

## Original Research Article

# Computed tomography in intestinal obstruction: a tertiary care perspective from Northern India

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## ABSTRACT

**Background:** Intestinal obstruction is a very common surgical emergency faced today in surgical ERs (emergency rooms) all around the globe. With the advent of newer technology, management of intestinal obstruction has changed significantly. Today computed tomography (CT) employs both intravenous as well as oral contrast for determining the cause and the level of obstruction. It also gives additional information regarding any malignancy causing the obstruction, its staging and status of vessels. Thus, a surgeon can go in the procedure with a plan already in mind which can be discussed in detail with experienced surgeons beforehand.

**Methods:** This was a prospective observational study that was done in department of surgery at GMC Jammu over a period of two years. Patients of intestinal obstruction who presented to our department were enrolled in this study. They were subjected to a contrast enhanced CT after due preparation and managed accordingly. Data was recorded in a tabulated fashion and evaluated.

**Results:** After implementing the exclusion criteria's, a total of 163 patients were included in this study, majority being males in the age group of 20-40 years. Major cause of intestinal obstruction was attributed to post-operative adhesions followed by band obstruction due to various cause. CT findings were seen to be quite significant in evaluation and management of intestinal obstruction. About 30 % of the patients enrolled in our study were treated conservatively while 70 % required operative intervention in form of exploratory laparotomy.

**Conclusions:** Computed tomography is widely available now a days at a cheaper cost. It greatly increases the armamentarium of the surgeon in dealing with this condition. A lot many cases today are dealt conservatively due to high utilisation of CT scan. It also helps the surgeon to preoperatively plan a proper surgical approach

**Keywords:** Intestinal obstruction, CT, Obturator hernia

## INTRODUCTION

Earliest known records of intestinal obstruction dates back to Hippocrates and Paxagoras who in around 3<sup>rd</sup> century created an enterocutaneous fistula to treat a case of intestinal obstruction.<sup>1</sup> Intestinal obstruction is defined as the impediment to the normal flow of the intestinal contents which can either be due to functional causes or mechanical causes.<sup>2,3</sup> Intestinal obstruction leads to

electrolyte imbalance and dehydration in the body. Stasis occurs due to intestinal obstruction which further causes overgrowth of intestinal flora. Overgrowth of bacterial flora and stasis leads to bacterial translocation across the bowel wall and sepsis. Also, obstruction leads to dilation of intestines and consequently leads to increased luminal pressures. Increased luminal pressure leads to decreased venous drainage and consequently edema. Gradually there is compromise of arterial flow subsequently leading

to bowel ischaemia, necrosis and bowel perforation. Patients with distal obstruction have marked obstruction and little emesis while patients with proximal obstruction have marked emesis and minimal obstruction. Most common causes include postoperative adhesions, hernias, tuberculosis, malignancies, intussusception, fecaliths etc. Diagnosis of bowel obstruction is based on clinical signs, patient history and radiographic findings.<sup>4</sup>

For decades together the philosophy of “never let the sun set or rise twice on bowel obstruction” was followed in high reverence. But in the last two decades, this surgical adage has lost its significance, especially with the advent of CT. More and more patients are now treated conservatively than surgically thus leading to decreased morbidity associated with a surgical procedure.<sup>5</sup> It was in 1972, that first CT scan for commercial use was introduced by British engineer Godfrey Hounsfield of EMI laboratories along with physicist Dr. Allan Cormack. He co-invented the technology with physicist Dr. Allan Cormack. CT scan utilises ionising radiations to create an image on the detector when these ionising radiations pass through different densities. Many such images are taken and aligned with the help of a computer system in different angles to get a detailed image of the human body. Such imaging gives a detailed view of human body but also subjects it to ionising radiation.<sup>6</sup>

Today, CT employs both Intravenous as well as oral contrast for determining the cause and the level of obstruction. It also gives additional information regarding any malignancy causing the obstruction, its staging and status of vessels.<sup>7</sup> Thus, a surgeon can go in the procedure with a plan already in mind which can be discussed in detail with experienced surgeons beforehand.

