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Original Research Article

Role of CT in the Evaluation of Intestinal Obstruction in a Tertiary Care Center – Cross Sectional Observational Study

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Abstract: ***Background*:** Intestinal obstruction is a common abdominal emergency in which timely identification of the site, cause and complications is essential for appropriate management. Contrast-enhanced computed tomography (CECT) provides detailed evaluation of bowel loops, transition points and associated complications. ***Aim*:** To evaluate the role of computed tomography in the assessment of intestinal obstruction in a tertiary care centre. ***Methods*:** This hospital-based, cross-sectional observational study included 70 consecutive patients aged 18 years or older with clinical suspicion of intestinal obstruction. All patients underwent contrast-enhanced 128-slice multidetector CT of the abdomen and pelvis. CT findings were assessed for the type, anatomical site, cause, grade and complications of obstruction. Imaging findings were compared with plain radiography and ultrasonography, and operative correlation was performed in surgically managed patients. ***Results*:** The mean age was 49.6 ± 13.8 years, and 61.4% were male. Small bowel obstruction was the predominant type (70.0%), with the distal ileum being the commonest site (31.4%). Adhesions were the leading cause (25.7%). Dilated bowel loops were identified in 98.6% of patients, while a transition point was identified in 84.3%. CT demonstrated sensitivity of 95.2%, specificity of 87.5%, positive predictive value of 98.3%, negative predictive value of 70.0% and overall diagnostic accuracy of 94.3%. CT altered the initial clinical diagnosis in 34.3% and identified unsuspected complications in 14.3%. Among 50 operated patients, CT findings showed 88.0% overall concordance with intraoperative findings. Surgical and conservative management were undertaken in 71.4% and 28.6%, respectively. ***Conclusion*:** Contrast-enhanced multidetector CT demonstrated high diagnostic accuracy and provided valuable information regarding the site, cause and complications of intestinal obstruction. Its findings supported clinical decision-making and preoperative assessment in this cohort.

Keywords: Intestinal Obstruction.

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INTRODUCTION

Intestinal obstruction is an important cause of acute abdominal pain and frequently requires urgent evaluation and management. It occurs when the normal passage of intestinal contents is partially or completely impeded, resulting in proximal bowel dilatation and varying degrees of distal bowel decompression. Depending on the anatomical location, it is classified into small bowel obstruction (SBO), large bowel obstruction (LBO), or combined obstruction. The condition may arise from a wide range of causes, including postoperative adhesions, obstructed hernias, malignancies, volvulus, strictures, intussusception and intraluminal lesions. The clinical presentation commonly includes abdominal pain, vomiting, abdominal distension, constipation and obstipation. Early and accurate diagnosis is essential because delayed recognition may lead to bowel strangulation, vascular compromise, ischaemia, gangrene and perforation, thereby increasing morbidity and mortality [1].

The aetiological spectrum of intestinal obstruction varies according to geographical region, patient characteristics and previous surgical history.

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Postoperative adhesions are a major cause of small bowel obstruction, particularly in patients with a history of abdominal surgery. Hernias, inflammatory strictures and malignancies also contribute substantially to the disease burden. In the case of large bowel obstruction, colorectal malignancies and volvulus are important underlying causes [2, 3]. Identification of the precise cause and anatomical level of obstruction is clinically important because these findings influence the treatment approach and help determine the need for surgical intervention.

Imaging plays a central role in the evaluation of suspected intestinal obstruction. Plain abdominal radiography is frequently used as an initial investigation and may demonstrate dilated bowel loops, abnormal air-fluid levels and paucity of distal bowel gas. However, its ability to identify the exact transition point, underlying cause and associated complications is limited. Ultrasonography can demonstrate dilated bowel loops, altered peristalsis and free intraperitoneal fluid, but its diagnostic performance may be affected by bowel gas, patient habitus and operator dependence. Comparative research has demonstrated the superior diagnostic performance of CT in identifying the presence, level and cause of intestinal obstruction [4, 5].

