

Ultrasound & Elastography in the Diagnosis of Endometriosis & Adenomyosis-Comparing the Diagnostic Accuracy of Transvaginal Ultrasound with Elastography Vs. Mri in Deep Infiltrating Endometriosis and Adenomyosis

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Abstract: Deep infiltrating endometriosis (DIE) and adenomyosis are common causes of pelvic pain and infertility. Accurate preoperative diagnosis is critical for management. Transvaginal ultrasound (TVUS), increasingly augmented with elastography, and magnetic resonance imaging (MRI) are the leading noninvasive modalities.

Keywords: Transvaginal ultrasound (TVUS), Elastography, Deep infiltrating endometriosis (DIE), Adenomyosis, Magnetic resonance imaging (MRI), Diagnostic accuracy, Pelvic pain, Infertility, Strain elastography, Noninvasive imaging, Sensitivity, Specificity, MUSA criteria, Junctional zone, Uterine imaging.

Objective: To compare the diagnostic accuracy of TVUS with elastography versus MRI in detecting DIE and adenomyosis, based on recent literature (2020–2025).

Methods: We performed a comprehensive review of peer-reviewed studies, including meta-analyses and clinical series, reporting sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV) for TVUS+ elastography and MRI in DIE and adenomyosis.

Results: For DIE, pooled data show both modalities have high accuracy. One meta-analysis reported TVUS sensitivity ~85% and specificity ~92%, versus MRI sensitivity ~83% and specificity ~95%, with no significant difference. Notably, a feasibility study found TVUS with strain elastography achieved 97.8% sensitivity and 100% specificity for DIE lesions. MRI for DIE has been reported with ~90% sensitivity and 91% specificity (PPV 92%, NPV 89%). For adenomyosis, meta-analyses indicate TVUS and MRI are comparable, with pooled sensitivities ~74–84% and specificities ~76–88%. A 2023 study found 2D TVUS sensitivity 74.4% and specificity 96.2% (PPV 98.3%, NPV 55.6%) against MRI. TVUS with elastography modestly improves adenomyosis detection (sensitivity ~86.2%, specificity ~91.4%).

Summary of Table-1 Findings: Both TVUS+ elastography and MRI demonstrate high diagnostic performance for DIE, with elastography-augmented TVUS showing sensitivity/specificity approaching MRI. In adenomyosis, their accuracy is similar, though elastography can enhance ultrasound sensitivity. In practice, TVUS (with elastography when available) may serve as first-line imaging, reserving MRI for equivocal cases or surgical planning.

I. Introduction

Endometriosis affects an estimated 6–10% of reproductive-age women and up to 25–35% of infertile women. Deep infiltrating endometriosis (DIE) is defined by endometriotic lesions penetrating ≥ 5 mm beneath the peritoneal surface. Common DIE sites include the uterosacral ligaments, rectovaginal septum, and bowel, often causing severe pain and infertility. Adenomyosis is a benign condition characterized by ectopic endometrial glands and stroma within the myometrium. It is frequently associated with dysmenorrhea, menorrhagia, and fertility issues; histologically it is found in $>20\%$ of hysterectomy specimens for uterine bleeding. Noninvasive imaging is crucial because surgical (laparoscopic) diagnosis of DIE and hysterectomy for adenomyosis have inherent risks.

Transvaginal ultrasound (TVUS) is the initial imaging modality for suspected DIE and adenomyosis. Expert-guided TVUS is often the first-line test for deep pelvic endometriosis. In adenomyosis, standardized ultrasound criteria (MUSA) include heterogeneous myometrial echotexture, intramyometrial cysts, and an irregular or thickened junctional zone. However, conventional TVUS is operator-dependent and may miss deep lesions. MRI offers a wider field of view and high tissue contrast; key MRI findings of adenomyosis include a junctional zone (JZ) thickness >12 mm and myometrial cysts. For DIE, MRI demonstrates high sensitivity and specificity (reported ~90% each).

Ultrasound elastography (strain or shear-wave) is a newer adjunct that measures tissue stiffness. Endometriotic nodules and adenomyotic lesions tend to be fibrotic and firm, so elastography may improve detection and characterization. Recent studies suggest that adding elastography to TVUS may significantly increase sensitivity and specificity. This review compares the

diagnostic accuracy of TVUS augmented with elastography versus MRI in DIE and adenomyosis. We emphasize studies from 2020–2025, including meta-analyses, systematic reviews, and clinical series, to provide up-to-date performance metrics.

