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Original Research Article

Relevance of scoring systems in acute appendicitis

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ABSTRACT

Background: Acute appendicitis continues to be a clinical dilemma, despite the addition of myriad diagnostic modalities to the surgeon's arsenal. A reliable scoring system would help streamline diagnosis as well as avoid unnecessary surgeries, in a limited resource setting.
Methods: Retrospective observational study evaluating 2 clinical scoring systems for acute appendicitis.
Results: For Teicher and Izbicki scores, a sensitivity of 49.5% and 55.71%, specificity of 63.41% and 51.22%, positive predictive value of 92.22% and 90.90%, negative predictive value of 12.56% and 11.67%, negative appendicectomy rate of 8.82% and 10% were found respectively.
Conclusions: Acute appendicitis is one of the most common cases presenting to the general surgeon and its diagnosis continues to be clinical enigma, owing to a variety of presentations, degrees of severity and differential diagnoses. Our study shows that Teicher and Izbicki scoring systems can be of value in decision making in acute appendicitis and in reducing the number of negative laparotomies, particularly in limited resource settings where access to advanced diagnostic modalities is limited and expensive. Amongst the two scoring systems, the Teicher score appears to be superior in reducing the negative appendicectomy rate.

Keywords: Acute appendicitis, Clinical scoring systems, Izbicki, Teicher

INTRODUCTION

Acute appendicitis is the most common cause for acute abdomen in young adults and a frequently encountered surgical emergency, constituting the most common cause for a laparotomy.[1] The lifetime risk for acute appendicitis varies between 7-10%.[2,3] Despite rapid advances in diagnostic modalities, none are a 100% accurate, and it remains essentially a clinical diagnosis.[4,5]

A decision to operate based on a presumptive diagnosis of acute appendicitis is a source of both significant financial expenditure as well as patient morbidity. This is especially true in the case of a 'negative appendicectomy', which has been shown to have higher rates of hospital stay, complication rates and mortality.[6]

The financial impact of negative appendicectomies in North America was assessed by Klum and Koespen and the annual expenditure for the same was found to be $742 million.[6]

Various scoring systems have been developed such as Ohmann, Lindberg, Teicher, Izbicki, Christian and Alvarado.[7-13] A significant reduction in the negative appendicectomy rate in patients subjected to clinical scoring systems has been observed.[14]

In a country with limited resources, a clinical scoring system which is reliable and easy calculated can have a role in the diagnosis and decision making in acute appendicitis, supplementing and is cases supplanting the need for expensive and at times unavailable complicated radiological and laboratory diagnostic modalities.

While much literature exists evaluating the efficacy of the Alvarado score, work on other scores is less forthcoming.[15-18]

To this end, our study compared two such commonly used scoring systems-Teicher and Izbicki in a retrospective analysis to determine the efficacy of each.

METHODS

This was a retrospective observational study conducted at SDM College of Medical Sciences and Hospital, Dharwad, Karnataka, India between January 2013 to March 2016. All patients presenting with acute abdominal pain with suspected acute appendicitis for whom appendicectomy was done were included in the study. All the patients underwent appendicectomy, either emergently or after an initial period of conservative management. Patients who were managed non-operatively or those whose records were unavailable were excluded from the study.

All of the above patients underwent a thorough history and physical examination, followed by a screening haemogram including total and differential leucocyte counts, abdominal radiograph and abdominal ultrasound. The appendicetomy specimen was subjected to histopathological examination, which was taken as the diagnostic reference gold standard. The presence of neutrophils in the muscularius propria was taken as the criterion for a diagnosis of acute appendicitis.

Teicher (Table 1 and Table 2) and Izbicki (Table 3 and Table 4) scores were calculated for each patient.

Table 1: Teicher score.

Clinical parameters	Score
Predictors of positive appendicectomy	
Male	+2
Age > 50 years	+3
Duration 1.5 days	+2
Duration 2 days	+1
Involuntary right lower quadrant muscle spasm	+3
White cell count >13 ×10^9 /L	+2
Predictors of negative appendicectomy	
Female	-1
Age 20-39 years	-1
Duration 3 days	-3
Genitourinary symptoms	-3
No right lower quadrant spasm	-3
Right sided rectal mass	-3
White cell count <10 ×10^9 /L	-3

From the above the sensitivity, specificity, positive predictive value, negative predictive value and negative appendicectomy rate were calculated as below.

