"Tenderness-guided" transvaginal ultrasonography: a new method for the detection of deep endometriosis in patients with chronic pelvic pain

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Objective: To determine the accuracy of transvaginal ultrasonography (TVUS) using a modified "tenderness-guided" approach in the diagnosis of deep endometriosis of the cul-de-sac, retrocervical region, and rectovaginal septum.

Design: Prospective study.

Setting: Academic department of obstetrics and gynecology.

Patient(s): Fifty women scheduled for laparoscopy for chronic pelvic pain.

Intervention(s): All patients underwent TVUS. The modified tenderness-guided approach consisted of TVUS combined with the introduction of 12 mL of ultrasound transmission gel (instead of the usual 4 mL) in the probe cover to create a stand-off to visualize the near-field area. The posterior fornix was evaluated accurately with an up-and-down sliding movement of the probe. In addition, when the patient indicated that tenderness was evoked by the probe's pressure, the sliding movement was stopped, and particular attention was paid to the painful site for detection of endometriosis lesions.

Main Outcome Measure(s): Sensitivity, specificity, and kappa values.

Result(s): Using this approach, we obtained a specificity of 95% with a sensitivity of 90%, associated with a very high kappa value of 0.86 (95% CI, 0.56–0.91).

Conclusion(s): Our new TVUS approach appears to be an accurate, inexpensive, and less invasive method for the diagnosis of deep endometriosis. (Fertil Steril® 2007;88:1293–7. ©2007 by American Society for Reproductive Medicine.)

Key Words: Deep endometriosis, transvaginal ultrasound, pelvic pain

Endometriotic implants that penetrate the retroperitoneal space for a distance of 5 mm or more are defined as deeply invasive endometriosis and typically involve the Douglas pouch (retrocervical endometriosis), the rectovaginal septum, or the uterosacral ligaments (1). Although deep endometriosis is strongly associated with severe chronic pelvic pain, dyspareunia, and dysmenorrhea, this disease is difficult to assess by physical examination (2). Because surgery for deep endometriosis requires considerable ability and experience (3), a preoperative evaluation is mandatory to select among the different treatment options, and an appropriate surgeon with sufficient experience in this type of surgery is required.

Several imaging techniques such as transvaginal ultrasonography (TVUS), transrectal ultrasonography (TRUS), rectal endoscopic ultrasonography (REUS), and magnetic resonance imaging (MRI) have been proposed for the assessment of deep endometriosis. Because of its high diffusion and relatively low cost and discomfort, TVUS should be considered the first-line procedure; however, in the diagnosis of deep endometriosis, this technique has had controversial results. The sensitivity of plain TVUS ranges from 44% to 89% and the specificity from 50% to 85% (4–6). Furthermore, in the rectovaginal septum location, the sensitivity would appear to be less than 30% (5).

In their series of 46 patients, Dessole et al. (6) proposed a new technique called sonovaginography for the assessment of rectovaginal endometriosis. Their TVUS technique is combined with the introduction of saline solution into the vagina to create an acoustic window between the transvaginal probe and the surrounding vaginal structures. As an alternative, we decided to create an acoustic window between the transvaginal probe and the surrounding vaginal structures by increasing the amount of ultrasound gel inside the probe cover. In addition, because the endometriotic nodule itself can induce pain, we asked patients to indicate during the ultrasonographic examination which points felt tender under gentle pressure from the probe, and we paid particular

attention to evaluating those sites. The aim of our study was to determine the accuracy of TVUS using this modified and "tenderness-guided" approach in the diagnosis of deep endometriosis of the cul-de-sac, retrocervical region, and rectovaginal septum.

MATERIALS AND METHODS

Between January 2005 and May 2005, 50 consecutive women scheduled for laparoscopic surgery for rectovaginal endometriosis, suspected on the basis of patient history of pelvic pain and/or clinical examination, were included in the study. The mean age ($\pm$SD) of the study population was 33 $\pm$ 5 years (range: 22 to 41 years). The indication for surgery was pelvic pain in all 50 women, of whom five had associated infertility. Nineteen patients (39%) reported dyspareunia and 42 (83%) dysmenorrhea. All 50 had had previous treatment for persistent pelvic pain with medication (estroprogestins and/or gonadotropin-releasing hormone agonist and nonsteroidal anti-inflammatory drugs) for at least 2 years. The study protocol was approved by our institutional review board.

