

Abdominal x rays made easy: abnormal intraluminal gas

Got a blockage in your learning? Let **Ian Bickle** and **Barry Kelly** help by explaining bowel obstruction and other causes of abnormal intestinal gas, in the second part of our series on abdominal radiographs

On an abdominal radiograph, as with all plain film images, four densities can be seen—white, grey, slightly darker grey, and black—representing bone, soft tissue, fat, and air. Metallic objects are seen as intense bright white. The abdominal radiograph is a representation of the abdominal viscera and bowel: the presence of gas in most instances is normal. Several medical and surgical conditions, however, are recognisable by an abnormal amount, distribution, or location of air on the radiograph. Abnormal gas can be (a) intraluminal, in the stomach, duodenum, and intestine, or (b) extraluminal—that is, elsewhere.

Large bowel obstruction and paralytic ileus

Most intraluminal gas is in the large intestine, which has the greatest luminal diameter of the intestinal tract. A diameter of more than 5 cm suggests a large bowel obstruction and would be considered abnormal (except in the caecum). As the intestine is a large long tube, any obstruction, either from within or by external compression, prevents the passage of faecal material and gas. Consequently, both will build up proximal to the obstruction, causing dilation.

Unless the ileocaecal valve is incompetent this gas-faecal material mix will be contained entirely within the large bowel. With time, the passage of a motion will empty any faecal material and gas distal to the blockage. This gives the appearance of a “cut off” point on the radiograph (fig 1). This is an important sign to appreciate, as it is indicative of a mechanical large bowel obstruction.

The large bowel can also dilate with paralytic ileus. In this condition, the bowel is aynamic (not undergoing normal peristalsis). This allows gas—which everyone swallows normally—to accumulate in the bowel, but importantly this air is contained within both the small and large bowel (fig 2). There is also no evidence of a “cut off” as it is bowel peristalsis, not obstruction, that is the problem.

Two other pertinent radiological signs help confirm that it is the large bowel that is obstructed. Firstly, large bowel has distinct transverse bands, termed haustra. These do not cross the full diameter of the bowel, unlike the transverse valvulae conniventes of



Fig 1. Large bowel obstruction

the small bowel. These can both be seen on plain radiograph.¹ Secondly, large bowel is found at the radiograph’s periphery as opposed to the small bowel loops, which take up central positions. This has been referred to as a “picture frame” of large bowel and the “picture” of small bowel within the frame.

Small bowel obstruction

In small bowel obstruction, dilated small bowel loops are seen centrally on the radiograph. The valvulae conniventes should be visible across the whole width of this dilated bowel. The dilated bowel diameter is greater than 3 cm but usually less than 5 cm. There are likely to be several dilated bowel loops. The number of small bowel loops gives an indication of the level at which the obstruction within the small bowel has occurred: the higher the obstruction, the fewer the number of loops seen. Unlike large bowel obstruction (table), no gas should be seen within the large bowel (fig 3).

So far we have considered supine abdominal radiographs. An erect film may show further evidence of small bowel obstruction: fluid levels, indicating an air-fluid interface. An erect film tends to show multiple small



Fig 2. Paralytic ileus

fluid levels, a “stepladder” appearance (fig 4).

Volvulus

A volvulus is the twisting of bowel about its mesentery, causing intestinal obstruction. The two most common sites are the sigmoid and the caecum. With a sigmoid volvulus, an extremely dilated loop of sigmoid bowel forms two large compartments which look like a coffee bean (hence the name of the sign). This single loop usually fills most of the lower abdominal radiograph. On erect abdominal radiographs a fluid level may be noted.

Comparison of large and small bowel obstruction features

Feature	Obstruction	
	Small bowel	Large bowel
Bowel diameter (cm)	>3 and <5	>5
Position of loops	Central	Peripheral
Number of loops	Many	Few
Fluid levels (on erect film)	Many, short	Few, long
Bowel markings	Valvulae (all the way across)	Haustra (partially across)
Large bowel gas	No	Yes



Fig 3. Small bowel obstruction—supine

In caecal volvulus, the caecum is displaced to the upper left abdominal quadrant from its normal location (the right lower quadrant). This leaves the area empty so the term “empty caecum” is used. The volvulus usually consists of a single loop, again showing a fluid level on an erect radiograph. Distal to the volvulus the large bowel is empty.

Toxic megacolon, acute pancreatitis, duodenal obstruction, and meteorism

Toxic megacolon, seen in inflammatory bowel disease (especially ulcerative colitis), has an associated risk of bowel perforation. It is seen as grossly dilated large bowel, typically the transverse colon, with “thumb printing” evident (fig 5).

In acute pancreatitis a small sentinel loop (a collection of intraluminal gas) of bowel may be seen: the inflamed pancreas paralysing the adjacent bowel, making it adynamic. Duodenal obstruction, congenital or acquired, gives the appearance of two gas bubbles, one in the duodenum and the normal gastric air bubble; this is termed the “double bubble” sign.

Meteorism (excessive swallowed air) is particularly common in crying children and hyperventilating adults. Although there are prominent bowel loops, there is no cut off point: the bowel has been likened to crazy paving (fig 6).

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Next month: Abnormal extraluminal gas

1 Bickle IC, Kelly B. Abdominal x rays made easy: normal radiographs. *studentBMJ* 2002;10:102-3. (April)



Fig 4. Small bowel obstruction—erect



Fig 5. Toxic megacolon



Fig 6. Meteorism