

Multidetector Computed tomography of Crohn's disease: a Pictorial Review.

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Learning objectives

- To understand the pathophysiology, clinical manifestations and disease spectrum of Crohn's disease;
- To illustrate the important radiological features of Crohn's disease that can allow a correct differential diagnosis in the setting of acute bowel disease.

Background

Crohn's disease is a systemic disease that can involve any portion of the gastrointestinal tract, although the small bowel is the most commonly affected portion of the bowel, particularly the distal ileum (80%). However, a significant proportion also has colonic involvement and up to 20% of patients have large bowel involvement only. [3]

Crohn's lesions have a segmental and asynchronous distribution.[5,7]

Approximately 20% with small or large bowel involvement also have perianal disease, while perianal disease alone is rare.

The initial presentation of disease is variable and can involve recurrent abdominal pain, diarrhea, fever, and obstruction. After the initial diagnosis up to 50% of patients relapse.

The cause of Crohn disease is not known, although several factors are believed to be involved including: [11]

- Infections (measles virus and atypical mycobacterium)
- Intestinal mucosal immune system abnormalities;
- Genetic;
- Vascular alterations;
- Diet;
- Psychogenic factors.

Crohn disease is more common in northern Europe and North America, with both genders equally affected and peak involvement in persons between 15 and 25 years of age.

However, approximately 15% of the cases of Crohn disease manifest in individuals older than 50 years of age. [2]

A familial tendency has been described with an increased risk of ulcerative colitis in relatives.

The earliest change caused by the disease occurs in the submucosa and consists of lymphoid hyperplasia, lymphedema and aphthoid ulcers. As the disease progresses, it extends transmurally to the serosa (*transmural stage*) and to the surrounding perienteric fat and mesentery (*extramural stage*).

Aphthoid ulcers develop into linear ulcers to produce an ulceronodular or "cobblestone" appearance. The bowel wall is thickened by a combination of fibrosis and inflammatory infiltrates. [5,6,9]

Bowel obstruction, strictures, abscesses or phlegmon, fistulas are common complications of advanced disease.

Although rare, both small bowel and colonic adenocarcinoma and lymphoma may also occur. [1,4]

Findings and procedure details

Crohn disease remains a difficult entity to diagnose clinically. While involvement of any segment of the gastrointestinal tract is possible, the disease most often affects the distal ileum, making direct endoscopic evaluation and biopsy difficult. Moreover, symptoms tend to be nonspecific, and there are no clinical symptoms or laboratory markers that allow a specific diagnosis.

While involvement of the small bowel is more common, Crohn's disease can also involve the large bowel, and in some cases, affect only the large bowel without small bowel involvement. [3]

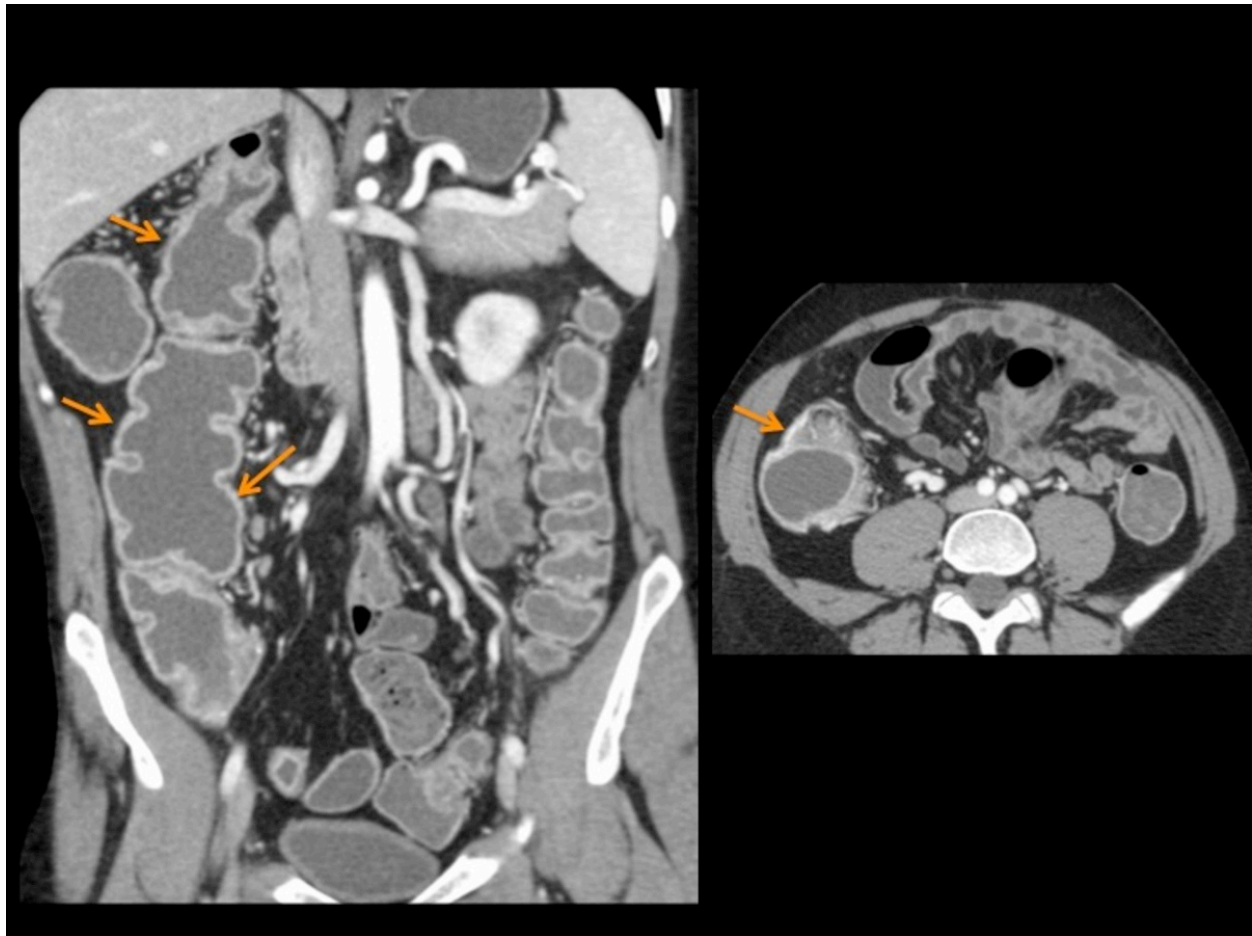


Fig. 1: The wall of the ascending colon is thickened and demonstrates intense enhancement (arrows).

References: - Coimbra/PT

CT imaging with intraluminal and intravenous contrast material are limited in the depiction of subtle mucosal lesions but provide excellent visualization of most intestinal lesions and demonstrate their extramural extent.

Early manifestations of Crohn disease such as enlarged lymphoid follicles, erosions, and aphthoid ulcers are well appreciated at barium studies and capsule endoscopy. Although capsule endoscopy provides better mucosal visualization, it does not allow evaluation of abnormalities outside the bowel lumen. Furthermore, capsule endoscopy cannot be performed when the presence of a stricture is suspected; the endoscopic capsule may become lodged at the diseased segment and cause obstruction, which can occur in up to 7% of patients with Crohn disease. [12]

CT enterography is the main imaging modality for evaluating known Crohn disease in patients with an acute exacerbation or suspected complications. [7,9] This is due to improved spatial and temporal resolution provided by multidetector CT scanners,

combined with good luminal distention provided by negative oral contrast agents. It is a noninvasive, easy to perform, and allows excellent visualization of the entire thickness of the bowel wall and the extraintestinal involvement, providing more detailed information about the extent and severity of the disease process.

The diagnosis of Crohn disease should include assessment of:

- The severity, the transmural extent, and inflammatory activity of lesions;
- Skip lesions;
- The presence of extraintestinal complications.

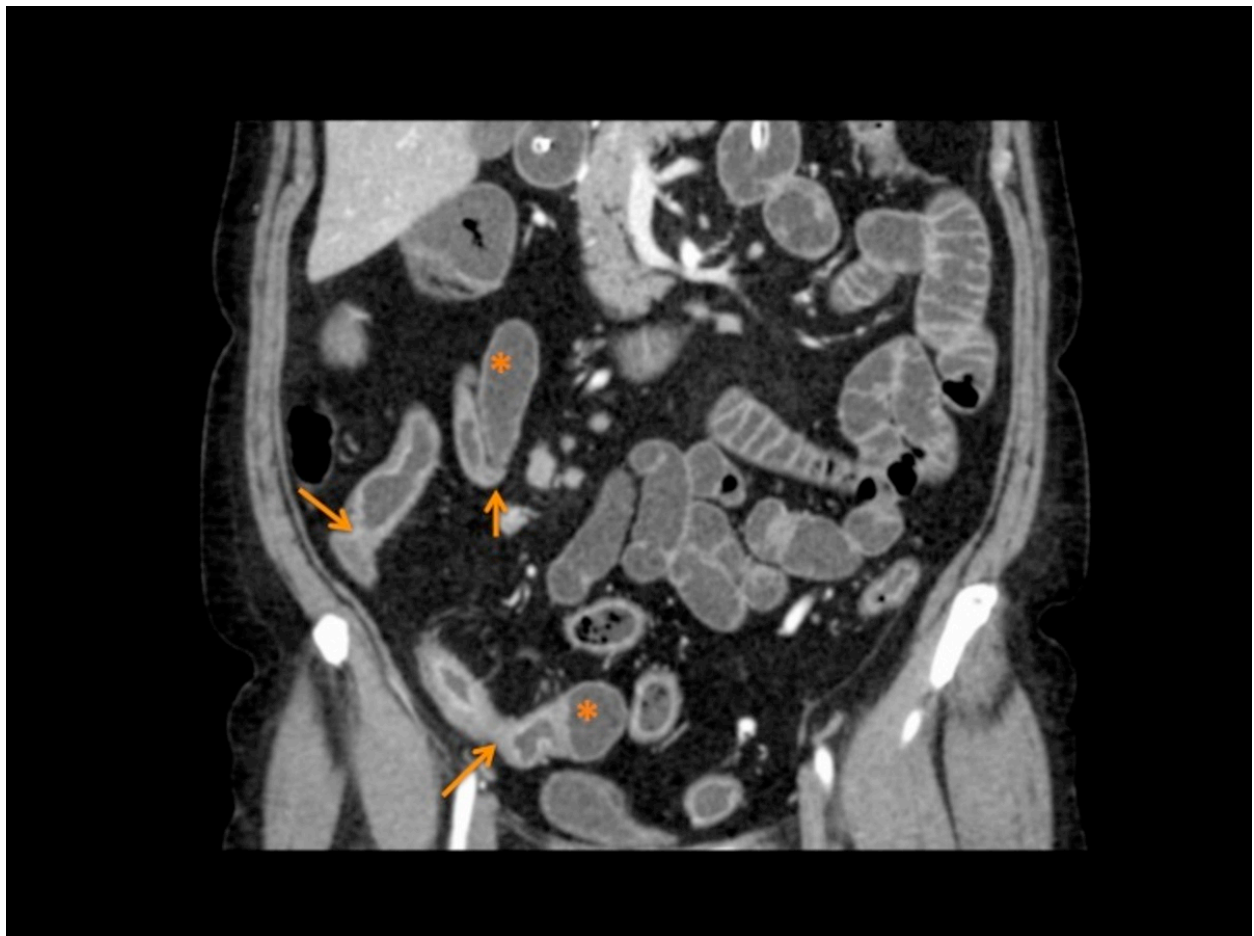


Fig. 2: Skip lesion in Crohn disease. Axial CT enterographic section depicts several inflammatory small bowel strictures (arrows) separated by segments of normal distended bowel (*), characteristic finding in Crohn disease.

References: - Coimbra/PT

The overall sensitivity of CT are reported to be 94%-100%.[6] Acquiring multiplanar images in addition to axial images significantly improves sensitivity in image interpretation

even if it does not reveal additional abnormalities. Coronal multiplanar reformats, volume rendered images, and maximum intensity projection (MIP) images can be very helpful in properly evaluating abnormal small bowel loops. The coronal reformations can be useful in cases of small bowel obstruction, particularly in identifying the site of transition. Moreover, the use of MIP as a routine component of enterography interpretation can play an important role in improving diagnostic accuracy.

The earliest phases of small bowel inflammation may be characterized only by subtle mucosal hyperenhancement with little or no wall thickening. However, as the degree of inflammation progresses, thickening of the bowel wall is typically visualized with evidence of mural stratification ("target" or "double halo appearance"). [6,8]

At more advanced stages, CT can help identify and characterize pathologically altered bowel segments as well as extraluminal lesions (eg, fistulas, phlegmon, abscesses, fibrofatty proliferation, increased vascularity of the vasa recta, lymph node enlargement).

Crohn's disease is most often diagnosed in a particularly radiation sensitive population, and the chronic course of the disease (with multiple relapses over the patient's lifetime) places the patient at risk for a significant cumulative lifetime radiation dose. However, several dose reduction techniques are now available on the latest generation of CT scanners. In addition, the use of advanced reconstruction techniques, such as iterative reconstruction, enables further dose reduction. [5,6]

CT has been the cross-sectional imaging modality of choice at most institutions and provides information that is crucial in the diagnosis of Crohn disease and in treatment planning. [7,8,10]

Technique

The recognition and characterization of intestinal lesions on cross-sectional images demand appropriate preparation and scanning techniques.

At our institution, all patients undergoing CT enterography are told to avoid any oral intake for at least 6 before the examination.

An adequate luminal distention of the small bowel is necessary because collapsed bowel loops can mimic disease or hide pathologic processes (wall thickening, abscess).

In order to achieve bowel distention a neutral oral contrast agent (polyethylene glycol) is administered. Typically, 2000mL of neutral oral contrast agent are administered within 60 minutes (min) prior to scanning, with 1500mL ingested over the first 15min, and two

250 mL fractions consumed 25 and 15min prior to examination. The use of negative intraluminal contrast agents (low attenuation at CT) facilitates visualization of the wall of normal and diseased bowel segments, especially after intravenous contrast material administration. Positive contrast agent (high attenuation at CT) helps in differentiating bowel loops from an extraluminal fluid collection such as an abscess. The presence of small bowel obstruction or fistulas is also well appreciated. However, the use of positive intraluminal contrast material may occult subtle bowel wall thickening and mural enhancement after intravenous injection.

The contrast material may be administered through a nasojejunal catheter at a rate of 100 -250 mL/min. CT imaging performed with this technique is called CT enteroclysis. Use of a nasojejunal catheter allows better luminal distention but causes patient discomfort.

Each patient was given 10 mg of oral metoclopramide 60 minutes prior to CT scanning in order to increase gastric and small-bowel peristalsis.

After the oral contrast agent is ingested, a bolus (1,5mL/Kg) of intravenous contrast material (Ultravist®, Iopromida 370mg/mL) followed by 50mL of saline solution is injected at a rate of 3,5-4 mL/sec, with scanning initiated after a 45-second delay. Contrast material is used to demonstrate the presence of intra or extra-intestinal lesions and to help evaluate their inflammatory activity.

Scanning is performed on a 64-channel multi-detector row CT scanner from the diaphragm to the symphysis pubis. Images are acquired with a section thickness of 3mm and a reconstruction interval of 1mm. Automatic coronal reformatted images are generated using similar parameters. Postprocessing techniques include multiplanar reformatting of axial image data and maximum intensity projection images (MIP), being the later particularly useful for visualizing the mesenteric vasculature.

Active Crohn Disease

CT enterographic features of active inflammatory Crohn disease:

- Mural hyperenhancement;
- Mural stratification;
- Bowel wall thickening (thickness > 3mm);
- Increased attenuation of the perienteric fat;
- Engorged vasa recta ("comb sign").
- Reactive lymphadenopathy in the mesentery adjacent to stenosed bowel segments;

Mural hyperenhancement refers to segmental enhancement of distended small bowel wall that was greater than that in the adjacent normal-appearing small-bowel loops.

Care should be taken to compare bowel loops with similar degree of distention, because normal collapsed loops may demonstrate areas of higher attenuation simulating hyperenhancement. Then, secondary signs of active Crohn disease must be used to make a correct diagnosis, such as mesenteric fat stranding, the vasa recta prominence ("comb sign") or presence of complications (fistulas and abscesses). It is also important to compare the bowel loops in the same segment since normal jejunal loops enhance to a greater degree than ileal loops. The degree of bowel wall enhancement correlates with the degree of inflammatory lesion activity. Then, mural enhancement is the most sensitive indicator of active Crohn disease. [5,6,8]

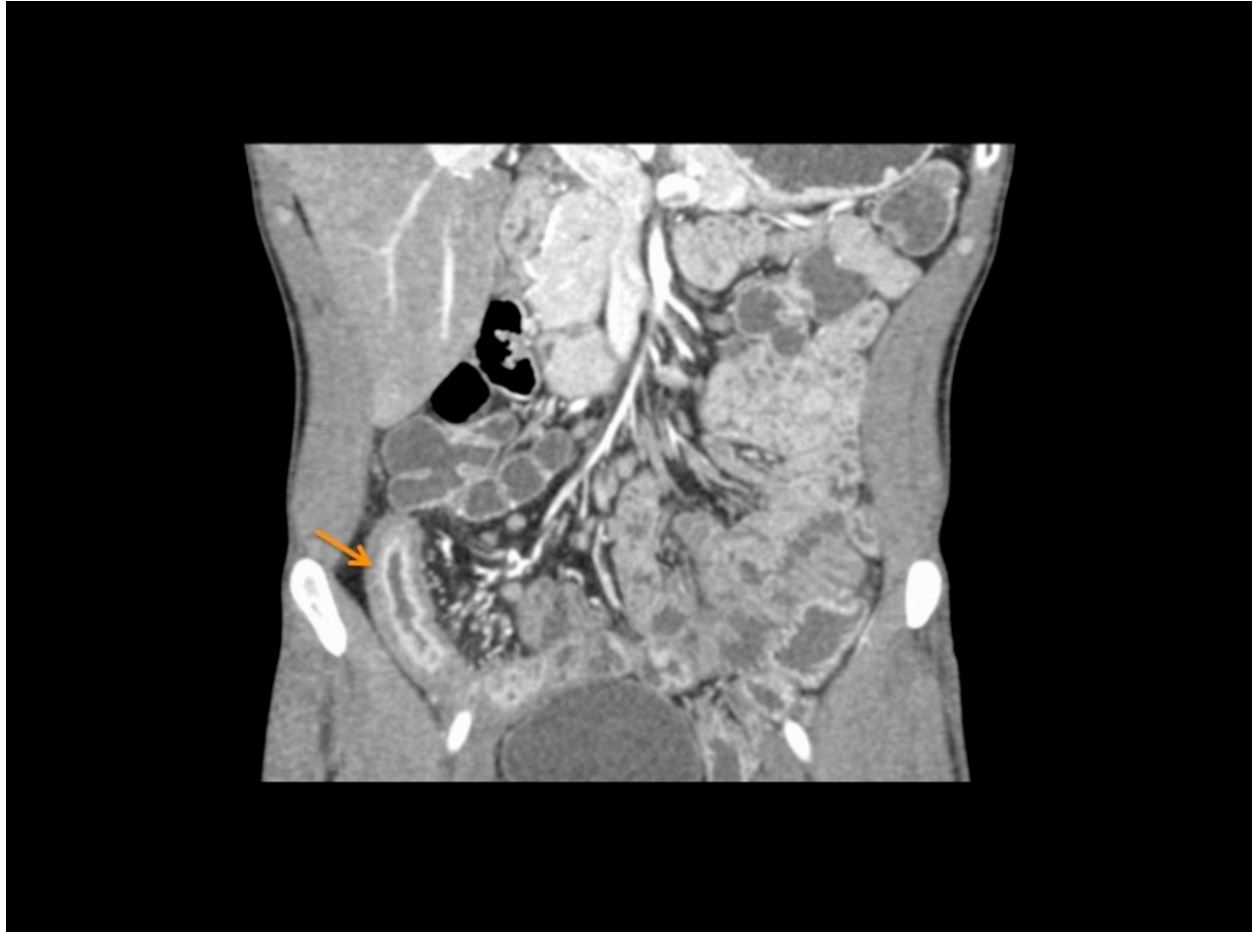


Fig. 3: Manifestations of active Crohn disease. Coronal contrast-enhanced computed tomography image demonstrates a markedly thickened, hyperemic loop of bowel and prominence of the vasa recta, in keeping with acute Crohn's related inflammation.

References: - Coimbra/PT

Mural stratification refers to recognition of layers of the bowel wall ("target" or "double halo appearance") at contrast-enhanced CT. Edematous bowel wall usually has a trilaminar appearance on CT enterography:

- an internal ring of mucosal enhancement;
- an interposed submucosal layer of lower attenuation (edema).
- an external ring of outer serosal layer of the bowel enhancement.



Fig. 4: Axial CT enterographic section reveals areas of small bowel wall thickening associated with multilayered aspect and mucosal enhancement (arrows) intercalated with normal areas (*), which is common in Crohn disease.

