Extended Transvaginal Sonography in Deep Infiltrating Endometriosis

Use of Bowel Preparation and an Acoustic Window With Intravaginal Gel: Preliminary Results

Mauricio León, MD, Humberto Vaccaro, MD, Juan Luis Alcázar, MD, PhD, Jaime Martinez, MD, Jorge Gutierrez, MD, Fernando Amor, MD, Alberto Iturra, MD, Hugo Sovino, MD

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Address correspondence to Juan Luis Alcázar, MD, PhD, Department of Obstetrics and Gynecology, Medical School, Clinica Universidad de Navarra, Avenida Pio XII 36, 31008 Pamplona, Spain.

E-mail: jalcazar@unav.es

Abbreviations
CI, confidence interval; LR, likelihood ratio

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Objectives—The purpose of this study was to assess the diagnostic performance of extended transvaginal sonography for diagnosing deep infiltrating endometriosis.

Methods—A prospective study was conducted comprising 51 women (mean age, 32.9 years; range, 23–43 years) with suspected deep infiltrating endometriosis based on clinical symptoms. All women underwent extended transvaginal sonography, which included assessment of 2 pelvic compartments (anterior compartment: bladder and distal ureters; and posterior compartment: posterior vaginal fornix, retrocervical area, pouch of Douglas, and rectosigmoid). The sliding sign for detecting pouch of Douglas obliteration was also assessed. All patients received bowel preparation before sonographic examinations. A single examiner performed all examinations. All women underwent laparoscopic surgery, and histologic confirmation of endometriosis was done. The sensitivity, specificity, positive likelihood ratio (LR+) and negative likelihood ratio (LR–) were calculated.

Results—Some women had more than 1 lesion, giving a total of 55 histologically confirmed lesions (rectosigmoid, n = 13; vagina, n = 5; retrocervical, n = 32; bladder, n = 5). The sensitivity, specificity, and LR+ for rectosigmoid involvement were 100%, 93%, and 14.0, respectively. The sensitivity, specificity, LR+, and LR– for vaginal involvement were 60%, 98%, 30.0, and 0.41. The sensitivity, specificity, LR+, and LR– for retrocervical involvement were 84%, 96%, 19.4, and 0.16. The sensitivity, specificity, and LR– for bladder involvement were 20%, 100%, and 0.80. The sensitivity, specificity, LR+, and LR– of the sliding sign for diagnosing pouch of Douglas obliteration were 89%, 92%, 10.7, and 0.12.

Conclusions—Except for bladder involvement, extended transvaginal sonography has good diagnostic performance for deep infiltrating endometriosis.

Key Words—deep infiltrating endometriosis; diagnosis; gynecologic ultrasound; sonography

Endometriosis is defined as the presence of endometrial tissue, glands, and stroma outside the uterine cavity. The actual prevalence of this disease is not known, but it is estimated that 1% to 8% of women have endometriosis,[1] with prevalence ranging from 15% to 70% in infertile women.[2,3] The clinical presentation varies independently from extension of the disease, and it manifests a number of symptoms characterized by secondary dysmenorrhea, chronic pelvic pain, intermenstrual pain, dyspareunia, dyschezia, intermittent diarrhea, hematochezia, and, in severe cases, bowel obstruction.[2]

Three different types of endometriosis, namely, ovarian, peritoneal, and deep infiltrating, have been described, and their physiopathologic mechanisms are still under discussion.[3] Ovarian endometriosis is the most common finding and is frequently diagnosed during routine sonography and in patients with a history of the disease or adnexal tumor findings.[4] Peritoneal, or superficial, endometriosis is characterized by lesions of variable extension that are commonly identifiable directly through laparoscopic views. Imaging techniques such as sonography and magnetic resonance imaging can detect them in some cases.[5,6] Deep infiltrating endometriosis is defined as an endometriotic lesion that extends greater than 5 mm from under the peritoneum.[7] This kind of disease is responsible for painful symptoms such as dyschezia, rectal bleeding, constipation, and dyspareunia associated with deep endometriotic implants. This disease is characterized by multifocal lesions, with the most common locations being the uterosacral ligaments, posterior vaginal fornix, bladder, and bowel.[7]

