

## COMPUTED TOMOGRAPHY OF SMALL BOWEL OBSTRUCTION

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### ABSTRACT

Abdominal computed tomographs done between May and August 1996 of 5 patients with signs and symptoms of small bowel obstruction are reviewed. Four of these patients proved to have small bowel obstruction. The causes were adhesions (2 patients), peritoneal carcinomatosis (1 patient), and obturator hernia (1 patient). Thickening of the small bowel wall, submucosal edema of the small bowel, and ascites were seen in one of these four patients, who on surgery proved to have gangrene of the terminal ileum. On surgery the fifth patient was found to have radiation enteritis but no bowel obstruction.

### INTRODUCTION

Small bowel obstruction is commonly encountered by surgeons and radiologists. This diagnosis is made on the basis of the patient's signs and symptoms. Plain abdominal radiography is usually used to confirm this diagnosis. Sometimes barium studies may be done to show the site and cause of obstruction. Recently computed tomography (CT) has been shown to be useful in revealing the site and cause of obstruction and possible bowel ischemia.<sup>1-7</sup>

### MATERIALS AND METHODS

Abdominal CT scans done between May and August 1996 of 5 patients with signs and symptoms of small bowel obstruction were reviewed. There were 4 females and 1 male with ages ranging from 26 to 74 years with a mean of 51.4 years. The CT scans were done immediately after a 100-ml intravenous bolus injection of contrast medium using 10-mm slice thickness and 12-mm spacing for the entire abdomen. In two of these patients 2% iodinated water-soluble contrast medium was also administered orally 1 hour

before scanning.

### RESULTS

The clinical histories, CT findings, and treatments are in Table 1. The causes of small bowel obstruction in the first two patients (cases 1 and 2) were adhesions. CT scans showed the sites of obstruction in both cases. There were no masses at the obstruction sites (Fig. 1). In case 2, CT also showed signs of strangulation of the small bowel (Fig. 2). In case 3, CT scans showed obstruction of the small bowel by one of the masses of the peritoneal carcinomatosis (Fig. 3).

The CT scans in case 4 showed obstruction of the ileum and the small bowel loop in the right obturator canal (Fig. 4) consistent with a right obturator hernia causing small bowel obstruction, but there was no proof of this because this elderly patient's relative requested no surgery be done.

In case 5, a false diagnosis of small bowel obstruction was made (Fig. 5). The CT findings

were dilatation of the jejunum and ileum, and thickening of the wall of the terminal ileum and the ascending colon. On surgery, the patient was

found to have radiation enteritis, but no bowel obstruction.

**TABLE 1.**

Patient No.	Clinical History	CT Findings	Treatment
1 42 y/F	Known CA rectum stage III, AP resection and colostomy 6 months prior. Chemotherapy and radiation therapy	Dilatation of jejunum and ileum. Distal ileum not dilated. Submucosal edema of segment of ileum.	Resection of distal ileum, end-to-end anastomosis, lysis of adhesions
2 52 y/F	Trans-abdominal hysterectomy, bilateral salpingo-oophorectomy and omentectomy for myoma uteri and endometriosis 7 years prior.	Dilatation of small bowel. Decrease in air in large bowel. Thickened wall of distal ileum, submucosal edema and ascites	Resection of the gangrenous segment of distal ileum, right half colectomy, lysis of adhesions
3 26 y/M	Right half colectomy for CA colon 2 years prior. Jejunum-sigmoidostomy for small bowel obstruction from peritoneal carcinomatosis in another hospital 20 days prior.	Dilatation of jejunum and ileum. Obstruction of ileum by masses in mesentery and pelvic cavity. Masses in greater omentum and rectovesical pouch.	Symptomatic
4 74 y/F	No previous surgery	Obstruction of distal ileum by right obturator hernia.	Surgery refused
5 63 y/F	CA Cervix stage IIIB, in radiation therapy	Dilatation of jejunum and ileum. Thickening of wall of terminal ileum and ascending colon.	Intraoperative bowel decompression

## DISCUSSION

Radiologic images supplement the patient's signs and symptoms to establish or exclude a diagnosis of small bowel obstruction, determine the level and site(s), establish a cause, and predict whether strangulation is present. The causes of small bowel obstruction vary; in general, the most common being adhesions, hernias, and neoplasms.<sup>8</sup>

