

Role of MDCT (128 Slice Scanner) in Acute AbdomenIrfan Ahmad¹, Sanjay Kumar Jha², Avinash Ranjan³¹Associate Professor, Department of Radio-diagnosis, Darbhanga Medical College and Hospital, Laheriasarai, Bihar.²Professor and HOD, Department of Radio-diagnosis, Darbhanga Medical College and Hospital, Laheriasarai, Bihar.³Senior Resident, Department of Radio-diagnosis, IGIMS, Patna, Bihar.

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Abstract

Background: Acute abdomen is a clinical condition characterized by the sudden and severe abdominal pain related symptoms typically requires urgent intervention. The term gained prominence in the 20th century and highlights the urgency associated with such presentations. Abdominal pain can arise from a wide spectrum of causes, ranging from minor self-limiting conditions to serious, life-threatening disorders. In cases of severe, diffuse abdominal pain, common underlying causes include acute pancreatitis, bowel perforation, ruptured abdominal aortic aneurysm, and acute mesenteric ischemia (AMI). Aims of this study was to assess the diagnostic precision of 128-slice MDCT in detecting the underlying etiologies of acute abdominal conditions, examine the capability of MDCT in differentiating among various disease processes leading to acute abdominal presentation and investigate the sensitivity and specificity of MDCT in acute abdomen evaluation, using operative, histological, or clinical findings as benchmark standards.

Methods: The present prospective study was conducted from August 2023 to April 2025, involving patients referred to the Department of Radiology, DMCH, Laheriasarai, and Bihar, who presented with clinical features suggestive of acute abdomen and underwent MDCT evaluation. Imaging was done with the GE Revolution EVO 128-slice CT machine. The CT findings were subsequently correlated with intraoperative observations, clinical diagnoses, and available histopathological results to assess the diagnostic accuracy and effectiveness for acute abdominal conditions.

Results: Evaluation of 106 patients done using Multi-Detector CT. The MDCT results were correlated with operative findings, tissue biopsy reports, and the clinical progress of patients who received non-surgical (conservative) management. 27 patients were females and 79 were males. Youngest patient had an age of 7 years to eldest patient having age of 82 years. Most common causes of acute abdomen were appendicitis in 22%, acute pancreatitis in 15%, acute and bowel obstruction in 18%. In our study the sensitivity, specificity and positive and negative predictable values of MDCT were 98.03%, 75%, 99% and 60% respectively.

Conclusion: We conclude that MDCT has high sensitivity and accuracy rate. In inconclusive cases, MDCT is recommended to arrive at a definitive diagnosis. The results obtained in the study were comparable to pioneer studies conducted worldwide.

Keywords: Multidetector computerized tomography (128 slice scanner), acute abdomen.

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Introduction

Many different diseases can be associated with acute abdominal discomfort, which is a typical primary complaint among patients seen in the emergency department (ED). Acute abdominal discomfort affects 4–5% of people who arrive to the emergency room.[1] Patients with acute abdominal pain experience stiffness and discomfort in their abdomens and are quite sick. These people were candidates for surgery prior to the widespread use of imaging. However, some patients with acute

abdominal pain will not have surgery due to the current role of imaging. Patients with acute abdominal pain often have a diagnostic work-up that includes computed tomography (CT), ultrasonography (US), and conventional radiography. Despite reports of 53% accuracy, the accuracy values for traditional radiography in individuals with acute abdominal pain are low.[2] The accuracy values of US and CT are significantly higher than those of conventional radiography.[2,3]

Conventional radiography has a sensitivity of 30%, but CT has an overall sensitivity of 96%.[2] Ultrasound (USG) is another imaging modality commonly used in the diagnostic work-up of patients with acute abdominal pain. USG is cheap, easily available and accessible investigation for acute abdomen. USG is a real-time dynamic examination that can reveal the presence or absence of peristalsis and depict blood flow. Furthermore, it is possible to correlate US findings with the point of maximal tenderness. Absence of radiation, easily availability, lesser cost, no need of intravenous contrast are advantages of USG over CT. In one study, US reportedly provided useful information for 56% of patients with acute abdominal pain after excluding patients who were strong suspicion of having perforated viscus, bowel obstruction, or appendicitis, and in another study, it either yielded unique diagnostic information in 65% of patients. [4,5]

The CT technique used to examine patients with acute abdominal pain generally involves scanning of abdomen from above level of diaphragm to femur neck with use of intravenous iodinated contrast medium. Although abdominal CT can be performed without contrast medium, the intravenous administration of contrast material facilitates good accuracy—with a positive predictive value of 95% reported for the diagnosis of appendicitis—and a high level of diagnostic confidence, especially in thin patients, in whom fat interfaces may be almost absent.[2,6]

