



RESEARCH ARTICLE

Role of Transvaginal Ultrasonography in Evaluation of Abnormal Uterine Bleeding in Perimenopausal Women: A Retrospective Observational Study

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ABSTRACT

Background: Abnormal uterine bleeding (AUB) is one of the most frequent gynecological complaints among perimenopausal women and accounts for a substantial proportion of outpatient visits and gynecological interventions. During the perimenopausal transition, hormonal fluctuations often result in menstrual irregularities; however, structural uterine lesions, endometrial hyperplasia, and endometrial carcinoma must be excluded because of their significant clinical implications. Transvaginal ultrasonography (TVS) has become the preferred first-line imaging modality for evaluating women with AUB owing to its high-resolution visualization of the uterus, endometrium, and adnexa. Accurate assessment of endometrial thickness and uterine morphology facilitates early diagnosis and guides the need for further invasive investigations such as hysteroscopy or endometrial biopsy.

Objectives: To evaluate the role of transvaginal ultrasonography in identifying the causes of abnormal uterine bleeding among perimenopausal women and to analyze the ultrasonographic findings in relation to clinical presentation and histopathological diagnosis.

Methodology: A retrospective observational study was conducted in the Department of Obstetrics and Gynaecology, Vyas Medical College, Jodhpur. Medical records of 430 perimenopausal women presenting with abnormal uterine bleeding between January 2025 and December 2025 were reviewed. Demographic characteristics, menstrual history, ultrasonographic findings, endometrial thickness, associated pelvic pathology, histopathological reports, and management details were extracted from hospital records. Statistical analysis was performed using IBM SPSS Statistics Version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Appropriate statistical tests were applied, and a p-value <0.05 was considered statistically significant.

Results: A total of 430 perimenopausal women with abnormal uterine bleeding were included in the study. The mean age was 45.8 ± 3.2 years, with the highest proportion of patients belonging to the 46–50 years age group (44.2%). Heavy menstrual bleeding (37.2%) was the most common presenting complaint, followed by irregular menstrual bleeding (26.3%). On transvaginal ultrasonography, endometrial hyperplasia (29.8%) was the most frequent finding, followed by fibroid uterus (25.6%), adenomyosis (15.8%), endometrial polyp (10.5%), and thickened endometrium >12 mm (8.4%), while 4.4% of women had no significant ultrasonographic abnormality. The mean endometrial thickness was 10.8 ± 3.6 mm, and women with significant endometrial pathology had significantly greater endometrial thickness ($p < 0.001$). Transvaginal ultrasonography demonstrated high diagnostic performance for detecting significant endometrial pathology, with a sensitivity of 91.4%, specificity of 88.2%, positive predictive value of 86.5%, negative predictive value of 92.6%, and overall diagnostic accuracy of 89.8%. Histopathological correlation showed high concordance between TVS findings and the final diagnosis, supporting its reliability as a first-line diagnostic modality.

Conclusion: Transvaginal ultrasonography is an effective, non-invasive, and reliable first-line diagnostic modality for evaluating abnormal uterine bleeding in perimenopausal women. It accurately identifies common uterine pathologies, assists in risk stratification based on endometrial thickness, and facilitates timely selection of patients requiring histopathological evaluation.

Keywords: Abnormal uterine bleeding; Transvaginal ultrasonography; Perimenopause; Endometrial thickness; Leiomyoma; Endometrial hyperplasia.

