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Role of multidetector computed tomography in clinically suspected acute small bowel obstruction

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Abstract

Introduction: Small bowel obstruction accounts for 60%-85% of cases of intestinal obstruction. MDCT is now readily available and has advantages over classic helical CT in the imaging of the mesenteric vasculature and of the bowel. Multidetector CT provides good spatial and contrast resolution, multiplanar reconstructions and more efficient scanning with few or no artifacts.

Aims and objectives: To assess the role of MDCT in evaluation of clinically suspected acute small bowel obstruction.

Methodology: This was a prospective study conducted on 50 patients suffering from clinically suspected acute small bowel obstruction in Department of Radiodiagnosis and Imaging, Govt. Medical College, Amritsar. The final diagnosis was confirmed by pathological correlation, post-operative data and clinical response to medical treatment. Multi Detector Computed Tomography imaging was performed for each patient. The data was tabulated and subjected to statistical analysis.

Results: Majority of participants (40%) belonged to age group 41 to 60 years. There were 60% males and 40% females. The most common frequent cause of intestinal obstruction among the examined patients was adhesive bowel obstruction, followed by obstructed hernia, intussusception and gall stone ileus.The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of small intestinal obstruction was found to be 100%, 95.65%, 66.67%, 100% and 96.00% respectively.

Conclusion: MDCT has high sensitivity and specificity to diagnose and determine the causes of bowel obstruction. It can be used in clinical practice as a modality for detecting intestinal obstruction which can aid in reducing the morbidity and mortality of patients with small intestine obstruction.

Key words: multidetector computed tomography, MDCT, small bowel obstruction

Introduction

Intestinal obstructions account for 20% of hospital admissions for acute abdomen requiring surgical consultation. It has been observed that the small bowel is more frequently involved, accounting for 60%-85% of cases of intestinal obstruction with a four to five times less common involvement of the large bowel.[1,2] It occurs either due to mechanical obstruction or functional abnormality that results in the interruption of the normal passage of intraluminal contents.[3]

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The small bowel loops have unique vascular supply, specific anatomical considerations and different physiological functions making them associated with pathological entities different from those affecting the large bowel loops.[4]

The patients with acute small bowel insult have different presentations and symptoms according to the underlying small bowel disease, usually diffuse non-localized abdominal pain is the first presentation leading to utilization of different imaging modalities to assess the underlying disease.[5]

Various causes of bowel obstruction have been identified, which can be categorized as extrinsic, intrinsic, or intraluminal based on their location. Extrinsic causes include adhesions, volvulus, hernia (leading to a closed-loop obstruction or strangulation) and intra-abdominal masses (neoplasms, diverticulitis, appendicitis). Intrinsic causes are neoplasms, intussusception, intramural hematoma, and inflammatory and infective conditions (Crohn's disease and tuberculosis). Polyps, ingested foreign bodies, and bezoars are the common intraluminal causes of bowel obstruction. Small bowel obstruction is most commonly caused by extrinsic lesions such as adhesions and hernia. Conversely, intrinsic lesions, such as neoplasm or inflammatory condition, contribute mostly to large bowel obstruction.[6,7]

In the present time, the continuous refinement of the 3D imaging process have greatly expanded the utility of CT for evaluating patients with bowel disease. MDCT is now readily available and has advantages over classic helical CT in the imaging of the mesenteric vasculature and of the bowel. Multidetector CT provides good spatial and contrast resolution, multiplanar reconstructions and more efficient scanning with few or no artifacts. Multidetector CT provides detailed examination of the small bowel diseases.[8]The purpose of this study was to assess role of MDCT in evaluation of small bowel obstruction

Methodology

This was a prospective study conducted on 50 patients suffering from clinically suspected acute small bowel obstruction in Department of Radiodiagnosis and Imaging, Govt. Medical College, Amritsar. The final diagnosis was confirmed by pathological correlation, post-operative data and clinical response to medical treatment.

Inclusion criteria

Patients of all age groups and gender referred to the department of Radio-Diagnosis with suspected small bowel obstruction.

Exclusion criteria

- Acute abdomen due to other causes than acute small bowel diseases.
- Chronic small bowel diseases.
- Patients have contraindications from intravenous contrast materials, e.g., patient with renal impairment and sever reaction to contrast materials.

