A Comparative Study of Ripasa Score and Alvarado Score in the Diagnosis of Acute Appendicitis

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ABSTRACT

Background: Acute appendicitis is the commonest surgical emergency worldwide and an acceptable negative appendectomy rate is 15-20%.The diagnosis of acute appendicitis is based on signs and symptoms whose interpretation is sometimes subjective (anorexia) and varied (pain perception, referral) and thus the diagnosis of appendicitis has always been a challenge to emergency surgeons. The difficulty in availability of the investigations and the costs incurred are a deterrent factor for most of the emergency units across the world and hence a need for a comprehensive scoring system for the diagnosis of acute appendicitis is the matter of the relevance today.

Aim & Objective: To study the diagnostic accuracy of RIPASA score with comparison to ALVARADO score in the diagnosis of acute appendicitis.

Materials and Methods: The study site is Government Medical Colleg, Suryapet Telangana, India.

Results: The Alvarado score, developed in 1986, is based on the points as enumerated by the acronym MANTRELL (each alphabet denoting a parameter assessed) and has been a popular scoring system for use worldwide. The reported literature suggests a sensitivity, specificity in the range of 53 to 88% and 75 to 80% respectively. The RIPASA (Raja Isteri Pengiran Anak Saleha Appendicitis) score was introduced in the year 2009-2010. The reported literature suggests sensitivity of 97.5%, specificity of 81.8%, PPV of 86.5%, NPV of 96.4% and a diagnostic accuracy of 91.8%. In an emergency setting, the on duty Medical Officer can make a quick decision upon seeing the patients with RIF pain by referring those with a RIPASA score $\geq$ 7.5 to the on-call surgical team for admission, while patients with a RIPASA score < 7.0 can either be observed in the ward or sending home with advice to patient party for observation. Thus RIPASA score is currently a much better diagnostic scoring system for acute appendicitis compared to the Alvarado score, with the former achieving significantly higher sensitivity, NPV and diagnostic accuracy, particularly in Indian population setting.

Conclusion: Further studies need to be done with larger patient population to validate the results obtained in this study. The importance of the RIPASA scores in context with other contemporary scores (e.g. Modified Alvarado with cut off at 6) needs to be evaluated in future.

Keywords: RIPASA scores, Alvarado score, Acute appendicitis, MANTRELL.

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INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies in clinical practice, with estimated lifetime prevalence about one in seven.[1] Diagnosis of acute appendicitis is essentially clinical; however, a decision to operate based on clinical suspicion alone can lead to removal of a normal appendix in 15-30% of cases.[2] Several scoring systems have been developed to aid in the decision-making process to reach a diagnosis of acute appendicitis in the quickest and easiest way.

The Alvarado score and the Modified Alvarado score are the two most commonly used scoring systems available. Reported sensitivity and specificity for both Alvarado and the Modified Alvarado scores ranges from 53 to 88% and 75 to 80% respectively.[3,4] However, these scoring systems were developed in western countries and several studies have reported very low sensitivity and specificity when applied to a population with a completely different ethnic origin and diet.[5-7]

In a recent study conducted in the Accident and Emergency department (AED) of Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital, Brunei Darussalam, from November 2008 to April 2009, they hypothesized a new clinical scoring system named as Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) scoring. The study demanded that this scoring system has much more sensitivity, specificity, positive and negative predictive value than Alvarado scoring system.[8]

The common perception that the appendix was a degenerative structure probably remains debatable. Comparative anatomical studies of the primate cecum and appendix have revealed the presence of an appendix in Old World monkeys and anthropoid apes such as orang-utans, but it is absent in prosimians and New World monkeys, suggesting that, far from being a vestigial organ, the appendix has actually developed progressively in primates.[10]

In this study, an attempt is made to compare the diagnostic accuracy between these two scoring systems and to draw a conclusion that which score is more accurate. It is also aimed at minimizing negative appendectomy as much as possible thereby reducing the morbidity, mortality and economic burden related to negative appendectomy.

Aims and Objectives

Hypothesis

The null hypothesis of this study is RIPASA scoring system is more superior and accurate compared to ALVARADO scoring system in the diagnosis of acute appendicitis.

