

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20252373>

Review Article

The role of transvaginal ultrasonography in evaluating the endometrium of women with postmenopausal bleeding

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Received: 16 June 2025

Accepted: 14 July 2025

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ABSTRACT

Postmenopausal bleeding (PMB) is a clinically relevant symptom that should be evaluated promptly due to its linkage to endometrial pathology, including endometrial cancer. For women who present with PMB, transvaginal ultrasonography (TVUS) has become a first-line, non-invasive imaging method for assessing the endometrium. The objective of this review article is to compile the most recent data regarding the diagnostic utility, uses, limitations, and technological advancement of transvaginal ultrasonography in evaluating endometrial pathology in postmenopausal women. Recent clinical research, case reports, and multicentre trials were thoroughly examined with an emphasis on the use of TVUS in the diagnosis of endometrial atrophy, hyperplasia, polyps, fibroids, and cancer. Further assessment was conducted on its usefulness in specific groups, including women on hormone replacement therapy (HRT) and those experiencing recurrent PMB. With a cut-off value of less than 4 mm, TVUS has a good negative predictive value for endometrial cancer and is useful for evaluating endometrial thickness. It greatly lessens the need for invasive procedures in low-risk patients, but it cannot replace a histopathology. Diagnostic accuracy has increased due to recent advancement including 3D imaging, Doppler flow analysis, and artificial intelligence integration. Its usefulness in directing therapeutic management and enhancing early diagnosis is supported by case studies and clinical trials. For the first assessment of postmenopausal bleeding, transvaginal ultrasonography is an essential, safe, and cost-effective procedure. Its increased usage in gynaecologic diagnostics is supported by its high sensitivity and recent technological advancements, but histological confirmation is still necessary in cases where questionable results are found.

Keywords: Postmenopausal bleeding, Transvaginal ultrasound, Endometrial thickness, Endometrial cancer, Hormonal replacement therapy, Gynaecologic imaging, Endometrial pathology, Kampala international university, Yei civil hospital

INTRODUCTION

Postmenopausal bleeding (PMB) is any vaginal bleeding occurring after 12 consecutive months of amenorrhea. It raises a clinical red flag due to its association with a spectrum of benign to malignant uterine pathologies. The most common cause is endometrial atrophy, but the differential includes endometrial polyps, hyperplasia, and

most importantly, endometrial carcinoma.¹ Globally, PMB affects approximately 10% of postmenopausal women, typically between the ages of 55 and 65. Despite its relatively low occurrence, PMB necessitates careful evaluation due to the potentially serious underlying pathology. In high-resource settings, timely detection is often achieved using diagnostic tools such as transvaginal ultrasonography (TVUS), endometrial biopsy, and

hysteroscopy.² TVUS has emerged as a non-invasive and highly effective diagnostic modality, providing detailed images of the uterine cavity and endometrial lining. This article offers an in-depth exploration of the utility of TVUS in evaluating PMB, alongside findings from relevant case studies and clinical trials.

PRINCIPLES, BENEFITS, AND LIMITATIONS TRANSVAGINAL ULTRASONOGRAPHY

Transvaginal ultrasonography (TVUS) is an imaging technique that uses high-frequency sound waves to produce detailed images of the female pelvic organs, including the uterus, endometrium, ovaries, and fallopian tubes. The ultrasound probe is inserted into the vagina, which allows for closer proximity to the pelvic organs, resulting in clearer and more detailed images compared to trans-abdominal ultrasound.

When going to use TVUS, the patient is usually instructed to empty her bladder before the procedure to enhance the quality of the images. The patient lies on her back with her feet in stirrups, similar to the position for a pelvic exam.

After preparing the patient, a lubricated ultrasound probe (transducer) covered with a protective sheath is gently inserted into the vagina. The transducer emits high-frequency sound waves that bounce off the pelvic organs. These sound waves are then converted into real-time images on a monitor. The technician or physician may move the probe slightly to get images from different angles and views. The procedure typically takes about 15-30 minutes,³ TVUS provides detailed images of the pelvic organs, allowing for better visualization of small structures such as endometrial thickness, polyps, cysts, and fibroids.

