Diagnostic Efficacy of Ripasa Scoring in Acute Appendicitis: A Tertiary Care Centre Study

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Abstract
Background: *appendicitis is one of the most common surgical conditions attended by young surgeons worldwide in emergency room. To diagnose appendicitis accurately, needs good clinical acumen, keen observing power and Surgical practice. Due to failure in in diagnosing appendicitis accurately mainly due to pitfalls in scoring systems followed all around the world we conducted this study to find out the usefulness of RIPASA scoring system in diagnosing acute appendicitis compared to the histopathological findings as the gold standard.*
Materials and Methods: *All patients presenting to the casualty department in the department of surgery and paediatric surgery with right iliac fossa pain with clinical suspicion of acute appendicitis were eligible for the study. Patients of all age groups were included.*
Result: *The results of our study shows that RIPASA scoring with a cut off at 7.5 will help differentiating acute appendicitis which needs emergency appendicectomy from other conditions.*
Discussion: *The sensitivity and specificity of RIPASA scoring in diagnosing acute appendicitis in our study was 0.93 and 0.67 when the cut off for RIPASA was fixed at 7.5 as suggested by the ROC analysis.*
Keyword: *appendicitis, ripasa score, histopathology.*

Introduction

Appendicitis is an inflammation of appendix, a $3^{1/2}$ inch long hollow tube that extends from large intestine. It occurs due to blockage with stool, foreign body, fecolith, or cancer [1]. This condition is usually presented in earlier half of life [2]. Appendicitis remains the most common acute surgical condition of abdomen, young surgeons attend in emergency room [3,4]. Surgery for acute appendicitis remains in the top list of surgeries done by any young surgeon all over the world. Though appendectomy remains in the top list of surgeries, negative histopathology reports are also high during their early career [5]. This is due to

failure in diagnosing appendicitis accurately and due to pitfalls in the scoring systems followed all around the world. Depending on the pain threshold, symptoms and signs may vary in patients to patients.

Diagnosing appendicitis remains mainly clinical, including mixture of observation, clinical acumen and surgical practice. Comparing with other surgical emergencies, patient with appendicitis have mild clinical symptoms and signs initially, that may be taken into least account by surgeons in their early clinical practice. Absolute diagnosis is possible only during surgery and histopathological examination of specimen. A definitive preoperative diagnosis based on gold standard histopathology is impractical, which leads to negative appendectomies (20-40%)

Usage of broad spectrum antibiotics, masking the clinical signs is also a hindrance to accurately diagnosing the condition.

In developing countries like India, as early identification of the disease in the first instance is important as good number of people may be having education from outside, working away from home stations, in rural areas or or may be in travel, or in places where expert clinical advise is not available. These factors can result in missing the diagnosis, and the patient end up in complications like, perforation peritonitis, abscess formation, mass formation, and hence increases the morbidity [6]. So a clinical scoring system that takes into account ofmainly clinical signs and symptoms is important, so that even a junior doctor working in the remotest area can accurately diagnose appendicitis and can timely refer the patient to a higher surgical centre with facilities and can prevent complications and thus reduce the morbidity.

One of the scoring system is alvarado system which is based on clinical and laboratory evidence. In developing countries like India, where advanced radiological investigations do not appear cost effective, clinical parameters remains the mainstay of diagnosis. The sensitivity and specificity of Alvarado, modified Alvarado range from 53-88%, and 75-80% respectively. In this aspect RIPASA scoring system play an important role in early diagnosis. It's sensitivity and specificity among Asian populations is 88% & 67% respectively with accuracy of 81% [7] [8-10]. We conducted this study to find out the usefulness of RIPASA scoring system in diagnosing acute appendicitis compared to the histopathological findings as the gold standard

Materials and Methods

This study was conducted at the government medical college, trivandrum, designed as a diagnostic evaluation of RIPASA score in predicting acute appendicitis compared to histopathological gold standard. We conducted the study during 2014 and 2015 after obtaining approval from the institutional ethics committee. This study is a part of a larger study comparing the new scoring system with classical scoring systems in diagnosis acute appendicitis. The study was conducted conforming to the standards of declaration of Helsinski.

All patients presenting to the casualty department in the department of surgery and paediatric surgery with right iliac fossa pain with clinical suspicion of acute appendicitis were eligible for the study. Patients of all age groups were included. Moreover, patients with sonological features of acute appendicitis were also included in the study. We excluded pregnant ladies and patient with other diagnosis at admission. In addition, recurrent appendicitis was not considered for the study. Other patients excluded from this study were those with malignancies and with history of previous laparotomies. Only those cases of appendicitis posted for appendicectomy were included in the study.

Acute appendicitis was diagnosed based on a combination clinical suspicion and investigation by the operating surgeon. The operation definition for a patient to be diagnosed with appendicitis was to have right iliac fossa pain of acute onset with or without sonologicalfinding suggestive of acute appendicitis and being diagnosed acute

appendicitis by the treating surgeon. Those cases satisfying the operational criteria for acute appendicitis were scored for RIPASA as detailed in the literature [5]. The decision to manage the patients with appendicectomy was taken by the operating surgeon. Open appendicectomy was done with Lanzincision, Rutherford Morrison incision or Grid iron incision. Laparotomies were resorted to in some cases [11]. Only those patients who underwent appendicectomy were considered for the study. For all patients demographic features, histopathological features, variables included in the RIPASA scoring were collected using a well designed case report form by residents given adequate training in data collection procedure. The data thus collected were cross checked by the principal investigator and entered in to an excel based database for analysis. The prospective scoring of RIPASA was done by an independent surgery resident not involved in the decision making to avoid potential selection bias. The RIPASA scoring was done at the time of decision taken by the attending surgeon or consultant to operate the patient.

