e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(3); 434-442

Original Research Article

Diagnostic Accuracy of Ultrasonography Compared with Computed Tomography in Non-Traumatic Acute Abdominal Pain

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Received: 18-01-2026 / Revised: 12-02-2026 / Accepted: 08-03-2026
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Conflict of interest: Nil

Abstract

Background: Non-traumatic acute abdominal pain is a frequent clinical presentation requiring prompt diagnosis to guide appropriate management. Imaging plays a critical role in identifying the underlying pathology. Ultrasonography (USG) is commonly used as the initial imaging modality due to its availability and safety profile, whereas computed tomography (CT) provides detailed anatomical evaluation and higher diagnostic accuracy. This study aimed to compare the diagnostic performance of USG and CT in the evaluation of non-traumatic acute abdominal pain.

Material and Methods: This cross-sectional observational study included 150 patients presenting with non-traumatic acute abdominal pain. Clinical details including the nature, duration, and localization of pain were recorded. All patients underwent ultrasonography followed by CT scanning for diagnostic evaluation. The distribution of abdominal pathologies and the sensitivity of USG and CT for different conditions were analyzed and compared.

Results: A total of 150 patients were evaluated. Acute pain of <24 hours duration was the most common presentation (48%), followed by subacute pain of 24–72 hours (32%) and chronic pain >72 hours (20%), with a mean pain duration of 31.6 ± 17.2 hours. The most frequent site of pain was the epigastric region (38.6%), followed by the right lower quadrant (24.3%) and flank region (18.3%). Acute pancreatitis was the most common pathology (26%), followed by appendicitis (12.6%), ureteric colic (12%), intestinal obstruction (10%), and acute cholecystitis (10%). Ultrasonography demonstrated variable sensitivity across different conditions, including 56.4% for pancreatitis, 78.9% for appendicitis, 88.9% for ureteric colic, 80% for intestinal obstruction and acute cholecystitis, and 20% for hollow viscus perforation. In contrast, CT showed 100% sensitivity in detecting all evaluated pathologies.

Conclusion: Ultrasonography serves as a useful initial imaging modality for patients presenting with non-traumatic acute abdominal pain; however, computed tomography demonstrates superior diagnostic accuracy and remains the preferred modality for definitive evaluation.

Keywords: Acute abdomen, ultrasonography, computed tomography, non-traumatic abdominal pain, diagnostic accuracy.

DOI: 10.25258/ijcpr.18.3.70

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Introduction

Acute abdominal pain is one of the most common reasons for emergency department visits and accounts for a substantial proportion of surgical consultations worldwide. The condition encompasses a wide spectrum of underlying pathologies ranging from benign, self-limiting disorders to life-threatening surgical emergencies such as appendicitis, intestinal obstruction, pancreatitis, and perforated viscera. Rapid and accurate diagnosis is therefore essential to guide appropriate management and reduce morbidity and mortality [1]. Clinical evaluation alone is often insufficient to determine the exact cause of acute abdomen because many abdominal diseases present with overlapping symptoms and nonspecific physical findings. As a result, imaging modalities have become an integral part of the diagnostic work-up of patients presenting with acute

abdominal pain. Appropriate imaging not only helps identify the underlying pathology but also assists in determining the severity of disease and guiding treatment decisions [1,2]. Ultrasonography (USG) is frequently used as the first-line imaging modality in patients with acute abdominal pain because it is widely available, non-invasive, inexpensive, and free from ionizing radiation. It is particularly useful for evaluating hepatobiliary disease, appendicitis, renal pathology, and certain inflammatory abdominal conditions. Several studies have demonstrated that ultrasonography can achieve good diagnostic accuracy for conditions such as appendicitis and acute cholecystitis, although its effectiveness may depend on operator experience and patient-related factors [3–5].

Computed tomography (CT), on the other hand, provides detailed cross-sectional visualization of abdominal organs and is highly sensitive for detecting a wide range of abdominal pathologies. CT is especially valuable when ultrasonography findings are inconclusive or when complex intra-abdominal conditions such as bowel obstruction, perforation, or pancreatitis are suspected. Comparative studies have shown that CT generally detects a greater number of clinically significant conditions than ultrasound and is often considered the most reliable imaging modality for evaluating acute abdominal pain in adults [2,6].

