

Approach to Small Bowel Obstruction

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Small bowel obstruction (SBO) is very common, constituting about 20% of surgical admission for acute abdomen⁽¹⁾. Radiologist has an important role in assisting surgeon for therapeutic decision. Plain radiograph is usually the initial imaging modality because of its low cost and availability. However, the sensitivity of plain radiography is low, about 50-60%⁽²⁾. CT is the best imaging modality for diagnosis of SBO, and the accuracy is about 95%⁽³⁾. Moreover, CT is able to demonstrate strangulation, which is the serious complication of SBO. Other imaging modalities, such as US, small bowel follow-through study, and small bowel enteroclysis, are not as good as CT, but may be used as an alternative, if CT is not available or diagnostic.

Radiologists should address the following questions⁽⁴⁾:

1. Is the small bowel obstructed?

2. Where is the site of obstruction?
3. What is the cause of obstruction?
4. How severe is the obstruction?
5. Is there any complication?

Question 1: Is the small obstructed?

Size transition is the most important sign for SBO. Radiologists should search for changing of caliber, from dilated loops to normal or collapsed loops. If there is no transitional zone, adynamic ileus or pseudo-obstruction should be considered. Other signs of SBO at plain abdominal radiographs include step-ladder pattern, and string sign (Figures 1A, B).

Question 2: Where is the site of obstruction?

Radiologists should use workstation to search for transition point, by following small bowel retrogradely

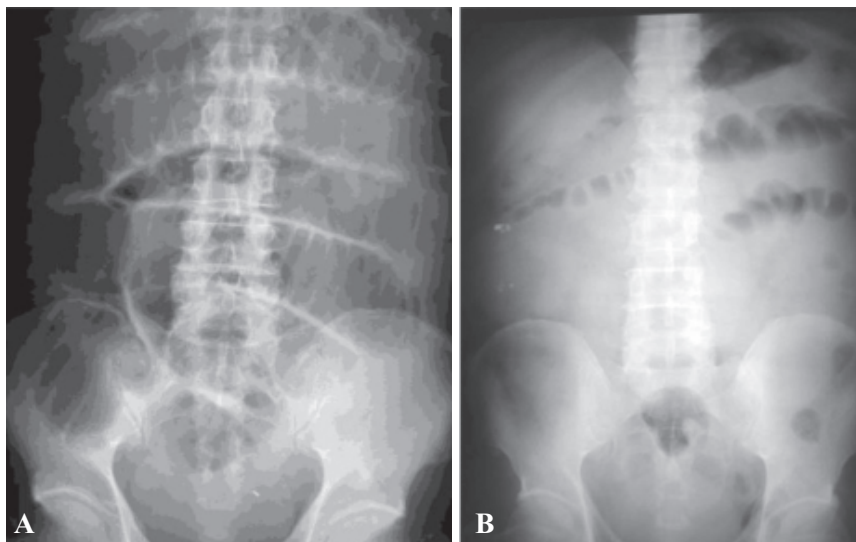


Figure 1. A. Step-ladder pattern of SBO; supine abdominal radiograph shows multiple dilated loops of small bowel, lying layer by layer, similar to multiple steps of the ladder.
B. String of pearl sign; upright abdominal radiograph shows two strings of air-fluid levels. This sign usually suggests predominantly fluid-filled small bowel loops.

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from cecum, or antegradely from stomach. SB feces sign is not common, but helpful sign⁽⁵⁾. If present, SB feces sign usually locates near the site of obstruction (Figure 2).

Question 3: What is the cause of obstruction?

Cause of obstruction is always at or near the site of obstruction. Causes of obstruction are numerous and could be categorized as following⁽⁴⁾:

1. Intrinsic conditions

1.1 Inflammatory diseases such as Crohn's, TB (Figure 3), and eosinophilic gastroenteritis

1.2 Neoplasms such as GIST, adenocarcinoma (Figure 4), lymphoma (Figure 5), and metastasis

1.3 Vascular diseases such as ischemia, vasculitis, and radiation enteropathy

2. Extrinsic conditions

2.1 Adhesion

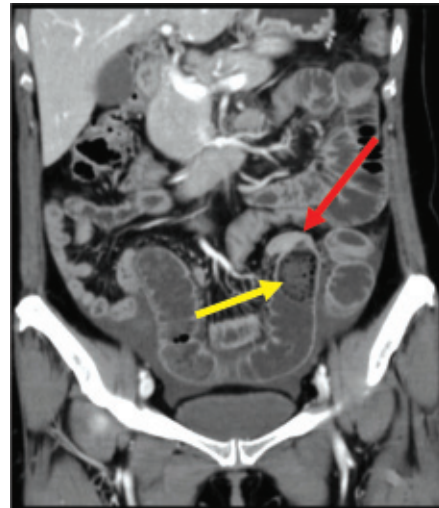


Figure 2. SB feces sign; coronal view of CT abdomen shows fecal material within the SB (yellow arrow), which usually signifies the site of obstruction (red arrow).

