

# RIPASA Scores; a Reliable Score for Diagnosis of Acute Appendicitis

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## ABSTRACT

**OBJECTIVE:** To establish the diagnostic precision of the RIPASA score for Acute Appendicitis taking histopathology as a gold standard.

**METHODOLOGY:** Cross-Sectional Study using non-probability consecutive sampling including 484 patients of both gender with migratory abdominal pain to right iliac fossa < 7 days, Fever  $\geq 101^{\circ}\text{F}$ , and WBC  $> 10000\text{mm}^3$ . This study was carried out at General Surgery Department, Jinnah Postgraduate Medical Centre Karachi, from May 2017 to February 2018. Patients with ASA scores III-VI, gangrenous appendicitis, peritonitis, and pregnant women were excluded. RIPASA score was assessed on admission, score summated, and had no effects on management. A score  $> 7.5$  was considered positive for acute appendicitis. The diagnosis was made clinically and with the help of abdominal sonography. Postoperatively specimens were sent for histopathology; results were noted, and diagnostic accuracy was recorded. SPSS version 22 was used to analyze the data.

**RESULTS:** The age range was 20 to 50 years with a mean of  $33.892 \pm 7.36$  years, mean duration of complaint was  $3.161 \pm 1.16$  days, and mean weight was  $79.402 \pm 8.42$  Kg. The majority of patients were males (68.4%). Ripasa score  $> 7.5$  diagnosed 78(16.1%) and 83(17.1%) confirmed by histopathology. Ripasa score  $> 7.5$  had 83.1% sensitivity, 97.8% specificity and diagnostic accuracy 95%, PPV 88.46%, NPV 96.55%, Likelihood positive and negative ratio 37.04 and 0.172 respectively. Ripasa score of 6.5 had a sensitivity of 85.5% and specificity of 94.3%, as shown by the ROC curve and its coordinates.

**CONCLUSION:** RIPASA is a manageable and comprehensive scoring system with high sensitivity and specificity for diagnosing acute appendicitis.

**KEYWORDS:** Acute appendicitis, RIPASA, Diagnostic accuracy, Right Iliac fossa's pain, ROC (Receiver Operating Characteristic), Reliable score.

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## INTRODUCTION

The appendix is reviewed as a vestigial organ and is surgically highlighted due to its propensity for inflammation, which results in acute appendicitis<sup>1</sup>. Therefore, it remained the highly prevalent cause of acute abdomen and appendectomy among the standard surgical intervention worldwide. Lifetime risk in the population is about six percent, 8.6% in males and 6.7% in females<sup>2</sup>. Acute appendicitis was diagnosed clinically with blood tests showing raised leucocytes with a left shift. Despite being prevalent, it remained an onerous conclusion, specifically in adolescent, elderly and reproductive women, like urinary tract issues and pelvic pathology can mock acute appendicitis<sup>3</sup>.

Furthermore, different anatomical positions of the appendix may lead to diverse and more complex clinical pictures each time<sup>4</sup>. A slowdown in undergoing an appendectomy to enhance its diagnostic correctness increases the probability of complications

and upturns morbidity and mortality<sup>5</sup>. In contrast, with low diagnostic accuracy, the negative and gratuitous appendectomy rate is exacerbated (20-40%)<sup>6</sup>. The high price the patients and the health care facilities paid after negative appendectomies and significant post-operative issues were also reported<sup>7</sup>. However, the diagnostic techniques are high-priced and may not be readily obtainable when required. This may lead to a further delay for confirmation of diagnosis and eventually slowdown of surgery<sup>8</sup>. Many algorithms evolved to assist in diagnosing acute appendicitis. Amongst them, Alvarado and the modified Alvarado score are the customary ones.

There is limited data on this topic in our general population, and the results from past literature cannot be generalized to all people. Therefore I have planned to get more evidence on this subject in our local population by determining the effectiveness of the RIPASA score for Acute Appendicitis by picking histopathology as the benchmark. Our research will pave the way for our doctor community to consider the RIPASA score for Diagnosis of Acute Appendicitis and plan further review.

