



Standardized Ultrasonographic Diagnostic Protocol to Diagnose Endometriosis Based on the International Deep Endometriosis Analysis (IDEA) Consensus Statement

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3.1 Introduction

In April of 1978, Sandler et al. published a series of ten cases entitled “The Spectrum of Ultrasonic Findings in Endometriosis” [1]. The authors made the recommendation that sonographers should consider endometriosis in the differential diagnosis when a pelvic mass was visualized on ultrasound. In the almost 40 years since this publication, the international scientific community has contributed to the literature on the utility of ultrasound in the diagnosis and management of endometriosis. The recent consensus statement on the systematic approach to sonographic evaluation of the pelvis in patients with suspected endometriosis demonstrates broad international collaboration [2]. This landmark paper was published in *Ultrasound in Obstetrics and Gynecology* in 2016 by the International Deep Endometriosis Analysis (IDEA) group, which was comprised of clinicians, gynecological sonologists, advanced laparoscopic surgeons, and radiologists. The 29 members of 15 different countries were invited to

participate based on their expertise in the diagnosis and management of endometriosis. The primary goal of this consensus is to standardize terminology, including definitions of anatomy, measurements of sonographic findings, and nomenclature of endometriosis lesions, for uniform use on the international scientific stage. The downstream objective is to encourage homogeneity in terminology to enhance comparison between future studies, promote multicenter studies, and improve patient outcomes.

The purposes of ultrasound in patients with suspected endometriosis are threefold: (1) attempt to explain the patient’s symptoms, (2) map the disease location, and (3) assess the severity of disease. The systematic approach to this ultrasound technique involves four basic steps (Table 3.1), which will be outlined in the section, “How We Do It.” Each of the four steps will then be expanded upon in greater detail in subsequent chapters.

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3.2 How We Do It

Prior to beginning the ultrasound scan, one should explain the nature of procedure to the patient and obtain consent to proceed. A transvaginal ultrasound (TVS) is the recommended imaging modality in the diagnosis of endometriosis [3]. Patients should be instructed to empty their bladder immediately prior to the TVS. They

Table 3.1 Four basic sonographic steps, which can be adopted in this or any order as long as all four steps are performed to confirm/exclude the different forms of endometriosis

First step	Routine evaluation of the uterus and adnexa (+ sonographic signs of adenomyosis/presence or absence of endometrioma)
Second step	Evaluation of transvaginal sonographic “soft markers” (i.e., site-specific tenderness and ovarian mobility)
Third step	Assessment of status of POD using real-time ultrasound-based “sliding sign”
Fourth step	Assessment for DE nodules in anterior and posterior compartments

POD pouch of Douglas, DE deep endometriosis

should then be positioned and draped appropriately. A wedged cushion or medical couch, with stirrups or lowering bottom section, can be used to ensure adequate mobility with the transvaginal probe. After sanitary protocols have been followed for probe cleaning, ultrasound gel should be placed on the tip of the probe. A probe cover can then be placed overtop, followed by lubricating gel to ease insertion of the probe into the patient’s vagina. The scan can then begin. It is recommended to implement a local protocol to ensure all steps are completed, though they may differ in order than that presented here. Most importantly, the operator needs to be experienced in the evaluation of patients with potential deep endometriosis (DE).

3.2.1 First Step

The first structure often identified is the uterus. The orientation (anteverted, retroverted, or axial) should be noted. Any uterine abnormalities should be noted. Specifically with endometriosis in mind, one should inspect carefully for signs of adenomyosis as there is significant correlation between the two processes [4]. These findings should be described using the terms and definitions published in the Morphological Uterus Sonographic Assessment (MUSA) consensus opinion [5]. Though not included in the MUSA group’s opinion, the “question mark sign” should be noted when seen as this can represent adenomyosis and/or endometriosis [5, 6]. In the context of endometriosis, this sign generally signifies a fixed (i.e., nonmobile) anteverted/retroflexed uterus with the fundus adhered posteriorly to the rectum and/or sigmoid colon.

