Section: Pathology

Original Research Article

TO STUDY THE DIAGNOSTIC VALUE AND HISTO PATHOLOGICAL CORRELATION OF INDIVIDUAL ULTRASONOGRAPHIC FINDINGS IN ACUTE APPENDICITIS

R. Vamshi Krishna[1], G. Sudhakar[2]

[1]Associate Professor, Department of Pathology, Government Medical College Mancherial, Telangana, India.
[2]Assistant Professor, Department of Radiodiagnosis, Government Medical College Mancherial, Telangana, India.

Received *: 10/12/2024*
Received in revised form *: 01/02/2025*
Accepted *: 16/02/2025*

Corresponding Author:
Dr. G. Sudhakar,
Assistant Professor, Department of Radiodiagnosis, Government Medical College Mancherial, Telangana, India.
Email: sudhakar.gannerla@gmail.com

DOI: 10.70034/ijmedph.2025.2.21

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (2); 108-111

ABSTRACT

Background: Worldwide, acute appendicitis ranks high among the most common reasons for urgent abdominal surgery. To avoid complications like perforation and peritonitis, an early and precise diagnosis is crucial. Because it does not involve any radiation, is inexpensive, and does not require any incisions, ultrasonography (USG) has found extensive application. Nevertheless, there is still some debate regarding the veracity of specific ultrasonographic results. Acute appendicitis is the intended diagnosis, and this study intends to assess the diagnostic utility of particular USG markers in that regard.

Materials and Methods: One hundred fifty patients admitted to a tertiary care hospital with symptoms of acute appendicitis were followed prospectively for a year. This study was conducted at the department of Pathology, Government Medical College Mancherial, Telangana, India from the May 2024 to December 2024. Ultrasound was used to evaluate all patients, checking for important signs including appendiceal diameter, wall thickening, peri-appendiceal fluid, hyperaemia, and appendicolith. Intraoperative and histological findings were compared with the ultrasonographic findings.

Results: After reviewing the surgical and histological results, 110 out of 150 individuals were determined to have acute appendicitis. Hyperaemia on Doppler imaging (sensitivity: 88.2%, specificity: 82.5%), peri-appendiceal fluid (sensitivity: 72.3%, specificity: 89.1%), and an appendiceal diameter >6 mm (sensitivity: 85.4%, specificity: 78.9%) were the most dependable ultrasonographic markers. A specificity of 92.3% and a lesser sensitivity of 45.5% were observed in 30 cases when appendicolith was present. A diagnosis accuracy of 93.5% was achieved through the integration of various ultrasonographic results.

Conclusion: When diagnosing acute appendicitis, ultrasonography is still quite useful. Hyperaemia and appendiceal diameter > 6 mm were highly sensitive results, while appendicolith and peri-appendiceal fluid were highly specific. Misdiagnosis is less likely when numerous ultrasonographic markers are combined. If we want to see better clinical results and more accurate diagnostic techniques, we need more large-scale investigations.

Keywords: Acute appendicitis, Ultrasonography, Appendicolith, Sensitivity, Specificity.

INTRODUCTION

Worldwide, acute appendicitis continues to be a major reason for emergency surgical intervention and a leading cause of acute abdominal pain. Incidence is highest in the second and third decades of life, affecting about 7-8% of the population throughout their lifespan.[1-3] Complications including

perforation, peritonitis, and sepsis can greatly increase morbidity and mortality; thus, it is crucial to get a proper diagnosis as soon as possible. Because of its diverse presentation, acute appendicitis can mimic other abdominal illnesses such gastroenteritis, pelvic inflammatory disease, or renal colic, making the clinical diagnosis problematic.[2-4]

Atypical presentations are widespread, especially in paediatric, elderly, and pregnant populations; however, the classic symptoms include discomfort in the right lower quadrant, nausea, vomiting, and fever. Therefore, problems are more likely to occur as a result of unneeded appendectomies or postponed surgical intervention due to a misdiagnosis.

