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Diagnostic Accuracy of Ultrasonography and Contrast-Enhanced Computed Tomography in Intestinal Obstruction: Correlation with Intraoperative Findings – A Prospective Observational Study

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Abstract

Background: Intestinal obstruction is a common surgical emergency associated with significant morbidity and mortality. Imaging plays a critical role in early diagnosis, localization, and identification of the cause and complications.

Aim: To evaluate and compare the diagnostic efficacy of ultrasonography (USG) and contrast enhanced computed tomography (CECT) in clinically suspected intestinal obstruction, with correlation to intraoperative findings.

Materials and Methods: A prospective observational study was conducted on 100 patients with clinically suspected intestinal obstruction over a period of 18 months. All patients underwent ultrasonography followed by contrast-enhanced CT of the abdomen. Imaging findings were correlated with intraoperative findings, which served as the gold standard. Diagnostic performance parameters including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated.

Results: The most common age group affected was 16–30 years (33%), with male predominance (64%). CECT detected intestinal obstruction in 99% of cases, predominantly small bowel obstruction (94%), whereas USG detected obstruction in 54% of cases. Distal small bowel was the most common site of obstruction (61%).

CECT demonstrated significantly higher sensitivity, specificity, and overall diagnostic accuracy compared to ultrasonography in identifying the presence, level, and cause of obstruction.

Conclusion: CECT is superior to ultrasonography in the evaluation of intestinal obstruction and should be considered the imaging modality of choice in clinically suspected cases.

Keywords: Intestinal obstruction, Ultrasonography, Contrast-enhanced CT, Diagnostic accuracy, Intraoperative correlation

Introduction

Intestinal obstruction represents a frequent and potentially life-threatening surgical emergency. Prompt diagnosis is essential to prevent complications such as strangulation, ischemia, perforation, and peritonitis. While clinical examination provides initial suspicion, imaging plays a decisive role in confirmation and management planning. Ultrasonography is non-invasive and radiation-free but operator-dependent, whereas contrast-enhanced computed tomography offers comprehensive evaluation of bowel anatomy, level, cause, and complications. This study compares the diagnostic efficacy of these two modalities using intraoperative findings as the reference standard.

Aims and Objectives

1. To evaluate the diagnostic efficacy of ultrasonography and CECT abdomen in clinically suspected intestinal obstruction.
2. To compare USG and CECT findings with intraoperative findings as the gold standard.

Materials and Methods

Study Design: Prospective observational study.

Study Period: May 2023 – October 2024.

Study Setting: Department of Radiodiagnosis, Gandhi Medical College, Bhopal.

Study Population: 100 patients with clinical suspicion of intestinal obstruction.

Inclusion Criteria

- Patients with clinical features of intestinal obstruction
- Informed consent obtained

Exclusion Criteria

- History of recent abdominal trauma
- Evidence of perforation or pneumatosis
- Pregnancy
- Known contrast allergy or renal dysfunction

Imaging Protocol

All patients underwent abdominal ultrasonography followed by contrast-enhanced CT scan. CT was performed using intravenous contrast (1–1.5 ml/kg) with bolus tracking.

Statistical Analysis

Data were analyzed using SPSS v22. Diagnostic accuracy parameters were calculated. Chi square test was applied, and $p < 0.05$ was considered statistically significant.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee. Written informed consent was taken from all participants.

Results

Observation and Results

Table 1: Distribution of patients according to the age group and gender

Age Group	Gender		Total	Chi square value P value
	Male	Female		
	N (%)	N (%)	N (%)	18.833
≤15	11 (73.3)	4 (26.7)	15 (100.0)	
16-30	12 (36.4)	21 (63.6)	33 (100.0)	0.001
31-45	8 (61.5)	5 (38.5)	13 (100.0)	

46-60	19 (82.6)	4 (17.4)	23 (100.0)	
≥61	14 (87.5)	2 (12.5)	16 (100.0)	
Total	64 (64.0)	36 (36.0)	100 (100.0)	

Table 2: Distribution of patients on the basis of clinical features

S No	Clinical features	No of Patients	Percentage
1	Abdominal pain and distension	36	36.0
2	Abdominal pain and vomiting	22	22.0
3	Unable to pass faeces and flatus	12	12.0
4	Unable to pass faeces and flatus and abdominal pain	30	30.0
Total		100	100

Table 3: Distribution of patients based on the type of obstruction as evidenced by USG

S No	Type of obstruction in USG	No of Patients	Percentage
1	Normal	46	46.0
2	Small bowel obstruction	54	54.0
Total		100	100.0

