# EVALUATION OF RIPASA SCORE FOR DIAGNOSIS OF ACUTE APPENDICITIS

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## ABSTRACT

**Objectives:** To determine the effectiveness of the RIPASA score in diagnosing acute appendicitis using per-operative findings as a gold standard.

**Study design:** Descriptive study.

**Setting:** January to August 2017, Accident and Emergency department and Surgical OPDs of HMC, NWGH, LRH, PIMS and NKBMH were recruited for the study.

**Materials and Methods:** The study was conducted on 76 patients that presented with the complaint of pain in the right iliac fossa. RIPASA score was recorded for each patient and the sensitivity, specificity, positive and negative predictive values were then derived for this score.

**Results:** Within a period of three and a half months, 76 patients with a mean age of 26.17 ± 12.80 years were assessed. Out of these, 71 had appendicectomies while the remaining 5 were put on conservative treatment. Taking 7.5 as the cut-off threshold score, a sensitivity of 86.89%, specificity of 57.14%, PPV of 95.24% and an NPV of 30.80% were obtained.

**Conclusion:** The RIPASA score is suitable for diagnosing cases of acute appendicitis in our population and more importantly in helping doctors avoid negative appendicectomies.

**Keywords:** RIPASA score, Acute appendicitis, Per-operative findings.

## INTRODUCTION

Acute appendicitis is one of the most common gastrointestinal emergencies, with a lifetime prevalence rate of one in seven[1]. It is characterized by a sudden, severe pain felt in the right lower abdomen. However, despite the prevalence and severity of the condition, it still eludes diagnosis with its accuracy amounting to only 70%[2]. In children and women of reproductive age, it is even more difficult to diagnose due to other inflammatory or gynecological problems with similar symptoms[3].

The diagnostic accuracy increases with the use of imaging such as CT or ultrasound[4], however these techniques are costly and time consuming and a delay in performing appendicectomy will increase the chances of complications, i.e. sepsis and perforation[5].

Scoring techniques such as The ALVARADO Score were developed in the West to aid in diagnostic accuracy, however, the sensitivity and specificity were relatively low in an Asian population measuring to 58.9% and 85.7% respectively[6].

Hence, the intention behind this research is to study a new score developed in Brunei to assess its effectiveness in diagnosing acute appendicitis in South East Asia.

### *LITERATURE REVIEW*

Various studies have been carried out in South East Asia to test the accuracy of the RIPASA score in diagnosing acute appendicitis. This scoring system was developed by a panel of surgeons in RIPAS (Raja Isteri Pengiran Anak Saleha) hospital, Brunei[7]. The RIPASA score is shown to have a significantly higher diagnostic accuracy, specificity and sensitivity than the Alvarado and Modified Alvarado scoring systems especially when applied to the South East Asian populations[8].

Initially, a retrospective study was carried out when the score was first developed in RIPAS hospital, Brunei. It was done by obtaining medical records from the Department of Surgery of 312 patients who had undergone emergency appendicectomy between October 2006 and May 2008. An optimal cut-off threshold score of 7.5 was derived using the ROC software. A sensitivity of 88.46% and specificity of 66.67% were calculated. The PPV and NPV were 93% and 53%, respectively whereas the diagnostic accuracy was 80.5%. The negative appendicectomy rate significantly decreased from 16.3% to 6.9%[7].

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Then, a prospective study was conducted on 144 consecutive patients of RIPAS Hospital. Out of these 98 underwent emergency appendicectomy with 19 patients negative for acute appendicitis, leading to a negative appendicectomy rate of 19.4%. Using the ROC software, a cut-off threshold of 7.5 was obtained, with a sensitivity of 97.5%, specificity of 81.8%, PPV of 86.5%, NPV of 96.4% and a diagnostic accuracy of 91.8%. A predicted negative appendicectomy rate of 13.5% was derived, showing a 5.9% reduction from the raw data (19.4%), with p= 0.28.[8]

Research conducted in Kerala, India, on 363 patients who presented with RIF pain gave a sensitivity and specificity of 93% and 67%, respectively. Around 13.5% patients had negative appendicectomies, resulting in a statistically significant difference between histologically positive and negative cases ($p<0.001$)[9].

Another study conducted in Meerut (U.P.) on 96 patients. A cut off value of 8.5 was derived using the ROC software as compared to the original cut off value of 7.5. A high sensitivity of 97.80%, specificity of 77.00%, PPV of 98.89%, NPV of 66.67% and an accuracy of 89.04% were calculated. The predictive negative appendicectomy rate was found to be 0.7%. They also observed that with a RIPASA score ≥12, the possibility of finding a gangrenous appendix was high.[10]

A similar study conducted in Maharashtra, India showed that 87 out of the 100 patients included in the study underwent emergency appendicectomy. A cut-off threshold value of 7.25 was derived using the ROC software, which yielded a sensitivity of 82.61%, specificity of 88.89%, PPV of 96.61%, NPV of 57.14% and a diagnostic accuracy of 83.91%. The predicted negative appendicectomy rate, using the RIPASA score, turned out to be 17.39%, which is a 2.01% reduction from the observed rate of 19.4%[11].

