

MR Enterography in Pediatric Croh Disease. Differences with ulcerous colitis. Our experience

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Learning objectives

The purpose of this report is to review radiographic features in entero-MRI of Crohn Disease in pediatric age patients and to set forth the differences with the Ulcerous Colitis (CU), as well as to expose the protocol and patient preparation that we perform in our hospital.

Background

Crohn disease (CD) and ulcerative colitis (UC) are inflammatory bowel diseases. CD extends to [gastrointestinal tract](#) discontinuously, the entire bowel wall is involved and ulcers extend deep into the bowel wall predisposing to fistulae. Ulcerative colitis predominantly affects the [colon](#), just mucosa and submucosa are affected and chronic disease is associated with a significantly elevated malignancy risk.

The lack of ionising radiation from MRI would become a better option to confirm diagnosis and follow-up in children, however, the availability and expertise of MRI is limited in many countries.

Findings and procedure details

MR is playing an increasing role in the evaluation of gastrointestinal disorders. MRI combines the advantages of excellent soft tissue contrast, noninvasiveness, functional information and lack of ionizing radiation. Furthermore, recent developments of MRI have led to improved spatial and temporal resolution as well as decreased motion artifacts.

1. INDICATIONS

The MR enterography, is most often used to evaluate inflammatory bowel disease (IBD) and particularly is useful in assessing the degree of inflammatory activity. Also, MR enterography allows evaluation of the bowel lumen and wall, adjacent mesentery and soft tissues, as well as a variety of extraintestinal abdominopelvic IBD manifestations, serving as a radiologic biomarker for response to medical therapy, and identifying a variety of complications, including strictures, fistulae, and abscesses.

2. PROTOCOL

2.1 Patient preparation

Patient preparation plays an important role in the quality of MR enterography images. Adequate luminal distension is needed. We use oral contrast to distend the bowel and there are, at least two benefits to use them for the assessment of IBD: (1) an adequate bowel distention minimizes false positive instances of bowel wall thickening and luminal narrowing; (2) oral contrast agents increase the conspicuity of mucosal/bowel wall hyperenhancement when used in combination with intravenous contrast material and probably increase the sensitivity of MR enterography.

Three groups of contrast agents can be utilized to achieve distension. They are classified as positive (bright lumen), negative (dark lumen), or biphasic contrast agents. Biphasic contrast agents (water-based) are usually preferred because they are easy to implement and provide excellent signal characteristics, resulting in bright lumen on T2-weighted and dark lumen on T1-weighted sequences.

Spasmolytic medications reduce motion artifacts related to normal bowel peristalsis, improving its visualization at MR imaging. Intravenous glucagon is the spasmolytic chosen in children and adolescents. Buscapin is contraindicated in these types of patients. These medications can cause nausea and trigger emesis.

2.2 MR Sequences

Next table shows basic sequences we may use in our Hospital:

Sequence	Plane
BFFE - Balanced Fast Field Echo	Axial y Coronal
FSE T2	Axial
FSE T2 FatSupresion	Axial
DWI b=1000	Axial
FSE T1 FatSupresion pre-contrast	Axial
THRIVE Dinamic with gadolinium iv (0, 30", 50", 2', 7')	Coronal
FSE T1 FatSupresion post-contrast	Axial

3. PRACTICAL APPROACH TO IBD INTERPRETATION

To an adecuate IBD interpretation we should do a systematic study of RM enterography.

Differents aspects of bowell, mesentery, peritoneal manifestations and extra-bowell manifestation are evaluated.

3.1 The bowel

MR enterography can evaluate the any part of tube digestive in abdomen. In spite of that, often the stomach and duodenum commonly appear normal on MR enterography images, whereas endoscopic biopsy results demonstrate inflammatory changes compatible with IBD.

These aspects should be evaluated in bowel:

- Bowel wall thickening.

Bowel wall thickening in IBD may be either concentric or eccentric and either smooth or nodular. Some sources suggest >3 mm as a numerical cut off for small bowel wall thickening. An adecuate oral contrast material preparation helps to accurately detect

small bowel wall thickening and helps prevent false positive diagnosis due to the underdistended bowel.

