



## ORIGINAL RESEARCH PAPER

## Surgery

### A STUDY TO VALIDATE RIPASA SCORE IN DIAGNOSIS OF ACUTE APPENDICITIS AMONG CLINICALLY SUSPECTED CASES.

**KEY WORDS:** Acute Appendicitis, RIPASA, Appendicular lump, Appendicular Abscess.

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#### ABSTRACT

The aim of this study is to evaluate the validity of RIPASA score – a new scoring system for diagnosis of acute appendicitis – in our local population. The study was conducted from May 2019 to August 2020, for a period of 18 months in Bankura Sammilani Medical College and Hospital, Bankura. The study was conducted in a group of 87 patients who underwent appendicectomy in the Department of General surgery of this institution after satisfying inclusion and exclusion criteria. The study involved applying of RIPASA in all 87 patients and findings were correlated with that of intra-operative and HPE findings. RIPASA score had sensitivity of 96.6%, specificity of 72.4%, positive predictive value of 87.5% and negative predictive value of 91.3%. These findings have suggested that RIPASA score is a good diagnostic scoring system in predicting acute appendicitis when applied in our local population. In addition there has been prediction of significant reduction in the number of negative appendicectomies, which will lead to less morbidity to the patient and also help in reducing unnecessary expenditure of health resources.

#### INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies, with a lifetime prevalence rate of approximately one in seven.<sup>1</sup> The incidence is 1.5–1.9 per 1,000 in the general population and is approximately 1.4 times greater in men than in women.<sup>2</sup>

The diagnosis of acute appendicitis is based purely on clinical history and examination combined with laboratory investigations such as elevated white cell count. Despite being a common problem, acute appendicitis remains a difficult diagnosis to establish, particularly among the young, the elderly and females of reproductive age, where a host of other genitourinary and gynaecological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis.<sup>3</sup> In abdominal surgery appendicectomy remains the most frequent emergency operations. An individual lifelong risk of acute appendicitis requiring appendectomy is 8.6% in male and 6.7% in female. Typical clinical presentation of acute appendicitis is present only in 50% of the cases making the exploration decision to take challenging.

The decision of early intervention in atypical presentation of acute appendicitis may lead to high negative appendectomy rates (20% - 40%). 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.<sup>4</sup> The opposite is also true, where with reduced diagnostic accuracy, the negative or unnecessary appendicectomy rate goes higher, and this is generally reported to be approximately 20%–40%. Diagnostic accuracy can be further improved through the use of ultrasonography or computed tomography imaging. However, these modalities are costly and may not be easily available all the time. Moreover, ultrasound is operator dependent which often misses or over-diagnose the condition, while CT is the most sensitive and specific in diagnosing the condition but with limited availability for every patient, especially in countries with limited resources.<sup>5</sup> Making arrangements for these diagnostic modalities may lead to further delays in diagnosis and surgery. So, several scoring systems have been developed to aid in the diagnosis of acute appendicitis and lowering negative appendectomy rates and to overcome the delay in diagnosis like Alvarado, Eskelinen, Samuel, Lindberg, Ohmann, Tzanakis, Fanyo, RIPASA and others.<sup>6</sup> The Alvarado score and the modified Alvarado score are the two most commonly used scoring systems. The reported sensitivity and specificity for the

Alvarado and the modified Alvarado scores range from 53%–88% and 75%–80% respectively.<sup>7</sup> However, these scoring systems were developed in western countries, and several studies have reported very low sensitivity and specificity when these scores are applied to Asian population. It have been shown to achieve a sensitivity ranging from 50 to 59% and specificity ranging from 23 to 94% which was relatively low, and was attributed to different factors including diet and environmental factors. In 2010, a new RIPASA scoring system was developed by doctors in a hospital in Brunei named Raja Isteri Pengiran Anak Saleha (RIPAS), which includes other parameters than Alvarado as gender, age, duration of pain. These parameters are shown to affect accuracy of the diagnosis of acute appendicitis and has been claimed to have better outcomes in Asian settings compared to the Alvarado scoring system. The purpose of this study is to validate the scoring system in our set up.

