

Role of Alvarado Score in Diagnosing Acute Appendicitis: A Prospective Observational Study

E Ramya¹, G Nagalekshmi²

¹Junior Resident, Department of Plastic Surgery, Thanjavur Medical College Hospital, Thanjavur, Tamil Nadu, India, ²Senior Assistant Professor, Department of General Surgery, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India

Abstract

Introduction: Acute appendicitis is a surgical emergency, which is associated with morbidity and mortality occasionally, so accurate diagnosis and timely intervention is needed. Therefore, the present study is conducted to evaluate the Alvarado scoring system in diagnosing acute appendicitis and its correlation with histopathology.

Aim: The aim is to study the effectiveness of Alvarado score in diagnosing acute appendicitis.

Materials and Methods: The study population consists of 100 patients admitted in casualty with suspicion of acute appendicitis. The Alvarado scoring system scores the severity of acute appendicitis and the patients were divided into three groups and managed according to the severity.

Results: Group A had 54 patients with scores 7–10 and considered acute appendicitis and taken for emergency appendicectomy. Out of 31 patients in Group B, 18 were conservatively managed, and 13 were diagnosed with acute appendicitis and operated. Out of 15 patients in Group C, two were operated, and 13 were managed conservatively.

Conclusion: In this study, the sensitivity, specificity, and positive predictive value were 89.66%, 59.52%, and 75.36%, respectively. Younger age group is predominant. This scoring system is a dynamic one, allowing observation and reevaluation of the clinical picture. Its value in decision-making is high both in males and females. Its application improves diagnostic accuracy and considerably reduces the negative laparotomy rate.

Keywords: Abdominal pain, Acute appendicitis, Alvarado score, Appendicectomy

INTRODUCTION

Diagnosis of appendicitis is usually easy, but it is still difficult to diagnose acute appendicitis mainly because of the challenge we face while diagnosing acute appendicitis on clinical grounds.^[1]

Acute appendicitis is a common cause of surgical emergency that needs to be diagnosed with accuracy to reduce the morbidity and mortality associated with it.^[1,2]

Acute appendicitis is seen in day-to-day practice in the emergency department as one of the most common surgical emergencies.

It can sometimes confuse the practitioners by its presentation. The delay in early diagnosis or failure in early diagnosis may happen many times. This may lead to disease prognosis. This will further lead on to increase in morbidity as well as occasional mortality in the patient.^[3]

Although there are many recent trends in investigatory modalities, diagnosis of acute appendicitis is still in a mystery, leading to an increase in operative indication for the patient due to the fear of complication followed by it.

There is an increase in the negative appendicectomy rate of about 20% seen in the literature.^[4,5]

Therefore, Alvarado developed a scoring system in 1986 to diagnose acute appendicitis, thereby reducing the rate of negative appendicectomy without causing an increase in morbidity and mortality.

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Corresponding Author: Dr. G Nagalekshmi, Department of General Surgery, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India.

Alvarado described the scoring system in 1986. Alvarado A in 1994 later modified it by taking one laboratory finding of the scoring system.^[6]

The Alvarado scoring system in patients with the pre-operative clinical diagnosis of appendicitis has been useful in the early diagnosis of acute appendicitis as demonstrated by various studies and helped reduce the incidence of negative appendicectomies without increasing the morbidity and mortality.^[6]

Aim

This study aims to study the effectiveness of Alvarado score in diagnosing acute appendicitis.

MATERIALS AND METHODS

A prospective observational study was done in the Department of General Surgery, Tirunelveli Medical College. One hundred patients suspected of acute appendicitis were included in the study. Patients satisfying the inclusion and exclusion criteria were enrolled in the study. Inclusion criteria: All patients presenting with the right iliac fossa pain. Exclusion criteria: Pain >5 days duration, appendicular lump/mass, features of peritonitis, features of intestinal obstruction, history of trauma to the right iliac fossa, patients with genitourinary complaints, pregnant females, patient with the previous history of any abdominal surgeries, patient not willing for surgery, and age <12 years were excluded from the study. Depending on individual presentation of signs and symptoms, a score was calculated for each suspected appendicitis case from eight values (based on Alvarado scoring system).

- Total score 7–10, these patients were considered to have acute appendicitis and patients were prepared and emergency appendicectomy was done
- Total score 5–6, these patients were considered equivocal, and hence, they are observed by conservative management. If the general condition and the patients’ symptoms were improved, means patients were discharged with the advice to return if the symptom recurs. If the patients developed severe pain and the total score increased, they had to be taken up for surgery
- Total score 1–4, these patients were considered to have either less severe appendicitis or some other. Such a group of patients were managed symptomatically and then discharged. They were also advised to come if the symptoms recur
- Histopathological examination of the appendix specimen was done.

RESULTS

In the present study, we had 100 cases out of which 43 were male and 57 were female. In this study, 69 were

operated for acute appendicitis, including 31 female patients and 38 male patients. The number of patients was highest in the age group of 13–20 years (57%) followed by 21–30 years (27%). The least was in the age group for more than 50 years (4%). Most of the patients were of a younger age group. The younger age group is predominant and the incidence peaks in the age group of 13–30 and decreases with age [Table 1].

Majority of the patients had tenderness in the right iliac fossa as the predominant symptom followed by anorexia and migrating pain [Table 2].

Out of 69 patients operated, 30 were taken up for open appendicectomy and 39 underwent laparoscopic appendicectomy [Table 3].

There were 11 cases of appendicular perforation and all those patients had Alvarado score of 7–10 and none of them was missed by Alvarado score. Only two cases were missed by Alvarado scoring and they had increased scores on reassessment and were operated. Out of 69 patients operated, ultrasonogram findings showed acute appendicitis in 32 patients, probe tenderness in RIF in 26 patients, and normal in 11 patients. Alvarado score was in favor of acute appendicitis even though ultrasonogram was normal in some patients [Table 4].

