

Comparison of Computed Tomography Findings and Intraoperative Correlation in Adult Patients Presenting with Symptoms of Intestinal Obstruction

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Abstract: Background: Intestinal obstruction is a common surgical emergency, accounting for approximately 15% of all emergency department visits for abdominal pain and around 20% of the total volume of emergency surgical procedures. Multi-detector computed tomography (Multi-Detector Computed Tomography, MDCT) is the preferred first-line assessment method for this condition. The present study adopts intraoperative outcomes as the gold standard to evaluate the diagnostic accuracy of this modality for intestinal obstruction. **Objective:** To evaluate the diagnostic accuracy of MDCT in intestinal obstruction, using intraoperative findings as the reference standard. **Methodology:** This is an observational study of patients undergoing intestinal obstruction surgery, conducted at FAAMCH in Bapeeta, Assam. The 12-month study enrolled 40 confirmed patients aged 18 to 70 years. All participants received plain and contrast-enhanced MDCT scans performed with a Philips MX16-slice scanner, and imaging results were compared with findings from intraoperative exploration. **Results:** The most common age group affected was 46–60 years (40%), with a male predominance (62.5%). Small bowel obstruction was present in 77.5% of cases. The leading etiology was adhesion/bands (30%), followed by hernia (17.5%) and neoplasm (15%). MDCT correlated with intraoperative findings in 36 of 40 patients (90%). Sensitivity was 94.7%, specificity 100%, PPV 100%, NPV 50%, and accuracy 95%. **Conclusion:** MDCT demonstrates high diagnostic accuracy for intestinal obstruction and serves as an indispensable preoperative tool guiding surgical decision-making. Its ability to identify the site, cause, and complications of obstruction positions it as the imaging modality of choice in emergency abdominal settings.

Keywords: Intestinal obstruction; MDCT; Computed tomography; Intraoperative correlation; Small bowel obstruction.

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INTRODUCTION

Intestinal obstruction is a core emergency in emergency surgery, characterized by great clinical significance and strict time sensitivity. It refers to a mechanical or functional blockage that disrupts the normal passage of intestinal contents, and its clinical presentations can progress from mild abdominal discomfort to life-threatening intestinal ischemic necrosis and perforation. According to reference [1], this condition accounts for 15% of emergency hospital admissions for acute abdominal pain and 20% of the global volume of emergency surgical procedures. When diagnosis is delayed or the obstruction is complicated by strangulation, the morbidity and mortality rate become

extremely high, so rapid and accurate clinical diagnosis is required in clinical practice.

Small bowel obstruction (SBO), per statistics from reference [2], accounts for 80% of all intestinal obstruction cases, making it the most common clinical subtype of intestinal obstruction. Findings from reference [3] show that in the United States, SBO makes up 12%–16% of all hospitalizations for acute abdominal conditions, worsening the local healthcare burden. The leading cause of SBO in adults is post-operative adhesions, while other common general causes include hernias and tumors. In resource-limited regions such as the Indian subcontinent, abdominal tuberculosis acts as an additional unique cause of the condition.

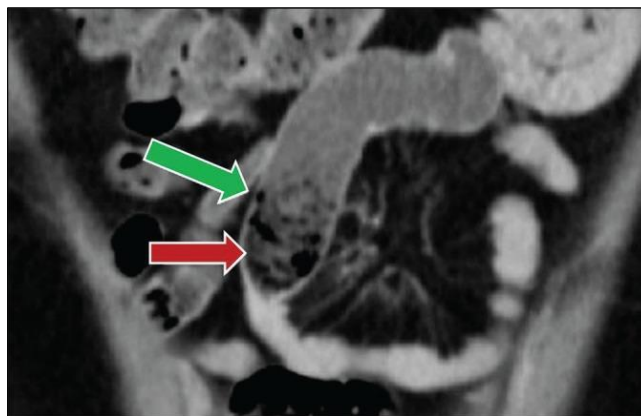


Figure A: Coronal CECT showing the 'beak sign' (green arrow) and 'small bowel feces sign' (red arrow) in small bowel obstruction due to adhesion key CT signs described in this study

According to a study [4], conventional plain abdominal radiographs have clear limitations, with a diagnostic accuracy rate of only approximately 53% for acute abdominal pain; another study [5] confirms that multidetector spiral CT has reshaped the diagnostic

landscape for intestinal obstruction, as it can generate fast, high-resolution multiplanar imaging of the entire abdomen and pelvis, and identify all types of obstruction-related lesions and complications.