The scoring system was further evaluated in Rajasthan, India in 2014 on 150 patients. 102 out of these underwent surgery with 13.7% patients being negative for appendicitis histopathologically. The sensitivity was found to be 97.73%, specificity 77.42%, PPV 86.00% and NPV 96.00%[12].

Recently, a study was conducted on 100 patients in India, with RIF pain. The sensitivity was 92.22%, specificity 90%, PPV 98.8% and NPV 56.25%. They also found a strong relationship between the RIPASA score and acute appendicitis using the Chi square tests as they obtained statistically significant values ($p=0.001$)[13].

A cross-sectional study was conducted in Combined Military Hospital, Kohat, Pakistan in 2012 on a total of 267 patients. There were only 8 false positive cases. Using the ROC software, a cut-off threshold of 7.5 was obtained. The sensitivity was 96.7%, specificity 93.0%, PPV 94.8%, NPV 95.54% and a diagnostic accuracy of 95.1%[14].

## OBJECTIVES

To test the accuracy of the RIPASA Scoring System in local population.

To determine the sensitivity and specificity of this system in our population so as to prevent unnecessary expensive radiological investigations as well as to avoid negative appendicectomies.

## METHODOLOGY

**Setting:** The cross-sectional study was performed on patients presenting to the emergency and out-patient departments of Surgery, at Hayatabad Medical Complex (HMC), Lady Reading Hospital (LRH), Northwest General Hospital (NWGH), Peshawar Institute of Medical Sciences (PIMS) and Naseerullah Khan Babar Memorial Hospital (NKBMH), Peshawar. Duration of study was from January 2017 to August 2017.

**Sample Size:** 76 patients through convenient sampling.

**Inclusion criteria**: Patients of all age groups presenting with right iliac fossa pain of less than 7 days duration.

**Exclusion criteria:** patients with non-RIF pain, appendicular mass and/or lump, generalized peritonitis, patients who have undergone appendicectomy, or patients referred with known cause of abdominal pain.

**Data Collection Procedure:** Data was obtained using the standardized scale on demographic data, symptoms, signs, and investigations like raised white cell count and Negative urinalysis

**Data Analysis Plan:** Data was analyzed using the SPSS version 20.0.

## RESULTS

Of the 76 patients, 63.2% were male and 36.8% were female. Of these patients 86.84% had age less than 40 years and the remaining were above 40 years of age, with a mean age of 26.30 + 12.79 years.

Also, 47 patients (61.8%) presented within 48 hours of onset of symptoms of acute appendicitis and the remaining 38.2% presented after 48 hours of onset of symptoms (Figure 1).

Out of the 76 patients, 71(93.4%) patients underwent emergency appendicectomy while 5 patients were managed conservatively. Out of the former, 69 (97.2%) had acute appendicitis confirmed upon gross examination by the surgeon postoperatively, in whom three had a gangrenous appendix, four had a nearly perforated appendix and six had a gangrenous perforated appendix. The remaining two patients had normal appendices, indicating a negative appendicectomy rate of 2.82% (figure 2).

Four types of clinical cases were encountered and were made use of in the 2x2 table. True positive

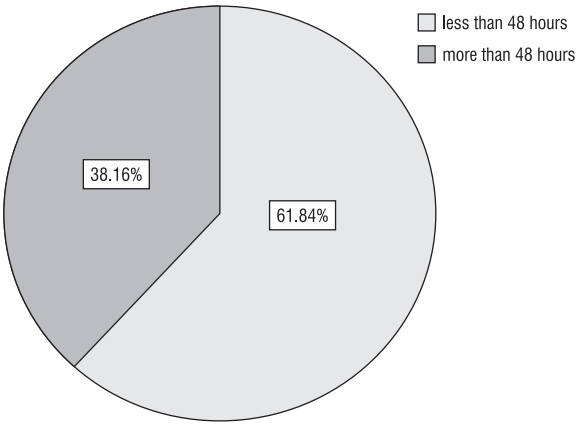


Figure 1: Distribution of Duration of symptoms

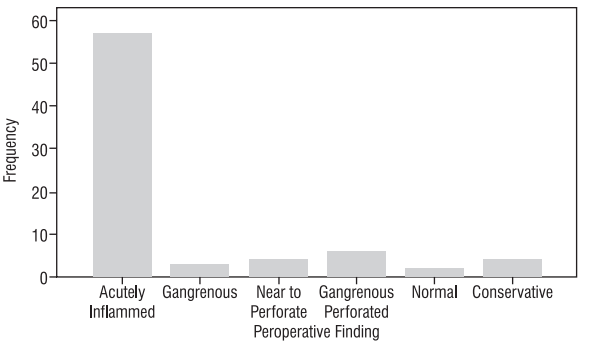


Figure 2: Per-operative findings

**Table 1: 2x2 table**

| RIPASA Score | Per-operative findings | |
|---|---|---|
| | **Diseased Appendix** | **Normal Appendix** |
| >7.5 | True Positive (60) | False Positive (3) |
| <7.5 | False Negative (9) | True Negative (4) |

