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Diagnostic Accuracy of RIPASA Score in Acute Appendicitis

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Abstract

Background: Acute appendicitis is the most frequent cause of surgical emergencies, yet it can be challenging to diagnose since it can be mistaken for a number of inflammatory illnesses. Different scoring systems have been in use to improve the diagnostic accuracy. One such scoring system is RIPASA score which was formulated in 2010. The aim of our study is to check the diagnostic accuracy of the RIPASA score.

Methods: The study was carried out in the Department of General Surgery, District Hospital Palakkad from May 2020 to April 2021. Appendicectomy was done based on the surgeon's judgement and not influenced by scores, the specimen was then sent for histopathological analysis.

Results: Of the 80 patients who had surgery for acute appendicitis, 18 (21.3%) had a negative histology report, 63 (78.8%) had a positive report, and 52 (65%) were male and 28 (35%) were female. At a cut-off value of 7, the RIPASA score's sensitivity was 85.7%, its specificity was 47.1%, its positive predictive value was 85%, and its negative predictive value was 47%.

Conclusion: A higher sensitivity, PPV and a lower NPV indicate that the RIPASA score is a much better diagnostic tool than the Alvarado and Modified Alvarado scoring systems for the diagnosis of Acute appendicitis in Indian people, as it provides a structured way to collect patient data and a more coherent and comprehensive preoperative evaluation and can be applied as an adjunct to clinical judgment

Keywords: Acute Appendicitis, Right Iliac Fossa pain, RIPASA Score, Indian Population

Introduction

Acute appendicitis is one of the common surgical emergencies encountered by surgeons and emergency appendicectomy. Diagnosing acute appendicitis is based on signs & symptoms whose interpretation is usually subjective (anorexia) and varied (pain perception & referral or migration) and therefore the diagnosis of appendicitis has continuously been a challenge to the surgeons. Radiological modalities like Computed Tomography (CT) imaging aid more in making a definite diagnosis and are reported to own high sensitivity (94%) and specificity (95%) for diagnosing acute appendicitis4. A recent study has suggested that such indiscriminate use of CT imaging might result in detection of early low-grade appendicitis & unnecessary appendectomies in a very condition that might otherwise have resolved spontaneously with antibiotic therapy [1] and also the patient will have unwanted radiation exposure. Furthermore, the process of arranging for CT imaging might cause more delay for emergency

appendicectomy. That's the reason, the diagnosis of acute appendicitis still depends on clinical judgment. Several scoring systems aid in the diagnosis of acute appendicitis RIPASA (Raja Isteri Pengiran Anak Saleha Appendicitis) score10 was introduced in the year 2009-2010 which is a qualitative scoring system based on 14 fixed parameters (2 demographics, 5 clinical symptoms, 5 clinical signs and 2 clinical investigations) [2]. All these are easily obtained from history, clinical examinations & simple investigations. The optimal cut-off threshold score is 7.5. The reported literature suggests the sensitivity of 97.5%, specificity of 81.8%, PPV of 86.5%, NPV of 96.4% and diagnostic accuracy of 91.8% in the diagnosis of acute appendicitis [2]. This study is an endeavour to cast light upon the RIPASA score by applying them to the rural population attending a secondary care hospital in northern Kerala with pain in the right iliac fossa that may indicate acute appendicitis.

Materials and methods

This study is based on data collected from 80 patients who visited the Department of General Surgery and emergency department in District Hospital Palakkad for approximately one year from May 2020 to April2021. Informed consent was obtained from patients or their relatives prior to the study. Ethical committee clearance for the protocol was obtained from Jubilee Mission Hospital, Thrissur.

Inclusion Criteria: The study included patients of either sex who are aged between 5 years and 60yrs presenting with Right Iliac Fossa (RIF) pain, suggestive of acute appendicitis

Exclusion criteria: Patients with generalized peritonitis, obvious appendicular mass, Gynecological & urological diseases on clinical ground were excluded from the study

Study Tool: A semi-structured questionnaire was used to collect data from patients.