Despite the advantages of CT, concerns regarding radiation exposure and cost necessitate careful selection of imaging strategies. Therefore, determining the optimal role of ultrasonography and CT in the evaluation of non-traumatic acute abdominal pain remains an important clinical consideration. The present study was undertaken to compare the diagnostic performance of ultrasonography and computed tomography in patients presenting with non-traumatic acute abdominal pain.

Material and Methods

Study Design and Study Setting: This observational study was conducted in the Department of Radiology at Sir T General Hospital, Bhavnagar, and Gujarat, India. The study included consecutive patients presenting with acute abdominal pain suspected to be of non-traumatic origin. The study period extended from August 2023 to February 2025.

Sample Size: A total of 150 patients presenting with non-traumatic acute abdominal pain and referred to the radiology department for imaging evaluation were included in the study.

Inclusion Criteria

- Patients referred to the radiology department for ultrasonography and CT examination with suspected non-traumatic acute abdominal pathology.

Exclusion Criteria

- Patients who did not provide written informed consent or, in the case of minors, whose parents or guardians did not provide consent.
- Patients presenting with traumatic causes of acute abdomen.
- Patients advised for contrast-enhanced CT who had a known allergy to iodinated contrast agents.

Data Collection Procedure: All patients underwent imaging evaluation using routine real-time ultrasonography and computed tomography. Ultrasonography examinations were performed using Philips Affiniti 50 ultrasound system and Esaote MyLab 7 ultrasound system. Computed tomography examinations were conducted using Canon Aquilion Lightning 16-slice CT scanner and GE Revolution EVO 128-slice CT scanner. Intravenous and rectal contrast agents were administered according to standard radiological guidelines whenever indicated. The imaging findings were subsequently correlated with clinical examination, laboratory investigations, and operative findings wherever surgical intervention was performed.

Ultrasonography Technique: Grey-scale ultrasonography was used as the initial imaging modality in patients presenting with acute abdominal pain. Two primary types of transducers were utilized: convex (curvilinear) and linear probes.

The convex transducer, operating at a frequency range of 2–5 MHz, provided greater depth penetration with moderate spatial resolution. Due to its wide field of view, it was primarily used for the evaluation of deeper abdominal structures including the liver, gallbladder, kidneys, pancreas, spleen, pelvic organs, and bowel loops.

The linear transducer operated at a higher frequency range of 5–15 MHz or higher, providing superior near-field resolution but limited penetration. This probe was mainly used for evaluation of superficial structures and targeted assessment when required.

A graded compression technique was applied during ultrasonographic examination. This technique involved gentle and gradual compression of the abdominal wall to displace bowel gas and adjacent fat, thereby improving visualization of deeper structures and reducing the distance between the transducer and the target organ. The method also allowed assessment of bowel wall rigidity and tenderness.

A systematic examination of the entire abdomen was performed to assess the gallbladder, pancreas, kidneys, abdominal aorta, stomach, small and large intestines, appendix, uterus, and ovaries. In female patients, a moderately filled urinary bladder facilitated evaluation of distal ureters and pelvic organs. The peritoneal cavity was screened using multiple vertically oriented overlapping scanning planes with a broad-based high-frequency probe to detect bowel pathology. Diseased bowel loops were identified by thickened hypoechoic walls contrasting with surrounding hyperechoic mesenteric fat.

Computed Tomography Technique: Contrast-enhanced computed tomography (CECT) of the abdomen was performed using multidetector CT scanners. Intravenous contrast medium consisted of non-ionic low-osmolar iodinated contrast (Iohexol, 350 mg/mL). Approximately 80–90 mL of contrast agent was administered intravenously at a rate of 3–5 mL/s.

CT acquisition included multiple phases depending on clinical indication:

- **Non-contrast phase:** Performed to detect calculi, hemorrhage, calcifications, or to provide a baseline for lesion characterization.
- **Arterial phase:** Acquired approximately 20–30 seconds after contrast injection for vascular assessment.
- **Portal venous phase:** Obtained 60–70 seconds after injection for optimal evaluation of solid abdominal organs, bowel wall, and vasculature.
- **Delayed phase:** Acquired 5–15 minutes after contrast administration when indicated, particularly for urinary tract evaluation or characterization of certain hepatic lesions.

