# *The Sensitivity and the Specifity of Rapid Antigen Test in Group A Streptococcal Tonsillopharyngitis*

## *Grup A Streptokok Tonsillofarenjitinde Hızlı Antijen Testinin Duyarlılığı ve Özgüllüğü Tonsillofarenjitte Hızlı Antijen Testi*

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**Abstract**

**Objective:** Acute tonsillopharyngitis is one of the most common reasons for doctor visits and medical care demand, and Group A streptococcus (GAS) is responsible for 15% to 36% of cases. Available diagnostic tests include throat culture and rapid antigen detection testing. We aim to detect the sensitivity and specificity of the rapid antigen detection test in Group A streptococcal tonsillopharyngitis, ratio of positive throat culture and rapid antigen detection tests.

**Material and Methods:** From April 2008 through March 2013, 6310 throat cultures and 4124 rapid antigen detection tests (RADT) were tested for GAS. The throat culture samples were taken with two swabs and the samples processed using the Ecotest strep A Rapid Test Device (Wellkang, UK) or SD rapid test kit (Standard Diagnostic, Korea). The samples of the patients for throat culture were cultivated in 5% sheep blood agar.

**Results:** In five years, RADT was detected positive in 434 (10.5%) patients, 266 (4.2%) throat cultures were positive for GAS. In the five year period, 2163 tests worked simultaneously for RADT and throat culture.

**Conclusion:** Sensitivity and specificity of our RADT test was 68.1% and 92.2% respectively. Positive and Negative Predictive Value of RADT was 36.4% and 97.8% respectively. *(J Pediatr Inf 2013; 7: 143-6)*

**Key words:** Group A streptococcus, tonsillopharyngitis, children, rapid antigen detection test

**Özet**

**Amaç:** En sık doktora veya sağlık kuruluşuna başvuru sebeplerinden birisi akut tonsillofarenjittir. Grup A streptokoklar (GAS), tüm tonsillofarenjit vakalarının %15-36'sından sorumludur. Hızlı antijen tarama testi ve boğaz kültürü hastalığın tanısal testleridir. Biz çalışmamızda hızlı antijen tarama testi ve boğaz kültürünün pozitiflik oranlarını; hızlı antijen tarama testinin duyarlılık ve özgüllük oranlarını saptamayı amaçladık.

**Gereç ve Yöntemler:** Nisan 2008-Mart 2013 tarihleri arasında 6310 boğaz kültürü ve 4124 hızlı antijen tarama testi çalışılmıştır. Hastaların boğazlarından iki sürüntü örneği alınmıştır. İlk sürüntü, Ecotest® strep A hızlı test kiti (Wellkang, İngiltere) veya SD® hızlı test kit (Standard Diagnostic, Kore) kullanılarak çalışılmıştır. Boğaz kültürleri %5 koyun kanlı agarına ekilmiştir.

**Bulgular:** Beş yıllık süreçte 434 (%10,5) hastada hızlı antigen testi pozitif bulunurken, 266 (%4,2) hastada boğaz kültüründe Grup A streptokok üremesi olmuştur. Toplam 2163 hastada boğaz kültürü ve hızlı antijen tarama testi birlikte çalışılmıştır.

**Sonuç:** Hızlı antijen tarama testinin duyarlılığı %68,1 ve özgüllüğü %92,2 bulunmuştur. Pozitif ve negatif prediktif (tahmini) değerleri sırasıyla %36,4 ve %97,8 bulunmuştur. *(J Pediatr Inf 2013; 7: 143-6)*

**Anahtar kelimeler:** Grup A streptokok, tonsillofarenjit, çocuklar, hızlı antijen tarama testi

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## Introduction

Acute tonsillopharyngitis is one of the most common reasons for doctor visits and medical care demands, especially in the pediatric age group. According to United States data, approximately 15 million outpatient physician visits attributable to sore throat occur each year among children in the United States, and group A streptococcus (GAS) is responsible for 15% to 36% of cases (1, 2). GAS tonsillopharyngitis is primarily a disease of children between 5-15 years, it consists of 30-37% of all cases. Under five years old, it is responsible for only 5-10% of all cases (3).

