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Role of Pelvic Ultrasound in the Evaluation and Management of Abnormal Uterine Bleeding in Reproductive-Age Women: A Cross-Sectional Study

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Abstract

Background:

Abnormal uterine bleeding (AUB) is one of the most common gynecological complaints in women of reproductive age. Accurate and timely identification of its underlying cause is crucial for effective management. Pelvic ultrasound, particularly transvaginal sonography (TVS), is widely used as a first-line diagnostic tool due to its non-invasive nature, affordability, and accessibility. This study aimed to assess the diagnostic utility of pelvic ultrasound in identifying structural causes of AUB and its impact on patient management.

Objectives:

1. To determine the prevalence of structural abnormalities in women with AUB using pelvic ultrasound.
2. To evaluate the diagnostic accuracy of ultrasound compared to histopathology/hysteroscopy.
3. To assess the role of ultrasound findings in guiding clinical management decisions.

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Methods:

A hospital-based cross-sectional study was conducted among 150 reproductive-aged women (20–45 years) presenting with AUB at a tertiary care hospital. All participants underwent pelvic ultrasound (transabdominal and/or transvaginal), followed by further diagnostic or therapeutic procedures as clinically indicated. Findings were analyzed using descriptive statistics and diagnostic accuracy measures (sensitivity, specificity, PPV, NPV).

Results:

The most common presenting symptom was heavy menstrual bleeding (43.3%). Pelvic ultrasound detected structural abnormalities in 110 women (73.3%), including uterine fibroids (33.3%), endometrial polyps (16.7%), and adenomyosis (13.3%). Ultrasound showed high diagnostic accuracy for fibroids (sensitivity: 93.3%, specificity: 95%) and reasonable accuracy for polyps (sensitivity: 80%, specificity: 90%). In 26.7% of cases, ultrasound revealed no structural abnormalities. Ultrasound findings influenced management decisions in 87 (58%) patients who underwent surgical treatment.

Conclusion:

Pelvic ultrasound, particularly TVS, is a valuable diagnostic tool in the evaluation of AUB among reproductive-aged women. It enables early detection of structural causes and guides appropriate clinical management. Integration of ultrasound findings with clinical and laboratory assessment enhances the diagnostic pathway and optimizes patient outcomes.

Keywords:

Abnormal uterine bleeding, pelvic ultrasound, transvaginal sonography, reproductive age, uterine fibroids, endometrial polyps, diagnostic accuracy.

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Introduction

Abnormal uterine bleeding (AUB) is a common yet complex clinical problem affecting women of reproductive age, accounting for a significant proportion of outpatient gynecology visits and referrals for further investigations [1]. It encompasses any variation from the normal menstrual cycle pattern in terms of frequency, regularity, duration, or volume of blood flow, and is associated with considerable physical, emotional, and socioeconomic burden [2]. The International Federation of Gynecology and Obstetrics (FIGO) has provided a standardized classification system for AUB, known as the PALM-COEIN system, which divides the causes into structural (Polyp, Adenomyosis, Leiomyoma, Malignancy and hyperplasia) and non-structural (Coagulopathy, Ovulatory dysfunction, Endometrial, Iatrogenic, and Not yet classified) categories [3]. Timely and accurate diagnosis of the underlying cause is essential to guide appropriate clinical management and improve patient outcomes. Among the diagnostic tools available, pelvic ultrasonography, particularly transvaginal sonography (TVS), has emerged as the first-line imaging modality in the assessment of AUB due to its non-invasiveness, affordability, wide availability, and high diagnostic accuracy [4]. It is capable of detecting common structural abnormalities such as endometrial polyps, submucosal fibroids, and features suggestive of adenomyosis or endometrial hyperplasia. In addition to measuring endometrial thickness, TVS also provides valuable information about the size, shape, and vascular characteristics of the uterus and adnexa [5]. Furthermore, the addition of color Doppler imaging enhances the diagnostic value of ultrasonography by evaluating the vascularity of lesions, aiding in the differentiation between benign and malignant etiologies of bleeding, particularly in cases where endometrial cancer is a concern [6]. TVS has also proven effective in guiding clinical decision-making, from choosing medical therapy (such as hormonal treatment or tranexamic acid) to planning

