Differential Diagnosis of CT Patterns of Bowel Wall Thickening in Acute Abdomen

Poster No.: C-1824
Congress: ECR 2013
Type: Educational Exhibit
Authors: J.-D. Chen; Taipei/TW
Keywords: Abdomen, Gastrointestinal tract, Emergency, CT, Contrast agent-intravenous, Dilatation, Inflammation, Ischemia / Infarction
DOI: 10.1594/ecr2013/C-1824

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

1. To demonstrate variable CT patterns of bowel wall thickening in acute abdomen.

2. To categorize major differential diagnosis by wall attenuation, thickness, length, contrast-enhancing pattern of bowel wall, and perienteric change.

3. To identify the main radiological features of bowel wall abnormalities in inflammation, ischemia, hemorrhage, neoplasm and hypoalbuminemia-related condition of bowels.

Background

CT plays an important role in the evaluation of patients with acute abdomen in emergency department. High-resolution imaging of gastrointestinal tract by helical CT or multidetector CT allows assessment of both mural abnormality and related extraluminal change. Thickened bowel wall is often encountered by the radiologists in CT interpretation of acute abdomen. Such an abnormal change of bowel wall may suggest gastrointestinal tract disorders, but differential diagnosis is wide, ranging from mild, non-specific medical condition to life-threatening surgical condition. Intriguing CT patterns of bowel wall thickening make the task of correct diagnosis more complicated. The authors observed different CT features of bowel wall thickening related to variable gastrointestinal diseases, including inflammation, ischemia, intramural hemorrhage, neoplasm and bowel edema (intramural fluid retention caused by portal hypertension, hypoalbuminemia or angioedema). Correct Diagnosis is important because treatment varies. The categorization of major differential diagnosis may be facilitated by analyzing the symmetry and degree of wall thickness, wall attenuation, distribution and length of extent, contrast-enhancing pattern and perienteric change.

Imaging findings OR Procedure details

CT Image of Normal Bowel Wall

When optimally distended, normal bowel wall is barely visible at CT. The thickness of small bowel and colon measures not greater than 1.5 mm and 2-3 mm, respectively. When the thickness of distended bowel is greater than 3 mm, bowel wall thickening is defined. After intravenous contrast material administration, the visible wall usually manifests modest enhancement at CT. The mean enhancement measures about 118-120 HU and 107-111 HU at arterial and portal phases, respectively. Normal
periarteric fat should appear as clear as subcutaneous or retroperitoneal fat, without evidence of stranding, haziness or fluid (Fig 1).

Symmetry and Degree of Wall Thickness

- **Symmetry**

The majority of gastrointestinal diseases present wall thickening of involved segment. In general, non-neoplastic diseased bowel wall is concentrically and smoothly thickened with long transition in most cases (Fig 2-5), while neoplastic bowel wall is often either asymmetrically and irregularly thickened or polypoid mass-like with abrupt shouldering (Fig 6-8). Nevertheless, some specific inflammatory diseases such as acute appendicitis and colonic diverticulitis may also cause asymmetric focal wall thickening of contiguous colon by extending from the inflammation origin (ie. vermiform appendix or diverticulum). Such asymmetrically thickened juxta-lesional colon wall may indent its lumen, thereby creating so-called "arrowhead sign" (Fig 9, 10). Smooth mucosal surface of bowel tumor may suggest submucosal, intramural or subserosal neogrowth such as gastrointestinal stromal tumors (GISTs) (Fig 11).

