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Ultrasonography for bowel endometriosis

Simone Ferrero, MD, PhD [a, b], Fabio Barra, MD [a, b, *], Carolina Scala, MD, PhD [c], George Condous, MD [d]

[a] *Academic Unit of Obstetrics and Gynecology, IRCCS Ospedale Policlinico San Martino, Largo R. Benzi 10, 16132, Genoa, Italy*
[b] *Department of Neurosciences, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health (DiNOGMI), University of Genoa, Italy*
[c] *Division of Obstetrics and Gynecology, Gaslini Institute, Genoa, Italy*
[d] *Acute Gynaecology, Early Pregnancy and Advanced Endosurgery Unit, Sydney Medical School Nepean, University of Sydney, Nepean Hospital, Sydney, NSW, Australia*

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A B S T R A C T

Transvaginal ultrasonography (TVS) should be the first-line investigation in patients with suspicion of deep endometriosis and, in particular, of rectosigmoid endometriosis. TVS cannot assess the presence of intestinal nodules located proximally to the sigmoid (such as ileal or cecal endometriotic nodules), because these lesions are beyond the field of the transvaginal probe. The ultrasonographic findings of rectosigmoid endometriosis are the presence of an irregular hypoechoic nodule in the anterior wall of the rectosigmoid colon. The learning curve for diagnosing rectosigmoid endometriosis by TVS is quite short; approximately, 40 scans are required to a sonographer who trained in general gynecologic ultrasonography to become proficient at diagnosing bowel endometriosis. Several meta-analyses confirmed the high diagnostic performance of TVS in diagnosing rectosigmoid endometriosis. The presence of "soft markers" (negative sliding sign and kissing ovaries) facilitates the diagnosis of rectosigmoid endometriosis. Enhanced TVS (rectal water-contrast transvaginal ultrasonography, sonovaginography, and tenderness-guided transvaginal ultrasonography) does not improve the performance of TVS in diagnosing rectosigmoid endometriosis. These investigations, however, may be useful to ascertain the depth of infiltration of endometriosis in the intestinal wall or the presence

* Corresponding author. Academic Unit of Obstetrics and Gynecology, IRCCS Ospedale Policlinico San Martino, Largo R. Benzi 10, 16132, Genova, Italy.
E-mail address: fabio.barra@icloud.com (F. Barra).

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of rectal stenosis. Magnetic resonance imaging has the same performance of TVS in diagnosing rectosigmoid endometriosis; however, it should be recommended as a second-line technique in the preoperative workup of patients with previous equivocal TVS findings.

Introduction

Deeply endometriosis (DE) is histologically defined as an endometriotic lesion penetrating into the retroperitoneal space or the wall of the pelvic organs to a depth of at least 5 mm. This type of endometriosis may involve uterine-sacral ligaments, vagina, urinary tract, recto-vaginal septum, and bowel [1,2].

Bowel endometriosis is defined as the presence of endometrial glands and stroma in the bowel wall, infiltrating at least the muscularis propria, where it causes smooth muscle hyperplasia and fibrosis [3]. An accurate preoperative diagnostic workup of rectosigmoid endometriosis is necessary to provide the patient with informed consent on the benefits and risks of the potential treatments (hormonal therapies [4–7] or surgical approach [8,9]) and to obtain adequate informed consent in case of surgery.

Transvaginal ultrasonography (TVS) is currently considered the first-line investigation in patients with suspicion of bowel endometriosis [10]. TVS has several advantages over other imaging techniques because it allows diagnosing pelvic DE lesions and endometriomas. It is non-invasive and well tolerated by the patients, cheap compared with radiological imaging, performed by gynecologists who typically treat patients with endometriosis, and does not require bowel preparation [11]. Over the last 20 years, TVS had been widely used to diagnose rectosigmoid endometriosis. However, it cannot assess the presence of intestinal nodules located proximally to the sigmoid (such as ileal or cecal endometriotic nodules) because these lesions are beyond the field of TVS. Therefore, this review will examine the role of TVS in diagnosing rectosigmoid endometriosis.