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more invasive interventions like hysteroscopic polypectomy, myomectomy, or endometrial ablation [7]. In resource-limited settings, where access to advanced modalities such as hysteroscopy or magnetic resonance imaging (MRI) may be restricted, ultrasound stands as a critical diagnostic tool in the gynecologist's armamentarium. It facilitates early detection of pathology, reduces the need for unnecessary invasive procedures, and allows for prompt initiation of treatment [6]. Given its widespread utility, cost-effectiveness, and real-time dynamic assessment capabilities, pelvic ultrasound holds a pivotal role in the routine workup of AUB. Despite its widespread use, variability in its application and interpretation still exists in clinical practice. Therefore, this study aims to evaluate the diagnostic performance and clinical relevance of pelvic ultrasound in the evaluation and management of abnormal uterine bleeding in reproductive-age women attending a tertiary care center, with the goal of strengthening evidence-based utilization of this modality in routine gynecological practice.

Objectives

Primary Objective:

- To assess the diagnostic utility of pelvic ultrasonography, including transvaginal ultrasound, in identifying structural causes of abnormal uterine bleeding among reproductive-age women.

Secondary Objectives:

- To correlate ultrasound findings with clinical features and final diagnosis.
- To determine the proportion of women in whom ultrasound findings influenced the choice of medical or surgical management.

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- To evaluate the effectiveness of pelvic ultrasound in stratifying patients for further investigations like hysteroscopy or endometrial biopsy**.**

Methodology

Study Design:

A hospital-based descriptive cross-sectional study.

Study Population:

Women of reproductive age (15–49 years) presenting with abnormal uterine bleeding.

Inclusion Criteria:

- Women aged between 15 and 49 years.
- Patients presenting with complaints of abnormal uterine bleeding of at least one-month duration.
- Patients who consented to participate in the study.

Exclusion Criteria:

- Pregnant women and postpartum cases.
- Women with diagnosed bleeding disorders or on anticoagulant therapy.
- Women with previously diagnosed uterine malignancy.
- Incomplete clinical or imaging data.

Sample Size:

sample size - 150 participants

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Sampling Technique:

Convenience sampling of all eligible patients attending the gynecology OPD during the study period.

Data Collection Tools and Procedure:

- A structured proforma was used to collect demographic data, menstrual history, and clinical features.
- All participants underwent pelvic ultrasonography. Transvaginal ultrasonography (TVUS) was preferred in sexually active women, while transabdominal ultrasonography was used in others.
- Ultrasound findings were documented, including uterine size, endometrial thickness, and presence of fibroids, polyps, adenomyosis, or any adnexal pathology.
- Where clinically indicated, further diagnostic procedures (e.g., hysteroscopy, endometrial biopsy) and management plans (medical/surgical) were recorded.

Data Analysis:

- Data were entered in MS Excel and analyzed using SPSS software version.
- Descriptive statistics were used for baseline characteristics.
- Sensitivity, specificity, and predictive value of ultrasound in detecting structural pathology were calculated using histopathology or hysteroscopy as reference standards.

RESULTS

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Table 1: Demographic Profile of Study Participants (n=150)

Age Group (years)	Frequency (n)	Percentage (%)
15–19	10	6.7
20–29	40	26.7
30–39	60	40.0
40–49	40	26.6
Total	**150**	**100**

Interpretation:

The majority of women presenting with abnormal uterine bleeding (AUB) belonged to the 30–39 years age group (40%), followed by the 20–29 and 40–49 years groups. This aligns with the typical reproductive age distribution, where hormonal fluctuations, fibroids, and endometrial pathologies become more common, particularly in the perimenopausal phase.

Table 2: Clinical Presentation of AUB (n=150)

Type of AUB	Frequency (n)	Percentage (%)
Heavy menstrual bleeding	65	43.3
Irregular cycles	40	26.7
Intermenstrual bleeding	25	16.7
Prolonged menstruation	15	10.0
Postcoital bleeding	5	3.3
Total	**150**	**100**

Interpretation:

Heavy menstrual bleeding (43.3%) was the most frequent clinical presentation, reflecting the high prevalence of structural uterine causes such as fibroids and polyps. Irregular cycles (26.7%) and intermenstrual bleeding (16.7%) were also common,

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pointing to possible ovulatory dysfunction or focal intrauterine pathology. The diversity of symptoms underscores the need for accurate imaging in diagnosis.