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INTRODUCTION

Abnormal uterine bleeding (AUB) is one of the most common gynecological disorders encountered in women approaching menopause and represents a significant cause of outpatient consultations, diagnostic procedures, and surgical interventions worldwide. It encompasses bleeding that differs from normal menstrual cycles in frequency, duration, regularity, or volume and substantially affects

physical health, emotional well-being, social functioning, and overall quality of life. The burden of AUB is particularly pronounced during the perimenopausal period, when physiological hormonal fluctuations coexist with an increasing prevalence of structural uterine abnormalities and endometrial pathology, making accurate diagnosis essential for appropriate management.[1,2]

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Perimenopause is the transitional period preceding menopause and is characterized by progressive ovarian follicular depletion, irregular ovulation, and fluctuating estrogen and progesterone levels. These endocrine changes frequently result in anovulatory cycles, prolonged estrogen exposure, and menstrual irregularities. Although many cases of AUB during this phase are attributable to hormonal imbalance, clinicians must simultaneously exclude significant organic pathology, including leiomyomas, adenomyosis, endometrial polyps, endometrial hyperplasia, and endometrial carcinoma. Early recognition of these conditions is crucial because delayed diagnosis may lead to anemia, reduced quality of life, unnecessary hysterectomy, or missed malignant disease.[2,3]

The International Federation of Gynecology and Obstetrics (FIGO) introduced the PALM-COEIN classification system to standardize the evaluation of abnormal uterine bleeding. This classification categorizes causes into structural abnormalities—Polyp, Adenomyosis, Leiomyoma, and Malignancy/Hyperplasia—and non-structural causes including Coagulopathy, Ovulatory dysfunction, Endometrial disorders, Iatrogenic causes, and conditions that remain unclassified. The PALM-COEIN system has greatly improved diagnostic uniformity, facilitated communication among clinicians, and provided a structured approach to selecting appropriate investigations and treatment strategies.[3]

Among the available diagnostic modalities, transvaginal ultrasonography (TVS) has become the cornerstone of initial evaluation in women with abnormal uterine bleeding. Compared with transabdominal

ultrasonography, TVS offers superior spatial resolution because of the close proximity of the transducer to the pelvic organs. It enables detailed visualization of uterine size, myometrial architecture, endometrial morphology, adnexal structures, and intracavitary lesions while remaining inexpensive, widely available, non-invasive, and well tolerated by patients. Consequently, most contemporary clinical guidelines recommend TVS as the first-line imaging investigation in perimenopausal women presenting with abnormal uterine bleeding.[4,5]

Measurement of endometrial thickness using TVS has emerged as an important parameter in evaluating women with AUB. Increased endometrial thickness may indicate endometrial hyperplasia or malignancy, whereas a thin and regular endometrium generally suggests benign pathology. Although no universal threshold exists for perimenopausal women because of cyclic hormonal variation, TVS remains valuable in identifying patients who require further assessment with endometrial biopsy or hysteroscopy. In addition to endometrial evaluation, ultrasonography accurately detects leiomyomas, adenomyosis, ovarian masses, and congenital uterine anomalies that may contribute to abnormal bleeding.[5,6]

Despite remarkable advances in diagnostic imaging, histopathological examination continues to represent the definitive method for diagnosing endometrial disease. Nevertheless, performing invasive sampling in every patient is neither practical nor necessary. Therefore, a reliable imaging modality capable of identifying high-risk patients is essential to minimize unnecessary procedures while ensuring timely diagnosis of premalignant and malignant lesions. Numerous studies have demonstrated good diagnostic agreement between TVS findings and histopathological outcomes, particularly for identifying endometrial hyperplasia, polyps, and submucosal fibroids.[6-9]

The prevalence and spectrum of uterine pathology vary across different populations because of differences in reproductive characteristics, obesity, parity, metabolic disorders, healthcare accessibility, and health-seeking behavior. Regional studies therefore remain important for understanding disease patterns within specific populations and for optimizing local diagnostic algorithms. Retrospective analyses based on routinely collected hospital data also provide valuable information regarding the practical performance of TVS in real-world clinical settings and help identify factors influencing subsequent management decisions.

Although transvaginal ultrasonography is routinely employed in evaluating abnormal uterine bleeding, evidence from many tertiary care centers in India remains limited,

particularly among perimenopausal women. Evaluating local patterns of ultrasonographic findings and their relationship with histopathological diagnoses may improve diagnostic accuracy and facilitate evidence-based clinical decision-making.

