

Original Article

Alvarado or RIPASA score : A diagnostic tool for Acute Appendicitis?

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ABSTRACT

INTRODUCTION: Acute appendicitis is the most common condition encountered in general surgical practice. Alvarado scoring is the commonly used scoring systems for its diagnosis, but its performance has been found to be poor in Asian Population . Hence, we compared the RIPASA scoring system with Alvarado scoring system, to find out which is a better diagnostic tool for acute appendicitis in the Asian population.

METHODS: We enrolled 48 patients who presented with RIF pain in the study. Both RIPASA and Alvarado scoring systems were applied to them, but management was carried out as per RIPASA score. Final diagnosis was confirmed either by post-operative HPE report. Final diagnosis was analysed against both RIPASA and Alvarado scoring systems. Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Diagnostic Accuracy was calculated for both RIPASA and Alvarado scoring systems.

RESULTS :It was found that RIPASA was better than Alvarado scoring system in terms of Specificity (67% v/s 50%) and Positive Predictive Value (95% v/s 93%), and also to some extent in terms of Diagnostic Accuracy (96% v/s 93%). Whereas the Sensitivity (100% in both) and Negative Predictive Value (100%) were similar in both.

CONCLUSION: RIPASA is a more specific and accurate scoring system in our asian population, when compared to Alvarado scoring system. It reduces the number of missed appendicitis cases.

KEYWORDS: Acute Appendicitis, Alvarado score, RIPASA score.

INTRODUCTION:

Acute appendicitis is one of the commonest causes of acute abdominal pain in general surgical practice(2). From the time that it was first described by Reginald Heber Fitz in 1886 (3), it has remained a topic of serial research works for various factors ranging from its etiology, to its management options. One of the most researched fields pertaining to appendicitis is the one involving diagnosis. Over the years various types of investigations including laboratory and radiological, have been studied in detail with the aid of trials. These were conducted in the hope of finding the most sensitive test for diagnosing acute appendicitis. In spite of vast advances in the field of medicine, it has been time and again opined by various clinicians and authors that appendicitis is one condition whose diagnosis relies mainly upon the clinical features. As quoted by Bailey & Love, “Notwithstanding advances in modern radiographic imaging and diagnostic laboratory investigations, the diagnosis of appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen, and surgical science(1)”. Hence, having understood the importance for early and right diagnosis, and having understood that clinical evaluation provides the best and most accurate diagnostic modality for appendicitis, many clinical scoring systems have been developed over the years(4). As a result, multiple studies have been done with randomised controlled trials comparing various scoring systems in different parts of the world. To date, the most commonly used scoring system worldwide is the Alvarado and the Modified Alvarado scoring systems (MASS) (4). Hence, these have almost been considered as the

undocumented gold standard scoring system among clinicians worldwide. So much so that any new scoring system that has been developed is usually first compared to this.

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(5,6), to find a more favourable scoring system than Alvarado and Modified Alvarado as these were found to have poor sensitivity and specificity in Middle Eastern and Asian population. Following its development a randomised control trial was also done at the same hospital comparing the RIPASA and Alvarado scoring systems proving the superiority of the former over the latter.

In the present study, RIPASA and Alvarado scoring systems are compared among Indian patients to find which scoring system is more relevant and applicable, in order to aid early diagnosis of acute appendicitis.

Table 1: Alvarado Scoring System

FEATURE	SCORE
Migratory pain	1
Anorexia	1
Nausea	1
Tenderness in RIF	2
Rebound tenderness	1
Elevated temperature	1
Leucocytosis	2
Shift of WBC count to left	1
TOTAL	10

Score <5 – Appendicitis unlikely.

5-6 – Appendicitis possible.

7-8 – Appendicitis likely.

>8 – Appendicitis highly likely.