Tonsillopharyngitis with GAS has an incubation period of 2-5 days. Patients with GAS phar-

yngitis commonly present with sore throat (generally of sudden onset), pain on swallowing, and fever (it may exceed 39ºC). Headache, weakness, arthralgia, nausea, vomiting, and abdominal pain may also be present. On examination, patients have tonsillopharyngeal erythema and tonsillar hypertrophy, with or without exudates, often with tender, enlarged anterior cervical lymph nodes. Patients may also have a red, swollen uvula; petechiae on the palate; excoriated nares (especially in infants), and a scarlatiniform rash. However, none of these findings are specific for GAS pharyngitis. Conversely, the absence of fever or the presence of clinical features such as conjunctivitis, cough, hoarseness, coryza, anterior stomatitis, viral exanthema, and diarrhea strongly suggest a viral rather than a streptococcal etiology. In temperate climates, it usually occurs in the winter and early spring (4-6).

Group A streptococcus is a common cause of infections of the upper respiratory tract (pharyngitis) and the skin (impetigo, pyoderma) in children and is a less common cause of septicemia, pneumonia, endocarditis, pericarditis, osteomyelitis, suppurative arthritis, myositis, cellulitis, and omphalitis. These microorganisms also cause distinct clinical entities (scarlet fever and erysipelas), as well as a toxic shock syndrome and necrotizing fasciitis. GAS is also the cause of two potentially serious nonsuppurative postinfectious complications: rheumatic fever and acute glomerulonephritis (7, 8).

Available diagnostic tests include throat culture and rapid antigen detection testing. Throat culture with blood agar plate is the standard method for establishing the diagnosis of pharyngitis caused by GAS in children, although the sensitivity and specificity of rapid antigen detection testing (RADT) have improved significantly. With correct sampling and plating techniques, a single swab throat culture is 90 to 95 percent sensitive. RADT allows for earlier treatment, symptom improvement, and reduced disease spread. RADT specificity ranges from 90 to 99 percent. Sensitivity depends on the commercial RADT kit used and was approximately 70 percent with older latex agglutination assays. Newer enzyme linked immunosorbant assays, optical immunoassays, and chemiluminescent DNA probes are 90 to 99 percent sensitive. Although RADT technology has evolved since these tests were first introduced, the American Academy of Pediatrics, the Infectious Diseases Society of America, and the American Heart Association continue to recommend confirmation of negative RADT results with a throat culture (9, 10).

**Table 1.** Distribution of positive tests according to seasons

| | RADT Positive (%) | Culture Positive (%) |
|---|---|---|
| Winter | 177 (40.7%) | 96 (36.1%) |
| Spring | 116 (26.7%) | 73 (27.4%) |
| Summer | 54 (12.5%) | 42 (15.8%) |
| Autumn | 87 (20.1%) | 55 (20.7%) |
| Total | 434(100%) | 266 (100%) |

We aim to detect the sensitivity and the specificity of RADT in Group A streptococcal tonsillopharyngitis, the ratio of positive throat cultures and RADT at our hospital.

## Material and Methods

From April 2008 through March 2013, patients of pediatric clinics and pediatric service were reevaluated. Patients up to sixteen years old were included. Electronic records, patients' documents and result books of the microbiology laboratory were reviewed. The throat culture samples were taken with two swabs, the samples were processed using the Ecotest strep A Rapid Test Device (Wellkang, UK) or SD rapid test kit (Standard Diagnostic, Korea) in accordance with the manufacturer's instructions. The samples of patients for throat culture were cultivated in 5% sheep blood agar at 35-37ºC for at least 18 up to 24 hours; the beta hemolytic colonies were identified according to bacitracin susceptibilities. Approval of parents was obtained with written informed consent.

## Results

During five years, 6310 throat cultures and 4124 RADT were tested for GAS. RADT was detected positive in 434 (10.5%) patients, 266 (4.2%) throat cultures were positive for GAS. There were 609 patients with either positive RADT or throat culture. 313 (51.4%) of 609 patients were boys and 296 (48.6%) were girls. The mean age of the patients was 70.47±38.64 (mean age±standard deviation, 3-183) months old. 41.7% (253/609) of patients were younger than 5 years old, 47.3% (288/609) were aged between five and ten years. Only 68 (11.2%) patients were 10-15 years old. Distributions of positive RADT and throat cultures according to seasons were given in Table 1. We see our patients mostly during the winter months.

