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Ultrasound in deep endometriosis: A narrative review

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Abstract

Background

Over the past decade, transvaginal ultrasound (TVUS) has revolutionized the diagnosis of deep endometriosis. We can now accurately describe and evaluate lesions in multiple compartments of the pelvis, increasing diagnostic capacity without the need for initial laparoscopy. Recent consensus and publications support the new and growing evidence for this technique. Research into deep endometriosis has increased substantially and new diagnostic evidence is now available.

Objectives

The aim of this article is to review the state of the art in ultrasound diagnosis of deep endometriosis.

Methods

We performed a detailed search of the PubMed database to identify eligible primary studies. We included English-language publications with the following terms: "endometriosis" AND "deep" AND "ultrasound" AND "transvaginal". Studies focusing on ultrasound in deep endometriosis were included, we selected them based on title reading, then narrowed the selection by reading the abstract. -We excluded publications that didn't use TVUS as one of the main techniques to evaluate deep endometriosis.

Results

243 studies were identified and selected as described above, resulting in a total of 73 studies included in this review.

Conclusions and outlook

Our understanding of deep endometriosis has evolved over the past decade. Efforts have been made to reduce the diagnostic delay in this common disease, particularly with the increased use of imaging, especially transvaginal ultrasound, as a first-line diagnostic modality because of its availability, good test performance, cost-effectiveness, and low environmental impact compared to other imaging modalities. This statement is supported by recent publications and guidelines from some medical societies. Advances in technology, equipment and research have allowed us to identify additional compartments involved, including the parametrium. The progress made in recent years offers hope for earlier detection and improved management of patients with suspected endometriosis who suffer not only from pelvic pain but also from infertility.

INTRODUCTION

Endometriosis is a disease characterized by the presence of endometrial-like epithelium and/or stroma outside the endometrium and myometrium, usually with an associated inflammatory process [1]. It affects 5 to 10% of women of reproductive age worldwide. Our understanding of the disease has evolved from a focus primarily on pelvic symptoms, such as pelvic pain, dysmenorrhea, and infertility, to a broader recognition of it as a chronic systemic disease [2,3].

Often referred to as the "missed disease" due to its unknown cause and long delays in diagnosis, despite advances in diagnostic tools and techniques, delays in diagnosis of up to 7 to 9 years have been described worldwide [4,5]. Patients affected by endometriosis have an economic burden at least comparable to other chronic diseases (such as diabetes mellitus, Crohn's disease and rheumatoid arthritis), it increases absenteeism, decreases productivity and significantly affects the quality of life of patients [6,7].

The importance of early diagnosis has been shown to benefit women by providing them with health management strategies to control the disease and a language in which to express and legitimize their diagnosis [8]. Over the past decade, international efforts have focused on reducing the diagnostic delay by shifting from a surgical and lesion-based diagnosis to a more comprehensive one that includes not only clinical presentation but also noninvasive findings on physical examination and imaging [2,9,10].

Over the past decade, transvaginal ultrasound (TVUS) has revolutionized the diagnosis of deep endometriosis. We can now accurately describe and evaluate lesions in multiple compartments of the pelvis, increasing diagnostic capacity without the need for initial laparoscopy. Recent consensus and publications support the new and growing evidence for this technique. The aim of this article is to review the state of the art in ultrasound diagnosis of deep endometriosis.

We performed a detailed search of the PubMed database to identify eligible primary studies. We included English-language publications with the following terms: "endometriosis" AND "deep" AND "ultrasound" AND "transvaginal". Studies focusing on ultrasound in deep endometriosis were included, we selected them based on title reading, then narrowed the selection by reading the abstract. We excluded publications that didn't use TVUS as one of the main techniques to evaluate deep endometriosis. 243 studies were identified and selected as described above, resulting in a total of 73 studies included in this review.

TRANSVAGINAL ULTRASOUND (TVUS)

Our understanding of endometriosis has evolved from relying primarily on invasive procedures such as diagnostic laparoscopy to using non-invasive imaging techniques such as TVUS for diagnosis. TVUS is the first-line imaging modality for the diagnosis of deep endometriosis at multiple sites in the pelvis. It can accurately replace diagnostic laparoscopy, especially for the diagnosis of deep and ovarian endometriosis [9,11-13].

These statements are supported by the recent update of the European Society of Human Reproduction and Embryology (ESHRE) guidelines on endometriosis [14]. A recent international consensus statement evaluating noninvasive imaging modalities for the diagnosis of deep pelvic endometriosis also agreed that TVUS performed by appropriately trained operators is recommended as a first-line imaging modality because of its availability, good test performance, cost-effectiveness, and low environmental impact compared with other imaging modalities [9].

Ultrasound has been a pivotal tool in the non-invasive diagnosis of gynecologic conditions, offering an examination that is accessible, affordable, and widely familiar to gynecologic healthcare professionals. However, it was not until 2016 that a standardized approach to the evaluation of endometriosis by ultrasound was established. The International Deep Endometriosis Analysis (IDEA) consensus, specifically the work of Guerriero et al [15], marked a significant milestone by providing a structured framework for ultrasound assessment and a common language for describing endometriosis.

This international consensus introduced a systematic approach that included four key steps: (1) assessment of the uterus and adnexa (signs of adenomyosis and endometriomas), (2) assessment of "soft markers" (site-specific tenderness and ovarian mobility), (3) assessment of the pouch of Douglas (POD) or "sliding sign", (4) and assessment of deep endometriotic nodules, which are divided into two distinct pelvic compartments: anterior and posterior. The anterior compartment includes the bladder, uterovesical region, and ureters. The posterior compartment includes the uterosacral ligaments (USLs), posterior vaginal fornix, rectovaginal septum (RVS), anterior rectum/anterior rectosigmoid junction, and sigmoid colon. This comprehensive approach is designed to be used by both experienced and non-experienced examiners [15].

According to the International Working Group of the American Association of Gynecologic Laparoscopist (AAGL), the European Society of Gynecologic Endoscopy (ESGE), the European Society of Human Reproduction and Embryology (ESHRE), and the World Endometriosis Society (WES), deep endometriosis (DE) is defined by endometrium-like tissue lesions in the abdomen that extend on or below the peritoneal surface. They are usually nodular, capable of infiltrating adjacent structures, and associated with fibrosis and disruption of normal anatomy, regardless of the depth of infiltration [1].

ANTERIOR COMPARTMENT

The anterior compartment corresponds to the bladder, uterovesical region, and ureters. (15)

Deep endometriosis affecting the urinary tract is considered a rare form of deep endometriosis. It may affect 1-2% of people with endometriosis [9,16-18], but appears to be more common in women with deep endometriosis, with prevalence ranging from 19% to 52% [16,19].

Bladder endometriosis (BE) is the most common type of urinary tract endometriosis (UTE), occurring in approximately 70-85% [20] of cases, while ureteral involvement accounts for 9-23% [16,17]. However, the prevalence may be higher because this form of the disease is probably underdiagnosed due to the lack of specific symptoms [19].

DE of the anterior compartment coexists with other forms of endometriosis and represents a challenging, multifaceted disease process that may be overlooked. BE may present with lower urinary tract symptoms including frequency, dysuria, hematuria, and less commonly, bladder pain and urgency. These symptoms may worsen with menstruation or have a noncyclic presentation [21]. It may also be asymptomatic and diagnosed incidentally at the time of surgery for another indication [22].

The bladder should contain a small amount of urine for optimal scanning [22]. DE of the bladder can be seen as a hypoechoic linear or spherical lesion with or without regular contours, cystic spaces, hyperechoic foci and/or regular contours involving the muscularis or (sub)mucosa of the bladder (Fig. 1-2). Lesions involving only the serosa represent superficial endometriosis [15,23].

The bladder can be divided into four zones: trigone, base, dome, and extra-abdominal bladder. BE is more commonly found in the base and dome [15]. The boundary between the base and dome of the bladder is the vesicouterine pouch.

Unfortunately, due to the rather low incidence of DE in the anterior compartment, there are few publications addressing its prevalence and the accuracy of different imaging modalities.

Guerriero et al. [24] performed a systematic review in 2015, including patients who underwent transvaginal ultrasound prior to surgery, and found a sensitivity of 62% and a specificity of 100% in the detection of BE. In a recent meta-analysis, Gerges et al [25] included eight studies that used preoperative imaging modalities with a surgical and/or histologic reference standard for the detection of deep bladder endometriosis. The overall pooled sensitivity and specificity were 55% and 99%, respectively.

Once the bladder is evaluated, the uterovesical region must be considered. It is a typical site for reduced or absent mobility due to endometriotic adhesions or lesions, but can also be affected after cesarean section. It can be evaluated using the sliding sign [15,26]. If the posterior bladder slides freely over the anterior uterine wall, it is considered non-obliterated; if the bladder does not slide freely, the uterovesical space can be considered obliterated [24].

