and Throat (ENT) Services in Southern Africa: A Scoping Review. *Global Health Action*, **17**, Article No. 2370102. https://doi.org/10.1080/16549716.2024.2370102

[11] Mulwafu, W., Ensink, R., Kuper, H. and Fagan, J. (2017) Survey of ENT Services in Sub-Saharan Africa: Little Progress between 2009 and 2015. *Global Health Action*, **10**, Article No. 1289736. https://doi.org/10.1080/16549716.2017.1289736

[12] Shaikh, N., Leonard, E. and Martin, J.M. (2010) Prevalence of Streptococcal Pharyngitis and Streptococcal Carriage in Children: A Meta-Analysis. *Pediatrics*, **126**, e557-e564. https://doi.org/10.1542/peds.2009-2648

[13] Aalbers, J., O'Brien, K.K., Chan, W., Falk, G.A., Teljeur, C., Dimitrov, B.D., *et al.* (2011) Predicting Streptococcal Pharyngitis in Adults in Primary Care: A Systematic Review of the Diagnostic Accuracy of Symptoms and Signs and Validation of the Centor Score. *BMC Medicine*, **9**, Article No. 67. https://doi.org/10.1186/1741-7015-9-67

[14] Mustafa, Z. and Ghaffari, M. (2020) Diagnostic Methods, Clinical Guidelines, and Antibiotic Treatment for Group a Streptococcal Pharyngitis: A Narrative Review. *Frontiers in Cellular and Infection Microbiology*, **10**, Article No. 563627. https://doi.org/10.3389/fcimb.2020.563627

[15] Lean, W.L., Arnup, S., Danchin, M. and Steer, A.C. (2014) Rapid Diagnostic Tests for

Group a Streptococcal Pharyngitis: A Meta-Analysis. *Pediatrics*, **134**, 771-781. https://doi.org/10.1542/peds.2014-1094

[16] Ouedraogo, A.S., Jean Pierre, H., Bañuls, A.L., Ouédraogo, R. and Godreuil, S. (2017) Emergence and Spread of Antibiotic Resistance in West Africa: Contributing Factors and Threat Assessment. *Médecine et Santé Tropicales*, **27**, 147-154. https://doi.org/10.1684/mst.2017.0678

[17] Okeke, I.N., Lamikanra, A. and Edelman, R. (1999) Socioeconomic and Behavioral Factors Leading to Acquired Bacterial Resistance to Antibiotics in Developing Countries. *Emerging Infectious Diseases*, **5**, 18-27. https://doi.org/10.3201/eid0501.990103

[18] Ayukekbong, J.A., Ntemgwa, M. and Atabe, A.N. (2017) The Threat of Antimicrobial Resistance in Developing Countries: Causes and Control Strategies. *Antimicrobial Resistance & Infection Control*, **6**, Article No. 47. https://doi.org/10.1186/s13756-017-0208-x

[19] Linder, J.A., Chan, J.C. and Bates, D.W. (2006) Evaluation and Treatment of Pharyngitis in Primary Care Practice. *Archives of Internal Medicine*, **166**, 1374-1379. https://doi.org/10.1001/archinte.166.13.1374

[20] Tanz, R.R. and Shulman, S.T. (2007) Chronic Pharyngeal Carriage of Group a Streptococci. *The Pediatric Infectious Disease Journal*, **26**, 175-176. https://doi.org/10.1097/01.inf.0000255328.19808.be