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Original Research Article

Validity of RIPASA Score in Diagnosis of Acute Appendicitis among Clinically Suspected Cases Admitted at a Tertiary Care Teaching Hospital, Eastern India

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Abstract

Background: 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.

Methodology: The study was conducted from March 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.

Results: RIPASA score had sensitivity of 96.6%, specificity of 72.4%, and positive predictive value of 87.5% and negative predictive value of 91.3%.

Conclusion: 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 in a country where there is limited resources like our country.

Keywords: Acute Appendicitis, Clinically Suspected Case, Diagnosis, RIPASA Score, ALVARADO Scoring System, USG, Histopathology.

Introduction

Acute appendicitis is one of the most common surgical emergencies, with a lifetime prevalence rate of approximately one in seven. [1] 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. [2] 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. [3] 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. [4] Typical clinical presentation of acute appendicitis is present only in 50% of the cases making the exploration decision to take challenging. [5]

The decision of early intervention in atypical presentation of acute appendicitis may lead to high negative appendectomy rates (20%-40%). [6] 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. [7] 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%. [8] Diagnostic accuracy can be further improved through the use of ultrasonography or computed tomography imaging. [9]

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. [10] 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. [11] The Alvarado score and the modified Alvarado score are the two most commonly used scoring systems. [12] The reported sensitivity and specificity for the Alvarado and the modified Alvarado scores range from 53%–88% and 75%–80% respectively. [13] 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. [14] 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.9 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. [15] The purpose of this study is to validate the scoring system in our set up.

ALVARADO Scoring System [12]

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

Modified Alvarado Scoring System (MASS) [16]

Symptoms	Score
Migratory RIF pain	1
Nausea/Vomiting	1
Anorexia	1
Signs	
Tenderness in RIF	2
Rebound tenderness in RIF	1
Elevated temperature	1
Laboratory Findings	
Leucocytosis	2
Total	**9**

- Score <5 – Unlikely to be appendicitis
- 5-6 – Low Probability to be appendicitis
- 6-7 – High Probability to be appendicitis
- >8 – Definite appendicitis

RIPASA Scoring System [15]

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>37^0C , <39^0C	1.0
Investigations	
Raised WBC count	1.0
Negative urinalysis	1.0
Additional Scores	
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

Several scoring systems have been developed to help clinicians in the diagnosis of acute appendicitis. The best-known scores are the Alvarado score, the modified Alvarado score, the Pediatric Appendicitis Score, the Appendicitis Inflammatory Response score, and the RIPASA score. These tools can not only be used for diagnostic purposes but also for stratification, separating those patients who require observation and workup from those who can be assigned for certain specific treatment. The aim of these scores is to reduce the number of negative appendectomies without increasing the number of complications related to delayed intervention like perforation.

The Alvarado score was described in 1986 [12] and since then has been evaluated and validated in many studies. It consists of three symptoms, three clinical signs, and two laboratory tests. This system uses a simple mnemonic (MANTRELS) that is easy to remember and can be applied in emergency settings without the need of a computer. The symptoms are migration of pain (one point), anorexia (one point), and nausea/vomiting (one point). The clinical signs are tenderness in the right iliac fossa (two points), rebound pain (one point), and elevation of body temperature (37.3°C or more) (one Point). [12]

The basic laboratory tests are a complete blood count (CBC) to look for leukocytosis (>10,000 cells/mm^3) and a differential white blood count (WBC) looking for left shift (increased stabs >5% or segmented neutrophils >75%). A urinalysis is useful to determine if there is acetone, which indicates the presence of a fasting state related to anorexia and also it may show many red cells due to an inflammatory process around the appendix. If the urine shows too many red cells, it may point to a ureteral calculus, and further investigation should be done. The C-reactive protein (CRP) test is not included in the score because it is a nonspecific test that detects an inflammatory process only and is not diagnostic for any particular condition. Besides this, it would be a redundancy since the shift to the left and leukocytosis are doing the same thing. Furthermore, it will not help in the initial stages of

acute appendicitis because it will defeat the purpose of the score, that is to say, to make an early diagnosis of acute appendicitis. Direct tenderness on the right lower quadrant can be replaced by direct percussion with the fist, as a mallet, on the right lumbar area in cases of retrocaecal appendicitis which occurs in 75–85% of cases. [15,16]