The scan coverage extended from the dome of the diaphragm to the symphysis pubis, encompassing the entire abdomen and pelvis.

For gastrointestinal tract evaluation, oral and rectal contrast agents were administered when required. Approximately 800–1000 mL of diluted water-soluble oral contrast was administered, with scanning performed after a delay of approximately 60–120 minutes to allow adequate bowel opacification.

Rectal contrast was administered as a 3% solution of water-soluble contrast diluted in saline via a rectal tube while the patient was positioned on the CT table. Up to 1000 mL of contrast was administered depending on patient tolerance.

Results

A total of 150 patients presenting with non-traumatic acute abdominal pain were included in the study. The age and gender distribution of different abdominal pathologies is illustrated in Figure 1. The distribution of patients according to the nature and duration of abdominal pain is summarized in Table 1. Acute pain of less than 24 hours duration was the most common presentation, observed in 72 patients (48%). Subacute pain lasting between 24–72 hours was noted in 48 patients (32%), while chronic pain of more than 72 hours duration was reported in 30 patients (20%). The overall mean duration of pain was 31.6 ± 17.2 hours. The localization of abdominal pain among the study population is shown in Table 2. The most common site of pain was the epigastric region, reported in 58 patients (38.6%). Right lower quadrant pain was observed in 36 patients (24.3%), followed by flank pain in 28 patients (18.3%). Diffuse abdominal pain was present in 15 patients (10%), while periumbilical pain occurred in 10 patients (6.3%). Left lower quadrant pain was the least frequent presentation, reported in 3 patients (2.3%).

The distribution of various non-traumatic acute abdominal conditions diagnosed in the study population is presented in Table 3. Acute pancreatitis was the most common pathology, accounting for 39 cases (26%). This was followed by appendicitis in 19 patients (12.6%) and ureteric colic in 18 patients (12%). Intestinal obstruction and acute cholecystitis were each identified in 15 patients (10%). Liver abscess was diagnosed in 10 patients (6.6%). Pyelonephritis and iliocolitis were each reported in 7 patients (4.6%). Hollow viscus perforation and choledocholithiasis were observed in 5 patients each (3.3%). Obstructed hernia was identified in 3 patients (2%) and intussusception in 2 patients (1.3%). Other miscellaneous conditions accounted for 5 cases (3.3%). The diagnostic performance of USG and CT in identifying various non-traumatic acute abdominal pathologies is summarized in Table 4. CT demonstrated a sensitivity of 100% for all evaluated conditions. In comparison, the sensitivity of USG varied depending on the underlying pathology. Overall, CT scan demonstrated superior diagnostic sensitivity compared to ultrasonography in the evaluation of non-traumatic acute abdominal pathologies (Table 4).

