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The Comparison of Diagnostic Value of Modified ALVARADO Score Vs. RIPASA Score in Acute Appendicitis Among Young Population Visiting Tertiary Care Center

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ABSTRACT

Objective: To determine the diagnostic accuracy of the RIPASA score in acute appendicitis compared to the modified Alvarado score, improving diagnosis and reducing negative appendectomies.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of Surgery, Combined Military Hospital, Bahawalpur Pakistan, from Nov 2023 to Jul 2024.
Methodology: A total of 110 patients were included. Young patients from 18 years to 40 years undergoing appendectomy were included. A histopathology of the sample was sent. Cut-off values of scores ≥7 and ≥7.5, were set for Alvarado and RIPASA scores, respectively. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated.

Results: Patients whose Modified Alvarado score was ≥7 were 66 whereas in RIPASA score 92 patients had scores ≥7.5. A significant association was found in both the scoring system and the histopathology findings. Sensitivity, specificity, negative predictive, positive predictive values, and accuracies for modified Alvarado score were found to be 65.31%, 83.33%, 22.73%, 96.97%, and 67.27%, while that of RIPASA was 92.86%, 91.69%, 61.11%, 98.91 %, and 92.73%, respectively.

Conclusion: The sensitivity, specificity, positive predictive value, negative predictive value, accuracy, and predicting negative appendectomy rates of the RIPASA scoring system as compared to Alvarado scoring are better when applied to the young Pakistani population.
Keywords: Appendicitis, Modified Alvarado score, Population, RIPASA, Young.

How to Cite This Article: *Mustafa MA, Akhtar MS, Niaz K, Ansari SA, Ahmed WI, Komal E. The Comparison of Diagnostic Value of Modified ALVARADO Score Vs. RIPASA Score in Acute Appendicitis Among Young Population Visiting Tertiary Care Center. Pak Armed Forces Med J 2026; 76(Suppl-1): S249-S253. DOI: https://doi.org/10.51253/pafmj.v76iSUPPL-1.11121*

INTRODUCTION

The most common surgical emergency that requires surgery is acute appendicitis which has been found in 7-12 % of the population.[1] Due to the difficulty in making diagnoses, there is a higher chance of negative appendectomies i.e. 8-35%. In women of reproductive age, the chances of negative appendectomy increase due to problems with pelvic organs.[2] This challenging diagnosis is the cause of the admission of a huge number of patients with symptoms of acute appendicitis but later they are diagnosed with other diseases like pelvic inflammatory disease, hydronephrosis, urinary tract infection, and gynecological and gastrointestinal issues.[3] If surgical intervention is not done in time, the chances of complications increase, which may lead to gangrene, perforation, empyema, and sepsis leading to prolonged hospital stay.[4] The accuracy of ultrasonography is 71-97 % and that of the CT- scan is 93-98% but these are high cost, operator dependency, contrast material issues, and less availability.[5,6]

Alvarado's scoring system is a well-known system. It was created in 1986 and had 8 parameters.[7] A modified Alvarado score was introduced in which the shift to the left parameter was omitted.8 In 2010 Raja Isteri Pengiran Anak Saleha appendicitis (RIPASA) was introduced for the diagnosis of acute appendicitis it has 15 parameters.[9] The parameters of the RIPASA scoring system include that of the Alvarado score and also include gender, age of the patient, rovsing sign, guarding of the abdomen, urine examination, and Asian origin which were not found in the modified Alvarado scoring system.[10]

Worldwide the Alvarado scoring system is already accepted but trials are still going on these two scoring systems. For that our study emphasizes comparing the diagnostic value of new scoring systems, the Modified Alvarado and RIPASA scoring systems among young people.

METHODOLOGY

It was a single-center study conducted in a tertiary hospital of the combined military hospital

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Received: 02 Nov 2023; revision received: 03 Oct 2024; accepted: 04 Oct 2024

Bahawalpur from November 2023 to July 2024. This quasi-experimental study was conducted as per ethical guidelines and approved by the ethical committee of Combined Military Hospital, Bahawalpur (ERC Ltr No.1516/EC/03/2023).