- Bowel wall hyperenhancement

Abnormal bowel wall enhancement after administration of intravenous gadolinium is the result of increased vascular permeability and angiogenesis and it can be seen in active disease and fibrosis. A variety of bowel wall hyperenhancement patterns may be observed in setting of IBD and they can be categorized in three types: homogeneous, mucosal and layered. There is some discussion about the value of the enhancement pattern.

a. Homogeneous enhancement.

Strong homogeneous enhancement is seen in active inflammation

b. Mucosal enhancement:

This is seen as bowel wall thickening with increased enhancement of the mucosal layer.

c. Layered enhancement pattern:

The layered pattern suggests severe disease activity or longstanding chronic disease. This appearance is caused by strong enhancement of the mucosa and the serosa with no enhancement of the middle layer, which is the submucosa and the muscular layer. This middle layer can consist of fat, edema or fibrotic tissue that can be distinguished using a fat sat T2 sequence.

- Bowel Wall Edema

Increased signal intensity within the bowel wall on fat-saturated T2-weighted images is a common finding in bowel segments affected by IBD and indicates the presence of mural edema suggesting active disease.

Fat suppression is routinely used to differentiate between mural fat depositions and mural edema. A low mural T2 signal intensity in bowel wall thickening with is suggestive of fibrotic disease. Fat depositions are the result of chronic bowel inflammation and therefore quite common in Crohn's disease.

It is important to remember that both bowel wall active inflammation and fibrosis commonly coexist so the edema presence does not indicate active disease.

- Bowel Wall Restricted Diffusion

Bowel inflammation shows restricted diffusion with high signal on DWI and low on ADC. Higher B values (1000) are most commonly used.

Recent studies suggest that increased restricted diffusion in the bowel wall is associated with the presence of increasing active inflammation.

- Luminal narrowing:

Luminal narrowing is common in CD and can be associated with obstructive symptoms and its presence may be either predominantly inflammatory or fibrotic. However, in many patients, strictures are likely due to a combination of active inflammation, chronic inflammation and fibrosis. In paediatric CD is an uncommon initial manifestation. The role of MR enterography is attempt to ascertain the degree of active inflammation associated with a stricture. This is important because inflammatory strictures can be resolved with anti-inflammatory/immunosuppressive medical therapy and strictures without radiologic evidence of active inflammation commonly may benefit from surgery or endoscopic intervention.

3.2 Mesentery

- Mesenteric Hyperemia:

Engorged mesenteric vascular structures are commonly observed when increase vascularity adjacent to the segments of actively inflamed bowel in the setting of IBD. The vessels are dilated and have a linear appearance resembling the teeth of a hair comb (comb sign).

Some studies comb correlates comb sign with increased IBD activity, higher incidences of ulcerations and patient hospitalizations, and is generally indicative the need for more aggressive medical therapy.

- Mesenteric Stranding:

Mesenteric stranding is commonly visualized adjacent to segments of bowel affected with inflammatory activity. This finding is due to inflammation, reactive edema and fluid. It is appreciated as ill-defined perienteric or pericolic signal hyperintensity on fat-saturated T2-weighted images.

- Lymphadenopathy:

Lymph node enlargement is common in IBD and is most often reactive in aetiology and may be present adjacent to any segment of bowel affected by IBD, including the appendix and rectum.

- Abnormal Fluid:

Abnormal fluid in peritoneal cavity may be seen in the setting of pediatric IBD. It is probably reactive in etiology and location is variable (such as within the pelvis, paracolic gutters, or immediately adjacent to inflamed bowel segments).

- Fibrofatty Proliferation:

Perienteric or pericolic fibrofatty proliferation is also known as creeping fat or fat wrapping and it is commonly noted adjacent to segments of persistently inflamed bowel.

This tissue have similar signal intensity to subcutaneous fat at FSE and balanced SSFP pulse sequences, loses signal intensity with fat saturation, and causes separation of bowel loops.

- Sinus Tracts and Fistulas:

Sinus tracts and fistulas are penetrating inflammatory complications in patients with Crohn's disease. Both show enhancement on T1 images after administration of gadolinium. Sinus and fistula tracts are the result of deep ulcerations that extend beyond the confines of the bowel wall. It can be seen going from one bowel loop to another bowel loop, to another hollow organ or to the skin.