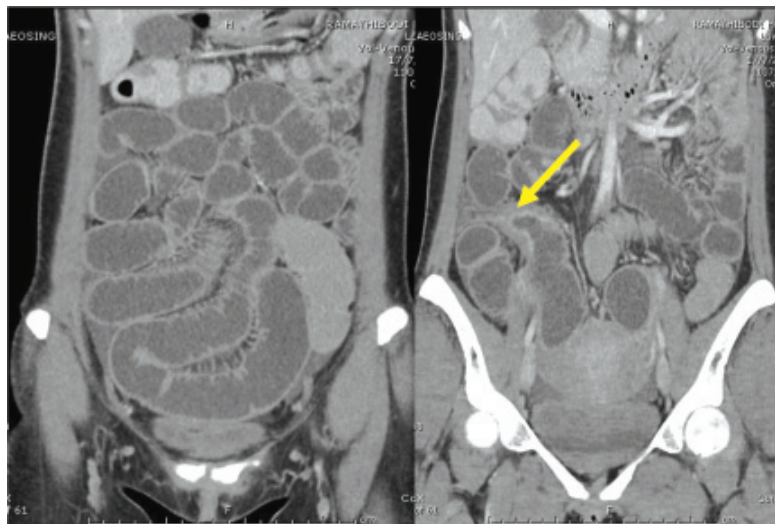


Figure 3. Tuberculosis as a cause of SBO; coronal views of CT abdomen show SBO and the site of obstruction is at distal ileum (arrow). The cause of obstruction is proved to be tuberculosis.

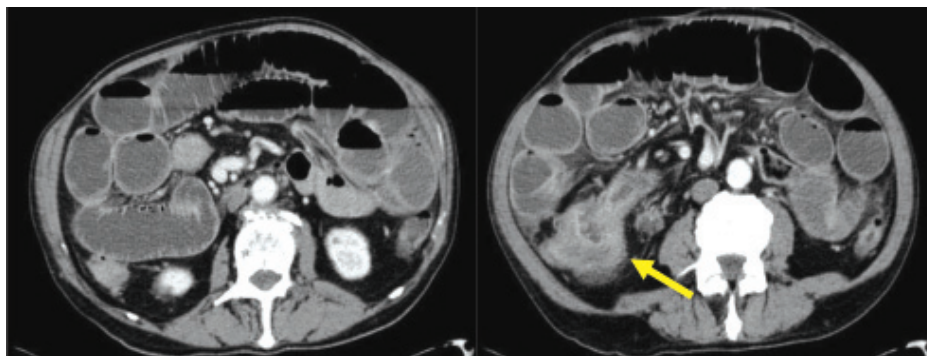


Figure 4. Cecal adenocarcinoma as a cause of SBO; axial views of abdomen show cecal mass (arrow) causing distal SBO. This mass is proved to be cecal adenocarcinoma.

- 2.2 Volvulus (Figure 6)
- 2.3 Hernias
- 2.4 Endometriosis
- 2.5 Hematoma
- 3. Intraluminal causes
 - 3.1 Gallstones (Figure 7)
 - 3.2 Bezoars
 - 3.3 Foreign bodies

The 3 most common etiologies in developed countries are adhesion, Crohn's disease, and neoplasms. The 3 most common etiologies in developing countries are adhesion, hernia, and neoplasms⁽⁴⁾.

Question 4: How severe is the obstruction?

Radiologists should try to distinguish high-grade SBO from low- to moderate-grade SBO. High-grade SBO tends to have serious complication, and may need urgent intervention. Criteria of high-grade SBO at plain radiographs includes 1) >3 sites of air-fluid levels, 2) >2 cm height difference in the same dilated loop, and 3) >2.5 cm diameter of dilated fluid-filled lumen. Criteria of high-grade SBO at CT includes 1) at least 50% difference in caliber between dilated and collapsed loops, 2) presence of SB feces sign, and 3) no passage of contrast beyond point of obstruction at 3-24 hrs⁽⁶⁾.