Inclusion Criteria: Young patients from 18 to 40 years suspected clinically as a case of acute appendicitis who were visiting the combined military hospital Bahawalpur and undergoing surgery were included in the research. The participants were included after their informed written consent.

Exclusion Criteria: We excluded pregnant patients, patients with conservative management for acute appendicitis, children, and old patients. Those who couldn't be followed up were not added to the data.

In this study, a total of one hundred and twenty-two patients were enrolled. The sample size was calculated by Raosoft ample size software. With 5% margin of error, confidence interval of 95%, response distribution of 75% and population size of 200 the sample was calculated to be 119. This was comparable to the sample size of previous research.[2,11] Out of these twelve were excluded on the basis of exclusion criteria (Figure-1). For all the qualified patients both scoring systems RIPASA and Modified Alvarado were done. Modified Alvarado system takes into account 7 parameters (Figure-2) whereas RIPASA score is a more comprehensive system containing a total of 18 parameters which also include the parameter of RIPASA as demonstrated in (Figure-3). The modified Alvarado scoring system has a total of score 9 and for RIPASA it was 17.5.

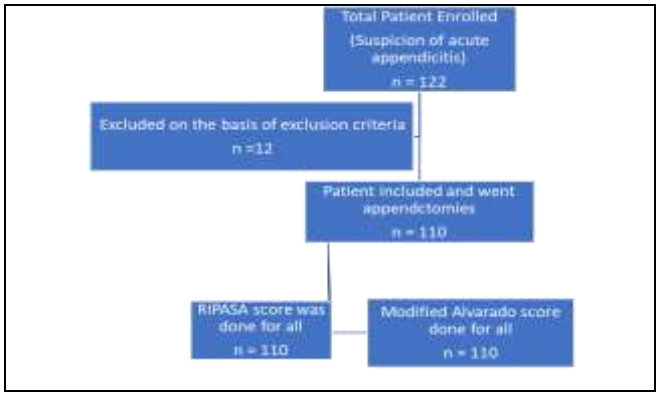

Figure-1: Patient Flow Diagram (n = 122)

The patients were admitted to the surgical ward. Investigations were done free of cost by the hospital laboratory. Printed proformas were made for personal details and scoring system data. These proformas were filled in by the attending postgraduate trainee. All the clinical signs and symptoms were carefully recorded by the trainee. Informed written consent was also taken. The final decision of surgery was made by the senior consultant doctor. Open and laparoscopic appendectomies were performed. The specimen of appendix for the Histopathology of each patient was also sent for definite diagnosis. Cut-off values of scores ≥7 and ≥7.5 were set for the Modified Alvarado score and RIPASA score, respectively. Patients having higher values were grouped as having a higher probability of appendicitis and the patients with lower values were grouped as low probability of diagnosis of acute appendicitis according to previous studies.[1,10] All the patients who underwent appendectomy were followed properly and a histopathology report was alsocollected. The Data was collected in the Statistical Package for Social Sciences (SPSS) Version 23. The analysis was done by Chi-square. The level of significance was set as a *p*-value of 0.05. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy for both Alvarado and RIPASA scoring systems were calculated. The histopathology of the appendix was helpful in identifying the rate of negative appendectomy.

Variable	Score
Symptoms	
Pain migratory to RIF	1
Anorexia	1
Nausea and vomiting	1
Signs	
RIF tenderness	2
Rebound tenderness	1
Fever	1
Laboratory	
Leukocytosis	2
Maximum score	9

RIF, right iliac fossa.

Figur- 2: Modified Alvarado Score 11

RESULTS

Our study comprised 110 patients who underwent appendectomies. Out of them, seventy-five (82.5%) were males, and thirty-five (17.5%) were female. The mean age of the patients was calculated as 29.46±5.17 years.

