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ROLE OF COMPUTED TOMOGRAPHY IN BOWEL OBSTRUCTION

Radiology

Dr. Vishakha Raosaheb Kale* Junior resident III, Department of Radiology, Government Medical College and Hospital, Chh. Sambhaji Nagar, 431001, Maharashtra, India *Corresponding Author

Dr. Anjali Pawar Dahiphale Professor and HOD, Department of Radiology, Super specialty building (SSB building) , Government medical college, Chh. Sambhaji Nagar, 431001, Maharashtra, India

Dr. Varsha Rote Kaginalkar Professor and HOD, Department of Radiology, Government Medical College and Hospital, Chh. Sambhaji Nagar, 431001, Maharashtra, India

Dr. Ajay Vare Associate Professor ,Department of Radiology, Government Medical College and Hospital, Chh. Sambhaji Nagar, 431001, Maharashtra, India

Dr. Prashant Uddhaorao Titare Associate Professor, Department of Radiology, Government Medical College and Hospital, Chh. Sambhaji Nagar, 431001, Maharashtra, India

ABSTRACT

Background- Bowel obstruction is a common surgical emergency associated with significant morbidity and mortality. Timely and accurate diagnosis is essential for appropriate management, and computed tomography (CT) has emerged as the imaging modality of choice for confirming obstruction, identifying its level and cause, and detecting complications such as ischemia and perforation. **Objective-** To study the Role of CT in Bowel Obstruction and to estimate the sensitivity, specificity, PPV & NPV of CT in the diagnosis of Bowel Obstruction by correlating with intra-operative findings. **Methodology-** This prospective study was conducted at Government Medical College and Hospital, Chh. Sambhajinagar over 18 months after ethical approval and included 50 patients with clinical suspicion of bowel obstruction. All patients underwent preliminary investigations followed by non-contrast and contrast-enhanced CT. Radiological findings were correlated with operative outcomes where applicable. Data were analyzed using SPSS version 20, with $p < 0.05$ considered statistically significant. **Result-** Post-operative adhesions 42.0% (21/50); Malignancy 24.0% (12/50); External hernia 12.0% (6/50); Intussusception 6.0% (3/50); Volvulus 6.0% (3/50); Intestinal TB 4.0% (2/50); Crohn's disease 4.0% (2/50); Unspecified hernia 2.0% (1/50); Trend toward site association ($p = 0.06$). No surgery 32.0% (16/50); Adhesiolysis 26.0% (13/50); Resection & anastomosis 18.0% (9/50); Hernia repair 10.0% (5/50); Sigmoid colectomy 6.0% (3/50); Segmental resection 2.0% (1/50); Sigmoid resection 2.0% (1/50); Stricturoplasty 2.0% (1/50); Procedure–site association significant ($p = 0.03$). Overall 4.0% (2/50); SBO 5.3% (2/38); LBO 0.0% (0/12); No site association ($p = 0.417$). **Conclusion-** Computed tomography facilitates early diagnosis and treatment ,thereby contributing to reduced mortality and proving beneficial to patient's outcome. Overall, the study reaffirms CT as the cornerstone imaging tool in bowel obstruction, providing both diagnostic clarity and essential guidance for patient management pathways.

KEYWORDS

Bowel obstruction, CT, Post-operative

INTRODUCTION

Bowel obstruction is a common and potentially life-threatening condition encountered in surgical and emergency practice. [1] It involves partial or complete blockage of the intestinal lumen, leading to impaired transit and serious complications such as ischemia, necrosis, or perforation if not promptly treated. Early diagnosis and appropriate management are therefore essential.

Small bowel obstruction (SBO) is more common and is typically caused by adhesions, hernias, or neoplasms, whereas large bowel obstruction (LBO) is more often due to malignancy, volvulus, or strictures. [2] Clinical presentation is frequently nonspecific, including abdominal pain, vomiting, distension, and obstipation, making imaging crucial for accurate diagnosis and management planning.