The patients referred to the Department of Radiodiagnosis and Imaging with clinically suspected bowel lesions satisfying the inclusion and exclusion criteria were included in the study. Informed consent was obtained from all patients. The protocol was approved by the Ethics Committee of the Institute. The data sheets were created which included patients' demographic characteristics, presenting complaints and relevant laboratory investigations wherever required. The data was tabulated and subjected to statistical analysis.

Multi Detector Computed Tomography imaging was performed on PHILIPS MACHINE 64 slice MDCT machine. Imaging technique was plain CT followed by oral and IV contrast. The contrast used was Omnipaque. Omnipaque is iohexol which is a non-ionic, water soluble radiographic contrast medium. Images were acquired following contrast in arterial, venous

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and delayed phases. Multi planar reformation and 3D reconstruction was done wherever necessary.

Results

Majority of participants (40%) belonged to age group 41 to 60 years, followed by 30% participants in age group 21-40 years, 25% participants were below 20 years of age and remaining 5% were above 60 years of age. The mean age of the study participants was 38.24 ± 19.03 years. The study showed male predominance. There were 60% males and 40% females.

Table no. 1: Distribution of study participants based on clinical presentation

Clinical presentation	Number	Percentage
Abdominal Distension	18	36%
Abdominal Pain	15	30%
Diarrhoea/Constipation	10	20%
Nausea/Vomiting	5	10%
Others	2	4%

Abdominal distension was most common clinical presentation observed in 36% study participants, followed by abdominal pain (30%), diarrhoea/constipation (20%), nausea/vomiting (10%) and others (2%).

Table no. 2: Distribution of study participants based on causes of obstruction

Causes	Number	Percentage
Adhesive bowel obstruction	35	70%
Hernia	6	12%
Intussusception	5	10%
Gall stone ileus	4	8%

The causes of small bowel obstruction included adhesive bowel obstruction which is the most common frequent cause of intestinal obstruction among the examined patients, followed by obstructed hernia, intussusception and gall stone ileus. All patients of adhesive bowel obstruction were surgically proved while only one patient was managed by conservative treatment and follow up who showed complete resolution of symptoms after one day of conservative treatment. Only 1 patient of adhesive small bowel obstruction had no history of previous surgical operation, while the rest of patients had history of previous surgical intervention.

Table no. 3: Distribution of study participants based on site

Site	Number	Percentage
Duodenum	5	10%
Jejunum	12	24%
Ileum	33	66%

Ileum was the most predominant site involved in 66% study participants, followed by jejunum in 24% and duodenum in 10% study participants.

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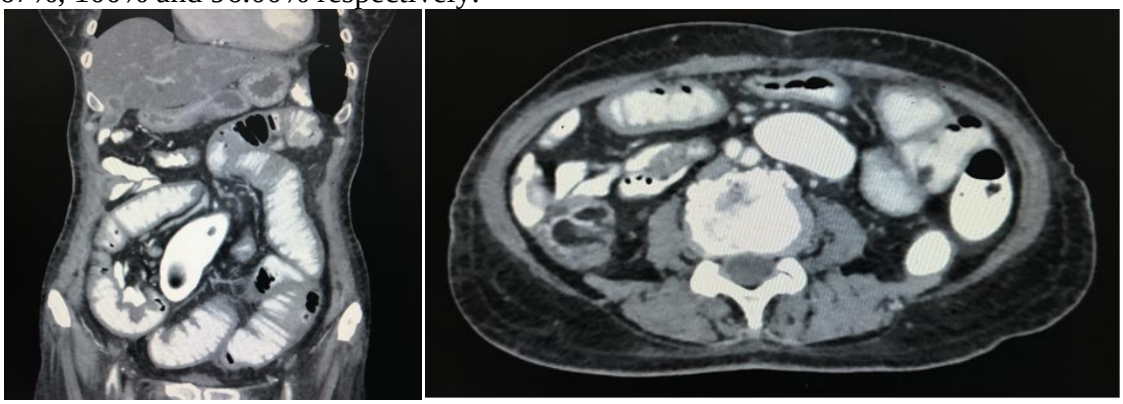
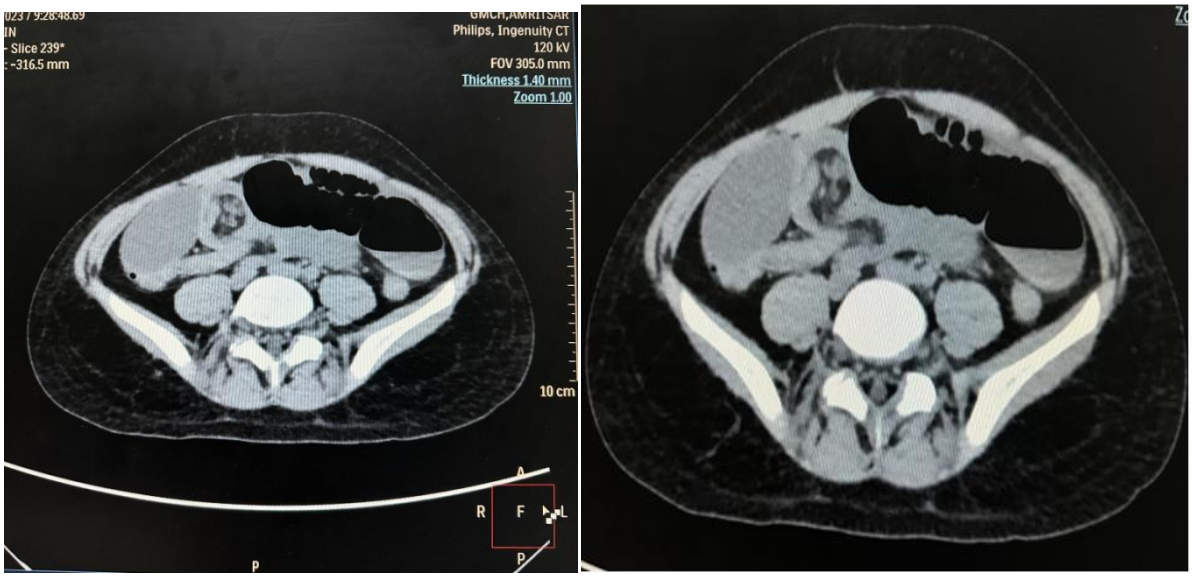
Table no. 4: Diagnostic Accuracy of MDCT in diagnosis of acute small intestine obstruction