Following these assessments, the ureters must be examined. On ultrasound, the ureters appear as typically long tubular hypoechoic structures with a thick hyperechoic mantle extending from the lateral aspect of the bladder base to the common iliac vessels. Peristalsis may demonstrate ureteral patency. Changes in ureteral dilatation may be caused by extrinsic or intrinsic lesions [15,27]. There is no specific clinical presentation when the ureters are involved. Some symptoms that have been reported are: abdominal flank pain, gross hematuria, dyspareunia and dysmenorrhea. However, a higher percentage of patients may be asymptomatic. If obstruction is present, it may lead to renal obstructive syndrome, possibly with silent loss of renal function [17,22,28-31]. Timely diagnosis can help preserve renal function by prioritizing women with ureteral endometriosis for urgent treatment.

The most common site of ureteral obstruction is 3 to 4 cm above the vesicoureteral junction. The left ureter is most commonly involved [31-35]. Mapping of a ureteral lesion should include the distance between the lesion and the ureteral orifices, so this information is key to planning surgical treatment [22,31,36]. When performing a scan for DE, a transabdominal scan of the kidney is necessary as a non-invasive and reproducible technique to exclude the presence of hydronephrosis, which is usually asymptomatic in cases of ureteral DE [15,17,22].

The severity of hydronephrosis can be graded based on the appearance of the calices and pelvis and the thickness of the renal parenchyma [17,37]. There are limited data regarding the specific evaluation of the ureters. A prospective observational study of 848 women with chronic pelvic pain and symptoms of endometriosis who underwent transvaginal ultrasound followed by surgery reported a sensitivity of 92% and a specificity of 100% in the evaluation of ureteral endometriosis [31]. In a recent systematic review and meta-analysis by Chway et al. [33] including a total of six prospective and retrospective studies on ultrasound evaluation of ureteral lesions and correlation with laparoscopy and histology, a pooled sensitivity and specificity of 81% and 100%, respectively, was found. However, the observed heterogeneity was high for both outcomes.

POSTERIOR COMPARTMENT

The posterior compartment corresponds to the uterosacral ligaments (USLs), posterior vaginal fornix, recto-vaginal septum (RVS), anterior rectum/anterior rectosigmoid junction and sigmoid colon [15].

Rectovaginal septum and vaginal wall endometriosis

DE of RVS is defined as endometriosis affecting the space below the line running along the lower border of the posterior lip of the cervix (under the peritoneum). It presents as the absence of the hyperechoic layer between the vagina and rectum due to the presence of a nodule [15] (Fig. 3). It is often associated with other sites of DE such as the posterior vaginal wall or the anterior rectal wall [15]. On the contrary, vaginal lesions may be suspected when the posterior vaginal fornix is thickened or when a nodule is found in the vaginal wall. This nodule may be homogeneous or inhomogeneous with or without large cystic areas with or without surrounding cystic areas [15,23,38,39] (Fig.4-5).

Guerriero et al. [24], in a 2015 meta-analysis that included patients who underwent TVUS prior to surgery, described a sensitivity and specificity for RVS endometriosis of 49% and 98%, respectively, and for vaginal deep endometriosis of 58% and 96%, respectively. The same author in a more recent meta-analysis [40] comparing TVUS and magnetic resonance imaging (MRI) for preoperative detection of endometriosis, using surgical data as the reference standard, found a sensitivity of 59% and a specificity of 97% for ultrasound detection of RVS endometriosis, with no statistical difference between the imaging modalities. Noventa et al. [41] meta-analysis with a head-to-head approach including 17 studies comparing three imaging modalities for DIE diagnosis (TVUS, MRI, and rectal endoscopy-sonography) reported a sensitivity of 47% with a specificity of 95% (calculated from their data) for RVS endometriosis. Gerges et al. [25] in a recent systematic review and meta-analysis found an overall pooled sensitivity and specificity of 57% and 100%, respectively, for RVS and a sensitivity and specificity of 52% and 98%, respectively, for deep vaginal endometriosis. However, ultrasound was considered inferior to MRI in detecting RVS endometriosis and deep vaginal endometriosis.

Uterosacral ligaments

The USL is one of the most common sites affected by endometriosis. Although lesions in this location can be difficult to detect [9,42,43]. Nodules in the uterosacral ligaments may appear as a hypoechoic thickening with regular or irregular margins, may be isolated, or may be part of a larger nodule extending into the vagina or other surrounding structures (Fig 6-8). A central thickening of the retrocervical area may be seen when the lesions involve the uterine torus [15].

The Cochrane review [44] compared different imaging modalities in seven studies and found a sensitivity of 64% and a specificity of 97% for transvaginal ultrasound in detecting endometriosis in USLs. Guerriero et al. performed two different meta-analyses [24,40] and described a sensitivity and specificity for transvaginal ultrasound of 53% and 93% in 2015 and a sensitivity and specificity of 67% and 86% in 2018. A meta-analysis [41] using a head-to-head approach comparing TVUS and MRI reported a sensitivity of 71% and a specificity of 89% (calculated from their data) for TVUS. Gerges et al [25], in a recent systematic review and meta-analysis including prospective studies that evaluated the preoperative detection of deep endometriosis in relation to surgery and/or histology, reported a sensitivity of 60% and a specificity of 95% for USLs.

Rectum/Rectosigmoid

DE of the bowel may involve the anterior rectum, rectosigmoid junction, and/or sigmoid colon [15]. It is one of the most commonly affected sites. In patients with endometriosis, DE of the bowel can be estimated to occur in 3

to 37% of cases. In 90% of cases, the rectum or sigmoid colon is involved [45-47]. Rectal deep endometriosis lesions may be associated with a second bowel lesion in more than 50% of cases [48,49]. Therefore, obtaining as much information as possible about the presence of one or more endometriosis nodules in the bowel is valuable for decision making in planning the surgical procedure [48].
The lesions may present as thickening of the hypoechoic muscularis propria or as hypoechoic nodules with or without hyperechoic foci with blurred margins [15,23] (Fig 9-13). TVUS is one of the most studied techniques and is often used as a first-line modality due to its accessibility, relatively low cost and non-invasiveness [9,50]. It is a valuable tool that has demonstrated comparable or better accuracy than other imaging modalities such as MRI [12,49,51-53].
In 2016, the Cochrane review by Nisenblat et al. [44] included 14 studies for TVUS and described an overall pooled sensitivity and specificity of 90% and 96%, respectively. Noventa et al. [41] in 2019 described in a meta-analysis, with a head-to-head approach comparing different imaging modalities, a sensitivity of 85% and a specificity of 94% (calculated from their data) for TVUS, with similar accuracy to MRI. Two posterior meta-analyses [54,55] comparing TVUS and MRI found sensitivities and specificities of 80-90% and 94-96%, respectively, for TVUS. Gerges et al. [25] presented a systematic review and meta-analysis of prospective studies describing an overall pooled sensitivity of 89% and specificity of 97% in 21 studies.
A recent systematic review and meta-analysis by Maderuelo et al. [52], which included nine studies evaluating bowel preparation with and without rectal water contrast to assess whether the use of the additional technique would improve diagnostic performance, described a pooled sensitivity and specificity of 93% and 94% for bowel preparation and 92% and 95% for bowel preparation with water contrast (Fig. 12). There was no significant difference between transvaginal ultrasound with bowel preparation with or without water contrast.

