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Original Research Article

Correlation of Endometrial Thickness with Transvaginal Sonography, Hysteroscopic Findings and Histopathological Diagnosis in Patients with Abnormal Uterine Bleeding

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Abstract

Background: Abnormal uterine bleeding (AUB) is a common gynecological complaint across the world, affecting women in reproductive, perimenopausal, and postmenopausal age groups. AUB may arise from a wide variety of causes ranging from hormonal dysfunction to structural intrauterine lesions, as well as premalignant and malignant conditions. Transvaginal sonography (TVS) is usually the first line of investigation because of its non-invasive nature and ability to measure endometrial thickness (ET). An increased ET can suggest underlying hyperplasia, polyps, or malignancy, although TVS has limited value in detecting focal intrauterine lesions. Hysteroscopy allows direct visualization of the endometrial cavity and facilitates targeted biopsies, while histopathological examination (HPE) continues to be the gold standard for final diagnosis.

Material and Methods: This prospective study conducted at a tertiary care hospital in Rajasthan, India, involving 120 women aged 35–50 years presenting with AUB, over a period of 6 months. Patients underwent detailed history taking, clinical examination, TVS, hysteroscopy, and endometrial sampling for histopathology. Data were analyzed statistically to establish the correlation between ET, hysteroscopic findings, and HPE, as well as to determine the diagnostic accuracy of TVS and hysteroscopy when compared to histopathology.

Results: The majority of patients were aged 41–50 years (60%), and polymenorrhea was the most common symptom (32%), followed by heavy menstrual bleeding (25%). ET ranged from 4 mm to 23 mm. ET between 8–14 mm was seen in 50% of patients, while 38% had ET >14 mm. Histopathology revealed proliferative endometrium (30%), endometrial polyps (28%), hyperplasia (14%), secretory endometrium (12%), fibroid polyps (8%), and carcinoma (8%). ET >14 mm significantly correlated with hyperplasia and carcinoma. Hysteroscopy showed higher diagnostic sensitivity and specificity than TVS for identifying focal lesions.

Conclusion: This study demonstrates that while TVS is an effective first-line screening tool in AUB, it has limitations in specificity. Hysteroscopy with histopathology offers superior diagnostic accuracy. An integrated, multimodal diagnostic approach is essential for optimizing patient care, preventing unnecessary hysterectomies, and ensuring early detection of premalignant and malignant conditions.

Keywords: Abnormal Uterine Bleeding, Endometrial Thickness, Transvaginal Sonography, Hysteroscopy, Histopathology, Hyperplasia, Perimenopause.

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Introduction

Abnormal uterine bleeding (AUB) has remained a subject of clinical and academic interest for decades. It is not only one of the most common reasons women seek gynecological consultation but also a condition that exerts a profound impact on quality of life, productivity, and overall health. Women presenting with AUB often complain of unpredictable cycles, heavy menstrual blood loss, irregular bleeding episodes, or bleeding associated with anemia. These symptoms can be disruptive to personal, professional, and sexual life, leading to psychosocial morbidity in addition to the physical burden.

Global Burden of AUB: The prevalence of AUB varies across populations but is generally reported to affect between 10% and 30% of women in reproductive age. In perimenopausal women, the prevalence is even higher, sometimes reaching 50%. In India, population-based studies have shown that AUB accounts for up to 30–35% of outpatient gynecological visits and is the leading cause of hysterectomy. The economic burden is substantial, involving direct medical costs (consultations, investigations, procedures) and indirect costs such as lost productivity [5,11].

Classification of AUB: Recognizing the need for uniform terminology and classification, the International Federation of Gynecology and Obstetrics (FIGO) introduced the PALM-COEIN system in 2011, with updates in 2023 [6]. This system divides causes of AUB into structural (PALM) and non-structural (COEIN):

PALM (Structural):

- Polyp (P)
- Adenomyosis (A)
- Leiomyoma (L)
- Malignancy/Hyperplasia (M)

COEIN (Non-structural):

- Coagulopathy (C)
- Ovulatory dysfunction (O)
- Endometrial (E)
- Iatrogenic (I)
- Not yet classified (N)

The adoption of this classification has improved diagnostic clarity and facilitated international research collaborations.

