

MAGNETIC RESONANCE ENTEROGRAPHY IN CROHN'S DISEASE

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ABSTRACT

Different methods are established for diagnosis and staging of inflammatory bowel diseases and their complications. Previously used techniques like barium small bowel follow-through and enteroclysis are associated with radiation exposure and have limited sensitivity. Furthermore, they are contraindicated in cases with suspect fistulae/abscesses. After initial data on magnetic resonance enterography (MRE) introduction for small bowel examination, the method gained a growing role in the diagnosis of small bowel diseases. Magnetic resonance of the intestine combines high tissue contrast resolution with multiplanar imaging of the abdomen and pelvis without using ionizing radiation. Similar to CT, MR enterography allows evaluation of the complications of inflammatory bowel disease and requires optimal distention of the intestinal lumen. MR enterography is useful for the diagnosis of inflammatory bowel disease in young patients. In addition, the method allows in many other intestinal diseases examination, such as postoperative adhesions, celiac disease, radiation enteritis, scleroderma and small bowel tumors.

KEYWORDS : magnetic resonance enterography, inflammatory bowel disease

Crohn's disease affects mainly the small intestine (up to 80% of cases) and the colon. However, any part of the digestive tract could be involved, as well as more than one location. The disease is characterized by erosions, ulcerations, inflammation engaging the entire thickness of the intestinal wall and formation of granulomas. Intestinal involvement is often segmental, with the inflamed segments being separated from healthy sections. "Skip" lesions and patchy inflammation are a typical imaging finding in Crohn's disease. "Skip" lesions refer to the interspersed inflammation skipping parts of the intestine, which are left unaffected. This type of involvement is in contrast to the continuous inflammation, which is seen in ulcerative colitis. The earliest changes affect the mucosa and cause aphthous ulceration and lymphoid hyperplasia, with subsequent progression involving longitudinal and horizontal ulceration of the mucosa and formation of transmural ulcers. Advanced changes include the formation of fistulas and abscesses. In the chronic phase, inflammation leads to fatty infiltration of the bowel wall and fibrofatty proliferation of the surrounding mesentery. A combination of clinical, biochemical, endoscopic, histological and imaging techniques are required both for the accurate and often problematic assessment of the spread and activity of Crohn's disease and for planning and decision making on immunosuppressive therapy.

Typical imaging changes for Crohn's disease include ileum involvement, wall thickening, fat wrapping, linear and aphthoid ulcers, fistula, "skip" lesions and "cobble stone" appearance. Because of the limited spatial resolution, the earliest manifestations of Crohn's disease - mucosal nodularity, erythema and superficial aphthoid ulcerations can't be identified. Insufficient distention of the lumen makes it difficult to detect mild wall thickening. Collapsed bowel loops can hide lesions or suggest pathologically thickened intestine wall.

Several MR findings are associated with increased disease activity: wall thickness greater than 4 mm, wall contrast enhancement, mucosal hyperaemia, intramural and mesenteric edema, inflammatory lymph nodes (often with hyper contrast enhancement), engorgement of vascular structures, transmural ulceration and fistula formation.

Bowel wall thickness

With adequate luminal distension the normal bowel wall has a thickness of 1-3 mm. A common categorization is 3-5 mm for mild thickening, 5-7 mm for moderate thickening and more than 7 mm for marked thickening of the intestinal wall. In patients with Crohn's disease the wall thickness is usually 5 to 10 mm. T1 weighted post-contrast images or not fat saturated T2 weighted images are preferred for measurement of bowel wall thickness (figure 1).

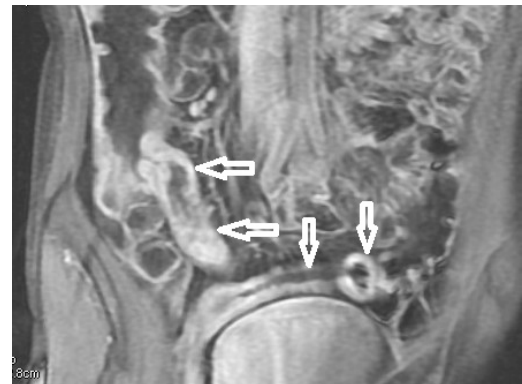


Figure 1. T1 weighted, post-contrast coronal image. Terminal ileum wall thickening with mucosal hyperaemia (arrows).