Descriptive statistical methods were used to calculate the p value, and Pearson chi-square value.

Table 2: Interpretation of Teicher score.

Score	Recommendation
<-6	Search for an alternative diagnosis
-6-+2	Initial Observation
>+2	Immediate operation

Table 3: Izbicki score.

Gender	Male	1	Female	0
White cell count	≥11,000 × 10^9/L	1	<11,000	0
Guarding	Present	1	Absent	0
Rebound pain	Present	1	Absent	0
Migration of pain to right lower quadrant	Present	1	Absent	0
Duration of pain	≤24 hours	1	≥24 hours	0
Types of pain	Intermittent	1	Other	0

Table 4: Interpretation of Izbicki score.

Scores	Recommendation
≤2	Monitoring
>2	Operation

Sensitivity

$$\text{Sensitivity} = \frac{number\ of\ true\ positives}{number\ of\ true\ positives + number\ of\ false\ negatives}$$

$$= \frac{Number\ of\ cases\ classified\ as\ appendicitis\ by\ scoring\ system\ confirmed\ by\ HPR}{number\ of\ cases\ classified\ as\ appendicitis\ by\ scoring\ system\ confirmed\ by\ HPR + number\ of\ cases\ classified\ as\ appendicitis\ by\ scoring\ system\ but\ proven\ normal\ by\ HPR}$$

Specificity

$$\text{Specificity} = \frac{number\ of\ true\ negatives}{number\ of\ true\ negatives + number\ of\ false\ postives}$$

$$= \frac{Number\ of\ cases\ classified\ as\ not\ appendicitis\ by\ scoring\ system\ confirmed\ by\ HPR}{number\ of\ cases\ classified\ as\ not\ appendicitis\ by\ scoring\ system\ confirmed\ by\ HPR + number\ of\ cases\ classified\ as\ not\ appendicitis\ by\ scoring\ system\ but\ proven\ to\ be\ appendicitis\ by\ HPR}$$

Positive predicitive value

$$\text{value} = \frac{Number\ of\ true\ positives}{number\ of\ true\ positives + number\ of\ false\ positives}$$

Negative predictive value

$$\text{Value} = \frac{Number\ of\ true\ negatives}{number\ of\ true\ negatives + number\ of\ false\ negatives}$$

Negative appendicectomy rate

$$\text{NAR} = \frac{no.of\ patients\ with\ negative\ histopathology\ reports\ assigned\ to\ the\ operation\ group}{total\ number\ of\ patient\ \text{sin}\ operation\ group}$$

RESULTS

A total of 800 case records were analyzed. Around 68% of the patients were male and 32% female. The age varied from 14-82 years with a mean age 31 years. The majority of the cases occurred below the age of 40 years (80%) with 20-29 being the predominant age group (40.75%) in which the disease presented (Table 5).

Table 5: Age and gender distribution among study population (n=800).

Age (years)	Male	Female	Total	Percentage (%)
10-19	82	36	118	14.75
20-29	234	92	326	40.75
30-39	124	74	198	24.75
40-49	52	34	86	10.75
>50	50	22	72	9.00
Total	542	258	800	100.00

Out of 800 case records analyzed and scored with the Teicher scoring system, appendicitis was ruled out in 286 (score <-6). Of the remaining 514, 378 were assigned to the observation group and 136 to the operative group (Table 6).

Table 6: Distribution of patients according to Teicher score (n=800).

<-6	≥-6 - ≤+2	>+2
286	378	136

Scored as per the Izbicki scoring system, 360 patients were assigned to the observation group(score ≤2) and 440 to the operative group(≥2) (Table 7).

Table 7: Distribution of patients according to Izbicki score (n=800).

≤ 2	>2
360	440

Table 9: Accuracy of Teicher score in diagnosis of acute appendicitis (n=800).

		Histopathology of appendix	
		Appendicitis	**No appendicitis**
Teicher score	Appendicitis	356	30
	No appendicitis	362	52

Pearson chi-square=2.489; p=0.115.

Table 10: Accuracy of Izbicki score in diagnosis of acute appendicitis (n=800).

