



CLINICAL STUDY TO EVALUATE THE RIPASA SCORING SYSTEM IN THE DIAGNOSIS OF ACUTE APPENDICITIS

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<p>Article Info <i>Received 28/10/2015</i> <i>Revised 07/11/2015</i> <i>Accepted 17/12/2015</i></p> <p>Key words: Computed tomography, Radiological modalities, Appendicectomy.</p>	<p>ABSTRACT</p> <p>Acute appendicitis is the most common surgical emergencies encountered by surgeons on-call, with emergency appendicectomy making up one in ten of all emergency abdominal surgeries. A quick and correct diagnosis of acute appendicitis leading to early appendicectomy and avoidance of complications arising from perforation can be difficult at times. Radiological modalities such as computed tomography (CT) imaging further aid in making a definite diagnosis and have been reported to have high sensitivity (94%) and specificity (95%) for diagnosing acute appendicitis. Thus, in most large hospitals, it is routine to request for CT imaging in all patients suspected of acute appendicitis. However, such routine practice will inflate the cost of healthcare substantially. Furthermore, the process of arranging for CT imaging may cause further delay for emergency appendicectomy. A recent study has suggested that such indiscriminate use of CT imaging may lead to the detection of early low-grade appendicitis and unnecessary appendicectomies in a condition that would otherwise have resolved spontaneously with antibiotics therapy. The present study was conducted in an attempt to evaluate the RIPASA score which is a new scoring system for diagnosis of acute appendicitis in patients presented to emergency department and the surgical wards with complaint of right iliac fossa pain.</p>
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INTRODUCTION

The vermiform appendix, recognized as a worm-like narrow extension beginning abruptly during the eighth week of embryologic development as a protuberance off the terminal portion of caecum. During both antenatal and postnatal development, the growth rate of the caecum exceeds that of appendix, so that the appendix displaced medially toward the ileocecal valve. The vermiform appendix is present only in humans, certain anthropoid apes and the wombat [1]. About 7% of people in Western countries have appendicitis at some time during their life, with a peak incidence between 10 and 30 years of age.

The vermiform appendix is considered by most to be a vestigial organ, its importance in surgery result only from its propensity for inflammation, which results in clinical syndrome known as acute appendicitis.

ANATOMY

In humans, the vermiform appendix is a small, finger-sized structure, found at the end of small gut at the iliocaecal junction. The adjective "vermiform" literally means "worm-like" and reflects the narrow, elongated shape of this intestinal appendage. The appendix can vary in length from <1 cm to >30 cm, but most appendices are 6 to 9 cm long, with its outside diameter ranging from 3-8 mm and its lumen ranging from 1-3 mm. Embryologically, appendix is a continuation of caecum arising from its inferior tip.

The base of the appendix is present at the convergence of the taeniae coli on the inferior aspect of cecum. The most common location is retrocecal but within the peritoneal cavity. The varying location of the tip of the



appendix likely explains the myriad of symptoms that are attributable to the inflamed appendix. The appendiceal artery, a branch of the ileocolic artery, supplies the appendix.

PATHOLOGY

Acute appendicitis may occur at any age, although it is relatively rare at the extremes of age. The maximum incidence of the disease occurs in the 2nd decade; thereafter, disease incidence declines with age.

The primary pathogenic event in the majority of patients with acute appendicitis is luminal obstruction. This may result from a variety of causes, which include fecoliths, lymphoid hyperplasia, foreign bodies, parasites, and both primary (carcinoid, adenocarcinoma, Kaposi sarcoma, and lymphoma) and metastatic (colon and breast) tumors.

Once appendiceal obstruction occurs, the continued secretion of mucus results in elevated intraluminal pressure and luminal distension. This stimulates the visceral afferent nerve fibres that enter the spinal cord at thoracic levels T8 through T10, which causes referred epigastric and periumbilical pain. This visceral pain is usually mild & poorly localised in 4-6 hours duration. Anorexia, nausea, and vomiting usually follow as the pathophysiology worsens. Increasing intraluminal pressure eventually exceed capillary perfusion pressure, which leads to venous engorgement, arterial compromise, and tissue ischemia. As the epithelial mucosal barrier becomes compromised, luminal bacteria multiply and invade the appendiceal wall, which causes transmural inflammation. All species of bacteria common to intestinal tract can be found and usually multiple organisms can be isolated eg. - Yersinia species, Adenovirus, Cytomegalovirus, Actinomycosis, Mycobacterium species, Histoplasma species, Schistosoma species, Pinworms, Strongyloides stercoralis.