Methodology:

During the period of study, we screened 80 patients with RIF pain and this data was used for finding out the diagnostic accuracy, specificity and sensitivity of RIPASA scoring system. The data collection includes –The patients' demographics (age and gender), the presenting symptoms (RIF pain, the migration of pain to the RIF, nausea and vomiting, anorexia and the duration of symptoms), Clinical signs (RIF tenderness, guarding, rebound tenderness, Rovsing sign and fever) and Laboratory investigations (elevated white cell count and negative urinalysis). The probability of each parameter is calculated and scores of 0.5, 1.0 or 2.0 points are allocated to each parameter based on its probability, with extra weight-age provided to two clinical signs: guarding and Rovsing sign. Confirmation of acute appendicitis as the final diagnosis was obtained from a histological analysis of the resected appendix at the Department of Histopathology at IIMS, Palakkad.

Data Entry and Statistical Analysis: All variables were documented in the study proforma. Data entry and analysis was done using Statistical Package for Social Sciences (SPSS) software version 23. To find the cut off value of each score Receiver Operator curve test is used.

Results

The age of the study subjects ranged from 5 to 60 years. Out of the total of study subjects, those in the age less than 40 age group formed the highest of 88% followed by age group more than 40 forming 13%. The age distribution of participants is given in [Figure-1]. Out of the total 80study subjects 65 % (52) were males and 35% (28) were females. The male female ratio is 1.84:1. Among 80 patients, 29 had both RIF

pain and migration of pain, 21 had RIF pain, anorexia and migration of pain. About 20 patients had all symptoms of acute appendicitis. The distribution of symptoms in participants is given in [Figure- 2,3].

Figure-1: Age distribution of participants

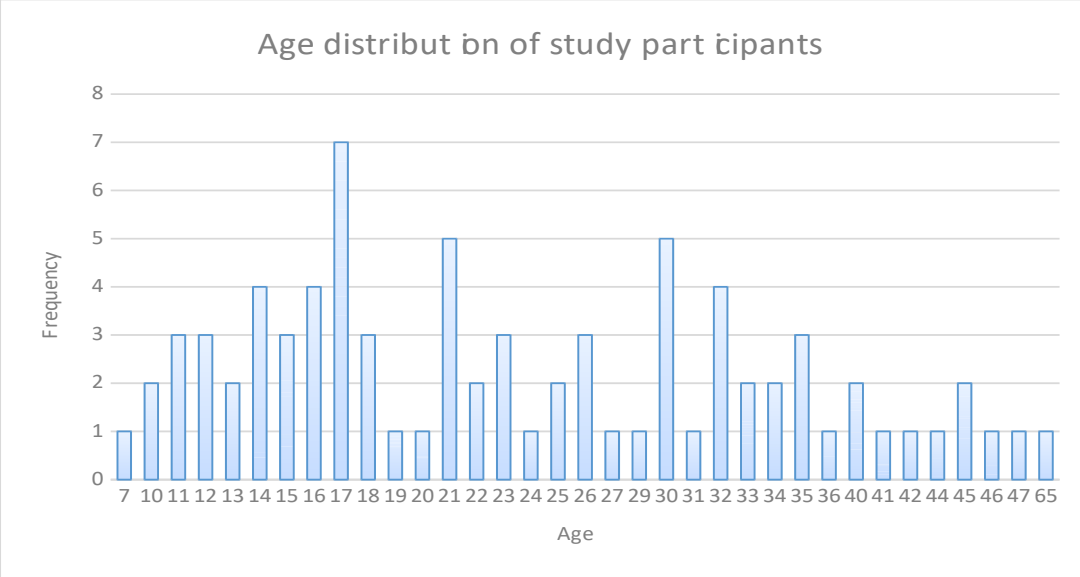
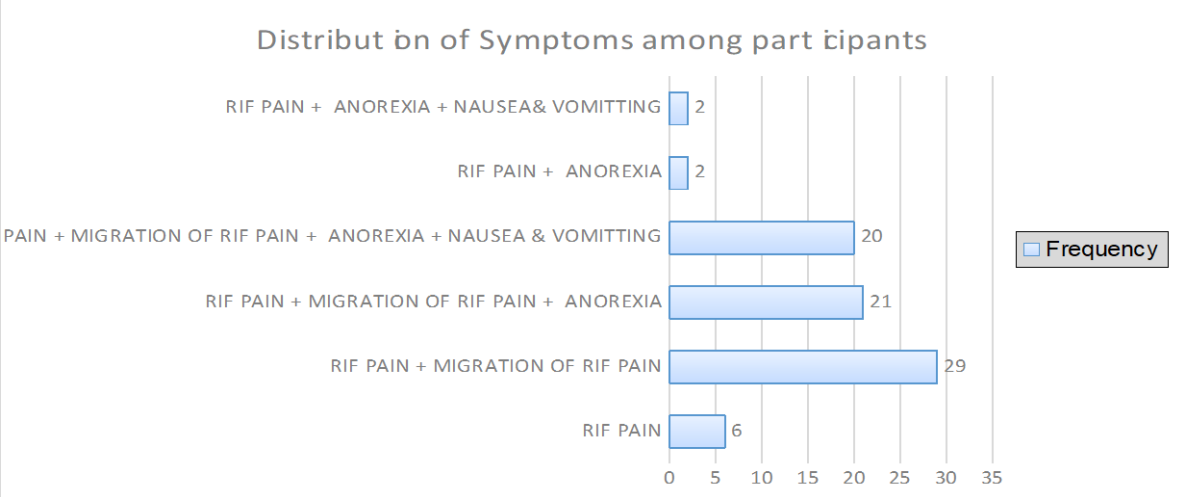