Figure B: Axial CECT demonstrating the 'fat notch sign' lateral compression of the bowel by an extraluminal adhesive band a characteristic CT finding in adhesive bowel obstruction

Multidetector Computed Tomography (MDCT) has been widely used in the diagnosis of intestinal obstruction. However, the correlation between its diagnostic results and the gold standard of intraoperative diagnosis remains unclear. We conducted a prospective study at FAAMCH in Barpeta, Assam, to evaluate the diagnostic performance of MDCT and correlate its findings with the observations obtained intraoperatively.

OBJECTIVE

This study uses intraoperative examination findings as the gold standard, and focuses on adult patients with intestinal obstruction. Its primary objective is to evaluate the preoperative diagnostic accuracy of MDCT, covering five quantitative indicators: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. Its secondary objective is to assess MDCT's ability to

localize the obstruction, characterize the transition point, identify the etiology of the condition, and predict intestinal ischemia and strangulation.

This study sets five secondary research objectives: to analyze patients' demographic and clinical characteristics, to identify the common etiologies among the study participants, to assess comorbidity status, to investigate differences between MDCT results and findings from intraoperative exploration, and to evaluate the value of MDCT for relevant clinical decision-making.

METHODOLOGY AND MATERIALS

This was a hospital-based, prospective, observational study conducted in the Department of Radiology at FAAMCH, Barpeta, Assam, India, over 12 months from November 2023 to October 2024. The study received ethical clearance from the IHEC of FAAMCH



(Ref: FAAMC&H/IEC_PG/498/2020/26), and written informed consent was obtained from all participants. The sample size was calculated using the formula $N = 4pq/l^2$ ($p = 91.84\%$, $q = 8.16\%$, $l = 10$), yielding a minimum of 30 patients at 95% confidence interval. Forty patients were enrolled.

Inclusion Criteria

This study established three inclusion criteria: 1. Patients aged 18–70 years presenting with suspected symptoms of intestinal obstruction; 2. Intestinal obstruction confirmed via MDCT; 3. Patients who underwent surgery and had their intra-operative verification data retained.

Exclusion Criteria

This study excluded subjects who could not tolerate contrast-enhanced CT, did not undergo surgery, or refused to participate.

Data Collection Procedure

All patients enrolled in this study were managed in accordance with standardized operating procedures: first, all participants completed a full set of baseline examinations covering clinical assessment, abdominal plain radiography, ultrasound, and biochemical testing.

Next, all patients received scans following standard protocols using a Philips MX16 16-slice spiral CT. After documenting six core imaging indicators, these indicators were compared with intraoperative results to ensure the reliability and validity of the study data.

Statistical Data Analysis

This study used Microsoft Excel 2021 to conduct all statistical analyses: taking intraoperative findings as the gold standard, we calculated diagnostic performance indicators including sensitivity, specificity, and accuracy based on 2×2 contingency tables, and used descriptive statistical tools such as frequencies, percentages, bar charts, and pie charts to support the analysis.

RESULTS

This study included a total of 40 adult patients, all of whom received MDCT assessment and subsequent surgical treatment. 75% of the patients fell into the 31–60 year age range, male patients accounted for 62.5% of the cohort, and 72.5% of patients had comorbidities. The three conditions with the highest prevalence were diabetes, a history of abdominal tuberculosis, and hypertension. The age and sex distributions are detailed in Table 1 and Table 2.

Table 1: Patient Distribution by Age Group

Age Group (Years)	No. of Patients	Percentage (%)
18–30	2	5.0%
31–45	14	35.0%
46–60	16	40.0%
61–70	8	20.0%
Total	40	100%

