Original Research Article

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Raja Isteri Pengiran Anak Saleha Appendicitis score for the diagnosis of acute appendicitis in comparison with the Alvarado score

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ABSTRACT

Background: Different scoring systems have been created to increase diagnostic accuracy, and they are inexpensive, non-invasive, and easy to use and reproduce. The modified Alvarado score is widely used in emergency services. The Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score was formulated in 2010 and has greater sensitivity and specificity. The aim of our article was to compare the usefulness of modified RIPASA score and Alvarado score in the diagnosis of patients with abdominal pain and suspected acute appendicitis.

Methods: A prospective study was undertaken among 100 cases presenting with signs and symptoms suggestive of acute appendicitis, conducted at the Narayana medical college hospital, Nellore. The questionnaires used for the evaluation process were applied to the patients suspected of having appendicitis.

Results: A total of 100 patients, 95% underwent laparoscopic procedure. The cut-off threshold point of the Alvarado score was set at 7.0, which yielded a sensitivity of 65% and a specificity of 52%. The positive predictive value was 65%. The cut-off threshold point of the modified RIPASA score was set at 7.5, which yielded 90% sensitivity and 72% specificity. The positive predictive value was 89% and the NPV was 30%.

Conclusions: On comparing both the scores, sensitivity and specificity was higher for modified RIPASA score. The positive predictive value was higher for the Alvarado and negative predictive value was higher for RIPASA score. Bothe p values were statistically significant.

Keywords: Appendicitis, Modified Alvarado score, RIPASA scale, Sensitivity, Specificity

INTRODUCTION

Acute appendicitis is still a difficult diagnosis to make, especially in young persons, the elderly, and in reproductive-age women, in whom a series of inflammatory conditions can have signs and symptoms similar to those of acute appendicitis. Acute appendicitis, with an incidence of 1.17 to 1.9 per 1,000 inhabitants per year and a lifetime risk of presenting with it of 8.6% in men and 6.7% in women. The most common age range is 25-35 years of age. The clinical presentation is typical in 50% of the cases, but the decision to explore the patient can sometimes be challenging and tests the

clinical acumen of the surgeon, particularly in young, elderly, and females of reproductive age group.

Late appendectomy to improve diagnostic accuracy increases the risk for appendicular perforation and sepsis, augmenting morbidity and mortality (surgical site infection 8-15%, perforation 5-40%, abscesses 2-6%, sepsis and death 0.5-5%). In contrast, premature diagnosis of appendicitis leads to reduced diagnostic accuracy with a consequent rise in negative or unnecessary appendectomies that have been reported at approximately 20-40%. Ultrasound and tomography imaging can improve diagnostic accuracy but are

expensive and not always available at healthcare centers.³⁻⁵

Different scoring systems have been created to increase the diagnostic accuracy of appendicitis that are low-cost, non-invasive, and easy to use or reproduce. They assign numerical values to define signs and symptoms. Clinical signs of abdominal pathology (type, pain location and migration, temperature, signs of peritoneal irritation, nausea, and vomiting, among others) and laboratory findings (leucocytosis) are generally used.⁵

It classifies patients with abdominal pain in the right iliac fossa into 3 groups of appendicitis probability:

- Low risk: (0-4 points, 7.7% probability of appendicitis),
- Intermediate risk: (5-7 points, 57.6% probability of appendicitis) and
- High risk: (8-10 points, 90.6% probability of appendicitis).

The Raja Isteri Pengiran Anak Saleha appendicitis (RIPASA) scoring system is relatively new. It was developed in 2010 at the RIPAS Hospital of Brunei and has improved sensitivity (98%) and specificity (83%). This score includes 14 clinical parameters, Score interpretation suggests 4 management groups:

- <5 points (unlikely, patient observation),
- 5-7 points (low probability, emergency room observation, abdominal ultrasound),
- 7.5-11.5 points (high probability, surgical evaluation and preparation for appendectomy), and
- >12 points (appendicitis diagnosis, appendectomy).²

Unfortunately, acute appendicitis is still difficult to diagnose, and misdiagnosis is not uncommon in the emergency department. Early diagnosis and prompt operative intervention is the key for successful management of acute appendicitis. However, the picture of acute appendicitis may not be classical, and in such situation, a policy of early intervention to avoid perforation may lead to high negative appendectomy rate.

