MR Enterography in IBD for evaluation of bowel wall and extra-enteric findings

Dr. Al-Hawary, University of Michigan, uses MRI in Crohn’s disease patients.
MR enterography stands out in evaluation of the bowel wall and extra-enteric findings in IBD patients

The University of Michigan uses MRI to evaluate the bowel wall and surrounding tissues in Crohn's disease

The University of Michigan Health System (Ann Arbor, Michigan, USA) is a large tertiary health care center. Philips MR systems Ingenia 3.0T, and two Achieva 1.5T are installed at the hospital’s adult center; and Ingenia 3.0T, Ingenia 1.5T and a Panorama HFO at the pediatric hospital. There are a high number of referrals of patients with IBD to the University Inflammatory Bowel Disease program, with a high percentage of these patients undergoing cross-sectional imaging at the Health System.
“We have excellent visualization of pathology in the bowel wall and surrounding mesentery on MRE examinations.”

Most MR enterography (MRE) exams at UHMS, about 60-70 per month on the adult and pediatric side, are done to evaluate patients with known inflammatory bowel diseases (IBD), mainly Crohn’s disease. A small percentage of cases are scanned for other indications such as evaluation of suspected bowel masses and other non-specific gastrointestinal symptoms to exclude IBD or other GI related diseases.

Radiologist Mahmoud Al-Hawary, MD, says, “Crohn’s disease is the main indication for MRE. There are three forms of Crohn’s disease. These include inflammatory, stricturing (stenosing) and penetrating disease. Our main goal when managing patients with Crohn’s disease is to try to differentiate patients with active inflammatory disease from those with stenosing disease (with rigid fibrotic bowel). Patients with active inflammation of the bowel wall will benefit from medical therapy, whereas patients with stenosing disease and fibrotic bowel wall require surgical resection of the diseased segment.”

“Other Crohn’s disease complications, including penetrating disease with abscesses and fistulae, definitely require medical and/or surgical treatment and such complications can be well seen on MRE as well. Often the bowel inflammation, fibrosis or associated penetrating complications are not readily apparent with physical exams and lab tests. However, imaging tests such as MRE can readily provide this information to help the referring clinician in determining the appropriate treatment. It is for these reasons that we use MRE so frequently.”

MR enterography on Achieva 1.5T
Axial and coronal T2-weighted single shot TSE show circumferential bowel wall thickening with high signal intensity in the bowel wall suggestive of bowel wall edema. Axial 3D T1-weighted gradient echo images with fat saturation following show striated mural signal intensity consistent with active inflammation.
Advantages of MR enterography over other methods

“Characteristically, Crohn’s disease involvement is transmural; the disease process extends across the bowel wall and can involve the tissues surrounding the bowel,” explains Dr. Al-Hawary. “While optical endoscopy, one of the most commonly used clinical tools for assessing IBD, only visualizes the inside of the bowel, MR and CT imaging can help evaluate the entire thickness of the bowel wall and the surrounding tissue. Thus, optical endoscopy and cross-sectional imaging with CT or MR examinations are complementary and often used in combination to manage IBD patients.”

“Because of the lack of ionizing radiation in MR, we have been moving more towards MR enterography as our primary imaging modality for patients with Crohn’s disease, in particular in younger patients and patients who require frequent follow-up examinations, to reduce the cumulative radiation dose acquired from multiple CT examinations. MR enterography is a dedicated examination of the bowel and is used to evaluate for inflammation, strictures, abscesses or fistulae. It is also used to evaluate the effect of treatment and to monitor development of new disease sites or complications.”

“MR offers several advantages over CT. In addition to the lack of radiation, there are other driving forces toward MR enterography,” says Dr. Al-Hawary. “The multiple biophysical contrast types obtainable with MR enable multiple prospects of the same pathology that help reveal the different disease characteristics, such as edema, inflammation and fibrosis, as opposed to CT.”

“All these advantages of MRE outweigh the minor disadvantages of a slightly longer examination, possible higher cost and limited availability of MR compared to CT.”

Bowel imaging requires large coverage

“Challenges in MRE include bowel motion from peristalsis, inadequate bowel distension, and the large coverage area needed across the abdomen and pelvis,” says Dr. Al-Hawary. “For bowel motion, we use anti-peristaltic agents which can be given at the beginning and/or during the exam to slow down bowel peristalsis and decrease resultant motion artifacts. Bowel distension is improved by administering a non-absorbable oral contrast agent that the patient starts drinking an hour prior to the examination. MRE examinations are performed with the patient in the supine position. We perform most of our adult MRE exams on the Achieva 1.5T scanner with the SENSE Torso XL coil, which covers the small and large bowel area in most patients. Pediatric patients are scanned on an Achieva or on Ingenia systems using the Posterior coil integrated in the table, and an Anterior coil, and because of their small size, we do not have issues with coverage. The MRE exam typically takes about 45 minutes. The image quality on the Ingenia is spectacular, especially the T1-weighted gradient echo fat suppressed images, which have high spatial and contrast resolution.”

Imaging focuses on bowel wall and mesentery

“When we scan the entire abdomen and pelvis, we usually acquire several dynamic series in the coronal and axial planes, and we aim for limiting the breath hold for these sequences not to exceed a tolerable 20 or 25 seconds,” says Dr. Al-Hawary. “The imaging sequences include breath hold single shot T2-weighted sequence, which is used to assess the degree of bowel dilatation, thickness of the bowel wall, and the presence of wall edema, as well as adjacent inflammation fistulae or inflammatory processes. Breath hold Balanced TFE images provide an excellent view of the surrounding mesenteric changes. Breath hold T1-weighted gradient echo sequences with fat saturation obtained in the coronal plane allow evaluation of the entire bowel for active inflammation. 3D gradient echo sequences in the axial and coronal planes are obtained to look for bowel distension and extra-enteric findings such as fluid collections or other complications of the disease.”

“Although it’s not yet a widely established practice, we routinely use diffusion weighted imaging (DWI) through the abdomen and pelvis, which takes about 3-4 minutes to acquire. DWI can help improve the radiologist’s confidence in identifying diseased bowel segments by showing high signal and impeded diffusion in the affected bowel segments.”

“MRE is used to visualize the thickened bowel wall, and evaluate for underlying bowel wall edema, inflammation, and probably fibrosis.”
MRE is nice tool for providing important information

“MR enterography is a diagnostic tool that does not involve the use of radiation and provides the clinicians with a great deal of important information. The Ingenia 3.0T scanner provides spectacular images and I would prefer to use it more,” says Dr. Al-Hawary. “It provides excellent visualization of bowel pathology in question, especially the degree of bowel wall thickening, edema and other abnormalities in the bowel wall, as well as inflammatory changes in the surrounding mesentery. It offers quick scanning, high signal- and contrast-to-noise ratio, and high spatial resolution images.”

Clinical research on MRE

“The main reason for doing most of our adult MRE exams on the Achieva 1.5T scanner is a special sequence called magnetization transfer, which is currently predominantly used for research purposes. This sequence is currently only available on our Achieva scanner. This sequence has been shown in an animal study to predict bowel fibrosis and we currently are working on translating the use of this sequence to humans. Several professional radiology organizations are currently working on establishing standardized guidelines for the acquisition and interpretation of MRE examinations. These guidelines will hopefully be published in the near future.”

References
