Original Article

The role of computed tomography for identifying mechanical bowel obstruction in a Pakistani population

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Abstract

Objective: To retrospectively review our experience of CT scan in cases with a final diagnosis of surgically confirmed mechanical bowel obstruction.

Methods: It is a retrospective analytical study, done from 2003 to 2008. All adult patients having undergone laparotomy in addition to a preoperative abdominal CT scan over a 5 year period were identified through the medical records and their case notes reviewed. Taking surgery to be the gold standard for diagnosing mechanical bowel obstruction, we compared results of the CT with operative findings to determine the sensitivity, specificity, positive and negative predictive values of CT scans. The data was analyzed using SPSS version 16.0.

Results: A total of 271 patient records were reviewed. The mean age was 46 ± 19 years and (64%) were men. Mechanical intestinal obstruction was found in 104 patients on laparotomy and CT scan had diagnosed 97 of these. The sensitivity and specificity was 93% respectively. CT scanning correctly identified the cause of the obstruction in 72 (74%) cases. The common reasons for bowel obstruction identified by surgery were adhesions 29 (40%), neoplasm 12 (17 %) and hernias 7 (10%).

Conclusion: CT scans are reliable at diagnosing intestinal obstruction with a high sensitivity and specificity but they are not as accurate at defining the etiology of the obstruction.

Keywords: Obstruction, Radiology, Sensitivity, Mechanical, Karachi (JPMA 61:871; 2011).

Introduction

Intestinal obstruction is a frequent surgical emergency.[1] It accounts for 20% of surgical admissions[2] and is a major cause of morbidity around the world.[3] Effective management depends upon early and accurate diagnosis.[4] A comprehensive diagnostic approach includes history, physical examination and radiological investigation.[5] CT scans are believed to have enhanced evaluation and thus aid management of bowel obstruction and have recently gained much popularity.[6]

Although CT has demonstrated great efficacy in detecting small bowel obstruction (SBO) with studies reporting a sensitivity as high as 93%, a specificity of up to 100% and an accuracy of around 94% in diagnosing SBO,[7] some suggest that a more significant role of CT lies in defining the etiology and/or severity of the obstruction rather than diagnosing it.[8] CT can accurately show the site, level and severity of obstruction[9] and has also been shown to be sensitive for the signs of strangulation and volvulus.[10,11]

Etiological patterns of intestinal obstruction have changed over the years. In the late 1920s hernias accounted for 50% of the cases of intestinal obstruction and adhesions for only 7%.[12] Presently adhesions are responsible for about 65% of the cases.[3] However intestinal obstruction due to adhesion is still considered a diagnosis of exclusion.[2,7,8] A major limitation of CT scans is its inability to detect adhesions.[2,7]

In the setting of a developing country like Pakistan, where health care resources are already limited and patients are self financed, a CT scan represents a significant undertaking. We hypothesized that CT scans have a high accuracy at diagnosing mechanical bowel obstruction.

This study was undertaken to try and define the sensitivity and specificity of CT scan for diagnosing the presence of mechanical bowel obstruction and correctly identifying the underlying etiology in surgical patients presenting to a tertiary care hospital.

Methods

We searched the computerized medical record system for all adult patients (≥ 18 years of age) who underwent an exploratory laparotomy for any cause, between December 31st, 2003 - December 31st 2008 and had had a pre-operative CT scan performed. Our inclusion criteria were such that we included in our review, all patients ≥ 18 years of age and those who had undergone a pre-operative CT scan and an exploratory laparotomy for any cause during the course of

