RESEARCH ARTICLE

🄳 **Humeyra Aslaner**[1]
🄳 **Selcuk Mistik**[2]
🄳 **Gozde Erturk Zararsiz**[3]
🄳 **Huseyin Kilic**[4]
🄳 **Neriman Cetin Benli**[5]

[1] Department of Family Medicine, Kayseri City Hospital, Kayseri, Turkey
[2] Department of Family Practice, Erciyes School of Medicine, Erciyes University, Melikgazi, Kayseri, Turkey
[3] Department of Biostatistics, Erciyes School of Medicine, Erciyes University, Melikgazi, Kayseri, Turkey
[4] Erciyes University, Medical Microbiology, Kayseri, Turkey
[5] Department of Family Medicine, Health Directorate of Kayseri, Kayseri, Turkey

Corresponding Author:
Hümeyra Aslaner
Department of Family Medicine, Kayseri City Hospital, Kayseri, Turkey
mail: *drhumeyra@hotmail.com*
Phone: +90 5066456944

Evaluation of the Use of the Mistik Score and Modified Centor Score in Sore Throat

ABSTRACT

Objective: There are various clinical scoring systems in acute tonsillopharyngitis. The Modified Centor Score was developed to predict streptococcal pharyngitis and the Mistik score was developed to diagnose viral agents. This study aimed to determine cut-off values of the Modified Centor Score and Mistik Score according to rapid antigen detection test (RADT) results of patients admitted with sore throat in the primary care and evaluate the use of these scoring systems by family physicians.

Methods: A total of 125 patients between the ages of 3 and 80 who were admitted with sore throat to the family health centers were included in the study. Physical examinations of the patients were performed and their Mistik and Modified Centor Scores were detected. Patients underwent RADT. Treatments of the patients were recorded. In the second stage of the study, patients underwent clinical scoring and the physicians completed a questionnaire to evaluate the use of the Mistik Score, Modified Centor Score and RADT.

Results: The optimal cut-off value for the Modified Centor Score was 3, sensitivity was 87.5%, specificity was 86.2%, positive predictive value was 48.3% and negative predictive value was 97.9%. The optimal cut-off value for Mistik score was 3, sensitivity was 61%, specificity was 87.5%, positive predictive value was 97% and negative predictive value was 25%. Of the physicians, 75% used clinical scoring during routine examination and the most common scoring system used was the Modified Centor Score (88.9%). Of the physicians, 75% used clinical scoring before the decision of RADT.

Conclusions: The use of clinical scoring systems such as the Mistik Score and Modified Centor Score will primarily allow RADT be used in the appropriate patient for sore throat that is very common in daily family practice. In addition, it will help family physicians decide on the best treatment options for tonsillopharyngitis. Therefore, we recommend the use of clinical scoring systems especially the Mistik Score, which is a viral scoring system.

Keywords: Sore Throat, Diagnose, Viral, Score.

Boğaz Ağrısında Mıstık Skoru ve Modifiye Centor Skoru'nun Kullanımının Değerlendirilmesi

ÖZET

Amaç: Akut tonsillofarenjitte, kullanılan çeşitli klinik skorlamalar mevcuttur. Streptokoksik farenjitini öngörmek için Modifiye Centor Skoru ve viral ajanlara tanı koymak için Mıstık Skoru geliştirilmiştir. Bu çalışma da birinci basamakta boğaz ağrısı şikayeti ile gelen hastaların hızlı antijen testi (HAT) sonuçlarına göre Modifiye Centor Skoru ve Mıstık Skoru'nun cutoff noktalarının belirlenmesi ve aile hekimleri tarafından kullanımının değerlendirilmesi amaçlandı.

Gereç ve Yöntem: Aile sağlığı merkezlerine boğaz ağrısı şikayeti ile başvuran 3-80 yaş arasındaki 125 hasta dahil edildi. Hastaların fizik muayeneleri yapılıp Mıstık Skoru ve Modifiye Centor Skor'ları tespit edildi. Hastalara HAT uygulandı, verilen tedavi kaydedildi. Çalışmanın 2. aşamasında hastalara klinik skorlama uygulanıp Mıstık Skoru, Modifiye Centor Skoru ve HAT kullanımının değerlendirilmesi için doktorlara anket uygulandı.

Bulgular: Modifiye Centor Skoru için en uygun kesim noktası 3 olup duyarlılığı %87.5 ve seçiciliği %86.2, pozitif kestirim değeri %48.3, negatif kestirim değeri %97.9 bulunmuştur. Mıstık Skoru için en uygun cutoff değeri 3 olup duyarlılığı %61 ve seçiciliği %87.5, pozitif kestirim değeri %97, negatif kestirim değeri %25 bulunmuştur. Aile hekimlerinin %75'i klinik skorlamayı rutin muayenede kullanıyordu ve en çok kullanılan skorlama yöntemi de ModifiyeCentor Skoru idi (%88.9). Aile hekimlerinin %75'i HAT' a karar vermeden önce klinik skorlama kullanmaktadır.

