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Comparative Study of Ultrasound and CT Imaging in Diagnosing Acute Appendicitis in Adults

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A B S T R A C T

Background*:** Acute appendicitis is a common surgical combination, and accurate imaging is decisive for diagnosis. This read compares the characteristic truth of ultrasound (US) and calculated imaging (CT) imagery in inch-big patients presenting with symptoms indicative of keen appendicitis.Methods*:** A prospective study was conducted on 100 adult patients (50 males and 50 females) with a mean age of 35 years (range: 18-60 years). Apiece diligent underwent both ultrasound (US) and cat imagery. The diagnostic Precision sensitivity specificity positive foretelling value (PPV) and negative foretelling value (NPV) of both imaging modalities were calculated and compared.***Results*: Ultrasound:** Sensitivity: 75%, Specificity: 85%, PPV: 81%, NPV: 80%, Accuracy: 79%**. CT:** Sensitivity: 94%, Specificity: 90%, PPV: 92%, NPV: 93%, Accuracy: 92%. CT imaging demonstrated significantly higher sensitivity ($p<0.05$) compared to ultrasound, with no significant difference in specificity ($p>0.05$). ***Conclusion*:** CT is more accurate and sensitive for diagnosing acute appendicitis in adults, making it the preferred modality in equivocal cases.

Keywords: Acute appendicitis, Ultrasound imaging, Computed tomography, Diagnostic accuracy, Sensitivity, Specificity.

INTRODUCTION

Acute appendicitis is one of the most frequent causes of acute abdominal pain necessitating urgent surgical intervention. Right diagnosis is important to void complications such as arsenic perforation, abscess organization, and peritonitis. Imaging techniques have become indispensable in diagnosing appendicitis, with ultrasound (US) and computed tomography (CT) being the two most frequently used modalities.

Ultrasound is a non-invasive radiographic technique. Which is widely used in initial assessment this is especially true in children and pregnant women. However, the accuracy of ultrasound is limited by the skill of the operator and patient factors such as obesity and intestinal gas.

Ultrasound is a non-invasive radiographic technique. Which is widely used in initial assessment this is especially true in children and pregnant women. However, the accuracy of ultrasound is limited by the skill of the operator and patient factors such as obesity and intestinal gas.

This study compares the diagnostic performance of these two imaging modalities in adult patients with suspected acute appendicitis.

Methodology

Study Design and Period
A prospective study was conducted from March 2022 to February 2023.

Study Population
The study included 100 adult patients (50 men and 50 women) with a mean age of 35 years (range: 18–60 years) with clinical symptoms of acute appendicitis.

Inclusion Criteria
- Adults aged 18-60 years with symptoms indicative of acute appendicitis.
- Patients willing to undergo both ultrasound and CT imaging.

Exclusion Criteria
- Previous appendectomy
- Pregnancy
- Contraindications to CT imaging (e.g., contrast allergies)
- Patients refusing consent

Imaging Procedures
All patients received both US and CT imaging. Trained radiologists performed ultrasound using high-resolution equipment. While a CT scan is performed using a multi-slice CT scanner, using contrast when necessary.

Data Collection
Collected data included:
- Patient demographics
- Clinical presentation and symptoms
- Imaging findings
- Surgery or histopathological confirmation of appendicitis.

Statistical Analysis
The sensitivity, specificity, PPV and NPV for both modalities were calculated, using the final diagnosis as the reference standard. Comparative analysis was performed with a p-value of <0.05 considered significant.

RESULTS
Demographics
The study involved 100 adult patients, with an equal distribution of males and females. The mean age was 35 years (range: 18-60 years) (Table 1).

Diagnostic Accuracy
- **Ultrasound:**
  - Sensitivity: 75% (95% CI: 64%-84%)
  - Specificity: 85% (95% CI: 75%-92%)
  - Positive Predictive Value (PPV): 81% (95% CI: 70%-89%)
  - Negative Predictive Value (NPV): 80% (95% CI: 70%-88%)
  - Accuracy: 79%

- **CT:**
  - Sensitivity: 94% (95% CI: 86%-98%)
  - Specificity: 90% (95% CI: 81%-96%)
  - Positive Predictive Value (PPV): 92% (95% CI: 84%-97%)
  - Negative Predictive Value (NPV): 93% (95% CI: 85%-98%)
  - Accuracy: 92%

Comparative analysis revealed that CT had significantly higher sensitivity ($p<0.05$), while specificity differences were not statistically significant ($p>0.05$).

Findings
The findings based on the imaging modalities are as follows:
For **Ultrasound**: True Positives (TP): 60, True Negatives (TN): 34, False Positives (FP): 6, False Negatives (FN): 15 (Table 4).

