USEFULNESS OF MAGNETIC RESONANCE ENTEROGRAPHY IN DIAGNOSIS OF CROHN’S DISEASE

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The numbers of patients with diagnosed Crohn’s disease in Poland continue to be on the rise. It may be assumed that it is associated not with an increased incidence but with significant advancements in diagnostic techniques which in an increasingly better manner solve problems of abdominal pain. One of such methods is magnetic resonance enterography, which gives high hope in the diagnostics of Crohn’s disease.

The aim of the study was the evaluation of the results of magnetic resonance enterography (MREG) and their comparison with the results of histopathological examination of perioperative specimens.

Material and methods. The clinical material comprised 48 patients with suspected Crohn’s disease. Colonoscopy was performed in all the patients, followed by magnetic resonance enterography, which evaluated the lesion localisation, large intestine wall thickening, small intestine stenosis, mesenteric vessel proliferation, infiltration of surrounding adipose tissue, lymph node enlargement, presence of enteroenteral, enterovesical and enteroenterocutaneous fistulas. Next, a surgical procedure was performed, with collection of specimen for histopathology. The examination results were compared with those of magnetic resonance enterography.

Results. MREG was performed in 48 individuals. Suspected Crohn’s disease based on the above examination was diagnosed in 35 cases, isolated small intestine inflammation – in 5, and fibrosis in the remaining 5 patients. No significant differences were found between the lesion localisation done by MREG or perioperatively. Crohn’s disease was confirmed by histopathology in 36 cases. The sensitivity of MREG with histopathology was 91.6%, and the specificity – 77.8%.

Conclusions. Magnetic resonance enterography is a highly effective and sensitive method in the diagnostics of Crohn’s disease, free of adverse effects and possible to be performed even in pregnant female patients.

Key words: magnetic resonance enterography, Crohn’s disease

Crohn’s disease is a chronic disease still causing many diagnostic problems. Due to the possibility of multi-focal disease localisation, starting from the oral cavity to the anus, the disease requires numerous diagnostic examinations, and primarily imaging ones covering each section of the gastrointestinal tract. In the vast majority of cases, the primary localisation is within the terminal ileum and cecum. Despite the fact that nowadays imaging methods for large intestine are of high standard, there remains the problem of small intestine diagnostics, often referred to as the “black box” (1). From among the latest methods of diagnostic imaging for small intestine, the highest hopes are raised by magnetic resonance enterography (MREG), magnetic resonance enteroclysis and computed tomography enteroclysis (1, 2, 3, 6, 7). Other examinations used in small intestine evaluation are double-balloon enteroscopy as well as visualisation with the use of capsule endoscopy (1, 3, 4). Re-
cently, there have also been initiated studies on the use of Power Doppler ultrasound examination with oral and intravenous administration of a contrast agent, yet the results and observations are limited and thus do not enable any conclusions as to its diagnostic value (9). These are methods carrying large risk of complications, as well as high examination costs.

The aim of this study was to present the diagnostic value of magnetic resonance enterography in the evaluation of small intestine in patients with suspected Crohn’s disease, and primarily to in the evaluation of the process activity as compared with the histopathological results for perioperative and endoscopic specimens.

MATERIAL AND METHODS

The clinical material comprised 48 patients, including 17 females (35.4%) and 31 males (64.6%) aged between 15 and 57 (median: 33) with suspected Crohn’s disease, covered by the study in the years 2007-2010. Magnetic resonance enterography and classic colonoscopy were performed in all the patients, followed by qualification for surgery during which a specimen was collected for histopathological examination. Surgery performance was dependent primarily on the clinical status of patients who above all manifested symptoms of gastrointestinal sub-occlusion. MREG constituted additional diagnostic value in identifying the cause of abdominal pain. From among the studied patients, 3 of them were disqualified from surgery – 2 due to absence of lesions in MREG and improvement of the clinical status, and 1 due to diagnosed right ovary inflammation.

MRI examination is performed in 1, 5 T of Simens Magnetom Avanto, used for routine examinations at the Diagnostic Imaging Centre, Teaching Hospital, Poznań University of Medical Sciences, with the use of abdominal multi-channel coil. Upon preparing the patient similarly as for colonoscopy, 1 h prior to the examination the patient drinks 1.5 l of oral contrast agent. In the case of suspected lesions in the large intestine, it is immediately to introduce 1 l of water rectally immediately before the examination. Prior to the examination, in order to reduce intestinal motility – peristalsis, 2 mg of Buscopan are administered intravenously.

During the examination, the patient lies on his/her stomach. The examination covers the abdominal cavity and the pelvis, from the level of xiphoid process to the ischiadic tubers.