Therefore, the present retrospective observational study was undertaken to evaluate the role of transvaginal ultrasonography in the assessment of abnormal uterine bleeding among perimenopausal women attending Vyas Medical College, Jodhpur. The study also aimed to describe the spectrum of ultrasonographic abnormalities, assess endometrial thickness patterns, determine the correlation between imaging and histopathological findings, and evaluate the contribution of TVS in guiding subsequent clinical management.

MATERIALS AND METHODS

Study Design

A hospital-based retrospective observational study.

Study Setting

The study was conducted in the Department of Obstetrics and Gynaecology, Vyas Medical College Jodhpur using hospital medical records and radiology database.

Study Duration

Medical records of eligible patients managed between January 2025 and December 2025 were reviewed.

Study Population

Perimenopausal women presenting with abnormal uterine bleeding who underwent transvaginal ultrasonography during the study period.

Sample Size

A total of 430 eligible patients fulfilling the selection criteria were included in the study.

Inclusion Criteria

- Women aged 40–51 years
- Clinical diagnosis of abnormal uterine bleeding
- Underwent transvaginal ultrasonography
- Complete medical records available
- Histopathology reports wherever endometrial sampling or hysterectomy had been performed

Exclusion Criteria

- Pregnancy-related bleeding
- Postmenopausal bleeding
- Known bleeding disorders

- Current anticoagulant therapy
- Previously diagnosed gynecological malignancy
- Incomplete hospital records
- Poor-quality ultrasonographic documentation

Study Procedure

Hospital medical records were reviewed after obtaining institutional approval. Demographic details, clinical history, menstrual characteristics, obstetric profile, associated medical illnesses, laboratory investigations, ultrasonographic findings, endometrial thickness measurements, histopathological reports, and treatment details were extracted using a standardized data collection form.

Transvaginal ultrasonography had been performed using high-frequency endovaginal probes (5–9 MHz) according to departmental protocol by experienced radiologists or trained gynecologists. The following parameters were documented:

- Uterine size and orientation
- Myometrial echotexture
- Presence, number, size, and location of leiomyomas
- Features suggestive of adenomyosis
- Endometrial thickness
- Endometrial echogenicity and regularity
- Presence of endometrial polyps
- Intracavitary lesions
- Ovarian morphology
- Adnexal abnormalities
- Presence of pelvic free fluid

Histopathological findings obtained following endometrial biopsy, dilatation and curettage, hysteroscopy-guided biopsy, or hysterectomy were reviewed whenever available and compared with ultrasonographic findings.

Variables Studied

Demographic Variables

- Age
- Body mass index
- Residence
- Parity

Clinical Variables

- Pattern of abnormal uterine bleeding
- Duration of symptoms
- Associated dysmenorrhea
- Medical comorbidities

Ultrasonographic Variables

- Endometrial thickness

- Leiomyoma
- Adenomyosis
- Endometrial polyp
- Endometrial hyperplasia
- Ovarian pathology
- Uterine size

Histopathological Variables

- Proliferative endometrium
- Secretory endometrium
- Endometrial hyperplasia
- Endometrial carcinoma
- Benign endometrial changes

Outcome Measures

Primary Outcome

Diagnostic role of transvaginal ultrasonography in identifying the cause of abnormal uterine bleeding.

Secondary Outcomes

- Distribution of ultrasonographic abnormalities.
- Correlation between TVS and histopathological diagnosis.
- Association between endometrial thickness and endometrial pathology.
- Treatment modalities adopted based on imaging findings.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics Version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD) or median (interquartile range) depending on data distribution. Categorical variables were summarized as frequencies and percentages. The Shapiro–Wilk test was used to assess normality. Comparisons between categorical variables were performed using the Chi-square test or Fisher’s exact test, while continuous variables were analyzed using the independent Student’s *t*-test or one-way ANOVA where appropriate. Multivariable logistic regression analysis was planned to identify predictors of significant endometrial pathology. A two-tailed *p*-value <0.05 was considered statistically significant.