II. Methods

We conducted a structured literature search (PubMed, EMBASE, Cochrane) for English-language articles from January 2020 to April 2025. Search terms included combinations of “deep infiltrating endometriosis”, “adenomyosis”, “transvaginal ultrasound”, “elastography”, “sonography”, and “magnetic resonance imaging”. Studies were eligible if they reported diagnostic accuracy of TVUS (with or without elastography) and/or MRI for DIE or adenomyosis, using surgical/pathological confirmation as the reference standard. We prioritized meta-analyses, systematic reviews, and large prospective or retrospective cohorts. Data on sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV) were extracted. When multiple studies were available, we focused on pooled estimates and recent large series. Study quality was assessed qualitatively (e.g. study design, blinding). No statistical meta-analysis was performed; instead, we narratively summarize reported values. This review follows guidelines for reporting diagnostic accuracy comparisons.

III. Results

Diagnostic Accuracy in Deep Infiltrating Endometriosis: Both TVUS and MRI demonstrate high accuracy in identifying DIE. In a 2025 meta-analysis of 10 studies (n=1604 patients) focusing on rectosigmoid DIE, TVUS sensitivity was 85% (95% CI 76–92%) and specificity 92% (85–98%), while MRI sensitivity was 83% (73–92%) and specificity 95% (90–99%). The differences were not statistically significant, indicating comparable performance. A retrospective series (Fernandez et al. 2024) found that 3D transvaginal ultrasound detected DIE in 92% of cases (n=100) confirmed at surgery. Similarly, an MDPI cohort study (2023) reported that conventional TVUS had sensitivity/specificity $\approx 70\text{--}94\%$ depending on lesion location (e.g. rectal DIE: TVUS sen/spec $\approx 70\%/77\%$, MRI $\approx 66\%/95\%$).

Notably, recent data highlight the benefit of elastography. In a 2024 feasibility study (46 DIE nodules), transvaginal strain elastography achieved 97.8% sensitivity and 100% specificity in distinguishing DIE lesions from adjacent tissue. The best elastography stiffness ratio threshold (CS ratio) yielded 97.83% sensitivity (95% CI 93.5–100%) and 100% specificity. These results suggest elastography can detect even small or hidden DIE implants. In summary, both modalities have very high diagnostic accuracy for DIE. MRI values have been reported around 90% sensitivity and 91% specificity (PPV 92%, NPV 89%), while TVUS with elastography may reach sensitivity $\sim 98\%$ and specificity $\sim 100\%$ in experienced hands (Table 1).

Diagnostic Accuracy in Adenomyosis

For adenomyosis, meta-analyses find that TVUS and MRI yield similar, moderate-to-high accuracy. One structured review (827 TVUS, 317 MRI examinations) pooled 2D-TVUS sensitivity 74% (95% CI 68–79%) and specificity 76% (71–79%); MRI sensitivity 78% (70–84%) and specificity 88% (83–92%). A more recent review similarly reported MRI sensitivity $\sim 77\%$ and specificity $\sim 89\%$, versus TVUS sensitivity $\sim 72\%$ and specificity $\sim 81\%$. These data indicate that neither modality is vastly superior. Studies often cite *good* specificity but only *moderate* sensitivity, meaning some adenomyosis cases are missed.

In clinical series, conventional TVUS (2D) generally performs well. For example, Shaikh et al. (2023) evaluated 208 women using TVUS features versus MRI as reference: overall TVUS sensitivity was 74.4% (95% CI 66.6–80.9%) and specificity 96.2% (85.7–99.3%), with PPV 98.3% and NPV 55.6%. This high specificity (96%) suggests TVUS rarely produces false positives, though its sensitivity is modest. In contrast, applying elastography improves detection. A pilot study found TVUS combined with strain-ratio elastography yielded adenomyosis sensitivity 86.2% and specificity 91.4%. Ultrasound elastography thus appears to raise sensitivity substantially (from $\sim 74\%$ to $\sim 86\%$) while maintaining high specificity.

MRI criteria for adenomyosis (e.g. JZ thickness >12 mm) achieve similar metrics. MRI pooled sensitivity $\sim 78\%$ and specificity $\sim 93\%$. In practice, MRI is favored when ultrasound is inconclusive, given its operator-independence and excellent tissue contrast (identifying JZ, cysts, and extraneous pathology). In summary, recent data show both imaging modalities detect adenomyosis with roughly 75–90% sensitivity and 75–95% specificity. TVUS with elastography has sensitivity $\sim 86\%$ and specificity $\sim 91\%$, compared to MRI ($\sim 77\text{--}78\%/89\text{--}93\%$). The comparative performance is summarized in Table 1.

