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ULTRASONOGRAPHY IN THE DIAGNOSIS OF ADENOMYOSIS: AN INTEGRATIVE REVIEW

ARIELA MAULLER VIEIRA PARENTE[1], WALDEMAR NAVES DO AMARAL[2], JUAREZ ANTÔNIO DE SOUSA[2], IZADORA CAIADO OLIVEIRA[3], FERNANDA HEIRICH PISTORI[3], GEOVANA ALMEIDA SPIES[3], JOÃO FLORENTINO DE SÁ TELLES[3], AMANDA VIEIRA PARENTE[4].

1. Grupo Fertile, Goiânia, Goiás, Brazil.
2. Departamento de Ginecologia e Obstetrícia da Faculdade de Medicina da Universidade Federal de Goiás - UFG, Goiânia, Brazil.
3. Faculdade de Medicina, Universidade Federal de Goiás, Goiânia, Goiás, Brazil.
4. Faculdade Alfredo Nasser – UNIFAN, Goiânia, Goiás, Brazil.

ABSTRACT

Adenomyosis presents a diagnostic challenge in gynecological practice due to its nonspecific symptoms, such as dysmenorrhea and abnormal uterine bleeding, which overlap with various other uterine pathologies. For many years, definitive diagnosis was only possible through hysterectomy, limiting early detection and conservative treatment strategies. With advances in imaging techniques, there is a growing need to evaluate non-invasive, effective, and accessible diagnostic tools.

This integrative review explores the role of ultrasonography—particularly transvaginal ultrasound (TVUS)—as the primary screening and diagnostic modality for adenomyosis. TVUS demonstrates good sensitivity and specificity, being capable of identifying features such as a heterogeneous myometrium, myometrial cysts, hypoechoic striations, and alterations in the junctional zone (JZ). The use of three-dimensional TVUS improves visualization of the JZ, although it does not significantly enhance diagnostic accuracy compared to the two-dimensional mode.

The review also addresses the utility of color Doppler and elastography in differentiating adenomyosis from leiomyomas, as well as the potential of contrast-enhanced ultrasound, which remains under investigation. Despite its diagnostic efficacy, TVUS is operator-dependent, and in inconclusive cases, magnetic resonance imaging (MRI) should be used as a complementary method.

In conclusion, this article emphasizes that ultrasonography, when properly performed, is a fundamental diagnostic tool for the early detection of adenomyosis, enabling less invasive and more personalized treatment approaches for patients.

Keywords: Adenomyosis, Diagnostic imaging, Review, Ultrasonography, Doppler ultrasonography.

INTRODUCTION

Adenomyosis is a gynecological condition characterized by the presence of endometrial glands and stroma within the myometrium, often associated with symptoms such as dysmenorrhea, abnormal uterine bleeding, and, in some cases, infertility. Historically, the diagnosis of adenomyosis

was made exclusively through histopathological examination following hysterectomy, which significantly limited the early clinical recognition of the disease.[1]

With advances in imaging technologies—especially ultrasonography—it has become possible to identify suggestive features of adenomyosis in a non-invasive manner. Pelvic ultrasonography has become the first-line imaging exam when clinical signs point to the disease.[1,2] In this context, it is essential to understand the role of ultrasonography in its different modalities, its characteristic findings, limitations, and the recent advances that contribute to a more accurate diagnosis.

OBJECTIVE

To analyze, through an integrative review, the role of ultrasonography in the diagnosis of adenomyosis, considering the available imaging modalities, the main ultrasound findings, the clinical impact, and the challenges in differentiating it from other gynecological pathologies.

METHODOLOGY

This integrative review aimed to analyze the role of ultrasonography in the diagnosis of adenomyosis, with an emphasis on the different modalities used, the main ultrasound findings, and the clinical applicability of the technique. Studies published between 2005 and 2025 were considered, in Portuguese, English, and Spanish, that addressed ultrasonography as an imaging method in the evaluation of adenomyosis.

The search was conducted in the PubMed, Scopus, Google Scholar, and LILACS databases using the following descriptors combined with Boolean operators: "adenomyosis," "transvaginal ultrasonography," "transabdominal ultrasonography," "diagnostic imaging," "three-dimensional ultrasonography," and "elastography."