References: - Coimbra/PT

Submucosal layer can have various degrees of attenuation depending on what pathological process is present. The presence of intramural fat indicates past or chronic inflammation, while the presence of intramural edema (water attenuation) indicates active inflammation. [5,6,7,10]

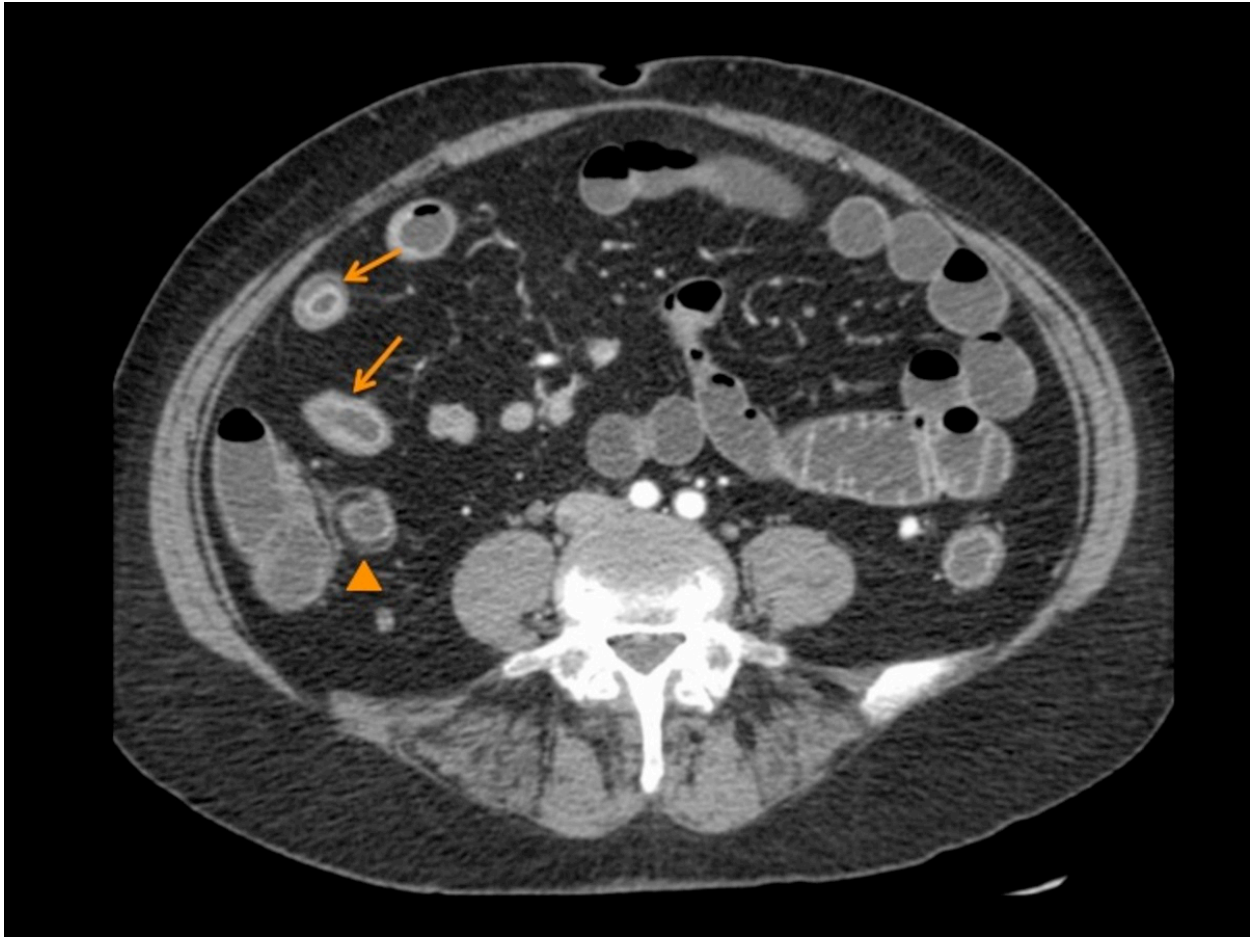


Fig. 5: Axial CT enterography section demonstrates mural stratification, with mucosal hyperenhancement and submucosal edema indicative of active Crohn disease (arrows). Submucosal fat deposition due to chronic disease is also present (arrowhead).

References: - Coimbra/PT

Mural stratification is not specific to Crohn disease and may be seen with other small bowel diseases such as bowel ischemia and ulcerative colitis.

Mural thickening was defined as a wall thickness of more than 3 mm in well-distended small bowel loops. This bowel wall thickness is asymmetric, affecting initially the mesenteric side of the bowel before progressing towards the antimesenteric border.[6] Bowel wall thickening is the most consistent feature of Crohn disease on cross-sectional images.

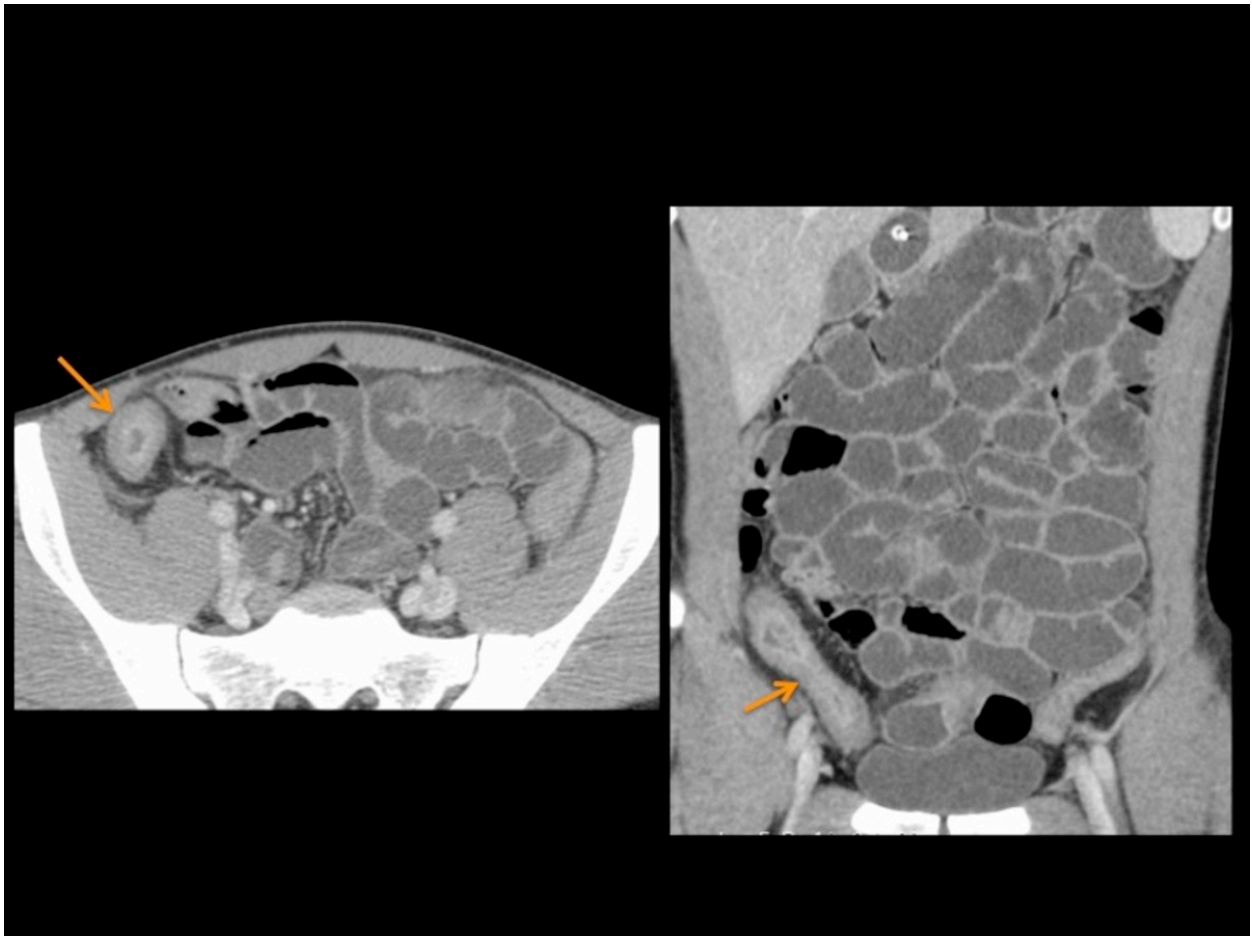


Fig. 6: Axial and Coronal volume rendered image demonstrates thickening and mucosal hyperemia of the terminal ileum, a classic appearance and location for acute Crohn's related inflammation.

References: - Coimbra/PT

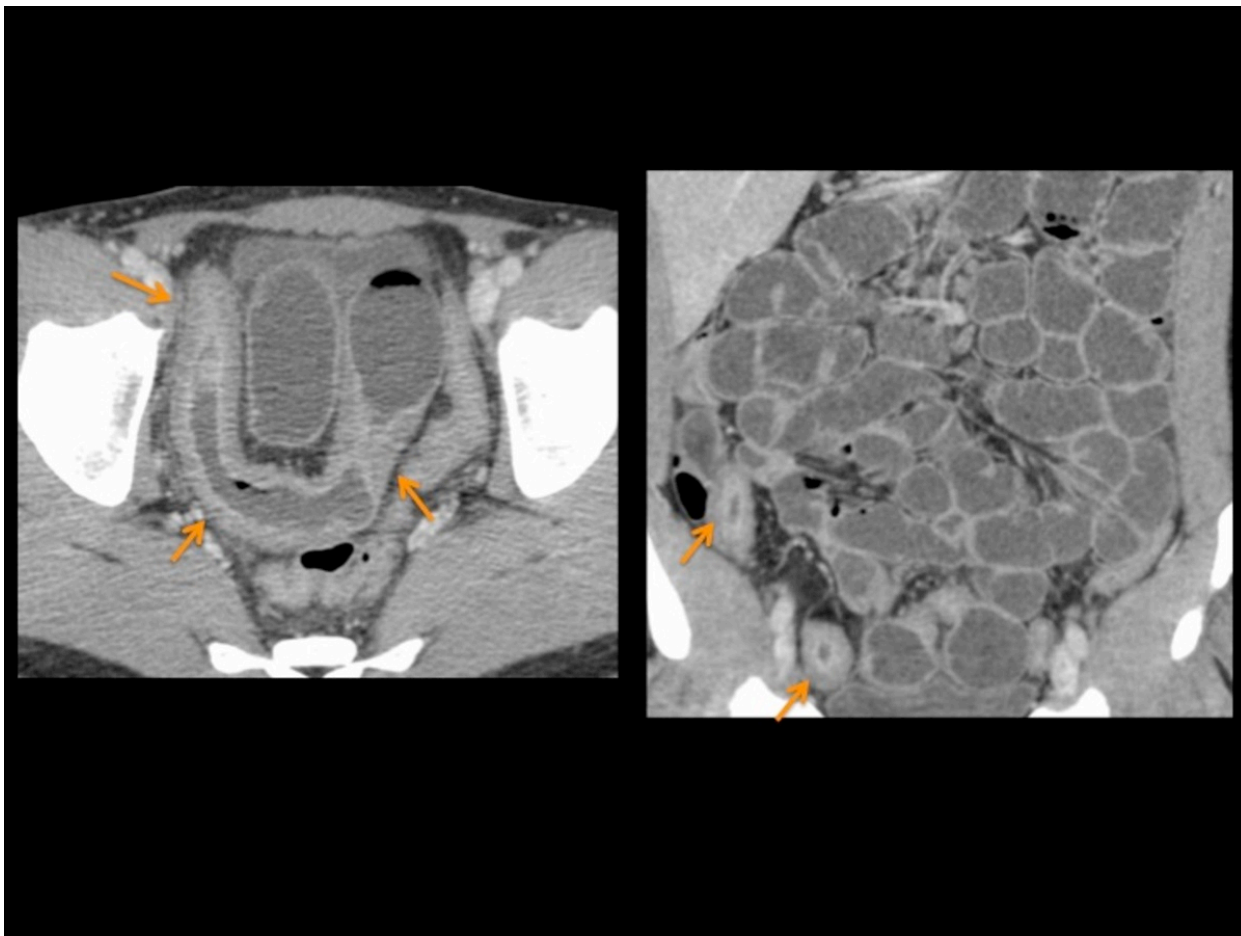


Fig. 7: Active Crohn's disease. Axial CT scan demonstrates prominent wall thickening and mucosal hyperemia encompassing a 10 cm segment of ileum (arrows). Coronal volume rendered images demonstrate a concentric parietal thickening of terminal ileum with trilaminar appearance (target sign).

References: - Coimbra/PT

Mesenteric fat stranding was defined as increased attenuation in the perienteric fat due to transmural extension of inflammation beyond the serosa and to engorgement of the hyperemic vasa recta surrounding the inflamed bowel segment. The prominence and dilation of the vasa recta adjacent to the affected bowel loop is known as "comb sign". This sign and increased perienteric fat attenuation are the most specific features of active Crohn disease. [5]

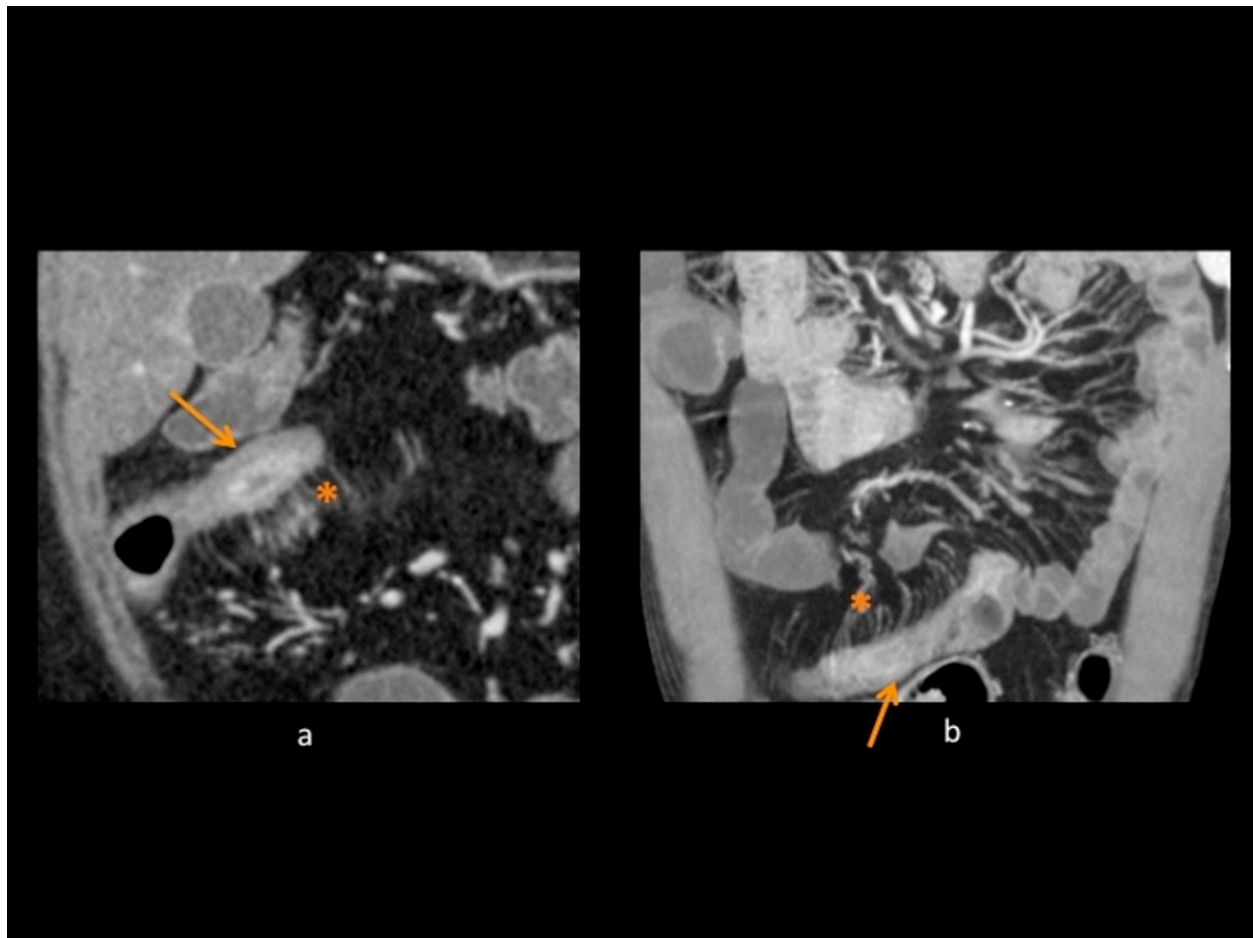


Fig. 8: Comb sign. Contrast-enhanced CT scan of the abdomen shows a diseased segment of the distal ileum (arrows) with prominently dilated adjacent mesenteric vessels (*). The MIP image (b) nicely accentuates the marked mesenteric hyperemia and vasa recta engorgement adjacent to the inflamed loop of bowel.

References: - Coimbra/PT

In particular, engorgement of the vasa recta is often best appreciated on coronal MIP images.

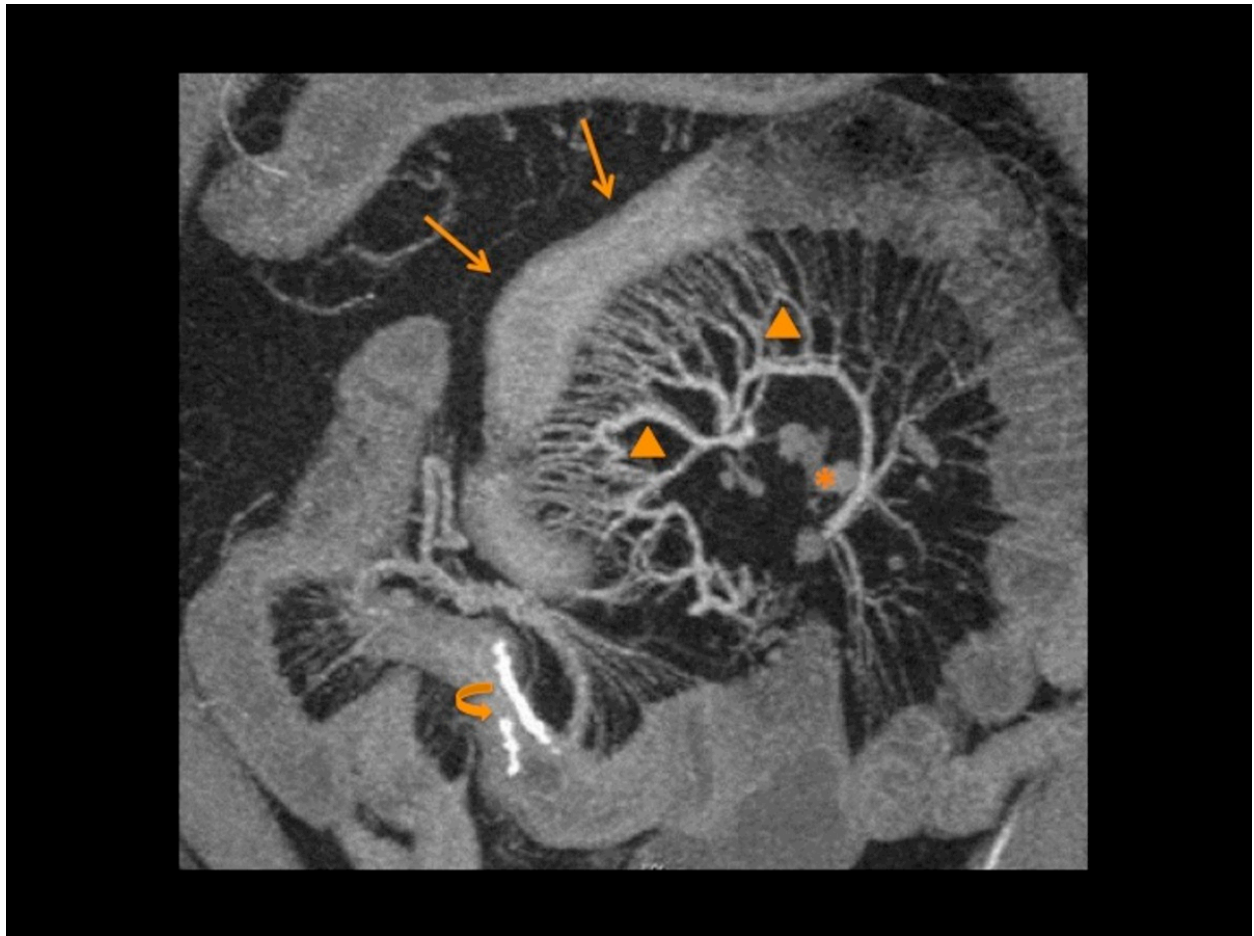


Fig. 9: MIP coronal reformation of a Crohn's disease patient with active disease who had previously had a segmental enterectomy shows mesenteric engorgement (arrowhead) and adenopathy (*) near a thickened bowel wall segment (arrows). Note the surgical clips at the ileal-ileal anastomosis (curved arrows)

References: - Coimbra/PT

An important correlation was found between the mesenteric findings of inflammation (engorgement of the vasa recta and increased attenuation of the perienteric fat), C-reactive protein levels and severity of disease. [5,8]

Chronic Crohn Disease

CT enterographic findings of inactive and chronic Crohn disease include:

- Submucosal fat deposition;
- Pseudosacculation,
- Surrounding fibrofatty proliferation;
- Fibrotic strictures.

In the chronic phases of the Crohn disease, submucosal fat deposition is a common finding but a nonspecific feature that can be seen not only in other causes of chronic bowel inflammation, but also in the setting of obesity, steroid use, and diabetes. A soft tissue attenuation wall thickening and mucosal hyperemia should not be present in this inactive phase. Intramural deposition of fat is commonly associated with longstanding disease and should not be confused with mural stratification. [9]

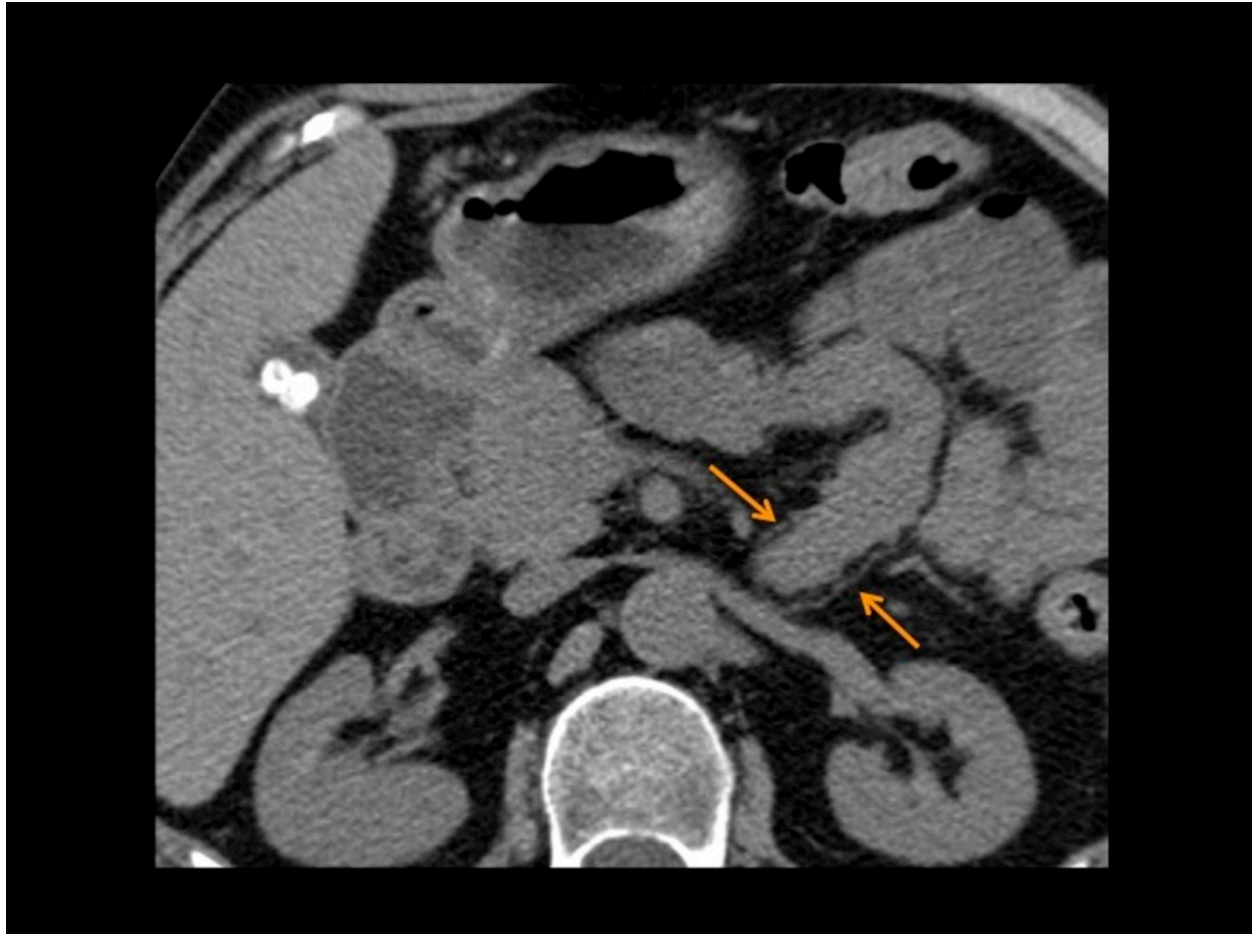


Fig. 10: Axial abdominal CT shows the fat halo sign (arrows) in the wall of the 4th portion of the duodenum, in a patient with chronic Crohn's disease. A gallstones are incidentally visualized in the gallbladder, a commonly associated finding in Crohn's disease.