A correct diagnosis significantly decreases morbidity and mortality.[2] An accurate diagnosis is the need of hour in patients with inconclusive USG examinations. In such cases, contrast enhanced computerized tomography is the investigation of choice for patients coming with intense abdominal pain.[7-9] It is the most rapid, time efficient, objective and informative imaging

technique. MDCT (128-slice scanner) provides a global judgment of the gastrointestinal tract, mesenteries, peritoneum and retroperitoneal areas in which ultrasound examination provides limited information. It also gives us significant information for another possible diagnosis, if the working clinical diagnosis is incorrect and has a significant outcome in planning treatment of patients with intense abdominal pain. With the introduction of multi planner reconstruction in the workstations, MDCT (128-slice scanner) has led to a great improvement in the management of these patients.

Material and Methods

The present prospective study was conducted from August 2023 to April 2025, involving patients referred to the Department of Radiology, Darbhanga Medical College and Hospital, Laheriasarai, Bihar, who presented with clinical features suggestive of acute abdomen and underwent MDCT evaluation. Imaging was done with the GE Revolution EVO 128-slice CT machine. The CT findings were subsequently correlated with intraoperative observations, clinical diagnoses, and available histopathological results to assess the diagnostic accuracy and effectiveness for acute abdominal conditions.

Total 106 patients presenting with clinical signs of acute abdominal pain who were subjected to MDCT examination. Patients with known contraindications to contrast agents in cases where contrast-enhanced imaging was required.

CT findings were correlated with intraoperative and histopathological results in patients who underwent surgery. For those managed conservatively without surgical intervention, clinical follow-up was conducted to monitor recovery, and outcomes were compared with initial MDCT findings to assess diagnostic accuracy.

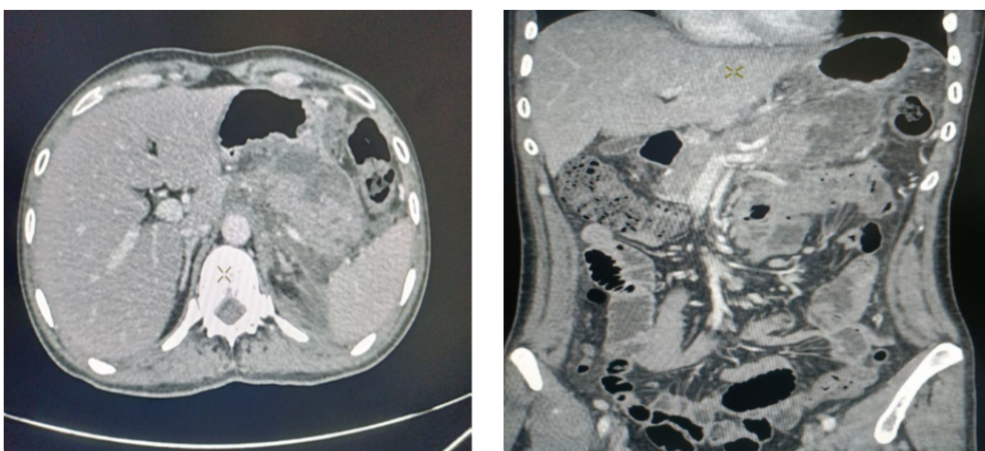


Figure 1: Acute Pancreatitis

Pancreas appears hypodense heterogeneous with peripancreatic fluid collection and peripancreatic fat stranding. Findings are consistent with acute pancreatitis.