Computed tomography has become an important imaging modality in the assessment of intestinal obstruction because it provides detailed cross-sectional evaluation of the bowel, mesentery and surrounding structures. It helps establish the presence of mechanical obstruction, identify the transition point, differentiate small from large bowel obstruction, assess the degree of obstruction and suggest the underlying aetiology. Multidetector CT, with its rapid image acquisition and multiplanar reconstruction capabilities, facilitates detailed assessment of bowel morphology and the anatomical extent of disease. Previous studies have demonstrated the value of CT in establishing the diagnosis of small bowel obstruction and differentiating complete from partial obstruction [6, 7]. The American College of Radiology considers CT of the abdomen and pelvis with intravenous contrast an usually appropriate imaging investigation in adults presenting with suspected acute small bowel obstruction [8].

An important advantage of contrast-enhanced CT is its ability to identify features suggestive of compromised bowel viability. Bowel wall thickening, reduced or absent mural enhancement, mesenteric congestion, free fluid, pneumatosis intestinalis, mesenteric venous gas and closed-loop configuration may indicate complicated obstruction. However, the sensitivity of CT for detecting bowel ischaemia may vary, and imaging findings must be interpreted in conjunction with the clinical condition [9, 10]. A systematic review and meta-analysis by Millet *et al*., highlighted the diagnostic importance of reduced bowel wall enhancement and mesenteric fluid in predicting strangulation and ischaemia in small bowel obstruction [11].

CT findings also contribute directly to treatment planning by helping clinicians distinguish patients who may be suitable for conservative management from those requiring urgent surgical intervention. The World Society of Emergency Surgery guidelines identify CT as an important investigation when the diagnosis of adhesive small bowel obstruction is uncertain or when signs of strangulation and bowel ischaemia need to be evaluated [12]. In addition to confirming obstruction, CT may identify unsuspected causes and complications that were not apparent during the initial clinical assessment. Correlation of CT findings with operative observations is therefore valuable for assessing the reliability of imaging in determining the presence, level, cause and severity of obstruction.

In view of the broad aetiological spectrum of intestinal obstruction and the importance of early identification of complications, the present study evaluated the role of 128-slice multidetector CT with contrast enhancement in patients presenting with suspected intestinal obstruction at a tertiary care centre. The study assessed the type, anatomical site, transition point, underlying cause, grade and associated complications of obstruction. It also evaluated the diagnostic performance of CT, compared its findings with plain radiography and ultrasonography, assessed its influence on management decisions and correlated CT findings with intraoperative observations wherever surgical intervention was performed.

METHODOLOGY

A hospital-based, cross-sectional observational study was conducted at a tertiary care teaching institute in India over a period of 18 months. A total of 70 consecutive patients aged 18 years and above who presented with acute abdominal symptoms and clinical suspicion of intestinal obstruction were enrolled using convenience sampling. Patients who were unwilling to provide consent, pregnant patients, individuals below 18 years of age and those with a known allergy to iodinated contrast agents were excluded. Institutional Ethics Committee approval was obtained, and written informed consent was taken from all participants. Demographic details, clinical history, physical examination findings and relevant previous surgical history were recorded using a structured case record form. Preliminary investigations, including complete blood count, serum electrolytes, renal function tests, plain abdominal radiography and ultrasonography, were documented. All patients underwent CECT of the abdomen and pelvis using a 128-slice multidetector CT scanner. Intravenous non-ionic iodinated contrast was administered at 1.5–2 mL/kg after assessment of renal function. Oral water-soluble contrast was given where clinically feasible. Axial images were acquired with 5-mm slice thickness and reconstructed at 1–1.25 mm, with coronal and

sagittal reformations. CT findings were assessed for the presence, type, site, level, cause, grade and complications of obstruction. Operative findings were correlated with CT findings in surgically managed patients. Data were analysed using Microsoft Excel and IBM SPSS Statistics version 26. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation and median with interquartile range. Diagnostic performance was assessed using sensitivity, specificity, positive predictive value, negative predictive value and accuracy. The chi-square or Fisher's exact test was applied, and Cohen's kappa was used to assess agreement. A p-value of less than 0.05 was considered statistically significant.