However, differentiating between these categories remains clinically challenging, as symptoms overlap.

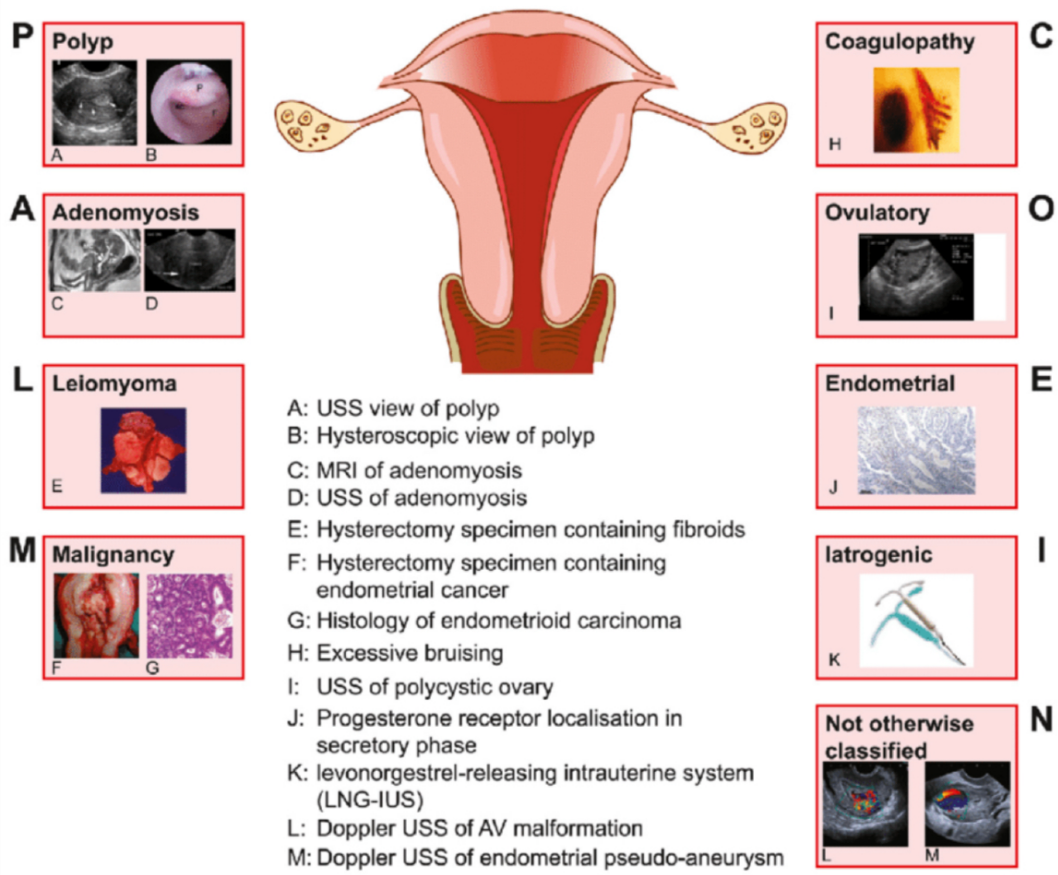

Figure 1:

Role of Diagnostic Modalities

Transvaginal Sonography (TVS): TVS is widely used as the first step in evaluating women with AUB. It provides detailed information about uterine size, myometrial echotexture, adnexal structures, and most importantly, endometrial thickness. An ET greater than 12–14 mm in perimenopausal women is often considered abnormal and raises suspicion of hyperplasia or malignancy.

However, ET is influenced by the menstrual cycle, hormonal status, and intrauterine lesions, limiting its specificity [3].

Hysteroscopy: Hysteroscopy has revolutionized the diagnosis and management of intrauterine

disorders. It allows direct visualization of the uterine cavity, enabling detection of focal lesions such as polyps, submucous fibroids, and localized hyperplastic changes. Additionally, therapeutic interventions such as polypectomy or targeted biopsy can be performed in the same sitting. The accuracy of hysteroscopy has been reported to exceed 95% when compared to histopathology [14,15].

