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Original Research Article

# Role of Alvarado Scoring System as a Diagnostic Aid in Preoperative Diagnosis of Acute Appendicitis

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**Abstract:**

**Background and Aim:** Alvarado scoring system is one of them and is purely based on history, clinical examination and few laboratory tests and is very easy to apply. Present study was done is to evaluate the role of Alvarado Scoring System (MANTRELS Scoring) in preoperative diagnosis of acute appendicitis.

**Material and Methods:** This study was carried out on 100 patients who are having pain in right Iliac Fossa region and these patients were admitted in Department of General Surgery, in our hospital for further evaluation and management. Evaluation of these patients will be done by Alvarado Score and Ultrasonography. Patients were divided in 3 groups: 1) Cases with score of 1-4 were observed and not operated. 2) Cases with score of 5-6 were observed for next 24 hours for revision of scoring. 3) A Patients with score of 7-10 who are considered candidates for appendectomy were assessed again after ultrasonography. The reliability of Alvarado scoring system is assessed by calculating Negative appendicectomy rate and Positive predictive value.

**Results:** There were 70 males and 30 females included in the study. The age range of included patients was found to be 8 to 55 years. Out of 100 cases, 14 patients had a score of <5. Out of them, 6 patients seemed to have an inflamed Appendix and 4 patients seemed to have a normal Appendix intraoperatively. On histopathological examination, it was proved that out of these 48 cases, 32 actually had acute appendicitis, 12 patients had chronic appendicitis while the remaining 4 had a normal Appendix.

**Conclusion:** Alvarado scoring System is a fast, simple, cost-effective, reliable, non-invasive, repeatable, and safe diagnostic method for acute appendicitis without complications.

**Keywords:** Acute Appendicitis**,** Alvarado scoring System, Iliac Fossa, Positive predictive value.

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## Introduction

The appendix was first described in 1521 and inflammation of the appendix has been known to be a clinical problem since 1759. The term 'appendicitis', however, was not used until Reginald Fitz described this condition in 1886. Appendicitis today is the most common reason for emergency abdominal surgery and has a lifetime risk of 7-8%. It is a disease more commonly seen in the younger population with a slight male preponderance. Its incidence rises slowly from birth and peaks in the late teen years, while gradually declining in the elderly age group. [1-3]

Simple appendicitis can progress to perforation, which is associated with a much higher morbidity and mortality, and surgeons have therefore been inclined to operate when the diagnosis is probable rather than wait until it is certain. [4,5] As a result of their concern about this, surgeons create for themselves a surgical security zone which allows them to accept a 15-30% negative appendectomy rate with impunity". These rates of negative appendicectomy have been considered "acceptable" because the morbidity associated with complicated appendicitis is significantly higher than that of non-therapeutic appendicectomy. [6,7] However, removing normal appendix is an economic burden both on patients and health resources. On the other hand, misdiagnosis and delay in surgery can lead to complications like perforation and finally peritonitis.

Scoring systems are valuable and valid instruments for discriminating between acute appendicitis and non-specific abdominal pain. [8] At present many scoring systems for the diagnosis of acute appendicitis are available. Alvarado scoring system is one of them and is purely based on history, clinical examination and few laboratory tests and is very easy to apply. The Alvarado score was described in 1986 and has been validated in adult surgical practice. The use of an objective scoring

system such as the Alvarado system can reduce the negative appendicectomy rate to 0-5%. [9,10] However, this system is not a substitute for clinical judgment and just an aid in diagnosing acute appendicitis and assist in arriving at a conclusion whether a particular case should be operated or not, so that the number of negative appendectomy will be reduced. Hence the present study was done is to evaluate the role of Alvarado Scoring System (MANTRELS Scoring) in preoperative diagnosis of acute appendicitis.

**Material and Methods**

This study was carried out on 100 patients who are having pain in right Iliac Fossa region and these patients were admitted in Department of General Surgery, in our hospital for further evaluation and management.

This study was carried out on admitted patients of right lower quadrant abdominal pain provisionally diagnosed as appendicitis. Evaluation of these patients will be done by Alvarado Score (comprehensive history, clinico-pathological examination, investigations) and Ultrasonography.