Plain abdominal roentgenographic findings serve as the basis for a diagnosis of small bowel

obstruction only 50-60% of the time.<sup>9,10</sup> They also can not be distinguished strangulating from non-strangulating obstruction easily. In the cases with strangulation, plain abdominal roentgenographic findings were positive in only 30% of the time.<sup>11</sup>

When the clinical picture or plain film examination does not lead to a diagnosis, further studies are necessary. Either small bowel series or barium enemas have been used in these situations. Our experience is that because most of



our patients do not seek medical help promptly, the small bowel series may require hours and peristaltic activity has been diminished. Furthermore the barium is diluted in the retained intestinal fluid. The point and cause of small bowel obstruction are difficult to be determined. Occasionally barium enemas are helpful in patients with distal small bowel obstruction when the barium refluxes into the terminal ileum.

The sensitivity of CT in diagnosing small bowel obstruction is 94-100%.<sup>1,5,6</sup> In one study the cause of obstruction was predicted correctly in 47 of 64 cases (73 %).<sup>1</sup>

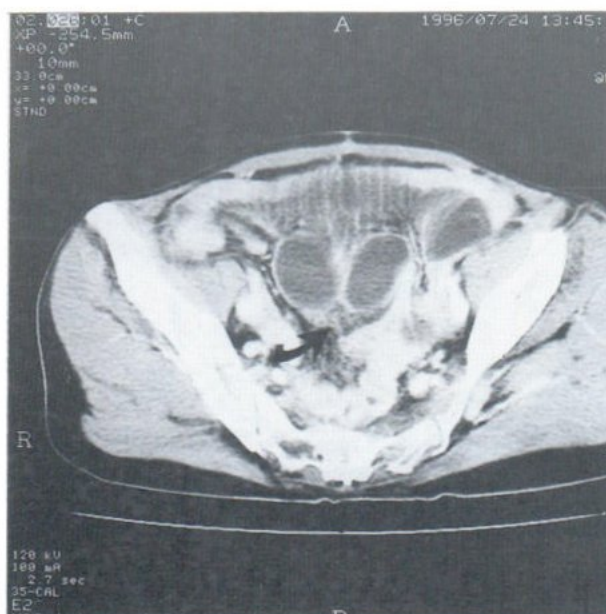
A great variety of obstructive processes can be demonstrated by CT. The diagnosis of adhesions is made after all other causes of obstruction have been eliminated.<sup>1</sup> Most adhesions cannot be seen.

Obturator hernia is rare as a cause of intestinal obstruction. It is difficult to be diagnosed and has a high mortality rate.<sup>12</sup> The characteristic clinical profile is an elderly, emaciated, ill woman with intestinal obstruction but no previous abdominal surgery. The incidence of correct preoperative diagnosis is 20-30%. The contents of an obturator hernial sac vary. Small bowel is most commonly encountered, the ileum being more frequent than the jejunum. There have been a few reported cases which have shown the usefulness of CT in diagnosing an obturator hernia causing small bowel obstruction.<sup>13,14</sup>

Intestinal obstruction in patients with previously treated cancer is common. It has occurred in up to 28% of patients with a history of colorectal cancer and 42% of patients with ovarian cancers.<sup>15</sup> The causes of obstruction include adhesions, peritoneal carcinomatosis, and radiation enteritis. A diagnosis of peritoneal carcinomatosis is based on demonstration of a mass or bowel wall thickening at the site of obstruction.<sup>16</sup>

