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RESEARCH ARTICLE

MDCT Imaging in Non-Traumatic Acute Abdomen with Its Ultrasound Correlation

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ABSTRACT

Introduction: Non-traumatic acute abdomen is a common clinical emergency with diverse etiologies requiring prompt and accurate diagnosis. Imaging plays a critical role in evaluation, with ultrasound (USG) often used as the first-line modality and multidetector computed tomography (MDCT) offering higher diagnostic accuracy, particularly when USG findings are inconclusive. The aim of the study is to evaluate the spectrum of MDCT findings in non-traumatic acute abdomen, analyze their correlation with USG results, and assess the diagnostic performance of both modalities.

Material and Methods: This prospective observational study was conducted over 1.5 years in the Department of Radio-diagnosis at Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly. A total of 151 patients presenting with acute abdomen (excluding trauma cases) underwent both USG and MDCT. Data were analyzed using SPSS v20 to determine diagnostic accuracy, sensitivity, specificity, and correlation with surgical, histopathological and clinical outcomes.

Results: MDCT identified abnormalities in 100% of cases, whereas USG failed to detect pathology in 27.8%. Concordance between USG and MDCT was observed in 60.3% of cases. The most common diagnoses were acute pancreatitis (21.2%), acute appendicitis (15.2%), bowel obstruction (11.9%), ureteric calculi (11.3%), and liver abscess (11.3%). MDCT demonstrated high sensitivity and specificity across all major conditions: pancreatitis (100, 95.6%), appendicitis (96.3, 95.8%), bowel obstruction (88.8, 99.3%), ureterolithiasis (100, 97.1%) and liver abscess (100, 98.7%).

Conclusion: MDCT proved superior to USG in evaluating non-traumatic acute abdomen, offering higher diagnostic accuracy, better anatomical detail, and aiding in early and precise clinical decision-making. The study supports the use of MDCT as the imaging modality of choice in emergency abdominal settings.

Keywords: Non-traumatic acute abdomen, MDCT, ultrasound, diagnostic imaging, abdominal emergencies, radiology.

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INTRODUCTION

Acute abdomen refers to the sudden onset of severe abdominal pain requiring urgent medical attention, often surgical.[1] The term encompasses a wide spectrum of underlying pathologies affecting abdominal and pelvic organs.[2] Accurate and timely diagnosis is critical to reduce morbidity and mortality.[3] This process involves a combination of clinical assessment, laboratory investigations, and imaging studies.

The most common causes vary by location of pain:

- Right upper quadrant: acute cholecystitis[4]
- Right lower quadrant: appendicitis[4]
- Left lower quadrant: diverticulitis[4]
- Diffuse pain: small bowel obstruction, pancreatitis, gastrointestinal perforation, mesenteric ischemia, and urolithiasis.[4]

In children and infants, common causes include appendicitis, intussusception, volvulus, and torsion of the gonads[5,6] Ultrasound (USG) is frequently used as the initial imaging modality due to its availability, non-invasiveness, and cost-effectiveness.[5] However, it is limited by operator dependency, patient body habitus, and bowel gas interference.[5] Multidetector computed tomography (MDCT) offers superior diagnostic capability owing to its high spatial resolution, rapid image acquisition, and the ability to perform multiplanar reconstructions.[7,8] It is particularly useful when USG findings are inconclusive or when a comprehensive evaluation is required.

This study was undertaken to evaluate the spectrum of MDCT findings in patients presenting with non-traumatic acute abdomen and to assess their correlation with ultrasound findings, thereby aiding in accurate diagnosis and guiding clinical management. The aim is to study the spectrum of MDCT findings and their association with ultrasound findings in patients presenting with non-traumatic acute abdomen.

MATERIALS AND METHODS

Study Design and Setting

A hospital-based prospective observational study was conducted in the Department of Radio-diagnosis at Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh.The study was carried out over a period of 1.5 years, from May 1, 2023, to October 31, 2024.

Study Population and Sampling

Inclusion criteria

Patients presenting with clinical features of acute abdomen and undergoing both MDCT and USG of the whole abdomen.

Patients not providing consent, patients with a history of blunt or penetrating abdominal trauma. Patients not undergoing MDCT. Patients lost to follow-up were excluded.

All eligible patients referred to the Department of Radio-diagnosis during the study period were included by complete enumeration. A simple random sampling technique was applied to ensure unbiased participant selection.

Data Collection Tools

- Pre-designed data collection proforma
- Informed consent form
- Imaging equipment:
  - CT Scanner: SOMATOM Definition Flash (128-slice dual-source dual-energy CT), SOMATOM Scope (32-slice)
  - Ultrasound Machines: ACUSON S2000, ACUSON JUNIPER, and ACUSON X700 with color Doppler capability

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee (Ref. No: SRMS IMS/ECC/2023/98 dated 29.08.2023). Written informed consent was obtained from all participants.