Plain abdominal radiographs have traditionally been used but offer limited diagnostic value, particularly in identifying the exact site, cause, and complications of obstruction. [3] Ultrasonography and contrast studies have restricted roles in adults due to technical limitations and time constraints. These shortcomings have led to the widespread adoption of computed tomography (CT) as the primary imaging modality.

CT has revolutionized the evaluation of bowel obstruction by accurately confirming its presence, localizing the transition point, distinguishing mechanical obstruction from ileus, and identifying complications such as ischemia, perforation, or closed-loop obstruction. [4] Importantly, CT can determine the underlying etiology-such as adhesions, malignancy, volvulus, or inflammatory strictures-there by directly influencing treatment decisions, from conservative management to urgent surgical intervention.

With high reported sensitivity and specificity, CT has become the first-line investigation in suspected bowel obstruction. [5] Although concerns regarding radiation exposure and contrast use remain, the diagnostic and clinical benefits of CT in acute obstruction far outweigh these risks.

In this context, the present study aims to evaluate the diagnostic performance of CT in bowel obstruction by assessing its accuracy in determining the level, cause, and complications of obstruction, and by correlating CT findings with intra-operative outcomes.

MATERIALS AND METHODS

The study was conducted at a tertiary care teaching hospital over a period of 18 months after receiving ethical clearance from the Institutional Ethics Committee. 50 patients were finalized for the study based on the inclusion and exclusion criteria.

Inclusion Criteria

Patients of any age and gender presenting with clinical suspicion of bowel obstruction (e.g., abdominal pain, distension, vomiting, inability to pass flatus or stool), referred from emergency or outpatient departments with suspected or diagnosed bowel obstruction, Post-operative patients with suspicion of bowel obstruction and willing to provide informed consent.

Exclusion Criteria

Patients with contraindications to intravenous contrast (e.g., contrast allergy, renal failure), pregnant women, hemodynamically unstable patients in whom CT could not be safely performed, prior abdominal surgeries whose imaging and clinical data were incomplete or inaccessible, accidental injuries and those refusing consent.

Patients were enrolled prospectively. Those with clinical suspicion of bowel obstruction underwent preliminary investigations (CBC, KFT, LFT, X-ray, and ultrasound) followed by CT evaluation. Two CT protocols were performed: (1) non-contrast CT with oral contrast and (2) contrast-enhanced CT using intravenous iodine-based contrast with oral water-soluble contrast. Scans were acquired on a 128-slice Siemens scanner with 5 mm axial sections and multiplanar and 3D

reconstructions.

Radiological findings, including dilated bowel loops, transition point, and signs of ischemia or perforation, were documented. Operative findings were recorded in surgical cases. All data was entered into a structured, pre-tested proforma, and patients were monitored for in-hospital recovery, complications, and outcomes. Data analysis was performed using SPSS version 20, with a p-value <0.05 considered statistically significant.

RESULTS

Table 1: Prior Abdominal Surgery with CT Bowel Category involvement

		CT Bowel Category		p Value
		Large Bowel	Small Bowel	
Prior Abdominal Surgery	No	5 (41.7%)	23(60.5%)	0.251
	Yes	7 (58.3%)	15 (38.5%)	

Prior surgery was more common in LBO than SBO, but the difference was not significant (p=0.251), indicating that surgical history does not reliably distinguish obstruction site. While prior surgery raises suspicion for adhesions, CT findings remain essential for accurate localization and management decisions.

Table 2: CT Segment involved in study population

CT Findings (segment)	Large Bowel	Small Bowel	p- value
Ascending Colon	2 (16.7%)	0(0%)	<0.05
Caecum	1(8.3%)	0(0%)	
Descending Colon	3(25%)	0(0%)	
Distal Ileum	0(0%)	17(44.70%)	
Distal Jejunum	0(0%)	7(18.40%)	
Proximal Ileum	0(0%)	9(23.7%)	
Proximal Jejunum	1(8.3%)	4(10.5%)	
Sigmoid Colon	4(33.3%)	0(0%)	
Terminal ileum	1(8.3%)	1(2.6%)	

Segment involvement correlated strongly with obstruction site, with ileal and jejunal segments predominating in SBO and colonic segments in LBO ($p < 0.05$), confirming internal consistency of CT interpretation. This segmental localization aids etiologic inference and guides operative planning, from adhesiolysis to segmental colectomy.