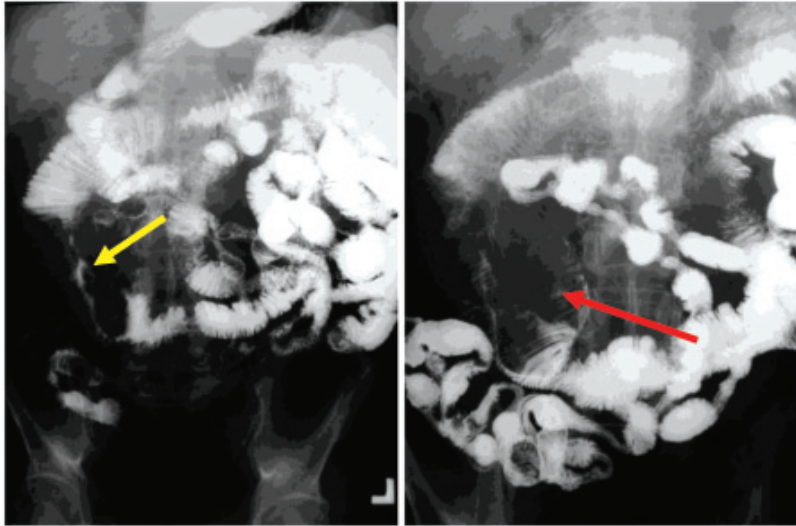


Figure 5. SB lymphoma as a cause of SBO; small bowel follow-through study shows string sign (yellow arrow) and coil-spring sign (red arrow) of intussusception. The leading point of intussusception is proved to be lymphoma.

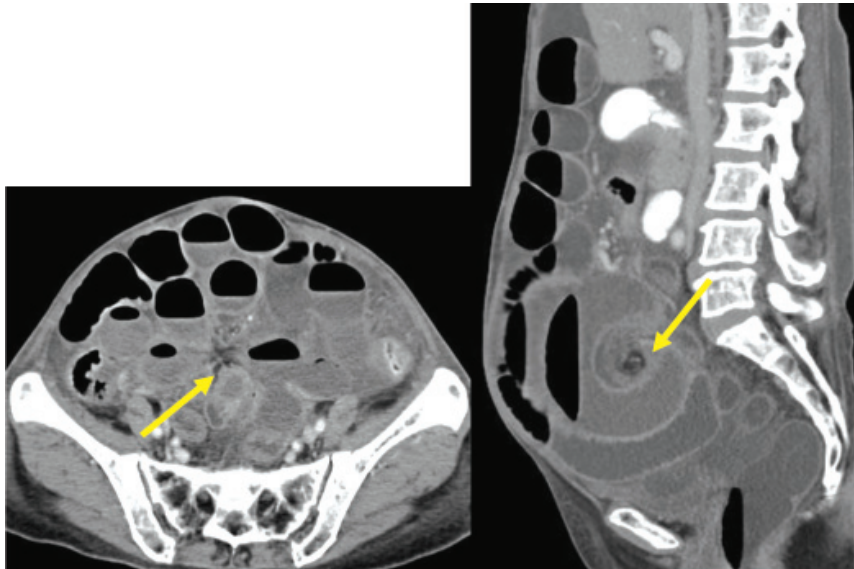


Figure 6. SB volvulus as a cause of SBO; axial and saggital views of the abdomen show swirling of the small bowel loops (whirl sign) around the twisting mesentery, consistent with SB volvulus.