Articles discussing the use of ultrasonography in the diagnosis, differentiation, and clinical monitoring of adenomyosis were included, encompassing clinical studies, systematic reviews, consensus statements, and guidelines. Studies addressing other gynecological pathologies without a direct relationship to adenomyosis, as well as experimental research in non-human populations, were excluded.

The analysis was conducted with a focus on the characteristics and limitations of transabdominal and transvaginal ultrasonography; the characteristic ultrasound signs of adenomyosis; the contributions of color Doppler and elastography in differentiating it from other uterine pathologies; and the potential advancements with three-dimensional and contrast-enhanced ultrasonography. The selection and interpretation of the studies were carried out qualitatively, prioritizing the clinical relevance of the findings and their applicability in the context of imaging diagnosis of adenomyosis.

RESULTS

Transabdominal Ultrasonography (TAUS)

TAUS has low sensitivity (around 30%) and high specificity (>95%) in the diagnosis of adenomyosis.[3,4] Although limited in resolution, it can be useful in cases of an enlarged uterus or when the vaginal route cannot be used[3]. Ultrasound findings include increased uterine volume, regular (possibly asymmetric) outer contour, myometrial heterogeneity, and intramyometrial cystic images.[2,4,5] However, TAUS does not allow differentiation between the different types of adenomyosis.

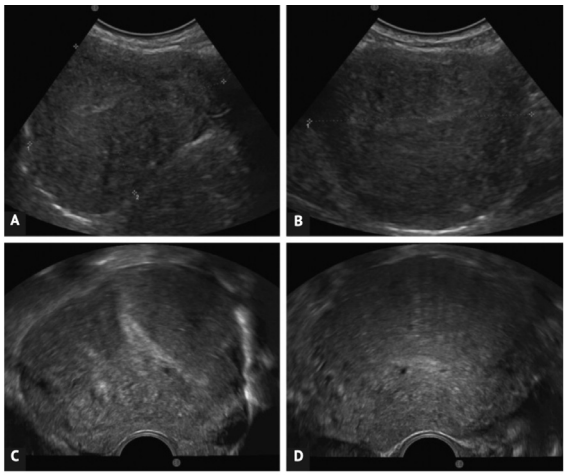

FIGURE 1. A and B. Comparison using TAUS, showing a globular uterus. C and D. 2D TVUS, showing subendometrial microcysts, heterogeneous myometrium, hyperechoic linear striations in the myometrium, and asymmetry of the myometrial walls.[2]

Transvaginal Ultrasonography (TVUS)

TVUS is the method of choice for investigating adenomyosis due to its accessibility, non-invasiveness, low cost, and high accuracy, especially when performed by experienced professionals[6,7]. It has a sensitivity of 83.8% and a specificity of 63.9%[7]. Studies indicate that, in cases of increased uterine bleeding with positive TVUS findings, the probability of adenomyosis is 68.1%; with a normal TVUS, the likelihood drops to 10%[8].

Among the characteristic ultrasound signs are:

- Myometrial heterogeneity;[3,9] (Figure 2)
- Radiating striations originating from the endometrium[3]; (Figure 3)
- Anechoic lacunae and myometrial cysts measuring 1–7 mm (high specificity);[3,9] (Figure 4)
- Increased or decreased echogenicity;[3]
- Combinations such as myometrial cysts with hypoechoic striations show 90% sensitivity and 100% specificity[3]. (Figure 5)

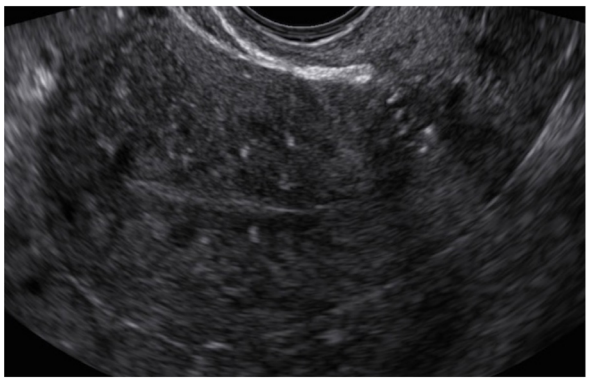

FIGURE 2. Heterogeneous myometrium on TVUS.[10]

FIGURE 3. Hypoechoic myometrial striations on TVUS.[10]

