Pelvic MRI for Endometriosis: A Diagnostic Challenge for the Inexperienced Radiologist. How Much Experience Is Enough?

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Purpose: The purpose of this study was to investigate the impact of radiologist experience on diagnostic performance of pelvic magnetic resonance imaging (MRI) for the evaluation of endometriomas and different localisations of deep pelvic endometriosis (DPE).

Materials and methods: In this prospective study all pelvic MRI examinations performed for pelvic endometriosis from December 2016 to August 2017 were evaluated by readers with different experience levels; junior resident (0–6 weeks of experience in female imaging), senior resident (7–24 weeks), fellow (6–24 months), and expert (10 years) in female imaging for the presence of endometriomas and DPE. Their evaluations were compared with surgery confirmed with pathology. Diagnostic performances of readers with different levels of experience were studied by the means of receiving operating characteristic curves and areas under the curve (AUC) were compared with the ones of the expert reader.

Results: Of 174 patients evaluated, the standard of reference was available for 59, consisting the final population of the study. The AUC for endometriomas, DPE for the posterior and anterior pelvic compartment, for rectosigmoid DPE and for overall evaluation were 0.983, 0.921, 0.615, 0.862, and 0.914 for the expert reader, 0.966 (p = 0.178), 0.805 (p = 0.001), 0.605 (p = 0.91), 0.872 (p = 0.317), and 0.849 (p = 0.0009) for the fellow level, 0.877 (p = 0.002), 0.757 (p < 0.001), 0.585 (p = 0.761), 0.744 (p = 0.239), and 0.787 (p < 0.001) for the senior resident level and 0.861 (p = 0.177), 0.649 (p < 0.001), 0.648 (p = 0.774), 0.862 (p = 1), and 0.721 (p < 0.001) for the junior resident level.

Conclusions: According to our results, interpretation of pelvic MRI for DPE should be performed by specialists as; even the performance of radiologists with up to 2 years of experience in female imaging was statistically inferior to that of experts.

Keywords: Endometriosis; Magnetic resonance imaging; Pelvis; Comparative study.

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Abbreviations: DPE deep pelvic endometriosis, ROC receiver operating curve, AUC area under the curve, FOV field of view, SENS sensitivity, SPEC specificity, PPV positive predictive value, NPV negative predictive value, LR likelihood ratio

INTRODUCTION

Endometriosis is a disease that affects 6–10% of women of reproductive age (1). It is characterized by the presence of endometrial-like glandular tissue outside the uterus (2), not in the pelvis but also in the abdominal wall and the diaphragm. It can also present in more atypical locations.

The main symptoms are dyspareunia, menstrual pain, dyschezia, microlgia, or chronic pelvic pain and infertility. The disease is heterogeneous in the appearance and typically classified in three types: superficial peritoneal implants, endometriomas, and deep endometriosis (3).

Ultrasonography (US) is the first-line imaging modality for the assessment of pelvic endometriosis. However, it has important limitations, mainly because it is an operator dependent modality but also because of the relatively limited field-of-view. MRI is increasingly performed as an additional investigation in complex cases and for surgical planning, its importance lying also in overcoming the limitations of ultrasound.

The optimal technical protocol of pelvic MRI for endometriosis has been standardized by the European society of urogenital radiology guidelines, making optimal imaging easier to obtain (4).
However, interpretation of pelvic MRI with the clinical question of endometriosis requires specific skill and experience. Superficial endometriosis is characterized by peritoneal implants invading less than 5 mm of depth from the peritoneal surface and is not often visible on MRI. They are usually more readily assessed at laparoscopy, which remains the gold standard for diagnosis. Endometriomas is a relatively straightforward diagnosis based on specific radiological signs. Deep pelvic endometriosis (DPE) is defined as disease penetrating the peritoneum more than 5 mm. It can affect the uoserosal ligaments, the vagina, the digestive tract, the urinary tract, and other extraperitoneal organs (5). DPE is a diagnostic challenge with imaging signs overlapping with other disease processes such as adhesions and fibrosis caused by pelvic inflammatory disease or previous surgical interventions. The purpose of this study was to investigate the impact of radiologist’s experience on diagnostic performance of pelvic MRI for the evaluation of endometriomas and different localizations of DPE.

MATERIALS AND METHODS

Patient Population

In this prospective study approved by the ethics commission of the canton of Geneva, Switzerland, we included all consecutive patients (>18 years old) undergoing pelvic MRI in our institution with the clinical indication of suspected or known endometriosis from December 2016 to August 2017 and who subsequently underwent surgery. Patients had signed an informed consent concerning the use of their data.

