Changes of Small Bowel Peristalsis in Patients with Crohns Disease.

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Purpose:

MR enterography (MRE) is one of the mainstays in the evaluation of Crohns disease (CD). A wide variety of studies have attempted to improve the sensitivity and specificity of MRE, all focusing on the evaluation of static images [1]. MRE however allows not only the static display of morphology, but can be combined with ultrafast scanning techniques (cineMRE) for analysis of bowel motility [2]. It is known from the literature, especially from fluoroscopy, that CD-related pathologies can lead to motility disorders [3].

The aim of the present study therefore was to assess whether motility disorders are present in active CD and if the addition of cineMRE to standard clinical MRE protocol improves the diagnostic performance.

Material and Methods:

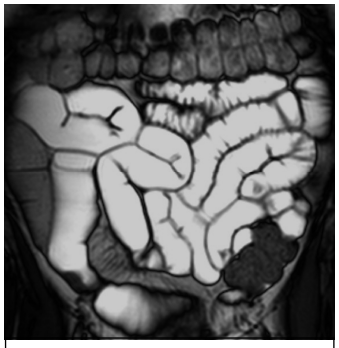

Fig 1: 2D True-FISP MRI of the small bowel of a patient suffering of active Crohn's Disease

Forty consecutive patients (22 m, 18 f; mean age 38 y, range 18-86 y) with biopsy-proven CD, presenting clinical signs of active disease and elevated CD acitivity index (CDAI) were included in this study. Clinical signs of active disease were defined as fever, abdominal pain, and diarrhea. A CDAI score above 150 was indicative of active disease. The institutional review board approved this retrospective study waiving the need for patient consent.

MRI was performed on a 1.5-Tesla system (Sonata; Siemens Medical Solution, Erlangen, Germany) using four body-array surface coils (Siemens Medical Solution, Erlangen, Germany) covering the abdomen/pelvis of the patient lying in a prone position. The applied MRE protocol included pre-exam fasting for 8 h and an oral uptake of 1000ml of 3% aqueous Mannitol (30g Mannitol dissolved in 1000cc of tap water), ingested over a period of one hour prior to the exam.

After measurement of a standard localizer, cineMRE was performed using a coronal 2D true-FISP (TR 3.8msec,TE 1.9msec, flip angle 50°, field of view 400 mm^2, matrix of 256 × 256, slice thickness 10 mm, slice repetition time of 500 msec in apnea, acquisition time 20sec). Cine sequences were acquired at different slice positions covering the entire abdomen from anterior to posterior in coronal orientation without gap. Depending on the size of the patient, 15 to 25 series were acquired. Subsequently, spasmolysis was accomplished by administering an intravenous (iv) bolus of 40 mg hyoscine N-butylbromide (Buscopan, Boehringer Ingelheim, Germany). Thereafter, the standard clinical MRE protocol was acquired with the following pulse sequences: 3D True-FISP, 2D-T2w-HASTE, repetition of 3 identical 3D T1w FLASH series, 20, 60, and 90 sec after start of iv contrast (0.1 ml per kg body weight of dimeglumine gadobenate, MultiHance, Bracco Diagnostics Inc., Italy) followed by a 2D T1w FLASH 5 min post iv contrast.

Two readers evaluated the images from each patient twice in consensus in randomized order. In one readout the readers were given only the standard MRE images without the CineMRE. In a second readout the readers were given the whole set of images including the cineMRE. The standard MRE were evaluated according to clinical practice. Cine MRE was evaluated using dynamic display mode. If a change in motility was found, a cross correlation to the identical localization on the static MRE sequences to identify and diagnose pathologies was performed. The cineMRE images were thus used as indicators of pathologic findings based on motility changes; the pathologies were definitively interpreted on the static MRE images. To ensure independence a minimal interval of 30 days between the two readings was maintained.

Each exam was analyzed for image quality, bowel distension and CD related pathologies: small bowel wall thickening, stenoses, layering of the bowel wall, comb-sign, enlarged lymph nodes (>1cm), fistulas and abscesses. To compare the findings the paired two-sided student-t-test was performed and a p-value < 0.05 was considered to be statistically significant.

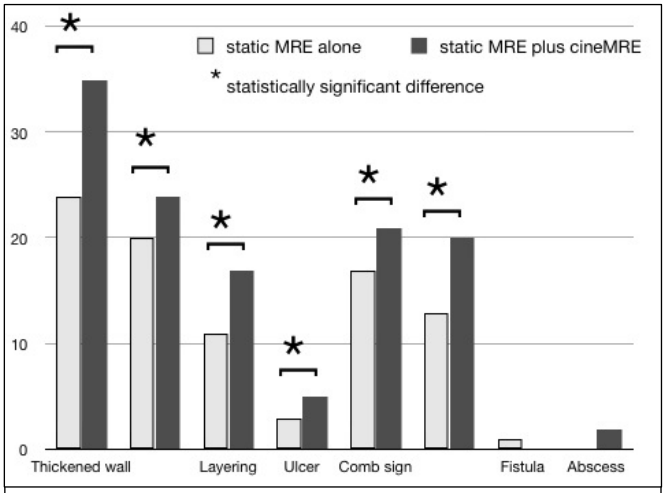

Fig 2: Comparison of CD-related findings detected by cine MRE combined with standard clinical MRE versus standard MRE alone. Significantly more pathological lesions were identified by adding cine MRE.

Results:

Static MRE image quality was scored as good by both readers in 70% of all cases in the upper abdomen, in 78% in the lower abdomen, and in 78% in the terminal ileum. Distention was scored as complete in 80% of patients in the upper abdomen, in 90% in the lower abdomen, and in 85% in the terminal ileum. The number of pathological findings detected by cineMRE plus static MRE compared to static MRE alone were 35 to 24 for small bowel wall thickening (p=0.002), 24 to 20 for stenoses (p=0.05), 17 to 11 for small bowel wall layering (p=0.02), 5 to 3 for mucosal ulcers (p=0.02), 21 to 17 for comb sign (p=0.05), 20 to 13 for enlarged lymph nodes (p= 0.01), and 2 to 0 for abscesses. CineMRE identified 34 patients with lesions corresponding to active disease, whereas static MRE alone identified only 28 patients (p=0.03).

Conclusion:

Cine MRE confirms localized small-bowel motility changes in patients with clinically active Crohns disease. The inclusion of small bowel motility evaluation increases the lesion detection rate for CD-related pathologic findings compared to that of clinically standard MRE.

References: [1] Masselli G et al., Eur Radiol 2008; 18: 438-47. [2] Froehlich JM et al.; JMRI 2005; 21: 370-5. [3] Antes G. et al, Radiology 1983; 148: 37-40.