

Value of MDCT Scan in Identifying Adhesive Small Bowel Obstruction and its Importance in Management Plan

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Abstract

Background: Multi detector computed tomography (MDCT) has become a mainstay in diagnosing bowel obstruction. Because the management of obstruction has dramatically changed with a decrease in the proportion of patients who need surgery, a precise CT evaluation is now both the gold standard and the common approach in patients with suspected bowel obstruction.

Results: A total of 51 patients were eligible for inclusion in our study, all patients were admitted to emergency Department of Kasr Al-Ainy Teaching Hospital with clinical and radiological features of acute small bowel obstruction (ASBO). MDCT showed bowel obstruction in 40 (78.4%) patients, small bowel obstruction in 35 (68.6%) patients and large bowel obstruction in 5 (9.8%) patients, follow-up CT scan showed that contrast reached the large bowel obstruction was reported in 20 (41.7%) patients. Twelve (23.5%) patients were indicated for surgical intervention, ICU admission was reported in 3 (5.9%) patients, while one case showed leakage on day 1 post exploration. CT showed adhesions in 38 (74.5%) patients with final diagnosis of adhesive intestinal obstruction (IO) in 29 (56.9%) patients.

Conclusion: We concluded that MDCT scan is a highly sensitive tool in detection of adhesive intestinal obstruction on the level of small and large bowel. MDCT scan can be used as a very accurate tool in screening for adhesive IO due to higher negative predictive value (100%).

Key Words: MDCT value – Adhesive small bowel obstruction – Management plan.

Introduction

SMALL bowel obstruction (SBO) is the most common surgery-related small intestine problem. Adhesions from earlier abdominal surgery are thought to be the direct cause of up to two-thirds of SBO cases, manifesting as adhesive small bowel obstruction (ASBO) [1]. It is a frequent cause of hospitalization and surgical consultation, represent-

ing 20% of all surgical admissions for acute abdominal pain [2,3].

Clinical evaluation is unpredictable, and its management is divisive. When indications and symptoms suggest intestinal strangulation, surgery is undertaken right away; otherwise, and in most situations, non-operative treatment must be used first [4]. SBO is often diagnosed late or misdiagnosed, resulting in significant morbidity and mortality [5].

Due to the lack of distinguishing laboratory findings and the inability of currently available imaging modalities to detect adhesions, many cases of ASBO will go misdiagnosed for lengthy periods of time, putting medical professionals in a diagnostic and therapeutic bind [5].

Individualized treatment plan can be done with patient history, clinical findings and triage examinations such as plain abdominal radiography. In cases of SBO, Radiology assists the therapeutic decision of the surgeon by addressing the following questions: Is the small bowel obstructed? How severe is the obstruction? Where is it located? What is its cause? And is strangulation present? [6].

Abbreviations:

ACR : American college of Radiology.
ASBO : Adhesive small bowel obstruction.
cm : Centimetre.
CRP : C-reactive protein.
CT : Computed tomography.
ICU : Intensive care unit.
LBO : Large bowel obstruction.
MDCT : Multi-detector CT.
mm : Millimetre.
NOM : Non operative management.
SBO : Small bowel obstruction.
SD : Standard deviation.

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CT has become a mainstay in diagnosing bowel obstruction. Because the management of obstruction has dramatically changed with a decrease in the proportion of patients who need surgery, a precise CT evaluation is now both the gold standard and the common approach in patients with suspected bowel obstruction [7].

Patients and Methods

Patients:

This study is a prospective cross-sectional analytic study which involves 51 patients presented with signs of acute small bowel obstruction who are referred from Emergency Department, Faculty of Medicine, Cairo University within the period from Jan 2022 till June 2022.

Inclusion criteria:

- Males & females <18 years of age.
- Hemodynamically stable patients presenting with bowel obstruction with no signs of sepsis.

Exclusion criteria:

Patients who are hemodynamically unstable, Pediatric and pregnant patients presenting with bowel obstruction.

Methods:

Informed consents were taken from all patients.

Proper history was taken from the patients followed by clinical examination.

Plain abdominal X-rays in the supine and erect position was requested. Once a clinical and radiological diagnosis of SBO was made, patients were treated with intravenous fluids, a urinary catheter to monitor urine output and a nasogastric tube.