In these patients, the Alvarado Score will be applied by taking Clinical history, examination (per abdomen), and routine investigations.

**Alvarado Scoring system: [11]**

- 1-4: Appendicitis unlikely
- 5-6: Appendicitis possible
- 7-10: Appendicitis definitive

All patients with scores 7 to 10 were considered to have either probable or definite diagnosis of acute appendicitis and were considered for appendicectomy in the first instance. All the patients with right iliac fossa pain under went for ultrasonography. An ultrasonography criterion for diagnosis of acute appendicitis is maximum diameter of 6 mm or more or wall thickness of 3 mm or more or increased periappendicular echogenicity.

Patients were divided in 3 groups:

1) Cases with score of 1-4 were observed and not operated. These patients were assessed by ultrasonography and were followed up after 6 months for the development of acute appendicitis.
2) Cases with score of 5-6 were observed for next 24 hours for revision of scoring. If scores become > 7 or their clinical condition is highly suspicious of acute appendicitis as decided by treating surgeon they were subjected for appendicectomy. All patients who are considered for appendicectomy underwent ultrasonography of abdomen primarily to rule out other conditions mimicking acute appendicitis.
3) A Patients with score of 7-10 who are considered candidates for appendectomy were assessed again after ultrasonography. If any other conditions mimicking acute appendicitis will found in them. They were operated and were considered as false positive cases.

Final correlation between the scoring system and ultrasonography finding were done and final diagnoses were made. All the specimens of appendix after appendectomy were sent for histopathological confirmation of acute appendicitis.

**Inclusion Criteria:** Patients coming to C U Shah Medical College and hospital with pain abdomen and diagnosed provisionally as acute appendicitis and posted for surgery are included in the study.

**Exclusion Criteria:** Pregnant females, presence of any mass per abdomen, patients with recent history of any abdominal surgery were excluded from the study.

**Diagnostic criteria for Acute Appendicitis**

- History of right lower quadrant pain or periumbilical pain migrating to the right lower quadrant with nausea and /or vomiting.
- Fever of more than 37.3° C.
- Right lower quadrant guarding and tenderness on physical examination.

Patients of any age group and both genders presenting to the Out Patient Department or emergency department with pain in right lower quadrant of abdomen presenting with symptoms & signs of acute appendicitis are included in the study. All included patients admitted, initially were subjected for detailed history taking which includes symptoms & duration of the disease; General Physical Examination and Systemic Examination.

Base- line investigations (full blood count, urine routine examination, USG Abdomen & Peripheral Smear for Shift to Left) are done. Then a specially designed proforma is filled in for each patient. These proforma have general information about the patients plus eight variables based on the Alvarado scoring system. Then the sum of all the scores is calculated for each patient and based on the results patients are divided into three groups.

- Those patients with scores of ≥ 7.
- Those patients with scores of 5-6
- Those patients with a score of <5.

Diagnosis of acute appendicitis is confirmed by operative findings, ultrasonographic findings and histopathological assessment of the appendicectomy specimen. Finally, the reliability of Alvarado scoring system is assessed by

calculating Negative appendicectomy rate (the proportion of operated patients having normal appendix removed) and Positive predictive value (the proportion of patients with a positive test result who actually have the disease).

## Results

In this series of 100 cases, the study was carried out on patients who are having pain in right Iliac Fossa region and these patients will be admitted in Department of General Surgery, in our hospital for further evaluation by Alvarado Score and Ultrasonography. Out of the total 100 cases that were admitted to the hospital with suspected acute appendicitis, all 100 cases were taken up for surgery. Among the cases that were operated 86 cases had acutely inflamed appendix. The percentage of inflamed appendix found on operation was 86%.

There were 70 males and 30 females included in the study. The age range of included patients was found to be 8 to 55 years. The maximum numbers of the patients were included in the age range of 11 to 20 years and minimum numbers of patients were more than 50 years of age. Maximum number of 72% of the cases of Acute Appendicitis occurred between the age group of 11-30 years.

