

Imaging and surgical mapping in endometriosis

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Abstract

Endometriosis is a chronic estrogen-dependent disease with inflammatory potential, characterized by the presence of ectopic endometrial tissue outside the uterus, with polymorphic and multifocal characteristics. In the same patient, there may be present several types of endometriotic lesions – from superficial endometriosis to endometriomas and deep infiltrative endometriosis. We can even say that it is a fibrotic condition in which the stroma and the endometrial epithelium are identified. **Materials and method.** We conducted a retrospective study, between 2017 and 2021, on a group of 126 patients, aged between 25 and 50 years old, operated in the "Prof. Dr. Panait Sîrbu" Clinical Hospital of Obstetrics and Gynecology, Bucharest, the Euroclinic Hospital – Private Health Network, and Monza Hospital, Bucharest. **Results.** We performed a comparative study of the diagnosis of ultrasound endometriosis/MRI and intra-operative endometriosis. According to information, the MRI diagnosis of endometriosis lesions is clearly superior, having a higher accuracy compared to the ultrasound diagnosis. **Conclusions.** There is no imaging method that can be used individually and be effective enough to identify the location and extent of endometriosis. The performance of these imaging procedures should be considered depending on the type of suspected endometriosis, the proposed therapeutic strategy, and the information to be provided to the patient. Transvaginal ultrasound is a repeatable, costless procedure that can be used to diagnose certain types and locations of endometriosis. The role of transvaginal ultrasound is to guide the type of subsequent complementary investigations depending on the location of the lesions, when suspected. **Keywords:** deep endometriosis, transvaginal ultrasound, magnetic resonance imaging (MRI)

Rezumat

Endometrioza este o boală cronică estrogen-dependență, cu potențial inflamator, caracterizată prin prezența țesutului ectopic endometrial în afara uterului, cu caracter polimorf și multifocal, la aceeași pacientă putând fi prezente mai multe tipuri de leziuni endometriozeice – de la endometrioza superficială la endometrioame și endometrioza profund infiltrativă. Putem spune chiar că este o afecțiune fibrotică în care se pot identifica stroma și epiteliul endometrial. **Materiale și metodă.** Am realizat un studiu retrospectiv, între 2017 și 2021, pe un grup de 126 de paciente, cu vârste cuprinse între 25 și 50 de ani, operate în Spitalul Clinic de Obstetrică-Ginecologie „Prof. Dr. Panait Sîrbu”, Spitalul Euroclinic – Rețeaua privată de sănătate și Spitalul Monza, București. **Rezultate.** Am efectuat un studiu comparativ al diagnosticului de endometrioza pus ecografic/pe baza IRM și al endometriozei intraoperatorii. Conform datelor, diagnosticul IRM al leziunilor endometriozei este net superior, având o precizie mai mare comparativ cu diagnosticul ecografic. **Concluzii.** Nu există o metodă imagistică utilizată individual care poate fi îndeajuns de eficientă pentru a identifica localizarea și amploarea endometriozei. Efectuarea acestor proceduri imagistice ar trebui luată în considerare în funcție de tipul de endometrioza suspectată, de strategia terapeutică propusă și de informațiile care trebuie furnizate pacientei. Ecografia transvaginală este o procedură repetabilă, necostisitoare, care poate fi utilizată pentru a diagnostica anumite tipuri și localizări de endometrioza. Rolul ecografiei transvaginale este de a ghida tipul de investigații complementare ulterioare în funcție de localizarea leziunilor, atunci când sunt suspectate. **Cuvinte-cheie:** endometrioza profundă, ecografie transvaginală, investigație prin rezonanță magnetică (IRM)

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Introduction

Endometriosis is a chronic, estrogen-dependent disease with inflammatory potential, characterized by the presence of endometrial ectopic tissue outside the uterus, with polymorphic and multifocal characteristics. In the same patient, there may be present several types of endometriotic lesions – from superficial endometriosis to endometriomas and deeply infiltrative endometriosis^(1,2,3). We can even say that it is a fibrotic condition in which the stroma and the endometrial epithelium can be identified⁽⁴⁾.

Therefore, the most important aspect in the diagnosis of deeply infiltrative endometriosis is the accuracy of the preoperative imaging – ultrasound and/or MRI diagnosis performed by an experienced clinician and radiologist.

Transvaginal ultrasound has a high sensitivity in the detection of deep endometriosis lesions in the uterosacral ligaments, vaginal wall, rectovaginal space, Douglas sac and rectosigmoid⁽⁵⁾.