A series of sonographic techniques have been developed for diagnosing deep infiltrating endometriosis, from conventional transvaginal sonography, which requires no preliminary preparation, to sonovaginography, with application of a saline solution in the acoustic window.[8] An analysis of different diagnostic tools revealed that the techniques that achieve the best performance are those that use a transvaginal sonographic view of the female pelvis in different compartments. The technique described by Gonçalves et al[9] is one of those that exemplify this concept. With preliminary bowel preparation, different types of nodular lesions can be identified at the vesicouterine pouch, retrocervical region, bladder, vaginal fornix, rectouterine fold, and anterior wall of the rectosigmoid. This technique encompasses observation of these structures plus those identified outside the pelvis, including the sigmoid in the abdominal portion, transverse and ascending colon, appendix, and ureters in the abdominal and intrapelvic portions. We have used the technique described by Gonçalves et al[9] without including the abdominal exploration and have defined it as extended transvaginal sonography. The purpose of this study was to assess the performance of extended transvaginal sonography for diagnosing deep infiltrating endometriosis, using surgical diagnostic laparoscopy and histologic analysis as the reference standard to confirm endometriosis.

Materials and Methods

We conducted a prospective study performed between August 2011 and October 2012 at the Department of Obstetrics and Gynecology, Ultrasound and Human Reproduction Unit, of the Indisa Clinic. During the study period, women with a clinical suspicion of deep infiltrating endometriosis based on clinical symptoms (chronic pelvic pain, deep dyspareunia, dyschezia, catamenial rectal bleeding, and catamenial hematuria) or physical pelvic examination findings (nonmobile uterus, posterior vaginal fornix nodules, and a painful pelvic examination) were considered eligible for the study. Patients with concomitant cancer, pregnancy, or a pelvic inflammatory process were not eligible.

The inclusion criteria were a clinical suspicion of deep infiltrating endometriosis and the patient's acceptance to undergo transvaginal sonography. There was no patient age limit for inclusion, and women with previous surgery were not excluded. Exclusion criteria were surgery performed in a center other than the recruitment center, the choice of medical treatment instead of surgery, and patient withdrawal before surgery. All patients gave oral informed consent, and Institutional Review Board approval was obtained.

Sonographic Technique

All extended transvaginal sonographic examinations were performed by an expert operator (M.L.) using a Voluson 730 Pro Value ultrasound machine (GE Healthcare, Milwaukee, WI) equipped with a 5–9-MHz transvaginal transducer. This examiner had more than 10 years of experience in gynecologic sonography and 3 years of experience in assessment of deep infiltrating endometriosis. Extended transvaginal sonography was performed as part of clinical care.

All patients received bowel preparation with an oral laxative (sodium picosulfate, 10 drops by mouth) the night before the examination and a simple rectal enema (120 mL of sodium diphosphate) 1 to 2 hours before the examination. The sonographic protocol comprised systematic examinations of 2 compartments:

Anterior Compartment

This compartment includes the bladder wall (assessing both muscle layers and bladder mucosa) and visualization of the distal ureters, including the meatus, intramural portion, extravesical portion, and pelvic portions to up to 6 cm over the ureterovesical limit. To achieve such an evaluation, the examiner must turn the transvaginal transducer 45° on its longitudinal axis, positioning it at the joint of the vesicoureteral fold and trying to get a longitudinal view at the axis of the intramural ureter. In this position, the ureter is identified by stimulation of the distal ureter with soft

compression by the transducer (Video 1). Finally, the vesicouterine fold is moved with the transducer, observing its mobility and sliding over the anterior uterine face. Deep infiltrating endometriosis was suspected by the presence of hypoechoic linear thickening or nodules/masses with or without regular contours involving the bladder wall or located between the bladder and uterus (Figure 1).