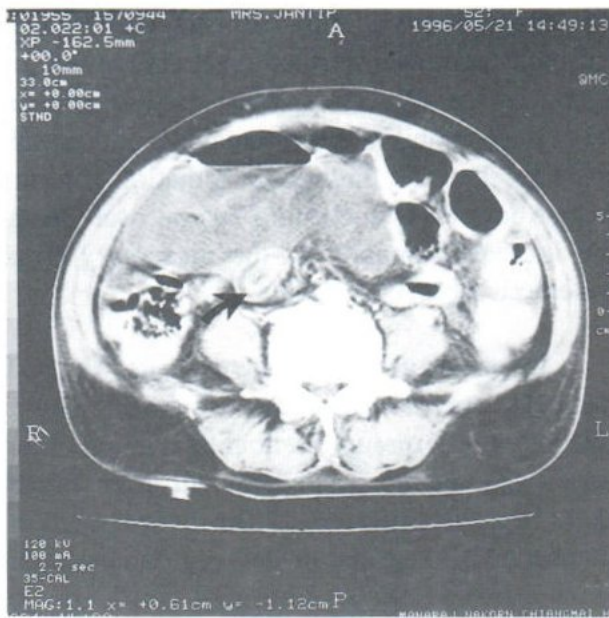
Regarding radiation enteritis, the ileum is the most common part of the small intestine injured by radiation therapy because the terminal ileum is less mobile than the remainder of the small intestine. The CT findings in radiation enteritis include bowel wall thickening, submucosal edema, and increased density of the mesentery from mesenteric fibrosis or edema.<sup>17</sup>

In strangulating obstructions, the CT findings are (1) evidence of small bowel obstruction; (2) circumferential thickening of the bowel wall, submucosal edema, air in the bowel wall, high attenuation of the bowel wall in unenhanced CT scans, or delayed enhancement of the bowel wall; and (3) fluid in the mesentery.<sup>16,18,19</sup> The sensitivity of CT in diagnosing strangulation in patients with bowel obstruction has been reported as 63%.<sup>20</sup> In a recent study,<sup>7</sup> the sensitivity was 100%, but the specificity is 61% because thickening of the bowel wall, submucosal edema, and fluid in the mesentery can be seen in other situations, such as inflammatory bowel disease, peritonitis, and radiation enteritis.

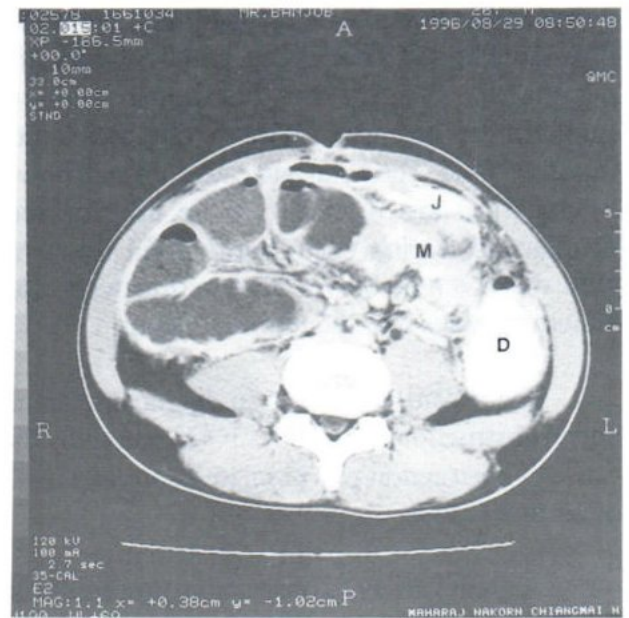


**Fig 1.** 42-year-old woman with ileal obstruction from adhesions. Note obstruction site adjacent to strands and inflammatory change in mesentery (arrow).