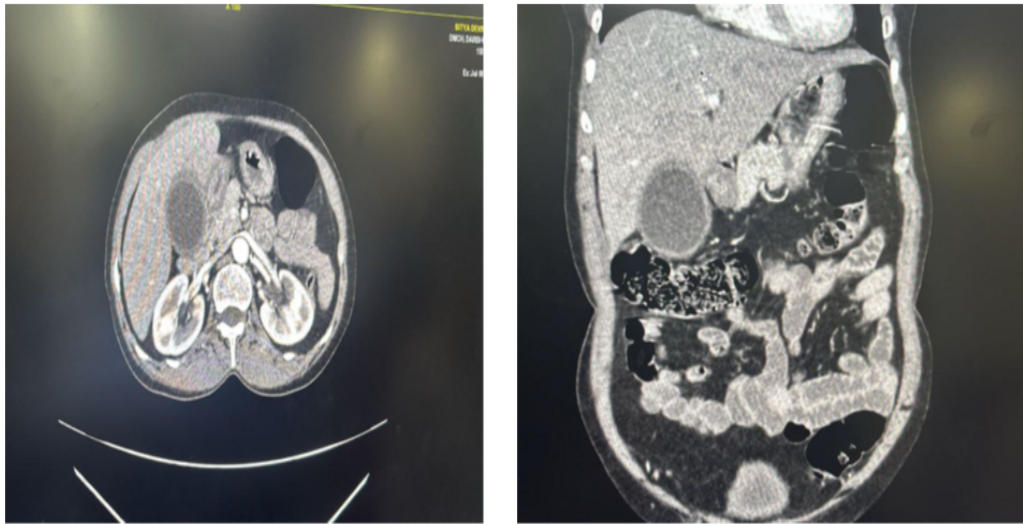


Figure 2: Acute Cholecystitis

Gall bladder wall appears thickened with pericholecystic fat strandings, features are consistent with acute cholecystitis.

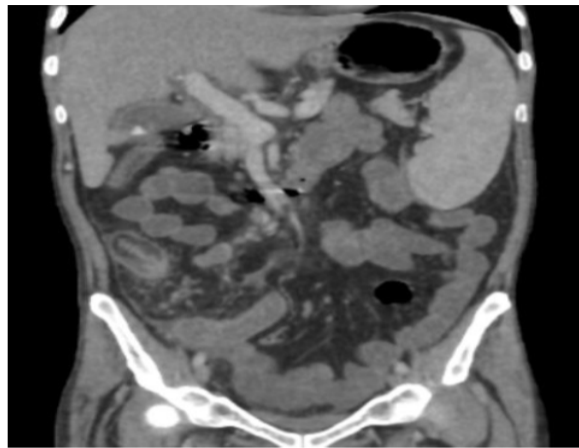


Figure 3: Cholelithiasis

Hyperdense calculus notes in Gallbladder lumen.

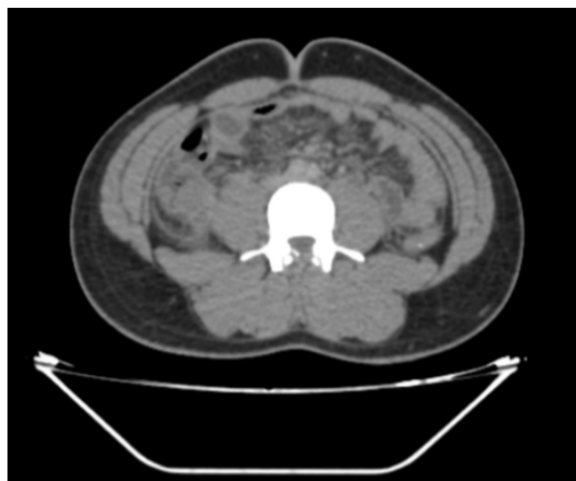


Figure 3: Appendicitis

A dilated tubular structure arising from right cecum with surrounding fluid collections, suggestive of acute appendicitis.

Results: Evaluation of 106 patients done using Multi-Detector CT. The MDCT results were correlated with operative findings, tissue biopsy reports, and the clinical progress of patients who received non-surgical (conservative) management.

Table 1: Distribution of age in the study population

Age group (in years)	No. of cases	Percentage
0-10	6	6%
11-20	10	9%
21-30	14	13%
31-40	24	22%
41-50	15	14%
51-60	15	14%
61-70	14	13%
71-80	7	8%
81-90	1	1%
Total	106	100%

Table 2: Distribution Based on Sex in the study population

Gender	No. of cases	Percentage
Male	79	74%
Female	27	26%
Total	106	100%

Table 3: Pathology found in the study population

Pathology	No. of cases	Percentage
Appendicitis	23	22%
Bowel Obstruction	19	18%
Acute Pancreatitis	16	15%
Perforation	15	14%
Urolithiasis	8	7%
Cholecystitis	5	5%
Bowel Ischemia	3	3%
Aortic Dissection	1	1%
Diverticulitis	3	3%
Aortic Aneurysm	3	3%
Intussusception	3	3%
Volvulus	3	3%
Non Specific Abdominal Pain	4	4%
Total	106	100%

Table 4: Abnormalities Based on Gender

Pathology	No. of cases	Male	Female
Appendicitis	23	16	7
Bowel Obstruction	19	13	6
Acute Pancreatitis	16	14	2
Perforation	15	10	5
Urolithiasis	8	6	2
Cholecystitis	5	5	
Bowel Ischemia	3	3	
Aortic Dissection	1	1	
Diverticulitis	3	3	
Aortic Aneurysm	3	3	
Intussusception	3	2	1
Volvulus	3	2	1
Non Specific Abdominal Pain	4	1	3
Total	106	79	27