CT abdomen and pelvis was taken two and twenty-four hours later.

Patients were scanned by using Toshiba Aquilion 64-detector row CT starting from diaphragm and down to ischial tuberosity.

CT scan parameters were 120kv, 200-250mAs, collimation 64 x 0.5mm, slice thickness of 3mm, and a reconstruction interval of 3.0mm).

Two expert radiological consultants were available to interpret the CT film.

Based on clinical evidence, a surgical indication was established on the radiological result, as well as the assisting surgeon's judgement.

Patients who experienced greater abdominal pain at any point during the study underwent laparotomy without the second CT abdomen and pelvis after 24 hours.

Those who improved after the first CT abdomen and pelvis were admitted under conservative management for 48 hours without the need for follow-up CT.

Statistical analysis:

Data was entered using the "Microsoft Office Excel Software" application for Windows (2010).

Statistical analysis for the data was conducted using SPSS 22nd edition, numeric variables were presented in mean and standard deviation, paired comparison was done using Wilcoxon sign rank test after normality testing. Categorical data were presented in frequency and percentage, paired comparison was conducted using McNamara test. Any *p*-value <0.05 was considered significant.

CT validity was assessed using ROC curve analysis.

Results

A total of 51 patients were eligible for inclusion in our final analysis, all patients were admitted to Emergency Department of Kasr Al-Ainy Teaching Hospital, they had a mean age 48.1±16.4 years old, mean number of operations 2±1.2 procedures, mean duration before presentation was 4±2.6 days, mean pulse 91.2±14.9mmHg, mean systolic blood pressure 120.3±14.6mmHg, mean diastolic 75.2±9mmHg, mean TLC 10.4±4.2 10/cc, and mean length of hospital stay 3.7±2.8 days.

Males outnumbered females accounting for 58.8% of the included patients, 15 (29.4%) patients had comorbidities, 23 (46%) patients had generalized abdominal distention, while 49 (98%) patients had multiple air fluid levels in the erect abdominal X-ray.

CT showed bowel obstruction in 40 (78.4%) patients, small bowel obstruction in 35 (68.6%) patients and large bowel obstruction in 5 (9.8%) patients, follow-up CT scan showed that contrast reached the large bowel obstruction was reported in 20 (41.7%) patients. Twelve (23.5%) patients were indicated for surgical intervention, ICU admission was reported in 3 (5.9%) patients, while one case showed leakage on day 1 post exploration. CT showed adhesions in 38 (74.5%) patients with final diagnosis of adhesive IO in 29 (56.9%) patients. (Table 1) (Fig. 1).

Bowel obstruction by CT abdomen and pelvis with oral contrast were significantly higher among Adhesive IO group with *p*-value 0.0001, CT abdomen and pelvis with oral contrast details showed small bowel obstruction more frequently in adhesive IO group with *p*-value 0.001. Operative intervention was more commonly performed for adhe-

sive IO group with *p*-value 0.034. Otherwise, there was no significant difference reported. (Table 2).

Sensitivity analysis showed that CT can significantly diagnose adhesive IO with *p*-value, sensitivity 100%, specificity 59.1%, and overall diagnostic accuracy 82.3%. (Tables 3).

Table (1): CT findings of the included participants.

	Count	%
<i>CT abdomen and pelvis with oral contrast:</i>		
Bowel obstruction	40	78.4
No IO	11	21.6
<i>CT abdomen and pelvis with oral contrast details:</i>		
Small bowel obstruction	35	68.6
Large bowel obstruction	5	9.8
No IO	11	21.6
<i>CT abdomens follow-up:</i>		
Contrast reached the large bowel	20	41.7
No contrast in the colon	19	39.6
Not indicated	9	18.8
<i>Operative intervention:</i>		
Yes	12	23.5
No	39	76.5
<i>Complications:</i>		
ICU admission	3	5.9
Leakage on day 1 post exploration	1	2.0
No	47	92.2
<i>Adhesions or not by CT:</i>		
Yes	38	74.5
No	13	25.5
<i>Final diagnosis (adhesions or not):</i>		
Yes	29	56.9
No	22	43.1

Table (2): Comparison of baseline and clinical characteristics of the included patients according to final diagnosis.