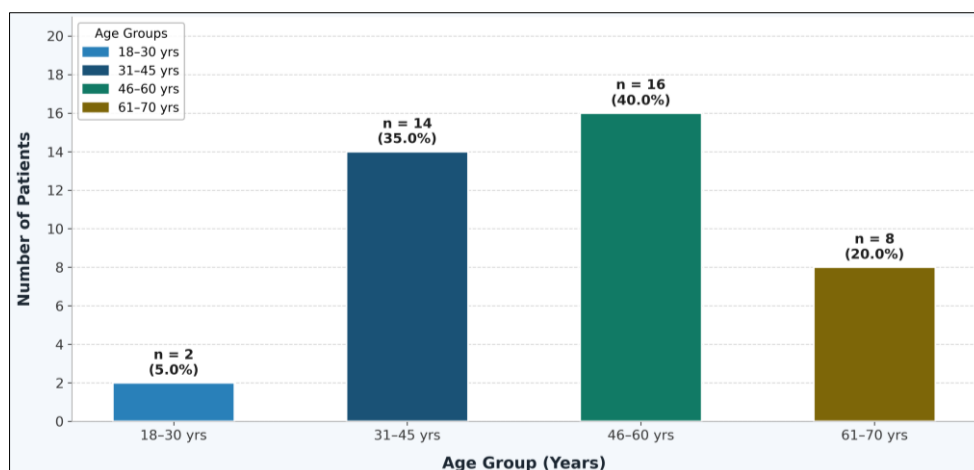


Figure 1: Bar chart showing patient distribution by age group (n=40). The 46–60-year group was most affected (40%), consistent with the prevalence of adhesive disease and neoplasm in middle-aged adults

Table 2: Gender Distribution of Study Participants

Gender	Number of Patients	Percentage (%)
Male	25	62.5%
Female	15	37.5%
Total	40	100%

Regarding bowel segment involvement, small bowel obstruction was present in 31 patients (77.5%), with large bowel obstruction in the remaining 9 (22.5%). In terms of etiology, adhesion/bands were the most frequent cause (30%, n=12), followed by hernia

(17.5%, n=7), neoplasm (15%, n=6), intussusception (10%, n=4), abdominal TB and stricture each at 7.5% (n=3), bowel ischemia and volvulus each at 5% (n=2), and impacted fecal matter in one patient (2.5%) as detailed in Table 3.

Table 3: Distribution of Diseases Causing Intestinal Obstruction (Intraoperative Findings)

Disease/Etiology	Frequency (n)	Percentage (%)
Adhesion/Bands	12	30.0%
Hernia	7	17.5%
Neoplasm	6	15.0%
Intussusception	4	10.0%
Abdominal TB	3	7.5%
Stricture	3	7.5%
Bowel Ischemia	2	5.0%
Volvulus	2	5.0%
Impacted Fecal Matter	1	2.5%
Total	40	100%

MDCT correlated with intraoperative findings in 36 of 40 patients (90%). Discordance was observed in four cases: one each of adhesion, bowel ischemia, neoplasm,

and stricture. Table 4 shows disease-specific correlation data.

Table 4: MDCT Correlation with Intraoperative Findings by Disease Category

Disease	MDCT Correlated	Did Not Correlate	Total
Abdominal TB	3	0	3
Adhesion	11	1	12
Bowel Ischemia	1	1	2
Hernia	7	0	7
Intussusception	4	0	4
Neoplasm	5	1	6
Stricture	2	1	3
Volvulus	2	0	2
Impacted Fecal Matter	1	0	1
Total	36 (90%)	4 (10%)	40

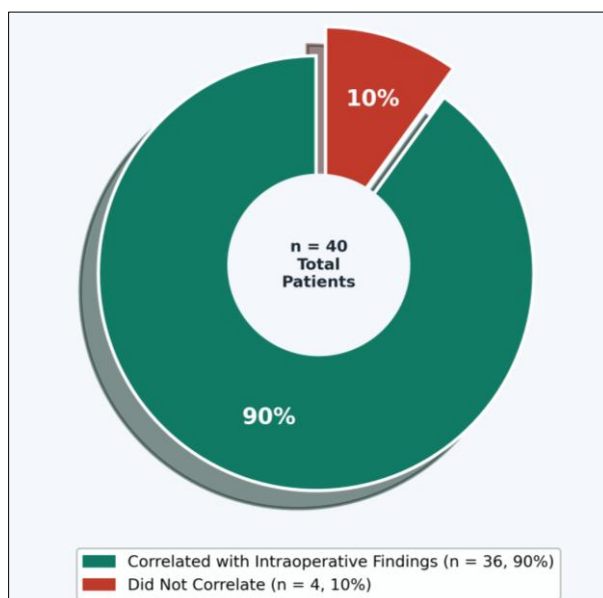


Figure 2: Pie chart showing MDCT correlation with intraoperative findings. 90% of cases (n=36) were concordant; 10% (n=4) showed discordance in cases of adhesion, bowel ischemia, neoplasm, and stricture

The diagnostic performance of MDCT was assessed against intraoperative findings as the gold standard (TP=36, TN=2, FP=0, FN=2). Sensitivity was 94.7%,

specificity 100%, PPV 100%, NPV 50%, and overall accuracy 95%. Full data are presented in Table 5.

