EVALUATION OF RIPASA SCORING IN THE DIAGNOSIS OF ACUTE APPENDICITIS

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ABSTRACT

BACKGROUND

Acute appendicitis is a commonly encountered surgical emergency and is often difficult to diagnose. The RIPASA appendicitis scoring system is easy and simple to apply and one of the most promising tool that can be obtained from a routine history and clinical examination. This present study aims to evaluate the usefulness of this scoring system in patients with a provisional diagnosis of acute appendicitis in a general hospital.

MATERIALS AND METHODS

This prospective study was conducted among 40 patients who presented with right iliac fossa pain in the Department of General Surgery at Sri Siddhartha Medical College and Research Institute, Tumkur between September 2016 and September 2018. Relevant history was taken, and clinical examinations and lab investigations were conducted. RIPASA and Modified ALVARADO score were applied to the patients.

RESULTS

The mean age of study population was 27.25 years and majority were males 29 (72.50%). Clinical presentation by patients included pain in right iliac fossa 39 (97.50%), migration of pain 34 (85%), anorexia 37 (92.50%), nausea and vomiting 39 (97.50%) and fever 33 (82.50%). The mean RIPASA score in the study population was 11. The RIPASA score had sensitivity of 97.3% (95% CI 92.08%- 100%) in predicting histopathology; the specificity of 66.7% (95% CI 13.37%- 100%), diagnostic accuracy of 95% (95% CI 88.25%- 100%).

CONCLUSIONS

RIPASA score has a sensitivity of 97.3% and specificity of 66.7%. The diagnostic accuracy OF RIPASA score was 95%. Considering the high sensitivity and specificity, as compared to previous scoring systems and almost comparable sensitivity and specificity with ultrasonography, RIPASA score can be considered as a useful tool in making clinical decisions in resource poor settings. The RIPASA appendicitis scoring system is a promising tool in detecting appendicitis.

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BACKGROUND

Acute appendicitis is an acute inflammation of the appendix and is one of the most common surgical emergencies making up 10% of all emergency abdominal surgeries.¹ The mortality rates associated with acute appendicitis is reported to be 26% and has dropped to less than 1% due to early surgical intervention and antibiotics. Despite being a common problem, acute appendicitis remains a difficult diagnosis to establish, particularly among the young, the elderly and females of reproductive age.

Failure to diagnose early appendicitis converts acute appendicitis to perforated appendicitis to perforated appendicitis, a disease with potential complication including perforation and sepsis with its attendant morbidity and occasional mortality.²

The diagnosis particularly difficult among the young, the elderly and gynaecological inflammatory conditions.

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This is particularly true in the early stages of the disease.

A negative appendectomy rate of 20-44% is not unusual in the surgical literature, and many surgeons would accept a negative appendectomy rate of up to 30% as inevitable. Further a host of other genitourinary and gynaecological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis.³

The exact diagnosis of the disease can be made only after surgery and pathological examination of the surgical specimen. Diagnostic accuracy can be further improved through the use of ultrasonography or computed tomography imaging. However, these modalities are costly and are not readily available.

Several scoring systems, such as the Alvarado and modified Alvarado scoring system, have been introduced since 1986 to help with the clinical decision-making process in achieving an accurate diagnosis of acute appendicitis in the fastest and cheapest way.^{2,4} However, these two scoring systems were created in the West, and when applied in different environments, such as the Middle East and Asia, the sensitivity and specificity levels achieved were very low.^{5,6} Khan et al.⁶ applied the Alvarado scoring system in an Asian population and only achieved a sensitivity and specificity of 59% and 23%, respectively, with a negative appendectomy rate of 15.6%. Another study by Al-Hashemy et al.⁵ in 2004 using the modified Alvarado scoring system in a Middle Eastern population reported similarly low sensitivity of 53.8% and a specificity of 80%⁴ suggesting a definite ethnic difference with regard to the Alvarado score.⁷ Both the

Alvarado and modified Alvarado scores lack parameters that have been shown to be important determinants in the diagnosis of acute appendicitis, such as age, gender and the duration of symptoms.

Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) is a new scoring system. RIPASA has been developed for a better diagnosis of acute appendicitis; this score includes 14 clinical parameters, which have higher sensitivity, specificity, and diagnostic accuracy than Alvarado scoring, especially in the Asian population. This new appendicitis scoring system is easy and simple to apply as the majority of the parameters can be obtained from a routine history and clinical examination. The RIPASA score is sensitive and specific for the diagnosis of acute appendicitis in a western population by Malik et al.⁸ Even in Indian population recently Singh, A., et al.⁹ have conducted a study to determine the validation of RIPASA score in diagnosis of acute appendicitis and histopathological correlation. There were limited studies in Indian settings to evaluate the usefulness of this scoring system in patients with a provisional diagnosis of acute appendicitis. Hence the present study aims to validate the RIPASA scoring system in the diagnosis of acute appendicitis among patients presenting with right iliac fossa pain.

