



Accuracy of rectal endoscopic ultrasonography and magnetic resonance imaging in the diagnosis of rectal involvement for patients presenting with deeply infiltrating endometriosis

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ABSTRACT

Objective To compare the accuracy of rectal endoscopic ultrasonography (REU) and magnetic resonance imaging (MRI) for predicting rectal wall involvement in patients presenting histologically proven deeply infiltrating endometriosis (DIE).

Methods This was a retrospective study of a continuous series of 81 patients presenting histologically proven DIE who underwent preoperative investigations using both REU and MRI. The sonographer and the radiologist, who were unaware of the clinical findings and patient history, but knew that DIE was suspected, were asked whether there was involvement of the digestive wall.

Results Rectal DIE was confirmed histologically in 34 of the 81 (42%) patients. For the diagnosis of rectal involvement, sensitivity, specificity and positive and negative predictive value for REU were 97.1%, 89.4%, 86.8% and 97.7% and for MRI they were 76.5%, 97.9%, 96.3% and 85.2%.

Conclusion The sensitivity and negative predictive value of REU were higher than those of MRI suggesting that REU performs better than MRI in the diagnosis of rectal involvement for patients presenting with DIE. Prospective studies with a large number of patients are needed in order to validate these preliminary results. Copyright © 2004 ISUOG. Published by John Wiley & Sons, Ltd.

INTRODUCTION

Surgical excision is the treatment of choice for deeply infiltrating endometriosis (DIE)¹. The bowel is one

of the locations involved with DIE^{2–6}, and whether bowel muscularis infiltration has occurred is one of the factors governing the approach for surgical treatment^{2,4}. Consequently it is best for the practitioner to know prior to the operation whether there is any intestinal endometriosis. However, it is not possible to be sure if there is bowel involvement from routine questioning^{6,7} or clinical examination⁸, and colonoscopy and barium enema are not sufficient to diagnose intestinal wall involvement with any accuracy^{6,9}. The lesions predominantly affect serosa, muscularis propria and submucosa, while the mucosa is rarely involved^{10,11}.

Rectal endoscopic ultrasonography (REU) is reliable for the diagnosis of bowel infiltration in patients presenting DIE^{12–14}, but few published studies have examined the possibilities afforded by magnetic resonance imaging (MRI) for the diagnosis of DIE^{15–19}. The aim of our study, therefore, was to compare the accuracy of REU and MRI for predicting rectal wall involvement in patients presenting histologically proven DIE. This is, to our knowledge, the first study to make such a comparison.

METHODS

This was a retrospective study of a continuous series of 81 patients presenting histologically proven DIE²⁰ who underwent preoperative investigation by both REU and MRI. For each patient data were collected for: (i) general patient characteristics (age, height, weight, parity, gravidity, body mass index (BMI)); (ii) pelvic pain symptoms (dysmenorrhea, deep dyspareunia) evaluated preoperatively using a visual analog linear scale marked from 0 to 10, on which 0 represented no pain at all and 10 represented the worst pain they had experienced in their

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life; (iii) previous surgical treatment for endometriosis; (iv) rAFS scores according to the American Fertility Society classification²¹.

All the patients underwent REU and MRI prior to surgery. The sonographer and the radiologist were not aware of the clinical findings and patient's history, knowing only that DIE was suspected¹³; they were asked whether there was involvement of the digestive wall.

Rectal ultrasonography was performed with an Olympus GF-UM20 scope (SCOP Medecine Olympus, 94150 Rungis, France) ultrasound machine, with 7.5- and 12-MHz probes, allowing circumferential imaging of the rectum wall and surrounding areas (including ovaries, uterosacral ligament areas, pouch of Douglas, posterior wall of the vagina). Examinations were conducted without sedation, after two rectal enemas, and lasted 15–20 min. The flexible nature of the echoendoscope allowed the transducer to be positioned in the distal sigmoid and then slowly withdrawn through the sigmoid and the rectum. Study of the bowel wall (with the five classic layers) and the adjacent areas was carried out by moving the probe up and down before and after instillation of water into the digestive tract lumen. The examination particularly focussed on the anterior and lateral sides of the rectum, where deep endometriotic nodules are usually located. The endometriosis appeared sonographically as rounded or triangular hypoechoic masses, located anterior or lateral to the rectum, immediately adjacent or close to the rectum wall. Infiltration of the digestive wall was defined as a thickened muscularis propria (the fourth hypoechoic layer of the digestive wall) infiltrated by endometriotic nodules¹² (Figure 1).