MRI Acquisition Protocol

All MRI examinations were performed on a 1.5T Avanto fit Siemens MR unit (Siemens Healthcare, Erlangen, Germany).

Patient preparation included a water enema before the examination to evacuate the rectum and the patients were instructed to empty their bladder and drink two glasses of water before the examination in order to have the bladder half full during the acquisition. On the MRI table, the vaginal cavity was filled with 60–120 mL of ultrasound gel to better delineate anatomy and detect any eventual vaginal invasion from endometriosis. An abdominal belt was used in order to attenuate abdominal wall movement due to respiration and reduce artifacts. Finally, 1 cc of Buscopan (20 mg/ml) i.m. was injected immediately prior to the beginning of acquisition, to reduce bowel motility.

MRI acquisition protocol included T2W turbo spin echo sagittal [field of view (FOV) 230 mm, matrix 320, in-plane resolution 0.7 × 0.7 mm, slice thickness 3 mm with gap 0.3 mm, parallel imaging acceleration factor 2, 3 averages, TR 5990 ms, TE 85 ms, bandwidth 200 Hz/px, acquisition time 4 min 53 s] and coronal oblique perpendicular to the latter (FOV 220 mm, matrix 320, in-plane resolution 0.7 × 0.7 mm, slice thickness 3 mm with gap 0.3 mm, parallel imaging acceleration factor 2, 2 averages, TR 4400 ms, TE 85 ms, bandwidth 200 Hz/px, acquisition time 3 min 06 s). An axial 3D T1 weighted Vibe with Dixon fat saturation on the pelvis (FOV 340 mm, matrix 320, in-plane resolution 1.1 × 1.1 mm, slice thickness 1 mm, parallel imaging acceleration factor 2, TR 6.9 ms, TE 2.39/4.77 ms, bandwidth 450 Hz/px, acquisition time 3 min 44 s), an axial DWI on the pelvis with the RESOLVE sequence (FOV 250 mm, matrix 124, in-plane resolution 2 × 2 mm, slice thickness 3 mm with no gap, parallel imaging acceleration factor 2, TR 10440 ms, TE 63 ms, bandwidth 1260 Hz/px, fat saturation with SPectral Attenuated Inversion Recovery (SPAIR) technique, acquisition time 5 min 03 s) and an axial T2 single shot turbo spin echo (Haste) acquisition of the entire abdomen and pelvis, including the kidneys was also performed (FOV 350 mm, matrix 384, in-plane resolution 0.9 × 0.9 mm, slice thickness 5 mm with gap 0.5 mm, parallel imaging acceleration factor 2, TR 1100 ms, TE 93 ms, bandwidth 723 Hz/px, acquisition time 1 min 19 s). According to European society of urogenital radiology guidelines of conformation, we do not routinely administer gadolinium contrast agent for the clinical indication of endometriosis (4).

MRI Reading

All MRI examinations were transferred to a dedicated workstation (OsiriX, Pixmeo, Bernex, Switzerland). A separate interpretation was performed for each examination by radiologists with four different levels of experience from one single center: a senior radiologist with 10 years of experience in female pelvic MRI, junior residents with of 0–6 weeks of experience in female pelvic MRI (but previous experience with MRI, including abdominal MRI interpretation), senior residents (7–24 weeks in female pelvis MRI), and fellows in female imaging unit with experience of 6–24 months in female pelvis MRI. The different cut-offs were chosen arbitrarily based on the staff of the female imaging unit of our institution according to the educational program in our university hospital. In their training, residents participate in the routine clinical work in the unit at three different stages in their formation: an initial 6-week rotation, followed by a 24-week rotation in the senior years. Some then continue a fellowship in female imaging with a total stay in the unit for two years. All radiologists were from the same hospital (Geneva University Hospitals, Switzerland) which is considered center of reference for endometriosis in Switzerland. In our institution, a radiologist is expected to read a mean of 10 pelvic MR examinations with the clinical indication of endometriosis per week of training based on the data of the last 3 years. Each reader was asked to report the presence or absence of endometriomas and of lesions of DPE.