RESULT

Table 1: Demographic Profile and Clinical Characteristics of the Study Population (N=70)

Parameters	Category	Number (n)	Percentage (%)
Age group (years)	18–30	7	10.0
	31–40	12	17.1
	41–50	15	21.4
	51–60	23	32.9
	61–70	9	12.9
	>70	4	5.7
Gender	Male	43	61.4
	Female	27	38.6
Relevant past history	Previous abdominal surgery	33	47.1
	History of tuberculosis	5	7.1
Clinical presentation	Pain abdomen	62	88.6
	Vomiting	57	81.4
	Constipation	47	67.1
	Abdominal distension	44	62.9
	Obstipation	33	47.1
	Fever	9	12.9

Table 2: CT-Based Characterisation of Intestinal Obstruction According to Type, Anatomical Site, Aetiology and Grade (N=70)

Parameter	Category	Number (n)	Percentage (%)
Type of obstruction	Small bowel obstruction	49	70.0
	Large bowel obstruction	19	27.1
	Combined SBO and LBO	2	2.9
Anatomical site	Distal ileum	22	31.4
	Proximal ileum	9	12.9
	Jejunum	11	15.7
	Ileocecal junction	4	5.7
	Duodenum	3	4.3
	Sigmoid colon	2	2.9
	Rectosigmoid	3	4.3
	Descending colon	8	11.4
	Transverse colon	4	5.7
	Cecum	1	1.4
	Splenic flexure	1	1.4
	Ileum + sigmoid	1	1.4
	Ileum + cecum	1	1.4
Aetiology	Adhesions	18	25.7
	Malignancy	11	15.7
	Obstructed hernia	11	15.7
	Volvulus	8	11.4
	Foreign body	4	5.7
	Gallstone ileus	4	5.7
	Tubercular stricture	4	5.7
	Bands	4	5.7
	Intussusception	4	5.7
	Radiation enteritis	2	2.9

Parameter	Category	Number (n)	Percentage (%)
Mechanism	Extrinsic	46	65.7
	Intrinsic	16	22.9
	Intraluminal	8	11.4
Grade of obstruction	Partial (low-grade)	41	58.6
	Complete (high-grade)	29	41.4

Table 3: CT Findings and Associated Complications in Patients with Intestinal Obstruction (N=70)

Parameters	CT findings	Number (n)	Percentage (%)
Primary CT findings	Dilated bowel loops	69	98.6
	Transition point identified	59	84.3
Bowel wall changes	Bowel wall thickening	31	44.3
	Abnormal mural enhancement	19	27.1
Mesenteric changes	Mesenteric fat stranding	34	48.6
	Mesenteric fluid/congestion	18	25.7
Associated findings	Ascites/free fluid	20	28.6
	Small bowel faeces sign	10	14.3
Specific CT signs	Closed-loop configuration	8	11.4
	Target sign	10	14.3
	Whirl sign	8	11.4
Associated complications	Strangulation	9	12.9
	Bowel ischaemia	6	8.6
	Gangrene	3	4.3
	Perforation	6	8.6
	Pneumatosis intestinalis	5	7.1
	Pneumoperitoneum	1	1.4

Table 4A: Diagnostic Performance of 128-Slice MDCT with CECT

Diagnostic parameter	Value (%)	95% Confidence interval (%)
Sensitivity	95.2	86.7–98.3
Specificity	87.5	52.9–97.8
Positive predictive value	98.3	91.1–99.7
Negative predictive value	70.0	39.7–89.2
Overall diagnostic accuracy	94.3	86.2–97.8

Table 4B: Parameter-Wise Diagnostic Performance of CT

Parameter	Sensitivity (%)	Specificity (%)	Accuracy (%)
Presence of obstruction	95.2	87.5	94.3
Level of obstruction	93.5	95.0	93.0
Cause/aetiology	88.7	92.0	89.4
Transition point	86.3	91.0	87.1
Bowel ischaemia	74.1	92.0	89.3
Strangulation	76.5	90.0	88.0
Closed-loop obstruction	81.8	93.5	92.1

Table 4C: CT–Intraoperative Correlation (n=50)

