

## A Comparative Study of Ripasa Score and Alvarado Score in Diagnosis of Acute Appendicitis

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**Abstract:** Among the most frequent causes of right iliac fossa pain is acute appendicitis. Developed to lower the likelihood of negative appendectomy are several scoring systems for diagnosing acute appendicitis. **Objective:** This study was motivated by a comparison of the RIPASA score with the Alvarado score based on histology reports for the diagnosis of acute appendicitis. **Methods:** Between November 2023 and June 2024, the Emergency General Surgery Department at Lady Reading Hospital, Peshawar, conducted a prospective cross-sectional study. Based on histopathology data, both scoring methods were applied to the same patient and assessed for sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy. Alvarado achieved a score of 7.5, which coincided with RIPASA's cut-off value of 7.5. **Results:** The study included a total of 194 patients. With values of 97.42% and 86.08%, respectively, the RIPASA score demonstrates a higher diagnostic accuracy than the Alvarado score. For RIPASA, sensitivity, specificity, PPV, and NPV came at 98.86%, 84.21%, 98.3%, and 88.89%, respectively. By contrast, Alvarado had sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of 96.89%, 33.33%, 87.64%, and 68.75%, respectively. **Conclusion:** The RIPASA scoring system demonstrates better sensitivity, specificity, and diagnostic accuracy than the Alvarado scoring system.

**Keywords:** RIPASA, Alvarado, Acute Appendicitis

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### Introduction

One of the most frequently identified causes of pain in the right iliac fossa is acute appendicitis. The lifetime incidence of acute appendicitis in men remains at 8.6%, whereas in women it is comparatively 6.7% (1, 2). It remains challenging to identify acute appendicitis accurately despite the existence of several grading systems. (3) The rate of negative appendectomy ranges from 15% to 30%, which is very high and unacceptable nowadays (4, 5). A novel system of diagnosis scoring, Including Lower negative appendectomies, benefits from the Raja Isteri Pengiran Anak Saleha Appendicitis Scoring (RIPASA) (6) in the diagnosis of acute appendicitis. Alvarado's score falls under migratory pain, anorexia, nausea and vomiting, tenderness, rebound tenderness in RIF, high temperature, and leukocytosis alongside neutrophil shift to the left. Alvarado's cut-off value for acute appendicitis is seven. Gender, age, duration of symptoms, guarding, negative urine test results, Rovsing sign, migratory pain, rebound tenderness in the right iliac fossa, anorexia, nausea, elevated temperature, leukocytosis, and non-Asian RIPASA scoring criteria. For acute appendicitis, the RIPASA score cut-off value is 7.5. The Alvarado scoring system has been shown to influence sensitivity, specificity, diagnostic accuracy, and the ROC curve of specific data, including age, gender, and symptom duration (7).

The cutoff value for the RIPASA score is 7.5, and Alvarado's score is 7. This study compared the RIPASA score with the Alvarado score in patients with acute appendicitis at Lady Reading Hospital, Peshawar. Similar patients underwent both scoring schemes. The final diagnosis was based on histopathological gold standards (8).

Since the World no longer tolerates such a high percentage of negative appendectomies, various grading methods have been developed to reduce the rate of negative appendectomies. Designed primarily for the Western population, Alvarado's scoring system has demonstrated reduced sensitivity, specificity, and diagnostic accuracy in the Asian population compared to the RIPASA scoring system (9). RIPASA scoring system vs. Alvarado scoring system for the diagnosis of acute appendicitis: RIPASA

is superior in terms of sensitivity, specificity, and diagnostic accuracy, thereby reducing the incidence of negative appendectomies. (10, 11).