Sonuç: Günlük aile hekimliği pratiğinde çok sık görülen boğaz ağrısında Mıstık Skoru, Modifiye Centor Skoru gibi klinik skor kullanımı öncelikle HAT testinin uygun hastada yapılmasını sağlayacaktır. İlaveten aile hekimlerinin tonsillofarenjit konusunda daha uygun tedavi kararları vermesini sağlayacaktır. Bu yüzden klinik skorlamaların kullanımını ve özellikle viral bir skorlama olan Mıstık Skoru'nun kullanımını önermekteyiz.

Anahtar Kelimeler: Boğaz Ağrısı, Teşhis, Viral, Skor.

INTRODUCTION

Sore throat is one of the most common patient complaints in primary care. Viral agents are the most common causes of sore throat. Group A beta-hemolytic streptococcus (GABHS) is the most common pathogen causing acute tonsillopharyngitis and accounts for 15-30% of all cases in children and 5-10% in adults (1). It is diagnosed by microbiological tests performed with clinical symptoms and findings. Rapid antigen detection test (RADT) and throat culture are diagnostic tests of the disease (2). RADT can give results within about 15-20 minutes and its usage is limited due to high costs (3). The criteria revealing in which clinical conditions these tests will be used in acute tonsillopharyngitis have also been determined. Whether the factors causing this infection are viral or bacterial is one of the most important points (4). A clinical scoring system has been developed to predict streptococcal pharyngitis. Centor was first to investigate how symptoms and findings were determinant in GABHS infection (5). The physicians can use RADT in patients with high possibility of streptococcus infection (e.g. Modified Centor Score of 3-4). Throat culture is not necessary after clinical scoring and negative test result in RADT negative patients (6). The Mistik Score has been developed to diagnose viral agents that are the most common reason of acute tonsillopharyngitis. A negative correlation between the Modified Centor Score and Mistik Score has been found. Physicians can use one of these scoring systems for the etiology of sore throat. However, using both of them will provide a better assessment in diagnosing bacterial and viral sore throat (7).

This study aimed to assess the use of the Modified Centor Score and Mistik score by family physicians in patients admitted with sore throat in the primary care and create a prediction for appropriate antibiotic prescribing in patients by increasing the use of these scoring systems.

MATERIAL AND METHODS

Study Design and Setting: Our study was performed as a cross-sectional study. It consisted of 2 stages. In the 1st stage, patients admitted with sore throat to the family medicine outpatient clinic were clinically assessed with the Modified Centor Score and Mistik Score. Scoring results of the patients were recorded into the patient assessment forms. Then, each patient underwent QuickVue-Strep A test, a rapid antigen detection test (RADT). Family physicians were immediately informed about the test results. Their treatment plans were recorded. In the 2nd stage of our study, family physicians completed a questionnaire. The questionnaire included questions about the use of clinical scoring systems and RADT. Statistical analysis of the data was performed with IBM SPSS 22.0 software program.

Our study was designed in compliance with the principles of Helsinki Declaration and regulation of patients' rights and approved by the clinical research ethics committee of Erciyes University, the Faculty of Medicine (15.05.2018/96681246).

Study Participants: A total of 125 patients between the ages of 3 and 80 were included in the 1st stage of the study. Those were patients who were admitted with sore throat to the Bunyamin Somyurek Family Health Center. The study was performed between the 1st of October and the 1st of November in 2018. Power analysis of the study was performed with G*power3.1 analysis program to determine the sample size. The minimum number of patients to participate in the study was determined as 125 (α- value:0.05, ß-value:0.80). The patients and their relatives were informed about the study and their informed consents were obtained.

Patients with the following characteristics were excluded from the study:
1.Patients below the age of 3 and above the age of 80,
2.Patients with noninfectious sore throat,
3.Patients who had used antibiotics in the last 3 days.

A total of 12 family physicians were included in the 2nd stage of the study. Those who used RADT and clinical scoring for patients in the 1st stage of the study were family physicians. Consents of all the physicians in the family health center where these 12 family physicians worked were obtained and the 12 family physicians completed a questionnaire between the 1st of November and 15th of November 2018.

Data Screening Process: It was reported that patients with the Modified Centor Score of 1 and below did not need antibiotics or further examination while throat culture was recommended for patients with the score of 2 and 3 or patients with the score of 4 and above needed empirical antibiotic therapy (Table 1).

