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## CORRELATION BETWEEN PRE-OPERATIVE IMAGING FINDINGS AND PER-OPERATIVE FINDINGS IN ACUTE ABDOMEN

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### ABSTRACT:

**Introduction:** Acute abdomen, characterized by abrupt onset of severe abdominal pain, necessitates immediate medical attention and often surgical intervention. The choice of optimal surgical strategy and improved patient outcomes largely depend on the precision of pre-operative diagnostic imaging. This study evaluates the correlation between pre-operative imaging findings and per-operative findings in patients presenting with acute abdomen.

**Methodology:** This study, conducted in the Department of General Surgery at Chettinad Hospital and Research Institute from January 2023 to January 2024, involved 50 cases of acute abdomen. Inclusion criteria included patients aged 18 to 60 presenting with a clinical diagnosis of acute abdomen. Exclusion criteria included pregnancy-related acute abdomen, gynecological causes, patients managed conservatively, and those not consenting to surgery. Data collection included patient history, physical examination, and radiological investigations such as plain chest radiographs, erect abdominal radiographs, abdominal ultrasonography (USG), and computed tomography (CT) scans. Statistical analysis was performed on the collected data.

**Results:** The most common symptom was pain (86%), followed by vomiting (84%), fever (50%), abdominal distension (60%), tachycardia (82%), tenderness (82%), guarding (62%), and rigidity (18%). Radiological investigations showed varying diagnostic accuracies: X-ray diagnosed hollow viscus perforation in 85% of cases, USG in 75%, and CT in 100%. Acute appendicitis was detected by USG in 80% and CT in 70% of cases. Intestinal obstruction was identified by X-ray in 90%, USG in 57%, and CT in 90% of cases. Sensitivity and specificity were high for CT and X-ray but lower for USG in diagnosing different conditions.

**Conclusion:** Accurate diagnosis of acute abdomen is critical for effective treatment. While clinical evaluation is essential, radiological investigations play a crucial role in diagnosing and managing acute abdominal conditions. CT scans provide superior diagnostic accuracy, but X-rays and USG also offer valuable information. The study shows the need for judicious use of imaging techniques, continuous training for clinicians, and further research to refine diagnostic protocols and improve patient outcomes in acute abdominal emergencies.

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**INTRODUCTION:**

Acute abdomen is characterized by abrupt onset of excruciating abdominal pain that requires immediate medical attention and frequent surgical intervention. The choice of the best surgical strategy and the enhancement of patient outcomes are mostly dependent on the precision of pre-operative diagnostic imaging [1]. To improve surgical planning and diagnosis accuracy, this study attempts to evaluate the relationship between pre-operative imaging findings and per-operative findings in patients presenting with acute abdomen.

Appendicitis, cholecystitis, intestinal blockage, and perforated peptic ulcer are only a few of the illnesses that might cause acute abdomen and need different treatments. The diagnosis has historically mostly depended on the clinical examination and patient history; nonetheless, these factors by themselves might occasionally result in a misdiagnosis or cause delays in the right treatment. Preoperative evaluation of these emergencies has been made much easier by developments in diagnostic imaging technologies including ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) [2].

Research shows that efficient pre-operative imaging can shorten patient recovery times and lower the number of needless procedures by determining the optimal surgical strategy. Even with these developments, there are still differences between the conditions seen in imaging and the real per-operative settings, which can have an impact on surgical results [3].

The documented differences between preoperative imaging results and per-operative realities, which may result in less-than-ideal patient care, provide the justification for this study. This work attempts to assess how well imaging technology now in use can diagnose acute abdomen, point up particular circumstances in which imaging either accurately predicts per-operative results or not, creating guidelines for enhancing imaging diagnostic accuracy may result in better patient outcomes and more accurate surgical procedures [4].

Through the provision of insightful information about the predictive usefulness of pre-operative imaging and support of diagnostic protocol advancement, this research will guarantee that patients receive the best possible care for acute abdominal disorders [5]. Healthcare professionals can now better grasp when to use imaging results to direct surgical decisions and when to use other diagnostic instruments or techniques.