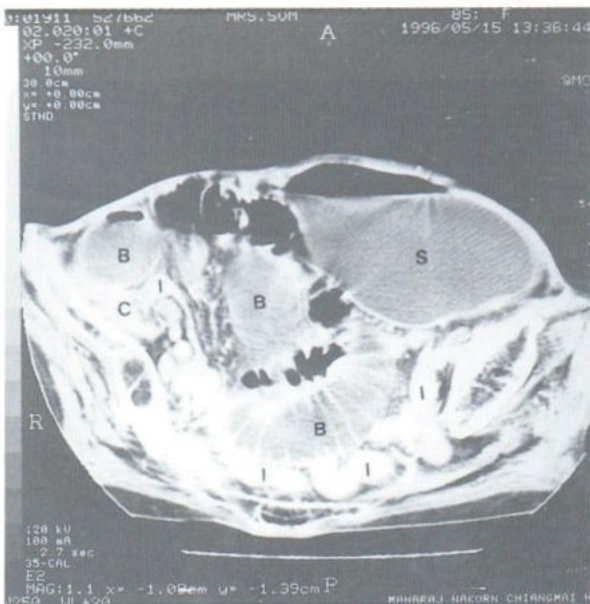




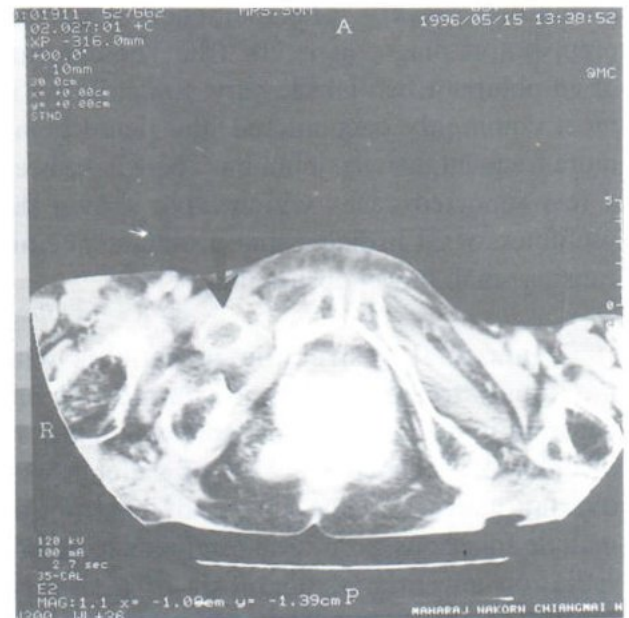
**Fig 2.** 52-year-old woman with strangulated ileal obstruction from adhesions. Note dilatation of small bowel loops, and submucosal edema (arrow).



**Fig 3.** 26-year-old man with small bowel obstruction from peritoneal carcinomatosis. Note dilatation of small bowel loops, soft tissue mass in the mesentery (M), and abnormal enhancement of the small bowel wall. Also note contrast medium in jejunum (J) and sigmoid colon (D) from bypass surgery.

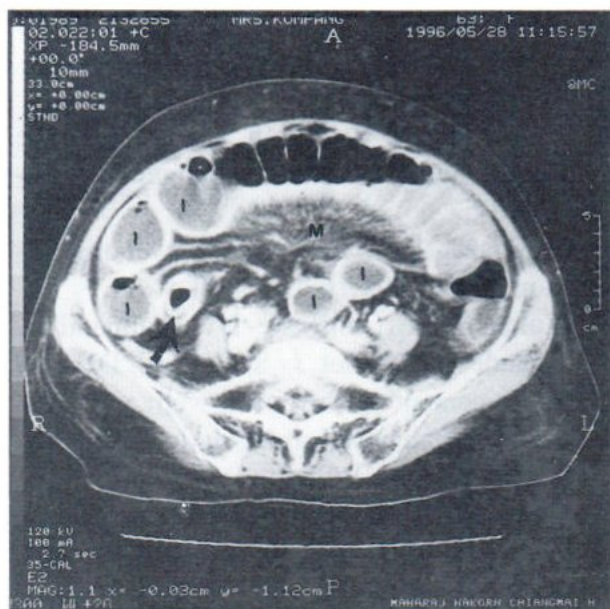


**Fig 4.** 74-year-old woman with small bowel obstruction from a right obturator hernia.  
4A: Note dilatation of stomach (S) and small bowel loops (B). The terminal ileum (I) and cecum (C) are not dilated.



4B: Note a small bowel loop in right obturator canal (arrow).





**Fig. 5.** 63-year-old woman with acute radiation enteritis. Note dilatation of small bowel loops, increased density of mesenteric fat (M), thickening of ileal wall (I), and submucosal edema of ileum (arrow).