Figure-2: Distribution of symptoms



Most common sign elicited was RIF tenderness, seen in 80 (100%), followed by rebound tenderness in 73 (91.3%), fever in 41(51.3%), guarding in 20 (25%) and Rovsing sign in 19(23.8%). Out of 80 subjects, 33 had RIF and rebound tenderness, 21 had RIF, rebound tenderness with fever. In19 patients, all signs of acute appendicitis could be elicited. The distribution of signs is given in [Figure-3]

Figure-3: Distribution of signs

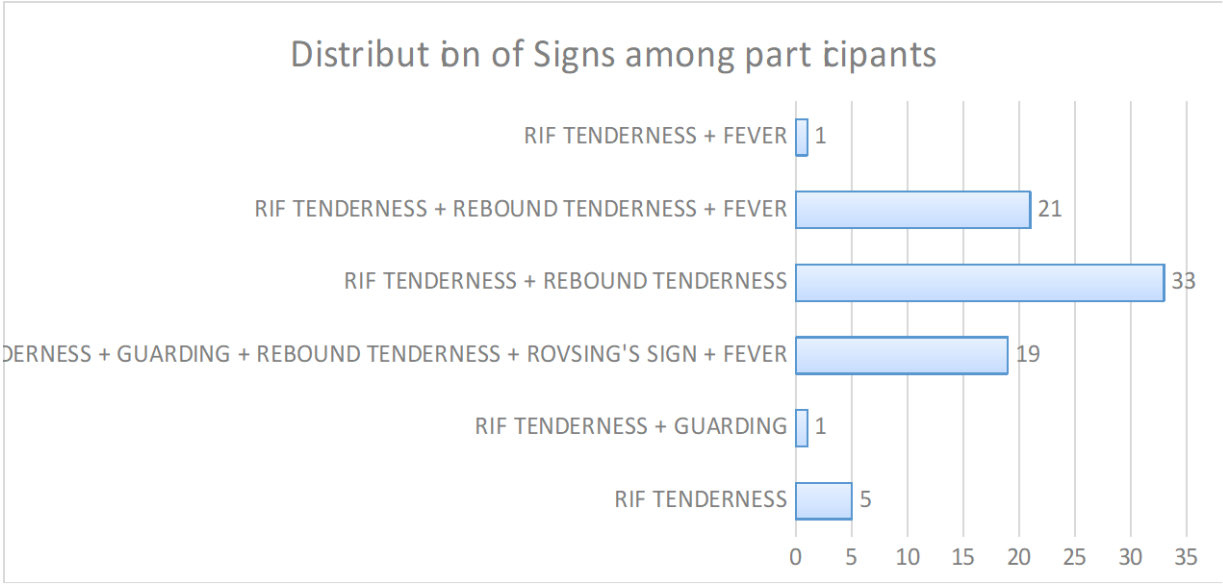


Table-1: RIPASA score

Patient characteristics	Score
Gender	
Female	0.5
Male	1.0
Age	
<40 years	1.0
>40 years	0.5
Symptoms	
RIF pain	0.5
Pain migration to RIF	0.5
Anorexia	1.0
Nausea and vomiting	1.0
Duration of symptoms	
<48 h	1.0
>48 h	0.5
Signs	
RIF tenderness	1.0
Guarding	2.0
Rebound tenderness	1.0
Rovsing's Sign	2.0
Fever >37 C, <39 C	1.0
Investigations	
Raised WCC	1.0
Negative urinalysis	1.0
Total	16.5

WCC: White cell count, RIPASA: Raja Isteri Pengiran Anak Saleha Appendicitis, RIF: Right iliac fossa

In our study the sensitivity and specificity of RIPASA score at cut off score more than 7 is 85.7% and 47.1% respectively with the Youden index being 0.328.[Table-2] shows sensitivity and specificity of RIPASA score

Table 2: sensitivity and specificity of RIPASA score

Test Variable(s)	Result Positive if Greater Than or Equal To	Sensitivity	Specificity	Youden Index
RIPASA score	6.25	0.968	0.235	0.203
	6.75	0.905	0.353	0.258
	7.25	0.857	0.471	0.328
	7.75	0.778	0.647	0.425
	8.25	0.683	0.882	0.565
	8.75	0.571	0.882	0.453
	9.25	0.46	1	0.46

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Table 3: PPV and NPV of RIPASA score

HPE GRADE		**NORMAL APPENDIX**	**ABNORMAL APPENDIX**	**Total**
Ripasa Grade	Normal	8	9	17
	Abnormal	9	54	63
Total		17	63	80

Positive Predictive Value: 85.71429
Negative Predictive Value: 47.05882

Table 4: Likelihood ratio of RIPASA score

RIPASA Grade	HPE GRADE		
	ABNORMAL APPENDIX	NORMAL APPENDIX	LR+
Probability of acute appendicitis is less likely	1	2	0.413978495
Low probability of acute appendicitis	8	6	0.685714286
High probability of acute appendicitis	34	9	1.008821171
Definite acute appendicitis	20	0	1.395348837

Among 80 patients who have undergone appendicectomy, 27 (33.75%) had recurrent inflammed appendix. 21(26.25%) had acute suppurative appendix, 14(17.5%) had faecolith inside appendix and 9(11.25%) had normal appendix in whom appendicectomy is not required. Out of 80 subjects, 63(78.8%) required surgery and 17(21.3%) need not require surgery. [Figure-5] shows different types of HPE among study participants.

