ONLINE FIRST

Diagnostic Accuracy of Ripasa and Alvarado Score in Detecting Acute Appendicitis

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ABSTRACT

OBJECTIVE: To find out RIPASA and ALVARADO score diagnostic accuracy in detecting acute appendicitis.

METHODOLOGY: A cross-sectional comparative study was performed on patients aged ≥ 18 years at the surgery department, Liaquat University of Medical and Health Sciences Jamshoro. Two hundred and thirty patients were evaluated from April to September 2019. Patients with right iliac fossa (RIF) pain were consecutively selected. Patients with right iliac fossa mass, pregnant women, having a pelvic inflammatory disease, or urolithiasis history were excluded from the study. RIPASA and ALVARADO scores were applied to each patient, and histopathology was used as the gold standard. Data analysis was performed with SPSS version 25.

RESULTS: Male were 132 (57.4%) and female were 98 (42.6%), presented with suspected acute appendicitis with mean age of 29.8 ± 9.2 years. Histopathology confirmed the acute appendicitis in 217 (94.3%) patients, whereas RIPASA score in 210 (91.3%) patients and ALVARADO score in only 30 (13.0%) patients. Sensitivity (94.01% vs 13.36%), specificity (53.85% vs 92.31%), positive predicitve value (PPV, 97.14% vs 96.67%), negative predicitve value (NPV, 35.00% vs 6.00%) and diagnostic accuracy (DA, 91.74% vs 17.83%) of RIPASA and ALVARADO respectively.

CONCLUSION: RIPASA score is more sensitive and accurate in predicting acute appendicitis than the ALVARADO score.

KEYWORDS: Acute appendicitis, abdominal, emergency, pain, RIPASA, ALVARADO.

INTRODUCTION

Acute appendicitis is the most frequent reason for abdominal surgery in an emergency, with a 7.0-8.0% lifetime risk [1]. The reported incidence of acute appendicitis is 233 per 0.1 million, with a mean age of 28 years. Males are more commonly affected with acute appendicitis with a lifetime risk of 8.6% than females with 6.7% [2]. Despite acute appendicitis being the most common health problem, its diagnosis is still difficult, specifically in children, young adults, and pregnant women. Early and accurate diagnosis is essential for decreasing perforation and worse appendectomy outcomes. Most emergency patients have signs and symptoms similar to other diseases like genitourinary or gynecologic inflammatory conditions. Therefore, diagnosis of acute appendicitis depends upon presenting complaints, physical examination, laboratory investigations, and different predicting scoring systems[3-5].

Different simple, inexpensive, non-invasive and reliable scoring systems are developed to diagnose acute appendicitis rapidly[5,6]. These systems decrease the negative appendectomy rate by approximately 5-10%. Alvarado score is the oldest and widely used with clinically approved diagnostic accuracy. It is the most commonly used and popular score among surgeons because it is simple, inexpensive and quick. It comprises eight predictive clinical factors with a maximum of ten score with a cut-off of ≥ 7 score[7,8]. The Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score is among the most widely used scoring system throughout the world. It comprises 15 predictive parameters with a maximum of 16 score with cut-off of ≥ 7.5. RIPASA score has a few additional parameters for predicting acute appendicitis that is not present in the Alvarado score[9,10].

Most of these scoring systems are developed for the population of western countries, such as initially Alvarado score was not applicable for Asian countries. Differences in ethnicity and diet can change the predictability of different scoring systems. Therefore, these scoring systems should be applied to the local population to get more accurate results in predicting acute appendicitis. The study focuses on finding RIPASA and ALVARADO score diagnostic accuracy in detecting acute appendicitis.

METHODOLOGY

A cross-sectional comparative study was performed at the department of surgery, Liaquat University of Medical and Health Sciences Jamshoro, after obtaining approval from the research ethics committee (LUMHS/REC/-781). During the study period from April to September 2019, 230 patients aged≥ 18 years who presented with right iliac fossa (RIF) pain were consecutively selected. Patients without RIF pain, with right iliac fossa mass, pregnant women, pelvic inflammatory disease or urolithiasis history were excluded from the study.

Suspected acute appendicitis was defined in right iliac fossa pain presence. RIPASA score consists of 15 parameters with a total score of 16 and a cut-off of ≥ 7.5. ALVARADO score consists of 08 parameters with a score of 10. ALVARADO score of ≥ 7.0 was used to confirm acute appendicitis (**Table I**).