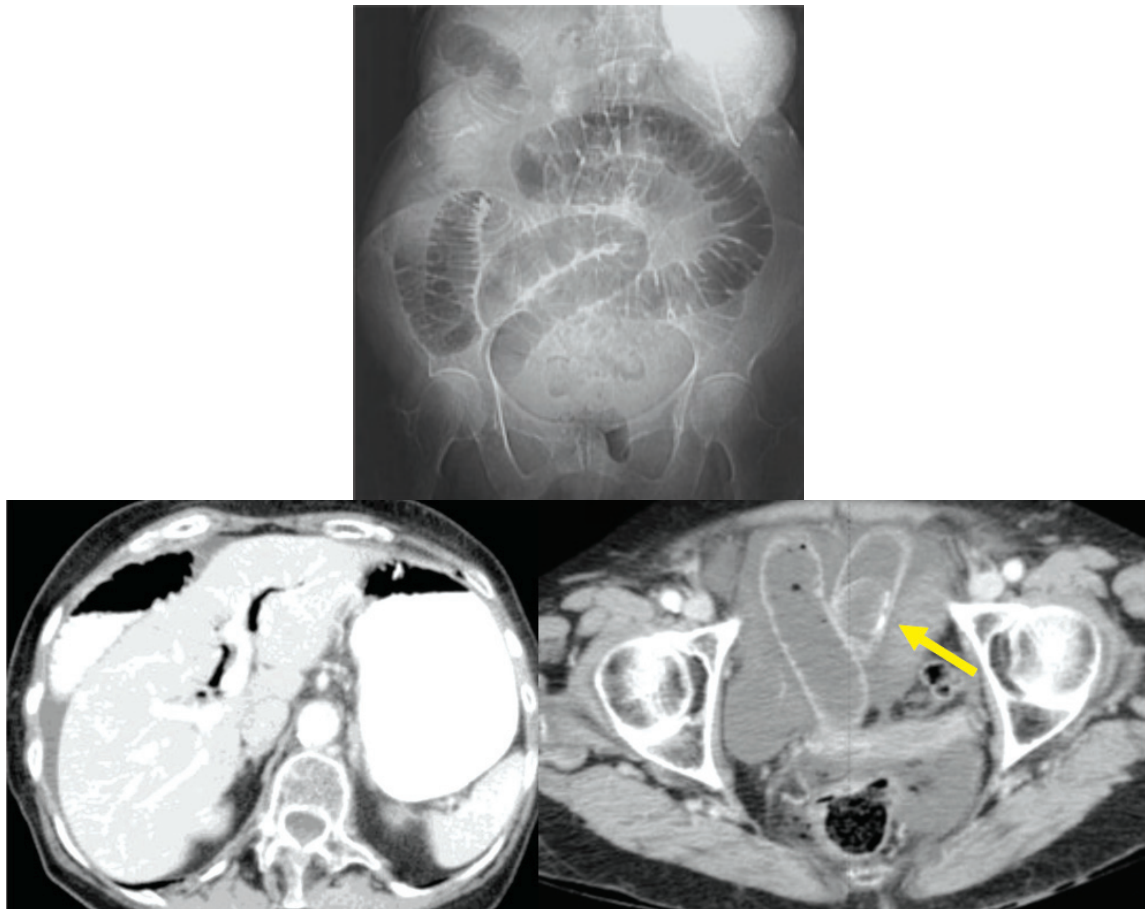


Figure 7. Gallstone ileus as a cause of obstruction; scout view of abdomen shows SBO. Axial views of CT abdomen show aerobilia, and ectopic gallstone (arrow) within small bowel loop. SBO, aerobilia, and ectopic gallbladder are called Rigler’s triad of gallstone ileus.

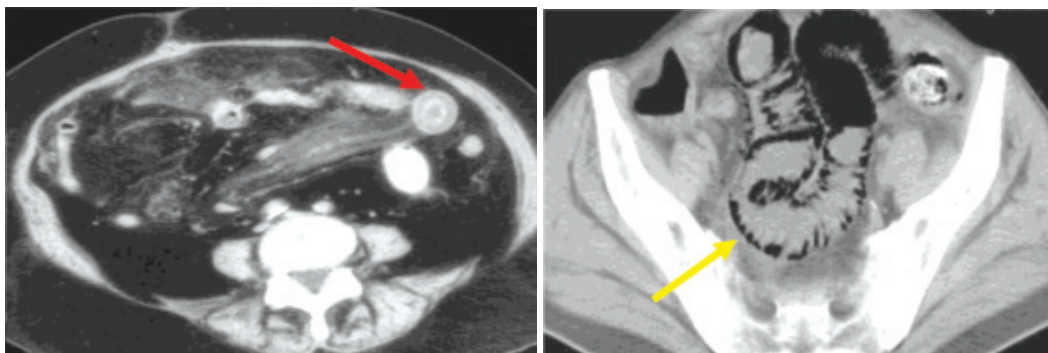


Figure 8. SB strangulation, a serious complication of SBO; axial CT views show pneumatosis intestinalis (yellow arrow), and target sign (red arrow) of ischemic small bowel loop.

Question 5: Is there any complication?

Two serious complications are closed-loop obstruction, and strangulation⁽⁷⁾. These complications are urgent conditions that need immediate surgical inter-

vention. CT findings indicating closed-loop obstruction include U- or C-shaped loop with converging mesenteric vessels, whirl sign, and beak or twisted sign. CT findings indicating strangulation include lack of

wall enhancement, halo or target sign associated with mesenteric fluid, and pneumatosis intestinalis as well as air within SMV or PV (Figure 8).

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