Ultrasonographic appearance of rectosigmoid endometriosis

The international deep endometriosis analysis (IDEA) group created a consensus opinion on terms, definitions, and measurements that should be used to describe the sonographic features of the different phenotypes of endometriosis [10]. Rectosigmoid DE nodules usually appear as irregular hypoechogenic mass, with or without hypoechogenic or hyperechogenic foci, with blurred margins, penetrating the intestinal wall (Fig. 1) [12,13]. In these patients, the normal aspect of the muscularis propria is replaced by the endometriotic tissue [13]. However, the IDEA consensus underlined that rectosigmoid nodules might have various morphological appearances [10]. The normal appearance of the muscularis propria may be replaced with a hypoechogenic nodule, with visible retraction and adhesions in some cases resulting in the so-called “Indian headdress” or “Moose Antler” sonographic signs [14] (Fig. 2). In other cases, a thinner section or “tail” can be observed at one end, resembling a “comet.”.

The IDEA consensus standardized the description of the location of rectosigmoid nodules. Nodules located below the level of the insertion of the uterosacral ligaments on the uterine cervix should be considered as lower (retroperitoneal) anterior rectal lesions; those above this level should be defined as upper anterior rectal lesions; nodules located at the level of the uterine fundus should be considered as rectosigmoid junction lesions, and nodules located above the level of the uterine fundus should be denoted as anterior sigmoid lesions. The IDEA consensus underlined that the diameters of the rectosigmoid nodules should be recorded in three orthogonal planes, and the distance between the lower margin of the most caudal lesion and the anal verge should be measured. Finally, the IDEA consensus pointed out that bowel lesions can be isolated or can be multifocal (multiple lesions affecting the same segment) and/or multicentric (multiple lesions affecting several bowel segments, i.e., small bowel,

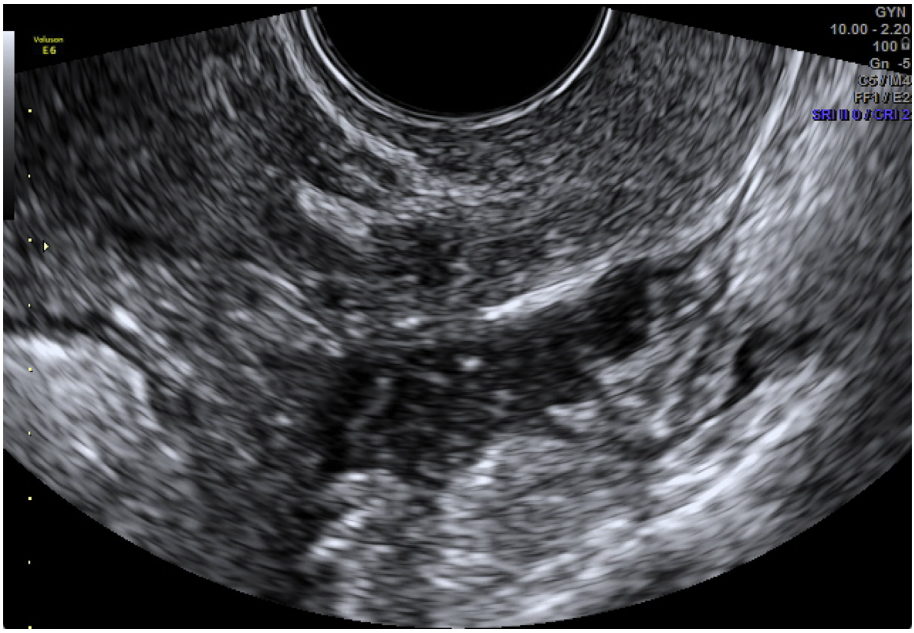

Fig. 1. Retroperitoneal endometriotic nodule appearing as a hypoechogenic mass, with or without hyperechogenic foci and with blurred margins.

