

## Original Research Article

# A comparative study of Alvarado and RIPASA scoring systems in diagnosis of acute appendicitis

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## ABSTRACT

**Background:** Acute appendicitis is a diagnostic dilemma for surgeons due to wide array of differential diagnosis and sometimes due to atypical presentation. Diagnosis using sonography, which is the most common modality, has a very low specificity and sensitivity. In such cases it puts a surgeon in dilemma especially in an emergency setting. The integration of clinical scores into the diagnostic process in acute appendicitis has been shown to improve decision making and reducing the negative appendectomy.

**Methods:** This is a prospective observational study attempted to compare the efficiency of Alvarado and Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score, in pre-operative diagnosis of acute appendicitis and to correlate these scores with histo-pathological diagnosis. 100 cases satisfying inclusion and exclusion criteria were selected for study. Based on detailed history and thorough clinical examination, diagnosis of acute appendicitis was made.

**Results:** Sensitivity for detecting acute appendicitis was found to be higher using RIPASA score. Negative appendectomy rate by RIPASA and Alvarado scoring systems were 11.5 and 19.2% meanwhile it was 12% with sonography.

**Conclusions:** In the diagnosis of acute appendicitis, clinical scoring is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without extra expense and complications. This study shows RIPASA is a better scoring system than Alvarado in the diagnosis of acute appendicitis.

**Keywords:** Appendicitis, Alvarado, RIPASA, Dilemma, Clinical score

## INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies which require prompt diagnosis. Acute appendicitis with protean manifestations may simulate almost any other acute abdominal illness and in turn may be mimicked by a variety of conditions. Appendicitis is a disease of the young, with 40% of cases occurring in patients between the ages of 10 and 29 years.<sup>1</sup> Its diagnosis is usually made depending on presenting history, surgeon's clinical evaluation, with the aid of laboratory tests and imaging modalities. A decision to

operate based on subjective clinical suspicion alone can lead to removal of a normal appendix in 15-30% cases.<sup>2</sup>

Negative appendectomies are one of the burdens facing not only the general surgeon but also the patient himself and the society as a whole, since appendectomy, as any other operation, results in socio-economic impacts in form of lost working days and declined productivity, in addition to complications arising out of operative trauma caused to peritoneal lining and bowel. Despite the increased use of ultrasonography (US), computed tomographic (CT) scanning, and laparoscopy, to aid clinical judgement, the rate of misdiagnosis of

appendicitis has remained constant (15.3%), as has remained the rate of appendicular rupture.<sup>3</sup> In developing countries, such as India, using advanced imaging modalities in every patient, as a diagnostic aid, can lead to substantial economic burden on health care system and is subject to availability of radiological expertise and imaging modalities in all health care facilities. In case of acute appendicitis definitive diagnosis, by gold standard test (histopathology) before surgery, is not possible. Hence decision making in cases of acute appendicitis may be difficult, especially for junior surgeons. The integration of clinical scores into the diagnostic process in acute appendicitis has had the purposes of improving decision making and reducing the negative appendectomy rates in this common condition.

Hence, it is the need of the hour to compare various clinical scoring systems in the diagnosis of acute appendicitis and incorporate them into the institutional protocol, which will improve the diagnostic accuracy, decrease dependency on imaging, reduce the number of negative appendectomies and hence the socio-economic burden of the commonest surgical emergency, that is acute appendicitis, in the Indian health care scenario.

## METHODS

The study is a prospective observational study. 100 consecutive patients admitted from emergency ward, base hospital within time period from September 2018 to August 2019 (one year) were included in study. All patients with provisional diagnosis of acute appendicitis, undergoing emergency surgical management were included in study. Patients on conservative management, appendicular mass or with complication like appendicular perforation or peritonitis were excluded from study. This study was conducted on patients presenting with pain in the right lower quadrant of abdomen, lasting fewer than 7 days who after clinical examination are provisionally diagnosed to have acute appendicitis.

Based on detailed history and thorough clinical examination, diagnosis of acute appendicitis was made.