It can be performed on an outpatient basis, it is costless, it can be repeated in dynamics without possible side effects compared to pelvic MRI, therefore it is considered a first-line investigation when the clinical suspicion of endometriosis is raised.

Materials and method

We conducted a retrospective study, between 2017 and 2021, on a group of 126 patients, aged between 25 and 50 years old, operated in the "Prof. Dr. Panait Sîrbu" Clinical

Hospital of Obstetrics and Gynecology, Euroclinic Hospital – Private Health Network, and Monza Hospital, Bucharest.

Results

The statistical analysis was performed using IBM SPSS Statistics 25 and Microsoft Office Excel/Word 2013. Quantitative variables were tested for distribution using the Shapiro-Wilk test and were expressed as means with standard deviations or medians with interpercentile intervals. The categorical variables were expressed in absolute or percentage form and were tested using the Fisher's Exact Test.

The existing correlations were made using the Pearson and Spearman's *rho* correlation coefficient, depending on the distribution of quantitative variables.

The data in Table 1 represent the characteristics of the studied group. The following are observed:

- The average age is 32.92 ± 5.418 years old, with a median of 33 years old.

- The most common age category is 30-39 years old (63.4%).

- The mean value of preoperative AMH is 1.824 ± 2.67 ng/mL, with a median of 1.07 ng/mL.

- The average total AFS-R score is 3.38 ± 0.825 points, with a median of 4 points.

- Most patients did not have postoperative complications (98.5%), only two patients had postoperative complications (postoperative fever and rhabdomyolysis).

The data in Table 2 represent the description of the pathologies observed ultrasound, describing the following:

- 29% of the patients had an endometriotic node.

- 79.4% of the patients had endometriotic cyst.

- 10.4% of the patients had hemorrhagic cyst.

- 5.6% of the patients had parametric lesion, more frequently straight (3.2%).

- 7.9% of the patients had LUS lesion, more frequently right (5.6%).

Table 1 Characteristics of the studied group

Parameter	Value
Age (mean \pm SD, median [IQR], min-max) (years)	32.92 ± 5.418 , 33 (29-37), 20-50
Age categories (no., %)	
20-29 years old	32 (26%)
30-39 years old	78 (63.4%)
40-49 years old	12 (9.8%)
50-59 years old	1 (0.8%)
Preoperative AMH (mean \pm SD, median IQR, min-max) (ng/mL)	1.824 ± 2.67 , 1.07 (0-2.79), 0-19.78
Total AFS-R Score (mean \pm SD, median IQR, min-max)	3.38 ± 0.825 , 4 (3-4), 0-4
Postoperative complications (no., %)	128 (98.5%)-; 2 (1.5%)+

Table 2 Description of pathologies observed on ultrasound

Pathology – ultrasound (no., %)	
Endometriotic node	88 (71%) Absent, 36 (29%) Present
Endometriotic cyst	26 (20.6%) Absent, 100 (79.4%) Present
Hemorrhagic cyst	112 (89.6%) Absent, 13 (10.4%) Present
Parametric lesion	119 (94.4%) Absent, 4 (3.2%) Right, 3 (2.4%) Left
USL lesion	116 (92.1%) Absent, 7 (5.6%) Right, 1 (0.8%) Left, 2 (1.6%) Bilateral
Peritoneal pseudocyst	124 (98.4%) Absent, 2 (1.6%) Present
Adenomyosis	107 (85.6%) Absent, 18 (14.4%) Present

The data in Table 3 represent the description of the pathologies observed on MRI. The following are observed:

- 27% of the patients had parametric lesions (right, left or bilateral).
- 27.6% of the patients had lesions of the rectovaginal septum.
- 43.8% of the patients had uterosacral ligament lesions, more frequently bilateral (24.7%).
- 25.8% of the patients had rectal nodules, more frequently unique (24.7%).
- 14.8% of the patients had sigmoid nodules, more frequently unique (12.5%).
- 1.1% of the patients had ileal nodules.
- 66.3% of the patients had other locations of endometriosis.
- The average size of the rectal nodules was 22.3 ± 9.541 mm, with a median of 22 mm (IQR = 15-30 mm).
- The average size of the sigmoid nodules was 27.23 ± 8.974 mm, with a median of 27 mm (IQR = 20-36 mm).
- The average distance of intestinal lesions from the external anal sphincter was 124.13 ± 18.626 mm, with a median of 120 mm (IQR = 120-130 mm).

