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A Comparative Study of RIPASA Score and Ultrasound in the Diagnosis of Acute Appendicitis

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A B S T R A C T

Background*:** Acute appendicitis is a common surgical emergency, with diagnostic challenges due to its varied presentations. Accurate diagnosis is crucial for effective management. This study compared the diagnostic accuracy of the RIPASA score and ultrasound in acute appendicitis cases.Methods*:** A cross-sectional analysis was conducted involving 100 patients with symptoms suggestive of acute appendicitis. The RIPASA score and ultrasound were evaluated against histopathological examination (HPE), which served as the gold standard.***Results*:** The RIPASA score identified acute appendicitis in 73% of patients, with a PPV of 89% and an NPV of 44%. Ultrasound identified appendicitis in 68% of patients, with a PPV of 86.8% and an NPV of 34.4%. The integration of both diagnostic tools suggested potential enhancements in overall diagnostic accuracy. ***Conclusion*:** Both the RIPASA score and ultrasound are effective diagnostic tools for acute appendicitis. However, the RIPASA score showed a slightly better PPV, and when combined with ultrasound, could offer a more robust diagnostic approach, particularly beneficial in resource-limited settings.

Keywords: Acute Appendicitis, RIPASA Score, Ultrasound, Diagnostic Accuracy, Positive Predictive Value, Negative Predictive Value.

INTRODUCTION

Acute appendicitis is the most common surgical emergency encountered in the abdominal region, presenting significant diagnostic challenges due to its varied clinical presentations. Prompt and accurate diagnosis is crucial to reduce the risk of complications such as appendiceal rupture, which significantly increases morbidity and mortality rates [1]. Traditionally, the diagnosis of acute appendicitis has relied on a combination of clinical assessment, laboratory findings, and imaging techniques [2]. Among these, ultrasound (US) and the RIPASA score (Raja IsteriPengiranAnakSaleha Appendicitis) are prominent tools used in different healthcare settings.

The RIPASA score, developed in Brunei in 2010, offers a tailored approach for diagnosing acute appendicitis in Asian populations. It incorporates clinical features, physical examination findings, and basic laboratory results, providing

a comprehensive scoring system that has been shown to be both sensitive and specific in various studies [3]. This scoring system includes parameters such as migration of pain, anorexia, nausea, and leukocytosis, among others, which are commonly associated with appendicitis but are often weighed differently in Western scoring systems like the Alvarado score.

On the other hand, ultrasound, as a non-invasive diagnostic tool, has the advantage of being readily available and does not expose patients to ionizing radiation, making it particularly useful in pediatric, pregnant, and reproductive-age female populations [4]. Ultrasound's effectiveness in diagnosing acute appendicitis can be influenced by the operator's expertise and the patient's body habitus, with some studies reporting sensitivity and specificity rates varying widely, generally between 44% to 94% and 47% to 95%, respectively [5].

Comparative studies between the RIPASA score and ultrasound have significant clinical relevance, especially in environments where healthcare resources are limited. The RIPASA score's simplicity and cost-effectiveness make it an attractive option in settings where advanced imaging modalities like computed tomography (CT) are not feasible or available [6]. Moreover, the comprehensive nature of the RIPASA score, which assesses both clinical signs and symptoms and basic laboratory values, may provide a more holistic view of the patient's condition than ultrasound alone.

However, despite its benefits, the reliance on ultrasound remains strong due to its ability to provide direct visual evidence of the inflamed appendix and other possible causes of abdominal pain. This is critical in atypical cases or when differential diagnosis includes conditions such as gynecological pathologies, intestinal intussusception, or kidney stones [7]. Therefore, a comparative analysis of these two diagnostic tools' effectiveness in different demographic settings and healthcare systems can offer valuable insights into their optimal use and potential integration into clinical pathways for diagnosing acute appendicitis.

Studies have shown that combining clinical scores with ultrasound findings can improve diagnostic accuracy for acute appendicitis [8]. For instance, integrating the RIPASA score with selective use of ultrasound could potentially enhance diagnostic certainty, reduce unnecessary imaging and surgeries, and optimize healthcare resource utilization. Such an integrated approach could be particularly beneficial in developing countries or rural areas where advanced imaging technologies and specialized healthcare professionals are scarce [9].

In conclusion, the ongoing debate and study into the comparative efficacy of the RIPASA score versus ultrasound in diagnosing acute appendicitis reflect broader themes in global healthcare—accessibility, cost-effectiveness, and the need for culturally adaptable diagnostic tools. It underscores the necessity for evidence-based strategies that align diagnostic accuracy with healthcare resource optimization, ensuring that the highest possible standards of care can be universally applied irrespective of geographical or economic barriers [10].

Aims and Objectives

The primary aim of our study was to compare the diagnostic accuracy of the RIPASA score and ultrasound in the identification of acute appendicitis among patients presenting with symptoms suggestive of this condition. Specifically, we sought to determine which diagnostic tool more accurately predicted the presence of appendicitis, thereby potentially reducing the rate of negative appendectomies. The objectives included assessing the sensitivity, specificity, positive predictive value, and negative predictive value of the RIPASA score compared to ultrasound findings. Furthermore, we aimed to evaluate whether a combination of these diagnostic methods could enhance the overall accuracy of appendicitis diagnosis.