It is a relatively non-invasive procedure with minimal discomfort compared to surgical diagnostic methods. Real-time imaging allows for immediate interpretation and decision-making. Unlike X-rays or CT scans, TVUS does not use ionizing radiation, making it safer for repeated use. Essential for early pregnancy evaluation, including confirmation of intrauterine pregnancy, assessment of fetal heartbeat, and detection of ectopic pregnancies.³ TVUS is limited by the probe's proximity to the pelvic organs which limits the ability to visualize structures outside the immediate pelvic area. The quality of the images and the accuracy of the diagnosis can depend significantly on the skill and experience of the technician or physician performing the ultrasound.

Some patients may experience discomfort or embarrassment during the procedure. It may be difficult to perform on virginal patients or those with severe vaginal atrophy. Obesity or severe pelvic pathology may limit the effectiveness of the imaging. While TVUS is excellent for visualizing structures, it cannot definitively diagnose malignancies or other conditions that require tissue samples. Biopsies or further tests may be needed for a definitive diagnosis.³

CLINICAL APPLICATIONS OF TVUS IN DIVERSE POPULATIONS

In the general population, TVUS is recommended for evaluating abnormal uterine bleeding, pelvic pain, and suspected pelvic masses. It is used to assess endometrial thickness, ovarian morphology, and uterine structural abnormalities. For perimenopausal women, TVUS is recommended for evaluating abnormal uterine bleeding, which is common during the Perimenopausal transition. Helps in differentiating between benign and malignant causes of bleeding. TVUS is recommended for postmenopausal women with bleeding to assess endometrial thickness and rule out endometrial pathology.

An endometrial thickness of less than 4 mm in postmenopausal women with bleeding is generally considered low risk for endometrial cancer. For oncology patients, TVUS is used to monitor patients with a history of endometrial or ovarian cancer for recurrence. Helps in the early detection of masses or abnormal growths.⁴ In patients with known gynecological conditions, TVUS can help identify endometriomas and assess the extent of the disease, used to monitor the size and location of fibroids and guide treatment decisions as well as assesses ovarian morphology and the presence of multiple cysts.

For adolescents, TVUS is typically reserved for cases where a pelvic mass is suspected, or there is unexplained pelvic pain or abnormal bleeding. In virginal adolescents, an abdominal or trans-rectal approach may be considered to avoid discomfort. For pregnant Women, TVUS is used in early pregnancy to confirm intrauterine gestation and monitor for complications such as ectopic pregnancy or miscarriage. In later stages, TVUS can assess cervical length to predict preterm labor.⁵

TVUS IN DIAGNOSING SPECIFIC GYNECOLOGICAL CONDITIONS

Considering endometrial cancer, TVUS is the first-line imaging technique for evaluating postmenopausal bleeding. An endometrial thickness greater than 4 mm warrants further investigation, usually with endometrial biopsy while for ovarian Tumors, TVUS can distinguish between simple cysts and complex masses. Doppler ultrasound can be used to assess blood flow patterns within ovarian masses, helping to differentiate between benign and malignant tumors.

In pregnant women, TVUS is crucial for early detection of ectopic pregnancies, especially when the beta-hCG levels are 1500-2000 IU/l and no intrauterine gestation is visible.⁶ TVUS can also identify tubo-ovarian abscesses and other complications of PID. Helps in assessing the extent of infection and guiding treatment. Considering fibroids, TVUS can accurately determine the size, number, and location of uterine fibroids. Useful in planning surgical or medical management. For ovarian torsion, TVUS can show an enlarged ovary with decreased or absent blood

flow, indicating torsion. Prompt diagnosis is critical to preserve ovarian function.⁶