True positive	False positive	True negative	False negative	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	Accuracy (%)	Youden's index
4	2	44	0	100.00	95.65	66.67	100.00	96.00	95.65

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of small intestinal obstruction was found to be 100%, 95.65%, 66.67%, 100% and 96.00% respectively.



CECT abdomen coronal and axial sections shows small bowel obstruction due to stricture ilium secondary to ileocecal tuberculosis (thickening of caecum is noted)



CECT Abdomen axial sections showing whirlpool sign in a patient with small obstruction secondary to partial mid gut volvulus

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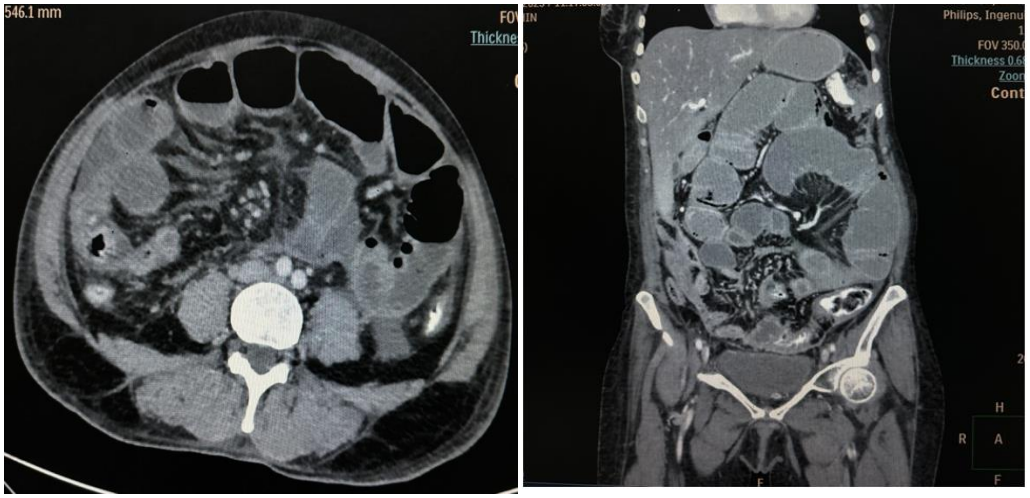

CECT Abdomen in patient with known inflammatory bowel disease demonstrating mesenteric inflammation and the so-called comb sign