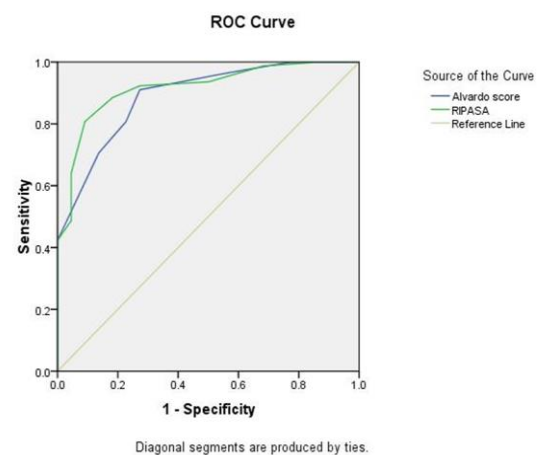
These patients were subjected to the required preoperative investigations, US and were taken for emergency or surgical management.

Alvarado and RIPASA scoring systems were applied on all these patients using scoring sheets. Proforma and scoring sheets were analyzed subsequently and compared to intra-operative findings and post-operative histopathological diagnosis. SPSS statistical software was used to measure various score performance parameters. Approval from institutional ethical committee was taken for the study.

## RESULTS

It was found that RIPASA score was more sensitive than Alvarado score in diagnosing acute appendicitis with a significant p value <0.05.

Negative appendectomy rates in RIPASA score was 11.52% and Alvarado score was 19.23% with a significant p value less than 0.001.



**Figure 1: Specificity and sensitivity of Alvarado and RIPASA scoring system.**

**Table 1: Comparison of RIPASA and Alvarado scoring systems.**

Variable	RIPASA	Alvarado	P value
Sensitivity	88	81	<0.05; not significant
Specificity	82	77	
Positive predictive value	95	93	
Negative predictive value	67	53	
Diagnostic accuracy	87	80	
Negative appendectomy rate	11.5	19.2	

**Table 2: Comparison of diagnostic approach with respect to negative appendectomy.**

	Negative appendectomies	Negative appendectomy rate	Area under ROC curve	P value
Alvarado (>7)	15	19.23%	0.89	<0.001
RIPASA (>7.5)	09	11.52%	0.92	<0.001

ROC: Receiver operating characteristic.

## DISCUSSION

Routine diagnosis of acute appendicitis still poses a challenge, especially in developing countries where advanced radiological investigations do not appear cost effective and so clinical parameters remain the mainstay of diagnosis. The decision to operate or not is very important, as surgical intervention in acute appendicitis is not without the risk of morbidity and mortality. The major areas of concern worldwide are the relatively high rates of negative appendectomies (25-30%), delayed surgeries, perforated appendices (15-20%) and longer hospital stay due to delay in diagnosis. Over the years, several diagnostic scoring systems have evolved with an aim to aid the clinician in arriving at a right diagnosis.<sup>4</sup>

This study was undertaken with an aim of determining the pattern of this extremely common disease. We tried to evaluate the usefulness of the various scoring systems in an Indian population. Result of this study shows that acute appendicitis was most common in the 21-30 years age group (40%). This is consistent with epidemiological studies.<sup>1</sup> Clinically males were more susceptible than female with a male-female ratio of 1.38: 1. Other studies also showed with male susceptibility.<sup>8,27</sup> Pain migration to right iliac fossa (RIF) was the commonest symptom (93%) while RIF tenderness was the commonest sign (100%), present in all patients. In 11% of cases, the intra operative finding recorded was not consistent with the histo-pathological findings. A histopathology examination of the appendix should be the gold standard in any study on appendicitis as intra operative findings may be unreliable.

The percentage of negative appendectomies in various series varies from 8 to 33%.<sup>22</sup> Our negative appendectomy rate (11-19%) was comparable to those reported in other studies.<sup>24-27</sup>

Study by Nagarajan showed that incidence of complicated acute appendicitis in the >40 years age group (75%) is statistically significant and higher as compared to the <40 years age group (11.3%).<sup>26</sup> However, in our study, incidence of complicated acute appendicitis in >40 years age group was 14.2% as compared to only 9.4% in <40 years age group. This difference is statistically non-significant with p value 0.517.

49% patients had mild to moderate anemia, 7 had history of similar illness in past, out of which 6 had acute appendicitis suggestive of recurrence. One of the 2 patients with history of TB had acute appendicitis. None of the 2 patients with hepatitis B had acute appendicitis. With improved diagnostics we should avoid such unnecessary surgical exposure in HIV and hepatitis B patients.

Despite the availability of radiological (US/CT) investigative modalities, a recent population-based study in USA indicated that there was essentially no change in

the frequency of negative appendectomy.<sup>27</sup> In our study also, US did not have any additional benefit over clinical scoring. We need to review the routine use US in every case of suspected acute appendicitis.<sup>27</sup>

In our study, US had very high (95.8%) sensitivity, but very low (19.08%) specificity. Negative appendectomy rate based on USG was 12%. Basing decision making on USG would not have caused statistically significant reduction in negative appendectomy rate.