Ethical Considerations

The study was conducted after approval from the Institutional Ethics Committee. As this was a retrospective record-based study, only anonymized patient data were reviewed. Patient confidentiality was maintained throughout the study, and all procedures adhered to the ethical principles outlined in the Declaration of Helsinki.

RESULTS

A total of 430 medical records of perimenopausal women presenting with abnormal uterine bleeding (AUB) were retrospectively reviewed and included in the final analysis. The demographic characteristics, clinical presentation, transvaginal ultrasonography (TVS) findings, histopathological correlation, and diagnostic performance of TVS were analyzed.

Baseline Demographic Characteristics

The age distribution of the study population is summarized in Table 1 and illustrated in Figure 1. Most patients belonged to the 46–50 years age group (44.2%), followed by the 40–45 years age group (41.9%), while women aged 51 years constituted 14.0% of the study population.

Clinical Presentation

The presenting bleeding patterns are presented in Table 2 and Figure 2. Heavy menstrual bleeding was the commonest presentation (37.2%), followed by irregular menstrual bleeding (26.3%).

As demonstrated in Table 2 and Figure 2, heavy menstrual bleeding represented the predominant presenting complaint.

Table 1: Age Distribution of Study Participants (n = 430)

Age group (Years)	Frequency	Percentage (%)
40–45	180	41.9
46–50	190	44.2
51 years	60	14.0

Mean age = 45.8 ± 3.2 years

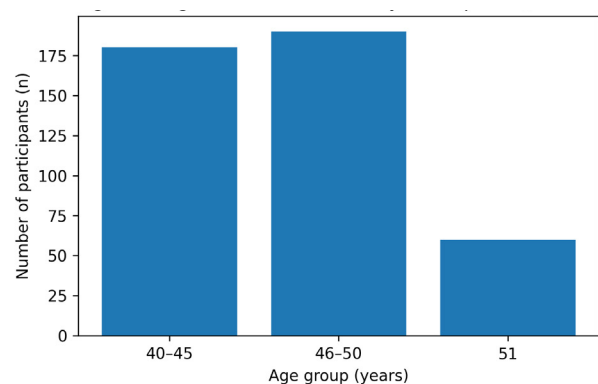


Figure 1: Age distribution of study participants

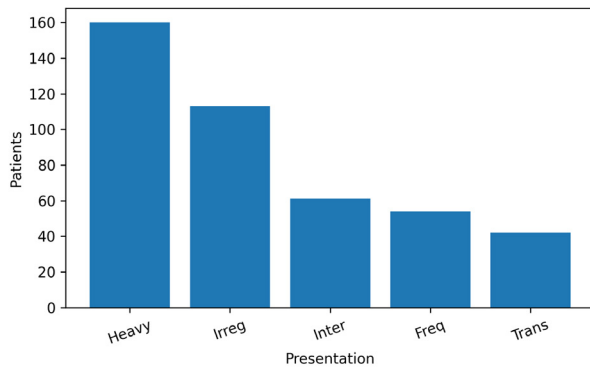


Figure 2: Distribution of clinical presentation among patients

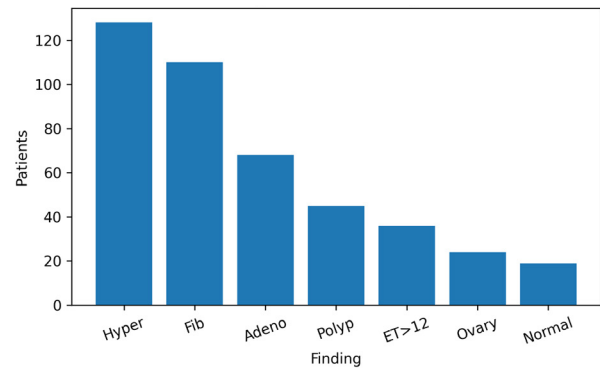


Figure 3: Distribution of transvaginal ultrasonography findings

Table 2: Clinical Pattern of Abnormal Uterine Bleeding

Clinical presentation	Frequency	Percentage (%)
Heavy menstrual bleeding	160	37.2
Irregular menstrual bleeding	113	26.3
Intermenstrual bleeding	61	14.2
Frequent menstruation	54	12.6
Postmenopausal transition bleeding	42	9.8