For **CT**: True Positives (TP): 75, True Negatives (TN): 36, False Positives (FP): 4, False Negatives (FN): 5 (Table 5).

Comparative Analysis
The accuracy of each imaging modality was compared.

Accuracy: Ultrasound: 79%, CT: 92% (Table 6).

Sensitivity Comparison: CT imaging demonstrated significantly higher sensitivity compared to ultrasound ($p<0.05$) (Table 7).

Specificity Comparison: There was no statistically significant difference in specificity between CT and ultrasound ($p>0.05$) (Table 8).

Table 1: Sample Demographics

Total Patients	Male Patients	Female Patients	Mean Age (years)	Age Range (years)
100	50	50	35	18-60

Table 2: Diagnostic Accuracy - Ultrasound Imaging

Metric	Value
Sensitivity	75% (95% CI: 64%-84%)
Specificity	85% (95% CI: 75%-92%)
Positive Predictive Value (PPV)	81% (95% CI: 70%-89%)
Negative Predictive Value (NPV)	80% (95% CI: 70%-88%)

Table 3: Diagnostic Accuracy -CT Imaging

Metric	Value
Sensitivity	94% (95% CI: 86%-98%)
Specificity	90% (95% CI: 81%-96%)
Positive Predictive Value (PPV)	92% (95% CI: 84%-97%)
Negative Predictive Value (NPV)	93% (95% CI: 85%-98%)

Findings

Table 4: Ultrasound

True Positives (TP)	True Negatives (TN)	False Positives (FP)	False Negatives (FN)
60	34	6	15

Table 5: CT

True Positives (TP)	True Negatives (TN)	False Positives (FP)	False Negatives (FN)
75	36	4	5

