ORIGINAL ARTICLE

RIPASA Score: A New Diagnostic Score for Diagnosis of Acute Appendicitis

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ABSTRACT

Objective: To determine the usefulness of RIPASA score for the diagnosis of acute appendicitis using histopathology as a gold standard.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Kohat, from September 2011 to March 2012.

Methodology: A total of 267 patients were included in this study. RIPASA score was assessed. The diagnosis of appendicitis was made clinically aided by routine sonography of abdomen. After appendicectomies, resected appendices were sent for histopathological examination. The 15 parameters and the scores generated were age (less than 40 years = 1 point; greater than 40 years = 0.5 point), gender (male = 1 point; female = 0.5 point), Right Iliac Fossa (RIF) pain (0.5 point), migration of pain to RIF (0.5 point), nausea and vomiting (1 point), anorexia (1 point), duration of symptoms (less than 48 hours = 1 point; more than 48 hours = 0.5 point), RIF tenderness (1 point), guarding (2 points), rebound tenderness (1 point), Rovsing's sign (2 points), fever (1 point), raised white cell count (1 point), negative urinalysis (1 point) and foreign national registration identity card (1 point). The optimal cut-off threshold score from the ROC was 7.5. Sensitivity analysis was done.

Results: Out of 267 patients, 156 (58.4%) were male while remaining 111 patients (41.6%) were female with mean age of 23.5 ± 9.1 years. 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%.

Conclusion: RIPASA score at a cut-off total score of 7.5 was a useful tool to diagnose appendicitis, in equivocal cases of pain.

Key Words: *Acute appendicitis. Histopathology. RIPASA score.*

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies, with an incidence of about 50% ranging between 13 - 77%.[1] Acute inflammation of the vermiform appendix is probably as old as man and an Egyptian mummy of the Byzantine era exhibits adhesions in right lower quadrant suggestive of old appendicitis.[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. A 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.[3]

The opposite is also true, where with reduced diagnostic accuracy, the negative or unnecessary appendicectomy rate is increased, and this is generally reported to be approximately 20 - 40%. Diagnostic accuracy can be further improved through the use of ultrasonography or computed tomography imaging.[4,5] However, these modalities are costly and may not be easily available when they are required. Making arrangements for these diagnostic modalities may lead to further delays in diagnosis and surgery. Several scoring systems have been developed to aid in the diagnosis of acute appendicitis. The Alvarado score and the modified Alvarado score are the two most commonly used scoring systems. The sensitivity and specificity for the Alvarado and the modified Alvarado scores range from 53 - 88% and 75 - 80%, respectively.[6]

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 a population with a completely different ethnic origin and diet. Therefore, a new scoring system was developed for the South-East Asian population with

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the name of "RIPASA score" which was claimed to have sensitivity and specificity of 88 and 67% respectively.[7]

The objective of this study was to determine the usefulness of RIPASA score for the diagnosis of acute appendicitis using histopathology as a gold standard.

METHODOLOGY

This was a cross-sectional study carried out at Combined Military Hospital, Kohat, from September 2011 to March 2012. Life time incidence of acute appendicitis is 50%,[1] so anticipated population proportion (p) was 0.5, confidence level was 95% and absolute precision required (d) was 0.08. So calculated sample size was 267. The inclusion criteria were all patients who presented with complaints of pain RIF of less than 7 days duration, while all patients presenting with non-RIF pain, those who had undergone appendectomy and those referred with known cause of abdominal pain were excluded.

After approval from hospital ethical committee, over a period of 6 months, 267 patients were prospectively recruited who came to the surgical department with a chief complaint of abdominal pain less than 7 days fulfilling the inclusion criteria. Informed written consent was taken from the patients. RIPASA score was assessed. The 15 parameters and the scores generated were age (less than 40 years =1 point); greater than 40 years = 0.5 point), gender (male = 1 point; female = 0.5 point), Right Iliac Fossa (RIF) pain (0.5 point), migration of pain to RIF (0.5 point), nausea and vomiting (1 point), anorexia (1 point), duration of symptoms (less than 48 hours = 1 point; more than 48 hours = 0.5 point), RIF tenderness (1 point), guarding (2 points), rebound tenderness (1 point), Rovsing's sign (2 points), fever (1 point), raised white cell count (1 point), negative urinalysis (1 point) and foreign national registration identity card (1 point). The optimal cut-off threshold score from the ROC was 7.5. The elements of the score were recorded in each patient on admission by postgraduate trainees, but the sum was calculated later and the score played no role in the management of the patient. The diagnosis of appendicitis was made by trainees and consultants clinically and with the aid of routine sonography of abdomen. After appendicectomies, resected appendix was sent for histopathological examination by consultant pathologist at AFIP/Army Medical College, Pathology Laboratory. All the data collected through the proforma was entered into the Statistical Package for Social Sciences (SPSS) version 13.0 and analyzed through its statistical package.

Mean and standard deviation was used for quantitative data like age while frequency and percentage was calculated for qualitative data like gender. The RIPASA score was applied to each patient's data and 2 x 2 table was used to determine sensitivity, specificity, positive predictive value and negative predictive value as shown in Table I.

RESULTS

A total of 267 patients were included in this study, during the period of 6 months from September 2011 to March 2012. Regarding age distribution, 214 patients (80.1%) were between 11 - 25 years of age, 40 patients (15.0%) were between 26 - 40 years old and 13 patients (4.9%) were 41-55 years. Mean age of the patients was 23.5 ± 9.1 years (Table II).