Posterior Compartment

This compartment includes the posterior vaginal fornix, the retrocervical area, and the anterior aspect of the rectosigmoid wall. To do this examination, the examiner places the transvaginal transducer in the posterior vaginal fornix, observing the mobility and sliding of the fornix. At the same time, the "sliding sign" is assessed (Video 2).[10] This sign shows whether uterorectal adhesions exist and whether the pouch of Douglas may be obliterated. The sliding sign was assessed by exerting gentle pressure against the cervix with the transvaginal probe to establish whether the anterior rectum glided freely across the posterior aspect of the cervix (posterior cervical region) and posterior vaginal wall. Then the examiner placed a hand over the patient's lower anterior abdominal wall to move the uterus between the palpating hand and the transvaginal probe to determine whether the rectosigmoid glided freely over the posterior aspect of the upper uterus/fundus. If the anterior rectal wall glided smoothly over the posterior cervix and posterior vaginal wall and the anterior rectosigmoid wall glided smoothly over the posterior upper uterus/fundus during transvaginal sonography, the sliding sign was considered positive. When the sliding sign was considered positive, the pouch of Douglas was recorded as not obliterated. If either of these anatomic regions showed that the anterior rectal wall or rectosigmoid did not glide smoothly over the posterior cervix or posterior uterine fundus, the sliding sign was considered negative, and the pouch of Douglas was recorded as obliterated.

Additionally, evaluation of the retrocervical region and uterine torus was performed, looking for the presence of nodular lesions (Figure 2). Finally, the uterosacral ligaments were assessed, looking for asymmetry in the insertion region of the ligaments and the presence of pain under compression by the transducer (Figure 3). Deep infiltrating endometriosis lesions were suspected in the presence of hypoechoic nodules at any area assessed. Bowel involvement was suspected in the presence of a nodular, predominantly solid, hypoechoic irregular lesion adhering to the intestinal wall (Figure 4).

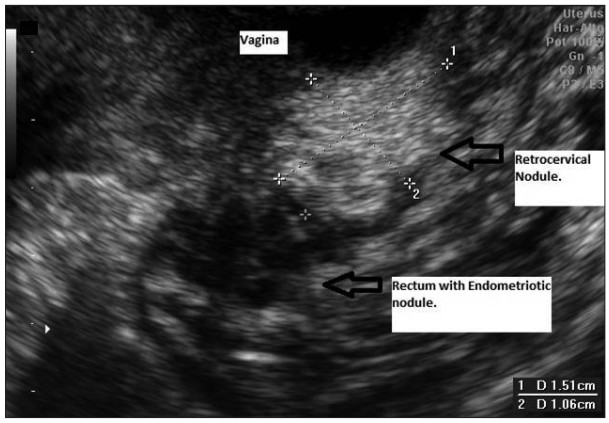


Figure 2. Longitudinal transvaginal sonogram showing a hypoechoic nodule involving the rectum in the retrocervical area as well as a hyperechoic irregular nodule (calipers) in the upper rectovaginal septum.

Figure 1. Hyperechoic irregular endometriotic nodule (calipers) involving the bladder wall.

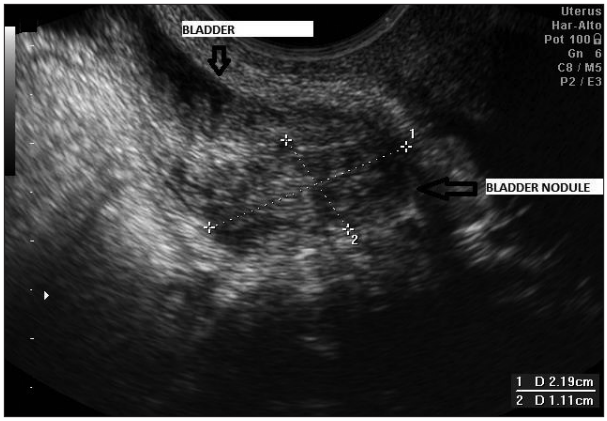
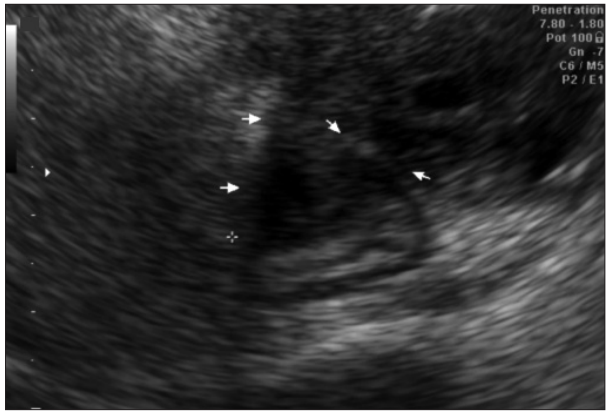