Parametrial endometriosis (PE)
The parametrium is a bilateral anatomical structure composed of pelvic ligaments along with vascular, lymphatic, and neural structures, which are enveloped by a double layer of visceral pelvic fascia [56].
The presence of parametrial involvement in deep endometriosis poses a significant diagnostic and surgical challenge, often resulting in more severe symptoms and requiring more complex surgical planning. It may present the possibility of major technical difficulties and the risk of complications during and after surgery [57-60]. Parametrial involvement may be overlooked or unrecognized during surgery in the absence of adequate preoperative diagnosis [61]. By correctly mapping these lesions, we could improve counseling and estimate surgical complexity [62].
According to Exacoustos et al [63], parametrial involvement is suggested when infiltrating, irregular, hypoechogenic tissue extending laterally to the cervix or vagina is seen on TVU. Other studies have attempted to provide other definitions of the parametrial lesions, considering the lack of standardization of terms and recognizing these anatomically complex spaces [58,59,64].
The IDEA consensus, published in 2016 [5], did not include the assessment of the parametrium due to the paucity of information and limited research on this diagnosis at that time. Guerriero et al. in 2021 [65] performed a systematic review and meta-analysis to evaluate the diagnostic accuracy of transvaginal ultrasound for the detection of parametrial endometriosis. The results obtained with four included studies showed a low sensitivity (31%) and a high specificity (98%) for the detection of PE. However, the included studies did not have a clear consensus on ultrasound definitions of PE, with a high heterogeneity between publications, which limited the interpretation of these findings.
Di Giovanni et al [58], in a retrospective cohort study evaluating 4983 patients in a specialized referral center undergoing laparoscopic surgery, found a high sensitivity (97-98%) and specificity (98-100%) in the evaluation of lateral and dorsal parametrial lesions. Roditis et al [66], in a retrospective review evaluating the ability to diagnose DE including parametrium by physical examination, TVUs and MRI, found a low sensitivity of 20.7% and a higher specificity of 97.1% for ultrasound detection of PE. These studies demonstrated the need for further research to standardize the assessment, terminology and imaging reproducibility of the parametrium.
In 2024, the IDEA group published an addendum to standardize ultrasound criteria for parametrial involvement in endometriosis [67]. Concepts that could provide clinicians with more tools to ensure consistency in the evaluation of patients suspected of having PE and to establish a universal language for subsequent descriptions and research. The ultrasound approach divides the parametrium into 3 parts: anterior, posterior, and lateral, based on anatomical landmarks [67].

The anterior region of the parametrium defines the roof of the ureteral tunnel along the proximal part of the ureter to the bladder inlet and includes the cervicovesical branches of the uterine artery. The vesicouterine, vesicovaginal, and lateral vesical ligaments are the medial, craniocaudal, and lateral borders, respectively [67]. The posterior region of the parametrium includes the rectovaginal ligaments, rectovaginal septum, and lateral rectal ligaments and is bounded by the peritoneal folds. Medial to the pelvic path of the ureters, contains the retroperitoneal structures extending posteriorly from the cervix to the sacrum, including the deep pelvic vessels and the sacral nerve roots S1-S4 [67]. The lateral parametrium is visualized in the pelvic retroperitoneum during surgical dissection of the pararectal and paravesical spaces. It contains the major blood and lymphatic vessels of the cervix [67,68].

Suspicion of anterior parametrial compromise arises when hypoechogenic nodules are identified in the distal ureteral wall or in the anterior parametrial borders. The endometriotic nodules may be regular or irregular, homogeneous or heterogeneous [67]. Lateral parametrial endometriosis is suspected when there is a regular or irregular star-shaped hypoechogenic nodule that may or may not infiltrate the ipsilateral ureter (Fig. 14-15) The nodule appearance may be homogeneous or heterogeneous, usually non-vascularized, with or without hyperechogenic buds. As previously mentioned, evaluation of the ureters and kidneys is warranted in the search for specific compromise [67].

An indirect sign of posterior parametrial endometriosis is a negative sliding sign. These hypoechogenic nodules may be infiltrative, regular or irregular, homogeneous or heterogeneous within the posterior parametrial borders. Since the involvement of this region may be associated with pelvic nerve involvement, this compromise should be specifically sought [67)]. Applying too much pressure on the probe during scanning may cause image distortion, leading to displacement (rotation) of the ligaments, changing the extent of the lesion and/or masking the diagnosis, thus affecting the accuracy of posterior parametrial DE [62].

Barra et al [69], in a retrospective analysis of 1079 patients, evaluated ultrasound indirect signs in women with DE undergoing surgery to predict the presence of PE. They performed a regression analysis and correctly classified lesions in 82.9% of cases. They also developed a predictive model that included, as significant independent indirect signs of deep endometriosis, the presence of: hydronephrosis, complete absence of the posterior sliding sign, presence of multiple endometriomas per ovary, and fixation of the ovary to the uterine wall. And as significant independent concomitants: deep endometriosis nodules, presence of uterosacral nodules with largest diameter >10 mm, presence of rectal endometriosis with largest diameter >25 mm, and rectovaginal septal infiltration. For optimal diagnostic balance, at least two concomitant DE nodules and at least one indirect DE sign were required (AUC 0.75; 95% CI 0.72-0.79). However, no single ultrasound feature had a relevant sensitivity for predicting PE.

A recent single-center prospective study by the same research group [70] described the diagnostic accuracy of TVUS in identifying PE. They found a sensitivity of 77.1% and a specificity of 99.1% in the evaluation of these lesions. PE was more common in the posterior parametrial region. DE of the rectum and RVS were the most commonly observed associated nodes in patients with PE. In addition, indirect signs such as fixed ovaries to the uterine wall or uterosacral ligaments and the absence of a posterior sliding sign were more common in the presence of parametrial nodules.

Garzon et al. [62] published a prospective observational study evaluating lateral parametrial endometriosis in patients undergoing surgery with histology as the gold standard, following a standardized approach. They found a prevalence of lateral PE of 23.95%. The diagnostic accuracy for right and left PE was 97.69% and 96.22%, respectively. Sensitivity and specificity were 90.74% and 98.58% for the right side and 87.91% and 98.18% for the left side. Moro et al. [71] found in 195 women that ultrasound examination provided good specificity for all the parameters, but sensitivity was low for the anterior and lateral parametria confirming the heterogeneity of ultrasonographic definition of these lesions.

Table 1 summarizes the most recently published studies on the sonographic diagnosis of parametrial endometriosis. There is apparent heterogeneity in terms of definitions, prevalence and diagnostic accuracy.

A recent publication by Szabo et al. [72] described a six-step ultrasound approach to evaluate the normal pelvic sacral nerve roots of the posterior parametrium. In this study, the overall visualization rate was 98.6%. The median time to visualization was 9 seconds. The sacral roots of the sacral plexus were described as having a typical bundle-of-straw appearance (hypoechogenic bands with echogenic septa) in longitudinal section on TVUS and a honeycomb echotexture in transverse section. A novel technique is proposed to evaluate lesions that were previously considered unevaluable. When the sacral plexus is affected by endometriosis, patients may present with dysesthesia, paresthesia, and chronic pelvic pain radiating to the ipsilateral lower extremity; it may also

present as chronic pain radiating to the pudendal region or motor weakness in the ipsilateral lower extremities. On TVUS, nodules may appear unilateral, firm, nonuniform, hypoechogenic, with hyperechogenic areas, with internal shadows, irregular spiculated contours, poorly vascularized, and 2 cm or more in diameter [73]. Thus, the description and evaluation of this recently described compartment is an important part of the examination. No published studies have yet adopted a multicenter prospective design nor proposed a learning curve to achieve competency in the diagnosis of PE, acknowledging the need for further research in this new area.

The increase in knowledge in recent years offers hope for improved management of patients with suspected endometriosis who suffer not only from pelvic pain but also from infertility. In particular, some authors [74] found that the prevalence of endometrioma and DE in women with subfertility diagnosed by systematic approach proposed by the IDEA group [15] was 21.8% [74]. Identification of previously undiagnosed individuals with DE and endometriomas using a non-invasive imaging modality early in their care would allow appropriate referral to such a surgeon and potentially expedite management and optimization of reproductive outcomes for these patients [75]. However, Fitz et al. [75] suggest that patients whose endometriosis was diagnosed after the start of assisted reproductive technologies (ART) were more likely to start IVF later, to have only intrauterine insemination, to undergo more ART cycles, and were less likely to have a live birth. If ART outcomes differ between the ultrasound-positive and ultrasound-negative populations in this study, there may be a benefit to universal use of this type of ultrasound at the time of initial evaluation of women with subfertility. Inclusion of this type of systematic ultrasound could triage patients to appropriate treatment interventions prior to initiation of IVF. Ultrasound diagnosis can guide the course of treatment by avoiding unnecessary recourse to surgery prior to ART, which in some cases is very risky and does not really improve the chance of spontaneous pregnancy [14].

Conclusions and outlook

Despite the fact that endometriosis affects 5-10% of women of reproductive age worldwide (2), there is still a delay in diagnosis worldwide. Efforts have been made to reduce this gap, particularly with the increased use of imaging, especially transvaginal ultrasound, as a first-line diagnostic modality. Our understanding of deep endometriosis has evolved over the past decade. Advances in technology, equipment and research have allowed us to identify additional compartments involved, including the parametrium. While more research is needed to establish a standardized diagnostic approach, the progress made in recent years offers hope for earlier detection and improved management of patients with endometriosis.