Aim

To study the diagnostic accuracy of RIPASA score with comparison to ALVARADO score in the diagnosis of acute appendicitis.

Objectives

The primary objective

To know the sensitivity and specificity of the RIPASA score and ALVARADO score in the diagnosis of acute appendicitis.

The Secondary Objectives

To know the positive predictive value and negative predictive value of RIPASA score and ALVARADO score in the diagnosis of acute appendicitis.

To know the negative appendectomy rate in applying RIPASA score and ALVARADO score to the patients with abdomen pain in right iliac fossa. And as a whole to minimise negative appendectomy rate as much low as possible.

MATERIALS & METHODS

Study Site: The study site is Government Medical College, Suryapet, Telangana.

Study Population: All the patients who are admitted in the surgical wards with right iliac fossa pain, clinical diagnosis of acute appendicitis, planned for emergency appendectomy and after fulfilling the inclusion & exclusion criteria.

Study Design: This study is a prospective, observational and comparative study.

Sample Size: 51 patients.

Nanjundaiah N et al,[10] in their study they compared prospectively RIPASA and ALVARADO scoring system by applying them to 206 patients.

Time Frame to Address the Study: 5 months, from October 2021 to February 2022.

Inclusion Criteria

Patients included in this study are

- Both male and female patients.

- Age $\geq$ 12yr   (to obtain self-history).

- All the patients with right iliac fossa pain, who are clinically diagnosed to be acute appendicitis and awaiting appendicectomy.

Exclusion Criteria

Patient presenting with following condition will be excluded from this study.

- Paediatric age group (Less than 12 years)

- Patients with right iliac fossa mass (appendicular lump)

- Pregnancy (by institutional protocol, these patients are referred to an apex referral centre)

- Patients with generalised peritonitis.

- Patients with pervious history of urolithiasis and pelvic inflammatory disease.

- Patients who presented with non-right iliac fossa pain and those who admitted previously for other complaints, but who subsequently developed right iliac fossa pain during their admission episode.

- Patient not fit for G.A. (General Anaesthesia)

- Uncontrolled bleeding diathesis.

- Major Cardio vascular and pulmonary disorders, in need of intervention cardio- pulmonary procedure (referred to an apex CTVS / Cardiology centre)

- Morbid obesity with BMI > 45 kg/m2 (referred to an apex Institute for minimal access surgery).

Methodology

Patients who admitted in surgical ward with right iliac fossa pain, suspicion of acute appendicitis and undergoing for emergency appendicectomy will be evaluated with RIPASA and ALVARADO scores. Detailed history taking and clinical examinations will be done as per the study tool (pre designed study proforma) for data collection. To assign scores Investigation reports will be reviewed obtaining informed consent of the patients.

Parameters to Be Studied:

- Score according to the ALVARADO System.

- Score according to the RIPASA System

- Histopathological reports.

Study Tools:

- Study Proforma

- ALVARADO Score chart.

- RIPASA Score chart.

- Equipments required for laboratory investigations (complete haemogram and urinalysis), Imaging study (USG) & histopathology.

Study Techniques:

- Scoring of patients posted for emergency appendectomy using both Alvarado and RIPASA Scoring Systems.
- Corroboration of both the scores with operative findings
- Corroboration of both the scores with histo- pathological findings.

Ethical issues

Before starting the study permission from Institutional ethics committee and Institutional scientific review board was obtained. Written informed consent was obtained from all patients after explaining them the study in detail. The surgical procedure related complications and the treatment options available are explained in detail. The surgical procedure was done according to the standard technique. No animal experimentation was involved.

Statistical Analysis

For statistical analysis data is entered into a Microsoft excel spreadsheet and then analysed by SPSS 20.0.1 and GraphPad Prism version 5. Data has been summarized as mean and standard deviation for numerical and count variables, and as percentages for categorical variables. The median and the   interquartile range have been stated for numerical variables that are not normally distributed. Student independent samples t-test is applied to compare normally distributed numerical variables between groups; unpaired proportions are compared by Chi-square test or Fischers exact test, as appropriate.

