

# 28

## BOWEL OBSTRUCTION



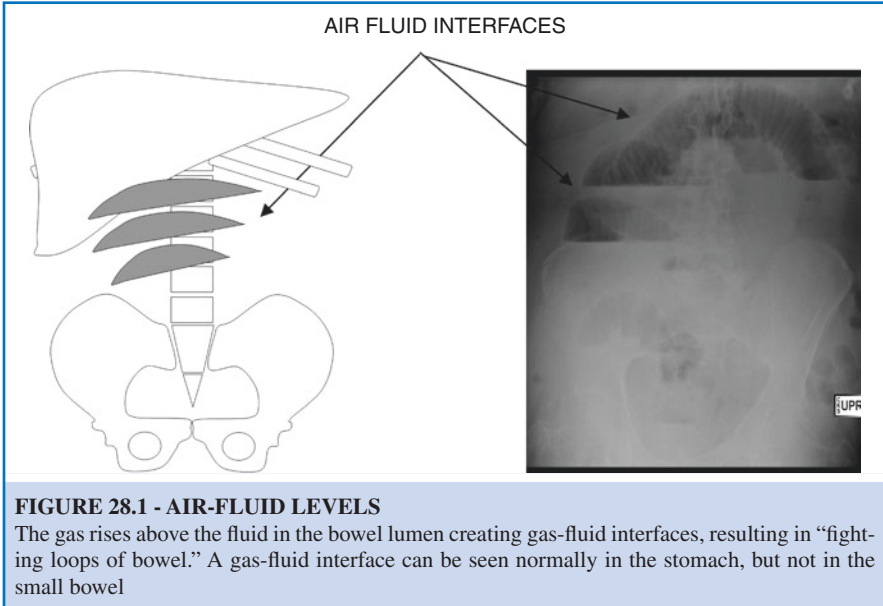
### Objectives:

1. Describe the radiographic findings of large and small bowel obstruction.
2. List criteria used to distinguish bowel obstruction from ileus.
3. Define the term “air-fluid level.”
4. Understand the advantages and disadvantages of conventional radiography and CT in the evaluation of bowel obstruction.

Gas is normally present in the stomach and colon. Small accumulations of gas may be found in the duodenum and upper portion of the jejunum as well. Scattered collections of gas may be present throughout much of the small intestine in physically inactive patients, patients on narcotics, and those who swallow large amounts of air habitually. Air can be seen as individual accumulations of rounded or ovoid-shaped lucency. If a single loop of normal intestine can be recognized because of gas filling, the shadow is seldom more than 5–8 cm in length. More often, the gas does not form any specific loop pattern. Conventional radiography is a useful and efficient means of evaluating for bowel obstruction. It is readily available, requires little to no patient preparation, is relatively low cost, and exposes the patient to minimal ionizing radiation. Abdominal radiography also serves as means to triage patients for additional (i.e., cross-sectional) imaging.

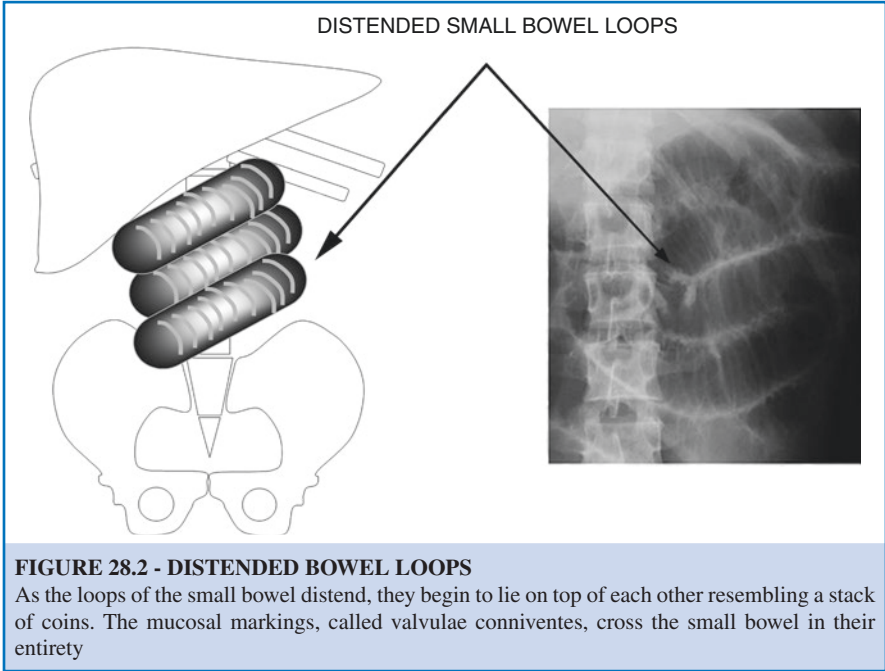
### Small Bowel Obstruction

When individual segments of small intestine are dilated 3–4 cm in transverse diameter, one should consider the possibility that the gas pattern is abnormal. Radiographic findings in small bowel obstruction develop over time as fluid and gas build up proximal to the obstructive process.