Parameter	CT concordance (%)	Cohen's kappa (κ)
Presence of obstruction	92.9	0.84
Level of obstruction	90.5	0.81
Cause/aetiology	85.7	0.78
Bowel viability/ischaemia	80.9	0.65
Strangulation	76.2	0.60

Table 4D: Overall CT–Operative Correlation

Correlation	Number (n)	Percentage (%)
Concordant findings	44	88.0
Discordant findings	6	12.0

Table 4E: Comparative Imaging Findings

Parameter	Plain radiograph n (%)	USG n (%)	CT (128-slice MDCT) n (%)	P value
Dilated bowel loops	49 (70.0)	49 (70.0)	69 (98.6)	<0.001
Transition point identified	Not applicable	15 (21.4)	59 (84.3)	<0.001
Free fluid/ascites	Not applicable	21 (30.0)	20 (28.6)	0.038
Inconclusive/non-diagnostic	20 (28.6)	Not assessed	0 (0.0)	<0.001
Fully correct diagnosis rate	~10–46%	~29–50%	~78–95%	<0.001

Table 4F: Clinical Impact of CT and Management Outcomes

Parameter	Number (n)	Percentage (%)
CT confirmed pre-CT clinical diagnosis	46	65.7
CT altered pre-CT clinical diagnosis	24	34.3
CT identified unsuspected complications	10	14.3
Surgical management	50	71.4
Conservative management	20	28.6

A total of 70 patients with clinical suspicion of intestinal obstruction were included in the study. The mean age of the study population was 49.6 ± 13.8 years, with a median age of 51 years (IQR: 40–58). The maximum number of patients belonged to the 51–60-year age group (32.9%), followed by 41–50 years (21.4%). Male patients constituted 61.4% of the study population, while females accounted for 38.6%, with a male-to-female ratio of approximately 1.6:1. A history of previous abdominal surgery was present in 47.1% of patients, whereas 7.1% had a history of tuberculosis. Pain abdomen was the most common presenting symptom (88.6%), followed by vomiting (81.4%), constipation (67.1%), abdominal distension (62.9%), obstipation (47.1%) and fever (12.9%).

Small bowel obstruction was the predominant type, accounting for 70% of cases, while large bowel obstruction was observed in 27.1% and combined small and large bowel obstruction in 2.9%. The distal ileum was the most frequently involved anatomical site (31.4%), followed by the jejunum (15.7%) and proximal ileum (12.9%). Among the large bowel locations, the descending colon was the most frequently affected site (11.4%). Adhesions were the leading cause of intestinal obstruction (25.7%), followed by malignancy and obstructed hernia (15.7% each), and volvulus (11.4%). Foreign body, gallstone ileus, tubercular stricture, bands and intussusception each accounted for 5.7% of cases, while radiation enteritis was observed in 2.9%. Extrinsic causes constituted the majority (65.7%), followed by intrinsic (22.9%) and intraluminal causes (11.4%). Partial obstruction was more common, accounting for 58.6% of cases, whereas complete obstruction was observed in 41.4%.

Among the CT findings, dilated bowel loops were identified in 98.6% of patients, while a transition point was demonstrated in 84.3%. Mesenteric fat stranding was observed in 48.6%, bowel wall thickening in 44.3%, abnormal mural enhancement in 27.1% and mesenteric fluid or congestion in 25.7%. Ascites or free fluid was present in 28.6% of cases. The small bowel faeces sign and target sign were each identified in 14.3%, while closed-loop configuration and whirl sign were observed in 11.4% each. Among the reported complications, strangulation was identified in 12.9%, bowel ischaemia and perforation in 8.6% each, and gangrene in 4.3%. Pneumatosis intestinalis was observed in 7.1%, while pneumoperitoneum was identified in 1.4% of patients.

The diagnostic performance of 128-slice multidetector CT with contrast enhancement demonstrated a sensitivity of 95.2%, specificity of 87.5%, positive predictive value of 98.3% and negative predictive value of 70%. The overall diagnostic accuracy was 94.3%. Parameter-wise assessment demonstrated a sensitivity of 93.5% and specificity of 95% for determining the level of obstruction, with an accuracy of 93%. The diagnostic accuracy for identifying the underlying cause was 89.4%, while transition point identification demonstrated an accuracy of 87.1%. The sensitivity for detecting bowel ischaemia and strangulation was 74.1% and 76.5%, respectively. Closed-loop obstruction was identified with a sensitivity of 81.8%, specificity of 93.5% and accuracy of 92.1%.