- **Degree**

The degree of wall thickness varies markedly among variable non-neoplastic and neoplastic bowel entities. In non-neoplastic bowel disorders, pseudomembranous colitis may present greatest wall thickness as compared to other inflammation of bowels (eg. neutropenic enterocolitis, viral or bacterial enterocolitis, diverticulitis and inflammatory bowel disease), ischemic bowel disease, and graft-versus-host disease (GVHD) (Fig 12, 13). Contrast material trapped between polypoid thickened haustral folds presents "accordion sign" once thought specific for pseudomembranous colitis but also reported in other severe colitis (Fig 14). Crohn disease shows thicker wall than does ulcerative colitis in inflammatory bowel disease (Fig 15, 16). Intramural hemorrhage arising from trauma, anticoagulation therapy or bleeding diathesis which sometimes need differentiation from bowel ischemia with subserosal hemorrhage at CT often has higher degree of wall thickening. The size of neoplastic wall thickness varies from mild thickening, small nodule to bulky or exophytic growing mass (Fig 17-19). Obstructed colon carcinoma is not infrequently associated with proximal ischemic colitis, which can be distinguished from tumoral segment by concentric, smooth, mild thickness (Fig 20). Variable wall thickness of intestinal tuberculosis (TB) depends on the ulcerative, hypertrophic or sclerotic forms. Hypertrophic form of TB may manifest exophytic masses around the ulcerated ileocecal lumen, mimicking lymphoma or carcinoma (Fig 21-23). However, lymphoma may be associated with aneurysmal luminal dilation, and cecal carcinoma rarely extends beyond ileocecal valve.
Wall Attenuations

On precontrast CT, although wall attenuation mostly contributes little for differential diagnosis, some specific attenuation abnormalities may give hints.

- **High-attenuation**

High-attenuation wall (grater than 50-60 HU) usually denotes intramural hemorrhage (Fig 24, 25).

- **Fat-attenuation**

Fat-attenuation mass lesion of wall represents intestinal lipoma (Fig 26). Bowel wall "fat halo sign" (wall stratification with a fat layer less than -10 HU) may be demonstrated in subacute or chronic inflammatory bowel disease (more often in ulcerative colitis [61%] vs. Crohn disease [8%]) (Fig 27), but also may represent a normal finding related to obesity.

- **Calcified-attenuation**

Some rare neogrowths of bowel such as carcinoids and GISTs may occasionally calcify.

- **Gas attenuation**

Gas attenuation within bowel wall (pneumatosis intestinalis) is reported a specific sign for diagnosis of bowel ischemia (Fig 28). However, it may also be seen in overdistension, ulcerative inflammatory bowels, long-term steroid use or post-endoscopy condition.

**Distribution and Length of Extent**

- **Distribution**

Acute appendicitis and diverticulitis can be specifically diagnosed at CT by the evidence of vermiform appendix- or diverticulum-centered inflammatory thickening (Fig 29, 30). Many other gastrointestinal diseases present a broad spectrum of intestinal distribution and length of disease involvement. Pseudomembranous colitis tends to involve whole course colon, though segmentally on occasion (Fig 31, 32). Ischemic colitis tends to involve vascular territory (Fig 33). Exclusive involvement of ileum and right colon is more frequent with Crohn disease, TB and neutropenic enterocolitis. Shock bowel, reversible transient ischemia due to prolonged hypoperfusion, typically demonstrates diffuse small bowel wall thickening, but often sparing the colon. Cirrhosis-related edematous bowel wall thickening predominantly involves right colon when caused by portal hypertension, or diffusely involves both colon and small bowel when caused by hypoalbuminemia (Fig 34).
• **Length of Extent**

Longer length of bowel involvement favors inflammatory or ischemic condition rather than neoplasm or intramural hemorrhage. Nevertheless, on the contrary to short length of adenocarcinoma, lymphoma can extend for longer bowel segment (Fig 35). Discontinuity of lesional involvement with intervening normal segments (skip lesions) is the hallmark of Crohn disease (Fig 36), yet it can also occur in gastrointestinal graft-versus-host disease, mesenteric vasculitis, TB, lymphoma or metastasis.

**Contrast-Enhancing Pattern**

• **Homogeneous and heterogeneous enhancing patterns**

Although both homogeneous and heterogeneous patterns of contrast enhancement of bowel wall can occur in either neoplastic or non-neoplastic gastrointestinal diseases, the former pattern is more frequent with non-neoplastic entities. The exception is ulcerative colitis, which presents inhomogeneous enhancement in 70% of cases (Fig 37), while Crohn disease classically enhances homogeneously (Fig 38). Malignant intestinal tumors are inclined to enhance more heterogeneously probably due to necrosis, cystic degeneration or hemorrhage; none the less, lymphoma enhances more homogeneously (Fig 39, 40).