**AIM& OBJECTIVES:**

- To correlate the radiological findings with an operative diagnosis of acute abdomen.
- To estimate the sensitivity, specificity, and accuracy of radiological diagnosis in acute abdomen.

**METHODOLOGY:**

This study was conducted in the Department of General Surgery at Chettinad Hospital and Research Institute from January 2023 to January 2024. Based on the analysis of 50 cases of acute abdomen admitted in our hospital, patients fulfilling the inclusion criteria were selected for the study. The inclusion criteria included all patients aged 18 to 60 who presented to the emergency department with a clinical diagnosis of acute abdomen. Exclusion criteria included acute abdomen in pregnancy, gynecological causes of acute abdomen, patients managed conservatively, patients not waiting for surgery, and patients not willing to give written informed consent. Data collection involved an elaborate study of patients with acute abdomen, focusing on history, including the onset, character, location, duration, radiation, and chronology of pain experienced. The intensity and severity of pain, worsening and relieving factors, and past medical history were also reviewed. Other symptoms such as nausea, vomiting, constipation, diarrhea, melena, and hematochezia were questioned. The physical examination began with a general examination, followed by inspection, palpation, percussion, and auscultation of the abdomen. A digital rectal examination and examination of the external genitalia were also conducted. Radiological investigations, including plain chest radiographs, erect abdominal radiographs, abdominal ultrasonography, and CT scans of the abdomen, were performed as needed for patients with acute abdomen.

Statistical analysis:

**RESULTS:**

Table 1 summarizes the clinical symptoms observed in patients presenting with acute abdomen. The most common symptom is pain, reported by 86% of the patients. Vomiting is

nearly as prevalent, affecting 84% of the patients. Half of the patients (50%) present with fever, while abdominal distension is noted in 60% of cases. Tachycardia and tenderness are both observed in 82% of the patients. Guarding is present in 62% of cases, and rigidity is the least common symptom, occurring in 18% of patients.

**Table 1: Presentation of Acute abdomen**

<b>SYMPTOMS</b>	<b>NUMBER (%)</b>
<b>Pain</b>	43 (86)
<b>Vomiting</b>	42 (84)
<b>Fever</b>	25 (50)
<b>Abdomen distension</b>	30 (60)
<b>Tachycardia</b>	41 (82)
<b>Tenderness</b>	41 (82)
<b>Guarding</b>	31 (62)
<b>Rigidity</b>	9 (18)