Table 1. Modified Centor Score (5,9)

Criterion	Score
Fever (> 38ºC)	1
No cough	1
Painful and enlarged anterior cervical lymph node	1
Tonsillar hypertrophy and exudate	1
Age	
3-14 years	1
15-44 years	0
45 years and older	-1

The Mistik Score: The probabilities of positive viral analysis in the scores between 0 and 5

were 8.3%, 14.7-20.4%, 25.2-36.3%, 42.2-55.3%, 61.9-70.7%, and 82.1% respectively.

Table 2. Mistik Score (7)

Variables	Score
No headache	1
Nasal obstruction	1
Sneeze	1
Fever on physical examination (≥37.5°C)	1
No exudate and/or hypertrophy in tonsils	1

Antigen Detection Test: The swabs were analyzed within 10-20 minutes to detect antigen with immunoassay method. In brief, the swab is centrifuged and kept in the tube including extraction solution for five minutes. The whole solution including the extracted material was transferred to the sample well. After a color developed in the control well (approximately five minutes), the test was assessed. In case a pink color developed in the control well and a positive sign appeared on the sample well the antigen detection test was regarded as positive.

Questionnaire: The questionnaire included questions about the attitudes and behaviors of family physicians on the use of clinical scoring systems and RADT. Demographic data and employment durations of the family physicians were also questioned. The number of RADTs they used in daily routine, whether they used clinical scoring in routine practice for patients admitted with sore throat or not, whether they decided to use RADT after clinical scoring or not, which clinical scoring system they mostly used and which clinical scoring system they found more useful during the 1st stage of the study were questioned. The questionnaire was completed by family physicians after the clinical scoring and RADT were used in the 1st stage of the study.

Statistical Analysis: Descriptive statistics for continuous variables were expressed as median, minimum and maximum values while categorical variables were expressed as number and percentile. Whether numerical data of the variables were normally distributed or not was determined with one-sample Kolmogorov Smirnov test. Chi-square test was used to determine the relationship between the groups and categorical variables. The linear correlation between the variables was assessed with Pearson's correlation analysis. Receiver operating characteristic (ROC) curves were used to identify the differentiating effect of the Mistik Score on Modified Centor Score. Area under the ROC curves were calculated with 95% confidence intervals. Youden index was calculated for optimal cut-off value. Sensitivity, specificity, and positive and negative predictive values were calculated with 95% confidence intervals. Internal consistency was obtained by the correlation of each item in the Mistik Score with total the total score. The

correlation of the Mistik Score with the Modified Centor Score was assessed by Spearman's correlation for convergent validity. All analyses were performed using TURCOSA (Turcosa Analytics Ltd. Co., www.turcosa.com.tr) statistical software, MVN (19) and easyROC (20) software. p values less than 5% were considered as statistically significant.

RESULTS
Results of the 1st Stage of the Study: This study was performed with patients admitted to Bunyamin Somyurek Family Health Center. Median age of the patients was 38 (min-max: 3-80). A total of 125 patients were included in the study and while 87 (70%) of them were female 38 (30%) were male. Clinical and demographic characteristics of the patients were given in Table 3.

Table 3. Demographic and clinical characteristics of the patients

	n	%
Gender		
Female	87	70
Male	38	30
Age Group		
Child	57	45.6
Adult	68	54.4
RADT		
Positive	16	12.8
Negative	109	87.2
Antibiotics		
Prescribed	26	20.8
Not Prescribed	99	79.2
Modified Centor scores		
-1	4	3.2
0	33	26.4
1	38	30.4
2	21	16.8
3	16	12.8
4	9	7.2
5	4	3.2
Mistik Scores		
1	19	15.2
2	37	29.6
3	43	34.4
4	23	18.2
5	3	2.4

The Modified Centor Score of 87.5% of RADT positive patients was 3 and above. The Modified Centor Score of 86% of RADT negative patients was 2 and below. Considering RADT positivity, the optimal cut-off value for the Modified Centor Score was found as 3, sensitivity as 87.5%, specificity as 86.2%, positive predictive value as 48.3% and negative predictive value as