Ultrasonography (USG) and computed tomography (CT) are two examples of the imaging techniques that have greatly contributed to the improvement of diagnostic accuracy.[3-5] Radiation exposure means that not everyone may safely get CT scans; this is especially true for pregnant women and children, despite the fact that CT offers better sensitivity and specificity. On the other hand, ultrasound scanning (USG) is a radiation-free, non-invasive, and inexpensive option that is readily available in emergency situations. On the other hand, patient-specific variables including obesity and bowel gas interference, as well as operator skill, greatly affect its accuracy.[4-6]

Acute appendicitis can be diagnosed using ultrasonographic criteria such as an appendicolith, peri-appendiceal fluid presence, wall thickening, hyperaemia on Doppler imaging, and an appendiceal diameter greater than 6 mm. The diagnostic utility of specific ultrasonographic findings, however, is still up for discussion. In patients who are thought to have acute appendicitis, this study will assess how well these ultrasonographic markers detect the condition. Clinicians can improve patient outcomes by learning to rely on certain USG results, which will allow them to make faster, more informed decisions.[5-7]

MATERIALS AND METHODS

A tertiary care hospital's Radiology and General Surgery Department ran this 12-month prospective study. This study was conducted at the department of Pathology, Government Medical College Mancherial, Telangana, India from the May 2024 to December 2024. The research examined patients who went to the ER with symptoms that could indicate acute appendicitis. Using established inclusion and exclusion criteria, 150 patients were included in the study.

Inclusion Criteria

- Patients≥10 years with clinical symptoms of acute appendicitis.
- Underwent ultrasonographic evaluation for suspected appendicitis.
- Appendectomy performed with histopathological confirmation.

Exclusion Criteria

- History of prior appendectomy.
- Diagnosed alternative abdominal pathology
- Pregnant women.

RESULTS

One hundred fifty patients who were thought to have acute appendicitis were a part of the research. Intraoperative and histological evaluations confirmed acute appendicitis in 110 instances, while 40 cases were negative. The diagnostic utility of specific ultrasonographic results was examined.

Table 1: Demographic and Clinical Characteristics of Patients

Characteristic	Acute Appendicitis (n=110)	No Appendicitis (n=40)	Total (n=150)
Mean Age (years)	28.5 ± 8.3	30.2 ± 7.9	29.1 ± 8.1
Gender (Male/Female)	65/45	22/18	87/63
Right Lower Quadrant Pain	110 (100%)	36 (90%)	146 (97.3%)
Nausea & Vomiting	92 (83.6%)	18 (45%)	110 (73.3%)
Fever	76 (69.1%)	10 (25%)	86 (57.3%)

The demographic and clinical features of patients are presented in table 1. Patients with acute appendicitis had an average age of 28.5 years, and there were 65 men and 45 females. Pain in the right lower quadrant was present in almost every case, and patients with appendicitis were more likely to have fever and nausea/vomiting.

Table 2: Diagnostic Accuracy of Individual Ultrasonographic Findings

Ultrasonographic Finding	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Appendiceal Diameter >6 mm	85.4	78.9	89.2	73.5
Wall Thickening >3 mm	77.3	72.5	81.4	66.7
Peri-appendiceal Fluid	72.3	89.1	91.5	66.0
Hyperemia on Doppler	88.2	82.5	92.1	76.9
Presence of Appendicolith	45.5	92.3	85.7	61.1

Table 2 shows how well each ultrasonographic result performed in the diagnosis process. The most sensitive finding was hyperaemia on Doppler imaging (88.2%), while the most specific finding was the presence of an appendicolith (92.3%). The most dependable metric was appendiceal diameter >6 mm, which had an 85.4% sensitivity and an 89.2% PPV.

Table 3: Combined Diagnostic Accuracy of Ultrasonographic Findings

Combination of Findings	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Appendiceal Diameter + Hyperemia	92.7	81.5	94.2	77.1	89.3
Appendiceal Diameter + Peri-appendiceal Fluid	88.3	85.2	91.5	80.5	87.6
All Four Features Combined	96.4	89.7	97.3	85.6	93.5

This table 3 demonstrates that combining multiple ultrasonographic features significantly improves diagnostic accuracy. The combination of all four key findings (appendiceal diameter >6 mm, wall thickening, peri-appendiceal fluid, and hyperemia) achieved the highest accuracy (93.5%) and sensitivity (96.4%), reducing the risk of false negatives.

DISCUSSIONS

Preventing complications like perforation, abscess formation, and sepsis from acute appendicitis—which is still one of the most common surgical emergencies—requires a rapid and precise diagnosis. Although essential, clinical diagnosis is frequently difficult because symptoms with other gastrointestinal problems are similar.[8-10] The purpose of this research was to determine which ultrasonographic features, both alone and in combination, are most useful for making a correct diagnosis of acute appendicitis.[9-11]

Ultrasound observations of hyperaemia on Doppler imaging, peri-appendiceal fluid, wall thickening, and an enlarged appendiceal diameter (>6 mm) are the most dependable for acute appendicitis, according to our results. Hyperaemia was the most sensitive (88.2% of cases), suggesting that elevated appendix vascularity is a robust indicator of inflammation. This confirms what other research has shown: that colour Doppler imaging improves ultrasound's diagnostic utility by picking up on elevated blood flow in an inflamed appendix.[12-14]

