Section: Obstetrics and Gynaecology

Original Research Article

ENDOMETRIAL THICKNESS BY TRANSVAGINAL ULTRASONOGRAPHY: CORRELATION WITH HISTOPATHOLOGICAL FINDINGS IN PERI AND POSTMENOPAUSAL WOMEN WITH ABNORMAL UTERINE BLEEDING

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Abstract

Background: Abnormal uterine bleeding (AUB) is a common gynecological condition, particularly among peri and postmenopausal women. Accurate diagnosis is critical for appropriate management. This study aims to evaluate the correlation between endometrial thickness measured by transvaginal ultrasonography (TVS) and histopathological findings in women with AUB, and to identify significant risk factors associated with endometrial pathology. **Materials and Methods:** This cross-sectional study included 176 women with AUB, of whom 52 were perimenopausal and 124 were postmenopausal. Endometrial thickness was measured using TVS, and endometrial samples were obtained via outpatient dilation and curettage under ultrasound guidance. Histopathological examination was performed by pathologists blinded to the TVS results. Statistical analysis was conducted to evaluate the correlation between endometrial thickness and histopathological findings and to identify risk factors associated with endometrial pathology. **Result:** The mean age of participants was 55.4 years (SD ± 6.8). Histopathological examination revealed that 61.9% of cases were benign, with endometrial polyps (20.5%) and simple hyperplasia without atypia (25.0%) being the most common. Endometrial malignancy was present in 17.6% of cases. Endometrial thickness demonstrated significant diagnostic value, with a sensitivity of 83% and specificity of 72% at a 5 mm cutoff (AUC = 0.80). Increasing endometrial thickness was strongly associated with higher odds of pathological findings (OR 1.2, 95% CI 1.15-1.25, $p < 0.001$). **Conclusion:** Endometrial thickness measurement via TVS is a valuable non-invasive tool in the evaluation of AUB, offering high sensitivity and specificity for detecting endometrial pathology. Age and postmenopausal status are significant risk factors for endometrial abnormalities. These findings support the use of TVS in clinical practice for risk stratification and diagnostic decision-making.

INTRODUCTION

Abnormal uterine bleeding (AUB) is a prevalent gynecological condition affecting up to 30% of women in peri and postmenopausal stages, significantly impacting their quality of life.[1] AUB encompasses deviations from normal menstrual patterns, including changes in frequency, duration, and volume of bleeding. The differential diagnosis for AUB is broad, ranging from benign conditions like hormonal imbalances and endometrial polyps to more serious conditions such as endometrial hyperplasia and malignancy.[2]

A pivotal aspect of evaluating AUB is assessing endometrial thickness, often done non-invasively using transvaginal ultrasonography (TVS).[3] TVS provides a clear visualization of the endometrium, aiding in the identification of structural abnormalities that contribute to abnormal bleeding patterns.[3]

In peri and postmenopausal women, the endometrial lining undergoes significant changes due to fluctuations and eventual decline in estrogen levels.[4] These changes increase the risk of various endometrial pathologies. For instance, in postmenopausal women, an endometrial thickness exceeding 4-5 mm raises suspicion for hyperplasia or

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malignancy, necessitating further investigation through histopathological examination.[4,5]

Histopathology remains the gold standard for diagnosing endometrial conditions.[6] Lierature indicate that approximately 10-15% of women with AUB will have endometrial hyperplasia, and a smaller percentage (1-2%) may have endometrial cancer, underscoring the importance of accurate diagnostic methods.[6-8]

Correlating ultrasonographic findings with histopathological results enhances diagnostic accuracy, guiding clinicians in making informed decisions about patient management.[9] Previous studies have shown varying degrees of correlation between endometrial thickness measured by TVS and histopathological findings, ranging from 60-90%, depending on the population studied.[9,10]

This study aimed to explore the correlation between endometrial thickness measured by ultrasonography and histopathological findings in peri and postmenopausal women presenting with AUB. By doing so, it seeks to provide robust evidence to refine diagnostic protocols and optimize the management of AUB in this demographic.