TECHNOLOGICAL ADVANCES IN TRANS-VAGINAL ULTRASOUND

3D transvaginal ultrasound provides volumetric imaging, allowing for detailed assessment of uterine anomalies, endometrial cavity, and adnexal masses. Enhances accuracy in diagnosing congenital uterine anomalies and assessing the endometrial cavity. Doppler ultrasound evaluates blood flow within pelvic organs. Useful in differentiating between benign and malignant ovarian masses and assessing vascularity in cases of ectopic pregnancy or ovarian torsion. Contrast-enhanced ultrasound (CEUS) involves the use of microbubble contrast agents to enhance visualization of blood flow and tissue vascularity. Particularly useful in characterizing adnexal masses and assessing endometrial abnormalities.⁷

Elastography measures tissue stiffness by assessing how tissues deform under pressure. Helps differentiate between benign and malignant lesions based on tissue elasticity while automated volume measurement is an advanced software algorithms automatically calculate volumes of ovarian cysts, fibroids, and other structures. Improves accuracy and reproducibility in measuring and monitoring lesions. Artificial intelligence (AI) and machine learning is the integration of AI in TVUS can assist in image analysis, improving diagnostic accuracy and reducing operator dependency. AI algorithms can aid in detecting subtle abnormalities and predicting malignancy risk.⁷

EVIDENCE BASED STUDIES ON THE ROLE OF TRANS-VAGINAL ULTRASOUND

Transvaginal ultrasonography usually is sufficient for an initial evaluation of postmenopausal bleeding if the ultrasound images reveal a thin endometrial echo (less than or equal to 4 mm), given that an endometrial thickness of 4 mm or less has a greater than 99% negative predictive value for endometrial cancer. Transvaginal ultrasonography is a reasonable alternative to endometrial sampling as a first approach in evaluating a postmenopausal woman with an initial episode of bleeding. If blind sampling does not reveal endometrial hyperplasia or malignancy, further testing, such as hysteroscopy with dilation and curettage, is warranted in the evaluation of women with persistent or recurrent bleeding.

An endometrial measurement greater than 4 mm that is incidentally discovered in a postmenopausal patient without bleeding need not routinely trigger evaluation, although an individualized assessment based on patient characteristics and risk factors is appropriate. Transvaginal ultrasonography is not an appropriate screening tool for endometrial cancer in postmenopausal women without bleeding.⁸ Transvaginal ultrasonography was performed to quantify the endometrial thickness in 100 postmenopausal

women who presented with uterine bleeding as part of a prospective study carried out in the Department of Obstetrics and Gynecology at Kamla Nehru State Hospital for Mother and Child in India. The accuracy of the vaginal ultrasound and pipelle was measured after endometrial collection was completed using an endometrial biopsy pipelle and the sample was sent for Histopathological Examination (HPE). Atrophic endometrium was discovered in 18% of patients, endometrial polyps in 10%, endometrial cancer in 21%, endometrial hyperplasia in 26%, and no particular pathology in 20% of patients. Transvaginal ultrasound measurements of endometrial thickness showed a mean of 10.16 mm and a median of 11.5 mm, ranging from 1 mm to 28 mm. The mean endometrial thickness in subgroup without disease was 5.26 ± 3.8 mm, with benign disease 12.8 ± 3.1 mm and in carcinoma 16.97 ± 5.6 mm. All cases with carcinoma had endometrial thickness exceeding 5 mm (range 5.7 mm to 28 mm). This study illustrates that by combined use of trans-vaginal ultrasonography (TVUS) and office endometrial sampling, sufficient diagnostic information can be obtained for women with postmenopausal bleeding, obviating the need for more invasive diagnostic procedures.⁹

