

MR Enterography in children with Crohn disease : results from the Belgian Pediatric Crohn Registry (Belcro)

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Abstract

Introduction : Magnetic Resonance enterography (MRE) is an imaging modality avoiding ionizing radiation and the discomfort associated with enteroclysis. The results of MRE at diagnosis in the patients of the Belgian pediatric Crohn registry (Belcro) are compared to endoscopic and histological results.

Methods : Results of MRE, endoscopy and histology were obtained from the medical charts and assigned to one of the following segments : jejunum, ileum, ascending colon, transverse colon, descending colon or rectosigmoid. MRE images were reviewed in a blinded way by 4 radiologists with specific interest in pediatric MRE.

Results : From the Belcro registry, twenty-two patients underwent a MRE during their work-up for Crohn disease. The results of endoscopy, histology and MRE were concordant (either all negative or positive) in the ileum in 16/18 patients and in the rectosigmoid, descending colon, transverse colon and ascending colon in resp 9, 8, 8 and 8/22 patients. In the non-concordant cases (MRE colon negative but endoscopy and/or histology positive), MRE could not reflect the subtle endoscopic or histologic lesions such as erosions that were described. In 4 cases where ileocaecal valve intubation was impossible ileal MRE findings were abnormal. MRE detected ileal stenosis, jejunal lesions and fistula in resp 4/22, 3/22 en 2/22 patients. The 100% and 75% interobserver agreement was resp 50-82% and 77.3-100% according to the different intestinal segments.

Conclusions : MRE is a promising imaging modality avoiding radiation in Crohn disease. It should probably become the technique of first choice for the evaluation of extensive small bowel disease in children with Crohn disease. (*Acta gastroenterol. belg.*, 2013, 76, 45-48).

Key words : MR enterography, Crohn disease, inflammatory bowel disease, children, pediatric.

Introduction

Several imaging techniques are available for assessing the small bowel in Crohn disease : ultrasound, small bowel follow through (SBFT)/enteroclysis, CT enterography/enteroclysis and MR enterography/enteroclysis. Each technique has advantages and disadvantages. CT enterography/enteroclysis has a good resolution, leads to a good visualization of intra- and extra-intestinal lesions and enables a differentiation between acute and chronic lesions. The main concern of this technique, especially in children with a chronic disease and a long life span, is the important cumulative radiation hazard. Organ and effective doses are up to five times higher with CT than with

SBFT (1). For patients who undergo numerous CT examinations, efforts should be made to minimize the number of CT examinations, decrease the CT dose, or consider MR enterography. Thanks to recent technical developments in terms of fast MR images acquisition a reasonable image quality can be easily achieved in children and adolescents. A majority of authors prefer the MR-enterography over the more invasive MR-enteroclysis in the assessment of ileal Crohn disease in children (2).

In this paper, we report the results of MR enterography in children and adolescents with Crohn's disease at diagnosis from the Belgian Pediatric Crohn Disease Registry (Belcro). These results are compared to the results of ileocolonoscopy and histology.

Patients and methods

During the period May 2008 - May 2010, 256 children and adolescents up to 18 years old were included in the Belgian Pediatric Crohn Disease Registry (Belcro) by pediatric and adult gastro-enterologists from 23 centers. The aim of the registry is to describe a cohort of old and newly diagnosed pediatric CD patients recruited over a 2 y period and to prospectively follow these patients for 5 y. Diagnosis of CD was made according to the Porto criteria (3). Informed consent was obtained from the parents or legal guardians. The registry was explained in a comprehensible way to the patients and they gave their assent. The study protocol was established following the declaration of Helsinki and GCP guidelines, approved by the ethics committee ZNA Middelheim, Antwerp Belgium (nr 3147) and registered on clinicaltrials.gov (B00920083829). From the registry those patients were taken who had received a MRE at diagnosis. Among all

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256 patients, 22 underwent a MRE in their diagnostic working-up. Those exams were performed in 5 centers. Their files were studied retrospectively.