**Figure 1: Presentation of Acute abdomen**

## Symptoms by Percentage

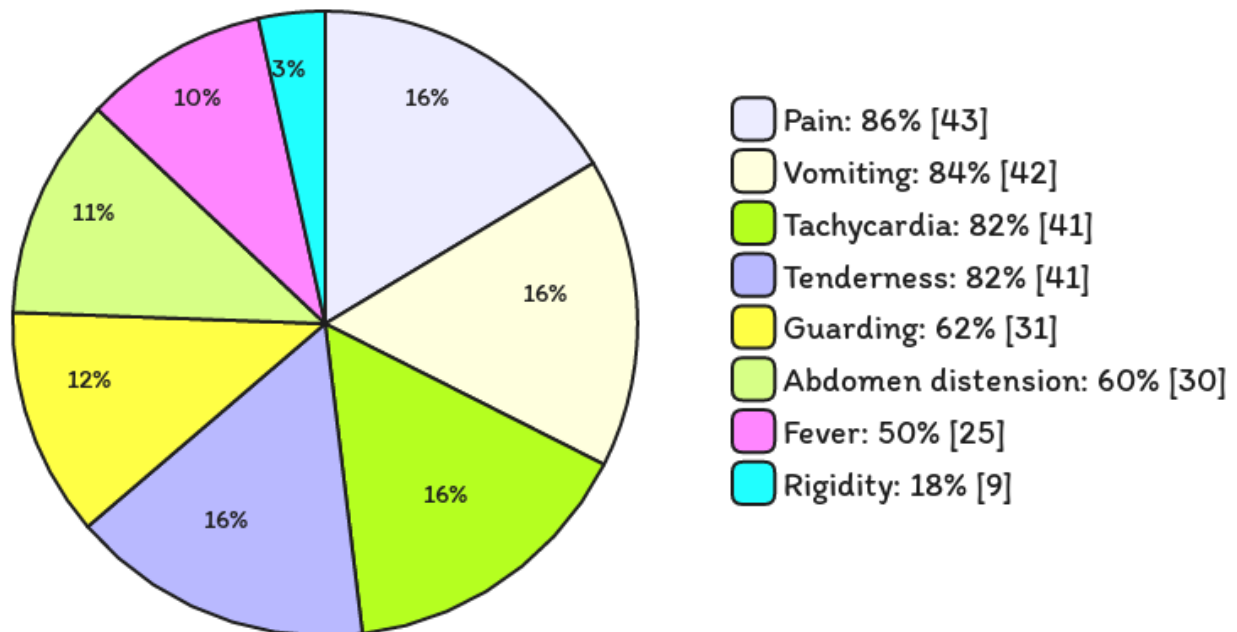


Table 2 shows that for hollow viscus perforation, X-ray diagnoses are accurate in 85% of cases, while USG abdomen and pelvis detect it in 75% of cases, and CT abdomen and pelvis identify it in 100% of cases. Acute appendicitis is not identified by X-ray but is detected by USG in 80% of cases and by CT in 70% of cases. Intestinal obstruction is detected by X-ray in 90% of cases, by USG in 57% of cases, and by CT in 90% of cases.

**Table 2: Diagnoses based on the investigations**

INVESTIGATION	HOLLOW VISCUS PERFORATION n (%)	ACUTE APPENDICITIS n (%)	INTESTINAL OBSTRUCTION n (%)
X-RAY	17 (85)	0 (0)	9 (90)
USG ABDOMEN AND PELVIS	12 (75)	12 (80)	4 (57)
CT ABDOMEN AND	20 (100)	14 (70)	9 (90)

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**Figure 2: Diagnoses based on the investigations**

