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Original Research Article

Comparative study of Alvarado score and RIPASA score in the diagnosis of acute appendicitis

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ABSTRACT

Background: Acute appendicitis despite being a common problem, remains a difficult diagnosis to establish. A delay to diagnose this condition as well as negative appendicectomies should be prevented. The above problems can be avoided by using scoring systems. This study aims to compare the efficacy of Alvarado score and RIPASA score in the diagnosis of acute appendicitis.
Methods: In this study, 100 cases of appendicitis were admitted. Alvarado and RIPASA scores were applied to all patients. The scores were compared with post-operative histopathology findings.
Results: Alvarado score was positive in 75% cases and RIPASA score was present in 90% cases. Histologically, appendicitis was present in 99% cases.
Conclusions: RIPASA score is more efficient in diagnosing acute appendicitis compared to Alvarado score.

Keywords: Alvarado, Appendicitis, Appendicectomy, RIPASA

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies with a lifetime prevalence of approximately 1 in 7.[1] Fitz RH, an anatomopathologist at Harvard, first described the disease and first introduced the term "Appendicitis" in 1886.[2]

Despite being a common problem, it remains a difficult diagnosis to establish, particularly among the young, the elderly and females of reproductive age, where a host of other genitourinary and gynecological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis.

A delay in performing an appendicectomy in order to improve its diagnostic accuracy increases the risk of appendicular perforation and sepsis, which in turn increases morbidity and mortality. The opposite is also true, where with reduced diagnostic accuracy, the negative or unnecessary appendicectomy rate is increased, and this is generally reported to be approximately 20%-40%. Several authors considered higher negative appendicectomy rates acceptable in order to minimize the incidence of perforation.[3,4]

Multiple scoring systems have been developed in order to identify those patients who need emergency appendicectomy thus avoiding the risk of delay as well as in identifying patients unlikely to need surgery, thus decreasing the burden of negative appendicectomies. Of these, the Alvarado scoring system described by Alfredo Alvarado in 1986 was most widely studied. The use of the Alvarado scoring system can reduce the negative appendicectomy rate to 0-5%.[5]

The gold standard method for confirmation of diagnosis is by histopathology. However, ultrasound of abdomen is

available for diagnosis but it is operator dependent. Usually, it is over-diagnosed or under diagnosed.[6] The next level is contrast computed tomography (CT) scan. The contrast CT scan has a high sensitivity and specificity but it is too costly and cannot be performed in routine.[7]

The cheaper, faster, and non-invasive diagnostic tool in diagnosing acute appendicitis is a clinical scoring system. Several scoring systems were developed, but the two common scoring systems are Alvarado system and RIPASA system. These two scoring systems are based on the clinical and laboratory evidence. The Alvarado scoring system was developed for people in the western countries, and the RIPASA score was developed for people in the South East Asian region.[8]

The Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score is a new diagnostic scoring system developed for the diagnosis of acute appendicitis and has been shown to have a significantly higher sensitivity, specificity and diagnostic accuracy than that reported for the Alvarado or Modified Alvarado scores, particularly when the latter two scores were applied in an Asian or oriental population.[9]

Although the RIPASA score is more extensive than the Alvarado score, it is simple to apply and has several parameters that are absent in the Alvarado score, such as age, gender and duration of symptoms prior to presentation. These parameters have been shown to affect the sensitivity and specificity of the Alvarado and Modified Alvarado scores.[10]

With this background, this study was aimed to compare the efficacy of Alvarado score with the RIPASA score in the diagnosis of acute appendicitis and to compare both these scores with the findings of ultrasound of abdomen and pelvis.

METHODS

This was a comparative cross sectional study with a sample size of 100 cases.

Inclusion criteria

Patients with the following criteria were included in the study:

- Pain in right iliac fossa
- Age >12 years

Exclusion criteria

Patients with the following criteria were excluded from the study:

- Patients discharged without surgery.
- Patient presenting with a diagnosed appendicular lump.
- Patient presenting with a right iliac fossa mass.
- Previously diagnosed case of acute appendicitis.
- Immunocompromised patients.
- Patients already operated for appendicitis.
- Age below 12 years.