The preparation and scanning-protocol was slightly different in the 5 centers (sequence parameters), but nevertheless in most of patient comparable and reflecting normal clinical settings. All patients fasted at least 4 hours before the examination. Bowel distension was achieved by ingesting at least one liter of water with 2.5% mannitol one hour before the start of the MR examination. No sedation was used. MRI was performed with a 1.5 T system and a phased-array surface coil. Images were acquired in prone position with breath-hold technique in coronal and axial plane. After a rapid multiplanar localization sequence, heavily T2-weighted 2D true fast imaging with steady-state precession sequences were acquired. First images were made about 1 hour after drinking. If bowel distension was insufficient, the patient was asked to drink more of the solution. In case of good small-bowel preparation, the examination was completed with administration of an IV spasmolyticum to prevent bowel motion artefacts. 3D T1 weighted gradient echo fat-suppressed imaging before and at 30, 60 and 80 seconds after intravenous administration of Gd-DOTA (0,2 mmol/kg) and T2 weighted imaging with and without fat-saturation completed the examination. During the procedure one MR-technician provide patient support in the MRI-room to reassure and coach the children.

In all patients an ileocolonoscopy was performed under general anesthesia after bowel cleansing, according to the protocol prevailing in each of the 5 hospitals. The endoscopist recorded the endoscopic findings in a standardized form. Standard biopsies were taken from the different intestinal segments.

The results of MR enterography were retrospectively compared to those of ileocolonoscopy and histology. All MR examinations were performed within 2 weeks of the endoscopic examinations. Results were obtained from the medical charts. Bowel wall thickening and oedema, deep ulceration, pseudo-diverticula, hyper-enhancement of bowel wall, stranding of fat, comb-sign and separation of bowel loops were considered positive MR lesions. The gastrointestinal tract was divided into several intestinal segments (rectosigmoid, descending colon, transverse colon, ascending colon, terminal ileum, jejunum) and the presence/absence of lesions per segment were recorded.

MR enterography findings were also reviewed in a blinded way by 4 radiologists with a specific interest in pediatric MR enterography. First of all, the bowel distension was assessed as good, moderate, or poor (only slight distension or collapsed bowel). In each intestinal segment (rectosigmoid, descending colon, transverse colon, ascending colon, terminal ileum, jejunum) pathological enhancement and bowel wall thickening (abnormal if > 3 mm) were scored as pathological or normal. In the terminal ileum and jejunum the length of the affected intestinal part was assessed as well as the presence or absence of eventual stenotic lesions with prestenotic

dilatation. The results are presented as full and 75% interobserver agreement if respectively the 4 radiologists or three out of the 4 radiologists scored identical for an item (all either present or absent).

Results

Among all 255 Belcro patients, 22 had MRE at diagnosis. Those exams were performed in 5 centres. The mean (SD) and median (min-max) age of the 22 patients was 12.99 (1.94) years and 12.58 (10-16) years respectively. Due to the retrospective character of the study it was not possible to assess the amount of ingested fluids and the time needed to complete the exam.

Comparison of endoscopy, histology and MRE

In figure 1 an example of positive MR findings in pediatric Crohn disease is shown. The comparative findings of endoscopy, histology and MRI in the colon are shown in figure 2. They were concordant for all three investigations (either all negative or all positive) in the rectosigmoid, descending colon, transverse colon and ascending colon in respectively 9, 8, 8 and 8 of 22 patients. In the cases where MRI in the colon was negative but endoscopy and/or histology was positive, subtle mucosal lesions such as erosions were described by endoscopy.

In contrast, a good concordance of the results for all three investigations was seen in the terminal ileum (Fig. 3). The results in the ileum were similar (either all negative or all positive) in 16/18 patients. MRE was superior to classical ileocolonoscopy and histology in describing the extent of the affected ileum (not shown). MRE gave additional information in the 4 cases where the ileocaecal valve could not be intubated and revealed ileal stenosis in 4 patients.

Comparison of results MRE read by 4 radiologists

Bowel distension were respectively scored as poor, moderate, good or excellent in 45.5%, 25%, 29.5% and 0% in the jejunum and 10.4%, 28.6%, 18,2% and 42.8% in the ileum.

Full interobserver agreement for pathological enhancement and bowel wall thickness was 68% in the rectosigmoid, 82% in the descending colon, 77.3% in the transverse colon and 50% in the ascending colon. 75% interobserver agreement was resp 77.3%, 100%, 86.4% and 90.9%. Full and 75% interobserver agreement for pathological enhancement and bowel thickness were resp 54.5% and 90.9% in the terminal ileum and 81.8% and 100% in the jejunum. There was a wide variation in the reported length of affected bowel. Full and 75% interobserver agreement for stenosis was 59.1 and 90.9%.