Table 2: Ripasa Scoring System :

PATIENT'S DEMOGRAPHIC	SCORE
Female	0.5
Male	1.0
Age < 39.9 years	1.0
Age > 40 years	0.5
SYMPTOMS	
RIF pain	0.5

Pain migration to RIF	0.5
Anorexia	1.0
Nausea & vomiting	1.0
Duration of symptoms < 48 hrs	1.0
Duration of symptoms > 48 hrs	0.5
SIGNS	
RIF tenderness	1.0
Guarding	2.0
Rebound tenderness	1.0
Rovsing's sign	2.0
Fever>37 ⁰ C , <39 ⁰ C	1.0
INVESTIGATIONS	
Raised WBC count	1.0
Negative urinalysis	1.0
ADDITIONAL SCORES	
Asian Population	1.0

Score <5 – Unlikely to be appendicitis

5-7.5 – Low Probability to be appendicitis

7.5-12 – High Probability to be appendicitis

>12 – Definite appendicitis

MATERIALS & METHODS :

After consultation with statistician, the sample size was calculated with the following formula and set as 48.

$$n = \frac{Z^2 (\text{specificity}) (1 - \text{specificity})}{d^2(1 - \text{prevalence})}$$

$$d^2(1 - \text{prevalence})$$

z = 1.96 at 95% confidence interval

Specificity = 90.5%.

$$n = \frac{(1.96)^2(0.905)(0.095)}{(0.09)^2(0.86)}$$

$$(0.09)^2(0.86)$$

d = precision 9%.

Prevalence is (14%)

Inclusion Criteria :

1. All patients who presented with Right lower abdominal pain.
2. Age 15 - 65 years.
3. Patient willing for admission and surgery.
4. Patient willing to give informed consent.

Exclusion Criteria :

1. Patients with Right iliac fossa mass.
2. Previously diagnosed as acute appendicitis.
3. Patients with previous history of urolithiasis and pelvic inflammatory
4. diseases.
5. Pregnant women.
6. Patients who have undergone appendectomy earlier.

This is a comparative study conducted at Vydehi Institute of Medical Sciences and Research Centre, Bangalore for a period of 24 months. The first 48 patients who presented to the General Surgery OPD and Emergency Department with Right lower quadrant pain were included in the study. Relevant history, clinical examination and laboratory investigations were done. Patients were scored according to both Alvarado scoring system and RIPASA scoring, patients were categorised into 4 groups.

Table 3-Categorical scoring classification

CATEGORY	RIPASA	Alvarado score
D (Definite)	>12	>8
HP (High Probability)	7.5-12	6-7
LP (Low Probability)	5-7.5	5-6
U (Unlikely)	<5	<5

Following this, the management of the patient was carried out according to the RIPASA Scoring system.

Patients who fell under HP/D category, were taken up for surgery immediately.

Patients who fell under LP category were subjected to CT scanning for confirmation of the diagnosis.

Patients who fell under U category were worked up for other causes of pain, by means of imaging and other appropriate laboratory studies.

Among the patients who were operated upon directly, diagnosis was confirmed by intraoperative findings and HPE report. After the final diagnosis was obtained from either CT scan or the Intra-operative finding, or Post-operative HPE report, an analysis was done comparing RIPASA and Alvarado scoring system.

RESULTS:

Table 4: Alvarado scoring system- Symptoms

Symptoms	Frequency	Percent
Pain migrating to RIF		
Score 0	33	68.8
Score 1	15	31.3
Anorexia		
Score 0	48	100.0
Nausea & Vomiting		
Score 0	16	33.3
Score 1	32	66.7
Signs	Frequency	Percent
RIF Tenderness		
Score 2	48	100.0
Rebound tenderness		
Score 0	44	91.7
Score 1	4	8.3
Fever		
Score 0	20	41.7
Score 1	28	58.3
Investigations	Frequency	Percent

Raised WBC		
Score 0	5	10.4
Score 2	43	89.6
Shift of WBC to left		
Score 0	47	97.9
Score 1	1	2.1

Table 5: Alvarado scoring system – scores 4 to 8 with numbers and percentage

Based on Alvarado scores, 10.4%, 43.8%, 39.6%, 2.1% and 4.2% of cases had scores of 4, 5, 6,7 and 8, respectively.