RESULTS

After analysing [Table 1] it is documented that acute appendicitis is a predominant disease of younger age group. The incidence is more in second decade in females and third decade in males. 65 % of total appendicitis patients are in the age group of 12 – 30 yrs. From the graph it is seen that there is a steep rise of incidence of acute appendicitis in second and third decade. The lowest age in our study is 12 yrs. and highest age is 60Yrs.

Regarding the female and male distribution of cases in our study, the ratio between the male: female ratio is 1:1.27, and but both the genders are showing same pattern of distribution according to their age.

Table 1: Patients Demographics (n=51)

Age Group	Male		Female		Total
	No.	%	No	%	
12-20 yrs.	5	9.8	13	25.49	18
21-30 yrs.	9	17.64	6	11.76	15
31-40 yrs.	6	11.76	7	13.72	13
41-50 yrs.	2	3.92	2	3.92	4
51-60 yrs.	1	1.96	0	0.00	1
					Total =51

[Table 2] is showing, 18(35.29%) patients are in age group 12-20 years, 15 (29.41%) patients are in age group 21 - 30 years, 13 (25.49%) patients are in age group 31 to 40 years, 4 (7.8%) patients are in age group 41- 50 years and 1(2.0%) patients are in age group 51-60 years. The Z-Score is 1.0975. The p-value is 0.27134. The result is not significant at p >0.05.

Table 2: Distribution of age groups in patients

Age (Years)	Frequency	Percent
12-20 yrs.	18	35.29%
21-30 yrs.	15	29.41%
31-40 yrs.	13	25.49%
41-50 yrs.	4	7.8%
51-60 yrs.	1	2.0%
Total	51	100.0%

As per the [Table 3], the mean age (Mean± S.D) of patients is 26.9020 ±10.5532 years with range 12.00-60.00 years and the median age is 26.00 years.

Table 3: Distribution of mean age in patients (in yrs)

Number	Mean	Std Dev (SD)	Minimum	Maximum	Median
51	26.9020	10.5532	12.0000	60.0000	26.0000

[Table 4] is showing, 28(54.9%) patients are females and 23(45.1%) patients are in males. Male: Female ratio is 1:1.27. The Z-Score is 0.9901. The p-value is 0.32218. The result is not significant at p >0.05.

Table 4: Distribution of Sex

Sex	Frequency	Percent
Female	28	54.9%
Male	23	45.1%
Total	51	100.0%

[Table 5] shows, that acute appendicitis is more prevalent in 2nd, 3rd and 4th decade. Gangrenous appendix is more common in 2nd and 3rd decade. Perforated appendix is more common in 2nd decade.

Of the 60 patients recruited, only 51 patients satisfied the study inclusion and exclusion criteria. The demographics of these 51 patients are shown in [Table 1 and 3]. The mean age of the patients is 26.90 ± 10.55 years. 51 patients underwent emergency appendectomy based on the surgeons" clinical judgement. Out of these, only 42 cases were confirmed histologically for acute appendicitis among them 32 (62.7%) cases are simple acute appendicitis, 7 (13.7%) cases had gangrenous appendicitis, 2 (3.9%) cases had perforated appendicitis and 1 (1.9%) had appendicular abscess. 9 cases were negative for acute appendicitis and histology specimens showed normal appendix, indicating a negative appendectomy rate of 17.6% [Table 5].

Table 5: Appendicular Pathology in Various Age Groups

Histopathology	12-20 Yrs.	21-30 Yrs.	31-40 Yrs.	41-50 Yrs.	51-60 Yrs.	Total (%) (n=51)
Acute Appendicitis	10	8	10	3	1	32 (62.7%)
Gangrenous Appendicitis	1	3	2	1	0	7 (13.7%)
Perforated Appendicitis	0	2	0	0	0	2 (3.9%)
Appendicular Abscess	1	0	0	0	0	1 (1.9%)
Normal Appendix	6	2	1	0	0	9 (17.6%)

[Table 6] is showing association between histopathology (HP) findings and RIPASA score. Cut off threshold for RIPASA score is≥7.5. The Chi-square value is 38.1665 and p-value is <0.0001(statistically significant). Association of HP findings according to RIPASA score is statistically significant.