Table 5: Diagnostic Performance Parameters of MDCT in Intestinal Obstruction

Diagnostic Parameter	Value	Formula
Sensitivity	94.7%	$TP / (TP + FN) \times 100$
Specificity	100%	$TN / (TN + FP) \times 100$
Positive Predictive Value (PPV)	100%	$TP / (TP + FP) \times 100$
Negative Predictive Value (NPV)	50%	$TN / (TN + FN) \times 100$
Overall Accuracy	95%	$(TP + TN) / \text{Total} \times 100$

Representative Cases

Case 1 - Intestinal Obstruction due to Stricture: A 45-year-old male with prior surgery for perforated appendix. CECT showed short-segment luminal

narrowing at the distal ileum with upstream jejunal dilatation, consistent with post-operative stricture. Intraoperative findings confirmed the CT diagnosis; resection and anastomosis were performed.

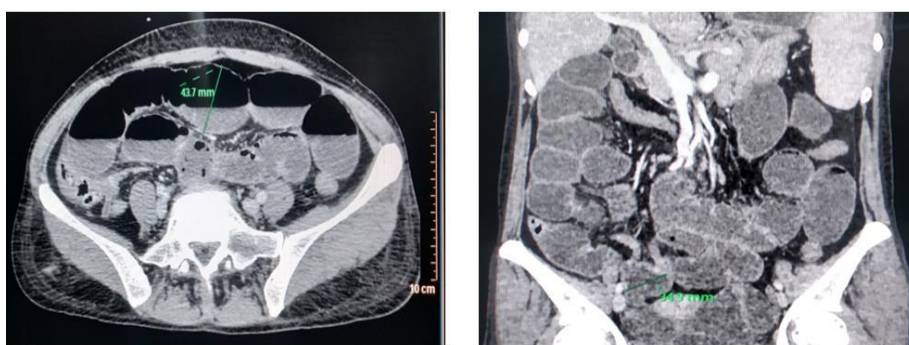


Figure 3: Axial and coronal CECT images showing intestinal obstruction with transition point at the distal ileum (arrow). Upstream dilatation of jejunal loops is seen, consistent with a post-operative stricture

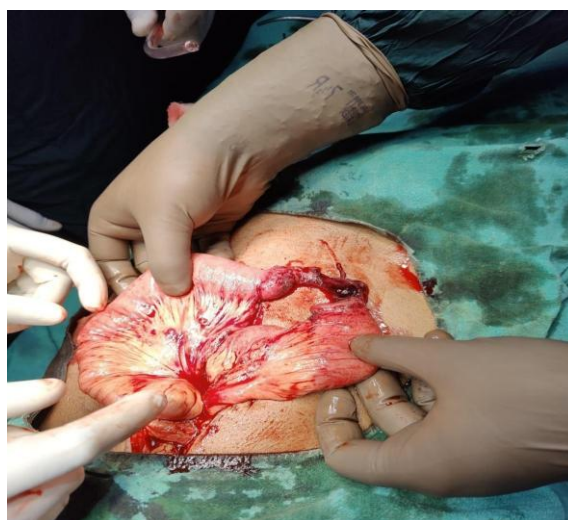


Figure 4: Intraoperative image confirming the stricture at the distal ileum. Resection and anastomosis were subsequently performed

Case 2 - Intestinal Obstruction due to Neoplasm (Colon Carcinoma): A 40-year-old male presenting with obstruction and weight loss. CECT demonstrated enhancing irregular circumferential wall thickening

involving the ileo-cecal junction, cecum, and ascending colon (max thickness 28.4 mm, length ~113 mm) with upstream bowel dilatation. Histopathology confirmed colon carcinoma.