cases represented patients with a score above 7.5 and having a diseased appendix. True negative cases were patients who had a score less than 7.5 and had a normal appendix. False positive cases included patients with a score greater than 7.5 but were negative for acute appendicitis. False negative were those patients who had a score less than 7.5 but had a diseased appendix.

The sensitivity of the RIPASA score was found to be 86.96%, specificity 57.14%, positive predictive value 95.24% and the negative predictive value 30.80% using the 2x2 table as shown in Table 1. The mean value of the RIPASA Score in these 71 cases was 9.947 with a standard deviation of ± 2.4119. This value is significantly greater than the diagnostic value 7.5. The p value was 0.001 i.e. it was statistically significant suggesting that in all cases of acute appendicitis, at least 7.5 out of 12 parameters were consistently positive, suggesting a strong relationship between RIPASA Scoring and acute appendicitis.

## DISCUSSION

This pilot study yielded a specificity and sensitivity of 57.14% and 86.96% respectively, taking 7.5 as the cut-off threshold score. The RIPASA score is inclusive of 15 parameters. It consists of variables that have not been included in previous scoring systems such as the Alvarado score, i.e.: age, sex, duration of symptoms, Rovsing's sign, right iliac fossa guarding and results of urinalysis.

With regards to the first three variables, clinically suspected cases were 76, out of which 66(86.8%) were <40years and 10(13.2%) were >40 years. There were 48(63.2%) males and 28(36.8%) females. The duration of symptoms in the majority of patients i.e. 47(61.8%) were <48hours while the remaining 29(38.2%) were >48hours.That sums up why a score of 1 is appointed to the age group of <40years and a score of 0.5 is appointed to age group of >40 years, male patients being appointed a score of 1 while female patients receive a score of 0.5 and a score of 1 was appointed to patients with duration of symptoms <48hours while a score of 0.5 to those with duration of symptoms >48hours.

Rovsing's sign and Guarding sign were included as surgeons felt that these were earlier manifestations of acute appendicitis cases while rebound tenderness, which is included in both Alvarado and RIPASA scores, is a much later sign[7]. Results of urinalysis are included to rule out ureteric causes of RIF tenderness.

With respect to demographic data, our study is comparable to the studies by Chong et al and Singh et al[7,9]. The age groups of patients less than and greater than 40 years are 86.94% and 13.16% respectively in our study. For Chong et al, it is 84.3% and 15.7% and for Singh et al, it is 89.0% and 11.0% respectively. As for the male:female ratio, all the studies have more or less an equal ratio except for Chong et al (0.75:1), Marwah et al (2.84:1) and Singh et al (2.34:1) compared to our ratio of 1.7:1.

Our findings are also similar to the study conducted in Rajasthan, in which they found that the most common clinical parameters in the patients with appendicitis were right iliac fossa tenderness (80.7%), anorexia (70.7%) and nausea and vomiting (78.0%) [(12)].

Using the Alvarado scoring system, Khan et al achieved a low sensitivity and specificity of 59% and 23%, respectively, with a negative appendicectomy rate of 15.6% in the Asian population[15].

The specificity and sensitivity of the RIPASA score as calculated by Chong et al. is 67% and 88%, respectively[7]. Similarly, a study conducted by Butt MQ et al. showed a specificity and sensitivity of 93% and 96.7% respectively[14]. The marked difference between their and our results is attributed to several factors:

Previously conducted studies made use of postoperative histo-pathological findings as their gold standard, as this is the most accurate method for assessing appendix inflammation. We made use of gross, postoperative findings due to lack of funds. We took 7.5 as a standard cut-off threshold of the score from previously conducted studies but could not calculate the threshold that differentiates between a positive and negative appendicitis case due to limitations in purchasing the ROC software used for calculating the threshold score value.

The small number of patients observed via convenient sampling due to time constraint, was subject to errors.

## CONCLUSION

It was observed that RIPASA score is a more accurate tool for diagnosing acute appendicitis in our population as it's based on a complete history, clinical examination and two simple investigations. Hence, it can aid in a quick and cost-effective management of the patient and help avoid unnecessary appendectomies. Further studies on the effectiveness of the RIPASA score in our population will help establish a firmer conclusion.

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