CT evaluation of inflammatory conditions of the colon

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Advanced Clerkship in Radiology
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Outline

1. Normal CT considerations of Bowel
2. Disease Spectrum
   - IBD (*Crohns, Ulcerative Colitis*)
   - Infectious (*Pseudomembranous Colitis, typhlitis*)
   - Vascular (*ischemic*)
   - Diverticulitis
   - Appendicitis
   - Epiplioic Appendagitis
**Outline**

1. **Normal CT considerations of Bowel**
2. **Disease Spectrum**
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Normal CT considerations of Bowel

• Advantages:
  – Ease of availability and performance
  – Accurate delineation of anatomy – intestinal and extraintestinal + complications
  – Multidetector CT => short scan times, thin slices, reformations
Normal CT considerations of Bowel

- **Normal Colon:**
  - Small Bowel: 3 cm
  - Large Bowel: 6 cm
  - Cecum: 9 cm

- **Bowel wall thickness:**
  - Normal: 3 mm
  - Distended: 1-2 mm
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Patient #1: Scout and Axial Films

29 yo F with 3 wks of abdo pain, anemia and increased WBC
Patient #1: Coronal Reformation

Note the distal ileal distribution of Bowel Wall thickness
Patient #1: Sagittal Reformations

Note the difference between small and large bowel wall (seen here is Transverse Colon) thickness.
Patient #1: Coronal Reformation

Note the difference between small and large bowel wall thickness
**IBD: Crohn’s**

- **Etiology:** unknown
- **Involvement:** mouth to perianal
  - 80%: small bowel (distal ileum = most common)
  - 50%: ileocolitis
  - 20%: limited to colon – sparing of rectum
- **Clinical Manifestations:**
  - Diarrhea, Abdo pain, Weight Loss, Fever, bleeding
  - SBO (fibrotic strictures)
  - Fistula (entero-vaginal/vesical/cutaneous)
  - Perforation: sinus tracts with serosal penetration

Related to Pathophysiology Of Transmural Bowel Wall inflammation
Crohn’s: Extraintestinal Manifestations

- Localized Episcleritis
- Anterior uveitis/iritis.
- Apthous Stomatitis
- Pyoderma gangrenosum
- Erythema Nodosum

Mintz et al. Inflamm Bowel Dis. 2004
Trost et al. Postgrad Med J. 2005
ERCP showing Sclerosing Cholangitis

Presti et al., Dig Dis Sci. 1997

Note: Narrow CBD and stenotic CHD with prestenotic dilatation of Left Hepatic Duct + intrahepatic duct pruning.
Crohn’s: Imaging Options

- Colonoscopy
- Barium studies
- CT (sens: 94-100%, spec 95%); sens 70% early stage disease

Disadvantage: Limited evaluation of extramural extension + extraintestinal complications

Colonoscopy showing Cobblestone Mucosa
Lee et al., Endoscopy 2006

Barium study demonstrating a crohns induced bowel Fistula
Maconi et al., Am J Gastroenterol. 2003
Crohns: Findings on CT

- Small bowel, terminal ileum; left sided colitis rare; rectal sparing
- Eccentric Wall thickening with contrast enhancement:
  - 11mm +/- 5.1
- Homogenous or Stratified/segmental appearance ("skip" lesions)
  - Psedodiverticula
- Luminal Narrowing with prestenotic dilatation ("string sign")
- Fibrofatty proliferation adjacent to small bowel segments ("Creeping fat") -> separation of small bowel loops
- Mesenteric Lymphadenopathy (3-8mm): if>1cm -> consider lymphoma
- Water Halo and Target Signs => acute bowel injury
- Engorged Mesenteric Vessel ("comb sign") => acute bowel injury
- Abscess, Fistulas
Close-up Axial and Sagittal views of Patient #1’s abdomen

- Bowel Wall Thickening (>1cm)
- Comb Sign + Fibrofatty proliferation
Close-up Axial view of patient #1’s Abdomen

Mesenteric Lymphadenopathy: Note size < 1 cm
Close-up Coronal View of Patient #1’s Abdomen: Target Sign

Target Sign:
1. Outer layer for high attenuation: inflamed muscularis propria
2. Middle layer: intermediate (edema)/low attenuation (fat)
3. Inner layer: inflamed muscosa
Follow-up + Summary for Patient #1

- Combination of Clinical and Radiological Findings point to diagnosis of Crohn’s Disease in our patient
- Radiological Findings: Distal Ileal Bowel wall thickening with Target sign, Comb sign, fibrofatty proliferation and Mesenteric Lymphadenopathy
- Patient had subsequent follow-up with Gastroenterology and a c-scope with biopsies confirming the diagnosis of Crohn's
Patient #2: Scout and Axial images of Abdomen

57yo M with history of Ulcerative Colitis presents with 4 days of watery diarrhea, afebrile, normal WBC. Previous allergic reaction to IV Iodine (thus, no IV contrast given)
Two Coronal Reformations in different planes for Patient #2

Note: Involvement of Hepatic Flexure

Note: Ahastral, thickened bowel transverse colon
Sagittal and Axial slices in Patient #2

Transverse Colon involvement

Ahaustal rectosigmoid colon => likely chronic UC
IBD: Ulcerative Colitis

- Etiology: unknown
- Involvement: Rectum -> Large Bowel
  - Beware of “backwash Ilietis”
- Clinical Manifestations:
  - Abdo pain, bloody diarrhea, weight loss, fever
  - Increased risk of colon cancer (increased with duration and extent of colonic involvement)
  - Toxic megacolon with muscle layer infiltration
  - Strictures, Abscess
- Extraintestinal Manifestations (see Crohn’s)
Ulcerative Colitis: Imaging Options

