Alternative diagnostic method for streptococcal pharyngitis: Breese scoring system

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This study was performed to determine the effectiveness of the Breese scoring system for the diagnosis of streptococcal pharyngitis with respect to different age groups. Two hundred and two children aged three years and younger (Group 1), and 514 children over three years old (Group 2) with complaints of acute pharyngitis were evaluated by Breese scoring and throat-swab cultures. In Group 1, no significant difference was detected in Breese scoring between subjects who had positive and negative culture for group A β-hemolytic streptococci (GABHS). However, in Group 2 the mean value of the Breese scores was found to be higher in subjects who had positive GABHS. The diagnostic value of Breese scoring was examined for each group. Its sensitivity, and positive and negative predictive values were higher in Group 2 than in Group 1. In conclusion, Breese scoring was determined to be helpful in the diagnosis of streptococcal pharyngitis in children over three years of age.

Key words: Breese scoring, diagnosis, streptococcal pharyngitis.

Group A beta-hemolytic streptococci (GABHS) are considered the most likely bacterial pathogens in children with symptomatic pharyngitis. Nevertheless, there are still many diagnostic and therapeutic problems concerning streptococcal pharyngitis. The principal importance of this medical condition is related to its suppurative complications such as parapharyngeal or retropharyngeal abscess, bronchopneumonia, and meningitis, and nonsuppurative complications such as rheumatic fever and glomerulonephritis. Accurate diagnosis of GABHS infection requires the taking of a throat-swab culture[1-3]. In cases where a throat-swab culture is unavailable due to technical insufficiency for throat culture or results of a culture cannot be awaited for 18 to 24 hours, differential diagnosis of GABHS is achieved through rapid antigen tests and the observation of clinical signs and symptoms[3-5].

The prevalence of GABHS varies considerably, but has been found to range from 15-20 percent in healthy school children. The observed prevalence depends on the season, sampling method, age group, and socioeconomic and other environmental factors[6]. In Turkey, Aysev[7] found that beta-hemolytic streptococci colonization was 14.0-17.6 percent in different age groups of asymptomatic children. In other studies, Özsan et al.[8] and Gülmezoğlu[9] found that beta-hemolytic streptococci colonization was 8.2-16.7 percent in throat cultures of healthy Turkish children. Microbiological evaluation of all patients with signs and symptoms of upper respiratory infections with throat-swab culture or rapid antigen test may frequently be impossible due to technical insufficiency and high cost. Therefore, clinical diagnosis of streptococcal pharyngitis is more important.

In 1977, Breese[4] developed the nine-factor scoring system which includes complaints, and clinical and laboratory data for tentative diagnosis of GABHS pharyngitis. Because clinical signs and symptoms of streptococcal pharyngitis are different in early childhood[5,10,11], it is difficult to achieve a reliable clinical diagnosis in different age groups using the Breese scoring system.

This study was carried out to determine the significance of the Breese scoring system in diagnosing streptococcal pharyngitis and to evaluate its effectiveness in different age groups.

Material and Methods

Seven hundred and sixteen children with signs and symptoms of upper respiratory infections such as fever, sore throat, cough, pharyngeal abnormality or rhinorrhea who admitted to Ankara University Hospital Out-patient Department of Pediatrics were enrolled in the study. All the patients were clinically diagnosed as having tonsillopharyngitis. Children with acute otitis media and sinusitis were excluded from the study group. The research population was divided into two age groups. Group 1 consisted of children aged three and below. Group 2 comprised children over three years of age. They were then assessed using both the Breese scoring system and throat-swab cultures. The two groups were compared using the Breese scores and GABHS-positivity in throat cultures.

The nine factors utilized in the Breese scoring system are as follows:

1. month of presentation, 2. age, 3. white blood cell (WBC) count, 4. degree of fever, 5. sore throat, 6. cough, 7. headache, 8. abnormal pharynx, and 9. abnormal cervical glands. The patients' signs and symptoms were scored as present (yes), absent (no), unknown or certain levels of these nine factors by the physicians as shown in Table I. The total of all items was accepted as the Breese score of the patient. A few simple rules for the scoring system have been established. For a symptom or sign to be listed as "yes", it should have developed concurrently with the onset of the present illness. The presence of moderate or intense redness or swelling, exudate, petechial bleeding, or ulceration of the throat should always be counted as symptomatic of an abnormal pharynx. The "abnormal cervical glands" are the submandibular or anterior cervical lymph nodes that drain the tonsillar area. They are considered abnormal if they are swollen (larger than 2x2 cm) without being tender or if they are palpable and tender. The presence of rhinorrhea and abdominal pain was also investigated, but these items were not included as factors in the scoring system. The study group was divided into two age groups because clinical manifestations and expressions of complaints are different in early childhood.