Table 6: ?

HP			
Ripasa Score	**AA**	**NA**	**Total**
≥7.5	41	1	42
Row %	97.6	2.4	100.0
Col %	97.6	11.1	82.4
<7.5	1	8	9
Row %	11.1	88.9	100.0
Col %	2.4	88.9	17.6
Total	42	9	51
Row %	82.4	17.6	100.0
Col %	100.0	100.0	100.0

[Table 7] is showing the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), diagnostic accuracy (DA) and negative appendectomy rate (NAR) of RIPASA score.

Table 7: ?

Sensitivity	97.6%
Specificity	88.86%
Positive Predictive Value	97.6%
Negative Predictive Value	88.88%
Diagnostic Accuracy	96.08%
Negative appendectomy Rate	2.4%

[Table 8] is showing true positive (TP), true negative (TN), false positive(FP) and false negative(FN) values according to RIPASA score. The Z-Score is 6.54. The p-value is <0.0001. The result is significant at p <0.05.

Table 8: TP, TN, FP and FN according to RIPASA score

	Frequency	**Percentage**
TP	41	80.3%
TN	8	15.7%
FP	1	2.0%
FN	1	2.0%
Total	51	100.0%

[Table 9] is showing association between histopathology (HP) findings and ALVARADO score. Cut off threshold for ALVARADO score is ≥7. The Chi-square value is 5.6685 and p-value is 0.01727 (statistically significant). Association of HP findings according to ALVARADO score is statistically significant.

Table 9: Association between HP and Alvarado Score

HP			
Alvarado score	**AA**	**NA**	**Total**
≥7	23	1	24
Row %	95.8	4.2	100.0
Col %	54.8	11.1	47.1
<7	19	8	27
Row %	70.4	29.6	100.0
Col %	45.2	88.9	52.9
Total	42	9	51
Row %	82.4	17.6	100.0
Col %	100.0	100.0	100.0

[Table 10] is showing the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), diagnostic accuracy (DA) and negative appendectomy (NAR) of ALVARADO score.

Table 10: Sensitivity, Specificity, PPV, NPV and DA and NAR of ALVARADO

Sensitivity	54.76%
Specificity	88.88%
Positive Predictive Value	95.83%
Negative Predictive Value	29.62%
Diagnostic Accuracy	60.78%
Negative appendectomy Rate	4.17%

Score

[Table 11] is showing true positive (TP), true negative (TN), false positive (FP) and false negative (FN) values according to ALVARADO score. The Z-Score is 3.2291. The p-value is 0.00124. The result is significant at p <0.05.

Table 11: ?

	Frequency	**Percentage**
TP	23	45.1%
TN	8	15.7%
FP	1	2.0%
FN	19	37.2%
Total	51	100.0%

[Table 12 and 13] are showing Mc Nemar chi-square test. The result shows that there is statistically significant difference in the diseased group and in the non-diseased group.

So, in this case there are significant differences in the RIPASA Score as it has more true positive cases (41) in comparison to Alvarado Score (23) and both these scores also have statically significant number of true negative cases (8).

Table 12: Distribution of ALVARDO and RIPASA for AA (DISEASED) group.

RIPASA			
Alvarado	≥7.5	<7.5	Total
≥7	23	0	23
Row %	100.0	0.0	100.0
Col %	56.1	0.0	54.8
<7	18	1	19
Row %	94.7	5.3	100.0
Col %	43.9	100.0	45.2
Total	41	1	42
Row %	97.6	2.4	100.0
Col %	100.0	100.0	100.0

Table 13: Distribution of ALVARDO and RIPASA for NA (Non-Diseased) group.