#### OBJECTIVES OF PROPOSED RESEARCH

**General Objective-** To evaluate the accuracy of RIPASA scoring system in diagnosis of acute appendicitis.

#### Specific Objectives-

- To diagnose acute appendicitis using RIPASA score.
- To find out the histopathological findings among the acute appendicitis cases diagnosed on the basis of RIPASA score
- To ascertain the diagnostic accuracy of RIPASA scoring system by estimating various attributes of a diagnostic method like sensitivity/specificity and predictive values.

#### 1. RIPASA SCORING SYSTEM<sup>15</sup>

PATIENT'S DEMOGRAPHIC	SCORE
Female	0.5
Male	1.0
Age < 39 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°C , <39°C	1.0
<b>INVESTIGATIONS</b>	
Raised WBC count	1.0
Negative urinalysis	1.0
<b>ADDITIONAL SCORES</b>	
Foreign NRIC	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

## METHODOLOGY

**STUDY DESIGN**-It is a hospital based Evaluation study of a diagnostic method based on longitudinal design.

**STUDY SETTING AND TIMELINES**-The study has been conducted in BSMC&H which is a rural based tertiary care hospital and medical college with a time frame of about one year and six months from acceptance of synopsis.

**A) Place of study & period of study**-Department of general Surgery, Bankura Sammilani Medical College and Hospital, Bankura, FROM MARCH 2019 TO AUGUST 2020

**c) Study population**-Patients with pain in RIF (suspected case of acute appendicitis) who were admitted in surgery ward of Bankura Sammilani Medical College and Hospital with inclusion criteria.

## D) SAMPLE SIZE / DESIGN

**Sample size:**

Final sample size is –86.

## F) INCLUSION / EXCLUSION CRITERIA:

**INCLUSION CRITERIA**-Patients of either sex aged of 14 years and above with RIF pain in suspected acute appendicitis.

## EXCLUSION CRITERIA-

1. Patients with RIF pain not giving consent.
2. Those who had been admitted by other specialties for other complains but subsequently develop RIF pain.
3. Patients presented with a diagnosed appendicular lump or proven malignancy.

**H) DATA COLLECTION AND INTERPRETATION**- This study has been conducted after getting permission from Institutional Ethical Committee and approval of The West Bengal University of Health Sciences among patients who were admitted in surgical ward, Department of General Surgery, Bankura Sammilani Medical College & Hospital, Bankura with RIF pain based on inclusion and exclusion criteria. Operative decision was taken according to the patient's clinical condition and available investigations. Operative notes and histopathology reports were reviewed and correlated with the RIPASA score. If patient was not operated and discharged, the negative appendicitis was confirmed during follow up visit.

I) Laboratory investigations-Relevant investigations were carried out when indicated. This includes:

## Routine investigation:

1. HEMOGLOBIN
2. TOTAL WBC COUNT
3. DIFFERENTIAL COUNT
4. USG WHOLE ABDOMEN

## SPECIFIC INVESTIGATION:

1. URINE ROUTINE EXAMINATION
2. URINE MICROSCOPIC EXAMINATION

## RESULT AND ANALYSIS

In our study, Mean age of the patients was 31.09+11.75 years, association of age in years vs. final diagnosis was not statistically significant ( $p=0.3016$ ). Twenty seven (31.0%) patients were female and 60 (69.0%) patient were male. All 87 (100.0%) patients had RIF Pain and 51 (58.6%) patients had pain migration to RIF. Fifty one (58.6%) patients had anorexia and 78 (89.7%) patients had nausea and vomiting. Forty nine (56.3%) patients had symptoms for <48 hr while 38 (43.7%) patients had for >48 hr. All 87 (100%) patients had RIF tenderness.

In this study, 52 (59.8%) patients had guarding and 54 (62.1%) patients had rebound tenderness. Fifteen (17.2%) patients had Rovsing's sign and 64 (73.6%) patients had fever. Thirty six (41.4%) patients had normal and 51 (58.6%) patients had raised WBC count. Seven (8.0%) patients had Positive urine analysis report. In our study, 64 (73.6%) patients had RIPASA score >7.5 and 23 (26.4%) patients had RIPASA score ≤7.5. Seventy one (81.6%) patients had acute appendicitis and 16 (18.4%) patients had normal appendix according to USG. Thirteen (14.9%) patients had appendicular abscess, 15 (17.2%) patients had appendicular perforation, 30 (34.5%) patients had inflamed appendix and 29 (33.3%) patients had normal appendix according to intra-operative finding. In our study, 37 (42.5%) patients had acute Appendicitis, 21 (24.1%) patients had acute appendicitis with necrosis and 29 (33.3%) patients had normal appendix in histopathological examination. Fifty eight (66.7%) patients had acute appendicitis and 29 (33.3%) patients had normal appendix. -square value: 4.8634; p-value: 0.3016

In patients with acute appendicitis, 15 (25.9%) patients were female and 43 (74.1%) patient were male. In patients with normal appendix, 12 (41.4%) patients were female and 17 (58.6%) patient were male. Association of sex vs. Final diagnosis was not statistically significant ( $p=0.1402$ ).

