Emergency radiology of the large-bowel: What radiologists should know

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Learning objectives

The aim is to demonstrate a spectrum of imaging findings of colonic pathologies found in emergency examinations. To clarify their clinical and imaging mimics as well as differential key features.
Background

Acute pathologies of the large-bowel are very common but even classic causes like diverticulitis can vary and show different complications such as pylephlebitis. Additionally, emergency scenarios of the large-bowel do not always have their origin in typical colonic pathologies. CT can be crucial in making the right diagnosis and distinguishing pathologies that can be treated conservatively from surgical causes of an acute large-bowel abdomen.
Findings and procedure details

Patients with acute large bowel pathologies present with unspecific abdominal pain and the cause of acute pain does not necessarily have to be related to acute infectious diseases.

Diverticulitis:

The prevalence of diverticulosis in industrial countries is increasing with age, e.g. 70 to 85 year old patients with 50% and over 85 year old patients with 66%. Also the incidence of diverticulitis - especially in younger patients - increased over 50% within the last seven years. In fact the mortality rate is higher when diverticulitis complicates (1).

An usual diverticulitis presents in CT examinations with thickened large bowel wall and surrounding fatty tissue involvement (Figure 1). Complications might be an abscess formation (Figure 2), a perforation, fistula or a thrombosis of the mesenteric or portal vein - i.e. pylephlebitis (Figure 3). Pylephlebitis is a rare complication of diverticulitis but diverticulitis is the number one cause of suppurative thrombophlebitis of the inferior mesenteric vein. It has a high mortality rate due to its ascending possibility with involvement of the portal vein and liver, causing abscesses (2,3).

Colonic cancer:

A differential diagnosis to acute pain due to diverticulitis is colonic cancer (4). A sudden onset of pain is often related to obstruction with or without proximal colitis. Especially the rectosigmoid is affected. In contrast to diverticulitis mostly just a small segment is involved. A possible metastatic spread to lymph nodes and other organs, e.g. the liver, should be in focus of imaging evaluation (Figure 4).

Non-touch "colon":

Acute onset of pain can also occur due to epiploic appendagitis or an omental infarction. Both pathologies can present clinically and radiologically very similar and do not need surgical treatment. However, there are a few radiological clues of differentiation: Epiploic appendagitis is a well circumscribed inflammation of fat tissue (epiploic appendage) adjacent to the colonic wall and measures mostly 1.5-3.5 cm (Figure 5) (5). In contrast an omental infarction presents as an encapsulated mass of the omental fat and measures mostly >5 cm (Figure 6) (5). In both cases the colonic wall is mostly not effected.

Volvulus:
Volvulus occurs due to a twisting of the intestine along their feeding vessel cords causing an obstruction. The greater the twist (≥360°), the lower the possibility of the volvulus to resolve spontaneously (4). Thus resulting in an emergence closed loop obstruction.

Sigmoid volvulus is by far the most common volvulus and occurs three to four times more common than caecal volvulus (4). In sigmoid volvulus the large bowel is distended proximal to the twisted segment, leaving a gasempty rectum (Figure 7a). A caecal volvulus can be present in case of a caecum mobile, allowing the caecum to twist due to its missing fixating peritoneal attachment. In contrast to sigmoid volvulus not only the rectum but also the other colonic portions (distal to caecum) present gasempty (Figure 8a). Both types of volvulus can present similar radiologic signs, like the coffee bean sign (dilatation of the twisted bowel loop in which the inner walls of the loop form the coffee bean cleft and the outer walls form the bean - in caecal volvulus also often described as the kidney bean sign) or the whirl sign (twisted vessels create a whirl impression) (4,6). However on CT slices the diagnosis might be challenging and a look at scout images can give the radiologist an overview needed to see the amount of dilated bowel loops (Figure 9). Also the whirl sign might be only visible in just one dimension of CT slices making it crucial to review reformatted CT slices (Figure 7b axial, Figure 8b coronal).