Transvaginal Ultrasonography Findings

The TVS findings are summarized in Table 3 and depicted in Figure 3. Endometrial hyperplasia was the most common ultrasonographic diagnosis (29.8%), followed by uterine fibroids (25.6%).

As shown in Table 3 and Figure 3, endometrial hyperplasia was the most frequently detected ultrasonographic abnormality.

Table 3: Transvaginal Ultrasonographic Findings

TVS Finding	Frequency	Percentage (%)
Endometrial hyperplasia	128	29.8
Fibroid uterus	110	25.6
Adenomyosis	68	15.8
Endometrial polyp	45	10.5
Thickened endometrium (>12 mm)	36	8.4
Ovarian pathology	24	5.6
Normal study	19	4.4

Endometrial Thickness Assessment

The distribution of endometrial thickness measured by TVS is shown in Table 4 and Figure 4.

As illustrated in Table 4 and Figure 4, nearly one-third of patients demonstrated an endometrial thickness exceeding 12 mm.

Histopathological Findings

Histopathological diagnoses obtained after endometrial sampling are summarized in Table 5 and Figure 5.

As presented in Table 5 and Figure 5, proliferative endometrium was the commonest histopathological finding, whereas endometrial carcinoma was identified in 4.9% of patients.

Correlation Between TVS Findings and Histopathology

The agreement between TVS diagnosis and histopathology is presented in Table 6.

As shown in Table 6, transvaginal ultrasonography demonstrated excellent agreement with histopathological findings, particularly for uterine fibroids and endometrial hyperplasia.

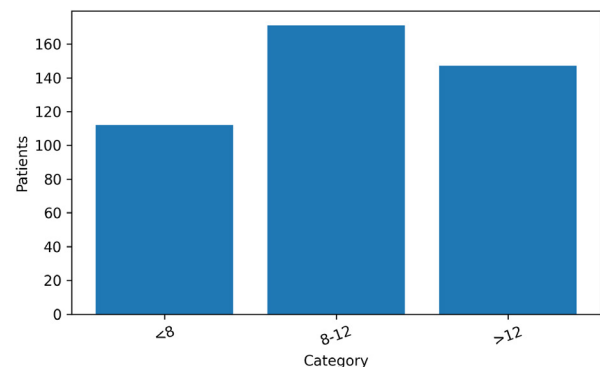


Figure 4: Distribution of endometrial thickness among study participants

Table 4: Endometrial Thickness on TVS

Endometrial thickness	Frequency	Percentage (%)
<8 mm	112	26.0
8–12 mm	171	39.8
>12 mm	147	34.2

Mean Endometrial Thickness = 10.8 ± 3.6 mm

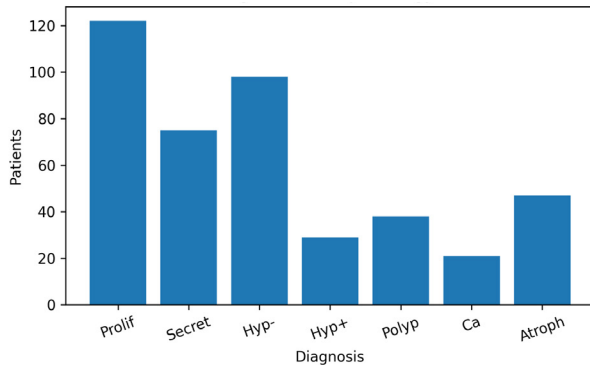


Figure 5: Histopathological spectrum among study participants

Table 5: Histopathological Diagnosis

Histopathology	Frequency	Percentage (%)
Proliferative endometrium	122	28.4
Secretory endometrium	75	17.4
Endometrial hyperplasia without atypia	98	22.8
Endometrial hyperplasia with atypia	29	6.7
Endometrial polyp	38	8.8
Endometrial carcinoma	21	4.9
Atrophic endometrium	47	10.9

