

## A Comparative Study of RIPASA and Modified Alvarado Scoring Systems for the Diagnosis of Acute Appendicitis

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### Abstract

**Background:** The most common emergency seen in general surgical practice is acute appendicitis. The most widely used scoring methods for its diagnosis are the Alvarado and Modified Alvarado scores (MASS), however they perform poorly in some groups. Objective: In order to determine whether is a superior diagnostic tool for acute appendicitis in the Indian population, we compared the RIPASA score with MASS.

**Methods:** A retrospective study-was done in the Department of General Surgery, IGMCRI Pondicherry, between August 2018 and October 2019. 100 participants who were diagnosed as appendicitis were Included in the study- They were scored based on RIPASA and MASS. Either a CT scan, an intraoperative discovery, or a post-operative HPE report supported the final diagnosis. Both RIPASA and MASS were used to compare the final diagnosis. For both RIPASA and MASS, sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were determined.

**Results:** In terms of Specificity (96% vs. 89%) and Positive Predictive Value (93% vs. 80%), as well as to some extent in terms of Diagnostic Accuracy (75% vs. 71%, it was discovered that RIPASA performed better than MASS. While the two models' sensitivities (49.4% and 67.6%, respectively) and negative predictive values (69 and 67%) were comparable.

**Conclusion:** When compared to MASS, RIPASA is a more precise scoring method for our local population. It decreases the proportion of appendicitis cases that are overlooked and effectively eliminates individuals who require a CT scan for diagnosis (scoring 5-7.5).

**Keywords:** Acute Appendicitis, Modified Alvarado Score, RIPASA Score.

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### Introduction

For good reason, the abdomen is sometimes compared to Pandora's box. The illnesses of the abdomen are the subject of considerable clinical curiosity since the belly houses several viscera and other anatomical components. [1] One of the most crucial diagnostic methods and the cornerstone of treatment for many illnesses presenting

with abdominal discomfort is a thorough examination of the abdomen and clinical correlation. [2] The value of a clinical examination cannot be overstated, despite significant breakthroughs in imaging technology and other types of study. [3] One of the most frequent causes of acute abdomen in any general surgical practice is

acute appendicitis. It has been the subject of ongoing investigation since Reginald Heber Fitz originally characterized it in 1886, for reasons ranging from its origins to its treatment alternatives. [4] The area of diagnosis for appendicitis is one of the most investigated. Trials have been used over the years to study numerous inquiry kinds in-depth, including laboratory and radiological investigations. These were carried out in an effort to identify the best accurate test for detecting acute appendicitis. But despite the enormous advancements in medicine, it has often been stated by a variety of authors and professionals. that one illness, appendicitis, is diagnosed mostly based on its clinical manifestations.[5] While it is also true that when overlooked, appendicitis can develop into an illness with significant morbidity and death, appendicitis can also be the most uncomplicated operation if diagnosed early and handled properly.[6] As a result, several clinical scoring systems have been established throughout the years as a result of the recognition of the value of early and precise diagnosis as well as the realization that clinical assessment offers the best and most accurate diagnostic tool for appendicitis. This has greatly benefited the clinician in making the correct diagnosis and initiating treatment.[7] Over time, what started out as a single scoring system multiplied into a number of them as individuals continued to alter them based on the local demographics or by including new variables. This led to the subsequent challenge of identifying the lone best scoring system, or the scoring system with the highest level of sensitivity and diagnostic precision.[8] As a result, several research using randomized controlled trials have been conducted in various regions of the world to compare alternative scoring methods. The Alvarado and Modified Alvarado scoring systems (MASS) are now the most widely utilized scoring systems in the world. [9] As a result, among doctors globally, they have nearly been regarded as the unverified gold standard rating system. So much so that every newly established

grading system is often initially compared to this. To determine whether scoring system is more suitable and relevant to help in the early diagnosis of acute appendicitis in the local population in the Indian subcontinent, RIPASA and Modified Alvarado scoring systems (MASS) are evaluated in the current study.[10]

## Methods

The research was done in the Department of General Surgery, IGMCRI Pondicherry, between August 2018 and October 2019. 100 participants who reported having RIF pain were recruited in the trial. They received management based on the RIPASA score despite having both RIPASA and MASS applied to them. Either a CT scan, an intraoperative discovery, or a post-operative HPE report supported the final diagnosis. Both RIPASA and MASS were used to compare the final diagnosis. For both RIPASA and MASS, sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were determined.