References: - Coimbra/PT

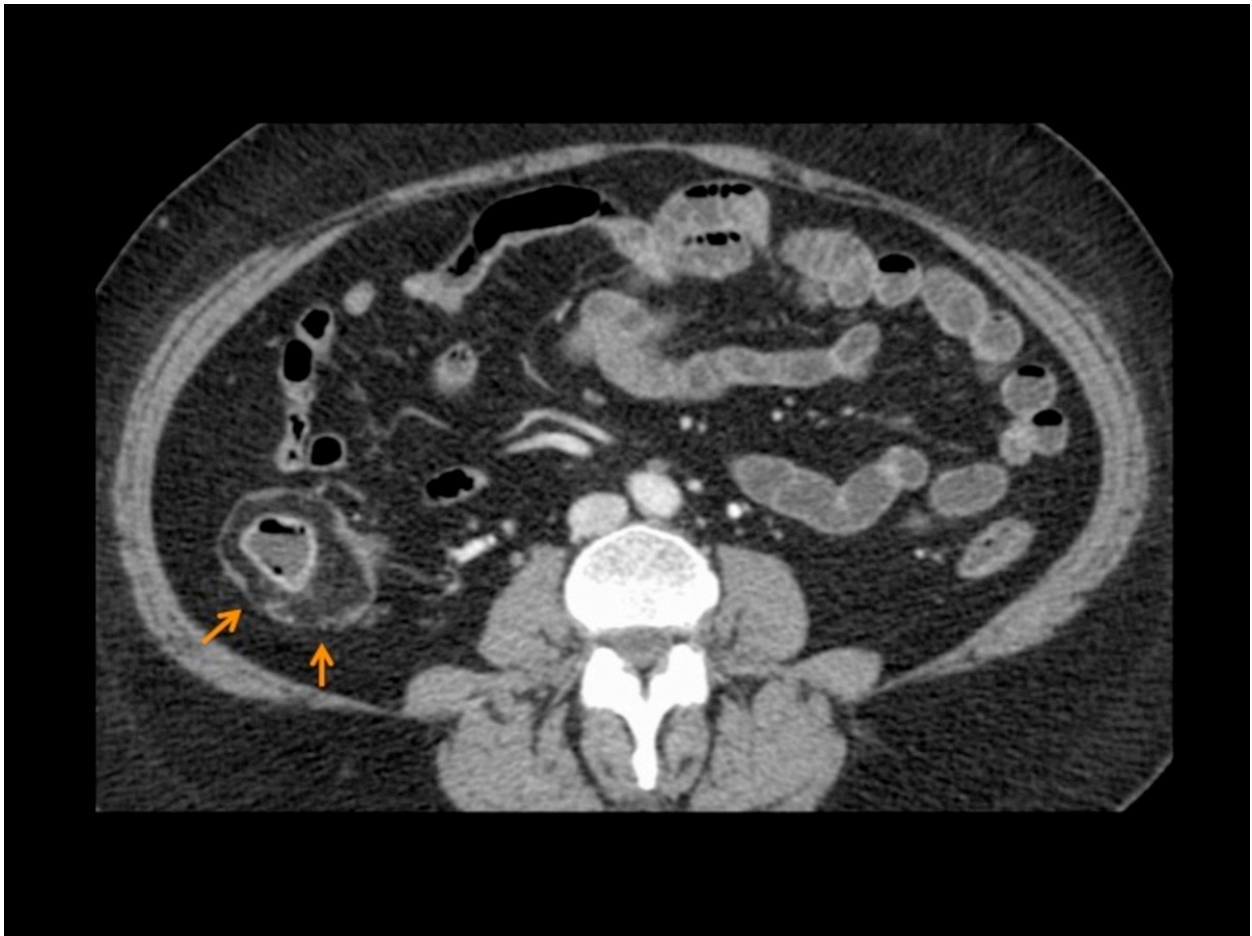


Fig. 11: Axial CT enterographic section shows bowel parietal deposition of fat at the ascending colon (arrows), indicating chronic disease.

References: - Coimbra/PT

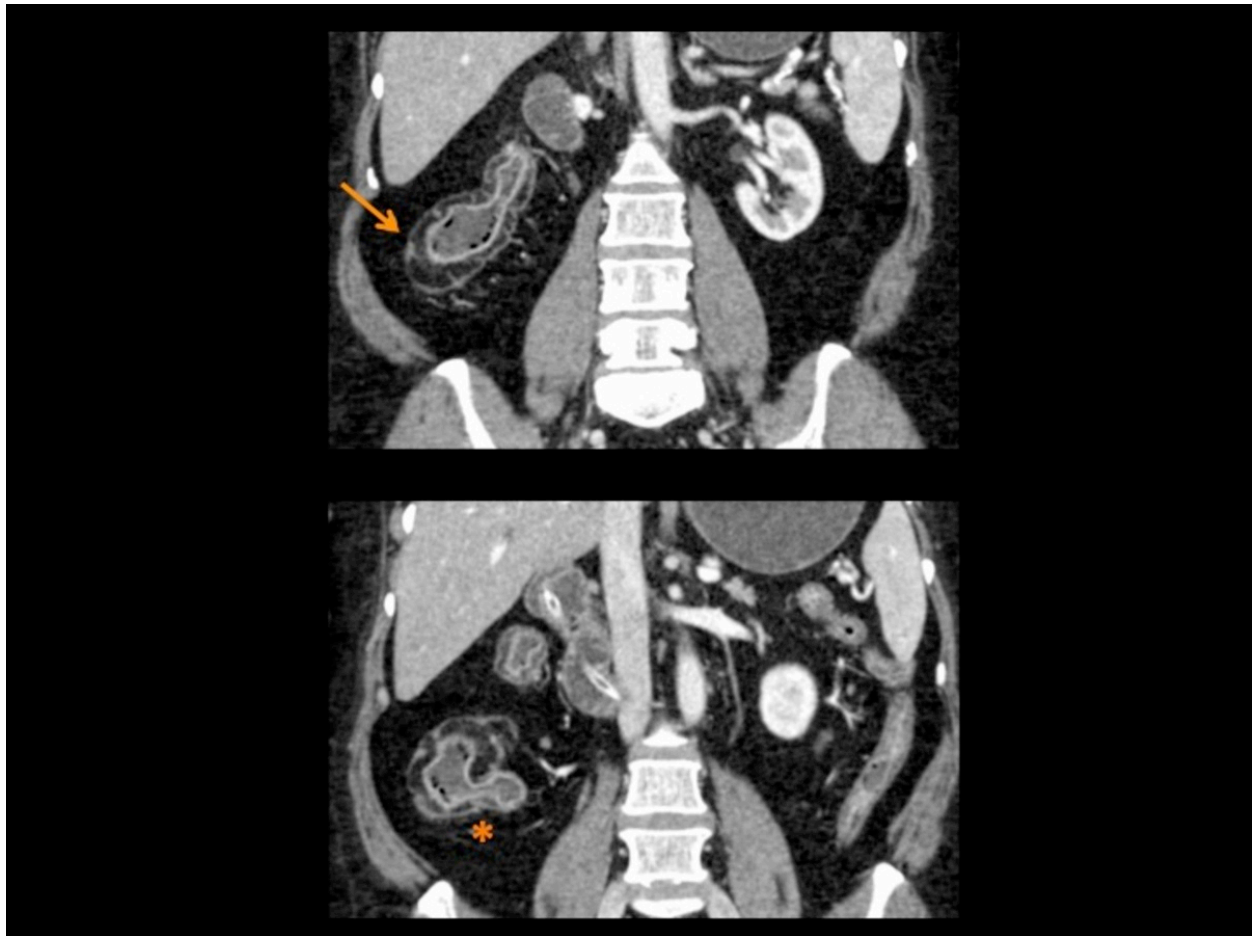


Fig. 12: Coronal CT enterographic section shows colic bowel parietal deposition of fat (arrows), indicating chronic disease.

References: - Coimbra/PT

As mentioned before, the mesenteric side of the bowel is preferentially affected, which results in asymmetric mural fibrosis and pseudosacculations along the mesenteric border.

Over time, fibrofatty proliferation ("creeping fat") can develop along the mesenteric border of the involved bowel segments. Fibrofatty proliferation in the surrounding mesentery is thought to play a role in sustaining the inflammatory process related to the production of tumor necrosis factor. [5,6]

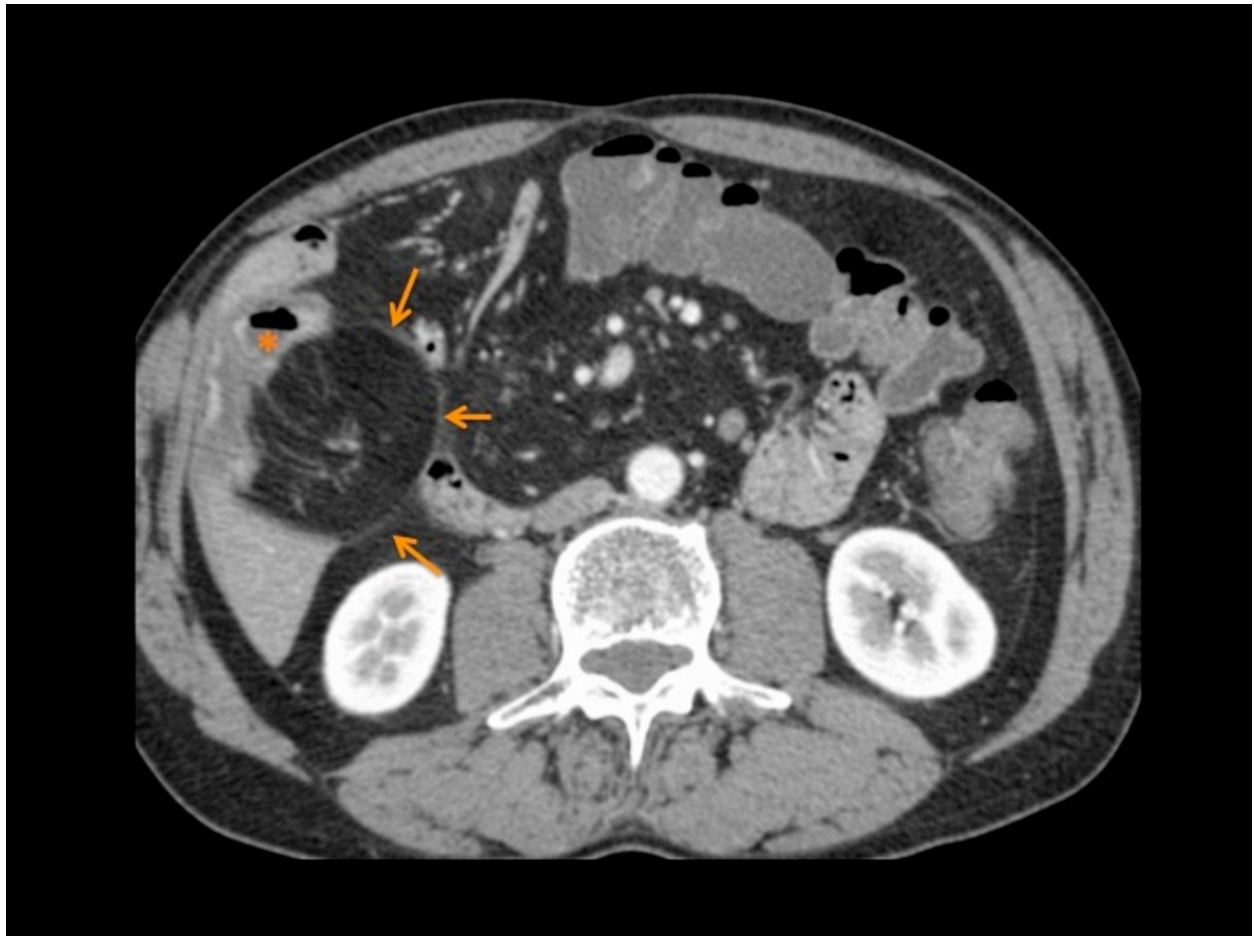


Fig. 13: Fibrofatty proliferation. Contrast-enhanced CT scan of the abdomen shows a proliferation of fat tissue around the small bowel (*).

References: - Coimbra/PT

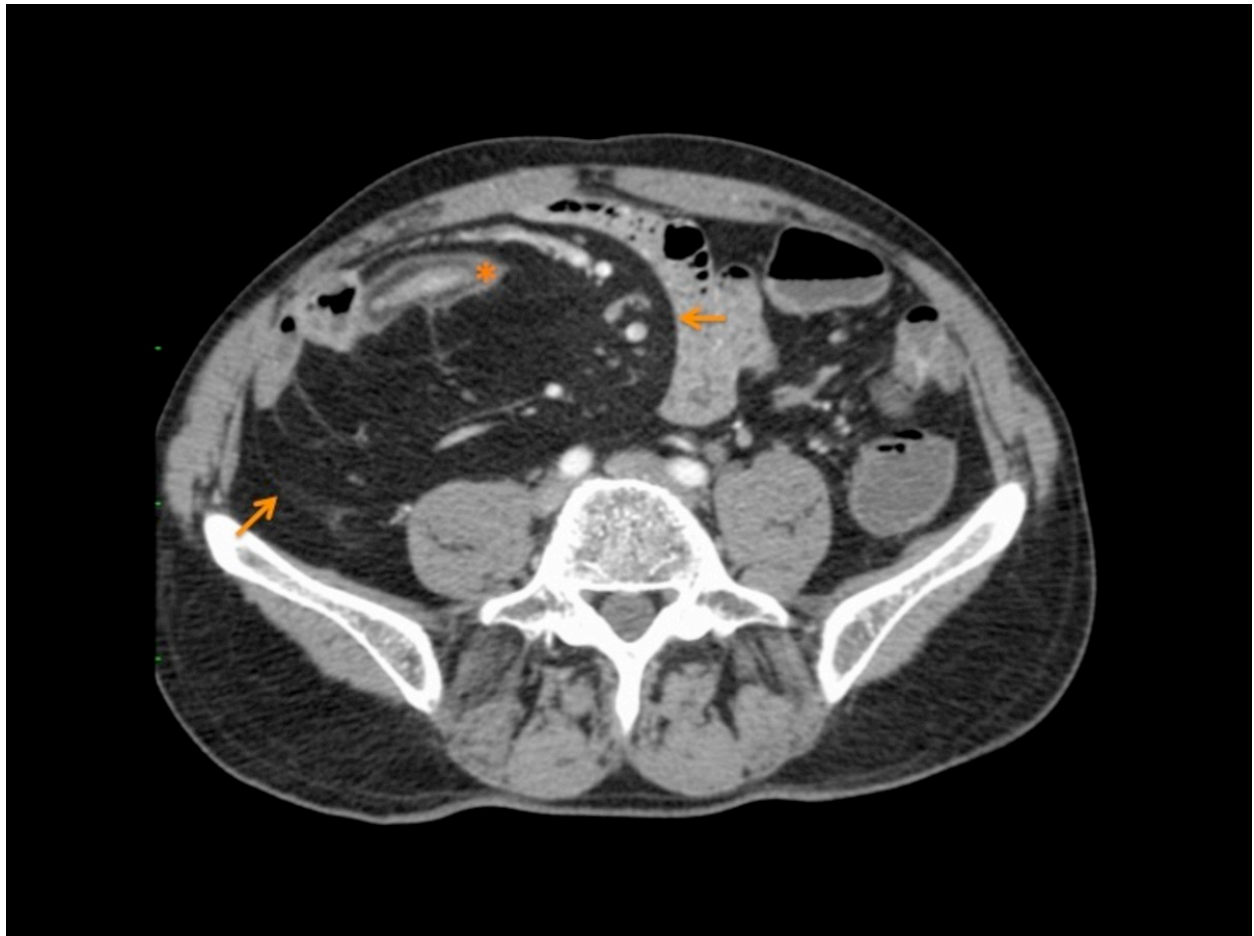


Fig. 14: Fibrofatty proliferation ("creeping fat"). Contrast-enhanced CT scan of the lower abdomen shows a proliferation of fat tissue (arrows) around the terminal ileum (*). The tissue has a heterogeneous appearance with increased attenuation.

References: - Coimbra/PT

Strictures can occur in patients with active disease, however, they are more frequent in inactive long-standing disease. Reversible strictures produced by active disease demonstrate mucosa hyperenhancement, mural stratification, fat stranding and engorgement of the vasa recta. Lack of enhancement and loss of stratification suggests transmural fibrosis. This differentiation is essential as irreversible strictures may require surgical approach, because the presence of a stricture can result in capsule retention and small bowel obstruction.[12]

CT enterography has high sensitivity for the detection of bowel strictures occurring as a complication of Crohn disease. However, it is not always straightforward to distinguish a true stricture from peristalsis. Signs of true bowel obstruction should be present, including proximal bowel dilatation, collapsed loops distally, and fecal material in the proximal small bowel as a result of delayed bowel transit and stasis.

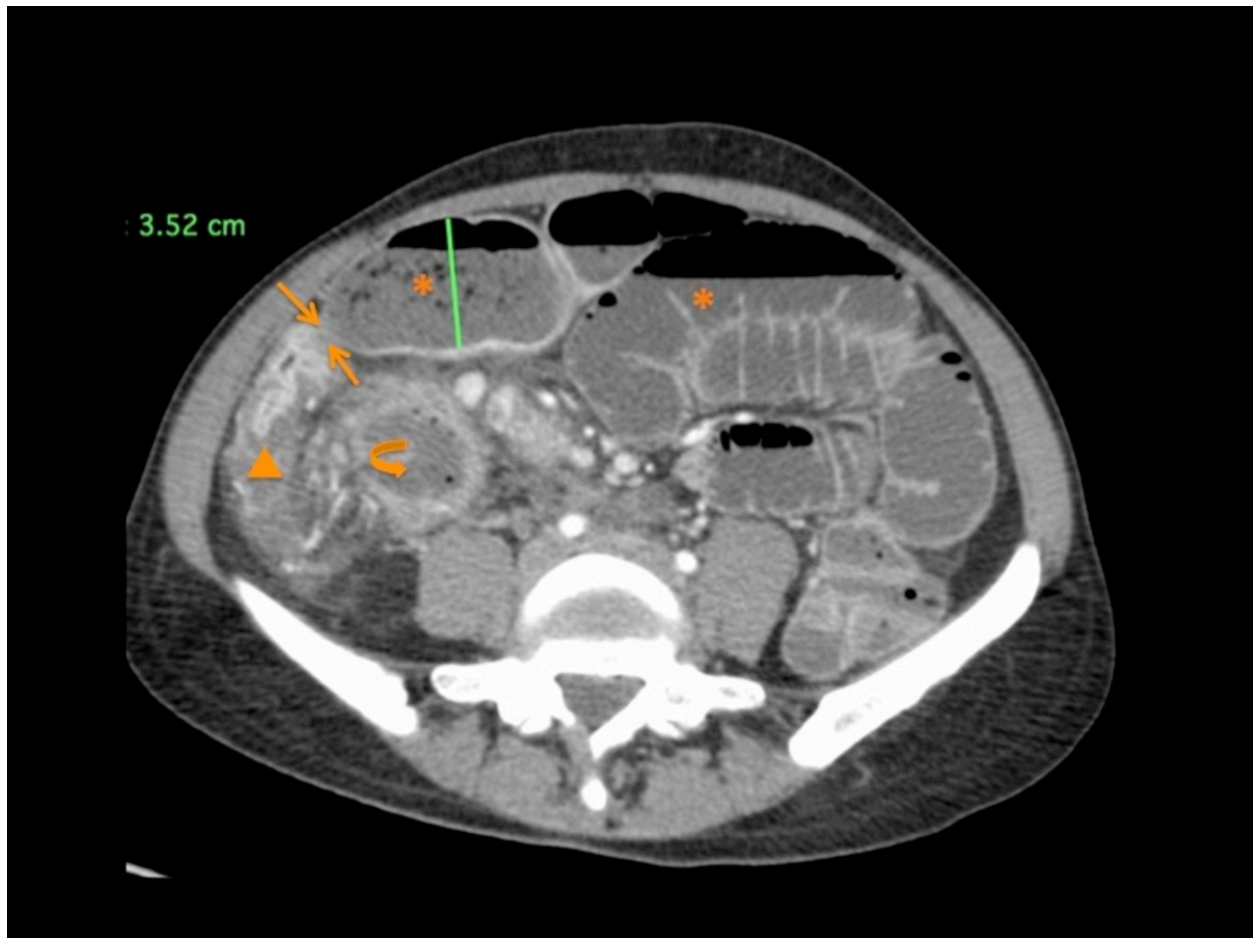


Fig. 15: Axial contrast-enhanced image demonstrates multiple dilated loops of small bowel (*) with a discrete transition point (arrows), in keeping with a small bowel obstruction. This image also demonstrates a long segment of bowel wall thickening and mucosal hyperemia with luminal narrowing (arrowhead). Note a fluid collection adjacent to the inflamed loop of small bowel.