Discussion

MR enterography is an interesting imaging modality avoiding ionizing radiation and being less invasive than

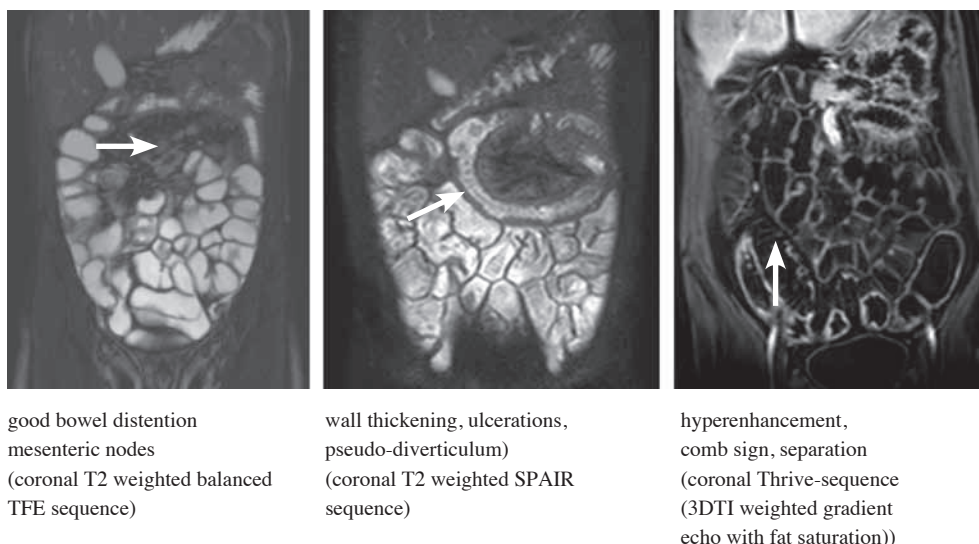


Fig. 1. — MR enterography findings in Crohn disease

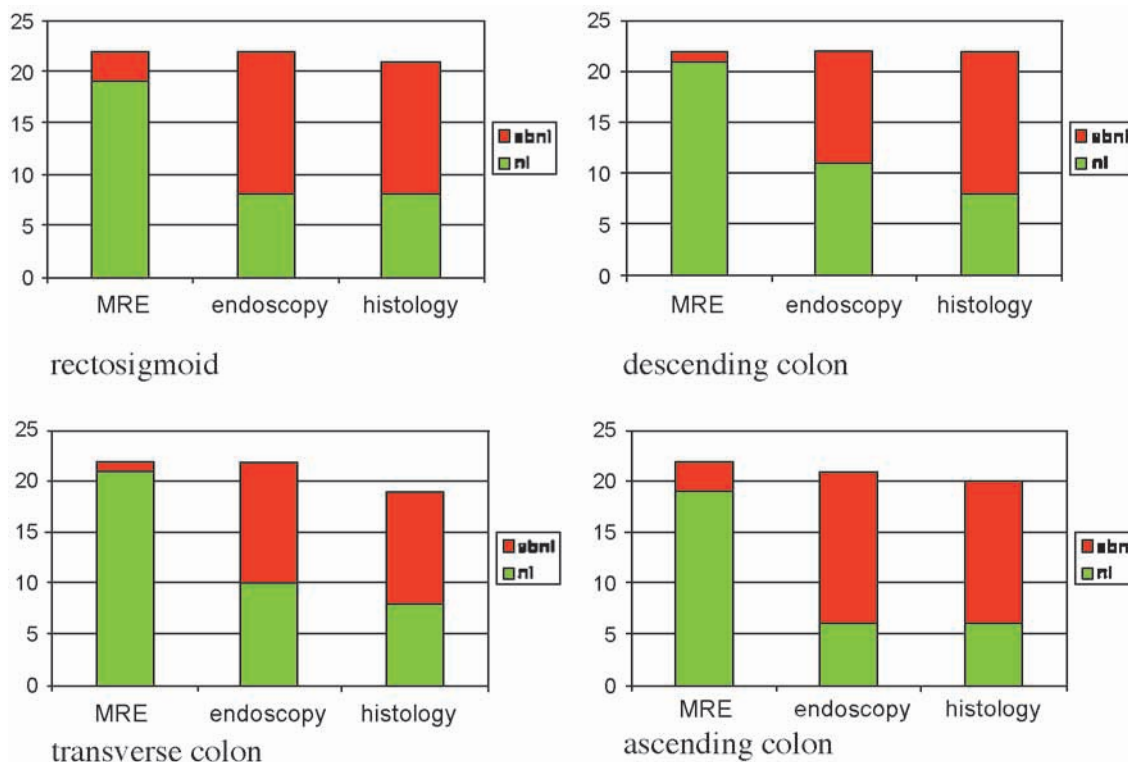


Fig. 2. — Abnormal/normal findings according to MR enterography (MRE), endoscopy and histology in the colon

MR enteroclysis. This examination was only performed at diagnosis in 22/255 patients of the Belcro registry and only performed in 5 of the 23 centers which participated in the registry.