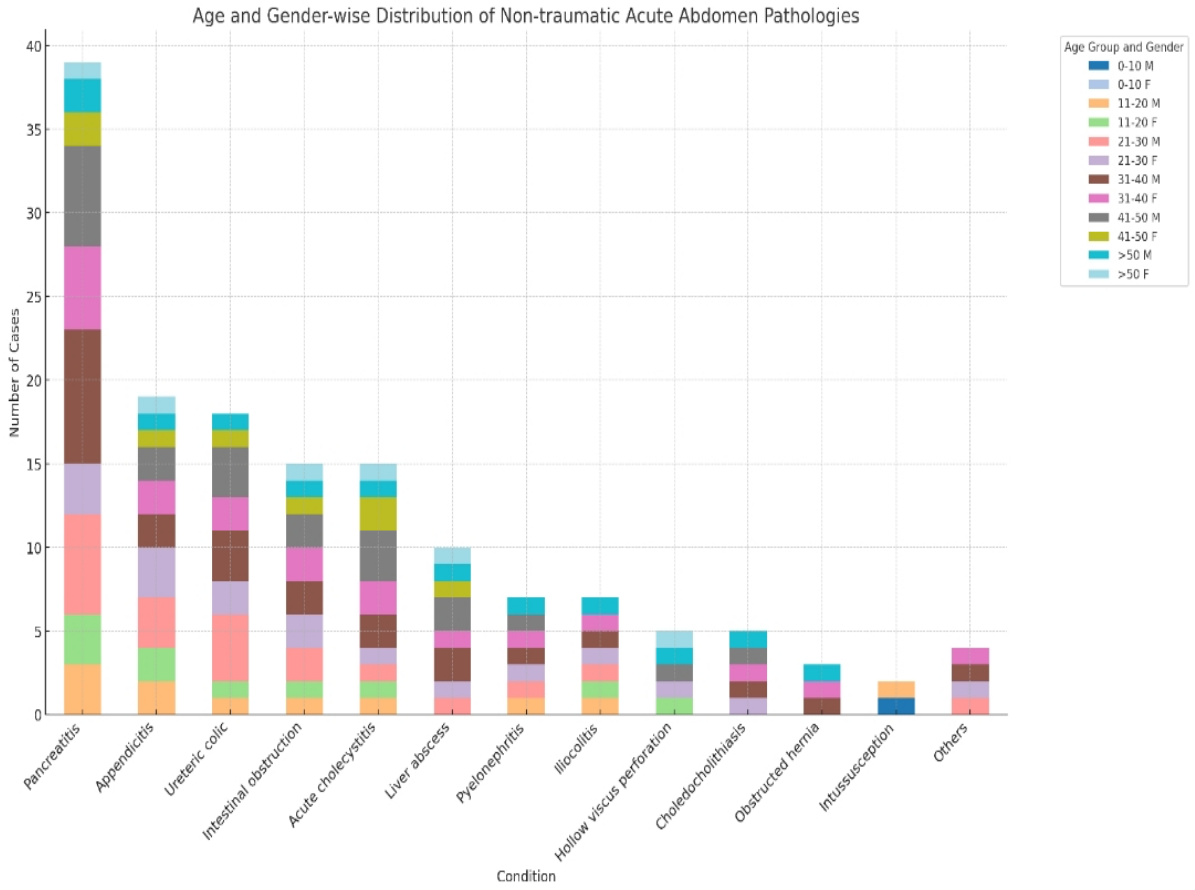

Figure 1: Grouped bar chart comparing age and Gender wise distribution of non-traumatic acute abdomen pathologies

Table 1: Distribution according to Nature and Duration of Pain

Pain Type	Duration	Number of Patients	Percentage (%)	Mean±SD (Hours)
Acute	<24 hours	72	48	-
Subacute	24–72 hours	48	32	-
Chronic	>72 hours	30	20	-
Total	**-**	**150**	**100**	**31.6±17.2**

Table 2: Distribution according to Localization and Radiation of Pain

Pain Localization	Number of Patients	Percentage (%)
Epigastric	58	38.6
Right Lower Quadrant(RLQ)	36	24.3
Flank Pain	28	18.3
Diffuse Abdominal Pain	15	10
Periumbilical	10	6.3
Left Lower Quadrant(LLQ)	3	2.3
Total	**150**	**100**

Table 3: Distribution of non-traumatic acute abdomen pathologies

Disease Condition	Number of Patients	Percentage (%)
Pancreatitis	39	26
Appendicitis	19	12.6
Ureteric Colic	18	12
Intestinal obstruction	15	10
Acute Cholecystitis	15	10
Liver abscess	10	6.6
Pyelonephritis	7	4.6
Iliocolitis	7	4.6

Hollow viscus perforation	5	3.3
Choledocholithiasis	5	3.3
Obstructed hernia	3	2
Intussusception	2	1.3
Others	5	3.3
Total	**150**	**100**

Table 4: Diagnostic accuracy of USG and CT in traumatic acute abdomen pathologies