Patients whose Modified Alvarado score was ≥7 were 66(60%), whereas in RIPASA score 92(83.63%) patients had scores ≥7.5. According to the histopathology report, 98(89.09%) patients were

confirmed for acute appendicitis, so 12(10.90 %) were total negative appendectomy. A significant association was found in both the scoring system and the histopathology findings in the diagnosis of appendicitis i.e. for RIPASA *p*-value <0.001 and for Modified Alvarado Score *p*-value <0.001 [Table-I].

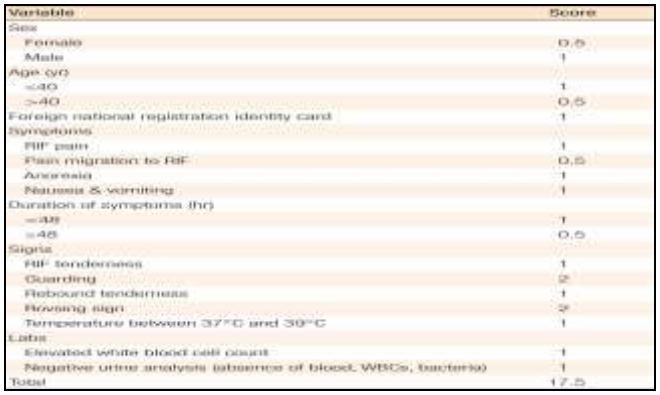

Figure-3: RIPASA Score12

Table-I: Comparison of Scoring System with Histological Findings (n=110)

	Acute appendicitis on Histology		
	Positive/ Yes n (%)	**Negative/No n (%)**	***p*-value**
Modified Alvarado system			
≥7	64(58.18 %)	2(1.81 %)	< 0.001
< 7	34(30.90 %)	10(9.09 %)	
RIPASA score			
≥7.5	91 (82.72 %)	1 (0.90 %)	< 0.001
< 7.5	7 (6.36 %)	11 (10 %)	

Table-I: Diagnostic Parameter of Both Scores (n=110)

Diagnostic Parameter	**Modified Alvarado score (%)**	**RIPASA Score (%)**
Sensitivity= True Positive/(True Positive +False Negative)	65.31	92.86
Specificity= True Negative /(True Negative +False Positive)	83.33	91.69
Negative Predictive Value= True Negative/(True Negative +False Negative)	22.73	61.11
Positive Predictive Value= True Positive/(True Positive+ False Positive)	96.97	98.91
Diagnostic Accuracy=(True Positive +True Negative)/All Patients	67.27	92.73

Sensitivity, specificity, negative predictive value, positive predictive values, and accuracies for Modified Alvarado score were found to be 65.31%, 83.33%, 22.73%, 96.97%, and 67.27%, while that of RIPASA was 92.86%, 91.69%, 61.11%, 98.91 %, and 92.73% [Table-II].

A total of 2(1.81 %) negative appendectomy rate for Modified Alvarado's score and that for RIPASA score was 1(0.90 %) with values greater or equal to 7 and 7.5 in scoring systems respectively.

DISCUSSION

Our study suggests the comparison of two scoring systems the Modified Alvarado which is a modification of the popular Alvarado score and RIPASA scoring systems among the young population. The RIPASA score is more sensitive and accurate in diagnosing appendicitis in the Asian population.[13] In our study, it was shown that in young patients both scoring systems showed promising values in predicting appendicitis. The number of patients with a high probability of appendicitis was higher in the RIPASA scoring system than in the Modified Alvarado scoring system which is 83.63% and 60% respectively. Also, the number of negative appendectomies was less in the RIPASA score group, which had a high probability of appendicitis, compared to the Modified Alvarado score. The RIPASA scoring system was more accurate in predicting appendicitis. It was also found that the sensitivity of the RIPASA score was more and so that the specificity.