The detailed medical history of each patient was obtained. RIPASA and ALVARADO scores were applied on each patient, and histopathology was used as the gold standard for confirming both scores' diagnoses. Data interpretation was made with the statistical package for social science (SPSS) version 25.

TABLE I: RIPASA AND ALVARADO SCORE CRITERIA

RIPASA Score		ALVARADO Score	
Characteristics	**Score**	**Characteristics**	**Score**
Gender			
Male	1.0	--	--
Female	0.5	--	--
Age			
≤ 40	1.0	--	--
> 40	0.5	--	--
Symptoms			
RIF pain	0.5	Migration of pain to right lower quadrant	1.0
Pain migration to right iliac fossa (RIF)	0.5	Nausea & Vomiting	1.0
Anorexia	1.0	Anorexia	1.0
Nausea & Vomiting	1.0	--	--
Duration of symptoms			--
≤ 48 Hours	1.0	--	--
> 48 Hours	0.5	--	--
Signs			
RIF tenderness	1.0	Tenderness in RIF	2.0
Guarding	2.0	Rebound tenderness in RIF	1.0
Rebound tenderness	1.0	Elevated temperature (> 37.3 ºC)	1.0
Rovsing's Sign	2.0	--	--
Temperature: >37 ºC & <39 ºC	1.0	--	--
Labs			
Raised WBC count	1.0	Leukocytosis > 10000 mm^3	2.0
Negative urine analysis (Absence of blood, WBCs, bacteria)	1.0	Shift to the left of Neutrophils	1.0
Additional Scores			
Foreign I.C.	1.0	--	--
Total Score	16		10

RESULTS

Out of 230 suspected patients, males were 132 (57.4%), and females were 98 (42.6%). 139 (60.4%) patients fall in the age group of 18-30 years and 66 (28.7%) patients in the age group of 31-40 years with a mean age of 29.8±9.2 years (**Table II**).

Out of 230 suspected patients, histopathology confirmed acute appendicitis in 217 (94.3%) patients, whereas RIPASA score in 210 (91.3%) patients and ALVARADO score in only 30 (13.0%) patients. The mean RIPASA score was 11.0 ± 2.7, and the ALVARADO score was 5.4±1.4 (**Table II**).

On RIPASA score, 210 (91.3%) patients were suspected of acute appendicitis, among which histopathology (true positive) confirmed acute appendicitis in 204 (94.0%) patients, 7 (53.8%) were true negative, 6 (46.2%) were falsely positive, and 13 (6.9%) were false negative. Similarly, on the ALVARADO score, only 30 (13.0%) patients were suspected of acute appendicitis, among which histopathology (true positive) confirmed acute appendicitis in 29 (13.4%) patients, 12 (92.3%) were true negative, 1 (7.7%) was false positive and 188 (86.6%) were false negative (**Table III**).

Sensitivity (94.01% vs 13.36%), specificity (53.85% vs 92.31%), positive predicitve value (PPV, 97.14% vs 96.67%), negative predicitve value (NPV, 35.00% vs 6.00%) and diagnostic accuracy (DA, 91.74% vs 17.83%) of RIPASA and ALVARADO respectively (**Table III**).

The receiver operating characteristic (ROC) curve also indicates a higher DA of RIPASA than Alvarado. The area under the curve (AUC) of RIPASA and Alvarado scores was 0.761 and 0.531, respectively (**Figure I**).

TABLE II: DEMOGRAPHICS AND DIAGNOSIS OF ACUTE APPENDICITIS PATIENTS (n=230)

Variables	Frequency	Percentage
Gender		
Male	132	57.4
Female	98	42.6
Age		
Mean ± SD	29.8±9.2 (18-58)	
18-30	139	60.4
31-40	66	28.7
41-50	16	7.0
51-60	9	3.9
Histopathology		
+VE	217	94.3
-VE	13	5.7
RIPASA Score		
Mean ± SD	11.0±2.7 (5.0-16.0)	
+VE	210	91.3
-VE	20	8.7
ALVARADO Score		
Mean ± SD	5.4±1.4 (4-10)	
+VE	30	13.0
-VE	200	87.0

