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Original Research Article

Comparative study of Alvarado score and RIPASA score in the diagnosis of acute appendicitis

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ABSTRACT

Background: Acute appendicitis is one of the most common surgical emergencies. Immediate and accurate diagnosis, mainly based on clinical assessment and laboratory results, is of paramount importance in order to reduce complications and mortality rates. Challenging diagnosis and fears of missing an inflamed appendix may lead to a negative appendectomy. Many scoring systems have been developed to reduce ambiguities in the diagnosis of appendicitis. The aim of the present study was to compare the efficacy of Alvarado score and RIPASA score in the diagnosis of acute appendicitis.
Methods: This study was conducted in the Department of Surgery, Nehru Hospital, BRD Medical College, over a period of 12 months. A total number of 50 cases with a clinical diagnosis of acute appendicitis were studied. Informed consent was obtained from all registered cases.
Results: 48% were male and 52% were females in the study. 70% belonged to <40 years and 30% belonged to >40 years. Among 50 patients, in patients ≥40 years of age, appendicitis was diagnosed in 10 patients and in patients <40 years of age, 24 were diagnosed with appendicitis. Among 50 patients, 24 were males out of which 19 were diagnosed with appendicitis compared to 15 out of 26 females. Anorexia and tenderness in RLQ were present in 100% patients. 100% patients had anorexia, RIF pain and tenderness. Alvarado and RIPASA score showed sensitivity 64.7% and 88.2% respectively.
Conclusions: The difference in the diagnostic accuracy between Alvarado and RIPASA scoring system is significant indicating that the RIPASA score is a much better diagnostic tool for the diagnosis of acute appendicitis. When the ROC curve was observed the area under the curve is high for RIPASA scoring system.

Keywords: Acute appendicitis, ALVARADO score, Diagnostic accuracy, Histopathology, RIPASA score

INTRODUCTION

The abdomen is commonly compared to a Pandora's box which contains within it innumerable viscera and other anatomical components, the diseases of the abdomen gives 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.[1] Acute appendicitis is one of the commonest causes for acute abdomen in any general surgical practice and is the most common source of infection in community-acquired intra-abdominal infection.[2] Approximately 7.0% of the population will have appendicitis in their lifetime with the peak incidence occurring between the age of 10 and 30 years. Abdominal pain is the most common clinical presentation. Anorexia,

nausea and vomiting with tenderness or guarding rigidity in right iliac fossa are seen on examination.

The classical history of peri-umbilical pain at beginning and later shifting to right iliac fossa is present in only 50% cases. In 70% of the cases the clinical presentation is typical and there is no difficulty in making a diagnosis. A negative appendicectomy ranging from 10% to 44% has been considered acceptable by various authors with view to minimize the incidence of perforation and associated morbidity and mortality. Various diagnostic modalities have been reported to influence the negative appendicectomy. This includes radiological, laproscopic, and laboratory methods of investigation. 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.[3] This has aided the clinician to a large extent in coming to the right diagnosis and providing early management. Till date, the most commonly used scoring system worldwide is the Alvarado and the modified Alvarado scoring systems (MASS).[3]

Hence, these have almost been considered as the undocumented gold standard scoring system among clinicians worldwide. 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, 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.[4,5]

In the present study, RIPASA and Alvarado scoring systems (ASS) 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.[6]

METHODS

This study was conducted in the Department of Surgery, Nehru Hospital, BRD Medical College, between December 2019 to November 2020 for a period of 12 months. A total number of 50 cases with a clinical diagnosis of acute appendicitis were studied. Informed consent was obtained from all registered cases.

Type of study

It was a prospective and comparative study.

Inclusion criteria

Patients with the following criteria were included in the study: pain in right iliac fossa, and age group 12 years -70 years.

Exclusion criteria

Patients with the following criteria were excluded from the study: patients presenting with a diagnosed appendicular lump, patient presenting with a right iliac fossa mass, previously diagnosed case of acute appendicitis, immunocompromised patients, patients already operated for appendicitis, age below 12 years, and pregnant females.

Methodology

A detailed clinical history and thorough clinical examination was done by the surgeon on duty. Relevant investigations like hemoglobin, leukocyte count, urine albumin, sugar and microscopic examinations were done in all cases. Blood sugar, blood urea, serum creatinine and plane X-ray abdomen were done. The final diagnosis of acute appendicitis was made clinically and supported by available laboratory investigation reports. The laboratory staffs were also not aware of the clinical findings, decision and the outcomes.