Table 5: Interpretation of Obtained Statistics

Statistic	MDCT in Acute Abdomen Cases
Sensitivity	98.03%
Specificity	75.00%
Positive Predictive Value	99.00%
Negative Predictive Value	60.00%

Table 6: Appendicitis (n=23)

Age Group (in years)	Male	Female
0-10	4	
11-20	5	3
21-30	3	
31-40	2	1
41-50	1	1
51-60	1	1
61-70		1
71-80		
81-90		
Total	16	7

Table 7: Obstruction of Bowel (n=18)

Age Group (in years)	Male	Female
0-10		
11-20	1	
21-30		
31-40	3	2
41-50	1	
51-60	3	2
61-70	3	2
71-80	1	
81-90	1	
Total	13	6

Table 8: Acute Pancreatitis (n=16)

Age Group (in years)	Male	Female
0-10		
11-20	1	
21-30	3	1
31-40	6	1
41-50	2	
51-60		
61-70	1	
71-80		
81-90	1	
Total	14	2

Table 9: Bowel Perforation (n=15)

Age Group (in years)	Male	Female
0-10	1	
11-20		
21-30	1	
31-40	3	2
41-50	3	3
51-60		
61-70	1	
71-80	1	
81-90		
Total	10	5

Table 10: Urolithiasis (n=8)

Age Group (in years)	Male	Female
0-10		
11-20		
21-30	2	
31-40	4	1
41-50		
51-60		
61-70		1
71-80		
81-90		
Total	6	2

Table 11: Cholecystitis (n=5)

Age Group (in years)	Male	Female
0-10		
11-20		
21-30		
31-40		
41-50		
51-60	3	
61-70		
71-80	2	
81-90		
Total	5	

Table 12: Summary of Obtained Statistics Interpretation

Statistic	MDCT in Acute Abdomen Cases
Sensitivity	98.03%
Specificity	75.00%
Positive Predictive Value	99.00%
Negative Predictive Value	60.00%
Concordance and Accuracy	
No. of Patients	104
Percentage	98.11%

Table 13: Distribution of different types of surgical management

Surgical Management	No. of cases
Appendicitis	23
Bowel Obstruction	14
Acute Pancreatitis	3
Perforation	15
Urolithiasis	8
Cholecystitis	5
Bowel Ischemia	3
Aortic Dissection	1
Aortic Aneurysm	1
Intussusception	3
Volvulus	3
Non Specific Abdominal Pain	4
Total	83

Table 14: Distribution of different types of conservative management

Conservative Management	No. of cases
Bowel Obstruction	5
Acute Pancreatitis	13
Diverticulitis	3
Aortic Aneurysm	2
Total	23

Table 15: Correlation of CT finding

Total No. of cases with Concordance	Total No. of cases with Discordance
104	2

Discussion

The study was conducted to analyse the diagnostic utility of 128-slice MDCT scanner, in identifying a wide spectrum of causes underlying acute abdomen. The results were analysed and correlated with way of management and tissue biopsy results for various abdominal pathologies. Over time, the evolution from single-slice to multidetector technology has significantly advanced management of acute abdominal cases. MDCT offers several pivotal advantages in the emergency setting:

Rapid Acquisition: Its reduced scanning time enables high-resolution image acquisition within seconds, minimizing motion artifacts and allowing efficient evaluation of critically ill or uncooperative patients.

High-Quality Multiplanar Imaging: The ability to reconstruct isotropic volumetric data into multiple planes allows for better anatomical delineation, even of minute or complex lesions.

Enhanced Vascular Imaging: Optimized contrast protocols and reconstruction techniques enable precise localization and characterization of vascular abnormalities, such as aneurysms and pseudoaneurysms.

Efficient Interpretation: Advanced software tools and faster processing significantly reduce turnaround time for diagnosis, particularly beneficial in time-sensitive emergencies.

Despite these benefits, MDCT is not without limitations. Artifacts such as the cone-beam effect, resulting from the wide x-ray beam's rotational motion, can impair image quality. Additionally, managing large volumes of image data—especially in abdominal scans—can pose challenges in interpretation, particularly when using printed films over digital workstations.

Nonetheless, MDCT has largely supplanted conventional radiography in the evaluation of acute abdomen due to its superior diagnostic accuracy, rapid execution, and ability to guide clinical decision-making even in equivocal presentations.

In our cohort of 106 patients (79 males and 27 females, aged 6 to 92 years), MDCT proved highly effective in identifying the etiology of acute abdominal conditions. These findings are consistent with global literature identifying appendicitis as a leading cause of surgical abdomen.