Enhancement

Abnormal bowel wall enhancement after administration of contrast media is the result of increased vascular permeability and angiogenesis. It is seen both in fibrosis and active disease. Enhancement can be classified by comparing to the precontrast images to nearby vascular structures and normal bowel loops. Layered enhancement pattern of mucosa and serosa of the bowel wall is associated with active histological inflammation contrary to homogenous enhancement characteristic of fibrosis.

Ulceration

Visualization of ulceration is dependent on the degree of lumen distention. Moderate to deep ulceration can be seen on T1 and T2 images. Small ulcerations can be difficult to distinguish from mucosal folds. Ulcerations are active spots of inflammation. They usually are characterized by increased enhancement on the post-contrast T1 weighted images.

Engorgement of vascular structures

The engorged vessels have a linear appearance, being similar to the teeth of a hair comb ("comb" sign). Mesenteric vascular engorgement is usually a consequence from increased inflammatory activity. "Comb" sign is frequently adjacent to a bowel segment indicating signs of active disease. It can be seen as parallel high-signal intensity lines oriented perpendicularly to the longitudinal axis of the affected bowel wall on T1 contrast-enhanced images. On FIESTA (fast imaging employing steady state acquisition) and T2 weighted images the "comb" sign looks like dark lines on the white mesenteric fat tissue background (figure 2).

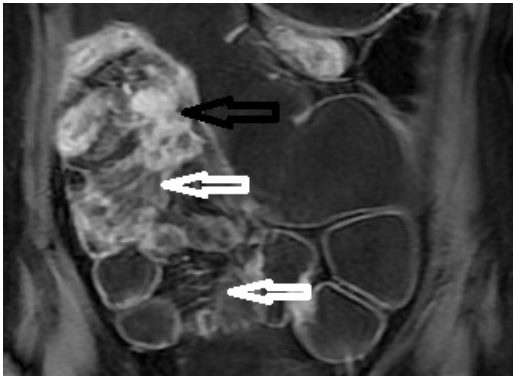


Figure 2. T1 weighted, post-contrast coronal image. Engorged vessels (white arrows) and agglomeration of inflamed bowel loops (black arrow).

Inflammatory lymph nodes

Mesenteric lymphadenopathy (figure 3) represents an enlargement, edema and hyperenhancement of the lymph nodes on the post contrast T1 weighted images. It is highly distinctive for active Crohn's disease. Lymph node edema is consequence from inflammation and it's better demonstrated on fat-suppressed sequences. Non-enhancing lymphadenopathy may include another possibilities and different etiology such as chronic infection such as tuberculosis or histoplasmosis or malignancy.

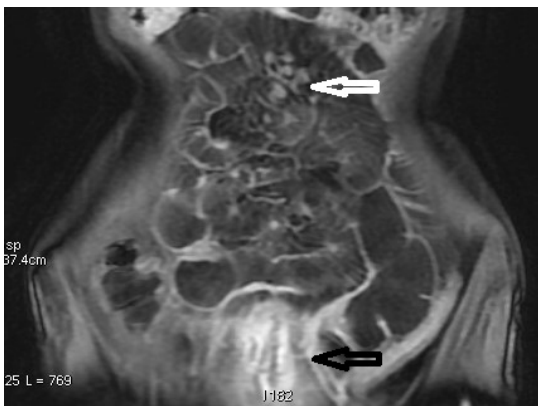


Figure 3. T1 weighted, post-contrast coronal image. Mesenteric lymphadenopathy (white arrow) and agglomeration of pelvic inflammatory bowel loops (black arrow).