MATERIALS AND METHODS

Study Design and Participants: This prospective cross-sectional study was conducted at department of Obstetrics and Gynaecology of tertiary care center of North India for a period of 2 years between January 2022 and December 2023. The study enrolled peri and postmenopausal women (aged 40 years and older) presenting with abnormal uterine bleeding (AUB) to the Obstetrics and Gynaecology outpatient department. AUB was defined as any irregularity in menstrual bleeding patterns, including changes in frequency, duration, or volume of bleeding. Women with a current pregnancy or within 6 weeks postpartum; history of hormonal therapy within the past 3 months, endometrial ablation, or known endometrial pathology (including polyps, hyperplasia, or malignancy); active pelvic inflammatory disease (PID) or acute pelvic infections; coagulopathies or bleeding disorders affecting safe conduct of endometrial sampling; and severe uterine anatomical abnormalities such as large fibroids or congenital anomalies, were excluded from the study.

Sample Size Calculation: The sample size calculation was based on previous studies indicating a correlation coefficient of 0.7 between endometrial thickness measured by ultrasonography and histopathological findings [9,10]. With a desired confidence level of 95% and a power of 80%, a minimum sample size of 176 participants was calculated using the formula for correlation studies. This sample size accounts for potential dropouts and ensures sufficient statistical power to detect significant correlations between variables. So, using the convenient sampling technique, during period a total of 176 patients were enrolled.

Data Collection: A structured questionnaire was designed specifically for this study to gather comprehensive demographic, clinical, and reproductive history data from participants presenting with abnormal uterine bleeding (AUB). The questionnaire included sections covering age, parity, menopausal status, menstrual history, use of hormonal therapies, and relevant medical and surgical histories. Participants were also queried about specific symptoms related to their abnormal bleeding patterns, such as duration, frequency, and associated pain. Additionally, the questionnaire included questions pertaining to lifestyle factors, including smoking status and body mass index (BMI), which are known to influence hormonal and reproductive health.

Transvaginal Ultrasound: Participants underwent a thorough clinical evaluation, including medical history and physical examination. Transvaginal ultrasonography (TVS) was performed (GE Healthcare Voluson S6 BT 12, Bengaluru) using a 6-9 MHz transducer. Patients were positioned in lithotomy position for optimal access, with a sterile, covered transducer used to maintain hygiene and patient comfort. The sonographers meticulously identified the echogenic interfaces: the endometrial-myometrial junction, characterized by the transition from hypoechoic myometrium to hyperechoic endometrium, and the endometrial-cavity junction, marking the boundary between hyperechoic endometrium and hypoechoic uterine cavity [Figure 1]. Endometrial thickness measurements were taken perpendicular to these interfaces to minimize variability. Each participant underwent three separate measurements at equidistant points along the uterine cavity. In cases where measurements showed variability greater than 1 mm, additional measurements were taken until consensus was achieved. The average of these measurements was calculated to ensure accuracy and mitigate potential measurement errors.

Histopathological Evaluation: Endometrial sampling was conducted using outpatient dilation and curettage (D&C) under real-time ultrasound guidance, ensuring precise targeting of the endometrial lining. The procedure took place in a specialized outpatient setting equipped with ultrasound imaging capabilities, facilitating accurate visualization of the uterus and guiding the insertion of a sterile, flexible curette through the cervix. Samples of endometrial tissue obtained during D&C were immediately fixed in formalin and sent to the pathology department for processing. Experienced pathologists, blinded to both the TVS findings and clinical histories, meticulously examined the specimens using standard histological techniques, including hematoxylin and eosin staining. Histopathological diagnoses encompassed a range of conditions, from benign entities like endometrial polyps and simple hyperplasia without atypia, to more complex findings such as complex hyperplasia

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with or without atypia, and potentially malignant lesions like endometrial malignancy.

