Original Article

Diagnostic accuracy of RIPASA scoring system against Alvarado score in acute appendicitis

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ABSTRACT

BACKGROUND

Acute appendicitis is a common surgical emergency. A number of scoring systems have been used to assist in equivocal cases in aiding in early diagnosis and decrease negative appendicectomy rates. Alvarado score is the most popular scoring system and recently The Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) has been designed for the diagnosis of acute appendicitis in the Asian population.

The aim of this study was to evaluate the RIPASA score and compare its performance in predicting risk of appendicitis with the Alvarado score.

METHODS

We compared Alvarado and RIPASA scoring system by applying them to 204 patients who presented with right iliac fossa pain in Manipal Teaching Hospital, Pokhara, Nepal between January 2022 and December 2024. Ethical clearance was taken. Statistical analysis was done using SPSS 21 and p value <0.05 was considered significant.

RESULTS

The study included 204 patients 114 (55.9%) males and 90 (44.1%) females. The mean age of patients was 26.44 ±15.52 years. RIPASA showed better sensitivity of 97.39%as compared to 89.58% of Alvarado score. The positive and negative predictive values of Alvarado score were 96.12% and 12.24%, as compared to 96.35% and 44.16% for RIPASSA score. Furthermore, the area under receiver operating curve of the RIPASA was better (0.690) than that of Alvarado score (0.638).

CONCLUSIONS

RIPASA score is more accurate with high specificity and sensitivity in diagnosing acute appendicitis than Alvarado scoring system in Nepalese population and in preventing negative appendectomies.

KEY WORDS

Appendectomy; Appendicitis; Early diagnosis.

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INTRODUCTION

Acute appendicitis is one of the commonest causes of acute abdomen in general surgical practice and has a lifetime risk of 7-8%.1,2. Acute appendicitis (AA)is still a difficult diagnostic entity with the peak incidence occurring between the age of 10 and 30 years.2 It is generally a clinical diagnosis, being aided by laboratory and radiological investigations. Particularly among children, elderly and females, where other conditions can mimic clinical features similar to those of AA, diagnosis is often difficult to establish. 3 Delay in treatment may increases the incidence of complications. Early diagnosis and prompt operative intervention is the key for successful management of acute appendicitis.4

Many scoring systems have been developed to aid the physicians in making the correct diagnosis.3 The most commonly used scoring system being the Alvarado score.5-6 Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score is a fairly newer scoring system developed in 2008, where a study was done in RIPAS Hospital, Brunnei Darssalem, to find a more favorable scoring system than Alvarado and modified Alvarado.7,8 The RIPASA scoring system includes more parameters than Alvarado system and the latter does not contain certain parameters such as age, gender, duration of symptoms prior to presentation.9 The RIPASA Score is a new diagnostic scoring system and has been shown to have significantly higher sensitivity, specificity and diagnostic accuracy compared to Alvarado Score, particularly when applied to Asian population.7

The aim of this study was to evaluate the RIPASA score and compare its performance in predicting risk of appendicitis with the Alvarado score in our population.

METHODS

A cross-sectional prospective study was carried out at the department of surgery Manipal College of Medical Sciences, Pokhara, Nepal from May 2023 to February 2025. Approval was obtained from the ethical review board of the institute (MCOMS/IRC/550), and informed consent was taken from all the participants.

Inclusion criteria: All consecutive patients admitted under general surgery with suspected acute appendicitis during the study period.

Exclusion criteria:
1. Patients with right iliac fossa mass.
2. Pregnant females.
3. Patients with known abdominal malignancies
4. Conservatively managed patients.
5. Incidental and valentino appendectomy

Patients presenting with pain abdomen were examined the laboratory investigations were performed including complete blood count (CBC), C- reactive protein, renal function test (RFT), random blood glucose (RBS). Though diagnosis and the decision for operation were based on clinical examination, ultrasound (USG) of the abdomen and pelvis was done in all patients to rule out other differential diagnosis. Patients suspected of acute appendicitis were then taken up for open or laparoscopic appendectomy. The decision on appendicectomy was solely based on surgeon's clinical judgment after taking into consideration clinical, laboratory and radiological investigation. Intra-operative findings were noted and routine post operative care given to all patients. Specimen of the appendix was then sent to the pathology department for histopathologic examination (HPE). Appendicitis was confirmed, when there was neutrophilic granulocytes infiltration into the muscularis propria.10

All of the variables required for evaluating the scores were noted and both Alvarado score and RIPASSA score were calculated. The Alvarado score contains 8 parameters whereas the RIPASA score contains 18 parameters (table 1 and table 2).

