Clinics of Surgery

Prospective Study of Acute Appendicitis with its Clinical, Radiological Profile and Scoring System in Tertiary Care Hospital

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Citation:

Deepak GR. et al., Prospective Study of Acute Appendicitis with its Clinical, Radiological Profile and Scoring System in Tertiary Care Hospital. Clin Surg. 2021; 6(2): 1-14

1. Abstract

1.1. Introduction: Acute appendicitis is the most common condition encountered in general surgical practice. Alvarado and Modified Alvarado Scores (MASS) are the commonly used scoring systems for its diagnosis, but its performance has been found to be poor in certain populations. Hence, we compared the RIPASA score with MASS, to find out which is a better diagnostic tool for acute appendicitis in the Indian population.

1.2. Methods: We enrolled 70 patients who presented with RIF pain in the study. Both RIPASA and MASS were applied to them. Final diagnosis was confirmed either by CT scan, intra-operative finding, or post-operative HPE report. Final diagnosis was analysed against both RIPASA and MASS. Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Diagnostic Accuracy was calculated for both RIPASA and MASS.

1.3. Results: In this study 33 patients (47.1%) were male and 37 patients (52.9%) were female. maximum patients were from age group 20–30 years who accounted for 42.9% followed by 30–40 years age group (21.4%) and least number of patients in the>61 years age group (4%). The histopathology showed Acute Appendicitis in 26 patients (37%). Acute suppurative appendicitis in 16 patients (22.8%) and chronic appendicitis in 10 patients (14.28%). The sensitivity and specificity of the RIPASA scoring system was 52% and 100% respectively. The sensitivity and specificity of the modified Alvarado scoring system was 44% and 100% respectively. The PPV of both RIPASA and MASS were 100%. The NPV of RIPASA and MASS were 42% and 38% respectively. The Diagnostic Accuracy was 64% for RIPASA and 59% for MASS.

1.4. Conclusion: RIPASA score is more sensitive than Modified Alvarado Score, and also has a higher negative Predictive Value and Diagnostic Accuracy

2. Introduction

The abdomen is commonly compared to a Pandora's Box, and for good reason. Since the abdomen contains within it innumerable viscera and other anatomical components, the diseases of the abdomen give rise to a lot of clinical curiosity. A meticulous examination of the abdomen and clinical correlation is one of the most important diagnostic tools and becomes cornerstone of management in many conditions presenting with abdominal pain. Despite the vast advances in the medical field in terms of imaging and other investigation modalities, the importance of clinical examination cannot be stressed upon enough [1].

Acute appendicitis is the commonest cause for acute abdomen in any general surgical practice [2]. From the time that it was first described by Reginald Heber Fitz in 1886 [3], it has remained a topic of serial research works for various factors ranging from its aetiology, to its management options.

One of the most researched fields pertaining to appendicitis is the one involving diagnosis. Over the years various types of investigations including laboratory and radiological, have been studied in detail with the aid of trials. These were conducted in the hope of finding the most sensitive test for diagnosing acute appendicitis. But in spite of the vast advances in the field of medicine, it has been time and again opined by various clinicians and authors that appendicitis is one condition whose diagnosis relies mainly upon the clinical features. As quoted by Bailey & Love, "Not withstand-

ing advances in modern radiographic imaging and diagnostic laboratory investigations, the diagnosis of appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen, and surgical science" [1].

So much has been stressed about the various methods of diagnosis, only because the same is extremely important. Appendicitis, which if caught early and managed appropriately can be the most uneventful surgery, while the other end of the spectrum is also true, that when missed, appendicitis can turn into a disease with great morbidity and mortality.

Hence, having understood the importance for early and right diagnosis, and having understood that clinical evaluation provides the best and most accurate diagnostic modality for appendicitis, many clinical scoring systems have been developed over the years [4].This has aided the clinician to a large extent in coming to the right diagnosis and providing early management. What began as a single scoring system, evolved into many over the years, as people constantly made modifications to the existing scoring systems based on the local demographics or by adding more factors. This brought along the next problem, of finding the single best scoring system, or the scoring system with the maximum sensitivity and diagnostic accuracy. As a result, multiple studies have been done with randomised controlled trials comparing various scoring systems in different parts of the world. To date, the most commonly used scoring system worldwide is the Alvarado and the Modified Alvarado Scoring Systems (MASS) [4]. Hence, these have almost been considered as the undocumented gold standard scoring system among clinicians worldwide. So much so that any new scoring system that has been developed is usually first compared to this.

Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score is a fairly newer scoring system developed in 2008, where a study was done in RIPAS Hospital, Brunnei Darssalem [5,6], to find a more favourable scoring system than Alvarado and Modified Alvarado as these were found to have poor sensitivity and specificity in Middle Eastern and Asian population. Following the development of it, a randomised control trial was also done at the same hospital comparing the RIPASA and Alvarado scoring systems and proving the superiority of the former over the latter.

In the present study, RIPASA and Modified Alvarado Scoring Systems (MASS) are compared among the local population in the subcontinent of India, to find out which scoring system is more feasible, reliable and effective in order to help in the early diagnosis of acute appendicitis.

Appendicitis is one of the routine conditions evoking emergency surgery worldwide [2], as also in our hospital.

3. Aims and Objectives

a) To assess the association between clinical, radiological and operative findings and thus evaluate clinical diagnostic accuracy and radiological diagnostic accuracy.

b) To compare RIPASA and Modified ALVARADO scoring system and to validate the scoring system in our set up.

4. Materials and Methods

•	All patients admitted to the surgical wards at SSIMS Hospital, DAVANGERE, with signs and symptoms of appendicitis.

•	Study design: Time bound cross sectional comparative study in which patients presenting with clinical suspicion of Acute Appendicitis in S.S Institute of Medical Sciences and Research Centre, were taken into study.

•	period of study: NOVEMBER -2017 to JULY-2020

•	Sample size:

$$\text{Sample size} = \frac{z2 \times p \times q}{d2}$$

z= 95% confidence interval=1.96

p= prevalence of acute appendicitis in Karnataka=6.7%

q=100-p=93.3

d=allowable error = 6%

Sample size $= \frac{(1.96)2 \times 6.7 \times 93.3}{6^2} = 66.70 = 70$

70 cases were taken up for study.

•	Data collection method: The details of patient complaints, clinical examination and investigations are recorded in a specially designed Performa. The Performa also includes surgical intervention which the patient underwent during hospital stay. Before subjecting the patients to investigation and surgery they are provided with patient's information sheet and they are briefly explained about the procedure do Informed written consent will be taken from each patient before the start of study.

•	Relevant history including age, sex, nationality, RIF pain, migration of RLQ pain, Anorexia, nausea and vomiting, duration of symptom is recorded in specially designed Performa.

•	Relevant examination including RIF tenderness, RIF guarding, Rebound tenderness, Rovsing's sign and fever is done.

•	Patients will undergo necessary investigations.