Statements

This study conforms to the Helsinki Declaration. Ethics approval was not required due to the nature of the publication (review).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Concept: SG, JLA, MAP, MR, MP, SA; Writing - original draft: FHO, SG, FF; Review & editing: SG, FHO FF, SA; Figures: MP AB, FD, AP, AM, BP, CD, Table: MP AB, FD, AP, AM, BP, CD

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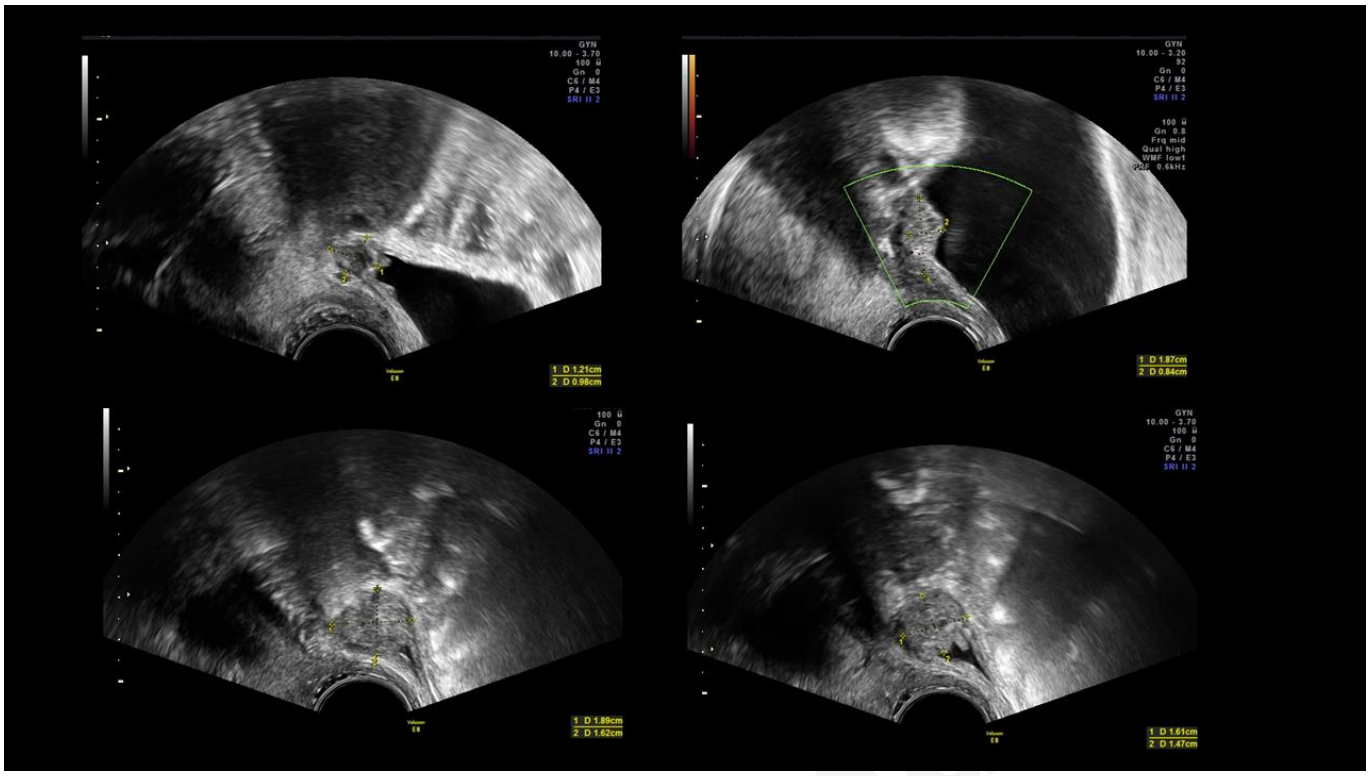
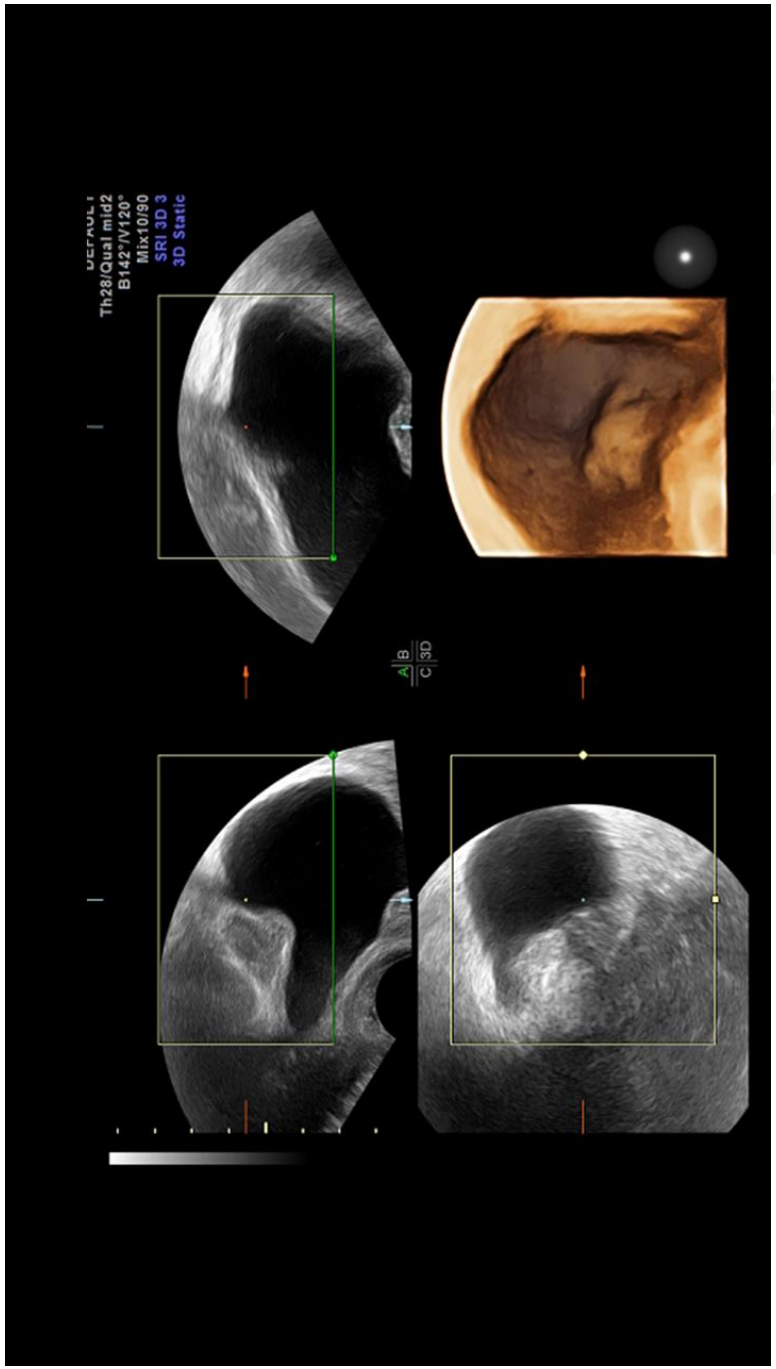
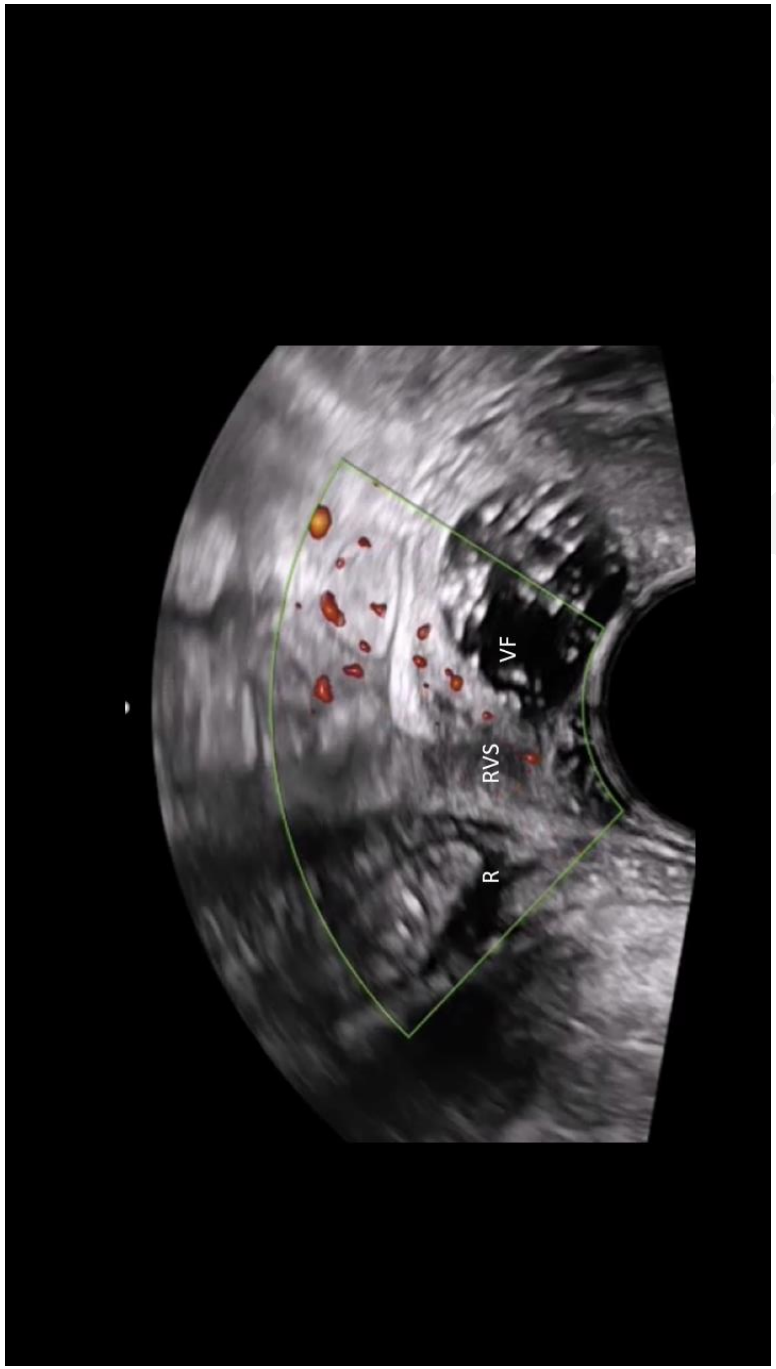
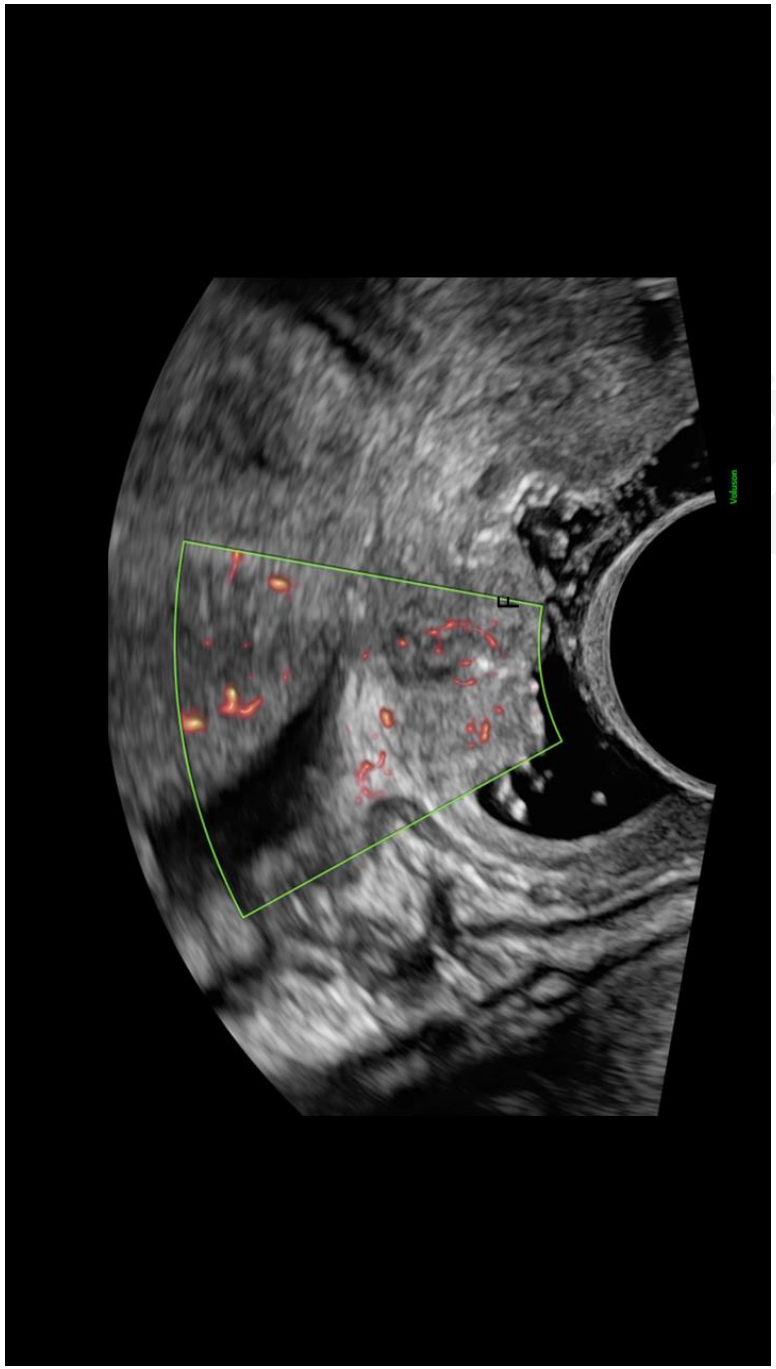
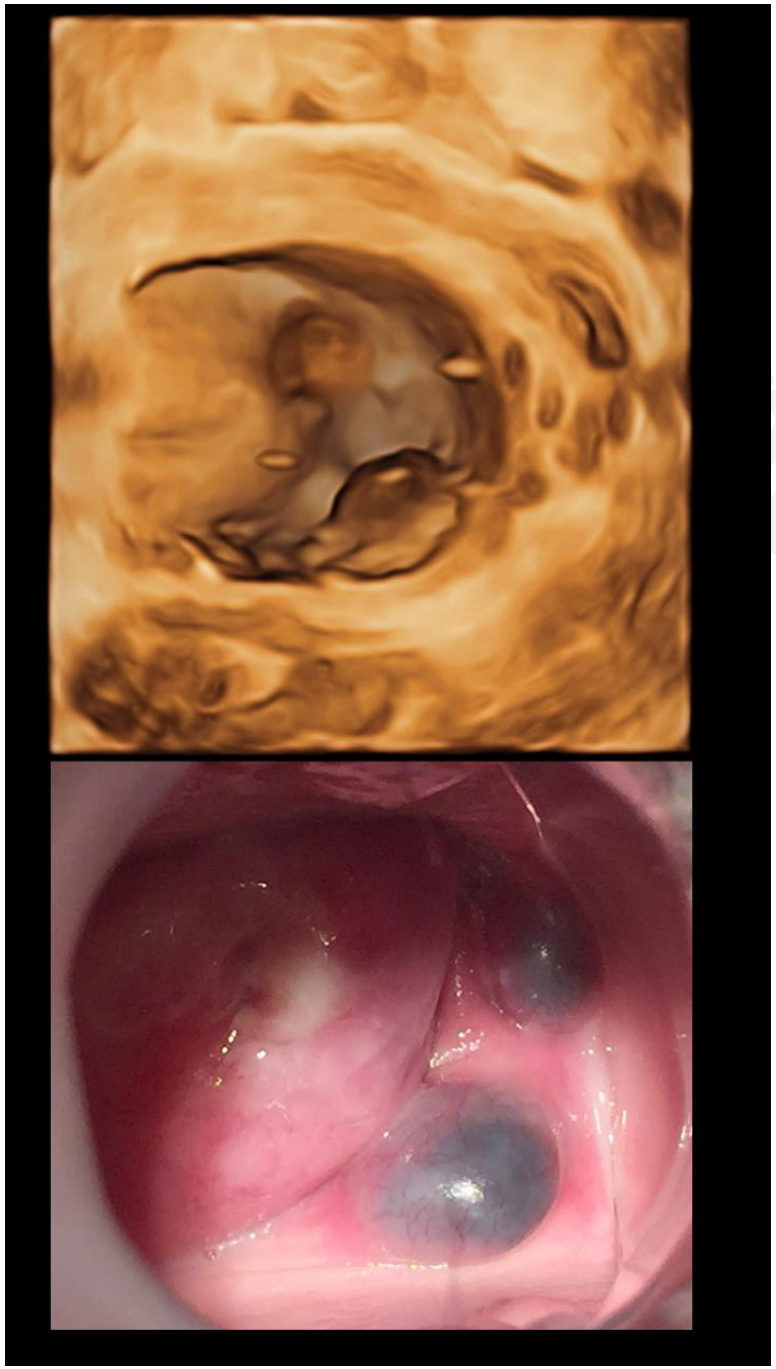
Legends of figures
Figure 1 Bladder lesions
Figure 2 Bladder lesions at three dimensional rendering
Figure 3 Rectovaginal lesion
Figure 4 Forniceal lesion
Figure 5 Forniceal lesion at three dimensional rendering
Figure 6 Uterosacral ligaments lesion
Figure 7 Another uterosacral ligaments lesion
Figure 8 Uterosacral ligaments lesion in a retroverted uterus
Figure 9 Normal rectosigmoid wall (A) and rectosigmoid lesion (B, arrows)
Figure 10 Rectosigmoid lesion
Figure 11 Rectosigmoid lesion at three dimensional rendering
Figure 12 wWter contrast evaluation of a rectosigmoid nodule
Figure 13 Three endometriotic lesions in the same plane: B, bowel endometriosis; U uterosacral endometriosis; F, forniceal endometriosis
Figure 14 Parametrial endometriosis with the typical star-shaped appearance
Figure 15 Three dimensional rendering of an ureteral occlusion due to the presence of a parametrial nodule

