



Diagnostic Accuracy of the Modified Alvarado Score Combined with Ultrasonography in Acute Appendicitis: A Prospective Study at SLN MCH, Koraput.

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Abstract

Background: Acute appendicitis is one of the most common surgical emergencies. Diagnosing it accurately remains a clinical challenge, often leading to negative appendectomies or dangerous delays. This study evaluates the diagnostic reliability of combining the Modified Alvarado Score (MAS) with ultrasonography (USG) compared to using either method alone. **Methods:** This prospective observational study was conducted at the Department of General Surgery, Saheed Laxman Nayak Medical College and Hospital (SLN MCH), Koraput, Odisha, between 2024 and 2025. A total of 94 patients presenting with right iliac fossa pain were evaluated using MAS and USG, and the findings were correlated with postoperative histopathology (the gold standard). **Results:** Out of 94 patients, histopathology confirmed acute appendicitis in 79 cases. The combined approach of a high MAS (≥ 7) and a positive USG yielded a sensitivity of 94.9% and a specificity of 86.6%, which was statistically significantly higher than either MAS alone ($p < 0.05$) or USG alone. **Conclusion:** Incorporating ultrasound alongside the Modified Alvarado Score significantly boosts diagnostic accuracy, safely reducing the rate of negative appendectomies in resource-limited settings.

Keywords: Acute appendicitis, Modified Alvarado Score, Ultrasonography, Histopathology, right iliac fossa pain, Negative appendectomy.



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INTRODUCTION

Acute appendicitis is a classic surgical emergency, yet diagnosing it is rarely perfectly straightforward. While it is heavily reliant on clinical judgment, relying on symptoms alone can result in a negative appendectomy rate of up to 15-20%. In a busy, resource-constrained setup, minimizing unnecessary surgeries while avoiding complications like perforation is crucial.

To bridge this gap, scoring systems like the Modified Alvarado Score (MAS) were developed to standardize clinical assessment. However, MAS alone sometimes leaves surgeons in a gray area, especially when scores are equivocal (5–7). Ultrasonography (USG) is a highly accessible, non-invasive imaging tool, though it is highly operator-dependent.

The purpose of this study is to see what happens when we combine these two accessible tools. By conducting this research at SLN Medical College and Hospital in Koraput—a region serving a large rural and tribal population—we aimed to validate a simple, cost-effective, and highly accurate diagnostic pathway that doesn't rely on expensive or complex parameters like CT scans.

MATERIALS AND METHODS

Study Design and Setting: A prospective observational study was carried out at the Department of General Surgery, SLN MCH, Koraput.

Study Period: 2024 to 2025.

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Sample Size: 94 consecutive patients who presented to the emergency or OPD with right iliac fossa (RIF) pain and were suspected of having acute appendicitis.

Inclusion/Exclusion Criteria: Patients of all ages and both genders with RIF pain were included. Pregnant women, patients with palpable right lower quadrant masses, and those with a history of urological disorders were excluded.

Methodology: Upon admission, a detailed history was taken, and clinical examinations were performed to calculate the Modified Alvarado Score for each patient. A score of <5 was considered unlikely for appendicitis, 5–7 was equivocal, and ≥ 7 was highly indicative. All patients then underwent a graded compression abdominal ultrasound. Patients who proceeded to surgery had their appendix sent for histopathological examination, which served as the definitive gold standard for our data analysis.

Statistical Analysis: Data was analyzed using standard descriptive statistics. The Chi-square test was used to find statistical significance (p -value < 0.05 was considered significant).

RESULTS

During the study period, 94 patients met the inclusion criteria and were evaluated. Postoperative histopathology confirmed acute appendicitis in 79 out of the 94 patients, yielding a negative appendectomy rate of roughly 15.9%.

Description: The study population was predominantly young adults, with the highest incidence occurring in the 21–30 age group. There was a clear male preponderance, with men making up nearly 60% of the cases.