• **Target enhancing pattern**

"Target sign" or "double halo sign" of wall enhancing pattern demonstrates alternating concentric high- and low-attenuated layers in bowel wall. This pattern consists of inner enhancing layer- mucosa, lamina propria and hypertrophic muscularis mucosa, intermediate hypodense layer- submucosal edema, inflammation or fat, and outer enhancing layer- muscularis propria & serosa. Target sign is manifested exclusively in non-neoplastic intestinal diseases, either acute or chronic, including Crohn disease, ulcerative colitis, infectious enterocolitis, pseudomembranous colitis, neutropenic enterocolitis, bowel ischemia, radiation damage, GVHD, Henoch-Schönlein purpura, bowel edema, and even intramural hemorrhage (Fig 41- 44). Conspicuous mucosal enhancement is most evident with shock bowel, GVHD and visceral angioedema (Fig 45).

• **Lack and delayed enhancing pattern**

Lack of mural contrast enhancement is specific for transmural bowel infarct (Fig 46). Delayed enhancing pattern of wall during bi-phasic dynamic CT scan associated with serrated thickened beaked transition zone has been reported as a sign for strangulation.
Perienteric Change

CT can superbly detect perienteric change related to bowel diseases. The perienteric change accompanying inflammatory or ischemic events is often non-specific but conspicuous, including mesenteric fat stranding, edema or fluid. Such perienteric change may help little for differential diagnosis of underlying disease, but signifies the severity of disease activity. Thickened bowel segment associated with mesenteric fibrofatty proliferation, perienteric fistula (enterocutaneous, enteroenteric, enterovesical or enterovaginal), sinus tract or abscess frequently denotes Crohn disease (Fig 47, 48). Peri-lesional phlegmon or abscess is also common seen with ruptured appendicitis or diverticulitis. Perienteric mesenteric infiltration may also be associated with malignant tumor, implying either direct tumor invasion, desmoplastic reaction or a complication of perforation. Beaded, nodular morphology of mesenteric vascular engorgement or "comb sign" is reported suggestive of mesenteric vasculitis (Fig 49), but similar finding may also be shown with Crohn disease and GVHD in the literature. Visualization of mesenteric arterial or venous occlusion adds credit to thickened bowel wall for diagnosis of ischemic bowel disease (Fig 50). Small mesenteric lymph nodes are not uncommon in inflammatory diseases. Necrotic or calcified mesenteric lymph nodes may relate to intestinal TB. Mesenteric or retroperitoneal bulky lymphadenopathy is characteristically associated with malignant tumors. Presence of parietal peritoneal nodular or plaque-like thickening, enhancement, mesenteric or omental masses and loculated ascites in association with thickened bowel wall denotes peritoneal carcinomatosis (Fig 51). Bloody ascites is frequently associated with intramural hemorrhage or bowel ischemia. Demonstration of extraluminal gas or extravasation of enteric contrast medium or feces is the evidence of perforation.

Images for this section:
Fig. 1: Normal bowel wall. Post-contrast CT performed for renal colic showed normal wall of distended bowel as a barely visible line with modest contrast enhancement (arrow). Surrounding perienteric fat was clear.

Fig. 2: A 75-year-old male with pseudomembranous colitis. A. Non-contrast CT revealed diffuse bowel wall thickening of transverse colon with concentric even thickness (arrows). Much ascites was also noted. B. Colon fibroscopy showed marked erythematous mucosal
swelling coated with multiple yellowish plaques, characteristic of pseudomembranous colitis.

Fig. 3: A 75-year-old male with infectious colitis. A. Post-contrast CT disclosed mild symmetrically circumferential wall thickening of sigmoid colon (arrows). B. Diffuse erythematous mucosal swelling was found over sigmoid colon by colon fibroscopy.
Fig. 4: A 44-year-old male with shock bowel due to blunt hepatic trauma Post-contrast CT demonstrated generalized marked circumferential wall thickening of whole small bowels with intense mucosal enhancement.
Fig. 5: A 41-year-old female with radiation enteritis after irradiation for iliac bone metastasis. Post-contrast CT revealed evenly circumferential wall thickening of ileum with submucosal edema (arrow).
Fig. 6: A 76-year-old male with adenocarcinoma of colon. Post-contrast CT scan revealed an asymmetrically marked thickened wall of descending colon (long arrow) with lobulated inner surface narrowing the lumen. Surrounding pericolic infiltration may be suggestive of periserosal invasion (short arrow).