Figure 3. Oblique transvaginal sonogram showing a nodular hypoechoic lesion (arrows) corresponding to an endometriotic nodule involving the right uterosacral ligament as well as the anterior rectal wall.



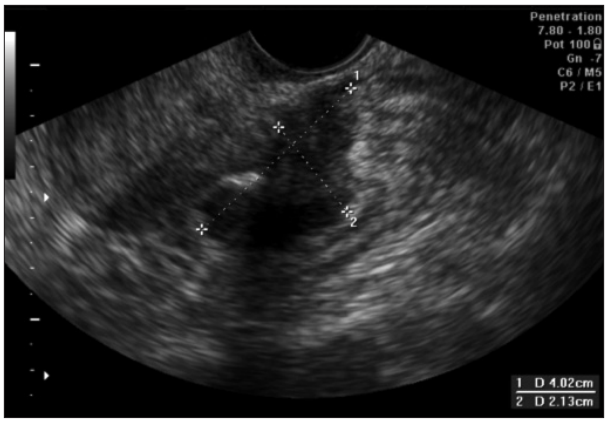


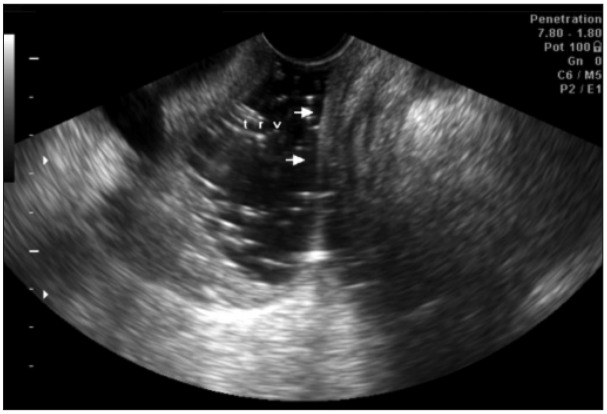
Figure 4. Longitudinal transvaginal sonogram showing a nodular lesion corresponding to a hypoechoic endometriotic nodule (calipers) with compromise of the anterior wall of the rectum.

The acoustic window is provided by intravaginal instillation of ultrasound gel (50 mL), which is commonly used in transvaginal explorations. The gel is introduced into the vagina with a catheter tip–type syringe, which enables the examiner to get a view of the vaginal walls and the rectovaginal septum to look for nodular lesions (Figures 5–7).[9]

Reference Standard

All patients underwent laparoscopy by an expert in endometriotic surgery (H.S.). The surgeon was asked to assess all areas under evaluation by sonography and to specifically determine the presence or absence of endometriotic implants. Any lesion suspected to be endometriosis should be biopsied to histologically confirm the presence of endometriotic tissue.

Figure 5. Sagittal transvaginal (trv) sonogram with the use of intravaginal gel showing a normal rectovaginal septum (arrows).



Statistical Analysis

A descriptive statistical analysis was performed. The sensitivity, specificity, positive likelihood ratio (LR+), and negative likelihood ratio (LR–) with their respective 95% confidence intervals (CIs) for extended transvaginal sonography were calculated. The analysis was performed per endometriosis site, not per patient, to calculate the performance of extended transvaginal sonography for diagnosing deep infiltrating endometriosis at specific anatomic regions. All statistical analyses were performed with the SPSS version 15.0 statistical package (IBM Corporation, Chicago, IL).

