

Diagnostic Accuracy of RIPASA and Modified Alvarado Scoring Systems in the Diagnosis of Acute Appendicitis: A Prospective Comparative Study

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Abstract

Background: Acute appendicitis is one of the most common surgical emergencies. Early diagnosis remains challenging because clinical presentation often overlaps with other causes of right iliac fossa pain. Clinical scoring systems such as the Modified Alvarado Score (MAS) and the Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score have been developed to improve diagnostic accuracy. This study compared the diagnostic performance of the two scoring systems using histopathology as the reference standard. **Methods:** A prospective observational study was conducted in the Department of General Surgery of a tertiary care teaching hospital between October 2016 and October 2018. One hundred consecutive patients aged >15 years with suspected acute appendicitis were included. RIPASA and Modified Alvarado scores were calculated before surgery. Histopathological examination of the appendectomy specimen served as the gold standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), diagnostic accuracy, and receiver operating characteristic (ROC) curve analysis were performed. **Results:** Histopathology confirmed acute appendicitis in 75% of patients. The RIPASA score demonstrated higher sensitivity (89.3% vs. 58.7%), higher PPV (94.4% vs. 93.6%), higher NPV (72.4% vs. 41.5%), and greater overall diagnostic accuracy (88% vs. 66%) than the Modified Alvarado score. ROC analysis showed superior discriminatory ability for RIPASA (AUC 0.891) compared with Modified Alvarado (AUC 0.702). **Conclusion:** The RIPASA score demonstrated superior diagnostic performance compared with the Modified Alvarado score in patients with suspected acute appendicitis. Its higher sensitivity and overall accuracy suggest that it may be a more reliable clinical tool, particularly in Asian populations.

Keywords: Acute appendicitis; RIPASA; Modified Alvarado score; Diagnostic accuracy; Histopathology.

1. Introduction

Acute appendicitis is the most common surgical emergency requiring urgent abdominal surgery. Despite advances in imaging modalities, diagnosis remains primarily clinical, and delayed diagnosis may lead to perforation, abscess formation, diffuse peritonitis, prolonged hospitalization, and increased morbidity. Conversely, over-diagnosis results in unnecessary appendectomy and avoidable healthcare costs. Various clinical scoring systems have therefore been developed to standardize assessment and improve diagnostic accuracy. The Modified Alvarado score is simple and widely used but has demonstrated variable diagnostic accuracy, particularly in Asian populations. The RIPASA score incorporates additional demographic and clinical variables and has been reported to perform better in Asian patients. The present study aimed to compare the diagnostic accuracy of the RIPASA and Modified Alvarado scoring systems using histopathological diagnosis as the gold standard.

2. Materials and Methods

Study design

Prospective observational study.

Study setting

Department of General Surgery, tertiary care teaching hospital.

Study duration

October 2016 to October 2018.

Participants

One hundred consecutive patients older than 15 years presenting with suspected acute appendicitis were enrolled.

Inclusion criteria

- Age >15 years
- Clinical suspicion of acute appendicitis
- Informed consent

Exclusion criteria

- Age <15 years
- Pregnancy
- Right iliac fossa mass
- Patients managed non-operatively
- Refusal to participate

For every patient, Modified Alvarado and RIPASA scores were calculated before surgery. Operative management was based solely on the treating surgeon's clinical judgment.

Histopathological examination of the appendectomy specimen served as the reference standard.

Diagnostic performance was evaluated by calculating sensitivity, specificity, PPV, NPV, diagnostic accuracy, and ROC curves. Statistical significance was considered at $p < 0.05$.

3. Results

Baseline characteristics

A total of 100 patients were included.

Mean age was **31.54 years**.

The majority were aged 15–35 years.

Sixty-four patients were male and 36 were female.

Histopathology confirmed acute appendicitis in **75 patients (75%)**.

Table 1. Baseline characteristics

Variable	Value
Sample size	100
Mean age	31.54 years
Male	64%
Female	36%
Histopathology positive	75%

Table 2. Diagnostic performance

Parameter	Modified Alvarado	RIPASA
Sensitivity	58.7%	89.3%
Specificity	88.0%	84.0%
PPV	93.6%	94.4%
NPV	41.5%	72.4%

Accuracy	66.0%	88.0%
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ROC analysis demonstrated better diagnostic performance of RIPASA (AUC 0.891) than Modified Alvarado (AUC 0.702).

4. Discussion

Early diagnosis of acute appendicitis remains essential for preventing perforation and reducing unnecessary appendectomy. Clinical scoring systems provide objective support for decision-making, particularly where advanced imaging is unavailable.

In the present study, the RIPASA score demonstrated substantially higher sensitivity (89.3%) than the Modified Alvarado score (58.7%), indicating greater ability to identify patients with true appendicitis. Although the Modified Alvarado score showed slightly higher specificity, RIPASA achieved superior overall diagnostic accuracy (88% versus 66%).

These findings are consistent with previous studies from Asian populations, which have reported higher sensitivity and better overall diagnostic performance of RIPASA. The improved performance is likely attributable to inclusion of additional demographic and clinical variables that better reflect disease presentation in Asian patients.

The ROC analysis further confirmed the superiority of RIPASA, with an AUC of 0.891 compared with 0.702 for the Modified Alvarado score. This suggests excellent discriminatory ability and supports its use as a reliable adjunct to clinical assessment.

Limitations

The study was conducted at a single tertiary care centre with a relatively small sample size. Imaging findings were not incorporated into the scoring systems, and external validation in larger multicentre studies is warranted.

Conclusion

The RIPASA scoring system demonstrated significantly better diagnostic accuracy than the Modified Alvarado score for diagnosing acute appendicitis. Its higher sensitivity, negative predictive value, and overall diagnostic accuracy make it a useful adjunct in clinical decision-making, particularly in Asian populations. Incorporating the RIPASA score into routine emergency surgical assessment may facilitate earlier diagnosis and reduce unnecessary appendectomy.

Declarations

Ethics approval: Approved by the Institutional Ethics Committee.

Informed consent: Written informed consent was obtained from all participants.

Funding: None.

Conflict of interest: The authors declare no conflict of interest.

Data availability: Available from the corresponding author upon reasonable request.

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