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**METHODOLOGY**

This Cross-Sectional Study was conducted in General Surgery Unit, Jinnah Postgraduate Medical Centre Karachi, from May 2017 to February 2018. WHO sample size calculator used for calculation: Sensitivity = 88.46%, Specificity = 66.67%, Prevalence = 6%, Precision level for sensitivity=12%, Precision level for specificity=12% and sample size (n) =484. Data was collected by Non-probability consecutive sampling, including patients between 12-50 years of age, of both genders, lower abdominal migratory pain to the right iliac fossa of < 7 days, fever ≥101°F, and WBC >10000mm<sup>3</sup>. Patients with ASA scores III-VI, gangrenous appendicitis, peritonitis, and pregnant women were excluded. Approval from the ethical review committee of the institute was taken, and informed consent was obtained. Basic demographics like age, duration of complaint, and weight were noted. RIPASA score was assessed for all patients. The trainee fellow noted the scorecard component on the presentation, which was not used for the management plangate, was summed up later on. More than a 7.5 score was contemplated significant. The conclusion of appendicitis was prepared clinically, and a pelvis ultrasound was also used. After appendectomies, specimens were sent for histopathological Evaluation. The histopathology and RIPASA score were noted, and diagnostic accuracy was recorded per the operational definition in the especially designed proforma. IBM-SPSS V.22 was used for DATA entry and analysis. For qualitative variables, frequency and percentage, whereas mean ± standard deviation was calculated for quantitative variables. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic precision for RIPASA score contradicting histopathology were calculated using the 2X2 model. ROC (Receiver Operating Characteristic) and likelihood ratio was also calculated. Stratification is used for effect modifiers like age, gender, weight, and complaint duration. Post-stratification using diagnostic accuracy was calculated, and p ≤0.05 was measured as statistically noteworthy.

**RESULTS**

In between 20 to 50 years age group, with a mean of 33.892±7.36 years, the mean duration of complaints was 3.161±1.16 days, and the mean weight was 79.402±8.42 Kg. The majority of patients were males, i.e., 68.4%. Ripasa score > 7.5 diagnosed 78(16.1%), and histopathology diagnosed 83(17.1%) patients having appendicitis. Ripasa score > 7.5 had shown a sensitivity of 83.1%, specificity of 97.8%, the diagnostic accuracy of 95%, PPV 88.46%, NPV 96.55%, Likelihood positive ratio of 37.04. In contrast, the negative ratio was 0.172 in

detecting appendicitis **Table I.**

A cut-off level of Ripasa scores of 6.5 had shown a sensitivity of 85.5% and specificity of 94.3%, as shown by ROC (Receiver Operating Characteristic) curve and its coordinates as shown in Graph-I. Stratification concerning the duration of complaints of Ripasa score > 7.5 versus histopathology is shown in **Table IIa & IIb**, respectively.

