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RESEARCH ARTICLE

A COMPARATIVE STUDY OF RIPASA AND MODIFIED ALVARADO SCORING SYSTEMS FOR THE DIAGNOSIS OF ACUTE APPENDICITIS

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ABSTRACT

Background: Acute appendicitis is one of the commonest causes for acute abdomen in any general surgical practice[1,2]. From the time that it was first described by Reginald Heber Fitz in 1886[3].Aims and objectives : To assess the RIPASA scoring system and the Modified Alvarado Scoring System (MASS) for the diagnosis of Acute Appendicitis, and compare them with respect to 1) Sensitivity 2) Specificity 3) Positive predictive value 4)Negative predictive value 5)Diagnostic Accuracy. MATERIALS & METHODS: This is a cross-sectional, comparative study conducted at ESIC Medical College & PGIMSR, K.K.Nagar, Chennai-78 for a period of 1 ½ years, from November 2013 to May 2015.RESULTS: Finally, out of the total score, the patients were categorized under 4 categories. 4% of the patients had a score of >12 and were categorized as D, 21% with a score of 7.5-12 fell under the category HP, 39% had a score of 5-7.5 and were categorized as LP and 36% with a score <5 were termed U. 81%,53%,47% and 48% had RIF tenderness, fever, raised TC and nausea/vomiting respectively. 23% patients had migratory pain and anorexia and about 17% had rebound tenderness. Conclusion: RIPASA is clinically and statistically a better scoring system for the diagnosis of acute appendicitis, as compared to MASS.

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INTRODUCTION

Acute appendicitis is one of the commonest causes for acute abdomen in any general surgical practice (Hamilton Bailey's, 1995 and Addiss, 1996). From the time that it was first described by Reginald Heber Fitz in 1886 (Williams, 1983), it has remained a topic of serial research works for various factors ranging from its aetiology, to its management options. To date, the most commonly used scoring system worldwide is the Alvarado and the Modified Alvarado scoring systems (MASS) (Evaluation of modified Alvarado score in the diagnosis of suspected acute appendicitis, 2015). 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 (Chong *et al*., 2010 and Chong, 1986), 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. 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 relevant and applicable, in order to aid early diagnosis of acute appendicitis.

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Aims and Objectives

To assess the RIPASA scoring system and the Modified Alvarado Scoring System (MASS) for the diagnosis of Acute Appendicitis, and compare them with respect to

- Sensitivity
- Specificity
- Positive predictive value
- Negative predictive value
- Diagnostic Accuracy

MATERIALS AND METHODS

This is a cross-sectional, comparative study conducted at ESIC Medical College & PGIMSR, K.K.Nagar, Chennai-78 for a period of 1 ½ years, from November 2013 to May 2015. The

first 180 patients who presented to the Surgery OPD and Emergency Department with RIF pain were included in the study. Relevant history, examination and lab investigations done. Patients were scored according to both Modified Alvarado Scoring System (MASS) and RIPASA Scoring, and both were documented in the proforma. In both groups after final scoring, patients were categorized into 4 groups.

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

After this, the management of the patient was carried out according to the RIPASA Scoring system. a) Patients who fell under HP/D category, were taken up for surgery immediately. b)Patients who fell under LP category were subjected to CT scanning for diagnosis. c)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. Conservatively managed patients were discharged and followed up in the OPD, while for the patients who were operated upon directly, diagnosis was confirmed by HPE. 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.

RESULTS

In the present study, patients of age group 5-50 years were included, with the mean age being 28+/- 11.6 years. The maximum number of patients belonged to the 2nd and 3rd decades (Fig.18). 31% of the patients belonged to the 25-35 years age group, followed by 26% belonging to 15-25 years age group, while only 9% belonged to the age group above 45 years. Both sexes were affected with a slight male preponderance (57% males and 43% females).

Analysis of Ripasa scoring

82% belonged to the age group below 40 years, and 18% above. Gender differentiation was 57% male and 43% female. 30% presented within 48 hours of onset of symptoms and 70% after. 100% of the patients had RIF pain, as was the inclusion criteria of the study. 81% of them had RIF tenderness, 57% had a negative urinalysis, 53% had fever and 47% had a raised TC. 48% of the patients had nausea or vomiting. Finally, out of the total score, the patients were categorized under 4 categories. 4% of the patients had a score of >12 and were categorized as D, 21% with a score of 7.5-12 fell under the category HP, 39% had a score of 5-7.5 and were categorized as LP and 36% with a score <5 were termed U.

Analysis of MASS

81%,53%,47% and 48% had RIF tenderness, fever, raised TC and nausea/vomiting respectively. 23% patients had migratory pain and anorexia and about 17% had rebound tenderness. With the final score, patients were classified into 4 categories. 12% with score >8 fell under D, 16% with 6-7 were under HP, 19% with score 5-6 were under LP, and 53% with score <5 were under U.