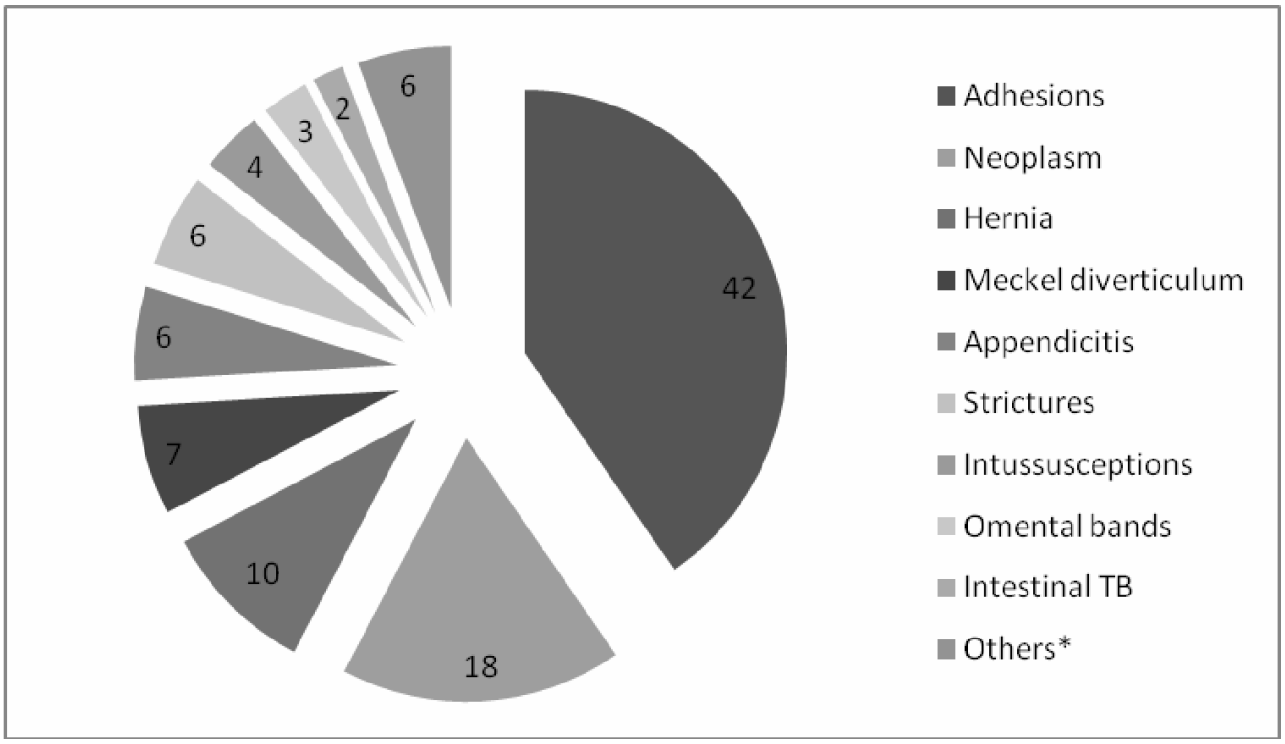
their hospital stay. Patients with incomplete surgical notes and those patients whose files could not be retrieved by the Patients Records Office at AKUH, were excluded. The medical records of all the patients who met the selection criteria were reviewed and information collected on demographics. Data was collected on standardized questionnaires.

The same 64 slice standard CT scanner, present on site in the hospital had been used to perform the CT scans in all the patients. Intestinal obstruction was defined by the presence of distended bowel loops (>2.5 cm in small bowel and >6.0 cm in large bowel), proximal to a point of obstruction, transitioning into a collapsed segment of the small/large bowel distal to the point of obstruction. In patients where the CT scan suggested mechanical bowel obstruction, the level and etiology of obstruction, were also recorded. To minimize the artifact of hindsight we used the original radiology report and did not have the images reevaluated. For each patient, the surgical notes of the subsequent exploratory laparotomy were thoroughly reviewed to see if the surgical findings corroborated with those of the pre-operative CT scan in terms of presence, level and etiology of mechanical bowel obstruction. The surgical diagnosis was deemed to be the definitive diagnosis i.e. the gold standard, against which the findings of the CT scan were compared.

Patient demographics (age and gender) and the presentation and etiology of the bowel obstruction were summarized by calculating the means for continuous variables and proportions for categorical ones. The sensitivity, specificity, positive and negative predictive values of CT scan for diagnosis of intestinal obstruction was determined using surgery as the gold standard. We also determined the proportion of cases in which CT scans accurately determined the etiology of the obstruction. Data was managed and analyzed on SPSS v 16.

Results

The initial search provided a list of 1145 patients who had undergone exploratory laparotomies for any cause in the 5 years encompassing our study period. A total of 794 patients were excluded as they had not undergone a pre-operative CT scan, and of the remaining 350 patients, the medical records for 79 patients were missing leaving 271 patients for review. The mean age was 46 ±19 years and 173 (64%) were males. Majority (73%) had presented through the emergency department and the rest were referred through the out-patient clinics. Intestinal obstruction was the final diagnosis, as confirmed by surgery, in 104 of these patients. Of them 90 (87%) had small bowel obstruction, 9 (9%) had large bowel and five (5%) patients had both small and large bowel obstructions. For these patients, the most common presenting



***Includes bowel ischemia, gall stone ileus, volvulus and enlarged lymph nodes.**

Figure: Causes of Intestinal Obstruction upon surgery (n=104).

Table: Performance of CT Scan at diagnosis intestinal obstruction using laparotomy as gold standard.