   - Blood counts-total leucocyte count, neutrophil count, platelet count, eosinophil count, leucocyte to neutrophil ratio.

   -Urine analysis- albumin, sugars, microscopy.

   -USG abdomen / pelvis.

   -CT-Abdomen (As and when required)

   -MRI (As and when required)

•	RIPASA and Modified ALVARADO score will be applied to the patient.

•	All diagnosed patients will be subjected to surgery.

•	In all cases, operative findings and post operative diagnosis by histopathological report will be correlated with the RIPASA score.

Table 1:

CATEGORY	RIPASA	MASS
D (Definite)	>12	>8
HP (High Probability)	7.5-12	6-7
LP (Low Probability)	5-7.5	5-6
U (Unlikely)	<5	<5

Table 2: Diagnostic evaluation of RIPASA with Final diagnosis

RIPASA	FINAL DIAGNOSIS-A	FINAL DIAGNOSIS-NA	TOTAL
SCORE POSITIVE	27	0	27
SCORE NEGATIVE	25	18	43
TOTAL	52	18	70

Final Diagnosis- A: Appendicitis as confirmed by CECT /Postop HPE report

Final Diagnosis- NA: Non-Appendiceal cause as confirmed by CECT/Postop HPE report

Score Positive- Score>7.5, under HP/D categories.

Score Negative- Score<7.5, under LP & U categories.

Table 3: Statistical Analysis of RIPASA

RIPASA	Estimate
Sensitivity	52%
Specificity	100%
PPV	100%
NPV	42%
Diagnostic Accuracy	64%

4.1. Inclusion Criteria

• All patients above the age of 18 years, admitted to the surgical department in the casualty or emergency ward, SSIMS&RC, with history of pain abdomen suggestive of acute appendicitis were included in our study

4.2. Exclusion Criteria

• Patient age group of 18 years and below.

• Patients admitted for interval appendicectomy following recurrent appendicitis, appendicular abscess, appendicular mass previously treated conservatively.

• Patients admitted with history of pain abdomen with clinical symptoms and signs suggestive of appendicular mass or appendicular abscess or diagnosed to be having other pathological conditions like PID, ruptured ectopic, right ureteric calculus, perforated duodenal ulcer, acute cholecystitis, torsion of omentum, enterocolitis, nonspecific mesenteric lymphadenitis, regional ileitis, obstructed carcinoma of the caecum, Meckel's diverticulum etc will be excluded from the study.

After this, the management of the patient was carried out according to the RIPASA Scoring system.

• Patients, who fell under HP/D category, were taken up for surgery immediately.

• Patients who fell under LP category were subjected to CT scanning for diagnosis.

• Patients who fell under U category were worked up for other causes of pain abdomen, other than appendicitis, by means of imaging and other appropriate laboratory studies.

The patients who were operated upon directly, diagnosis was confirmed by intraoperative findings and HPE report. With the final diagnosis confirmation got from either CT scan or Intra-operative finding, or Post-operative HPE report, an analysis was done comparing both RIPASA and MASS.

Table 4: Diagnostic evaluation of MASS with Final diagnosis

MASS	Final diagnosis-A	Final diagnosis-NA	Total
Score Positive	23	0	23
Score Negative	29	18	47
Total	52	18	70

Final Diagnosis- A: Appendicitis as confirmed by CECT /Postop HPE report

Final Diagnosis- NA: Non-Appendiceal cause as confirmed by CECT / Postop HPE report

Score Positive- Score>6, under HP/D categories.

Score Negative- Score<6, under LP & U categories.

Table 5: Statistical analysis of MASS

MASS	Estimate
Sensitivity	44%
Specificity	100%
PPV	100%
NPV	38%
Diagnostic Accuracy	59%

Table 6: Comparison Between Ripasa And Mass

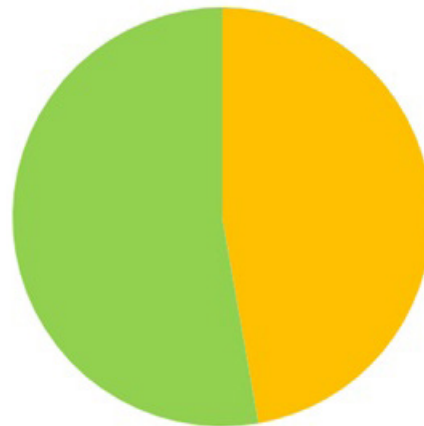| PARAMETER	RIPASA	MASS
SENSITIVITY	52%	44%
SPECIFICITY	100%	100%
POSITIVE PREDICTIVE VALUE	100%	100%
NEGATIVE PREDICTIVE VALUE	42%	38%
DIAGNOSTIC ACCURACY	64%	59%

5. Results

In the present study, patients of age group 18-70 years were included, with the mean age being 32 years. The maximum number of patients belonged to the 3rd and 4th decades (graph-1). 42.9% of the patients belonged to the 20-30 years age group, followed by 21.4% belonging to the 30-40 years age group, while only 7% belonged to the age group above 40 years. Both sexes were affected with a slight female preponderance (52.9% females and 47.1% males). (Graph-2)

As planned, RIPASA and MASS was applied to all the 70 patients who presented with RIF pain.
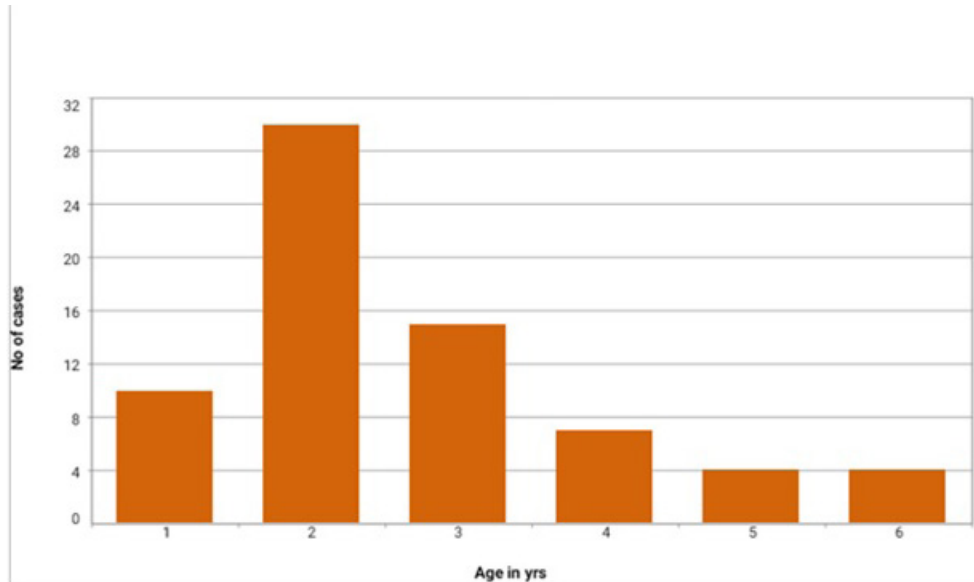
Graph 1: Age-wise distribution in the study

Graph 2: Gender distribution in the study

As planned, RIPASA and MASS was applied to all the 70 patients who presented with RIF pain

Analysis of RIPASA SCORING (graph 3)

77% belonged to the age group below 40 years, and 23% above. Gender differentiation was 47% male and 53% female. 51.4% presented within 48 hours of onset of symptoms and 45.7% after. 100% of the patients had RIF pain, as was the inclusion criteria of the study. 100% of them had RIF tenderness, 85.7% had a negative urinalysis, 37.2% had fever and 37% had a raised TC. 60% of the patients had nausea or vomiting.