Table 3: Bowel category wise Specific cause in study population

Specific Cause	Large Bowel	Small Bowel	p- value
Crohn's Disease	0(0%)	2(5.3%)	0.06
External Hernia	2(16.7%)	4(10.5%)	
Hernia	0(0%)	1(2.6%)	
Intestinal TB	1(8.3%)	1(2.6%)	
Intussusception	0(0%)	3(7.9%)	
Malignancy	3(25%)	9(2.7%)	
Post-op Adhesions	3(25%)	18(47.4%)	
Volvulus	3(25%)	0(0%)	

Etiologic patterns aligned with expectations: adhesions predominated in SBO, volvulus occurred only in LBO, and malignancy affected both. Although not statistically significant ($p = 0.06$), this supports CT's role in early etiologic differentiation that directly guides management decisions.

Table 4 : CT bowel category wise histopathology reports in study population

Histopathology Findings	Large Bowel	Small Bowel	p- value
Adenocarcinoma	1(8.%)	3(7.9%)	0.401
Crohn's	0(0%)	2(5.3%)	
GIST	0(0%)	3(7.9%)	
Lymphoma	0(0%)	1(2.6%)	
Count	10(83.3%)	29(76.3%)	
Tuberculosis	1(8.3%)	0(0%)	

Histopathology did not differ significantly by site ($p = 0.401$), with most cases having no HP due to non-resectional management, especially in SBO. Malignant and inflammatory etiologies occurred across both sites, reinforcing that CT and clinical course primarily guide management when tissue is unavailable.

Table 5: Complication (Bowel Perforation and Ischemia) in study population

Complication Ischemia, Bowel perforation	Frequency	Percent
Bowel perforation	3	6.0
Ischemia	4	8.0
No Complication	43	86.0

CT identified ischemia in 8% (4/50) and bowel perforation in 6% (3/50); most patients had no CT complication (86%, 43/50). In the site crosstab, perforation was numerically higher in LBO (16.7%) versus SBO (2.6%), while ischemia was similar (≈8% each); the overall difference was not significant ($p=0.2$). Clinically, the pattern of obstruction (e.g., closed loop), mural enhancement changes, mesenteric edema, and pneumatosis/portal venous gas are high-specificity markers that should prompt urgent surgical consultation regardless of site category.

Table 6: Bowel category wise complications in study population

Complication	Large Bowel	Small Bowel	p- value
Bowel perforation	2(16.7%)	1(2.6%)	0.2
Ischemia	1(8.3%)	3(7.9%)	
No Complication	9(75%)	34(89.5%)	

Perforation was more frequent in LBO (16.7%) than SBO (2.6%), while ischemia rates were similar (≈8% each). The composite association was not significant ($p=0.2$).

Table 7: Operative procedure performed in study population

Operative Procedure	Frequency	Percentage
Adhesiolysis	13	26.0
Hernia repair	5	10.0
Laparotomy	1	2.0
No	16	32.0
Resection and anastomosis	9	18.0
Segmental resection	1	2.0
sigmoid colectomy	3	6.0
Sigmoid resection	1	2.0
Stricturoplasty	1	2.0

No operation was required in 32% of patients; among operative cases, adhesiolysis was most common, followed by resection and hernia repair. Colectomies were confined to LBO. A significant site–procedure association ($p = 0.03$) showed SBO favored non-operative management or adhesiolysis, while LBO more often required resection, reinforcing CT's role in guiding early triage and operative planning.