Institutional ethical forum approved the study. Written consent was obtained for all patients in the study population. The risks and benefits involved in the study were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

Patients were scored according to both Alvarado scoring system (ASS) and RIPASA scoring, and both were documented in the proforma. Results of all the investigations and scoring were correlated with USG finding of acute appendicitis which is the investigation modality of choice.

Sonographic findings in acute appendicitis include: non-compressible, blind-ended, aperistaltic tubular structure in right lower quadrant arising from the base of cecum, target lesion or Bull's-eye appearance of appendix, appendiceal diameter >6 mm, lumen distended with anechoic and hypoechoic material, appendicolith, circumferential loss of submucosal layer of appendix, loculated and prominent pericecal fluid, and prominent pericecal fat. Alvarado score contained 8 parameters, whereas RIPASA score contained 18 parameters. The score for the parameters ranged from 0.5 to 2 for RIPASA and 1 to 2 for Alvarado as shown above. A score of 7 is taken as high probability of acute appendicitis for Alvarado scoring system and a score of 7.5 for RIPASA scoring system. The decision on appendicectomy was solely based on surgeon's clinical judgment after taking into consideration all the findings of clinical, laboratory and radiological investigation.

Statistical analysis

All the measurements are done using statistical package for the social sciences (SPSS) version 21.0 and open epi software 3.01 $p<0.05$ is considered as statistically

significant. Scores will be tabulated and compared by applying Chi-square test.

RESULTS

48% were male and 52% were females in the study. 70% belonged to <40 years and 30% belonged to >40 years (Table 1).

Table 1: Demographic details.

Characteristics	Frequency	%
Gender		
Male	24	48
Female	26	52
Age		
<40	35	70
≥40	15	30

Among 50 patients, in patients ≥40 years of age, appendicitis was diagnosed in 10 patients and in patients <40 years of age, 24 were diagnosed with appendicitis. Among 50 patients, 24 were males out of which 19 were diagnosed with appendicitis compared to 15 out of 26 females (Table 2).

Anorexia and tenderness in RLQ were absent in 100% patients (Table 3).

100% patients had anorexia, RIF pain and tenderness (Table 4).

ALVARADO and RIPASA score showed significant differences (Table 5).

ALVARADO and RIPASA score showed sensitivity 64.7% and 88.2% respectively (Table 6).

Table 2: Appendicitis according to age.

Variables	Appendicitis present/absent				P value
	Absent		Present		
	Frequency	%	Frequency	%	
Age					
≥40	5	31.3	10	29.4	0.895
<40	11	68.8	24	70.6	
Sex					
Female	11	68.8	15	44.1	0.104
Male	5	31.3	19	55.9	

Table 3: Evaluation of individual variables in Alvarado scoring system and their individual efficacy in predicting the outcome.

Variables	Appendicitis present/absent				P value
	Absent		Present		
	Frequency	%	Frequency	%	
Migratory pain	3	18.8	9	26.5	0.728
Anorexia	16	100.0	34	100.0	-
Nausea	12	75.0	30	88.2	0.249
Tenderness in RLQ	16	100.0	34	100.0	-
Rebound tenderness	10	62.5	26	76.5	0.305
Elevated temp	4	25.0	23	67.6	0.007
Leukocytosis	3	18.8	23	67.6	0.002
Shift to left	1	6.3	17	50.0	0.004

Table 4: Evaluation of individual variables in RIPASA scoring system and their individual efficacy in predicting the outcome.

Variables	Appendicitis present/absent				P value
	Absent		Present		
	Frequency	%	Frequency	%	
Sex					
0.5	11	68.8	15	44.1	0.104
1	5	31.3	19	55.9	
Age					
0.5	5	31.3	10	29.4	

Continued.

Variables	Appendicitis present/absent				P value
	Absent		Present		
	Frequency	%	Frequency	%	
1	11	68.8	24	70.6	0.895
RIF pain	16	100.0	34	100.0	-
Migratory pain	3	18.8	10	29.4	0.508
Anorexia	16	100.0	34	100.0	-
N and V	12	75.0	28	82.4	0.707
Duration of symptom	3	18.8	15	44.1	0.081
RIF tenderness	16	100.0	34	100.0	-
RIF guarding	5	31.3	19	55.9	0.104
Rebound tenderness					
1	10	62.5	26	76.5	0.263
2	1	6.3	0	0.0	
Rovsing's sign	1	6.3	10	29.4	0.080
Fever					
1	3	18.8	27	79.4	<0.001
2	1	6.3	0	0.0	
Raised WBC	2	12.5	26	76.5	<0.001
NEG urinalysis	13	81.3	34	100.0	0.029
Foreign NRIC	0	0.0	1	2.9	1.000

Table 5: Comparison between Alvarado and RIPASA score.