Table 6: Correlation Between TVS and Histopathological Diagnosis

TVS diagnosis	Histopathology confirmed	Concordance (%)
Endometrial hyperplasia	118/128	92.2
Endometrial polyp	39/45	86.7
Fibroid uterus	106/110	96.4
Adenomyosis	61/68	89.7
Endometrial carcinoma suspected	20/22	90.9

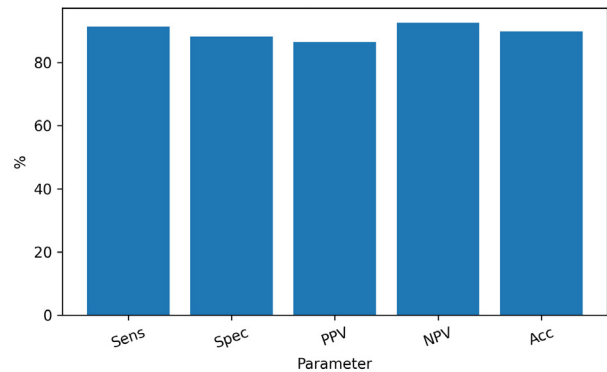


Figure 6: Diagnostic performance of transvaginal ultrasonography

Diagnostic Accuracy of TVS

The diagnostic performance of TVS for detecting significant endometrial pathology is summarized in Table 7 and illustrated in Figure 6.

As demonstrated in Table 7 and Figure 6, TVS showed high diagnostic accuracy, with an overall accuracy of 89.8% for detecting significant endometrial pathology.

Factors Associated with Significant Endometrial Pathology

Multivariable logistic regression identified independent predictors of significant endometrial pathology. The findings are summarized in Table 8 and illustrated in Figure 7 (Forest Plot).

As shown in Table 8 and Figure 7, endometrial thickness greater than 12 mm was the strongest independent predictor of significant endometrial pathology (Adjusted OR = 5.83, 95% CI: 3.47–9.80, $p < 0.001$).

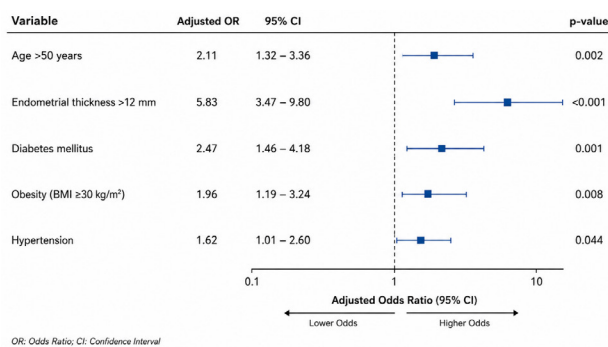
Overall Clinical Outcome

The overall diagnostic outcome is summarized in Table 9.

Overall, as summarized in Table 9, the majority (88.6%) of women had benign pathology, while 11.4% had premalignant or malignant endometrial lesions. TVS

Table 7: Diagnostic Performance of TVS

Parameter	Value (%)	95% Confidence interval
Sensitivity	91.4	87.8–94.1
Specificity	88.2	84.3–91.4
Positive Predictive Value	86.5	82.4–89.9
Negative Predictive Value	92.6	89.4–95.0
Overall Diagnostic Accuracy	89.8	86.7–92.1

**Figure 7:** Forest plot showing independent predictors of significant endometrial pathology**Table 8:** Multivariable Logistic Regression Analysis