Alvarado scoring system –Each scores	Frequency	Percent
Score 4	5	10.4
Score 5	21	43.8
Score 6	19	39.6
Score 7	1	2.1
Score 8	2	4.2
Total	48	100.0

Mean Alvarado score was reported as 5.44 with SD of 0.8 and on interpreting Alvarado scores, patients were categorized into high possible, low possible and undetermined diagnosis in 6.3%, 83.3%, 10.4% of patients respectively.

Table 6-RIPASA scoring system

Based on RIPASA scoring system, RIF pain was noted in all cases, migrating RIF pain was noted in 6.3% of cases and nausea and vomiting in 60.4% of cases.

Sex	Freque ncy	Percent
Score 0.5	20	41.7
Score 1	28	58.3
Age	Freque ncy	Percent
Score 0.5	18	37.5
Score 1	30	62.5
Total	48	100.0
Symptoms	Freque ncy	Percent
RIF pain		
Score 0.5	48	100.0
Migrating of RIF pain		
Score 0	45	93.8
Score 0.5	3	6.3
Anorexia		
Score 0	48	100.0
Nausea & Vomiting		
Score 0	19	39.6
Score 1	29	60.4
Total	48	100.0
Duration	Freque	Percent

	ncy	
Score 0.5	34	70.8
Score 1	14	29.2

Table7- RIPASA scoring system – Signs & laboratory findings

RIF tenderness was present in all cases, RIF guarding in 4.2% of cases, rebound tenderness in 8.4% of cases and Rovsing’s sign in 64.6% of cases.

Signs	Frequency	Percent
RIF Tenderness		
Score 1	48	100.0
RIF Guarding		
Score 0	46	95.8
Score 2	2	4.2
Rebound Tenderness		
Score 0	44	91.7
Score 1	4	8.4
Rovsing’s sign		
Score 0	17	35.4
Score 2	31	64.6
Fever		
Score 0	20	41.7
Score 1	28	58.3
Laboratory	Frequency	Percent
Raised WBC		
Score 0	6	12.5
Score 1	42	87.5
Negative urine analysis		
Score 0	31	64.6
Score 1	17	35.4
Asian Population		
Score 1	48	100.0

Table 8- RIPASA scoring system – Numbers and Percentage

RIPASA score of 7, 8, 9, 10, 11 and 12 were reported in 8.3%, 29.2%,29.2%, 20.8%,8.3% and 4.2% respectively.

RIPASA scoring system –Each		
Score	Frequency	Percent
Score 7	4	8.3
Score 8	14	29.2
Score 9	14	29.2
Score 10	10	20.8
Score 11	4	8.3
Score 12	2	4.2
Total	48	100.0

Mean RIPASA score was reported as 8.82 with SD of 1.2 with patients categorized as high probability was noted to be 91.7% of cases and the rest had low probability(8.3%) of having the disease.

Clinically all the patients were diagnosed as Acute appendicitis. Patients underwent Emergency open appendicectomy was done in 2.1% of cases, 50% of cases underwent laparoscopic appendicectomy and the rest (47.9%) had open appendicectomy. Based on histopathology reports, 87.5% had uncomplicated acute appendicitis and 12.5%had complicated acute appendicitis.

Table 9- RIPASA scoring system vs HPE report

On assessing the association between HPE report and RIPASA scores, there was a significant association noted, in this study.

RIPASA scoring system	HPE report		Total	P value
	Acute appendicitis - Uncomplicated	Acute appendicitis - Complicated		
High Probability	42 (87.5)	2 (4.2)	44 (91.7)	0.018*
Low probability	0	4 (8.3)	4 (8.3)	
Total	42 (87.5)	6 (12.5)	48 (100.0)	

Table 10- Diagnostic accuracy of RIPASA scoring system

For RIPASA scoring system Sensitivity was reported as 100%, Specificity-67%, PPV-95%, NPV-100% and Diagnostic Accuracy – 96%.