References: - Coimbra/PT

CT enterography also may depict Crohn disease involving the large bowel, perianal region and surgical anastomosis.

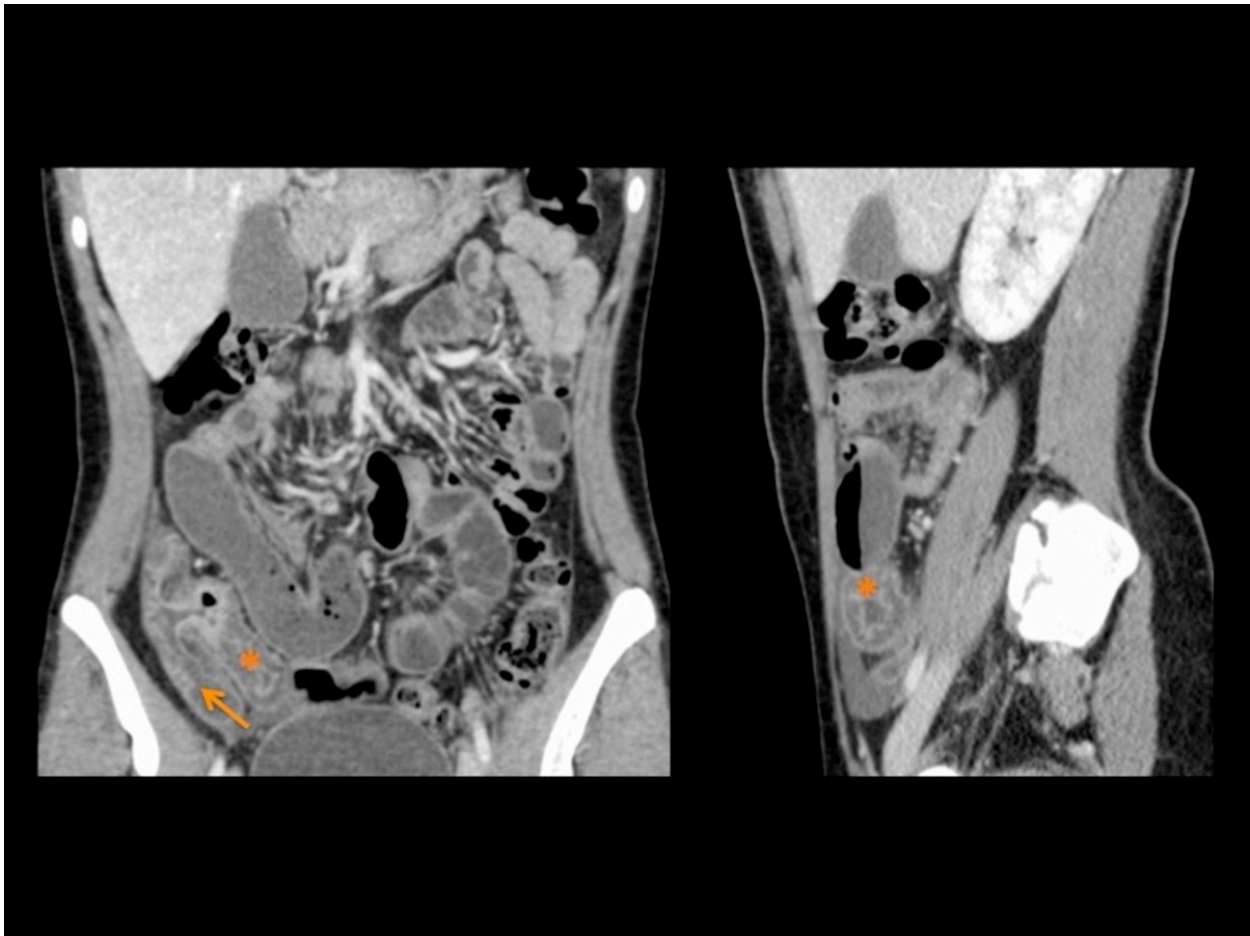


Fig. 16: Coronal reformatted CT scan images clearly shows bowel wall thickening at the distal ileum (*) and colon (arrows). The thickened wall has a stratified appearance. These findings are suggestive of active lesions from Crohn disease.

References: - Coimbra/PT

Small bowel capsule endoscopy is contraindicated when fibrotic strictures cause narrowing of the intraluminal diameter to less than 1 cm, a condition in which there is an increased risk of capsule retention leading to bowel obstruction. [5,12] To avoid this complication, CT enterography may be performed to evaluate the patency of the small bowel before capsule endoscopy is undertaken. The detection of penetrating disease is important and may alter management.

Complications of Crohn's disease

The excellent spatial resolution and multiplanar imaging capability make CT enterography the modality of choice for evaluating extraintestinal complications.

Abscesses and fistulas

Although the perianal region is the most common site of fistula formation, fistulas can develop anywhere (enteroenteric, coloenteric, colocolic, rectovaginal, enterocutaneous, and enterovesicular fistulas). In the most evident cases, fistulas appear as enhancing linear tracts, commonly connecting bowel segments that show signs of active inflammation. However, in many cases a discrete tract will not be identified. In such cases, the presence of a fistula must be presumed by other signs such as fat stranding and the presence of ectopic gas between bowel loops.

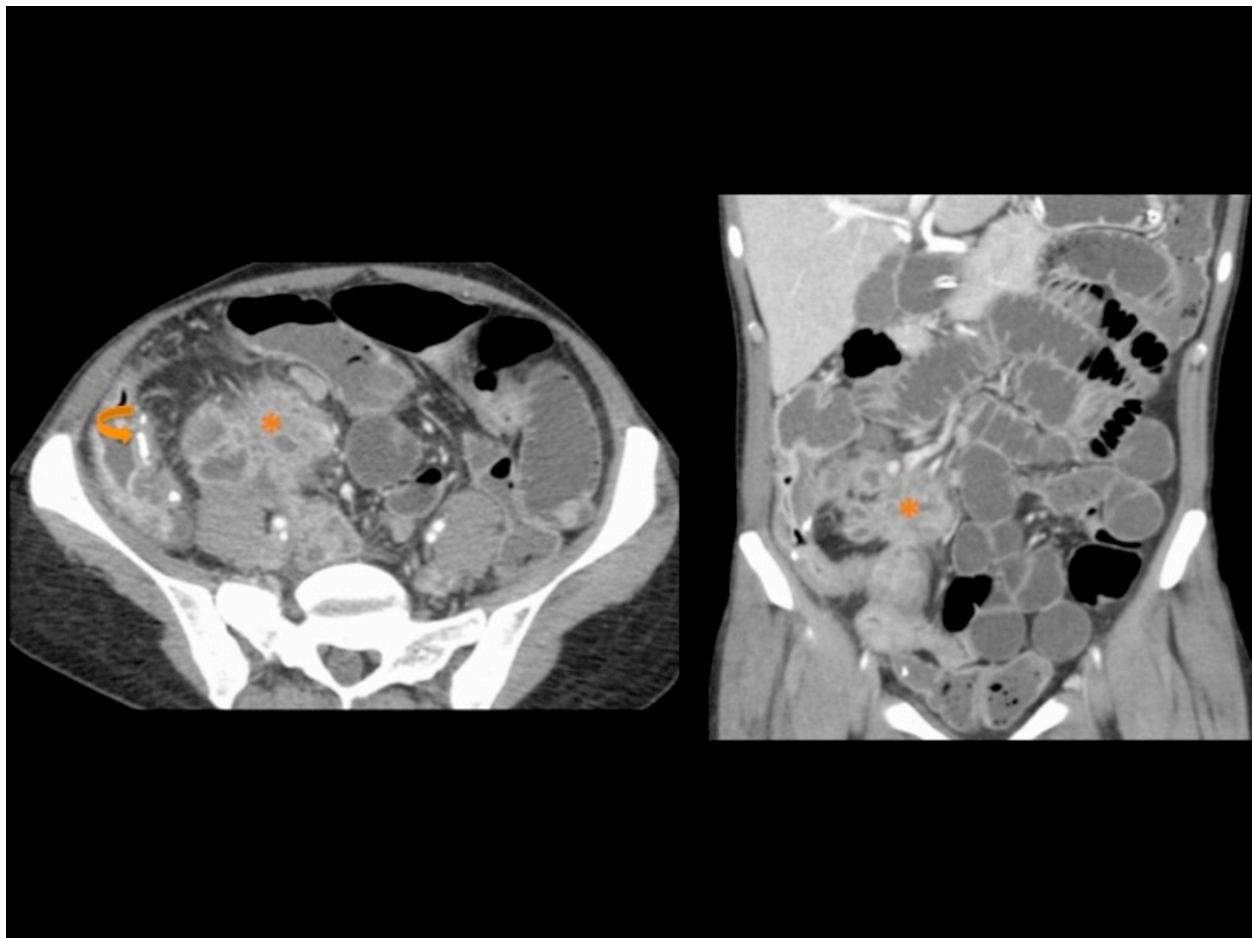


Fig. 17: Fifty-year-old male with Crohn's disease and history of prior ileal resection. Axial and coronal reformatted CT enterographic sections demonstrates marked thickening, mucosal hyperemia of the neo-terminal ileum and multiple loculated fluid collections (*). While discrete fistulous tracts could not be visualized, this constellation of findings is highly suggestive of complex fistulizing Crohn's disease. Note the surgical clips at the ileal-ileal anastomosis (curved arrows)

References: - Coimbra/PT

It is important to know that CT is much less sensitive to the presence of a perianal fistula compared to magnetic resonance imaging. However, the presence of any soft tissue stranding, induration, or fluid in this location should raise concern.

Better delineation of a fistula is one of the few indications where a positive oral contrast agent may be helpful. Coronal images can be very useful in delineating the full extent of a patient's fistulous disease and can facilitate visualization of fistulous tracts which are difficult to appreciate on routine axial images. [7,8]

Patients with Crohn's disease are at high risk of developing abscesses in the mesentery. They appear as extraluminal fluid collections without communication with the bowel lumen.

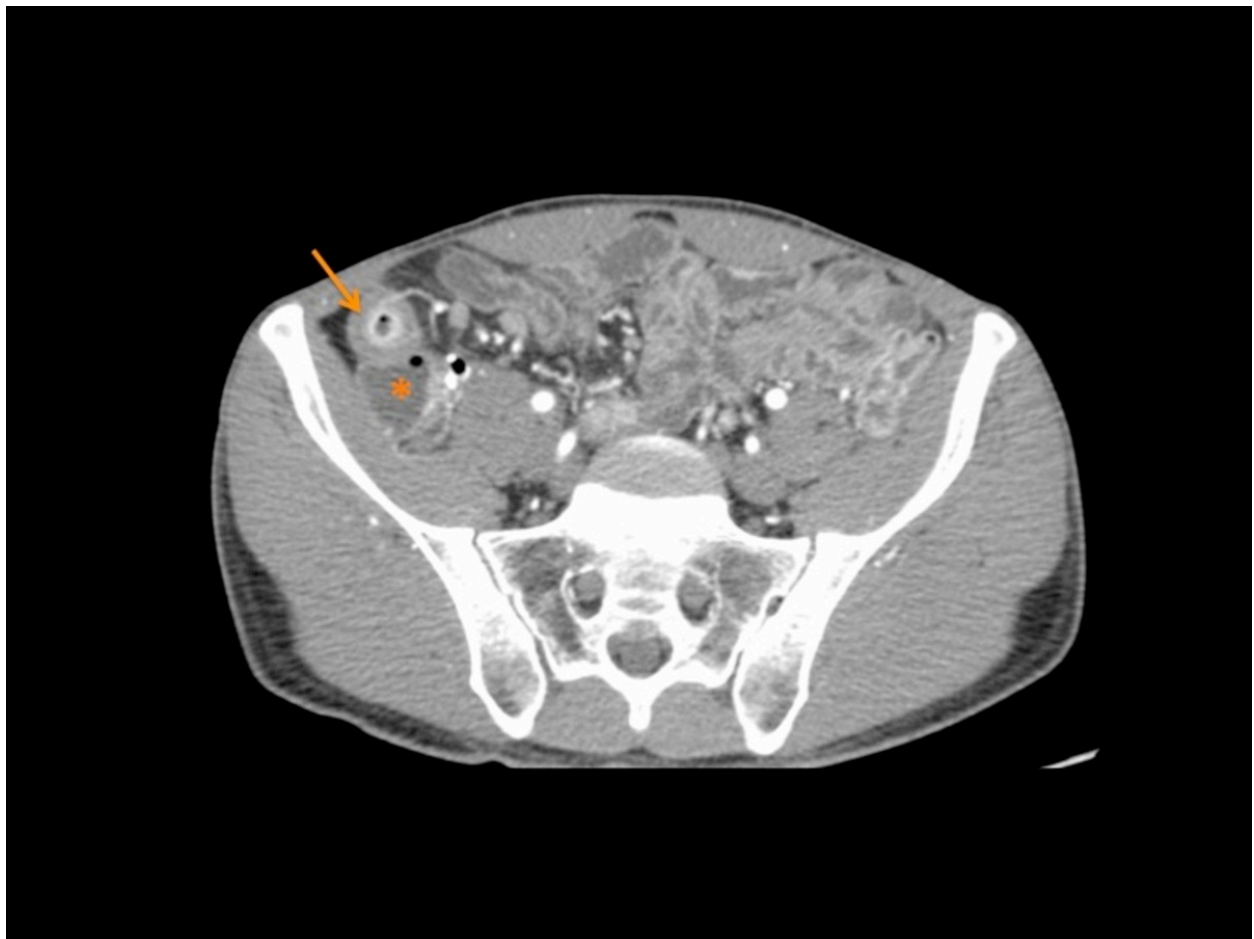


Fig. 18: Abscess formation in Crohn disease. Axial CT enterographic sections show a large fluid collection (arrows) with gas. Note the evidence of active Crohn disease (*) in the terminal ileum.

References: - Coimbra/PT

Bowel Obstruction

The most common complication of Crohn's disease is small bowel obstruction.

In the setting of active disease, obstruction occurs due to inflammatory edema and spasm. In chronic disease, the repeated bouts of inflammation result in fibrosis, adhesions and strictures.

Bowel Perforation

Transmural ulceration in active disease typically results in microperforation and contained collections, while free perforation is less frequent.

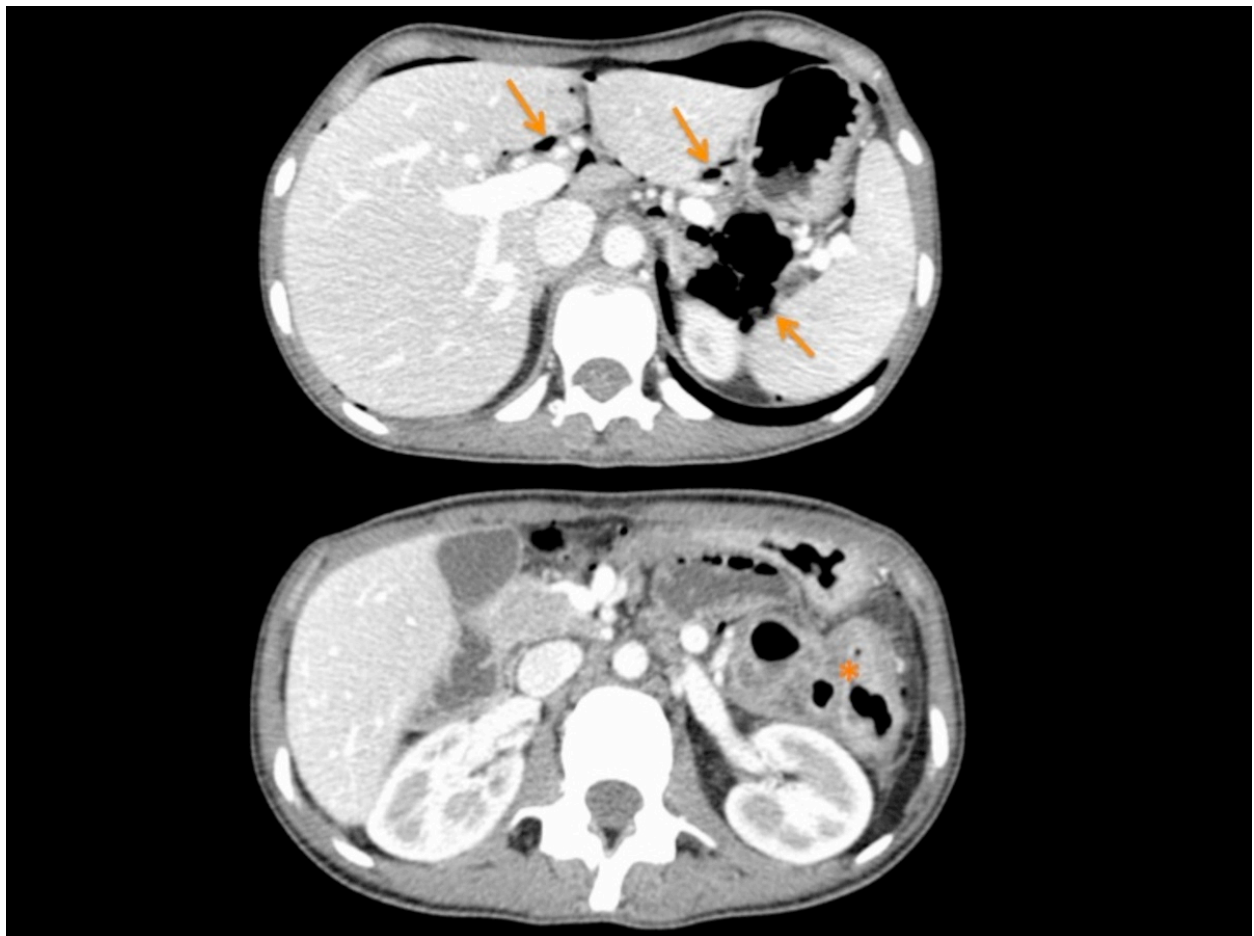


Fig. 19: Perforation and phlegmon at the small bowel in the left abdomen(arrows).

References: - Coimbra/PT

A rare manifestation of transmural ulceration is penetration into the mesenteric vasculature with resultant mesenteric venous gas. Perforation may also occur into adjacent structures, such as the retroperitoneum, with resultant abscess formation. Terminal ileal inflammation can perforate posteriorly and progress to formation of ileopsoas abscess.



Fig. 20: Iliopsoas muscle abscess. Contrast-enhanced CT scan of the pelvis shows an air-containing abscess in the right iliopsoas muscle (*) in a patient with terminal ileitis (arrow) .

References: - Coimbra/PT

Toxic Megacolon

Crohn's patients with colonic involvement may present with acute colitis. However, Toxic Megacolon is rare in Crohn's disease.

Urological complications

The two most common severe urological complications are the development of:

- Obstructive uropathy;
- Enterovesicular fistulas. #

The development of obstructive uropathy is relatively common in Crohn's disease. Obstructive uropathy (most common on the right side) are typically the result of either acute inflammatory change enveloping a portion of the ureter, or fibrotic narrowing of the ureter as a result of a prior inflammatory episode. [7,8]

Enterovesicular fistulas are a rare and typically they result of an adjacent inflamed loop of bowel. A direct enhancing tract can be identified extending from an adjacent bowel loop to the bladder. However, in the absence of directly visualizing a tract, the presence of ectopic gas in the bladder, focal bladder wall thickening adjacent to an inflamed loop of bowel should raise concern for the presence of a fistula. [7,8,9]

Patients with Crohn's disease are also at increased risk of developing both renal stones and urinary infections, even in the absence of an active inflammatory episode. The increased incidence of renal stones in Crohn's patients is related to fat malabsorption and occurs in 5-10% of patients.

Hepatic and biliary complications

Patients with Crohn's disease also show an increased incidence of gallstones. Vitamin B12 deficiency results in increased bile salts in the colon, which results in an increased risk of gallstone formation.

Although rare, there is a known association between Crohn's disease and primary sclerosing cholangitis (PSC). It is less common than in Ulcerative Colitis patients. [7,8,10] The presence of ductal beading and irregularity, cirrhosis, and significant enlargement of the caudate lobe are all signs that should be suggestive of PSC in the setting of known Crohn's disease.