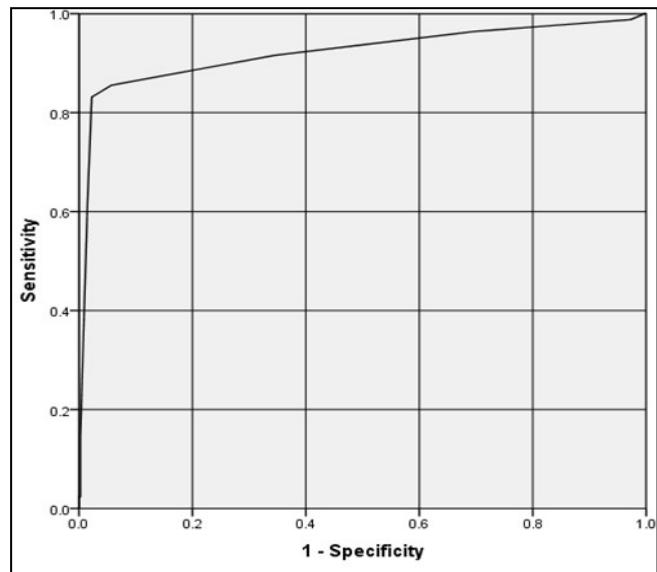
**TABLE I: RIPASA SCORE VERSUS HISTOPATHOLOGY FOR ACUTE APPENDICITIS**

Ripasa Score	Histopathology		Total
	Positive	Negative	
Positive	69 (TP)	9 (FP)	78
Negative	14 (FN)	392 (TN)	406
<b>Total</b>	<b>83</b>	<b>401</b>	<b>484</b>

Chi square = 332.82

P value = 0.000

**GRAPH I: ROC CURVE**



**Sensitivity: 83.1%**

**Specificity: 97.8%**

**Diagnostic Accuracy: 95%**

**PPV: 88.46%**

**NPV: 96.55%**

**Likelihood Ratio positive = 37.04**

**Likelihood Ratio negative = 0.172**

**COORDINATES OF THE CURVE**

Ripasa Score	Sensitivity	1 – Specificity
1.0000	1.000	1.000
2.5000	1.000	.998
3.5000	.988	.973
4.5000	.964	.696

5.5000	.916	.344
6.5000	.855	.057
7.5000	.831	.022
8.5000	.614	.015
9.5000	.145	.002
10.5000	.108	.002
11.5000	.024	.002
12.5000	.024	.000
13.5000	.012	.000

**TABLE IIa: STRATIFICATION CONCERNING THE DURATION OF COMPLAINTS (1-3 DAYS) OF RIPASA SCORE VERSUS HISTOPATHOLOGY (n=313)**

Ripasa score	Histopathology		Total	P-value
	Positive	Negative		
Positive	54 (TP)	56 (FP)	110	0.833
Negative	259 (FN)	257 (TN)	516	
<b>Total</b>	<b>313</b>	<b>313</b>	<b>626</b>	

**Sensitivity:** 17.3%

**Specificity:** 82.1%

**DA=50%**

**PPV=49.6%**

**NPV=49.8%**

**LR+= 0.96**

**LR-=1.00**

**TABLE IIb: STRATIFICATION CONCERNING THE DURATION OF COMPLAINTS (4-6 DAYS) OF RIPASA SCORE VERSUS HISTOPATHOLOGY (n=171)**

Ripasa score	Histopathology		Total	P-value
	Positive	Negative		
Positive	24 (TP)	27 (FP)	51	0.648
Negative	147 (FN)	144 (TN)	291	
<b>Total</b>	<b>171</b>	<b>171</b>	<b>342</b>	

**Key:**

**Sensitivity:** 14%

**Specificity:** 84.2%

**DA=49%**

**PPV=47.05%**

**NPV=49.4%**

**LR+= 0.88**

**LR-=1.02**

**DISCUSSION**

Acute appendicitis is the most frequent cause of acute abdomen and has a lifetime threat of about seven percent. The symptoms overlap and mimic many other illnesses, making diagnosis more difficult, especially in

the initial stage. If admission takes place, specific imaging is needed before moving for an appendectomy<sup>9</sup>. Exceptional imaging like CT scan has significant sensitivity (94%) and specificity (95%) for displaying appendicitis<sup>10</sup>. Carrying out imaging (CT scan) is usual in tertiary setups especially suspecting appendicitis in the elderly<sup>11</sup>. Although such execution can be excessive and overstretched, it thus far encumbered the national healthcare system.

