



COMBINED USE OF MODIFIED ALVARADO SCORING SYSTEM AND ULTRASOUND IN THE DIAGNOSIS OF ACUTE APPENDICITIS –A STUDY

General Surgery

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ABSTRACT

Background: Acute appendicitis is one of the most common acute abdominal surgical emergencies; the diagnosis of which is often challenging. If there is a delay in the diagnosis and prompt action is not taken, it may lead to perforation and other complications. Scoring systems have been devised like the Modified Alvarado score [MAS]. Ultrasound {USG} also has gained importance in recent years. This study aims in combining the use of Modified Alvarado score and USG in the diagnosis of acute appendicitis to bring down the rate of negative appendicectomies. **Methods:** This prospective observational analytical study was done in 100 patients admitted in mallareddy narayana multispeciality hospital from 2022 to 2024 with appendicitis. Patients were evaluated using mas and usg. Decision for surgery was made independent of the score and USG findings. The diagnosis was confirmed by intraoperative and histopathological findings. Results were analyzed by chi-square test. A negative appendicectomy was considered when a noninflamed appendix was removed. **Results:** In our study, out of the 100 patients who were operated, 94 patients had appendicitis and 6 were normal according to intraoperative and histopathological findings. Modified Alvarado score (>7) had a sensitivity of 97.67%.USG had a sensitivity of 61% and a specificity of 83.3%. Both combined together had a sensitivity of 31.9% only. **Conclusion:** The use of MAS and USG in the diagnosis of acute appendicitis have a good statistical correlation but with combined, the sensitivity is less.

KEYWORDS

Modified Alvarado score; Ultrasound; Appendicitis diagnosis.

INTRODUCTION

Approximately one in seven people will experience acute appendicitis in their lifetime, making it one of the most common surgical emergencies.^{1,2} Acute appendicitis is essentially a clinical diagnosis. It has been suggested that diagnostic tools¹² can significantly cut down on hospital stays, perforations, and the number of appendicectomies performed on patients who do not have appendicitis¹. Ultrasonography scoring systems,^{8,9} computer programs,¹⁰ computed tomography^{2,3,4}, magnetic resonance imaging, and laparoscopy are among the techniques recommended to help in the diagnosis of appendicitis^{6,7}. It has been demonstrated that imaging techniques are especially accurate. The least expensive of these is graded compression ultrasonography with accuracy of 71% to 95%.

Aims And Objectives

To evaluate the specificity & sensitivity of the combined use of Modified Alvarado Scoring system and Ultrasound in the diagnosis of acute appendicitis and to reduce the rate of negative appendicectomy.

MATERIALS AND METHODS

This is a study of 100 patients with provisional diagnosis of acute appendicitis who were admitted and operated in the surgical department of Malla Reddy Narayana Multispecialty Hospital from 2022 to 2024. A Modified Alvarado Score was applied, and ultrasound abdomen was done using Siemens G-50, linear transducer 5-10MHz, preoperatively. The decision for surgery was made independent of the score and ultrasound finding.

Diagnosis of patients who underwent appendicectomy was confirmed by both operative findings and histopathology. The Alvarado score was described in 1986¹⁵. It is also known as the MANTRELS score¹⁴, which tabulates migration of pain, anorexia, nausea and/or vomiting, tenderness in the RLQ, rebound tenderness, elevated temperature, leukocytosis and shift to the left¹³ [deleted in the modified score].

Criteria For Acute Appendicitis By Modified Alvarado Score.

Table1: Modified Alvarado Score¹⁴

Clinical feature		Score
Symptoms	Migratory RIF pain	1
	Anorexia	1
	Nausea/vomiting	1
Signs	Tender RIF	2
	Rebound tenderness	1
	Elevated temperature	1
	Leukocytosis	2
	Total	9

Score of 7 to 9 -Probable acute appendicitis
Score of 5 to 6-Possible of acute appendicitis
Score of 1 to 4- appendicitis unlikely.

Criteria For Acute Appendicitis By Ultrasound

Sonographically, appendicitis is suggested by the presence of pain on graded compression at abnormal appendix site, seen as a tubular, blind ending, non-compressible with a diameter of 7 mm or greater. The presence of a fecolith or prominence of peri appendicular fat is an indirect sign. Ultra sonography was considered negative when the appendix could not be found, was normal, or non-appendicular pathology discovered.

Criteria For Appendicitis By Histopathology:

A histological criterion for the diagnosis of acute appendicitis is polymorphic leucocytic infiltration of the muscularis mucosa.

Inclusion Criteria:

1. Patients with provisional diagnosis of acute appendicitis, clinically presenting with right iliac fossa pain and operated for the same.

Exclusion Criteria:

1. Patients who have diagnosed to have other causes of right lower quadrant.
2. Age less than 14 years.
3. Pregnant females.
4. Patients who were managed conservatively.
5. Patients who had a palpable abdominal mass.

Statistics:

The results of Modified Alvarado score and ultrasound were correlated with the operative finding and histopathological examination using the chi-square test.