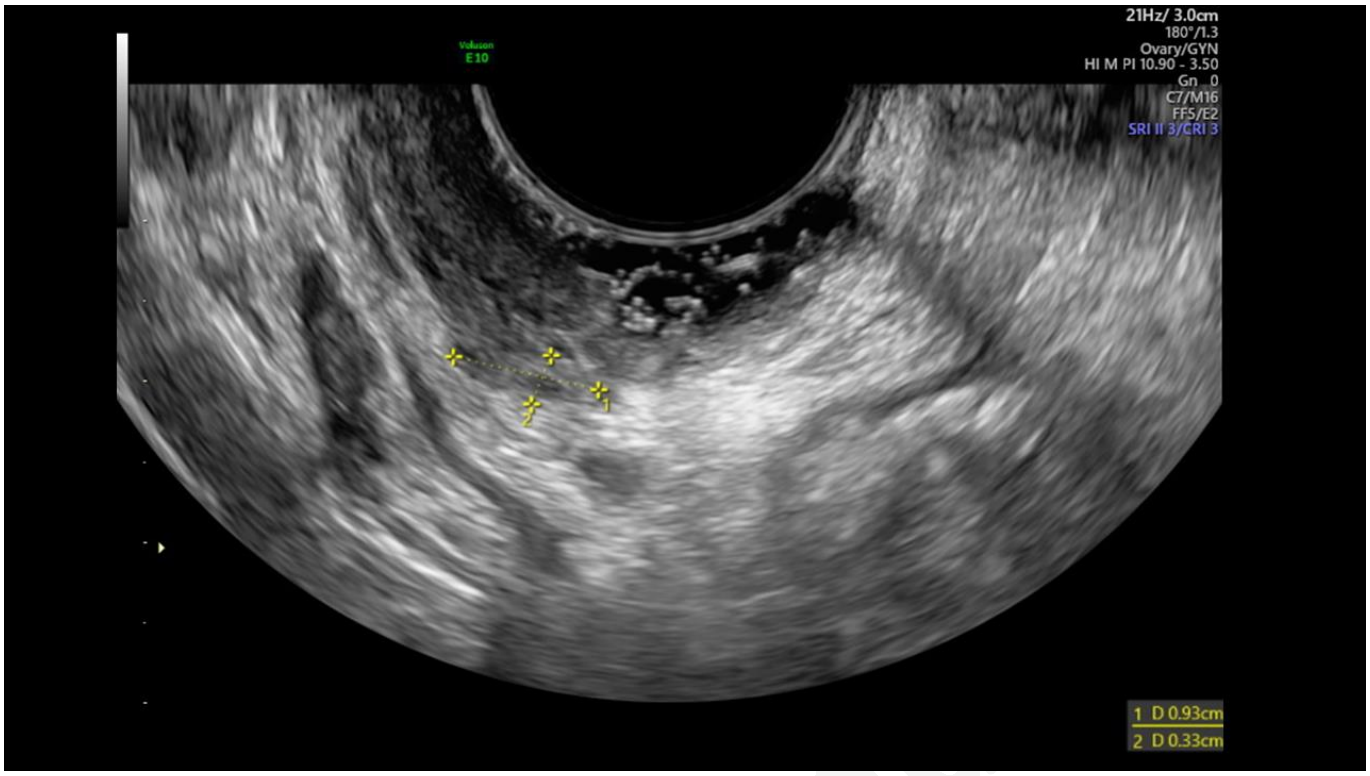


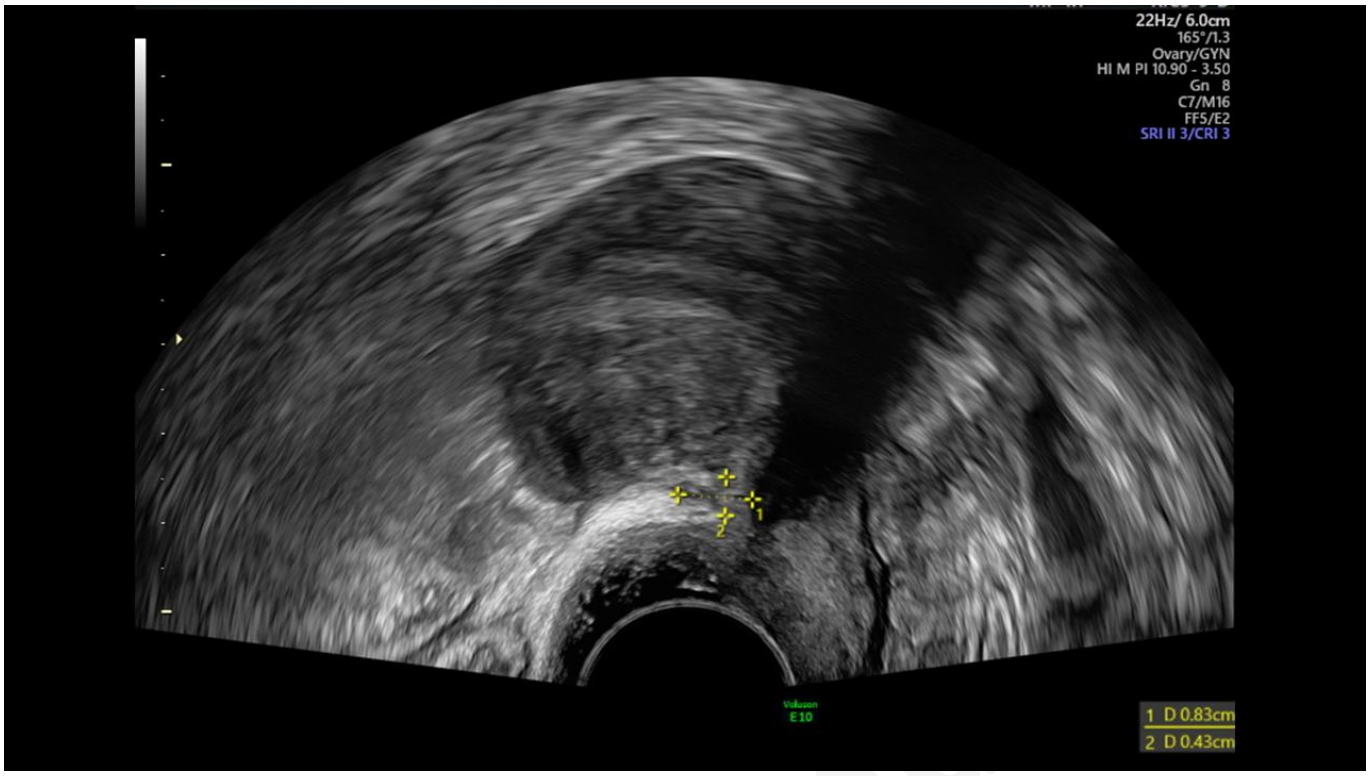


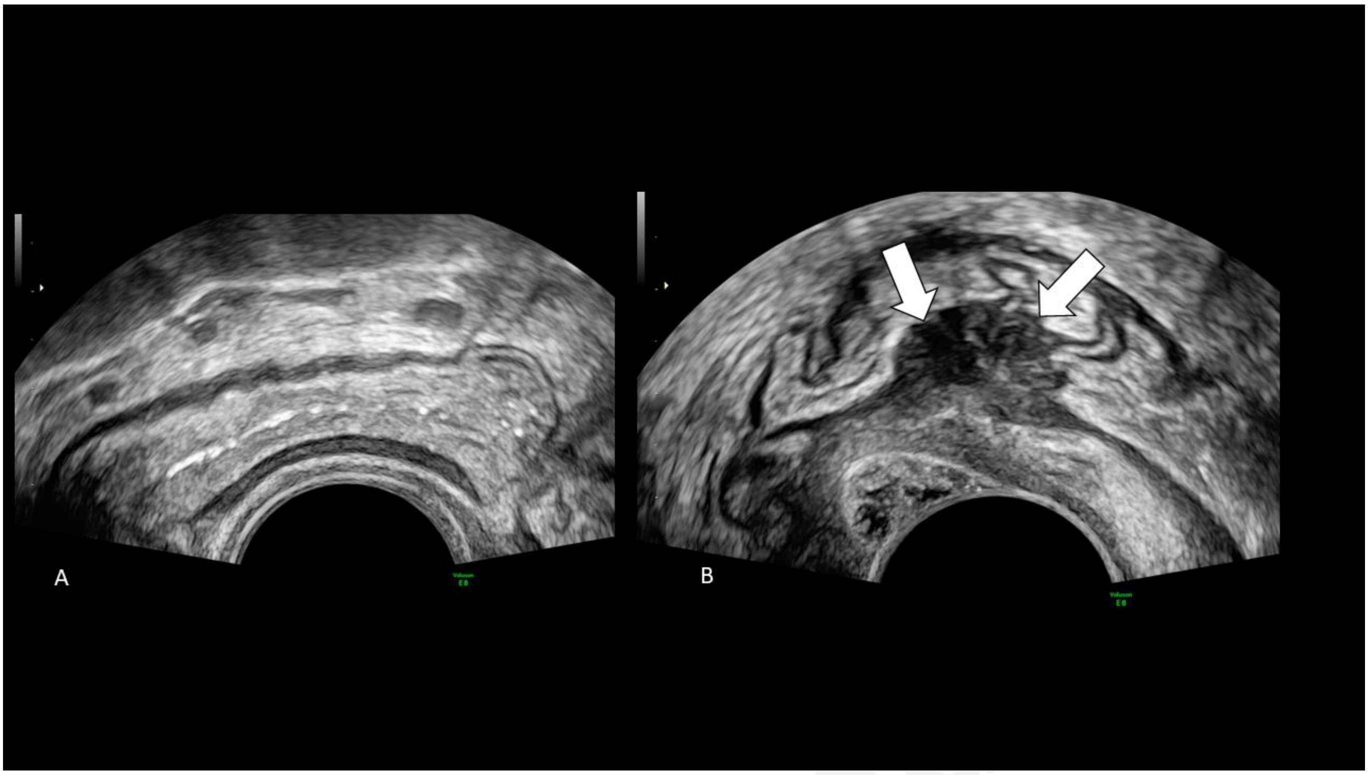


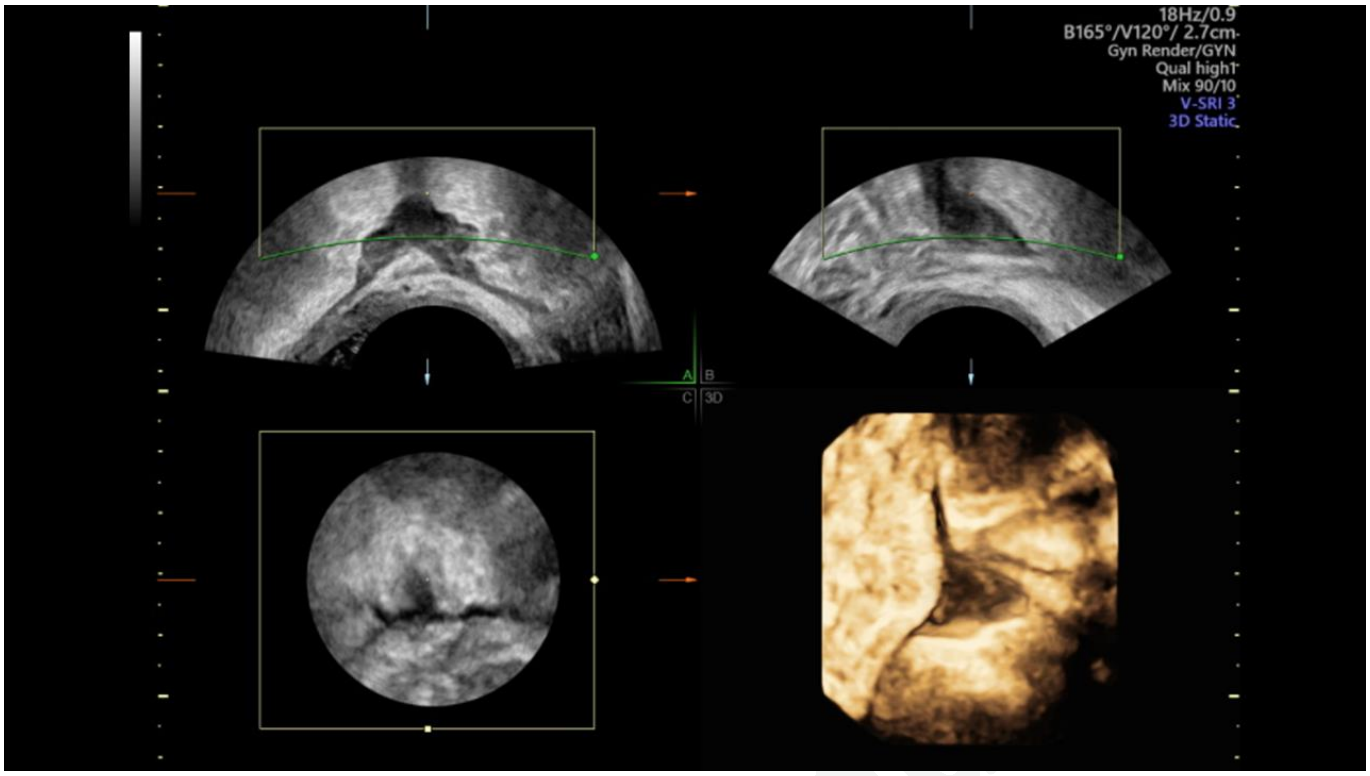


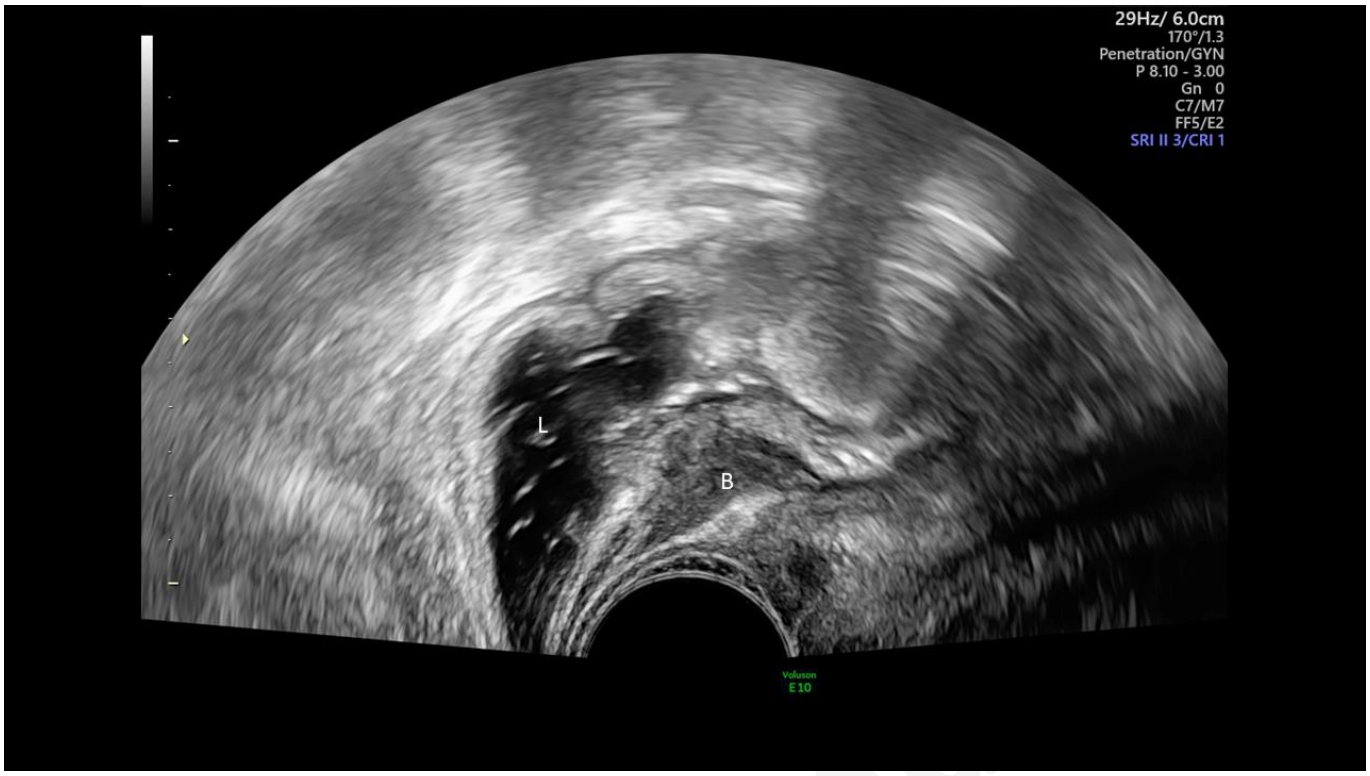


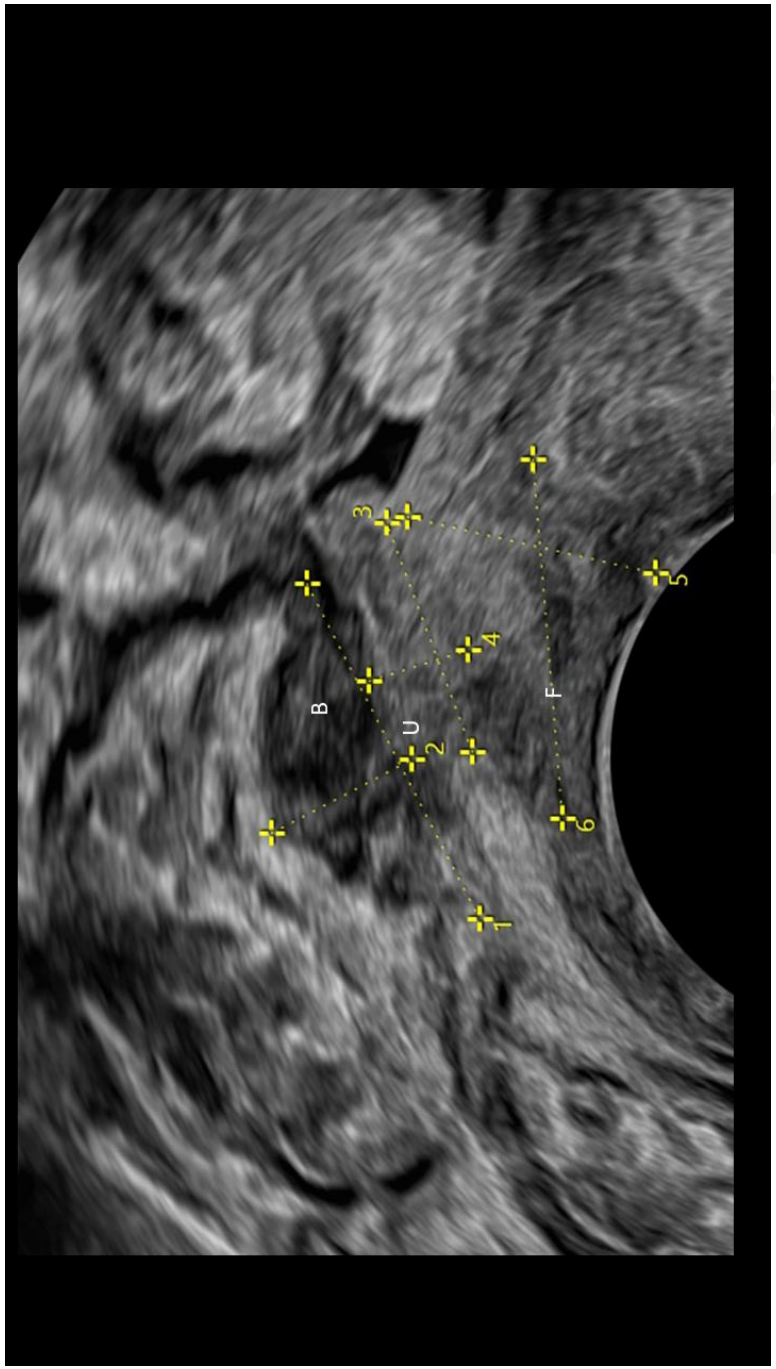


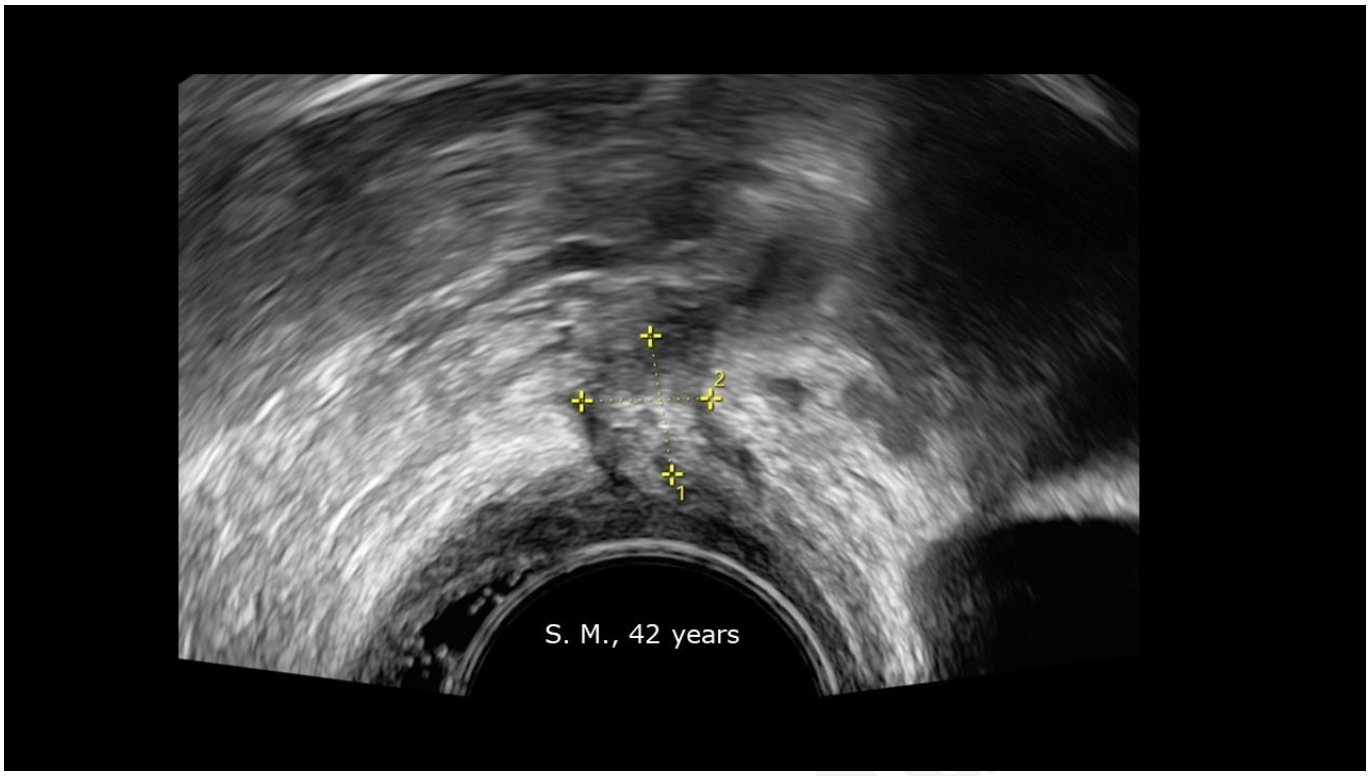












Authors	Types of study	Year of publication	US parametrial nodules findings	Anatomical landmark for us study lateral parametrium	n	Prevalence	Sensitivity	Specificity
Di Giovanni et al	Retrospective	2022	Lesion located lateral or dorsal to the retrocervical insertion of ULs	USL-lateral to retrocervical insertion of LUS	4983	34% (right) 41% (left)	97.9% (right) 98.9% (left)	98.4% (right) 99.2% (left)
Roditis et al	Retrospective	2024	Presence of echogenic tissue area extending laterally to the cervix or vagina associated or not with lateral dilatation	Lateral cervix area	178	32.6%	20.7%	97.1%
Garzon et al	Prospective	2024	Hypoechoic lesions altering the ligament's regular pattern, with no or scanty signs of vascularizzation at power Doppler	USL/paracervix area	476	24%	91%(right) 88% (left)	98% (right) 98% (left)
Barra et al	Prospective	2024	Midly hypoechoic lesion with a starry morphology infiltrating the retroperitoneal space irregular	Uterine vessels(medium ureter)	545	17%(right) 18.5 %(left)	77% (	99%
Moro et al	Prospective	2024	hypoechoic tissue with hyperechoic outer border, irregular margins but also fibrosis	ureter at the level of the crossing point with the uterine vessels (lateral parametrium)	164	39%(right) 40 %(left	62%(right) 69% (left)	79% (both right and left)

Table 1 Summary of the most recent published studies on sonographic diagnosis of parametrial endometriosis