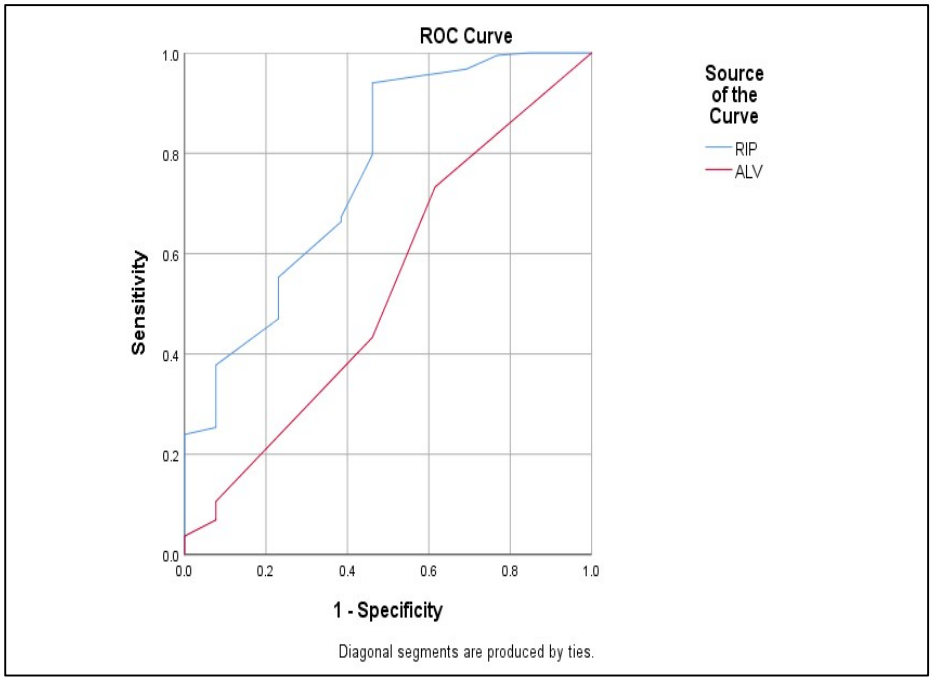
TABLE III: DIAGNOSTIC FINDINGS AND SENSITIVITY ANALYSIS (n=230)

Variables	Histopathology (Gold Standard)		P-value
	Present (n=217)	Negative (n=13)	
RIPASA Score			
+VE	204 (94.0%)	6 (46.2%)	< 0.001*
-VE	13 (6.9%)	7 (53.8%)	
ALVARADO Score			
+VE	29 (13.4%)	1 (7.7%)	0.55
-VE	188 (86.6%)	12 (92.3%)	

Sensitivity Analysis	RIPASA	ALVARADO
Sensitivity	94.01%	13.36%
Specificity	53.85%	92.31%
Positive Predictive Value	97.14%	96.67%
Negative Predictive Value	35.00%	6.00%
Diagnostic Accuracy	91.74%	17.83%

*P-values are calculated on the Chi-square test and significant on ≤ 0.05

FIGURE I: ROC CURVE OF RIPASA AND ALVARADO SCORE



DISCUSSION

Acute appendicitis diagnosis is very much challenging for emergency physicians. It requires a detailed medical history of the patient, presenting clinical signs and symptoms, and laboratory investigations but is still considered a diagnostic dilemma. Therefore, various diagnostic scoring systems are utilized for the early diagnosis of acute appendicitis. The current study evaluated 230 suspected patients of acute appendicitis using RIPASA and ALVARADO scores followed by histopathology to confirm their predicted diagnosis.

Most of the patients with RIF pain were males in the current study; 132 (57.4%) and 98 (42.6%) were females. The majority of the patients were young adults with a mean age of 29.8±9.2 years. Similar Pakistani studies such as Damani SAAR 2016[11] and Davis GN 2019[9] also reported a similar higher male prevalence of 64.5% and 58.4%, with a mean age of 24.7±10.2 and 23.5±9.1 years. Similar to other studies such as Shuaib A et al.[12], Özsoy Z 2017[13], Chisthi MM 2020[14] and Kothari D 2017[15] also reported a similar higher male prevalence mean age. All studies help conclude that young male adults are more prone to developing acute appendicitis.