	Final diagnosis (adhesions or not)				<i>p</i> value
	Yes		No		
	Count	%	Count	%	
<i>CT abdomen and pelvis with oral contrast:</i>					
- Bowel obstruction	28	96.6	12	54.5	<0.001
- No IO	1	3.4	10	45.5	
<i>CT abdomen and pelvis with oral contrast details:</i>					
- Small bowel obstruction	23	79.3	12	54.5	<0.001
- Large bowel obstruction	5	17.2	0	0.0	
- No IO	1	3.4	10	45.5	
<i>CT abdomens follow-up:</i>					
- Contrast reached the large bowel	14	51.9	6	28.6	0.057
- No contrast in the colon	11	40.7	8	38.1	
- Not indicated	2	7.4	7	33.3	
<i>Operative intervention:</i>					
- Yes	10	34.5	2	9.1	0.034
- No	19	65.5	20	90.9	

Table (3): Diagnostic indices of CT in diagnosis of adhesive IO.

Statistic	Value	95% CI
Sensitivity	100.00%	88.06% to 100.00%
Specificity	59.09%	36.35% to 79.29%
Positive Predictive Value	76.32%	66.10% to 84.19%
Negative Predictive Value	100.00%	
Accuracy	82.35%	69.13% to 91.60%

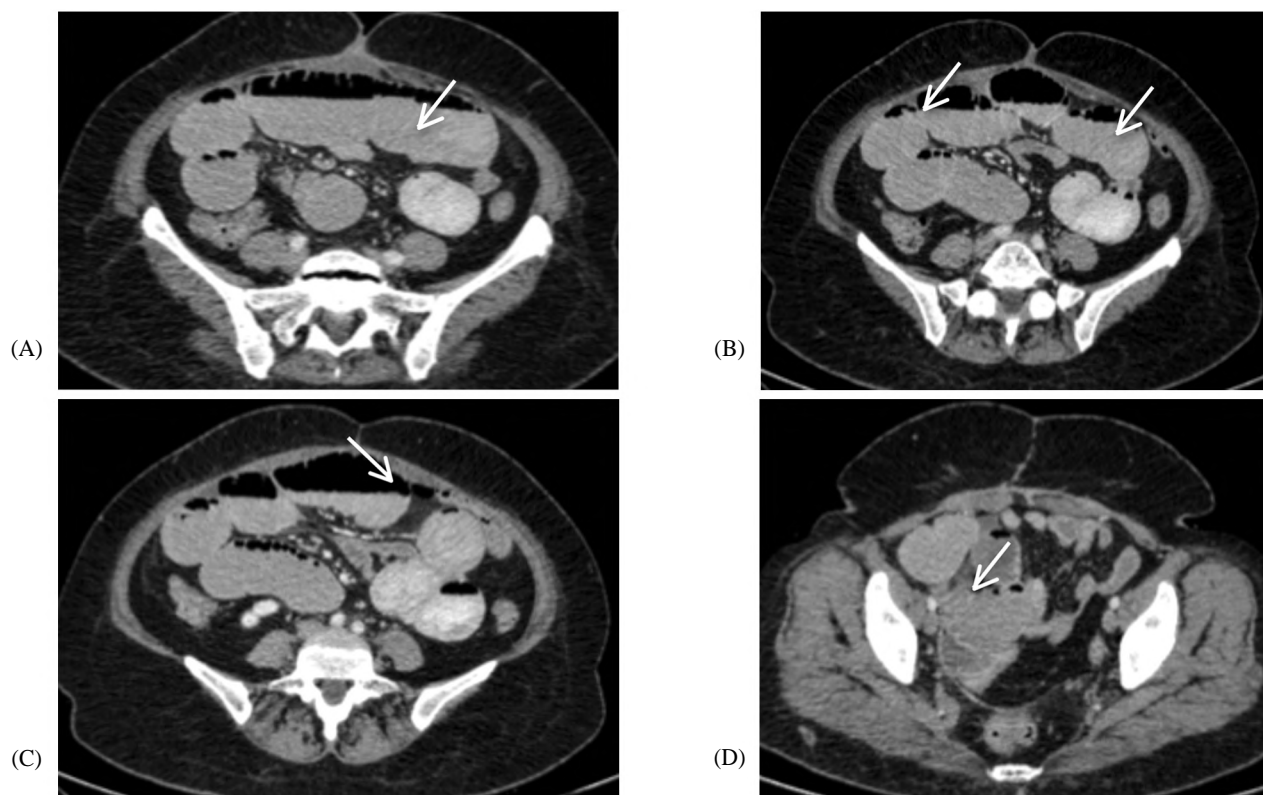


Fig. (1): A 56-year old female patient presented in ER with chief complains of vomiting and absolute constipation. She had a surgical history of hysterectomy 14 years ago, MDCT abdomen and pelvis was done, axial images (A,B,C,D) revealed dilated small bowel loops with air fluid level within the dilated loop (white arrows). MDCT showing showed adhesions at operative bed (yellow arrow) which was confirmed by Surgical exploration, patient underwent adhesiolysis.

Discussion

Intestinal obstruction (IO), defined as a partial or total blockage of the intestine, is a common emergency gastrointestinal disease encountered in the intensive care unit (ICU) and emergency department, with substantial morbidity and mortality [8].

Adhesions, hernias, intussusception, foreign substances, ischemia, malignancies, and other conditions are common causes of Intestinal Obstruction. Delays in diagnosing and treating IO are associated with increased mortality from consequences such as intestinal necrosis, perforation, sepsis, and septic shock [9].

Adhesive IO is the most common small intestinal issue; in one assessment of 87 papers including 110076 patients, the incidence of adhesive small bowel obstruction (ASBO) following all forms of abdominal surgery was 2.4% [10].