### **Common abdominal emergencies and CT scan**

#### *Gastroduodenal ulcers perforation*

In cases of gastroduodenal ulcer perforations CT scan is 95% sensitive and 93% specific in diagnosing the etiology by identifying free air, signs of peri-duodenal fat stranding, ulcer, and wall thickening can be seen 72-89%.<sup>8</sup>

#### *Cholecystitis*

Ultrasonography is most commonly deployed for detecting cholelithiasis and diagnosing acute calculous cholecystitis. CT can detect gallstones in 50% of cases, but in patients with equivocal ultrasonographic findings, CT scan can help to visualize increase wall thickness, peri-cholecystic stranding, and pericholecystic fluid.

Complications of cholecystitis, such as emphysematous, hemorrhagic and perforated cholecystitis can also be detected using CT scan.<sup>9</sup>

#### *Cholelithiasis*

CT is rarely used for diagnosis of cholelithiasis as it has a diagnostic sensitivity of 56.5 to 81% and a specificity of 72.8% to 96%. Thus, in patients with suspicion of cholelithiasis CT is not used now as the initial imaging study of choice.<sup>10</sup>

#### *Pancreatitis*

In cases of pancreatitis, CT scan has a sensitivity of 92% and specificity of 100% in identifying the patients suffering from acute pancreatitis. In cases of pancreatic necrosis, it is 80-90% accurate with a 90% sensitivity and 33% specificity in identifying the disease. CT scan imaging also allows for classification of pancreatitis as per Atlanta and revised Atlanta classification.<sup>11</sup>

#### *Small bowel obstruction*

CT scan plays a great role when it comes to diagnosing complete bowel obstruction. It can do so with a sensitivity of (81-100%) and a specificity of (68-100%). CT scan, with a sensitivity of 83 % (63-100%) and 92% (61-100%) specificity, is able to diagnose intestinal ischemia. In cases where plain radiograph films are inconclusive, CT scan has great value especially helpful in determining the likely etiology of the obstruction, whether it is due to hernias, adhesions, or malignancy.<sup>12</sup>

#### *Mesenteric ischemia*

In cases of acute mesenteric ischaemia, CT angiography scan is rapid and non-invasive for its diagnosis. It is also helpful to get information regarding its multiple etiologies (arterial thrombosis, arterial embolism, mesenteric vein thrombosis, and nonocclusive ischemia), with a sensitivity and specificity of 96% and 94%, respectively.<sup>13</sup>

#### *Appendicitis*

In cases of acute appendicitis, ultrasonography is the first line of investigations for the diagnosis. CT is deployed in cases of doubt. When CT scan is used, it identifies the condition with a sensitivity of 91% and specificity of 90%. Thus, it is a great tool for those patients where there is suspicion of acute appendicitis, which cannot be clearly diagnosed on ultrasonography. One thing to keep in mind is that use of oral contrast is futile in such cases however benefit of using intra venous contrast cannot be undermined. In addition, CT scan can also be deployed to grade the severity of acute appendicitis. Appendicitis can be categorised as inflamed, perforated with localized free fluid, perforated with regional abscess, perforated with diffuse peritonitis. This grading of acute appendicitis helps the surgeon to plan appropriate treatment, which may be either operative or drainage under ultrasonographic or CT guidance.<sup>14</sup>

### Diverticulitis

In the diagnosis of acute diverticulitis CT scan is 94% sensitive and 99% specific. Apart from the identification of the presence or absence of perforation, CT scan allows for Hinchey classification of perforated diverticulitis. This facilitates the surgeon to decide whether hospitalization is required for the patient and also whether the patient can be treated with medical therapy.<sup>15</sup>

CT Scan has its own cons and risks. The average CT scan has an estimated radiation dose of 3-10 mSv in pediatric patients for abdomen and pelvis with contrast.