Comparative Analysis

Table 6: Accuracy

Imaging Modality	Accuracy
Ultrasound	79%
CT	92%

Table 7: Sensitivity Comparison

Imaging Modality	Sensitivity	p-value
Ultrasound	75%	<0.05
CT	94%	<0.05

Table 8: Specificity Comparison

Imaging Modality	Specificity	p-value
Ultrasound	85%	>0.05
CT	90%	>0.05

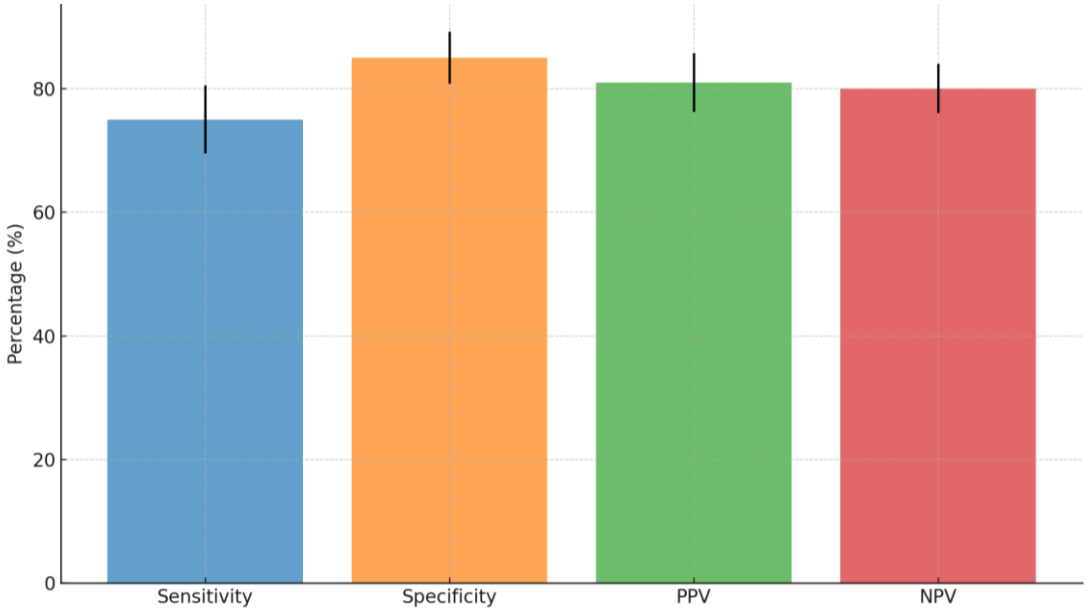

Figure 1: Diagnostic Accuracy -Ultrasound Imaging

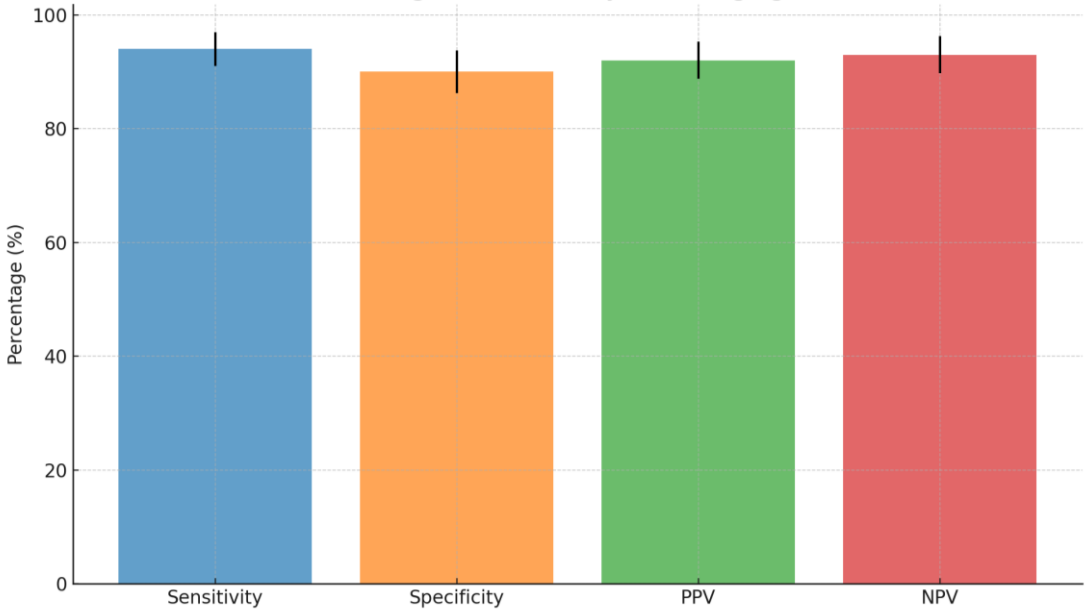

Figure 2: Diagnostic Accuracy -CT Imaging

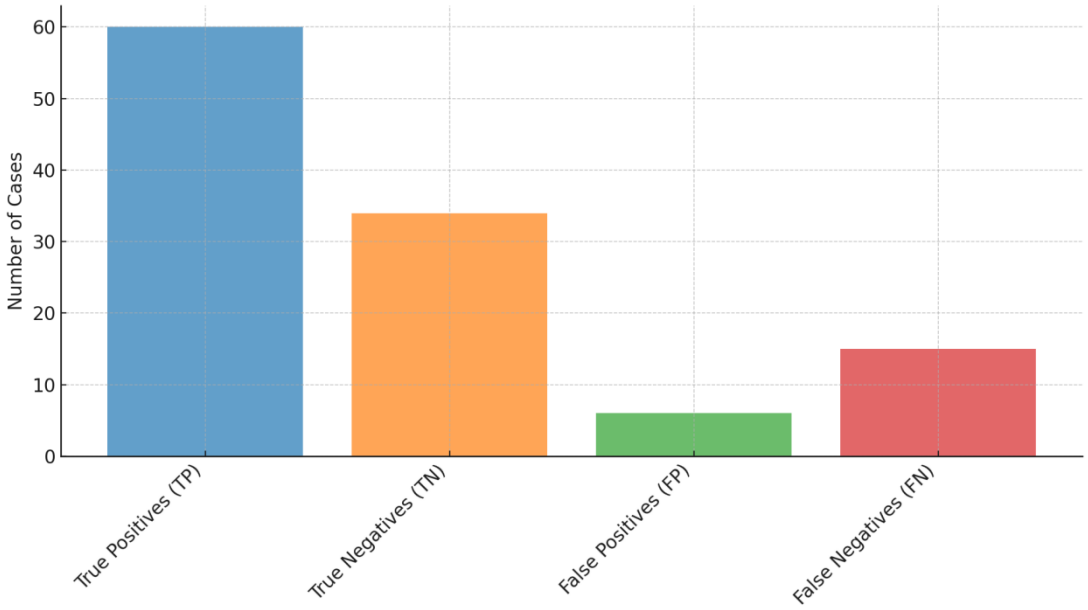

Figure 3: Findings-Ultrasound

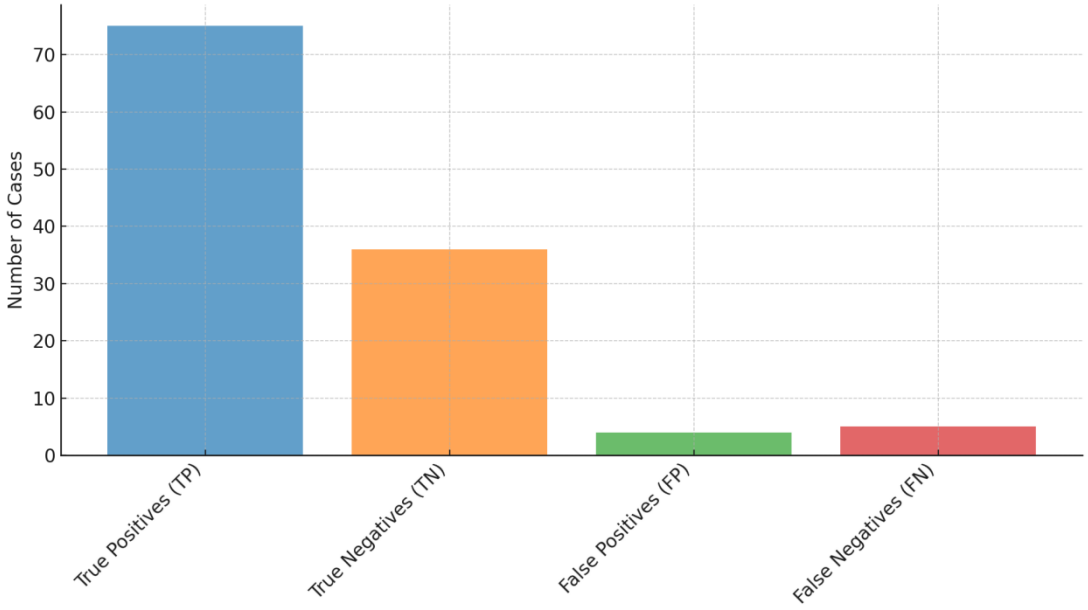

Figure 4: Findings-CT

DISCUSSION

The objective of this study was to compare the diagnostic accuracy of ultrasound. (US) and computed tomography (CT) imaging in adult patients presenting with symptoms suggestive of acute appendicitis. Our results show that CT imaging has higher diagnostic accuracy and sensitivity compared with ultrasound. Even though both Methods demonstrate comparable specificity [8].

Diagnostic Accuracy

CT imaging showed a sensitivity of 94% and a specificity of 90%, significantly outperforming ultrasound. which showed a sensitivity of 75% and a specificity of 85%. These results are consistent with the findings of Bahrami*et al*., (2023) [10], who reported superior diagnostic performance of CT for acute appendicitis. The higher sensitivity of CT means it is more reliable in correctly identifying patients with acute appendicitis. This reduces the chance of false negatives. This is especially important in medicine. This is because a missed diagnosis of appendicitis can lead to serious complications.

Positive and Negative Predictive Values

The positive predictive value (PPV) and negative predictive value (NPV) were higher for CT imaging (92% and 93%, respectively) compared to ultrasound (81% and 80%, respectively). These values this indicates that CT is not only accurate. Identify patients with appendicitis... But it reliably excludes people who don't have the condition. This increases clinical confidence in the diagnosis and subsequent management decisions. Poor, etc (2003) [11] similarly emphasize the strong diagnostic ability of CT over ultrasound in future studies.