Analysis of RIPASA SCORING(graph-3)

77% belonged to the age group below 40 years, and 23% above. Gender differentiation was 47% male and 53% female. 51.4% presented within 48 hours of onset of symptoms and 45.7% after. 100% of the patients had RIF pain, as was the inclusion criteria of the study. 100% of them had RIF tenderness, 85.7% had a negative urinalysis, 37.2% had fever and 37% had a raised TC. 60% of the patients had nausea or vomiting.

Finally, out of the total score, the patients were categorized under 4 categories. 1.4% of the patients had a score of >12 and were categorized as D, 34.3% with a score of 7.5-12 fell under the category HP, 51.4% had a score of 5- 7.5 and were categorized as LP and 12.9% with a score <5 were termed U (graph-4).
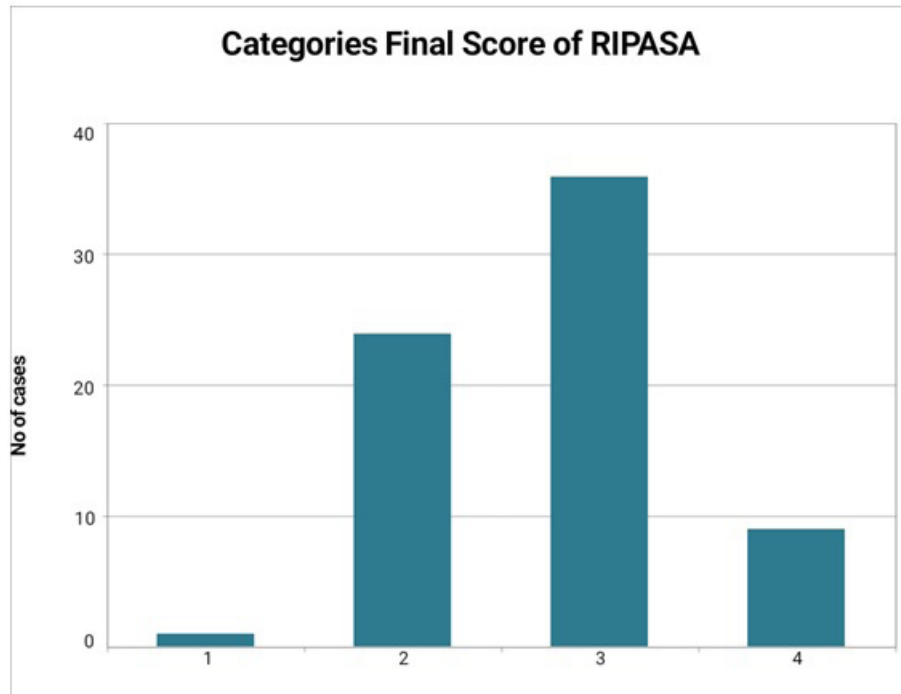
Analysis of MASS(graph-5)- 100%, 32.9%, 48.6% and 62.9% had RIF tenderness, fever, raised TC and nausea/vomiting respectively. 31.4% patients had migratory pain and anorexia in 10% and about 52.9% had rebound tenderness.

With the final score, patients were classified into 4 categories. 3% with score >8 fell under D,20% with 6-7 were under HP,14% with score 5-6 were under LP, and 33% with score <5 were under U (graph-6).
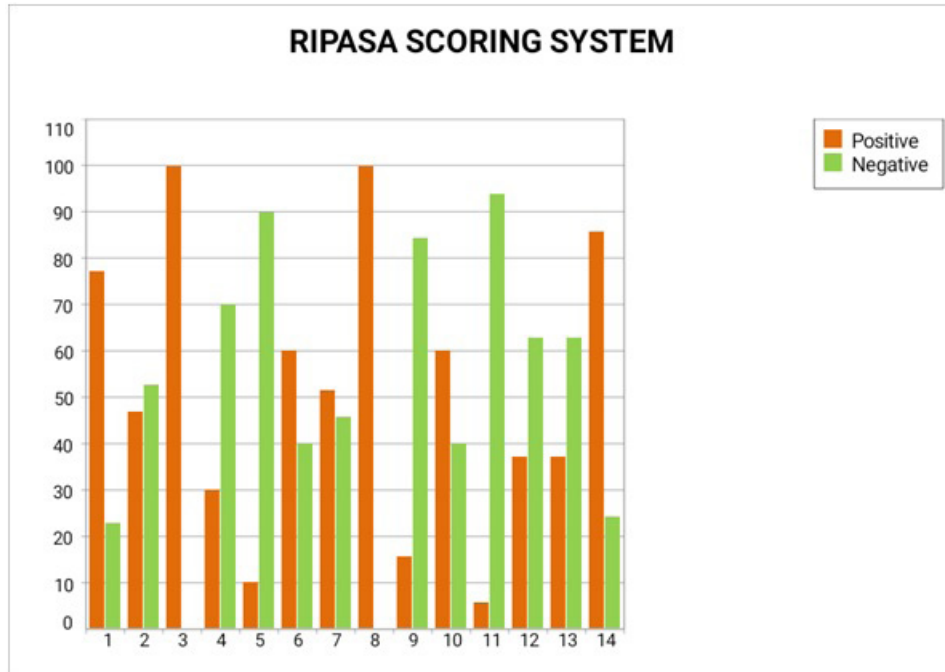
**Graph 3:** Parameters of RIPASA score in the sample of present study