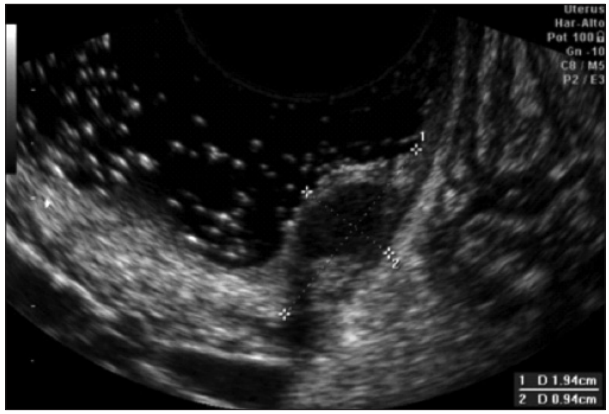
Results

During the study period, 110 women were evaluated. Fifty-nine women were excluded because surgery was not performed at the center of recruitment (n = 30), medical treatment was given instead of surgery (n = 25), and the patients withdrew before surgery (n = 4). Ultimately, 51 women were included. In 39 patients, the deep infiltrating endometriosis diagnosis was confirmed, and some of them had more than 1 lesion, for a total of 55 lesions confirmed by histologic studies (Table 1).

The patients' mean age ± SD was 32.9 ± 4.7 years (range, 23–43 years). A summary of clinical signs and symptoms is shown in Table 2. In half of the cases, bimanual vaginal examinations provided a suspicion of deep infiltrating endometriosis.

Table 3 shows the diagnostic performance of extended transvaginal sonography for identifying different types of deep infiltrating endometriosis lesions. In 59% of the cases of confirmed deep infiltrating endometriosis (23/39),

Figure 6. Sagittal transvaginal sonogram with the use of intravaginal gel showing an endometriotic nodule (calipers) located in the posterior vaginal fornix.



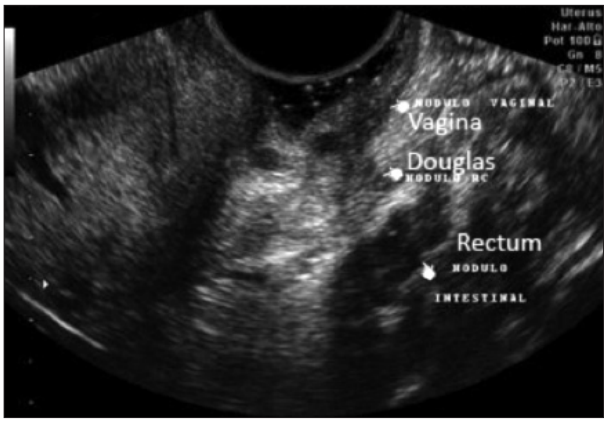


Figure 7. Sagittal transvaginal sonogram with the use of intravaginal gel showing deep infiltrating endometriosis lesions in the vagina, pouch of Douglas, and rectum.

ovarian endometriosis and deep infiltrating endometriosis coexisted. In 13 women (55%), ovarian lesions were bilateral.

The sensitivity, specificity, LR+, and LR– of the sliding sign for diagnosing pouch of Douglas obliteration were 89% (95% CI, 72%–97%), 92% (95% CI, 74%–98%), 10.7 (95% CI, 2.8–40.5), and 0.12 (95% CI, 0.04–0.35), respectively (Table 4). In cases of a negative sliding sign, we did not observe any other finding that could explain this negative (eg, adhesions secondary to pelvic inflammatory disease).

In the cases of pouch of Douglas obliteration, it is important to point out that of the 24 cases of obliteration, 13 had rectal involvement. Of these 13 cases, 12 had a negative sliding sign. On the other hand, there were 11 cases with a negative sliding associated with the presence of retrocervical nodules. Finally, there were only 2 false-positive cases (negative sliding sign and absence of deep infiltrating endometriosis).

