Take a Loop: Bowel Wall Classical Findings at CT scan with Clinical Correlation.

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Learning objectives

The purpose of our educational exhibit is to:

- Review and describe some bowel wall classical findings at abdominal CT scan, with clinical correlation.
- Help radiologists to remember some typical bowel wall findings at abdominal CT scans that can lead to a most likely diagnosis when only a few clinical data are available.
- Describe typical cases with the most significant clinical and radiological features.
Background

Bowel wall abnormalities at CT scans are frequently nonspecific and overlap of image findings are common among digestive diseases. In a simple way, intestinal diseases can be classified as infectious, inflammatory, neoplastic and vascular. The expression of all this pathologic conditions at CT scan studies can be quite similar and the most frequent findings are:

- Bowel wall thickening, that should be analyzed by its morphology, attenuation and enhancement pattern.
- Alteration of abdominal fat tissue.
- Secondary findings as lymphadenopathy, ascites, vascular filling defects and others.

Despite the similarities, some abdominal imaging findings at CT are typical and can lead to a most likely diagnosis with only a few clinical and laboratorial data. In this cases, radiologists play an important role by suspecting and making contact with physicians and surgeons to collect information that will support the diagnosis.
Findings and procedure details

The cases presented here were selected from a radiologic learning archive at an University Hospital (Instituto de Medicina Integral Prof. Fernando Figueira - IMIP). Every patient has clinical data that corroborates the radiologic suspected diagnosis.

PSEUDOMEMBRANOUS COLITIS

Pseudomembranous colitis (PMC) is an acute disease related to a toxin produced by unopposed proliferation of Clostridium Difficile. Elevated yellow- white plaques forming pseudomembranes on the colonic mucosa is the pathologic mark of the disease. The infection is usually nosocomial and the use of antibiotics is known as the main triggering factor. Other less important causes are abdominal surgery, colonic obstruction and severe illness. Clinically, a significant number of patients is asymptomatic, while others may have diarrhea, abdominal pain and fever and the most severe cases can evolve to a toxic megacolon, with perforation and sepsis[2].

CT FINDINGS:

- Wall thickening, usually with low attenuation that represents mucosal and submucosal edema
- The "Accordion sign"
- Periocolonic stranding
- Ascites

The accordion sign occurs when orally ingested contrast becomes trapped between thickened haustral folds. Colonic submucosal edema with mucosal enhancement can have a similar appearance. This finding is highly suggestive of PMC and happens in advanced cases. However it is not an often seen sign.

TYPICAL CASE - Internal patient that recently used antibiotics with onset of diarrhea, fever and abdominal pain presenting the accordion sign at CT scan, with other related findings. PMC is the most likely diagnosis (Fig. 1).
NEUTROPENIC COLITIS

Also called Typhlitis, Neutropenic Colitis (NC) is an acute disease, characterized by fever and a right lower quadrant pain, with or without evidence of peritonitis in immunocompromised patients, especially those undergoing chemotherapy for malignancies. The typical location helps the diagnosis: the pathologic process begins on the caecum and may progress to the ascending colon, appendix and terminal ileum. The mechanism of this disease is not completely clear, but involves intestinal mucosal damage that can rapidly progress to perforation due to a combination of infection, ischemia and hemorrhage[3].

CT FINDINGS

- Cecal distention
- Cecal wall thickening that is usually circumferential and symmetric.
- Inflammatory stranding of the adjacent mesenteric fat.
- Extension to ascending colon, appendix, terminal ileum and rarely to transverse colon.
- Pneumatosis, pneumoperitoneum, and pericolic fluid collections that should be recognized because surgical intervention may be needed.

TYPICAL CASE - Immunocompromised/neutropenic patient undergoing chemotherapy for malignancy with fever and a right lower quadrant pain, presenting cecal and ascending colon wall thickening with inflammatory fat stranding. NC is the most likely diagnosis (Fig. 2).

GRAFT VERSUS HOST DISEASE

Graft versus host disease (GVHD) is a systemic disease that affects bone marrow transplant patients receiving immunocompetent lymphocytes from the donor that reacts against the receptor tissues. This pathologic condition may occur on an early or late phase. Acutely, the involvement of the gastrointestinal tract usually happens after other systemic manifestations as skin lesions with rash and pruritus. Intestinal form alone is rare, but the most commonly encountered imaging findings in GVHD are small bowel and colon disease. Patients presents with abdominal pain, diarrhea and fever. Pathologically, there is a mucosal lesion and replacement by granulation tissue. The differentiation from infectious enteritis and radiation enteritis can be difficult and biopsy should be made to confirm the doubtful cases, once the treatment of GVHD is immunosupression[4].
CT FINDINGS:

- Bowell Wall thickening
- Mucosal enhancement with configuration of a "halo sign" (hyperemic granulation tissue surrounded by lower-attenuation outer bowel wall layers).
- Mesenteric stranding
- Ascites
- GHVD tends to be diffuse and involves a large segment of gastrointestinal tract.
- Stomach and esophagus can be affected.

TYPICAL CASE - Patient treated with stem cell transplantation 10-40 days earlier with abdominal symptoms and previous skin manifestation, presenting at CT scan bowel wall thickening with diffuse enhancement, the "halo sign", involvement of a large segment of gastrointestinal tract, mesenteric stranding and ascites. GVHD is the most likely diagnosis. However, is extremely important to rule out the possibility of infection (Fig. 3).