While, in clinical practice, residents and fellow radiologists are under the supervision of a senior radiologist, for the
purpose of the study, they were blinded to the senior radiologist’s report and filled-in a dedicated datasheet for the study. All readers evaluated the presence of endometriosis and the presence of different organs’ invasion in a scale of 0–3 (0 = absent, 1 = likely not present, 2 = likely present, 3 = present). Evaluation scores 0 and 1 were considered negative while 2 and 3 as positive interpretations for the calculation of diagnostic performances. All readers had full access to clinical information in order to assimilate real conditions in clinical practice.

The diagnosis of endometriomas was based on the presence of a unique ovarian cyst hyperintense on T1 fat saturated (fat sat) images with T2 shading and/or T2 dark spots or of multiple hyperintense cysts on T1 fat sat with or without T2-shading as described in the literature (6,7). For DPE, depending on the different localizations, diagnostic criteria used were the presence of T1 and T2 hypointense nodular retracile lesions with the presence of bright spots on T1 fat sat sequences and T2, asymmetric nodular thickening of uterosacral ligaments, the “hourglass” sign (posterior extension of a posterior forniceal lesion toward the anterior rectal muscularis), nodular or diffuse thickening of bladder wall with or without hemorrhagic T1 hyperintense spots, and secondary signs as uterine retroflexion or retraction from the midline and the kissing ovaries sign according to the literature (6–14). The readers were asked to localize the identified lesions as follows: endometriomas of the right or left ovary, DPE lesions of the posterior pelvic compartment including the pouch of Douglas, the retrocervical region, and the uterosacral ligaments or the anterior compartment including lesions of the vesicouterine pouch and the round ligaments. The readers also evaluated bladder and ureteral invasion as described in the literature (8,10,13). The invasion of the rectosigmoid colon was also reported if it concerned at least the muscularis.

**Statistical Analysis**

Sensitivity (SENS), specificity (SPEC), positive (PPV), and negative (NPV) predictive values with likelihood ratios (LR) were calculated based on interpretations of each readers’ group. Overall diagnostic performance of the different groups was expressed by the means of areas under the curve (AUC) of the corresponding receiving operating characteristic (ROC) curves. ROC curves of different readers were compared to those of the senior reader by the means of a Bonferroni analysis, while standard error of difference (SE) estimation and confidence intervals were calculated with DeLong (1988) method.

Differences with p values of ≤ 0.05 were considered statistically significant.

The data treatment was performed with PRISM (version 6) software (Graphpad software, Inc) and online “easyROC” (version 1.3.1) software (15).

**RESULTS**

Of, 174 female patients undergoing pelvic MRI for endometriosis gold standard was available for 59 patients, who were included in this study. The mean age of patients was 37 ± 7.9 years (range 18.3–53.4). The mean time interval from the MRI to the operation was 4.9 ± 2.8 months (range 0.6–11.3).

Twenty-two patients had histologically confirmed endometriomas, five of whom bilateral. DPE was confirmed in 36 (28 only in the posterior compartment, 1 only in the anterior compartment and 7 in both anterior and posterior compartments). Five patients had rectal wall invasion, one had vaginal wall invasion, one had bladder wall invasion and none had ureteral invasion.

The overall diagnostic performance for all localizations was as follows: the expert reader had a sensitivity of 0.893 [95% confidence interval (CI) 0.836 to 0.933] and specificity of 0.964 (95% CI 0.946 to 0.976) and an AUC of 0.914. The fellow level reader had a sensitivity of 0.807 (95% CI 0.739 to 0.863), a specificity of 0.927 (95% CI 0.905 to 0.945), AUC of 0.849 and a p value of 0.009. The senior resident level reader had a sensitivity of 0.731 (95% CI 0.658 to 0.795), a specificity of 0.900 (95% CI 0.876 to 0.921), AUC of 0.787 and a p value < 0.001. The junior resident level reader had a sensitivity of 0.491 (95% CI 0.416 to 0.566), a specificity of 0.909 (95% CI 0.886 to 0.929), AUC of 0.721, and a p value < 0.001.

For endometriomas, the expert reader had a sensitivity of 0.964 (95% CI 0.816 to 0.999) and specificity of 0.977 (95% CI 0.921 to 0.997) and an AUC of 0.983. The fellow had a sensitivity of 1 (95% CI 0.872 to 1.00), a specificity of 0.933 (95% CI 0.860 to 0.975), AUC of 0.966, and a p value of 0.177. The senior resident had a sensitivity of 0.862 (95% CI 0.683 to 0.961), a specificity of 0.886 (95% CI 0.800 to 0.944), AUC of 0.877, and a p value of 0.002. The junior resident had a sensitivity of 0.857 (95% CI 0.673 to 0.959), a specificity of 0.842 (95% CI 0.750 to 0.911), AUC of 0.861, and a p value of 0.001.