Fig. 2. Retroperitoneal anterior rectal endometriotic nodule (largest diameter 3.7 cm). The normal appearance of the muscularis is replaced with a hypoechogenic nodule. Estimated distance between the distal part of the nodule and the anal verge is 10 cm.

large bowel, cecum, ileocecal junction, and/or appendix). TVS can be used to visualize multifocal rectosigmoid nodules, and other imaging techniques (such as computed tomographic colonography) can be used to diagnose multicentric bowel endometriosis.

TVS has been widely performed after bowel preparation (in general, a rectal enema performed a few hours before the exam) [15–18]. However, a recent prospective study, including 262 patients (118 with surgically confirmed rectosigmoid endometriosis) demonstrated that bowel preparation does not significantly improve the accuracy of TVS in diagnosing rectosigmoid endometriosis (93.5% with bowel preparation vs. 92.3% without bowel preparation). Furthermore, bowel preparation did not improve the performance of TVS in diagnosing submucosal infiltration, multifocal disease, and in estimating the maximum diameter of the largest nodule and the distance between the more caudal rectosigmoid nodule and the anal verge [11].

Performance of transvaginal ultrasound in diagnosing rectosigmoid endometriosis

In 2004, Bazot et al. performed a pioneering prospective study investigating the diagnostic accuracy of TVS for the diagnosis of deep pelvic endometriosis [13]. This study demonstrated that TVS accurately diagnose rectosigmoid endometriosis; the sensitivity and specificity were 87.2% and 96.8%, respectively. Subsequently, several other studies confirmed the performance of TVS in diagnosing rectosigmoid endometriosis (Table 1) [12,16,19–28]. Hudelist et al. critically analyzed the diagnostic value of TVS for the diagnosis of rectosigmoid endometriosis by performing a systematic review and meta-analysis [29]. Ten studies, including 1106 patients, were considered in the analysis. The authors found that the sensitivity was 91%, the specificity 98%, the positive predictive value (PPV) 98%, the negative predictive value (NPV) 95%, the positive likelihood ratio (LR+) 30.36, and the negative likelihood ratio (LR−) 0.09. Guerriero et al. performed a systematic review and meta-analysis to investigate the accuracy of TVS in diagnosing deep endometriosis of the rectosigmoid colon [30]. Nineteen studies reporting on 2639 patients (992 with rectosigmoid endometriosis) were included in the final analysis. Overall pooled sensitivity, specificity, LR+, and LR− of TVS for detecting rectosigmoid endometriosis were 91%, 97%, 33.0, and 0.10, respectively. This meta-analysis found significant heterogeneity for sensitivity and specificity in the published studies. The major cause of heterogeneity was the wide prevalence of rectosigmoid endometriosis in the populations included in the studies with values of >80% in some cases and <10% in others. A Cochrane review investigated the accuracy of imaging tests for endometriosis [31]. TVS met the criteria for the SpPin triage test (if specificity is high, a positive test rules in pathology in mapping) in the diagnosis of rectosigmoid endometriosis. Its sensitivity was 90% (95% CI, 82–97%) and its specificity was 96% (95% CI, 94–99%; 14 studies, 1616 participants).

Table 1
Performance of TVS in the diagnosis of rectosigmoid endometriosis.

Authors	Study population (n)	Patients with rectosigmoid endometriosis (n, %)	Accuracy (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	LR+	LR−
Bazot et al. [12]	40	18 (45.0%)	96.7	95.5	100.0	100.0	88.8		
Bazot et al. [13]	142	47 (33.1%)	93.7	87.2	96.8	93.2	93.9		
Abrao et al. [19]	104	54 (51.9%)	99.0	98.1	100.0	100.0	98.0		
Piketty et al. [20]	134	66 (49.3%)		90.7	96.5	97.1	88.9		
Bazot et al. [22]	92	66 (71.7%)	95.6	93.6	100.0	100.0	87.9		
Goncalves et al. [16]	194	81 (41.8%)	99.0	97.5	100.0	100.0	98.3		
Hudelist et al. [23]	129	31 (24.0%	97	90.3	99.0	96.6	97.0	88.51	0.10
Savelli et al. [24]	69	56 (81.2%)	91.4	91.1	100.0	100.0	28.6		
Vimercati et al. [25]	90	20 (22.2%)	91.1	77.8	94.4	77.8	94.4	14.0	0.2
Holland et al. [26]	198	11 (5.6%)		33.3	98.9	60.0	96.9	31.5	0.68

