

# Ultrasound in the Diagnosis of Deep Endometriosis

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## Abstract

**Deep pelvic endometriosis** is defined as subperitoneal infiltration of endometrial implants in the uterosacral ligaments, rectum, rectovaginal septum, vagina, or bladder. Although laparoscopy and biopsy remain the gold standard for diagnosis, transvaginal ultrasonography should be considered as the first-line procedure because of its high diffusion and relatively low cost and discomfort. We analyzed in the present review the diagnostic capability of transvaginal ultrasonography in the detection of presence of deep endometriosis in some specific pelvic localizations such as bowel, uterosacral ligaments, rectovaginal septum and/or vagina. We also analyzed the few studies performed in the evaluation of bladder endometriosis. Although some studies are controversial, transvaginal ultrasonography seems to be an accurate technique in the identifications of deep endometriosis in several pelvic locations but a specific training of the operators is suggested.

**Keywords:** Deep endometriosis, transvaginal ultrasonography, laparoscopy

## INTRODUCTION

**Deep pelvic endometriosis** is defined as subperitoneal infiltration, for a distance of  $\geq 5$  mm, of endometrial implants in the uterosacral ligaments, rectum, Douglas pouch (retrocervical endometriosis), rectovaginal septum, vagina, or bladder.<sup>1</sup> It is responsible for chronic severe pelvic pain, dyspareunia and dysmenorrhea.<sup>1</sup> Laparoscopy and biopsy remain the gold standard for diagnosis although imaging techniques have been described to allow the surgeon to perform the best surgical procedure, and sometimes the laparoscopy let us to see only the tip of the iceberg.<sup>2-16</sup> Various sonographic approaches (i.e. transvaginal ultrasonography, transrectal ultrasonography, rectal endoscopic ultrasonography) but also magnetic resonance imaging (MRI) have been proposed in last years to help gynecologists in diagnosis of deep endometriosis and to give an accurate preoperative assessment of disease, extension and localization of this disease and to discuss the procedure with the patient and to define the best surgical team.<sup>2-16</sup> Because of its high diffusion and relatively low cost and discomfort, transvaginal ultrasonography should be considered as the first-line procedure, even if it has had controversial results

in the diagnosis of deep endometriosis. By ultrasonography, deep endometriosis implants can be suspected from the presence of hypoechoic linear thickening or nodules/masses with or without regular contours in some specific locations such as: (i) vaginal walls (Figs 1 and 2), (ii) rectovaginal septum (Figs 3 and 4), (iii) bowel (rectosigmoid involvement) (Figs 5 and 6), (iv) uterosacral ligaments (Figs 7 and 8) and (v) anterior pouch and/or bladder (anterior compartment) (Figs 9 and 10). In particular, rectosigmoid involvement can be suspected in cases which showed the presence of nodules which had thin band-like echoes departing from the centre of the mass that were defined as 'Indian head dress' (Figs 5 and 6). Also the anterior compartment must be examined to evaluate the presence of bladder endometriosis (Figs 9 and 10). In the last years several authors have investigated the presence of endometriosis in different localizations demonstrating a wide range of accuracies. We analyzed in the present review the diagnostic capability of transvaginal ultrasonography in the detection of presence of deep endometriosis in some specific localizations such as bowel, uterosacral ligaments, rectovaginal septum and/or vagina. We



Fig. 1: Deep endometriosis of vaginal walls: presence of hypoechoic mass without regular contours



**Fig. 2:** Another case of deep endometriosis of vaginal walls: presence of hypoechoic vascularized nodule with regular contours



**Fig. 5:** Deep endometriosis with bowel involvement: presence of hypoechoic mass with rectosigmoid involvement characterized by thin band-like echoes departing from the center of the mass, the so called 'Indian head dress' sign



**Fig. 3:** Deep endometriosis of rectovaginal septum: presence of hypoechoic nodules without regular contours



**Fig. 6:** Another case of deep endometriosis with bowel involvement: presence of hypoechoic masses without regular contours and 'Indian head dress' sign



**Fig. 4:** Another case of deep endometriosis of rectovaginal septum: presence of hypoechoic masses without regular contours