- Imaging
  - Flexible Sigmoidoscopy
  - Colonoscopy
  - Barium enema – rare use: low sensitivity in mild disease, risk of bowel perforation in severe disease
  - CT
    - Rectal involvement + Left sided/pancolitis – occasional backwash ileitis
    - Symmetric wall thickening: 7.8mm +/- 1.9
    - Proliferation of perirectal fat
    - Target sign, Comb Sign in large bowel
    - Colon cancer, Toxic Megacolon

Tests of choice
Coronal Slice of Patient #2 and Axial Slice of another patient (patient #3) with UC

Ahaustral Transverse colon

Sigmoid Colon involvement in a different patient with known Ulcerative colitis and possible rectal stricture
Axial Slices for patient #3

Rectal Wall Thickening

Stricture: note the increase in bowel wall thickness along the horizontal plane versus the vertical plane
Coronal and Sagittal Views of Patient #3

Target Sign + sparing of small bowel at rectosigmoid junction

Rectosigmoid involvement
Follow-up + Summary for Patient #2

• Again, Combination of Clinical and Radiological Findings point to the diagnosis of UC exacerbation in our patient

• Radiological Findings: Rectal wall thickness + exclusive large bowel involvement, perirectal fatty proliferation, target sign in rectosigmoid junction

• Subsequent Colonoscopy confirmed the diagnosis in this patient
Patient #4: Scout and Axial images of Abdomen

86 yo F with Fever, Abdo Pain, watery diarrhea x 2days.
Multiple recent hospitalizations. Last June 2006 for pneumonia

Note the irregular looking Bowel wall appearance
Sagittal and Coronal Reformation of Patient #4’s Abdomen

Reformations indicate pancolitis

Sigmoid Wall thickness
Pseudomembranous Colitis

- Etiology: C. Difficile
  - Nosocomial, s/p antibiotics
- Involvement: Pancolitis/isolated colitis
- Clinical Manifestations
  - Asymptomatic carrier, watery diarrhea, abdo pain, fever, high WBC: 5-10d s/p Antibiotics (penicillin, clindamycin, cephalosporins)
  - Toxic Megacolon: colonic dilatation > 7 cm
Pseudomembranous Colitis: Imaging

- Imaging:
  - Sigmoidoscopy/Colonoscopy:
    - Pseudomembrane plaques
  - CT

Kawamoto et al, Radiographics. 1999

Pathology specimen showcasing plaques (straight arrows) + erythema/edema (curved arrow)

Often not necessary: Clinical Diagnosis
Pseudomembranous Colitis: CT Findings

- Bowel Wall thickening: 3-32mm (mean 14.7mm)
  - Irregular, “shaggy”
- Target Sign
- Accordion Sign: alternating bands of high and low attenuation (contrast trapped between thickened folds): non-specific (also found in other infectious colitis, ischemic colitis)
- Ascites: Important in differentiating from IBD (but again, non-specific)
Close up Axial and normal Axial images of abdomen in Patient #4

Accordion Sign
Follow-up + Summary for Patient #4

- Clinical history particularly important in this case although, as demonstrated by the radiographic findings, P. Colitis demonstrates an irregular ("shaggy") wall appearance with an accordion sign +/- ascites that allow for a reasonably distinct appearance.

- Stool for C. Diff confirmed the diagnosis of P. Colitis. Antibiotic treatment was started for this patient.
Complication of \( P. \) coli\( \text{tis} \) + UC

- Toxic Megacolon: bowel wall $> 7$ cm

Thoeni et al. Radiology. 2006
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**Typhlitis**

- Terminal ileum/ Cecal / Asc. colon involvement
- Neutropenic patients
- Fever, watery/bloody diarrhea
- Unknown etiology
- Txt: conservative – resolution with return of functioning neutrophils

Axial image of abdomen showing circumferential thickening of the cecal wall + pericecal inflammation

Horton et al. Radiographics. 2000
Appendicitis

- Luminal occlusion with venous congestion, ischemia, inflammation
- RLQ pain
- CT: thickened wall with dilated appendix (>6mm) + pericecal inflammation
- Txt: Surgery (risk of perforation)

Axial Image of Abdomen showing inflamed appendix and periappendiceal fat stranding
Horton et al. Radiographics. 2000
Diverticulitis

- Outpouchings of colonic mucosa/submucosa at site where vessels exit
- Etiology: Obstruction by stool/food/inflammation
- CT: descending/sigmoid colon wall thickening with pericolic inflammation in patient with diverticulae

Axial Image of Abdomen demonstrating mild fat stranding and fascial thickening in 60 yo M with LLQ pain
Ischemic Colitis

- Older population
- Ischemia (MI, Arrhythmia, embolus)
- Colonic mucosal changes due to restoration of blood flow (free radical damage)
- “Watershed” area: distal transverse colon (splenic flexure) + distal descending colon (rectosigmoid junction)
Epiploic Appendagitis

- 1–4-cm, oval, fatty pericolic lesion with surrounding mesenteric inflammation
- Associated with torsion/thrombosis
- Can be confused clinically with appendicitis
- Conservative management

Axial image of Abdomen showing peripheral enhancement of fatty epiploic appendage with surrounding mesenteric inflammation. Note the sparing of the large bowel.

Thoeni et al. Radiology. 2006
Summary: clinical history is paramount

Thoeni et al. Radiology. 2006

- **Crohns**: Right sided, distal ileum, left sided (rare) with rectal sparing
- **UC**: Rectal involvement +/- large bowel involvement, occasional ileitis
- **P. colitis**: pancolitis, accordion sign, ascites, Hx of antibiotic use
References


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Chisasibi, Northern Quebec, summer 2003