From the variables collected, RIPASA scores were calculated for each patient. A formal sample size calculation was done before the study. Sensitivity and specificity across all possible score were calculated and ROC curve was plotted for RIPASA. In addition, we calculated the area under the curve and its confidence interval. Thereafter we determined the optimum cut off point for each score in the ROC curve. Demographics were summarized with median and IQR for continuous variables and as proportions for categorical data. Group wise differences were assessed with wilcoxon rank sum test for continuous variables and chi square test for categorical variables. All statistical analysis were implemented in R statistical software.

Results

This study included 363 patients diagnosed with acute appendicitis and operated. Patients who underwent conservative management were not considered for the study. The baseline features of the patients included in the study are shown in table 1. The median age was 20 [16-28] with predominantly more males (male:female ratio,1.8:1). Of these patients,314(86.5%) patients had acute appendicitis proven histopathologically. The remaining 49(13.5%) patients had negative appendicitis histopathologically.

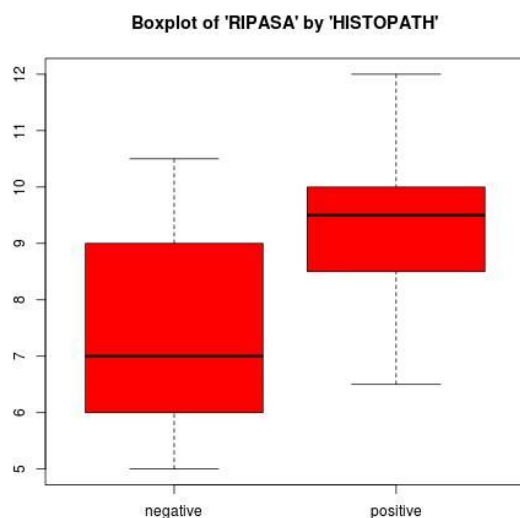|	Overall
n	363
AGE (median [IQR])	20.00 [16.00, 28.00]
GENDER = Male/Female (%)	234/129 (64.5/35.5)
RIPASA (median [IQR])	9.00 [8.50, 10.00]
HISTOPATH = positive/negative (%)	314/49 (86.5/13.5)

As shown in table 2, the median RIPASA score was 9.5 in histopathologically proven cases and 7 in appendicectomy cases where histopathology turned out to be negative and the difference was statistically significant. The proportion of male in histopathologically proven case but was not statistically significant.

Table 2: Summary descriptive table by histopathology

	[ALL] N=363	negative N=49	positive N=314	P value
GENDER:				0.322
Female	129 (35.5%)	21 (42.9%)	108 (34.4%)	
Male	234 (64.5%)	28 (57.1%)	206 (65.6%)	
AGE	20.0 [16.0;28.0]	22.0 [17.0;32.0]	20.0 [16.0;28.0]	0.140
RIPASA	9.00 [8.50;10.0]	7.00 [6.00;9.00]	9.50 [8.50;10.0]	<0.001

Receiver operating curve (ROC) calculated for various sensitivities and specificities plotted is given in figure1. In addition, the best cut off value for each was calculated.There is a statistically significant difference between histopathologically positive cases and negative cases with ROC cut at 7.5 (p<0.001). The sensitivity of RIPASA was

0.93(0.90-0.96) and the specificity 0.67(0.52-0.80).The area under the curve (AUC) for the ROC was 0.74(CI 0.67-0.80).

Boxplot of 'RIPASA' by 'HISTOPATH'

Discussion

This study was designed to answer the research question whether the use of RIPASA scoring helps in diagnosing acute appendicitis. The results of our study shows that RIPASA scoring with a cut off at 7.5 will help differentiating acute appendicitis which needs emergency appendice-ctomy from other conditions.

The sensitivity and specificity of RIPASA scoring in diagnosing acute appendicitis in our study was 0.93 and 0.67 when the cut off for RIPASA was fixed at 7.5 as suggested by the ROC analysis. The sensitivity in our study is consistent with that obtained in the study by Chong et all [5]. The specificity in our study is lower than that obtained in the above study obtained. The reason for this difference could be the difference in the ethnic group and the different age group in our study. The sensitivity in our study is higher that that obtained by Erdemet at.. This could be due to the use of different cut off value used in their study [7]. The specificity in our study is lower compared to other studies [5,7].

RIPASA scoring applied to the clinically diagnosed appendicitis cases who underwent appendectomy has an area under the curve of 0.74.

The application of RIPASA scoring in our setting resulted in correctly classifying 93 percent of patients with histopathological evidence to the group with high chance of acute appendicitis. Another strength of the study compared to other studies is our formal sample size calculation before conducting the study. Moreover we have included all categories of age group in our study. Instead of consecutive sampling, we opted for a systematic sampling technique and so more generalizable.

One of the limitations of our is the lower specificity of RIPASA score in our study. Further studies need to be planned to develop a modified version of RIPASA score that could increase the specificity of the study. This will reduce the number of patients falsely classified as negative for appendicitis.

Conclusion

Our study has shown that RIPASA scoring can be used for screening purposes in emergency care setting to better diagnose acute and can aid in decision making in regard to operative intervention

Acknowledgement

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