Ripasa			
Alvarado	≥7.5	<7.5	Total
≥7	1	0	1
Row %	100.0	0.0	100.0
Col %	100.0	0.0	11.1
<7	0	8	8
Row %	0.0	100.0	100.0
Col %	0.0	100.0	88.9
Total	1	8	9
Row %	11.1	88.9	100.0
Col %	100.0	100.0	100.0

NA: Normal Appendix

Mc Nemar chi-square test done; p=<0.005 (statistically significant)

[Table 14] shows the distribution of the 51 patients in four groups according to the RIPASA score at a cut-off threshold score of 7.5 and the Alvarado score at a cut-off threshold of 7.0. The RIPASA score correctly classified 41 (97.6%) patients confirmed with histological acute appendicitis to the high-probability group (RIPASA score ≥ 7.5) compared with 23 (54.76%) patients with Alvarado score ≥ 7.0 (Table 15, p < 0.001). The 19 patients who were missed by the Alvarado score were classified wrongly into the false negative group with Alvarado score < 7.0. This number was significantly higher than those wrongly classified as false negative by the RIPASA score [Table 15] (p < 0.001).

Both the RIPASA and Alvarado scores correctly classified 8 (88.88%) and 8 (88.88%) patients without acute appendicitis into the true negative group with scores < 7.5 and < 7.0, respectively. There was no statistical significance between the true negative groups (p= 1.0000). The mean total RIPASA scores for each group are shown in Table 14. True positive cases achieved mean total RIPASA scores of 9.5 ± 1.5 (range 7.5–14.5), while true negative cases had mean scores of 5.8 ±.69 (range 5.0-6.5)

At the optimal cut-off threshold score of 7.5 for the RIPASA score, the calculated sensitivity and specificity were 97.6% (95% confidence interval [CI]) and 88.88% (95% CI), respectively compared with 54.76% (95% CI) and

88.88% (95% CI), respectively for Alvarado score at an optimal cut-off threshold of 7.0 [Table 15]. The PPV and NPV for the RIPASA score were 97.6% (95% CI) and 88.88% (95% CI), respectively compared with 95.83% (95% CI) and 29.62% (95% CI), respectively for the Alvarado score [Table 15]. The NPV was significantly higher for the RIPASA score compared to that for the Alvarado score (p < 0.001). The diagnostic accuracy is 96.08% (95% CI), for the RIPASA score and 60.78% (95% CI) for the Alvarado score, showing a difference of 35.3% (p < 0.001), which is statistically significant. This difference of 35.3% equates to a total of 18 patients with confirmed histological acute appendicitis who are missed from being diagnosed by Alvarado score. The predicted negative appendectomy rates for both the RIPASA and Alvarado scores are 2.4% and 4.16% respectively, which is not statistically significant (p=0.3942) [Table 15].

Table 14: Distribution of patients according to RIPASA and ALVARADO scores

	TP		FP		TN		FN	
	RIPASA ≥7.5	ALVARADO ≥7	RIPASA ≥7.5	ALVARADO≥7	RIPASA <7.5	ALVARADO <7	RIPASA <7.5	ALVARADO <7
No of Patien ts	41	23	1	1	8	8	1	19
Age (Mean ±SD)	28.4634 ±10.4883	30.0435 ±11.5108	12.00000± 0.0000	12.0000± 0.0000	21.5 000 ±9.0 869	21.5000 ±9.0869	21.00 000± 0.0000	26.1579 ±8.7640
Sex (M/F)	22/19	14/9	1/0	1/0	0/8	0/8	0/1	8/11
Total Score (Mean ±SD)	9.5366±1 .5748	7.9565 ±.7057	8.0000 ± 0.0000	7.0000 ± 0.0000	5.87 50 ±.69 44	3.7500 ±1.0351	7.0000 ± 0.0000	5.1579 ±.7647
Range	7.5-14.5	7.0-9.0	8.0-8.0	7.0-7.0	5.0-6.5	3.0-6.0	7.0-7.0	4.0-6.0

Table 15: Comparison between RIPASA and ALVARADO scores with respect to the different variables.