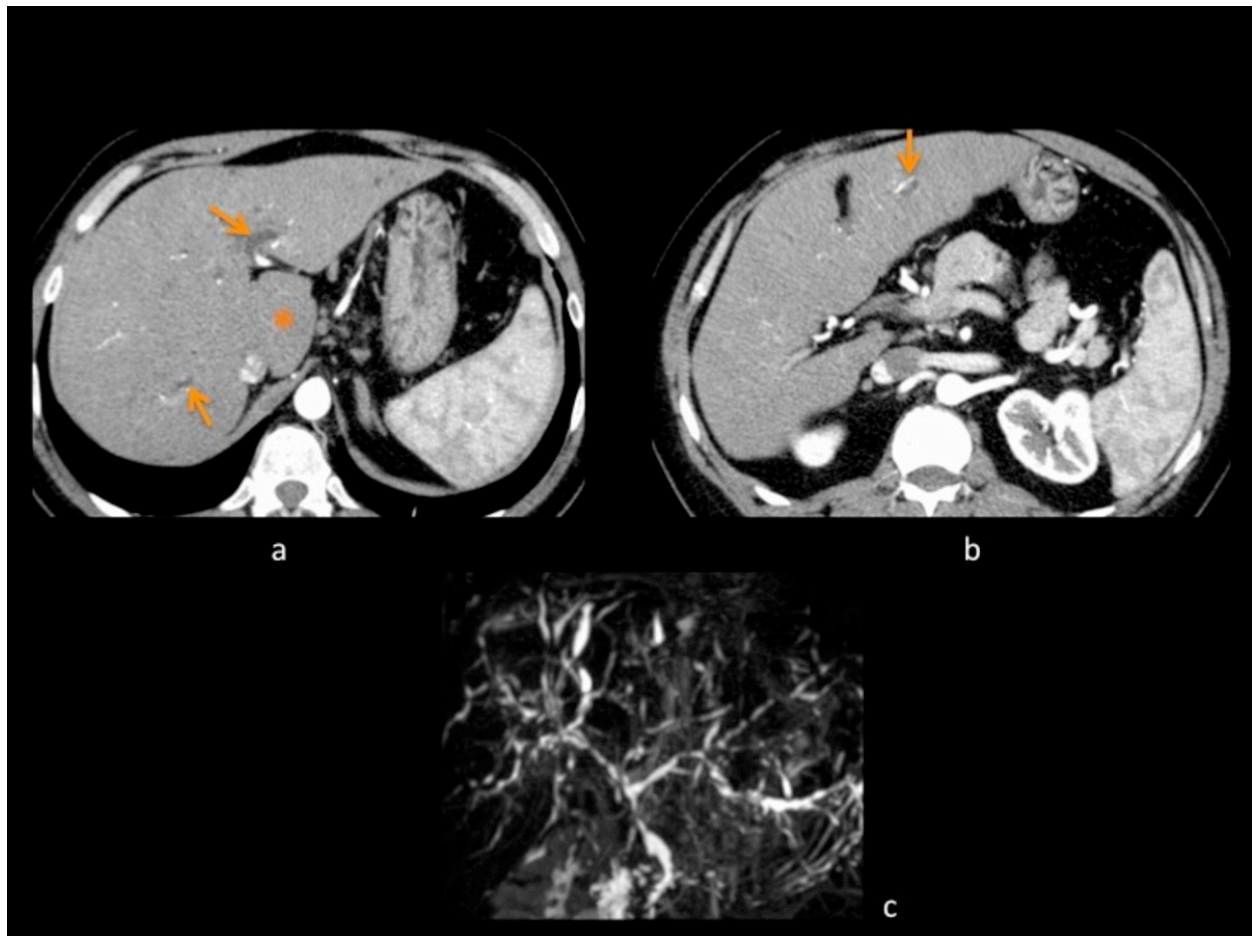


Fig. 21: Primary sclerosing cholangitis and Crohn's disease. Contrast-enhanced CT scan (a and b) shows mild bile duct dilatation with a discontinuous pattern (arrows) and morphologic changes of cirrhosis with caudate hypertrophy (*). Coronal MRCP image (c) demonstrates multifocal strictures and irregularity of the intrahepatic bile ducts.

References: - Coimbra/PT

Osseous complications

The association between bilateral, symmetric sacroiliitis and Crohn's disease has been well established in the literature. Enteropathic Arthropathy, is a seronegative #spondyloarthropathy seen in 3-16% of Crohn's patients. It is clinically and radiologically indistinguishable from Ankylosing Spondylitis. The symptoms usually precede the onset of gastrointestinal symptoms and progression is independent of bowel disease. [9,10]

Hypertrophic pulmonary osteoarthropathy is also associated with inflammatory bowel disease and avascular necrosis can occur due to steroid therapy.

Perianal Disease

Perianal disease is an important cause of morbidity in Crohn's patients. A perianal fistula is defined as an abnormal communication between the anal canal and the perineum. One of the complications of perianal disease is the formation of ischioanal collections and fistulas to the genitourinary tract. [5,6]

Malignancy

Overall Crohn's patients have an increased mortality compared to the general population. Crohn's patients are at a greater risk of developing small bowel adenocarcinoma than the general population, with more aggressive tumors and tumors occurring at a younger age. The most common sites of small bowel adenocarcinoma are in the distal and terminal ileum, as opposed to the general population, where small bowel adenocarcinomas are most common in the duodenum. [1,4]

As a result, the possibility of a tumor must be considered when evaluating any CT enterography study. Any site of narrowing (whether inflammatory or fibrotic) should be treated as a site of suspicion until proven otherwise, even if a discrete soft tissue mass is not identified. Moreover, asymmetric wall thickening and irregularity should not automatically be assumed to simply represent a site of active inflammation, particular if mural stratification of the thickened wall is not seen.

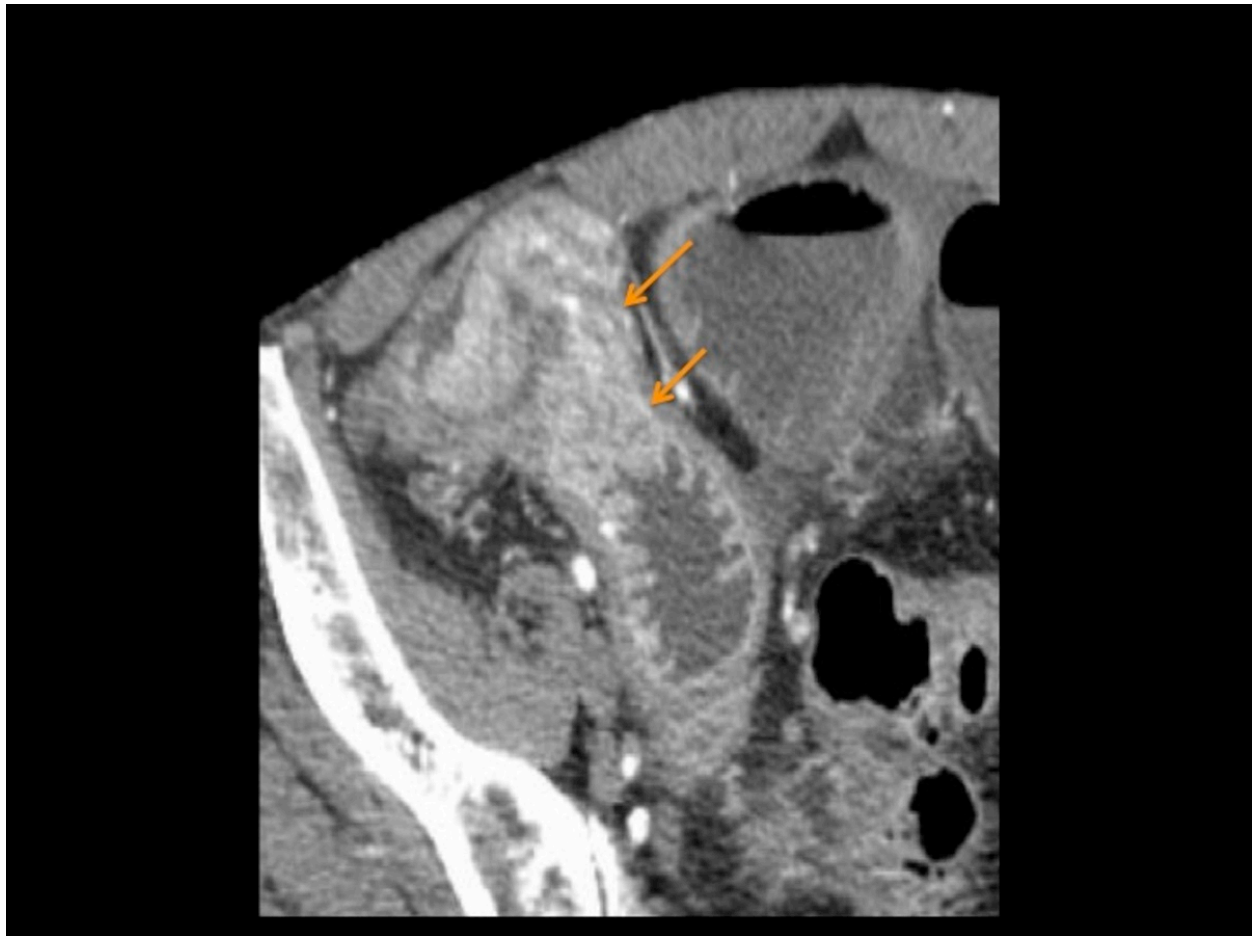


Fig. 22: Abdominal CT of a patient with an adenocarcinoma of the ileum that extended to the ileocecal valve shows focal irregular thickening with enhancement of the terminal ileum (arrows). Note absence of mesenteric inflammatory signs.

References: - Coimbra/PT

Crohn's related small bowel adenocarcinomas patterns:

- Focal soft tissue mass;
- Short severe stenosis;
- Long stenosis with wall irregularity;
- Irregular circumferential wall thickening of a bowel loop.

It is also critical to assess local adenopathy. Although reactive nodes are commonly noted in patients with active Crohn's disease, large nodes should raise the possibility of an underlying malignancy.

Lymphoma

Gastrointestinal lymphoma would be thought to be more common in Crohn's disease. There is a suggestion that Biologic agents have been shown to be associated with an increased risk of Non-Hodgkins Lymphoma. [4, 6]

Mesenteric lymphadenopathy ranging from 3 to 8 mm in size is depicted. When lymph nodes are larger than 10 mm, lymphoma and carcinoma must be excluded.

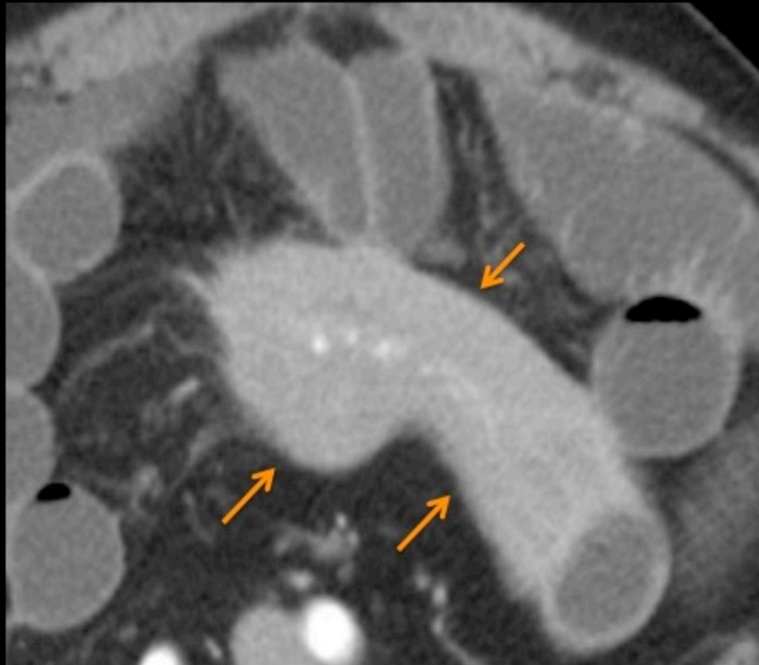


Fig. 23: CT enterography shows homogeneous enhancing and greatly thickened wall of an ileal loop (arrows). Pathologic examination revealed small cell B lymphoma.

References: - Coimbra/PT

Post-Operative Complications

The spectrum of post-operative complications includes:

- Collections;
- Anastomotic leak;
- Adhesions;

- Intussusception;
- Obstruction.
- Short Gut Syndrome

The majority of Crohn's patients will undergo at least one surgical procedure in their lifetime. The risk of post-operative recurrence is increased in smokers, and where there was pre-existing fistulizing disease.

Short Gut Syndrome is a global malabsorption syndrome due to insufficient absorptive capacity resulting from extensive small bowel resections (where there is less than 100cm of small bowel remaining). If the colon remains, it can adapt and adopt some digestive functions such as absorption of short chain fatty acids and increased water and electrolyte absorption.

Treatment

Patients with active inflammatory disease are commonly treated with a combination of medical therapies. [5,6]

Surgery is required in:

- Fistulating disease that is not responsive to medical therapy;
- Fibrostenosing disease with marked pre-stenotic dilatation;
- Complications: intestinal hemorrhage, fistulas, skip lesions perforations or abscesses.

Images for this section:

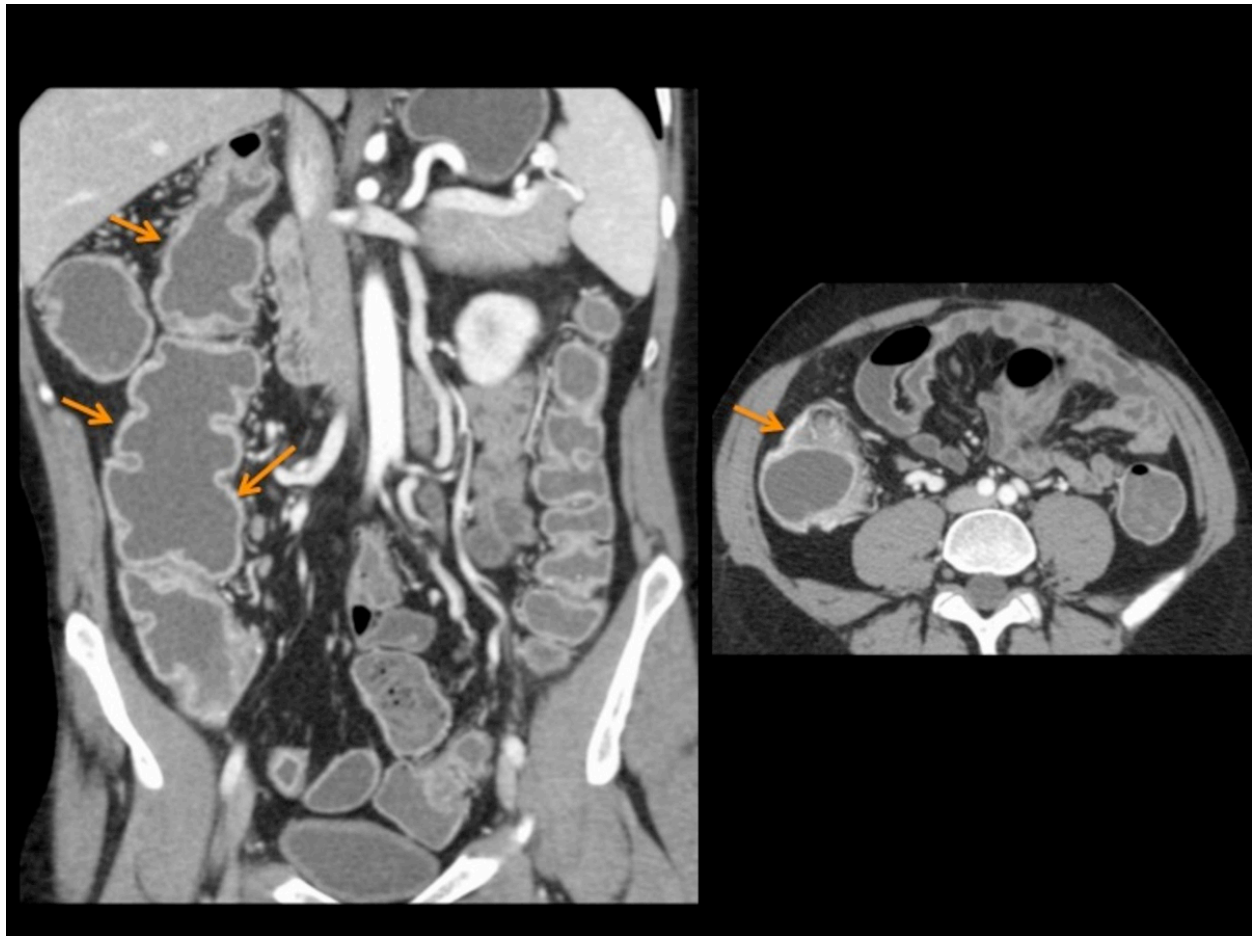


Fig. 1: The wall of the ascending colon is thickened and demonstrates intense enhancement (arrows).

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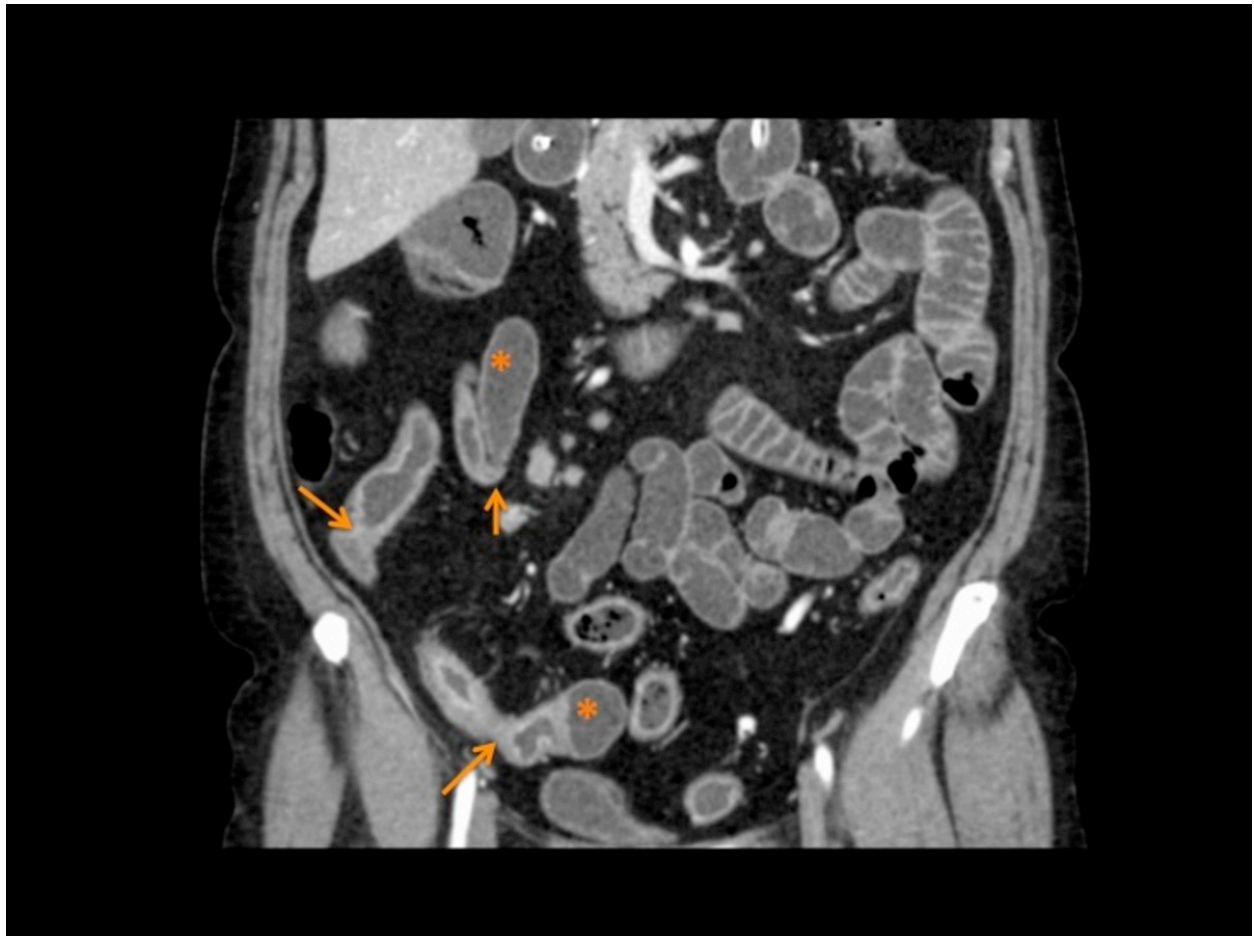


Fig. 2: Skip lesion in Crohn disease. Axial CT enterographic section depicts several inflammatory small bowel strictures (arrows) separated by segments of normal distended bowel (*), characteristic finding in Crohn disease.

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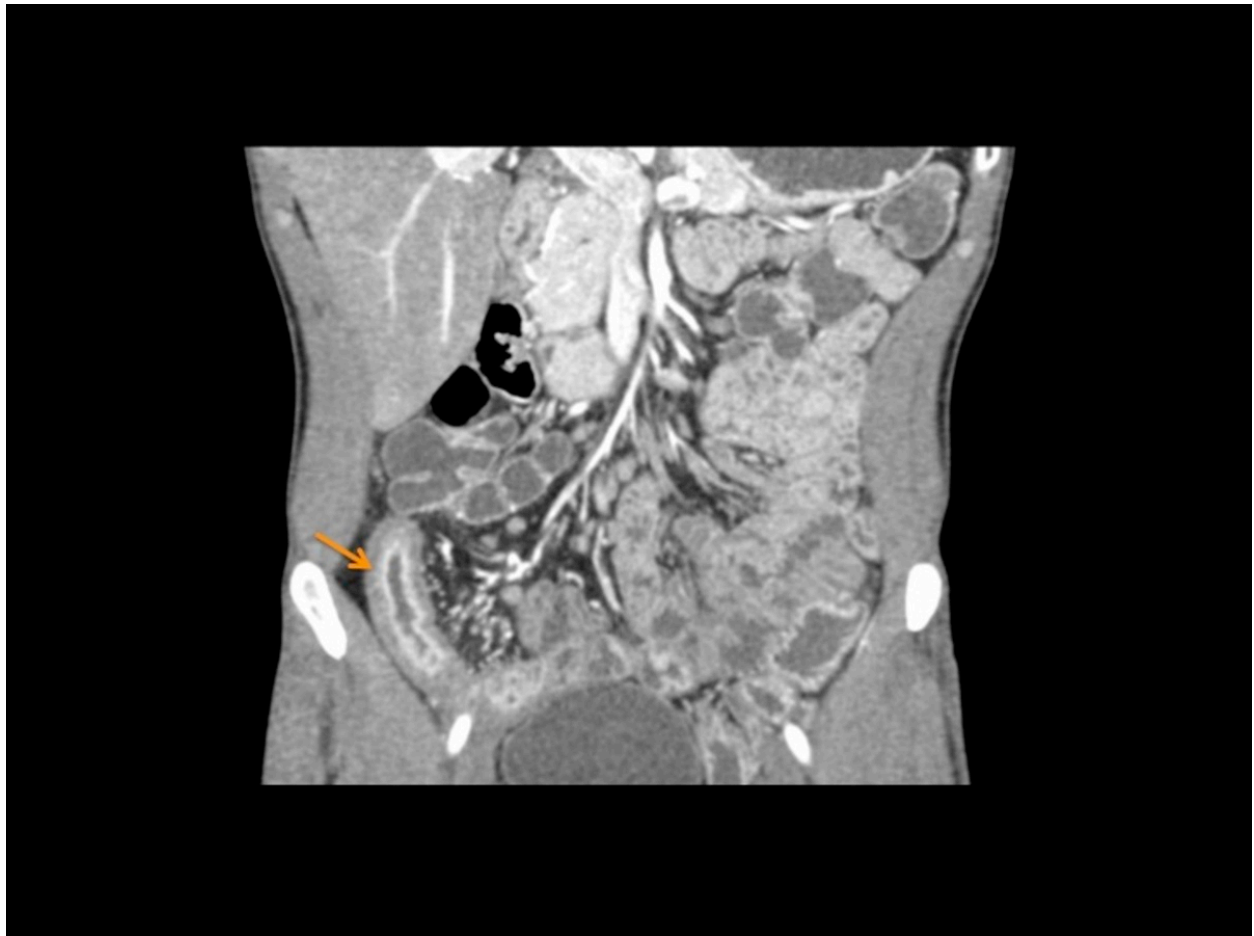


Fig. 3: Manifestations of active Crohn disease. Coronal contrast-enhanced computed tomography image demonstrates a markedly thickened, hyperemic loop of bowel and prominence of the vasa recta, in keeping with acute Crohn's related inflammation.