INTESTINAL SMALL VESSELS VASCULITIS

Intestinal vasculitis may be observed in many clinical and radiological forms depending on the size of the affected vessels and the gastrointestinal location. Small vessels vasculitis is a manifestation of diseases like Wegener Granulomatosis (WG), Microscopic Polyangiitis, Churg-Strauss Syndrome (CSS), Henoch-Schönlein Syndrome and Systemic Lupus Erythematosus (SLE). Microscopically, there is inflammation on arterioles and capillaries caused by different mechanisms in each disease that lead to bowel wall injury. Deposition of antigen-antibody complex is seen in SLE, while granulomatous inflammation occurs in WG and CSS as examples [5].

CT FINDINGS:

- Dilated bowel wall
- Focal or diffuse bowel wall thickening that is usually multifocal and not confined to a single vascular territory because vasculitis may affect several small vessels at the same time
- Abnormal bowel wall enhancement that may configure the "halo sign"
- Engorged mesenteric vessels
- Ascites and lymphadenopathy
- Ancillary findings in other organs

TYPICAL CASE - Patient with an underlying disorder associated to vasculitis with onset of abdominal pain and malaise and CT scan showing diffuse bowel wall thickening, with a
"white" enhancement pattern or the "halo sign". Small vessel vasculitis is the most likely diagnosis, if laboratorial data do not suggest infection (Fig 4-5).

PNEUMATOSIS

Pneumatosis is defined as the presence of gas inside the bowel wall. It is caused by a break in the mucosa with air passage to the wall layers. The majority of the cases are related to severe intestinal damage and imminent perforation. Therefore, should be considered a life-threatening condition. Many diseases can lead to pneumatosis. Among adults, closed-loop bowel obstructions and mesenteric ischemia both with delayed treatment are common causes of pneumatosis. However, sometimes pneumatosis do not represent a serious injury and occurs after hematopoietic stem cells transplantation and associated with the use of some chemotherapy drugs, with a benign behavior [1].

CT FINDINGS:

- "Black attenuation" of the bowel wall corresponding to the intestinal air dissecting the layers.
- Findings of the primary cause that led to the bowel injury, like internal hernias and mesenteric vessels filling defects as examples.
- Pneumoperitoneum and intra-abdominal fluid collections in case of perforation.

TYPICAL CASE - Patient with acute abdominal pain, distention and obstructive symptoms with CT scan showing pneumatosis and findings of the primary cause that led to bowel injury (Fig. 6)

CROHN DISEASE

Crohn disease is a chronic inflammatory bowel condition that can affect gastrointestinal tract from the mouth to the anus. It is characterized by a discontinuous distribution, presence of stenosis, dilatations, fistula and abscess in result of a transmural inflammatory process. Patients usually presents with chronic diarrhea, abdominal pain, weight loss, perianal abscess and fistula. The terminal ileum and the colon are the most affected locations. Different phases of the disease can be observed at CT scan[6].

CT FINDINGS

Acute phase:

- Bowel wall thickening with higher enhancement
- Mesenteric stranding
• Mucosal ulcers
• Abscesses

Chronic phase:

• Stenosis and prestenotic dilatation
• Skip lesions
• Fistulas
• Mesenteric fibrofatty proliferation
• Increased vascularity of the vasa recta (combsign)
• Mesenteric adenopathy

TYPICAL CASE - Patient with chronic diarrhea, abdominal pain, weight loss and CT scan showing bowel wall thickening with enhancement, stenosis and dilatations, mesenteric fibrofatty proliferation and increased vascularity of the vasa recta - "combsign" - (Fig. 7).
Fig. 1: A - Pseudomembranous colitis in a 3-years old boy with previously use of antibiotic, with onset of abdominal pain and diarrhea. Axial contrast-enhanced CT shows ascites and colonic wall thickening (straight arrow). The hyperemic enhanced mucosa is stretched over markedly thickened submucosal folds. Those findings are similar to the accordion sign even in the absence of oral contrast material. B - Axial contrast-enhanced CT shows complete resolution of the disease after treatment (curved arrow).

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Fig. 2: Neutropenic colitis (typhlitis) in a 30 years old patient who had undergone a stem cell transplant 8 days earlier. Coronal (A) and axial (B, C) contrast-enhanced CT demonstrates wall thickening of the caecum/ascending colon (straight arrows) and fat stranding (curved arrow).

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Fig. 3: Coronal (A) and axial (B) contrast-enhanced CT shows diffuse bowel wall thickening, mucosal and serosal enhancement (halo sign, straight arrows) in a 41 years old woman with confirmed graft versus host disease who had undergone allogenic stem cell transplant 31 days earlier.

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Fig. 4: 44 years old woman with acute abdominal pain and Systemic Lupus Erythematosus (SLE). Axial (A) and coronal (B) contrast-enhanced CT demonstrates diffuse bowel wall thickening with the "halo sign" (straight arrows) and ascitis (curved arrow). Those findings are suspicious for vasculitis.

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Fig. 5: The same patient (44 years old woman with SLE) uses azathioprine and developed colonic thickening (straight arrow on A, B and C) with a central band of fat attenuation (C).

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Fig. 6: 51 years old woman with acute abdominal pain. Axial (A) and coronal (B) unenhanced CT shows black attenuation (straight arrows) of caecum and ascending colon wall corresponding to the intestinal air dissecting the layers.

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Fig. 7: 32 years old woman with Crohn’s disease. Axial (A) and coronal (B) contrast enhanced CT shows bowel wall thickening (straight arrow) with mucosal zones of irregularity that may correspond to ulcers (arrowhead) and hypervascular appearance of the mesentery - comb sign (curved arrow). Those findings are correlated with active disease.

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Conclusion

Clinical correlation is very important to radiologists and when bowel wall abnormalities are present, it can be the determinant issue that will lead to the correct diagnosis.
References

REFERENCES