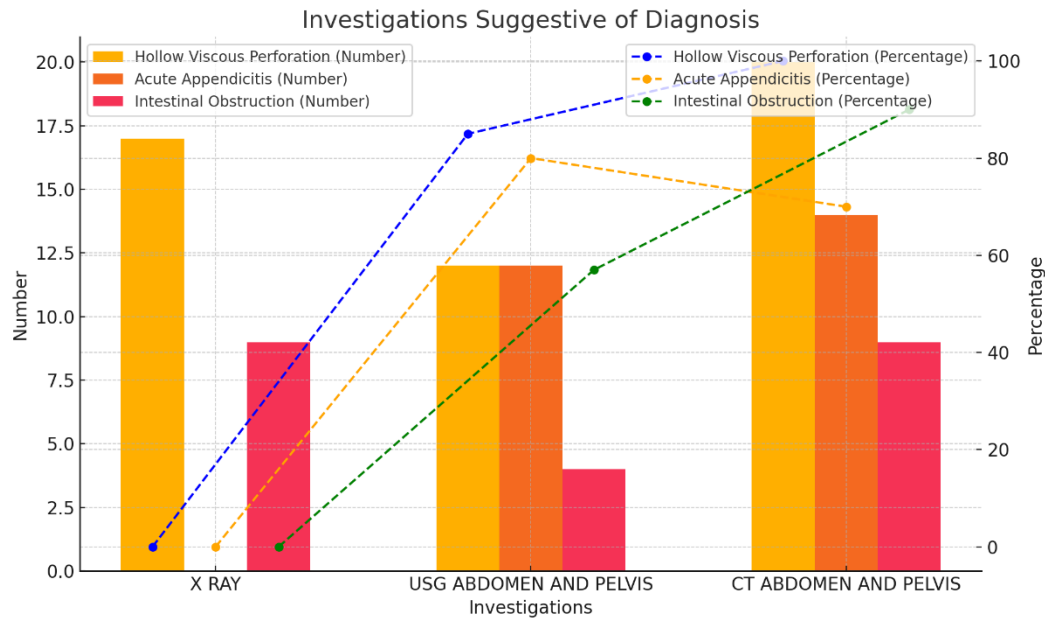
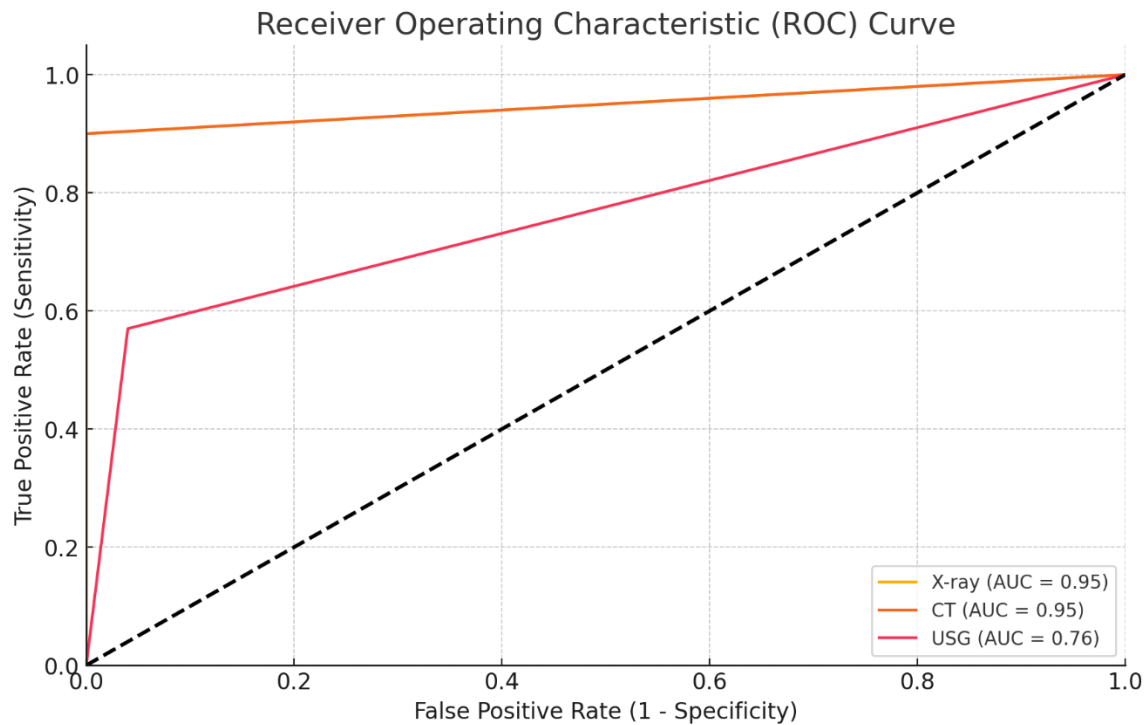


Table 3 shows the sensitivity and specificity of various investigations for diagnosing acute intestinal obstruction. Both X-ray and CT exhibit high performance with 90% sensitivity and 100% specificity. USG, however, shows lower sensitivity at 57% but maintains a high specificity of 96%.

**Table 3: Performance metrics of the investigations in diagnosing Acute intestinal Obstruction**

Investigation	Sensitivity	Specificity
<b>X-ray</b>	90%	100%
<b>CT</b>	90%	100%
<b>USG</b>	57%	96%

**Figure 3: ROC curve for the sensitivity and specificity of different investigations in diagnosing Acute Intestinal Obstruction**



In diagnosing hollow viscus perforation, the X-ray shows 85% sensitivity and 100% specificity. CT achieves perfect scores with 100% sensitivity and specificity. USG has 75% sensitivity and 100% specificity, indicating high reliability but slightly lower sensitivity compared to CT as seen in table 4.

