

Accuracy of RIPASA Scoring System and Ultrasound in the Diagnosis of Acute Appendicitis: A Comparative StudySanjeev Kumar Khulbey¹, Dusi Venkata Surya Lakshminarayana Sarma², Varsha Joshi³¹Associate Professor, Department of General Surgery, Apollo Institute of Medical Sciences and Research, Jubilee Hills, Hyderabad, Telangana²Professor, Department of General Surgery, Apollo Institute of Medical Sciences and Research, Jubilee Hills, Hyderabad, Telangana³Assistant Professor, Department of Radiology, Apollo Institute of Medical Sciences and Research, Jubilee Hills, Hyderabad, Telangana

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Conflict of interest: Nil

Abstract:

Introduction: Acute appendicitis (AA) is a significant health issue that requires fast and accurate diagnosis to avoid complications. Clinical diagnosis remains critical, despite advances in imaging and diagnostic technologies. A variety of scoring systems have been developed to minimize doubt in appendicitis diagnoses. Aside from imaging modalities such as ultrasonography, the RIPASA score is seen to be a more effective diagnostic grading strategy for adults.

Material and Methods: A source of 132 cases presented with clinical features suggestive of appendicitis were screened and underwent RIPASA score assessment. Subsequently, all patients underwent ultrasonography to identify characteristics indicative of appendicitis. The accuracy of diagnosing acute appendicitis with the RIPASA score and ultrasound results was linked to the histopathological examination.

Results: The comparison of RIPASA score with HPE showed that 66.67% cases who are diagnosed to have appendicitis by RIPASA score are truly had appendicitis by HPE and 5.38% of cases were normal by HPE. The sensitivity, specificity, PPV and NPV of RIPASA score was 86.24%, 63.40%, 89.80%, 47.89% respectively. Whereas for ultrasound, sensitivity, specificity, PPV and NPV of RIPASA score was 73%, 58%, 85.24%, 39.36% respectively.

Conclusion: Ultrasonography exhibits low sensitivity and can serve as an adjunctive method for diagnosing appendicitis to exclude alternative etiologies of right iliac fossa pain. The RIPASA score system seems to be an effective instrument for diagnosing acute appendicitis. Consequently, it can be inferred that the RIPASA scoring system is superior, both clinically and statistically, for the evaluation of appendicitis in comparison to ultrasonography.

Keywords: RIPASA scoring system, Ultrasonography, Acute appendicitis, histopathological examination.

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Introduction

Acute appendicitis represents a common surgical emergency encountered globally, with prevalence rates varying from 13% to 77% [1,2]. Delays in early diagnosis often lead to significant morbidity. Experts estimate that acute appendicitis affects approximately 6% of the population during their lifetime, highlighting the importance of early diagnosis and intervention [3,4].

Acute appendicitis represents the most prevalent surgical abdominal emergency, affecting 10% of the general population; however, it continues to pose a diagnostic challenge [5]. Multiple clinical indices and laboratory diagnostic tests can facilitate an accurate diagnosis [6]. Given the several causes

of right iliac fossa pain and the different clinical presentations of appendicitis, grading systems have been used to help doctors in reaching more accurate diagnosis and in reducing needless appendectomy. Imaging techniques including CT scans have lately solved diagnostic difficulties [7].

Clinical scoring criteria are nevertheless considered as crucial diagnostic supplementary tools in situations when ordering frequent CT scans would result in extra resources and expense constraints [8]. Historically, the most often used scoring system in this context has been the Alvarado score; second in importance is the modified Alvarado score. Designed in Brunei Darussalam in 2008, the

Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score system has shown success in stratifying the risk of acute appendicitis among Asians [9]. The RIPASA grading system's components taken together produce a total score of 17.5. In particular groups, the RIPASA score shows a sensitivity of 88% and a specificity of 67% compared to the Alvarado score in past research.

This forces an analysis of the relative accuracy of the RIPASA scoring system for the clinical diagnosis of appendicitis in respect to ultrasonography (USG) [10]. This work intends to improve the present knowledge by methodically assessing and contrasting the clinical diagnosis of acute appendicitis using ultrasonic waves with the RIPASA scoring system. Hence, this study was designed to assess the efficacy of RIPASA scoring system and ultrasound in the diagnosis of acute appendicitis.

