



## Radiodiagnosis

## CT ASSESSMENT OF BOWEL OBSTRUCTION SITE AND AETIOLOGY AND CORRELATION WITH SURGICAL FINDINGS: EXPERIENCE IN A TERTIARY CARE TEACHING HOSPITAL.

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**ABSTRACT** **Introduction:** Bowel obstruction is responsible for approximately 20% of surgical admissions for acute abdominal conditions. CT plays an important role in revealing the site and aetiology of obstruction and its complications.

**Aim:** To assess the site and aetiology of bowel obstruction using CT and correlation with surgical findings.

**Materials and Methods:** This was a prospective study conducted on 70 patients with bowel obstruction, diagnosed on CT. X-ray and ultrasound abdomen was also done in all the patients. 56(80%) patients were operated while 14(20%) were managed conservatively. CT findings were correlated with operative findings and analyzed statistically.

**Results:** Out of 70 patients, 29 (41%) were males and 41 (59%) were females. The most frequently encountered symptom was abdomen distention (88%). The site of obstruction diagnosed on CT was ileum (44%), I-C junction (13%), jejunum (10%), duodenum(6%), colon (6%) and rectum (3%). Benign stricture(33%) and adhesions(20%) were the most common causes of obstruction diagnosed on CT. Regarding site of obstruction, CT and operative findings were concordant in 39(70%) of the patients and for cause of obstruction, CT and operative findings were concordant in 35(62%) of the patients. The sensitivity and specificity of CT for the site of obstruction was 71% & 93.3% respectively, while the sensitivity and specificity of CT for the cause of obstruction was 63.3% & 93.3% respectively.

**Conclusion:** CT has high specificity with moderate sensitivity in diagnosing site and cause of bowel obstruction. This study shows high degree of agreement between CT and operative findings.

**KEYWORDS :** Bowel obstruction, Computed Tomography, Site, Cause

## INTRODUCTION

Bowel obstruction is one of the leading causes of admission in surgical and Emergency units. Many previous studies have demonstrated computed tomography (CT) to be a valuable technique for imaging intestinal obstruction.<sup>(1,2,3,4,5)</sup>

Bowel obstruction can be classified as dynamic due to impacted foreign bodies, bezoars, gallstones, stricture, malignancy, hernia and volvulus or adynamic (paralytic ileus, mesentric vascular occlusion, pseudo-obstruction).<sup>6</sup>

Small-bowel obstruction (SBO) continues to be a substantial cause of morbidity and mortality, accounting for 12%–16% of hospital admissions for the evaluation of acute abdominal pain in the United States. Most patients with SBO are treated successfully with nasogastric tube decompression and IV antibiotics and fluids.<sup>7</sup> However, the mortality of SBO ranges from 2% to 8% and may increase to as high as 25% if bowel ischemia is present and there is a delay in surgical management.<sup>8</sup>

Large bowel obstruction (LBO) is colonic luminal occlusion anywhere along the course of large bowel with colonic dilatation proximal to site of obstruction with major sites being cecum, hepatic and splenic flexures and recto-sigmoid colon. It typically occurs in the elderly and requires prompt medical or surgical treatment.<sup>9</sup> The urgency of management is driven by the risk of rupture in the distended or compromised colon with the danger of faecal peritonitis.<sup>10</sup>

Ultrasonography is widely available, portable and non invasive and may reliably confirm or exclude small bowel obstruction with reported sensitivity of 95% and specificity of 82%.<sup>11</sup> Ultrasonography may demonstrate the features and causes of small bowel obstruction, and it is of particular value in looking at the dynamics of the small bowel.<sup>12</sup>

CT imaging has advantages of accurate demonstration of the site, level and cause of the obstruction and can be done in emergency setting. Disadvantage is high radiation exposure, though with the advent of technology and dose reduction techniques significant reduction in patient dose has been achieved.<sup>(13,14,15,16,17)</sup>

MRI is comparable to CT and other imaging modalities in the

assessment of bowel obstruction. MRI provides rapid, highly accurate identification of small bowel obstruction and localization of the site, and assists estimation of the etiology. The use of MRI could enable more accurate and timely selection of patients for operative intervention without radiation exposure.<sup>16,18</sup>

This study was undertaken to assess the site and aetiology of bowel obstruction using CT and to correlate CT findings with surgical findings.

## MATERIALS AND METHODS

This prospective study was conducted in the Department of Radio diagnosis at Subharti Medical College & associated CSS Hospital after obtaining approval from institutional ethical committee between September 2016 to August 2018. A total of 70 patients with clinical and CT findings suggestive of bowel obstruction were included in the study. Patients with ileus and patients refusing consent were excluded. Informed written consent was obtained from the patients or from the nearest kin of the patients. A complete history of patient's present/past illness was taken, and relevant clinical examination was performed in all the cases. Relevant laboratory investigations were carried out in all patients. Initial X-ray abdomen erect (AP view) and ultrasound were also done, and findings were duly recorded on the decided pro forma.