		Score
1.	**Patients:**	
	Female	0.5
	Male	1.0
	Age <40 years	1.0
	Age >/= 40 years	0.5
2.	**Symptoms**	
	RIF pain	0.5
	Pain migrating to RIF	0.5
	Anorexia	1.0
	Nausea and vomiting	1.0
	Duration of symptoms < 48 hrs	1.0
	Duration of symptoms > 48 hrs	0.5
3.	**Signs**	
	RIF tenderness	1.0
	Guarding	2.0
	Rebound tenderness	1.0
	Rovsing Sign	2.0
	Fever > 37° C < 39° C	1.0
4.	**Investigations**	
	Raised WBC	1.0
	Negative Urine analysis	1.0
5.	Additional Score	
	Foreign resident	1.0
	Total Score	**17.5**

RIF, right iliac fossa; WBC, white blood cell

Table 1: RIPASA appendicitis (RIPASA) score

		Score
1.	**Symptoms**	
	Pain Migration to RIF	1.0
	Anorexia	1.0
	Nausea/Vomiting	1.0
2.	**Signs**	
	RIF Tenderness	2.0
	Rebound Tenderness	1.0
	Fever	1.0
3.	**Investigations**	
	Raised WBC	2.0
	Shift of WBC to left	1.0
	Total Score	**10**

RIF, right iliac fossa; WBC, white blood cell

Table 2. Alvarado score

The scores for each of the parameters ranged from 0.5 to 2 for the RIPASA system, 1 to 2 for the Alvarado system. A score of ≥7 was considered as a high probability of AA for the Alvarado scoring system whereas those scores for the RIPASA scoring systems was more than ≥7.5. The patients were monitored from admission until discharge from the hospital. Histopathology findings of the operated case were correlated with either score.

The study was approved by institutional ethics committee. Informed and written consent was obtained from all the enrolled cases and consent was obtained from the parents or guardians in children less than 16 years.

Statistical analysis was performed with SPSS version 21 statistical software (SPSS Inc, Chicago, IL). Sensitivity, specificity, positive predictive value, negative predictive value (at score of 7 for Alvarado scoring system and a score of 7.5 for RIPASA scoring system), diagnostic accuracy and negative appendectomy rate were calculated for both scoring systems and compared using chi square test (McNemar). The area under the receiver operating characteristic (ROC) curves used to examine the performance characteristics of the two scoring systems. P value < 0.05 was considered as statistically significant

RESULTS

The present study included 204 patients for final analysis. There were 114 (55.9%) males and 90 (44.1%) females. The mean age of patients was 26.44 ±15.52 years. Majority of the patients were of age group 10-20 years (34.8%) followed by 20-30 years age group (24%). Laparoscopic appendectomy was performed in 121(59.3%) and open appendectomy in 83(40.7%) (Table 3).

		Number	Percentage
Age-group	≤10 yrs	20	9.8
	10-20yrs	71	34.8
	20-30yrs	49	24
	30-40 yrs	31	15.2
	40-50 yrs	12	5.9
	50-60 yrs	12	5.9
	60-70 yrs	8	3.9
	70-80 yrs	1	0.5
Operation	Open appendectomy	83	40.7
	Laparoscopic appendectomy	121	59.3
Histopthology	Acute appendicitis	192	94.1
	Normal appendix	12	5.9

Table 3: Age-group and test results in study population (N=204).

There was a statistically significant association between RIPASSA score categories with the diagnosis of acute appendicitis (p=0.00) than between Alvarado score and the histopathologic (HPE) diagnosis (p=0.041). (Table 4)

Parameter	Histopathology		Chi-Square Value	P value
	Acute appendicitis (N=192)	Acute appendix (N=12)		
RIPASA				
≥7.5	187	4	77.686	0.000
<7.5	5	8		
Alvarado				
≥7	172	8	5.714	0.039
<7	20	4		

Table 4: Association between the risk scores and histopathology findings in study population

At a cut off score of > 7.5 for acute appendicitis, the RIPASA score had a high sensitivity of 97.39% but specificity was low at only 66.66%. Among those with a score >7.5, 97.90% had appendicitis; however, only 38.47% with lower scores had appendicitis. RIPASSA score has an accuracy of 95.58%. However negative predictive value for Alvarado score was only 16.66%.

At a cut off value of ≥7, Alvarado score had a sensitivity of 89.58%, a specificity of 33.33% and an accuracy of 86.27 percent. Both scoring systems had a high positive predictive value (97-98%).

The study showed better sensitivity of RIPSSA score (96.91%) as compared to 77.6% of Alvarado score. The positive and negative predictive values of Alvarado score were 96.12% and 12.24%, as compared to 96.35% and 44.16% for RIPASSA score. (Table 5)

Diagnostic value	Alvarado score 7	RIPASA score 7.5
Sensitivity	89.58%	97.39%
Specificity	33.33%	66.66%
Positive Predictive value	97.72%	97.90%
Negative Predictive value	16.66%	61.53%
Accuracy	86.27%	95.58%

Table 5: sensitivity, specificity, PPV, NPV of Alvarado score of 7 and RIPASA score of 7.5.