Next the adnexa should be evaluated. Ovarian size and characteristics should be documented. The presence or absence of endometriomas should be noted. The following three elements are critical when assessing endometriomas. *First*, the size, measured in three orthogonal planes. To achieve appropriate orthogonal plane measurements, the length is obtained in the midsagittal plane, thickness in the anteroposterior plane, and transverse diameter in the transverse plane. *Second*, the number of endometriomas should be noted. *Third* and lastly, the sonographic characteristics should be described according to terminology published by the International Ovarian Tumor Analysis (IOTA) group [7]. When an endometrioma is visualized, there is significantly higher likelihood of multiple lesions of DE [8]. Though the IDEA consensus statement recommends all four steps in all patients with suspected endometriosis, operators performing the ultrasound should be more vigilant for DE when an endometrioma is diagnosed.

The Fallopian tubes, though not usually visible on ultrasound in a normal state, may be distorted or blocked by adhesions in patients with endometriosis. If a hydrosalpinx or hematosalpinx is seen on ultrasound, endometriosis should be considered as an etiology.

3.2.2 Second Step

The next element of the scan is a dynamic assessment of “soft markers” – site-specific tenderness (SST) and ovarian mobility [2]. “Soft markers” are defined as sonographic features that indirectly suggest the presence of endometriosis, specifically superficial endometriosis and intra-abdominal

adhesions, neither of which can be directly visualized [9, 10]. These “soft markers” are elicited using the transvaginal probe [10].

Firstly, before evaluating for SST, it is important to inform the patient that he or she may experience discomfort or pain. Their feedback to the operator performing the scan is essential to this step. The key anatomic locations to assess in this component of the scan include the uterus, adnexa, uterosacral ligaments (USL), and pouch of Douglas (POD). No scoring system has been validated as yet for SST. Currently, the IDEA group recommends a scoring system of 0 or 1: 0 for no pain and 1 for pain. It may be prudent to complete this aspect of the ultrasound at the very end to prevent interruption or termination of the scan secondary to pain.

Secondly, ovarian mobility should be judged by applying pressure to the ovaries using the transvaginal probe. The ovaries may be fixed laterally to the pelvic side wall, medially to the uterus, or inferiorly to the USLs. In some cases, the ovaries

may be adhered to each other, known as “kissing” ovaries (Fig. 3.1). Not only does this particular ultrasound sign indirectly indicate intra-abdominal adhesions, but it may also represent underlying DE of the Fallopian tubes and/or bowel [11].

3.2.3 Third Step

The third step is another dynamic, real-time ultrasound technique involving assessment of the status of the POD called the “sliding sign.” When the uterus and cervix move independently (i.e., slide) along the anterior rectum and sigmoid, the test is *positive* and the POD is *not* obliterated. When the uterus and cervix move in unison with the anterior rectum and sigmoid, the test is *negative* and the POD is thought to be obliterated [12, 13]. Depending on the orientation of the uterus, the method to test for POD obliteration is slightly different (Table 3.2).

Fig. 3.1 “Kissing” ovaries sign; indirectly indicates intra-abdominal adhesions, and possibly underlying DE of posterior compartment. This ultrasound image depicts a right (Rt) ovarian endometrioma and a left (Lt) ovarian hemorrhagic cyst [2]

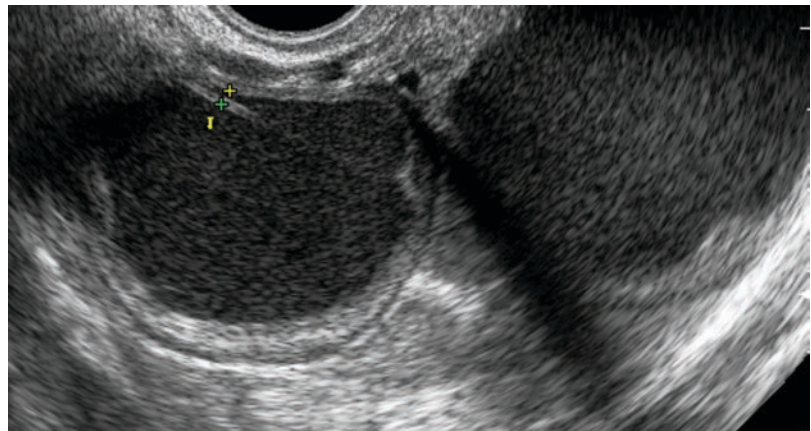


Table 3.2 Pouch of Douglas assessment for obliteration using “sliding sign”