On top of that, requesting a CT scan further delays emergency appendectomy. Recent literature documented that the promiscuous use of CT scans can pick up early appendicitis. These patients may then be put through a superfluous appendectomy, in a condition that can be treated with antibiotics therapy<sup>12</sup>. Algorithms like Alvarado and its Modified version succor clinicians' in establishing a diagnosis in an agile and economical way; they can also recommend surgeons for an emergency appendectomy or conservative management<sup>13,14</sup>. The "Raja Isteri Pengiran Anak Saleha Appendicitis" (RIPASA) score is a straightforward calculation of fourteen variables (two demographics, five clinical symptoms, five clinical signs, and two clinical investigations) and one supplementary variable (foreign ID). The RIPASA score manifested 88.46% sensitivity, 66.67% specificity, and diagnostic accuracy of 81%<sup>15, 16</sup>.

RIPASA score was commenced due to low sensitivity (53-88%) and specificity (75-80%) of Alvarado and the Modified Alvarado<sup>17</sup>.

In one of the studies, the RIPASA score appropriately categorized ninety-seven percent of patients with histology-proven acute appendicitis to the highly suspected group (>7.5) and eighty-one percent of negative appendicitis with less suspicion group (<7.5). A small percent of 9.7 patients were in the indeterminate group, in whom abdominal ultrasound was needed<sup>17</sup>. These outcomes outperform the Alvarado and the Modified Alvarado scoring system when applied to a comparable population<sup>18-21</sup>.

'Appendicitis inflammatory response score' by Anderson et al. in 2008, with a sensitivity of ninety-six percent and a specificity of seventy-three percent if the score is >4 or sensitivity of 37% and specificity of 99% at >8 score<sup>22, 23</sup>. In the Appendicitis inflammatory response score, a significant number of thirty-seven percent were in the indeterminate group, compared with 9.7% for the RIPASA score (p<0.0001)<sup>22, 23</sup>. Furthermore, the RIPASA score's sensitivity and specificity are comparable to those attained with specialized imaging for appendicitis<sup>23</sup>. Therefore, the applicability of the RIPASA score reduces the number of radiological imaging for diagnosing appendicitis in the indeterminate group (9.7%).

A score from 7.5 and 12, especially in females, needs additional imaging, such as pelvis U/S to omit pelvic pathologies because of the high prevalence of females in the false-positive group (75%)<sup>24, 25</sup>. The

RIPASA score is a straightforward and undemanding scoring system amongst 14 clinical parameters; many of them can be retrieved from a decent history and examination. Including a urine dip that can be effortlessly executed. Therefore, a swift method and a quick diagnosis can be made with a score of >7.5. It has an additional and rare parameter of overseas nationality. Even though the RIPASA score was explicitly for residents, the fourteen clinical parameters can apply to all populations. The other parameter of foreign NRIC can be counted for nations with considerable overseas workers. In short, the RIPASA score is an uncomplicated scoring system comprising fourteen clinical parameters estimated from well-taken history and well-performed clinical exam, with significant sensitivity and specificity for diagnosing acute appendicitis<sup>26</sup>. RIPASA Score Management guidelines, showing a score of <5.0 in that case probability of acute appendicitis is doubtful, the patient needs observation and then revise the score after an hour or proceed for imaging, if decreasing score, can send home and follow up in the outpatient department. In contrast, managing as per score if it's raised, a score of 7.5-11.5 has high suspicion and needs a review of the on-duty surgeon, also repeat score in 1 to 2 hours. Subsequently, it remained high and required surgical intervention, but women underwent pelvic ultrasound to exclude any gynecological issues. A score of >12 can be suspected as definitive appendicitis, referring to a surgeon for appendectomy, keeping NPO and appropriate antibiotic.

## CONCLUSION

RIPASA is a straightforward and effortless method with favorable sensitivity and specificity for diagnosing appendicitis. Balanced patient history and examination will be able to assess all the 14 clinical parameters. Therefore quick conclusion on the management can be constructed. Even though this score came about for our indigenous population, but can be applied to all regions.

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**Data Sharing Statement:** The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## AUTHOR CONTRIBUTIONS

Magsi AM: Conception, Study design

Malik M: Manuscript drafting, data analysis

Khan MI: Literature review and final review of manuscript

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