To prevent this, different scoring system are available now. Hence, the aim of the present study was to increase the diagnostic accuracy of appendicitis through a comparison of the Alvarado score and the RIPASA score that are used for diagnosing patients with abdominal pain and suspected acute appendicitis.

METHODS

A prospective study was undertaken among 100 cases who presented with signs and symptoms suggestive of acute appendicitis at Narayana Medical College and Hospital, Nellore during September 2018 to October 2019.

Patients with above age of 18 years with history and clinical features suggestive of acute appendicitis were included in the study. Patients willing to participate in the study with no history of acute appendicitis were also included in the study. Children below eighteen years of age, and non-consenting adults and co-existent pathologies were excluded from the study.

Demographics of all patients were analysed and recorded in the proforma. RIPASA and Alvarado scores were recorded for all patients.

Table 1: Alvarado score (Alvarado and modified by Kalan et al).^{6,7}

Symptoms/ signs/ investigation	Score
Migration of pain	1
anorexia	1
Nausea and vomiting	1
Rif tenderness	1
Rebound tenderness	2
Elevated temperature >37.3°C	1
Leucocytosis >10,000 cells/cu.mm.	2
Shift to left	1

Table 2: Modified RIPASA score.

Female	0.5
Male	1
Age <40 years	1
Age >40 years	0.5
RIF pain	0.5
Pain migration to RIF	0.5
Anorexia	1
Nausea and vomiting	1
Duration <48 hours	1
Duration >48 hours	0.5
RIF tenderness	1
Guarding	2
Rebound tenderness	1
Rovsing sign	2
Temperature	1
Leucocytosis	1
Negative urine analysis	1

The other investigations include complete hemogram including total white blood cell count and urinalysis (urine routine microscopy).

The variables analyzed were age, surgical result, and score results from the modified Alvarado score and the RIPASA score.

The management of the patient was carried out based on clinical, radiological evidence. histopathology performed to diagnose on the basis of neutrophilic infiltration in the muscularis proporia.

The data analysis was carried out through descriptive statistics of the demographic data of the population, measures of central tendency, and analyses for diagnostic tests (sensitivity, specificity, and positive and negative predictive values). A ROC curve was then plotted to evaluate both scores using the SPSS version 20.0 software.

RESULTS

The two scores were completed before the surgical event. All patients had abdominal X-rays in 2 positions, as part of the study protocol. Twenty-one women had abdominal ultrasound and 17 patients had a non-contrasted abdominal tomography scan. The population was

predominantly young, with a mean age of 35.50 ± 18.53 years. There was a steep decrease in incidence of acute appendicitis as the age increases. Out of 100 patients included in the study, majority of patients in the study group were males (59%).

There are 17 % in <20 yr age group, 38% between 21-30 yr age group, 20% between 31-40 yr age group, 25% in >40 age group patients registered.

All patients underwent ultrasound abdomen scanning and 45% of them needed CT to confirm the diagnosis of appendicitis.

Table 3: Cross tabulation of RIPASA scoring and USG abdomen.

			USG		
			Positive	Negative	Total
	Positive	count	40	50	90
RIPASA —	rositive	% of total	40%	50%	90%
		Count	0	10	10
	Negative	% of total	0%	10%	10%
Total		Count	40	60	100
1 Otal		% of total	40%	60%	100.0%
Chi-square test	Value	De	Asymp. sig. 9	E4 -i (2 -i-11)	E4 -! (1 -!-1-)
Cin-square test	varue	Df	(2-sided)	Exact sig. (2-sided)	Exact sig. (1-side)
Pearson Chi-square	0.195a	1	(2-sided) 0.659	Exact sig. (2-sided)	Exact sig. (1-side)
•				Exact sig. (2-sided)	Exact sig. (1-side)
Pearson Chi-square	0.195a		0.659	Exact sig. (2-sided)	Exact sig. (1-side)
Pearson Chi-square Continuity correction	0.195a 0.030		0.659 0.862	0.790	0.427
Pearson Chi-square Continuity correction Likelihood ratio	0.195a 0.030		0.659 0.862		

Table 4: Cross tabulation of Alvarado and USG abdomen.