Variables	Appendicitis present/absent		P value
	Absent	Present	
	Mean±SD	Mean±SD	
Alvarado total	5.25±1.61	7.44±1.94	<0.001
RIPASA total	8.25±1.60	10.88±2.10	<0.001

Table 6: Comparison of the sensitivity and specificity of Alvarado and RIPASA scoring in predicting the diagnosis of acute appendicitis.

Scoring	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Alvarado	64.7	93.8	95.7	55.6	74.0
RIPASA	88.2	68.8	85.7	73.3	82.0

DISCUSSION

From the time the concept of clinical scoring systems has been introduced, multiple studies have been done in search of the most sensitive, specific and 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. 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.

Out of 50 patients, majority belonged to the age group <40 years, out of which 24 were found to have acute appendicitis. In age group ≥40 years out of 15 patients 10 were found to have acute appendicitis. Among 24 males in study 19 were diagnosed with acute appendicitis and out of 26 females 15 were acute appendicitis patient. In study done by Nunjhandaih et al, males were majority constituting 61.6% of the total subjects which is higher than present study population males.[7,11] Even in the study done by Ali et al males were majority about 74% when compared to females of 26%.[8] Hence, hosts of scoring system were derived in order to diagnose acute appendicitis. Alvarado scoring system is the most popular one. This scoring system had a very good sensitivity and specificity when applied to western population.[6,9] Subsequently, when this scoring was applied to oriental populations, it showed relatively less specificity and sensitivity to diagnose acute appendicitis.[10,11] So, a new scoring system was devised called the RIPASA scoring system which was more extensive yet simple scoring system consisting of 17 fixed parameters and an additional parameter (NRIC) that is unique to Asian population. Alvarado and RIPASA score showed sensitivity 64.7% and 88.2% respectively. In a study done by Nanjundaiah et

al, at optimal cutoff threshold of >7 the sensitivity and specificity of the Alvarado scoring system were 58.9% and 85.7% respectively which is very much comparable with present study.[7]

Our study compared sensitivity and specificity between Alvarado scoring system with that of RIPASA. Sensitivity or true positive rate is the proportion of actual positives which is correctly identified that is the percentage of sick people who are correctly identified as having the condition. Specificity or true negative rate is the proportion of negatives which are correctly identified that is the percentage of healthy people who are correctly identified as not having the condition.[12] The RIPASA score was considerably better than Alvarado score in correctly diagnosing acute appendicitis. Using the RIPASA score, 96.2% of patients who actually had acute appendicitis were correctly diagnosed and placed in the high probability group (RIPASA score >7.5), compared to only 58.9% when using the Alvarado score on the same population sample. The difference in diagnostic accuracy of 33.93% between the RIPASA sore and Alvarado score was statistically significant (p<0.0001), indicating that the RIPASA score is a much better diagnostic tool for the diagnosis of acute appendicitis. Our study is comparable with the study done by Chong.[13]

Out of 14 patients in definite category, 13 (93%) were found to have acute appendicitis, in high probability category 10 (83.3%) patients out of 12 were diagnosed to have acute appendicitis. Whereas in low probability group, 9 (56.25%) out of 16 were having acute appendicitis. In unlikely group 2 (25%) out of 8 were positive for acute appendicitis. While analyzing individual parameters in Alvarado scoring significant association was found between diagnosis of acute appendicitis and elevated temp, leukocytosis and shift of WBC to left with p value <0.05 for all these parameters. In the study, out of 236 patients 92% showed score above 6 showing high probability of appendicitis where as 8% showed lower probability. The mean score was 8.18.[13] They were not comparable to present study.

Out of 9 patients in definite category, 9 (100%) were found to have acute appendicitis, in high probability category 23 (63.88%) patients out of 36 were diagnosed to have acute appendicitis. Whereas in low probability group, 2 (40%) out of 5 were having acute appendicitis. While analyzing individual parameters in RIPASA scoring significant association was found between diagnosis of acute appendicitis and fever, raised WBC, and negative urinalysis with p value <0.05 for all these parameters.

In a study done by Chong et al the RIPASA score correctly classified 98 percent of all patients confirmed with histological acute appendicitis to the high-probability group (RIPASA score greater than 7.5) compared with 68.3 percent with the Alvarado score (Alvarado score greater than 7.0; p value less than 0.0001).[13]

Limitations

This study was conducted in a single center; the number of patients was small and only patients with abdominal pain referred to general surgery were evaluated.

CONCLUSION

The present study concluded that, in the diagnosis of acute appendicitis, RIPASA scoring system is better than ASS in terms of sensitivity, 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 diagnosis. 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 ASS.

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