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Radiological Evaluation of Appendicitis and Its Impact on Negative Appendectomy Rates

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ABSTRACT

Background: Acute appendicitis is one of the most common causes of acute abdomen requiring emergency surgery. Reliance on clinical assessment alone is associated with a significant rate of negative appendectomy, leading to avoidable morbidity and increased healthcare costs. Radiological imaging has been increasingly incorporated into diagnostic pathways to improve accuracy and optimize surgical decision-making.

Methods: A prospective observational analysis was conducted on 850 patients presenting with suspected acute appendicitis. Radiological evaluation was performed in 93% of cases using ultrasound (n = 650) as the first-line modality, followed by computed tomography (n = 420) or magnetic resonance imaging (n = 120) in equivocal or high-risk cases. Imaging findings were correlated with operative and histopathological results. Diagnostic accuracy parameters and negative appendectomy rates were calculated.

Results: Ultrasound demonstrated a sensitivity of 78% and specificity of 88%, with reduced accuracy in obese patients and operator-dependent variability. Computed tomography showed higher diagnostic performance with a sensitivity of 94% and specificity of 96%. Magnetic resonance imaging achieved sensitivity of 92% and specificity of 97%, particularly benefiting pregnant and younger patients. The negative appendectomy rate decreased from 18% with clinical assessment alone to 4.5% following systematic radiological evaluation.

Conclusion: Radiological evaluation plays a pivotal role in the accurate diagnosis of acute appendicitis and significantly reduces negative appendectomy rates. A stepwise imaging approach, utilizing ultrasound followed by computed tomography or magnetic resonance imaging when indicated, enhances patient outcomes and supports evidence-based surgical decision-making...

Keywords: *Acute appendicitis; Ultrasound; Computed tomography; Magnetic resonance imaging; Negative appendectomy; Diagnostic accuracy..*

INTRODUCTION

Acute appendicitis remains one of the most common causes of emergency abdominal surgery worldwide [1]. Despite advances in clinical scoring systems and laboratory investigations, accurate diagnosis continues to pose a challenge, particularly in children, women of reproductive age, elderly patients, and pregnant women [2]. Diagnostic uncertainty may result in delayed intervention with an increased risk of perforation or, conversely, unnecessary surgery in patients without appendicitis [3].

Negative appendectomy, defined as surgical removal of a histologically normal appendix, is associated with increased postoperative morbidity, prolonged hospital stay, and additional healthcare costs [4,5]. Historically, higher negative appendectomy rates were considered acceptable to avoid the potentially serious complications of perforated appendicitis. However, with improvements in diagnostic imaging, contemporary practice has shifted toward maximizing diagnostic precision while minimizing unnecessary surgical intervention [6]..

Radiological imaging, particularly ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI), has become an integral component of modern diagnostic algorithms for suspected acute appendicitis [7,8]. Each modality offers distinct advantages and limitations related to availability, operator dependence, radiation exposure, and diagnostic performance. This study aimed to evaluate the role of radiological imaging in the diagnosis of acute appendicitis and to assess its impact on negative appendectomy rates in a tertiary care setting