Fig. 7: A 78-year-old male with advanced stomach cancer. A. Post-contrast CT scan showed a lobulated heterogeneous enhancing soft tissue thickening of gastric antrum, with central ulceration (small arrow) and peripheral abrupt shouldering (open arrows),
characteristic of malignant neogrowth. Note perigastric lymphadenopathy (long arrows).

B. UGI series revealed circumferential mass lesion with mucosal destruction over gastric antrum, causing luminal narrowing and rigidity, consistent with advanced stomach cancer.

**Fig. 8:** A 70-year-old male with malignant lymphoma. Post-contrast CT showed a bulky soft tissue mass with heterogeneous enhancement over ileocecal junction (long arrow), associated with enlarged mesenteric lymph nodes (short arrows).
**Fig. 9:** A 72-year-old male with diverticulitis of ascending colon. Post-contrast CT demonstrated inflamed diverticula (short arrows). Asymmetrically focal thickening of colon wall contiguous with an inflamed diverticulum was shown to indent the colon lumen, resulting in "arrowhead sign" (long arrow).
**Fig. 10:** A 25-year-old patient with acute appendicitis. Post-contrast CT revealed a swollen vermiform appendix with marked periappendiceal fat stranding (long arrow). Uneven wall thickening of the cecum causing focal indentation, resulting in "arrowhead sign" (short arrow).
Fig. 11: A 38-year-old male with benign gastrointestinal stromal tumor (GIST). A. Post-contrast CT showed a well-defined eccentric soft tissue mass with smooth margin over distal ileum (arrow), suggestive of submucosal lesion. B. Small bowel series after barium meal also disclosed this eccentric submucosal mass over distal ileum (arrow).

Fig. 12: A 69-year-old male with pseudomembranous colitis. A. Post-contrast CT scan showed marked circumferential wall thickening of sigmoid colon (arrows). B. Colon fibroscopy revealed yellowish plaques coating erythematous swollen mucosa (arrows). C. Pathology (H & E stain) revealed inflammatory cell infiltration and vascular proliferation in markedly thickened mucosa (M) with glandular tissue necrosis. There was profuse inflammatory exudate coating mucosal surface (arrow), corresponding to endoscopic finding of yellowish plaque. SM: submucosa.
Fig. 13: A 75-year-old male with pseudomembranous colitis. Non-contrast CT scan disclosed marked wall thickening of ascending and descending colon (arrows), with surrounding pericolic fat stranding and much ascites.
Fig. 14: Accordion sign in infectious colitis. A. and B. Contrast-enhanced CT scan showed marked circumferential wall thickening with polypoid haustral fold swelling of colon (arrows).
Fig. 15: A 56-year-old female with ulcerative colitis. A. Contrast-enhanced CT scan showed mild circumferential wall thickening of rectum and sigmoid colon (arrows) with mild surrounding fat standing. B. sigmoidoscopy revealed swollen mucosa with erythema and shallow ulcers (arrows).
**Fig. 16:** A 55-year-old female with Crohn disease. A. Contrast-enhanced CT scan demonstrated two separate segments of circumferential wall thickening over ileocecal region (short arrow) and descending colon (long arrow). Focal hyperemic soft tissue swelling was seen over LT flank wall with colocutaneous fistula (open arrow). B. Barium enema showed segmental luminal strictures (arrows) identical with CT finding, but the colocutaneous fistula over LT flank was not opacified.

![CT scan showing Crohn disease](image)

**Fig. 17:** A 76-year-old male with adenocarcinoma of colon. Contrast-enhanced CT scan showed circumferential marked wall thickening with heterogeneous enhancement over descending colon (arrow), consistent with neogrowth.