97.9%. The ROC curve showed a significant sensitivity and specificity (Area under ROC curve= 0.918) (CI: 0.856-0.960) (p<0.001) (Figure 1) (Table 4).
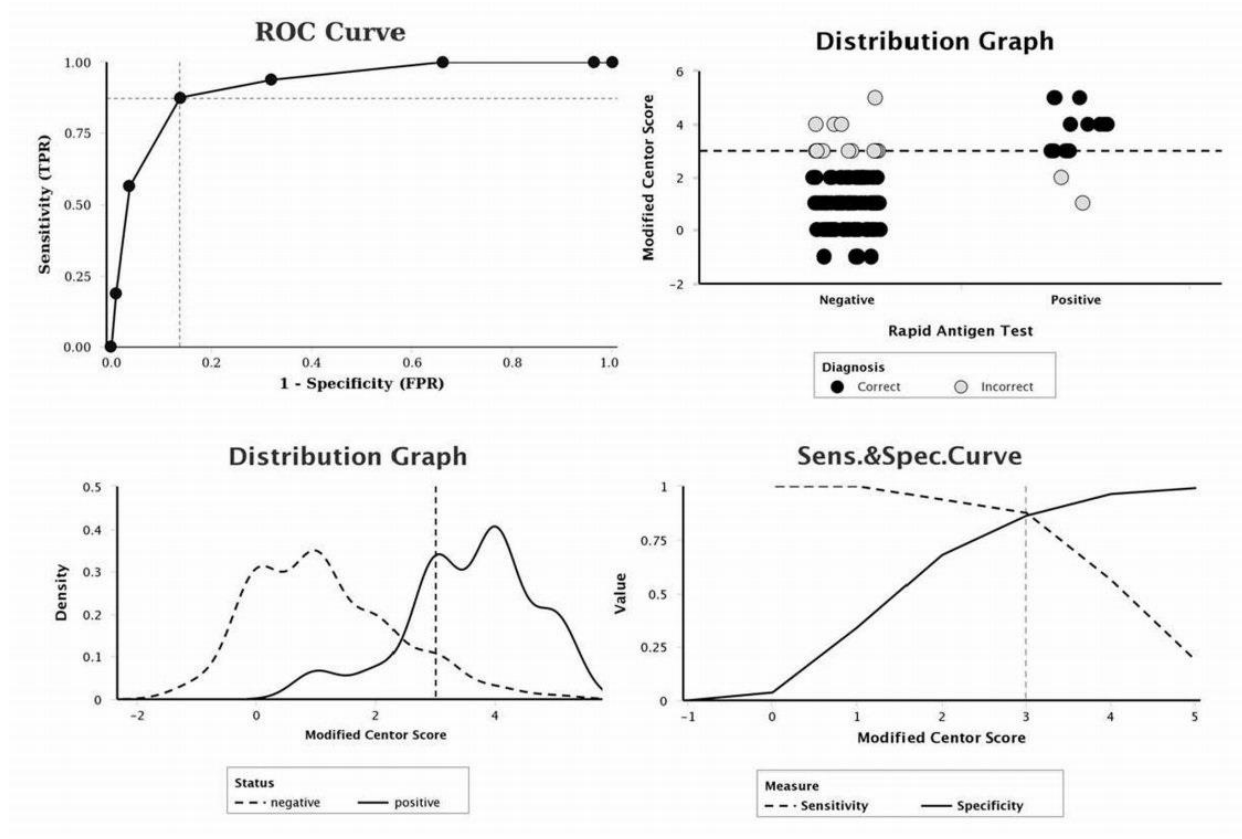

Figure 1. Specificity, sensitivity and ROC curve for the Modified Centor Score

Table 4. ROC curve results and statistical diagnostic measurements for (RADT positive) determining elderly with or without a normal Modified Centor Score.

Statistics	Estimate	Confidence Interval (95%)
ROC curve statistics		
Area under curve	0.918	0.856-0.960
p value	<0.001	
Diagnostic measurements		
Sensitivity	0.875	0.640-0.965
Specificity	0.862	0.785-0.914
Positive predictive value	0.482	0.314-0.656
Negative predictive value	0.979	0.927-0.994

The Mistik Score of 25 (23%) of RADT negative patients was 3 and above. The Mistik Score of 14 (87.5%) of RADT positive patients was 2 and below. There was a statistically significant difference between the groups (p<0.05). Considering RADT negativity, the optimal cut-off value for the Mistik score was found as 3, sensitivity as 87.5%, specificity as 61%, positive

predictive value as 25%, and negative predictive value as 97%.

The ROC curve for the Mistik Score showed a significant sensitivity and specificity (Area under ROC curve= 0.760) (CI: 0.676-0.832) (p=0.001) (Table 5) (Figure 2).

Table 5. ROC curve results and statistical diagnostic measures for (RADT negative) determining elderly with or without a normal Mistik Score