Materials and Methods

The study was conducted as a hospital-based, cross-sectional analysis at a tertiary care centre, Chamarajanagar. We enrolled a total of 100 patients who presented to the emergency department with symptoms indicative of acute appendicitis over a six-month period from January to June 2020. The inclusion criteria were patients aged 18 years and older, presenting with right iliac fossa pain suspected to be acute appendicitis. We excluded patients below 18 years of age, those with a known pelvic inflammatory disease, gastrointestinal tumors, or a palpable right iliac fossa mass, and pregnant women to avoid any confounding factors that could influence the ultrasound evaluations.

Upon admission, all participants underwent a standardized evaluation using the RIPASA score, which included clinical assessment, pain migration, anorexia, nausea, vomiting, and specific laboratory tests like white blood cell count. Simultaneously, all patients were assessed using abdominal ultrasound by a radiologist with over ten years of experience, who was blinded to the RIPASA score results. The ultrasound examination focused on the appendix area, looking for signs of inflammation, appendiceal diameter greater than 6 mm, and the presence of an appendicolith.

Following these initial assessments, patients who scored more than 7.5 on the RIPASA scale or showed positive ultrasound findings indicative of acute appendicitis were recommended for surgical intervention. The final diagnosis was confirmed postoperatively via histopathological examination of the appendectomy specimen, which served as the gold standard for diagnosing acute appendicitis in this study.

Statistical analysis was performed using SPSS version 25. The diagnostic performance of the RIPASA score and ultrasound was evaluated by calculating the sensitivity, specificity, positive and negative predictive values. A p-value of less than 0.05 was considered statistically significant. Additionally, a receiver operating characteristic (ROC) curve was generated to compare the diagnostic accuracy between the RIPASA score and ultrasound findings.

In summary, this study methodically assessed the efficacy of both the RIPASA score and ultrasound in diagnosing acute appendicitis, with a clear structure for inclusion and exclusion criteria and detailed analysis plans to ensure the reliability of the findings.

RESULTS

The analysis of diagnostic tools for acute appendicitis in this study encompassed 100 patients who presented with symptoms suggestive of this condition. The demographic breakdown revealed an almost equal distribution between genders: 53 males and 47 females, representing 53% and 47% of the study population respectively.

RIPASA Score Evaluation: The RIPASA score was utilized to assess all 100 patients, with results indicating that 73% (n=73) scored above 7.5, suggesting a diagnosis of acute appendicitis. The remaining 27% (n=27) scored 7.5 or below, classified as normal. This classification highlights the RIPASA score's ability to distinguish between suspected appendicitis and non-appendicitis cases based on clinical and laboratory parameters.

Ultrasound Imaging: Ultrasound, as another diagnostic modality in the study, was performed on all participants. It identified appendicitis in 68% (n=68) of the cases, with these patients showing typical sonographic signs of the condition. The other 32% (n=32) were found to have no sonographic evidence of appendicitis, underscoring ultrasound's role in differentiating other possible causes of abdominal pain.

Histopathological Confirmation: The definitive diagnosis of acute appendicitis was confirmed through histopathological examination of the surgically removed appendix. Of the 100 patients, 80 were confirmed to have appendicitis, translating to an 80% prevalence rate in this clinical setting. The remaining 20% did not exhibit histopathological signs of appendicitis, affirming the absence of the disease.

Comparative Analysis of Diagnostic Tools: A detailed comparative analysis of the RIPASA score and ultrasound was conducted against the histopathological findings. The RIPASA score demonstrated a Positive Predictive Value (PPV) of 89% and a Negative Predictive Value (NPV) of 44%, with 65 out of 73 positive diagnoses confirmed by histopathology. In contrast, ultrasound had a PPV of 86.8% and an NPV of 34.4%, with 59 out of 68 positive diagnoses confirmed through histopathology. These statistics suggest that both the RIPASA score and ultrasound are reliable diagnostic methods, though the RIPASA score showed slightly higher accuracy in confirming acute appendicitis.

This study's findings provide robust evidence of the utility and effectiveness of both the RIPASA score and ultrasound in diagnosing acute appendicitis. Each diagnostic tool offers substantial accuracy, with the RIPASA score presenting a slight advantage in predicting actual appendicitis cases as confirmed by histopathology. These results underscore the potential benefits of integrating clinical scores with imaging techniques to enhance diagnostic precision in suspected appendicitis cases, particularly in settings where reducing unnecessary surgical interventions is critical.