Materials and Methods

The present cross-sectional analysis was conducted in the Department of General surgery in association with Department of Radiology at Apollo Institute of Medical Sciences and Research, Jubilee Hills, Hyderabad from September 2023 to August 2024. A total of 132 cases presented with clinical features suggestive of appendicitis attending AIMSR were

recruited. We included individuals over 18 years of age who presented with severe pain in the right iliac fossa, suspected of having acute appendicitis, and gave their consent to participate. Cases presenting with mass right iliac fossa pain, a history of urolithiasis, and pelvic inflammatory disease who were unwilling to participate were excluded.

All patients who arrived at the emergency room with clinical manifestations indicative of appendicitis were screened and underwent RIPASA score assessment. Subsequently, all patients underwent ultrasonography to identify characteristics indicative of appendicitis. Prior to surgery, we administered antibiotics and analgesics to the patients. Patients with a RIPASA score over 7.5 or those with ultrasound findings indicative of appendicitis were scheduled for surgery.

The accuracy of diagnosing acute appendicitis with the RIPASA score and ultrasound results was linked to the biopsy samples sent for histopathological examination after surgery. We computed the sensitivity, specificity, positive predictive value, and negative predictive value of the RIPASA score and ultrasound at the conclusion of the investigation.

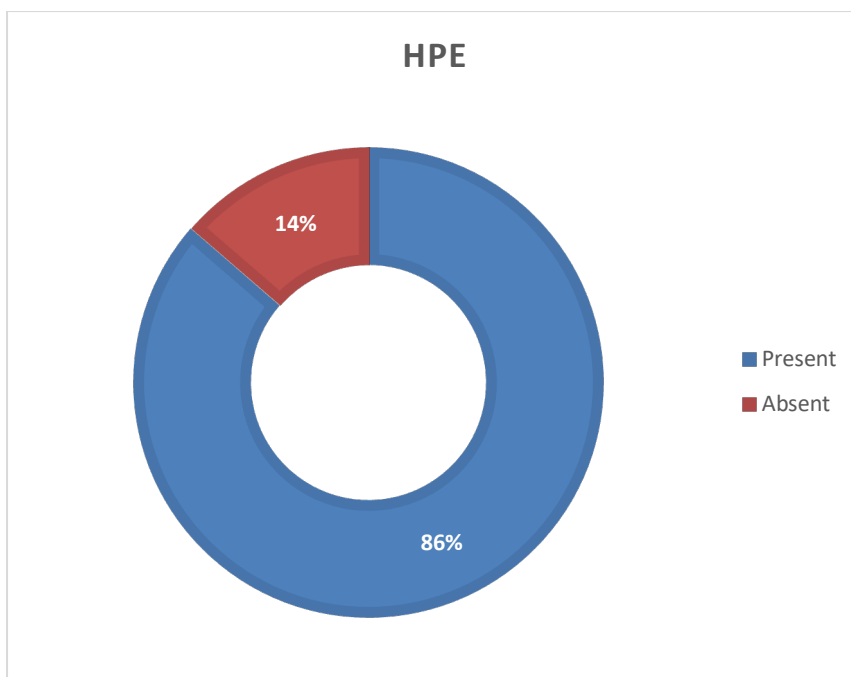
Results

Table 1: Sociodemographic characteristics of study participants.

| Sociodemographic data | Total cases (n=132) | |
|-----------------------|---------------------|------------|
| | Frequency | Percentage |
| Age | | |
| <20 | 29 | 21.96% |
| 21-30 | 38 | 28.78% |
| 31-40 | 34 | 25.75% |
| 41-50 | 18 | 13.64% |
| 51-60 | 11 | 8.33% |
| >60 | 02 | 1.51% |
| Gender | | |
| Male | 98 | 74.24% |
| Female | 34 | 25.76% |

Table 2: Diagnosis of acute appendicitis by study procedures.

| Diagnosis method | Total cases (n=132) | | Chi-square test | p-value |
|------------------------|---------------------|------------|-----------------|---------|
| | Frequency | Percentage | | |
| RIPASA score | | | | |
| ≤7.5 | 39 | 29.54% | 11.561 | 0.001 |
| >7.5 | 93 | 70.45% | | |
| Ultrasonography | | | | |
| Present | 102 | 77.28% | 8.906 | 0.001 |
| Absent | 30 | 22.72% | | |