	Anteverted	Retroverted
Step 1	Place gentle pressure against the retro-cervix using the transvaginal probe. Observe whether the anterior rectum glides freely across the posterior aspect of the cervix and posterior vaginal wall	Place gentle pressure against the posterior upper uterine fundus with the transvaginal probe. Observe whether the anterior rectum glides freely across the posterior upper uterine fundus
Step 2	Place one hand over lower anterior abdominal wall and ballot the uterus between the palpating hand and the transvaginal probe. Assess whether the anterior bowel glides freely over the posterior aspect of the upper uterine fundus	Place one hand over lower anterior abdominal wall and ballot the uterus between the palpating hand and transvaginal probe. Assess whether the anterior sigmoid glides freely over the anterior lower uterine segment

3.2.4 Fourth Step

The fourth and last step entails searching for DE lesions in the anterior and posterior compartments (Fig. 3.2). The anterior compartment is comprised of the urinary bladder, uterovesical region, and ureters. The posterior compartment sites include USLs, posterior vaginal fornix, rectovaginal septum (RVS), anterior rectum/anterior rectosigmoid junction and sigmoid colon [2, 14].

The IDEA group has recommended that DE lesions located in the bladder, RVS, vagina, USLs, anterior rectum, and rectosigmoid should be measured, like endometriomas, systematically in three orthogonal planes (Fig. 3.3) [2].

3.2.5 Anterior Compartment

Ideally by the time the bladder is scanned, some urine has accumulated. A small amount of urine reduces the frequency of false-negative findings [2]. The anatomical landmarks of the bladder will be discussed in greater detail in Chap. 8. To meet diagnostic criteria for a DE lesion, the muscularis of the bladder wall must be affected. Generally, this is the most common layer impacted by endometriosis. Lesions may appear as hypoechoic linear or spherical lesions, with or without regular contours [15–21]. With respect to the uterovesical region, the most important aspect to understand is whether the posterior bladder is tethered to the uterus (i.e., obliteration of the space). The concept of the “sliding sign” can be applied here as well, but one must interpret the results in the context of the patient’s past surgical history, including cesarean sections [22].

The ureters can also be imaged and assessed for damage secondary to endometriosis. First, identify the urethra in the sagittal plane and move the probe toward the lateral pelvic wall. Along this path, and in order, is the intravesical segment of the ureter, the site of ureter exiting bladder, and finally, where it crosses the bifurcation of the common iliac vessels. The examiner should evaluate for ureteric dilatation, and if present, the distance between the dilatation and the distal ureteric orifice should be measured [23–25]. In the event of DE on TVS, a

transabdominal scan of the kidney is necessary [2]. The purpose of the ultrasound is to rule out hydronephrosis, which may exist in asymptomatic ureteral stenosis [26, 27].

3.2.6 Posterior Compartment

DE nodules in the posterior compartment should be sonographically localized based on the anatomic landmarks specified in the IDEA consensus statement. Moreover, it is critical to document the size and characteristics of these nodules. Generally, they appear as hypoechoic thickening of the bowel wall or vagina, or as hypoechoic solid nodules with variable sizes and contours [2]. Chapters 9–12 will focus on the various aspects of the posterior compartment in greater detail.

In order to satisfactorily perform a TVS of the posterior compartment with the intention of diagnosing DE, one must understand the anatomy. The IDEA group has developed a schematic to delineate the RVS and the posterior vaginal fornix (Fig. 3.4). Involvement of the RVS should be suspected when a DE nodule is seen on TVS in the rectovaginal space below the line passing along the lower border of the posterior lip of the cervix (under the peritoneum) [20]. Involvement of the posterior vaginal fornix and/or lateral vaginal fornix should be suspected when a DE nodule is seen on TVS in the rectovaginal space below the line passing along the caudal end of the peritoneum of the lower margin of the POD and above the line passing along the lower border of the posterior lip of the cervix (under the peritoneum) (Fig. 3.4). In the same vicinity, a rectovaginal nodule could be identified, extending from the posterior vaginal fornix to the anterior rectum. These appear as hourglass-shaped or “diabolo”-like nodules (Fig. 3.5) [28]. As these lesions lie beneath the peritoneum of the POD, they are not visible on laparoscopy. However, they are usually large at an average of 3 cm [29].