### Methodology

Ethical approval for the prospective cross-sectional study was obtained from the Ethics Committee Board at Lady Reading Hospital, Peshawar; all patients involved signed consent forms. Independent of gender, 194 patients showed up at Lady Reading Hospital's emergency room with discomfort in the right iliac fossa and suspected acute appendicitis between the ages of 15 and 60 years. Data were collected over eight months, from November 2023 to June 2024. On identical patients, both the Alvarado and RIPASA rating methods were used. Alvarado has eight parameters with a score ranging from 1 to 2 for each parameter; RIPASA includes 18 parameters with a score ranging from 0.5 to 2 for each parameter (Tables 1 and 2). Alvarado has a maximum of 10 scores, while the RIPASA scoring system has a maximum of 17.5 scores. Senior residents evaluated all patients using both the RIPASA and Alvarado scoring systems; the consultant made the ultimate choice based on these evaluations. Following these clinical examinations, laboratory tests, and imaging studies, samples from the appendix were sent for histological examination. The histopathology results were noted and compiled for comparison with both the Alvarado and RIPASA rating systems. Statistically, a chi-squared test was used. The histology report was compared with the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of both the RIPASA scoring system and the Alvarado scoring system.

### Results

Out of the 194 patients who underwent surgery for acute appendicitis, sixteen experienced negative appendectomies. Alvarado achieved a score of 7.8, while RIPASA recorded a mean score of 10.8. The majority of the patients, comprising young men and women, received a diagnosis of acute



appendicitis. Alvarado achieved a score of 7.5, which coincides with the cut-off value of 7.5 established by RIPS.

The RIPASA scoring system demonstrated sensitivity and specificity values of 98.86% and 84.21%, respectively. In contrast, the Alvarado scoring system yielded sensitivity and specificity values of 96.89% and 33.33%, respectively. In comparison to the positive predictive values and

negative predictive values of Alvarado, which stand at 87.64% and 68.75%, respectively, the PPV and NPV for RIPASA are significantly higher at 98.30% and 88.89%. In comparison to the Alvarado scoring system, the RIPASA scoring system also demonstrates diagnostic accuracy rates of 97.42% and 86.80%.

**Table 1. RIPASA appendicitis scoring system**

Patient	Score
Female	0.5
Male	1
Age < 39.9years	1
Age > 40years	0.5
Pain RIF	0.5
Pain Migratory to RIF	0.5
Anorexia	1
Nausea/Vomiting	1
Duration of symptoms < 48 hours	1
Duration of symptoms > 48 hours	0.5
Tenderness	1
Guarding	2
Rebound tenderness	1
Rovsing's Sign	2
Fever > 37C < 39C	1
Leukocytosis	1
Negative Urine analysis	1
Non-Asian	1
Total score	17.5

**Table 2. Alvarado appendicitis scoring system**

Patient	Score
Migratory Pain	1
Anorexia	1
Nausea/Vomiting	1
Tenderness	2
Rebound Tenderness	1
Elevated Temperature	1
Leukocytosis	2
Left Shift (>75% Neutrophils)	1

**Tables 3 & 4. RIPASA scoring & ALVARADO scoring system interpretations**

RIPASA Score	Diagnosis Guidelines	Alvarado score	Diagnosis Guidelines
<5	Unlikely Acute Appendicitis	<5	Unlikely Acute Appendicitis
5-7	Low Probability of Acute Appendicitis	5-6	Low Probability of Acute Appendicitis
7.5-11.5	High Probability of Acute Appendicitis	>7	High Probability of Acute Appendicitis
>12	Definite Acute Appendicitis		

**Table 5. Comparison between the RIPASA score and the Histopathological reports among patients**

RIPASA Score	Acute Appendicitis	Negative acute appendicitis
Histopathology (+)	173	03
Histopathology (-)	02	16

**Table 6. Comparison of the Alvarado score and histopathological reports among patients.**

Alvarado score	Acute Appendicitis	Negative Acute Appendicitis
Histopathology (+)	156	22
Histopathology (-)	5	11

**Table 7. Compare the Sensitivity, Specificity, PPV, NPV, and Diagnostic accuracy of the RIPASA scoring system and the Alvarado scoring system.**

RIPASA Parameters		Alvarado Parameters	
Sensitivity	98.86%	Sensitivity	96.89%

Specificity	84.21%	Specificity	33.33%
PPV	98.30%	PPV	87.64%
NPV	88.89%	NPV	68.75%
Diagnostic accuracy	97.42%	Diagnostic accuracy	86.08%