			USG		T-4-1
			Positive	Negative	Total
		Count	30	40	70
Alvarado	Positive	% of total	30%	37.6%	66.1%
	Negative	Count	10	20	30
	Negative	% of total	10%	20%	30%
Total		Count	40	60	100
Total		% of total	40%	60%	100.0%
Chi-square test	Value	Df	Asymp. sig. 9 (2-sided)	Exact sig. (2-sided)	Exact sig. (1-side)
Pearson Chi- square	0.063a	1	0.801		
Continuity correction	0.002	1	0.963		
Likelihood ratio	0.063	1	0.801	0.840	0.483
Fishers exact test					
Linear by linear	0.063	1	0.802		
N of valid cases	100				

RIPASA and ultrasound abdomen

The cut-off score to diagnose acute appendicitis in modified RIPASA was fixed at 7.5.

The correlation between RIPASA and ultrasound was studied and although the sensitivity was high the p value was >0.5 and hence no relationship was inferred from the analysis with p value 0. 659, which is not significant,

sensitivity- 82.61%, specificity- 14.29%, positive predictive value- 41.30%, negative predictive value- 52.49%.

Alvarado and USG abdomen

The cut-off score to diagnose acute appendicitis in Alvarado was fixed at 7. The percentage of patients who had a score of above 7 in Alvarado was 70%.

Table 5: Conversion to open surgery.

Lap/open		Frequency	Percent	Valid percent	Cumulative percent
	Lap	95	95	95	95
Valid	Open	5	5	5	100.0
	Total	100	100.0	100.0	

Table 6: Histopathological analysis.

Histopathology		Frequency	Percent	Valid percent	Cumulative percent
	Positive	90	90	90	90
Valid	Negative	10	10	10	100.0
	Total	100	100.0	100.0	

Table 7: RIPASA.

		Frequency	Percent	Valid percent	Cumulative percent
	Positive	90	90	90	90
Valid	Negative	10	10	10	100.0
	Total	100	100	100.0	

The percentage of patients who had a score of above 7.5 in the modified RIPASA was 90%.

Table 8: Alvarado score.

		Frequency	Percent	Valid percent	Cumulative percent
	Positive	70	70	70	70
Valid	Negative	30	30	30	100.0
	Total	100	100.0	100.0	

Table 9. Evaluating modified RIPASA score.

			HPE Positive	Negative	Total
	Danitian.	Count	89	1	90
	Positive	% of total	89%	1%	90%
	Nagatina	Count	1	9	10
RIPASA	Negative	% of total	1%	9%	10%
	Total	Count	90	10	100
	Total	% of total	90%	10%	100.0%

P value is 0.000, sensitivity=90%, specificity=72%, positive predictive value=89%, negative predictive value=30%.

Table 10. Evaluating Alvarado score.

			HPE	НРЕ		
			Positive	Positive Negative		
Alvarado Positive	Count	65	5	70		
	Positive	% of total	65%	5%	70%	
	Nagativa	Count	25	5	30	
	Negative	% of total	25%	5%	30%	
T.4.1	Count	90	10	100		
	Total	%of total	90%	10%	100.0%	

P value is 0.156, sensitivity-65%, specificity-52%, positive predictive value-65%, positive likelihood ratio-1.50, negative likelihood ratio-0.55.

Table 11: Area under curve.

Variables	Area	
RIPASA	0.815	
Alvarado	0.618	

Sensitivity=89%, specificity=72%.

The area under the ROC curve for RIPASA is significantly higher than Alvarado's area under the curve. This signifies that RIPASA has a higher statistical significance in predicting acute appendicitis.