Pilot Study

A pilot study was conducted on 15 patients (10% of the expected sample size) to evaluate the feasibility and practicality of the data collection tools and imaging workflow. These cases were excluded from the final analysis.

Imaging Protocol

Ultrasound

Performed using standard abdominal protocols.

MDCT

- Non-contrast and contrast-enhanced scans were performed with the patient in supine position.
- Intravenous contrast (non-ionic, 275–370 mg iodine/mL) was administered at 1–2 mL/kg body weight using a power injector at 4 mL/sec.
- Scanning phases included pre-contrast, arterial (25 seconds), venous (45 seconds), and delayed (7 minutes).
- Oral and rectal contrast were used selectively based on clinical indication.

Image Reconstruction

- Axial images reconstructed at 1 and 5 mm thickness.
- Multiplanar reconstructions (MPR), maximum intensity projection (MIP), and volume rendered technique (VRT) were employed where necessary.

Data Collection Procedure

A structured proforma was used to collect clinical history, examination findings, imaging results, and where applicable, surgical and histopathological outcomes. Patients managed conservatively were followed clinically.

Data Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 20. Descriptive statistics were used for demographic data. Diagnostic accuracy of MDCT was assessed using sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for six major conditions: acute appendicitis, acute pancreatitis, intestinal obstruction, liver abscess, obstructive urolithiasis, and acute cholecystitis. Correlation between MDCT and USG findings was evaluated using percentage agreement.

RESULTS

This prospective observational study included 151 patients presenting with non-traumatic acute abdomen, evaluated using both ultrasonography (USG) and multidetector computed tomography (MDCT). The diagnostic performance of MDCT and its correlation with USG findings were analyzed.

Patient Demographics and Clinical Profile

Total number of patients enrolled in the study were 151. 99 (65.6%) were male and 52 (34.4%) were female, with a male-to-female ratio of approximately 1.9:1. The most common age group was 41–60 years (34.4%), followed by 20–40 years (30.5%).

Abdominal pain was the universal presenting symptom (100%), while nausea/vomiting (23.8%), fever (14.6%), and abdominal distension (6.6%) were also noted. Laboratory abnormalities included leukocytosis (53%), elevated liver enzymes (20.5%) in cases of liver abscess, and raised amylase/lipase levels (~19%), particularly in pancreatitis (Table 1).

Imaging Findings and Diagnostic Spectrum

Table 2 shows that MDCT detected abnormalities in 100% of cases, while USG failed to identify pathology in 27.8% (42 patients). Concordance between USG and

Table 1: Demographics, Clinical Features, and Laboratory Findings (n = 151)

Category	*Subcategory*	*n (%)*
Sex	Male	99 (65.6%)
	Female	52 (34.4%)
Age groups	<20 years	30 (19.9%)
	20–40 years	46 (30.5%)
	41–60 years	52 (34.4%)
	61–80 years	22 (14.6%)
	>80 years	1 (0.7%)
Presenting symptoms	Abdominal pain	151 (100%)
	Nausea/Vomiting	36 (23.8%)
	Fever	22 (14.6%)
	Abdominal distension	10 (6.6%)
Laboratory abnormalities	Leukocytosis	80 (53.0%)
	Elevated liver enzymes	31 (20.5%)
	Elevated amylase	29 (19.2%)
	Elevated lipase	28 (18.5%)

Table 2: Diagnostic yield of USG *vs* MDCT in common conditions

Final diagnosis	*Cases (n)*	*USG detected (n)*	*USG detection (%)*	*MDCT detection (%)*
Acute pancreatitis	32	18	56.2	100
Acute appendicitis	23	11	47.8	100
Bowel obstruction	18	6	33.3	100
Ureteric/renal calculi	17	11	64.7	100
Liver abscess	17	10	58.8	100
Acute cholecystitis	10	10	100	100
Other abdominal causes	34	Variable	—	100
Overall accuracy	151	109	72.2	100

Table 3: Diagnostic performance of MDCT compared to reference standard

Condition	*Sensitivity (%)*	*Specificity (%)*	*PPV (%)*	*NPV (%)*
Acute appendicitis	96.3	95.8	84.2	98.9
Acute pancreatitis	100	95.6	84.4	100
Liver abscess	100	98.7	88.3	100
Ureterolithiasis	100	97.1	86.7	100
Bowel obstruction	88.8	99.3	88.9	99.3
Acute cholecystitis	98.0	99.2	92.3	99.3

MDCT was observed in 60.3% of cases. Discrepant findings were noted in bowel-related conditions, deep pelvic pathologies, and in obese patients where USG had limited acoustic windows.

The most common final diagnoses on MDCT were:

- Acute pancreatitis (21.2%)
- Acute appendicitis (15.2%)
- Bowel obstruction (11.9%)
- Ureteric/renal calculi (11.3%)
- Liver abscess (11.3%)

MDCT Imaging Characteristics

MDCT provided detailed characterization in all major diagnoses:

Pancreatitis

Most cases showed <30% necrosis with peripancreatic fat stranding and fluid collections.