The thorat-swabs were smeared on sheep's blood agar plate for the identification of GABHS on throat. The bacitracin and trimethoprim sulfamethoxazole sensitivity tests were used for diferentiating group A beta-hemolytic-strains from non-group A strains.

Table I. Breese Scoring System* for Diagnosis of Pharyngitis due to Group A Beta-Hemolytic Streptococci

	Scores		Scores
1. Season of Year		5. Cough	
February, March, April	4	Yes	2
December, January, May	3	No or unknown	4
June, October, November	2		
July, August, September	1	6. Headache	
		Yes	4
2. Age (Years)		No or unknown	2
5-10	4		
4, 11-14	3	7. Sore Throat	
3, ≥ 15	2	Yes	4
2 ≤	1	No or unknown	2
3. WBC/mm^3		8. Abnormal Pharynx	
≤ 8,400	1	Yes	4
8,500-10,400	2	No	1
10,500-13,400	3	Unknown	3
13,500-20,400	5		
≥ 20,500	6	9. Abnormal Cervical Glands	
Not done	3	Yes	4
		No	2
4. Fever ≥ 38 °C		Unknown	3
Yes	4		
No or unknown	2		

* Breese BB, American Journal of Disease in Childhood, 1977; 131: 514-517.

In both groups, the diagnostic value of the Breese scoring system was determined by comparison with the results of the throat-swab cultures, which were accepted as the reference tests. Breese found that more than 50 percent of the population with positive cultures had a minimum score of 30 and suggested that a minimum of 30 points was enough for the diagnosis of streptococcal pharyngitis[4]. In this study the minimum score for more than 50 percent of the children with streptococcal pharyngitis was 31, but the mean of the Breese scores of all children with positive cultures was 30 points. Therefore, the lowest definitive score for positive diagnosis of streptococcal pharyngitis was accepted to be 30 points as suggested by Breese.

The statistical evaluation of the data was performed using chi-square and student's t tests.

Results

Two hundred and two of the 716 children with tonsillopharyngitis were from Group 1 and 514 were from Group 2. Group 1 consisted of 91 girls

and 111 boys. Group 2 comprised 231 girls and 283 boys. The mean age of the children in Group 1 was 1.9 ± 0.1 years (range: 6 months-3 years) and in Group 2 was 7.4 ± 1.7 years (range: 4-17 years).

The percentage of children diagnosed GABHS-positive as a result of throat-swab cultures was 17.8 percent in Group 1 and 31.3 percent in Group 2. The difference between the two groups in terms of GABHS-positivity was statistically significant ($p < 0.001$).

The Breese scores were between 18 and 33 in Group 1, and 20 and 37 in Group 2. The mean scores of the GABHS-positive children were 25.6 ± 0.6 in Group 1 and 30.7 ± 0.5 in Group 2. This difference between the two groups was statistically significant ($p < 0.0001$).

In Group 1, there was no difference between the mean Breese scores of GABHS-positive and negative children. In Group 2, the mean Breese scores were higher in GABHS-positive than in GABHS-negative children (Table II). The relationship between the Breese scores and GABHS-positivity was determined in both age groups (Table III).

The diagnostic value of the Breese scoring system in Group 1 was: sensitivity, 25.0 percent; specificity, 90.9 percent; positive predictive value, 37.5 percent; and negative predictive value 84.8 percent; and in Group 2: sensitivitiy, 76 percent; specificity, 66.9 percent; positive predictive value, 51.3 percent; and negative predictive value, 86.1 percent.

All the factors included in this study were evaluated in terms of their ability to indicate GABHS as a factor in pharyngtis (Table IV). In Group 1, coughing is the only factor that was observed more frequently than the others. This difference was statistically significant. In Group 2, fever, sore throat, hedache, abdominal pain, and enlarged (abnormal) cervical glands were frequently observed in GABHS-positive children, while coughing and rhinorrhea were frequently observed in GABHS-negative children. There was no difference in the mean of the WBC counts of the two age groups, but in the GABHS-positive children aged three years and above, the mean of the WBC count was higher. A high frequency of GABHS-positive cases was found in September, October, November, December, February, and March of the year of this study.