CLINICAL FEATURES

Patients typically experience the classic migration of pain to the right lower quadrant of the abdomen. This somatic pain is continuous and is more severe than the early visceral pain. The patient often gives a history of similar attacks in the past. The attacks commence at any time, but frequently it occurs in the morning hours awakening the patient from sleep. The classic migration of pain need not occur, and the point of maximal tenderness may be distinct from McBurney's point if the appendix is in an atypical location. Later, a worsening progressive pain along with vomiting, nausea, and anorexia are described by the patient. Usually fever is not present at this stage. This pain increases with the act of coughing (Dunphy sign). With the passage of time, accurate localization of tenderness becomes more difficult as muscular rigidity too becomes evident in addition to tenderness. Tenderness is less marked in retrocecal appendix. Various authors like Bhatnagar [2-

4] have emphasized that pain is a predominant symptom followed by vomiting.

DIAGNOSIS

If the diagnosis is confirmed from the history, physical examination and laboratory studies, taking the patient directly to surgery without imaging is justified. For now the use of imaging modalities in atypical presentation of suspected cases of appendicitis should complement, but not replace, clinical assessment and judgment.

IMAGING STUDIES

Ultrasonography

Ultrasonography (US) is valuable in the diagnosis of suspected cases of appendicitis and is a cost-efficient adjunct to the clinical evaluation. Use of preoperative ultrasonography is associated with overall lower negative appendectomy rate [5].

The inflamed appendix is seen as a blind-ended, aperistaltic, noncompressible, tubular structure that arises from the base of the caecum having a diameter greater than 6 mm. Presence of a fecolith may aid in arriving at a positive diagnosis. Loculated pericecal fluid, phlegmon or abscess, prominent pericecal fat and circumferential loss of the submucosal layer of appendix are associated with appendiceal perforation.

Advantages of sonography include its non-invasiveness, short acquisition time, lack of radiation exposure and potential for diagnosis of other causes of abdominal pain, particularly in the subset of women of childbearing age.

Computerised Tomography

CT is more precise than ultrasonography and more reproducible from hospital to hospital having a diagnostic accuracy rate of 93 to 98%. Abdominal CT has become the most important imaging study in the evaluation of patients with atypical presentations of appendicitis.

Abdominal Radiography

The kidney-urinary-bladder (KUB) view is typically used. Visualization of an appendicolith in a patient with symptoms consistent with appendicitis is highly suggestive of appendicitis, but this occurs in fewer than 10% of cases.

MRI

A single retrospective study assessed the accuracy of MRI in 51 pregnant patients with suspected appendicitis in whom ultrasonography was nondiagnostic. Sensitivity, specificity, positive and negative predictive values, and accuracy for MRI was 100%, 93.6%, 91.4%, 100% and 94.04% respectively.

OTHERS TESTS

Scoring systems



Physical examination, laboratory or radiological, clinical suspicion and experience of surgeon can lead to diagnosis. A number of clinical scores have been developed to decrease the number of negative appendicectomies. In the past, various scoring systems had been described for acute appendicitis and the cited studies are either computer based or retrospective. Scoring systems would appear to be ideal as they are accurate, non-invasive and require no special equipment. Clinical scoring systems are attractive because of their simplicity, however, none has been shown prospectively to improve on the physician's judgment in the subset of patients evaluated for abdominal pain suggestive of appendicitis.

The various scoring systems are: -

The Eskelinen score, The Fenyo-Lindberg score, The Christian scores, The Ohmann score, The Samuel score, The Teicher Cohen score, The Tzanakis score and The Alvarado score, RIPASA Score.(Newer scoring system)

Alvarado score is one such scoring system described by Alvarado in 1986 and has been validated in adult surgical practices and is the simplest of all. It is based on three symptoms, three signs and two laboratory investigations with score of 10 [6].

In the year 1994, Kalan gave a slightly modified version of the original Alvarado score in which the laboratory finding of shift to the left of neutrophil maturation (score 1) was not used. This was done because the test is not routinely available in many of the centers. So a Modified Alvarado Score (MAS) with a total score of nine was used after having excluded the score for the left shift of neutrophil maturation. Presence of a high score was found to be an easy and satisfactory aid to early diagnosis of appendicitis in children and men. However, the false positive rate for appendicitis in women was unacceptably high [7-10].