**Inclusion criteria:** Right Iliac Fossa (RIF) pain is a common presenting symptom in all individuals.

**Exclusion criteria:** patients in critical condition, pregnancy, k/c/o tuberculosis, Below 5yrs and above 50 yrs. A pertinent history was taken, a physical exam was conducted, and lab tests were run. Both the RIPASA Scoring, and the Modified Alvarado Scoring System (MASS) were used to evaluate patients, and both results were recorded in the proforma. Patients in both groups were divided into 4 groups following final grading. Following this, the patient was managed in accordance with the RIPASA Scoring system. Patients that fit into the HP/D group were Planned for surgery. Patients that fit into the LP group were diagnosed via CT scanning. Imaging and other pertinent laboratory tests were used to rule out causes of abdominal pain other than appendicitis in patients who came under the U group. Patients who had

conservative management were released and followed up in the OPD, but for patients who underwent direct surgery, intraoperative findings and the HPE report supported the diagnosis. An analysis comparing RIPASA and MASS was conducted once the definitive diagnosis was confirmed by a CT scan, intra-operative finding, or post-operative HPE report.

**Results**

Patients across the age range of 5 to 50 years were included in the current study, with a mean age of 28 +/- 11.6 years. The two decades with the most patients were the second and third ones (Fig.10.1). 31% of the patients were between the ages of 25 and 35, followed by 26% of patients between the ages of 15 and 25, and just 9% of patients were beyond the age of 45. There was a little male preponderance (57% men and 43% females) although all sexes were afflicted. 82% of the population was under 40 years old, while just 18% was above. 57% of the population identified as male and 43% as female. 70% of the patients appeared after 48 hours and 30% before. As required by the study's inclusion criteria, all participants had RIF discomfort.

Of them, 81% experienced RIF soreness, 57% had negative urinalyses, 53% were feverish, and 47% had elevated T-C. 48% of the patients reported feeling queasy or vomiting. Finally, the patients were divided into 4 categories based on their overall score. 4% of the patients had a score of 12 or higher and were classified as D, 21% had a score of 7.5 to 12 and were classified as HP, 39% had a score of 5 and were classified as LP, and 36% had a score of 5 or less and were classified as PL. 81%, 53%, 47%, and 48% of patients, respectively, experienced RIF discomfort, fever, elevated TC, and nausea/vomiting. Anorexia and migratory pain affected 23% of patients, while rebound tenderness affected 17% of them. When the final diagnosis of appendicitis and the HP/D categories of RIPASA and MASS were retrospectively compared, it was shown that 93% of RIPASA's HP/D categories were appendicitis but only 81% of MASS's HP/D categories were. In the LP group, only 58% of cases in RIPASA and 80% in MASS were appendicitis.

**Ripasa Scoring System**

**Table 1: Diagnostic evaluation of RIPASA with Final diagnosis**

RIPASA	Final Diagnosis- A	Final Diagnosis - NA	Total
Score Positive	30	20	50
Score Negative	12	25	36
Total	42	45	97

**Table 2: Statistical Analysis of RIPASA**

Parameter	Estimate	Lower - Upper 95% CIs
RIPASA		
Sensitivity	49.40%	(38.91, 59.94 <sup>1</sup> )
Specificity	96.91%	(91.3, 98.94 <sup>1</sup> )
Positive Predictive Value	93.18%	(81.77, 97.65 <sup>1</sup> )
Negative Predictive Value	69.12%	(60.92, 76.27 <sup>1</sup> )
Diagnostic Accuracy	75%	(68.2, 80.76 <sup>1</sup> )
<b>Method: Wilson Score</b>		

**Interpretation:**

Sensitivity and specificity in this

investigation were 49.4% and 96.91%, respectively, with a 95% confidence interval of 38.91, 59.94. An estimate of 93.18% with a 95% confidence range (81.77, 97.65) was shown by Positive

Predictive Value (PPV). Additionally, RIPASA has a high (75%), accurate diagnosis rate.

### Modified Alvarado Scoring System

**Table 3: Diagnostic evaluation of MASS with Final diagnosis**

MASS	Final Diagnosis- A	Final Diagnosis - NA	Total
Score Positive	35	10	45
Score Negative	15	37	52
Total	50	47	97

**Table 4: Statistical analysis of MASS**

Parameter	Estimate	Lower - Upper 95% CIs
MASS		
Sensitivity	49.40%	(38.91, 59.94 <sup>1</sup> )
Specificity	89.69%	(82.05, 94.3 <sup>1</sup> )
Positive Predictive Value	80.39%	(67.54, 88.98 <sup>1</sup> )
Negative Predictive Value	67.44%	(58.95, 74.92 <sup>1</sup> )
Diagnostic Accuracy	71.11%	(64.1, 77.24 <sup>1</sup> )
<b>Method: Wilson Score</b>		

**Interpretation:** In this investigation, the specificity was 89.69% with a 95% confidence interval of 82.05–94.3 and the sensitivity was 49.4% with a 95% confidence interval of (38.91, 59.94). An estimate of 80.39% with a 95% confidence interval (67.54, 88.98) was shown by Positive Predictive Value (PPV). MASS has a diagnosis accuracy rate of 71.11%.