A score of 7 was taken as high probability of acute appendicitis for Alvarado scoring system and a score of 7.5 for RIPASA scoring system. The decision on appendicectomy was solely based on the surgeon's clinical judgment after taking into consideration all the findings of clinical, laboratory and radiological investigations. Ultrasound (USG) of abdomen and pelvis was done within 6 hours in all clinically suspected cases. Findings of USG were recorded and compared with the Alvarado and RIPASA scores.

All patients clinically diagnosed as appendicitis and who were having a significant Alvarado and/ or RIPASA scores or a positive diagnosis of acute appendicitis on ultrasound of abdomen and pelvis were operated for appendicectomy (either by the open method or by the laparoscopic technique) and the specimens of appendix were sent for histo-pathological examination (HPE).

Post-operative histopathology report was compared with the scores. A score of 7.5 was the optimal cut off threshold for RIPASA and 7 for Alvarado scoring system.

Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for RIPASA and Alvarado were calculated. The results of Alvarado score and the RIPASA score were tabulated and compared by using an appropriate statistical analysis.

RESULTS

Table 1: Distribution of cases according to alvarado score criteria.

Criteria score symptom	Score value	Cases	%
Migratory RIF pain	1	89	89.00
Anorexia	1	84	84.00
Nausea and vomiting	1	89	89.00
Signs			
Tenderness in RIF	2	100	100.00
Rebound tenderness	1	87	87.00
Elevated temperature >37.5°C	1	49	49.00
Laboratory			
Leucocyte count (>10x0x⁹/l)	2	76	76.00
Shift to left	1	14	14.00
Total	10	100	100.00

Migratory RIF pain was observed in 89 cases; anorexia was observed in 84 cases; nausea and vomiting was observed in 89 cases. Among signs, tenderness in RIF was observed in all cases; Rebound tenderness was observed in 87 cases; Elevated temperature >37.5°Cwas observed in 49 cases; Laboratory cases; Leucocyte count (>10x0x^9/l) was observed in 76 cases; and Shift to left was observed in 14 cases.

Table 2: Distribution of cases according to RIPASA score criteria.

Parameter score		Score value	Cases	%
Sex	Male	1.0	71	71.00
	Female	0.5	29	29.00
Age	<39.9 years	1.0	96	96.00
	>40.0 years	0.5	4	4.00
Symptoms	RIF pain	0.5	100	100.00
	Migration of RLQpain	0.5	89	89.00
	Anorexia	1.0	84	84.00
	Nausea and vomiting	1.0	89	89.00
Duration of symptoms	<48 hours	1.0	82	82.00
	>48 hours	0.5	18	18.00
Signs	RIF tenderness	1.0	100	100.00
	RIF guarding	2.0	11	11.00
	Rebound tenderness	1.0	87	87.00
	Rovsing's sign	2.0	31	31.00
	Fever	1.0	49	49.00
Laboratory	Raised WBC	1.0	76	76.00
	Negative urine analysis	1.0	93	93
	Foreign NRIC	1.0	0	0%
Total		17.5	100	100.00

Table 2 shows distribution of cases according to various criteria of the RIPASA score.

Table 3: Distribution of cases according to Alvarado and RIPASA Score.

	Cases (n=100)	Percentage
Alvarado score		
≥7	75	75.0
<7	25	25.0
RIPASA score		
≥7.5	90	90.0
<7.5	10	10.0

Males were 71 and females were 29. Cases less than 40years of age were 96 and more than 40 years were 4.

RIF pain was observed in 100 cases, migration of RLQ pain was observed in 89 cases; Anorexia was observed in 84 cases, nausea and vomiting was observed in 89 cases.

Duration of symptoms less than 48 hours was observed in 82 cases and more than 48 hours was observed in 18 cases.