Finally, out of the total score, the patients were categorized under 4 categories. 1.4% of the patients had a score of >12 and were categorized as D, 34.3% with a score of 7.5-12 fell under the category HP, 51.4% had a score of 5- 7.5 and were categorized as LP and 12.9% with a score <5 were termed U (graph 4).
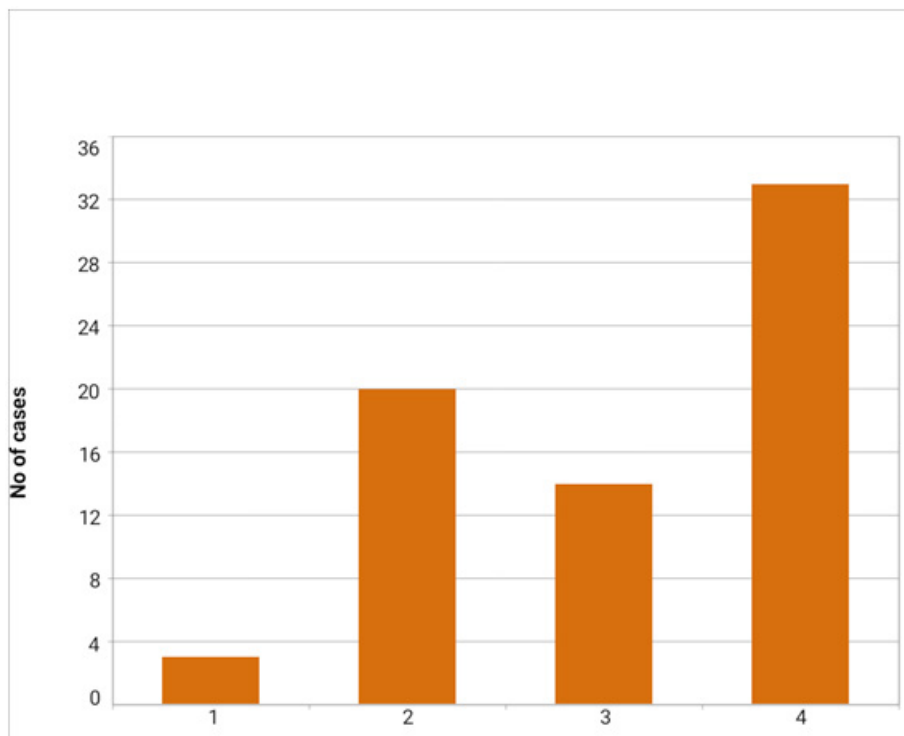

Graph 4: Categories in final score of RIPASA

D- Definite, HP- High Probability, LP- Low Probability, U- Unlikely

Analysis of MASS (graph 5)- 100% ,32.9%, 48.6% and 62.9% had RIF tenderness, fever, raised TC and nausea/vomiting respectively. 31.4% patients had migratory pain and anorexia in 10% and about 52.9% had rebound tenderness.
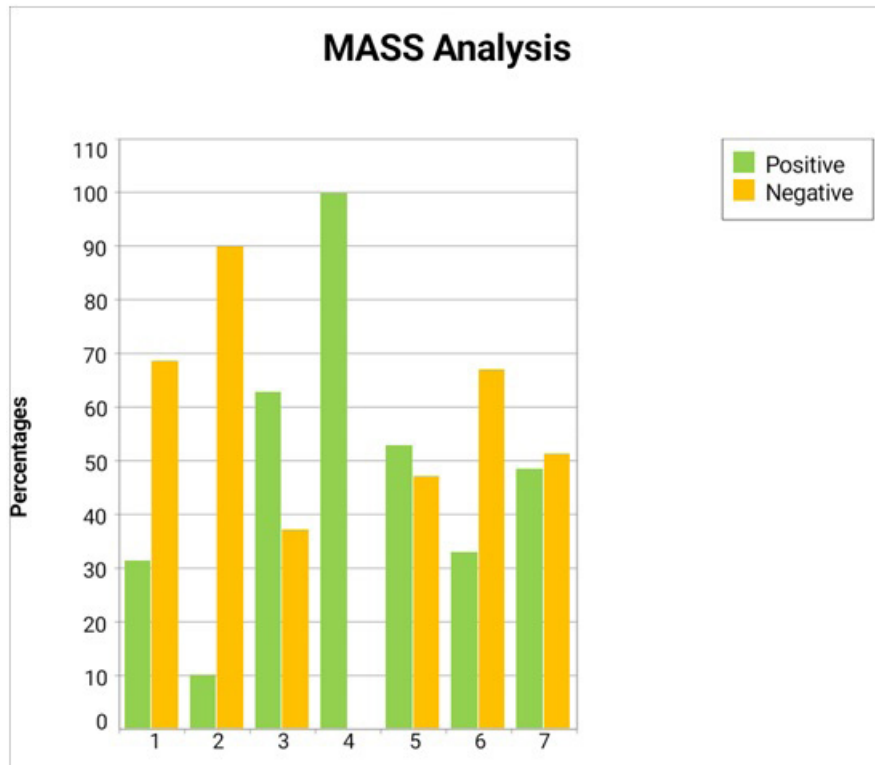
Graph 5: Parameters of MASS in the sample of present study

With the final score, patients were classified into 4 categories. 3% with score >8 fell under D,20% with 6-7 were under HP,14% with score 5-6 were under LP, and 33% with score <5 were under U (graph 6).


Graph 6: Categories in final score of MASS

D- Definite, HP- High Probability, LP- Low Probability, U- Unlikely

As decided in the protocol, plan of management was carried out as per RIPASA score. Patients with U were subjected to USG scanning and other investigations to find out cause for pain abdomen. Patients with LP were subjected to CECT Abdomen since it has a high sensitivity and specificity for diagnosis of appendicitis. (57) The findings in the CT scan among the LP patients were as follows- Among the 36 patients who fell under LP category of RIPASA, 75% were diagnosed with appendicitis (A) and 25% had other non-appendiceal (NA) causes of pain abdomen (graph 7).

As decided in the protocol, plan of management was carried out as per RIPASA score. Patients with U were subjected to USG scanning and other investigations to find out cause for pain abdomen. Patients with LP were subjected to CECT Abdomen since it has a high sensitivity and specificity for diagnosis of appendicitis 57. The findings in the CT scan among the LP patients were as follows- Among the 36 patients who fell under LP category of RIPA-SA, 75% were diagnosed with appendicitis (A) and 25% had other Non-Appendiceal (NA) causes of pain abdomen (graph-7).