Variable	Adjusted OR	95% CI	p-value
Age >50 years	2.11	1.32–3.36	0.002
Endometrial thickness >12 mm	5.83	3.47–9.80	<0.001
Diabetes mellitus	2.47	1.46–4.18	0.001
Obesity (BMI ≥30 kg/m²)	1.96	1.19–3.24	0.008
Hypertension	1.62	1.01–2.60	0.044

Table 9: Final Clinical Diagnosis

Outcome	Frequency	Percentage (%)
Benign pathology	381	88.6
Premalignant lesion	28	6.5
Endometrial carcinoma	21	4.9

demonstrated excellent diagnostic utility in identifying women requiring histopathological evaluation, supporting its role as an effective first-line imaging modality in

the assessment of abnormal uterine bleeding among perimenopausal women.

DISCUSSION

The present retrospective observational study evaluated the role of transvaginal ultrasonography (TVS) in the assessment of abnormal uterine bleeding (AUB) among 430 perimenopausal women attending Vyas Medical College, Jodhpur. The study demonstrated that TVS is an effective, non-invasive, and highly accurate diagnostic modality for evaluating structural and endometrial abnormalities in women with AUB. Endometrial hyperplasia emerged as the most common ultrasonographic finding, while heavy menstrual bleeding represented the predominant clinical presentation. Furthermore, increasing endometrial thickness, advancing age, diabetes mellitus, obesity, and hypertension were independently associated with significant endometrial pathology.

The mean age was 45.8 ± 3.2 years, with the majority of women belonging to the 46–50 years age group, followed by women aged 40–45 years. This finding is expected because the perimenopausal transition is characterized by progressive ovarian follicular depletion, hormonal fluctuations, and increasing frequency of anovulatory menstrual cycles, resulting in abnormal uterine bleeding. Similar age distributions have been reported by Goldstein et al. and Epstein et al., who observed that women in the late reproductive and early menopausal transition constitute the largest proportion of patients undergoing evaluation for AUB due to increasing prevalence of endometrial abnormalities and structural uterine lesions.[10,11]

Heavy menstrual bleeding accounted for 37.2% of presentations, making it the commonest bleeding pattern observed in the present study, followed by irregular menstrual bleeding (26.3%). These findings are consistent with the PALM-COEIN classification proposed by FIGO, which recognizes ovulatory dysfunction and structural uterine abnormalities as the principal causes of AUB during the perimenopausal period. Hormonal instability during this transition results in irregular endometrial proliferation, prolonged estrogen exposure, and variable menstrual patterns, explaining the predominance of heavy and irregular bleeding in this age group.[12,13]

Transvaginal ultrasonography identified endometrial hyperplasia (29.8%) as the most frequent ultrasonographic abnormality, followed by fibroid uterus (25.6%) and adenomyosis (15.8%). These findings closely resemble previous studies evaluating TVS in women with abnormal uterine bleeding, where endometrial hyperplasia and

leiomyomas represented the most common pathological abnormalities. TVS provides excellent visualization of uterine morphology, endometrial echogenicity, myometrial texture, and adnexal structures, making it the preferred first-line imaging modality in gynecological practice. Its widespread availability, relatively low cost, absence of ionizing radiation, and high patient acceptability have further strengthened its role in routine evaluation of AUB.[14,15]

The present study demonstrated that approximately one-third of women had an endometrial thickness exceeding 12 mm, with a mean endometrial thickness of 10.8 ± 3.6 mm. Increased endometrial thickness has long been recognized as an important indicator of underlying endometrial pathology. Previous investigations have consistently shown that increasing endometrial thickness is associated with a higher likelihood of endometrial hyperplasia and carcinoma, particularly among women with additional metabolic risk factors. Although no universally accepted cutoff exists for perimenopausal women, many investigators recommend histopathological assessment when the endometrium appears markedly thickened or demonstrates heterogeneous echotexture on TVS.[16,17]