Rebound tenderness can be replaced by other indirect signs such as the Rovsing sign, Dunphy sign (cough test) or the Markle's test (heel-drop jarring test), pain on walking, pain with jolts or bumps in the road, and the inspiration test. Uncommon tests of peritoneal irritation such as the psoas and the obturator tests can replace the rebound tenderness test also. In children who are unable to communicate well, cutaneous hyperesthesia can be added to replace the migration symptom. [15]

In order of decreasing importance, the best predictive factors have been proven to be localized tenderness on the right lower quadrant, leukocytosis, migration of pain, shift to the left, temperature elevation, nausea or vomiting, anorexia or acetone in the urine, and direct rebound tenderness. Two points are assigned to the more important factors (tenderness and leukocytosis) and a value of 1 for each one of the others, for a possible total score of 10. A score of 4–5 is compatible with the diagnosis of acute appendicitis, a score of 7 or 8 indicates a probable appendicitis, and a score of 9 or 10 indicates a very probable appendicitis. To this score the clinician could subtract two points if the patient complains of headache because this symptom is very rare in cases of acute appendicitis. In this particular situation, the patient may need further investigation to rule out a different disorder. [16]

Scores of 5 or 6 are in a gray area, and in this case, the clinician may want to observe the patient for a short time (reevaluate every 4–6 hours) for 12–24 hours and if the score remains the same, consider other tests such as ultrasound or diagnostic laparoscopy. When the score is 3 or 4, the clinician has two options: the patient could be kept under observation and repeat the tests or even more, order additional tests such as an US or a CT scan if they are available in that particular setting. Another option is to rely on the clinical impression of the examiner because "there is always an intangible ingredient in the diagnosis of acute appendicitis."

Materials and Methods

It was a hospital based evaluation study of a diagnostic method based on longitudinal design. The study has been conducted in Department of General Surgery, BSMC&H, Bankura, West Bengal which is a rural based tertiary care hospital and medical college from March 2019 to August 2020 after taking Institutional Ethics Committee approval. 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. Based on a formula used for evaluation of a diagnostic method, the formula is-

$$n = \frac{Z^2 \times Sn(100-Sn)}{L^2 \times P}$$

Where -

Z= 1.96 (two tailed at 95% confidence interval)

Sn= Sensitivity of the index test/method/score

P= Prevalence / Incidence of target disease

L= Acceptable error around the reported prevalence/incidence of target disease

Considering 10% of non-responders in the study, final sample size is – 86.

Sampling Design:

As per record 3-4 such patients get admitted in General Surgery department of BSMC&H. Any two days of a week were selected via simple random technique using lottery method, conducted at the start of each week. On each day of data collection, one eligible case was included in the study.

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 specialities for other complains but subsequently develop RIF pain.
3. Patients presented with a diagnosed appendicular lump or proven malignancy.
4. Patients with history of blunt trauma abdomen.

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. Relevant investigations were carried out when indicated.

This includes hemoglobin, total wbc count, differential count and USG whole abdomen

Parameters Used in RIPASA Scoring System [15]

- Male 1
- Female 0.5
- Age <39 1
- >40 0.5
- RIF Pain 0.5
- Migration of Pain To RIF 0.5
- Anorexia 0.5
- Nausea and Vomiting 0.5
- Duration of Symptoms<48 Hrs 1
- >48 Hrs 0.5
- Rif Tenderness 1
- Rif Guarding 2
- Rovsing Sign 2
- Rebound Tenderness 1
- Fever 1
- Raised White Cell Count 1
- Negative Urinalysis 1
- Foreign Nationality(Optional)1

Score >7.5/15 is suggestive of acute appendicitis

For statistical analysis data has been entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data has been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involve independent samples or unpaired samples. Paired t-tests are a form of blocking and has greater power than unpaired tests. A chi-squared test ($\chi 2$ test) is used in any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions have been compared by Chi-square test or Fischer's exact test, as appropriate. P-value $\leq$ 0.05 has been considered as statistically significant.

Results

Table 1: Distribution of age and sex among participants

Age in Years	Frequency	Percent
≤20	18	20.7%
21-30	33	37.9%
31-40	14	16.1%
41-50	17	19.5%
51-60	5	5.7%
Female	27	31.0%
Male	60	69.0%
Total	87	100.0%

In our study, 18(20.7%) patients were ≤20 years old, 33(37.9%) patients were 21-30 years old, 14(16.1%) patients were 31-40 years old, 17(19.5%) patients were 41-50 years old and 5(5.7%) patient were 51-60 years old. Mean age found to be 31.09 years. in our study, 27(31.0%) patients were female and 60(69.0%) patient were male [Table 1]. In our study, all 87(100.0%) patients had RIF Pain. In our study, 51(58.6%) patients had pain migration to RIF [Table 2].