For the anterior compartment lesions, the expert reader had a sensitivity of 0.965 (95% CI 0.921 to 0.999) and specificity of 0.977 (95% CI 0.921 to 0.997) and an AUC of 0.983. The fellow had a sensitivity of 0.9 (95% CI 0.872 to 1.00), a specificity of 0.933 (95% CI 0.860 to 0.975), AUC of 0.976, and a p value of 0.177. The senior resident had a sensitivity of 0.862 (95% CI 0.683 to 0.961), a specificity of 0.886 (95% CI 0.800 to 0.944), AUC of 0.877, and a p value of 0.002. The junior resident had a sensitivity of 0.857 (95% CI 0.673 to 0.959), a specificity of 0.842 (95% CI 0.750 to 0.911), AUC of 0.861, and a p value of 0.001.

For the anterior compartment lesions, the expert reader had a sensitivity of 0.714 (95% CI 0.290 to 0.963) and specificity of 0.580 (95% CI 0.385 to 0.775) and an AUC of 0.615. The fellow had a sensitivity of 0.375 (95% CI 0.085 to 0.755), a specificity of 0.960 (95% CI 0.865 to 0.995), AUC of 0.605, and a p value of 0.198. The senior resident had a sensitivity of 0.428 (95% CI 0.098 to 0.815), a specificity of 0.923 (95% CI 0.814 to 0.978), AUC of 0.585, and a p value of 0.761. The junior resident had a sensitivity of 0.375 (95%
CI 0.085 to 0.755), a specificity of 0.921 (95% CI 0.811 to 0.978), AUC of 0.648, and a $p$ value of 0.774.

For posterior compartment pooled lesions, the expert reader had a sensitivity of 0.909 (95% CI 0.812 to 0.965) and specificity of 0.935 (95% CI 0.872 to 0.973) and an AUC of 0.921. The fellow had a sensitivity of 0.793 (95% CI 0.673 to 0.885), a specificity of 0.844 (95% CI 0.762 to 0.903), AUC of 0.805, and a $p$ value < 0.001. The senior resident had a sensitivity of 0.741 (95% CI 0.615 to 0.844), a specificity of 0.810 (95% CI 0.725 to 0.878), AUC of 0.757, and a $p$ value < 0.001. The junior resident had a sensitivity of 0.432 (95% CI 0.312 to 0.559), a specificity of 0.861 (95% CI 0.781 to 0.920), AUC of 0.649, and a $p$ value < 0.001.

For vaginal invasion, the expert reader had a sensitivity of 1 (95% CI 0.025 to 1) and specificity of 0.935 (95% CI 0.901 to 0.970) and an AUC of 0.991. The fellow level reader had a sensitivity of 0.999 (95% CI 0.999 to 1), a specificity of 1 (95% CI 1 to 1), an AUC of 1, and a $p$ value < 0.001.

For rectal invasion, the expert reader had a sensitivity of 0.800 (95% CI 0.283 to 0.994) and specificity of 0.925 (95% CI 0.821 to 0.979) and an AUC of 0.862. The fellow had a sensitivity of 0.800 (95% CI 0.283 to 0.994), a specificity of 0.944 (95% CI 0.846 to 0.988), AUC of 0.872, and a $p$ value of 0.317. The senior resident had a sensitivity of 0.600 (95% CI 0.146 to 0.947), a specificity of 0.888 (95% CI 0.773 to 0.958), AUC of 0.744, and a $p$ value of 0.239. The junior resident had a sensitivity of 0.800 (95% CI 0.283 to 0.994), a specificity of 0.925 (95% CI 0.821 to 0.979), AUC of 0.862, and a $p$ value of 1.

Table 1 shows in detail the sensitivities, specificities, PPV, NPV, LR as well as AUC and respective $p$ values resulting from the comparison of ROC curves resulting from the interpretation of expert radiologist and those of fellows, senior, and junior residents.

Figure 1 shows the pooled comparison of ROC curves for all readers for the presence of endometriosis and also for endometriomas, anterior compartment, retrocervical/Douglas pouch, uterosacral ligaments, vaginal invasion, rectal invasion, posterior compartment pooled, and overall diagnostic performance.

For ureteral invasion, the senior reader and the fellow had no false positive results while the senior and junior residents had one false positive, respectively.