**Table 5: Comparison Between RIPASA and MASS**

Parameter	RIPASA	MASS
Sensitivity	49.40%	49.40%
Specificity	96.91%	89.69%
Positive Predictive Value	93.18%	80.39%
Negative Predictive Value	69.12%	67.44%
Diagnostic Accuracy	75%	71.11%

**Significance:** Both RIPASA and MASS have similar sensitivity, however RIPASA scoring appears to be superior than MASS in terms of specificity, positive predictive value, and to some extent, diagnostic accuracy.

### Discussion

Numerous research have been conducted since the idea of clinical scoring systems was developed in an effort to find the most sensitive, specific, and diagnostically precise clinical score to help in the diagnosis of acute appendicitis. Alvarado is one of the most well-known and extensively researched scores for acute appendicitis since its debut in 1986.[11] Its alteration MASS has also been widely used.

Since this is the most well-known and often applied scoring system, we intended to contrast it with the more recent scoring system (RIPASA) and evaluate its effectiveness with regard to, among other things, sensitivity, specificity, and diagnostic accuracy. RIPASA and MASS were compared in the current investigation, which had 97 patients (n=97), and the final diagnosis was examined in relation to CECT, intra-operative findings, and post-operative HPE reports.[12] It was discovered that while sensitivity for both RIPASA and MASS was the same (49.4%), specificity for RIPASA was greater (96.9%) than for MASS (89%). Since RIPASA featured more numerical parameters than MASS, it seemed to the

subject that it more accurately summed up the patient's clinical status. The application of the scores (RIPASA and MASS) took only a brief amount of time and did not significantly slow down management. MASS is a commonly used scoring system for the diagnosis of acute appendicitis around the world, however its sensitivity and specificity are weak.[14] Alvarado score had a sensitivity and specificity of 90% and 72%, respectively, according to a prospective study by Thien A et al on 187 patients with suspected appendicitis. [15] In a retrospective research, Christian F. et al. discovered that the sensitivity and specificity for an Alvarado Score of >7 were 60% and 61%, respectively.[16] Dirksen JL, et al. discovered greater sensitivity and specificity, 92% and 82%, respectively, in their retrospective analysis. According to this study, CT scanning would have decreased by 27% if patients with scores >7 had been treated immediately by appendectomy rather than receiving a CT scan. [17] It had a 98% positive predictive value and a 95% negative predictive value. Thus, they came to the conclusion that RIPASA was an effective technique for diagnosing appendicitis. In the current investigation, RIPASA was shown to have sensitivity, specificity, PPV, and NPV of 49.4%, 96.9%, 93%, and 69%, respectively, when compared to the literature. Studies have also been conducted to assess the utility of imaging modalities like CT scanning in the diagnosis of appendicitis over the past several years due to the introduction of newer imaging systems and the varying clinical accuracy of scoring systems. [17] Even though research indicates that CT scanning has the highest sensitivity and specificity for diagnosing acute appendicitis, it hasn't been used very frequently, at least not in a developing nation like India. This is due to a number of factors, including both universal ones like the risk of radiation exposure as well as more concrete economic and practical ones like cost and availability. As a result, studies were conducted to try and determine

which patient groups benefited from CT scans and to filter the available resources. [18] The current study was categorically examined while keeping all of these considerations in mind. When we looked back at the proved appendicitis cases with the scores, we saw that RIPASA identified 93% of the instances as having a high chance of appendicitis, but MASS identified just 81% of the cases as having a high probability. Thus, we realized that patients that fell into the HP/D group can be more securely scheduled for surgery by utilizing the RIPASA score, without the requirement for any imaging modalities. [19] All patients in the LP group of RIPASA underwent a CT scan, and 58% of them were found to have acute appendicitis, compared to 80% in MASS. The argument that RIPASA filters out low probability instances better than MASS is further supported by this. The patients who fit into the LP group (RIPASA 5-7.5) can thus be assumed to gain the most from a CT scan.[20] RIPASA recorded no appendicitis instances within the U category, or "Unlikely to be appendicitis" category. This implies that it demonstrated the improbability of every single scenario. In contrast, 16% of those in MASS's doubtful group ultimately received an appendicitis diagnosis. Therefore, there would have been more missed instances in MASS. Therefore, in the current investigation, RIPASA appears to be superior than MASS clinically and statistically. [21,22]

### Conclusion

The current study comes to the conclusion that the RIPASA score is more specific than the Modified Alvarado Score in the diagnosis of acute appendicitis and also has a greater Positive Predictive Value and Diagnostic Accuracy. It suggests that in most cases, patients in the HP/D category can be immediately taken up for surgery without requiring any additional imaging modality, patients in the LP category would benefit most from CT imaging, and patients in the U category can be worked up for

diagnoses other than appendicitis. This categorization provides a clearer picture for the clinician regarding how to manage patients with RIF pain. Additionally, RIPASA lowers the incidence of "missed appendicitis" patients. As a result, RIPASA is statistically and clinically superior than MASS as a grading system for the diagnosis of acute appendicitis.

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