Table 8: CT bowel category wise operative procedures in study population

Operative procedures	Large Bowel	Small Bowel	p- value
Adhesiolysis	2(16.7%)	11(28.90%)	0.03
Hernia repair	2(16.7%)	3(7.9%)	
Laporotomy	0(0%)	1(2.6%)	
Resection and anastomosis	4(33.3%)	5(13.20%)	
No	1(8.3%)	15(39.5%)	
Segmental resection	0(0%)	1(2.6%)	
sigmoid colectomy	3(25%)	0(0%)	
Sigmoid resection	0(0%)	1(2.6%)	
Stricturoplasty	0(0%)	1(2.6%)	

A significant site–procedure difference was observed ($p = 0.03$): SBO more often required no surgery or adhesiolysis, while LBO concentrated resections, reflecting underlying etiologies. This highlights CT's role in preoperative planning by accurately identifying the transition point and cause, and in selected LBO cases enabling stent-as-bridge strategies.

Table 9: Post-Operative Complication

Post-Operative Complication	Large Bowel	Small Bowel
Yes	1	4
No	11	34

Using LBO as a predictor of post-operative complications showed poor performance (sensitivity 20%, PPV 8.3%, accuracy 70%), with no excess risk compared to SBO ($p=0.825$). Anatomical site did not predict complications; CT severity features and clinical status are more reliable for risk stratification.

Table 10: In-Hospital Death

	Large Bowel	Small Bowel
Yes	0	2
No	12	36

Two in-hospital deaths occurred in the cohort (4%, 2/50), both in Small-

Bowel obstruction (SBO). Large-Bowel obstruction (LBO) had 0/12 deaths. The association between site and mortality is not significant ($\chi^2 \approx 0.66$, p=0.417), and with only two events, any site-based inference is underpowered. If you (as before) treat LBO as "test positive" for predicting death, diagnostic performance is poor: sensitivity 0.00, specificity 0.75, PPV 0.00, NPV 0.947, accuracy 0.72. Risks: LBO 0.0% vs SBO 5.3%(risk difference −5.3%). Conclusion: Anatomical site doesn't predict mortality in this dataset; prioritize CT severity markers (ischemia, perforation), physiology, and time- to-definitive care.

DISCUSSION

The primary aim of this study was to evaluate how multi-detector computed tomography (CT) guides diagnosis, etiologic attribution, severity grading, and management of bowel obstruction in a real-world acute-care cohort, and to link imaging phenotypes with operative decisions and early outcomes. We quantified case mix by site, localized transition points, classified etiologic mechanisms, characterized CT severity, and examined relationships between imaging findings, comorbidities, procedures, complications, histopathology, mortality, and time to surgery.

Prior laparotomy was present in 44% of patients, and postoperative adhesions were the leading cause (42%). However, prior surgery did not significantly segregate obstruction site (p=0.251), highlighting that large-bowel obstruction (LBO) often arises independently of operative history. This aligns with prior reports showing adhesions as the dominant extrinsic cause and demonstrating high MDCT accuracy for site and etiology (Quezada-Sanhueza et al., 2014 [6]; Sekhon et al., 2016 [7]. Our lower prior-surgery proportion likely reflects the broader case-mix, including LBO (24%), rather than under-ascertainment.

Segmental distribution followed expected anatomic patterns, with distal ileum being the most common site (34%) and sigmoid colon the leading large-bowel segment (8%), and the segment-by-site association was significant ($p<0.05$). These findings mirror earlier series reporting distal ileum predominance in small-bowel obstruction (SBO) and sigmoid dominance in LBO (Sekhon et al., 2016 [7]). Expert literature emphasizes the transition point as the most valuable CT sign, independently predicting surgery (OR 19) (Suri et al., 2014 [8]), and highlights additional actionable signs such as the whirl sign and small-bowel feces sign (Galia et al., 2015 [9]). Segment-level localization in our cohort facilitated etiologic narrowing and management planning.

Etiologically, postoperative adhesions (42%) and malignancy (24%) were the most common causes, followed by hernia (12%), intussusception (6%), volvulus (6%), tuberculosis (4%), and Crohn's disease (4%). Adhesions clustered in SBO, while volvulus was confined to LBO, reinforcing established patterns (Quezada-Sanhueza et al., 2014 [6]; Elsayed et al., 2018 [10]). These distributions supported CT-guided decision-making for adhesiolysis, oncologic resection, or emergent detorsion.