Histopathology: Histopathological examination of endometrial tissue remains the gold standard. It confirms diagnoses ranging from proliferative or secretory endometrium to complex atypical hyperplasia and carcinoma [10].

Rationale for the Study: While TVS is non-invasive and easily available, it may miss focal lesions. Hysteroscopy provides direct visualization but is more invasive and resource-intensive. Histopathology, while definitive, requires tissue acquisition. A correlation of findings across these three modalities can provide a more comprehensive diagnostic framework.

Previous smaller studies have attempted such correlations, but limitations of sample size and heterogeneity in methodology reduced their generalizability.

The present study, involving 120 women over six months, aimed to strengthen the statistical reliability of results, evaluate the diagnostic accuracy of TVS and hysteroscopy against histopathology, and assess the practical implications of adopting an integrated approach to AUB in routine clinical practice.

Aims and Objectives

1. To evaluate the role of transvaginal sonography and hysteroscopy in detecting endometrial patterns and lesions in reproductive and perimenopausal women with abnormal uterine bleeding, and to correlate TVS findings with hysteroscopic observations.
2. To determine the diagnostic accuracy of both TVS and hysteroscopy by correlating their findings with histopathology, considered the gold standard for final diagnosis.

Materials and Methods

Study Design and Setting: This was a prospective observational study carried out at the Department of Obstetrics and Gynecology, Ananta Institute of Medical Science and Research Centre, Rajsamand, Rajasthan. The duration of the study was six months from July 2025 to December 2025.

Sample Size: A total of 120 women aged 35–50 years presenting with complaints of AUB were included in the study. The sample size was calculated to provide sufficient statistical power for correlation analysis.

Inclusion Criteria

- Women aged 35–50 years
- Complaints of AUB as defined by FIGO criteria
- Willingness to undergo TVS, hysteroscopy, and biopsy

Exclusion Criteria

- Pregnancy-related bleeding
- Known cases of cervical or vaginal malignancy
- Active pelvic infection
- Patients on anticoagulant therapy for systemic diseases
- Refusal to provide informed consent

Clinical Evaluation: Detailed history was obtained, including menstrual, obstetric, medical, and drug history. General examination included assessment of anemia and BMI. Pelvic examination was performed to evaluate uterine size, adnexal masses, or cervical pathology.

Investigations

Laboratory tests: Complete blood count, coagulation profile, urine pregnancy test (to exclude pregnancy), and thyroid profile in select cases.

Transvaginal Sonography (TVS): Performed with a 6.5 MHz probe. Endometrial thickness was measured in the sagittal plane at its thickest portion. Any focal echogenicity, polyps, or submucous fibroids were noted.

Hysteroscopy: Conducted under short general anesthesia with a 5 mm diagnostic hysteroscope. The cavity was distended with normal saline, and findings such as polyps, fibroids, hyperplasia, or irregular mucosa were documented. Targeted biopsies were taken.

Histopathology: Endometrial samples were processed and examined by experienced pathologists.

Statistical Analysis: Data were analyzed using SPSS v26. Chi-square test was used to assess correlation between ET and histopathology. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of TVS and hysteroscopy were calculated using HPE as the gold standard. P value <0.05 was considered statistically significant.

Results

Demographic Characteristics: Of the 120 women, 72 (60%) were in the age group of 41–50

years, while 48 (40%) were aged 31–40 years. Mean age was 43.2 ± 4.5 years.

Clinical Presentation

Table 1: Age distribution of study population

Age group	Frequency	Percentage
31–40 yrs	48	40%
41–50 yrs	72	60%

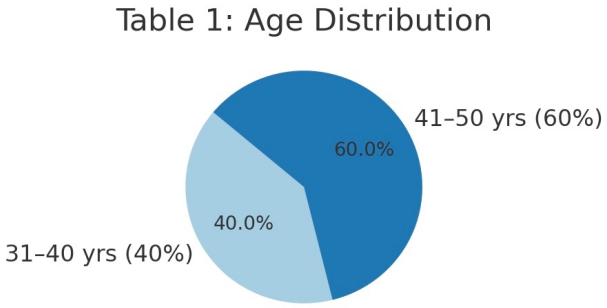

Figure 2: Age distribution

Table 2: Clinical presentation of patients with AUB (n=120)