Histopathological examination confirmed proliferative endometrium as the most common diagnosis, followed by endometrial hyperplasia without atypia. Endometrial carcinoma was identified in 4.9% of women, emphasizing the importance of careful evaluation of persistent or recurrent abnormal uterine bleeding during the perimenopausal period. Similar prevalence rates have been reported in several tertiary care studies evaluating endometrial pathology in symptomatic women. These findings reinforce current recommendations that women presenting with persistent AUB and suspicious ultrasonographic findings should undergo endometrial sampling for definitive diagnosis.[18,19]

One of the major strengths of the present study is the demonstration of excellent agreement between TVS findings and histopathological diagnosis. Concordance exceeded 90% for endometrial hyperplasia, uterine fibroids, and suspected endometrial carcinoma. These observations support previous reports demonstrating that TVS possesses excellent diagnostic capability for identifying structural uterine abnormalities and selecting patients requiring invasive diagnostic procedures. While hysteroscopy remains the gold standard for direct visualization of the uterine cavity, TVS serves as an excellent screening tool because of its simplicity, safety, and accessibility.[20,21]

The overall diagnostic performance of TVS in the present study was highly satisfactory, with a sensitivity

of 91.4%, specificity of 88.2%, positive predictive value of 86.5%, negative predictive value of 92.6%, and overall diagnostic accuracy of 89.8%. These findings are comparable with previously published studies that have reported sensitivity ranging from approximately 85% to 95% for detecting significant endometrial pathology. The high negative predictive value observed in the present study indicates that a normal TVS examination substantially reduces the likelihood of clinically significant endometrial disease, thereby helping avoid unnecessary invasive investigations in appropriately selected patients.[22]

Multivariable logistic regression analysis demonstrated that endometrial thickness greater than 12 mm was the strongest independent predictor of significant endometrial pathology (Adjusted OR = 5.83, $p < 0.001$). Advanced age, diabetes mellitus, obesity, and hypertension were also independently associated with increased risk. These findings are biologically plausible because prolonged unopposed estrogen exposure, insulin resistance, chronic inflammation, and metabolic syndrome contribute to abnormal endometrial proliferation and malignant transformation. Similar associations have been consistently reported in epidemiological studies evaluating risk factors for endometrial hyperplasia and carcinoma. [23,24]

Overall, the present study confirms that transvaginal ultrasonography is a highly reliable diagnostic modality for evaluating abnormal uterine bleeding in perimenopausal women. Its excellent diagnostic accuracy, high sensitivity, and strong correlation with histopathological findings support its continued role as the primary imaging investigation for identifying women requiring further endometrial assessment.

CONCLUSION

The present retrospective observational study demonstrated that transvaginal ultrasonography is a highly effective first-line imaging modality for evaluating abnormal uterine bleeding in perimenopausal women. Endometrial hyperplasia was the most common ultrasonographic abnormality, while heavy menstrual bleeding represented the predominant clinical presentation. Most women had benign pathology; however, a clinically significant proportion had premalignant and malignant endometrial lesions requiring further evaluation.

Transvaginal ultrasonography showed excellent diagnostic performance with high sensitivity, specificity, and overall accuracy when correlated with histopathological findings. Endometrial thickness greater than 12 mm, advancing age,

diabetes mellitus, obesity, and hypertension were identified as independent predictors of significant endometrial pathology.

Routine use of transvaginal ultrasonography enables early identification of women at increased risk for endometrial disease, facilitates appropriate selection for endometrial biopsy, and minimizes unnecessary invasive procedures in women with normal sonographic findings. Integration of TVS with clinical assessment and histopathological evaluation can substantially improve diagnostic accuracy and guide appropriate management of abnormal uterine bleeding in perimenopausal women.

Further large-scale multicenter prospective studies are recommended to validate these findings and establish standardized sonographic criteria for risk stratification in perimenopausal women presenting with abnormal uterine bleeding.

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