In retrospective comparison between final diagnosis of appendicitis and HP/D categories of RIPASA and MASS, it was seen that 100% of HP/D among RIPASA were appendicitis (graph-8) also 100% of HP/D categories under MASS were appendicitis. (graph-9).
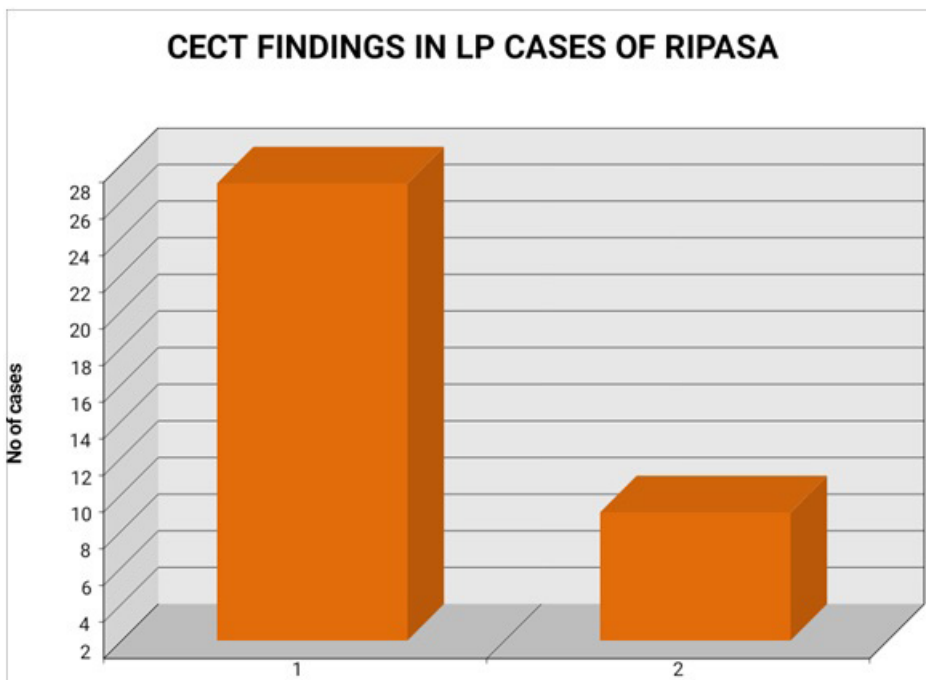

Graph 7: CECT results in LP cases of RIPASA

In retrospective comparison between final diagnosis of appendicitis and HP/D categories of RIPASA and MASS, it was seen that 100% of HP/D among RIPASA were appendicitis (graph 8) also 100% of HP/D categories under MASS were appendicitis (graph 9).
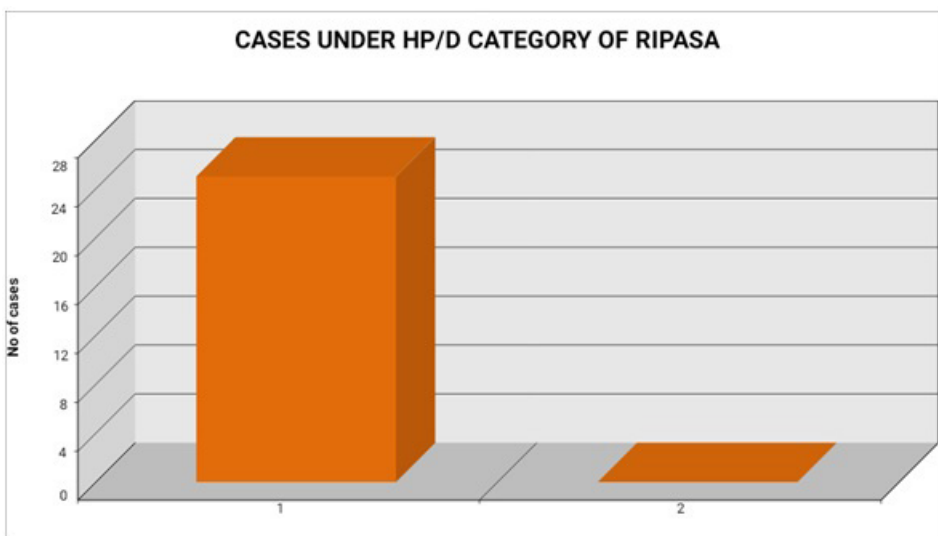
Graph 8: Cases under HP/D category in RIPASA
A-Appendicitis, NA-Non-Appendiceal cause
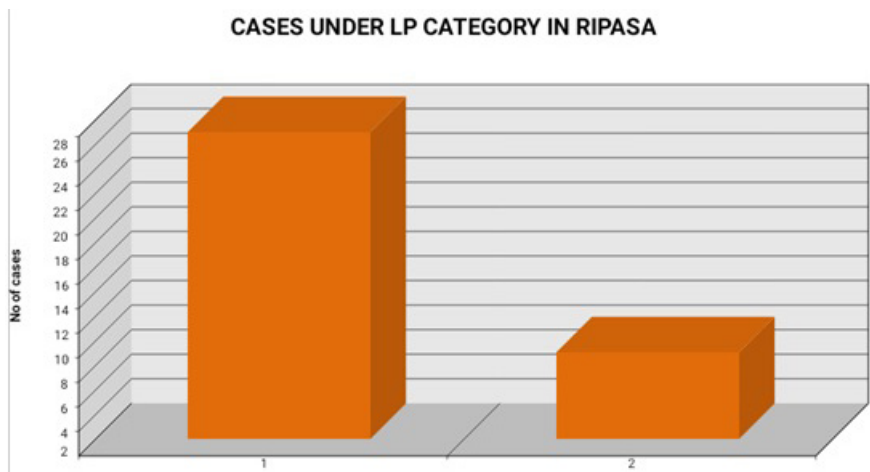
CASES UNDER HP/D CATEGORY OF MASS
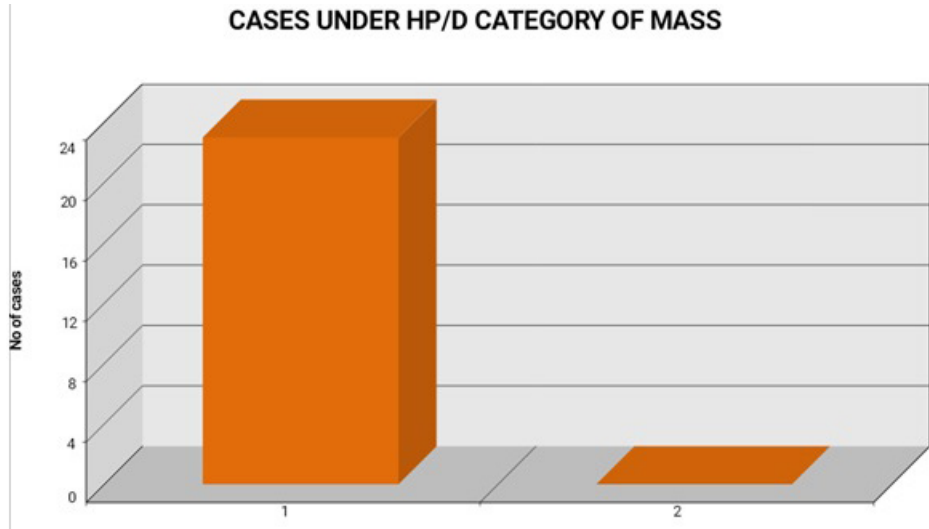
Graph 9: Cases under HP/D category in MASS