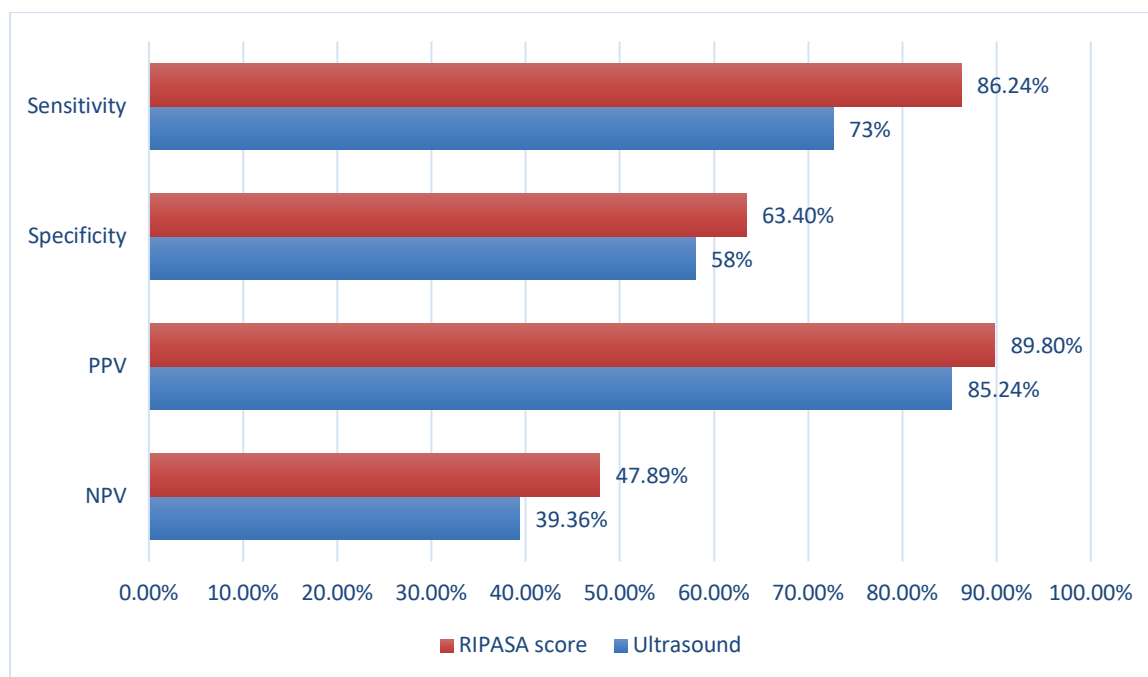
Graph 1: Histopathological examination

Table 3: Comparison of ultrasound with HPE findings

| Ultrasound | Histopathological examination | |
|-----------------|-------------------------------|-------------|
| | Present | Absent |
| Present (n=102) | 94 (92.15%) | 08 (7.84%) |
| Absent (n=30) | 20 (66.67%) | 10 (33.33%) |

Table 4: Comparison of RIPASA with HPE findings

| RIPASA | Histopathological examination | |
|-------------|-------------------------------|-------------|
| | Present | Absent |
| ≤7.5 (n=39) | 26 (66.67%) | 13 (33.33%) |
| >7.5 (n=93) | 88 (94.62%) | 05 (5.38%) |



Graph 2: Diagnostic outcome of RIPASA score and ultrasonography

Discussion

Majority participants were below 40 years of age (76.51%) with male predominance (74.24%) (Table 1). 70.45% of the cases had RIPASA score above 7.5 and 29.54% had below 7.5. 77.28% of cases were found to have acute appendicitis in the ultrasonography. The difference of RIPASA score and ultrasonography was statistically significant ($p=0.001$) (Table 2). According to histopathological examination, 86.36% of cases had diagnosed with appendicitis (Graph 1). The comparison of ultrasound findings with HPE showed that 92.15% cases who are diagnosed to have appendicitis by ultrasound truly had appendicitis by HPE and 7.84% of cases were normal by HPE (Table 3). The comparison of RIPASA score with HPE showed that 66.67% cases who are diagnosed to have appendicitis by RIPASA score truly had appendicitis by HPE and 5.38% of cases were normal by HPE (Table 3). The sensitivity, specificity, PPV and NPV of RIPASA score was 86.24%, 63.40%, 89.80%, 47.89% respectively. Whereas for ultrasound, sensitivity, specificity, PPV and NPV of RIPASA score was 73%, 58%, 85.24%, 39.36% respectively (Graph 2).