With a sensitivity of 85.4% and specificity of 78.9%, appendiceal diameter >6 mm was determined to be a very dependable criterion. Multiple studies have found that an increased appendiceal diameter is the main sonographic criteria for appendicitis, therefore this seems sense. A big problem with this criterion is that it might lead to false positives because a dilated appendix can be detected in illnesses like moderate enteritis or lymphoid hyperplasia.[13-15] With a specificity of 89.1%, peri-appendiceal fluid was detected in 72.3% of the confirmed cases. So, it's not always there, but when it is, it lends a lot of credence to the diagnosis. With a specificity of 92.3% and a sensitivity of 45.5%, appendicolith presence was the most reliable indicator. While appendicoliths aren't very sensitive in simple episodes of appendicitis, their association with more severe complications like perforation or abscess formation explains why they're so common.[14-16]

The results show that the diagnostic accuracy is greatly improved when numerous sonographic observations are combined. Adding peri-appendiceal fluid further enhanced accuracy to 93.5%, while combining appendiceal diameter >6 mm with hyperaemia on Doppler imaging improved accuracy to 89.3%. Based on these results, it seems that misdiagnosis could result from using just one ultrasonographic feature, while a more thorough evaluation would be obtained by evaluating numerous sonographic factors.[17-19]

Ultrasonographic interpretation is best approached using a multimodal strategy, as has been stressed in earlier research. Consistent with our results, Kurtz et al. (2020) found that the use of numerous sonographic findings increased sensitivity to 94%. In order to decrease needless appendectomies and missed diagnoses, a combination of gray-scale and Doppler ultrasonography improves overall sensitivity and specificity.[18-20]

The non-invasiveness, absence of radiation exposure, and cost-effectiveness of ultrasonography make it a popular choice. However, the accuracy of this imaging technique depends on the operator and can be impacted by patient-related factors including obesity and bowel gas interference. When it comes to appendicitis diagnosis, computed tomography (CT) is typically regarded as the gold standard due to its superior sensitivity (94-98%) and specificity (95-99%). Patients with renal impairment, pregnant women, or children should not have CT because of the ionising radiation it uses and the contrast it uses.[20-22]

An additional option that minimises radiation exposure while yet providing accurate diagnoses is magnetic resonance imaging (MRI), which is especially useful in pregnant women. On the other hand, ultrasonography is more convenient and faster than MRI. Ultrasonography is still a beneficial first-line imaging modality for suspected appendicitis, especially in settings with limited resources, as our study shows when employed successfully with a combination of results. Significant therapeutic implications stem from the results of this investigation. To begin, in order to increase the reliability of their diagnoses, doctors should consider more than just one ultrasonographic parameter. Secondly, even if the appendiceal diameter is borderline, a significant suspicion of appendicitis should be raised in the presence of hyperaemia and peri-appendiceal fluid. Third, appendicolith is very specific for appendicitis, therefore its presence provides strong evidence of the diagnosis, particularly in more complex patients.[21-23]

Findings from imaging studies should be integrated with clinical evaluation, according to the study. It is important to conduct additional testing, like a second

ultrasound or alternative imaging, on patients who have severe clinical symptoms but unclear ultrasound results in order to prevent a wrong diagnosis. Our study has certain drawbacks, despite its strengths. To begin, there is some room for error in diagnosis due to the fact that ultrasonographic results are highly dependent on operator experience. Second, there's a chance that the sample size doesn't reflect real differences between patient populations, even when it's sufficient. Thirdly, a more thorough assessment of diagnostic accuracy would have been achieved if we had directly compared ultrasound results with CT or MRI. The results should be confirmed across varied groups in larger multicenter investigations, which should be the focus of future study. To further improve diagnosis accuracy and decrease reliance on operators, it may be worthwhile to investigate ultrasound interpretation with the help of artificial intelligence. The optimal method for diagnosing acute appendicitis could be better understood if research compared ultrasound with CT and MRI in various clinical contexts.[24-26]

CONCLUSION

This study confirms that ultrasonography is a valuable diagnostic tool for acute appendicitis, with specific findings such as hyperemia, appendiceal diameter >6 mm, and peri-appendiceal fluid showing high diagnostic value. Combining multiple ultrasonographic parameters significantly improves accuracy and reduces the risk of misdiagnosis. While ultrasound should be the first-line imaging modality, especially in pediatric and pregnant patients, clinicians should integrate imaging findings with clinical judgment for optimal patient management.

Funding: None

Conflict of Interest: None

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