The data in Table 4 represent the description of the pathologies observed intraoperatively. The following are observed:

- Most patients had a normal appearance of the uterus (68.5%), 16.2% of the patients had fibroids and 15.4% of the patients had adenomyosis.
- 53.8% of the patients had anterior sac lesions, more frequently with a black appearance (43.8%), with an average size of 25.65 ± 6.962 mm.
- 38% of the patients had straight parametric lesions, more frequently class B2 (17.8%), and 46.9% of the patients had left parametric lesions, more frequently class B2 (27.3%).
- 19.5% of the patients had lesions of the rectovaginal septum, more frequently class A2 (10.2%).
- 20.8% of the patients had straight USL lesions, more frequently with a black appearance (15.4%) and an average size of 14.78 ± 6.6 mm, and 32% of the patients had left USL lesions, more frequently with a black appearance (26.6%) and with an average size of 15.83 ± 7.242 mm.
- 44.2% of the patients had intestinal lesions, more frequently class C3 (20.9%), 32% had rectal lesions, more frequently single (28.9%), with an average size of 23.51 ± 9.058 mm, 15.6% had sigmoid lesions, more frequently unique (12.5%), with an average size of 26.6 ± 7.989 mm.

Table 3 Description of pathologies observed on MRI

Pathology – MRI (no., %)	
Parametric lesions	
Absent	65 (73%)
Right	8 (9%)
left	8 (9%)
Bilateral	8 (9%)
Rectovaginal septum lesions	63 (48.5%)-; 24 (27.6%)+
Uterosacral ligament lesions	
Absent	50 (56.2%)
Right	14 (15.7%)
Left	3 (3.4%)
Bilateral	22 (24.7%)
Rectal nodules	66 (74.2%)-; 22 (24.7%) – single; 1 (1%) – multiple
Sigmoid nodules	75 (85.2%)-; 11 (12.5%) – single; 2 (2.3%) – multiple
Ileal nodules	88 (98.9%)-; 1 (1.1%)+
Other implants – endometriosis	30 (33.7%); 59 (66.3%)+
Lesion dimensions – MRI (mean \pm SD, median IQR, min-max)	
Rectal nodules (mm)	22.3 \pm 9.541, 22 (15-30), 10-42
Sigmoid nodules (mm)	27.23 \pm 8.974, 27 (20-36), 13-40
Distance of intestinal lesion from external anal sphincter (EAS) (mm)	124.13 \pm 18.626, 120 (120-130), 80-160

Table 4 Description of lesions observed intraoperatively

Uterine appearance	Uterovesical region – appearance	Right parametric – Enzian	Left parametric – Enzian	Rectovaginal septum – Enzian	Right USL – appearance
89 (68.5%) Normal	60 (46.2%) Absent	80 (62%) Absent	68 (53.1%) Absent	103 (80.5%) Absent	103 (79.2%) Absent
21 (16.2%) Fibroma	11 (8.5%) red	18 (14%) B1	14 (10.9%) B1	7 (5.5%) A1	3 (2.3%) red
20 (15.4%) Adenomyosis	2 (1.5%) white	23 (17.8%) B2	35 (27.3%) B2	13 (10.2%) A2	4 (3.1%) white
	57 (43.8%) black	6 (6.2%) B3	11 (8.6%) B3	5 (3.9%) A3	20 (15.4%) black
Left USL – appearance	Intestinal lesions	Rectal lesions	Sigmoid lesions	Diaphragmatic lesions	Appendicular lesions
87 (68%) Absent	72 (55.8%) Absent	87 (68%) Absent	108 (84.4%) Absent	128 (99.2%) Absent	127 (99.2%) Absent
6 (4.7%) red	13 (10.1%) C1	37 (28.9%) Unique	16 (12.5%) Unique	1 (0.8%) Present	1 (0.8%) Present
1 (0.8%) white	17 (13.2%) C2	4 (3.1%) Multiple	4 (3.1%) Multiple		
34 (26.6%) black	27 (20.9%) C3				
Lesions dimensions – intraoperative (mean ± SD, median IQR) (mm)					
The uterovesical region		25.65 ± 6.962, 30 (20-30)			
Right USL		14.78 ± 6.6, 15 (10-20)			
Left USL		15.83 ± 7.242, 15 (10-20)			
Rectum		23.51 ± 9.058, 25 (16.5-30)			
Sigmoid		26.6 ± 7.989, 30 (20-33.75)			
Ileal		16.67 ± 5.774, 20			

■ 0.8% of the patients had diaphragmatic or appendicular invasion.

The data in **Table 5 and Figure 1** represent the comparison of ultrasound/MRI and intraoperative endometriosis diagnoses. According to the data, the MRI diagnosis of endometriosis lesions is clearly superior, having a higher accuracy compared to the ultrasound diagnosis.

