

THE DIAGNOSTIC ACCURACY OF SONOGRAPHY IN THE ASSESSMENT OF ENDOMETRIAL HYPERPLASIA: A SYSTEMATIC REVIEW

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Abstract

Keywords

transvaginal ultrasound (TVUS), endometrial hyperplasia, diagnostic accuracy, and Endometrial cancer.

Article History

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Copyright @Author Corresponding Author: * Muhammad Zubair **Background:** Endometrial hyperplasia (EH) is a prevalent condition that arises from the presence of either naturally occurring or externally introduced estrogen, combined with a relative insufficiency of progesterone. It rarely occurs at a younger age of about 35 years. Endometrial cancer ranks as the second most prevalent gynecologic malignancy. This study aims to assess the diagnostic accuracy of sonography in the diagnosis of endometrial hyperplasia by comparing its specificity and predictive values.

Methods: This systematic review follows the PRISMA guidelines. A comprehensive literature search was conducted including PubMed, Scopus, Web of Science and Google Scholar etc.

Results: A total of 23,300 articles were retrieved from database searches. After removing 1,300 duplicates, 22,000 articles proceeded to screening. During the title and abstract review, 21,500 were excluded for not meeting inclusion criteria, leaving 500 for full-text assessment. After a detailed review, 490 were excluded due to issues like insufficient data, poor methodology, or lack of relevance. Ultimately, 10 high-quality studies were selected for the systematic review.

Conclusion: This systematic review demonstrates the accuracy of sonography in diagnosing endometrial hyperplasia. Findings indicate that transvaginal ultrasound (TVUS), especially with Doppler studies, is a non-invasive and effective method for detecting endometrial thickening and abnormalities suggestive of hyperplasia.

INTRODUCTION

Endometrial hyperplasia (EH) is a prevalent condition that arises from the presence of either naturally occurring or externally introduced estrogen, combined with a relative insufficiency of progesterone¹. It rarely occurs in younger age of about 35 years. It is not cancer but raises the chances of developing endometrial carcinoma, a type of uterine carcinoma¹. In premenopausal women normal endometrial thickness depends on the stage of the menstrual cycle, but thickness >15 mm is considered the upper limit of normal in the secretory phase. In postmenopausal women the thickness of endometrium >5 mm is considered abnormal. Hyperplasia can be excluded in patients when the



of EH is chronic exposure to unopposed estrogen². EH is more frequently observed in postmenopausal women and/or premenopausal women with risk factors such as obesity, unopposed estrogen exposure, polycystic ovary syndrome (PCOS), or a history of infertility³. Clinically, it presents with abnormal uterine bleeding, but in some cases, it may be asymptomatic and detected only through endometrial biopsy³. The endometrial biopsy is the gold standard for diagnosing EH3. Studies have shown high sensitivity and specificity for endometrial hyperplasia and carcinoma³. Although the biopsy can accurately diagnose hyperplasia and atypia, it may miss focal lesions or small areas of malignancy due to sampling error, particularly in cases of heterogeneous disease³. TVUS is a non-invasive imaging tool commonly used to assess the thickness of the endometrial lining³. Ultrasound is the first modality line investigative to evaluate the endometrial thickness in perimenopausal & postmenopausal women presents with abnormal uterine bleeding. Imaging the endometrium on 5-10 day of reproductive cycle reduces the variability in endometrial thick ness⁴. Hysteroscopy uses a thin, lighted tool called a hysteroscope to examine the cervix and the uterus. This procedure can be performed along with a dilation and curettage (D&C). With hysteroscopy, the clinician can see abnormalities within the endometrial cavity and take a targeted biopsy of any suspicious area⁴. Advances in transvaginal ultrasound technology have significantly improved the ability of clinicians to discriminate between benign and malignant changes'. Transvaginal sonography has a moderate diagnostic



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accuracy in detecting endometrial hyperplasia. Due to the fact that TVS is safe, acceptable and easily available in most secondary and tertiary care settings nowadays and is non-invasive⁵. However, further studies are needed to determine the exact accuracy of TVS in diagnosing EH^{6,7}. The appropriate diagnostic threshold of vaginal ultrasound diagnosis is 5.65 mm in asymptomatic postmenopausal women⁸. It aims to integrate imaging parameters and clinical variables for improved differentiation between benign and malignant endometrial conditions⁹. The aim of this study is to assess the diagnostic accuracy of sonography in the diagnosis of endometrial hyperplasia by comparing its specificity and predictive values against histopathological findings or other imaging modalities.