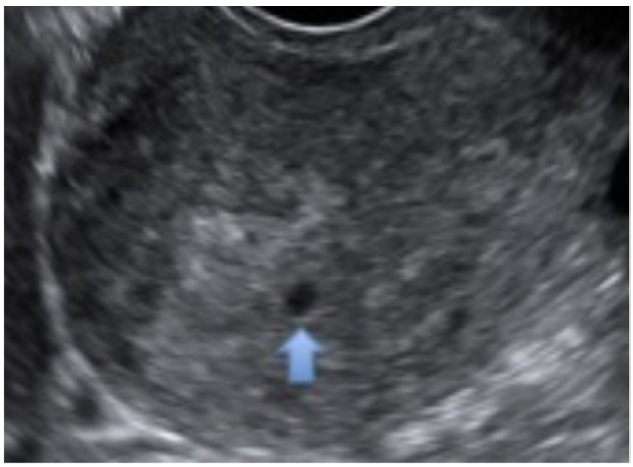

FIGURE 4. Myometrial cyst (arrow) and irregular endometrial–myometrial junction on TVUS.[10]

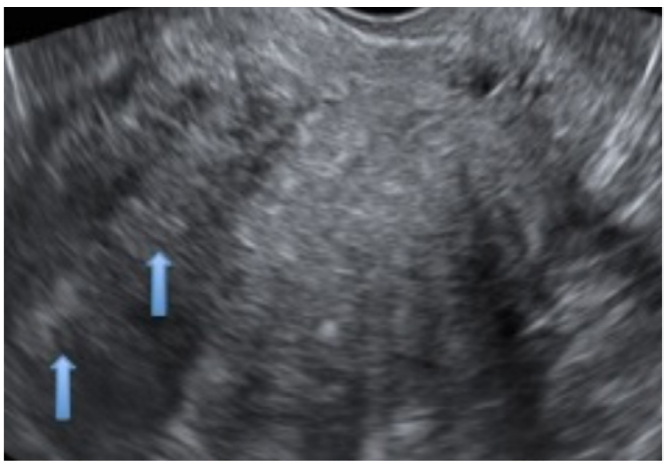

FIGURE 5. Hyperechoic myometrial islands (arrows), hypoechoic myometrial striations, and indistinct endometrial–myometrial junction on TVUS.[10]

For diagnosis, the presence of three or more of these findings is recommended.[10,11]

Three-Dimensional Transvaginal Ultrasonography (3D-TVUS)

3D-TVUS allows for better assessment of the junctional zone (JZ), especially in coronal planes. High-sensitivity findings include distortion and infiltration of the JZ, thickening >8 mm, a difference >4 mm in JZ thickness, and hypoechoic myometrial striations[4,9,11,12]. Despite its anatomical superiority, no significant improvement in overall diagnostic accuracy has been observed compared to the two-dimensional mode[11,13]. (Table 1)

TABLE 1. Main ultrasound findings in adenomyosis. Sensitivity (Se), specificity (Sp), negative predictive value (NPV), and positive predictive value (PPV).[12]

ULTRASOUND CRITERIA	SE (%)	SP (%)	VPN (%)	PPV(%)
Subendometrial cyst	53	83	81	55
Predominantly hypoechoic myometrial echotexture	60	82	83	58
Predominantly heterogeneous myometrial echotexture	35	76	74	38
Subendometrial linear striations	37	92	78	67
Poorly defined endometrial–myometrial junction	45	83	78	53
Nodule at the endometrial–myometrial junction	53	83	83	83
Subendometrial echogenic nodules	32	96	77	76
Asymmetric myometrium	23	94	75	67
Globular uterus	43	79	77	46

Differential Diagnosis: Leiomyomas vs. Adenomyosis

Differentiating between leiomyomas and adenomyosis is challenging, as both conditions can cause a globular or asymmetric uterus.[2] Leiomyomas typically present with well-defined margins, a rounded shape, mass effect, and possible acoustic shadowing. On color Doppler, they show peripheral vascularization. In contrast, adenomyosis is characterized by poorly defined margins, absence of a mass effect, and multiple attenuation foci, with a translesional vascular pattern that crosses the hypertrophied myometrium.[2,11]