To evaluate for endometriotic lesions of the USLs, place the transvaginal probe in the posterior vaginal fornix in the midline in the sagittal plane and then sweep the probe inferolaterally to

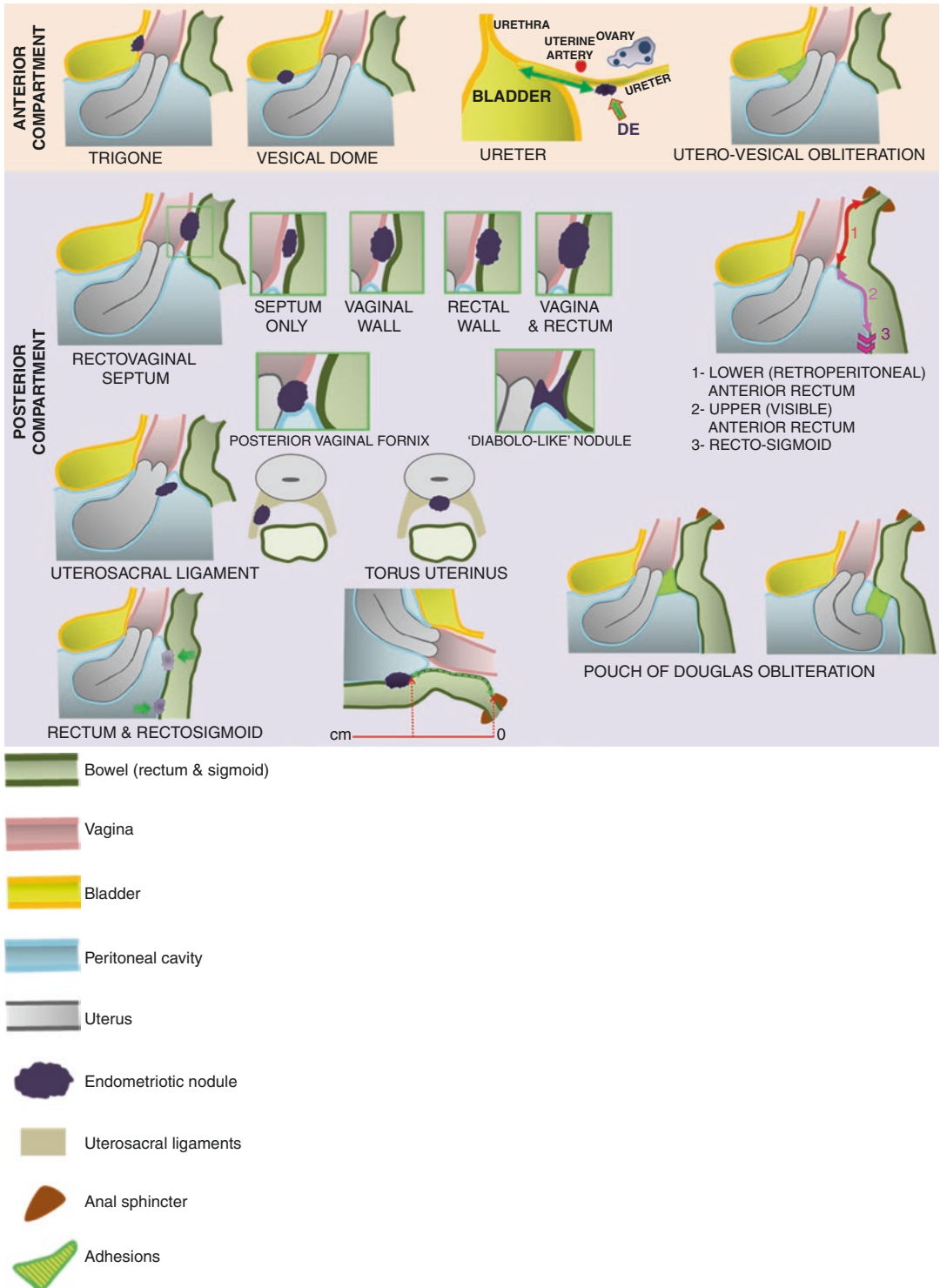


Fig. 3.2 Overview schematic demonstrating various sites of endometriotic nodules and adhesions in the anterior and posterior compartments, with associated legend. Reprinted with permission from Wiley Publishers [2]