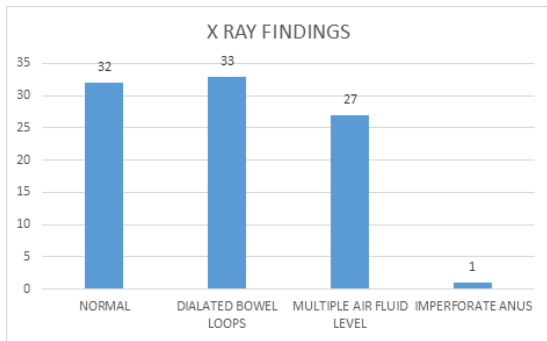
Subsequently CECT abdomen was done in all the patients on 128 slice Ingenuity MDCT (Philips Medical Systems) with the following protocol. Area of examination was taken from domes of diaphragm to the pelvis. Factors selected were 120 kV and 300 mAS. Pre IV contrast scan was done in all patients with or without oral contrast (Gastrograffin) as clinically indicated. Contrast enhanced CT scan of abdomen was obtained after intravenous (IV) administration of non-ionic contrast (iohexol) containing 300 mg/ml of iodine, contrast delay- 20 sec with rate of injection- 2.5ml/sec and patient dose- 1ml/Kg, saline infusion- 25-30ml, at rate of 2.5ml/sec. CT was done in a single breath hold or in quite respiration. The acquired image dataset was reconstructed and studied in desired plane in detail. CT findings were recorded as per the proforma for the level, cause and complications of obstruction. The CT findings were correlated with surgical findings/clinical follow-up with statistical analysis of the data using online available software.

**OBSERVATIONS AND RESULTS**

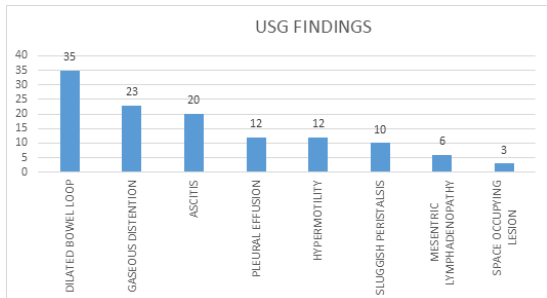
The majority of the patients were found to be female (59%) followed by males (41%) and were in the age group 31-40 yrs (26%). The most common presenting symptom was abdominal distension in 62(88%) followed by abdominal pain in 60(86%), vomiting in 51(72%) and fever in 30(43%) patients. On clinical examination 47(67%) patients were found to have abdominal guarding while 32(46%) patients had abdominal tenderness.

Abdominal X-ray and ultrasound findings were analyzed and presented in Figure 1 and 2 respectively.

**Figure 1: X-Ray Abdomen findings**



**Figure 2: Ultrasound abdomen findings**



**CT Findings**

On CT in 57(81%) patients the site of obstruction was found while in the rest 13 (18%) site was inconclusive (Table 1).

**Table 1: Site of obstruction on CT**

SITE OF OBSTRUCTION	NO. OF PATIENTS (%)
ILEUM	31(44)
ILEO-CAECAL JUNCTION	09 (13)
JEJUNUM	07(10)
DUODENUM	04(6)
COLON	04(6)
RECTUM	02(3)
INCONCLUSIVE	13 (18)
TOTAL	70

In 49(70%) patients the aetiology of obstruction was found on CT while in the rest 21 (30%) CT was inconclusive (Table 2).

**Table 2- Showing aetiology of bowel obstruction detected on CT**

AETIOLOGY OF OBSTRUCTION	NO. OF PATIENTS (%)
BENIGN STRICTURES	23(33)
ADHESIONS	14(20)
EXTRINSIC COMPRESSION BY MASS LESION/ MESENTERIC METASTASES	3(4)
PRIMARY BOWEL MALIGNANT STRICTURE	2(3)
EXTERNAL INGUINAL HERNIA	2(3)
MATTED ADHESIONS	2(3)
VOLVULUS	1(1.4)
ANO-RECTAL MALFORMATION	1(1.4)
BOWEL ISCHEMIA (SMA THROMBUS)	1(1.4)
CT INCONCLUSIVE	21(30)

56(80%) patients were managed operatively while the rest 14(20%) were given conservative treatment. Correlation of CT findings was done with operative findings regarding the site of obstruction as shown in table 3.

**Table 3. Shows distribution of patients according to agreement between CT and operative findings regarding site of obstruction**

CT findings in relation to surgical findings regarding site of obstruction	No. of Patients (%)
Concordant	39 (70)
Discordant	17 (30)
Total	56
P-value 0.0001(significant)	

Correlation of CT findings with surgical findings was done regarding the aetiology of obstruction (Table 4)

**Table 4- Shows distribution of patients according to agreement between CT and operative findings regarding aetiology of obstruction**

CT findings in relation to surgical findings regarding aetiology of obstruction	No. of Patients
Concordant	35 (62.5%)
Discordant	21 (37.5%)
Total	56
P- value 0.006 (significant)	

**DISCUSSION**

In our study the X-ray abdomen showed dilated bowel loops in 33(47%) patients and multiple air fluid levels in 20(37%) patients suggestive of bowel obstruction. Whereas Sekhon et al<sup>19</sup> detected obstruction on X ray in 62.5 % patients, and Suri et al<sup>20</sup> showed X- rays were able to diagnose intestinal obstruction in 77% patients,

In this study ultrasound abdomen showed dilated bowel loops in 35 patients i.e. 50 % had features of intestinal obstruction. Sekhon et al<sup>19</sup> showed obstruction in 30% patients on ultrasound, similar to our study. In contrast Suri et al<sup>20</sup> study showed dilated bowel loops in all the patients with suspected obstruction on ultrasound.