In the current study, the gold standard diagnostic of acute appendicitis, i.e., histopathology, confirmed acute appendicitis in 217 (94.3%) patients. In contrast, the RIPASA score was also accurate and diagnosed acute appendicitis in 210 (91.3%) patients, but the ALVARADO score was inappropriate and diagnosed acute appendicitis in only 30 (13.0%) patients. Damani SAAR 2016[11] diagnosed acute appendicitis in 90.0% of patients based on histopathology, 91.1% of patients based on RIPASA score and 11.7% of patients based on ALVARADO score. Histopathology is the gold standard in diagnosing acute appendicitis, while the results of the RIPASA score are almost similar to histopathology.

In the current study, the diagnostic accuracy of the RIPASA score was much higher than the ALVARADO score. Sensitivity (94.01% vs 13.36%), specificity (53.85% vs 92.31%), positive predictive value (97.14% vs 96.67%), negative predictive value (35.00% vs 6.00%) and diagnostic accuracy (91.74% vs 17.83%) of RIPASA and ALVARADO respectively. Damani SAAR 2016[11] reported similar results with a higher diagnostic accuracy of RIPASA score than ALVARADO score. Sensitivity (91.11% vs 11.67%), specificity (60.0% vs 95.0%), PPV (95.34% vs 95.45%), NPV (42.85% vs 10.67%) and DA (88.0% vs 20.0%) of RIPASA and ALVARADO score respectively. Davis GN 2019[9] also reported the higher sensitivity (96.7%), specificity (93.0%), PPV (94.8%), NPV (95.54%) and DA (95.1%) of RIPASA score. Similar studies [12, 14, 16-21] also reported similar results that the RIPASA score is more appropriate with higher sensitivity, specificity and diagnostic accuracy.

In this study, the ROC curve's area under the curve also showed a higher diagnostic value of RIPASA score than ALVARADO, with higher AUC of 0.761 and 0.531, respectively. Different other studies also reported a higher AUC with RIPASA than ALVARADO to score, such as Damani SAAR 2016[11] 0.889 vs 0.633, Chisthi MM 2020[14] 0.910 vs 0.726, Pasumarthi V 2018[16] 0.810 vs 0.771 and Sanjive JG 2019[17] 0.920 vs 0.490 in RIPASA and ALVARADO score respectively as ROC curve shows that RIPASA score has higher diagnostic value and AUC than ALVARADO score. It helps to conclude that the RIPASA scoring system is a more powerful diagnostic tool than ALVARADO in diagnosing acute appendicitis.

However, no any diagnostic scoring system or laboratory investigation is 100.0% reliable in diagnosing acute appendicitis. Our study findings conclude that the accuracy of diagnosing acute appendicitis is directly associated with a higher score of RIPASA and ALVARADO. RIPASA scoring system is more reliable than ALVARADO and can be used for deciding about patient surgery or conservative treatment. Suspected acute appendicitis patients with a score of 7.5 or greater should be managed with surgery. Patients with a score of 7 or less

should be handled with conservative treatment and kept under continuous observation. If the score exceeds 7.5 or greater, the patient will undergo surgery. If the score falls below 5, the patient will be discharged from the hospital and advised to come to the hospital immediately if symptoms persist or worsen.

CONCLUSION

RIPASA score is a more sensitive, reliable and accurate diagnostic tool in predicting acute appendicitis than the ALVARADO score. RIPASA scoring system uses simple parameters that help the surgeons to reach the final decision in patients who presented with RIF pain in an emergency.

ABBREVIATIONS:

AUC: Area Under The Curve
DA: Diagnostic Accuracy
NPV: Negative Predictive Value
PPV: Positive Predictive Value
RIF: Right Iliac Fossa
RIPASA: Raja Isteri Pengiran Anak Saleha Appendicitis
ROC: Receiver Operating Characteristic
SPSS: Statistical Package For Social Science

Ethical Permission: Liaquat University of Medical & Health Sciences REC letter No. LUMHS/REC/-781, dated: 11-04-2019
Conflicts of Interest: The authors have no conflicts of interest to declare.
Financial Disclosure / Grant Approval: There was no funding agency used for this research.
DATA SHARING STATEMENT: The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

AUTHOR CONTRIBUTIONS

Nazir S: Main idea and Design of Study
Abro S: Collection of data and analysis
Pathan MR: Interpretation of data
Kumari A: Compilation and finalizing of manuscript
Sehrish R: Critical review of manuscript
Sulman S: Reference collection

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