Mean duration of hospital stay was 4.31±3.76 (range 2-21) days. Five patients (5%) developed post-operative complications in the form of surgical site infection and urinary tract infection. None of the patients developed serious post-operative complications like intra-abdominal abscess or intestinal obstruction, even on long term follow up of 6 months. No mortality occurred in the study.

Macklein et al showed a sensitivity of 76% with Alvarado score, while Malik et al had a sensitivity of 82%. Recent studies by Chong on Asian population shows sensitivity of 59%, 68.32% and diagnostic accuracy of 86.51%.<sup>15,18-20,24</sup> This is comparable to our study where Alvarado score had sensitivity of 81 % with diagnostic accuracy of 80%.

The Alvarado score, is a simple score and it showed very good sensitivity and specificity when applied in a Western population.<sup>5</sup> However, several subsequent studies have shown its limitations when applied in an Asian or oriental population.<sup>17</sup> It is useful when a decision needs to be taken on whether to operate on a clinically borderline case since it has a high positive predictive value (93%). RIPASA score has the higher sensitivity (88%) and best negative predictive value (67%). The RIPASA score is considerably better than the Alvarado score in terms of sensitivity (p value<0.05) as well as in finding those who were having negative predictive values for acute appendicitis. The RIPASA score is a useful, rapid diagnostic tool for acute appendicitis, especially in the settings of the emergency ward, as it requires only the patient's demographics, a good clinical history, clinical examination and two simple investigations.

With its high diagnostic accuracy 87%, the RIPASA score can also help to reduce unnecessary and expensive radiological investigations such as routine CT imaging, thus further helping to reduce annual healthcare expenditure.

When we compared negative appendectomy rate using subjective clinical judgement (23%) to that by using USG (12%), the reduction was statistically insignificant. However, both scoring systems showed statistically significant reduction in negative appendectomy rate (p value<0.001, for Alvarado, and for RIPASA).

## RIPAS APPENDICITIS (RIPASA) SCORE

 PATIENT'S NAME: \_\_\_\_\_  
 IC NO: \_\_\_\_\_ MRN NO: \_\_\_\_\_

Date of Assessment					
Time of Assessment					
	Score	Score	Score	Score	Score
<b>Patient's Demographic</b>					
Female					
Male					
Age < 39.9 yrs					
Age > 40 yrs					
<b>Symptoms</b>					
RIF pain					
Pain migration to RIF					
Anorexia					
Nausea & Vomiting					
Duration of symptoms < 48 hrs					
Duration of symptoms > 48 hrs					
<b>Signs</b>					
RIF tenderness					
Guarding					
Rebound tenderness					
Rovsing's Sign					
Fever >37°C, <39°C					
<b>Investigations</b>					
Raised WCC					
Negative urinalysis					
<b>Additional Scores</b>					
Foreign NRIC					
<b>Total</b>					

A

## ALVARADO APPENDICITIS SCORING SYSTEM

 PATIENT'S NAME: \_\_\_\_\_  
 NO: \_\_\_\_\_ MRN NO: \_\_\_\_\_

Date of Assessment					
Time of Assessment					
	Score	Score	Score	Score	Score
<b>Symptoms</b>					
Pain migration to RIF					
Anorexia					
Nausea & Vomiting					
<b>Signs</b>					
RIF tenderness					
Rebound tenderness					
Fever					
<b>Investigations</b>					
Raised WCC					
Shift of WCC to left					
<b>Total</b>					

B

Figure 2 (A-B): Alvarado and RIPASA scoring system.

## CONCLUSION

Acute appendicitis is a very common emergency faced by every clinician. Diagnostic dilemma in treating the condition can lead to unwanted morbidity and mortality. In the diagnosis of acute appendicitis, clinical scoring is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without extra expense and complications. It is very handy in peripheral hospitals where back up facilities are sparse. It can be very helpful for junior doctors provided it is applied purposefully and objectively in patients of abdominal emergencies.

Our study shows that scoring system is comparable to sonography in sensitivity of detecting acute appendicitis. We recommend use of these clinical score for early detection of acute appendicitis and management. RIPASA scoring system was found to be more sensitive and negative appendectomy rates are also significantly less than Alvarado scoring system.

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