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Original Article

Role of Multidetector Computed Tomography in Bowel Obstruction

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Abstract

Introduction: Intestinal obstruction accounts for 20% of surgical admissions of patients with acute abdomen. The early diagnosis of bowel obstruction is critical in preventing complications, particularly perforation and ischemia. Mechanical large bowel obstruction is 4-5 times less common than small bowel obstruction, most common cause being neoplasm.

Materials and Methods: This is a hospital-based cross-sectional study (observational study) done on 53 patients, suspected to have intestinal obstruction referred for computed tomography (CT) scan of the abdomen to the Department of Radio Diagnosis at Saifee Hospital, Mumbai. The study period was 2 years (July 2013-June 2015).

Results: This study comprised of 53 cases with suspicion of intestinal obstruction. The age group of patients ranged from 1 to 83 years with a mean of 49.2 years. Out of 53 cases, 26 cases were males (49.06%) and 27 were females (50.94%). Abdominal distention and inability to pass stools were most common symptoms in the study. Overall performance of CT in diagnosis of intestinal obstruction consisted of 75% true positive cases, 14.58% true negative cases, 8.33% false positive cases, and 2.08% cases of false negative. Thus, on statistical analysis (McNemar's Chi-square test) CT was found to be 97.29% sensitive and 63.63% specific in diagnosis of intestinal obstruction.

Conclusion: CT has become the most important non-invasive imaging tool to diagnose small and large bowel diseases as it has the potential to provide significant information which leads to timely appropriate treatment and thus positively affect the outcome, morbidity, and mortality of patients.

Key words: Adhesion/band, Computed tomography, Intestinal obstruction, Small bowel obstruction

INTRODUCTION

Intestinal obstruction accounts for 20% of surgical admissions of patients with acute abdomen. The early diagnosis of bowel obstruction is critical in preventing complications, particularly perforation and ischemia.[1]

The morbidity and mortality associated with acute small-bowel obstruction is significant. It accounts for 12-16% of all surgical admissions in patients with acute abdominal conditions. Post-operative adhesions accounts for 70% cases of small-bowel obstruction. Other common causes include hernias, neoplasms, and Crohn's disease.[2] Mechanical large bowel obstruction is 4-5 times less common than small bowel obstruction, most common cause being neoplasms.[3] Plain films are usually obtained initially and have overall 69%, 57%, and 67% sensitivity, specificity, and accuracy, respectively.[4] Its accuracy in diagnosing the site and cause of obstruction and the presence of strangulation is even lower.

A gastrointestinal contrast study may be indicated when a low-grade partial bowel obstruction is suspected. Small-bowel follow-through was traditionally performed and has been largely replaced by enteroclysis with the nasoenteric tube, advanced beyond the duodenojejunal junction. It has high performance in depicting and demonstrating the level and cause of obstruction, even in lower grades of bowel obstruction and multifocal incomplete obstructions. However, enteroclysis is contraindicated in patients with acute and complete or high-grade bowel obstruction and those with strangulation or suspected perforation. Its use should also be avoided in patients with markedly diminished

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intestinal peristalsis. The clinical usefulness of magnetic resonance imaging in this field is still limited; however, favorable results have been reported.[5]

Given the relative lack of sensitivity and specificity of plain film findings in patients with symptoms of bowel obstruction, in acute settings, and computed tomography (CT) plays a central role in evaluation.

MATERIALS AND METHODS

This is a hospital-based cross-sectional study (observational study) done on 53 patients, suspected to have intestinal obstruction referred for CT scan of the abdomen to the Department of Radio Diagnosis at Saifee Hospital, Mumbai. The study period was 2 years (July 2013-June 2015). Initially, written informed consent was obtained from all patients. Thereafter, the individual details, clinical history, and history if any were recorded.

Procedure

Study was conducted on Phillips Brilliance 40 slice CT with collimation 40 × 0.625 mm, slice thickness 0.6 mm and 40 slices per rotation. Plain scans were obtained before giving positive oral contrast (trazogastro, containing diatriazoatemeglumine, and diatriazoate sodium in aqueous base). Oral contrast was avoided if bowel is already distended with intraluminal fluid or if patient cannot tolerate it. Rectal contrast is given if large bowel pathology is suspected. Intravenous contrast (injection contrapaque or omnipaque [350 mg/ml]) was injected using dual head CT pressure injector and triphasic-contrast study was carried out. Thin 1 mm reconstructions were obtained to study axial, coronal, and sagittal reformatted images on workstation. DICOM images were saved in CD format for future reference. Surgical, histopatholgical, clinical, and other relevant follow-ups were obtained if available.

Statistical Analysis

Descriptive statistics were reported using mean and standard deviations for continuous variables, number and percentages for categorical variables. Cross tabulation was done for all the variables of interest. McNemar's Chi-square test was done to test the significance of proportions of CT with surgical findings. Sensitivity, specificity, positive, and negative predictive values were computed. $P < 5\%$ were considered statistically significant. All the analyses were performed using SPSS software.

RESULTS

This study comprised of 53 cases with suspicion of intestinal obstruction. The age group of patients ranged from 1 to 83 years with a mean of 49.2 years. Out of 53 cases, 26 were males (49.06%), and 27 were females (50.94%). Abdominal distention and inability to pass stools were most common symptoms in the study (Table 1).

Out of 53 cases studied, 30 cases were given positive oral contrast and almost all the patients were given intravenous contrast except one patient, in which contrast study was not required and only plain study was sufficient to provide required information.

The "small bowel feces sign" and the "CT string of beads sign" were found in 3/53 and 2/53 patients, respectively, and were always present with presence of intestinal obstruction.