Morbidity and mortality rates associated with appendicitis increased when perforation ensues. Following perforation, the length of stay in hospital increases, wound infection rates may triple, risk of infertility rises, post-operative intra-abdominal collection develops 15 times more frequently and mortality of appendicitis normally quoted as 1% rises to 5-8%. It is therefore, obvious that the aim of the surgeon must be to prevent perforation at any price. Therefore, a high false positive appendicectomy rate has been regarded as acceptable in the light of the severe complications of sitting on a 'hot appendix' and risking perforation. It appears therefore, that surgeons have created for themselves a surgical security zone which allows them to accept a 15-30% false positive appendicectomy rate.

The **Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA)** score is a new diagnostic scoring system developed for the diagnosis of acute appendicitis and has been shown to have significantly higher sensitivity,

specificity and diagnostic accuracy than that reported for the Alvarado or Modified Alvarado scores, particularly when the latter two scores were applied in an Asian or oriental population. Although the RIPASA score is more extensive than the Alvarado score, it is simple to apply and has several parameters that are absent in the Alvarado score, such as age, gender and duration of symptoms prior to presentation. These parameters have been shown to affect the sensitivity and specificity of the Alvarado and Modified Alvarado scores. The RIPASA score consists of 14 fixed generalised parameters, with an additional parameter that is specific to our local population. We prospectively evaluate the RIPASA score by applying score to patients who presented to our Accident and Emergency (A&E) Department with right iliac fossa (RIF) pain and who were suspected of acute appendicitis.

AIMS AND OBJECTIVES

1. To study different parameters helpful in diagnosis of acute appendicitis.
2. To evaluate the RIPASA scoring system in the diagnosis of acute appendicitis.

MATERIALS AND METHODS

The present study was conducted in General Surgery Department of S.P. Medical College, Bikaner. A hospital based analytic type of observational study September 2013 to February 2014 the desired sample were covered
Sample size was calculated 150 subjects.
Every case falling in inclusive criteria till the sample size completed.
Patient with pain in RIGHT ILIAC FOSSA getting admitted in Department of General Surgery, PBM Hospital, Bikaner.

METHODOLOGY

The study was conducted in the general surgery department of PBM hospital and associated group of hospital, Bikaner. The patient presenting with pain in RIF was included in my study .On admission RIPASA was performed by completion of score sheet shown below. The RIPASA score sheet consists of fourteen parameters and the scores were age (less than 40 years is 1 point; greater than 40 years is 0.5 point), gender (male is 1 point; female is 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 is 1 point; more than 48 hours is 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).

After admission to surgical ward scoring carried out by the admitting surgeon. Scoring were performed at every review at the next morning round, if the patient was



admitted in early hours of morning until a decision was made for either appendectomy or continued conservative treatment. All the data regarding patient admission and discharge dates, data of appendectomy (if performed), name & signature of the confirming surgeon, postoperative complication and radiological investigation used should be record in score sheet. All patients underwent for emergency appendectomy were confirmed by histopathological examination.

Inclusion Criteria

- Patient with right iliac fossa pain.
- Consented for study

Exclusion Criteria

- Those patient who had been admitted previously for other complaints but who subsequently develop right iliac fossa pain during their admission episodes.

Preoperative Workup:

- A standardized history was obtained.
 - Past history for TB, Diabetes, Hypertension, Drug Allergy, Bronchial Asthma and Previous Abdominal or Pelvic Surgery was taken.
 - Personal history with regards to his dietary habits, bowels habits, smoking was taken.
 - RIPASA Scoring were done for every patient in study.
- In our study patients with score 7.5 & more considered positive for RIPASA Score.

- Routine blood investigations, USG, ECG and Chest X-ray were obtained.
 - Appendicetomy was performed in those cases which were positive for RIPASA Score. Then operative findings were confirmed by histopathology.
- Follow Up** - Histopathology report was obtained and compared with RIPASA Score.

Data Collection and Analysis

- The proforma was filled systematically for each patient.
- The data collected was subjected to statistical analysis.

Statistical Analysis

Guidelines for management according to RIPASA Score

Score Interpretation

- < 5 probability of acute appendicitis unlikely
- 5 – 7 low probability
- 7.5 -11.5 high probability
- >12 definite acute appendicitis.