The involvement of the bowel wall in UC is characteristically superficial and we don't use to recognize this finding.

- Abscesses:

Abscesses are characterized by rim enhancement on post-contrast T1 images and central high signal intensity on T2 images. Abscesses are often seen in patients with severe active Crohn's disease and they are frequently surrounded by fat stranding and free fluid.

3.3 Perineal IBD Manifestations

Perineal complications, including perianal, scrotal and valvular, are rare in UC patients and are quite common in CD. Several forms of this complications may be identified at MR enterography.

3.4 Extraintestinal Manifestations may be recognized if they are present. Sclerosing cholangitis, cholelithiasis, sacroiliitis are included can appear in setting of IBD

5. MAIN DIFFERENCES BETWEEN CROHN DISEASE AND ULCERATIVE COLITIS

	CROHN DISEASE	ULCERATIVE COLITIS
SEGMENT AFFECTED	50% no rectal involvement Children: colon. Adults: any part of the gastrointestinal tract. Small bowel is affected in 70-80% of cases and the terminal ileum is usually affected first.	It begins in rectum and then extends distally
MACROSCOPIC	Skip lesions Bowel wall thickening Deep ulcers	Continua Less Wall thickening Superficial ulcers
MICROSCOPIC	Transmural Granulomas no caseating (50%) Lymphocytic infiltrate Crypt abscess (-F)	Limited to the mucosa Inflammatory infiltrate nonspecific No lymphocytic infiltrate Crypt abscess (+F)
CLINIC	Fever + Diarrhea + Abdominal pain Palpable mass Tobacco makes it worse	Tenesmo Bloody diarrhea
COMPLICATIONS	Strictures Perianal fistulas	Toxic megacolon - Perforation Malignancy
ASSOCIATIONS	Erythema nodosum Thrush Calcium oxalate stones Recurrence after surgery	Pyoderma gangrenosum Sclerosing cholangitis Curative colectomy

Images for this section:

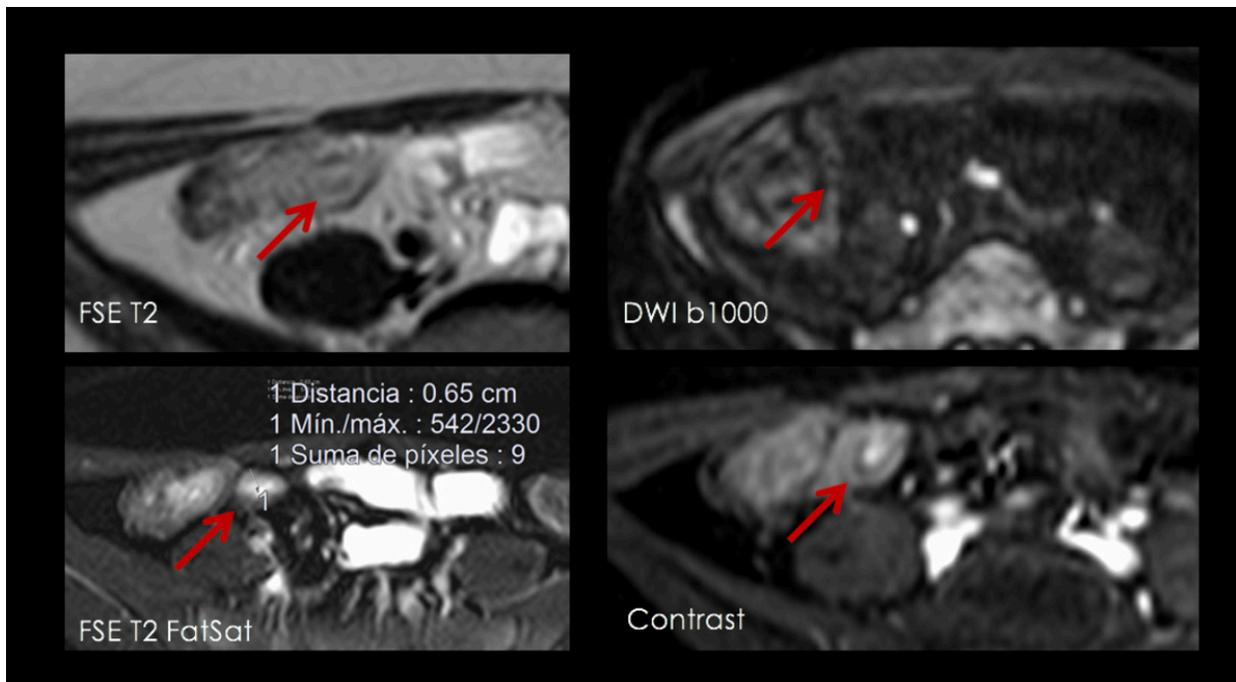


Fig. 1: - Personal and clinical dates: female, 5 years old with diagnosis of CD. The test is made to medical treatment control. - Findings: mural thickening (6,5mm) associate to normal intensity on T2-weighted fat-suppressed images, low signal on DWI and homogeneous mural enhancement with gadolinium i.v without layering attributable to fibrosis. - Diagnosis: chronic ileitis without acute inflammation.

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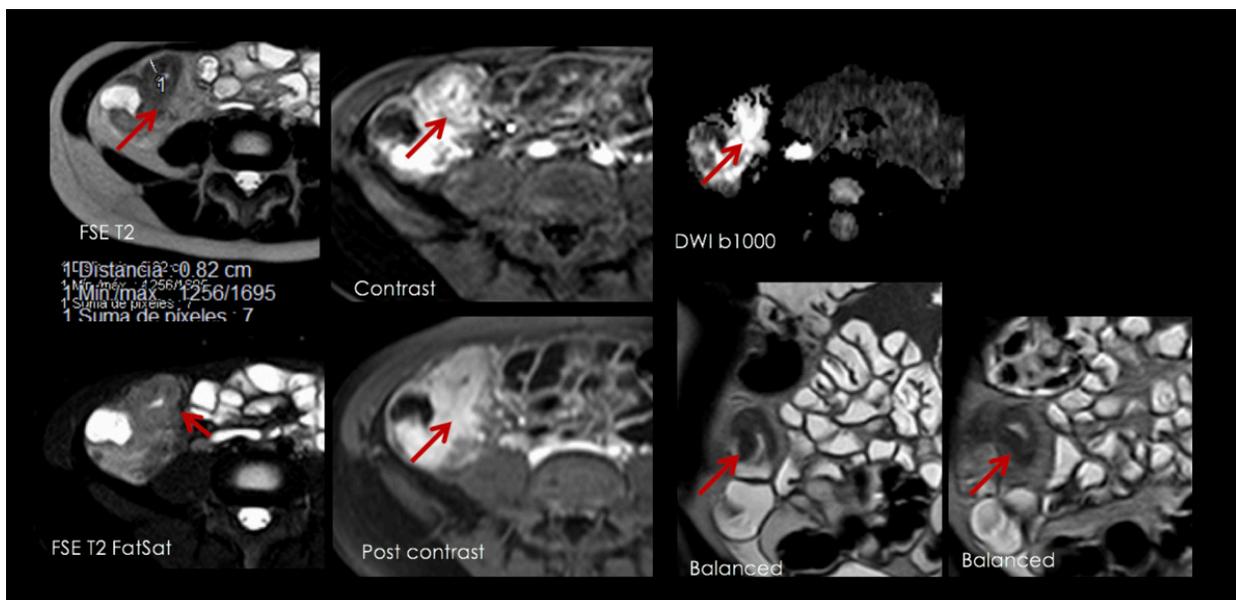


Fig. 3: - Personal and clinical dates: male, 4 years old with abdominal pain, fever and constipation. - Findings: terminal ileum thickening (8mm) and luminal narrowing associate to high signal intensity on T2-weighted fat-suppressed images (edema) plus high signal on DWI, low signal on ADC and layered mural enhancement on arterial phase with intravenous gadolinium. - Diagnosis: terminal ileitis with acute inflammation and stenosis patron.

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Conclusion

The lack of ionising radiation from MRI is a better option to confirm CD and its follow up with children. Despite of endoscopic findings are the gold standard to confirm and evaluate complications in CU, MRE can differentiate from EC and it is useful to demonstrate extension and acute inflammation.

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