MRI was performed with a 1.5 Tesla Unit (Signa 1.5, GEMS, Milwaukee, WI, USA). For all patients, MRI examination included visualizing axial, sagittal and coronal planes with a phased-array coil. Axial and sagittal T2-weighted fast spin echo images (repetition time, 4000 ms; echo time, 104 ms (4000/104)), axial T1-weighted spin echo images (500/10), and T1-weighted with a fat suppression, from the symphysis to the aortic bifurcation, were obtained with 5-mm thick contiguous sections (field of view: 28 × 28 cm, two signals acquired, a 512 × 256

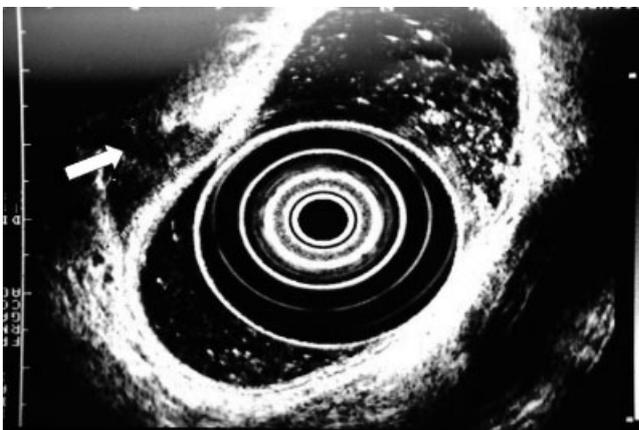


Figure 1 Rectal endoscopic ultrasound image showing involvement of the rectal wall by deeply infiltrating endometriosis (arrow).

matrix with the pelvic phased-array coil). Anterior, superior and inferior saturation pulses and no-phase wrap options were used for surface coil imaging. No contrast agent was used. Morphology (size, shape (nodule or not)) and signal intensity were recorded for all lesions. The anatomical location relative to the cervix, uterosacral ligaments and rectovaginal wall were also analyzed. Intestinal infiltration was diagnosed if the hypointense line corresponding to rectal muscularis mucosae was disrupted¹⁹ (Figures 2 and 3). Rectal adhesions were visible with MRI as hypointense thick lines in the pouch of Douglas.

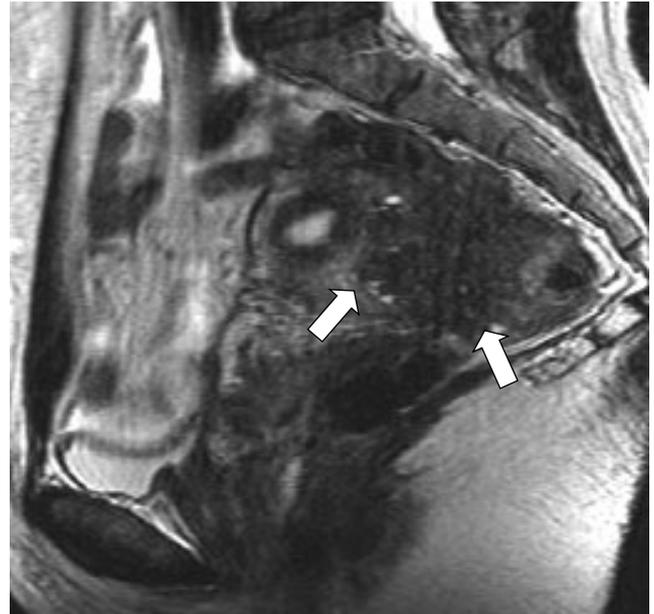


Figure 2 Magnetic resonance image (sagittal image, T2-weighted sequence) showing a huge hypointense endometriotic nodule, with hyperintense hemorrhagic foci, located within the rectovaginal wall (arrows) and infiltrating the rectal wall. Hypointensity of the lesion is invading the isointensity of the normal rectal wall (same patient as Figure 3).