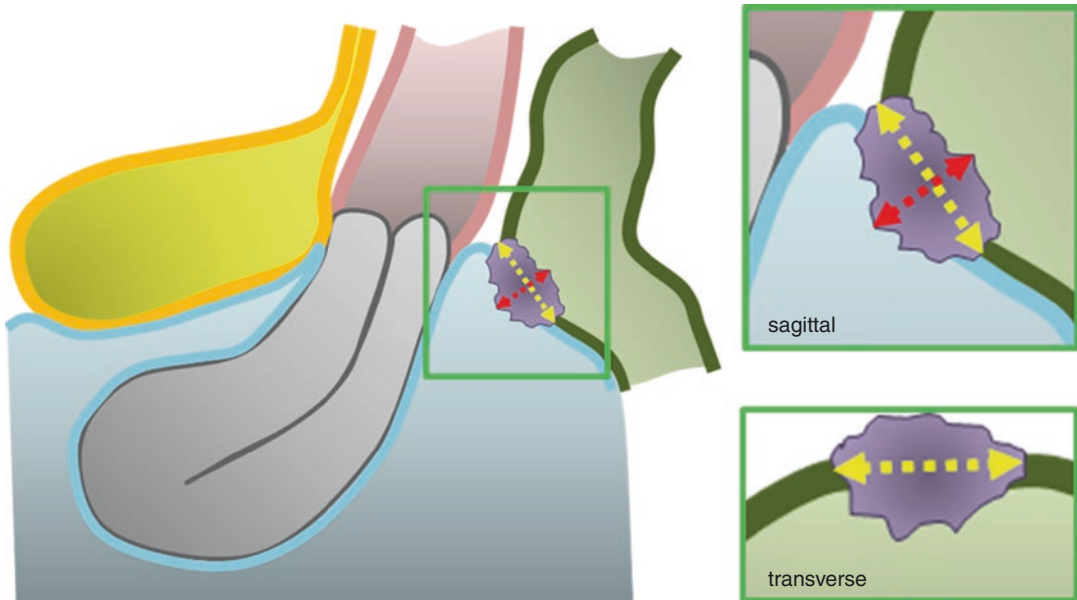


Fig. 3.3 Schematic drawing demonstrating method of obtaining orthogonal measurements, i.e., midsagittal, anteroposterior, and transverse. Reprinted with permission from Wiley Publishers [2]

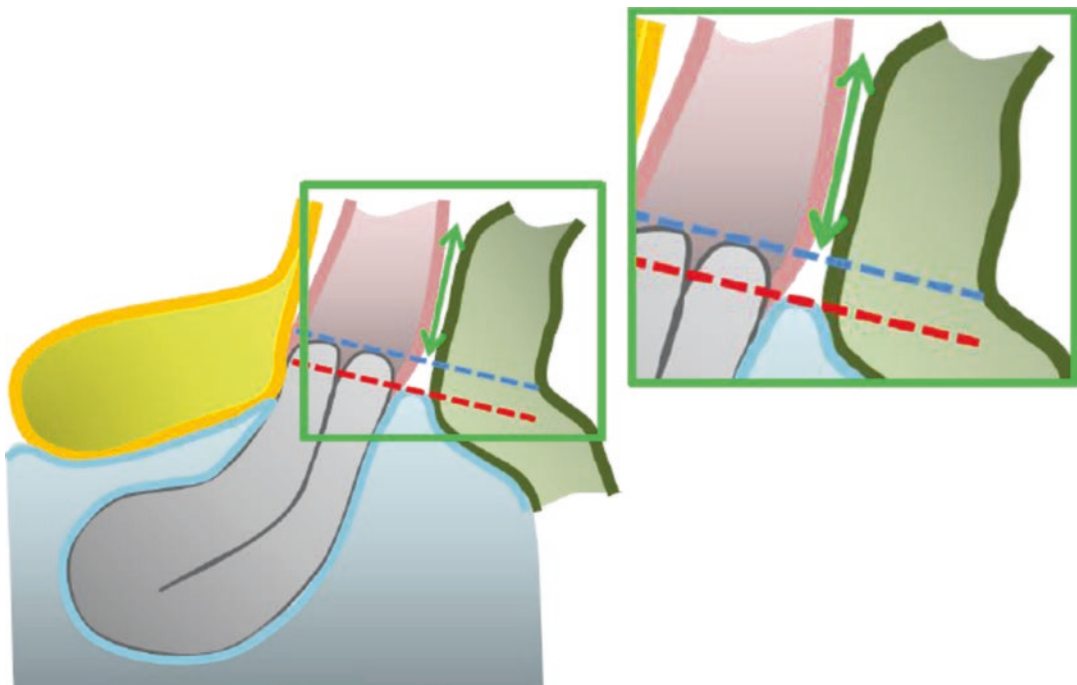
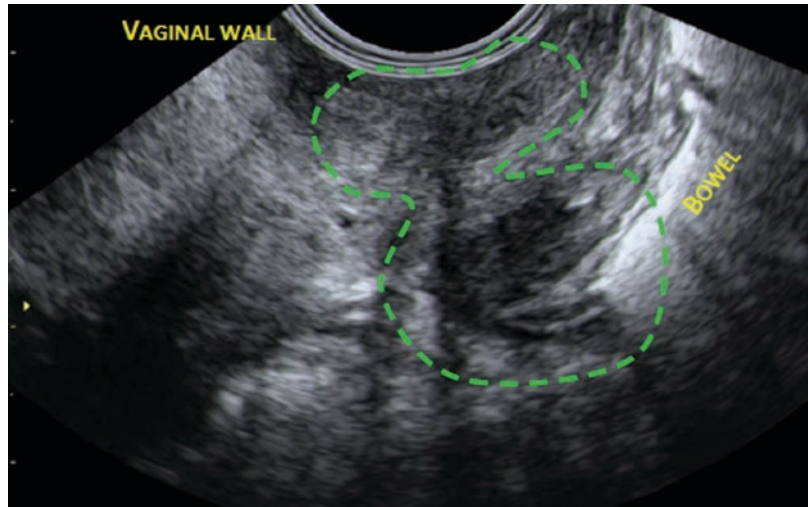


