

## To Evaluate the Modified Alvarado Score in Patients with Acute Appendicitis

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Received: 20-08-2022 / Revised: 21-09-2022 / Accepted: 01-10-2022

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Conflict of interest: Nil

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### Abstract

**Background:** Appendicitis has been one of the most widely studied and researched about topic since the early years. Even after elapse of more than 120 years since its first description this common surgical disease continues to remain a diagnostic problem and can baffle best of the clinician. There is nausea but vomiting more than twice is rare. A low grade pyrexia and constipation is usual. An alternative outcome is that the appendix becomes surrounded by a mass of omentum or adjacent viscera which walls off the inflammatory process and prevents inflammation spreading to the abdominal cavity yet resolution of the condition is delayed.

**Aim:** To Evaluate the Modified Alvarado Score in patients with acute appendicitis in J.A. Group of Hospitals with respect to sensitivity, specificity, positive predictive value and negative predictive value and diagnostic accuracy.

**Methods:** After approval from ethical committee this study was done on over 100 patients of acute appendicitis admitted in Surgery Department, J. A. Group of hospitals & G. R. Medical College Gwalior who have consented to participate in the study we enrolled the patients for this study from Dec. 2017 to Aug. 2019. With clinical suspicion of acute appendicitis, admitted from outpatient department and emergency in ward giving consent for participating in the study in Surgery Department, J.A. Group of Hospital during the study period.

**Results:** For the study, there were 100 patients considered from different age groups. The study has involved the patients from the age of 7 to 79 years. Moreover, the study has involved both male and female patients for carrying the study. Here, the percentage of male patient was 70% and female was 30%. The maximum incidence was in age group of 21 to 30 years. According to analysis of the diagnostic test results positive results were found among the 72 patients and 16 patients were found to be true negative. Their appendices were subjected to histopathological examination and 80(85.1%) were confirmed having acute appendicitis. The sensitivity of system was calculated as 90% and specificity 80%, with a positive predictive value of 94.3% and negative predictive value of 66.6%. The Commonest presenting symptom was pain in right iliac fossa (96%), followed by nausea / vomiting (88%) and, fever (85%).

**Conclusion:** The modified Alvarado scoring system is a good diagnostic indicator tool for acute appendicitis. It is highly sensitive in diagnosing acute appendicitis. A cut off point of 7 for diagnosis of acute appendicitis, it can be used to improve diagnostic accuracy of acute appendicitis and subsequently reduce the negative appendicectomy. Modified Alvarado score >7 sensitivity is very high and score ≤7 sensitivity of Modified Alvarado score is decreased.

**Keywords:** Modified Alvarado, scoring system, diagnostic indicator, acute appendicitis.

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## Background

Appendicitis has been one of the most widely studied and researched about topic since the early years. Some literature is available which dates back to the study of appendicitis to as early back as the 3rd century the Roman rule under Caesar [1]. Acute appendicitis is one of the commonest causes for acute abdomen in all age groups in any general surgical practice. In 1886 Reginald Heber Fits described the classical signs and symptoms of acute appendicitis as a disease entity [2].

Since then acute appendicitis has remained the most common acute surgical condition of the abdomen in all ages and of course, a common disease in surgical practice. Even after elapse of more than 120 years since its first description this common surgical disease continues to remain a diagnostic problem and can baffle best of the clinician [3]. Delay in diagnosis definitely increases the morbidity, mortality and cost of treatment.

In equivocal cases aggressive surgical approach "when in doubt take it out" has resulted in increased negative laparotomy [4]. The spectrum of presentations of acute appendicitis can mimic number of variety of acute medical and surgical abdomino-thoracic conditions. Early diagnosis is a primary goal to prevent morbidity and mortality in acute appendicitis. Another important issue is decreasing the negative appendectomy rate [5]. The appendicular artery is a single end artery closely applied to the wall distally, and secondary thrombosis is common giving rise to gangrene which explains the short progressive history (3-5 days) of appendicitis and the poorer prognosis with the arteriosclerosis of the aged [6].

The classical presentation of referred, dull, poorly localized, colicky periumbilical pain (visceral) from the luminal obstruction (mid-gut origin) for 12-24 hrs that shifts and localizes to the right iliac fossa as peritoneal irritation by the inflamed appendix occurs (somatic pain) is most common in adolescents [7]. There is nausea but vomiting more than twice is rare. A low grade pyrexia and constipation is usual. An alternative outcome is that the appendix becomes surrounded by a mass of omentum or adjacent viscera which walls off the inflammatory process and prevents inflammation spreading to the abdominal cavity yet resolution of the condition is delayed [8].

In spite of advance in medical diagnostics, its diagnosis is mainly clinical one [9]. Over the last two decades different protocols have been introduced and tested by different researchers which include Lidverg, Fenyo, Christian, Ohman and Alvarado scoring system to facilitate early diagnosis of this sometimes very elusive disease [10]. Alvarado in 1986 introduced a criterion for the diagnosis of acute appendicitis which was later modified to accommodate additional parameters along with original Alvarado scoring system [11].

### Aim

To Evaluate the Modified Alvarado Score in patients with acute appendicitis in J.A. Group of Hospitals with respect to sensitivity, specificity, positive predictive value and negative predictive value and diagnostic accuracy.

### Method and material

After approval from ethical committee this study was done on over 100 patients of acute appendicitis admitted in Surgery Department, J. A. Group of hospitals & G.

R. Medical College Gwalior who have consented to participate in the study we enrolled the patients for this study from Dec. 2017 to Aug. 2019.

### Inclusion Criteria

Patients presenting with

- Pain in right iliac fossa
- Pain in right iliac fossa  $\pm$  fever,  $\pm$  vomiting and  $\pm$  anorexia
- Short history of pain around umbilicus.
- Tenderness and rebound tenderness in right iliac fossa.

