

Comparative Morphological Characteristics Of Uterine Diseases Identified By Ultrasound Examination

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ABSTRACT

This article presents a comparative analysis of the morphological characteristics of uterine diseases identified through ultrasound examination and evaluates their clinical relevance and diagnostic value. The study includes a range of uterine pathologies such as fibroids (leiomyomas), adenomyosis, endometritis, and other structural abnormalities observed in patients of varying reproductive ages. Ultrasound (US) remains one of the most effective, non-invasive, and accessible diagnostic tools in gynecology. Its high sensitivity allows for the early detection of changes in uterine structure, even in asymptomatic patients. In this study, the echo graphic features of various uterine diseases were compared with their corresponding histopathological (morphological) findings obtained through biopsy, curettage, or surgical specimens. The specific ultrasound criteria and patterns for each pathology were described in detail to aid in differential diagnosis.

For example, uterine fibroids were characterized by well-defined, hypoechoic masses with a homogeneous or heterogeneous internal structure, while adenomyosis typically showed a diffusely enlarged uterus with myometrial cysts and indistinct endometrial-myometrial borders. Endometritis was associated with an irregular endometrial lining and increased vascularity on Doppler imaging.

The results of the study demonstrate that when ultrasound data are interpreted in conjunction with morphological analysis, the accuracy of diagnosis significantly improves. This integrated approach enhances clinical decision-making, enabling timely and appropriate treatment interventions. The paper concludes that sonographic examination, combined with histological assessment, remains essential for the comprehensive evaluation of uterine diseases.

Keywords: Ultrasound examination, Uterine diseases, Morphology, Fibroids (Leiomyoma), Adenomyosis, Endometritis, Echography, Histopathology, Diagnosis, Reproductive health

1. INTRODUCTION

Ultrasonography has become an indispensable tool in the diagnosis and management of uterine diseases, offering a non-invasive, cost-effective, and widely accessible means of evaluating the female reproductive system. Among the various uterine pathologies, uterine fibroids, adenomyosis, and endometrial disorders are prevalent conditions that pose significant clinical challenges. Understanding the morphological characteristics of these diseases as visualized through ultrasound imaging is crucial for accurate diagnosis and appropriate treatment planning.

Uterine Fibroids

Uterine fibroids, or leiomyomas, are benign smooth muscle tumors of the uterus and are among the most common gynecological conditions affecting women of reproductive age. They are typically well-circumscribed, solid masses that can vary in size and number, often presenting with symptoms such as heavy menstrual bleeding, pelvic pain, and reproductive dysfunction. Ultrasonographic examination reveals hypoechoic masses with well-defined borders, often exhibiting a whorled pattern on histological analysis. The presence of calcifications and cystic changes within fibroids can also be identified, providing additional diagnostic information.

Adenomyosis

Adenomyosis is a condition characterized by the presence of endometrial tissue within the myometrium, leading to uterine enlargement and symptoms such as dysmenorrhea and menorrhagia. Ultrasound findings indicative of adenomyosis include a globularly enlarged uterus, asymmetrical myometrial thickening, and the presence of myometrial cysts. The junctional zone, which separates the endometrium from the myometrium, may appear irregular or interrupted. Additionally, the use of Doppler imaging can reveal increased vascularity within the affected areas. Three-dimensional ultrasound imaging has further enhanced the ability to assess the extent and distribution of adenomyotic lesions.

Endometrial Disorders

Endometrial disorders encompass a range of conditions, including endometrial polyps, hyperplasia, and carcinoma. Ultrasonography plays a pivotal role in the detection and evaluation of these conditions. Endometrial polyps typically appear as localized, echogenic masses within the endometrial cavity and may be sessile or pedunculated. Endometrial hyperplasia is characterized by an increased endometrial thickness, which can be assessed through transvaginal ultrasound measurements. While ultrasound can suggest the presence of endometrial carcinoma, definitive diagnosis often requires histopathological examination following biopsy.

Comparative Analysis

The comparative analysis of the morphological characteristics of uterine diseases as identified by ultrasound examination is essential for differentiating between various pathologies and guiding clinical decision-making. While fibroids present as well-defined, hypoechoic masses, adenomyosis is characterized by diffuse myometrial involvement with associated cystic changes and irregularities in the junctional zone. Endometrial disorders, depending on the specific condition, can manifest as localized masses or generalized thickening of the endometrium. Understanding these distinct ultrasonographic features allows for accurate diagnosis and appropriate management of uterine diseases.

Ultrasonography serves as a cornerstone in the evaluation of uterine diseases, providing detailed morphological insights that are crucial for diagnosis and treatment planning. The ability to distinguish between different uterine pathologies based on their ultrasonographic characteristics enhances clinical outcomes and patient care. Ongoing advancements in ultrasound technology and imaging techniques continue to improve the accuracy and efficacy of uterine disease diagnosis.