Histopathology of the specimen is the only way to get a definite diagnosis. but, the plan to undergo surgery is only based on clinical examination and a little help from laboratory investigation. Chances of complications increase like perforation if it is misdiagnosed.[14] Ultrasonography and CT scans abdomen and pelvis with contrast have been used for diagnosis with greater specificity and sensitivity but have a heavy cost burden. So, different scoring systems were advised for predicting appendicitis with less time and cost.[15]

On reviewing different research, Mumtaz *et al.*, study showed that RIPASA scoring has a 96.75% sensitivity, an 82.35% specificity, 98.02% positive predictive value, and an accuracy of 95.3% in the confirmation of acute appendicitis. These findings coincide with our study results. Moreover, in Asian people, it was found that the RIPASA scoring system has higher accuracy than the modified Alvarado scoring system in detecting appendicitis.[16] Similarly, a study conducted by l Madhushankar *et al.*, showed almost similar results to ours, that the modified Alvarado score had a sensitivity of 52.94%, specificity

of 53.33%, PPV of 86.54%, NPV of 16.67%, and 53% accuracy in the diagnosis of acute appendicitis. while, the RIPASA score had a sensitivity of 96.47%, specificity of 33.33%, PPV of 89.13%, NPV of 62.5%, and 87% accuracy in the diagnosis of acute appendicitis. He also found an association between intraoperative findings and the RIPASA score but no association with the Modified Alvarado scoring system.[17] Another study conducted by Frountzas *et al*., also showed an almost similar result of the RIPASA scoring system to ours. His study included twelve studies that enrolled 2161 patients. The sensitivity of the RIPASA score was 94% and the specificity was 55%. The sensitivity of Alvarado's score was 69% and the specificity was 77%. He showed that the RIPASA scoring system is more sensitive than the Alvarado one.[18] Karapolat *et al*., showed a strong positive association between the RIPASA scores of the patients and the pathological stage of appendicitis (p<0.001).[19] Although it is found to be more sensitive and specific in the Asian population with the exclusion of the foreign identity parameter that is the Modified RIPASA score it showed similar results.[14,20]

The increased accuracy and sensitivity of the RIPASA scoring system is most likely due to more numbers of relative parameters like age, gender, symptoms duration, and urinalysis, as compared to the modified Alvarado score which lacks these parameters. The Modified Alvarado score has been studied a little and not much used as compared to the Alvarado score. However, both show great measures for diagnosis. This study emphasizes that the use of the Modified Alvarado score may increase in the future with such research pieces of literature.

Ultrasonography has been very helpful in assisting the diagnosis, although it cannot be compared with the clinical approach. The sensitivity and specificity of ultrasound is found to be almost 50% and 80%, respectively. However, expertise is needed for visualization. It is so much more difficult to visualize that ultrasound done in 45% of the patients could not visualize the appendix.[20] Radiological investigation having higher levels of diagnostic values like contrast-enhanced computerized tomography (CECT) scan can prevent negative appendectomies at a better rate, but performing such investigation on every patient with only suspicion of appendicitis is not accessible and an easy task, particularly in developing countries with a lack of resources.[21] So, these scoring systems will be helpful in the diagnosis with great accuracy where radiological investigations are not available. As already the most common and used system is Alvarado. With this study, we will be able to modify our scoring system for better understanding and early diagnosis cost-effectively and efficiently. As both the RIPASA and Modified Alvarado Scoring system have great diagnostic value in acute appendicitis.

LIMITATIONS OF STUDY

Only the young population was selected for the study. The foreign identity card parameter had no meaning as all of our patients belonged to the Asian population. It was also difficult to define exactly when the symptoms appeared. Clinical examination was subjective which may slightly affect the scoring system results.

CONCLUSION

The sensitivity, specificity, positive predictive values, negative predictive value, accuracy, and predicting negative appendectomy rates of the RIPASA scoring system as compared to Modified Alvarado scoring are better when applied to the young Pakistani population. RIPASA scoring system has a significant decrease in the number of negative appendectomies. However, both scoring systems have shown significant association in the diagnosis of acute appendicitis.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MAM & MSA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

KN & SAA: Data acquisition, data analysis, approval of the final version to be published.

WIA & EK: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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