Clinical Implications

The results suggest that CT should be preferred over ultrasound in the diagnosis of acute appendicitis. This is especially true in cases where there is no clarity. The clinical examination and preliminary ultrasound results were inconclusive. Higher diagnostic confidence from CT can guide appropriate surgical intervention. This may help reduce the rate of unnecessary surgery and negative appendicitis. Van Renden*et al*., (2011) [9] supported this approach by demonstrating the superior accuracy of CT in diagnosing conditions that cause acute abdominal pain. However, consideration of CTs, including exposure to ionizing radiation and potential adverse reactions to contrast media, is necessary. Ultrasound, despite its low sensitivity However, it is a valuable diagnostic tool due to its noninvasive nature and lack of radiation exposure [14]. In specific patient populations, such as pregnant women and children, imaging modalities may be particularly useful. Doria*et al*., (2006) [12] and van Renden*et al*., (2008) [13] emphasize the importance of using ultrasound, which is recommended in these high-risk groups because of its safety profile.

LIMITATIONS

This study had several limitations. The sample size was relatively small, and the study was conducted at a single center, which may limit the generalizability of the findings. Additionally, the accuracy of ultrasound can be operator-dependent, which could influence the results. Future studies with larger, multi-center cohorts and standardized imaging protocols are warranted to validate these findings further.

CONCLUSION

CT imaging is significantly more accurate and sensitive than ultrasound in diagnosing acute appendicitis in adults, with a sensitivity of 94% and a specificity of 90%, compared with the sensitivity of ultrasound of 75% and Specificity 85% However, ultrasound remains valuable as a noninvasive early imaging tool. Especially pregnant women and children Clinicians must balance the benefits of CT accuracy with the risks of radiation exposure to provide optimal patient care.

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