Follow up: Following histopathological diagnosis, participants diagnosed with benign conditions such as endometrial polyps or simple hyperplasia without atypia were advised on conservative management strategies and scheduled for routine follow-up visits every 6-12 months. These visits included clinical examination and repeat TVS to monitor for recurrence or progression of endometrial pathology. Participants diagnosed with complex hyperplasia with or without atypia or endometrial malignancy were referred to gynecologic oncologists for further management, including consideration of hysterectomy, hormonal therapy, or more frequent surveillance.

Statistical Analysis: Data were analyzed using statistical software SPSS version 20.0. Descriptive statistics were used to summarize demographic and clinical characteristics. Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. The correlation between endometrial thickness measured by TVS and histopathological findings was assessed using Pearson correlation coefficient. Receiver operating characteristic (ROC) curve analysis was performed to determine the optimal cutoff value of endometrial thickness for predicting significant endometrial pathology.

Ethical Considerations: The study protocol was approved by the Institutional Review Board (IRB). Informed consent was obtained from all participants before enrollment in the study.

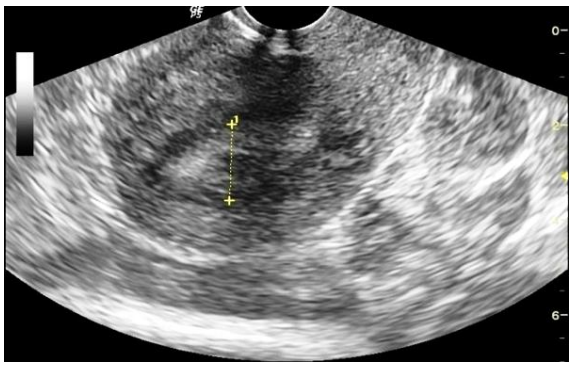

Figure 1: Transvaginal Ultrasound (thickness 15 mm) among postmenopausal women with Endometrial malignancy.

RESULTS

The study included 176 women with a mean age of 55.4 years (SD ± 6.8). The median parity was 3, with an interquartile range (IQR) of 1 to 4. In terms of menopausal status, 52 women (29.5%) were perimenopausal, while 124 women (70.5%) were postmenopausal. The mean body mass index (BMI) was 24.5 kg/m² (SD ± 4.3). Regarding smoking status, 143 women (81.3%) were non-smokers, 20 women (11.4%) were former smokers, and 13 women (7.3%) were current smokers. A history of hormonal therapy was reported by 12 women (6.8%). The median duration of symptoms was 6 months, with an IQR of 3 to 12 months [Table 1].

Among 176 women, 109 (61.9%) had benign conditions with a mean endometrial thickness of 5.4 ± 1.9 mm. Endometrial polyps (36, 20.5%) had a mean thickness of 5.2 ± 1.8 mm, simple hyperplasia without atypia (44, 25.0%) had 5.5 ± 2.2 mm, and other benign conditions (29, 16.5%) had 5.6 ± 1.9 mm. Complex hyperplasia without atypia (21, 11.9%) had a mean thickness of 7.3 ± 2.3 mm, and complex hyperplasia with atypia (15, 8.5%) had 8.2 ± 2.7 mm. Endometrial malignancy (31, 17.6%) showed a significantly higher mean thickness of 10.5 ± 4.1 mm ($P < 0.001$). Perimenopausal and postmenopausal women had 39 (22.2%) and 70 (39.7%) benign cases, respectively, with malignancy in 4 (2.3%) and 27 (15.3%) cases [Table 2].