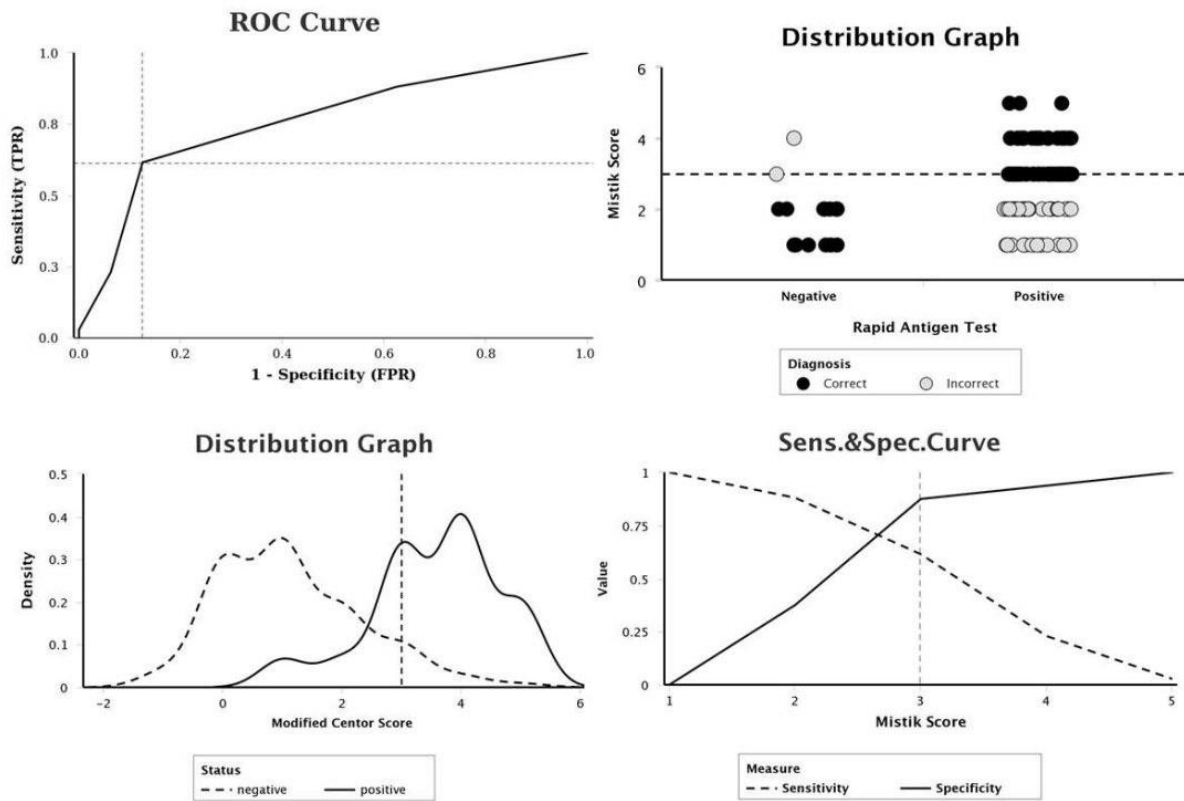| Statistics	Estimate	Confidence Interval 95%)
ROC curve statistics		
Area under curve	0.760	0.676-0.833
p value	<0.001	
Diagnostic measurements		
Sensitivity	0.615	0.521-0.700
Specificity	0.875	0.640-0.965
Positive predictive value	0.971	0.900-0.992
Negative predictive value	0.250	0.155-0.377

Figure 2. Specificity, sensitivity and ROC curve for the Mistik Score

There was a weak, negative and statistically significant correlation between the variables of the Modified Centor Score and Mistik Score (r value: -0.272) (p= 0.002).

A significant difference was found between the groups in terms of antibiotherapy according to RADT results. While 16 (100%) patients in the RADT positive group received a therapy 10 (9.2%) patients in the RADT negative group received a therapy (p<0.001). The number of patients with cervical node, hypertrophic and exudate tonsils, and fever (>38) was higher in the RADT positive group compared to the RADT negative group (p<0.001, p<0.001, and p<0.001 respectively). The number of patients with sneeze was higher in the RADT negative group (p<0.001). The Modified Centor Score was higher in the RADT positive group (p<0.001) and the Mistik Score was higher in the RADT negative group (p=0.001). Patients' demographic data, symptoms and data including clinical scoring points according to RADT results were given in Table 6.

Table 6. Comparison of RADT positive and RADT negative groups

Rapid Antigen Diagnostic Test	Positive (16)	Negative (109)	p value
Age, median (25-75 percentile)	12 (5-30.75)	23 (12.5-44.5)	0.045
Gender (Female)	11 (68.8)	76 (69.7)	0.930
Child	11 (68.80%)	47 (43.1)	0.490
No coughing	12 (75)	48 (44)	0.190
Cervical node	14 (87.5)	32 (29.4)	<0.001
38^0C fever	10 (62.5)	9 (8.3)	<0.001
Hypertrophy/Exudate in Tonsils	14 (87.5)	23 (21.1)	<0.001
No headache	6 (37.5)	46 (42.2)	0.471
Nasal obstruction	9 (56.3)	88 (80.7)	0.360
Sneeze	3 (18.8)	68 (62.4)	0.001
Fever (>37.5 º C)	10 (62.5)	32 (29.4)	0.011
The Modified Centor Score	4 (1-5)	1 (-1-5)	<0.001
The Mistik Score	1.81±0.8	2.75±1	0.001
Antibiotherapy	16 (%100)	10 (%9.2)	<0.001

Results of the 2nd Stage of the Study:
Mean age of the family physicians who participated in the study was 51.5±7.9. Mean employment duration of the family physicians in this occupation was 25.5+7.4. Mean number of RADTs used by the family physicians while working was 10.4±4.1. Mean rate of the use of RADT in daily routine practice was 1.25±0.45. Responses of the family physicians about their attitudes and behaviors on clinical scoring and RADT were given in Table 7. The rate of those who found the Mistik score useful was higher.