Within 7 days before surgery, all patients underwent TVUS using a Technos MPX (Esaote, Genova, Italy) with a 6.5–7.0 MHz transvaginal probe. The modified tenderness-guided approach consisted of TVUS combined with the introduction of 12 mL of ultrasound gel instead of the usual 4 mL into the probe cover (usually a finger from a latex glove) to create a stand-off to visualize the near-field area. The probe was inserted gently to avoid the risk of squeezing out the gel. The vaginal wall at the level of the posterior fornix could be evaluated accurately with a sliding up-and-down movement of the probe (Fig. 1).
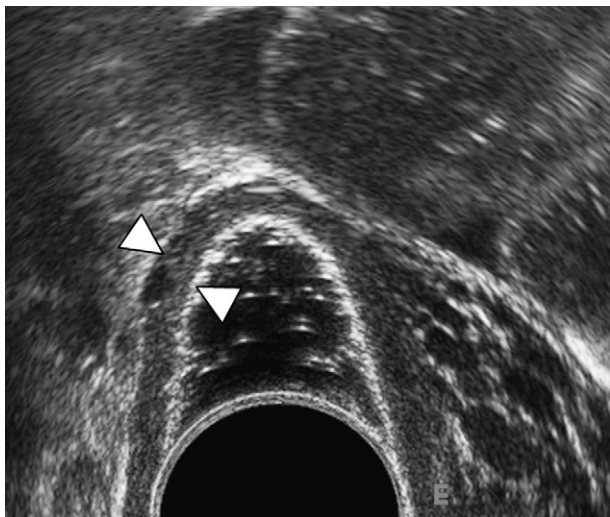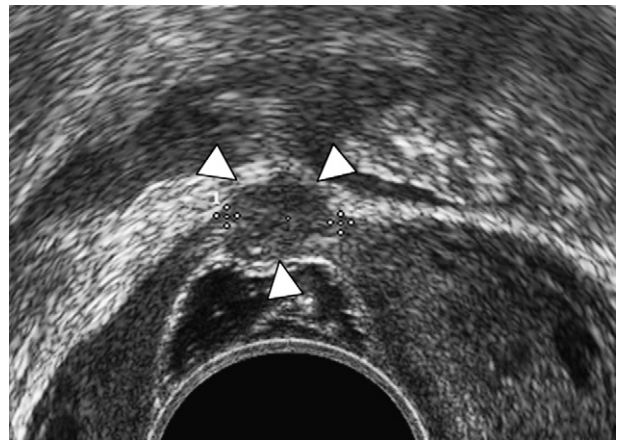
After the initial evaluation, the patient was asked to inform the operator about the onset and site of any tenderness experienced during the probe's pressure in the posterior fornix. When tenderness was evoked, the sliding movement was stopped, and particular attention was paid to the painful site via gentle pressure with the probe's tip for the detection of endometriosis lesions. The mean time involved in the performance of our technique was 15 to 20 minutes in cases of suspected deep endometriosis, but less time when the examination was negative. All scans were performed by one investigator (G.S.), who has had more than 15 years of experience with TVUS.

In accordance with Bazot et al. (4), deep endometriosis was defined at ultrasonography by visualization of hypoechoic linear thickening or nodules/masses with or without regular contours in the cul-de-sac, retrocervical region, and rectovaginal septum, involving or not involving the vaginal wall (Fig. 2). The maximum transverse, anteroposterior, and longitudinal diameter of the lesions also were assessed. The suspected involvement of intestine and partial or complete obliteration of the pouch of Douglas were recorded (Figs. 3 and 4).