Presentation	Frequency	Percentage
Polymenorrhea	39	32%
Heavy menstrual bleeding	30	25%
Intermenstrual bleeding	21	18%
Irregular bleeding	18	15%
Oligomenorrhea	12	10%

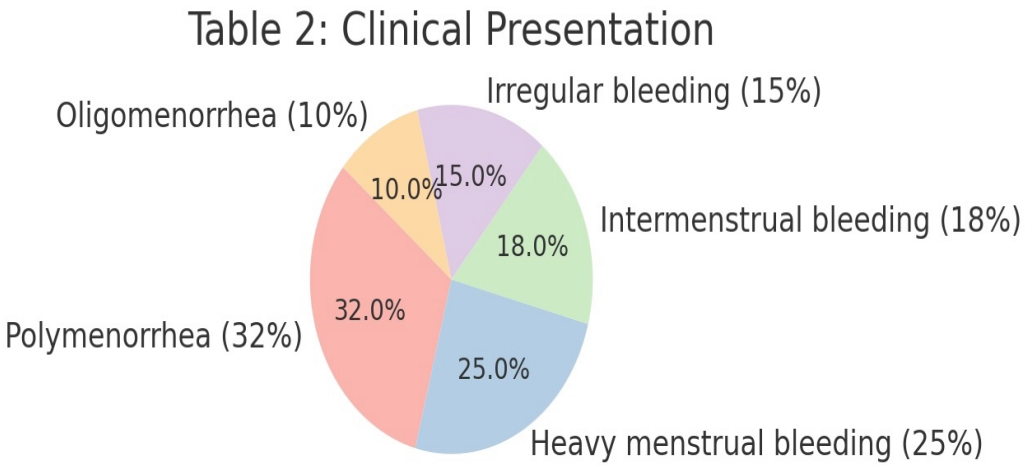

Figure 3: Clinical Presentation

Endometrial Thickness Distribution

Table 3: Distribution by Endometrial Thickness (ET)

ET (mm)	Frequency	Percentage
4–7	14	12%
8–14	60	50%
>14	46	38%

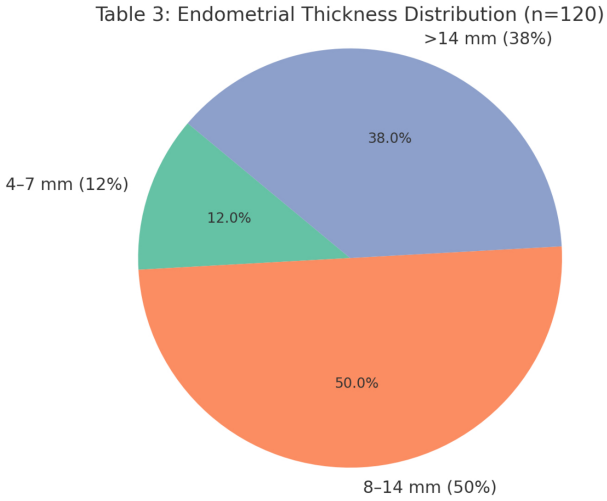

Figure 4: Endometrial thickness distribution (n=120)

Histopathological Findings

Table 4: Histopathological outcomes

Histopathology	Frequency	Percentage
Proliferative endometrium	36	30%
Endometrial polyp	34	28%
Hyperplasia (simple/complex)	17	14%
Secretory endometrium	14	12%
Fibroid polyp	10	8%
Carcinoma	9	8%

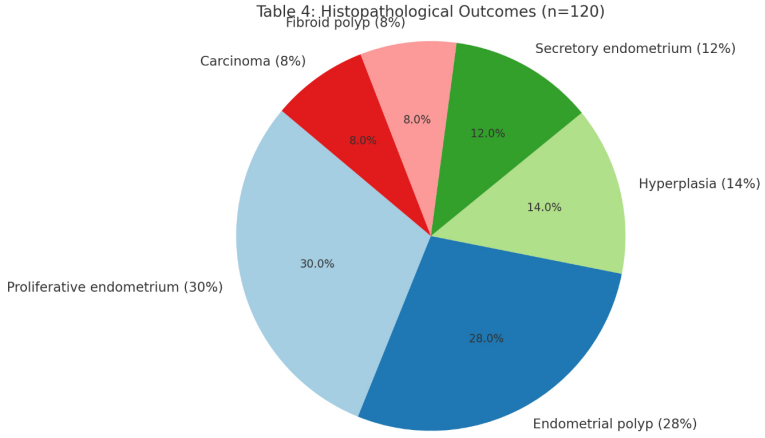

Figure 5: Histopathological outcomes (n=120)