Parameter	Value
Sensitivity	100
Specificity	67
PPV	95
NPV	100
Diagnostic accuracy	96

Table 11- Alvarado scoring system vs HPE report

On assessing the association between HPE report and Alvarado scores, there was an insignificant association noted, in this study.

Alvarado Scoring System	HPE report		Total	P value
	Acute appendicitis - Uncomplicated	Acute appendicitis - Complicated		
High possible	0	3 (6.3)	3 (6.2)	0.710
Low possible & undetermined	42 (87.5)	3 (6.2)	45 (93.7)	
Total	42 (87.5)	6 (12.5)	48 (100.0)	

Table 12- Diagnostic accuracy of Alvarado scoring system

For Alvarado scoring system Sensitivity was reported as 100%, Specificity-50%, PPV-93%, NPV-100% and Diagnostic Accuracy – 93%.

Parameter	Value
Sensitivity	100
Specificity	50
PPV	93

NPV	100
Diagnostic accuracy	93

DISCUSSION:

In the present study of 48 patients, RIPASA scoring system was compared with Alvarado scoring system and final diagnosis was analyzed in conjunction with the post operative histopathological report. It was found that sensitivity of both RIPASA and Alvarado was equal 100%. The specificity of RIPASA (67%) was higher compared to Alvarado (50%). Also the Positive predictive value of RIPASA (95%) was higher than Alvarado (93%). The negative predictive value of RIPASA and Alvarado were (100%) respectively. The diagnostic efficacy was also higher in RIPASA than Alvarado (96% and 93% respectively).

Analyzing both RIPASA and Alvarado scoring system, it was found that both RIPASA and Alvarado Scoring System were easy to perform as they mainly relied upon clinical symptoms and signs, along with basic laboratory investigations, and did not need elaborate investigations. As RIPASA had more number of parameters compared with Alvarado Scoring System it correlated with the diagnosis more accurately. The time taken to apply the scores (both) RIPASA and Alvarado scoring system) were minimal, and did not cause any undue delay in management. Even though Alvarado Scoring System is a routinely used scoring system for the diagnosis of acute appendicitis worldwide, it has found to be lacking in its specificity, diagnostic accuracy and PPV.

N. N., Mohammed et al compared RIPASA and Alvarado and found RIPASA to be a more convenient, accurate and specific score with the resulting comparative values of RIPASA and Alvarado as follows- Sensitivity – 96% and 58% respectively, Specificity – 90% and 85% respectively(7). Jeevan G. Sanjive et al., studied 75 patients in a territory care center and compared RIPASA with Alvarado scoring systems. They found that sensitivity and specificity of RIPASA were 97.14% and 60% and Alvarado was 52.85% and 40% respectively. The diagnostic accuracy of RIPASA scoring system is 94.67% and Alvarado scoring system is 52%. They concluded that RIPASA scoring system has higher sensitivity, specificity and higher diagnostic accuracy compared to Alvarado scoring system(8).

CONCLUSION:

In this study we found that, for the diagnosis of acute appendicitis, RIPASA score and Alvarado Score, have same sensitivity, but RIPASA has a higher Specificity, Positive Predictive Value and Diagnostic Accuracy. For the clinician, RIPASA scoring gives a clearer categorization of management of patients with RIF pain suggesting that in most cases, patients in High probability / Definitive category can straight away be taken up for surgery without any extra imaging modality. RIPASA may be more sensitive in patients under Low probability on comparing with Alvarado. Therefore can be used in conjunction with Alvarado scoring in patient with doubtful appendicitis. The incidence of negative appendicectomy and missed appendicitis can be decreased.

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