Migratory RIF Pain was main symptoms was recorded in all the patients. RIF tenderness was found in 92% of the patients, followed by fever and in lab findings the leukocytosis was found in 78% of the patients. Abdominal pain was found in all the patients, followed by nausea and vomiting, followed by anorexia. For assessment, in our study, the patients were categorized into 3 groups depending upon their Alvarado Scoring System, namely, those with score <5, 5-6 and 7-10. Out of 100 cases, 14 patients had a score of <5. Out of them, 6 patients seemed to have an inflamed Appendix and 4 patients seemed to have a normal Appendix intraoperatively. On ultrasonography, 6 patients had an acutely inflammed appendix, 2 patient had subacute appendicitis while 6 patients had normal appendix. But on histopathological examination, it was proved that out of these 14 cases, 6 patients had acute appendicitis, 2 patients had chronic appendicitis while the remaining 6 had a normal Appendix.

Out of 100 cases, 38 patients had a score of 5-6. Out of them, 30 seemed to have an inflamed Appendix and 8 patients seemed to have a normal Appendix intraoperatively. On ultrasonography, 24 patients had an acutely inflamed appendix, 10 patients had subacute appendicitis while 4 patients had normal appendix. But on histopathological examination, it was proved that out of these 38 cases, 24 patients had an acute appendicitis, 10 patients had chronic appendicitis while 4 patients had normal appendix.

Out of 50 cases, 48 cases had score of 7-10. Out of them, 44 patients seemed to have an inflamed Appendix while 4 patients seemed to have a normal Appendix intraoperatively. In Ultrasonography, 34 patients had an acutely inflammed appendix, 8 patients had subacute appendicitis and 2 patients had an appendicular abscess while 4 patients had normal appendix. But on histpathological examination, it was proved that out of these 48 cases, 32 actually had acute appendicitis, 12 patients had chronic appendicitis while the remaining 4 had a normal Appendix.

**Table 1: Sensitivity of the Modified Alvarado Scoring System**

| Sensitivity | Score | | |
|---|---|---|---|
| <5 | <5 | 5-6 | 7-10 |
| Operative Finding | 42.86% | 78.95% | 91.67% |
| Ultrasonographic Findings | 57.14% | 89.47% | 91.67% |
| Histopathological Finding | 57.14% | 89.47% | 91.67% |

## Discussion

Globally, acute appendicitis is the most common abdominal emergency and morbidity. Thus, accurate and early diagnosis of acute appendicitis is necessary to reduce morbidity, mortality, and complications. This condition also has a negative appendicectomy rate, wasting staff and financial resources. [12] None of the USG or CT scans confirm acute appendicitis. Many diagnostic tests have been developed, but surgeons still struggle to diagnose acute appendicitis. Acute appendicitis is difficult to diagnose due to its variable presentation and lack of reliable tests. Some investigations are discussed that are expensive, time-consuming, and require advanced equipment and expertise, while others are not feasible or available. Even today, a thorough clinical examination with basic tests like Total Leucocyte Count (WBC) is the key to diagnosing acute appendicitis. [13,14]

Surgeons are using different scoring systems to diagnose acute appendicitis faster and reduce negative appendiciectomy rates. A clinical scoring system like Modified Alvarado Scoring System, one of many available today, can improve initial assessment of right iliac fossa pain patients. It is based on clinical history, physical exam, and few lab tests. The simple, easy-to-use, and inexpensive complementary aid helps diagnose acute appendicitis. Ultrasonography should supplement clinical diagnosis in equivocal cases to reduce

negative appendicectomies. The Alvarado scoring system was tested for its ability to reduce negative appendicectomy and diagnose acute appendicitis. Ultrasonographic findings were compared to our findings. [15,16]

**Comparison of the Age and Sex Distribution:** The current series had 70 males and 30 females. Acute appendicitis was common in 11–30-year-olds. The incidence is lower in younger and older age groups, peaking at 72% in the 2nd and 3rd decades. Similarly, Oguntola AS, et al. found that 52% were male. Both sexes have seen similar increases. The mean age was 25.79 years (M 25.94 and F 25.43), with 6% under 10 and 1.3% over 60. Male and female incidence peaked in the second and third decades. Higher incidences occurred during the rainy season (April-September, 68%, P < 0.05), peaking from June-August with 39.5% of cases. [17]

**Comparison of the Clinical Features:** All cases (100%) in this series had pain as the main symptom. The next most common symptoms were nausea/vomiting (70%), and anorexia (56%). 8% had urinary complaints, 16% had constipation, and 10% had diarrhoea. The most common sign on clinical examination was tenderness at McBurney's point (92%). Fever occurred 60% of the time. Guarding occurred in 14% of patients. It was present during severe inflammation. 50% had rebound tenderness.