Table 7. Attitudes and behaviors of the family physicians on clinical scoring and RADT at the end of the study

Do you use clinical scoring? (Yes)	9 (75%)
If yes, which one do you use?	
The Modified Centor Score	8 (88.9%)
Other scoring system	1 (11.1%)
Do you use RADT? (Yes)	9 (75%)
In which age range you prefer RADT?	
Age range of 3-17	6 (50%)
Age range of 18-65	3 (25%)
Ages above 65	1 (8.3%)
All ages	2 (16.7%)
Do you use clinical scoring before deciding on RADT? (Yes)	9 (75%)
Do you think clinical scoring systems are helpful in diagnosing? (Yes)	11 (91.7%)
Is the Modified Centor Score useful?	10 (83.3%)
Is the Mistik Score useful?	11 (91.6%)

DISCUSSION

Considering RADT positivity, the optimal cut-off value for the Modified Centor Score was found as 3 and considering RADT negativity, the optimal cut-off value for the Mistik Score was found as 3 in this study. It was found that 75% of the family physicians used clinical scoring in routine examination before deciding on RADT.

In the treatment of acute tonsillopharyngitis, which is one of the most common causes of sore throat, detecting whether it is bacterial or viral in an early period is important. The therapy should immediately be decided and initiated to prevent especially GABHS from leading to complications such as acute rheumatic fever. The Infectious Diseases Society of America recommends throat culture or RADT in detection of GABHS (8).

In detection of GABHS, rapid tests based on detecting the antigen are resulted in a short time. Positive result provides early diagnosis and treatment (9). Sensitivity rates of antigen detection tests are known to range from 75% to 90% while their specificity rates range from 86% to 100%. Specificity rates of these tests are higher than their sensitivity rates compared to throat culture. This means they have low rate of false positivity (10,11,12).

RADT used for detecting GABHS was positive in 14% in the study by Cannarpur et al. and in 18.2% in the study on children by Pontin et al. (13,14).

In our study, 12.8% of the patients were RADT positive and 19.3% of pediatric patients were RADT positive. These rates are consistent with those in literature.

As well as RADT, clinical scoring systems are also used in approximate diagnosing to predict streptococcus infection in patients with sore throat. It is commonly asserted that clinical scoring systems can be used alone or in combination with antigen detection tests (2). The use of clinical scoring for acute sore throat forms the treatment and decreases the use of antibiotics. In studies, the use of clinical scoring for adult patients with tonsillopharyngitis by family physicians is strongly recommended (15).

Palla et al. used the Modified Centor Score and collected throat culture in a group including 137 patients of a low-socioeconomic status community in Pakistan among patients between the ages of 14-65. While 88% of the patients had scores of 0, 1, 2 and 3 17 (12%) patients had the score of 4. Sensitivity rate of the Modified Centor Score was found as 80%, specificity as 68.7%, positive predictive value as 12.7% and negative predictive value as 100%. They also found a direct correlation between the results of the Modified Centor Score and throat culture (16). In our study, patients had the Modified Centor Scores between -1 and 5. Especially the following results were similar to the findings in literature: 96.3% of RADT negative patients had the score of 3 and below, the sensitivity of the Modified Centor Score was 87.5%, specificity was 86.2%, positive predictive value was 48.3%, and negative predictive value was 97.9%. Like in other studies, sensitivity of the Modified Centor Score was higher than its specificity in our study. RADT negative patients in our study had the Modified Centor Score of -1 and 0, which reveals that the Modified Centor Score is compliant with RADT. Negative RADT result in low Modified Centor Score increases the possibility of viral infection.

The optimal cut-off value for the Modified Centor Score in RADT positive patients is 3. McIsaac et al. recommend RADT for patients with the Modified Centor Score of 2-3. In our study, the optimal cut-off value for the Modified Centor Score in RADT positive patients was found as 3, which is consistent with the findings in literature. We think preferring RADT in case the Modified Centor Score is 2 and below is unnecessary while RADT must be preferred in case the Modified Centor Score is 3 and above.