OBSERVATION AND RESULTS

In the present study, 100 cases were provisionally diagnosed of acute appendicitis and were operated during the study period. The study shows a maximum of 37 patients are in the age group of 21-30 (37%). The study had 55 female patients and 45 male.

Table 2: Mantrel Distribution

MANTREL	No of patients	p value
M	98	0.0001
A	99	0.0001
N	58	0.0049
T	99	0.0001
R	53	0.005

E	27	0.0047
L	39	0.0047

The table 2 shows the distribution of MANTREL. 99 patients had tenderness in the right iliac fossa and anorexia. 98 patients had migratory RIF pain. 39 patients had elevated leukocytosis $>10 \times 10^9$ and 27 had fever. The p values of each parameter, when individually compared to HPE is <0.05 which is statistically significant. (Table 2).

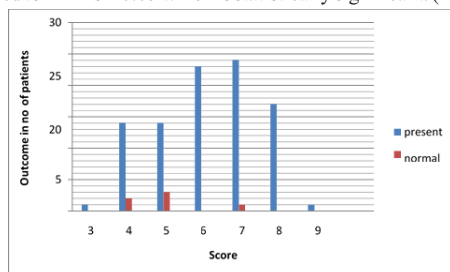


Figure 1: Modified Alvarado Score vs the Histopathological Outcome

From the figure 1, it is concluded that of 100 patients, 1 patient had a score of 3 and histologically he was found to have appendicitis. 16 patients had a score of 4, out of which 14 had inflamed appendix and 2 were normal. 17 patients had a score of 5 out of which 14 were inflamed and 3 were normal. 25 patients had a score of 7, out of which 24 were inflamed and 1 was normal. Only one patient had a score of 9 and it was inflamed.

Table 3: Correlation of Modified Alvarado score, USG with per operative and Histopathological examination of the appendix

	Appendicitis	Normal	Total
MAS	43	57	100
USG	61	39	100
Per-op and HPE	94	6	100
Total	198	102	300

From the above table, {table 3}; the p value was calculated to be 0.0007 using chi square test. This shows that according to our study, there is a statistically significant result when combining Modified Alvarado score and ultrasound in the diagnosis of acute appendicitis.

When MAS and USG are combined and considered as a single unit (i.e. only when USG is more than 7mm and MAS is more than 7) then according to the above table, the sensitivity when compared to the HPE outcome is only 31.9%.

DISCUSSION

The main aim of this clinical study is to decrease negative appendectomy with combined use of Alvarado scoring system and USG abdomen. Ultrasonography and Computed tomography are being used in an attempt to increase the diagnostic accuracy. Several scoring systems like Modified Alvarado score is devised.

In our study of 100 patients (55 males and 45 females), on histopathological examination; 94 patients had acute appendicitis, among which 52 were females and 42 were males, with a negative appendectomy rate of only 6%. In similar studies done by Khan et al¹⁵, Ohmann et al¹⁶, and Arian et al¹⁷, negative appendectomy rates of 14%, 14.3% and 16.1% respectively were observed.

According to our study, all the parameters in the MANTREL score were found to have a statistical significance with p values of 0.0001, 0.0001, 0.0047, 0.0051, 0.0047, 0.0049 and 0.0001 respectively. [Table 2] According to a study done by Wantetal¹⁸, the sensitivity of leukocytosis count was 67% in the diagnosis of appendicitis. In another study done by Cardalletal¹⁸, the sensitivity of leukocytosis was 76% and elevated temperature was 47%. They considered this significant. In a study done by Andersson et al¹⁹, elevated temperature, leukocytosis, tender RIF, and rebound tenderness had individual statistical significance in the diagnosis of acute appendicitis.

In our study, 43 patients had a score of >7 of which 42 proved to have acute appendicitis on operative and histopathological examination, with a sensitivity of 97.7%. In a study by Lone et al¹³ a sensitivity of 93% was seen.

The overall sensitivity of patients with a score of 5-6 was 92.5% with a

negative appendectomy rate of 8% and the overall sensitivity of patients who had a score of 1-4 was 88.23% with a negative appendectomy rate of 11.8%.

According to our study, USG alone had a sensitivity of 61% and a specificity of 83.3% in the diagnosis of acute appendicitis. In other studies, done by Skaane et al²⁰ and Douglas et al, the sensitivity and specificity were 78%, 92% and 94.7% and 88.9% respectively.

Finally in our study, when combining the Modified Alvarado score and the USG findings in the clinical diagnosis of acute appendicitis, we got a p value of 0.0007 which has a statistical significance, a sensitivity of 31.9% and a specificity of 83.3%.

CONCLUSION

In our study, Modified Alvarado score and USG both had a good sensitivity and specificity.

Modified Alvarado score has a high diagnostic value (97.7%). It is noninvasive, not expensive, and fast.

USG also has more of a role in ruling out normal appendix when some other pathology is involved with a specificity of 83.3%.

When we try to diagnose appendicitis based on the individual results of Modified Alvarado score and USG, we get a statistically significant value; but with both positive, the sensitivity decreases.

To conclude, both Modified Alvarado score and USG should be applied in the diagnosis of appendicitis, but the diagnosis is better made depending on the results of either of them individually rather than when both are considered together as a single unit.

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