On the basis of the ultrasonographic images, rectovaginal endometriosis was also graded using the scoring system of Adamyan (7), which classifies endometriosis according to the extent of disease in the retrocervical area. In stage I, endometriotic lesions are confined to the rectovaginal cellular tissue in the area of the vaginal vault. In stage II, the endometriotic tissue has invaded the cervix and penetrated the vaginal wall, causing fibrosis and small cyst formation. In stage III, lesions have spread into the sacrouterine ligaments and the rectal serosa. In stage IV, the rectal wall, rectosigmoid zone, and rectouterine peritoneum are completely involved, and the rectouterine pouch is totally obliterated (7).

FIGURE 1

A normal vaginal wall (*triangles*) visualized using a stand-off obtained by increasing the amount of ultrasound transmission gel in the probe cover.

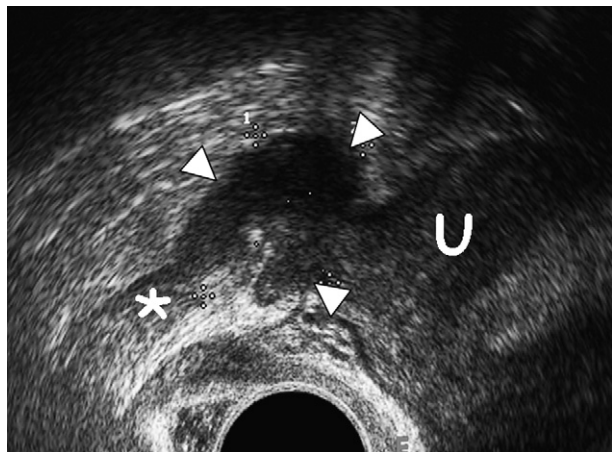*Guerriero. Deep endometriosis and TVUS. Fertil Steril 2007.*

FIGURE 2

An endometriotic nodule (*triangles*) in the vaginal wall near the cervix.

Guerriero. Deep endometriosis and TVUS. Fertil Steril 2007.

Retrocervical nodule (*triangles*) involving bowel (*asterisk*) and the uterine isthmus (*U*).

Guerriero. Deep endometriosis and TVUS. Fertil Steril 2007.

The suspicion of the presence of ovarian endometriosis also was recorded. With B-mode sonography, the presence of an endometrioma was suggested when a mass was present that was characterized by circular homogeneous, hypoechoic "tissue" without papillary proliferations and a clear demarcation from the ovarian parenchyma (8).

In accordance with Bazot et al. (9), deep pelvic endometriosis was diagnosed at laparoscopy in our patients [1] when endometrial tissue (endometrial gland and stroma) was found during the histopathologic examination in at least one resected subperitoneal lesion; or [2] when direct visualization

Two nodules involving the vaginal wall (*triangles*) and retrocervical region (*arrows*).
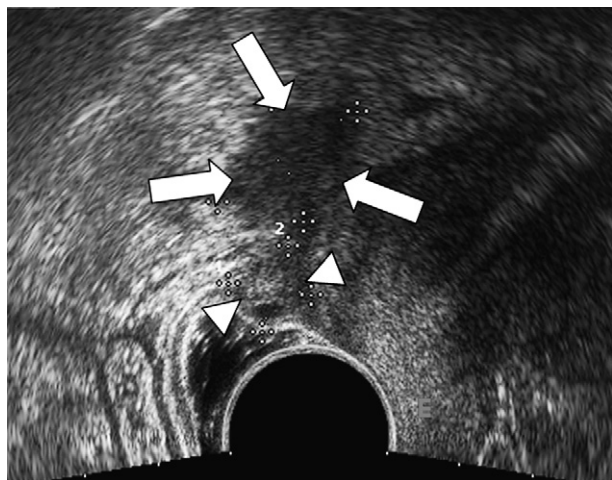
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of a deep pelvic lesion of endometriosis was associated with a biopsy sample showing only fibrosis (or without biopsy findings of the deep lesion, as in the case of the patient with subperitoneal endometriosis, which was diagnosed on the basis of the presence of another histologically proved location of endometriosis); or [3] when complete cul-de-sac obliteration was observed secondary to endometriosis (in such cases, the tissue that caused the obliteration was unresectable because the surgeon considered it too risky or because the patient refused to undergo surgical removal of deep endometriosis).