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Fig. 4: Axial CT enterographic section reveals areas of small bowel wall thickening associated with multilayered aspect and mucosal enhancement (arrows) intercalated with normal areas (*), which is common in Crohn disease.

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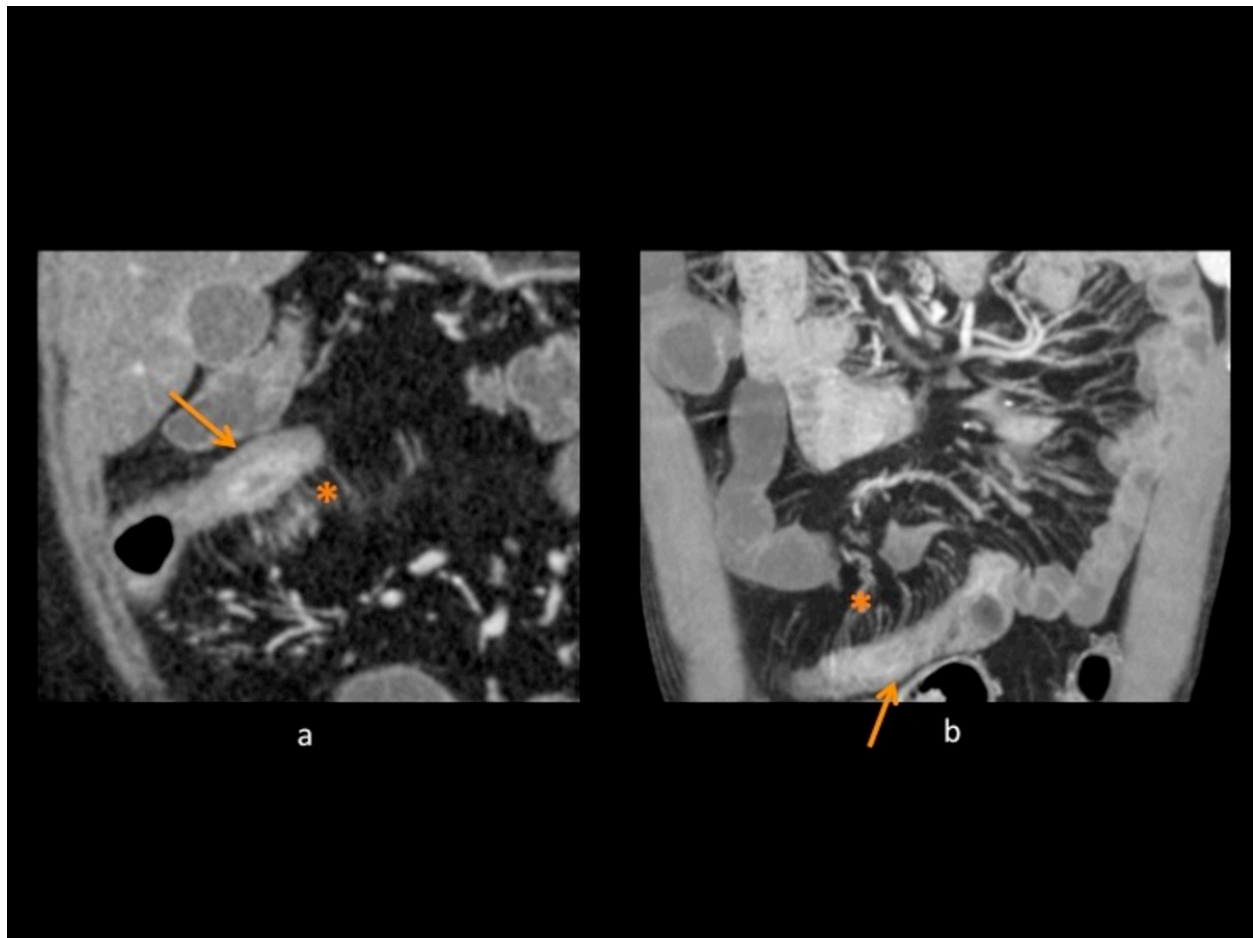


Fig. 8: Comb sign. Contrast-enhanced CT scan of the abdomen shows a diseased segment of the distal ileum (arrows) with prominently dilated adjacent mesenteric vessels (*). The MIP image (b) nicely accentuates the marked mesenteric hyperemia and vasa recta engorgement adjacent to the inflamed loop of bowel.

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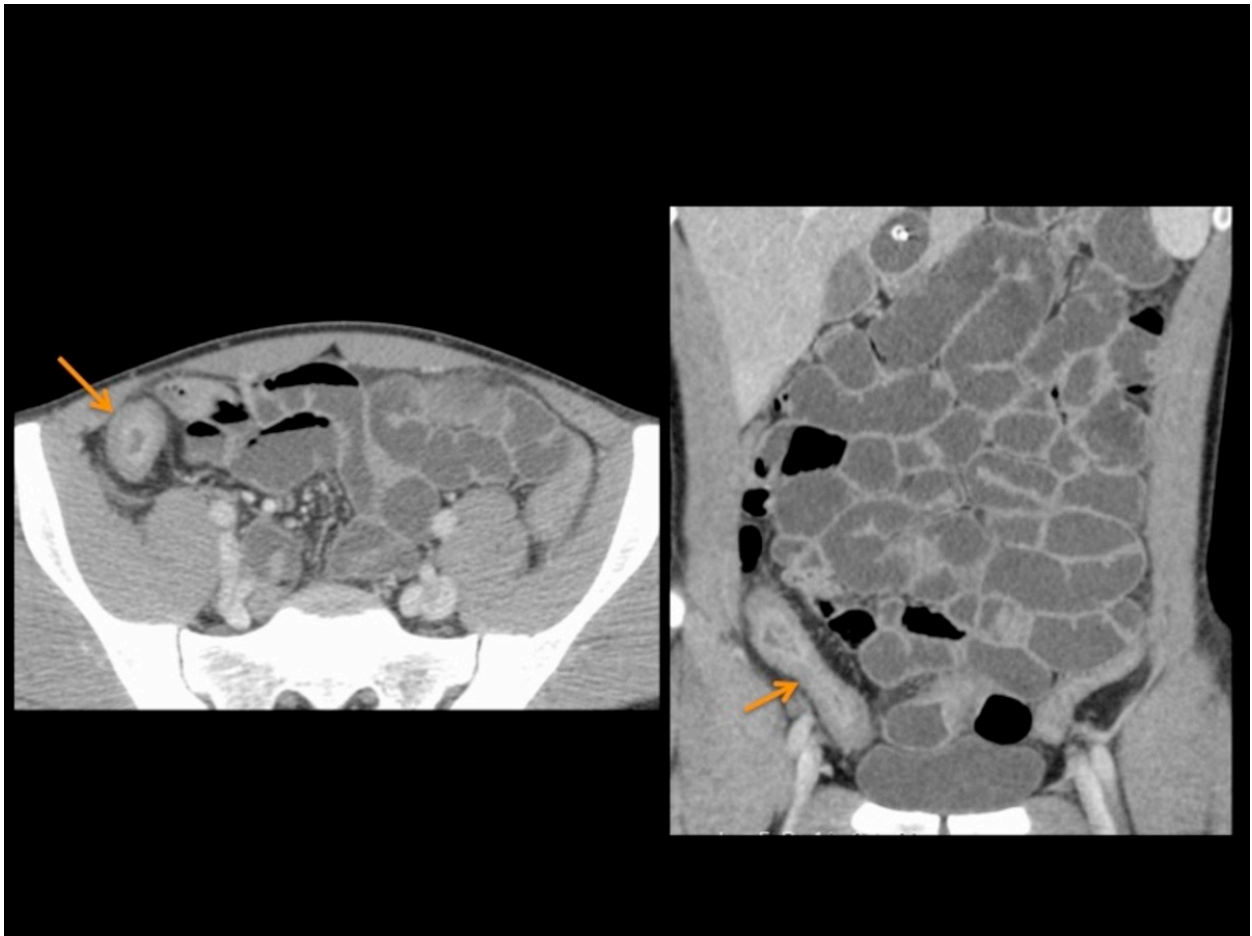


Fig. 6: Axial and Coronal volume rendered image demonstrates thickening and mucosal hyperemia of the terminal ileum, a classic appearance and location for acute Crohn's related inflammation.

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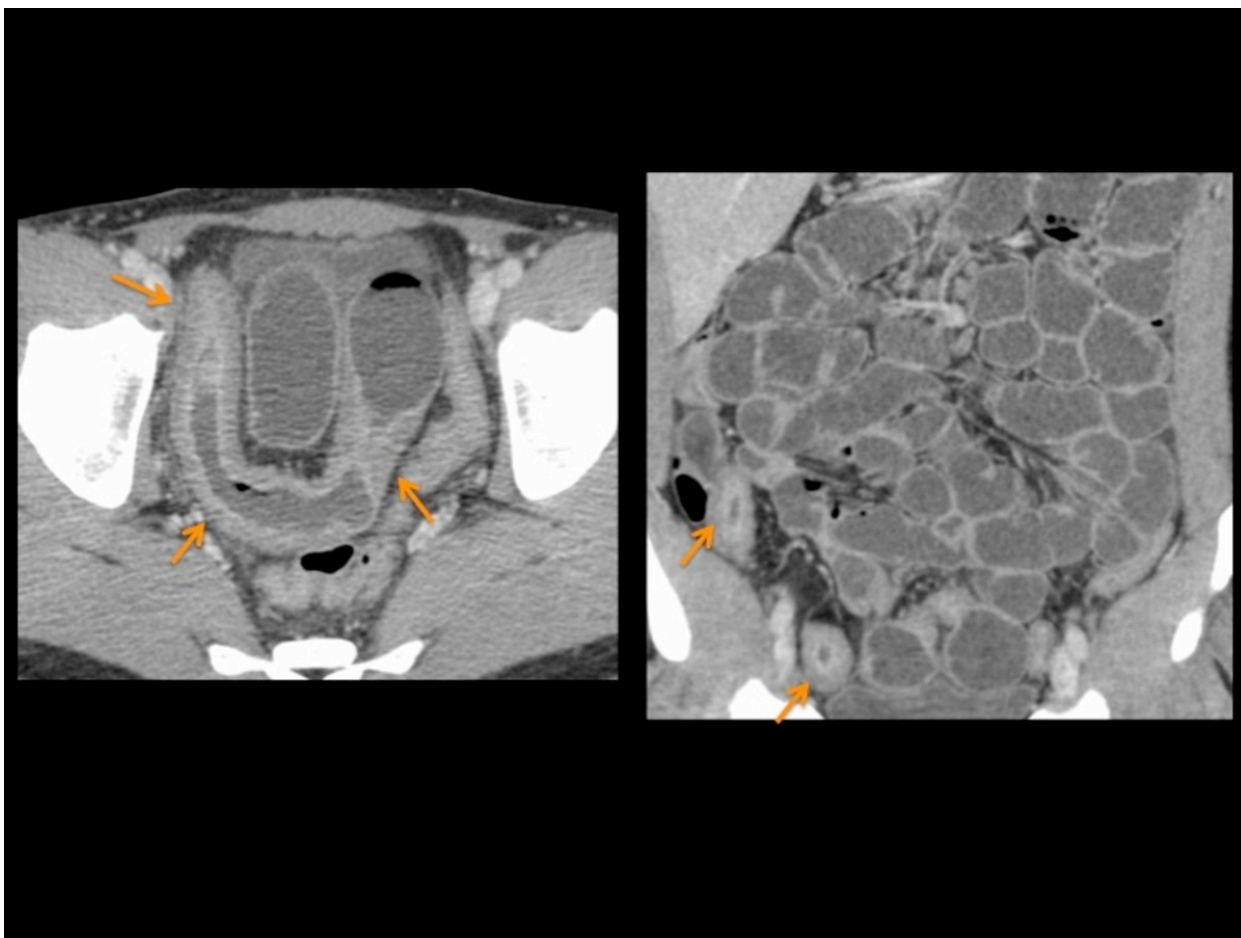


Fig. 7: Active Crohn's disease. Axial CT scan demonstrates prominent wall thickening and mucosal hyperemia encompassing a 10 cm segment of ileum (arrows). Coronal volume rendered images demonstrate a concentric parietal thickening of terminal ileum with trilaminar appearance (target sign).

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Fig. 9: MIP coronal reformation of a Crohn's disease patient with active disease who had previously had a segmental enterectomy shows mesenteric engorgement (arrowhead) and adenopathy (*) near a thickened bowel wall segment (arrows). Note the surgical clips at the ileal-ileal anastomosis (curved arrows)

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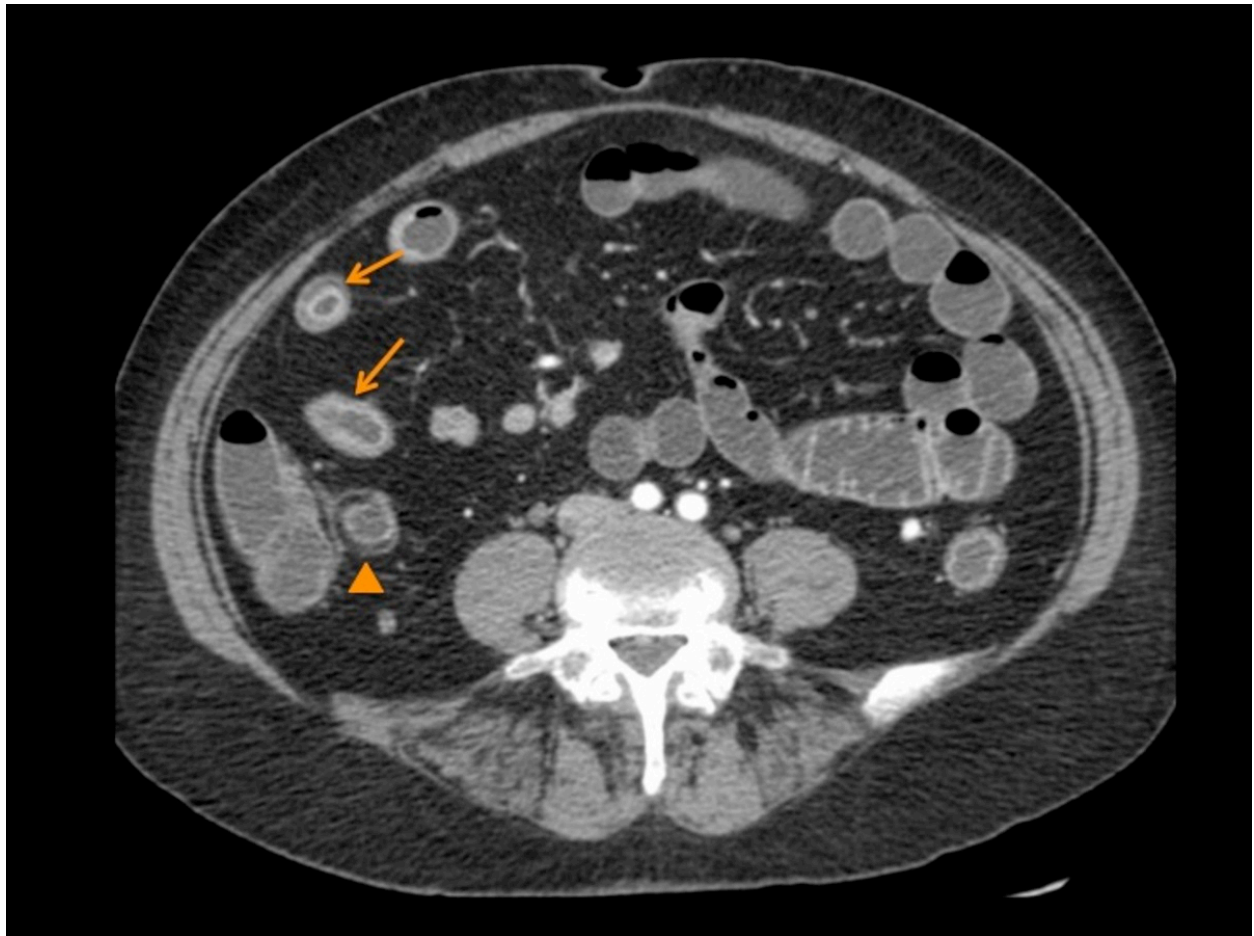


Fig. 5: Axial CT enterography section demonstrates mural stratification, with mucosal hyperenhancement and submucosal edema indicative of active Crohn disease (arrows). Submucosal fat deposition due to chronic disease is also present (arrowhead).

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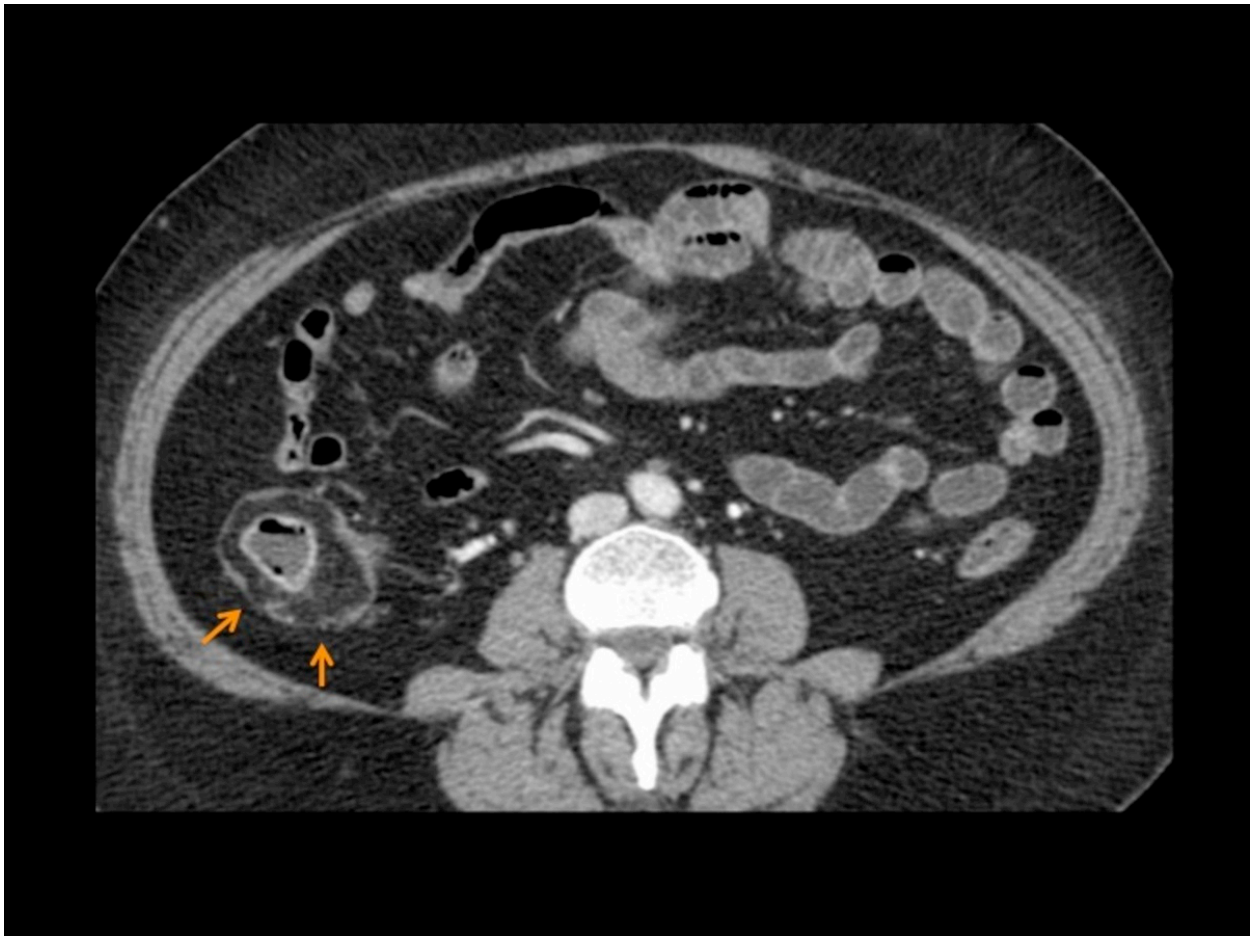


Fig. 11: Axial CT enterographic section shows bowel parietal deposition of fat at the ascending colon (arrows), indicating chronic disease.