Diagnosis	Number of cases	USG Positive	CT Positive	Sensitivity of USG	Sensitivity of CT
Pancreatitis	39	22	39	56.4%	100%
Appendicitis	19	15	19	78.9%	100%
Ureteric colic	18	16	18	88.9%	100%
Intestinal obstruction	15	12	15	80.0%	100%
Acute cholecystitis	15	12	15	80.0%	100%
Liver abscess	10	8	10	80.0%	100%
Pyelonephritis	7	6	7	85.7%	100%
Iliocolitis	7	5	7	71.4%	100%
Hollow viscus perforation	5	1	5	20.0%	100%
Choledocholithiasis	5	3	5	60.0%	100%
Obstructed hernia	3	2	3	66.7%	100%
Intussusception	2	2	2	100.0%	100%
Others	5	3	5	60.0%	100%

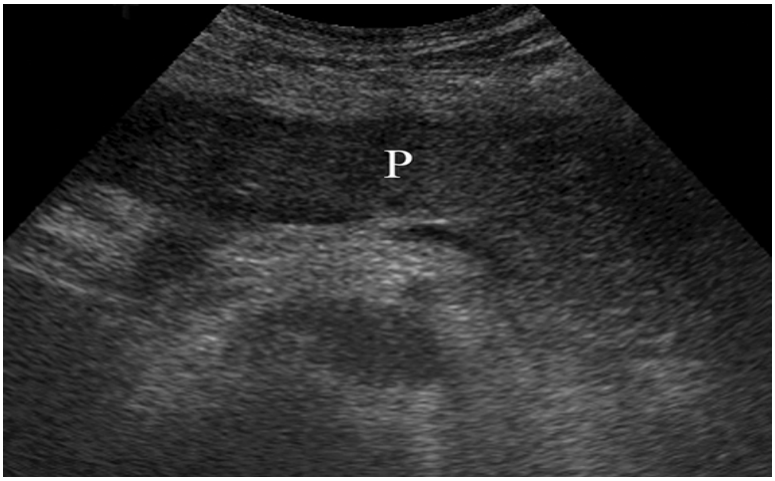

Figure 2 (A): USG: Diffusely enlarged pancreas with mild peripancreatic fluid.

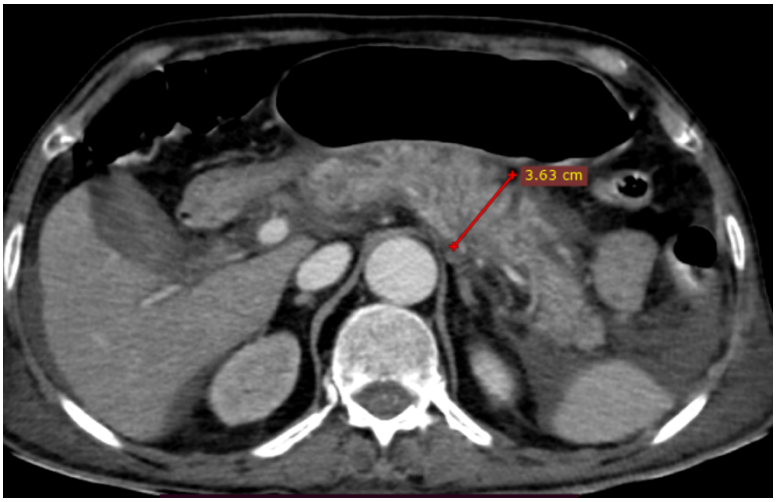

Figure 2 (B): CT: Swollen pancreas with peripancreatic fat stranding and fluid collection.

Figure 3 (A): USG: few focal necrotic areas seen in head and body of pancreas.