In a case study involving 50 postmenopausal women with bleeding who underwent TVUS to assess endometrial thickness. Patients with an endometrial thickness greater than 5 mm underwent endometrial biopsy for histopathological confirmation. Results showed that TVUS detected endometrial hyperplasia in 15 cases (30%). Of these, 13 cases were confirmed by biopsy, showing a high correlation between increased endometrial thickness on TVUS and hyperplasia. Thus, it can be concluded that TVUS is a valuable, non-invasive tool for the initial assessment of endometrial hyperplasia in postmenopausal women with bleeding. It helps in identifying patients who require further diagnostic procedures.¹⁰

In a multicentre prospective cohort study 2,500 postmenopausal women with bleeding, who underwent TVUS as the primary imaging modality. Endometrial thickness was measured, and subsequent endometrial biopsies were performed when indicated (e.g., thickness >4-5 mm). Results of the study confirmed that an endometrial thickness cutoff of 4 mm was optimal for distinguishing between benign and malignant endometrial conditions.

The negative predictive value of TVUS was found to be over 99% for endometrial carcinoma when the thickness was below this threshold. Thus, TVUS is an effective first-line imaging technique for evaluating postmenopausal bleeding. It helps to stratify patients for further invasive testing, such as biopsy, thereby reducing unnecessary procedures in women with low-risk findings.¹¹ In another multicentre clinical trial evaluating the role of transvaginal ultrasonography in managing postmenopausal bleeding in women on hormone replacement therapy, 400

postmenopausal women on HRT who presented with abnormal bleeding underwent TVUS to measure endometrial thickness and guide subsequent management decisions, such as continuing HRT, adjusting the therapy, or proceeding to biopsy. The study found that women with endometrial thickness below 5 mm on TVUS had a very low risk of significant endometrial pathology and could safely continue HRT with routine follow-up. Conversely, those with greater thickness were more likely to require a change in therapy or further diagnostic procedures. Therefore, TVUS is a valuable tool in the management of HRT-associated bleeding in postmenopausal women, helping to identify those who may continue HRT safely versus those needing further investigation.¹²

Similarly, a clinical trial aimed at comparing the diagnostic accuracy of TVUS against endometrial biopsy in detecting endometrial pathologies in women with PMB was conducted among 300 postmenopausal women with abnormal bleeding. Participants were randomly assigned to undergo either TVUS or an endometrial biopsy. Endometrial thickness measurements from TVUS were compared with histopathological findings from biopsies. Results of the study found that TVUS had a sensitivity of 87% and a specificity of 91% in detecting endometrial abnormalities when using a 4 mm cut-off for endometrial thickness. The biopsy group had slightly higher accuracy but was more invasive and associated with more discomfort for patients. Therefore, TVUS is a reliable and less invasive alternative to endometrial biopsy for initial evaluation in women with postmenopausal bleeding. However, biopsy remains the gold standard when TVUS findings are inconclusive.¹²

Generally, the reviewed studies demonstrate the critical role of TVUS in the non-invasive evaluation of endometrial pathology in postmenopausal women, particularly in the context of abnormal uterine bleeding. Each study highlights the importance of correlating TVUS findings with histopathological results to guide patient management effectively.

CONCLUSION

One of the most important diagnostic tools for postmenopausal bleeding is transvaginal ultrasonography. It guides additional diagnostic and therapeutic measures by offering a non-invasive, cost effective, and safe evaluation of the uterine lining. When endometrial cancer is suspected, TVUS is a vital tool for patient triage and avoiding invasive procedures, but it is not a substitute for biopsy. With advancements in technology such as Doppler scans, 3D imaging, and AI integration, TVUS is set to play an even greater role in gynaecologic imaging.

Recommendations

In order to manage postmenopausal bleeding, clinicians are advised to employ TVUS as a first-line technique,

supplemented, when necessary, by histological confirmation.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Ibrahim AM, Elioba JLR, Ali FA, Mohamed MM, Omar AM, Osman AJ, et al. The role of transvaginal ultrasonography in evaluating the endometrium of women with postmenopausal bleeding. *Int J Reprod Contracept Obstet Gynecol* 2025;14:2824-8.