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ORIGINAL ARTICLE

Intraobserver and interobserver agreement for identifying extraluminal manifestations of Crohn's disease with magnetic resonance enterography

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KEYWORDS

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Summary *Background:* Magnetic resonance (MR) enterography has emerged as a new imaging modality in evaluating patients with Crohn's disease. However, whether interpretations of MR enterography findings are consistent among radiologists has not yet been fully investigated. The purpose of this study is to evaluate the intraobserver and interobserver agreement for identifying extraluminal manifestations of Crohn's disease with MR enterography.

Methods: MR enterography was performed with a 3-tesla system. We retrospectively enrolled patients with Crohn's disease that had MR enterography between November 2011 and March 2013. Three radiologists reviewed the images independently. Extraluminal findings of these patients were recorded and described. Intraobserver and interobserver agreement were calculated using the kappa statistic.

Results: A total of 22 sessions of MR enterography were performed on 15 patients (12 men and 3 women) with Crohn's disease. The mean age was 38.7 ± 11.4 years. We identified extraluminal manifestations such as engorged vasa recta, enlarged mesenteric lymph nodes, fibrofatty proliferation, fistulas, and abscesses. In addition, avascular necrosis of the femoral head as a complication of long-term steroid treatment was also depicted. The intraobserver agreement

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was almost perfect ($\kappa = 0.83$; $p < 0.001$), and the interobserver agreement was substantial ($\kappa = 0.65$; $p < 0.001$).

Conclusion: MR enterography is a clinically useful tool for evaluating extraluminal manifestations of Crohn's disease with good intraobserver and interobserver agreement.

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Introduction

Crohn's disease is a chronic relapsing inflammatory process of the gastrointestinal tract, which usually begins in young adulthood and persists throughout life. It most commonly involves the distal ileum, and is characterized by intestinal ulcerations in discontinuous segments, transmural inflammation, and penetrating and stricturing complications [1].

It is important to recognize extraluminal manifestations of Crohn's disease because these conditions may cause significant morbidities. These include disease-related mesenteric changes, such as engorged vasa recta, fibrofatty proliferation of the mesentery, and lymphadenopathy; penetrating complications such as fistulas and abscesses; and extraintestinal manifestations of the disease itself, such as uveitis, pyoderma gangrenosum, primary sclerosing cholangitis, and ankylosing spondylitis [2].

Cross-sectional imaging techniques are useful and complementary to endoscopy in the assessment of the disease extent of Crohn's disease. Magnetic resonance (MR) enterography is an emerging imaging tool, which requires orally administered enteral contrast agents, an antiperistaltic medication, and fast imaging sequences [3,4]. The unique advantages of MR enterography include clear soft tissue delineation and freedom from radiation hazards. MR enterography has high sensitivity and specificity in evaluating Crohn's disease (per patient sensitivity of 93%; per patient specificity of 90–92.8%) [5,6], and can be used to assess disease extent and activity, detect perianal disease, evaluate complications, and monitor treatment response [7,8]. MR enterography is especially helpful in evaluating extraluminal involvement of Crohn's disease [9,10], to which endoscopic examinations have limited access.

However, whether the interpretations of MR enterography findings are consistent among radiologists has not yet been fully investigated. In this study, we summarized

our experience in identifying extraluminal manifestations of Crohn's disease with MR enterography, and determined the intra- and interobserver agreement.

Methods

Participants

Between November 2011 and March 2013, we retrospectively enrolled adult patients with an established diagnosis of Crohn's disease that had MR enterography. The diagnosis of Crohn's disease was made according to clinical, endoscopic, radiological, and pathological findings. Patients who were younger than 20 years or had indeterminate colitis were excluded. The hospital institutional review board had approved this retrospective study, and the requirement to obtain informed consent was waived.

MR enterography protocol

MR enterography was performed with a 3-tesla system (MAGNETOM Verio, Siemens Medical Solutions, Erlangen, Germany). Patients were instructed to have nothing *per os* for 4 hours before examination, and drink 1500–2000 mL of a 2.5%-mannitol solution as an enteric contrast ~90 minutes before examination. Intravenous hyoscine-*N*-butylbromide (20 mg, Buscopan; Boehringer Ingelheim Espana, S.A., Barcelona, Spain) was injected to halt peristalsis of the intestines, in order to minimize motion artifacts on the images.

The range of image acquisition included the abdomen and pelvic cavity, from the diaphragm to the anus. Breath holding was essential. We utilized the pulse sequences indicated in Table 1. Volumetric interpolated breath-hold examination (VIBE) sequences were acquired before and

Table 1 Pulse sequences of MR enterography.

	Plane	Slice thickness (mm)	FOV (mm)	TR/TE (ms)	Flip angle
T2-HASTE	Coronal	5	300 × 300	1200/97	160
T2-HASTE	Axial	5	300 × 300	1600/99	160
T2-HASTE with fat saturation	Axial	5	300 × 300	1600/99	160
VIBE	Coronal	1.2–1.4	450 × 450	3.16/1.08	9
FLASH 2D	Axial	5	300 × 300	140/3.69	70

FLASH = fast low-angle shot; FOV = field of view; MR = magnetic resonance; T2-HASTE = T2-weighted half-Fourier single-shot turbo spin-echo; TE = echo time; TR = repetition time; VIBE = volumetric interpolated breath-hold examination.

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