All the presented studies were prospective.
PPV: positive predictive value; NPV: negative predictive value; LR+: positive likelihood ratio; LR−: negative likelihood ratio.

Role of "soft markers" in the diagnosis of rectosigmoid endometriosis

The "soft markers" are indirect signs of the presence of DE and, some of them are signs of rectosigmoid endometriosis. The term "kissing ovaries" is used to indicate that the ovaries are entirely or partly joined together and stabilized behind the uterus in the pouch of Douglas (POD). A prospective study evaluated whether the presence of kissing ovaries at ultrasound is a marker for endometriosis and whether it correlates with the severity of the disease [32]. This study included 722 premenopausal women who had laparoscopic surgery for an adnexal mass or suspected pelvic endometriosis. The study demonstrated that bowel (18.5% vs. 2.5%) endometriosis was significantly more frequent in patients with kissing ovaries (18.5%) than in patients without kissing ovaries (2.5%).

The presence of adhesions in the POD can be assessed using TVS. Using the pressure of the transvaginal probe, it is possible to observe immobility of the rectum against the uterus and the posterior cervix/vaginal fornix. This finding is considered as "sliding sign negative", reflecting possible adhesion, and endometriotic involvement of these structures. In contrast, the sliding of the rectum against the uterine wall is considered as "sliding sign positive." A prospective multicenter study evaluated whether the presence of a negative sliding sign could aid in the diagnosis of rectal endometriosis [33]. The study included 117 patients and 34 (29.1%) had rectal endometriosis. A negative sliding sign was useful in the prediction of rectal endometriosis: accuracy 93%, sensitivity 85%, specificity 96%, PPV 91%, NPV 94%, LR+ 23.6, and LR− 0.15. This sign is reproducible and easy to learn [34–36] (Video 1).

Supplementary video related to this article can be found at https://doi.org/10.1016/j.bpobgyn.2020.05.010

A recent prospective study evaluated the use of ultrasonographic soft markers as a first-line imaging tool to raise suspicion of rectosigmoid involvement in women suspected of having deep endometriosis [37]. Several ultrasonographic soft markers were evaluated for the prediction of rectosigmoid involvement: the presence of ultrasonographic signs of uterine adenomyosis, the presence of an endometrioma, the adhesion of the ovary to the uterus (reduced ovarian mobility), and the presence of "kissing ovaries" and the absence of the "sliding sign"). The absence of a sliding sign with an odd ratio (OR) of 13.95 and the presence of "kissing ovaries" with an OR of 22.5 were the only significant variables found. When the sliding sign was negative or kissing ovaries were present, TVS showed a specificity of 75% and a sensitivity of 82% for the detection of rectosigmoid endometriosis. In these patients, the pretest probability of rectosigmoid endometriosis was 32%, and this probability increased to 61% when at least one of these features was present and fell to 10% when these TVS "soft markers" were absent.

Enhanced ultrasonographic techniques

Several ultrasonographic techniques based on the distention of the vagina and/or rectosigmoid with saline solution and/or ultrasonographic gel have been proposed to improve the diagnosis of DE. These distention media create acoustic windows in the vagina, rectum, or both of them, facilitating the diagnosis of DE. These techniques are named "enhanced" or "modified" TVS [38], and they include rectal water-contrast transvaginal ultrasonography (RWC-TVS), sonovaginography (SVG), and tenderness-guided transvaginal ultrasonography (tg-TVS).