Figure 4: Distribution of RIPASA Score

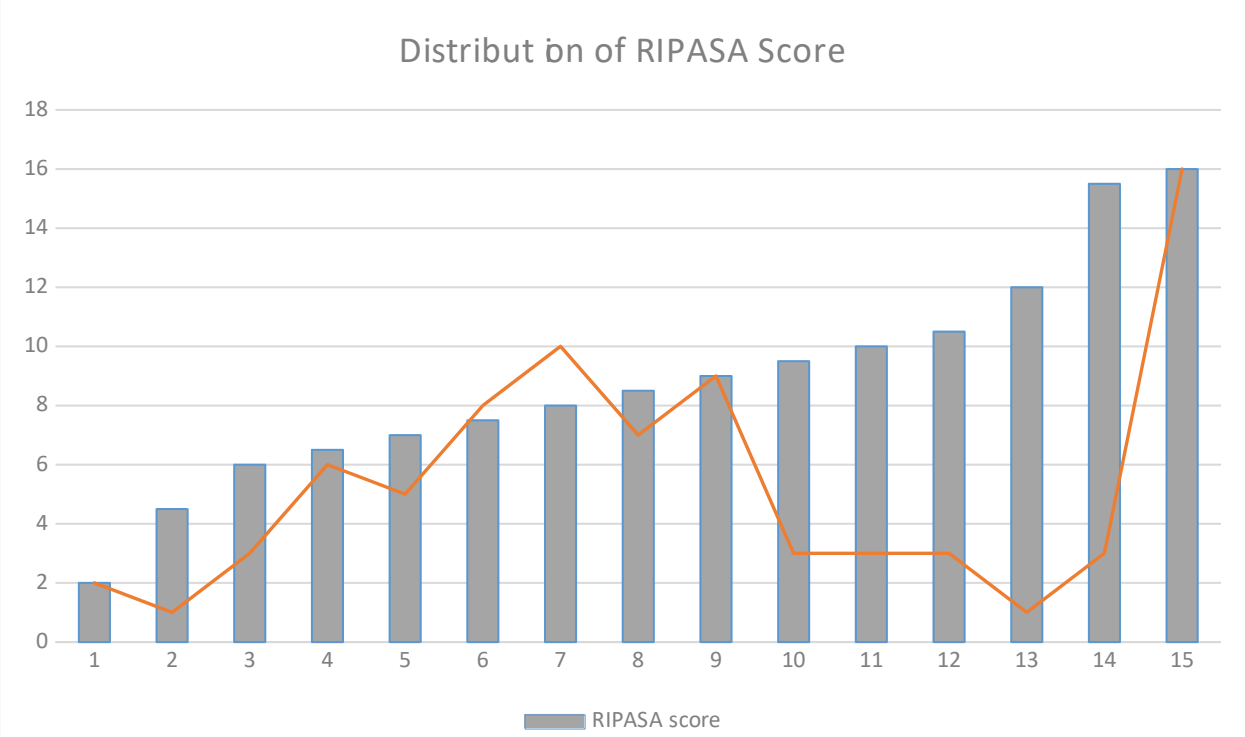
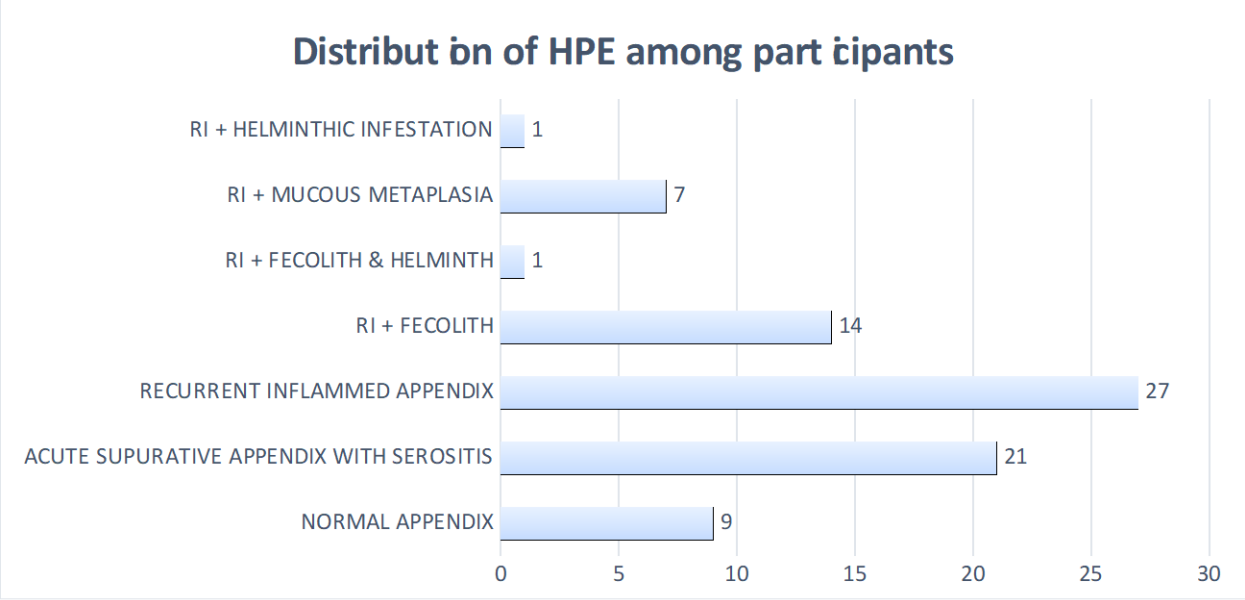