Histopathology was available in 22% of cases, reflecting that many SBOs are managed non-operatively or by adhesiolysis without resection. Diagnoses included adenocarcinoma (8%), GIST (6%), Crohn's disease (4%), lymphoma (2%), and tuberculosis (2%), with no significant site-based difference (p=0.401). This mirrors prior series reporting carcinoma as a frequent intraluminal cause and sigmoid colon as the most common LBO site (Elsayed et al., 2018 [10]). Operative-matched studies have demonstrated high concordance between CT and surgical findings (~89%), supporting reliance on CT for triage (Waseem et al., 2019 [11]). However, real-world sensitivity for ischemia and closed-loop obstruction may be modest, necessitating integration of imaging, clinical, and temporal data (Nielsen et al., 2023 [12]).

CT identified ischemia in 8% and perforation in 6%, with most patients (86%) showing no complications. Perforation was more frequent in LBO, while ischemia rates were similar across sites, though the association was not significant (p=0.2). Prior studies demonstrate high specificity but variable sensitivity for ischemia and closed-loop obstruction (Quezada-Sanhueza et al., 2014 [6]; Nielsen et al., 2023 [12]). Narrative and expert reviews emphasize structured evaluation of mural enhancement, mesenteric edema, free fluid, pneumatosis, portomesenteric gas, and whirl sign to guide escalation (Taghavifar et al., 2021 [13]; Galia et al., 2015 [9]). Our protocol mandates structured reporting of these features to facilitate timely operative decision-making. Non-operative management was pursued in 32% of patients, consistent with conservative treatment of partial, uncomplicated SBO. Among surgical cases, adhesiolysis (26%) was most common, followed by resection and anastomosis (18%) and hernia repair (10%). Sigmoid colectomy (6%) was confined to LBO. Procedure distribution differed significantly by site (p=0.03), with SBO favoring non-operative or adhesiolysis approaches and LBO more often requiring resection. This aligns with prior evidence demonstrating that CT severity, particularly ischemia and high-grade obstruction, increases operative probability (Quezada-Sanhueza et al., 2014 [6]; Suri et al., 2014 [8]). Given real-world limitations in CT sensitivity for ischemia (Nielsen et al., 2023 [12]), we advocate standardized descriptors and multidisciplinary discussion when imaging and clinical status diverge.

Post-operative complications occurred in 10% of patients, with no significant difference by site (p=0.8). Although event numbers were small, the low complication rate suggests appropriate selection and timing of surgery, likely guided by CT severity markers. Literature supports that CT severity, rather than anatomic site, predicts adverse outcomes (Quezada-Sanhueza et al., 2014 [6]; Suri et al., 2014 [8]; Nielsen et al., 2023 [12]).

In-hospital mortality was 4%, with both deaths occurring in the SBO group, though this association was not significant (p=0.417). The small number of events precludes stable inference. Prior studies indicate that mortality risk is driven more by imaging severity and timeliness of intervention than by SBO versus LBO classification (Quezada-Sanhueza et al., 2014 [6]; Nielsen et al., 2023 [12]). Narrative guidance supports rapid escalation when CT demonstrates ischemic or strangulating features (Taghavifar et al., 2021 [13]; Galia et al., 2015 [9]). Our findings support embedding structured vascular and mesenteric danger-sign checklists in reports and promoting early multidisciplinary engagement.

CONCLUSION

CT findings were pivotal in guiding clinical decisions, determining urgency, and planning operative versus conservative management. Practically, CT serves as the gatekeeper to tissue: it identifies those who should go to the operating room for resection/biopsy now, those suited to endoscopic stent-as-bridge or urgent decompression, and those who can safely remain on a conservative pathway. The ability of CT to reveal complication indicators such as ischemia or perforation ensured timely escalation of care. Computed tomography facilitates early diagnosis and treatment , thereby contributing to reduced mortality and proving beneficial to patient's outcome. Overall, the study reaffirms CT as the cornerstone imaging tool in bowel obstruction, providing both diagnostic clarity and essential guidance for patient management pathways.

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