

Diagnostic Evaluation of Alvarado Score in Pre-operative Diagnosis of Acute Appendicitis

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Abstract

Introduction: Acute appendicitis is one of the most common surgically correctable acute abdomens presenting at emergency department worldwide. In spite of all advances in diagnostic modalities and surgical techniques, diagnosis remains difficult sometimes as a challenge and delayed decision making complicates this surgical disease. Alvarado scoring system is one of available scoring system for diagnosis of acute appendicitis, based on history, clinical examination, and laboratory investigations and easy to apply, helps in clinical decision regarding planning surgery and avoid negative laparotomies. The aim of the study was to evaluate diagnostic accuracy of Alvarado scoring system in pre-operative diagnosis of acute appendicitis and correlating with post-operative findings.

Methods: This study was conducted in 50 cases of suspected appendicitis admitted in Surgery Department, from January 2018 to December 2020 by adopting Alvarado scoring system. Results were recorded and analyzed.

Results: Out of 50 patients admitted with suspected acute appendicitis, number of cases operated suspecting acute appendicitis were 41 of which 39 were found to have acutely inflamed appendix. Results of Alvarado score of operated patients are as follows: 39 patients had score 7–10, and 4 patients had score 5–6, patients with Alvarado score <5 (17 pts) were managed conservatively.

Conclusions: The Alvarado scoring system is a simple and useful diagnostic tool for diagnosis of acute appendicitis with acceptable sensitivity and specificity and can be used with high degree of accuracy. Our findings suggest that patients presenting with abdominal pain and Alvarado scores >7 are more likely to have appendicitis.

Key words: Abdominal pain, Acute appendicitis, Alvarado score, Appendicitis

INTRODUCTION

Acute appendicitis is an inflammation of the appendix that occurs suddenly. It's the most prevalent kind of acute abdominal emergency that necessitates immediate surgical intervention. If early diagnosis fails, simple appendicitis may develop to perforation, resulting in increased morbidity and death; hence, surgeons have been more willing to operate when the diagnosis is likely rather than wait until it is confirmed. Despite more than a century of practice, the surgeon is still unable to make an accurate diagnosis.^[1,2]

When diagnosing a suspected case of acute appendicitis, the core essential concern is whether or not to operate if identified without increasing the likelihood of needless negative surgical procedures.^[1]

Acute appendicitis is prevalent due to its unusual presentations, but diagnosis becomes more difficult when the symptoms coincide with those of other diseases, making diagnosis difficult, especially at an early stage of presentation.^[3] The clinical examination's accuracy has been found to vary from 71% to 97%, and it varies substantially depending on the examiner's expertise.^[4] Due to the serious repercussions of missing ruptured appendices, surgeons have typically accepted a 20% incidence of negative findings during appendectomy and the removal of a normal appendix. Negative appendectomy (removal of a normal appendix in patients with other reasons of stomach discomfort) is said to occur between 20% and 30% of the time.^[5,6]

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Alvarado developed a ten-point clinical scoring system, dubbed “Mantrels,” in 1986 for the diagnosis of acute appendicitis based on symptoms, signs, and diagnostic tests in patients with suspected acute appendicitis.^[7]

The Alvarado score facilitates risk classification in patients with abdominal discomfort by correlating the likelihood of appendicitis with recommendations for discharge, monitoring, or surgical intervention. When the risk of appendicitis is in the intermediate range, more investigations such as ultrasound and computed tomography scanning are required.^[6,7]

Scoring methods are beneficial and accurate for differentiating acute appendicitis from nonspecific abdominal discomfort. Alvarado scoring system is one of many accessible scoring systems for acute appendicitis diagnosis. It is entirely based on history, clinical examination, and a few laboratory tests and is quite simple to administer.^[8] Using an objective grading method such as the Alvarado system, it is possible to minimize the rate of negative appendectomy to 0–5%. However, this method is not intended to take the place of clinical judgment. It assists in identifying acute appendicitis and determining whether or not to operate on a specific instance, hence minimizing the frequency of negative laparotomies. The present study aims at evaluating the efficacy of Alvarado scoring system in pre-operative diagnosis of acute appendicitis and correlating it with post-operative findings.