METHOD AND MATERIAL

This systematic review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta- Analyses) guidelines but does not include a meta-analysis. A comprehensive literature search was conducted between time period of (year 2015 – 2025) including are PubMed, Scopus, Web of Science and Google Scholar etc. Terms included combinations of keywords and Medical Subject "Endometrial Headings (MeSH) such as: hyperplasia", "Ultrasound", "Sonography", ultrasound", "Diagnosis", "Transvaginal "Assessment", "Detection. The aim of our study is to assess the diagnostic accuracy of sonography in the diagnoses of endometrial hyperplasia by comparing its sensitivity, specificity, and predictive values.

Inclusion and Exclusion Criteria

All types of articles published in the last 10 years like reviews, commentary, correspondence, journals, and original research article relevant to the subject of the review were searched. Our study included all the case control studies, cohort studies and meta-analysis. Our study mainly focused on women who were undergoing ultrasound assessment due to suspected endometrial hyperplasia. Both transvaginal and transabdominal studies are eligible. Whereas the study excluded were animal-based studies, studies that do not use ultrasound as a primary assessment. Studies with incomplete or missing data are also excluded from our analysis.

Data Extraction

Two reviewers, AA and MZ independently collected appropriate information from the particular studies by means of a data extraction table based on the predefined inclusion criteria. If there were any disagreements or differences in their findings. Two more reviewers HR, and AA facilitated resolve them over discussion. Information is extracted with a consistent form including study characteristics such as author and year of publication of study, with age group, the primary modality used in each study is transvaginal sonography. The performance of sonography includes sensitivity, specificity, positive predictive value and negative predictive value.

RESULTS

Study Selection

A total of 23,300 articles were initially retrieved from database searches. After removing 1,300 duplicates, 22,000 articles proceeded to the screening phase. During the title and abstract review, 21,500 articles were excluded for not meeting the inclusion criteria.



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This left 500 full-text articles for detailed eligibility assessment. Following a thorough review, 490 articles were excluded due to reasons such as insufficient data, poor methodology, or lack of relevance to the research question. Finally, 10 high-quality studies were selected for the systematic review.

We compare the Accuracy, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) of (TVS) transvaginal ultrasound in detecting endometrial hyperplasia across studies. Accuracy remains high (69%-88.25%), indicating reliable detection. However, PPV varies significantly, with some studies reporting high values (e.g., 97.7%), while others show much lower reliability (e.g., 9.87%). In a similar vein, the NPV fluctuates, ranging from 95% to 0.34%, highlighting the variability in false negatives. The plot makes it clear that TVS is useful, but its effectiveness depends on the conditions of the study, the demographics of the patients, and the comparisons to gold standards (Figure 1).



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Figure 1: PRISMA flow diagram.



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Table 1: The diagnosis of endometrial hyperplasia using transvaginal sonography.											
Authors	Year	Mean	Total	Cases of EH	Modality	Sensitivity	Specificity	Gold Standard	Accuracy	PPV	NPV
		Age	Cases			%	%			%	%
Norbert Stachowicz et	2020	60	394	158	TVS	71	60	Intrauterine contrast	69	2.47	0.40
al ¹⁰								sonography			
Phuc Nhon Nguyen et	2022	40	` 150	59	TVS	43.96	56.43	Endometrial biopsy	70	96	80
al ¹¹											
Behrooz Shekouhi et al ¹²	2015	52.12	120	85	TVS	90.7	84	Hysteroscopic examination	88.25	97.7	84
Vatsal Patel et al ¹³	2017	55	304	30	TVS	90.6	83	Endometrial biopsy	82.5	33.0	95
M.R Metin et al ¹⁴	2016	55	61	32	TVS	81.3	100	Endometrial biopsy	84	100	70
Yingshao Yao et al ¹⁵	2019	65	1354	350	TVS	69	78	Hysteroscopic cytology	79	9.87	0.34
Aqsa Hafeez et al ⁴	2021	51	11935	1488	TVS	100	63.7	Hysteroscopy	84	100	69
Fatima Nazim et al ¹⁶	2013	45	263	83	TVS	100	63.7	Hysteroscopy	75	56.3	100
Cenkyasa et al ¹⁷	2016	59	276	9	TVS	90	54.7	Endometrial biopsy	80	9.6	94.8
Yu Ran Park et al ¹⁸	2019	60	92	14	TVS	100	95	Hysteroscopy	69	18.25	93.5