For bladder invasion, the expert reader as well as the senior resident and the fellow correctly identified the only positive case with no false positive while the junior resident did not identify it and moreover he had one false positive result.
DISCUSSION

Endometriosis is a complex disease that is often associated with pelvic pain and infertility. MRI plays a major role, either by confirming the diagnosis, in association with the clinical examination, or by revealing other causes of pelvic pain. Accurate diagnosis obtained by MRI also plays an important role in surgical planning. Based on MRI findings, the preoperative multidisciplinary meeting may decide that the presence of colorectal surgeon or urologist is mandatory during the intervention depending on the degree of suspicion of rectal, bladder, or ureteral involvement. MRI diagnosis of endometriosis may be challenging and it has been assumed that a certain degree of expertise is required.

Fig. 1. Pooled comparison of receiver operating curve (ROC) curves for all readers for the presence of endometriosis for all lesions (Fig 1a), for endometriomas (Fig 1b), for posterior compartment (Fig 1c), for anterior compartment (Fig 1d), for rectal invasion (Fig 1e).
This is the first study, to our knowledge, that directly addresses the issue of radiologist’s experience required for optimal interpretation of MRI in the clinical context of endometriosis. Most previous studies included only experienced readers (16-19). Those that included experienced and less experienced readers in female pelvic MRI, they did not directly compare their performances, but rather included two or more readers aiming to test reproducibility of MRI findings (20-22). Bazot et al (21) included two readers, one with more than 20 years of experience, and one with less than 1 year. The latter focused on performance of MRI for the diagnosis of endometriosis of uterosacral ligaments. They found, as expected, that the expert reader had a better performance than the junior one. However, these performances were not directly statistically compared.

Saba et al (22) in a paper examining the role of clinical information in the interpretation of MRI for endometriosis study the performances of radiologists with experience varying between 13, 9, 8, and 3 years. Although this study did not aim to compare the performance of radiologists, it seems that the authors found no significant differences between them. However, all readers of this study had significant previous exposure to pelvic MRI.

In contrast, most often, radiology specialization does not include more than 3-6 months of female pelvis imaging. In our institution, only fellows in female imaging can benefit from more than 6 months experience of MRI of the female pelvis. As a consequence, a general radiologist is often confronted with pelvic MRI interpretations with much less experience.

Especially for endometriosis, patients have traditionally been referred in an outpatient basis to small peripheral radiology centers where radiologists do not necessarily have the required experience for interpretation of complex cases. With the creation of referral centers for endometriosis, the complex diagnosis of this disease is routine. Furthermore, expert radiologists participate on a regular basis in multidisciplinary panels, where the clinical and radiological diagnoses are correlated and the consequent therapeutic approach is decided. In this context, MRI interpretation of inexperienced radiologists from peripheral centers is often compared in clinical practice with the expert’s opinion and often the diagnosis is entirely different.

This is the reason why, in our study, we wanted to test the diagnostic performances of readers with less experience, simulating the experience of a general radiologist in everyday clinical practice. The aim was to identify what degree of experience is considered “adequate,” so that clinicians could ideally address their patients to the appropriate radiologists.

We are aware that, in many cases, a radiologist when finishing his residency has less experience in female imaging than our fellows. In this study, we wanted to imitate in a safe environment (blinded only for the study and not for clinical practice) conditions that would be real life for a junior board certified radiologist who would be called upon to independently report on pelvic MRIs with little previous experience.

In our study, all readers had satisfactory diagnostic performance for the diagnosis of endometriomas (Fig 2) with sensitivities of 0.857-1 and specificities of 0.842-0.933. This finding was expected, as the diagnosis of endometriomas is a straightforward, based on the presence of precise descriptors as the presence of shading, dark T2 spots in the cystic lesion and multiplicity of lesions with blood signal.

However, compared to the expert reader, only fellow level readers had no statistically significant difference in their diagnostic performance, while for senior and junior residents the difference was statistically significant with 14 and 18 misclassified lesions respectively and p values of 0.002335 and 0.0006173. The majority misclassified lesions, were millimetric implants of superficial endometriosis on the ovarian serosa that were falsely classified as endometriomas because of their high signal on T1 fat sat sequence. There were also two cases of hematosalpinges that were interpreted as endometriomas. Inversely, there were four false negative results that were considered as hematosalpinges and one as a hemorrhagic cyst.