Variable Parameters	Score % (95% CI)		P-Value
	Alvarado	RIPASA	
Sensitivity	54.76	97.6	<0.001
Specificity	88.88	88.88	>0.05
Positive Predictive Value	95.83%	97.6%	0.4065
Negative Predictive Value	29.62%	88.88%	<0.00
Diagnostic Accuracy	60.78%	96.08%	<0.001
Negative appendectomy Rate	4.17%	2.4%	>0.05

DISCUSSION

Acute appendicitis is one of the most common surgical emergencies encountered by the surgeons with emergency appendectomy making up one in ten of all emergency abdominal surgeries.[11,12] A quick and correct diagnosis of acute appendicitis leading to early appendectomy and avoidance of complications arising from perforation can be difficult at times. Radiological modalities such as computed tomography (CT) imaging further aid in making a definite diagnosis and have been reported to have high sensitivity (94%) and specificity (95%) for diagnosing acute appendicitis. Thus, in most large hospitals, it is routine to request for CT imaging in all patients suspected of acute appendicitis. However, such routine practice will inflate the cost of healthcare substantially. Furthermore, the process of arranging for CT imaging may cause further delay for emergency appendectomy. A recent study has suggested that such indiscriminate use of CT imaging may lead to the detection of early low-grade appendicitis and unnecessary appendectomies in a condition that would otherwise have resolved spontaneously with antibiotics therapy.[13]

The Alvarado score, which was developed in 1986, was a simple additive scoring system to help with the diagnosis of acute appendicitis.[3] Although it showed very good sensitivity and specificity when applied in a Western population, several subsequent studies have shown its limitations when applied in an Asian or Oriental population.[7,5] As a result, a new scoring system called the RIPASA score has been developed, which a more extensive yet simple additive is scoring system consisting of 14 fixed parameters that is unique to our population setting and one additional score of foreign NRIC. All these 15 parameters are easily obtainable from a good clinical history, examination and investigations. In a retrospective study, the RIPASA score has been shown to achieve better sensitivity (88%) and specificity (67%) than the Alvarado score (sensitivity 59%, specificity 23%) in an Asian population.8 In this study the RIPASA score considerably better than the Alvarado score in terms of correctly diagnosing the acute appendicitis (sensitivity and diagnostic accuracy) as well was found to be as those who were negative for acute appendicitis (NPV).

Using the RIPASA score, 97.6% of patients who actually had acute appendicitis (true positive) were correctly diagnosed and placed in the high-probability group (RIPASA score ≥ 7.5) and managed appropriately, compared to only 54.7% when using the Alvarado score on the same population sample. Thus, the Alvarado score failed to diagnose 18 patients with acute appendicitis and wrongly classified them in the low-probability group (Alvarado score < 7.0). The difference in diagnostic accuracy of 35.3% between the RIPASA score and Alvarado score was statistically significant (p < 0.001), indicating that the RIPASA score is a much better diagnostic tool for the diagnosis of acute appendicitis in our patient population, which is representative of an Indian population group. Similarly, for patients who were classified in the low-probability group, i.e. true negative group with RIPASA score < and Alvarado score < 7.0, the RIPASA score again outperformed the Alvarado score by correctly diagnosing 88.88% of patients who did not have acute appendicitis, compared with the Alvarado score, which only managed to correctly diagnose 29.62% (p < 0.001).

The RIPASA score is a useful, rapid diagnostic tool for acute appendicitis, especially in the settings of emergency, as it requires only the patients demographics (age, gender and nationality, which are all available on registration), a good clinical history (RIF pain, migration to RIF, anorexia, nausea and vomiting), clinical examination (RIF tenderness, localised guarding, rebound tenderness, Rovsings sign and fever) and two simple laboratory investigations (raised white cell count and negative urinalysis performed at triage, which is defined as an absence

of red and white blood cells, bacteria and nitrates). Thus, in an emergency setting, the on duty Medical Officer can make a quick decision upon seeing patients with RIF pain, by referring those with a RIPASA score ≥ 7.5 to the on-call surgical team for admission, while patients with a RIPASA score < 7.0 can either be observed in the ward or sending home with advice to patient party for observation.

The use of a numerical score also improves the working relationships between the on-duty emergency medical officer and the on-call surgeon, since any patient with a RIPASA score ≥ 7.5 needs to be admitted. With its high sensitivity (97.6%) and NPV (88.88%), the RIPASA score can also help to reduce unnecessary and expensive radiological investigations such as routine CT imaging, thus further helping to reduce annual healthcare expenditure.