Comparison of imaging modalities demonstrated that CT identified dilated bowel loops in 98.6% of patients compared with 70% on plain radiography and ultrasonography. The transition point was identified in 84.3% of patients on CT compared with 21.4% on ultrasonography. Plain radiography was reported as inconclusive or non-diagnostic in 28.6% of cases, whereas CT was reported as diagnostic in all patients. The reported differences were statistically significant. CT confirmed the pre-CT clinical diagnosis in 65.7% of patients and altered it in 34.3%. It also identified unsuspected complications in 14.3% of patients. Surgical management was undertaken in 71.4% of cases, while 28.6% were managed conservatively. Among the 50 surgically managed patients, CT findings showed overall concordance with intraoperative findings in 88% of cases. The highest concordance was observed for the presence of obstruction (92.9%, $\kappa = 0.84$), followed by the level of obstruction (90.5%, $\kappa = 0.81$). Concordance for aetiology, bowel viability/ischaemia

and strangulation was 85.7%, 80.9% and 76.2%, respectively.

DISCUSSION

Intestinal obstruction is a common clinical emergency that requires prompt diagnosis, identification of the underlying cause and assessment of bowel viability. In the present study, the mean age of patients was 49.6 ± 13.8 years, with a male predominance of 61.4%. The highest proportion of patients belonged to the 51–60-year age group. This demographic distribution was comparable to the Indian observations described in the dissertation's background literature, where middle-aged and older individuals constituted a substantial proportion of patients with intestinal obstruction. The male predominance was also consistent with the epidemiological pattern reported in previous studies [2, 3]. Previous abdominal surgery was documented in 47.1% of patients, supporting the clinical importance of postoperative adhesions in the development of intestinal obstruction. Adhesions were also the most common aetiology in the present study, accounting for 25.7% of cases. This finding is consistent with the established role of postoperative adhesions as a major cause of small bowel obstruction [1, 2].

Small bowel obstruction accounted for 70% of cases, making it the predominant type of obstruction in the present study. The distal ileum was the most frequently involved anatomical site, followed by the jejunum and proximal ileum. Adhesions were the leading cause, followed by malignancy and obstructed hernia. The observed variation in aetiology highlights the importance of determining the underlying cause rather than merely establishing the presence of obstruction. Paulson and Thompson emphasised the role of CT in identifying the cause and anatomical location of small bowel obstruction, while Jaffe and Thompson described its importance in evaluating large bowel obstruction and differentiating its various causes [2, 3]. In the present study, the identification of extrinsic, intrinsic and intraluminal causes further demonstrated the value of cross-sectional imaging in comprehensive assessment.

The most frequent CT finding was dilatation of bowel loops, observed in 98.6% of patients, followed by identification of the transition point in 84.3%. Identification of the transition point is particularly important because it helps localise the obstruction and directs attention towards its underlying cause. Frager *et al*., demonstrated the usefulness of CT in establishing the diagnosis of small bowel obstruction and determining its degree and cause [6]. Similarly, Balthazar highlighted the role of CT in the evaluation of small bowel obstruction and its associated complications [7]. In the present study, CT also demonstrated bowel wall thickening, mesenteric fat stranding, free fluid and abnormal mural enhancement, providing additional information regarding the severity and associated changes in the obstructed bowel.

An important aspect of CT evaluation is the detection of complications that may require urgent surgical intervention. In the present study, strangulation was identified in 12.9% of patients, bowel ischaemia and perforation in 8.6% each, and gangrene in 4.3%. CT signs such as abnormal mural enhancement, bowel wall thickening, mesenteric congestion, pneumatosis intestinalis and closed-loop configuration are important in assessing the possibility of compromised bowel viability. Millet *et al*., reported that reduced bowel wall enhancement and mesenteric fluid were valuable CT findings for predicting strangulation and ischaemia in small bowel obstruction [11]. Sheedy *et al.,* also demonstrated the importance of recognising specific CT signs of small bowel ischaemia, although their study showed that sensitivity could remain limited despite relatively high specificity [9]. In the present study, the sensitivity for detecting bowel ischaemia and strangulation was comparatively lower than that for identifying the presence of obstruction. This finding emphasises that the absence of obvious CT signs should not independently exclude bowel compromise, particularly when clinical suspicion remains high.