A-Appendicitis, NA-Non-Appendiceal cause

Under LP category, in RIPASA only 75% were appendicitis (graph-10) whereas in MASS, 100% were appendicitis (graph 11).
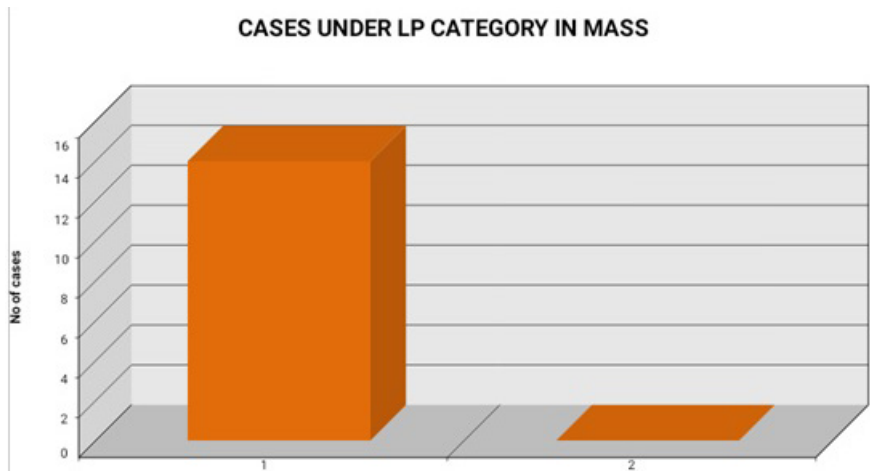
Under LP category, in RIPASA only 75% were appendicitis (graph-10) whereas in MASS, 100% were appendicitis (graph-11).

Under the U category, RIPASA had 0 appendicitis cases, i.e. it proved that 100% of the cases were unlikely (graph-12), whereas in MASS, 45.45% cases were found to have appendicitis (graph-13).

CASES UNDER LP CATEGORY IN RIPASA

Graph 10: Cases under LP category in RIPASA

A-Appendicitis, NA-Non-Appendiceal cause
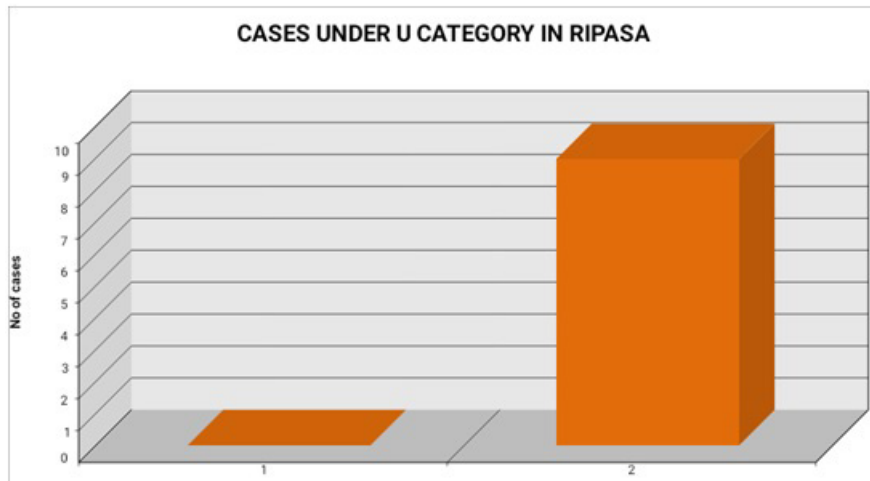
CASES UNDER LP CATEGORY IN MASS

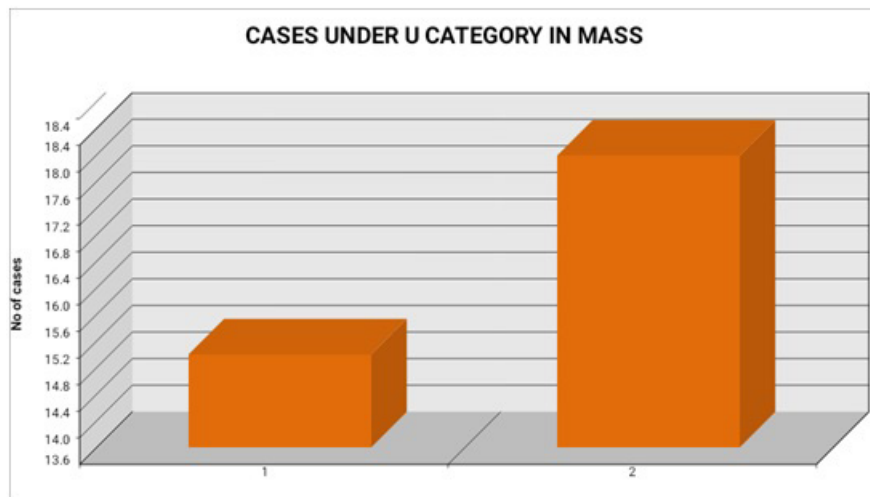**Graph 11:** Cases under LP category in MASS

A-Appendicitis, NA-Non-Appendiceal cause

Under the U category, RIPASA had 0 appendicitis cases, i.e. it proved that 100% of the cases were unlikely (graph 12), whereas in MASS, 45.45% cases were found to have appendicitis (graph 13).

Graph 12: Cases under U category in RIPASA
A-Appendicitis, NA-Non-Appendiceal cause

Graph 13: Cases under U category in MASS
A-Appendicitis, NA-Non-Appendiceal cause

Among 70 patients, on histopathology 26% (18) patients had normal appendix, whereas   74 %(52) of patients had abnormal appendix (graph-14).
Among 74% of with abnormal histopathology 50% had features suggestive of acute appendicitis, 31% had features of acute suppurative appendicitis, 19% had features of chronic appendicitis (Graph-15).

Among 70 patients, on histopathology 26% (18) patients had normal appendix, whereas 74%(52) of patients had abnormal appendix (graph-14).

Among 74% of with abnormal histopathology 50% had features suggestive of acute appendicitis, 31% had features of acute suppurative appendicitis, 19% had features of chronic appendicitis (Graph-15).
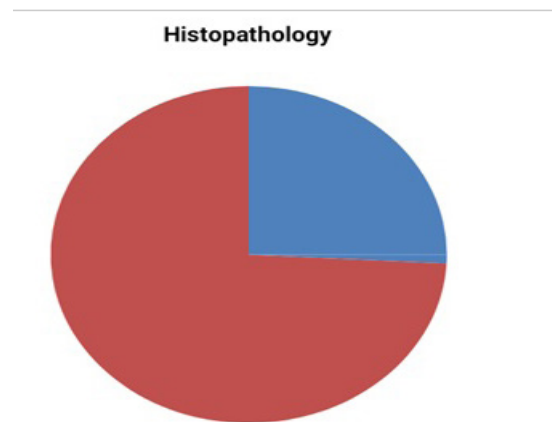
Graph 14: histopathological diagnosis in patients undergoing appendectomy
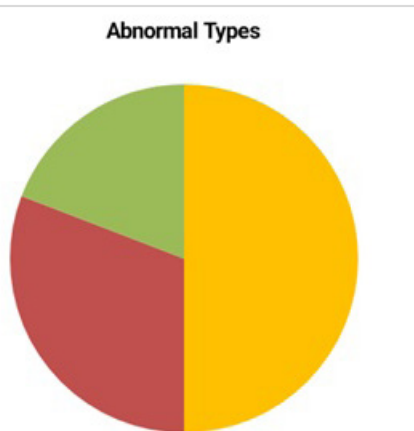
Graph 15: different types of appendicitis

Statistical Analyses was performed with IBM SPSS program for Windows Version 22. Results were as follows-

5.1. Ripasa Scoring System

5.1.1. Interpretation: In this study, Sensitivity was 52% with 95% confidence interval, and specificity was 100% with 95% confidence interval. Positive Predictive Value (PPV) showed an estimate 100% with 95% confidence interval, negative predictive value was 42%. Diagnostic accuracy of RIPASA is also high i.e, 64%.