**Fig. 7:** Deep endometriosis of uterosacral ligaments: presence of hypoechoic nodule without regular contours



**Fig. 8:** Another case of deep endometriosis of uterosacral ligaments: presence of hypoechoic linear thickening without regular contours



**Fig. 9:** Deep endometriosis of anterior pouch: presence of hypoechoic nodule with regular contours but involving the uterine wall



**Fig. 10:** Deep endometriosis of anterior pouch and bladder: presence of two hypoechoic nodules, one of 28 × 21 mm involving the uterine wall and one of 23 × 20 mm involving the bladder

also analyzed the few studies performed in the evaluation of endometriosis of anterior pouch such as bladder endometriosis.

## BOWEL LOCALIZATION

The surgical treatment of deep endometriosis requires an expert operator with considerable ability, as well because the total resolution may require complete surgical resection of lesions. In particular digestive infiltration is a difficult therapeutic problem. Preoperative diagnosis can be difficult and digestive infiltration may remain unidentified with incomplete resection and sometimes recurring surgery. In 1998, Chapron et al,<sup>2</sup> in a retrospective study, evaluated the role of rectal endoscopic ultrasonography in the diagnosis of deep endometriosis interesting intestinal wall. They recruited 38 patients who presented with deep pelvic endometriosis which was confirmed histologically. In 17 cases on 38 (44.7%) rectal endoscopic ultrasonography revealed an image compatible with deep infiltration of the intestinal wall. Sixteen of these 17 patients underwent laparotomy with bowel resection. The histological results confirmed in each of these 16 patients (100%) that there was deep infiltration of the intestinal wall by endometriotic lesions. For the 21 patients with no rectal endoscopic ultrasonography evidence of rectal infiltration complete laparoscopic surgical exeresis was achieved in every case (100%) without broaching the intestinal wall. In 2003, Koga et al<sup>3</sup> utilized transvaginal and transrectal ultrasonography to study the rectosigmoid endometriotic lesions and they compare the ultrasonographical findings with histology. In all cases, the lesion was detected as a hypoechoic irregular-shaped area surrounded by a hyperechoic rim located posterior to the uterus, with size ranging from 18 to 29 mm in diameter. They observed that these lesions correspond at histology, to a layer of hypertrophic muscularis propria of the lesion, while the hyperechoic rim represented the layer including the mucosa, submucosa and serosa.<sup>3</sup>

In the same year, Bazot et al<sup>4</sup> evaluated the accuracy of transvaginal ultrasonography and rectal endoscopic sonography for the diagnosis of deep endometriosis with rectal involvement, and they compare the results with histological findings. The results were the following: the sensitivity, specificity, positive and negative predictive values of transvaginal ultrasonography and rectal endoscopic sonography for the diagnosis of rectosigmoid endometriosis were 95 and 82%, 100 and 88%, 100 and 95% and 89 and 64 % respectively, and so they concluded that transvaginal ultrasonography is as efficient as rectal endoscopic sonography for detecting posterior pelvic endometriosis and should therefore be used as the first-line examination. Bazot confirmed this conclusion in another study in 2007.<sup>5</sup> The same author, a year later, evaluated the presence and extent of endometriosis involving the uterosacral ligaments, vagina, rectovaginal septum, intestines, bladder and ovaries shown by transvaginal ultrasonography and compared the

sonographic results with surgical and histological findings.<sup>6</sup> Transvaginal ultrasonography gave in a diagnosis of intestinal endometriosis in 44/142 (30.9 %) women. Among the 41 patients with true-positive results there was a deep correlation between the sites of involvement identified by transvaginal ultrasonography and those found at surgery. Five of 6 patients with false-negative results had suspected intestinal involvement at surgery but did not undergo biopsy. All 3 patients with false-positive results had adhesions between uterus and intestines.<sup>6</sup>