Table 1: Gender Distribution of Patients Diagnosed with Appendicitis

Gender	Number of Patients	Percentage
Male	53	53%
Female	47	47%

Total Patients: 100

Table 2: RIPASA Score Diagnostic Accuracy for Appendicitis

RIPASA Score	Diagnosis	Number of Patients	Percentage	Cumulative Percentage
> 7.5	Appendicitis	73	73.0%	73.0%
≤ 7.5	Normal	27	27.0%	100.0%

Total Patients: 100

Table 3: Ultrasound Diagnostic Accuracy for Appendicitis

Ultrasound Result	Diagnosis	Number of Patients	Percentage	Cumulative Percentage
Positive	Appendicitis	68	68.0%	68.0%
Negative	Normal	32	32.0%	100.0%

Total Patients: 100

Table 4: Histopathological Examination (HPE) for Appendicitis

HPE Result	Diagnosis	Number of Patients	Percentage	Cumulative Percentage
Positive	Appendicitis	80	80.0%	80.0%
Negative	Normal	20	20.0%	100.0%

Total Patients: 100

Table 5: Comparison of Diagnostic Accuracy between RIPASA Score and Ultrasound for Acute Appendicitis

Diagnostic Criteria	Patients Evaluated	Positive Diagnoses	Confirmed by HPE	PPV	NPV
RIPASA Score	100	73	65	89%	44%
Ultrasound	100	68	59	86.8%	34.4%

DISCUSSION

This study aimed to compare the diagnostic accuracy of the RIPASA score and ultrasound in detecting acute appendicitis, contextualized within a broader framework of global research. The RIPASA score's superiority in predictive values over ultrasound, as observed in our findings, aligns with similar studies yet offers a platform for discussion on integrating these tools to optimize diagnostic pathways.

The Positive Predictive Value (PPV) of the RIPASA score in our study was 89%, which is significantly higher compared to the Negative Predictive Value (NPV) of 44%. This indicates that while the RIPASA score is effective in confirming cases of appendicitis, its ability to rule out the disease is less reliable. Comparatively, in a study conducted by Chong *et al*., the RIPASA score demonstrated a PPV of 96.2% and an NPV of 50% [11], suggesting a similar trend in the effective identification of true positives. The slight variation in NPV might be attributable to differences in demographic profiles and clinical settings.

Ultrasound, with a PPV of 86.8% and an NPV of 34.4% in our study, also shows a disparity favoring positive diagnosis. These findings are in concordance with those of Rettenbacher*et al*., who reported a PPV of 88% and an NPV of 76% for ultrasound in diagnosing acute appendicitis [12]. The lower NPV in our study could be related to operator dependency and the inherent limitations of ultrasound in visualizing the appendix, especially in obese patients or those with complicated appendicitis.

The integration of the RIPASA score and ultrasound has been advocated by several studies to enhance diagnostic accuracy. A study by D'Souza *et al*., suggested that combining clinical scores with ultrasound increases the sensitivity to 97%, significantly higher than using either method alone [13]. This is particularly relevant in settings where CT scans, which are more definitive but also more costly and expose patients to radiation, are not readily available.

Statistical analysis in comparative studies often employs chi-square tests to determine the significance of observed differences. In our study, the p-values associated with the comparison of diagnostic accuracies were not specified but are critical for establishing statistical significance. Previous studies, such as that by Leeuwenburgh*et al*., utilized such methods to substantiate the enhanced accuracy of combined diagnostic approaches, reporting p-values <0.05, which indicate significant improvements in diagnostic outcomes [14].

These discussions underscore the importance of context-specific diagnostic strategies. In resource-limited settings, the RIPASA score provides a cost-effective and clinically effective method for diagnosing acute appendicitis, potentially reducing unnecessary surgeries. In contrast, ultrasound remains a valuable tool for its non-invasive nature and ability to exclude other pathologies, though its effectiveness can be enhanced when combined with clinical scoring systems.

CONCLUSION

This comparative study distinctly outlined the diagnostic accuracies of the RIPASA score and ultrasound in the identification of acute appendicitis. The results demonstrated a Positive Predictive Value (PPV) of 89% for the RIPASA score, which confirms its reliability in diagnosing true positive cases of appendicitis. Conversely, its Negative Predictive Value (NPV) at 44% indicates some limitations in ruling out the disease when the score is low. Ultrasound showed a PPV of 86.8% and an NPV of 34.4%, reflecting its utility but also highlighting its limitations, particularly in cases where the appendicitis presentation is not typical or in patient populations where ultrasound imaging is challenging.

Our findings suggest that while both diagnostic tools are effective, they have distinct strengths and weaknesses. The RIPASA score, with its higher PPV, proves to be a strong diagnostic tool in confirming cases of appendicitis, especially useful in resource-limited settings where more advanced imaging techniques may not be available. Ultrasound, despite its lower NPV, is invaluable for its ability to visually confirm the presence of an inflamed appendix and rule out other abdominal pathologies.

Integrating the RIPASA score with ultrasound could potentially enhance diagnostic accuracy, reduce the incidence of negative appendectomies, and optimize the use of healthcare resources. Such a combined approach should be considered, especially in clinical pathways where rapid and accurate diagnosis is critical to patient outcomes.

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