These cases involved local peritonitis or anterior appendix inflammation. The Rovsing sign was positive in 12%. When RIF is inflamed, this sign appears. Psoas was positive 2% of the time. In 6%, rectal tenderness occurred. The present study found 78% TLC increase and 22% left shift. Mahesh S.V. (2016) found a mean age of 24.08 years. 33 (66%) patients were 11-30. Pain (100%) was the most common presenting symptom, followed by nausea and vomiting (84%), and anorexia (68%). 100% of patients had right iliac fossa tenderness, 74% had rebound tenderness, and 62% had fever. Left shift in 48% and leukocytosis in 62%. 86% of appendicectomy patients were positive and 14% were negative. [18]

**Comparison of the Findings:** To assess patients, we divided them into three groups based on their Alvarado Scoring System score: <5, 5-6, and 7-10. Out of 100 cases, 14 patients scored <5. Four patients had normal appendices intraoperatively, while six had inflamed ones. On ultrasonography, 6 patients had acute appendicitis, 2 had subacute, and 6 had normal appendices. Histopathological examination revealed that 6 of these 14 cases had acute appendicitis, 2 had chronic, and 6 had normal appendices. Only 38 of 100 patients scored 5-6. Eight had normal appendices intraoperatively, while 30 had inflamed ones. Ultrasonography showed 24 acutely inflamed appendices, 10 subacute, and 4 normal appendices.

Histpathological examination revealed that 24 of these 38 patients had acute appendicitis, 10 had chronic, and 4 had normal appendices. Out of 50 cases, 48 scored 7-10. Four patients had normal appendices intraoperatively, while 44 had inflamed ones. Ultrasonography showed 34 acutely inflamed appendices, 8 subacute, 2 abscessed, and 4 normal appendices. Histpathological examination revealed that 32 of these 48 cases had acute appendicitis, 12 had chronic, and 4 had normal appendices. We found that the sensitivity of operative, ultrasonographic, and histopathological findings for a score of <5 using Alvarado scoring system was 42.86%, 57.14%, and 57.14%, respectively. Operative, ultrasonographic, and histopathological findings for a score of 5-6 using Alvarado scoring system were 78.95%, 89.47%, and 89.47% sensitive.

Operative, ultrasonographic, and histopathological findings for a score of 7-10 using Alvarado scoring system were 91.67%, 91.67%, and 91.67% sensitive. The Alvarado Scoring System's P values for operative, ultrasonographic, and histopathological findings were 0.01 (Significant), 0.0587, and 0.0587, respectively. Our study had 44 (88%), histopathologically positive acute appendicitis patients. Total negative Appendicectomy rate was 14%, 75 of which increased. A negative appendicectomy rate of 6% is observed for Alvarado Score <5, and even lower for Score 7-10.

Adopting the ALVARDO score ≥ 5 improves sensitivity and diagnostic accuracy for appendicitis diagnosis, reducing negative appendicitis surgeries to 14%. Comparing these findings to Mahesh S.V. (2016), this study found 19 patients (38%) with scores of 7, 1 with a score of 10, and none with scores of 1, 2 or 4. The intra-operative diagnosis of simple acute appendicitis was confirmed in 34 (68%) patients. Overall positive and negative appendicectomy rates were 86% and 14%, respectively, with a 7-cutoff Alvarado scoring system sensitivity and specificity of 74.42% and 57.14%.

## Conclusion

Alvarado scoring System is a fast, simple, cost-effective, reliable, non-invasive, repeatable, and safe diagnostic method for acute appendicitis without complications. Effective for routine practice. Ideal for rural hospitals lacking access to other imaging modalities like ultrasounds and CT scans. This scoring system enhances diagnosis. Using Ultrasonography with this scoring system can reduce negative appendicectomy rates and complication rates.

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