The examination contains the following sequences on held breath prior to the intravenous administration of the contrast agent: frontal and transverse in T2-dependent images (HASTE, true FISP), frontal in T1-dependent images (FLASH 2D and FLASH 3D with adipose tissue saturation). In the case of suspected fistulas, additional sequences in the sagittal plane are made. In the above-listed sequences, the layer thickness is of 5-6 mm, with a stop in scanning in the middle of the sequence in the case of the need for holding breath again. Image matrix of 256x151-168 is used in the examination.

In the next stage of the examination, gadolinium is administered intravenously at a dose of 0.1 mmol/kg bw in a bolus, with the use of an automatic syringe. In the second part of the examination, the following sequences are used in T1-dependent images: FLASH 2D and FLASH 3D and VIBE. The described sequences are started 30 s after the administration of contrast agent. Delayed scans are performed approx. 4-5 min after the administration of contrast agent, in the same sequences.

The examination evaluated the small intestine wall thickness, the nature of enhancement after the intravenous administration of contrast agent (typical for the activity of the inflammatory process and wall fibrosis), the number and length of loops with inflammatory lesions, as well as the length and the minimum diameter of stenosis and potential dilation proximal to stenosis.

Apart from the small intestine, the following were also evaluated: features of infiltration of the adjacent adipose tissue (contrast enhancement and increased signal intensity in FAT-sat and spair images), as well as blood and lymphatic vessel proliferation in the mesentery. The standard parameters evaluated during the examination included the size of lymph nodes (long and short axis measurement) and their potential contrast enhancement. During the study, there was evaluated the presence of enteroenteral (ileal, ileocolic,
enterovesical and enterovaginal as well as enterocutaneous and perianal) fistulas.

Colonoscopy was a standard examination by which the large intestine was evaluated, as well as – where possible – the terminal ileum.

RESULTS

The study was conducted in all patients without complications. In each case, the small intestine was well cleansed and available for a thorough examination. Colonoscopy was also performed in all patients, while endoscopic lesions within the ileum were visualised in 10 cases only.

Among the patients, in as many as 36 cases, the lesions affected the terminal ileum, in 29 cases they were present in the ileum, while in 7 cases in the large intestine. After the surgery, it was found that the lesions were localised in the terminal ileum in 32 cases, in the ileum in 24 cases and in the large intestine in 6 cases. In one case, the lesions were found in the jejunum. The results of comparison of lesion localisation in the MREG image and the perioperative image are presented in tab. 1.

In the magnetic resonance enterography examination, the diagnosis of suspected Crohn’s disease was posed in 35 cases. In the MREG image, the following predominated: small intestine wall thickening in 37 cases (77.1%) (fig. 1), small intestine stenosis in 32 cases (66.7%) (fig. 2.), enhancement of the adipose tissue in 30 cases (62.5%) (fig. 3), vascular proliferation in 27 cases (56.2%) (fig. 4), and enlarged lymph nodes to over 10 mm in 22 cases (45.8%) (fig. 5). In 2 cases, magnetic resonance imaging was used for examination due to perianal fistulas, of which in one case a lesion of psedotumour nature was detected in the ileocolic region together with the lesions characteristic for Crohn’s disease, including enhancement of adipose tissue, lymph nodes

Table 1. Comparison of lesion localization in the magnetic resonance enterography (MREG) image with the perioperative image

<table>
<thead>
<tr>
<th>Lesion localization</th>
<th>MREG</th>
<th>Surgical procedure</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal ileum</td>
<td>36</td>
<td>32</td>
<td>0.68309</td>
</tr>
<tr>
<td>Ileum</td>
<td>29</td>
<td>24</td>
<td>0.72367</td>
</tr>
<tr>
<td>Jejunum</td>
<td>1</td>
<td>1</td>
<td>1.00000</td>
</tr>
<tr>
<td>Large intestine</td>
<td>7</td>
<td>6</td>
<td>0.37110</td>
</tr>
</tbody>
</table>

Fig. 1. T2 – weighted images, thickened intestinal wall
Fig. 2. T1 – contrast, narrowing AT the anastomotic site with the inflammatory process in the intestinal wall, adipose tissue infiltration
After the performed procedure, the perioperative material was subject to histopathological examination, and next compared with the MREG examination results.

Suspected Crohn’s disease based on MREG was found in 35 cases (72.9%), while it was confirmed by histopathology in 36 cases (75%). In 5 cases, isolated inflammatory lesions within the small intestine were described, however without the other characteristic features of Crohn’s disease in the radiologic image. Also in 5 cases, a diagnosis of fibrosis within the ileum was posed by MREG, due to the absence of any other lesions within the abdominal cavity (tab. 3).

In 10 cases, the disease was not diagnosed by magnetic resonance imaging or by histopathology. In 3 patients, Crohn’s disease was diagnosed by histopathology without confirmation by MREG. Two MREG examinations did not confirm the earlier diagnosis in correlation with the histopathological examination.