**Other examples / causes of colitis:**

- **Segmental:**

  A neutropenic colitis, also known as typhilitis, is a special form of colitis affecting immunosuppressed patients, e.g. due to neutropenia, leukemia, hematopoietic stem cell transplantation (HSCT) (7). Typically caecum and ascending colon are affected and show distinctive bowel wall thickening (Figure 10).

  A segmental manifestation of colitis is usually also present in ischemic colitis caused by an insufficient vascular supply and intestinal ischemia. It can involve the right colon from caecum to splenic flexure (supplied by superior mesenteric artery), the left colon from the splenic flexure to the rectum (inferior mesenteric artery) or the watershed areas, especially in cases of hypoperfusion (8). In sever cases of ischemia also intramural or portal venous gas can be present (Figure 11).

- **Pancolitis:**

  Another cause of colitis might be due to an antibiotic treatment allowing an overgrowing spread of Clostridium difficile within the large bowel, causing a pseudomembranous colitis. In these cases rectal involvement is present in the majority of patients (90-95%) and typically extending along the whole colon (9).

However, a pancolic involvement does not need to be caused by Clostridium difficile. The origin can be also an underlying disease of the patient, e.g. cystic fibrosis (Figure 12).
Fig. 1: A 64-year old patient with sigmoid diverticulitis presenting with thickened large bowel wall (orange arrow) and adjacent fatty tissue inflammation (green arrows).

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Fig. 2: A 71-year old patient shows an abscess formation (yellow arrows; a,c) due to a complicated diverticulitis (orange arrows; b,d).

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Fig. 3: A 57-year old patient with sigmoid diverticulitis (green arrows; a,b) complicated by pylephlebitis of the inferior mesenteric vein (blue arrows; c,d).

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**Fig. 4:** A 65-year old patient presented with lower abdominal pain caused by an obstruction of colonic carcinoma (red arrow; a). Adjacent lymph node metastases (purple arrow; a) and liver metastases (asterisk; b) were already present by the time of diagnosis.

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**Fig. 5:** A 39-year old patient with epiploic appendagitis (arrows) clinically mimicking a sigmoid diverticulitis.

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**Fig. 6:** A 67-year old patient with omental infarction (arrows). Note the size discrepancy to the epiploic appendagitis in figure 5.

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**Fig. 7:** A 94-year old patient with sigmoid volvulus already evident on the scout image due to the coffee bean sign (a) and the gasempty rectum. In the axial CT images the whirl sign is present (circle; b) and dilated bowel loops (asterisk; b). The change in caliber due to the volvulus is also visible (arrow; c).
Fig. 8: A 54- year old patient with caecal volvulus shows a kidney bean sign on scout images (a) and a gasemty ascending colon up to the rectum. A whirl sign is visible on sagittal CT slices (circle; b) with caecal dilatation (asterisk; b), which is displaced to the left hemiabdomen.
**Fig. 9:** Comparison of scout images of figure 7 and 8 showing a sigmoid volvulus (a) and a caecal volvulus (b). Note the difference of large bowel distention with a nearly complete distended colon in sigmoid volvulus and only caecal distension in caecal volvulus.

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**Fig. 10:** A 53-year old patient with neutropenic colitis (typhilitis) of the ascendic colon (orange arrows). No involvement of the other colon, e.g. descending colon (green arrows) was visible.
**Fig. 11:** A 69-year old patient with ischemic colitis (open arrows; c,d) as a complication of prior dissection of the aorta involving the superior mesenteric artery (arrow; b). Mesenteric and intrahepatic portal venous gas was present (circles; a,d).

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Fig. 12: Pancolitis (green arrows; a-d) due to cystic fibrosis with typical abdominal manifestations: pancreatic lipomatosis (yellow arrows; a,b), gallstones (purple arrow; b), renal stones (orange arrow; c).

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Conclusion

Acute abdomen of the large-bowel can be seen in daily routine. However, the causes vary, can be challenging and have different therapeutic approaches. Emergency-CT examinations are mostly essential to guide the right therapy.
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References