**Table 8. Comparison of Sensitivity, Specificity and Diagnostic accuracy of different studies**

	RIPASA Score			Alvarado Score		
	Sensitivity	Specificity	Diagnostic Accuracy	Sensitivity	Specificity	Diagnostic Accuracy
Nanjundaiah et al 2014	96.2%	90.5%		58.9%	85.7%	
Vamsavardhan et al 2018	75%	65%	73.28%	52.08%	80%	56.9%
Celerino et al 2018	98.8%	71.4%		90.7%	64.3%	
Shehryar Noor et al., 2020	98.52%	90%	97.67%	68.15%	80%	69.33%
Uttam Pachya et al 2021	98.71%	80%	96.6%	52.56%	70%	54.4%
Current Study	98.86%	84.21%	97.42%	96.89%	33.33%	86.08% <sup>s</sup>

## Discussion

Among the most often occurring surgical emergencies in the general surgery division is acute appendicitis. To improve the accuracy of diagnosis, several scoring systems have been developed to evaluate and detect acute appendicitis, including the Alvarado, Modified Alvarado, and AIR scoring systems. Still, a 15% rate of negative appendectomies has been recorded despite these techniques. Originally designed to enable early and accurate diagnosis of acute appendicitis, these scoring systems, developed in the Western World, later gained popularity in Asian countries as well. Previous research, however, has shown low sensitivity and specificity among the Asian population for both the Alvarado and modified Alvarado scores (Table 8). Some Alvarado parameters, as well as modified Alvarado scoring systems. These exhibit shortcomings that affect sensitivity, specificity, and diagnostic accuracy, including age, gender, length of stay, guarding, the Rovsing sign, and urine retention or elevation. The results suggest that, with a sensitivity of 98.86%, a specificity of 84.21%, a positive predictive value (PPV) of 98.30%, a negative predictive value (NPV) of 88.89%, and a diagnostic accuracy of 97.42%, the RIPASA scoring system demonstrates superior performance. Using a sensitivity of 96.89%, specificity of 33.33%, positive predictive value (PPV) of 87.64%, negative predictive value (NPV) of 68.75%, and diagnostic accuracy of 86.08%, the Alvarado scoring system yields lower values.

Numerous studies have shown that the RIPASA scoring system significantly decreases the rate of negative appendectomies compared to the Alvarado scoring system. For instance, Nanjundaiah et al. reported that the sensitivity and specificity of RIPASA are 96.2% and 90.5%, respectively, while the sensitivity and specificity of Alvarado are 58.9% and 85.7%, respectively. A further investigation was carried out by Vamsavardhan et al. in 2018 (12), has also mentioned that the sensitivity, specificity, and diagnostic accuracy of RIPASA are 75%, 65%, and 73.28%, compared to Alvarado's 52.08%, 80%, and 56.9%, respectively. Celerino et al. (2018) study results show that the sensitivity and specificity of RIPASA are 98.8% and 71.4%, respectively, and are compared to Alvarado's, which are 90.7% and 64.3%. Uttam Pachya et al 2021 (13). A conducted comparison study in Nepal showed that the sensitivity, specificity, and diagnostic accuracy of RIPASA are 98.71%, 80%, and 96.60%, respectively, compared to the sensitivity, specificity, and diagnostic accuracy of Alvarado, which are 52.56%, 70%, and 54.4%, respectively. The results of the RIPASA scoring system, compared to the Alvarado scoring system, have significantly reduced the rate of negative appendectomies.

## Conclusion

The RIPASA scoring system is superior to the Alvarado scoring system in terms of sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy for diagnosing acute appendicitis.

## Declarations

### Data Availability statement

All data generated or analysed during the study are included in the manuscript.

### Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-LRHP-03401-24)

### Consent for publication

Approved

### Funding

Not applicable

## Conflict of interest

The authors declared the absence of a conflict of interest.

## Author Contribution

**JM** (Post Graduate Resident)

*Manuscript drafting, Study Design, and Data Collection*

**MA** (Post Graduate Resident)

*Review of Literature, Data entry, Data analysis, and drafting an article.*

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**SMK** (Post Graduate Resident),

*Manuscript drafting, Study Design,*

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*All authors reviewed the results and approved the final manuscript version. They are also accountable for the integrity of the study.*

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