RIF tenderness was observed in 100 cases, RIF guarding was observed in 11cases, rebound tenderness was observed in 87 cases and Rovsing's sign was observed in 31 cases. Fever was observed in 49 cases.

Raised WBC was observed in 76 cases; Negative urine analysis was found in 93 cases; and Foreign NRIC was observed in nil cases.

Alvarado score of 7 or more is suggestive of surgical intervention for appendicitis. Out of 100 cases, Alvarado score was 7 or more in 75% cases. RIPASA score of 7.5 or more is suggestive of surgical intervention for appendicitis. Out of 100 cases, RIPASA score was indicative of surgical intervention in 90% cases.

Table 4: Comparison of mean Alvarado score and RIPASA score in perforated and non-perforated appendicitis cases.

Intra-operative findings	Patients	Mean±SD Alvarado score	Mean±SD RIPASA score
Non-perforated Appendix	93	7.32±1.33	9.68±1.87
Perforated Appendix	7	8.0±1.58	11.5±2.03
P value		0.174	0.01

Table 4 shows RIPASA score to be significantly higher among perforated cases while in Alvarado score the difference was not statistically significant.

Table 5: Comparison of mean Alvarado score and RIPASA score with histopathological finding of appendix.

Histopathological Finding	Cases	Alvarado Score (Mean±SD)	RIPASA Score (Mean±SD)
Normal appendix	1	5*	7*
Acute appendicitis	77	8.31±1.69	11.52±1.99
Suppurative appendicitis	12	6.69±1.00	9.03±1.32
Perforated appendicitis	7	6.11±1.89	8.44±1.44
Gangrenous appendicitis	3	7.34±2.03	8.02±1.82

* SD can not be calculated for single sample

The mean Alvarado score was 8.31 in acute appendicitis, 6.69 in suppurative appendicitis, 6.11 in perforated appendicitis and 7.34 in gangrenous appendicitis. It was 5 in normal appendix.

Table 6: Comparison of USG findings with histopathological findings of appendix.

USG findings	Histopathological diagnosis		Total
	Appendicitis (n=99)	No appendicitis (n=1)	
Appenditicits	65 (65.7%)	1 (100%)	66
No appendicitis	34 (34.3%)	0 (0.0%)	34

The mean RIPASA score was 11.52 in acute appendicitis, 9.03 in suppurative appendicitis, 8.44 in perforated appendicitis and 8.02 in gangrenous appendicitis. It was 7 in normal appendix. Thus, the Alvarado and RIPASA scores were higher in appendicitis cases compared to normal appendix.

Table 7: Comparison of validity of USG findings, Alvarado score and RIPASA score.

Statistical analysis	USG Finidngs	Alvarado	RIPASA
Sensitivity	65.66%	75.76%	90.82%
Specificity	0.00%	100%	100%
Positive predictive value	98.48%	100%	100%
Negative predictive value	0%	4.00%	10.00%
Accuracy	65.0%	76%	90%
Negative appendicectomy rate	1.51%	0.00%	0.00%

Out of 100 cases, in 66 cases USG findings were suggestive of appendicitis. Among the 99 histopathologically confirmed cases of appendicitis, USG was showing appendicitis in 65 (65.7%) cases while among the 1 histopathologically non appendicitis case, USG was positive in that case.

All statistical parameters were the highest for RIPASA score.

DISCUSSION

In our study, Alvarado score was less than 7 in 25% cases and it was 7 or more in 75% cases. In a study by Regar MK et al Alvarado score when applied in all the clinically suspected patients, has 65% cases with score >7 and 35% cases with score less than 7.[11] In a study by Nasiri S et al 65.33% patients had Alvarado score ≥7 and 34.67% patients had Alvarado scores<7.[12] This study shows that almost two thirds of symptomatic cases had Alvarado score ≥7and present study is comparable with the studies above. Contrary to these results, a study by Chong CF et al found that out of 192 cases 80 (41.66%) had Alvarado score ≥7 and in remaining 112 cases it was <7.[8]

Out of 75 cases having Alvarado score was ≥7, all had RIPASA score ≥7.5. In the remaining 25 cases, Alvarado score was <7(non-significant).However among these cases, RIPASA score was ≥7.5 (significant) in 15 cases and in the remaining 10 cases, Alvarado score was <7 and the RIPASA score was <7.5(non-significant).