Gas is visualized readily in supine radiographs, but the presence of fluid can only be confirmed on upright or decubitus views. In the upright view, the gas rises above the fluid, and the interface between gas and fluid forms a straight horizontal margin: an air-fluid level. Figure 28.1 demonstrates an air-fluid level in the small bowel. Air-fluid levels are generally considered to be abnormal in the small intestine. (Note that an air-fluid level is normally observed in the stomach because swallowed air is almost invariably present.) Air-fluid levels may be seen in the first portion of the duodenum where air may be trapped temporarily when the patient assumes the upright position. In the early stage of obstruction, only one or two such gas-distended segments are visualized. With increasing time, more distended loops may become visible. For this reason, serial examinations may be necessary for the diagnosis of small bowel obstruction. As distension increases, more loops become visible, and they tend to lie transversely at different levels, forming so-called fighting loops. Gas-filled loops may be recognized as small intestine rather than colon when they occupy the central portion of the abdomen rather than the periphery. Also, the pattern of mucosal folds in the small bowel, the valvulae conniventes, is finer and closer together than the colonic haustra. Unlike the haustral markings of the colon, these folds traverse the entire width of the bowel loop (Fig. 28.2). This is referred to as the “stack of coins” appearance.

When two gas-filled loops of bowel lie adjacent to one another, the soft tissue density between them represents a double thickness of intestinal wall. Thus, information concerning wall thickness is available. In a simple obstruction, a double thickness of intestine wall seldom amounts to more than a few millimeters in width, since the walls are thinned considerably by the distension. Inflammatory changes in



the wall or fluid in the peritoneal cavity interposed between the bowel loops result in a thickening of this soft tissue shadow. Abnormal thickening of the bowel wall indicates a more complex process, such as underlying inflammation, edema, or ascites. If obstruction of the small intestine is complete, little or no gas will be found in the colon, a valuable differentiating point between mechanical obstruction and ileus. However, it is important to note that small bowel obstruction can also present with a conspicuous absence of gas in the abdomen when the small bowel loops are entirely fluid filled.

If the obstruction is very proximal in the small intestine or if the patient has been decompressing the obstruction by vomiting, or if a gastric or biliary tube is in place providing decompression, the gas and fluid which would normally accumulate above an obstruction may not be present, and the typical findings may not be seen on the radiograph.

## Large Bowel Obstruction

Gas is normally present in the colon. Because of this, the diagnosis of colonic obstruction (large bowel obstruction) may be made only when the colon is thought to be dilated from the cecum to the level of the lesion. Usually the abnormally



**FIGURE 28.3 - TOTAL COLONIC OBSTRUCTION**

Note the dilated, air-filled colon from the cecum to the proximal sigmoid. The cecum measures roughly 10 cm transversely

distended colon ends abruptly at the level of the lesion with the colon distal to the lesion free of gas. This is similar to what was previously discussed for the small bowel, and the principle is the same. Namely, distended bowel is found proximal to the obstruction. There is a paucity of gas distal to the obstruction with time. The large bowel is considered pathologically dilated when the diameter is greater than 7 cm in the left colon or greater than 9 cm in the cecum. Figure 28.3 shows the plain abdominal radiograph of a patient with a total colonic obstruction. Can you identify the point of obstruction?

The most likely site for obstruction of the large bowel, as might be expected, is in the rectosigmoid region since this is the most common site for colon carcinoma. The cecum undergoes the greatest distension in colonic obstruction and is the most likely site for perforation even when the obstruction is in the more distal colon. When the ileocecal valve is incompetent and the colon can decompress into the ileum, there is a lower likelihood of perforation. When the cecum distends to ten or more centimeters, perforation becomes a more likely possibility. Fluid levels are of less significance in the diagnosis of colonic obstruction than they are in the small bowel.

Another cause of large bowel obstruction is volvulus. Occurring typically in either the sigmoid colon or the cecum, volvulus refers to a twisting of the bowel around the mesentery, resulting in a closed loop obstruction and proximal bowel

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dilation. Sigmoid volvulus is most common in elderly patients and on x-ray characteristically demonstrates a large air-filled bowel loop above the transverse colon known as the “northern exposure” sign as seen in Fig. 28.3. Cecal volvulus occurs in younger adults and often demonstrates an air-filled loop of large bowel located in the left upper quadrant.

## Evaluation for Obstruction

Computed tomography (CT) is generally considered the study of choice for further evaluation and characterization of obstruction, though at the expense of additional ionizing radiation to the patient. The zone of transition, presence of pneumoperitoneum or free fluid, degree, and etiology of obstruction may all be identified via CT. In addition, CT is readily available, requires minimal patient preparation, and is rapidly performed, allowing for quick triage of the acutely ill patient.