Table 2: Distribution of pain migration to RIF

Pain Migration to RIF	Frequency	Percent
No	36	41.4%
Yes	51	58.6%
Anorexia		
No	36	41.4%
Yes	51	58.6%
Nausea & Vomiting		
No	9	10.3%
Yes	78	89.7%
Duration	**y**	
<48 hr	49	56.3%
>48 hr	38	43.7%
Guarding		
No	35	40.2%
Yes	52	59.8%
Rebound Tenderness		
No	33	37.9%
Yes	54	62.1%
Rovsing's Sign		

No	72	82.8%
Yes	15	17.2%
Fever		
No	23	26.4%
Yes	64	73.6%
WBC Count		
Normal	36	41.4%
Raised	51	58.6%
Urine Analysis		
Negative	80	92.0%
Positive	7	8.0%
Total	87	100.0%

In our study, 51(58.6%) patients had anorexia. In our study, 78(89.7%) patients had nausea and vomitting. In our study, 49(56.3%) patients had symptoms for <48 hr while 38(43.7%) patients had for >48 hr. In our study all 87(100%) patients had RIF tenderness. In our study, 52(59.8%) patients had guarding. In our study, 54(62.1%) patients had rebound tenderness. In our study, 15(17.2%) patients had Rovsing's sign. In our study, 64(73.6%) patients had fever. In our study, 36(41.4%) patients had Normal and 51(58.6%) patients had raised WBC count. In our study, 7(8.0%) patients had positive urine analysis report [Table 2].

Table 3: Distribution of RIPASA Score

RIPASA SCORE	Frequency	Percent
>7.5	64	73.6%
≤7.5	23	26.4%
Total	87	100.0%

In our study, 64(73.6%) patients had RIPASA score >7.5 and 23(26.4%) patients had RIPASA score ≤7.5 [Table 3].

Table 4: Distribution of USG

USG	Frequency	Percent
Acute Appendicitis	71	81.6%
Normal Appendix	16	18.4%
Total	87	100.0%

In our study, 71(81.6%) patients had acute appendicitis and 16(18.4%) patients had normal appendix according to USG [Table 4].

Table 5: Distribution of intra-op finding

Intra-Op Finding	Frequency	Percent
Appendicular Abscess	13	14.9%
Appendicular Perforation	15	17.2%
Inflammed Appendix	30	34.5%
Normal Appendix	29	33.3%
Total	87	100.0%

In our study, 13(14.9%) patients had appendicular abscess, 15(17.2%) patients had appendicular perforation, 30(34.5%) patients had inflammed appendix and 29(33.3%) patients had normal appendix according to intra-operative finding [Table 5].

Table 6: Distribution of HPE findings

HPE Findings	Frequency	Percent
Acute Appendicitis	37	42.5%
Acute Appendicitis with necrosis	21	24.1%
Normal Appendix	29	33.3%
Total	87	100.0%

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 [Table 6].

Table 7: Distribution of final diagnosis

Final Diagnosis	Frequency	Percent
Acute Appendicitis	58	66.7%
Normal Appendix	29	33.3%
Total	87	100.0%

In our study, 58(66.7%) patients had acute appendicitis and 29(33.3%) patients had normal appendix [Table 7].

Table 8: Association between HPE findings: final diagnosis

Final Diagnosis			
HPE Findings	**Acute**	**Normal**	**Total**
Acute Appendicitis	37	0	37
Row %	100.0	0.0	100.0
Col %	63.8	0.0	42.5
Acute Appendicitis with necrosis	21	0	21
Row %	100.0	0.0	100.0
Col %	36.2	0.0	24.1
Normal Appendix	0	29	29
Row %	0.0	100.0	100.0
Col %	0.0	100.0	33.3
Total	58	29	87
Row %	66.7	33.3	100.0
Col %	100.0	100.0	100.0

Chi-square value: 87.0000; p-value: <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) [Table 8].