Also Abrao *et al*<sup>7</sup> in 2007, evaluated the different role of transvaginal ultrasonography and magnetic resonance imaging in the preoperative diagnosis of retrocervical and rectosigmoid involvement, compared with digital examination. The results were the following: with respect to the rectosigmoid sites, digital vaginal examination had a sensitivity of 72%, specificity of 54%, positive predictive value (PPV) of 63%, negative predictive value (NPV) of % and accuracy of %. For transvaginal ultrasonography, sensitivity was 98%, specificity 100%, PPV 100%, NPV 98% and accuracy 99%. MRI had a sensitivity of 83%, specificity of 98%, PPV of 98%, NPV of 85% and accuracy of 90%. There were significant differences in the parameters of the three methods with the exception of sensitivity, for which the similar results of MRI and digital vaginal examinations, differed from that obtained by transvaginal ultrasonography. In conclusion, according to this group TVUS had better sensitivity, specificity, PPV, NPV and accuracy in cases of rectosigmoid endometriosis when compared with MRI and digital vaginal examination, confirming that it is an important preoperative examination for the definition of surgical strategies. Recently, Menada *et al*,<sup>8</sup> compared the role of transvaginal ultrasonography combined with water-contrast in the rectum (RWC-TVS) in the diagnosis of rectal infiltration in women with rectovaginal endometriosis, with transvaginal ultrasonography alone. RWC-TVS is a technique described by the same group in 2007 and consists in injecting saline solution into the rectal lumen under ultrasonographic control through a 6-mm catheter. Presence of rectovaginal nodules, presence and degree of rectal infiltration, and the largest diameter of the bowel nodules were evaluated. Ultrasonographic results were compared to surgical and histological findings. They concluded that RWC-TVS determines the presence of rectovaginal nodules infiltrating the rectal muscularis propria more accurately than TVS; RWC-TVS could be used when transvaginal ultrasonography cannot exclude the presence of rectal infiltration.

Guerriero *et al* in 2007,<sup>9</sup> proposed a new technique useful in the diagnosis of deep endometriosis (particularly of the cul-de-sac, retrocervical region, and rectovaginal septum): the “tenderness guided” transvaginal ultrasonography. They evaluated 50 patients scheduled for laparoscopy for chronic pelvic pain. The new approach consists in 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 (Fig. 11). The posterior fornix was evaluated



**Fig. 11:** The upper part of vagina as visualized using the modified ultrasound scanning proposed by Guerriero *et al* (ref. 9-10)

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.<sup>9</sup> In 2008 Guerriero *et al*,<sup>10</sup> performed a study to extend the transvaginal ultrasonographic “tenderness-guided” approach, previously described, to other locations of deep endometriosis: vaginal walls, rectosigmoid involvement, uterosacral ligaments and anterior compartment. In case of rectosigmoid involvement, this technique reported a specificity of 92%, with a sensitivity of 67%; the pretest probability of rectosigmoid involvement in the study’s population was 44% and this probability of disease rose to 87% when the test was positive and decreased to 22% when it was negative.

## UTEROSACRAL LIGAMENTS LOCALIZATION

In 1996, Ohba *et al*<sup>11</sup> evaluated the role of transrectal sonography in the diagnosis of deep endometriosis involving uterosacral ligaments. They found that patients with USL involvement showed thick and irregularly-shaped uterosacral ligaments by the transrectal ultrasound examination and that the thickness of uterosacral ligaments was associated with the clinical symptoms: women with endometriosis revealing tenderness in the paracervical region on rectal examination had significantly thicker uterosacral ligaments. Uterosacral ligaments  $\geq 14$  mm were frequently (16/17) associated with the tenderness at the uterosacral ligament.

Fedele *et al*<sup>12</sup> in 1998 evaluated 140 patients scheduled for surgery for possible endometriosis, using rectal ultrasound. They described uterosacral ligaments as low-echoic, thick, and irregularly shaped arcs at both sides of the cervix at transrectal ultrasonographic examination. The sensitivity and a specificity of the technique were 80% and 97% respectively, for the diagnosis of uterosacral ligaments involvement. Bazot *et al*

comparing TVS and RES,<sup>4</sup> in 2003, did not find any significant difference between the two methods in uterosacral ligaments involvement diagnosis. The same author, in 2004, obtained a sensitivity of 70.6% and a specificity of 95.9% in detecting uterosacral ligaments endometriosis using transvaginal ultrasonography.<sup>13</sup> In 2007 Bazot demonstrated that rectal endoscopic sonography is less accurate compared with transvaginal ultrasonography for diagnosing uterosacral ligament endometriosis.<sup>5</sup>