The diagnostic performance of 128-slice MDCT with contrast enhancement was encouraging, with a sensitivity of 95.2%, specificity of 87.5% and overall accuracy of 94.3% for the diagnosis of intestinal obstruction. The positive predictive value was 98.3%, indicating a high proportion of CT-positive cases among patients classified as having obstruction according to the study reference standard. These findings support the diagnostic usefulness of CT in suspected intestinal obstruction. Earlier studies by Suri *et al*., and Maglinte *et al*., also demonstrated the diagnostic contribution of CT compared with conventional imaging modalities in the evaluation of intestinal obstruction [4, 5]. The present study further demonstrated the ability of CT to identify the level and cause of obstruction, with diagnostic accuracies of 93% and 89.4%, respectively. However, the lower sensitivity observed for bowel ischaemia and strangulation indicates that the assessment of complications remains a challenging aspect of CT interpretation.

Comparison with plain radiography and ultrasonography demonstrated that CT provided better identification of dilated bowel loops and the transition point in the present study. CT identified the transition point in 84.3% of cases, compared with 21.4% on ultrasonography. Plain radiography was inconclusive or non-diagnostic in 28.6% of patients. These observations are consistent with the comparative imaging literature, which has demonstrated the additional diagnostic information provided by CT in determining the site and cause of obstruction [4, 5]. The American College of Radiology also considers CT of the abdomen and pelvis with intravenous contrast an appropriate imaging investigation in adults with suspected acute small bowel obstruction [8].

The findings of the present study also demonstrated the clinical impact of CT on patient management. CT confirmed the initial clinical diagnosis in 65.7% of patients and altered it in 34.3%. Furthermore, unsuspected complications were identified in 14.3% of cases. Surgical intervention was undertaken in 71.4% of patients, while 28.6% were managed conservatively. These observations highlight the importance of CT in providing information that assists clinicians and surgeons in selecting an appropriate management strategy. The Bologna guidelines emphasise the role of CT in evaluating adhesive small bowel obstruction, particularly when the diagnosis is uncertain or when signs of strangulation and ischaemia need to be assessed [12].

Correlation with intraoperative findings was available in 50 surgically managed patients. Overall concordance between CT and operative findings was 88%, with the highest concordance observed for the presence of obstruction (92.9%) and the level of obstruction (90.5%). Concordance for the underlying cause was 85.7%, while agreement was comparatively lower for bowel viability/ischaemia and strangulation. Cohen's kappa values demonstrated substantial agreement for the presence, level and cause of obstruction, while agreement for bowel viability and strangulation was comparatively lower. These findings support the role of CT as a useful preoperative imaging modality for localisation and characterisation of intestinal obstruction. Nevertheless, the comparatively lower agreement for complications reinforces the need to interpret imaging findings alongside clinical and intraoperative assessment.

Overall, the present study demonstrated that contrast-enhanced multidetector CT provided important diagnostic information regarding the presence, anatomical level, underlying cause, grade and complications of intestinal obstruction. Its ability to alter the initial clinical diagnosis, identify unsuspected complications and demonstrate good correlation with intraoperative findings supports its value in the evaluation and management planning of patients presenting with suspected intestinal obstruction. However, the diagnostic performance estimates should be interpreted in the context of the study's sample size and the availability of operative correlation in only 50 patients.

CONCLUSION

128-slice MDCT with contrast enhancement demonstrated high diagnostic accuracy in evaluating intestinal obstruction, with excellent utility in identifying its anatomical level, underlying cause and associated findings. Its ability to detect complications, influence management decisions and demonstrate good intraoperative correlation supports its role as an important imaging modality in the comprehensive assessment of intestinal obstruction.

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