- The data was tabulated, analyzed and the observations and results of the study were discussed for arriving at conclusions regarding the sensitivity, specificity, positive predictive value and negative predictive value of RIPASA Score.

OBSERVATIONS

Table 1. Distribution of Cases according to age group (years) in relation to sex

Age Group (years)	Female		Male		Total	
	No.	%	No.	%	No.	%
≤30	39	58.2	54	65.1	93	62.0
31-45	17	25.4	21	25.3	38	25.3
46-60	8	11.9	8	9.6	16	10.7
>60	3	4.5	0	-	3	2.0
Total	67	100	83	100	150	100
Mean Age	30.49		28.65		29.47	
SD	15.68		11.73		13.62	

According to above table, maximum number of patients were males (83) while maximum patients were in age group ≤30 (n=93). Mean age in females was 30.49±15.68 while mean age in males was 28.65±11.73.

According to RIPASA score, 55.3% was males while 44.7% were females. In our study, inclusion criteria was pain in right iliac fossa, so 100% of our patients were present in pain in right iliac fossa.

Table 2. Distribution of Cases according to Migratory Pain to Right Iliac Fossa

Migratory Pain to Right Iliac Fossa	Points	Frequency	Percent
Absent	0.00	77	51.3
Present	0.50	73	48.7
Total		150	100

Migratory pain to right iliac fossa was present in 73(48.7%) while it was absent in 77(51.3%).



Table 3. Distribution of cases according to Total RIPASA Score group

Total RIPASA Score	Frequency	Percent
5-7	50	33.3
7.5-11.5	71	47.3
>11.5	29	19.3
Total	150	100

Table 15 shows distribution of cases according to total RIPASA score. Out of total 150 patients 50 patients scored 5-7 RIPASA score, 71 patients scored 7.5-11.5 RIPASA score while 29 patients scored >11.5 RIPASA score.

Table 4. Different variables in RIPASA Score

Variable	According to RIPASA Score
True Positive	86
True Negative	48
False Positive	14
False Negative	2
Total	150

In present study, out of total 150 patients, according to RIPASA Score 86 patients had true positive results, 48 patients had true negative results, 14 patients had false positive results while 2 patients had false negative results.

Table 5. Diagnostic Effectivity of RIPASA Score

Diagnostic Effectivity	RIPASA Score (%)
Sensitivity	97.73
Specificity	77.42
Positive Predictive Value	86.00
Negative Predictive Value	96.00

According to diagnostic effectivity of RIPASA Score sensitivity was found in 97.73% of patients, specificity was found in 77.42%, positive predictive value was 86% while negative predictive value was 96%.

Table 6. Negative appendicectomy rate

	Total Cases	%
False Positive	14	13.7
True Positive	86	
False Negative	2	
Total	102	

According to above table 14 patients had false positive results, 86 patients had true positive values while 2 patients had false negative results.

DISCUSSION

The present study was conducted in an attempt to evaluate the RIPASA score new scoring system for the diagnosis of acute appendicitis in patients presented to emergency department and the surgical wards with right iliac fossa pain. Total 150 patients recruited for our study by applying inclusion and exclusion criteria.

This new appendicitis scoring system includes the three parameters mentioned above as well as four other new parameters deemed important in our local settings, including clinical signs of RIF guarding, Rovsing's sign, negative urinalysis and foreign NRIC status.

Guarding and Rovsing's sign are earlier indicators of a local inflammatory process such as acute appendicitis, while rebound tenderness is a much later sign when the peritoneum is involved with peritonism. Negative urinalysis was also included to exclude urinary causes of RIF pain.

The RIPASA scoring system which is more extensive yet simple additive scoring system consists of 14 fixed parameters i.e. sex (male 1.00; female 0.50), age (<39.9 = 1.00; >40 = 0.50, RIF pain (Present 0.5), Migratory pain to right iliac fossa (Present 0.5), Anorexia (present 1), Nausea/vomiting (present 1), Duration of symptoms (<48hrs = 1; ≥48 hrs = 0.50), RIF Tenderness (Present 1), Guarding (Present 2), Rebound tenderness (Present 1), Rovsing's Sign (Present 2), Fever (Present 1), Raised WBC (Present 1) and Negative urinalysis (Present 1). All these 14 parameters were easily obtainable from a good clinical history examination and investigations.