Rectal water-contrast transvaginal ultrasonography

Bowel cleansing is usually recommended before RWC-TVS [39–43], but there is no evidence that it improves the performance of the exam [44]. An 18 Ch flexible is inserted through the anal canal into the rectosigmoid (up to 15 cm from the anal verge) [39,41,45–47]. A syringe is used to inject 100 and 350 mL of saline solution into the rectosigmoid. The time required to perform RWC-TVS ranges between 16 and 18 min [40,41]. RWC-TVS is usually well tolerated by the patients [45]. Prospective studies compared investigated the performance of RWC-TVS in diagnosing rectosigmoid

Table 2
Diagnostic performance of rectal water-contrast TVG in the diagnosis of rectosigmoid endometriosis.

	Study population (n)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	LR+	LR−
Valenzano Menada et al. [45]	35	100.0	85.7	91.3	100.0	–	–	–
Valenzano Menada et al. [46]	90	95.7	100	100.0	98.5	98.9	–[a]	0.04
Bergamini et al. [43]	61	96.1	90.0	98.0	81.8	–	–	–
Ferrero et al. [39]	96	93.8	97.9	97.8	94.0	95.8	45.00	0.06
Leone Roberti Maggiore et al. [41]	286	92.7	97.0	97.2	92.3	94.8	31.29	0.08
Ferrero et al. [40]	70	92.5	96.7	97.4	90.6	94.3	27.8	0.08
Jiang et al. [47]	198	88.2	97.3	98.0	88.0	92.4	41.67	0.13
Barra et al. [50]	36	90.1	78.6	87.0	84.6	86.1	42.0	0.11

PPV: positive predictive value; NPV: negative predictive value; LR+: positive likelihood ratio; LR−: negative likelihood ratio.
[a] LR + could not be calculated because of the absence of false-positive cases.

endometriosis demonstrating that it is more accurate than TVS [46] and as accurate as multidetector computerized enema [39], transrectal ultrasonography (REU) [43], computer tomographic colonography (CTC) [40], double-contrast barium enema (DCBE) [47], and magnetic resonance enema (MR-e) [41] (Table 2, Fig. 3). Also, RWC-TVS is accurate in identifying significant stenosis of the intestinal lumen [43], in estimating the depth of infiltration of endometriosis in the intestinal wall (particularly, the infiltration of the submucosa) and the largest diameter of the bowel endometriotic nodules. RWV-TVS cannot diagnose ileal and cecal endometriotic nodules [39,47]. Quite recently, some authors proposed the use of tridimensional ultrasonography during RWC-TVS (3D-RWC-TVS, Fig. 4) [42,48,49]. However, up to now, there is no evidence that 3D-RWC-TVS is superior to 3D-RWC-TVS in diagnosing rectosigmoid endometriosis [50,51].

Sonovaginography

In the original description of SVG, a 24-mm Foley catheter, introduced into the vagina, is used to inject 200–400 mL of saline solution [52]. Other stand-off techniques have been proposed to create an acoustic window. Some authors insert a condom in the posterior vaginal fornix attached to saline-giving set and the condom is filled with 200–400 mL of saline solution [53]. Alternatively, a hydraulic ring (Colpo-Pneumo Occluder, Cooper Surgical, Berlin, Germany) located at the base of the transvaginal probe and filled with 40 mL of saline solution can be used to prevent the escape of the saline solution (60–120 mL) that is subsequently injected into the vagina using a Foley catheter [54]. A modified SVG consists of the use of ultrasound gel instead of a saline solution. A syringe is used to place 20–40 mL of ultrasound gel in the posterior vaginal fornix [33,36–40]. SVG is well tolerated by the patients [35]. A multicenter prospective study (220 patients) investigated the performance of SVG with gel in the diagnosis of posterior DE [55]. The sensitivity of SVG in diagnosing rectosigmoid endometriosis was 88.4%, specificity 93.2%, PPV 79.2%, NPV 96.5%, LR+ 12.9%, and LR− 0.12%. The accuracy of SVG in diagnosing rectosigmoid endometriosis was confirmed by other prospective studies [56,57].