A value of 0.65 indicates a strong positive correlation between endometrial thickness measured by transvaginal ultrasonography (TVS) and histopathological findings. This suggests that as endometrial thickness increases, the likelihood of more significant histopathological abnormalities also increases. The Table 3, presents the diagnostic performance of various endometrial thickness cutoff values measured by transvaginal ultrasonography (TVS) in predicting endometrial pathology. As the cutoff value increases from 4 mm to 8 mm, specificity and positive predictive value (PPV) improve, indicating better ability to correctly identify true negatives and the likelihood that a positive test result reflects actual pathology. Specifically, at a cutoff of 4 mm, sensitivity is high at 89%, meaning the test is good at detecting true positives, but specificity is lower at 61%, leading to more false positives. As the cutoff value increases to 8 mm, sensitivity decreases to 61%, indicating fewer true positives are detected, but specificity increases to 89%, meaning fewer false positives. The area under the curve (AUC) also increases from 0.75 at 4 mm to 0.88 at 8 mm, reflecting improved overall diagnostic accuracy. The cutoff value of 7 mm appears to balance sensitivity (70%) and specificity (85%) with an AUC of 0.85, suggesting it might be a reliable threshold for clinical decision-making.

The [Table 4], presents odds ratios (OR) indicating the associations between various factors and the risk of endometrial pathology. Age shows a significant increase in pathology odds with each year (OR 1.05, 95% CI 1.02 - 1.09, $p = 0.002$), while each millimeter increase in endometrial thickness correlates strongly (OR 1.2, 95% CI 1.15 - 1.25, $p < 0.001$). Postmenopausal status is associated with a 2.5-fold increase in pathology odds (OR 2.5, 95% CI 1.20 - 5.20, $p = 0.014$). However, history of hormonal therapy does not significantly affect pathology odds (OR 0.7, 95% CI 0.30 - 1.60, $p = 0.4$). These findings underscore age, endometrial thickness, and postmenopausal status as significant risk factors for endometrial pathology, while suggesting that hormonal therapy history does not influence the risk.

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Table 1: Demographic and Clinical Characteristics of Participants.

Variable	Frequency (%)/ Mean±SD
Age (years)	55.4±6.8
Parity [median (IQR)]	3 (1-4)
Menopausal status	
Perimenopausal	52 (29.5)
Postmenopausal	124 (70.5)
BMI (kg/m²)	24.5±4.3
Smoking status	
Non-smoker	143 (81.3)
Former smoker	20 (11.4)
Current smoker	13 (7.3)
History of hormonal therapy	12 (6.8)
Symptoms duration (months) [median (IQR)]	6 (3-12)

Table 2: Endometrial Thickness Measured by TVS and Histopathological Findings.

Histopathological Diagnosis	Total	Peri*	Post#	Endometrial Thickness (mm)		P- value
	Frequency (%)			Mean±SD	Range	
Benign (total)	109 (61.9)	39 (22.2)	70 (39.7)	5.4 ± 1.9	2.1 - 8.6	<0.001
Endometrial polyps	36 (20.5)	7 (4.0)	29 (16.5)	5.2 ± 1.8	2.1 - 8.1	
Simple hyperplasia without atypia	44 (25.0)	12 (6.8)	32 (18.2)	5.5 ± 2.2	2.5 - 9.2	
Other benign conditions	29 (16.5)	9 (5.1)	20 (11.4)	5.6 ± 1.9	2.6 - 8.4	
Complex hyperplasia without atypia	21 (11.9)	6 (3.4)	15 (8.5)	7.3 ± 2.3	4.2 - 10.7	
Complex hyperplasia with atypia	15 (8.5)	3 (1.7)	12 (6.8)	8.2 ± 2.7	5.5 - 12.8	
Endometrial malignancy	31 (17.6)	4 (2.3)	27 (15.3)	10.5 ± 4.1	6.4 - 16.7	

*Perimenopausal, #Postmenopausal

Table 3: Receiver Operating Characteristic (ROC) Analysis for Endometrial Thickness Predicting Significant Pathology.

Cutoff Value (mm)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	AUC
4	89	61	65	88	0.75
5	83	72	72	85	0.8
6	81	78	75	82	0.83
7	70	85	78	77	0.85
8	61	89	82	75	0.88

PPV: Positive Predictive Value, NPV: Negative Predictive Value, AUC: Area Under the Curve

Table 4: Multivariate Analysis of Predictors for Endometrial Malignancy.