The use of computed tomography in the diagnosis of intestinal blockage is critical. Indeed, computed tomography can confirm a bowel obstruction as well as pinpoint the location and source of the obstruction [11].

We conducted a single center cross section study which included 51 patients admitted to emergency department of KasrAlAiny teaching hospital during the period between Jan 2022 till June 2022, they had a mean age 48.1 ± 16.4 years ranging from 13-77 years, females accounted for 58.8% of the included population. Nonetheless, 29.4% had comorbidities, mean duration before presentations 4 ± 2.5 days. Clinical examinations showed a mean Pulse 91.24 ± 14.89 , mean SBP 120.29 ± 14.62 mmHg, mean DBP 75.20 ± 8.95 mmHg, TLC 10.36 ± 4.25 10/cc, and Discharge date 3.65 ± 2.77 days.

These findings were similar to ones reported by Abdellatef et al., [12] who assessed the role of CT in assessment of intestinal obstruction, who conducted a prospective study of 50 patients presented with acute abdomen who had a mean age 46.5, and females accounted for 56% of the included participants.

Another study reported a lower mean age of the included participants 38.95 years, in Radiology Department, Menoufia University, however this lower age can be explained by inclusion of pediatrics in their study [13].

In the current study, CT abdomen and pelvis diagnosed 40 (78.4%) patients of having bowel obstruction, 35 (68.6%) patients showed small bowel obstruction and 5 (9.8%) patients had large bowel obstruction. (Fig. 2).

Our findings were similar to ones reported by Patrice et al., [14] who found that small bowel obstruction accounts for about 65-75% of obstructions and large bowel obstruction accounts for 25-

35%, they also mentioned that adhesive IO compose 60-80% of the total number of SBOs in industrialized countries.

Our findings supported a higher rate of small intestinal obstruction compared to a study conducted in Benha University, Egypt. They stated that small bowel obstruction was diagnosed in 51.28% of cases, whereas large bowel obstruction in 48.71 % of cases [12].