Out of 267 patients, 156 (58.4%) were male while remaining 111 patients (41.6%) were female. Positive cases of acute appendicitis on histopathology were 152 and RIPASA score diagnosed 155 cases of acute appendicitis. True positive were 147, false positive 8, false negative 5, and true negative 107 (Table II). Sensitivity of RIPASA score was 96.7%, specificity 93.0%, diagnostic accuracy was 95.1%, positive predictive was 94.8% and negative predictive was 95.54%.

Table I: Showing sensitivity, specificity, positive and negative predictive values.

	Histopathology of Appendix	
	Inflamed appendix	Normal appendix
RIPASA score		
≥ 7.5	True Positive (a)	False Positive (b)
≤ 7.0	False Negative (c)	True Negative (d)
Sensitivity	= a / a + c x 100	
Specificity	= d / b + d x 100	
Positive predictive value	= a / a + b x 100	
Negative predictive value	= d / c + d x 100	

Table II: Distribution of cases by age (n=267).

Age (years)	Number	Percentage
11 - 25	214	80.1
26 - 40	40	15.0
41 - 55	13	04.9
Total	267	100.0

Mean ± SD 23.5±9.1

DISCUSSION

Acute appendicitis is one of the most common and challenging surgical emergencies, and can lead to appendiceal perforation and peritonitis, which are concomitant with high mortality and morbidity.[8] Making the decision for a surgical operation based only on the patient's signs and symptoms results in removing normal appendices (negative appendectomy) in 15% to 30% of cases.[9-11] The rational approach is to decrease the negative appendectomy as well as appendiceal rupture rates. A decrease in unnecessary appendectomies should not cause an increase in perforation rates.[12,13]

Ultrasound and clinical scoring systems are very helpful in making the diagnosis. Ultrasound is non-invasive, available and cost-effective, and can accomplish more

than CT scans. However, there is no certainty about its effect on the clinical outcomes of patients, and it is operator dependent. Counting the neutrophils as a parameter of the Alvarado scale is not routine in many laboratories.[14] Computed Tomography (CT) imaging also aids in making a definite diagnosis and have been reported to have high sensitivity (94%) and specificity (95%) for diagnosing acute appendicitis.[15]

Various scoring systems, such as the Alvarado and modified Alvarado scoring system, have been in clinical practice since 1986 to help in clinical decision-making process in achieving an accurate diagnosis of acute appendicitis in the quickest and cheapest way.[16] However, these two scoring systems were developed in the West, and when applied in different environments, such as the Middle East and Asia, the sensitivity and specificity levels achieved were very low.[16,17] A study by Al-Hashemy *et al*. in 2004 using the modified Alvarado scoring system in a Middle Eastern population reported a low sensitivity of 53.8% and a specificity of 80%.[18] Khan *et al*. applied the Alvarado scoring system in an Asian population and achieved a sensitivity and specificity of 59% and 23%, respectively, with a negative appendicectomy rate of 15.6%.[18] The sensitivity of the Alvarado score achieved when applied in an oriental population, at the suggested cut-off threshold of 7.0, was also low at 50.6%, but achieved a high specificity of 94.5%. However, this improved when the cut-off threshold was lowered to 6.0, with a sensitivity and specificity of 88.3% and 94.5%, respectively,[19] suggesting a definite ethnic difference with regard to the Alvarado score.[19]

RIPASA score is a more extensive yet simple additive scoring system consisting of 14 fixed parameters and an additional parameter (NRIC) that is unique to our population setting. All these 15 parameters are easily obtainable from a good clinical history, examination and investigations. In a retrospective study, the RIPASA score has been shown to achieve better sensitivity (88%) and specificity (67%) than the Alvarado score (sensitivity 59%, specificity 23%) in an Asian population.[7] Chong *et al*. in their study compared the RIPASA and Alvarado scores in this patient population who presented with RIF pain and who were suspected of acute appendicitis.[7] The RIPASA score is considerably better than the Alvarado score in terms of correctly diagnosing patients with acute appendicitis (sensitivity and diagnostic accuracy) as well as for those who were negative for acute appendicitis (NPV).[20]

In present study, using the RIPASA score, sensitivity was 96.7%, specificity 93%, diagnostic accuracy 95.1%, positive predictive value 94.8% and negative predictive value 95.54%. The present results are comparable with the study of Chong *et al*.[7] Chong *et al*. reported that 98.0% of patients who actually had acute appendicitis were correctly diagnosed and placed in the high-probability group (RIPASA score > 7.5) and managed appropriately.[20]

The RIPASA score is a useful, rapid diagnostic tool for acute appendicitis, especially in emergency settings, as it requires only the patient's demographics (age, gender and nationality, which are all available on registration), a good clinical history (RIF pain, migration to RIF, anorexia, nausea and vomiting), clinical examination (RIF tenderness, localised guarding, rebound tenderness, Rovsing's sign and fever) and two simple investigations (raised white cell count and negative urinalysis performed at triage, which is defined as an absence of red and white blood cells, bacteria and nitrates). Majority (84%) of patients could be placed correctly into either a high-probability or low-probability of acute appendicitis upon completion of clerking, examination and urinalysis without having to wait for the results of the white cell count. In fact, for this study, only 7% of patients had to wait for a raised white cell count before being classified into a high-probability group.

Thus, in an accident and emergency setting, the casualty officer can make a quick decision upon seeing patients with RIF pain, by referring those with a RIPASA score > 7.5 to the on-call surgical team for admission, while patients with a RIPASA score < 7.0 can either be observed in the unit's day ward or discharged with an early clinical review appointment.

CONCLUSION

RIPASA score at a cut-off total score of 7.5 is a useful tool to diagnose appendicitis. It is non-invasive and gives rapid results. It helps to make a prompt decision in equivocal cases of right iliac fossa pain.

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