Table 1. Locations of Deep Infiltrating Endometriosis Lesions

Location	n
Rectosigmoid	13
Vaginal nodules	5
Retrocervical	32
Bladder	5
Total	55

Table 2. Signs and Symptoms in Patients With a Suspicion of Deep Infiltrating Endometriosis

Sign/Symptom	n (%)
Dysmenorrhea	51/51 (100)
Chronic pelvic pain	46/51 (90)
Dyspareunia	39/51 (76)
Dyschezia	34/51 (67)
Hematochezia	5/51 (10)
Suspicious bimanual examination	26/51 (51)

Discussion

Our study shows that extended transvaginal sonography is a good diagnostic tool for the preoperative assessment of patients with a suspicion of deep infiltrating endometriosis. We performed a systematic pelvic sonographic evaluation in 2 compartments, enhancing the study of the posterior compartment and the evaluation of the bladder walls. With movement of the transducer into the vesicouterine fold and inspection of the inferior portion of the uterus, it is possible to find nodular lesions that can affect this compartment, providing useful information for planning surgery.

The results of the diagnosis of bladder and vaginal involvement were relatively poor, probably because not all patients were evaluated with a distended urinary bladder, and the sizes of the lesions might have been too small for sonographic detection. Some of the patients with false-negative results were evaluated with an empty bladder, worsening our capacity for diagnosing lesions in this compartment. We also have to consider the low prevalence of bladder lesions due to endometriosis in our patients, making it harder to achieve an appropriate learning curve. This aspect is also the experience of other researchers, which reported sensitivity as low as 44% for diagnosis of bladder endometriosis.[11]

Regarding lesions found in the retrocervical region, our results achieved lower sensitivity than those of other researchers.[9] It is probable that this finding could have been related to the examiner's experience and the learning curve, as our experience was lower. In the preoperative study of the posterior compartment, we achieved high sensitivity for diagnosing rectosigmoid nodules (100%) with very good specificity (92%), similar to previous studies.[9,12–15]

Recently, Reid et al[10] described a negative sliding sign as a predictor of pouch of Douglas obstruction, achieving sensitivity of 83% and specificity of 97%. These findings were also in agreement with our results. Additionally, the results obtained show that the absence of sliding (negative sliding sign) is strongly associated with involvement of the retrocervical region and the rectosigmoid. This factor is relevant, since Khong et al[16] showed that pouch of Douglas obliteration was a risk marker for deep infiltrating endometriosis in the bowel and the risk of surgery due to rectal involvement.

Table 3. Diagnostic Performance of Extended Transvaginal Sonography

Location	Sensitivity, % (n)	Specificity, % (n)	LR+	LR–
Rectosigmoid	100 (13/13) [77–100]	93 (39/42) [81–97]	14.0 [4.7–41.7]	NA
Retrocervical	84 (27/32) [68–93]	96 (22/23) [79–99]	19.4 [2.8–132.7]	0.16 [0.07–0.37]
Bladder	20 (1/5) [4–62]	100 (50/50) [93–100]	NA	0.80 [0.52–1.24]
Vaginal fornix	60 (3/5) [23–88]	98 (1/50) [89–99]	30.0 [3.8–237.3]	0.41 [0.14–1.19]

Values in brackets are 95% CIs. NA indicates not available.

Our study had some limitations. One was that in spite of the high experience of the surgeon, some deep infiltrating endometriosis lesions are not visible on laparoscopy and could have been missed.[17] Thus, some false-negative sonographic findings could certainly have been a mistake. Another was that all sonographic examinations were performed by a single expert examiner, and we did not assess interobserver variability. Therefore, observer variability remains unclear. Additionally, the sample size was small, which could explain the wide CIs observed for sensitivity and specificity. Finally, we have to recognize that diagnostic performance may have been overestimated because our sample was a selected one, since many women had advanced deep infiltrating endometriosis. This fact may affect the generalizability of our results.

In conclusion, our results confirm that extended transvaginal sonography is useful for diagnosis of deep infiltrating endometriosis in advanced cases. The systematized use of sonography in compartments, bowel preparation, and the use of intravaginal gel together achieve an optimum assessment of these patients, and we believe that this procedure is a useful and easy way to conduct a preoperative study in daily practice. Larger trials are needed to confirm our results.