The predictive validity of RIPASSA score as assessed by area under the ROC curve was 0.690, which is greater than the area under the curve(AUC) of Alvarado score of 0.638. (Figure1)

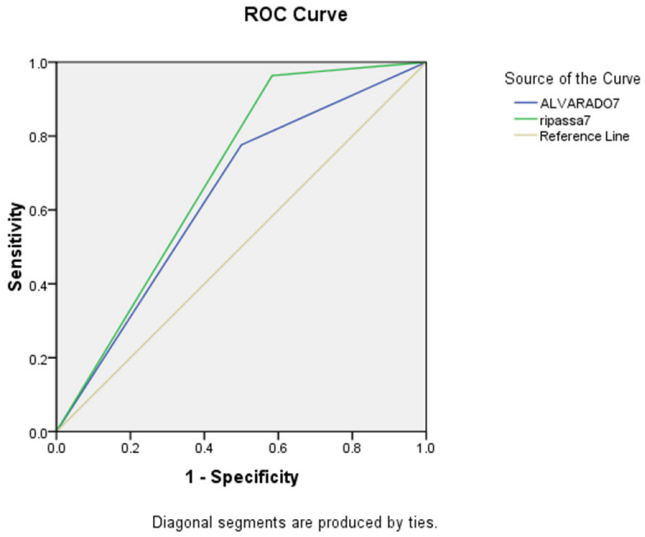

Figure 1. The receiver operating characteristic (ROC) curve curves demonstrate the sensitivity vs. specificity of the Alvarado and RIPASA scoring systems in the diagnoses of acute appendicitis.

DISCUSSION

Acute appendicitis is one of the common surgical emergencies worldwide.11AA is often a clinical diagnosis, and confirmation can be achieved by histopathology of the excised specimen. Is imperative to identify all patients with the disease as early in their clinical course as possible, so as to avoid complications associated with the disease. At the same time, it is necessary to reduce the rates of negative appendectomies, as these lead to patient morbidity, increase in the healthcare cost for the patient and country.12 Diagnostic accuracy can be improved with the use of computed tomography (CT) imaging. A recent study has suggested that such indiscriminate use of CT imaging may lead to unnecessary appendectomies for early low-grade appendicitis which would otherwise be resolved spontaneously by antibiotics therapy.13

The, male to female ratio in our study was 1.26:1 with mean age of 26.44 ±15.52 years. These results are consistent with study by Alnjadat where male to female ratio was 1.5:1 and 16 mean age was 26.52 years.14 The negative appendectomy rate was 6% which is lower than that reported by Alnjadat in which negative appendectomy was 17%.14

A variety of scoring systems have been created with acceptable sensitivity, specificity and negative appendectomy rate, with RIPASA and Alvarado being the most widely utilized. The original study for the Alvarado Score in 1986 achieved a sensitivity of 81% and a specificity of 74%.15 Our study compared sensitivity and specificity between Alvarado scoring system with that of RIPASA. The RIPASA score had a better edge than Alvarado score in correctly diagnosing AA. The RIPASA score is a new diagnostic scoring system developed for the diagnosis of AA and has been shown to have significantly higher sensitivity, specificity and diagnostic accuracy compared to Alvarado Score, especially when applied to Asian population. Using the RIPASA score, 97.39% of patients who actually had acute appendicitis were correctly diagnosed and placed in the high probability group (RIPASA score > 7.5), compared to only 89.58% when using the Alvarado score (score >7) on the same population sample.

In this study sensitivity and specificity of Alvarado scoring system was 89.58%, 33.33% respectively. Positive and negative predictive value were 97.12% and 16.66% respectively with diagnostic accuracy of 86.27%. In a study on 125 patients in Nepal by Timilsina et al,4 sensitivity and specificity of Alvarado score was 68.64%, 28.57% respectively while positive and negative predictive value were 94% and 5.12% respectively with diagnostic accuracy of 66.4%. In another study in Turkey by Din et al, the RIPASA score sensitivity and specificity were 95.8% and 87.9%, respectively, whereas the Alvarado score was 71.1% sensitive and 75.8% specific. RIPASA score has a PPV and NPV of 98.88% and 97.67% compared to the Alvarado scores of 96.84% and 21.82%. The RIPASA and Alvarado scores' diagnostic accuracy was 97.67% and 69.33%, respectively.16 Chisthi et al. have conducted a study in India which reported RIPASA as 87.78% sensitive, 76.47% specific with a diagnostic accuracy of 85.98%.17. In a prospective study by Chong CF et al, the sensitivity, specificity, PPV, NPV and diagnostic accuracy of the RIPASA score were 98%, 81.3%, 85.3%, 97.4 % and 91.8 % respectively when compared to Alvarado score with sensitivity, specificity, PPV, NPV and diagnostic accuracy of 68.3%, 87.9 %, 86.3 %, 71.4 % and 86.5%, respectively.18 Higher sensitivity of RIPASA scoring system compared to Alvarado could be, because the RIPASA score uses more

parameters that are not present in the Alvarado scoring, including age, gender and the duration of symptoms prior to presentation.19 The area under the ROC curve with the RIPASA scoring system was significantly larger than with the Alvarado scoring systems.

CONCLUSION

The RIPASA score is currently a better diagnostic scoring system for acute appendicitis compared to the Alvarado score, with the former achieving significantly higher sensitivity and diagnostic accuracy. The use of RIPASA scoring can decrease unnecessary inpatient admissions and expensive radiological investigations.

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