MR enterography for Crohn's disease in children

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Crohn disease
Idiopathic chronic transmural IBD
Increasing incidence
7/100,000 in North America
Age
15-30 years
15-25% present during childhood

Characterization
Mouth to anus
Most involve small bowel
10-20% only colonic
Transmural
Skip lesions
Noncaseating granulomas

GI Complications
Fistulae
Strictures
Anal fissures
Perirectal abscesses
Anorectal fistulae
Primary sclerosing cholangitis

Microscopy
Focal inflammation around the crypts
Ulceration
Crypt abscesses
Noncaseating granulomas
Extends to all layers
Abscesses
Fistulas

Children
Crohn's disease in MR enterography for
What causes Crohn Disease?

- Genetic
- Abnormal immune response
- Infection
- Dietary
- Psychosocial factors

Crohn disease

- Prolonged diarrhea
- Abdominal pain
- Weight loss
- Low grade fever
- Malabsorption

Marker of disease activity

- Serologic Tests
  - ASCA
    - 50%-70% in Crohn disease
    - Specificity 85-97%
    - 15% in UC
    - 0-5% normal population
    - Higher rate and earlier need for surgery
  - P-ANCA
    - More commonly found in UC

What causes Crohn Disease?
Diagnosis
Extension of disease (small bowel)
Activity of disease
Complications
Intestinal
Extra-intestinal

Evaluation of remission
- Small bowel follow through fluoroscopy
- Computerized tomography
- MR enterography
- CT enterography
- Barium

Typically a patient will drink 2 cups
Contrast

X IV iodinated contrast
X Shows enhancement when there is inflammation
X Oral contrast
X Delineate the small bowel lumen

Positive contrast Neutral contrast

Diluted iodinated contrast
X Used in CT enterography
X Showed improved delineation of the small bowel

Volumen® (E-Z-EM Inc. New York, NY)
X 0.1% w/v Barium, 0.1% w/w, 450 ml bottle mixture with Sorbitol
X Slowly absorbed
X Shown to have excellent distension over water, MC
X Generally good pt acceptance
X Fewer side effects than MC, PEG

The increased radiation from CT is a public health issue
MRE became the imaging of choice for Crohn disease.

- Sensitivity and specificity
  - Meta-analysis (six pediatric studies)
    - Sensitivity 84% (95% CI 77% to 90%)
    - Specificity 97% (91% to 99%)

Aliment Pharmacol Ther 2011;34:125–45
Aliment Pharmacol Ther 2013;37:1121–31

Evaluation of extramural complications

Assessment of disease activity

- Protocols
  - Coronal HASTE, TrueFisp
  - TrueFisp Cine
  - Axial T2 FS
  - Dynamic post IV contrast
  - Diffusion
  - Evaluation of peristaltic activity
    - Decrease peristaltic activity associated with inflamed bowel
    - Quantifing terminal ileum motility (n=28)
    - Compared to biopsy
    - Meta-analysis (x pediatric studies)
    - Specificity 98% (95% CI 96% to 99%)
    - Sensitivity 77% (95% CI 67% to 84%)
    - Meta-analysis children and adults
      - Specificity and sensitivity
Normal structure with restricted diffusion

\[ b=50 \text{ ADC} \]

Quantitative measurements of ADC

Normal bowel: 2.4-3.1 \times 10^{-3} \text{ mm}^2/\text{s}

Inflamed bowel: 1.6-2.0 \times 10^{-3} \text{ mm}^2/\text{s}


MRE in evaluation of activity

Signs of active disease

- T2
- Wall signal > muscle
- + Gad
- Early mucosal enhancement
- Gradual increased wall enhancement
- Prominent mesenteric vasa recta (comb sign)

Signs of fibrosis

- Low bowel wall T2
- Low signal intensity ≤ muscle
- + Gad
- Absent or minimal transmural enhancement

12 year-old boy, Crohn disease

What are the common complications?

- Acute inflammation
- Intraluminal
- Strictures
- Extraluminal
- Abscess
- Fistula between bowel loops
- Perianal fistula

Normal structure with restricted diffusion
15 year-old boy, Crohn disease

14 year-old girl, colonic Crohn disease

6 year-old girl with Crohn disease and fistula

15 year-old boy, Crohn disease with abscess formation

6 year-old girl with Crohn disease and fistula

Mucosal ulcerations

14 year-old girl, colonic Crohn disease

15 year-old boy, Crohn disease
Perianal Fistula and Abscess

About 30% of patients with Crohn have perianal fistula.

MRI vs endoscopic US

- MRI better delineate the tract of the fistula
- Positive and negative predictive values: 73% and 87% for MR, 57% and 64% for EUA
- MRI improve surgery outcome
- Postoperative recurrence: 16% if acted on MRI findings, 57% if ignored MRI findings

Limitations of MRI

- Sedation/GA
- <4 YO
- Possible 4-6 YO
- No oral preparation if sedated

Contraindications

- Ferromagnetic metallic or electronic devices implants
- Glucagon
- Contraindications: Pheochromocytoma, insulinoma
- Emesis

Summary

- MRE became the primary imaging for Crohn disease
- Diffusion increase sensitivity in detection of active disease
- Future research
  - Standardized reporting (scoring system)
  - Quantitative evaluation (ADC measurements)
  - New techniques
    - Evaluation of remission