Table 4. Diagnostic Performance of the Sliding Sign for Pouch of Douglas Obliteration With Rectosigmoid Involvement

	Laparoscopic Diagnosis		
Sliding Sign	Obliteration	No Obliteration	Total
Negative	24	2	26
Positive	3	22	25
Total	27	24	51

References

1. Falcone T, Lebovic DI. Clinical management of endometriosis. *Obstet Gynecol* 2011; 118:691–705.
2. Ballweg ML. Impact of endometriosis on women's health: comparative historical data show that the earlier the onset, the more severe the disease. *Best Pract Res Clin Obstet Gynaecol* 2004; 18:201–218.
3. Nisolle M, Donnez J. Peritoneal endometriosis, ovarian endometriosis, and adenomyotic nodules of the rectovaginal septum are three different entities. *Fertil Steril* 1997; 68:585–596.
4. Van Holsbeke C, Van Calster B, Guerriero S, et al. Endometriomas: their ultrasound characteristics. *Ultrasound Obstet Gynecol* 2010; 35:730–740.
5. Benacerraf BR, Groszmann Y. Sonography should be the first imaging examination done to evaluate patients with suspected endometriosis. *J Ultrasound Med* 2012; 31:651–653.
6. Chamié LP, Blasbalg R, Pereira RM, Warmbrand G, Serafini PC. Findings of pelvic endometriosis at transvaginal US, MR imaging, and laparoscopy. *Radiographics* 2011; 31:E77–E100.
7. Fauconnier A, Chapron C, Dubuisson JB, Barakat H, Vieira M, Bréart G. Deep infiltrating endometriosis. *Fertil Steril* 2002; 78:719–726.
8. Guerriero S, Ajossa S, Gerada M, D'Aquila M, Piras B, Melis GB. "Tenderness-guided" transvaginal ultrasonography: a new method for the detection of deep endometriosis in patients with chronic pelvic pain. *Fertil Steril* 2007; 88:1293–1297.
9. Gonçalves MO, Dias JA Jr, Podgaec S, Averbach M, Abrão MS. Transvaginal ultrasound for diagnosis of deeply infiltrating endometriosis. *Int J Gynecol Obstet* 2009; 104:156–160.
10. Reid S, Lu C, Casikar I, et al. Prediction of pouch of Douglas obliteration in women with suspected endometriosis using a new real-time dynamic transvaginal ultrasound technique: the sliding sign. *Ultrasound Obstet Gynecol* 2013; 41:685–691.
11. Savelli L, Manuzzi P, Pollastri M, Mabrouk M, Seracchioli R, Venturoli S. Diagnostic accuracy and potential limitations of transvaginal sonography for bladder endometriosis. *Ultrasound Obstet Gynecol* 2009; 34:595–600.
12. Bazot M, Thomassin I, Hourani R, Cortez A, Darai E. Diagnostic accuracy of transvaginal sonography for deep pelvic endometriosis. *Ultrasound Obstet Gynecol* 2004; 24:180–185.

13. Abrao MS, Gonçalves MO, Dias JA Jr, Podgaec S, Chamie LP, Blasbalg R. Comparison between clinical examination, transvaginal sonography and magnetic resonance imaging for the diagnosis of deep endometriosis. *Hum Reprod* 2007; 22:3092–3097.
14. Hudelist G, English J, Thomas AE, Tinelli A, Singer CF, Keckstein J. Diagnostic accuracy of transvaginal ultrasound for non-invasive diagnosis of bowel endometriosis: systematic review and meta-analysis. *Ultrasound Obstet Gynecol* 2011; 37:257–263.
15. Savelli L, Manuzzi M, Coe M, et al. Comparison of transvaginal sonography and double-contrast barium enema for diagnosing deep infiltrating endometriosis of the posterior compartment. *Ultrasound Obstet Gynecol* 2011; 38:466–471.
16. Khong SY, Bignardi T, Luscombe G, Lam A. Is pouch of Douglas obliteration a marker of bowel endometriosis? *J Minim Invasive Gynecol* 2011; 18:333–337.
17. Piketty M, Chopin N, Dousset B, et al. Preoperative work-up for patients with deeply infiltrating endometriosis: transvaginal ultrasonography must definitely be the first-line imaging examination. *Hum Reprod* 2009; 24:602–607.