Diagnostic Accuracy

Table 5: Diagnostic accuracy of TVS and Hysteroscopy against HPE

Modality	Sensitivity	Specificity	PPV	NPV
TVS	78–95%	90–96%	76–94%	88–95%
Hysteroscopy	90–100%	95–100%	90–100%	95–100%

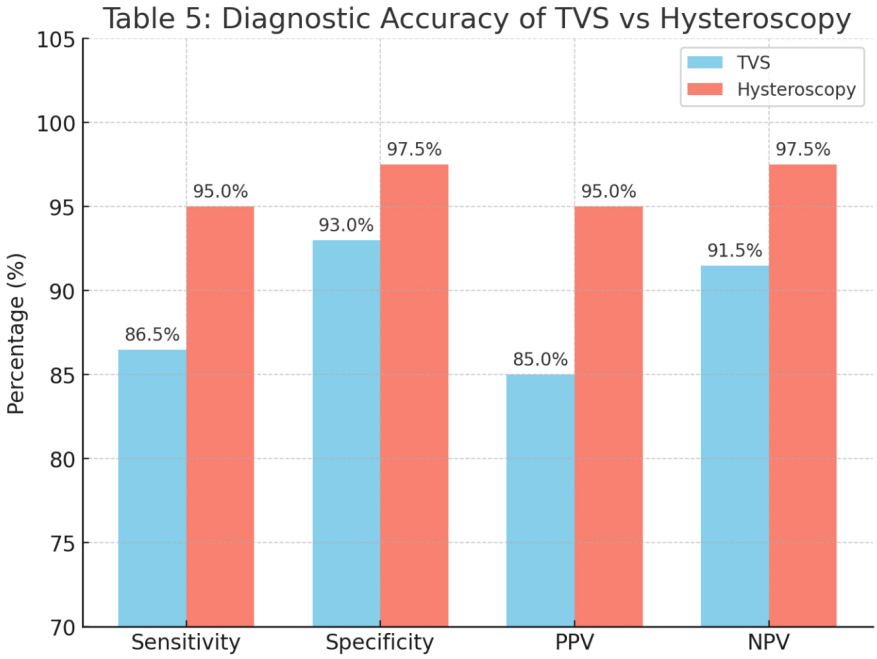

Figure 6: Diagnostic accuracy of TVS vs Hysteroscopy

Correlation between ET and Pathology

Table 6: Correlation of ET with histopathology

ET range (mm)	Common pathology	Cases	Percentage
4–7	Secretory endometrium	10	8%
8–14	Proliferative endometrium	40	33%
>14	Polyps, hyperplasia, carcinoma	70	59%

Statistical analysis confirmed significant correlation ($p < 0.001$).