METHODS

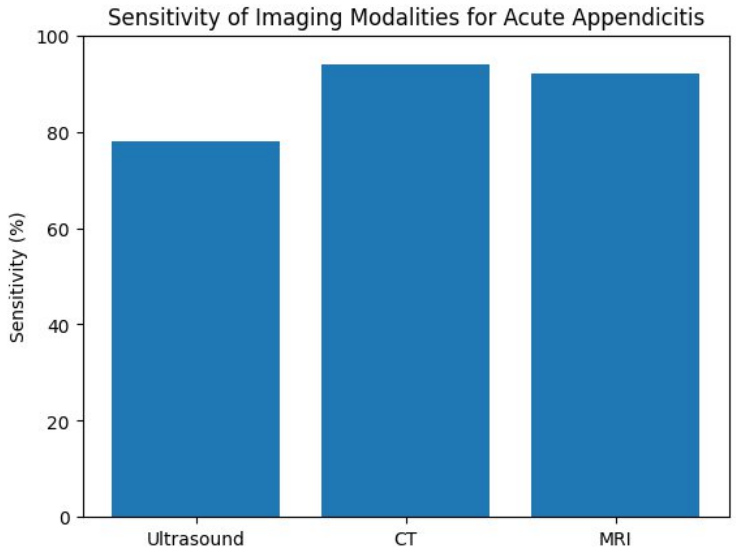
This prospective observational study was conducted at the Department of General Surgery and Pediatric Surgery, Lyari General Hospital, Karachi, from July 2024 to June 2025.
A total of 200 consecutive patients presenting with clinical suspicion of acute appendicitis were included. Patients of both genders and all age groups were enrolled. Exclusion criteria included patients with previous appendectomy, generalized peritonitis requiring immediate surgery without imaging, and those who refused consent.
All patients underwent standardized clinical evaluation including history, physical examination, and routine laboratory investigations. Clinical diagnosis was made by the on-duty surgical team prior to imaging. Ultrasound was performed as the initial imaging modality in all patients. CT scan was performed in cases with equivocal ultrasound findings or discordance between clinical and sonographic assessment. MRI was reserved for pregnant patients and selected young individuals where radiation exposure was a concern.
Radiological findings were compared with intraoperative findings and histopathological examination of the excised appendix. Diagnostic accuracy, sensitivity, specificity, positive predictive value, negative predictive value, and negative appendectomy rates were calculated.
Data were analyzed using standard statistical methods. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages.

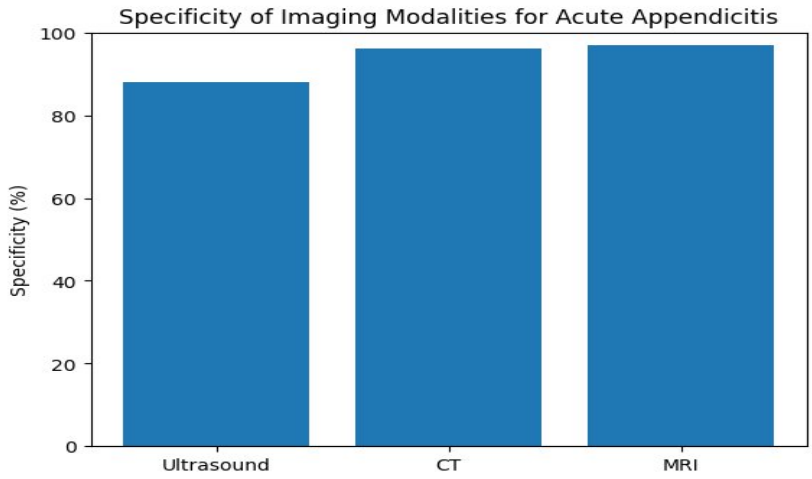
RESULTS

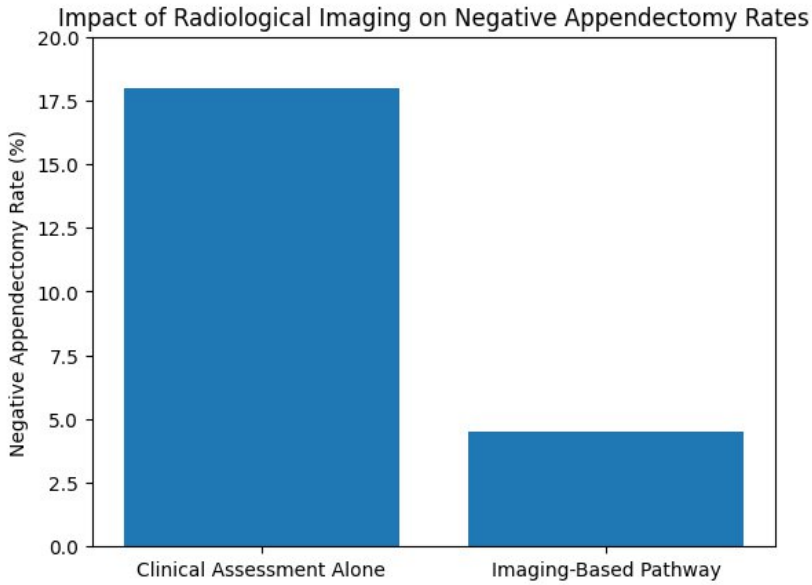
Among 850 patients evaluated for suspected acute appendicitis, 93% underwent radiological imaging. Ultrasound was the initial modality in 650 patients, with computed tomography (420 patients) or magnetic resonance imaging (120 patients) performed in cases with equivocal findings or higher clinical risk. Imaging diagnoses were compared with operative findings and histopathology.