2. MATERIALS AND METHODS

Study Design

This study was designed as a prospective, observational, and comparative analysis aimed at evaluating the morphological characteristics of various uterine diseases diagnosed through ultrasound examination. The investigation took place at a tertiary care hospital with a specialized department in obstetrics and gynecology. The duration of the study spanned over 18 months, from January 2023 to June 2024.

Study Population

The study population included 150 women aged between 18 and 60 years who presented with various gynecological complaints, including but not limited to abnormal uterine bleeding (AUB), pelvic pain, menstrual irregularities, and infertility. Patients were referred for ultrasound evaluation as part of their routine diagnostic workup.

Inclusion criteria:

Female patients aged 18–60 years

Presenting with gynecological symptoms suggestive of uterine pathology

Underwent transvaginal or transabdominal ultrasound followed by histopathological confirmation (if applicable)

Provided informed written consent

Exclusion criteria:

Pregnant women

Patients with known pelvic malignancies under treatment

History of recent pelvic surgery (within last 3 months)

Refusal to consent

Ultrasound Examination

All ultrasound examinations were conducted using a high-resolution ultrasound machine equipped with both transabdominal (3.5–5 MHz) and transvaginal (5–9 MHz) probes. The choice of probe was determined by the clinical context, patient comfort, and the anatomical location of suspected pathology.

Each patient underwent:

A **transabdominal pelvic scan** with a full bladder for general pelvic assessment

A **transvaginal ultrasound** for detailed uterine morphology, where appropriate and accepted by the patient

The scans were performed by experienced sonographers and radiologists trained in gynecologic ultrasonography. Each examination focused on identifying:

Uterine size and contour

Endometrial thickness and echotexture

Myometrial texture

Presence, size, and location of focal lesions (fibroids, polyps)

Junctional zone appearance

Color Doppler evaluation for vascularity

Ultrasound-Based Diagnosis

The following uterine conditions were evaluated based on their typical sonographic features:

Uterine Fibroids (Leiomyomas):

Well-circumscribed, hypoechoic or heterogeneous masses

May be submucosal, intramural, or subserosal

Possible calcifications or cystic degeneration

Posterior acoustic shadowing

Adenomyosis:

Diffuse or focal thickening of the myometrium

Myometrial cysts (anechoic areas within myometrium)

Heterogeneous myometrial echotexture

Poorly defined endometrial–myometrial junction

"Venetian blind" shadowing pattern

Endometrial Polyps:

Focal echogenic mass within endometrial cavity

Attached by a stalk, may be mobile

Enhanced vascular pattern on color Doppler

3. ENDOMETRIAL HYPERPLASIA AND CARCINOMA

Thickened endometrium (>14 mm in postmenopausal or >20 mm in reproductive-age women)

Irregular endometrial contour

Heterogeneous echotexture with possible cystic areas

Increased vascularity or irregular blood flow patterns

All cases suspected of pathology based on ultrasound were followed by confirmatory diagnostic procedures, including **endometrial biopsy, dilatation and curettage (D&C)**, or **surgical specimen analysis** (e.g., myomectomy or hysterectomy).

Histopathological Evaluation

Tissue samples obtained from the uterus were subjected to histopathological examination by experienced pathologists. The specimens were stained with hematoxylin and eosin (H&E) and analyzed for confirmation of:

Cellular architecture

Degree of glandular proliferation (in hyperplasia)

Smooth muscle versus fibrous content (in fibroids)

Presence of ectopic endometrial glands (in adenomyosis)

Malignant transformation or dysplasia (in carcinoma cases)

Histopathological diagnosis was considered the gold standard against which ultrasound findings were compared.

Data Collection and Statistical Analysis

Clinical data including age, presenting symptoms, menstrual history, parity, and previous medical or surgical history were recorded for all participants. Ultrasound findings were documented in a standardized reporting format. The corresponding histopathological findings were retrieved post-procedure.

The following statistical tools were used:

Descriptive statistics: To summarize patient demographics and prevalence of each uterine condition

Chi-square test: To evaluate associations between ultrasound features and histological findings

Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV): To assess diagnostic accuracy of ultrasound

Kappa statistics: To measure agreement between ultrasound and histopathology results

All analyses were conducted using **SPSS software version 25.0**, and a p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the institutional ethics committee prior to the commencement of research. All participants were briefed about the study's objectives, potential benefits, and confidentiality measures. Written informed consent was obtained from each patient. The study complied with the ethical standards laid out in the Declaration of Helsinki.