MATERIALS AND METHODS

This was a prospective observational study conducted among 40 patients presenting with RIF pain in the Department of general surgery at Sri Siddhartha Medical College, Tumkur between October 2016 and April 2018 for a period of 18 months. The sample size was calculated assuming expected proportion of people with histopathologically confirmed appendicitis as 89.3% as per the study by Nanjundaiah N et al.¹⁰ A 7% precision for sensitivity and 30% precision for specificity calculation was considered. An expected sensitivity of 96.2% and expected specificity of 90.5%, were hypothesized as per the same reference study. The sample size was calculated using Bruder's formula. To account for a loss to follow up and non-participation rate of 5% another 2 subjects were added and the final study had included 40 subjects.

All the eligible patients presenting with right iliac fossa pain were recruited into the study consecutively till the sample size is reached. Exclusion criteria were patients with non-RIF pain, admitted for reasons other than RIF, received antibiotic treatment in the last 48 hours for the pain, not willing for surgery, pregnancy, less than the age of 12 years, with appendicular mass or abscess. Ethical clearance was obtained from the institution review board before the start of study. Informed consent was collected from the participants and all the relevant parameters were documented in a structured study proforma. A detailed case history was taken. Examination included RIF tenderness, RIF guarding, rebound tenderness, Rovsing's sign and fever. Laboratory investigations included CBC, routine urine test. The RIPASA score was computed as per guidelines. RIPASA score of <7.5 was considered as cut off to label a person as high or low probability of appendicitis. Operative notes and histopathology reports were reviewed and correlated with the RIPASA score. If the patient was not operated and discharged, the negative appendicitis was confirmed during follow up visit or by a phone call to see if the patient has got operated elsewhere.

Statistical Analysis

RIPASA score was considered as the screening test. Histopathology was considered as primary outcome variables. Age, gender, comorbidities etc., were considered as other variables of interest for analysis. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. The association between categorical explanatory variables and the quantitative outcome was assessed by comparing the mean values. The mean differences along with their 95% CI were presented. Independent sample t-test/ was used to assess statistical significance. The sensitivity, specificity and predictive values of the RIPASA score categories were calculated against the gold standard (Histopathology examination) P value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.¹¹

RESULTS

A total of 40 subjects were included in the final study, majority were males (72.5%) with a mean age of 27.25 ± 10.92 (Table 1)

Demographic Characteristic	Mean ± SD
Age	27.25 ± 10.92
Gender	N (%)
Male	29 (72.5)
Female	11 (27.5)

Table 1. Demographic Characteristic of Study Population (n= 40)

Table 2 provides the baseline characteristic of study population. Majority of the study population 39 (97.50%) had right iliac fossa pain. Most common symptoms were anorexia (92.5), nausea and vomiting (97.5%), fever (82.5%).

Baseline Characteristic	n (%)
Right Iliac Fossa Pain	39 (97.5)
Migration of Pain	34 (85)
Anorexia	37 (92.5)
Nausea and Vomiting	39 (97.5)
Fever	33 (82.5)
Duration of Symptoms <48 (Hours)	17 (42.5)
Duration of Symptoms >48 (Hours)	23 (57.5)
RIF Tenderness	36 (90)
Rebound Tenderness	32 (80)
Guarding	13 (32.5)
Rovsing's Sign	18 (45)
WBC	39 (97.5)
Negative Urine Analysis	39 (97.5)
Positive Ultra Sound Sonography	36 (90)
Positive Histopathology	37 (92.5)

Table 2. Baseline Characteristics of Study Population (n= 40)

The mean RIPASA score in the study population was 11.1 ± 1.76 with the minimum 4.50 and maximum 14.50 (95% CI 10.54- 11.66). Majority of the study population (60%) were with a 7.5-11.5 range of RIPASA score, 37.50% of the study population scored >11.5 RIPASA score and only 2.50 % scored <7.5 RIPASA score. Table 3 shows the association of various parameters with RIPASA score. A significant difference was found between mean RIPASA score with

nausea and vomiting, RIF tenderness, Rovsing's sign raised WBC count.