The 14 fixed parameters can be easily and rapidly obtained in any population setting by taking a complete history, and conducting a clinical examination and two simple investigations. In majority of the patients, a quick decision can be made with regard to a referral to an on-call surgical team, discharge or further observations. The option of having additional parameters makes the RIPASA score more flexible and adaptable to different geographical regions. In terms of healthcare cost savings, the use of RIPASA score may help to reduce unnecessary inpatient admissions and expensive radiological investigations.

It was previously been hypothecated that in view of ethnicity and dietary habit the Alvarado score per se may not be as predictable in the South Asian population as it in the Western World.[5-7] On the other hand the RIPASA score has been hypothecated to be directly approachable to the South Asian population.8 The current study put this perspective in comparison, by specific statistical tools available (ROC). Analysis of the collected data revealed that an Alvarado score of 6 (and not 7) is more consistent with the operative and histopathological findings. This translates into a significant patient population receiving conservative treatment in case a score of 7 is taken as the cut-off point.

The RIPASA score specifies a cut off score of 7.5 for accepting an operative approach. Analysis of the collected data shows consistency with this cut off point (p=<0.001). This possibility means that the RIPASA score of 7.5 as the cut-off point is more suitable for the decision-making algorithm when applied to the South Asian population.

CONCLUSION

Scoring systems for acute appendicitis is a necessity in the emergency scenario for avoiding negative appendectomy with ALVARADO score and RIPASA score being established scoring systems for diagnosis of acute appendicitis

The sensitivity, specificity, positive predictive value and negative predictive value of the ALVARADO score in this study is 54.76%, 88.88%, 95.83% and 29.62% respectively.

The sensitivity, specificity, positive predictive value and negative predictive value of the RIPASA score in this study is 97.6%, 88.88%, 97.6% and 88.88% respectively.

The RIPASA score is a better tool in evaluation of suspected appendicitis based on the more sensitivity, more negative predictive value and diagnostic accuracy in comparison to ALVARADO score.

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REFERENCES

1. Stephens PL, Mazzucco JJ. Comparison of ultrasound and the Alvarado score for the diagnosis of acute appendicitis. Conn Med 1999; 63:137-40.

2. Russell RCG, Williams NS, Bulstrode CJK. Bailey & Love's Short Practice of Surgery; 25th Ed.London. Hodder Arnold; 2007. P-1205, 1211.

3. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med 1986; 15:557-64.

4. Kalan M, Talbot D, Cunliffe WJ, et al. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. Ann R Coll Surg Engl 1994; 76:418-9.

5. Al-Hashemy AM, Seleem MI. Appraisal of the modified Alvarado Score for acute appendicitis in adults. Saudi Med J 2004; 25:1229-31.

6. Khan I,ur Rehman A.Application of Alvarado scoring system in diagnosis of acute appendicitis. J Ayub Med Coll Abbottabad. 2005;17:41-4.

7. Jang SO, Kim BS, Moon DJ. Application of Alvarado score in patients with suspected appendicitis. Korean J Gastroenterol 2008; 52:27-31

8. Chong, et al. Evaluation of the RIPASA Score: a new scoring system for the diagnosis of acute appendicitis. Brunei Int Med J. 2010; 6 (1): 17-26.

9. Scott GB. The primate caecum and appendix vermiformis: a comparative study. J Anat 1980; 131:549-63.

10. Nanjundaiah N, Ashfaque M, Venkatesh S, Kalpana A, Priya SA. A Comparative Study of RIPASA Score and ALVARADO Score in the Diagnosis of Acute Appendicitis.J Clin Diagn Res.2014 Nov 20; 8(11):3-5. doi:10.7860/JCDR/2014/9055.5150.

11. Pal KM, Khan A. Appendicitis: a continuing challenge. J Pak Med Assoc1998; 48:189-92.

12. Kumar V, Cotran RS, Robbins SL. Appendix. In: Robbin's Basic Pathology.5th ed. London: WB Saunders, 1992: 520.

13. Livingston EH, Woodward WA, Sarosi GA, Haley RW. Disconnect between incidence of nonperforated and perforated appendicitis: implications for pathophysiology and management. Ann Surg 2007; 245:886-892.