In our study the site of obstruction was found in 57(81%) patients on CT, while Colon et al<sup>21</sup> detected site of intestinal obstruction on CT in 75% cases, and Gupta et al<sup>22</sup> diagnosed site of obstruction on CT in all the patients(100%).

Our study showed ileum to be the most common site of obstruction i.e. 31 patients accounting for 44% cases. Similarly Sekhon et al<sup>19</sup> showed the most common site of obstruction was ileum(67%cases) and small bowel obstruction accounted for 95% cases, while Singhanian et al<sup>23</sup> showed obstruction site in small bowel in around 69% cases and Gupta et al<sup>22</sup> study showed small bowel obstruction in 78% cases.

In this study CT could identify cause of obstruction in 49(70%) patients, while in the Fukuya et al<sup>24</sup> study CT could identify cause of obstruction in only 47% cases, in contrast Maglante et al<sup>17</sup> were able to identify cause of obstruction on CT in 95% cases. Further in our study, CT showed benign structures (33%) to be the most common cause, followed by adhesions(28%). In contrast Sekhon et al<sup>19</sup> study showed most common cause of obstruction were adhesions in 32% of the patients and Gupta et al<sup>22</sup> showed adhesions as the most common cause of bowel obstruction in 43.5% patients.

Regarding site of obstruction in this study, CT and operative findings were concordant in 39(70%) of the patients. Barnett et al<sup>25</sup> study showed CT and operative concordance in 64% patients, and Colon et al<sup>21</sup> showed 63% correlation between CT and intraoperative findings, regarding obstruction site, both of which are in agreement to our study. However Matsuoka et al<sup>18</sup> have reported agreement between CT and surgical findings regarding site of obstruction in approximately 58% cases only.

In our study regarding the cause of obstruction, CT and operative findings were concordant in 35(62%) of the patients. Whereas studies done by Matsuoka<sup>18</sup>, Sekhon<sup>19</sup>, Suri<sup>20</sup>, Megibow<sup>26</sup> and Mohi<sup>27</sup> showed CT imaging and operative findings concordance regarding aetiology of obstruction in 88.5%, 89%, 73%, 77% and 73.6 % patients respectively.

In this study the sensitivity and specificity of CT for the site of obstruction was 71% & 93.3 % respectively, while the sensitivity and specificity of CT for the cause of obstruction was 63.3% & 93.3% respectively. In Matsuoka et al<sup>18</sup> study CT sensitivity and specificity for the site of obstruction was 55.5% and 100% respectively, while for the cause of obstruction CT sensitivity was 88.5% and specificity was 95.8%. Khatri et al<sup>28</sup> showed CT had overall sensitivity and specificity of 73.3 % & 75.5 % respectively.

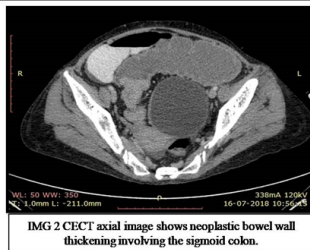
**CONCLUSION**

CT has high specificity with moderate sensitivity in diagnosing site and cause of intestinal obstruction. This study shows high degree of agreement between CT and operative findings which highlights the role of CT in patient management and pre-surgical planning. X-ray abdomen and ultrasound can be helpful adjunct modalities but have variable accuracy especially in emergency setting. This study highlights benign strictures and adhesions as most common causes of intestinal obstruction. Due to inherent disadvantage of small study population, larger study is warranted for corroboration of findings.

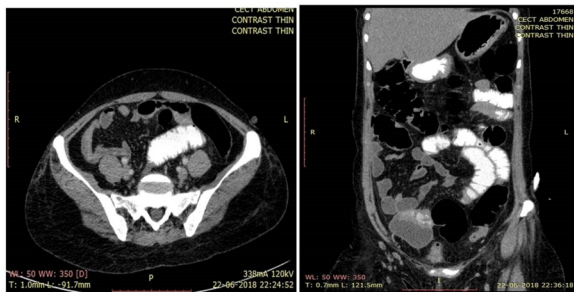
**Images**



**IMG 1 a) CECT axial, b) Cor show small intestine malrotation with SAIO transition zone in distal ileum with multifocal short segment strictures (arrow)**



**IMG 2 CECT axial image shows neoplastic bowel wall thickening involving the sigmoid colon.**



**IMG 3 a) axial & b) Cor show adhesion involving the proximal ileum**



**IMG 4 a) axial CECT, b) Cor show heterogeneously enhancing left ovarian lesion causing compression over ileum and causing small bowel obstruction.**

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