Figure-5: Distribution of HPE among participants



Discussion

Of the 80 participants in this study, 35% (28) were female and 65% (52) were male. The ratio of men to women is 1.84:1. According to Addiss DG et al.'s study, the male-to-female appendicitis ratio is 1.4:1 [3]. Men are more likely than women to get appendicitis (79%) compared to 60% in another study by Andersson RE et al. [4]. These studies indicate that acute appendicitis is more common in men than in women. The male preponderance in my study is consistent with earlier research from the West and India.

The study participants in this investigation ranged in age from 5 to 60. The largest percentage of study participants were in the under-40 age category, including 70 (87.5%), followed by the over-40 age group, which included 10 (12.5%). According to a study by Addiss DG et al., people under 40 had the highest incidence of appendicitis (23.3 per 10,000 population annually) [3]. These studies indicate that those under 40 years of age had a higher risk of developing acute appendicitis than those over 40. The age group under 40 years old is the most prevalent in my study, which is consistent with earlier research from India and the West.

Nearly every participant in my study experienced RIF pain 80 (100%) followed by RIF pain migration in 70 (87.5%), anorexia in 45 (56.3%), and nausea and/or vomiting in 22 (27.5%). 91% of the 66 patients in the study by Lee SL et al. reported having migratory pain, indicating that both physical examination and migratory pain are still valid and accurate ways to diagnose acute appendicitis [5]. In their 2008 study, Mark H. Ebell et al. found that the symptoms that most accurately predict appendicitis in adults are pain in the right lower quadrant and pain that migrates from the umbilicus area to the right lower quadrant, while the absence of pain prior to vomiting significantly lowers the risk of appendicitis [6]. These studies indicate that the most typical presentation of acute appendicitis is RIF pain and pain migration. In line with earlier research, data from our study also demonstrates a preponderance of RIF pain and pain migration.

RIF tenderness was the most often observed sign in the current study, occurring in 80 patients (100%), followed by rebound tenderness in 73 patients (91.3%), fever in 41 patients (51.3%), guarding in 20 participants (25%), and Rovsing sign in 19 participants (23.8%). A study by Alshehri MY et al. showed that the rebound tenderness had the highest sensitivity (94.7%) [7] In 1996, Golledge J et al. conducted research in England with 100 patients. They come to the conclusion that percussion tenderness was more specific (specificity 0.86), but less sensitive (sensitivity 0.57). The results showed that rebound tenderness was accurate (86%), specific (0.89), and sensitive (0.82). Rebound tenderness hence had an 86% positive predictive value [8]. In 2018, Matthew J. Snyder and colleagues conducted a study. The Rovsing sign's positive likelihood ratio is 3.562, making it the most dependable test for excluding acute appendicitis in children. According to all of these studies, the best indicators of acute appendicitis in adults are pain in the right lower quadrant and pain radiating to the right lower quadrant. Of all the clinical indications, rebound tenderness is the most sensitive. In children with the highest positive likelihood ratio, the rovsing sign is the most accurate way to rule out acute appendicitis. Additionally, our investigation showed outcomes that were equivalent to those of the aforementioned studies.