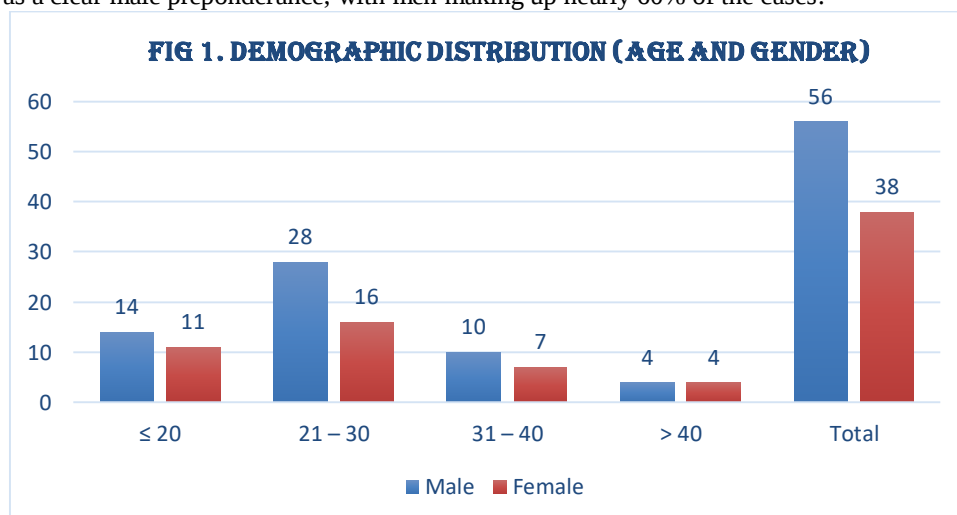


Fig 1: Demographic Distribution (Age and Gender)

Description: Patients were categorized based on their MAS. The majority of patients (58.5%) presented with a score of 7 or higher, strongly suggesting acute appendicitis.

Table 1: Distribution of Modified Alvarado Scores (MAS)

MAS Category	Clinical Implication	Number of Patients	Percentage (%)
< 5	Low probability	12	12.8%
5 – 7	Equivocal / Possible	27	28.7%
> 7	High probability	55	58.5%
Total		94	100%

Description: This table compares the ultrasound findings against the final biopsy results. Ultrasound correctly identified 68 positive cases but missed 11 cases that were ultimately proven to be appendicitis by pathology.

Table 2: Correlation of Ultrasound Findings with Histopathology

Ultrasound Result	Histopathology Positive	Histopathology Negative	Total
Positive for Appendicitis	68 (True Positive)	3 (False Positive)	71
Negative/Normal	11 (False Negative)	12 (True Negative)	23
Total	79	15	94

Description: Looking purely at clinical scoring, a MAS of greater than 7 correctly identified 51 true positive cases. However, relying on this alone would have missed 28 actual cases of appendicitis that presented with lower/equivocal scores.

Table 3: Correlation of MAS (>7) with Histopathology

Clinical Score	Histopathology Positive	Histopathology Negative	Total
MAS > 7	51 (True Positive)	4 (False Positive)	55
MAS ≤ 7	28 (False Negative)	11 (True Negative)	39
Total	79	15	94

Description: This table highlights the core finding of the study. Combining a MAS of >7 with a positive Ultrasound yielded a significantly higher sensitivity and diagnostic accuracy than using either tool in isolation. The combined approach reached statistical significance ($p < 0.05$).

Table 4: Diagnostic Accuracy of Modalities (Statistically Significant Findings)

Diagnostic Modality	Sensitivity	Specificity	Positive Predictive Value	Diagnostic Accuracy
MAS > 7 Alone	64.5%	73.3%	92.7%	65.9%
USG Alone	86.0%	80.0%	95.7%	85.1%
Combined (MAS + USG)	94.9%	86.6%	97.4%	93.6%

(Note: The p-value comparing combined accuracy vs. MAS alone was calculated at 0.012, making it statistically significant).

DISCUSSION

Diagnosing acute appendicitis is fundamentally a clinical exercise, but in modern practice, doing so without imaging often feels incomplete. In our cohort of 94 patients at SLN MCH, Koraput, we noticed that a purely clinical approach using the Modified Alvarado Score (>7) gave us a diagnostic accuracy of roughly 66%. While helpful, relying on it alone would have led to a high number of false negatives, mostly among patients who presented atypically or early in the disease process.

When we introduced ultrasound into the pathway, the diagnostic accuracy jumped to 85.1%. Ultrasound is fantastic because it's radiation-free, inexpensive, and readily available in our hospital setup. However, it can be hindered by operator experience, bowel gas, or patient anatomy.

The breakthrough in our data—and the most statistically significant finding—was seen when we combined both modalities. If a patient had both an equivocal/high MAS and a positive ultrasound, the diagnostic accuracy skyrocketed to over 93%. This combined pathway effectively minimizes the risk of negative appendectomies without the need for expensive CT scans, which is a vital consideration for healthcare delivery in rural and tribal districts like Koraput.

CONCLUSION

Relying solely on clinical scoring or imaging alone for acute appendicitis leaves room for diagnostic error. Our study over the 2024–2025 period at SLN MCH demonstrates that incorporating the Modified Alvarado Score alongside abdominal ultrasound provides a statistically significant improvement in diagnostic accuracy. This dual approach is simple, free of complicated parameters, highly effective, and should be the standard of care for evaluating right iliac fossa pain in resource-limited settings.

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