![CT scan showing adenocarcinoma](image)
**Fig. 18:** A 62-year-old male with T-cell lymphoma of jejunum. Contrast-enhanced CT scan disclosed circumferential, homogeneous neoplastic wall thickening of a jejunal loop with luminal dilatation (arrow).
**Fig. 19:** A 65-year-old female with adenocarcinoma of duodenum. A small eccentric contrast-enhancing soft tissue lesion was identified over the junction between 2nd and 3rd portions of duodenum (large arrow), causing luminal stenosis. Note a regional lymph node (small arrow).
Fig. 20: A 84-year-old male with adenocarcinoma of proximal sigmoid colon and ischemic colitis of D-colon. A. Non-contrast CT scan showed a soft tissue mass over proximal sigmoid colon (large arrow) and mild concentric wall thickening of neighboring descending colon. B. Pathology (H & E stain) revealed inflammation (long arrow) adjacent to the neogrowth (short arrow). M: mucosa; SM: submucosa.

Fig. 21: A 63-year-old male with intestinal TB. A. Contrast-enhanced CT scan showed multiple segments of circumferential wall thickening over cecum (open arrow), terminal
ileum and jejunum (short arrows). Enlarged mesenteric lymph nodes were found as well (long arrow). B. Barium enema revealed segmental narrowing and deformity with mucosal thickening and destruction over the cecum (long arrow) and terminal ileum (small arrows).

**Fig. 22:** A 60-year-old male with intestinal TB. Contrast-enhanced CT scan disclosed hypertrophic form of TB as bulky, homogeneous enhancing masses (open arrow) involving cecum (short arrow) and ileum (long arrows). Note also enlarged mesenteric lymph nodes.
**Fig. 23:** A 50-year-old female with malignant lymphoma of small intestine. Contrast-enhanced CT revealed a lobulated, homogeneous enhancing soft tissue mass over ileocecal junction (arrows),
Fig. 24: A 89-year-old male with intramural hemorrhage of small bowel due to Coumadin overdose. Non-contrast CT scan showed short segmental circumferential wall thickening of a small bowel loop (arrows), in which the mural attenuation measures up to 70 HU, consistent with hematoma.
Fig. 25: A 25-year-old male with post-traumatic intramural hematoma of duodenum. Non-contrast CT scan showed a fusiform high-attenuated (measuring up to 85 HU) mass (arrow) over 3rd portion of duodenum, with marked compression of the lumen, consistent with intramural hematoma.
Fig. 26: A 68-year-old male with ileocecal lipoma causing intussusception. Contrast-enhanced CT scan demonstrated a well-defined intraluminal fat-containing mass (small arrow) protruding into proximal ascending colon (large arrows), consistent with lipoma.
Fig. 27: A 48-year-old male with ulcerative colitis in remission stage. Contrast-enhanced CT scan showed concentric stratification appearance with a submucosal fat layer (arrow), displaying "fat halo sign". Note fatty proliferation at presacral space.

Fig. 28: A 78-year-old female with end-stage renal disease and mesenteric infarction. A. Contrast-enhanced CT scan showed mild circumferential wall thickening of small bowel loops with perienteric fat stranding and fluid (long arrows). There was intramural air (pneumatosis) in some bowel segments, characteristic for bowel gangrene (small arrows). Small mesenteric venous air was also noted (short arrows). B. Pathology (H &
E stain) revealed extensive necrosis of mucosa (M) and submucosa (SM) with areas of hemorrhage and inflammatory cell infiltration. Areas of defect in submucosa and deep mucosa (arrows) may represent areas of intramural air extension.

Fig. 29: A 30-year-old male with diverticulitis of ascending colon suffering from diverticular perforation 2 days after this CT exam. A. Contrast-enhanced CT scan depicted a gas-filled, thick-walled diverticulum (arrow) with marked edematous thickening of surrounding colon wall and perienteric fat stranding, diagnostic of diverticulitis. B. Pathology (H & E stain) showed inflammatory cell infiltration of thickened mucosa (M) and submucosa (SM) with areas of hemorrhage. The star denotes inflammatory exudates, blood and fecal material in the diverticular lumen.
Fig. 30: A 18-year-old male with acute appendicitis. Contrast-enhanced CT scan presented a dilated, fluid-filled, blind-ended tubular structure with hyperemic wall thickening, contiguous with medial aspect of cecum, diagnostic of acute appendicitis.

Fig. 31: A 76-year-old male with pseudomembranous colitis. A. Contrast-enhanced CT scan revealed diffuse marked wall thickening with conspicuous contrast enhancement of
polypoid thickened mucosa over ascending, transverse and descending colon (arrows). B. Colonoscopy confirmed the diagnosis by evidence of extensive yellowish plaques coating swollen colon mucosa. C. Inflammation scan showed increased gallium uptake in almost whole colon.