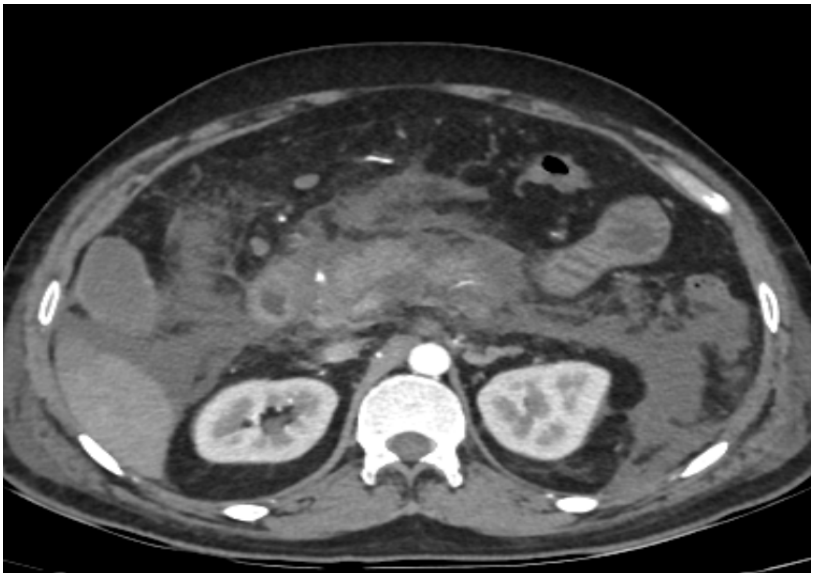

Figure 3 (B): CT: non-enhancing necrotic pancreas with surrounding fat stranding and fluid collection

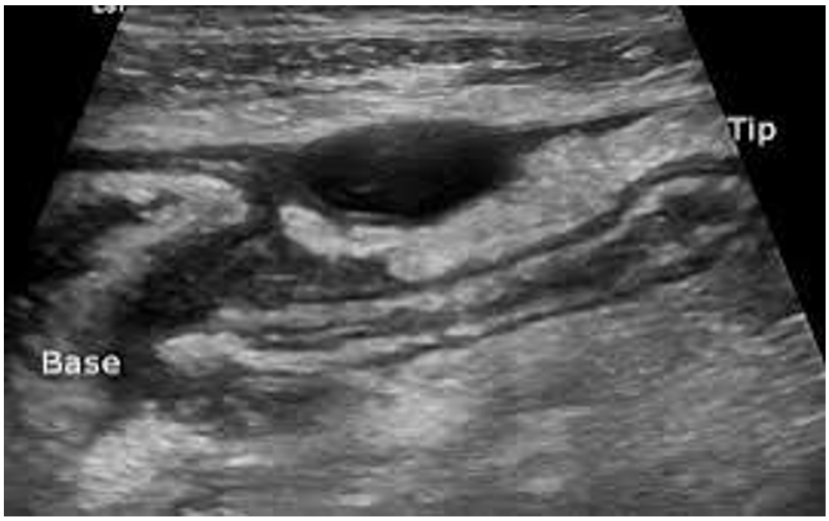

Figure 4 (A): USG: Dilated non-compressible tubular structure in RIF with surrounding echogenic fat and hypoechoic fluid collection adjacent to base.

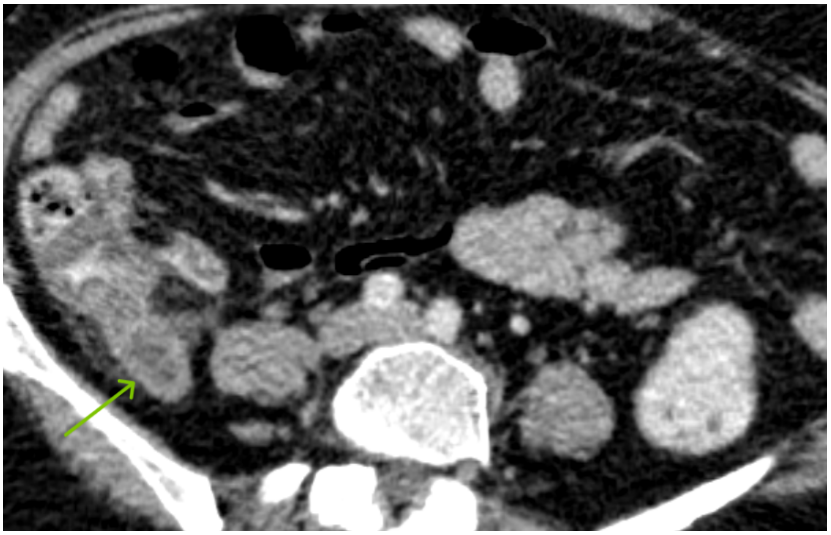

Figure 4 (B): CT: Dilated appendix with wall enhancement and periappendiceal fat stranding

Figure 5 (A): USG: Hydronephrosis with echogenic focus in ureter causing shadowing.