At surgery, rectovaginal endometriosis was also graded using the Adamyan (7) scoring. The sensitivity, specificity, and positive and negative predictive values of TVUS ($\pm$95% CI) were calculated for each patient. To evaluate the overall agreement between a test result and the actual outcome, the kappa (κ) index ($\pm$95% CI) was calculated according to the criteria of Fleiss (10); kappa values between 0.40 and 0.75 were assumed to indicate a good agreement. The diagnostic value of each test also was evaluated using likelihood ratios, which are not affected by the prevalence of disease in the population studied.

RESULTS

Laparoscopic assessment showed the absence of endometriotic lesions in seven patients and the presence of superficial peritoneal and/or ovarian pelvic endometriosis alone in 12 patients. Thirty-one patients showed evidence of nodular deep endometriosis in the rectouterine pouch and rectovaginal septum (prevalence: 62%).

In the deep endometriosis group, vaginal wall infiltration was confirmed in 15 patients and rectal wall infiltration in seven patients, and one or both the uterosacral ligaments were involved in one patient. Severe adhesions involving the bowel were present in eight cases. Table 1 shows the staging of endometriosis at TVUS and after intraoperative assessment according to the Adamyan (7) criteria for retrocervical endometriosis.

The mean ($\pm$SD) ultrasonographic diameter of endometriotic nodules was 14 ± 9 mm (range: 8 to 29 mm). Of the 29 patients suspected of having deep endometriosis after TVUS (see Figs. 2–4), 28 cases were confirmed by laparoscopy. In the false-positive case (Fig. 5), severe pelvic adhesions in absence of superficial and deep endometriosis were found at surgery. Of the 21 patients considered negative at TVUS, 18 were confirmed as negative; in three patients, endometriosis of rectovaginal septum with obliteration of the cul-de-sac was present.

Vaginal wall infiltration was diagnosed via TVUS in 14 out of 15 cases; rectal wall infiltration was suspected in four out of seven cases; severe adhesions involving the bowel were diagnosed in seven out of eight cases; and there was no suspicion of uterosacral ligament involvement in the only case. In one patient, an endometriotic lesion that was suspected after

TABLE 1

Staging of endometriosis at ultrasonographic evaluation and after intraoperative assessment according to Adamyan staging of retrocervical endometriosis.

Adamyan stage of disease[a]	Ultrasonographic assessment	Intraoperative assessment
Absence of disease	21	19
Stage I	6	3
Stage II	13	11
Stage III	6	11
Stage IV	4	6

[a] Adamyan L. Additional international perspectives. In: Nichols DH, ed. Gynecologic and obstetric surgery. St. Louis: Mosby Year Book, 1993:1167–82.

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ultrasonography was detected at the level of the vesical wall and anterior vaginal fornix. The concordance between suspected stage at TVUS and the actual stage at surgery (based on Adamyan [7]) was 85% (18 out of 21) for absence of disease, 33% (2 out of 6) for stage I, 46% (6 out of 13) for stage II, 83% (5/6) for stage III, and 100% (4 out of 4) for stage IV.

Using this new approach, we obtained a specificity of 95% (95% CI, 78–100%) with a sensitivity of 90% (95% CI, 80–93%), a positive predictive value of 97% (95% CI, 85–100%), and a negative predictive value of 86% (95% CI, 70–90%), associated with a kappa value of 0.86 (95% CI, 0.56–0.91). The positive likelihood ratio was 17.2 and

FIGURE 5

A false-positive case. This mass was suspected to be a retrocervical nodule of endometriosis, but intraoperative examination revealed the presence of severe pelvic adhesions in the absence of superficial and deep endometriosis.

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negative likelihood ratio 0.1, both indicating a good to excellent test.

In this small series, nine endometriomas were present, and all were diagnosed preoperatively with TVUS. Transvaginal ultrasonography showed a specificity of 100% with a sensitivity of 100% for the diagnosis of ovarian endometriosis.

