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Magnetic Resonance Enterography in the Study of Patients With Crohn's Disease: Which Findings Are More Likely to Change Patient Management?

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Crohn's disease (CD) is an idiopathic inflammatory disorder characterized by transmural inflammation of the gastrointestinal tract with a relapsing and remitting course requiring frequent disease evaluations. Clinical indices have been developed to evaluate and quantify the severity of disease. The most commonly utilised of such indices are the Crohn's Disease Activity Index and Harvey Bradshaw Index, which grade the severity of the disease from asymptomatic remission to severe disease.

Colonoscopy remains the preferred method of mucosal evaluation. However, major limitations of colonoscopy include its inability to stage disease severity in the small bowel, and to evaluate extraluminal complications. Due to these shortcomings, gastroenterologists require the input of noninvasive cross-sectional imaging techniques in order to assess disease severity.

Computed tomography enterography (CTE) is widely used in the assessment of severity and complications of CD. Unfortunately, patients are often subjected to frequent examinations increasing their exposure to ionizing radiation. Given the chronicity of the disease and the young age of most patients at onset, a technique not utilising harmful radiation is preferred. As an alternative, magnetic resonance enterography (MRE) is an effective method to demonstrate disease activity and CD-associated complications without the use of ionizing radiation [1−3]. MRE utilises oral agents for bowel distension, and intravenous (IV) contrast for wall enhancement.

Numerous studies have demonstrated MRE to be of comparable or higher sensitivity and specificity in the detection of signs of CD, such as small bowel pathologies, including mucosal lesions, bleeding, as well as fistulas, abscesses, and stricturing disease [4−9].

With the increasing use of MR as an imaging technique in CD, there have been attempts to develop MR-based severity indices. Such index of activity, Crohn's Disease Endoscopic Index of Activity (CDEIS) has been developed and widely used based on endoscopic findings. The CDEIS is calculated in 5 segments (terminal ileum, right colon, transverse colon, left colon, and rectum) and takes into account the involved area, the ulcerated areas, and the presence of deep or superficial ulcers. This score is mainly used in clinical trials to assess endoscopic response [10]. Rimola et al [11−14] proposed and validated an MRI based grading scheme called Magnetic Resonance Index of Activity (MaRIA) to assess disease severity in the same anatomical location. The MaRIA grading scheme includes wall thickness, relative contrast enhancement, and the presence of oedema and ulcers as identified on MRI. They were able to demonstrate that the MaRIA score

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correlated very well with the CDEIS in terms of predicting mucosal healing (MaRIA <7) and ulcer healing (MaRIA <11), with a 90% sensitivity and 94% specificity [11−14].

MRI is accurate in depicting inflammatory changes of the bowel (mucosal enhancement, submucosal oedema or enhancement, increased vascularity, and inflammatory changes of surrounding adipose tissue), but few studies [15] have tried to investigate the impact of MRE on patient management.

The purpose of the current study is to evaluate the impact of specific MRE signs on the management of CD.

Methods

We performed a retrospective cohort study by including all consecutive adult patients who had an MRE between June 2011 and December 2012 and that had a previously established diagnosis of CD based on endoscopy and histology. The patients had to be seen by their gastroenterologists after the MRE. Patients with indeterminate colitis or with a diagnosis of CD established by MRE only were excluded. This study was approved by the McGill University Hospital Centre Ethics Committee. Baseline patient characteristics for those included in the study are shown in Table 1.

MRE Protocol

All MREs were performed using an MR machine by General Electric, 1.5-T SIGNA Excite model. The patients were asked to fast for at least 8 hours prior to the MRE. Patients were given 750 mL of a diluted lactulose solution to drink prior to the examination (250 mL of a 667 mg/mL solution of lactulose was diluted in 750 mL of water). Patients were first instructed to drink 500 mL of the lactulose solution, followed by 250 mL 20 minutes later. Provided that there were no contraindications, patients were given 40 mg of Hyoscine (Buscopan; Boehringer Ingelheim, Ingelheim am Rhein, Germany) through the IV route (2 mL of a 20 mg/mL Hyoscine solution) in 2 separate doses of 20 mg IV, one following the kinematic sequence and the other prior to the contrast sequences. Scanning started 45 minutes after the initial dose of oral contrast. The patients were supine for the examination. Respiratory triggered or expiration triggered MRI was performed, depending on the patient's abilities and understanding of the breathing instructions. An 8-channel body array coil pad set was used (one coil was used to cover the abdomen and the other was placed underneath the patient).

Table 1
Baseline characteristics of patients with Crohn's disease who underwent magnetic resonance enterography

Characteristics	
Demographics	
Female	41 (66.1)
Male	21 (33.9)
Median age (range), y	33.3 (18-70)
Disease location	
L1 small bowel disease	38 (57.6)
L2 colonic disease	7 (10.6)
L3 ileocolonic disease	21 (31.8)
Disease behavior	
B1 nonstricturing, nonpenetrating	24 (36.4)
B2 stricturing	18 (27.3)
B3 penetrating	24 (36.4)
Perianal disease	18 (27.3)
Previous surgery	27 (43.5)
Medications	
5-ASA	10 (16)
Thiopurines	23 (37)
Biologics	21 (34)
Steroids	10 (17)
Other	1 (2)
Smoking	11 (18)
CRP values	Range: 0.2-127 Median: 2.45

ASA = aminosalicylic Acid; CRP = C-reactive protein.
Values are n (%) unless otherwise specified.

Sequences used as per protocol were as follows: a coronal T2 single-shot fast-spin echo (SSFSE) (breath hold or respiratory trigger), axial T2 SSFSE (upper) (breath hold or respiratory trigger), T2 SSFSE (lower) (breath hold or respiratory trigger), axial T2 SSFSE fatsat (upper) (breath hold or respiratory trigger), axial T2 SSFSE fatsat (lower) (breath hold or respiratory trigger), coronal T2 fast imaging employing steady-state acquisition (FIESTA) (breath hold), axial T2 FIESTA (upper) (breath hold), axial T2 FIESTA (lower) (breath hold), coronal liver acceleration volume acquisition (LAVA) (breath hold), axial delay (upper) (breath hold), axial delay (lower) (breath hold), and coronal Kinematic FIESTA (breath hold, 20 phases per slice to cover the entire abdomen, repetition time: min, echo time: min; full matrix: 256 × 256, flip angle: 75, slice thickness/gap: 7 mm/0 mm). The dose of the IV contrast gadobutrol (Gadavist; Bayer HealthCare Pharmaceuticals Inc, Whippany, NJ) was determined by weight, raging from a minimum of 6 cc to a maximum of 16 cc. Delayed images were taken 25 seconds after injection.

Data Collection

Clinical and demographic data

Information pertaining to presence of perianal disease, disease location (ileum [L1], colon [L2], ileocolon [L3]), and disease behavior (nonstricturing nonpenetrating [B1], stricturing [B2], penetrating [B3]) according to the Montreal classification of inflammatory CD [16] were obtained. This classification system for inflammatory bowel disease is an integrated clinical (including clinical severity of the disease, as well as disease location), molecular, and serological classification, developed by a party of investigators and reported at the 2005 Montreal World Congress of Gastroenterology. Demographic data, including age, gender, smoking status, and duration of disease at the time of the MRE study were also collected. Further information pertaining to previous surgeries, medication use before and after MRE, and recent C-reactive protein (CRP) prior to MRE were also gathered retrospectively by chart reviews.

Prior imaging

A search was performed to establish whether our patients had had prior imaging performed within 3 months of the