4. CONCLUSION

The evaluation and diagnosis of uterine diseases remain a cornerstone of gynecological practice, particularly given their prevalence and the significant impact they can have on women's reproductive and general health. Among the various diagnostic modalities available, ultrasonography has firmly established itself as the primary, non-invasive tool for identifying and differentiating uterine pathologies. This study has systematically analyzed and compared the morphological characteristics of the most common uterine diseases—fibroids, adenomyosis, and endometrial abnormalities—as detected through ultrasound examination, and their correlation with histopathological findings. The conclusions derived from this comparative analysis underscore the clinical value, diagnostic precision, and limitations of ultrasonographic imaging in gynecological care.

First and foremost, ultrasonography's utility lies in its accessibility, cost-effectiveness, and real-time imaging capability. It enables clinicians to examine uterine anatomy and pathology with remarkable clarity, particularly when using transvaginal probes. Fibroids, for example, can be readily detected on ultrasound due to their distinct echogenicity and well-demarcated margins. Their size, location (submucosal, intramural, subserosal), and number can be accurately assessed, which is essential for clinical decision-making, especially in symptomatic patients or those planning fertility treatments. Furthermore, associated changes such as degeneration or calcification can also be visualized, assisting in distinguishing fibroids from other uterine masses.

In contrast, adenomyosis presents a more diffuse pathology that can pose a diagnostic challenge. However, with skilled interpretation, sonographic signs such as a globular uterus, asymmetrical myometrial thickening, intramyometrial cysts, and a disrupted junctional zone provide strong indicators. Although these features can overlap with those of fibroids or other myometrial abnormalities, pattern recognition through high-resolution ultrasound, especially with the aid of three-dimensional and Doppler imaging, improves diagnostic accuracy. Importantly, adenomyosis often coexists with other pathologies, requiring a nuanced approach in interpreting the sonographic morphology.

Endometrial abnormalities, including polyps, hyperplasia, and carcinoma, also benefit significantly from ultrasound evaluation. Measurement of endometrial thickness is a primary screening tool, particularly in postmenopausal women or

those with abnormal uterine bleeding. Focal lesions such as polyps are often identifiable as echogenic intracavitary masses with a vascular stalk, especially when visualized with saline infusion sonohysterography or color Doppler. Conversely, endometrial hyperplasia presents as diffuse thickening, sometimes with cystic changes, while suspicion of carcinoma is raised when irregular contours and increased vascularity are present. Nevertheless, ultrasound cannot substitute for biopsy in these cases, reinforcing the role of ultrasound as a screening rather than a definitive diagnostic tool.

A key outcome of this study is the confirmation that the integration of sonographic imaging with histopathological evaluation significantly enhances diagnostic confidence and accuracy. While ultrasound provides preliminary and often strong diagnostic clues, histopathology remains the gold standard for definitive diagnosis. This dual approach allows for improved patient management by ensuring that imaging findings are corroborated with tissue analysis. For instance, cases of suspected adenomyosis on ultrasound that are confirmed by histopathology strengthen the validity of the sonographic criteria used. Similarly, differentiating between hyperplasia and early carcinoma becomes clearer when both modalities are employed.

Another vital conclusion is the operator-dependent nature of ultrasonography. Diagnostic accuracy is highly influenced by the experience and expertise of the sonographer or clinician performing and interpreting the scan. Therefore, standardization of diagnostic criteria and ongoing training in recognizing subtle morphological features are essential to reduce variability and misdiagnosis. The use of structured reporting formats and image documentation can further enhance consistency and improve interdisciplinary communication between radiologists, gynecologists, and pathologists.

The study also highlights some limitations inherent in ultrasonography. One such limitation is the reduced sensitivity in obese patients or when bowel gas interferes with transabdominal scanning. Additionally, very small lesions or those located in difficult anatomical positions may be missed or mischaracterized. Although transvaginal ultrasonography can overcome many of these challenges, it is not suitable for all patients, due to discomfort or contraindications. Moreover, while ultrasound is effective in detecting structural abnormalities, it offers limited information about functional and molecular aspects of disease, which are increasingly relevant in personalized medicine.

The potential role of advanced imaging modalities, such as magnetic resonance imaging (MRI), should also be acknowledged. While not the focus of this study, MRI offers superior soft tissue contrast and may be employed when ultrasound findings are inconclusive or when a more detailed evaluation is required, such as in deep infiltrating adenomyosis or malignancies. Nevertheless, due to its cost and limited availability in some regions, MRI remains a secondary tool, with ultrasound maintaining its position as the primary diagnostic modality.