Parameter	RIPASA Score Mean $\pm$ SD	Mean Difference (95% CI)	p Value
Gender			
Male	11.12 $\pm$ 1.84	0.08 (-1.20- 1.38)	0.906
Female	11.05 $\pm$ 1.62		
Age Group			
Up to 40 years	11.22 $\pm$ 1.42	1.22 (-0.64 - 3.08)	0.191
40 years and above	10 $\pm$ 3.87		
Right Iliac Fossa Pain			
Yes	11.12 $\pm$ 1.78	0.62 (-3.03- 4.26)	0.735
No	10.5 $\pm$ 0		
Migration of Pain			
Yes	11.15 $\pm$ 1.85	0.31 (-1.28- 1.91)	0.692
No	10.83 $\pm$ 1.17		
Anorexia			
Yes	11.24 $\pm$ 1.42	1.91 (-0.16- 3.98)	0.070
No	9.33 $\pm$ 4.37		
Nausea and Vomiting			
Yes	11.27 $\pm$ 1.41	6.77 (3.87 - 9.67)	<0.001
No	4.5 $\pm$ 0		
Duration of Symptoms <48 Hours			
Yes	10.85 $\pm$ 1.37	-0.43 (-1.57- 0.72)	0.452
No	11.28 $\pm$ 2.01		
Duration of Symptoms >48 Hours			
Yes	11.17 $\pm$ 2.15	0.17 (-0.98- 1.33)	0.762
No	11 $\pm$ 1.09		
RIF Tenderness			
Yes	11.29 $\pm$ 1.47	1.92 (0.12 -3.71)	0.037
No	9.38 $\pm$ 3.28		
Rebound Tenderness			
Yes	11.3 $\pm$ 1.45	0.98 (-0.40- 2.37)	0.159
No	10.31 $\pm$ 2.66		
Guarding			
Yes	11.54 $\pm$ 1.51	0.65 (-0.55- 1.85)	0.280
No	10.89 $\pm$ 1.86		
Rovsing's Sign			
Yes	12.08 $\pm$ 1.19	1.79 (0.80- 2.77)	<0.001
No	10.3 $\pm$ 1.76		
Fever			
Yes	11.61 $\pm$ 1.2	2.89 (1.73- 4.05)	<0.001
No	8.71 $\pm$ 2.08		
Raised White Cell Count			
Yes	11.27 $\pm$ 1.41	6.77 (3.87- 9.67)	<0.001
No	4.5 $\pm$ 0.12		
Negative Urine Analysis			
Yes	11.19 $\pm$ 1.68	3.69 (0.25- 7.14)	.036
No	7.5 $\pm$ 0.27		

Table 3. Association of RIPASA Score with Various Parameters

Among the people with positive Histopathology 36 (97.29%) were with high (≥ 7.5) RIPASA score and only 1 (2.702%) was with low (< 7.5) RIPASA score. The difference in the proportion of high and low RIPASA scores between

histopathology was statistically significant (P value <0.001).

Parameter	RIPASA score	Ultrasound
Sensitivity	97.3%	94.6%
Specificity	66.7%	66.7%
False Positive Rate	33.3%	33.3%
False Negative Rate	2.7%	5.4%
Positive Predictive Value	97.3%	97.2%
Negative Predictive Value	66.7%	50.0%
Diagnostic Accuracy	95.0%	92.5%

Table 4. Predictive Validity of RIPASA Score and Ultrasound as Compared to HPE (N=40)

The RIPASA score had sensitivity of 97.3% and specificity of 66.7% in predicting acute appendicitis. Whereas ultrasound had 94.6% and 66.7% sensitivity and specificity in predicting acute appendicitis compared to histopathology. This showed that both RIPASA score and ultrasound can be used for predicting appendicitis among patients with the highest diagnostic accuracy for RIPASA score (95%).

DISCUSSION

Preoperative diagnosis of acute appendicitis is one of the great enigmas of surgery so much so that doing negative appendectomies is an acceptable term and a high percentage of negative appendectomies (20%) is regarded as reasonable.¹² The current prospective study evaluated 40 study participants to validate the RIPASA score in the diagnosis of acute appendicitis.

The mean age of the study population was 27.25 years. The proportion of males was (72.50%) significantly higher than females (27.50%). The male to female ratio was 2.63:1. Similar study settings were seen in Singh, A., et al⁹ study where the mean age of the participants was 27.55 years. But a study by Malik, M. U., et al⁸ showed that mean age of the study population was 22.7 years, which is slightly lower than the current study. The proportion of male and females was also almost equal (51% Vs 49%).

In our study, the proportion of participants with right iliac fossa pain were 97.50%. Migration of pain was seen in 85% of the participants. Singh, A., et al⁹ have reported a slightly lower proportion (92%) of participants with right iliac fossa pain. But in a study by Srikantaiah, H. et al,¹³ all the study participants, had RIF pain and migration of pain was seen in 59% of the participants. In Naresh, G. et al.¹⁴ Study also all the 100 participants had RIF pain, but the migration of pain was seen in 48% of the cases. In the present study, 92.50% of the study population had Anorexia. The proportion of participants with nausea and vomiting was 97.50%. Fever was found in 82.50% of the study participants. Naresh, G. et al. ¹⁴ reported that 34 % gave a positive history of anorexia while 47 patients (47%) gave a history of nausea and vomiting and this proportions were 29% and 33% respectively Srikantaiah, H. et al.¹³

In our study, 42.50% of the study participants had Duration of symptoms <48 hours whereas 57.50% people had Duration of symptoms >48 hours. Similar to our study in Naresh, G., et al.¹⁴ study among the 100 patients, 55 patients (55%) presented with a history lasting less than two days (48 hrs) while 45 patients (45%) presented with a history lasting more than 2 days (>48 hrs). A duration of symptoms of < 48 hours showed a higher probability of acute appendicitis and

was scored with 1.0 point, while duration of symptoms > 48 hours was scored with 0.5 points.