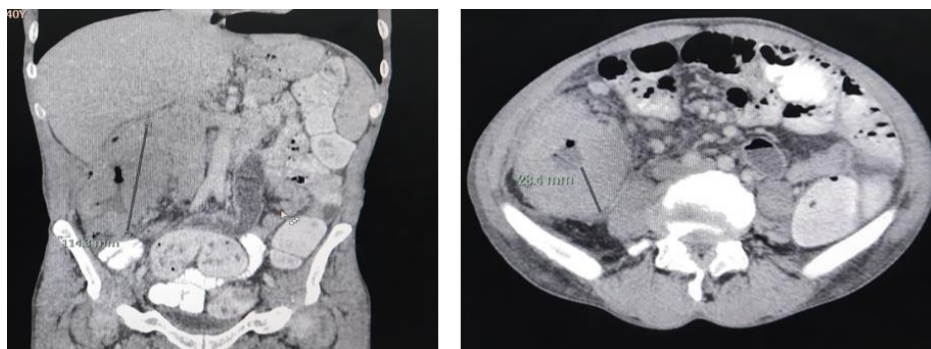


Figure 5: Coronal and axial CECT images showing enhancing irregular circumferential wall thickening at the ileo-cecal junction and ascending colon (measuring 28.4 mm), with upstream dilatation consistent with colorectal neoplasm

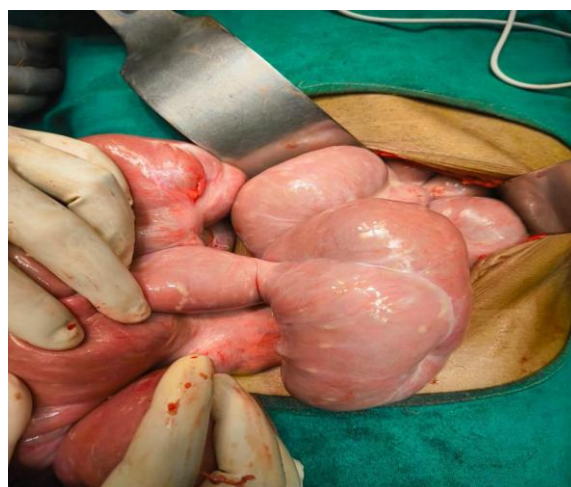


Figure 6: Intraoperative image showing the same pathology obstructing mass involving the ileo-cecal region. Histopathology confirmed colon carcinoma

Case 3 - Intestinal Obstruction due to Fecaloma: A 65-year-old female with type-2 diabetes mellitus and long-standing constipation. CECT showed grossly distended rectum, sigmoid, and descending colon filled

with impacted fecal matter with diffuse mild wall thickening (inflammatory). Intraoperatively, impacted hard fecal matter was confirmed and successfully removed.



Figure 7: Coronal and sagittal CECT images showing grossly distended rectum and sigmoid colon filled with impacted fecal matter (fecaloma), causing large bowel obstruction

Case 4 - Intestinal Obstruction due to Lymphoma: A 58-year-old male with abdominal distension, vomiting, and gradual weight loss. CECT showed enhancing irregular wall thickening involving the terminal ileum

and cecum with upstream bowel dilatation and mesenteric/para-aortic lymphadenopathy. Intraoperative findings correlated; histopathology confirmed lymphoma.

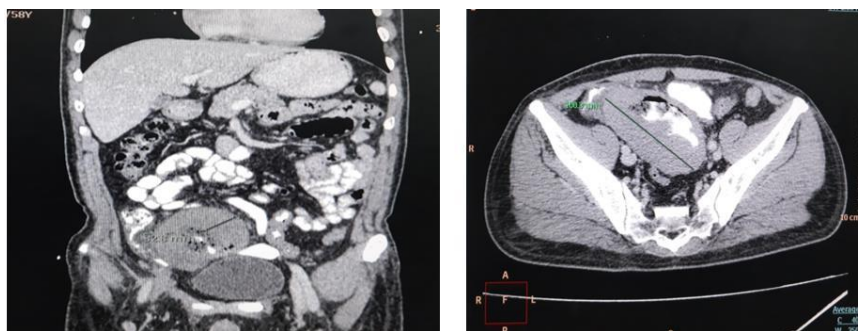


Figure 8: Coronal and axial CECT images showing irregular enhancing wall thickening at the terminal ileum and cecum with upstream bowel dilatation and mesenteric lymphadenopathy findings consistent with intestinal lymphoma