**Fig. 2.** A 45-year-old woman with meno-metrorrhagia and chronic pelvic pain. Figure 2a shows a solitary cystic lesion of the right ovary, with shading on axial plane T2-weighted (T2W) image (white arrows in Fig 2a) and homogeneous hyperintense signal in axial T1-weighted (T1W) Dixon-Water sequence (white arrows in Fig 2b), which is typical for endometrioma. This was correctly diagnosed by all readers, even by the least experienced ones.
Concerning DPE, the performances of different readers varied significantly. For the posterior compartment, the difference was particularly important: the expert reader had a sensitivity of 0.91 and specificity of 0.93, results that are comparable to the literature (23). However, even the fellow with experience between 6 months and two years had a sensitivity of 0.79 and specificity of 0.844 with the respective ROC curves being significantly different (Fig 3). The less-experienced readers had even poorer performances (Fig 4). This difference is understandable, as there is a significant overlap

Fig. 3. A 25-year-old woman presenting with chronic pelvis pain. Sagittal (Fig 3a) and axial (Fig 3b) plane T2-weighted (T2W) images show a subtle thickening of the left utero-sacral ligament (white arrows), without hemorrhagic spots in axial T1-weighted (T1W) Dixon-Water (Fig 3c). This image corresponded on pathology to a deep pelvis endometriosis localization, only seen by the senior radiologist.

Fig. 4. A 38-year-old woman with severe pelvic pain and dyschezia. Sagittal (Fig 4a) and coronal oblique (Fig 4b) T2-weighted (T2W) images show a large low signal retractile lesion of the Douglas pouch infiltrating the muscularis of the rectal wall (white arrows in 3a and b). Both the lesion and its extension to the rectal wall were correctly identified by the by senior radiologist, fellow, and senior resident, but not by junior resident.
between DPE and adhesions due to infectious disease or previous surgical interventions associated with similar retractile images. The distinction between the different entities requires greater radiologists’ experience and this justifies the lower specificities of less experienced readers. Moreover, often the lesion of DPE is less evident and only perceptible due to indirect signs mostly due to retraction. This might be the reason explaining the higher sensitivity of expert reader.

For rectal wall involvement, diagnostic performance of all readers was similar with ROC curves that were not statistically different. In order to obtain optimal evaluation of rectal imaging in our institution we proceed to a water enema to obtain an empty rectosigmoid colon. At the same time, we do not proceed to rectal filling with ultrasound gel; thus rectal wall distension is avoided and evaluation of the depth of invasion from eventual endometriotic lesions is easier. This imaging protocol might be responsible for the adequate diagnostic performance of less-experienced readers.

Concerning anterior compartment localizations, even the expert reader had much lower sensitivity (0.713) maintaining a high specificity (0.98). This is also in accordance to the literature (20,23). The AUC was 0.615, not significantly higher than the fellow (0.605). However, in this study, there were only eight cases of anterior compartment disease and the results should be interpreted under this perspective. The reason of the relatively lower performance of MRI for anterior compartment endometriosis might be the filling of the bladder, which was not always optimal. The bladder should ideally be full. However, this not always easy to obtain in clinical practice.

There was only one case of proven bladder involvement and no case of ureteral invasion in our study. Thus no statistically reliable results can be extracted for these localizations. For bladder invasion, the junior resident had one false negative and one false positive result while all other readers correctly identified the only positive case with no false positive results. Concerning ureteral involvement, the false positive interpretations of the two resident level readers concerned two different cases. One with a big endometrioma that displaced the ureter laterally without invasion and the other where the ureter was probably falsely identified by the reader as having a trajectory through a DPE nodule, however without any dilatation.

Our study has limitations. First, the relatively small number of cases is a limiting factor, especially for evaluation of rare localizations of endometriosis.

Secondly, due to the fact that we used only surgery/histology as the standard of reference, the incidence of the disease in our population was high, as only patients with high probability of endometriosis were operated. However, this limitation is to overcome, as, in contrast to other indications of imaging, a follow-up cannot be considered as a reliable standard of reference.

In conclusion, obtaining an accurate diagnosis with MRI is crucial as it can affect the surgical planning of endometriosis. MRI of endometriosis should be performed by expert readers in female pelvis imaging, as, according to our results, even readers with up to two years of experience had significantly lower diagnostic performances, especially concerning DPE of the posterior compartment that is the most frequent localization of the disease. Institutions providing education to future radiologists should insist on female pelvic imaging. On the other hand, referring clinicians should refer patients to radiologists with adequate experience in the domain.

DECLARATION OF COMPETING INTEREST
None.

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REFERENCES


SUPPLEMENTARY MATERIALS

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