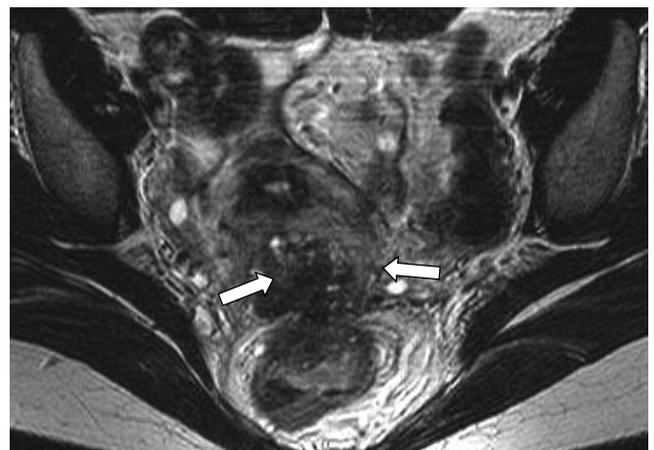


Figure 3 Magnetic resonance image (axial image, T2-weighted sequence) showing the nodule clearly visible within the myometrium (arrows), corresponding to focal adenomyosis, which is infiltrating the posterior rectovaginal wall. Hemorrhagic foci are clearly depicted with T1- and T2-weighted sequences and correspond to endometrial glands within the endometriotic nodule (same patient as Figure 2).

All REU and MRI findings were compared with the surgical and histological results. Surgical operations were carried out using operative techniques (operative laparoscopy or laparotomy) described previously². In every case exeresis was considered by the surgeon to be complete at the end of the operation. Anatomical locations of DIE lesions were coded according to a previously published classification². Locations were classified as: uterosacral ligament(s), upper third of posterior vaginal wall, and intestine. The pathologist considered that DIE was intestinal endometriosis when lesions involved the muscularis propria of the rectum.

We calculated the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of REU and MRI in the diagnosis of rectal involvement for patients presenting histologically proven DIE. Statistical analysis was done with use of confidence intervals.

RESULTS

Characteristics of the 81 patients included in the study are presented in Table 1. Infiltration of the rectal wall was observed in 34 (42.0%) cases. The anatomical locations of DIE lesions included: uterosacral ligament(s) (27 cases, 33.3%); vagina (20 cases, 24.7%); intestine (34 cases, 42.0%). Of the 81 patients, 47 (58.0%) were treated by operative laparoscopy.

The accuracy of REU and MRI in the diagnosis of rectal involvement for patients presenting with DIE is presented in Table 2. For REU, the sensitivity, specificity, PPV and NPV were, respectively, 97.1%, 89.4%, 86.8% and 97.7%. For MRI, these values were 76.5%, 97.9%, 96.3% and 85.2%. The sensitivity and NPVs of REU were higher than were those of MRI for diagnosis of rectal involvement for patients presenting with DIE.

Table 1 Patient characteristics ($n = 81$)

Characteristic	Mean \pm SD
Age (years)	31.9 \pm 6.7
Parity	0.3 \pm 0.6
Gravidity	0.6 \pm 0.8
Height (cm)	163.9 \pm 6.1
Weight (kg)	59.1 \pm 8.9
Body mass index (kg/m ²)	22.3 \pm 3.3
Mean number of previous surgical procedures for endometriosis	1.6 \pm 1.7
Mean VAS score	
Dysmenorrhea	7.6 \pm 2.6
Deep dyspareunia	6.0 \pm 3.3
Mean rAFS* score	
Implants rAFS score	13.3 \pm 12.7
Adhesions rAFS score	31.6 \pm 33.9
Total rAFS score	45.0 \pm 42.1

*Mean scores according to the American Fertility Society Classification²¹. VAS, visual analog linear scale.

Table 2 Sensitivity, specificity and positive and negative predictive values of rectal endoscopic ultrasonography (REU) and magnetic resonance imaging (MRI) in the diagnosis of rectal involvement for patients presenting with deeply infiltrating endometriosis ($n = 81$)

Procedure	% (n)	95% CI
REU		
Sensitivity	97.1 (33/34)	91.4–100.0
Specificity	89.4 (42/47)	80.5–98.2
PPV	86.8 (33/38)	76.1–97.6
NPV	97.7 (42/43)	93.2–100.0
MRI		
Sensitivity	76.5 (26/34)	62.2–90.7
Specificity	97.9 (46/47)	93.7–100.0
PPV	96.3 (26/27)	89.2–100.0
NPV	85.2 (46/54)	75.7–94.7