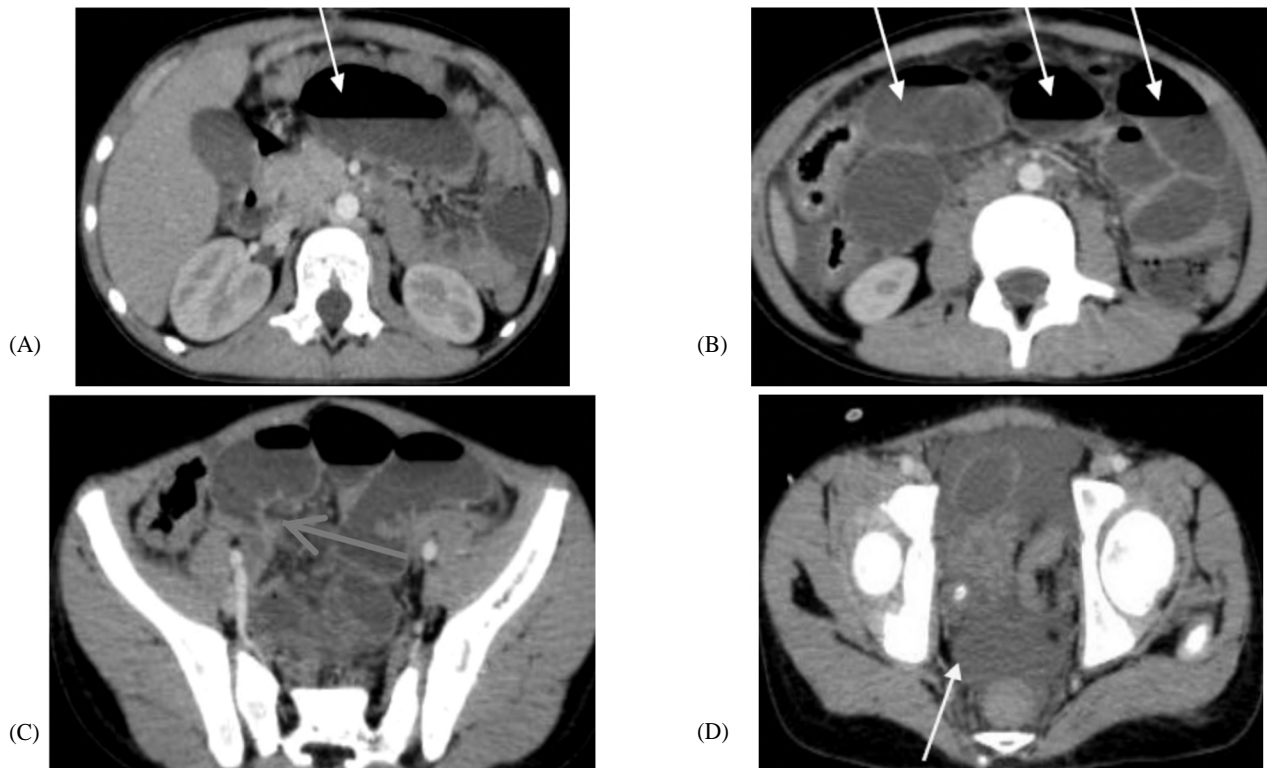


Fig. (2): A 32-year male patient presented to ER with complain of abdominal pain, constipation and vomiting. He had surgical history of abdomen exploration for splenectomy after RTA 3 months back. MDCT abdomen and pelvis was done, axial images (A,B,C,D) Showed multiple dilated small bowel loops with air fluid level (white arrows) and pelvic ascites (yellow arrow). It also showed transition point where adhesions are located (blue arrow). Conservative management was done for this case.

As well, another study conducted in Menoufia University, Egypt showed that small bowel obstruction was reported in (55%), while large bowel obstruction was documented in (40%) of the included participants [13].

Follow-up CT showed Contrast reached the large bowel in 20 (41.7%) patients, no contrast in the colon 19 (39.6%) patients. Operative intervention was indicated for 12 (23.5%) patients, 3 patients were admitted to ICU postoperatively, adhesions were diagnosed with CT in 38 (74.5%), while only 29 (56.9%) patients were finally diagnosed with adhesions.

In the current study, CT abdomen and pelvis with oral contrast showed a sensitivity 100%

(95% CI 82.24% to 99.91 %), Specificity 59.1 % (95% CI 24.39% to 67.79%), Positive Predictive Value 76.32%, Negative Predictive Value 100%, and overall diagnostic Accuracy 82.35%. Operative intervention was indicated in 34.5% of all patients diagnosed with adhesive IO versus 9.1 % in non-adhesive arm.