In patients with acute appendicitis, 34 (58.6%) patients had Pain Migration to RIF. In patients with normal appendix, 74 (58.6%) patients had Pain Migration to RIF. Association of Pain Migration to RIF vs. Final diagnosis was not statistically significant ( $p=1.0000$ ). In patients with acute appendicitis, 38 (65.5%) patients had anorexia. In patients with normal appendix, 13 (44.8%) patients had anorexia. Association of anorexia vs. Final diagnosis was not statistically significant ( $p=0.0647$ ). In patients with acute appendicitis, 55 (94.8%) patients had nausea & vomiting. In patients with h normal appendix, 23 (79.3%) patients had nausea & vomiting. Association of nausea & vomiting vs. Final diagnosis was statistically significant ( $p=0.0250$ ).

In patients with acute appendicitis, 32 (55.2%) patients had duration of symptoms for <48 hr and 26 (44.8%) patients had it for >48 hr. In patients with normal appendix, 17 (58.6%) patients had duration of symptoms for <48 hr and 12 (41.4%) patients had it for >48 hr. Association of duration of symptoms vs. final diagnosis was not statistically significant ( $p=0.7598$ ). In patients with acute appendicitis, 42 (72.4%) patients had guarding. In patients with normal appendix, 10 (34.5%) patients had guarding. Association of guarding vs. final diagnosis was statistically significant ( $p=0.0006$ ). In patients with acute appendicitis, 46 (79.3%) patients had rebound tenderness. In patients with normal appendix, 8 (27.6%) patients had rebound tenderness. Association of rebound tenderness vs. Final diagnosis was statistically significant ( $p<0.0001$ ). In patients with acute appendicitis, 13 (22.4%) patients had Rovsing's sign. In patients with normal appendix, 2 (6.9%) patients had Rovsing's sign. Association of Rovsing's sign vs. Final diagnosis was not statistically significant ( $p=0.0708$ ). In patients with acute appendicitis, 48 (82.8%) patients had fever. In patients with normal appendix, 16 (55.2%) patients had fever. Association of fever vs. Final diagnosis was statistically significant ( $p=0.0059$ ). In patients with acute appendicitis, 17 (29.3%) patients had normal

and 41(70.7%) patients had raised WBC count. In patients with normal appendix, 19(65.5%) patients had normal and 10(34.5%) patients had raised WBC count. Association of WBC count vs. Final diagnosis was statistically significant ( $p=0.0012$ ). In patients with acute appendicitis, 3(5.2%) patients had positive urine analysis report. In patients with normal appendix, 4(13.8%) patients had Positive urine analysis report. Association of urine analysis vs. Final diagnosis was not statistically significant ( $p=0.1634$ ). In patients with acute appendicitis, 52(89.7%) patients had acute appendicitis and 6(10.3%) patients had normal appendix in USG. In patients with normal appendix, 19(65.5%) patients had acute appendicitis and 10(34.5%) patients had normal appendix in USG. Association of USG vs. Final diagnosis was statistically significant ( $p=0.0061$ ).

In patients with acute appendicitis, 13(22.4%) patients had appendicular abscess, 15(25.9%) patients had appendicular perforation and 30(51.7%) patients had inflamed appendix. In intraoperative findings, 29(100.0%) patients had normal appendix. Association of Intra-Op finding vs. final diagnosis was statistically significant ( $p<0.0001$ ). In patients with acute appendicitis, 37(63.8%) patients had acute appendicitis and 21(36.2%) patients had acute appendicitis with necrosis in histopathological examination. In histopathology, 29(100.0%) patients had normal appendix. Association of HPE findings vs. final diagnosis was statistically significant ( $p<0.0001$ ).