The minimum and maximum total scores achievable with RIPASA scoring system were 2 and 16, respectively. This new appendicitis scoring system is easy and simple to apply as the majority of the parameters can be obtained from a routine history and clinical examination.



Out of 150 patients in our study, 86 patients were true positive according to RIPASA score those had total RIPASA score 7.5 or more then 7.5 and positive appendicitis on HPE, 14 patients were false positive according to RIPASA score, those had total RIPASA score 7.5 or more than 7.5 and negative appendicitis or HPE.

Forty Eight patients were true negative according to RIPASA score those had total RIPASA score <7.5. Two patients were false negative according to RIPASA score those had total RIPASA score <7.5 but appendicitis positive on HPE.

Using the RIPASA score, at the optimal cut-off threshold score of 7.5 for the RIPASA score, the calculated sensitivity and specificity were 97.73% and 77.42% respectively.

This was a definite improvement from the Alvarado Score (sensitivity 50.6-59%; specificity 23.0-94.5%) and modified Alvarado score (sensitivity 53.8% and specificity 80%) when applied to Middle-Eastern Asian or oriental population. The positive predictive value and negative predictive value for RIPASA score were 86% and 96%.

In our study, 48 patients out of 150 were managed conservatively that is consisting 32% while 102 out of 150 were managed by surgical management.

Our study showed that out of 102 surgically managed patients, 88 patients were histopathologically positive for acute appendicitis and 14 patients were histopathologically negative for acute appendicitis.

According to our study, overall negative appendicectomy were 13.7%. This reduction in unnecessary negative appendicectomy would translate to significant healthcare cost saving as well as unnecessary morbidity subjected to the patients. Furthermore, the sensitivity and specificity achieved by the RIPASA score is equivalent to those achieved with CT scan for acute appendicitis. Hence by applying the RIPASA score, the number of costly CT scans performed to exclude acute appendicitis can be reduced.

SUMMARY AND CONCLUSION

This study was conducted in the Department of General Surgery, S.P. Medical College and Associated group of Hospitals, Bikaner during September 2013 to February 2014.

- In present study, maximum number of patients were males (83) while maximum patients were in age group ≤ 30 (n=93). Mean age in females was 30.49 ± 15.68 while mean age in males was 28.65 ± 11.73 .
- In Present study, according to RIPASA score, 55.3% was males while 44.7% were females.
- In all the patients (100%) right iliac fossa pain was present.
- Migratory pain to right iliac fossa was present in 73(48.7%).

- Anorexia was present in 106 patients.
- Nausea/Vomiting was present 117 (78%) of patients
- According to RIPASA score, duration of symptoms >48 hours was found in 48(32%) of patients while remaining 68% cases were in duration of symptoms ≤ 48 hours.
- According to RIPASA, RIF tenderness was present in 121(80.7%) of cases.
- Guarding was present in 82(54.7%) of patients and in 45.3% of cases guarding was not present.
- Rebound Tenderness was present in 72(48%) of cases while it was absent in 52% of patients.
- According to RIPASA score, Rovsing's Sign was present in only 33(22%) of patients.
- Fever was present in 49(32.7%) of patients according to RIPASA Score while 101 patients had no fever.
- Out of total 150 patients, according to RIPASA score 98(65.3%) patients had raised WBC.
- Urinalysis was negative in 118 patients according to RIPASA Score while urinalysis was positive in 32(21.3%) of patients.
- In present study, out of total 150 patients 50 patients scored 5-7 RIPASA Score, 71 patients scored 7.5-11.5 RIPASA Score while 29 patients scored >11.5 RIPASA Score.
- In present study, out of total 150 patients, according to RIPASA Score 86 patients had true positive results, 48 patients had true negative results, 14 patients had false positive results while 2 patients had false negative results.
- According to diagnostic effectivity of RIPASA Score sensitivity was found in 97.73% of patients, specificity was found in 77.42%, positive predictive value was 86.00% while negative predictive value was 96.00%.
- According to our study, overall negative appendicectomy were 13.7%.

We concluded that that RIPASA score is currently a much better diagnostic scoring system for acute appendicitis with significantly higher sensitivity and negative predictive value, particularly in our population setting. 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 terms of healthcare cost savings, the use of RIPASA score may help to reduce unnecessary inpatient admissions and expensive radiological investigations.

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None

CONFLICT OF INTEREST

No interest



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