DISCUSSION

We found that REU had a higher sensitivity and NPV compared with MRI for diagnosis of rectal involvement in patients presenting with histologically proven DIE. Knowing preoperatively that there is bowel infiltration is essential to the strategy for the operation^{12,22}. In addition to its diagnostic value in detecting the existence of bowel infiltration, REU allows assessment of the depth to which the DIE lesions penetrate into the rectal wall²³. In contrast, although results obtained with MRI for the diagnosis of intestinal endometriosis have been reported^{16,19}, no publication available in the literature reports whether it is possible for MRI to analyze the depth to which the DIE lesions penetrate in the rectum wall. This information is also important in that it allows the type of rectal resection to be discussed prior to the operation (segmental, full thickness, deep partial thickness, superficial thickness)²⁴. The limitations of REU in this context are that it allows only the distal part of the bowel to be investigated (rectum, recto-sigmoid junction). One of the characteristics of DIE lesions is their multifocal nature^{2,4}. One case out of three DIE lesions infiltrating the rectum wall are associated with an overlying sigmoid lesion² that is difficult to diagnose with REU. This observation raises the question as to whether it is necessary, when REU indicates a suspicion of rectal involvement, to carry out additional investigations (notably helicoidal computed tomography scan with rectal opacification) to search for a second location further up. This information as to the existence of a second bowel location is also important when deciding on the approach (laparotomy or operative laparoscopy)^{2,4}.

The fact that REU is better at diagnosing rectal infiltration does not mean that there is no place for MRI in this context. The major advantage of MRI is that at present it is the only means of investigation that can provide a work-up for the whole pelvis. Unlike transvaginal ultrasonography, which is ideal for examining the bladder, uterus and ovaries, MRI allows not only the anterior pelvic compartment to be explored (bladder, ovaries, uterus) but at the same time also the posterior compartment (uterosacral ligaments, rectovaginal septum, vagina, rectum)^{19,25}, where DIE

lesions are most often located^{2,26}. It is crucial to have a complete work-up for the pelvis because the success of the operation depends on how radical is the exeresis¹ of these often multifocal lesions^{2,4,26}. Consequently, studies are required to establish whether the diagnostic possibilities of REU and MRI in this context are comparable when the aim is to achieve a comprehensive map of the site of posterior pelvic DIE lesions.

A few preliminary studies have looked at the capabilities of REU with respect to the assessment of rectovaginal endometriosis^{13,27,28}. Ohba *et al.*²⁸ were the first to use REU for the evaluation of the uterosacral ligaments. They report that uterosacral ligaments in non-endometriosis subjects were observed as hypoechoic homogeneous arcs in both sides of the uterine cervix and that patients who had endometriosis on the ligaments showed thick and irregularly shaped uterosacral ligaments²⁸. The merit of this work is that it is the first on the subject, but it is not perfect from a methodological point of view. The authors speculated that the thickened uterosacral ligaments of the patients with endometriosis were caused by DIE lesions, but no biopsy was made, nor was there any surgical exeresis of the uterosacral ligaments. In the study by Fedele *et al.*¹³, 34 patients had DIE lesions confirmed by combined surgical and pathological findings and the sensitivity, specificity, PPV and NPV of REU in the diagnosis of infiltration of the vagina and the uterosacral ligaments were 100%, 100%, 100%, 100% and 80%, 97.7%, 72.1%, 98.4%, respectively. These preliminary results are very encouraging. Recently Bazot *et al.*²⁷ in a prospective study of 30 patients reported that for diagnosis of rectosigmoid endometriosis the sensitivity, specificity, PPV and NPV were, respectively, 82%, 88%, 95% and 89%. These preliminary results are similar to those reported in our study.

To conclude, REU would appear to perform better than MRI in the diagnosis of rectal involvement for patients presenting with DIE. Prospective studies with a large number of patients are needed in order to validate these preliminary results. In the context of DIE the objective is to obtain a work-up as accurate as possible in order to be able to inform the patient about the various surgical possibilities prior to the operation. Further studies are necessary to clarify the respective indications of the various complementary means of investigation, the goal being to perform a complete work-up for the pelvis without carrying out surplus investigations. In this context the possibilities of transvaginal ultrasonography^{27,29,30} should be compared with those of REU and MRI.

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