		Histopathology of appendix	
		Appendicitis	**No appendicitis**
Izbicki score	Appendicitis	400	40
	No appendicitis	318	42

Pearson chi-square=0.714; p=0.398.

Histopathological examination of the appendicectomy specimens showed 86 (10.75%) patients to have only minimal hyperemia of the serosa with no evidence of acute appendicitis. The remaining 714 (89.25%) showed acute appendicitis. The comparison between retrospective classification according to scoring system and the final histopathological reports is shown in Tables 9 and 10. For the Teicher scoring system a score of ≤-3 was taken to be diagnostic of appendicitis. For the Izbicki scoring system, a score of ≤2 was taken to be diagnostic of appendicitis.

For the Teicher score, sensitivity was found to be 49.58% specificity 63.41%. The positive predictive value was 92.22% and negative predicitive value 12.56%. The negative appendicectomy rate was 8.82%, a reduction from the 10.75% arrived at without the application of a scoring system.

For the Izbicki score, sensitivity was found to be 55.71% specificity 51.22%. The positive predictive value was 90.90% and negative predicitive value 11.67%. The negative appendicectomy rate was 10%, which is approximately the same as the 10.75% arrived at without the application of a scoring system. The results are summarized in Table 11.

Table 11: Results of Teicher and Izbicki scoring systems (N=800).

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Negative appendectomy rate
Teicher scoring system	49.58%	63.41%	92.22%	12.56%	8.82%
Izbicki scoring system	55.71%	51.22%	90.90%	11.67%	10%

DISCUSSION

An accurate diagnosis of acute appendicitis remains necessary in the day to day practice of a general surgeon, to prevent unnecessary delay, resulting in complications such as perforation, as well as to avoid 'negative appendicectomies'. Both of these result in significant morbidity for the patient as well as considerable financial expenditure. As such, scoring systems present as simple, easy to use and inexpensive diagnostic and decision making tool.[8] While a considerable body of work exists on the application and utility of more popular scoring

systems such as the Alvarado scoring system, literature on the Teicher and Izbicki systems is less forthcoming.[19-21] The Teicher scoring system was based on seven predictors found to be statistically significant. The cutoff value was devised by weighing the improved diagnostic accuracy against risk to the patient. The primary intent of the score was to distinguish patients requiring surgical intervention as opposed to candidates for conservative management, rather than making a primary diagnosis of the acute appendicitis.

From the study, it can be seen that the Teicher and Izbicki systems suffer from low sensitivity of 49.58% and 55.71% respectively and specificity of 63.41% and 51.22% respectively. This differs with the values arrived at in other studies.[22] A study by Subramaniyan P et all found the Teicher score to have sensitivity of, 93.9% specificity of 83.3%, positive predictive value of 54.4% and negative predictive value of 55.6%. In this light, the values arrived at in our study, in a relatively large sample size, is certainly unusual.

In our case series, both the Teicher and Izbicki systems were found to have high positive predictive values of 92.22% and 90.90%. However, their negative predictive values of 12.56% and 11.67% respectively were rather low, making them prone to miss a large number of cases of acute appendicitis. This combined with their low specificity and sensitivity in our case series would suggest that they are not reliable tools for the primary diagnosis of acute appendicitis. However, while a negative clinical score cutoff cannot rule out a diagnosis of acute appendicitis, a positive cutoff can establish the diagnosis with a fair degree of confidence.

The Teicher and Izbicki systems produced negative appendicectomy rates of 8.82% and 10% respectively in our study series. These represent a significant reduction in the number of negative appendicectomies, the accepted value for the NAR as per literature being <15%, though surgeons will accept a rate of upto 30%.[23] Hence, despite being a less than desirable to tool for the primary diagnosis of the disease, each scoring system provides an excellent means of segregating those patients who require appendicectomy, thereby reducing the number of negative appendicetomies.

CONCLUSION

Acute appendicitis is one of the most common cases presenting to the general surgeon and its diagnosis continues to be clinical enigma, owing to a variety of presentations, degrees of severity and differential diagnoses. Our study shows that Teicher and Izbicki scoring systems can be of value in decision making in acute appendicitis and in reducing the number of negative laparotomies, particularly in limited resource settings where access to advanced diagnostic modalities is limited and expensive. Amongst the two scoring systems, the Teicher score appears to be superior in reducing the negative appendicectomy rate.

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