Out of 53 cases studied, 43 were diagnosed as presence of intestinal obstruction on CT with 69.8% having small bowel obstruction, 11.32% having large bowel obstruction and level was not identified in 18.87% case. Adhesion/band was most common cause on CT (27.9%). Other common causes being primary bowel tumor (11.63%), hernia (6.98%), intussusceptions (4.65%), and volvulus (4.65%) (Table 2).

On follow-up, 64.15% cases were managed surgically, 26.42% were managed conservatively and follow-up of 5 cases (9.43%) was lost. Out of remaining 48 cases final diagnosis of intestinal obstruction was present in 37/48 patients (77.08%) with final level of obstruction being small bowel in 29/48 cases and large bowel in 6/48 case. Final diagnosis of both small and large bowel obstruction was found in 2 cases. Out of 48 cases with follow-up, final most common cause of intestinal obstruction was found to be adhesion/band (22.92%). Other common causes were volvulus (8.33%), primary

Table 1: Distribution of the individuals according to the symptoms

Clinical features	Number of patients=53 (%)
Abdominal distension	40 (75.47)
Constipation	39 (73.58)
Vomiting	29 (54.72)
Abdominal pain	30 (56.60)
Others	20 (37.74)

Table 2: Distribution of the individuals according to the level of obstruction on CT

Level of obstruction on MDCT	Number of patients=53 (%)
Small bowel	37 (69.81)
Large bowel	6 (11.32)
Not applicable	10 (18.87)
Total	53 (100.00)

CT: Computed tomography, MDCT: Multidetector computed tomography

bowel tumor (6.25%), hernia (6.25%), and intussusceptions (6.25%) (Table 3).

Overall performance of CT in diagnosis of intestinal obstruction consisted of 75% true positive cases, 14.58% true negative cases, 8.33% false positive cases, and 2.08% cases of false negative. Thus, on statistical analysis (McNemar's Chi-square test) CT was found to be 97.29% sensitive and 63.63% specific in diagnosis of intestinal obstruction (Table 4).

Out of total 37 cases, with final diagnosis as intestinal obstruction, CT could identify correctly the cause of 70.27% case and was incorrect in identifying the causes of 29.73% cases. CT was found to be correct in identifying the level of 89.19% cases and incorrect in identifying level of 10.81% cases.

DISCUSSION

In the study by Markogiannakis *et al.*,[6] of the 150 patients with small and large bowel obstruction, 121/150 (80.6%) presented with inability to pass stools, 118/150 (78.6%) presented with vomiting, 98/150 (65.3%) with abdominal distension and 111/150 (74%) presented with abdominal pain.

In our study, of the 53 patients, 40 patients (75.4%) had abdominal distension, 39 patients (73.5%) had constipation, 29 patients (54.7%) had vomiting, and 30 patients (56.6%) presented with abdominal pain. Abdominal distension was found to be most frequent clinical feature in our study; however, in the study by Markogiannakis *et al.*,[6] inability to pass stools was most common clinical feature.

The "small bowel feces sign" and the "CT string of beads sign" were found in 3/53 and 2/53 patients, respectively, and were always present with presence of intestinal obstruction.

Lazarus *et al.*[7] found that the "small bowel feces sign" was present in 19/34 patients (55.9%) with small bowel obstruction in their study and Catalano[8] found that was present in 7.4% of 94 patients with small bowel obstruction.

In our study, this sign was seen in two out total 53 patients (3.7%), no studies in literature have evaluated this sign for diagnosing obstruction, although this sign has been described for small bowel obstruction.[9]

In our study, adhesion/band was most common cause on CT (27.9%). In the study by Megibow *et al.*,[10] where both large and small bowel obstructions were considered together, out of 64 patients with confirmed obstruction, adhesion was the most common cause of obstruction (37 cases, i.e., 57.8%), followed by primary tumor (7 cases), metastasis (6 cases), Crohn's disease (4 cases), hernia (3 cases), hematoma and diverticular disease (2 cases each) and one case each of gall stone ileus, intussusception, and appendicitis causing obstruction.

In our study, CT was found to be 97.29% sensitive and 63.63% specific in diagnosis of intestinal obstruction. The overall sensitivity and specificity of CT for diagnosis of both small and large bowel obstruction in our study is different when compared to the results obtained by Megibow *et al.*[10] Our results show more sensitivity and less specificity. Our study had four false positives and one false negative.

In our study, CT was able to identify correctly the cause of 70.27% case and was incorrect in identifying the causes of 29.73% cases. In the study done by Maglinte *et al.*,[11] CT correctly showed the cause of obstruction in 95% of the cases (39/41). The two cases which proved wrong on CT were Crohn's disease and radiation enteritis.

Table 3: Distribution of the participants according to the cause of obstruction on CT

Cause on CT	Number of patients=53 (%)
Primary bowel tumor	5 (11.63)
Hernia	3 (6.98)
Adhesions/band	12 (27.91)
Intussusception	2 (4.65)
Malrotation	2 (4.65)
Volvulus	2 (4.65)
Tumor recurrence	1 (2.33)
Extrinsic cause	3 (6.98)
Inflammatory cause	4 (9.30)
Foreign body	2 (4.65)
Not identified	7 (16.28)
Total	43 (100.00)

CT: Computed tomography

Table 4: Performance of CT in diagnosis of intestinal obstruction

CT performance in diagnosing intestinal obstruction	Frequency *n*=53 (%)
True positive	36 (75.00)
True negative	7 (14.58)
False positive	4 (8.33)
False negative	1 (2.08)
Total	48 (100.00)

CT: Computed tomography

CONCLUSION

CT has become the most important non-invasive imaging tool to diagnose small and large bowel diseases as it has the potential to provide significant information which leads to

timely appropriate treatment and thus positively affect the outcome, morbidity, and mortality of patients.

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