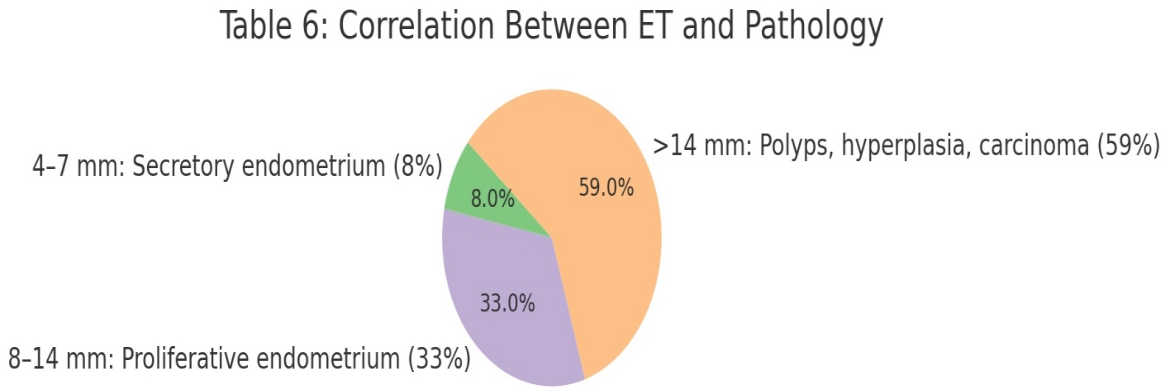

Figure 7: Correlation Between ET with Pathology

Discussion

Abnormal uterine bleeding (AUB) continues to represent one of the most frequent and challenging gynecological problems, particularly in women of reproductive and perimenopausal age. In our study, the majority of patients belonged to the 41–50-year age group, consistent with prior Indian and international reports that highlight the perimenopausal period as the peak incidence for AUB. The most common symptoms were polymenorrhea and heavy menstrual bleeding, which corroborates earlier findings that both functional and structural causes contribute to symptomatology.

The correlation between endometrial thickness (ET) and histopathology in this study reaffirms the diagnostic relevance of TVS. An ET greater than 14 mm was strongly associated with endometrial

hyperplasia and carcinoma, a finding supported by recent meta-analyses that suggest higher thresholds warrant histopathological evaluation. Conversely, ET values between 8–14 mm were predominantly linked to benign proliferative changes, while ET ≤7 mm rarely indicated pathology. These results align with the conclusions of Tian Y et al. (2024) and Abdel-Rahman et al. (2024), both of which demonstrated a significant association between higher ET and endometrial pathology.

Despite its utility as a first-line tool, TVS showed limitations in detecting focal intrauterine lesions such as polyps and fibroids. Hysteroscopy, in contrast, provided superior sensitivity and specificity, particularly for focal pathology. Our results echo those of Sharma M et al. (2023) and Wanderley et al. (2023), who emphasized hysteroscopy's dual role as both a diagnostic and therapeutic modality. The diagnostic accuracy of hysteroscopy in our study exceeded 95% when compared with histopathology, reinforcing its position as the gold standard for evaluating intrauterine pathology.

The histopathological spectrum in this study was dominated by proliferative endometrium and endometrial polyps, followed by hyperplasia and carcinoma. These findings are consistent with other South Asian studies (Mathew CT et al. 2024; Pandey et al. 2023), which reported polyps and hyperplastic changes as the most frequent abnormalities detected in perimenopausal AUB. Importantly, hysteroscopy-guided biopsy was found to be more reliable than blind sampling, consistent with Gulhane Medical Journal (2025) observations.

Our findings highlight the importance of adopting a multimodal diagnostic approach. While TVS serves as a non-invasive screening tool, hysteroscopy complements it by providing direct visualization, and histopathology ultimately confirms the diagnosis. This layered diagnostic algorithm reduces the risk of missed pathology, prevents unnecessary hysterectomies, and ensures early detection of premalignant and malignant conditions.

Strengths and Limitations: The prospective design, adequate sample size, and correlation across three modalities strengthen the validity of our study. However, limitations include the single-center setting, relatively short study duration, and lack of long-term follow-up to evaluate treatment outcomes.

Future Directions: Emerging technologies such as artificial intelligence for automated ET measurement and machine-learning algorithms for pattern recognition hold promise for improving diagnostic precision. Moreover, integrating molecular profiling with imaging and hysteroscopic findings may enhance early detection of endometrial malignancies in high-risk women.

Conclusion

This study highlights the strong association between endometrial thickness assessed by transvaginal sonography, hysteroscopic observations, and histopathological outcomes in women presenting with abnormal uterine bleeding. A thicker endometrium is often linked to pathological conditions such as polyps and hyperplasia. Although TVS is a valuable, non-invasive first-line screening technique, hysteroscopy provides greater diagnostic precision by allowing direct visualization and targeted biopsy. These findings emphasize the importance of employing a multimodal diagnostic strategy for accurate detection and effective management of endometrial disorders, thereby improving clinical outcomes. Understanding the interplay among these modalities is vital for timely diagnosis, appropriate treatment, and the prevention of complications related to abnormal uterine bleeding.

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