In our study, 90% of the participants had RIF tenderness. 80% of them had shown Rebound tenderness. 32.50% of the study participants had Guarding, and Rovsing's sign was seen on 45% of cases. In Naresh, G. et al.¹⁴ study all the participants RIF tenderness. Our study findings were comparable with Singh, A., et al⁹ where RIF tenderness was observed in 84% of cases, 79% of the cases had Rebound tenderness. The proportions of Guarding and Rovsing's sign were 17% and 30% respectively. In the current study, 97.50% of the study population had raised white cell count whereas 97.5% showed negative Urine analysis. Like our study Srikantaiah, H. et al¹³ 92% of patients with appendicitis had raised TC, but urine analysis was positive only in 15% of cases. In the current study, the mean RIPASA score in the study population was 11.1 with the minimum 4.50 and maximum 14.50. Majority of the study population (60%) were with a 7.5-11.5 range of RIPASA score, 37.50% of the study population scored >11.5 RIPASA score and only 2.50 % scored <7.5 RIPASA score. Singh et al⁹ have shown that the RIPASA score of < 5 is observed in 11 patients (M, 5; F, 6), 5-7 in 36 patients (M, 19; F, 17), 7.5-11.5 in 137 (M, 95; F, 42), > 12 in 16 (M, 9; F, 7).

In the current study, 90% of the study population showed positive results in Ultrasound sonography and the proportion of cases with positive histopathology report was 92.50%.

The current study showed a significant difference in positive histopathological findings and mean RIPASA score. Similarly, in a study by Singh, A., et al⁹ shown that among 178 operated cases, histopathology report of 146 showed changes consistent with acute appendicitis and among these are the following: 140 had a RIPASA score of > 7.5 (True positive); six patients had a score of < 7.5 but histopathology was suggestive of acute appendicitis; 32 patients had normal appendix on histopathological examination and out of them, 13 had score of > 7.5 (false positive) and 19 had a score of <7.5 (true negative). In the current study the RIPASA score had sensitivity of 97.3% (95% CI 92.08%- 100%) in predicting histopathology and specificity of 66.7%, the false Positive rate was 33.3%, the False negative rate was 2.7% the positive predictive value was 97.3%, the negative predictive value was 66.7%. The final diagnostic accuracy was 95%. Similar findings were reported by Malik et al⁸ where Twenty-two had a false positive, 19 had a false negative and 51 had a true negative resulting in a sensitivity of 85.93%, specificity of 69.86%, PPV of 84.06%, NPV of 72.86% and diagnostic accuracy of 80.01%. Our study findings also comparable with Singh et al⁹ where sensitivity of the RIPASA score was 95.89%, specificity 75.92%, positive predictive value 91.50%, and negative predictive value 87.23% with diagnostic accuracy of 90.5%. Our results are comparable with previous studied on RIPASA score like Chee Fui Chong et al.^{15,16} and (Sensitivity of 97.5%, specificity of 81.8%, PPV of 86.5%, NPV of 96.4%, and a diagnostic accuracy of 91.8%). Butt, M. Q., et al¹⁷ have shown that Sensitivity of RIPASA score was 96.7%, specificity 93.0%, diagnostic accuracy was 95.1%, positive predictive value was 94.8% and negative predictive value was 95.54%.

But these results should be considered under studies limitations. First and foremost, owing to the cross-sectional nature of the study the observed association cannot be

interpreted as causal inferences. Second, we had used non-probability sampling technique which is not a true representation of the general population. The generalizability of study findings to other settings may be very limited, as the study was conducted in a single centre and the population evaluated represents a limited geographical locality. There is a need to conduct further large-scale studies on the subject to further demonstrate the utility of RIPASA score in different settings.

CONCLUSION

RIPASA score has a sensitivity of 97.3% and specificity of 66.7%. The diagnostic accuracy OF RIPASA score was 95%. Considering the high sensitivity and specificity, as compared to previous scoring systems and almost comparable sensitivity and specificity with ultrasonography, RIPASA score can be considered as a useful tool in making clinical decisions in resource poor settings. The RIPASA appendicitis scoring system is a promising tool in detecting appendicitis.

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