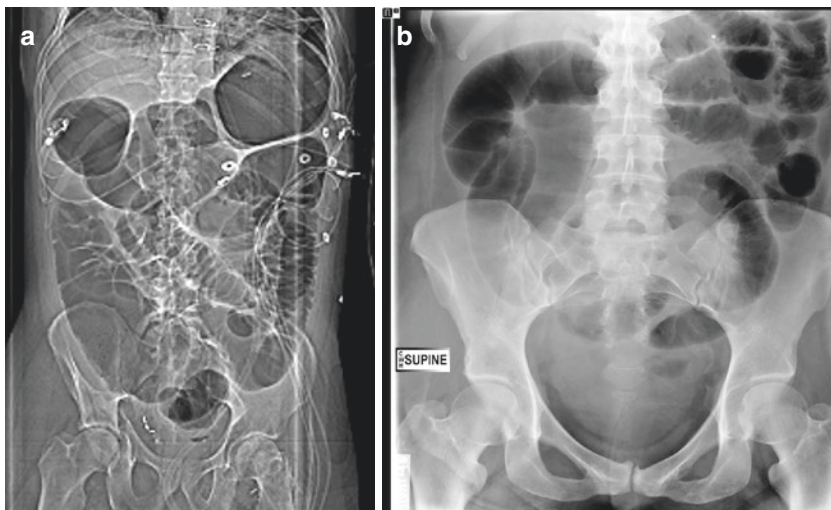
Given the diagnostic yield and ready availability of CT, contrast fluoroscopic evaluation has become less common in the evaluation of obstruction. However, this modality still has significant diagnostic yield as it can be utilized in the simultaneous localization and quantification of obstructive processes. If the location of an obstruction is not known, the colon is studied first, typically with a retrograde (enema) examination. In the setting of suspected obstruction or leak, only water-soluble contrast should be used, as barium-based contrast agents may result in intraluminal barium concretions or peritonitis secondary to peritoneal spillage of contrast.

In evaluating small bowel obstructions, the same principles apply. However, dilute water-soluble contrast is typically administered orally or via an existing gastric tube. Multiple serial radiographs are then taken over the ensuing time period until the contrast can be identified in the colon.

## Ileus

There are many conditions which may reduce the motility of the large and small bowel. When this occurs, gas will accumulate within the bowel, giving a distended appearance both clinically and radiographically (Fig. 28.4). Note that the stomach and large and small bowel are all affected in equal proportion suggesting a diffuse rather than focal abnormality. These findings may be useful in distinguishing ileus from bowel obstruction, although certainly this differentiation can be difficult in some patients.

Occasionally, ileus can present focally without diffuse bowel distention. Focal ileus is caused by local inflammation that impairs motility of a small segment of bowel. On plain radiography, this has the appearance of a single dilated bowel loop



**FIGURE 28.4 - ILEUS**

Supine scout CT image (a) and radiograph (b) of two separate patients with ileus. Noted are multiple dilated, gas-filled small and large bowel loops measuring up to 5.5 cm in diameter throughout the abdomen and the upper portion of the pelvis. Equally distended loops of large bowel are seen extending down to the rectum

which can be similar in appearance to bowel obstruction. CT can be used to differentiate ileus from bowel obstruction and to find the etiology for the ileus (e.g., appendicitis, diverticulitis, cholecystitis, etc.). A focal loop of ileus, known as a “sentinel loop,” can have the same appearance as an early small bowel obstruction. Serial clinical exams and follow-up radiography may be of use in further differentiation.

## Mucosal Edema

Finally, the bowel wall may become edematous either in the presence of or the absence of obstruction. This is characterized by mucosal edema termed “thumb-printing.” Bowel edema can be the result of infectious processes (i.e., *C. difficile*), intramural hemorrhage, or ischemia, among other causes.

Figure 28.5 demonstrates a prominent transverse colon with thickened haustra. This usually indicates edema of the bowel wall. The acute development of these findings is concerning, and further diagnostic evaluation with CT is warranted. Conditions which chronically inflame the colon may give a similar appearance. Hence, as in all radiographic interpretations, the clinical history is essential.



**FIGURE 28.5 - LARGE BOWEL THUMBPRINTING**

There is the suggestion of bowel wall thickening with thumbprinting of the transverse and descending colon (*arrows*)

- S:** The rapid assessment and triage of acute bowel abnormalities can be accomplished via conventional radiography, fluoroscopy, and CT, all of which are readily available, quickly performed, and relatively noninvasive. The amount of radiation from each increases from radiography to fluoroscopy and CT.
- A:** Radiographs and CT are indicated in the initial and follow-up assessment of acute bowel abnormalities, particularly suspected bowel obstruction.
- F:** An understanding of the anatomy and radiographic appearance of bowel obstruction, ileus, pneumoperitoneum, and other acute bowel abnormalities is necessary for the accurate interpretation of radiographic and CT exams. As an example, recognizing a focal transition point of obstruction on CT examination is invaluable during the ensuing surgical intervention.
- E:** It is of paramount importance to recognize acute bowel abnormalities, such that appropriate triage and management can occur without increase in morbidity or mortality. Acute abdominal abnormalities, including pneumoperitoneum and obstruction, should be communicated to the ordering service verbally as soon as possible.