**Fig. 32:** A 50-year-old male with pseudomembranous colitis. Coronal reformation of contrast-enhanced CT image demonstrated whole colon involvement of marked wall thickening with haustral fold swelling.
**Fig. 33:** A 48-year-old female with ischemic colitis. A. Post-contrast CT scan axial image and coronal reformation demonstrated circumferential wall thickening involving left-side colon of the territory of inferior mesenteric artery. B. Colon fibroscopy revealed pale (ischemic) change of mucosa associated with focal ulcers and hemorrhage (*) over descending colon.

**Fig. 34:** A 72-year-old male with cirrhosis-related hypoalbuminemia. Contrast-enhanced CT scan disclosed extensive wall thickening with submucosal edema of most small bowels and right-side colon. In the presence of feature of liver cirrhosis and submucosal
edema of GB wall, hypoalbuminemia-related bowel edema should be considered. Intestinal disease was excluded during exploratory laparotomy for initial misinterpretation as ischemic bowel disease.

**Fig. 35:** A 62-year-old male with intestinal lymphoma. A. Contrast-enhanced CT scan showed long segmental involvement of homogeneous enhancing wall thickening over jejunum (arrows). B. Pathology (H & E stain) showed complete replacement of normal mucosa (M) and submucosa (SM) by lymphomatous cells. Some areas of hemorrhage with red blood cell aggregates were also noted (arrows).
Fig. 36: A 20-year-old male with Crohn disease. A. and B. Contrast-enhanced CT scan showed multiple separate segments of circumferential homogeneous wall thickening (skip lesions) (short arrows) over jejunum, terminal ileum and cecum with intervening normal bowel segments (long arrows).
Fig. 37: A 47-year-old male with ulcerative colitis. A. and B. Contrast-enhanced CT scan revealed heterogeneous contrast enhancement of circumferential thickened wall of rectum and sigmoid colon (arrows).
**Fig. 38:** A 39-year-old male with Crohn disease. Contrast-enhanced CT scan showed homogeneous contrast enhancement of thickened wall of small bowels (arrows), causing luminal stricture and intestinal obstruction.
Fig. 39: A 70-year-old male with adenocarcinoma of proximal ascending colon and acute appendicitis. Contrast-enhanced CT scan showed strong heterogeneous contrast-enhancing mass lesion over ascending colon (large arrow), consistent with adenocarcinoma. Swollen vermiform appendix with hyperemic thickened wall and periappendiceal fat stranding was also identified as acute appendicitis (small arrow).
**Fig. 40:** A 78-year-old male with sarcoma of ileum. A. Contrast-enhanced CT scan disclosed a large heterogeneous contrast-enhancing mass lesion involving terminal ileum (arrows) compressing of cecum (open arrow) laterally. B. Color Doppler sonogram showed echo-complex mass lesion with increased vascularity and cystic or necrotic areas (arrow).

**Fig. 41:** A 82-year-old male with ischemic colitis. A. Contrast-enhanced CT scan showed target sign of thickened wall of distal transverse colon and descending colon with pericolic fat stranding (arrows). B. Pathology (H & E stain) showed necrosis of mucosa (M) with loss of normal cellularity and presence of hemorrhage and inflammatory cell infiltrates (arrows) and severe edematous submucosa (SM).
**Fig. 42:** A 64-year-old female with ischemic bowel disease. A. Contrast-enhanced CT scan showed marked bowel wall thickening with target sign over jejunum (small arrows), associated with marked perienteric mesenteric fat stranding (large arrow). B. Pathology (H & E stain) showed whole layer necrosis and thickening of both mucosa (M) and submucosa (SM), with inflammatory exudates over mucosal surface (arrows).