5.2. Modified Alvarado Scoring System

5.2.1 Interpretation: In this study, Sensitivity was 44% with 95% confidence Interval and specificity was 100% with 95% confidence interval. Positive Predictive Value (PPV) showed an estimate 100% with 95% confidence interval, negative predictive value was 38%. Diagnostic accuracy of MASS is 59%.

Area under ROC curve for RIPASA is more compared to the area under ROC curve for MASS i.e,0.760 and 0.721 respectively suggesting that RIPASA is more accurate than MASS in diagnosing appendicitis (graph 16-17).

5.3. Significance

Specificity, PPV of both RIPASA and MASS are comparable, but there seems to be a definite upgrade in sensitivity, Negative predictive value, and diagnostic accuracy in RIPASA scoring over MASS.

6. Discussion

From the time the concept of clinical scoring systems have been introduced, multiple studies have been done in search of the most sensitive, specific and scoring systems with better PPV, NPV, diagnostically accurate clinical score to aid in the diagnosis of Acute appendicitis.

Since its introduction in 1986, Alvarado is one of the most well known and studied scores for acute appendicitis [7]. Its modification MASS has been equally in common use. As this is the most popular and commonly used scoring system, we planned to compare the newer scoring system (RIPASA) with it, and study its efficacy in terms of sensitivity, specificity and diagnostic accuracy among other factors.
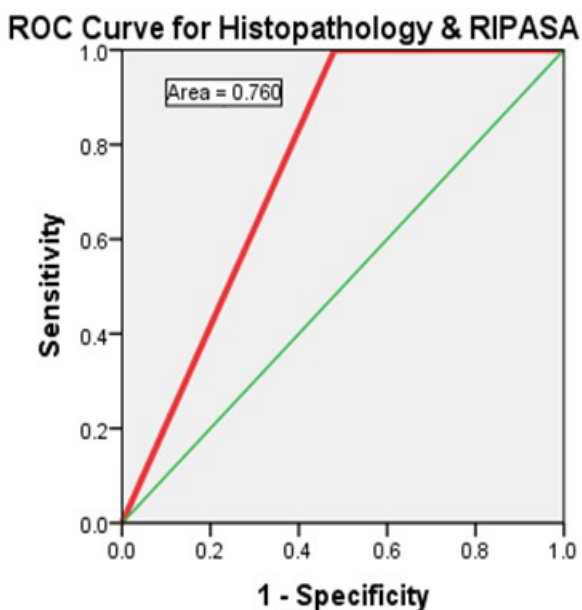
Graph 16: ROC curve for Histopathology & RIPASA
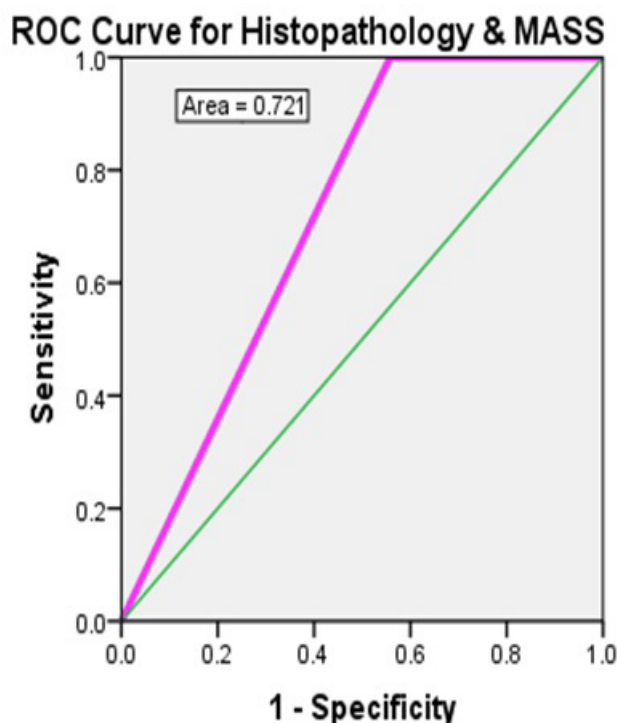
Graph 17: ROC curve for Histopathology & MASS

In the present study conducted on 70 patients (n=70), RIPASA and MASS were compared, and final diagnosis was analysed in relation to CECT/intra-operative findings/ post-operative HPE reports.

It was found that both RIPASA and MASS had equal specificity (100%), but sensitivity was higher in RIPASA (52%) as compared to MASS (44%). Also the RIPASA and MASS were found to have same Positive predictive value of 100%. The negative predictive value of RIPASA and MASS were comparable (42% and 38% respectively). The diagnostic accuracy was higher in RIPASA than MASS (64% and 59% respectively).

Analysing both RIPASA and MASS, it was found that both were easy to perform as they mainly on clinical findings, along with basic laboratory investigations. RIPASA had more parameters compared with MASS, hence it summarized the patient's clinical condition better. Both the scoring systems took minimal time to apply and did not cause any undue delay in management. Even though MASS is a routinely used scoring system for the diagnosis of acute appendicitis worldwide, it has found to be lacking in its sensitivity and specificity.

Bond et al prospectively studied 187 patients with suspected appendicitis and found Alvarado score to have a sensitivity and specificity of 90% and 72% respectively [8].

Hsiao et al conducted a retrospective study and found sensitivity and specificity for an Alvarado Score ≥7 were 60% and 61% respectively [9].

Rezak et al, in their retrospective study, founda higher sensitivity and specificity- 92% and 82% respectively. This study also suggested that if patients with scores >7 been managed directly by

appendectomy without CT evaluation, this would have caused a 27% reduction in CT scanning [10].

Owen et al prospectively evaluated 215 patients and found the sensitivity and specificity of Alvarado scoring were 93% and 81% [11].

Shreef et al recently in 2010, performed a dual-centre prospective study, reviewing 350 patients and found the sensitivity and specificity of Alvarado scoring were 86% and 83% respectively [12].

Macklin et al studied the sensitivity and specificity of MASS and found it to be 76.3% and 78.8% respectively [13].

Meltzer et al conducted a prospective observational study on 261 patients and found MASS to have poor sensitivity and specificity at 72% and 54% respectively [18].