Fig. 3.4 Schematic drawing demonstrating ultrasound definition of the rectovaginal septum (RVS) (double-headed green arrow) and the posterior vaginal fornix (space between the blue line and the red line). Reprinted with permission from Wiley Publishers [2]

Fig. 3.5 Ultrasound image demonstrating a “diabolo-like” nodule of deep endometriosis from the posterior vaginal fornix extending into the anterior rectum. Reprinted with permission from Wiley Publishers [2]



the cervix [2]. Normal USLs are not usually visualized on TVS. If a hypoechoic thickening is seen within the peritoneal fat surrounding the USLs, it is felt that the USLs are harboring DE. An attempt should be made to identify whether the lesion is part of a larger complex, encompassing other nearby anatomic sites.

Bowel endometriosis generally involves the anterior rectum, rectosigmoid junction, and/or sigmoid colon [14]. The schematic in Fig. 3.6 delineates these areas but also dichotomizes the anterior rectum into lower (retroperitoneal) and upper (visible at laparoscopy). Bowel DE usually appears on TVS as a thickening of the hypoechoic muscularis propria or as hypoechoic nodules, with or without hyperechoic foci (Fig. 3.7). Any nodule recognized in the bowel wall 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 using TVS. Lastly, the morphological appearance should be documented based on the types of lesions described in the IDEA consensus opinion [2].

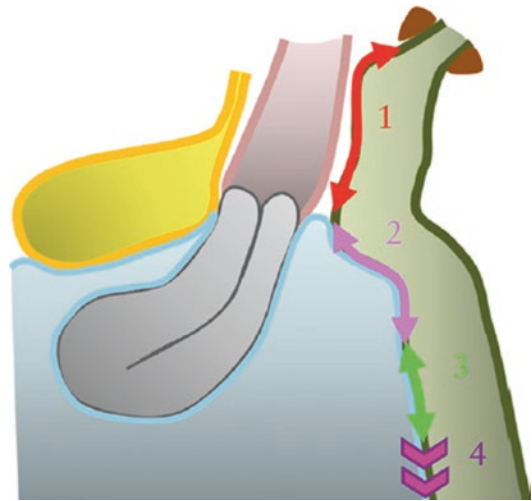


Fig. 3.6 Schematic drawing identifying distinct segments and the rectum and sigmoid colon: lower (or retroperitoneal) anterior rectum (1), upper (visible at laparoscopy) anterior rectum (2), rectosigmoid junction (3), and anterior sigmoid (4). Reprinted with permission from Wiley Publishers [2]

3.3 Important Technical Tips

- Various ultrasound techniques for the diagnosis of endometriosis have been published in the literature [30, 31] prior to the publication of the IDEA consensus statement. No single
- The patient should understand the nature of the ultrasound, including the indication, benefits, and risks. They should provide their informed consent. They should be aware that

method has been externally validated. The consensus opinion approach is currently undergoing a multicenter study to externally validate its recommendations.