In the terminal ileum a good concordance was seen among the results of ileocolonoscopy, histology and MRE. MRE was even superior in describing the lesions in this part of the small intestine since it gave additional information on terminal ileum disease in the 4 cases

where the ileocaecal valve could not be intubated, on the disease extent and on the presence of ileal stenosis/strictures. MRE has the additional advantage in detecting lesions in the jejunum, since this part of the intestine is not in the yield of classical endoscopy. Jejunal stenosis was found in 3 patients. There was no good concordance between the lesions seen in the colon. MRE is not depicting subtle lesions such as erosions. In two cases peri-anal fistulae could be documented.

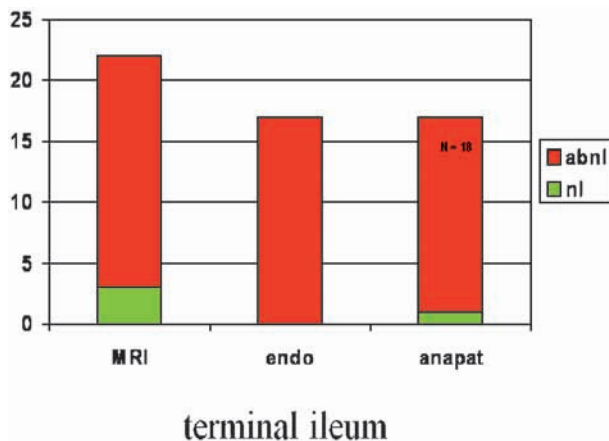


Fig. 3. — Abnormal/normal findings according to MR enterography, endoscopy and pathology in the terminal ileum.

Although bowel distension is usually inferior in magnetic resonance imaging with oral contrast versus magnetic resonance enteroclysis, the oral delivery of contrast medium is preferred by many authors due to the lesser invasive effect and the reasonable quality of imaging (4). If bowel distension was insufficient one hour after drinking, the patient was asked to drink more of the solution, leading to a better bowel distension in most of the patients. The coaching and reassurance of a MR-technician was important (communication of participating radiologists). In our population the examination was successfully used in children and adolescents aged 10-16 years without sedation. Due to the retrospective character of the study no more details about the amount of ingesting fluid and time needed for finishing the protocol can be given.

MRE reliably describes the presence of severe inflammatory changes within the bowel wall. Histologic features of acute small-bowel inflammation in Crohn disease were shown to be reflected by increased mural thickness, high mural intensity on T2-weighted fat-saturated images and a layered pattern of enhancement on MR imaging (5).

The diagnostic performance of MRE is known to be inferior in the detection of superficial mucosal disease, which are well depicted at endoscopy (6). Our study clearly demonstrated this phenomenon in the large intestine. If MRE is compared to wireless capsule endoscopy, the same conclusions can be made for the small intestine (7). In the study of Negaard *et al.* (4) concerning adult patients with CD, interobserver agreement for individual MRI items such as bowel wall thickening and pathological enhancement being scored as either pathological or normal, was very good. Attempts to refine the MRI findings and to correlate the degree of bowel wall enhancement and disease severity in pediatric patients are leading to a lower interobserver agreement (5), as

clearly shown in our study. Strict standardisation of imaging protocols and the use of software tools, for instance to measure the length of the diseased small bowel segment or to measure enhancement-curves, could improve the interobserver agreement and could even show a positive correlation between the degree of inflammatory activity on MRE and the disease activity (8). Although the preparation protocol was tailored for small bowel visualization, we believe that the colon visualization might be improved if the volume of mannitol solution can be increased and imaging timing altered.

MRE should be regarded as an interesting ionizing sparing technique and should probably become the technique of first choice for the evaluation of extensive small bowel disease in children with Crohn disease.

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