It is estimated that a patient is exposed to a radiation dose of 0.3-3 mSv in pediatric patients when an CT angiogram of abdomen iOS undertaken. When possible, the risks of radiation exposure are minimized in the pregnant and pediatric populations. Depending on the pathology, ultrasound and MRI are viable options with similar accuracy. Ultrasonography, in the pediatric population, approaches the accuracy of CT in diagnosing acute appendicitis with a sensitivity of 88% and specificity of 94%. In cases of pregnant females, suspected of having appendicitis, MRI has a 97% sensitivity and 95% specificity. Most of the non-trauma patients are candidates for CT for diagnosis. However, it is not recommended for patients with impaired renal function or in those who are unstable and in their extremis. For those with renal dysfunction, exposure to contrast agents should be minimized. The risk of contrast-induced nephropathy is well known in such cases.<sup>16</sup>

### Aims and objective

The aim and objectives of the study were to correlation of CT scan findings with intra-operative findings.

### METHODS

This study was conducted in department of surgery, government medical college, Jammu. The study was a cross sectional observational study. It was conducted over a period of three years from 01<sup>st</sup> February 2018 to 31<sup>st</sup> January 2021. All the patients who presented to our emergency department with features of intestinal obstruction were included in the study. A detailed history and clinical examination were done. Patients were subjected to all baseline investigations. The baseline investigations included a hemogram, blood counts, kidney function test, liver function test, coagulation profile and electrolytes. X-ray chest and abdomen was done and clinical data of the patients was tabulated. Patients were optimised and properly hydrated. A nasogastric tube was inserted to allow for decompensation of gastrointestinal tract. In case of any electrolyte imbalance, electrolytes were corrected. After applying the exclusion criteria, as mentioned below, the patients were subjected to contrast enhanced CT using both oral and intravenous contrast. Patients were given

750 ml of oral contrast and 30 ml of IV contrast and subjected to the scan. Oral contrast was omitted in patients having episodes of vomiting. Patients were managed either conservatively or surgically based upon the clinical observation over time. Those operative findings in the group who were surgically treated were correlated with CT findings.

### Inclusion criteria

Stable patients with acute abdomen included in study.

### Exclusion criteria

Patients who required urgent laparotomy, patients with X-ray findings suggestive of perforation, patients with abnormal kidney function test and pregnant females were excluded from the study.

### RESULTS

A total of 227 patients were admitted with the department of surgery over the specified period of three years. However, after applying the exclusion criteria only 163 patients were included in this study.

### Age and sex distribution

Out of 163 patients, there were 94 males and 69 females with a ratio of 1.36 (Table 1). Youngest patient in this study was a 5 years old boy having fecalith as the cause of obstruction while the oldest patient was a 78 years old man having obstruction due to malignancy. Majority of patients belonged to 20-40 years of age. Least number of patients were in the age group of less than 20 years age group which had only 15 patients comprising about 9% of the total. Mean age of patients was 48.6 years.

**Table 1: Age distribution.**

Age (years)	Male	Female	Total
<20	09	06	15
20-40	36	31	67
40-60	16	12	28
>60	33	20	53
<b>Total</b>	<b>94</b>	<b>69</b>	<b>163</b>

### Symptomatology

Most common symptom was abdominal pain. Almost all the patients had the primary complaint of abdominal pain. Followed by abdominal distension, constipation and vomiting. Patients having distal obstruction had abdominal distension while patients having proximal obstruction suffered more with complaints of emesis. Least common sign was obstipation (Table 2).

### CT scan findings

CT findings of the patient showed dilated gut loops as the major finding. It was in patients with proximal obstruction that this finding of dilated gut loops was absent. It was followed by constriction, bands and strictures. The least cause was that of obturator hernia that was seen in two patients both being females in eighth decade of life. Other CT findings include malignancy intussusception and sub-acute intestinal obstruction.