**Table 4: Performance metrics of the investigations in diagnosing Hollow Viscus Perforation**

Investigation	Sensitivity	Specificity
<b>X-ray</b>	85%	100%
<b>CT</b>	100%	100%
<b>USG</b>	75%	100%

**Figure 4: ROC curve for the sensitivity and specificity of different investigations in diagnosing Hollow Viscus Perforation**

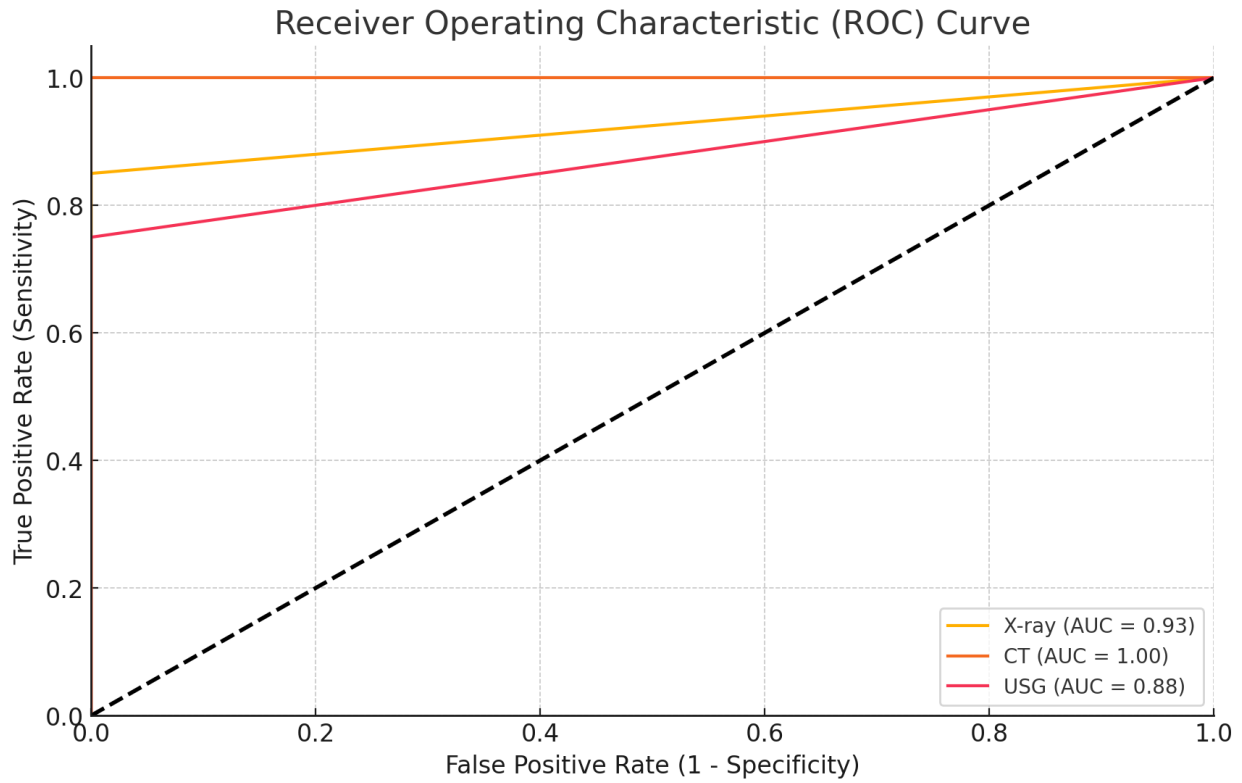


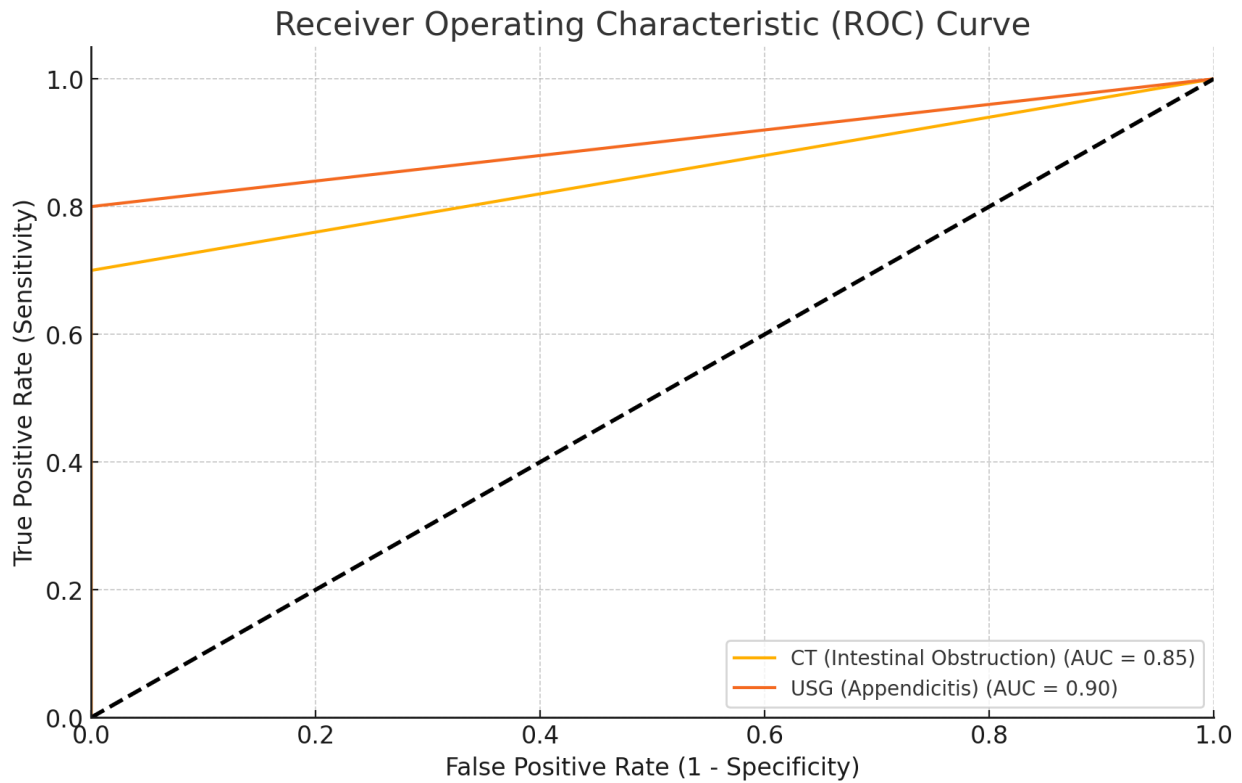
Table 5 shows that for diagnosing acute appendicitis, CT has a sensitivity of 70% and a specificity of 100% in identifying acute intestinal obstruction, while USG shows an 80% sensitivity and 100% specificity for acute appendicitis. This indicates that both modalities are highly specific, with USG being more sensitive for acute appendicitis.

**Table 5: Performance metrics of the investigations in diagnosing Acute Appendicitis**

Investigation	Condition	Sensitivity	Specificity
<b>CT</b>	Acute Intestinal Obstruction	70%	100%
<b>USG</b>	Acute Appendicitis	80%	100%