**Sensitivity:** 96.6

**Specificity:** 72.4

**Positive Predictive Value:** 87.5

**Negative Predictive Value:** 91.3

**Accuracy:** 88.5% (TP+TN/Total) X100

In Acute Appendicitis, 2(3.4%) patients were in RIPASA Score group  $\leq 7.5$ , 12(20.7%) patients were in RIPASA Score group  $> 7.5-10$ , 40(69.0%) patients were in RIPASA Score group  $> 10-12.5$  and 4(6.9%) patients were in RIPASA Score group  $> 12.5$ .

In Normal Appendix, 21(72.4%) patients were in RIPASA Score group  $\leq 7.5$ , 7(24.1%) patients were in RIPASA Score group  $> 7.5-10$  and 1(3.4%) patients were in RIPASA Score group  $> 12.5$ .

Association of RIPASA Score group vs Final Diagnosis was statistically significant ( $p<0.0001$ ).

## DISCUSSION

Our study showed that overall mean age was  $31.09 \pm 11.75$  years. Davis GN et al(2019) found that over all mean age was  $27.81 \pm 9.23$  years. Our study showed that 27(31.0%) patients were Female and 60(69.0%) patient were Male. In acute appendicitis, 15(25.9%) patients were Female and 43(74.1%) patient were Male. Davis GN et al(2019) found that among 206 patients, 126(61%) were males and 80(39%) were females.

All 87(100.0%) patients had RIF Pain. In acute appendicitis, 34(58.6%) patients had Pain Migration to RIF. Gallenotogallego et al<sup>8</sup> found that 49% patients had pain migration to RIF.

Overall 51(58.6%) patients had anorexia. In acute appendicitis, 38(65.5%) patients had anorexia. Kalan M et al found that 85% patients had anorexia. Nausea & vomiting was present in 78(89.7%) patients among all 87 cases. In acute appendicitis, 55(94.8%) patients had nausea & vomiting. Owen Td et al<sup>9</sup> found that 84% patients had nausea and vomiting. George Mathews et al found that 92% patients had nausea and vomiting.

Overall 49(56.3%) patients had symptoms for  $< 48$  hr and 38(43.7%) patients had it for  $> 48$  hr. In acute appendicitis, 32(55.2%) patients had symptoms for  $< 48$  hr and 26 (44.8%) patients had for  $> 48$  hr.

All 87(100.0%) patients had RIF tenderness. George Mathews et al<sup>10</sup> found that 99% patients had RIF tenderness. Kalan M et al found that 95% patients had RIF tenderness. Gallenotogallego et al found that 94% patients had RIF tenderness.

Among total 87 cases, 52(59.8%) patients had guarding. In acute appendicitis, 42(72.4%) patients had guarding.

Overall 54(62.1%) patients had rebound tenderness. In acute appendicitis, 46(79.3%) patients had rebound tenderness. Owen Td et al found that 60% patients had rebound tenderness. Gallenotogallego et al<sup>11</sup> found that 56% patients had rebound tenderness.

It was found that 15(17.2%) patients had Rovsing's sign among all 87 patients. In acute appendicitis, 13(22.4%) patients had Rovsing's sign.

Among 87 cases, 64(73.6%) patients had fever. In acute appendicitis, 48(82.8%) patients had fever. George Mathews et al found that 74.03% patients had fever. Kalan M et al<sup>12</sup> found that 40% patients had fever.

In our study 36(41.4%) patients had Normal and 51(58.6%) patients had raised WBC count among total 87 patients. Among acute appendicitis patients, 17(29.3%) patients had Normal and 41(70.7%) patients had raised WBC count. Gallenotogallego et al<sup>13</sup> found that 65% patients had raised WBC count. Peiper R et al found that 60% patients had raised WBC count. Raffery AT et al also found that 60% patients had raised WBC count. Elagovan S<sup>14</sup> found that 80% patients had raised WBC count.

Overall 7(8.0%) patients had Positive urine analysis report. Among acute appendicitis patients, 3(5.2%) patients had Positive urine analysis report.