Appendicitis: Twenty three patients were diagnosed with acute appendicitis or related findings. One case demonstrated discordance between MDCT and intraoperative findings, which

ultimately revealed ileocecal tuberculosis confirmed on histopathology. This highlights a rare but important diagnostic pitfall. Despite this, the modality achieved a sensitivity of 100% and a PPV of 93.75%, aligning with findings from Rao PM et al.[10], who reported sensitivities ranging from 91–100%.

Bowel Obstruction: Nineteen patients were diagnosed with bowel obstruction due to varied causes such as adhesions, hernias, strictures, and mesenteric bands. MDCT achieved 100% sensitivity and PPV, comparable to results from Mallo et al.[11], who reported sensitivities of 81–100% and specificities of 68–100%. Our findings reaffirm those by Suri S et al.[12], emphasizing MDCT's precision in identifying both the cause and level of obstruction.

Acute Pancreatitis: Sixteen patients exhibited imaging features of acute pancreatitis, predominantly in males in their 40s, with alcohol as the most common etiology. MDCT showed 100% sensitivity in detecting severe necrotizing cases, which was consistent with studies by Beger HG et al.[13] However, detection rates declined in mild or early necrosis. MDCT was especially valuable in assessing complications like peripancreatic fluid collections, pseudoaneurysms, and vascular thrombosis. Curved planar reconstructions were particularly helpful in visualizing the pancreatic duct and associated vasculature.

Bowel Perforation: Out of ten suspected cases of bowel perforation, MDCT accurately diagnosed eight. One false-negative cases were identified during surgery, presenting with sealed perforations and delayed clinical signs. The sensitivity and accuracy were 90%, which aligns with data by Sung Hwan Kim et al.[14], reporting 82–90% accuracy in localizing the perforation site. The ability of MDCT to detect minute amounts of free air makes it especially useful for identifying early or contained perforations.

Urolithiasis: In five cases, MDCT successfully identified ureteric calculi, achieving a sensitivity of 100%. These results are comparable with the reports of Isabelle Sala et al.[15] Use of thin-slice reconstructions facilitated detection of even sub-millimetric stones, and secondary signs such as periureteral fat stranding improved diagnostic confidence, especially when direct visualization was challenging.

Cholecystitis: Five cases of acute cholecystitis were diagnosed with MDCT, also demonstrating 100% sensitivity. The imaging helped identify complications such as emphysematous and

gangrenous changes. These findings are in concordance with Tsushima Y et al.[16], who highlighted MDCT's superior ability to characterize gallbladder wall changes and associated complications.

Other Pathologies: Additional diagnoses included bowel ischemia (3 cases), volvulus (3), aortic dissection (1), intussusception (3), diverticulitis (3), and aortic aneurysm (3). In all these cases, MDCT demonstrated high sensitivity, though definitive conclusions about specificity are limited due to small sample sizes.

Negative Findings: In three patients, MDCT revealed no significant abnormalities. These were subsequently confirmed by diagnostic laparoscopy, reinforcing the importance of clinical-radiologic correlation in equivocal cases.

Conclusion

Multidetector Computed Tomography (MDCT) demonstrates high sensitivity and diagnostic accuracy in evaluating a broad spectrum of acute abdominal conditions. Its rapid image acquisition, high-resolution output, and multiplanar reconstruction capabilities make it indispensable in emergency settings, particularly when initial clinical assessment or imaging (e.g., X-ray, ultrasound) is inconclusive.

Our study findings align with international literature, reinforcing MDCT's established role in acute abdomen diagnosis. However, the relatively small sample size in our study is a notable limitation, potentially affecting the generalizability of results and underrepresenting less common conditions. One diagnostic challenge encountered was MDCT's limited sensitivity in detecting sealed bowel perforations, especially when patients present late and air or fluid is no longer detectable. This underscores the importance of integrating CT findings with clinical evaluation. Despite such limitations, MDCT remains the investigation of choice for acute abdominal pain due to its objectivity, speed, and ability to detect complications like abscesses, ischemia, or vascular compromise. However, barriers such as limited emergency referrals—due to reliance on clinical and ultrasound findings—reduce opportunities for MDCT evaluation and radiological-pathological correlation.

Additional constraints include its limited use in pregnancy, due to radiation risks, and high costs, which may restrict access in resource-limited settings. These factors highlight the need for judicious patient selection and a multidisciplinary approach balancing diagnostic benefit with safety and affordability.

In conclusion, while MDCT has limitations, its overall diagnostic performance in acute abdomen is excellent. Ongoing technological advancements will likely enhance its utility and reinforce its central role in emergency radiology.

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