Using 'tenderness-guided' ultrasonography Guerriero et al<sup>10</sup> showed in 2008 that the probability of uterosacral ligaments involvement rose to 75% (vs 27% of pretest value) when the test was positive and decreased to 17% if it was negative. They obtained a good specificity (94%) with a lower sensitivity if compared with other endometriotic localizations.<sup>10</sup> Because the results are comparable with that obtained using transrectal ultrasonography, we suggest the use of a less invasive technique as transvaginal ultrasonography.

### RECTOVAGINAL SEPTUM AND VAGINAL LOCALIZATION

Fedele et al in 1998<sup>12</sup> evaluated the role of transrectal ultrasonographic examination in detection of rectovaginal septum endometriosis. Ultrasonography showed a sensitivity and specificity of 97% and 96%, respectively, in the diagnosis of the presence of rectovaginal septum involvement.<sup>12</sup> A new sonographic technique, called 'vaginasonography', was proposed by Dessole et al in 2003<sup>14</sup> for the assessment of rectovaginal endometriosis. This procedure is based on transvaginal ultrasonography combined with the introduction of saline solution to the vagina that creates an acoustic window between the transvaginal probe and the surrounding structures of the vagina. Sonovaginography diagnosed rectovaginal endometriosis more accurately than did transvaginal ultrasonography, with a sensitivity and specificity of 90.6% and 85.7%, respectively, whereas the transvaginal ultrasonography has shown a sensitivity and specificity of 43.7% and 50%, respectively. Patient discomfort did not differ significantly between the procedures. Bazot et al in 2004,<sup>13</sup> analyzing the use of TVS in diagnosis of deep endometriosis obtained, for rectovaginal septum localization, a sensitivity of 99.3% and a specificity of 87.2%.

Guerriero et al in 2007,<sup>9</sup> using the 'tenderness-guided' ultrasonography, previously described, and partially derived from the method of Dessole et al<sup>14</sup> 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).

### ANTERIOR ENDOMETRIOSIS

Anterior endometriosis includes bladder localization and anterior pouch (vesicouterine pouch) localization. Few studies are present in the literature about these endometriotic

localizations. A study published in 2002 compared the use of MRI and transvaginal ultrasonography in diagnosis of bladder endometriosis and showed that MRI had advantages over transvaginal ultrasonography in diagnosing small lesions of associated posterior deep endometriotic lesions giving a contribute to establish correct surgical approach.<sup>15</sup>

The role of transvaginal sonography in diagnosis of bladder endometriosis (and other locations) was also studied by Bazot et al in 2004.<sup>13</sup> The mean size of bladder endometriotic lesions which they described, was 24.2 mm (15-30 mm); there were no false-positive results; the two patients with false-negative results had, at surgery, small implants (15 mm). The sensitivity of TVS for this location was 71.4%, a value lower than that reported by Fedele et al in 1997<sup>16</sup> but the range of size of the lesions reported by Fedele et al was 25-40 mm. Guerriero et al reported a pre-test probability of anterior pouch involvement of deep pelvic endometriosis of 20% and this probability of disease rose to 100% when the test was positive and decreased to 67% when the test was negative.<sup>10</sup>

### CONCLUSIONS

In conclusion the preoperative diagnosis of endometriosis is extremely important and the gynecologic and/or radiologic centers should develop specific protocols to stage properly the disease but also perform specific training of the operators. This training should be based on: a. the knowledge of some procedures, such as 'tenderness-guided' ultrasonography; b. evaluation of specific site of the pelvis as, for example, retrocervical areas; c. recognition of ultrasonographic patterns associated with endometriotic lesions. One of the most important target is the accuracy of the method for the various sites<sup>2-16</sup> but also a good cost-benefit and to avoid discomfort during the examination. An interesting challenge should be the creation of one-stop endometriosis clinics, enabling most patients to benefit from the need for a only single hospital visit and the availability of immediate results. This approach could significantly shorten 'the interval' between referral and beginning of treatment, surgical or medical.<sup>10,17-20</sup>

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