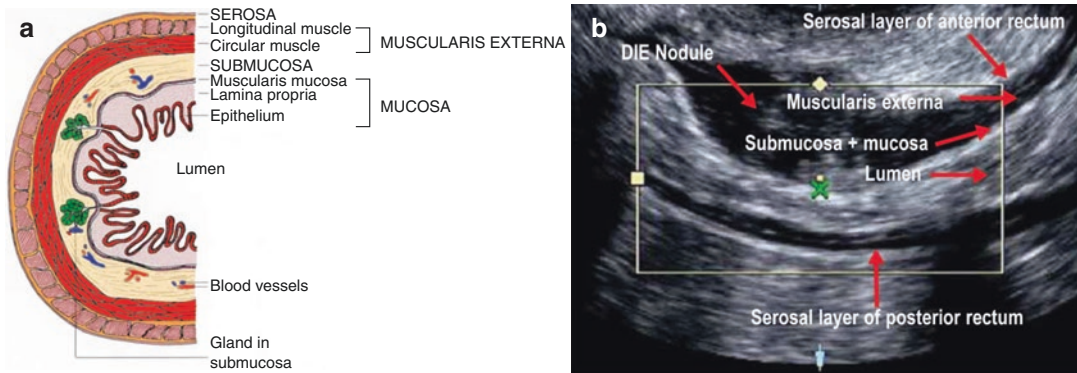


Fig. 3.7 Schematic image showing the histological layers of the rectum (a), which can be seen on the adjacent ultrasound image (b); a DE nodule can be seen as labeled. Reprinted with permission from Wiley Publishers [34]

this is a dynamic ultrasound involving testing for SST, which may cause discomfort or pain.

- The operator should understand the indications for the ultrasound and ensure appropriate patient selection.
- A strong knowledge of pelvic anatomy and the ultrasound appearance of anatomy is critical to a successful scan, regardless of findings.
- Operators should follow a protocol that encapsulates all four of the steps for all scans. The protocol *does not* have to follow the same order of steps outlined in the IDEA consensus. Thoroughness every time is key, but when more routinely identified abnormalities such as endometriomas are seen, operators should be on high alert for other lesions.
 - It may be advisable to perform aspects that are pain-evoking toward the end of the procedure.
- When DE is visualized, it should be described in detail in a standardized fashion as outlined in the IDEA consensus statement.
 - Ultrasound features
 - Location
 - Size (three orthogonal planes)
 - Proximity to important structures (e.g., anal verge, ureteric orifice)
- When DE is diagnosed on ultrasound, a trans-abdominal ultrasound of the kidneys should be done to ensure there is no evidence of hydronephrosis.
- Importantly, the absence of DE on ultrasound scan does not mean the patient does not have endometriosis [32].

3.4 Future Perspectives

From a general perspective, there are two natural next steps. Presently, an observational non-interventional academic multicenter study is underway. This study will evaluate the use of the IDEA terminology in different groups of patients in whom pelvic ultrasound is currently routinely performed, e.g., dysmenorrhea, dyspareunia, and/or dyschezia. The IDEA group will evaluate prospectively if the ultrasound appearances of the pelvis in patients with chronic pelvic pain can predict the different phenotypes of endometriosis in patients scheduled for laparoscopic surgery.

Secondly, educational studies are necessary to understand the learning curves to reach competency in the techniques described above. Tammaa et al. have suggested that in gynecologists experienced in ultrasound for general gynecologic problems (defined as having performed approximately 2500 transvaginal scans), roughly 40 endometriosis-focused scans are required to reach competency in the prediction of POD obliteration and DE of the rectum [33]. Lesser experienced operators' learning curve is still to be determined. As an advanced ultrasound approach, operators of diverse backgrounds may require different amounts of time, number of scans, or levels of supervision before they can independently perform this scan. Implementation of this approach as standard of care requires a stronger appreciation of this concept.

We have described the IDEA group's systematic approach, using dynamic ultrasound, to

examine the pelvis in patients with suspected endometriosis. The published defined anatomical terms and measurements used to describe the appearances of all endometriosis phenotypes should represent the benchmark standard for endometriosis ultrasound henceforth. This in turn will not only raise the standard of diagnostic ultrasound in this field but also ensure that experienced operators, regardless of country of origin, describe the location and extent of disease in a way which is uniform and easily interpretable.

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