Figure 5 (B): CT: Ureteric calculus with upstream mild hydronephrosis.

Discussion

The present study evaluated the diagnostic utility of USG and CT in patients presenting with non-traumatic acute abdominal pain. Imaging plays a central role in the diagnostic work-up of acute abdomen because clinical findings alone may not reliably differentiate among various abdominal pathologies. Modern imaging modalities provide rapid identification of underlying causes and guide appropriate therapeutic management [7].

In the present study, acute pain of less than 24 hours duration was the most common clinical presentation, followed by subacute and chronic pain. Similar patterns of presentation have been reported in studies evaluating acute abdominal pain in emergency settings, where patients frequently present with sudden onset pain requiring urgent diagnostic evaluation [7]. Early identification of the underlying pathology is therefore essential to avoid delays in management and prevent complications.

Among the different disease conditions identified in this study, acute pancreatitis was the most common pathology, followed by appendicitis, ureteric colic, intestinal obstruction, and acute cholecystitis. Acute pancreatitis is a common cause of severe epigastric pain and frequently requires imaging for confirmation and evaluation of disease severity. Computed tomography is particularly useful in these cases because it allows visualization of pancreatic inflammation, fluid collections, and local complications [8]. CT-based scoring systems such as the CT severity index are widely used to assess the severity and predict complications of acute pancreatitis, demonstrating high diagnostic accuracy in clinical practice [9].

The findings of the present study also demonstrate that ultrasonography showed variable sensitivity depending on the underlying pathology. USG demonstrated relatively higher sensitivity for conditions such as ureteric colic, appendicitis, and hepatobiliary diseases, while its sensitivity was considerably lower for conditions like pancreatitis and hollow viscus perforation.

These findings are consistent with previous studies showing that ultrasonography is highly operator-dependent and its diagnostic accuracy may be limited by factors such as bowel gas, obesity, and deep anatomical location of certain organs [10].

Computed tomography, on the other hand, demonstrated superior diagnostic performance in the present study, with 100% sensitivity for all evaluated pathologies. Several comparative studies have similarly reported that CT has higher diagnostic accuracy than ultrasound in evaluating acute abdominal conditions. For example, CT has been shown to have greater sensitivity and specificity for diagnosing appendicitis compared with ultrasonography, leading to more accurate clinical decision-making [11]. Prospective studies evaluating emergency abdominal imaging have also demonstrated that CT provides higher overall diagnostic accuracy than ultrasound in patients presenting with acute abdominal pain [12].

In addition to diagnosing the primary pathology, CT also provides comprehensive evaluation of intra-abdominal structures and can detect complications or alternative diagnoses that may not be evident on ultrasound. The ability of CT to provide cross-sectional imaging and detailed visualization of abdominal organs significantly enhances its diagnostic capability in complex cases of acute abdomen [13].

Despite the higher diagnostic accuracy of CT, ultrasonography continues to play an important role as the initial imaging modality because it is inexpensive, widely available, and does not involve ionizing radiation. Current evidence suggests that ultrasound may be used as a first-line investigation in selected patients, while CT should be reserved for cases with inconclusive findings or when more detailed anatomical evaluation is required [14].

Conclusion

CT demonstrated superior diagnostic performance compared with USG in the evaluation of non-traumatic acute abdominal pain. While ultrasonography proved useful as an initial, non-invasive, and readily available imaging modality—showing good sensitivity for conditions such as ureteric colic, appendicitis, intestinal obstruction, and hepatobiliary infections—its diagnostic yield was limited in certain pathologies, particularly pancreatitis and hollow viscus perforation. In contrast, computed tomography showed consistently higher sensitivity and was able to accurately detect all evaluated abdominal pathologies in the study. Therefore, ultrasonography can serve as an effective first-line imaging tool for the preliminary assessment of patients with acute abdomen, whereas computed tomography remains the most reliable modality for definitive diagnosis, especially in complex or inconclusive cases.

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