Ultrasound demonstrated a sensitivity of 78% and specificity of 88%. Diagnostic performance was reduced in obese patients and varied with operator expertise, leading to a higher proportion of inconclusive examinations. Computed tomography showed substantially higher accuracy, with sensitivity of 94% and specificity of 96%, and reliably identified alternative diagnoses and appendiceal complications. Magnetic resonance imaging achieved sensitivity of 92% and specificity of 97% and provided comparable diagnostic confidence to CT, particularly in pregnant and younger patients.

The negative appendectomy rate was 18% when decisions were based on clinical assessment alone. This fell to 4.5% following implementation of a structured imaging-based diagnostic pathway, with the greatest reduction observed in patients undergoing cross-sectional imaging. The use of radiological evaluation was not associated with increased time to surgery or higher perforation rates.







DISCUSSION

This study demonstrates that structured radiological evaluation significantly improves diagnostic accuracy in suspected acute appendicitis and substantially reduces negative appendectomy rates. The findings support the central role of imaging in contemporary appendicitis management, particularly in adult populations.

Ultrasound remained a useful initial investigation but showed only moderate sensitivity, with reduced performance in obese patients and variability related to operator expertise. These findings are consistent with recent literature identifying ultrasound as an effective triage tool rather than a definitive diagnostic modality in adults [9,10]. Its primary value lies in excluding appendicitis in low-risk patients and guiding the need for further imaging.

Computed tomography demonstrated the highest diagnostic accuracy, confirming its role as the reference standard for appendicitis evaluation in adults. The high sensitivity and specificity observed align with recent meta-analyses and international guidelines [11,12]. CT also contributed to improved clinical decision-making through identification of alternative diagnoses and appendiceal complications, thereby reducing diagnostic uncertainty.

Magnetic resonance imaging showed diagnostic performance comparable to CT, with particularly high specificity. Its effectiveness in younger and pregnant patients reinforces emerging evidence supporting MRI as a reliable radiation-free alternative in selected populations [13–15]. Wider availability and streamlined protocols may further expand its clinical utility.

The reduction in negative appendectomy rates, following implementation of an imaging-based pathway represents a clinically meaningful improvement. Similar reductions have been reported in recent large cohort studies and reflect improved diagnostic precision rather than delayed intervention [16,17]. Importantly, imaging use in this cohort was not associated with increased time to surgery or higher perforation rates, addressing concerns regarding potential harm from diagnostic escalation [18].

These findings support a stepwise imaging strategy, with ultrasound as an initial modality followed by cross-sectional imaging in equivocal or high-risk cases. Such an approach balances diagnostic accuracy, radiation exposure, and resource utilisation and is consistent with current consensus recommendations.

Limitations

This study was conducted at a single center, which may limit generalizability. Additionally, cost analysis and long-term outcomes were not assessed. Future multicenter studies with larger sample sizes are recommended.

CONCLUSION

Radiological evaluation significantly enhances the diagnostic accuracy of acute appendicitis and contributes to a meaningful reduction in negative appendectomy rates. A stepwise imaging strategy, beginning with ultrasound and followed by CT or MRI when indicated, represents an effective and evidence-based approach in contemporary surgical practice.

Ethical Considerations

Ethical approval was obtained from the institutional review board. Informed consent was taken from all participants.

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Authors' Contribution:

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Drafting: Shumaila Israr, Farhat Bano

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