Viral agents are the most common causes of sore throat. Mistik et al. developed a new scoring system to find out the rate of bacterial and viral causes, reveal seasonal changes and diagnose viral sore throat. They collected throat culture from each patient for GABHS and nasopharyngeal swab to detect 16 respiratory tract viruses and analyzed a total of 624 throat cultures and polymerase chain

reaction throughout 52 weeks. They detected viral infection in 277 (44.3%) patients and GABHS infection in 116 (18.5%) patient. These viruses had all the Modified Centor Scores between -1 and 5 and similarly all the Mistik Scores between 0 and 5. In the study by Mistik et al., sensitivity of the Mistik Score was 60.2%, specificity was 72.5%, positive predictive value was 62.5% and negative predictive value was 70.5%. Diagnostic accuracy of the Mistik Score was 68% while that of the Modified Centor Score was 75%. A negative correlation was found between the Modified Centor Score and Mistik Score (7). While the Mistik Score of all the patients in our study was between 1 and 5 that of RADT positive patients was observed to be between 1 and 4. RADT positivity never had the Mistik Score of 5. This is because the possibility of viral infection is high when the Mistik Score is 5. In the Mistik Score of 5, the possibility of viral infection is 82%, which is also consistent with these results. As in literature, specificity of the Mistik Score was higher than its sensitivity in our study. There are no similar studies finding that the optimal cut-off value for the Mistik Score in RADT negative patients is 3 and above. We think RADT must not be used in case the Mistik Score is 3 and above while we recommend the use of RADT in case the score is 2 and below. The significant and negative correlation between the Mistik Score and Modified Centor Score is similar to findings in literature.

In the study including 223 pediatric patients admitted with the diagnosis of pharyngitis by Kose et al., the number of patients without cough and with cervical lymph node were higher in GABHS positive patients compared to the GABHS negative group (p<0.05 and p<0.05 respectively). The symptoms of fever (above 38 degrees), nasal obstruction, and tonsillar crypt and hypertrophy were similar (p>0.05, p>0.05, p>0.05, and p>0.05 respectively). Median (25p-75p) Modified Centor Score in GABHS positive group was 3 (3-4) and lower than that of GABHS negative group (p<0.05). In our study, the number of patients with cervical lymphadenopathy was higher in RADT positive group, which is similar to findings in literature. The number of patients with fever (above 38 degrees) and tonsillar exudate/hypertrophy was higher in RADT positive group, which is different from findings in literature. The number of patients with nasal obstruction was lower in RADT positive group, which is different from findings in literature. These may be because RADT was used instead of throat culture and a mixed population including adults and children was included in our study.

Clinical scoring systems in patients admitted with sore throat are easy-to-apply and useful and decreases the cost of RADT (17). The number of studies assessing the use of clinical scoring is limited in literature. In a study in which the Modified Centor Score was followed by RADT,

utility of clinical scoring systems and RADT was assessed by healthcare workers and patients. All the patients (100%) who underwent RADT found it useful. They stated that the test was satisfactory (99.3%) and that they would undergo the test again in the future if necessary. All the pharmacists who participated in that study also found the intervention useful. The pharmacists spent 6-15 minutes to apply clinical scoring systems and 98.6% of the pharmacists who gave feedback explained that they were ready to use clinical scoring systems in daily practice. All the pharmacists stated that RADT was easy-to-use, 75.7% stated that it was not hard to collect pharyngeal swab and 97.3% stated that scoring systems were sufficient to guide clinical treatments. Patients' level of accepting RADT and compliance with the recommendations were observed to be very high. Putting a combination of clinical scoring and RADT into use in the management of sore throat has been positively responded by both patients and pharmacists (18). In our study, family physicians stated at the end of the study that clinical scoring systems were satisfactory in 91.7% of patients admitted with sore throat, which is consistent with findings in literature. Family physicians stated that they mostly used the Modified Centor Score, which may be because the Modified Centor Score was the most commonly used and known clinical scoring system in the United States of America and European countries. Family physicians stated at the end of the study that the Mistik Score was more useful, which may be because the rate of viral infections was higher and there was no other scoring system for viral infections in literature.

Another study in France revealed that RADTs were not commonly used by family physicians although they were provided free of charge by health insurance. The time needed for the test was one of the most common obstacles reported for the use of RADT (18). Another study revealed that French family physicians used RADT in only 60.1% of the pediatric patients with tonsillopharyngitis (19). The number of RADTs used by family physicians in that study was higher than the rates of its daily use. Family physicians stated that they preferred RADT mostly in pediatric age group, which is consistent with findings in literature. In our study, the reason why RADT was not commonly used was similar to that in literature and may be the time insufficiency for examination. Moreover, family physicians may also have used RADT more in the pediatric age group due to the sequela of acute rheumatic fever.

Limitations of the Study: The most important limitation of the study is using RADT, which helps diagnosis, for diagnosis in the 1st stage of the study instead of throat culture which is the gold standard test. Other limitations are that the number of patients participating in the study was

low and the study group was a mix of children and adults. Another limitation is that the number of family physicians participating in the 2nd stage of the study was low.

Strengths of the Study: The number of studies assessing the use of clinical scoring and RADT used in the primary care in patients with sore throat is low and there are ongoing studies. One of the strengths of this study is that it was performed with RADT giving rapid results and clinical scoring was used for patients before RADT.