Abdellatef et al., [12], reported in a prospective study for patients presented with acute abdomen and assessed by multi-detector CT scan and stated that MDCT showed a sensitivity and specificity 100% and 91.4%, while PPV, NPV and accuracy were 87.5%, 100%, and 96.9% respectively, our data showed lower sensitivity rate as we only investigated the adhesive IO between all causes of IO.

Other study has shown that the sensitivity and specificity of CT scans in diagnosing intestinal blockage are as high as 94% and 96%, respectively [15]. El-sayed and colleagues [13] conducted a prospective cross section study and reported 100% accuracy, sensitivity, and specificity.

In a study conducted by Petrovic et al. [16], who evaluated the IO by presence of adhesive band and reported that a sensitivity of CT in detecting adhesive IO was 61% (95% CI 0.51-0.71), specificity of 63%, positive predictive value of 71%, negative predictive value 52%.

A large meta-analysis showed that the sensitivity, specificity, and accuracy of CT scans for adhesive IO diagnosis are, respectively, ranging between 90%-94%, and 95%-96% respectively [17].

Oral contrast typically requires an observation period following its administration to allow opacification of the small bowel and passage of contrast into the colon [18]. Oral contrast resulted in delayed diagnosis and increased emergency department length of stay [19]. A frequent argument against oral contrast is that the diagnosis of SBO with CT can be made by the presence of secreted fluids and ingested air, which are already present in the bowel lumen and provide sufficient contrast [20].

The American College of Radiology (ACR) Appropriateness Criteria guidelines suggest against administering oral contrast in patients suspected of small bowel obstruction because it “will not reach the site of obstruction, wastes time, adds expense, can induce further patient discomfort, will not add to diagnostic accuracy, and can lead to complications, particularly vomiting and aspiration” [21].

Despite the ACR's recommendation, a recent study showed that 69% of emergency medicine providers continue to administer oral contrast when obtaining CT for SBO [22].

Limitations:

In the present study we have few limitations including relatively small sample size, lack of comparison between CT and other imaging modalities for diagnosis of adhesive intestinal obstruction, we only investigated the presence of adhesive IO and no other etiologies.

Recommendations:

- We do recommend performing large prospective studies including variety of causes of intestinal obstruction.

- Assessment of role of CT with oral contrast in detection of level of obstruction.
- Conduction of multicenter study across country to validate an examination protocol for detection of adhesive IO.

Conclusion:

We concluded that CT scan with oral contrast is a highly sensitive tool in detection of adhesive intestinal obstruction on the level of small and large bowel.

CT scan with oral contrast can be used as a very accurate tool in screening for adhesive IO due to higher negative predictive value (100%).

Declaration:

Ethical approval and consent to participate:

This study was approved by the Research Ethical Committee (REC) of Faculty of Medicine Cairo University in Egypt. The ethics committee reference number is MS-7-2022.

A written consent was taken from all patients accepting to participate in our research work.

Consent for publication:

All patients included in this research gave written informed consent to publish the data contained within this study.

Availability of data and materials:

Data available within the article or its supplementary materials.

Competing interests:

The authors declared that they have no conflicts of interest.

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Authors' contributions:

MF and RM have designed this study together. PL contributed to the data collection & data analysis. RM, MF & PL contributed to data processing. PL and RM shared together in writing the manuscript.

ALL authors read and approved the final manuscript.

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قيمة الأشعة المقطعية متعددة المقاطع في تحديد انسداد الأمعاء الدقيقة اللاصقة وأهميتها في خطة الإدارة

أصبحت الأشعة المقطعية متعددة المقاطع هي الدعامة الأساسية في تشخيص انسداد الأمعاء. نظراً لأن إدارة الانسداد قد تغيرت بشكل كبير مع انخفاض نسبة المرضى الذين يحتاجون إلى الجراحة، فإن التقييم الدقيق بالأشعة المقطعية أصبح الآن المعيار الذهبي والنهج الشائع في المرضى الذين يشتبه في إصابتهم بانسداد الأمعاء. كأنما مجموعة مريضاً مؤهلين للتضمين في دراستنا. خلصنا إلى أن الأشعة المقطعية متعددة المقاطع هي أداة حساسة للغاية في الكشف عن انسداد الأمعاء اللاصقة على مستوى الأمعاء الدقيقة والغليظة نظراً لارتفاع القيمة التنبؤية إلى ١٠٠٪.