Fat wrapping

"Creeping fat" or fat wrapping can be defined as a mass effect caused by proliferation of mesenteric fat tissue (figure 4). It can proceed in a displacement of intra-vascular structures or abdominal viscerae. Fat wrapping is commonly asymmetric. It tends to arise more often on the mesenteric side of the bowel wall. The hypertrophic fat is best seen on FIESTA images.

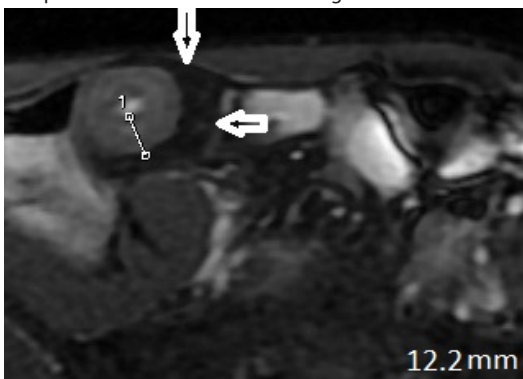


Figure 4. T2 FIESTA axial image. Wall thickening and fat wrapping (white arrows).

Penetrating disease

MR enterography allows accurate diagnosis of penetrating complications of Crohn's disease (figure 5). Current guidelines recommend either CTE or MRE for diagnosis of intraabdominal complications of Crohn's disease, with a pooled sensitivity of 76% and specificity of 96% comparable to the accuracy of CT.



Figure 5. T1 weighted, post-contrast coronal image. Enterocolic fistula (white arrow).

Fistulae

MRE can demonstrate aifferent types of intra-abdominal fistulae in Crohn's disease patients. An entero-enteric fistula may become visible as an enhanced sinus tract between adjacent small bowel loops. A "star sign" represent a agglomeration of inflamed bowel loops interrelated by multiple fistulous tracts. Entero-vesical and entero-vaginal fistulae are difficult to diagnose. However, the appearance of an air bubble in the urinary bladder or vagina, which are usually air-free, especially close to an affected bowel loop, favors their detection.

Abscesses

Abscesses represent fluid collections encapsulated by an enhanced wall unrelated with bowel lumen, which may also contain air. The accuracy of MR enterography for diagnosis of intra-abdominal abscesses in Crohn's disease, have pooled sensitivity of 86% and specificity of 93%, which is similar to the reported pooled accuracy of CTE. MRI may-guide percutaneous drainage procedures of the abscess. MRE is useful for post-drainage follow-up.

Limitations of MRE

There are several important limitations of MRE in comparison to CTE. CT generally provides superior image quality with better spatial resolution. CT requires a considerably shorter acquisition time (7–11 s for CTE and 20–25 min for MRE), therefore MRI is not convenient for claustrophobic patients. MRI scanners are currently less available, especially in the smaller and more peripheral centers. MRI examinations are considerably more costly.

Regardless of these limitations, MRE have a diagnostic accuracy similar to CT enterography, without the exposure to ionizing radiation. The lack of radiation exposure should be considered, especially in patients requiring repeated examinations. In perianal Crohn's disease, MR imaging is the diagnostic modality of choice due to its exclusive soft tissue visualization enabling exact diagnosis and staging of perianal fistulae.

CONCLUSION

Crohn's disease is characterized by cumulative structural damage in the small intestine, from inflammation to penetration and fibrosis. MR enterography acquires increasing use for evaluation in patients with complex and recurrent Crohn's disease. Magnetic resonance tomography in Crohn's disease allows assessment of both intra- and extraluminal complications without the use of ionizing radiation and the resulting risks. The method can also be used in children over the age of 9, having the advantage of not requiring anesthesia and the use of radiation. Disease treatment strategy increasingly focuses on achieving lasting remission in the fastest way and potentially

improving the long-term prognosis. Improved understanding and familiarity of the limitations and strengths of this diagnostic modality by the clinicians will make possible better interdisciplinary cooperation with the radiologists both for choosing the imaging modality and for the interpretation of the results obtained. MRI enterography plays an increasingly important role in the diagnosis, staging and monitoring of Crohn's disease [1-14].

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