DISCUSSION

Physical examination and laparoscopic exploration may not allow diagnosis or prediction of the extent of deep pelvic endometriosis, especially in pelvic subperitoneal sites (2, 11). Because the extent of involvement of posterior pelvic organs remains difficult to determine by physical examination alone, further investigation is required. A combination of REUS and/or TRUS and MRI has been recommended to evaluate posterior pelvic endometriosis (12, 13).

However, REUS has some limitations, as noted by Bazot et al. (4). First, REUS can accurately diagnose posterior pelvic lesions but may miss anterior pelvic lesions. Second, REUS has poor sensitivity in diagnosis of endometriomas and obliteration of the pouch of Douglas. Third, REUS may require the use of anesthesia (14). Fourth, in several countries it would not be considered a customary tool for gynecologists, who are generally the first to be involved in the diagnosis of deep endometriosis. Further, some data have suggested that the overall accuracy of TVUS and REUS is similar.

Transrectal ultrasonography (TRUS) with biplane probes was proposed by Fedele et al. (15) for the diagnosis of rectovaginal endometriosis; they reported a specificity of 97% and a sensitivity of 96%. As with all diagnostic techniques, TRUS may identify false-positive cases; the Fedele study included three false-positive cases of rectal infiltration. Our series identified several cases of rectal and bowel involvement with similar results in terms of accuracy when compared with Fedele et al. (15), but we believe TVUS is superior to TRUS because TRUS does not allow good evaluation of other pelvic organs, such as the ovaries for endometriomas. Magnetic resonance imaging (MRI) also has been used for diagnosis of deep pelvic endometriosis with an overall good accuracy (sensitivity of

90%, specificity of 91%) (9), but it was found to lack sensitivity for diagnosis of the disease when there was rectal involvement (12). In addition, because MRI is more expensive, it can be considered less cost effective.

Transvaginal ultrasonography is the first-line procedure for the investigation of several pelvic disorders, and it has been extensively evaluated for the diagnosis of endometriomas (16–19). With an almost perfect accuracy, our results in this series are in keeping with our own previous studies and those of several other investigators, suggesting that TVUS alone is sufficient to diagnose ovarian endometriosis (8, 16–19). However, TVUS usually is not recommended for the diagnosis of deep endometriosis because a wide range of specificities and sensitivities have been reported in the literature; however, those variations may be related to the different prevalence of disease reported in these studies, their varying definitions of deep endometriosis, and the variety of methods used in performing the scans.

Our TVUS approach showed comparable results in terms of accuracy with those reported by Dessole et al. (6). This was as we had expected, as our approach was objectively derived from their original sonovaginosonography technique, which had a sensitivity of 91% and a specificity of 86%. Our results also were comparable with MRI (9), although that technique has been tested in larger series. Our tenderness-guided technique with the creation of a stand-off to visualize the near-field area of posterior fornix and the vaginal wall, which we obtained by using a larger amount of ultrasound transmission gel in the probe cover, showed a higher sensitivity and specificity in comparison with plain TVUS for the diagnosis of endometriosis of the cul-de-sac, retrocervical region, and rectovaginal septum when compared with other studies (4–6). In addition, for the first time, we have demonstrated a good concordance between the suspected stage at ultrasonography and the actual stage at surgery, especially for advanced stages but also with absence of disease.

This new approach would appear to be an accurate, inexpensive, and less invasive method for diagnosing the extension and infiltration of deep endometriosis in the cul-de-sac, retrocervical region, and rectovaginal septum. Our method allows accurate preoperative evaluations for selecting the right kind of surgery for each patient, and also permits postponing laparoscopy in cases of negative TVUS findings based on the likelihood ratio of 0.1. Similar to the study by Dessole et al. (6), our data were derived from a small number of patients; however, deep endometriosis of the cul-de-sac, retrocervical region, and rectovaginal septum is a relatively rare condition, and our preliminary results with this simple technique are very encouraging.

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