Appendicitis

Inflamed appendix with fat stranding and appendicoliths in select cases; perforation detected in 2 patients.

Bowel obstruction

MDCT delineated transition points and causes (e.g., hernia, stricture).

Renal/ureteric calculi

Stones were visualized with secondary signs like hydronephrosis or perinephric stranding.

Liver abscesses

MDCT identified both solitary and multiloculated abscesses, including small lesions missed on USG.

Diagnostic Accuracy of MDCT

When compared against surgical findings, histopathology, or clinical resolution, MDCT demonstrated high diagnostic accuracy (Table 3).

DISCUSSION

Non-traumatic acute abdomen is a common emergency with a broad range of differential diagnoses, making timely and accurate diagnosis crucial for effective management. Imaging plays a central role in this setting, with multidetector computed tomography (MDCT) emerging as the primary modality due to its high diagnostic yield. This study evaluated the diagnostic performance of MDCT in comparison with ultrasonography (USG) in patients presenting with non-traumatic acute abdominal pain.

In our cohort of 151 patients, the majority were between 41–60 years (34.4%), with a male predominance (65.6%), consistent with trends observed by Kesarwani *et al*.[9] Abdominal pain was the universal presenting symptom, accompanied by nausea/vomiting (23.8%) and fever (14.6%). Laboratory parameters, including leukocytosis (53%) and elevated hepatobiliary or pancreatic enzymes (≈20%), supported the high incidence of inflammatory and visceral pathologies.

MDCT demonstrated superior diagnostic performance compared to USG, with concordance between the two modalities in 60.3% of cases. In 39.7% of cases, MDCT provided additional or divergent findings, particularly in conditions such as pyelonephritis, bowel obstruction, and deep-seated or gas-obscured lesions, where USG was limited.

Acute pancreatitis was the most common diagnosis (21.2%). MDCT accurately identified all cases and characterized disease severity, while USG detected only 56.2%. These findings are in line with Paulson *et al*.[10], who emphasized the value of MDCT in staging and identifying complications.

Appendicitis was diagnosed by MDCT in 23 cases (15.2%), showing high sensitivity (96.3%) and specificity (95.8%), outperforming USG, which detected 11 cases. These results mirror those of Khurana *et al*.[11], highlighting the ability of MDCT to detect subtle peri-appendiceal inflammation.

Bowel obstruction was diagnosed in 18 patients using MDCT (11.9%), with a sensitivity of 88.8% and specificity of 99.3%. The ileum was the most frequent site, with benign strictures and adhesions being the leading causes—consistent with findings from Kesarwani *et al*[9]. and Barnett *et al*.

In cases of liver abscess, MDCT demonstrated 100% diagnostic accuracy and distinguished between pyogenic and amoebic etiologies, aided by characteristic imaging features such as the "double target" and "cluster" signs. *E. coli* was the predominant organism, in line with microbiological profiles reported by Singh *et al*.[12]

MDCT also proved highly effective in diagnosing renal and ureteric calculi, with 100% sensitivity and 97.1% specificity, detecting complications such as hydronephrosis and pyelonephritis. USG detected only 11 of 17 cases. These findings align with data from Wang *et al*.[13] and Smith *et al*.[14]

Clinical Implications

The diagnostic performance of MDCT in this study supports its use as the first-line imaging modality in non-traumatic acute abdomen. Its advantages include:

- High sensitivity and specificity across a range of conditions
- Precise anatomical localization and characterization
- Improved surgical planning and decision-making
- Reduced rates of negative laparotomies
- Enhanced clinical outcomes through timely intervention

Our findings support prior recommendations by Maglinte *et al*.[15], who advocate for the routine use of MDCT in acute abdominal emergencies.

LIMITATIONS

This study was limited by its single-center design and relatively small sample size for certain pathologies. The tertiary care setting may also introduce referral bias. These factors may limit generalizability.

Future Directions

To strengthen the evidence base, future studies should consider:

- Multicenter trials with larger patient cohorts
- Cost-effectiveness analyses of MDCT in emergency settings
- Development of standardized MDCT reporting templates

- Implementation of low-dose CT protocols to reduce radiation exposure

CONCLUSION

MDCT offers a comprehensive, rapid, and highly accurate diagnostic tool for evaluating non-traumatic acute abdomen. It clearly outperforms ultrasound in most clinical scenarios, particularly in detecting pancreatic, appendiceal, intestinal, renal, and hepatobiliary pathologies. The strong concordance with final clinical and surgical diagnoses reinforces its pivotal role in emergency imaging.

Consistent with previous studies, including those by Kesarwani *et al*.[9] and Maglinte *et al*.[15], our findings advocate for the integration of MDCT as the imaging modality of choice in the acute abdominal setting.

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