Tenderness-guided transvaginal ultrasonography

In the introduction, tg-TVS consists of 12 mL of ultrasound gel into the probe cover (usually, a finger of a latex glove) to create a stand-off to visualize the near-field area. The exam is performed with a sliding up-and-down movement of the probe [58,59]. During the exam, the patient is requested to inform the examiner about the onset and site of any tenderness experienced during the probe's gentle pressure in the posterior vaginal fornix. When tenderness is evoked, attention is given to the painful site to detect endometriotic lesions [58,59]. Two prospective Italian studies demonstrated the performance of tg-TVS in diagnosing rectosigmoid endometriosis [58,59].

Fig. 3. RWC-TVS showing the bulge caused in the intestinal lumen by a retroperitoneal anterior rectal endometriotic nodule.

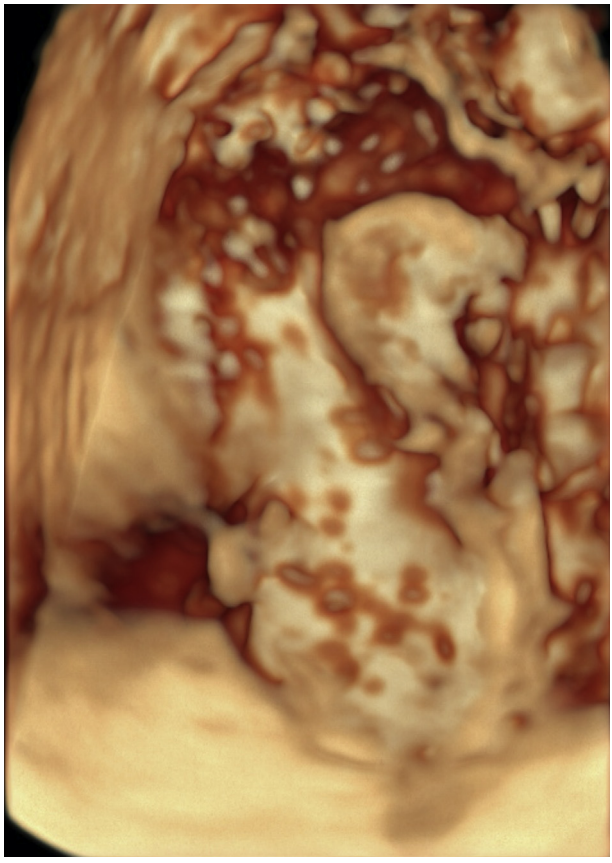

Fig. 4. Three-dimensional RWC-TVS showing an endometriotic nodule infiltrating the anterior rectal wall.

Summary

Enhanced TVS techniques are easy to perform and they are cheap. These techniques may cause some pain because of the distention of the rectosigmoid in RWC-TVS or the compression of the nodules in tg-TVS. However, these exams are generally well-tolerated and they can be performed without anesthesia. Enhanced TVS techniques (in particular, RWC-TVS) have good performance in the diagnosis of rectosigmoid endometriosis. However, a systematic review and meta-analysis did not find significant differences in the performance of non-enhanced TVS and enhanced TVS in the diagnosis of rectosigmoid endometriosis [30]. This finding may be justified by the fact that enhanced techniques are more suitable as second-step investigations to ascertain the depth of infiltration of endometriosis in the intestinal wall or the presence of rectal stenosis [38].