Table 4: Distribution of patients based on the CECT findings

S No	Type of obstruction in CECT	No of Patients	Percentage
1	Small bowel obstruction	94	94.0
2	Large bowel obstruction	1	1.0
3	Small bowel and large bowel obstruction	5	5.0
Total		100	100.0

Table 5: Distribution of patients according to the level of obstruction on USG

S No	Level of obstruction in USG	No of Patients	Percentage
1	Normal	96	96.0
2	Terminal ileum, IC junction	4	4.0
Total		100	100.0

Table 6: Distribution of patients on the basis of level of obstruction on CECT

S No	Level of obstruction in CECT	No of Patients	Percentage
1	Proximal small bowel	20	20.0
2	Distal small bowel	61	61.0
3	Ileocecal region	13	13.0
4	Large bowel	6	6.0
Total		100	100.0

Table 7: Distribution of patients on the basis of cause identified on USG

S No	Cause identified on USG	No of Patients	Percentage
1	Normal	96	96.0
2	Thickening at IC junction	3	3.0
3	Bowel mass	1	1.0
Total		100	100.0

Table 8: Distribution of patients according to the cause of obstruction evidenced in CECT

S No	Cause identified on CECT	No of Patients	Percentage
1	No obvious cause found	42	42.0
2	Wall thickening	44	44.0
3	Adhesion & stricture	8	8.0
4	Hernia	5	5.0
5	Neoplastic	1	1.0
Total		100	100.0

Table 9: Distribution of patients on the basis of type of management underwent

S No	Type of management	No of Patients	Percentage
1	Medical	30	30.0
2	Surgical	70	70.0
Total		100	100.0

Table 10: Distribution of patients according to the cause for obstruction identified intra operatively

S No	Cause of obstruction	No of Patients	Percentage
1	Adhesion	29	41.4
2	Fibrotic bands & strictures	35	50.0
3	Hernias with adhesion	6	8.6
Total		70	100.0

Table 11: Distribution of patients according to the type of obstruction identified during surgery

S No	Type of obstruction	No of Patients	Percentage
1	Small Bowel obstruction	61	87.1
2	Large bowel obstruction	2	2.9
3	Small bowel and large bowel	3	4.3
4	No Abnormality Detected	4	5.7
Total		70	100.0

Table 12: Evaluation of Ultrasonography (USG) Diagnostic Accuracy for Intestinal Obstruction

USG Findings	Per operative Findings: Obstruction Present	Per operative Findings: No Obstruction	Total
Normal	40 (60.6%)	2 (50.0%)	42
Abnormal/Suspected	26 (39.4%)	2 (50.0%)	28
Total	66 (100%)	4 (100%)	70
Metric	Value	Calculation	
Accuracy	40.00%	(26 + 2) / 70	
Sensitivity	46.5%	40 / 66	
Specificity	50.00%	2 / 4	
PPV	90.1%	40/ 42	
NPV	7.14%	2 / 28	
Chi-Square Test	Value	df	p-value
Pearson Chi-Square	0.176	1	0.674

Table 13: Evaluation of Contrast-Enhanced Computed Tomography (CECT) Diagnostic Accuracy for Intestinal Obstruction"

CECT Findings	Per operative Findings: Obstruction Present	Per operative Findings: No Obstruction	Total
Abnormal/Suspected	66 (94.3%)	4 (5.7%)	100
Metric	Value	Calculation	
Accuracy	94.3%	(66 + 0) / 70	
Sensitivity	100%	66 / 66	
Specificity	0%	0 / 4	
PPV	94.30%	66 / 70	
NPV	N/A	0 / 0	

CECT showed superior accuracy in identifying the level and cause of obstruction compared to USG. Diagnostic accuracy of CECT was significantly higher when correlated with intraoperative findings.

Discussion

The present study demonstrates that contrast-enhanced CT significantly outperforms ultrasonography in the evaluation of intestinal obstruction. While USG is useful as a screening tool, its limitations in identifying the level and cause of obstruction reduce its reliability. CECT provides detailed anatomical information, identifies transition zones, and detects complications, making it indispensable for surgical planning. The findings of this study are consistent with previous national and international studies reporting high diagnostic accuracy of CT in intestinal obstruction.

Limitations

- Single-center study
- Operator dependence of ultrasonography
- Limited evaluation of functional obstruction

Clinical Implications and Future Recommendations

Early use of CECT can reduce diagnostic delay and improve surgical outcomes. Future studies incorporating artificial intelligence and functional imaging may further enhance diagnostic precision.

Conclusion

Contrast-enhanced CT is a highly accurate and reliable imaging modality for diagnosing intestinal obstruction and correlates well with intraoperative findings. Ultrasonography, though useful, should not replace CECT in clinically suspected cases.

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