METHODS

This study was conducted on 50 patients presenting with symptoms and signs of acute appendicitis to the casualty over a period of 2 years from January 2018 to December 2020. Results were analyzed using Microsoft Excel software.

Inclusion Criteria

Patients with symptoms and signs of acute appendicitis in whom emergency appendectomy was done; both the genders and all age groups were included in the study; patients who were willing to participate in study were included in this study.

Exclusion Criteria

Patients with appendicular mass, urinary calculus, gynecological causes of right iliac fossa (RIF) pain; patients who underwent elective/interval appendectomy; patients who were not willing to participate in the study were excluded in this study.

Patients with clinical signs and symptoms suggestive of acute appendicitis such as abdominal pain, rebound tenderness, nausea, vomiting, or elevated temperature who met the inclusion criteria were admitted and after taking informed consent and initial assessment were subjected for detailed history taking, physical examination, routine laboratory investigations, and imaging. Then, they were evaluated using Alvarado scoring system as per the scores of all variables of the scoring system and the aggregate score was given for each patient [Table 1]. Based on the score patients were classified into three groups.

- Group 1: Score 7–10 was most likely acute appendicitis; these patients were taken up for emergency appendectomy
- Group 2: Score 5–6 was possibly acute appendicitis. Patients in this group were admitted and kept under observation for a day with reassessment of the clinical findings and reapplication of the score. Some patients improved with conservative treatment which was shown by a decrease in score and were discharged with advice that they should revert back if symptoms persist, recur or increase in intensity
- Group 3: Score 1–4 was unlikely acute appendicitis: These patients, after giving initial symptomatic treatment, were discharged and sent home with the instructions to revert back if symptoms recur or worsen.

Decision for appendectomy was made after the assessment of the patient depending on the Alvarado scoring system for patients with score of 7–10. All the patients were operated by open method (open appendectomy). Intra operative findings were documented and definitive diagnosis of acute appendicitis was made based on histopathological examination of the appendectomy specimen.

Finally, the reliability of Alvarado scoring system was assessed by calculating negative appendectomy rate (the proportion of operated patients having normal appendix removed) and positive predictive value (the proportion of

Table 1: Alvarado scoring system

Variables	Score
Symptoms	
Migratory right iliac fossa pain	1
Anorexia	1
Nausea/vomiting	1
Signs	
Tenderness in right iliac fossa	2
Rebound tenderness in the right iliac fossa	1
Elevated temperature	1
Lab findings	
Leukocytosis	2
Shift to the left of neutrophils	1
Total	10

patients with a positive test result who actually have the disease).

RESULTS

One hundred patients were preoperatively diagnosed to have acute appendicitis were admitted and studied. Of the 50 cases that were admitted with suspicion of acute appendicitis, 41 cases were taken up for surgery based on the Alvarado scoring system while 8 cases with Alvarado score <5 and 1 case with palpable mass in RIF was kept under conservative management. Among the 41 cases that were operated 37 cases had acutely inflamed appendix. The percentage of inflamed appendix found on operation was 90.24%.

The age group in which acute appendicitis occurred commonly is between 11 and 30 years, that is, about 65%. Incidence is less in younger and older age group with peak incidence in second and third decade. Table 2 depicts the frequency of patients as per the symptoms.

Pain was the most common symptom seen almost in all of the patients (98%), followed by nausea and vomiting (80%), rebound tenderness (76%), and anorexia (64%).

Results of Alvarado Score

The patients were categorized into three groups, that is, male, female and children. Out of 100 cases studied 24 were male, 17 were female and 9 were children (<12 years).

Out of 24 male patients, 17 had a score of 7–10; 2 had a score of 5–6 and 4 patients had score <5; 1 patient had mass in RIF. Out of 17 female patients, 13 had a score of 7–10; 2 had a score of 5–6 and 2 patients had score of <5. About 9 children had a score between 7 and 10 and all the children were operated on [Table 3].

Among the 10 patients of score <6 and 1 patients with mass in RIF were observed in the hospital with conservative treatment and did not undergo surgery since they improved symptomatically. The patients with mass in RIF were advised for interval appendicectomy.

Operative Findings

A total of 41 patients were operated, out of which 19 were males; 13 were females; 9 were children. In the present study, the number of male patients (24) outnumbered females (17) approximately in the ratio of 1.41:1.