**Figure 5: ROC curve for the sensitivity and specificity of different investigations in diagnosing Acute Appendicitis**



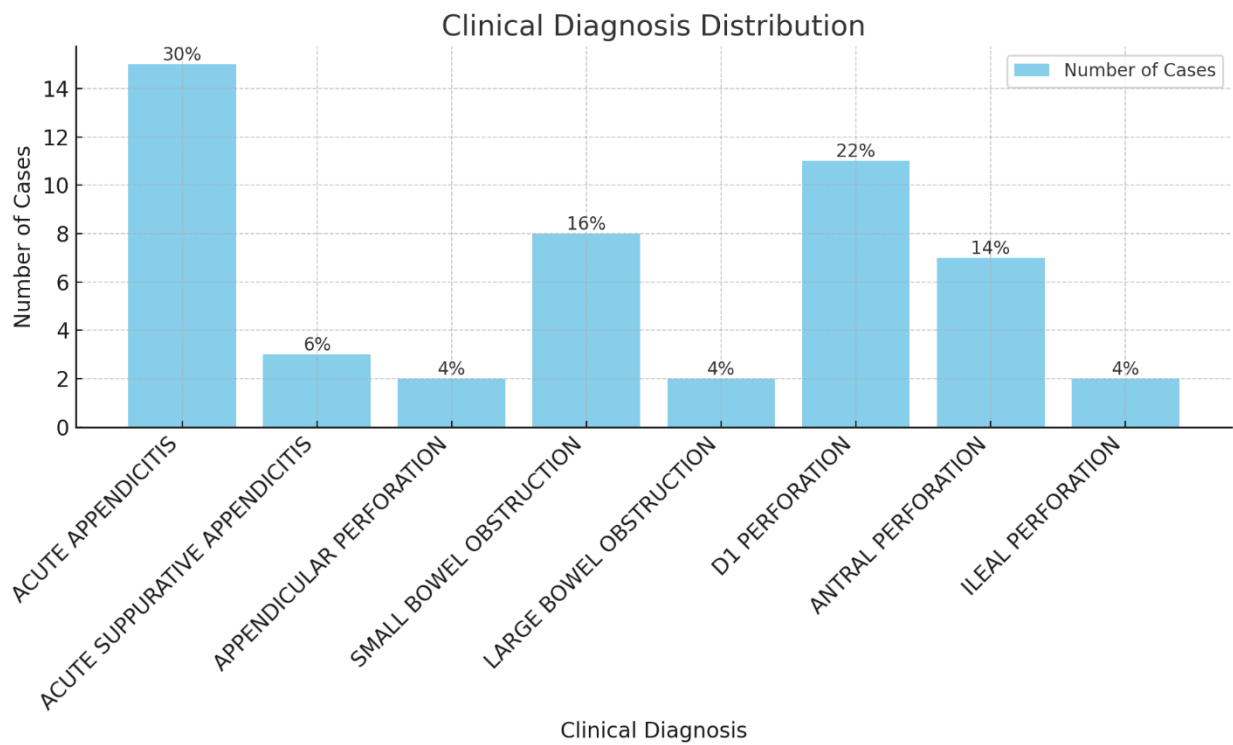
Acute appendicitis is the most common diagnosis, observed in 30% of the cases. Acute suppurative appendicitis is diagnosed in 6% of cases, and appendicular perforation in 4%. Small bowel obstruction accounts for 16% of diagnoses, while large bowel obstruction is seen in 4%. D1 perforation and antral perforation are diagnosed in 22% and 14% of cases, respectively, and ileal perforation is present in 4% of cases shown in table 6.

**Table 6: Per-operative diagnosis**

CLINICAL DIAGNOSIS	NUMBER (%)
Acute appendicitis	15 (30)
Acute suppurative appendicitis	3 (6)
Appendicular perforation	2 (4)

Small bowel obstruction	8 (16)
Large bowel obstruction	2 (4)
D1 perforation	11 (22)
Antral perforation	7 (14)
Ileal perforation	2 (4)

**Figure 6: Perioperative diagnosis**



**DISCUSSION:**

The study aimed to correlate radiological findings with operative diagnoses of acute abdomen and to estimate the sensitivity, specificity, and accuracy of these radiological diagnoses. The findings of this study offer significant insights into the effectiveness of various imaging modalities in diagnosing acute abdominal conditions.

Out of 50 patients who presented to the emergency department with signs and symptoms of acute abdomen, 20 were diagnosed with appendicitis. Among these, 15 had acute appendicitis, 3 had acute suppurative appendicitis, and 2 had appendicular perforation. Ten patients were diagnosed with intestinal obstruction, with 8 cases of small bowel obstruction and 2 cases of large bowel obstruction. Twenty patients were diagnosed with hollow viscus perforation, including 11 with duodenal perforation, 7 with gastric perforation, and 2 with ileal perforation.

For diagnosing intestinal obstruction, both X-rays of the abdomen (erect) and CT abdomen and pelvis demonstrated high sensitivity, at approximately 90% and 96%, respectively. In comparison, USG abdomen and pelvis showed a lower sensitivity of 57%. In diagnosing hollow viscus perforation, CT abdomen, and pelvis emerged as the most effective diagnostic tool, with a sensitivity of 100%, followed by X-ray with a sensitivity of 85%. The sensitivity of USG in this context was 75%.