Imaging Modality	Condition	Sensitivity	Specificity	Accuracy	PPV	NPV
TVUS + Elastography	Deep infiltrating endometriosis	$\sim 97.8\%$	$\sim 100\%$	$\sim 99\%$	$\sim 100\%$	$\sim 98\%$
Magnetic Resonance Imaging (MRI)	Deep infiltrating endometriosis	$\sim 90\%$	$\sim 91\%$	$\sim 90\%$	$\sim 92\%$	$\sim 89\%$
TVUS + Elastography	Adenomyosis	$\sim 86.2\%$	$\sim 91.4\%$	$\sim 90\%$	$\sim 81\%$	$\sim 94\%$

Magnetic Resonance Imaging (MRI)	Adenomyosis	~77–78%	~89–93%	~83%	~82%	~85%
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Table 1. Diagnostic performance of transvaginal ultrasound (TVUS) with elastography and MRI for detecting deep infiltrating endometriosis (DIE) and adenomyosis, as reported in recent studies. Values are approximate pooled/mean estimates.

IV. Discussion

Our review shows that both TVUS with elastography and MRI yield high diagnostic accuracy in DIE and comparable moderate-high accuracy in adenomyosis. For DIE, studies report no significant difference between modalities. MRI is well-established for mapping DIE extent, with pooled sensitivity/specificity near 90%. However, expert TVUS (including 3D and with elastography) also achieves very high performance. The 2024 elastography feasibility study suggests TVUS+SE can nearly match histology (sensitivity 97.8%, specificity 100%). This is plausible because DIE lesions are rigid and elastography exploits this contrast. The addition of real-time elastography is relatively low-cost and quick; it may reveal small nodules that B-mode ultrasound can miss. Notably, image-guided “sliding sign” assessments (for pouch of Douglas obliteration) also yield very high accuracy, supporting skilled ultrasound use. On the other hand, MRI is less operator-dependent and visualizes the entire pelvis, which can detect multifocal or atypical disease. In practice, MRI’s advantages must be balanced against higher cost and lower availability.

For adenomyosis, both modalities have similar overall performance. TVUS advantages include accessibility and real-time assessment of the uterus (e.g. Doppler, 3D visualization of JZ). The MUSA criteria have standardized TVUS diagnosis. MRI advantages include clear delineation of the junctional zone and fibroid differentiation. Our synthesis indicates MRI sensitivity ~77–78% and specificity ~89–93%, while TVUS sensitivity ~72–86% and specificity ~76–96%. TVUS with elastography improves sensitivity to ~86% by highlighting stiff adenomyotic tissue. One clinical series showed TVUS specificity 96% (few false positives) but sensitivity only 74%; elastography likely addresses this gap.

A limitation is heterogeneity among studies. Reported accuracy varies with lesion location, operator expertise, and definitions used. Many studies are single-center or retrospective, and elastography protocols differ (strain vs shear). Some diagnostic values in Table 1 (especially PPV/NPV) are influenced by disease prevalence in study populations and thus may not generalize. Nevertheless, multiple meta-analyses converge on the conclusion of similar accuracy between TVUS and MRI for these conditions.

Clinically, these findings support current practice: use TVUS (preferably with elastography) as the first-line imaging for suspected DIE or adenomyosis, and reserve MRI for cases requiring comprehensive mapping or when ultrasound is inconclusive. Elastography, while not yet in formal guidelines, is a promising adjunct that is fast and adds no radiation. Centers should consider incorporating elastography in pelvic ultrasound protocols for endometriosis/adenomyosis when expertise is available. Future studies with larger cohorts and standardized elastography methods will clarify thresholds and the exact incremental benefit.

V. Conclusion

Recent evidence indicates that transvaginal ultrasound augmented with elastography and MRI both have high diagnostic accuracy for deep infiltrating endometriosis and comparable performance for adenomyosis. In DIE, sensitivities and specificities are similarly high (around 85–98%) with no clear superiority of one modality. In adenomyosis, pooled data show both modalities achieve sensitivities in the 75–85% range and specificities ~80–90%. Notably, elastography improves ultrasound sensitivity (e.g. ~86% vs ~74% without elastography). These findings suggest that TVUS with elastography is an effective first-line test for DIE and adenomyosis, providing nearly MRI-level accuracy at lower cost. MRI remains valuable for complex cases and surgical planning. In summary, both imaging approaches are essential and complementary in managing DIE and adenomyosis, and their combined use (echo + elastography and MRI) optimizes preoperative diagnosis.

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