In the present study as well, sensitivity and specificity of MASS was 44% and 100%.

RIPASA, during its development by Chong et al, was found to have a sensitivity and specificity of 88% and 67% respectively [16]. But few studies have been done consecutively, showing better results.

Butt MQ et al conducted a cross sectional study on 267 patients and found RIPASA score to have a sensitivity and specificity of 96.7% and 93% respectively. Its Positive predictive value was 98% and negative predictive value was 95%. Hence they concluded that RIPASA was a useful tool in diagnosis of appendicitis [19].

A few studies have been done comparing RIPASA with MASS with the following results-

Chong et al, after developing RIPASA score, continued to evaluate their new score by prospectively enrolling 200 adults and children

in a comparison of the RIPASA and Alvarado Scores. In this group of patients, the RIPASA was statistically superior to the Alvarado Score in Sensitivity (98% vs. 68%), NPV (97% vs. 71%) and accuracy (92% vs. 87%). Specificity and PPV were similar between the 2 scores [16].

N .N., Mohammed et al compared RIPASA and Alvarado and found RIPASA to be a more convenient, accurate and specific score with the resulting comparative values of RIPASA and Alvarado as follows- Sensitivity 96% and 58% respectively, Specificity – 90% and 85% respectively [20].

Erdem et al studied 113 patients in a tertiary care centre and compared four clinical scoring systems- Alvarado, Eskelinen, Ohmann and RIPASA. They found a sensitivity level of 81%, 80.5%, 83.1% and 83% for each respectively. They concluded that Ohmann and RIPASA scores were the most specific in diagnosis of acute appendicitis [21].

As compared to literature, in the present study, RIPASA was found to have sensitivity, specificity, PPV and NPV of 52%, 100%, 100% and 42% respectively.

Over the last few years, since the advent of newer imaging systems, and due to the varied clinical accuracy of scoring systems, studies have also been done to evaluate the use of imaging techniques like CT scanning in diagnosis of appendicitis.

Li SK conducted a retrospective study on 396 patients and concluded that MASS along with CT scan was very useful in identifying the pathological type of appendicitis, and hence aided in choosing the right therapeutic option [24].

Liu W et al did a study in 297 patients who had undergone a CT for diagnosis of appendicitis, and retrospectively compared them with RIPASA and Alvarado scores. Their respective results were as follows- Sensitivity – 98.9% v/s 95.2% v/s 63.1%, Specificity – 96.4% v/s 73.6% v/s 80.9%, Diagnostic accuracy – 98% v/s 87.2% v/s 69.7%. They concluded that Multislice CT was the optimal tool for diagnosis of acute appendicitis, followed by RIPASA and then Alvarado scoring [22].

Although studies show that CT scanning has maximum sensitivity and specificity in diagnosis of acute appendicitis, this has not been very widely in use, at least in a developing country like India. This is due to multiple factors not only universal factors like risk of radiation exposure, but also other economic and practical causes like cost and availability. Hence some studies were done to try and find out which group of patients benefitted from CT scan, to try and filter the available resources.

Tan WJ et al prospectively compared Alvarado and CT scan, and found that CT scan was mainly beneficial in patients with Alvarado score <6 in males, and <8 in females [23].

Jones et al in their study concluded that adults with an Alvarado score less than 3 were unlikely to benefit from a CT scan [25].

Keeping all these factors in mind, the present study was analysed category-wise. When we retrospectively analysed the proven appendicitis cases with the scores, we found that among the HP/D categories, both RIPASA and MASS picked up 100% cases as high probability of appendicitis. Hence, we understood that by using the RIPASA score, cases that fall under HP/D category can be more confidently taken up for surgery, without the need for any imaging modality.

Under the LP category in RIPASA, CT scan was done for all patients, and 58% of them turned out to be acute appendicitis, as compared to 100% in MASS. This further strengthens the point that RIPASA filters out low probability cases better than MASS. Hence, it can be inferred that the patients who fall under the LP category (RIPASA 5-7.5) will benefit the most from a CT scan.

Under the U category, or "Unlikely to be appendicitis" category, RIPASA had 0 appendicitis cases. That means, it proved that 100% of the cases were unlikely. Meanwhile, MASS had 45.45% cases under unlikely category which were finally diagnosed as appendicitis. Hence, the numbers of missed cases are higher in MASS. Hence in the present study, comparatively RIPASA seems to be better than MASS clinically as well as statistically.

7. Conclusion

•   The present study concludes that, in the diagnosis of acute appendicitis, RIPASA score is more sensitive than Modified Alvarado Score and also has a higher negative Predictive Value and Diagnostic Accuracy.

•   For the clinician, it gives a clearer categorization of management of patients with RIF pain suggesting that in most cases, patients in HP/D category can straight away be taken up for surgery without any extra imaging modality, patients in LP category would benefit the maximum from CT imaging and that patients in the U category can be worked up for non-appendiceal diagnoses.

•   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 remote settings or emergency, a quick decision can be made with regards to referral to an operating surgeon or observation.

•   RIPASA also reduces the number of "missed appendicitis" cases.

Hence, RIPASA is clinically and statistically a better scoring system for the diagnosis of acute appendicitis, as compared to MASS.

8. Summary

The present study was conducted to find out a more suitable scoring system for enabling early diagnosis of acute appendicitis. It was conducted in the General Surgery Department in S S Medical College & hospital, Davangere for duration of 32 months, with a total study sample of 70.

The first 70 patients among the age group of 18-70, presenting with RIF pain were recruited in the study. The mean age group was 32 years. Both sexes were affected with a slight female preponderance. RIPASA and MASS were calculated for all patients. Management was carried out according to RIPASA scoring.

• In this study 33 patients (47.1%) were male and 37 patients (52.9%) were female.

• In this study, maximum patients were from age group 20 – 30 years who accounted for 42.9 % followed by 30 – 40 years age group (21.4%) and least number of patients in the >61 years age group (4%).

• The histopathology showed Acute Appendicitis in 26 patients (37%). Acute suppurative appendicitis in 16 patients (22.8%) and chronic appendicitis in 10 patients (14.28%). Normal histology was found in 18 patients (25.7%).

• The 2 scoring systems were applied on these patient populations with the histologic confirmation as the Gold standard.

• The sensitivity and specificity of the RIPASA scoring system was 52% and 100% respectively.

• The sensitivity and specificity of the modified Alvarado scoring system was 44% and 100% respectively.

• The PPV of both RIPASA and MASS were 100%.

• The NPV of RIPASA and MASS were 42% and 38% respectively.

• The Diagnostic Accuracy was 64% for RIPASA and 59% for MASS.

• The Sensitivity, NPV, and Diagnostic accuracy of RIPASA scoring was significantly higher than the MASS.

• There appeared to be no statistically significant difference in the specificity, and PPV.

The RIPASA scoring appeared to be a better test for scoring the probability of Acute Appendicitis.

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