**Fig. 43:** A 84-year-old male with ischemic bowel disease. A. Contrast-enhanced CT scan showed marked thickening of small bowel wall with homogeneous contrast enhancement (small arrows) and mesenteric edema and fluid (*). One bowel loop enhanced with target sign over left abdomen (large arrow). B. Pathology revealed extensive necrosis of both mucosa (M) and submucosa (SM) with profuse red blood cell aggregates. MM: muscularis mucosae.
Fig. 44: A 25-year-old male with aplastic anemia and neutropenic enterocolitis. Contrast-enhanced CT scan showed circumferential wall thickening with target pattern of contrast enhancement over cecum (large arrow) and terminal ileum (small arrow).
Fig. 45: A 26-year-old male with multiple major trauma and profound hypovolemic shock. Contrast-enhanced CT scan demonstrated conspicuous contrast enhancement of mucosa of thickened small bowel (long arrow). Some subcutaneous emphysema extending from above was identified (short arrow).
**Fig. 46:** A 38-year-old male with protein C deficiency suffering from veno-occlusive ischemic bowel disease. Contrast-enhanced CT scan showed mild wall thickening of colon without contrast enhancement (long arrows), characteristic of ischemic change. Intraluminal filling defect was depicted within superior mesenteric vein (short arrow).
Fig. 47: A middle-aged male with Crohn disease suffering from cutaneous discharging sinus over lower abdominal wall. Contrast-enhanced CT scan showed homogeneous enhancing thickened wall of small bowel (large open arrow) and target-like enhancement of thickened wall of sigmoid colon (small open arrow). An enterocutaneous fistula was depicted with strong contrast enhancement (short arrow). Another cystic lesion with contrast-enhancing wall was noted over right pelvic cavity, suggestive of abscess formation (long arrow).
Fig. 48: A 57-year-old male with Crohn disease. A. Contrast-enhanced CT scan revealed focal homogeneous thickened wall of terminal ileum (arrow) and cecum, with a small abscess nearby the ileocecal junction (arrowhead). B. Barium enema with cone compression well demonstrated the small abscess and fistula (small arrow) communicating with strictured terminal ileum (large arrows).
Fig. 49: A 38-year-old male with systemic lupus erythematosus suffering from mesenteric vasculitis. A. and B. Contrast-enhanced CT scan showed wall thickening with target sign over cecum and distal ileum (small arrows). Mild irregular engorgement of small mesenteric arteries (comb sign) was noted (large arrows), suggestive of vasculitis.
**Fig. 50:** A 51-year-old male with atrial fibrillation suffering from arterio-occlusive ischemic bowel disease with bowel perforation. Contrast-enhanced CT scan showed complete occlusion of superior mesenteric artery (large arrow). Diffuse wall thickening was seen over right colon and some small bowel loops, which mostly poorly enhanced (small arrows). A: free air.
Fig. 51: A 55-year-old female with peritoneal carcinomatosis from colon cancer. Contrast-enhanced CT scan showed wall thickening of ascending colon (large arrow) and clustered distended small bowel (medium arrow). Soft tissue densities were also seen over retracted mesentery (small arrows) with multiple loculated ascites. These features were typical of peritoneal carcinomatosis.
Conclusion

Wall thickening of short length, asymmetric irregular thickness with abrupt shouldering, and solid homogeneous or heterogeneous contrast enhancing pattern suggests intestinal neoplasm. Wall thickening of long length, concentric smooth thickness with long transition, and target pattern of contrast enhancement favor non-neoplastic conditions. Absence of mural contrast enhancement signifies bowel ischemia. High-attenuated wall thickening on precontrast image indicates intramural hemorrhage. Perienteric fat stranding is most prominent with severe inflammation, ischemia and invasive malignancy. Bloody ascites frequently relates to intramural hemorrhage or ischemia. Analysis of the CT patterns of bowel wall thickening and perienteric change in correlation with the clinical settings facilitates correct diagnosis and subsequent appropriate management.

References

• Kircher MF. et al. Frequency, sensitivity, and specificity of individual signs of diverticulitis on thin-section helical CT with colonic contrast material: experience with 312 cases. AJR. 178(6):1313-8, 2002.

**Personal Information**

Jen-Dar Chen, MD. & MSc.

Chief of Department of Radiology, Taipei City Hospital - Zhongxiao Branch, Taipei, Taiwan.

Consultant radiologist of Department of Radiology, Taipei Veterans General Hospital, Taipei, Taiwan.

e-mail address: DAS69@tpech.gov.tw