CONCLUSION

In conclusion, the use of clinical scoring systems and RADT makes diagnosis more approximate in GABHS tonsillopharyngitis. The use of clinical scoring systems such as the Mistik Score and Modified Centor Score in sore throat commonly seen in daily family medicine practice will help the decision on whether additional RADT is necessary or not and most importantly help family physicians decide on the better therapy options.

We believe allowing the use of RADT and clinical scoring in Family Healthcare Centers will be effective in reducing antibiotic use and help patients who only need symptomatic treatment receive therapy without waiting. Therefore, we recommend the use of clinical scoring systems. The use of the Mistik Score may be better in diagnosing viral sore throat especially due the high rate of viral tonsillopharyngitis.

REFERENCES

1. Smith JL. Pharyngitis. In: Paulman PM HJeTsMoFMP, 2007; pp. 274-6.
2. Bisno AL. Practice guidelines for the diagnosis and management of group A streptococcal pharyngitis Clin Infect Dis. 2002;113-25.
3. Tanz RR, Gerber MA, Kabat W, Rippe J, Seshadri R, Shulman ST. Performance of a rapid antigen-detection test and throat culture in community pediatric offices: implications for management of pharyngitis. Pediatrics. 2009;123(2):437-44.
4. Hashigucci K, Matsunobu T. Etiology of acute pharyngitis in adults: the presence of viruses and bacteria. Nippon Jibiinkoka Gakkai Kaiho. 2003;106(5):532-9.
5. Centor RM, Witherspoon JM, Dalton HP, Brody CE, Link K. The diagnosis of strep throat in adults in the emergency room. Med Decis Mak. 1981;1(3):239-46.
6. Pelucchi C, Grigoryan L, Galeone C, Esposito S, Huovinen P, Little P, et al. Guideline for the management of acute sore throat: ESCMID Sore Throat Guideline Group. Clin Microbiol Infect. 2012;18:1-27.
7. Mistik S, Gokahmetoglu S, Balci E, Onuk FA. Sore throat in primary care project: a clinical score to diagnose viral sore throat. Fam Pract. 2015;32(3):263-8.
8. Bisno AL, Peter GS, Kaplan EL. Diagnosis of strep throat in adults: are clinical criteria really good enough? Clin Infect Dis. 2002;35(2):126-9.
9. Gonzales R, Camargo Jr CA, MacKenzie T, Kersey AS, Maselli J, Levin SK, et al. Antibiotic treatment of acute respiratory infections in acute care settings. Acad Emerg Med. 2006;13(3):288-94.
10. Gerber MA. Comparison of throat cultures and rapid strep tests for diagnosis of streptococcal pharyngitis. Pediatr Infec Dis J. 1989;8(11):820-4.
11. Carroll K, Reimer L. Microbiology and laboratory diagnosis of upper respiratory tract infections. Clin Infect Dis. 1996;23(3):442-8.
12. Hoffmann S. Detection of group A streptococcal antigen from throat swabs with five diagnostic kits in general practice. Diagn Microbiol Infect Dis. 1990;13(3):209-15.
13. Pontin IPO, Sanchez DCJ, Di Francesco R. Asymptomatic Group A Streptococcus carriage in children with recurrent tonsillitis and tonsillar hypertrophy. Int J Pediatr Otorhinolaryngol. 2016;86:57-9.
14. Cabbarpur C, Büyüklü F, Çakmak Ö, Haşimoğlu R, Ergın F, Özhan Zr, et al. Akut tonsillofarenjitte rapid strep a testi kullanımı. KBB-Forum. 2004;3:10–2.
15. Little P, Hobbs FR, Moore M, Mant D, Williamson I, McNulty C, et al. Clinical score and rapid antigen detection test to guide antibiotic use for sore throats: randomised controlled trial of PRISM (primary care streptococcal management). BMJ. 2013;347.
16. Palla AH, Khan RA, Gilani AH, Marra F. Over prescription of antibiotics for adult pharyngitis is prevalent in developing countries but can be reduced using McIsaac modification of Centor scores: a cross-sectional study. BMC Pulm Med. 2012;12(1):70.
17. Demoré B, Tebano G, Gravoulet J, Wilcke C, Ruspini E, Birgé J, et al. Rapid antigen test use for the management of group A streptococcal pharyngitis in community pharmacies. Eur J Clin Microbiol Infect Dis. 2018:1-9.
18. Pulcini C, Rabaud C. Comment mieux prescrire les antibiotiques? Rev Prat. 2012;62(7).
19. Michel-Lepage A, Ventelou B, Verger P, Pulcini C. Factors associated with the use of rapid antigen diagnostic tests in children presenting with acute pharyngitis among French general practitioners. Eur J Clin Microbiol Infect Dis. 2014;33(5):723-8.