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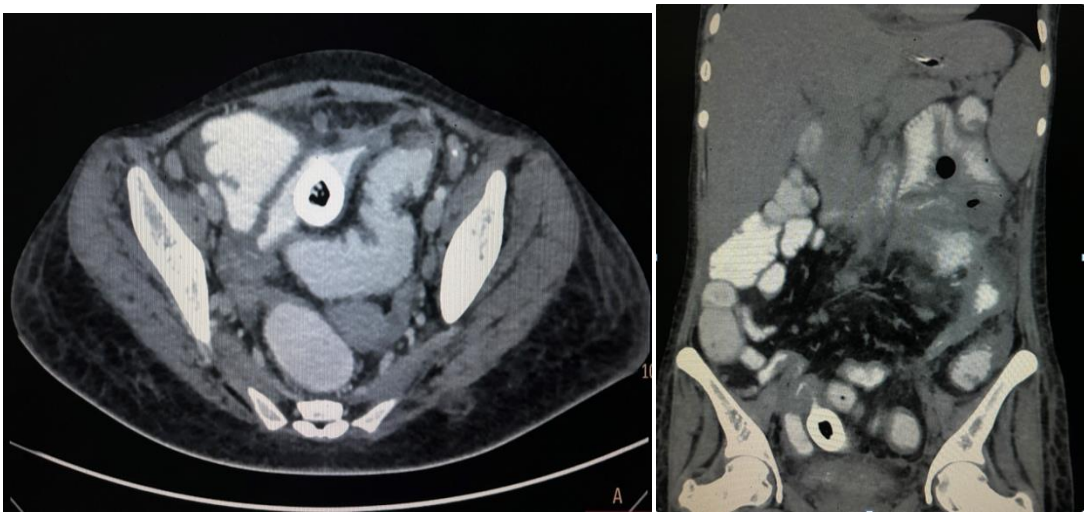
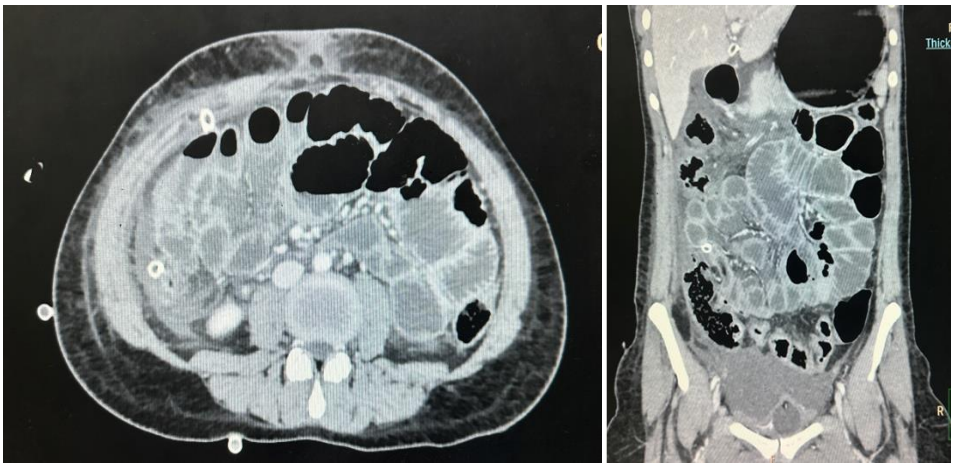
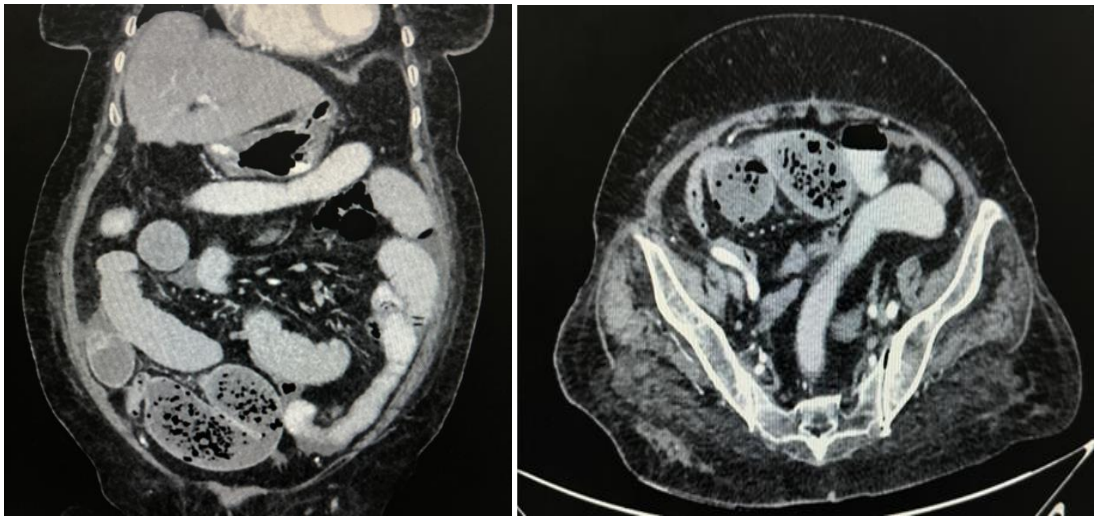