With clinical suspicion of acute appendicitis, admitted from outpatient department and emergency in ward giving consent for participating in the study in Surgery Department, J.A. Group of Hospital during the study period.

### Exclusion Criteria

- Patients posted as elective cases of appendicitis for interval appendectomy.
- Critically ill patients.
- Age above 80 years not included in this study.
- Age below 7 years not included in this study.
- Blunt trauma abdomen patients complaining of pain in right iliac fossa were not included in this study.

### Results

For the study, there were 100 patients considered from different age groups. The study has involved the patients from the age of 7 to 79 years. Moreover, the study has involved both male and female patients for carrying the study. Here, the percentage of male patient was 70% and female was 30%.

**Table 1: Showing detailed analysis of modified Alvarado scoring system**

Parameters	Manifestations	Score
Symptoms	Migratory pain	1
	Anorexia	1
	Nausea/vomiting	1
Signs	RIF tenderness	2
	Rebound tenderness	1
	Elevated temperature	1
Laboratory test	Leucocytosis (>10,000/m <sup>3</sup> )	2
Total score		9

The table has provided data related to the score of the patients considered for analysis. There were 9 patients were identified during the scoring considering the level of emergency issues.

**Table 2: Showing Alvarado score**

Alvarado score	No. of patients	Percentage
<7	24	24%
>7	76	76%

According to analysis of table 2, 24 patients were having MASS of <7 were treated conservatively and observed and re-evaluated after twenty-four hours. Patients with increased score underwent surgery and those with decreased score were discharged home.

**Table 3: Showing sensitivity and specificity of modified Alvarado score**

Diagnostic test result	Appendicitis	Non-appendicitis	Total
Score >7 (positive)	True positive- 72	False positive- 4	76
Score <7 (negative)	False negative-8	True negative- 16	24
Total	80	20	100

The maximum incidence was in age group of 21 to 30 years. According to analysis of the diagnostic test results positive results were found among the 72 patients and 16 patients were found to be true negative.

**Table 4: Showing Alvarado score of different diagnostic test**

Diagnostic test	Percentage
Sensitivity	$72/80 \times 100 = 90\%$
Specificity	$16/20 \times 100 = 80\%$
Positive predictive value	$72/76 \times 100 = 94.73\%$
Negative predictive value	$16/24 \times 100 = 66.6\%$
Diagnostic accuracy	$72 + 16/100 \times 100 = 88\%$

All the patients underwent appendectomy, their appendices were subjected to histopathological examination and 80(85.1%) were confirmed having acute appendicitis. The sensitivity of system was calculated as 90% and specificity 80%, with a positive predictive value of 94.3% and negative predictive value of 66.6%. Patients with Score >7 termed as MAS positive group and those with a score <7 termed as MAS negative group. Present study observed maximum incidences of acute appendicitis in age group 21-30 years (35%). The Commonest presenting symptom was pain in right iliac fossa (96%), followed by nausea / vomiting (88%) and, fever (85%).

### Discussion

Since then acute appendicitis has remained the most common acute surgical condition of the abdomen in all ages and of course, a common disease in surgical practice. Early diagnosis is a primary goal to prevent morbidity and mortality in acute appendicitis. Another important issue is decreasing the negative appendectomy rate. The appendicular artery is a single end artery closely applied to the wall distally, and secondary thrombosis is common giving rise to gangrene which explains the short progressive history (3-5 days) of appendicitis and the poorer prognosis with the arteriosclerosis of the aged.

As Right Lower Quadrant (RLQ) Pain and Left Shift were found to be the most prevalent, they received 2 points each, while each of the remaining criteria was

given 1 point. The basis of all medical diagnoses and decisions depend upon the ability of a clinician to assess the potential risk and benefit, along with sound clinical knowledge [12]. This helps in making wise, educated decisions, which is the cornerstone of good medical practice.

According to findings of current study, there were 9 patients were identified during the scoring considering the level of emergency issues. 24 patients were having MASS of <7 were treated conservatively and observed and re-evaluated after twenty-four hours. Patients with increased score underwent surgery and those with decreased score were discharged home.

Moreover, the outcome of current study has suggested that Patients with Score >7 termed as MAS positive group and those with a score <7 termed as MAS negative group. Present study observed maximum incidences of acute appendicitis in age group 21-30 years (35%). The Commonest presenting symptom was pain in right iliac fossa (96%), followed by nausea / vomiting (88%) and, fever (85%). As per the study of Kasabe and Relekar (2020) [13], in their study of evaluation of Modified Alvarado score in the diagnosis of Acute Appendicitis and its correlation with ultrasound and histopathology found that Pain was the most common presenting symptom and had been observed in all the cases. The classical shifting of pain from umbilicus to right iliac fossa was present in 86% of the cases. Other common symptoms observed were anorexia in 73% cases, fever

in 83% cases, nausea and vomiting in 87% cases [14].

Apart from this, the study of Jayaraman and Muralidharan (2021) [15] has suggested that Alvarado score which was present in patients of acute appendicitis. Abdominal tenderness was present in all the cases while migratory right iliac fossa pain in 87% of cases. Other components like anorexia, nausea and vomiting, rebound tenderness, fever and Leukocytosis were present in 44%, 72%, 46%, 57% and 76% of cases respectively. [16]

### Conclusion

The modified Alvarado scoring system is a good diagnostic indicator tool for acute appendicitis. It is highly sensitive in diagnosing acute appendicitis. A cut off point of 7 for diagnosis of acute appendicitis, it can be used to improve diagnostic accuracy of acute appendicitis and subsequently reduce the negative appendicectomy. Modified Alvarado score >7 sensitivity is very high and score <7 sensitivity of Modified Alvarado score is decreased.

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