■ For **parametric lesions**: MRI accuracy 51.68% versus ECO accuracy 40.32%; MRI sensitivity 33.9% versus ECO sensitivity 8.6%; MRI specificity 86.7% versus ECO specificity 100%.

■ For **USL lesions**: MRI accuracy 73.03% versus ECO accuracy 61.9%; MRI sensitivity 70.3% versus ECO sensitivity 12%; MRI specificity 75% versus ECO specificity 94.7%.

■ For **rectovaginal septal lesions**: MRI accuracy 78.16% versus ECO accuracy 71.54%; MRI sensitivity 64.7% versus ECO sensitivity 52.2%; MRI specificity 81.4% versus ECO specificity 76%.

■ For **rectal lesions**: MRI accuracy 89.77% versus ECO accuracy 72.35%; MRI sensitivity 73.3% versus ECO sensitivity 52.6%; MRI specificity 98.3% versus ECO specificity 81.2%.

■ For **sigmoid lesions**: MRI accuracy 89.65% versus ECO accuracy 70.73%; MRI sensitivity 62.5% versus ECO sensitivity 50%; MRI specificity 95.8% versus ECO specificity 74.8%.

■ For **peritoneal endometriotic nodules**: MRI accuracy 79.77% versus ECO accuracy 66.93%; MRI sensitivity 76% versus ECO sensitivity 46%; MRI specificity 84.6% versus ECO specificity 88.5%.

Discussion

In our study, the accuracy of MRI proved to be clearly superior in the diagnosis of parametric lesions, uterosacral ligaments, rectovaginal septum and upper intestinal lesions.

Transvaginal ultrasound has a high sensitivity in detecting deep endometriosis of the uterosacral ligament, rectovaginal septum, the vaginal wall of the Douglas sac and the rectosigmoid.

Conclusions

There is no single imaging device that can be used individually and be sufficiently efficient to identify the location and extent of endometriosis. The performance of these

Table 5 Comparison of ultrasound/MRI and intraoperative endometriosis diagnoses

<i>Ultrasound (US) – lesions par./intraoperative – lesions par.</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
Ultrasound – Absent	43 (100%)	74 (91.4%)	0.095
Ultrasound – Present	0 (0%)	7 (8.6%)	
<i>MRI/intraoperative parametric lesions</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
MRI – Absent	26 (86.7%)	39 (66.1%)	0.046
MRI – Present	4 (13.3%)	20 (33.9%)	
<i>Ultrasound lesions (USL)/intraoperative USL</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
US – Absent	72 (94.7%)	44 (88%)	0.193
US – Present	4 (5.3%)	6 (12%)	
<i>MRI/intraoperative USL lesions</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
MRI – Absent	39 (75%)	11 (29.7%)	<0.001
MRI – Present	13 (25%)	26 (70.3%)	
<i>US nodule/intraoperative septum lesions</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
US – Absent	76 (76%)	11 (47.8%)	0.011
US – Present	24 (24%)	12 (52.2%)	
<i>MRI/intraoperative rectovaginal septum lesions</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
MRI – Absent	57 (81.4%)	6 (35.3%)	<0.001
MRI – Present	13 (18.6%)	11 (64.7%)	
<i>US nodule/intraoperative rectal nodule</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
US – Absent	69 (81.2%)	18 (47.4%)	<0.001
US – Present	16 (18.8%)	20 (52.6%)	
<i>MRI/intraoperative rectal nodules</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
MRI – Absent	57 (98.3%)	8 (26.7%)	<0.001
MRI – Present	1 (1.7%)	22 (73.3%)	
<i>Ultrasound nodule/intraoperative sigm. nodule</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
Echo – Absent	77 (74.8%)	10 (50%)	0.034
Echo – Present	26 (25.2%)	10 (50%)	
<i>MRI/intraoperative sigmoid nodule</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
MRI – Absent	68 (95.8%)	6 (37.5%)	<0.001
MRI – Present	3 (4.2%)	10 (62.5%)	
<i>US nodule/intraoperative nodule</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
US – Absent	54 (88.5%)	34 (54%)	<0.001
US – Present	7 (11.5%)	29 (46%)	
<i>MRI nodule/intraoperative nodule</i>	Intraoperative – Absent	Intraoperative – Present	p*
	No./%	No./%	
MRI – Absent	33 (84.6%)	12 (24%)	<0.001
MRI – Present	6 (15.4%)	38 (76%)	