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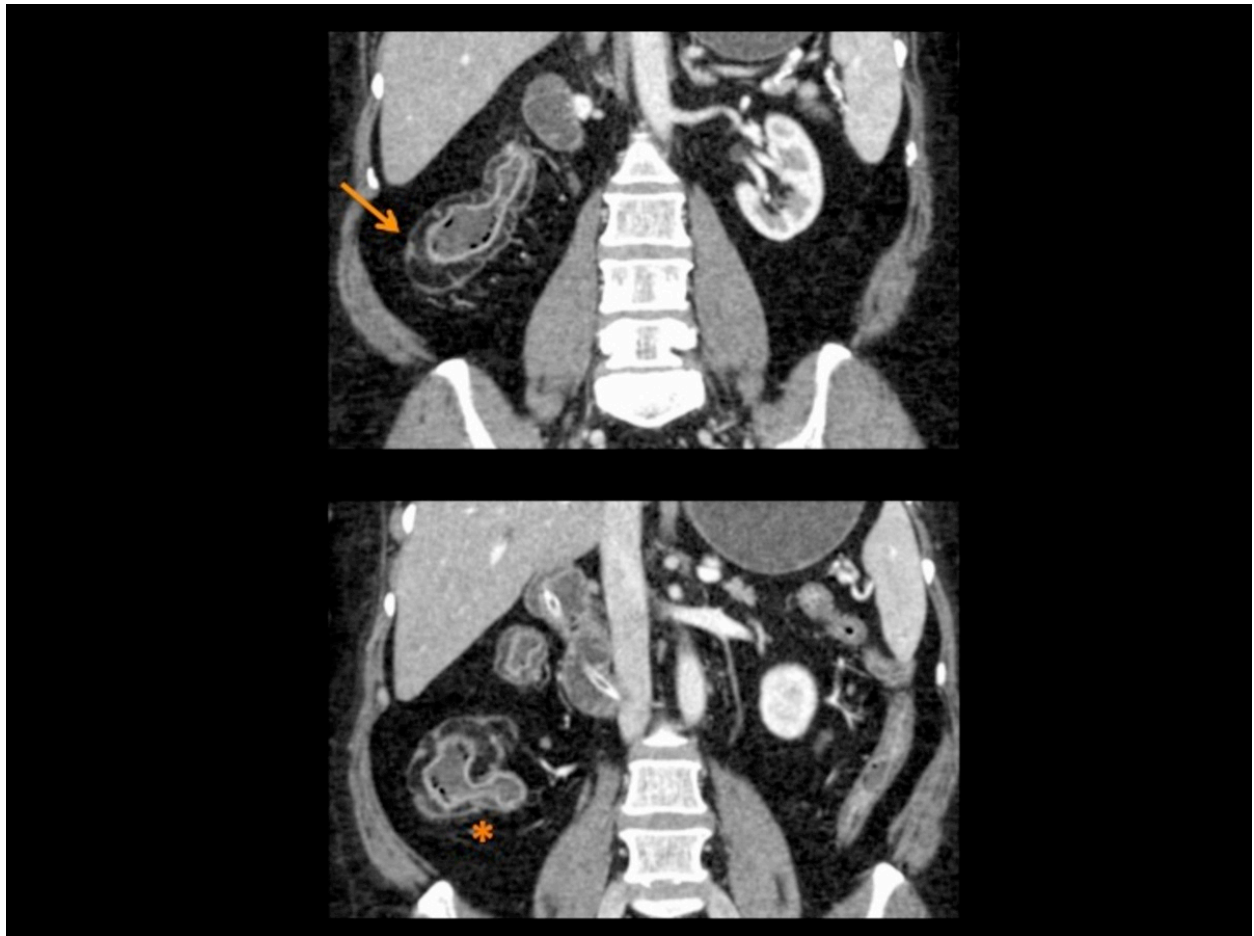


Fig. 12: Coronal CT enterographic section shows colic bowel parietal deposition of fat (arrows), indicating chronic disease.

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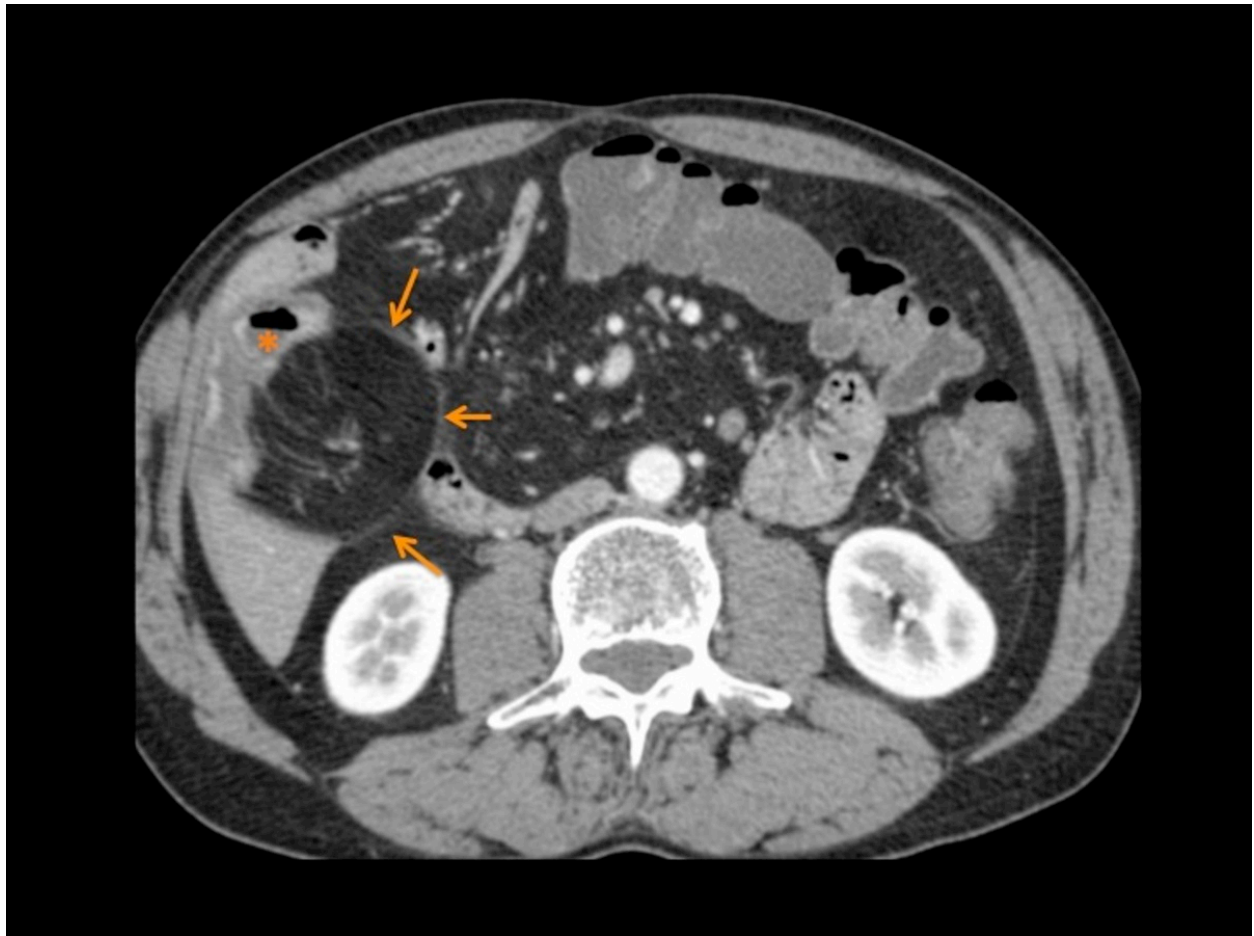


Fig. 13: Fibrofatty proliferation. Contrast-enhanced CT scan of the abdomen shows a proliferation of fat tissue around the small bowel (*).

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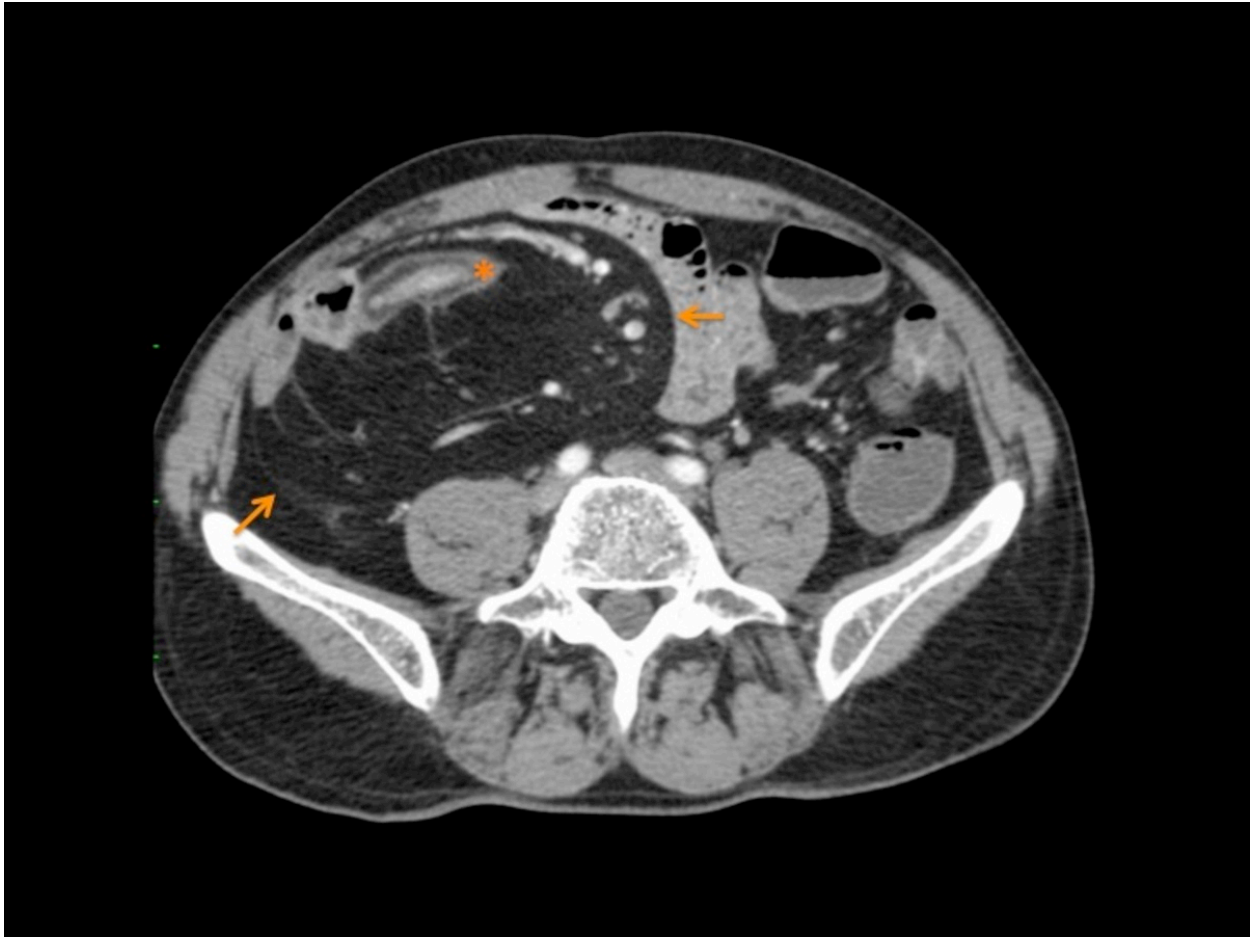


Fig. 14: Fibrofatty proliferation ("creeping fat"). Contrast-enhanced CT scan of the lower abdomen shows a proliferation of fat tissue (arrows) around the terminal ileum (*). The tissue has a heterogeneous appearance with increased attenuation.

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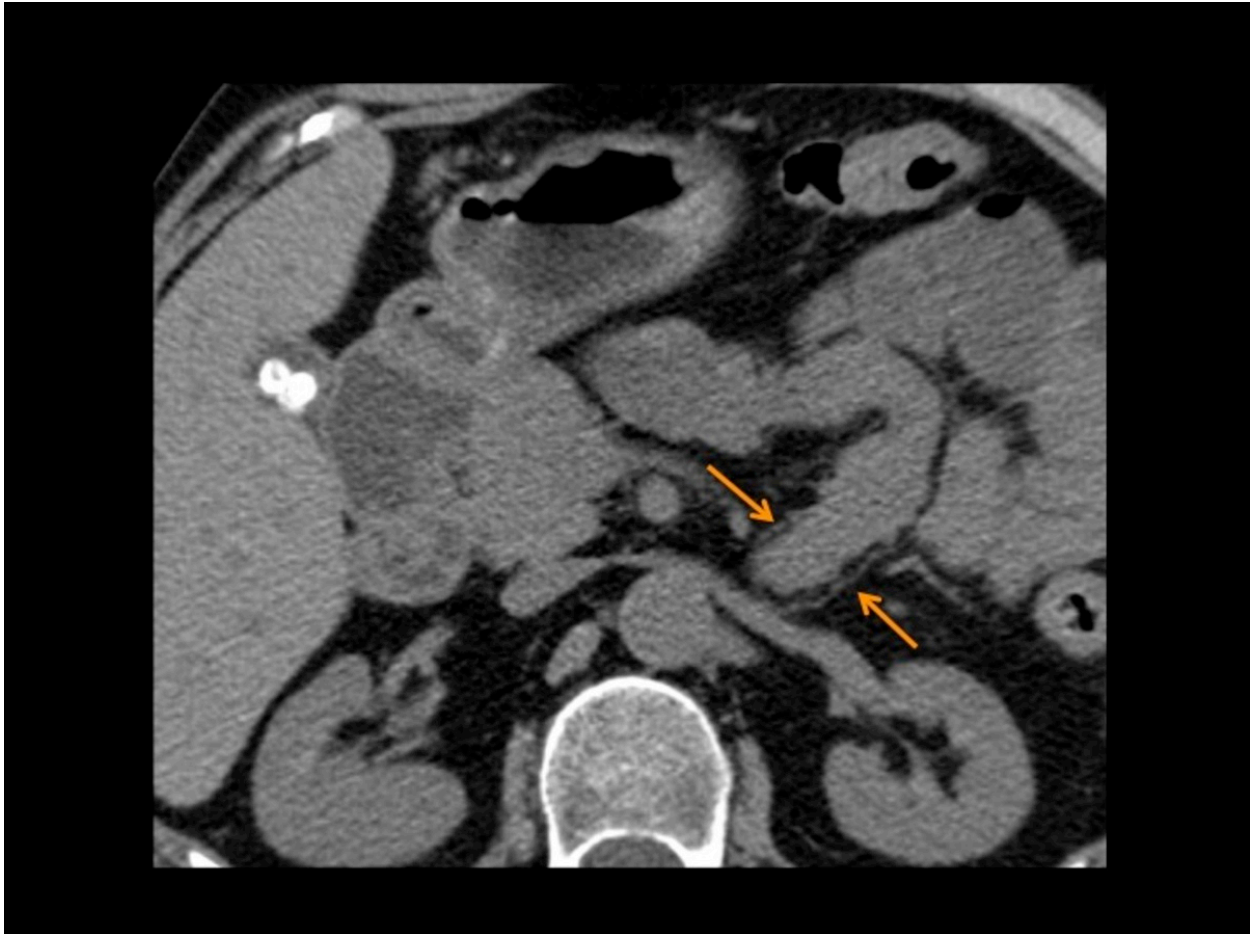


Fig. 10: Axial abdominal CT shows the fat halo sign (arrows) in the wall of the 4th portion of the duodenum, in a patient with chronic Crohn's disease. A gallstones are incidentally visualized in the gallbladder, a commonly associated finding in Crohn's disease.

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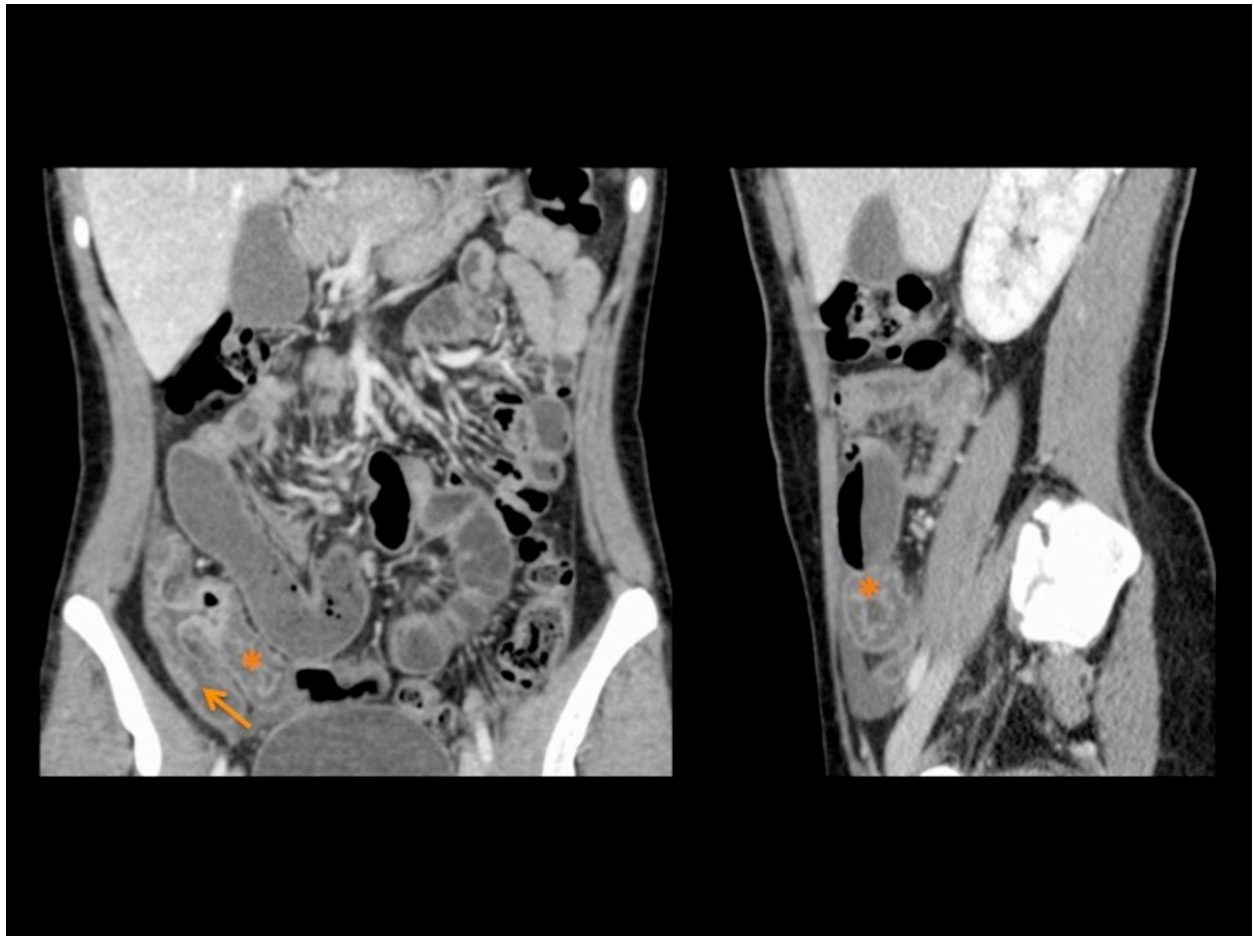


Fig. 16: Coronal reformatted CT scan images clearly shows bowel wall thickening at the distal ileum (*) and colon (arrows). The thickened wall has a stratified appearance. These findings are suggestive of active lesions from Crohn disease.

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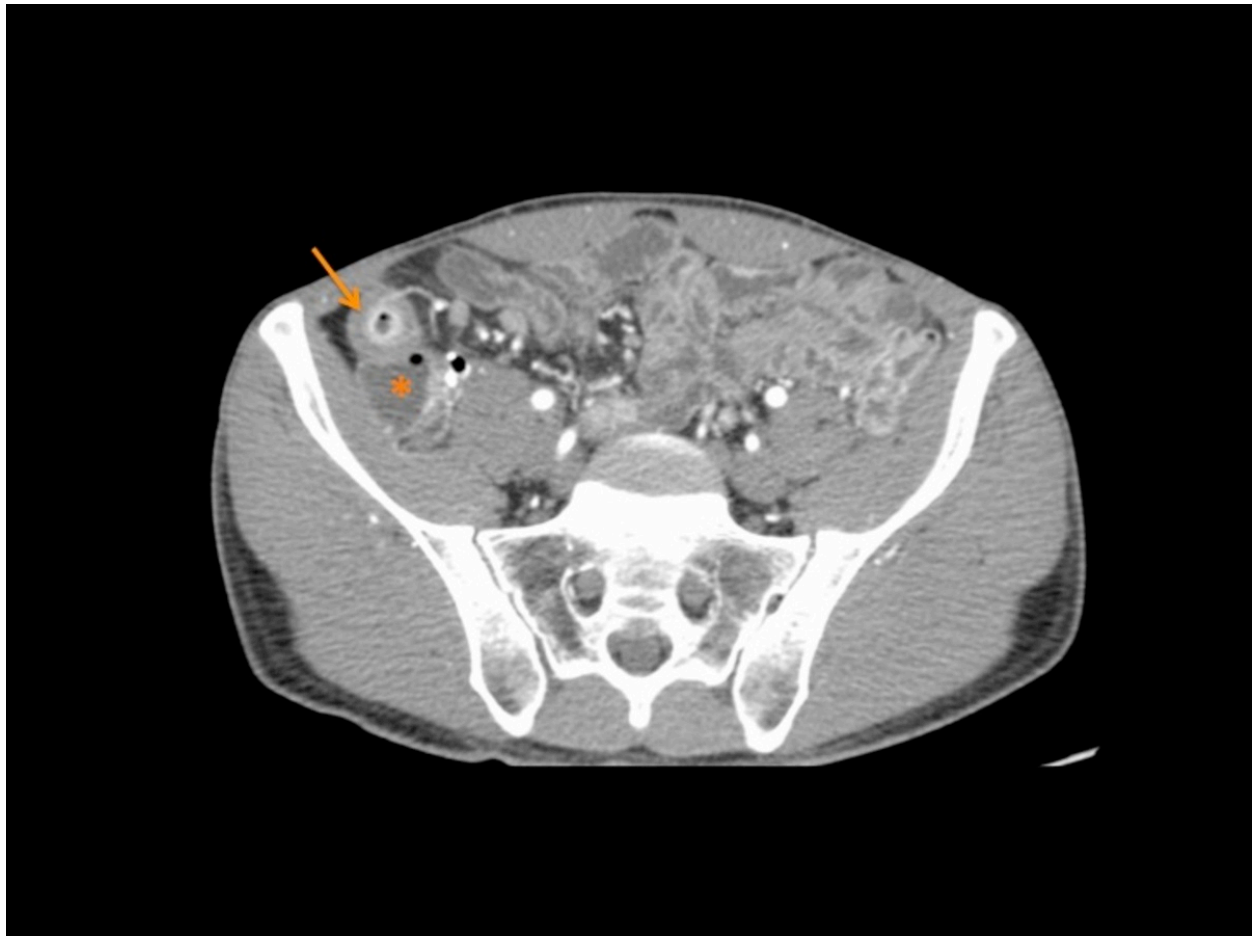


Fig. 18: Abscess formation in Crohn disease. Axial CT enterographic sections show a large fluid collection (arrows) with gas. Note the evidence of active Crohn disease (*) in the terminal ileum.