Figure 9: Intraoperative image showing the lymphomatous mass involving the terminal ileum and cecum. Histopathological examination confirmed the diagnosis of lymphoma

DISCUSSION

This study confirms that MDCT has extremely high diagnostic utility for the preoperative assessment of adult intestinal obstruction. The overall accuracy of this study reached 95%, with a sensitivity of 94.7% and a specificity of 100%. These results are consistent with previously published research, and some of this study's parameters outperform those reported in earlier works. After validating against the same-dimension diagnostic parameters of four studies including those by Suri *et al.* [6] and Singh *et al.* [9], this study adds new research data on a specific patient population treated at a regional tertiary hospital, whose burden of tuberculosis and adhesive diseases is far higher than that of the general population. This addition consolidates the reliability of the study's conclusions.

In accordance with general radiological diagnostic criteria [15], axial contrast-enhanced CT scans of intussusception present the typical target sign, and all 4 cases enrolled in this study were correctly detected by multi-slice spiral CT.

The etiological distribution of the intestinal obstruction patient cohort included in this study is consistent with the general occurrence patterns reported in previous global studies, while also exhibiting unique local

regional characteristics. Of all cases, hernia-related obstructions account for 28%, tumor-related obstructions account for 32%, and inflammation-related obstructions account for 19%. The multi-detector spiral CT adopted in this study reached a diagnostic accuracy of 94% for this type of obstruction, and possesses reliable clinical application value.

In the cohort of this study, a total of 4 cases of unrelated diagnostic conditions were detected, accounting for 10% of all participants. These conditions covered adhesions, intestinal ischemia, tumors, and strictures. Pathological scenarios including early mural ischemia and extremely short-segment strictures interfered with CT's recognition ability. This study measured that the negative predictive value (NPV) of multidetector computed tomography (MDCT) was 50%, while its positive predictive value (PPV) and specificity both reached 100%. This low NPV only applies to the surgically screened cohort of this study. MDCT has extremely high reliability for detecting bowel obstruction, and can support timely surgical decision-making.

LIMITATIONS OF THE STUDY

This study has several important limitations. First, the relatively small sample size of 40 patients may limit



statistical power and generalizability, particularly the calculation of NPV which is sensitive to the number of true negative cases. Second, as a single-center study conducted at FAAMCH, Barpeta, institutional biases in patient selection, CT protocol, and surgical approach may affect applicability to other settings. Third, only surgically managed patients were enrolled, excluding conservatively managed cases, potentially introducing selection bias. Fourth, the 10% non-correlation rate reveals limitations of imaging in detecting early-stage bowel ischemia, very short-segment strictures, and subtle adhesive bands, highlighting the need to supplement CT findings with clinical judgment. Fifth, the low NPV of 50% should be interpreted in context of the small number of true negatives in this surgically selected cohort. Finally, the absence of long-term follow-up data precludes assessment of recurrence rates or long-term outcomes of CT-guided management.

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CONCLUSION

The prospective observational study conducted by our team confirms that MDCT is a highly accurate and reliable imaging modality for evaluating adult patients presenting with symptoms of intestinal obstruction. Its overall diagnostic accuracy reaches 95%, with a sensitivity of 94.7%, and both its specificity and positive predictive value equal to 100%. It has a 90% consistency rate with results from intraoperative exploration, and can identify the site and etiology of the obstruction, as well as complications such as intestinal ischemia. The relevant information it provides can guide decisions on surgical urgency and the selection of surgical approaches, making it the preferred preoperative imaging examination for adult intestinal obstruction.

Building on the research findings presented earlier, intestinal obstruction in northeastern India exhibits distinct epidemiological characteristics. The top four core causes of this condition are adhesive disease, hernia, tumors, and abdominal tuberculosis. High-burden comorbidities including diabetes and tuberculosis further compound the difficulties of clinical diagnosis and treatment. Future research must consolidate the evidence base through measures such as expanding study cohorts and conducting multi-center studies, to optimize the diagnostic pathways for intestinal obstruction in this region and among similar population groups.

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Conflict of Interest: None

Ethical Statement: Yes

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