Of the 80 participants in our study, 41 (51.3%) experienced fever (temperature > 38.3°C) and 78 (97.5%) had elevated total count (leucocytosis). In their 2008 study, Mark H. Ebell et al. found that fever, rebound tenderness, vomiting, and rectal tenderness are more beneficial (having a higher positive likelihood ratio) in children than in adults [6]. In their investigation of forty-two participants, R. R. Marrero et al. found that the average temperature was 99.6°F. White blood cell counts were 18,000 +/- 4000 on average [9]. According to Wang et al.'s research, appendicitis affected 30% of toddlers (1–3.9 years old) with high

WBC counts and 4.8% of toddlers with normal WBC counts. Although toddlers with normal WBC counts were not excluded from having appendicitis, the negative predictive value (NPV) for both normal and low WBC counts was significant (NPV = 95.6%). A high WBC count was both sensitive and specific for diagnosing appendicitis in children in the 4–11.9% age group (sensitivity = 71%, specificity = 72%). Likewise, there found a substantial correlation between left shift and appendicitis in kids and teens [10]. These studies found that while a normal WBC level did not rule out appendicitis, those with elevated WBC counts had acute appendicitis. Additionally, it found that the inflammatory biomarkers and the white blood cell (WBC) count alone are not reliable indicators of acute appendicitis. Likewise, there found a substantial correlation between left shift and appendicitis in kids and teens. Sensitivity was increased when WBC and left shift were paired with other symptoms and indicators. Additionally, our investigation showed outcomes that were equivalent to those of the aforementioned studies.

The best cut-off threshold score, according to Chong C F et al. [2] and Muhammad Usman Malik et al. [11], was 7.5. They also observed that the sensitivity ranged from 85.39% to 88%, the specificity ranged from 69.86% to 67%, the PPV was 93%, and the NPV was 53% to 72.86%. With a diagnosis accuracy of 80%, the negative appendicectomy rate dropped from 16.3% to 6.9%, a 9.4% decrease (p equals 0.0007) Additionally, our investigation showed outcomes that were equivalent to those of the aforementioned studies. Our study's Youden index was 0.328, and the sensitivity and specificity of the RIPASA score at cutoff scores greater than 7 were 85.7% and 47.1%, respectively. For a RIPASA score of 7 or higher, the positive and negative predictive values were 47.05% and 85.7%, respectively. These investigations, together with our own, show that the Raja Isteri Pengiran Anak Saleha appendicitis (RIPASA) score is more sensitive in Middle Eastern and Asian populations. For the diagnosis of acute appendicitis, the RIPASA score is a straightforward scoring method with a reasonable sensitivity and PPV. The RIPASA score diagnoses complications early, preventing terrible complications, but it also has limited specificity.

Conclusion

According to our research, the Alvarado scoring system was more specific and had a higher NPV, whereas the RIPASA scoring system had a higher sensitivity, a positive LR, and a lower negative LR. However, the low specificity necessitates the use of an additional mean in order to provide an appropriate diagnosis. The RIPASA score is a simple scoring technique with a reasonable sensitivity for the diagnosis of acute appendicitis. Overall, the RIPASA Score has limited specificity, which results in a somewhat higher negative appendectomy rate with the ensuing morbidity and mortality of needless operation, but it does detect early complications, preventing terrible complications.

RIPASA score performs better than the Alvarado score because it can identify a sizable percentage of individuals that the Alvarado score would otherwise overlook. However, by employing the RIPASA score, needless and costly radiological tests can be avoided, lowering health care costs. According to the study analysis, the RIPASA scoring system is a more sensitive test for identifying acute appendicitis. It is also simple, quick, affordable, and applicable in both rural and urban locations where alternative diagnostic modalities might not be available.

The RIPASA score is a better diagnostic tool for the diagnosis of acute appendicitis in Indians overall, as evidenced by its higher sensitivity, PLR, and lower NLR. This is because it offers a structured method of gathering patient data, a more thorough and cohesive preoperative evaluation, and can be used as a supplement to clinical judgement.

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