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Fig. 20: Iliopsoas muscle abscess. Contrast-enhanced CT scan of the pelvis shows an air-containing abscess in the right iliopsoas muscle (*) in a patient with terminal ileitis (arrow) .

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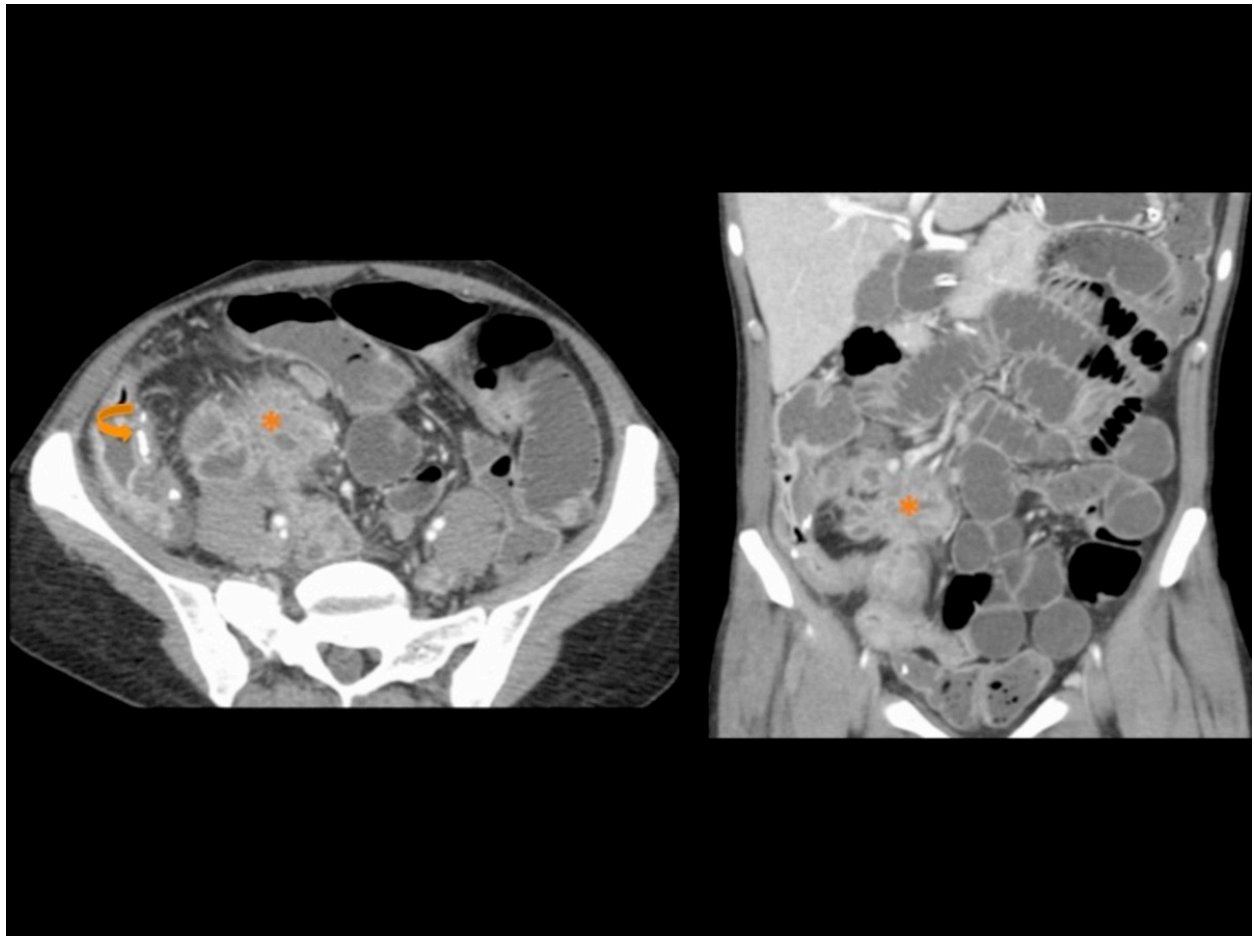


Fig. 17: Fifty-year-old male with Crohn's disease and history of prior ileal resection. Axial and coronal reformatted CT enterographic sections demonstrates marked thickening, mucosal hyperemia of the neo-terminal ileum and multiple loculated fluid collections (*). While discrete fistulous tracts could not be visualized, this constellation of findings is highly suggestive of complex fistulizing Crohn's disease. Note the surgical clips at the ileal-ileal anastomosis (curved arrows)

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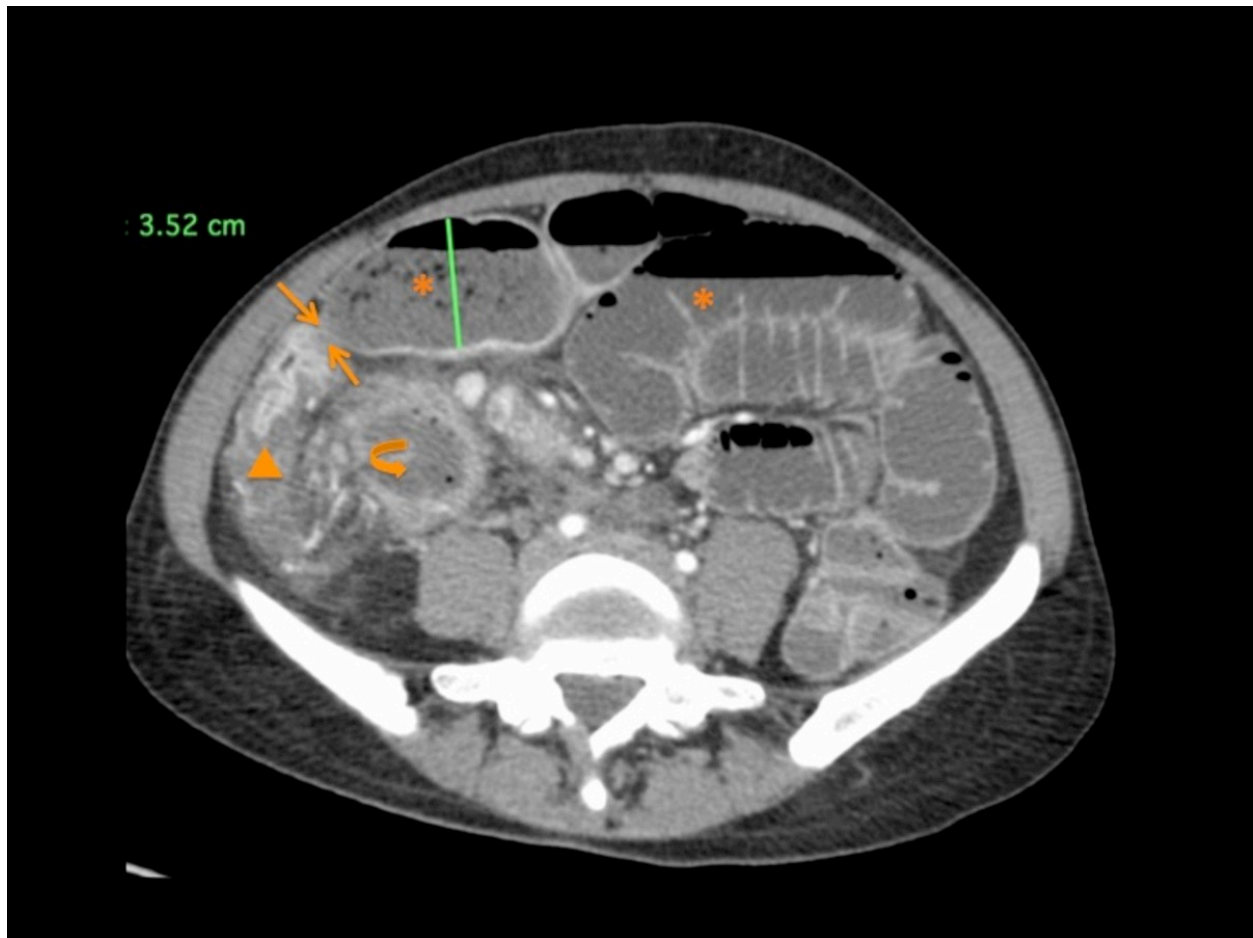


Fig. 15: Axial contrast-enhanced image demonstrates multiple dilated loops of small bowel (*) with a discrete transition point (arrows), in keeping with a small bowel obstruction. This image also demonstrates a long segment of bowel wall thickening and mucosal hyperemia with luminal narrowing (arrowhead). Note a fluid collection adjacent to the inflamed loop of small bowel.

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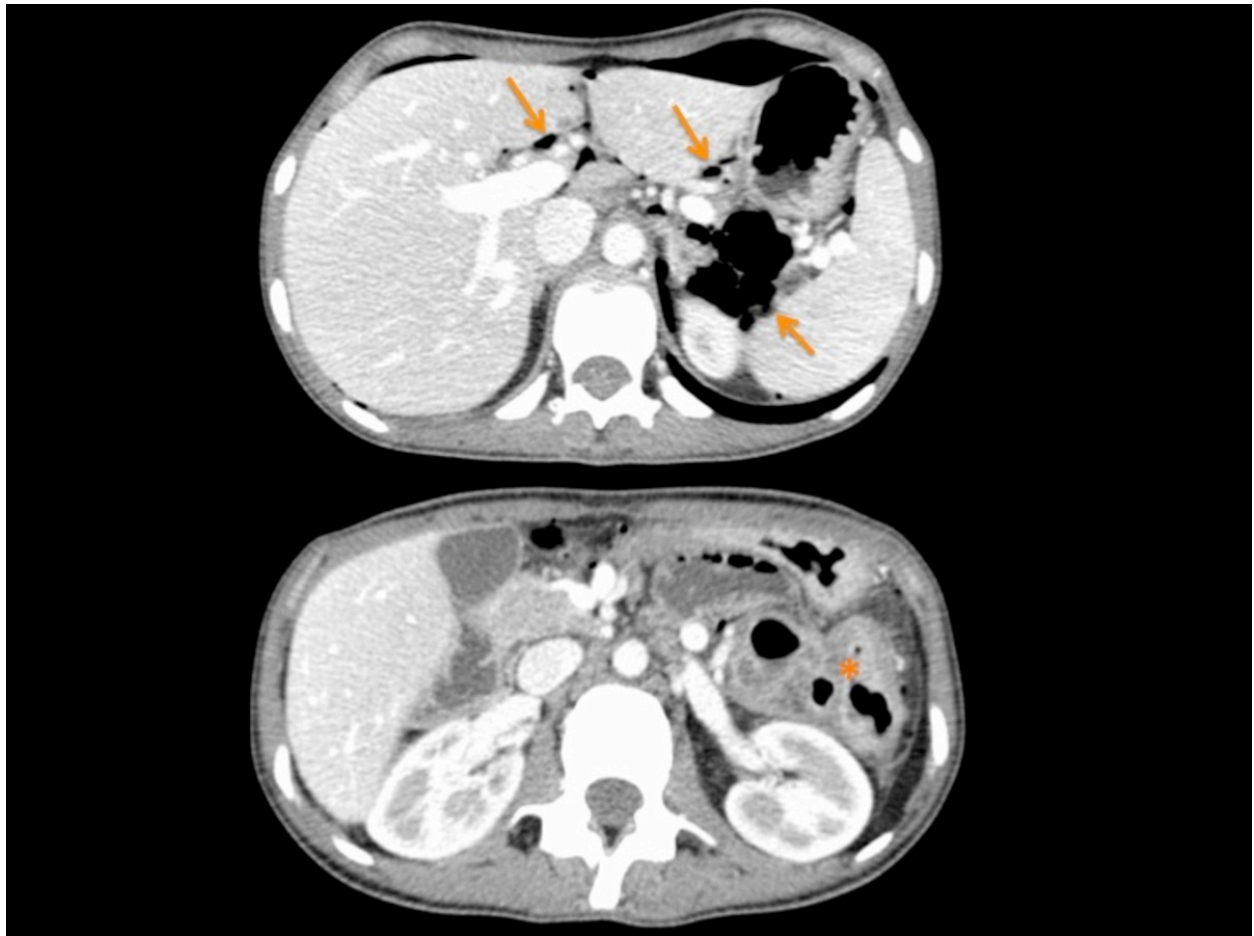


Fig. 19: Perforation and phlegmon at the small bowel in the left abdomen(arrows).

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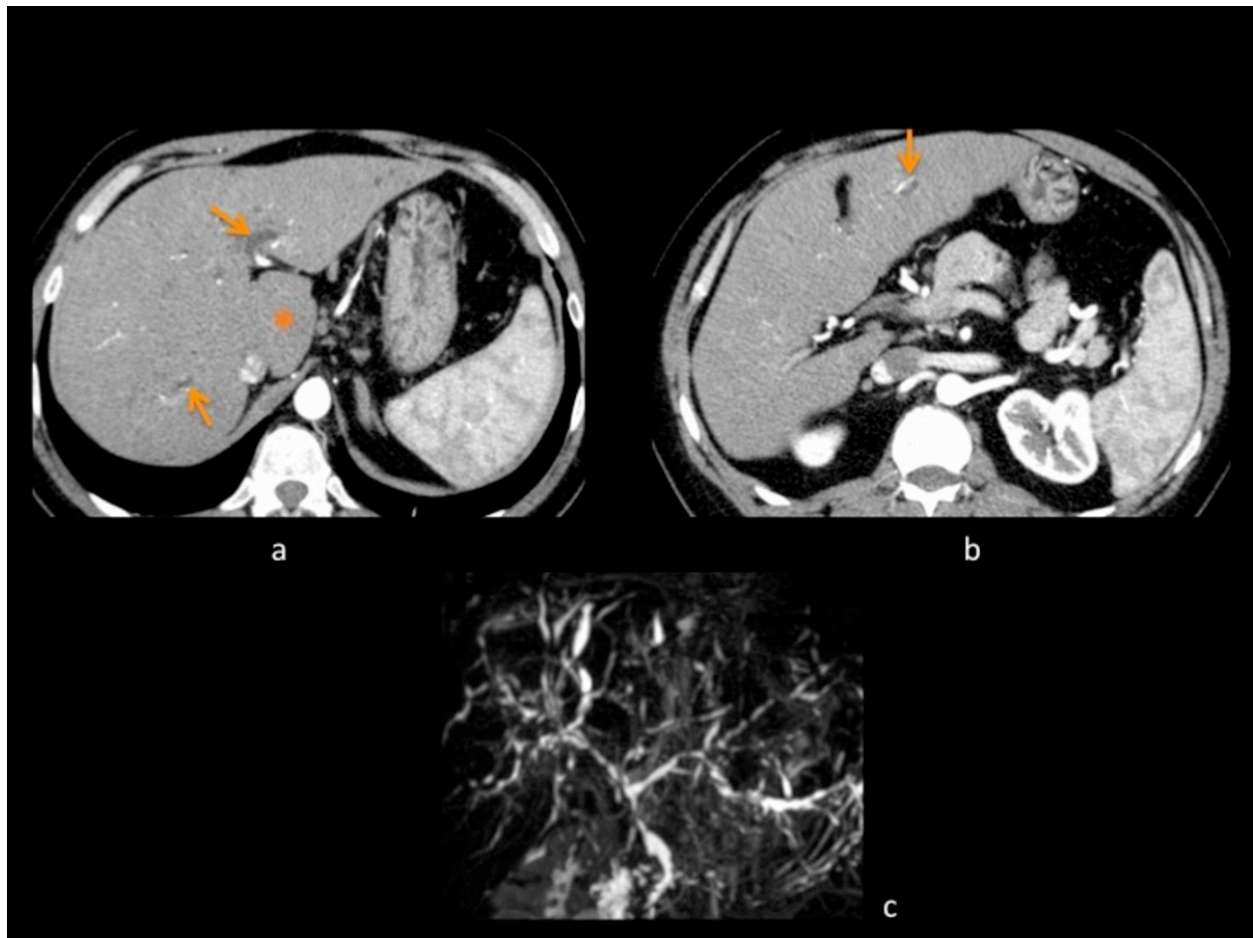


Fig. 21: Primary sclerosing cholangitis and Crohn's disease. Contrast-enhanced CT scan (a and b) shows mild bile duct dilatation with a discontinuous pattern (arrows) and morphologic changes of cirrhosis with caudate hypertrophy (*). Coronal MRCP image (c) demonstrates multifocal strictures and irregularity of the intrahepatic bile ducts.

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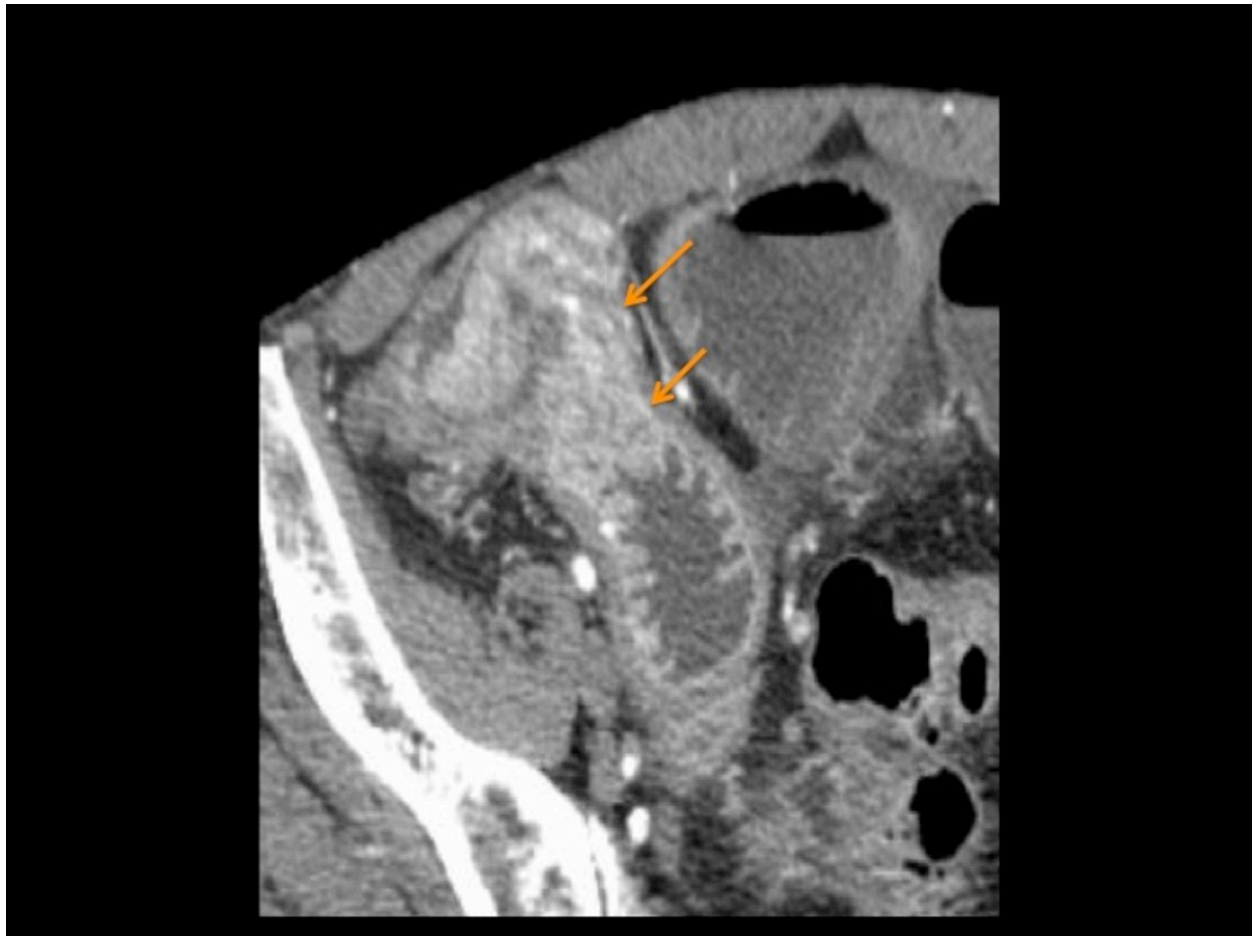


Fig. 22: Abdominal CT of a patient with an adenocarcinoma of the ileum that extended to the ileocecal valve shows focal irregular thickening with enhancement of the terminal ileum (arrows). Note absence of mesenteric inflammatory signs.

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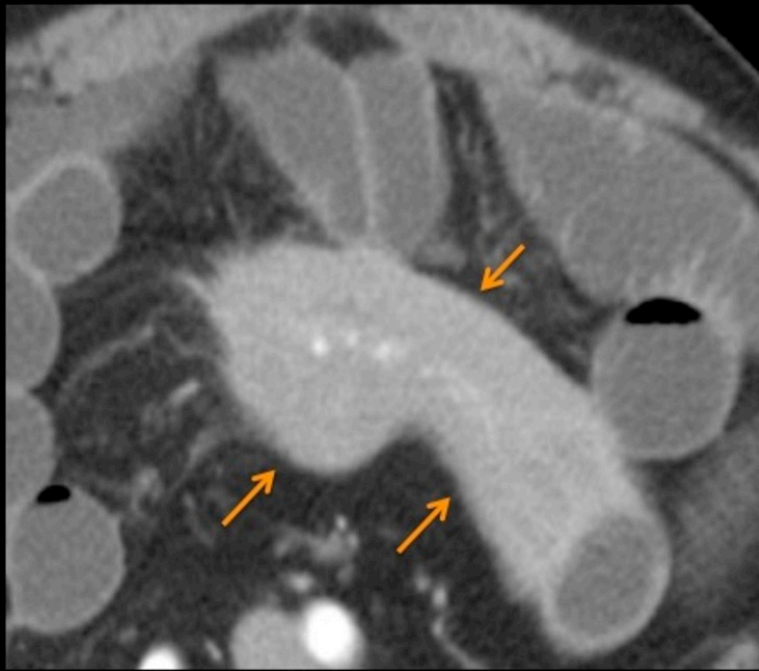


Fig. 23: CT enterography shows homogeneous enhancing and greatly thickened wall of an ileal loop (arrows). Pathologic examination revealed small cell B lymphoma.

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Conclusion

The multidetector computed tomography has become crucial for the diagnosis of Crohn's disease and its complications, with a proven efficacy in identifying the enteric and extraenteric manifestations of the disease.

This modality can clearly depict inflammatory lesion activity and conditions that require elective gastrointestinal surgery, thereby aiding in treatment planning.

Personal information

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