The concomitant presence of fibroids can reduce the sensitivity of TVUS to around 30%, reinforcing the importance of clinical correlation and the complementary use of magnetic resonance imaging when necessary[6]. (Figure 6)

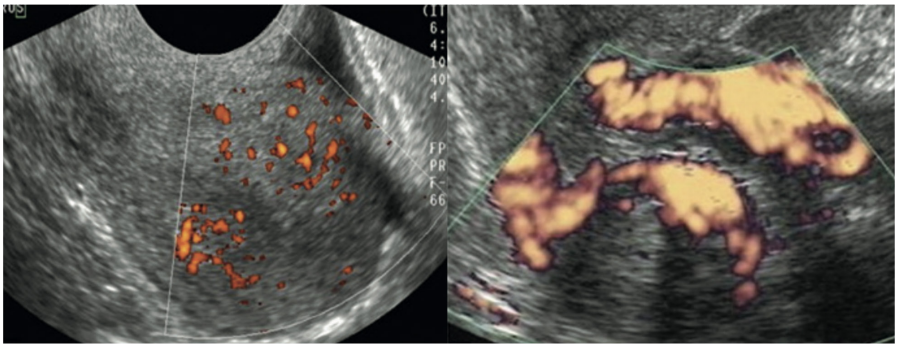

FIGURE 6. Differences in vascularization in adenomyosis and leiomyoma, shown on TVUS with Power Doppler. A. Vascularization crossing the hypertrophied myometrium in diffuse adenomyosis. B. Peripheral vascular projections in leiomyoma.[2]

Technical Advances: Elastography and Contrast-Enhanced Ultrasonography

Elastography, which measures tissue stiffness through gentle compression, has shown promise in distinguishing between adenomyosis and leiomyomas due to the difference in tension generated between the tissues[5]. Studies have already demonstrated improved specificity of TVUS elastography compared to two-dimensional ultrasonography[13],[14].

Moreover, there is evidence that adenomyotic tissue presents angiogenesis and vascular alterations compared to normal myometrium[15], suggesting a potential future role for contrast-enhanced ultrasonography in the diagnosis of adenomyosis. However, no clinical reports have been published to date.[16]

CONCLUSION

Ultrasonography—especially transvaginal ultrasonography—is currently the main imaging method for the non-invasive diagnosis of adenomyosis. The identification of specific ultrasound signs—particularly when three or more are present—allows for an effective and accessible diagnostic approach. Technologies such as Doppler, elastography, and 3D-TVUS provide additional support in differentiating adenomyosis from other pathologies, such as leiomyomas, although ultrasonography remains highly operator-dependent.

In inconclusive or difficult-to-interpret cases, magnetic resonance imaging remains the recommended complementary examination. The continuous advancement of ultrasound techniques, combined with the training of professionals, has the potential to further optimize the diagnosis of adenomyosis and improve clinical management for patients.

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MAILING ADDRESS

JUAREZ ANTÔNIO DE SOUSA
Departamento de Ginecologia e Obstetrícia, Faculdade de Medicina,
Universidade Federal de Goiás, 5ª Avenida, Goiânia - GO, Brasil.
E-mail: juarez_antonio@ufg.br

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Authors:
Ariela Mauller Vieira Parente - http://lattes.cnpq.br/0780896170758778 - https://orcid.org/0000-0001-8353-833X

Waldemar Naves do Amaral - http://lattes.cnpq.br/4092560599116579 - https://orcid.org/0000-0002-0824-1138

Juarez Antônio De Sousa - http://lattes.cnpq.br/4484429936026476 - https://orcid.org/0000-0001-5986-7926

Izadora Caiado Oliveira - http://lattes.cnpq.br/3881728533555375 - https://orcid.org/0000-0001-8597-8347

Fernanda Heirich Pistori - http://lattes.cnpq.br/1184510754601913 - https://orcid.org/0000-0003-4963-2677

Geovana Almeida Spies - http://lattes.cnpq.br/3263505670593756 - https://orcid.org/0009-0002-3644-5039

João Florentino de Sá Telles - http://lattes.cnpq.br/2250967216299048 - https://orcid.org/0009-0005-8684-4558

Amanda Vieira Parente - http://lattes.cnpq.br/8284453419124489 - https://orcid.org/0009-0009-8266-740X

Library Review: Izabella Goulart
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