*Fisher's Exact Test

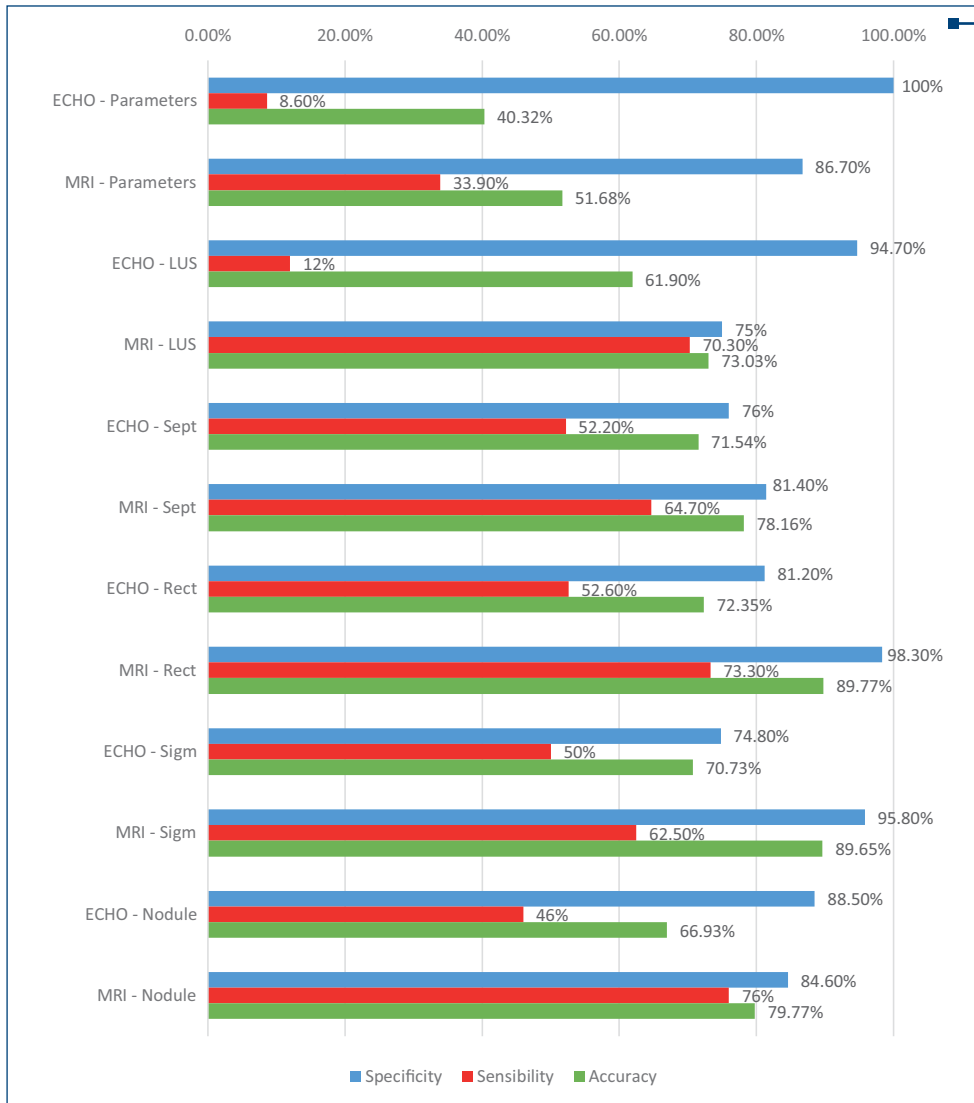


Figure 1. Sensitivity and specificity of ultrasound diagnoses versus MRI in relation to the investigated pathologies

imaging procedures should be considered depending on the type of suspected endometriosis, the proposed therapeutic strategy and the information to be provided to the patient.

Transvaginal ultrasound is a costless, repeatable procedure that can be used to diagnose certain types and locations of endometriosis. The role of transvaginal ultrasound is to guide the type of subsequent complementary investigations depending on the location of the lesions, when suspected⁽⁶⁾.

The diagnosis of endometriosis is closely dependent on the operator.

A multidisciplinary approach with superior outcomes is needed in terms of complete resection of endometriotic lesions and improvement of the quality of life of the patient with deep infiltrative endometriosis⁽⁷⁾.

High-resolution transvaginal ultrasonography and in particular magnetic resonance imaging are increasingly used to diagnose the presence and extent of infiltrating lesions and the involvement of rectosigmoid and ureters^(8,9). ■

Conflict of interests: The authors declare no conflict of interests.

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