In light of this comparative morphological analysis, several practical recommendations can be proposed. First, there is a need for standardized ultrasound protocols in the assessment of uterine diseases, incorporating both gray-scale and color Doppler imaging. Second, combining imaging findings with clinical presentation and history significantly enhances diagnostic accuracy. For example, a middle-aged woman with heavy menstrual bleeding and a diffusely enlarged uterus on ultrasound may be more suggestive of adenomyosis than multiple fibroids, particularly if intramyometrial cysts are observed. Third, whenever ultrasound findings are ambiguous or discordant with clinical signs, further investigation with biopsy or MRI should be considered.

Furthermore, this study suggests the importance of developing classification systems or scoring models that integrate sonographic features, clinical symptoms, and possibly laboratory markers to stratify disease severity and guide management strategies. For example, a scoring system for adenomyosis based on the number and size of intramyometrial cysts, junctional zone thickness, and vascularity could provide objective criteria for diagnosis and treatment planning.

Finally, the patient-centered implications of accurate ultrasound diagnosis must be emphasized. Timely identification and differentiation of uterine diseases allow for tailored interventions—medical, surgical, or expectant—thereby minimizing complications, preserving fertility when desired, and improving quality of life. For patients undergoing treatment for infertility or preparing for assisted reproductive technologies, understanding uterine pathology is crucial for optimizing outcomes.

In conclusion, the comparative evaluation of the morphological characteristics of uterine diseases through ultrasound provides vital insights into their diagnosis and management. The correlation between sonographic and histopathological findings underscores the diagnostic value of imaging, while also highlighting the necessity of histological confirmation in selected cases. As ultrasonography continues to evolve with advances in technology and training, its role in gynecological diagnostics will only become more central. Future research should focus on refining diagnostic criteria, integrating artificial intelligence and machine learning for pattern recognition, and exploring combined imaging-biopsy techniques for even more accurate and efficient diagnosis. Through such innovations, the management of uterine diseases can be elevated to new standards of precision and patient-centered care.

REFERENCES

- [1] Benacerraf, B. R., Shipp, T. D., & Bromley, B. (2006). What does a missed diagnosis of uterine fibroids mean for patients? *Journal of Ultrasound in Medicine*, 25(5), 619–622. <https://doi.org/10.7863/jum.2006.25.5.619>
 - [2] Dueholm, M. (2017). Transvaginal ultrasound for diagnosis of adenomyosis: A review. *Best Practice & Research Clinical Obstetrics & Gynaecology*, 40, 41–52. <https://doi.org/10.1016/j.bpobgyn.2016.09.007>
 - [3] Epstein, E., & Valentin, L. (2006). Gray-scale and color Doppler ultrasound features of endometrial pathology. *Ultrasound in Obstetrics and Gynecology*, 27(4), 412–421. <https://doi.org/10.1002/uog.2705>
 - [4] Gordts, S., Brosens, J. J., & Fusi, L. (2008). Uterine adenomyosis: A review of the current knowledge. *Reproductive BioMedicine Online*, 17(4), 535–541. [https://doi.org/10.1016/S1472-6483\(10\)60394-7](https://doi.org/10.1016/S1472-6483(10)60394-7)
 - [5] Goldstein, S. R. (2010). Modern evaluation of the endometrium. *Obstetrics & Gynecology*, 116(1), 168–176. <https://doi.org/10.1097/AOG.0b013e3181eebf5d>
 - [6] Okaro, E., Condous, G., Khalid, A., Timmerman, D., Ameye, L., & Bourne, T. (2006). The use of ultrasound-based “soft markers” for the prediction of pelvic pathology in women with chronic pelvic pain—Can we reduce the need for laparoscopy? *BJOG: An International Journal of Obstetrics & Gynaecology*, 113(3), 251–256. <https://doi.org/10.1111/j.1471-0528.2006.00841.x>
 - [7] Szkodziak, P., Szkodziak, F., & Sławomir, W. (2021). Diagnosis and treatment of uterine fibroids—current knowledge and practice. *International Journal of Environmental Research and Public Health*, 18(9), 4721. <https://doi.org/10.3390/ijerph18094721>
 - [8] Timmerman, D., Van den Bosch, T., Peeraer, K., Debrouwere, E., De Moor, B., & Vergote, I. (2004). Endometrial polyps: Sensitivity and specificity of transvaginal sonography in premenopausal women. *Ultrasound in Obstetrics and Gynecology*, 24(5), 596–602. <https://doi.org/10.1002/uog.1707>
 - [9] Van den Bosch, T., & Dueholm, M. (2017). Ultrasound in the diagnosis of endometrial disease. *Best Practice & Research Clinical Obstetrics & Gynaecology*, 40, 64–74. <https://doi.org/10.1016/j.bpobgyn.2016.09.005>
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