RIPASA scoring system

Table 1. Diagnostic evaluation of RIPASA with Final diagnosis

RIPASA	Final Diagnosis- A	Final Diagnosis - NA	Total
Score Positive	41	3	44
Score Negative	42	94	136
Total	83	97	180

Table 2. Statistical Analysis of RIPASA

Parameter	Estimate	Lower - Upper 95% CIs
RIPASA		
Sensitivity	49.40%	(38.91, 59.94[1])
Specificity	96.91%	(91.3, 98.94[1])
Positive Predictive Value	93.18%	(81.77, 97.65[1])
Negative Predictive Value	69.12%	(60.92, 76.27[1])
Diagnostic Accuracy	75%	(68.2, 80.76[1])
Method:Wilson Score		

Interpretation: In this study, Sensitivity was 49.4% with 95% confidence interval (38.91, 59.94), and specificity was 96.91% with 95% confidence interval (91.3, 98.94). Positive Predictive Value (PPV) showed an estimate 93.18% with 95% confidence interval (81.77, 97.65). Diagnostic accuracy of RIPASA is also high (75%).

Modified alvarado scoring system

Table 3. Diagnostic evaluation of MASS with Final diagnosis

MASS	Final Diagnosis- A	Final Diagnosis - NA	Total
Score Positive	41	10	51
Score Negative	42	87	129
Total	83	97	180

Table 4. Statistical analysis of MASS

Parameter	Estimate	Lower - Upper 95% CIs
MASS		
Sensitivity	49.40%	(38.91, 59.94[1])
Specificity	89.69%	(82.05, 94.3[1])
Positive Predictive Value	80.39%	(67.54, 88.98[1])
Negative Predictive Value	67.44%	(58.95, 74.92[1])
Diagnostic Accuracy	71.11%	(64.1, 77.24[1])
Method:Wilson Score		

Interpretation: In this study, Sensitivity was 49.4% with 95% confidence interval (38.91, 59.94), and specificity was 89.69% with 95% confidence interval (82.05, 94.3). Positive Predictive Value (PPV) showed an estimate 80.39% with 95% confidence interval (67.54, 88.98). Diagnostic accuracy of MASS is 71.11%.

Comparison between ripasa and mass

PARAMETER	RIPASA	MASS
Sensitivity	49.40%	49.40%
Specificity	96.91%	89.69%
Positive Predictive Value	93.18%	80.39%
Negative Predictive Value	69.12%	67.44%
Diagnostic Accuracy	75%	71.11%

Significance

Sensitivity of both RIPASA and MASS are comparable, but there seems to be a definite upgrade in specificity, positive predictive value, and to a certain amount in diagnostic accuracy as well in RIPASA scoring over MASS.

DISCUSSION

Since its introduction in 1986, Alvarado is one of the most well-known and studied scores for acute appendicitis. Its modification MASS has been equally in common use. As this is the most pop 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. In the present study conducted on 180 patients (n=180), 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 sensitivity (49.4%), but specificity was higher in RIPASA (96.9%) as compared to MASS (89%). Also the Positive predictive value of RIPASA (93%) was higher than MASS (80%). The negative predictive value of RIPASA and MASS were comparable (69% and 67% respectively). The diagnostic accuracy was also slightly higher in RIPASA than MASS (75% and 71% respectively). Analysing both RIPASA and MASS, it was found that both RIPASA and MASS were easy to perform as they mainly relied upon clinical symptoms and signs, along with basic laboratory investigations, and they did not need elaborate investigations. As RIPASA had more number of parameters compared with MASS, subjectively it felt like it summarized the patient's clinical condition better. The time taken to apply the scores (both RIPASA and MASS) were minimal, 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.

But few studies have been done consecutively, showing better results. Butt *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. 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. 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. 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. As compared to literature, in the present study, RIPASA was found to have a sensitivity, specificity, PPV and NPV of 49.4%, 96.9%, 93% and 69% 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. 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. 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 *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. Li 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. Jones *et al*[15] in their study concluded that adults with an Alvarado score less than 3 were unlikely to benefit from a CT scan.

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, RIPASA picked up 93% cases as high probability of appendicitis, whereas MASS picked up only 81% as high probability cases. 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 80% 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 16% cases under unlikely category which were finally diagnosed as appendicitis. Hence, the number of missed cases would have been higher in MASS. Hence in the present study, comparatively RIPASA seems to be better than MASS clinically as well as statistically. After final analysis, it was found that RIPASA was statistically superior to MASS in

terms of Specificity (96% v/s 89%) and Positive Predictive Value (93% v/s 80%), and also to some extent in terms of Diagnostic Accuracy (75% v/s 71%). Whereas the Sensitivity (49% in both) and Negative Predictive Value (69% v/s 67%) were similar.

Conclusion

The present study concludes that, in the diagnosis of acute appendicitis, RIPASA score is more specific than Modified Alvarado Score, and also has a higher Positive 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. 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.

Source of Support: Nil

Conflict of Interest: Nil

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