

Inflammatory Bowel Imaging: Technique

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Who will benefit from this information?

This lecture is aimed at radiologists, clinical support scientists and MR technologists who are involved in bowel imaging and wish to learn about the techniques and applications of MRI for inflammatory bowel disease.

How was a problem determined?

Imaging of inflammatory bowel disease primarily concerns imaging of Crohn's disease, which is an inflammatory disease of the gastrointestinal tract characterized by ulcers, fistula formation and strictures. The small bowel is a frequent site of disease involvement; however, it is also the part of the gastrointestinal tract that is least accessible to endoscopy. Furthermore, Crohn's disease predominantly affects young people, and its relapsing and remitting course potentially exposes patients to numerous imaging examinations that require ionizing radiation, including fluoroscopy and CT.

Examples of how these issues have been addressed

MR enterography (MRE) provides excellent soft tissue contrast without the use of ionizing radiation, can visualize mural and extraluminal manifestations of Crohn's disease, and can assess small bowel motility with the use of fast imaging techniques (cine MRE)¹. Specific protocols vary with institutions; however, in general, patient preparation and imaging protocol have the components described below.

Patient Preparation

Adequate small bowel distension is important for optimal image interpretation. Most institutions have patients fast for 4-6 hours before ingesting approximately 1-1.5 L of oral contrast 1-2 hours prior to imaging. Most oral contrast agents are biphasic, i.e. T2 hyperintense and T1 hypointense. The most common biphasic agents are 0.1% barium sulfate with sorbitol, mannitol, polyethylene glycol, and locust bean gum. At some institutions, patients are asked to follow a low residue diet in the days preceding the examination. Immediately prior to imaging, IV metoclopramide is sometimes administered to promote gastric emptying.

MR Imaging Protocol

There is evidence to suggest that prone imaging provides better distention of bowel loops; however, prone positioning may be uncomfortable in the setting of stomas and enterocutaneous fistulas, in which case supine imaging provides equivalent lesion detection and feature visualization².

The goals of MRE are to document disease location and extent, determine of active vs. fibrotic disease, and assess for complications such as strictures, fistulous tracts and abscess formation. With these goals in mind, the following pulse sequences are usually performed (see table).

Pulse Sequence	Plane	Purpose	~Time
Localizer (SSFSE or HASTE)	3-plane	Assess for adequate bowel distension	20 sec
CINE bSSFP (FIESTA, trueFISP)	Coronal; 15-20 phases per slice	Assess bowel motility; done with free breathing	3-4 minutes
T2 weighted Single Shots (SSFSE or HASTE) with fat saturation	Axial and/or Coronal	Bowel wall thickening, submucosal edema, free fluid in mesenteric folds, extraintestinal disease	3-4 minutes
bSSFP (FIESTA, true FISP) or T2w single shot (SSFSE, HASTE) without fat saturation	Axial and/or Coronal	Bowel wall thickening, lymphadenopathy	2-3 minutes
Diffusion-weighted EPI	Axial	Intramural inflammation, abscess formation	2-3 minutes
SPGR (LAVA, VIBE, THRIVE) with fat suppression in the arterial, venous, delayed phases	Coronal (arterial) Axial or coronal for venous/delayed phase	Mucosal hyperenhancement, stratified wall enhancement, mesenteric vascular engorgement (comb sign), extraintestinal disease	20 seconds x 3

Anti-peristaltic agents such as glucagon or hyoscine butylbromide are administered to temporarily stop bowel peristalsis. These agents are either given IV in a single dose just prior to gadolinium-based contrast administration or split into two doses, one given after acquiring the CINE images and the second given just prior to IV gadolinium-based contrast infusion.

What will learners be able to do differently because of this information?

After listening to the presentation, learners should have a better idea of how to implement or improve MR enterography protocols at their institution.

References

1. Froehlich JM, Waldherr C, Stoupis C, Erturk SM, Patak MA. MR motility imaging in Crohn's disease improves lesion detection compared with standard MR imaging. *Eur Radiol.* 2010;20(8):1945–1951.
2. Cronin CG, Lohan DG, Mhuircheartaigh JN, et al. MRI Small-Bowel Follow-Through: Prone Versus Supine Patient Positioning for Best Small-Bowel Distention and Lesion Detection. *American Journal of Roentgenology.* 2008;191(2):502–506.