Table II. Comparison of Mean Breese Scores According to Results of Throat-Swab Culture

	GABHS-positive		GABHS-negative		
Groups	Patients (%)	Breese Score X ± SE	Patients (%)	Breese Score X ± SE	Total n-%
Group 1 ≤ 3 years	17.8	25.6 ± 0.6[a]	82.2	24.5 ± 0.2[a]	202-100.0
Group 2 > 3 years	31.3	30.7 ± 0.5[b]	68.7	27.9 ± 0.1[b]	514-100.0
Total	27.5	29.6 ± 0.3[c]	72.5	26.3 ± 0.2[c]	716-100.0

a: $p > 0.05$; b: $p < 0.0001$; c: $p < 0.0001$.

Table III. Relation of Scores to Assigned Streptococcal Diagnosis and Accuracy of Such Diagnosis in Both Age Groups

	Group 1		Group 2	
Breese score	No. of patients (n)	GABHS-positive patients (n-%)	No. of patients (n)	GABHS-positive patients (n-%)
15-19	3	0-0.0	0	0-0.0
20-24	102	14-13.7	49	5-10.2
25-29	73	13-17.8	225	33-14.7
Total 15-29	178	27-15.2	274	38-13.9
30-34	24	9-37.5	230	114-49.6
35-39	0	0-0.0	10	9-90.0
Total 30-39	24	9-37.5	240	123-51.3

Table IV. Results of Throat-Swab Cultures and Frequency of Signs and Symptoms in Both Age Group

	Group 1			Group 2		
	GABHS			GABHS		
Symptoms	Positive %	Negative %	P	Positive %	Negative %	P
Fever	69	53	NS	78	46	< 0.0001
Sore throat	22	28	NS	78	63	< 0.001
Headache	8	21	NS	65	46	< 0.001
Abdominal pain	6	8	NS	24	13	< 0.01
Cough	50	74	< 0.05	38	67	< 0.0001
Rhinorrhea	47	50	NS	17	39	< 0.0001
Hoarseness	8	8	NS	7	14	< 0.05
Abnormal cervical glands	19	30	NS	70	49	< 0.0001
WBC (/mm^3) (Mean)	10,409	9,768	NS	13,830	9,583	< 0.0001

NS: Not significant.

Discussion

A throat-swab culture is necessary for accurate diagnosis of streptococcal pharyngitis. Recently, a number of rapid diagnostic techniques have become available, allowing a diagnosis of infection due to GABHS within minutes. If the rapid antigen test is positive, treatment is initiated, but negative test results should be confirmed with a throat-swab culture[3,10-12].

Clinical diagnosis is a guide in deciding whether to perform a throat-swab culture or rapid antigen test[3-5]. In 1977, after evaluating 20,000 cases of acute respiratory illness in children, Breese described a scoring system for diagnosis of streptococcal pharyngitis. It was found that in 57.9 percent of the population with scores of 30 or above, the mean percentage of positive cultures was 77.6 percent. It was suggested that antibiotherapy should be given to children with a score above 30 points[4,5].

Streptococcal pharyngitis is rare in children younger than two years of age[6,11], and the symptoms of streptococcal pharyngitis may be different in early childhood[5,6,10]. Of note is that in young children one to three years of age with GABHS, upper respiratory infection may sometimes present with fever and serous rhinitis[10]. Moreover, younger children are often not able to specify their complaints such as dysphagia, headache and abdominal pain. Although age is one of the factors in the scoring system, this study reevaluated the Breese scoring system with two different age groups. In children aged three years and under (Group 1) with scores of 30 or more, the percentage of positive cultures, i.e., the positive predictive value and sensitivity of the scoring system, was very low. These results suggest that the Breese scoring system is not useful with younger children with upper respiratory infections. In Group 2 with scores of 30 or above, the positive predictive value was 51.3 percent and sensitivity was 76.4 percent. The negative predictive value of the scoring system was above 80 percent in both groups. Similarly, Funamura and Berkowitz[13] found the system to be most useful in predicting culture-negative patients (80% accurate) in a study of 892 patients at a teaching hospital.

When the relationship between the culture results and clinical findings was evaluated for each parameter (Table IV), only coughing implied that infection was not bacterial in the children three years of age and younger. However, in the older children, fever, abnormal lymph nodes, headache, sore throat, and abdominal pain implied streptococcal pharyngitis, while rhinorrhea and hoarseness indicated a non-bacterial etiology. These findings show that signs and symptoms of respiratory illness may be helpful for diagnosis of streptococcal pharyngitis in older children.

In conclusion, the Breese scoring system did not seem to be effective in the diagnosis of streptococcal pharyngitis in early childhood. However, in children over three years of age, this scoring system is useful for streptococcal pharyngitis, especially in deciding whether or not to take o throat-swab culture and in cases where there is no opportunity to take a culture and an immediate decision to start antibiotherapy should be made.

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