Table 1: Distribution of age group

Age group (year)	Frequency	Percent
<20	57	57.0
21–30	27	27.0
31–40	9	9.0
41–50	3	3.0
>50	4	4.0
Total	100	100.0

Table 2: Distribution of symptoms

Features	Score	Frequency	Percentage
M	1	67	67.0
A	1	72	72.0
N	1	55	55.0
T	2	98	98.0
R	1	23	23.0
E	1	43	43.0
L	2	65	65.0
S	1	42	42.0

Table 3: Cross-tabulation of Alvarado score with management

Alvarado score	Management	
	Surgery	Conservative
7–10	54	0
5 and 6	13	18
1–4	1	14

In this study, the sensitivity, specificity, and positive predictive value were 89.66%, 59.52%, and 75.36%, respectively [Table 5 and Figure 1].

DISCUSSION

Acute appendicitis is the most common acute surgical condition of the abdomen. Over the past 100 years, the morbidity and mortality rates related to this condition have markedly decreased. This is because of the recognition of the deleterious effects of appendiceal perforation. Thus, an aggressive surgical treatment strategy involving early operation with acceptance of a high negative appendectomy rate of 15–30% is universal. Although the negative appendectomy has negligible mortality, it has associated morbidity rate of 10%. The diagnostic accuracy of clinical assessment of acute appendicitis varies from

50% to 80%. The clinical diagnosis is especially difficult in the very young, the elderly, and the women of reproductive age group.^[7,8]

Appendicitis still poses a diagnostic challenge and many methods have been investigated to reduce the removal of a normal appendix without increasing the perforation rate. Radiological methods such as ultrasonography and computed tomography and an invasive procedure like laparoscopy are all methods that have been investigated previously. Many diagnostic scores have seen advocated but most are complex and difficult to implement in a clinical situation. The Alvarado score first described in 1988, is a simple scoring system. Good clinical acumen remains the mainstay of correct diagnosis of appendicitis.^[6] It is a scoring system that can be instituted easily in the outpatient setting and a cheap and quick tool to apply in the emergency room Alvarado score is an objective assessment of the right lower quadrant pain. The score indicated >7 which indicates high probability of acute appendicitis. Practically speaking, it is equivalent to one's degree of clinical suspicion. Therefore, this scoring system was used to reach the clinical diagnosis. It was considered that using the scoring system to make the clinical diagnosis would allow uniformity as more than 1 senior surgical resident was involved in making the decision. Men accounted for 41% and women 59% of the study group. The maximal incidence of acute appendicitis was found between the ages of 21 and 30, comparable with the literature. In the study by Ohmann *et al.*^[9] and Arian *et al.*,^[10] the negative appendectomy rate was 14.3% and 16.1%. In this study, all the 11 cases of perforative appendicitis had scored 7 or more and were operated, thereby giving 0% missed perforation rate. The two cases which were missed initially came back with increased severity of symptoms and had a higher Alvarado score on reevaluation and were operated. The probable reason for the two false negatives in our study may be the very early stage of acute appendicitis they might have presented initially, thereby hindering the clinical diagnosis.

In this study, the sensitivity, specificity, and positive predictive value were 89.66%, 59.52%, and 75.36%, respectively. This study also shows that the Alvarado scoring system application in diagnosing acute appendicitis can provide a high degree of positive predictive value and thus diagnostic accuracy. This study's positive predictive value is comparable with the studies done by Kalan *et al.*,^[11] Malik *et al.*,^[12] and Owen *et al.*^[2] who reported 87.5%, 85.3%, and 87.4%, respectively.

Table 4: Cross-tabulation of Alvarado score with HPE

Alvarado score	HPE			Total
	Conservative	Acute appendicitis	Perforated appendix	
7–10	0	43	11	54
5 and 6	18	13	0	31
1–4	14	1	0	15

Table 5: Area under the curve

AUC	Std. error ^a	P-value	Asymptotic 95% confidence interval	
			Lower bound	Upper bound
0.947	0.020	0.0001	0.908	0.986

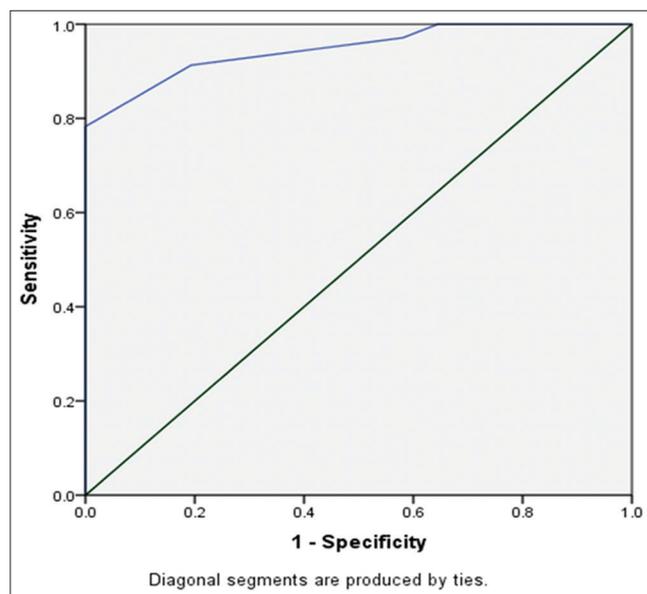


Figure 1: ROC curve

CONCLUSION

The Alvarado scoring system in patients with the pre-operative clinical diagnosis of appendicitis has been

useful in the early diagnosis of acute appendicitis as demonstrated by various studies and helped reduce the incidence of negative appendicectomies without increasing the morbidity and mortality.

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