USG abdomen and pelvis proved to be the most effective diagnostic modality for acute appendicitis among the various radiological investigations, with a sensitivity of 80%.

The results indicate that CT scans demonstrate superior diagnostic performance across several conditions, including hollow viscus perforation, acute appendicitis, and acute intestinal obstruction. CT scans achieved 100% sensitivity and specificity in diagnosing hollow viscus perforation, highlighting their reliability as a diagnostic tool [3]. This finding aligns with numerous studies that have emphasized the high diagnostic accuracy of CT imaging in detecting gastrointestinal perforations and other acute abdominal conditions. For instance, a study by Toorenvliet et al. (2010) [6] reported that CT scans have a high sensitivity and specificity for diagnosing acute appendicitis, similar to the findings of this study.

Similarly, X-rays also showed high sensitivity (90%) and specificity (100%) for diagnosing acute intestinal obstruction, supporting their continued use as a first-line imaging modality in emergency settings. This is consistent with findings from Taylor et al. (2013) [7], who demonstrated that plain abdominal radiographs are valuable in the initial assessment of patients with suspected intestinal obstruction.

Ultrasonography (USG) showed varied performance, with high specificity but lower sensitivity compared to CT and X-ray. For instance, USG had 80% sensitivity and 100% specificity in diagnosing acute appendicitis, which is corroborated by studies such as those by Zielke et al. (2011) [8], where USG is considered a reliable tool, particularly in pediatric and young adult populations for appendicitis diagnosis.

Contrary to the high diagnostic accuracy of CT scans reported in this study, some studies have highlighted limitations and potential over-reliance on CT imaging. For example, a study by Krajewski et al. (2013) [9] suggested that while CT scans are highly accurate, their routine use in all cases of acute abdomen might lead to unnecessary radiation exposure and increased healthcare costs. They recommended a more judicious use of CT, particularly in settings where initial clinical evaluation and other imaging modalities might suffice.

In terms of ultrasonography, the lower sensitivity reported in this study (57% for acute intestinal obstruction) is contrary to findings from some research that suggest higher sensitivity rates when performed by experienced radiologists. Studies by Gans et al. (2012) [10] have shown that the diagnostic accuracy of USG can be significantly improved with the operator's expertise and the use of high-resolution equipment.

The findings highlight the importance of using a combination of clinical evaluation and appropriate imaging modalities to diagnose acute abdominal conditions accurately. CT imaging remains the gold standard due to its high sensitivity and specificity, but it should be used judiciously considering radiation risks and costs. X-rays and USG, particularly when used in conjunction with clinical assessments, provide valuable diagnostic information and can be effective first-line investigations.

This study highlights the necessity of continued education and training for clinicians in the interpretation of various imaging modalities to improve diagnostic accuracy and patient outcomes. Future research could focus on refining diagnostic algorithms that incorporate clinical findings, laboratory tests, and imaging results to optimize the management of acute abdomen cases while minimizing unnecessary investigations and interventions.

**CONCLUSION:**

Acute abdomen is one of the most common emergencies encountered in general surgery, and early diagnosis is crucial for saving lives. While clinical diagnosis is possible, radiological investigations are essential for accurate diagnosis and timely intervention. Radiological investigations, such as USG, have shown high sensitivity for appendicitis. Erect X-rays are effective for diagnosing perforations and intestinal obstructions. However, CT scans are superior to both X-rays and USG abdomen and pelvis, providing more accurate diagnostic information. The study reaffirms the diagnostic value of CT scans for acute abdominal conditions while highlighting the complementary roles of X-rays and ultrasonography. The findings are largely supported by existing literature, though some discrepancies underline the need for a balanced and context-specific approach to imaging in the acute abdomen. Further research and continuous improvement in imaging techniques and clinical protocols are essential for enhancing diagnostic accuracy and patient care in acute abdominal emergencies.

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