In male patients having score of 7–10; 15 patients had acute appendicitis; 1 patient had normal appendix and 1 patient had diseases in the form of ileal perforation and Meckel's diverticulitis.

Table 2: Distribution of patients as per the symptoms (variables of Alvarado scoring system) presented (n=100)

Clinical symptoms	Number of patients n (%)
Migratory RIF pain	20 (40)
Anorexia	32 (64)
Nausea and vomiting	40 (80)
Tenderness over RIF	49 (98)
Rebound tenderness RIF	38 (76)
Elevated temperature	32 (64)
Leukocytosis	31 (62)
Shift to left	23 (46)

RIF: Right iliac fossa

Table 3: Distribution of patients based on Alvarado score

Alvarado score	Number of patients n (%)
7–10	39
5–6	4
1–4	6

In female patients having score of 7–10; 10 had acute appendicitis; 1 patient had normal appendix and 1 patient had other diseases, out of which 1 had pelvic inflammatory disease; 1 had twisted right ovarian cyst. All the 9 children who underwent appendicectomy had acute appendicitis.

DISCUSSION

In our study, the age range of our patients in this study was 9–60 years, with mean age of 24–25 years. Of all 41 patients operated, 26 patients (63.41%) were in the age group of 9–30 which is comparable to those found in Talukder and Siddiq^[9] and Shrestha *et al.*^[10] studies.

In this study, there was male preponderance (24 patients) as compared to females (17 patients) with a male to female ratio of 1.41:1 which is comparable to 1.27:1 in Subedi *et al.*^[11] whereas it was 3.2:1 in Patra *et al.*^[12]

In our study, the most common presenting symptom was pain (98%) followed by nausea/vomiting in 80% of the patients and rebound tenderness in 76%. The least common symptom seen was migratory RIF pain which was found in 40% cases. 62% of the patients had leukocytosis and 46% had shift to left. These findings were comparable to those of Lameris *et al.*^[13] Subedi *et al.*^[11] reported that 98% of patients with acute appendicitis presented with pain in peri-umbilical region migrating to RIF, but leukocytosis was seen in only 65% of cases which was comparable to present study. Merhi *et al.*^[14] concluded that anorexia, neutrophils left shift and rebound tenderness are significantly correlated with a correct diagnosis of appendicitis.

In our study, 15 patients (38.46%) had a score of 7, only 3 of the patients had a score of 10 and none of the patients were seen with scores of 1 and 2. 83 patients (78%) were in score range of 7–10, 8% (4 patients) in 5–6 range and 12% (6 patients) were in 1–4 score range which was comparable to Singh *et al.*^[15]

In this study, acute appendicitis (simple appendicitis) was confirmed intra-operatively in 34 (82.92%) patients. 3 (7.31%) had acute gangrenous appendicitis and 4 (9.75%) had perforated appendix. These findings were comparable to those reported by Dey *et al.*^[16] Subedi *et al.*^[11] found that the most common pre-operative finding was acutely inflamed appendix (84%) followed by perforated appendix (7.5%), gangrenous appendix (3.5%) and appendicular mass (1.5%). Shrestha *et al.*^[10] observed that appendicitis accounted for 88.8%.

In our study, positive and negative appendicectomy rates overall were 90.24% and 9.76%, respectively which was comparable to other studies.^[16] Bhattacharjee *et al.*^[17] concluded that high Alvarado score was found to be a dependable aid both in the pre-operative diagnosis of acute appendicitis and in the reduction of negative appendicectomies in men and children but the same was not true for women who had a high false positive rate for acute appendicitis. In the present study, positive predictive value was 90.24% which was comparable to other studies.

CONCLUSIONS

In our study, the most common age group affected by appendicitis was identified to be 9–30 years which is 63.41% of study group. Out of 50 patients 39 patients had Alvarado score of 7–10 and were taken up for surgery. Males were affected more than the females (1.41:1), high Alvarado score was very much correlating with the intra operative findings among males and children than females. Acute appendicitis is the most common histological examination finding in our study group (82.94%). Hence, applying Alvarado scoring

system improves diagnostic accuracy and reduces negative appendicectomy rate in majority of the patients and also help in anticipating possible complications. In our study, positive and negative appendicectomy rates overall were 90.24% and 9.76%, respectively.

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