In a study by Chong CF et al, out of 192 cases 116 (60.42%) had RIPASA score ≥7.5 and in remaining 76 cases the score was <7.5.[8]

During the operative procedure direct observation of appendix was recorded as 'perforated Appendix' and 'non- perforated appendix'. In non perforated appendix group, mean Alvarado score was 7.32 and RIPASA score was 9.68**.** In perforated appendix group, mean Alvarado score was 8 and RIPASA score was 11.5. RIPASA score was significantly higher among perforated cases while in Alvarado score the difference was not statistically significant.

In present study, in **77**% cases it was acute appendicitis, in 12% cases it was suppurative appendicitis, in 7% cases it was perforated appendicitis and in 3 cases it was gangrenous appendicitis. In 1% case the appendix was normal.

Histopathological findings were grouped in to two categories – appendicitis and no appendicitis. Case having normal appendix was 1, grouped in to 'no appendicitis' group while remaining 99 cases with various types of appendicitis were grouped under 'appendicitis'.

In a study by Regar MK et al histopathologically 95 patients were in appendicitis group and 5 patients were in no appendicitis group.[11] Muduli IC et at found that out of 96 cases, 76.04% were confirmed as acute appendicitis by histopathological examination while remaining 23.94 samples were normal appendix.[13] These studies were comparable with present study.

Among the 99 appendicitis cases, Alvarado score was suggestive of operative procedure in 75.8% cases while in the same group the RIPASA score was suggestive of operative procedure in 90.9% cases. Among the one non appendicitis case, Alvarado score was suggestive of operative procedure in 0.0% cases and in the same group the RIPASA score was also suggestive of operative procedure in none.

In present study the negative appendicectomy rate of Alvarado score was 0% indicating no negative In a study by Regar MK et al negative appendicectomy rate was 1.54% according to Alvarado score.[11]

In this study the negative appendicectomy rate was nil for RIPASA score. In a study by Regar MK et al negative appendicectomy rate was 2.17% and accuracy was 93% according to RIPASA scoring system.[11] In this study overall all indicators were showing better results for RIPASA score compared to Alvarado score.

In current study of 100 cases, in 66 cases USG findings were suggestive of appendicitis while 34 cases were normal. Among the 99 histopathologically confirmed cases of appendicitis, USG was showing appendicitis in 65 (65.7%) cases while among the 1 histopathologically non appendicitis case, USG was positive in that case.

Pesent study reveals that ultrasound provides reliable findings for the diagnosis of acute appendicitis in some cases. But the results were poor specifically for negative cases where as Alvarado score and RIPSA scores show better results in positive as well as negative cases. These results emphasize again that a positive ultrasonography for appendicitis is in favor of a diagnosis of acute appendicitis. However, a negative ultrasound is not sufficient to rule out the diagnosis of acute appendicitis.

CONCLUSION

From this study we would like to conclude that

- Among the clinical scoring systems used to diagnose acute appendicitis, the RIPASA scoring system is better compared to the Alvarado scoring system.
- As compared with ultrasonography of abdomen and pelvis, the Alvarado score is more diagnostic in cases of acute appendicitis.
- As compared with ultrasonography of abdomen and pelvis, the RIPASA score is more diagnostic in cases of acute appendicitis.
- Negative findings of acute appendicitis on ultrasonography of abdomen and pelvis are not the diagnostic test to rule out appendicitis.
- The RIPASA score is more diagnostic compared to the Alvarado score in cases of perforated appendicitis.

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