**Table 2. Clinical profile of the patients.**

Sign/ symptom	No. of patients
Abdominal pain	163
Abdominal distension	147
Nausea/ vomiting	132
Constipation	119
Obstipation	21
Abdominal tenderness	47
Guarding	19

**Table 3: CT findings.**

CT finding	No. of patients
Dilated bowel loops	149
Constriction bands	71
Sub-acute intestinal obstruction	46
Intussusception	12
Suspected malignancy	34
Obturator hernia	02
Perforation	26

Out of 163 patients, 114 patients were surgically managed while 114 patients were managed conservatively. This accounts for about 70% of patients which were managed surgically and 30% of the patients which were managed conservatively. CT findings matched with the intraoperative findings in 99 patients out of 114 patients making a percentage of 86.8%.

### DISCUSSION

This study was conducted over a period of three years and 163 patients were included in this study. Majority of the patients belonged to third and fourth decade of life. Important reason for this, was the etiology, which was post-operative adhesion obstruction. Young population was often found to be involved in road traffic accidents and assaults which warranted a laparotomy and hence forth lead to an increase incidence of adhesion obstruction in this age group. Operative intervention allows for adhesions to occur either at the area of obstruction or under surface of abdomen where it is closed. Also, this population had a major incidence of obstruction due to Meckel's band. Following this age group another peak was seen in 7<sup>th</sup> decade of life which was mainly due to high incidence of large gut malignancies in this population group causing obstructive

symptoms. Majority of our subjects were males which could also be ascertained due to the various etiological factors responsible, found mainly in the male population such as increased incidence of road traffic accidents, increased incidence of malignancy, increased incidence of hernia, increased incidence of GIT malignancies etc.

Abdominal pain and distension were the most common symptoms that the patient presented to us with. Abdominal distension as earlier discussed was due to increased intraluminal pressure and distension and were more remarkable in distal obstruction. It was associated with colicky abdominal pain which was moderate to severe in intensity. It was associated with episodes of nausea, vomiting and constipation. Features of nausea and vomiting were more pronounced in proximal obstruction. Abdominal tenderness and guarding were seen in patients presenting late. These features develop as a result of either bacterial translocation along the intestinal wall or peritonitis due to gut perforation following necrosis. Both were indicators of prolonged obstruction and thus were a poor indicator for conservative management of the patients. Similar results were seen in studies conducted earlier in literature as that of Malik et al, Saini et al and Chang et al.<sup>17-19</sup>

Contrast enhanced CT was done in all cases included in the study. Dilated gut loops were seen in almost all of these patients. Many of them showed features suggestive of band obstruction and sub-acute intestinal obstruction. CT cannot see a band directly. However, presence of a sudden transition point without any evidence of growth or thickening can give rise to indirect proof of band obstruction. Many signs present in such cases include beak sign, fat notch sign and whirl sign.<sup>7,20,21</sup> Contrast CT was of particular help in patients where obstruction was due to malignancy.<sup>22</sup> It helped to stage the tumor pre operatively and also guided us regarding the proper management of the patient both at emergency and elective setup. Value of CT in gut malignancies can very well be confirmed by work of authors such as Moraitis et al in the past.<sup>23</sup> We also had the 2 preoperative diagnosis of obturator hernia with the help of CECT abdomen which are in fact rare cause of intestinal obstruction.<sup>24</sup>

About 30% of patients enrolled in our study were treated conservatively while 70% required operative intervention in form of exploratory laparotomy. In this set of 114 patients who operated intra-op findings matched in about 99 patients which is approximately 86.8%. This shows high reliability of CT scans in diagnosing cause of intestinal obstruction and surgical management as well.

### CONCLUSION

Surgeon in today's world comes across the diagnosis of intestinal obstruction quite frequently. It is important for a Surgeon to recognise both the common and unusual causes of obstruction. CT is widely available now a days at a cheaper cost. It greatly increases the armamentarium

of the surgeon in dealing with this condition. A lot many cases today are dealt conservatively due to high utilisation of CT scan. Also, helps surgeon to pre-op plan a proper surgical approach. Recently MDCT have emerged as great tool to supplement traditional CT scan. However, more trials are required to establish CT scan as investigation of choice for intestinal obstruction.

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