EH= Endometrial Hyperplasia, TVS= Transvaginal sonography, PPV= Positive Predictive Value, NPV= Negative Predictive Value.







DISCUSSION

A study was performed by Norbert Stachowicz on transvaginal ultrasound (TVS) with 394 cases, an average age of 60 years, achieving 71% accuracy and 60% sensitivity. It was a retrospective cohort study of women with postmenopausal bleeding. From June 2012 to June 2020, we studied a group of 394 women who underwent standard transvaginal ultrasound examination followed by power Doppler intrauterine vascularity assessment¹⁰. The median age was 60.3 years (range 10.7). The median body mass index (BMI) was 30.4 (range 6.0). Histological examination revealed 158 cases of endometrial hyperplasia (EH) and 236 cases of EC. The study claims that ultrasound is the first line diagnostic modality for HP.¹¹ In the 2022 study conducted by Phuc Nhon Nguyen, transvaginal ultrasound (TVS) was evaluated for its diagnostic performance in a cohort of 150 cases involving individuals aged 40 and above. The study reported an accuracy of 43.96%, indicating that TVS correctly identified the presence or absence of the condition being studied in less than half of the cases. This suggests that while TVS is a commonly used imaging modality, its overall reliability in this specific population or diagnostic context may be

limited. Furthermore, the study found a sensitivity of 56.43%, which refers to the ability of TVS to correctly detect cases that truly have the condition. A sensitivity value above 50% implies that TVS was able to identify more than half of the true positive cases, In 2015, Behrooz Shekouhi studied transvaginal ultrasound (TVS) in 120 cases aged 48-67, reporting 90.7% accuracy and 84% sensitivity. Sixty-eight patients were premenopause, and 52 were postmenopause. TVS reported EH in 85 cases (70.83%). Pathology results showed EH in 85 (70.83%) including cases simple cvstic hyperplasia in 82 cases, atypical, simple hyperplasia in one case and complex hyperplasia in two cases. Among these 85 cases, EH was confirmed by pathology in 81 cases. The accuracy, sensitivity, specificity, PPV, and NPV were 88.25%, 90.7%, 84%, 97.7%, and 84% in premenopause and 100% in postmenopause women.

Vatsal Patel examined transvaginal ultrasound (TVS) in 304 cases aged 55 and above, achieving 90.6% accuracy and 83% sensitivity. Endometrial thickness as measured by transvaginal ultrasound (TVUS) is being increasingly used as a first-line method to evaluate patients with vaginal



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bleeding. Our study aims to examine correlation between the histopathologic diagnosis and the results of TVUS and find a threshold that could reliably exclude carcinoma.¹³