Arroyo-Rangel C et al. examined 100 cases of suspected acute appendicitis and discovered that the RIPASA score had higher diagnostic accuracy than the Alvarado score, with a sensitivity of 98.8% and specificity of 71.4%, versus 90.7% and 64.3%, respectively. The RIPASA score had an area under the curve of 0.88, whereas the Alvarado scale had a value of 0.80. In comparison to the Alvarado score for the Mexican population, the RIPASA score is more exact, simple, and accurate [11]. Ramya M et al. found that the RIPASA score had sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV) of 0.82, 0.57, 0.79, 0.92, and 0.24 in 100 cases of acute abdominal pain with a provisional diagnosis of acute appendicitis. In contrast, ultrasonography has a sensitivity, specificity, PPV, and NPV of 0.75, 0.42, 0.71, 0.86, and 0.24, respectively. The RIPASA grading system accurately assesses the severity of acute appendicitis and aids in prognosis [12]. Anand RB et al. found that the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for ultrasonography were 75.51%, 100%, 100%, and 7.69%, respectively, while those for the RIPASA scoring system were 93.9%, 100%, 100%, and 25%, respectively [13].

A study conducted by Soujanya Mynalli et al. involving 150 patients of suspected acute appendicitis indicated that the integration of HRUSG and RIPASA score has decreased the negative appendectomy rate (NAR) from 39% with clinical assessment alone and 7.4% with USG

alone to 3.1%. The incorporation of HRUSG into the clinical evaluation of acute appendicitis enhances both sensitivity and specificity, decreases the false positive rate (NAR), and aids in surgical decision-making in ambiguous situations to avert complications and morbidity [14]. A study by Mardan et al. evaluated the role of ultrasonography in managing acute appendicitis and found that incorporating ultrasonography into clinical assessment reduces sensitivity while significantly enhancing specificity, thereby decreasing the false positive rate and resulting in a lower NAR [15]. A study conducted by Karapolat B involving 106 instances of acute appendicitis revealed that histological analyses indicated that all 100 patients (94.3%) with RIPASA values of 7 or higher were diagnosed with acute appendicitis, while the six patients (5.7%) with scores below 7 did not have appendicitis. A study by Şenocak R et al. analyzed 202 consecutive patients who underwent emergency appendectomy for acute appendicitis and reported a negative appendectomy rate of 15.8%. The amalgamation of Ohmann and USG resulted in a decrease in negative appendectomy rates for women from 6.9% to 4%. The integration of ultrasound and scoring systems does not enhance the diagnostic precision of acute appendicitis. Nonetheless, the rates of negative appendectomy are markedly diminished when utilizing both ultrasound and the Ohmann scale in females, but this reduction is negligible in males [17]. A meta-analysis conducted by Frountzas M et al. encompassed 12 investigations with 2161 participants, revealing a sensitivity of 94% and a specificity of 55% for the RIPASA score. The Alvarado score had a sensitivity of 69% and a specificity of 77%. The RIPASA scoring system exhibits more sensitivity than the Alvarado system; however, its low specificity need an additional method to ensure proper diagnosis [18].

Several studies have reported that RIPASA scoring system can be used as an alternative to the Alvarado scoring and other scoring system in the management of cases with pain in lower quadrant of abdomen [19-22]. Similarly, our study showed RIPASA scoring system was superior in the diagnosis of acute appendicitis.

Conclusion

Ultrasonography exhibits low sensitivity and can serve as an adjunctive method for diagnosing appendicitis to exclude alternative etiologies of right iliac fossa pain. The RIPASA score system seems to be an effective instrument for diagnosing acute appendicitis. Consequently, it can be inferred that the RIPASA scoring system is superior, both clinically and statistically, for the evaluation of appendicitis in comparison to ultrasonography.

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