DISCUSSION

Diagnosis of AA is often a challenging job to the surgeon. Delayed diagnosis can lead to high morbidity and even mortality in few of the perforated peritonitis cases. To prevent complication, a high negative appendectomy 15-25% was accepted in the past. It's not that negative appendectomy is not without any complication as it increases morbidity like postoperative adhesion. Hence, diagnosis should be prompt to prevent all these complications. Diagnostic accuracy can further be improved through the use of ultrasonography or computed tomography imaging. 8-10

Complete physical examination of the abdomen should include digital rectal examination and women should undergo a pelvic examination. Incorrect or late diagnosis increases the risk for complications, such as surgical wound infection (8 to 15%), appendiceal perforation (5 to 40%), abscesses (2 to 6%), and sepsis and death (0.5 to 5%). 11-13

There has been a lot of work to improve the diagnostic accuracy of acute appendicitis but is still a great challenge to the treating surgeon because of different abdominal and pelvic condition that can mimic acute appendicitis, especially in children and female of patient of reproductive age.

The Alvarado score and the RIPASA score can easily be applied by surgical emergency.

This prospective evaluation of RIPASA score in our study had 100 patients. The highest incidence of acute appendicitis observed in age group of 21-30 years. Study by Naveen et al quoted same incidence. In this study males were higher than females. Similarly, Chong et al also showed the same proportion.¹⁴

Clinically, all the patients were suffering acute right iliac fossa pain. All were undergone ultrasound abdomen. Some needs CT for further confirmation. By ultrasound, 55% were diagnosed and by CT scan remaining 45% were diagnosed acute appendicitis. Park JS et al were also confirmed by both methods.¹⁵

Out of 100 cases, 95% underwent laparoscopic procedure and remaining 5% had conversion to open

appendicectomy. Study by Sakpal et al also reported similar rates. ¹⁶

On histopathology, 90 patients were proven appendicitis, 10 patients had negative appendicectomy.

Out of 90 cases, 40 reported as acute appendicitis, 23 as peri-appendicitis, 25 as acute suppurative and 2 cases as gangrenous appendicitis. All 10 negative cases were reported as reactive lymphoid hyperplasia. Study by Park et al reported a negative appendicectomy rate of 15%.

In our study, the Alvarado score's cut off value set a score of 7 and above for the conformation of acute appendicitis. This data was analysed in comparison with histopathology reports.

The sensitivity and specificity values were calculated at 65% and 52%. The positive predictive value was 65% The p value is 0.156, not significant. Erdem et al reported similar values. Whereas Domink et al reported 91% sensitivity, and 81% specificity. 17,18

The cutoff value for modified RIPASA score was at a score of 7.5 and above to diagnose acute appendicitis. The sensitivity and specificity were 90% and 72% respectively. The positive predictive value 89% and negative predictive value 30% and p value is less than 0.000, highly significant. A study by Kumar et al reported similar values.¹⁹

Whereas Sarang reported 82.6% and 66.7% specificity and sensitivity. A study by Reyes-García at the Hospital General de México had the following results: 89.5% sensitivity and 69.2% specificity with the Alvarado score and 91.2% sensitivity and 84.6% specificity with the RIPASA score. 2

On comparing both scores, sensitivity and specificity was higher for modified RIPASA score. The positive predictive value was higher for the Alvarado and negative predictive value was higher for RIPASA score. Bothe p values were statistically significant.

ROC curve shows a larger area under the curve for RIPASA when compared to Alvarado.

Parameters like age, sex, duration of symptoms were also for scoring and they have to take consider for diagnosis. Local inflammatory indicators Rovsing's sign and guarding were also included in the score.

Thus, modified RIPASA was concluded to be a more applicable and useful score in an Indian population.

CONCLUSION

The RIPASA score is the best diagnostic scoring system for acute appendicitis than compared to the Alvarado score, with the former achieving significantly higher sensitivity and diagnostic accuracy. Unwanted admissions and expensive imaging studies can also be avoided by using RIPASA score.

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Institutional Ethics Committee

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