## CONCLUSION

Since CT is expensive and a plain abdominal radiograph is sufficient for diagnosis in 50-60% of cases, the plain abdominal radiograph remains the primary radiologic method to diagnose intestinal obstruction. Because of the high sensitivity of CT in diagnosing small bowel obstruction, its rapidity, and its ability to diagnose bowel strangulation, CT is recommended in (1) patients with a possibility of small bowel obstruction with normal or nonspecific plain abdominal radiographs,<sup>16</sup> (2) patients with histories of abdominal malignancy and clinical symptoms of bowel obstruction;<sup>1</sup> (3) patients where obstruction is suspected and the patients have inflammatory disease, sepsis, a palpable abdominal mass, or a possibility of strangulation.<sup>18</sup>

Barium studies are recommended in patients with histories of recurring obstruction or low grade mechanical obstruction to define the obstructed segment precisely

## REFERENCES:

1. Megibow AJ, Balthazar EJ, Cho KC, Medwid SW, Birnbaum BA, Noz ME. Bowel obstruction: evaluation with CT. *Radiology* 1991;180:313-318.
2. Maglinte DDT, Gage SN, Harmon BH, et al. Obstruction of the small intestine: accuracy and role of CT in diagnosis. *Radiology* 1993;188:61-64.
3. Ha HK, Park CH, Kim SK, et al. CT analysis of intestinal obstruction due to adhesions: early detection of strangulation. *J Comput Assist Tomogr* 1993;17(3):386-389.
4. Gazelle GS, Goldberg MA, Wittenberg J, Halpern EF, Pinkney L, Mueller PR. Efficacy of CT in distinguishing small-bowel obstruction from other causes of small-bowel dilatation. *AJR* 1994;162:43-47.
5. Frager D, Medwid SW, Baer JW, Mollinelli B, Friedman M. CT of small-bowel obstruction: value in establishing the diagnosis and determining the degree and cause. *AJR* 1994; 162:37-41.
6. Frager DH, Baer JW, Rothpearl A, Bossart PA. Distinction between postoperative ileus and mechanical small-bowel obstruction: value of CT compared with clinical and other radiographic findings. *AJR* 1995;-164:891-894.
7. Frager D, Baer JW, Medwid SW, Rothpearl A, Bossart P. Detection of intestinal ischemia in patients with acute small-bowel obstruction due to adhesions or hernia: efficacy of CT. *AJR* 1996;166:67-71.
8. Mucha P. Small intestinal obstruction. *Surg Clin North Am* 1987;67(3):597-620.
9. Gough IR. Strangulating adhesive small bowel obstruction with normal radiographs. *Br J Surg* 1978;65:431-434.
10. Nelson SW, Christoforidis AJ. The use of barium sulfate suspensions in the study of suspected mechanical obstruction of the small intestine. *AJR* 1967;101(2):367-378.

11. Czechowski J. Conventional radiography and ultrasonography in the diagnosis of small bowel obstruction and strangulation. *Acta Radiol* 1996;37:186-189.
12. Lo CY, Lorentz TG, Lau PWK. Obturator hernia presenting as small bowel obstruction. *Am J Surg* 1994;167:396-398.
13. O'Connell G, Cole A. Obturator hernia: diagnosis through medical imaging. *Australas Radiol* 1995;39:306-308.
14. Roston AD, Rahmin M, Eng A, Dannenberg AJ. Strangulated obturator hernia: a rare cause of small bowel obstruction. *AJG* 1994;89(2):277-278.
15. Tang E, Davis J, Silberman H. Bowel obstruction in cancer patients. *Arch Surg* 1995;130: 832-837.
16. Megibow AJ. Bowel obstruction evaluation with CT. *Radiol Clin North Am* 1994;32(5):861-870.
17. DuBrow RA. Radiation changes in the hollow viscera. *Semin Roentgenol* 1994;-29:38-52.
18. Balthazar EJ. CT of small-bowel obstruction. *AJR* 1994;162:255-261.
19. Zalcman M, Gansbeke DV, Lalmand B, Braude P, Closset J, Struyven J. Delayed enhancement of the bowel wall: a new CT sign of small bowel strangulation. *J Comput Assist Tomogr* 1996;20(3):379-381.
20. Balthazar EJ, Birnbaum BA, Megibow AJ, Gordon RB, Whelan CA, Hulnick DH. Closed-loop and strangulating intestinal obstruction: CT signs. *Radiology* 1992;-185:769-775.