5; In 2016, M.R. Metin conducted a study on transvaginal ultrasound (TVS) with 61 cases aged 53-60 years. TSE had a sensitivity of 81.3%, a specificity of 100%, a positive predictive value of 100% and a negative predictive value of 70% in differentiating endometrial carcinoma from hyperplasia.¹⁴ endometrial Yingshao Yao conducted a study evaluating the effectiveness of transvaginal ultrasound (TVS) in diagnosing conditions in postmenopausal women aged 60 and above. The study analyzed 1,354 cases and reported an accuracy of 69% and a sensitivity of 78%. Accuracy refers to the test's overall correctness in identifying both diseased and nondiseased cases, meaning TVS correctly classified 69 out of 100 cases. Sensitivity, on the other hand, measures the test's ability to detect true positive cases, and a sensitivity of 78% indicates that TVS correctly identified 78 out of 100 individuals who actually had the condition. However, this also implies that 22% of cases were missed (false negatives). While the results suggest that TVS is a relatively effective diagnostic tool.¹⁵ In 2021, Aqsa Hafeez conducted a large-scale study on transvaginal ultrasound (TVS) with 11,935 cases aged 45-60, reporting 100% accuracy and 63.7% sensitivity. In this systematic review of 15 studies, including perimenopausal and postmenopausal women ultrasound is utilized to investigate the HP. Sonography has high positive predictive value for diagnosing endometrial hyperplasia but does not adequately define focal and cancerous endometrial lesion. Transvaginal ultrasonography is significantly better in defining intrauterine abnormalities due to high sensitivity (100%) and specificity (63.7%).In the view of the results obtained from studies included in this systematic review, we conclude that ultrasound is an appropriate diagnostic tool in detecting EH. Fatima Nazim conducted a study using transvaginal ultrasound (TVS) on 263 women who were 45 years old. TVS is a type of medical test that helps doctors see inside a woman's body, especially the

reproductive organs. The study found that the test was completely accurate in identifying cases correctly, meaning it did not give any false results. However, the sensitivity of the test was 63.7%, which means it was able to correctly detect a condition in about 64 out of every 100 cases where the condition was actually present. This study helped in understanding how reliable TVS is for diagnosing medical issues in women of this age group. Cenkyasa conducted a study on transvaginal ultrasound (TVS) with 276 cases aged 59 and above, reporting 90% accuracy and 54.7% sensitivity.¹⁷ Yu Ran Park studied the use of transvaginal ultrasound (TVS) in 92 women who were 60 years old or older. TVS is a medical imaging test that helps doctors examine a woman's reproductive organs. The study found that the test was completely accurate in identifying cases correctly, meaning it did not give any false results. Additionally, the sensitivity of the test was 95%, which means it was able to correctly detect a condition in 95 out of every 100 cases where the condition was actually present. This study showed that TVS is a highly reliable method for diagnosing medical issues in older women.¹⁸

CONCLUSION

This systematic review highlights the diagnostic accuracy of sonography in assessing endometrial The findings hyperplasia. suggest that transvaginal ultrasound (TVUS), particularly when combined with Doppler studies, provides a non-invasive and effective tool for detecting endometrial thickening and abnormalities suggestive of hyperplasia. However, while sonography demonstrates moderate to high sensitivity and specificity, its diagnostic performance varies based on endometrial thickness cut-off values, menopausal status, and the presence of atypia.

LIMITATIONS AND FUTURE RESEARCH

The accuracy of sonography in detecting endometrial hyperplasia depends on factors such as the thickness threshold used, the experience of the sonographer, and the quality of the ultrasound machine. This variation can lead to

differences in results across studies. While ultrasound can detect endometrial thickening, it cannot reliably distinguish between simple hyperplasia and atypical hyperplasia, which has a higher risk of progressing to cancer. This makes histopathological confirmation (biopsy) necessary. Sonography alone is not sufficient for a definitive diagnosis. It often requires additional tests like Doppler imaging, hysterosonography, or biopsies, which can increase costs and complexity. Future research should explore the role of new imaging such technologies as contrast-enhanced ultrasound, 3D ultrasound, and artificial intelligence (AI)-based image analysis to improve detection and differentiation of hyperplasia types.

Abbreviations

AA= Aimen Ali MZ=Muhammad Zubair HI= Hira Irshad AA= Ayesha Ayub

AUTHOR CONTRIBUTION

Author	Contribution				
Aimen Ali	manuscript writing,				
	Conceptualization, and				
	methodology				
Muhammad	Supervision, review of				
Zubair	methodology, and editing of the				
	final draft.				
Hira Irshad	Data extraction, risk of bias				
	assessment, data synthesis, and				
	critical revision of the				
	manuscript.				
Ayesha Ayub	Quality assessment, formatting,				
	reference management, and				
	proofreading				

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