	Intestinal Obstruction on Laparotomy		
	Yes	No	Total
Intestinal Obstruction on CT			
Yes	97	12	109
No	7	155	162
Total	104	167	271

complaints were abdominal pain (89%), nausea/vomiting (65%), constipation (31%) and abdominal distention (24%).

Pre-operative CT scan had correctly predicted the presence of obstruction in 97 of the 104 patients with surgically confirmed obstruction, corresponding to a sensitivity of 93% (Table). True negative CT scans were found in 155 out of 167 patients with no obstruction upon surgical exploration leading to a specificity of (93%). The accuracy of CT scan in determining the presence of obstruction was 93%. Of the seven cases in which CT scan missed the diagnosis five were found to be due to adhesions, one due to bowel ischaemia and one was a strangulated hernia. CT scanning had a positive predictive value (PPV) of 89% and a negative predictive probability (NPV) of 96% for diagnosing MBO.

The common reasons for bowel obstruction identified by surgery were adhesions (40%), neoplasm (17%) and hernias (10%) (Figure). Of the findings described in the 97 positive CT scans the correct etiology was described in 72 (74%) cases. For intrinsic (intramural) causes of obstruction (which include; neoplams, Crohn's disease, tuberculosis, and intussusceptions) CT scan correctly identified 19 out of 26 (73%) causes. For extrinsic causes (including adhesions, bands, closed loop, hernias and extrinsic masses carcinoid tumours, metastatic tumours, lymphoma, appendicitis, diverticulae) CT scanning correctly identified 53 out of 71 (75%).

Discussion

CT scan proved to be accurate at diagnosing bowel obstruction in our study with a high sensitivity (93%), specificity (93%) and positive predictive value (89%). Standard CT scans emerged as an important preoperative imaging modality for evaluation of intestinal obstruction two decades ago.[5] Many studies since, have consistently demonstrated high sensitivities (90%-96%) and specificities (96% to 100%)[5,7] of CT at determining the presence of obstruction. Our study demonstrates a high accuracy of CT scanning in a non-experimental practical setting when an expert radiologist is not always available to review the CT scan.

CT scanning over time has proven to be better at confirming the diagnosis of bowel obstruction than most of the other radiological modalities; plain film radiography can miss up to 20% of diagnoses,[13] ultrasounds are accurate but are dependent on the expertise of the sonologist and the presence of obscuring gas filled loops of bowel.[13,14] Contrast studies have shown to have a sensitivity of 100%,[15] however they are time consuming and the contrast has to be ingested by the obstructed patient.[14,16] MRI has been demonstrated to be a limited but promising imaging modality and has shown to surpass even CT in terms of sensitivity, specificity, and accuracy.[17] However, more evidence is necessary to establish the role of MRI in imaging of SBO. Plain film abdominal radiography is still the preferred initial investigation after patient history and physical examination.[18] It is diagnostic in up to 60% cases, equivocal in 20%-30% and incorrect in 10-20% cases.[14]

CT scan is generally used when results are equivocal, to confirm the diagnosis, characterize the severity of the obstruction, identify the transition point, identify the cause or to look for complications.[5] Our study however demonstrated that CT could correctly identify the cause of the obstruction in only 74% of cases. CT scan performs worst at detecting adhesions as a cause of intestinal obstruction.

The proportion of obstruction attributed to adhesions has been increasing in our population. A study at our institution in 1987-1991 demonstrated adhesions to be the cause of intestinal obstruction in 34% patients[12] while the present study from 2004-2009 demonstrates it to be the cause in 40% patients. A recent study of 229 patients in Lahore, Pakistan similarly demonstrated adhesions to be the cause of 41% cases of bowel obstruction.[19] In their study however abdominal tuberculosis accounted for the second majority (25%) while hernias accounted for 18% of cases. The etiological distribution of mechanical bowel obstruction is changing in our population. This may have implications on management and guidelines.

Since this was a retrospective review we were limited by information provided in medical records when records were available thus selection bias may be a possible issue worth considering when drawing recommendations. However based on similar finding from the literature and personal experience the authors think that the demographic proportions and case mix are appropriate and show no signs of a group of patients being selectively over or under represented. Another limitation due to the retrospective nature of the study was that we were unable to determine which patients benefitted from CT scans and which did not; did it lead to a change in management in situations and what those situations are would be better studied in a prospective study.

Conclusion

In this study CT scan proved to be accurate at diagnosing bowel obstruction with a high sensitivity and specificity, however it was not as accurate in determining the

cause of the obstruction. A prospective study on our population is needed to determine factors that help in determining the need for a pre-operative CT scan in patients with intestinal obstruction.

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