Variable	OR	95% (CI)	p-value
Age (per year increase)	1.05	1.02 - 1.09	0.002
Endometrial Thickness (per mm increase)	1.2	1.15 - 1.25	<0.001
Postmenopausal Status	2.5	1.20 - 5.20	0.014
History of Hormonal Therapy	0.7	0.30 - 1.60	0.4

OR: Odds Ratio, CI: Confidence Interval

DISCUSSION

This study comprehensively investigated the association between clinical and pathological factors with endometrial pathology among peri and postmenopausal women. Our findings highlight several significant observations that contribute to understanding risk factors and diagnostic markers for endometrial abnormalities.

Our study cohort comprised 176 participants with abnormal uterine bleeding, predominantly postmenopausal (124, 70.5%). The mean age was 55.4 years (SD ± 6.8), with a median parity of 3 (IQR 1-4). Most participants had a BMI within the normal range (mean BMI 24.5 kg/m² ± 4.3), and the majority were non-smokers (81.3%). Similar demographic profile was observed in the studies by Sajitha et al., Damle et al., and Jetley et al.[11-13]

Histopathological examination revealed various findings: benign conditions were predominant (61.9%), with endometrial polyps being the most common (20.5%), followed by simple and complex hyperplasia without atypia. Endometrial malignancy was noted in 31 participants (17.6%). The studies Jose et al., and Vijayaraghavan et al., by also documented the similar distribution of histopathogical findings.[14,15]

Endometrial hyperplasia and malignancy are characterized by abnormal cellular proliferation, influencing ultrasound-measured thickness.[16] Endometrial malignancy showed a significantly higher mean thickness of 10.5 ± 4.1 mm ($P < 0.001$). These findings underscore the clinical relevance of our study in guiding effective management strategies for peri and postmenopausal women at risk of endometrial pathology.[17]

Endometrial thickness exhibited significant diagnostic value across different cutoff points. At a 5 mm cutoff, sensitivity was 83%, specificity was 72%, and the AUC was 0.80, indicating robust discriminatory power. The cutoff value of 7 mm appears to balance sensitivity (70%) and specificity

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(85%) with an AUC of 0.85, suggesting it might be a reliable threshold for clinical decision-making. The cut off varied among studies by Thulasi et al., Shrestha et al., and Qureshi et al.[18-20]

Increasing thickness correlated with higher odds of pathological findings (OR 1.2, 95% CI 1.15-1.25, $p < 0.001$), highlighting its role as a predictive marker for endometrial pathology. The diagnostic efficacy of endometrial thickness echoes findings by Shobhitha et al., Sur et al., and Palipana et al., affirming its role as a reliable indicator for detecting endometrial abnormalities.[21-23]

Age and postmenopausal status emerged as significant risk factors for endometrial pathology. Each year increase in age corresponded to 5% higher odds of abnormal findings (OR 1.05, 95% CI 1.02-1.09, $p = 0.002$), while postmenopausal status increased the odds by 2.5-fold (OR 2.5, 95% CI 1.20-5.20, $p = 0.014$). Age-related hormonal changes and cumulative estrogen exposure were pivotal in our observations, aligning with existing literature [24,25]. Conversely, history of hormonal therapy did not significantly influence outcomes (OR 0.7, 95% CI 0.30-1.60, $p = 0.4$).[26,27]

Our findings underscore the clinical utility of endometrial thickness measurement in evaluating abnormal uterine bleeding, offering high sensitivity and specificity across various cutoff values. These results support its integration into clinical practice for risk stratification and decision-making on further diagnostic procedures.

CONCLUSION

In conclusion, this study contributes valuable insights into the assessment of endometrial pathology among peri and postmenopausal women. Age, endometrial thickness, and menopausal status emerged as significant predictors, highlighting the importance of targeted monitoring and early intervention in clinical practice. Future research efforts could explore novel diagnostic approaches to refine risk assessment and improve patient outcomes.

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