Comparison with other imaging techniques

In patients with previous equivocal TVS, magnetic resonance imaging (MRI) is currently recommended as a second-line technique in the preoperative workup of patients with DE [60]. However, over the last 20 years, MRI has been widely used for the diagnosis of DE, including rectosigmoid nodules [61,62]. A systematic review and meta-analysis compared the accuracy of TVS and MRI in diagnosing DE [63]. Six studies (424 patients) were included in the analysis. Pooled sensitivity and specificity of MRI in the detection of rectosigmoid endometriosis were 85% (95% CI, 78–90%) and 95% (95% CI, 83–99%), respectively; LR+ and LR− were 18.4 (95% CI, 4.7–72.4) and 0.16 (95% CI, 0.11–0.24), respectively. Pooled sensitivity and specificity of TVS in the detection of rectosigmoid endometriosis were 85% (95% CI, 68–94%) and 96% (95% CI, 85–99%), respectively; LR+ and LR− were 20.4 (95% CI, 4.7–88.5) and 0.16 (95% CI, 0.07–0.38), respectively. Therefore, the meta-analysis demonstrated that the two imaging techniques had similar performance in the diagnosis of rectosigmoid endometriosis. A more recent meta-analysis compared the accuracy of TVS and MRI in the diagnosis of rectosigmoid endometriosis [64]. Eight studies (1132 patients) were included in the analysis. The pooled sensitivity, specificity, LR+, and LR− values of MRI for the diagnosis of rectosigmoid endometriosis were 90% (95% CI, 87–92%), 96% (95% CI, 94–97%), 17.26 (95% CI, 3.57–83.50), and 0.15 (95% CI, 0.10–0.23), respectively; the values of TVS were 90% (95% CI, 87–92%), 96% (95% CI, 94–97%), 20.66 (95% CI, 8.71–49.00), and 0.12 (95% CI, 0.08–0.20), respectively. The meta-analysis confirmed that the two methods have similar performance in the diagnosis of rectosigmoid endometriosis.

Several studies demonstrated the good performance of REU in the diagnosis of rectosigmoid endometriosis [12,22,65–71]. A meta-analysis compared the performance of TVS, REU, and MRI in the diagnosis of DE [72]. TVS and MRI were equally accurate in the diagnosis of rectosigmoid endometriosis, and the authors concluded that TVS should be considered the first-line investigation because it is less invasive than REU.

DCBE was the first exam used to diagnose bowel endometriosis [73]. A prospective study compared the accuracy of DCBE and TVS in the diagnosis of rectosigmoid endometriosis [24]. TVS performed better than DCBE in diagnosing rectosigmoid endometriosis. However, DCBE provides a complete overview of the entire colon, allowing to diagnose endometriotic lesions located proximally to the sigmoid colon (such as cecal lesions).

CTC is now widely used for the diagnosis of bowel endometriosis [40,74–78]. A prospective study compared the performance of TVS and CTC in diagnosing deep infiltrating endometriosis [49]. TVS had higher accuracy in diagnosing rectal and sigmoid endometriosis; however, similar accuracy for the two imaging methods was observed for the diagnosis of overall intestinal endometriosis. A prospective study compared the performance of CTC and RWC-TVS in assessing the presence and characteristics of rectosigmoid endometriosis [58]. CTC and RWC-TVS had similar accuracy in diagnosing rectosigmoid endometriosis. CTC was significantly more precise than RWC-TVS in estimating the distance between the lower margin of the rectosigmoid nodule and the anal verge. CTC was less accurate than RWC-TVS in diagnosing multifocal disease. However, CTC may provide an overview of the entire colon, allowing

to diagnose endometriotic lesions located proximally to the sigmoid colon. Recently, in another prospective study, 3D-RWC-TVS and CTC confirmed similar diagnostic accuracy for diagnosing rectosigmoid endometriosis; however, CTC was more accurate in ruling out sigmoid nodules [51].