Positive throat cultures for GAS were 134 but no RADT was taken for them, 186 RADT were positive for GAS but no throat culture were taken either. In the five year period, 2163 tests were taken simultaneously for RADT and throat culture (Table 2). Sensitivity and specificity of our RADT test was 68.1% and 92.2% respectively. Positive and Negative Predictive Value of RADT was 36.4% and 97.8% respectively.

## Discussion

During five years, 6310 throat cultures were taken, 266 (4.2%) throat cultures were positive for GAS at our hospital.

**Table 2.** Results of 2163 tests studied simultaneously

| | Culture + | Culture - | Total |
|---|---|---|---|
| RADT + | 90 | 157 | 247 |
| RADT - | 42 | 1874 | 1916 |
| Total | 132 | 2031 | 2163 |

Sensitivity of RADT: 68.1%
Specificity of RADT: 92.2%
Positive Predictive Value: 36.4%
Negative Predictive Value: 97.8%

The prevalence of GAS in Ankara was 2.43% of healthy children (11). In India, the prevalence of GAS was found to be 1.9% (12), but in a metaanalysis, about GAS the prevalence of children is 12% in all age groups (13). In children with tonsillopharyngitis, the positive throat culture rate was between 22.62% and 45.8% (14-16). Our positive culture rate is lower than these studies. We take throat cultures routinely from all hospitalized patients due to any bacterial infection or fever regardless of antibiotic use. It may be a factor for this low rate. We did not have the patients' clinical information, which is a limitation of our study.

There are more than forty different commercial products for rapid antigen detection tests for GAS. Their specificity is higher than 95%, sensitivity changes between 70 and 90% (17). Specificity and sensitivity of our RADT test was 92.2% and 68.1% respectively. We have 5 studies from Turkey about GAS and RADT. Specificities of RADT tests were between 89.7% and 99% (18-22). Sensitivities of tests are between 64.6% and 68.2% which are similar to our result (18-20). Two studies had sensitivities of 89.7% (21) and 100% (22) which were higher than our result. Variations in RADT sensitivity only occur in patients with light inocula. RADT sensitivity was greater for children with heavy than light inoculum (23). It is important to take accurate samples for testing, so we need experienced staff to obtain reliable test results.

Positive Predictive Value of RADT was 65.2% (19), 80.95% (20), 95.0% (21) respectively, our test had 36.4% Positive Predictive Value. It is lower than all other studies. None of the RADTs gave any false-positive results with commensal flora, they were 100% specific (24). In our study, the high rate of false positive RADT might be due to blockage of antibiotics use for positive throat culture or possibility of high prevalence of GAS carriers in Antalya. We need further studies for that. The Negative Predictive Value of RADT was 90.9% (19), 92.82% (20), 93.8% (21) respectively; our study had 97.8% Negative Predictive Value of RADT.

Fever and cough were the two main complaints of children at the emergency department, and half of the children (55%) were diagnosed as upper respiratory tract infection (25). As 66.5% of hospitalized patients with respiratory tract infection are viral in origin (26), we need rapid tests to detect GAS tonsillopharyngitis. Screening of all children with pharyngitis by performing RADT may reduce the antibiotic prescription rate by almost 50% (27).

## Conclusion

Patients with acute GAS pharyngitis should be treated with an appropriate antibiotic at an appropriate dose for the duration likely to eradicate the organism from the pharynx (usually 10 days). Based on their narrow spectrum of activity, infrequency of adverse reactions, and modest cost, penicillin or amoxicillin is the recommended drug of choice for those non-allergic to these agents. Treatment of GAS pharyngitis in penicillin-allergic individuals may include a first generation cephalosporin (for those not anaphylactically sensitive) for 10 days, clindamycin or clarithromycin for 10 days, or azithromycin for 5 days (28).

**Conflict of Interest**
No conflict of interest was declared by the authors.

**Peer-review:** Externally peer-reviewed.

**Informed Consent:** Written informed consent was obtained from parents of the patient who participated in this study.

**Author Contributions**
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