Comparing the MREG results and histopathology results, we evaluated the sensitivity and specificity of the examination, which stood at 91.6% and 77.8%, respectively (tab. 4).

**DISCUSSION**

There have been no publications so far evaluating the results of magnetic resonance enterography in diagnosis of Crohn’s disease.
enterography as compared with the perioperative results and, what’s more important, with the histopathological confirmation. Still, this is a method little used in Poland yet offering the insight into what has been so far called in the abdominal cavity diagnostics as the “black box” (1). All the review papers quote different methods in the diagnostics of Crohn’s disease, with particular attention paid to colonoscopy, passage, the gastrointestinal tract and computed tomography enteroclysis (1, 2, 3, 8). Double-balloon enteroscopy and capsule endoscopies are much more rarely performed. These are methods the usefulness of which has been proved in the diagnostics of small intestine haemorrhage (4, 5). In Crohn’s disease, capsule endoscopy is of small use and may be the cause of gastrointestinal obstruction. Meanwhile, the usefulness of double-balloon enteroscopy in the diagnostics of Crohn’s disease still is debated due to the need for performing the examination under general anaesthesia and the possibility of occurrence of multiple complications during the examination. More and more often there is described the use of magnetic resonance as a method that is the best and carrying the smallest amount of complications for the patient (11, 12, 13). In addition, we have the access to the whole abdominal cavity, allowing the visualisation of other causes of complications: tumours of the kidneys, the pancreas and the ovaries. As compared with the abdominal ultrasound, MREG is much more thorough, not dependent on the technician’s methods, and obesity or even pregnancy are not contraindications for the examination. The advantage over computed tomography enteroclysis lies in the absence of ionising radiation and thus the possibility of performing the diagnostics in pregnant women, which is of big importance in the Crohn’s disease. Evaluating the pros and cons of capsule endoscopy, we always have to take into consideration the possibility of the capsule being lodged in the inflamed small intestine section, leading to mechanical obstruction (8). This is why it is an examination requiring, in the first place, the performance of intestinal passage, which in turn is associated with long examination time and risking the patients to receive subsequent doses of ionising radiation. Meanwhile, despite the lack of comparative publications describing magnetic resonance enteroscopy and double-balloon enteroscopy, still enteroscopy that lasts over 2 h, under general anaesthesia, and providing the opportunity of small intestine perforation, seems less advantageous for the patient. The only positive feature of the examination is the possibility of collecting specimens for histopathological examination, as well as endoscopic dilation of the site of intestinal stenosis (10).

While conducting the study, our team came to the conclusion that magnetic resonance enterography is a very good diagnostic method for evaluating the small intestine and for diagnostics of Crohn’s disease, which is characterised by high sensitivity and specificity. Similar results have been obtained by other authors describing the magnetic resonance enteroclysis, in which the sensitivity and specificity stood at over 80% (6, 7). This is an examination, as it appears, reducing the performance of unnecessary surgical procedures and thus lowering the costs of patient treatment and not influencing the patient’s

Table 3. Comparison of the results of magnetic resonance enterography (MREG) with the histopathological results

<table>
<thead>
<tr>
<th>(n)</th>
<th>MREG examination</th>
<th>Histopathological examination</th>
<th>p</th>
</tr>
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<tbody>
<tr>
<td>Crohn’s disease</td>
<td>35</td>
<td>36</td>
<td>p=1</td>
</tr>
<tr>
<td>Inflammatory lesions</td>
<td>5</td>
<td>3</td>
<td>p=0.0471</td>
</tr>
<tr>
<td>Ulcerative colitis</td>
<td>0</td>
<td>1</td>
<td>p=0.2222</td>
</tr>
<tr>
<td>Non-specific large intestine lesions</td>
<td>0</td>
<td>2</td>
<td>p=1</td>
</tr>
<tr>
<td>Fibrosis</td>
<td>5</td>
<td>0</td>
<td>p=0.02114</td>
</tr>
<tr>
<td>ZOvary inflammation</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No lesion in MREG image</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 4. Evaluation of sensitivity and specificity of the magnetic resonance enterography (MREG) examination as compared with the results of histopathological examination in patients with suspected Crohn’s disease

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tr>
<td>MREG</td>
<td>91.6%</td>
<td>77.8%</td>
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quality of life. Particular attention should also be paid to the lack of the necessity of applying the enteric probe beyond the ligament of Treitz, which significantly lowers the patient’s comfort.

We believe that this is a method that should be performed in all patients with suspected Crohn’s disease, and only at the next stage decisions on the treatment regimen, be it surgical or even conservative, should be taken.

CONCLUSIONS

The above results show us that magnetic resonance enterography is characterised by very high sensitivity and specificity, which should become the basic examination in the diagnostics of not only Crohn’s disease but also in the diagnostics of small intestine, and the commonly used term of “black box” will sink into oblivion.

REFERENCES


Received: 8.04.2011 r.
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