Learning curve of TVG in the diagnosis of rectosigmoid endometriosis

The performance of TVS in the diagnosis of rectosigmoid endometriosis is largely dependent on the experience of the examiner. However, there is evidence that the learning curve for diagnosing DE (including rectosigmoid endometriosis) by TVS is short. A prospective study investigated the learning curve of TVS in the diagnosis of DE and tried to identify the causes for inaccuracies in the diagnosis of bowel lesions and POD obliteration [79]. The study demonstrated that 36 scans were required to achieve competency in the detection of bowel nodules. A 1-week training for someone with prior experience in TVS may allow for the diagnosis of DE with high diagnostic accuracy. Daily feedback between surgeons and imaging specialists leads to constant fine-tuning of the interpretation of ultrasound findings. These findings were confirmed by a retrospective study performed in a referral center for endometriosis [80]. The study demonstrated that 38 examinations are required for a sonographer who trained in general gynecologic ultrasonography to become proficient at diagnosing bowel endometriosis. Another study suggested that the combined use of real-time TVS and offline 3D volume virtual navigation could be helpful to adequate training, in a short time (2 weeks), for ultrasound assessment of deep infiltrating endometriosis [81]. In the suggested learning program, competence for diagnosing rectosigmoid nodules was reached after 39 evaluations, but with a wide range between trainees (ranging from 30 to 60 evaluations). The accuracy for each trainee was high ranging from 80% to 94% after the training. An advantage of this learning program was the possibility of carrying out this intensive course without creating discomfort for the patients.

Conclusion

TVS should be the first-line investigation in patients with suspicion of rectosigmoid endometriosis. However, it cannot assess the presence of intestinal nodules located proximally to the sigmoid (such as ileal or cecal endometriotic nodules), because these lesions are beyond the field of the transvaginal probe. Rectosigmoid nodules may have various morphological appearances; in general, they are irregular hypoechoic nodule located in the anterior wall of the rectosigmoid colon [10]. Several meta-analyses confirmed the high diagnostic performance of TVS in diagnosing rectosigmoid endometriosis [29–31]. The presence of “soft markers” (negative sliding sign and kissing ovaries) facilitates the diagnosis of rectosigmoid endometriosis. Enhanced TVS (RWC-TVS, SVG, and tg-TVS) does not improve the performance of TVS in diagnosing rectosigmoid endometriosis. However, these investigations may be useful to ascertain the depth of infiltration of endometriosis in the intestinal wall or the presence of rectal stenosis [38]. MRI has the same performance of TVS in diagnosing rectosigmoid endometriosis [63,64]; however, it should be used as a second-line technique in the preoperative workup of patients with previous equivocal TVS findings.

A strength of TVS in the diagnosis of rectosigmoid endometriosis is that it is highly reproducible when performed by a well-trained examiner [82]. The learning curve for diagnosing rectosigmoid endometriosis by TVS is quite short; approximately, 40 scans are required to a sonographer who trained in general gynecologic ultrasonography to become proficient at diagnosing bowel endometriosis [79–81].

Declaration of competing interest

The authors have no conflicts of interest.

Practice points

- At transvaginal ultrasonography (TVS), rectosigmoid endometriotic nodules appear as irregular hypoechogenic mass, with or without hypoechogenic or hyperechogenic foci, with blurred margins, penetrating the intestinal wall.
- The sonographic features of rectosigmoid endometriotic nodules should be reported according to the consensus opinion of the international deep endometriosis analysis (IDEA) group.
- Enhanced TVS (rectal water-contrast transvaginal ultrasonography [RWC-TVS], sonovaginography [SGV], and tenderness-guided transvaginal ultrasonography [tg-TVS]) does not improve the performance of TVS in diagnosing rectosigmoid endometriosis. These investigations may be useful to ascertain the depth of infiltration of endometriosis in the bowel wall or the presence of intestinal stenosis.
- In patients with previous equivocal TVS, magnetic resonance imaging (MRI) may be used as a second-line technique in the preoperative workup of patients with deep infiltrating endometriosis.
- The learning curve for diagnosing rectosigmoid endometriosis by TVS is quite short, approximately, 40 scans are required to a sonographer who trained in general gynecologic ultrasonography to become proficient at diagnosing bowel endometriosis.

Research agenda

- Future studies should assess whether TVS can diagnose superficial endometriotic lesions located on the rectosigmoid.
- Future studies should investigate the role of bi- and tridimensional RWC-TVS in evaluating the degree of stenosis of the intestinal lumen in patients with rectosigmoid endometriosis.
- Future studies should compare the performance of different enhanced TVS techniques in diagnosing rectosigmoid endometriosis.

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