Table 9: Association between RIPASA Score: Final Diagnosis

Final Diagnosis			
RIPASA Score	**Acute**	**Normal**	**Total**
>7.5	56	8	64
Row %	87.5	12.5	100.0
Col %	96.6	27.6	73.6
≤7.5	2	21	23
Row %	8.7	91.3	100.0
Col %	3.4	72.4	26.4
Total	58	29	87
Row %	66.7	33.3	100.0
Col %	100.0	100.0	100.0

Chi-square value: 47.2826; p-value: <0.0001; Statistically significant; Sensitivity: 96.6; Specificity: 72.4; Positive Predictive Value: 87.5; Negative Predictive Value: 91.3; Accuracy: 88.5% (TP+TN/Total)X100

Table 10: Association between RIPASA Score group: Final Diagnosis

Final Diagnosis			
RIPASA SCORE group	**Acute Appendicitis**	**Normal Appendix**	**TOTAL**
≤7.5	2	21	23
Row %	8.7	91.3	100.0
Col %	3.4	72.4	26.4
>7.5-10	12	7	19
Row %	63.2	36.8	100.0
Col %	20.7	24.1	21.8
>10-12.5	40	0	40

Row %	100.0	0.0	100.0
Col %	69.0	0.0	46.0
>12.5	4	1	5
Row %	80.0	20.0	100.0
Col %	6.9	3.4	5.7
TOTAL	58	29	87
Row %	66.7	33.3	100.0
Col %	100.0	100.0	100.0

Chi-square value: 55.2879; p-value: <0.0001

In Acute Appendicitis, 2(3.4%) patients were in RIPASA Score group ≤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 ≤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) [Table 9 & 10].

Discussion

Our study showed that overall mean age was 31.09±11.75 years. We had taken patients aged above 14 years as there could be more false positive results with inclusion of that age group. Davis GN et al (2019) [17] found that overall mean age was 27.81±9.23 years. Abd El Maksoud WM et al (2017) [18] found that mean age was 23.3±9.7 years. Regar MK et al (2017) [19] found that the mean age was 24.86 years (10-80 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) [17] found that among 206 patients, 126(61%) were males and 80(39%) were females. Singh A er al (2018) [20] found that M:F ratio was 1.56:1. Regar MK et al (2017) [19] found that there were 61 males and 39 females in the study. Butt MQ et al [21] (2014) found that out of 267 patients, 156 (58.4%) were male while remaining 111 patients (41.6%) were female.

All 87(100.0%) patients had RIF Pain. In acute appendicitis, 34(58.6%) patients had Pain Migration to RIF. Galleneto gallego et al [22] 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 [23] found that 85% patients had anorexia. Nausea & vomitting was present in 78(89.7%) patients among all 87 cases. In acute appendicitis, 55(94.8%) patients had nausea & vomitting. Owen Td et al [24] found that 84% patients had nausea and vomitting. George Mathews et al [25] found that 92% patients had nausea and vomitting. 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 al25 found that 99% patients had RIF tenderness. Kalan M et al [23] found that 95% patients had RIF tenderness. Galleneto gallego et al [22] 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 [24] found that 60% patients had rebound tenderness. Galleneto gallego et al [22] 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 [25] found that 74.03% patients had fever. Kalan M et al [23] 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. Galleneto gallego et al [22] found that 65% patients had raised WBC count. Peiper R et al [26] found that 60% patients had raised WBC count. Raffery AT et al [27] also found that 60% patients had raised WBC count. Elagovan S28 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 (2011) [29] 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. Galleneto Gallego et al [22] found that 82% patients had acute appendicitis on USG. Douglas et al [30] found that sensitivity and specificity of USG in the diagnosis of acute appendicitis was 94.7% and 88.9% respectively. Ziedan et al [31] found that sensitivity and specificity of USG in the diagnosis of acute appendicitis was 93.7% and 74.2% respectively.

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) [15] 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)32 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 [21] (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 [33] (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 [34] (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 [34] (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 [35] (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 [36] (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 [37] (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. RIPASA Score sensitivity is 96.6%, Specificity is 72.4%, Positive Predictive Value is 87.5%, Negative Predictive Value is 91.3% and Accuracy is 88.5%. There has been significant reduction of rate of negative appendectomy with increase of RIPASA score. As the Positive Predictive Value is high, so it is useful in our local population for diagnosis of acute appendicitis. As it is mostly a clinical study apart from some basic laboratory investigations like WBC count and urine analysis, so it can be used even in primary health care facilities where imaging facilities are not available.

Limitations of the Study

In spite of every sincere effort my study has some lacunae.

The notable short comings of this study are:

1. The study has been done in a single centre.
2. The study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

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