Among all 87 patients, 71(81.6%) patients had Acute Appendicitis and 16(18.4%) patients had Normal Appendix in USG. We found that among acute appendicitis patients, 52(89.7%) patients had Acute Appendicitis and 6(10.3%) patients had Normal Appendix according to USG. In cases of normal appendix, 19(65.5%) patients had Acute Appendicitis and 10(34.5%) patients had Normal Appendix in USG. Association of USG vs. Final diagnosis was statistically significant ( $p=0.0061$ ). Gökçe AH et al<sup>15</sup> (2011) found that One hundred thirty-three (88.67%) of 150 patients diagnosed as acute appendicitis on US examinations were also reported as acute appendicitis on histopathological examination. Sixty (70.59%) of 85 patients diagnosed differently on US examination were reported as acute appendicitis on histopathological examination. Gallenotogallego et al<sup>16</sup> found that 82% patients had acute appendicitis on USG. Douglas et al found that sensitivity and specificity of USG in the diagnosis of acute appendicitis was 94.7% and 88.9% respectively. Ziedan et al found that sensitivity and specificity of USG in the diagnosis of acute appendicitis was 93.7% and 74.2% respectively.

Overall 13(14.9%) patients had Appendicular Abscess, 15(17.2%) patients had Appendicular Perforation, 30 (34.5%) patients had Inflamed Appendix and 29(33.3%) patients had Normal Appendix in intraoperative findings. Association of Intra-Op Finding vs. Final diagnosis was statistically significant ( $p<0.0001$ ). Khan I et al (2005) found that Perforation rate was 7.8%.

In histopathological examination 37(42.5%) patients had Acute Appendicitis, 21(24.1%) patients had Acute Appendicitis with necrosis and 29(33.3%) patients had Normal Appendix. 58(66.7%) patients had Acute Appendicitis and 29(33.3%) patients had Normal Appendix in final diagnosis. Association of HPE findings vs. Final diagnosis was



statistically significant ( $p < 0.0001$ ). Kothari D et al<sup>17</sup> (2017) found that histological examination confirmed appendicitis in 54 patients (67.5%). The remaining 26 patients were found to have normal appendix giving a negative appendicectomy rate of 32.5%. George Mathews et al found that 84.28% patients had acute appendicitis by histopathological confirmation. Geryk B et al<sup>18</sup> found 78.2% patient had acute appendicitis on histopathological examination.

We found that RIPASA Score sensitivity was 96.6%, Specificity was 72.4%, Positive Predictive Value was 87.5%, Negative Predictive Value was 91.3% and Accuracy was 88.5%. Chong CF et al (2010) found that the optimal cut-off threshold score from the ROC was 7.5, with a sensitivity of 88 percent, a specificity of 67 percent, a PPV of 93 percent and an NPV of 53 percent. In another study, Chong CF et al (2011) also found that the sensitivity, specificity, PPV, NPV and diagnostic accuracy were 68.3 percent, 87.9 percent, 86.3 percent, 71.4 percent and 86.5 percent, respectively in another study. Butt MQ et al (2014) found 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%. Nanjundaiah N et al<sup>19</sup> (2014) found that score of 7.5 is the optimal cut off threshold for RIPASA and sensitivity and specificity of RIPASA score were 96.2% and 90.5% respectively. Rathod S et al (2015) found that RIPASA had sensitivity of 82.61% (95% CI 72.02, 89.76) and specificity of 88.89% (95% CI 67.2, 96.9). It had a PPV of 96.61% (95% CI 88.46, 99.07), NPV of 57.14% (95% CI 39.07, 73.49), and a diagnostic accuracy rate of 83.91% (95% CI 74.78, 90.17) using intraoperative diagnosis confirmed by histopathology as gold standard. Regar MK et al (2017) found that RIPASA score is a more valuable tool for diagnosing acute appendicitis with 93% accuracy, sensitivity 94.74% and specificity 60%. Subramani B et al<sup>20</sup> (2017) found that the sensitivity and specificity of the RIPASA scoring system was 98.0% and 80.43% respectively and PPV (positive predictive value) and NPP (negative predictive value) of RIPASA was 84% and 97% respectively. The diagnostic accuracy was 89%. Singh A et al<sup>21</sup> (2018) found that sensitivity of the RIPASA score was 95.89 with specificity 75.92% and diagnostic accuracy of 90.5%. Naik AT et al (2019) found that the sensitivity and specificity of RIPASA score were 91.78% and 66.66% respectively.

## CONCLUSION

In our study, RIPASA Scoring system is found to be very useful in predicting acute appendicitis and therefore helping in early diagnosis of acute appendicitis and avoiding complications associated with late diagnosis.

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