CECT abdomen coronal shows small bowel obstruction due to a large calculus in ileum (Gallstone ileus)



CECT Abdomen coronal and axial sections shows small bowel obstruction due to strict urein ileum



Contrast enhanced CT image shows faeces bowel sign in a patient with small bowel obstruction due to partial stricture

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Discussion

Intestinal obstruction is a commonly encountered emergency condition requiring urgent surgical management. The early diagnosis and detection of intestinal obstruction is crucial to prevent bowel ischemia and necrosis and the resultant bowel resection. MDCT has been utilized as a rapid and accurate technique in the detection of the cause and site of bowel obstruction as well as its complications, thus helping to achieve the desired outcome.

We observed that majority of participants (40%) belonged to age group 41 to 60 years, followed by 30% participants in age group 21-40 years, 25% participants were below 20 years of age and remaining 5% were above 60 years of age. The mean age of the study participants was 38.24 ± 19.03 years. The study showed male predominance. There were 60% males and 40% females. Similarly, in study by Afzal S et al[9], majority (64.63%) of the patients were between 46 and 70 years of age, while 52 (35.37%) patients had ages between 18 and 45 years. There were 76 (51.70%) males and 71 (48.30%) females with male to female ratio of 1.2:1.

Abdominal distension was most common clinical presentation observed in 36% study participants, followed by abdominal pain (30%), diarrhoea/constipation (20%), nausea/vomiting (10%) and others (2%). In study by Sultan A et al[10], abdominal distension was the most common presentation seen in 37 patients (30.83%) followed by vomiting in 25 patients (20.83%). This is similar to findings of this study. In study conducted by Afzal S et al[9], there were 97.27% patients who presented with abdominal pain while abdominal distension was observed in 82.99% patients.

Similar to this study, ileum was the commonly involved site in study by Sultan A et al.[10]

Pongpornsup S et al[11] studied the various causes of bowel obstruction and found adhesions as the most common cause of bowel obstruction. He reported that adhesions were seen in 36% of patients of small bowel obstruction found in nine out of 25 patients. In a study by Memon W et al, out of 120 patients, 59 (57.8%) were found to have adhesions, with 19 patients having adhesions at multiple levels.[12]The results of our study are in concordance with the results of these studies.

The sensitivity of MDCT on diagnosis of small intestinal obstruction was found to be 100% in this study. This is consistent with findings of Silva et al[13] and Paulson et al[14]as they observed that MDCT has high sensitivity to diagnose small bowel obstruction reaching up to 100%.Elsayed EE et al[15]studied the usefulness of multidetector computed tomography (MDCT) in the evaluation of intestinal obstruction and their results showed a very high sensitivity and specificity of 100%. Fedrele et al[16] stated that MDCT can combine the advantages of volume challenge in detecting and grading partial obstruction with the ability of CT to demonstrate the cause of obstruction and any pertinent extra-intestinal manifestations, including vascular impairment. It demonstrates signs of threatened bowel viability and can exclude other causes of an acute abdomen making it particularly valuable in the acute clinical setting. Our study also showed high diagnostic performance in diagnosis of both small bowel obstruction and large bowel obstruction. The study by Bassiouny RH et al[17]also showed high diagnostic performance in identifying the presence of SBO with and without strangulation. The administration of enteric contrast material in SBO patients significantly accentuates the ability of CT to identify the transition zone and accordingly the location of an obstruction. However, it increases the risk of aggravated or acute obstructions.

Conclusion

MDCT has high sensitivity and specificity to diagnose and determine the causes of bowel obstruction. It not only determines the site of obstruction but also the cause of obstruction. Thus, it has improved our ability of accurate diagnosis of intestinal obstruction but also improved patient care through timely and proper treatment. The MDCT can be used routinely

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as a modality for detecting intestinal obstruction which can aid in reducing the morbidity and mortality of patients with small intestine obstruction.

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