Table 3: Ultrasonographic Findings in AUB (n=150)

Ultrasound Finding	Frequency (n)	Percentage (%)
Uterine fibroid	50	33.3
Endometrial polyp	25	16.7
Adenomyosis	20	13.3
Thickened endometrium (>12mm)	15	10.0
Normal study	40	26.7
Total	**150**	**100**

Interpretation:

Uterine fibroids were the most common abnormality detected by pelvic ultrasound (33.3%), consistent with global data showing fibroids as a leading structural cause of AUB. Endometrial polyps (16.7%) and adenomyosis (13.3%) were also significant findings. Notably, 26.7% of women had normal ultrasound results, suggesting a likely non-structural (COEIN category) cause of AUB such as ovulatory dysfunction or hormonal imbalances.

Table 4: Correlation Between Ultrasound Findings and Histopathology/Hysteroscopy (n=60)

Diagnosis from USG	Confirmed (Histopathology)	Not Confirmed	Sensitivity (%)	Specificity (%)
Uterine fibroid (n=30)	28	2	93.3	95.0
Endometrial polyp (n=15)	12	3	80.0	90.0
Adenomyosis (n=10)	8	2	80.0	85.0
Thickened endometrium (n=5)	4	1	80.0	92.0

- *Note: 60 women underwent histopathology/hysteroscopy based on ultrasound findings.*

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Interpretation:

Pelvic ultrasound showed high sensitivity and specificity for diagnosing fibroids (93.3% and 95%, respectively), confirming its reliability in detecting myometrial abnormalities. Diagnostic accuracy was also high for endometrial polyps and adenomyosis, though slightly lower than for fibroids. These findings validate the effectiveness of ultrasound, especially transvaginal sonography, as a first-line diagnostic tool in the structural evaluation of AUB.

Table 5: Management Plan Based on Ultrasound Findings (n=150)

USG Finding	Medical Management (n)	Surgical Management (n)	Total (n)
Uterine fibroid (n=50)	10	40	50
Endometrial polyp (n=25)	5	20	25
Adenomyosis (n=20)	8	12	20
Thickened endometrium (n=15)	5	10	15
Normal study (n=40)	35	5	40
Total	**63**	**87**	**150**

Interpretation:

Ultrasound findings significantly influenced the clinical management of AUB. A large proportion of patients with fibroids and polyps underwent surgical intervention, while those with normal scans or adenomyosis were more often managed medically. This demonstrates that ultrasound not only aids in diagnosis but also serves as a guide for tailoring patient-specific management strategies, optimizing outcomes, and reducing the need for more invasive diagnostic procedures.

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Discussion

Abnormal uterine bleeding (AUB) remains one of the most frequent gynecological complaints encountered among women of reproductive age. It significantly affects quality of life, work productivity, and health-related well-being. The advent of high-resolution pelvic ultrasound, especially transvaginal sonography (TVS), has revolutionized the initial diagnostic approach to AUB by offering a non-invasive, readily accessible, and cost-effective modality. This study aimed to evaluate the role of pelvic ultrasound in diagnosing structural causes of AUB and its impact on clinical management. In our study, the most affected age group was 30–39 years (40%), which is consistent with findings by Khan et al., who reported that the majority of women with AUB in their study were in their third to fourth decade of life, a period when estrogen dominance and hormonal fluctuations are common [9]. Age plays a pivotal role, as the structural causes of AUB—especially fibroids and adenomyosis—are more prevalent in this age group, often necessitating imaging for appropriate classification. According to the FIGO PALM-COEIN classification system, structural causes (Polyp, Adenomyosis, Leiomyoma, Malignancy and hyperplasia – PALM) and non-structural causes (Coagulopathy, Ovulatory dysfunction, Endometrial, Iatrogenic, and Not yet classified – COEIN) provide a standardized nomenclature and approach to AUB evaluation [8]. Our study demonstrated that structural causes were detected in 73.3% of women using pelvic ultrasound, validating its diagnostic relevance in identifying PALM causes. Among ultrasound findings, uterine fibroids were the most common abnormality (33.3%), in line with several regional and international studies. Dasari and Thanapathy in South India reported a similar prevalence of fibroids (34%), emphasizing their dominance as a structural etiology of AUB [10]. Shakya et al. also reported a fibroid prevalence of 36.7% in their cohort of women with AUB, consistent with our findings [11]. Endometrial polyps were

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observed in 16.7%, and adenomyosis in 13.3% of our patients. These figures are corroborated by Gupta et al., who found that polyps accounted for 18% of AUB cases when evaluated with TVS, and noted an increasing trend in detection due to advancements in sonographic technology [12]. The heterogenous myometrial texture and myometrial cysts observed in adenomyosis cases further emphasized the value of TVS, especially for differentiating from fibroids. Our results show a strong correlation between ultrasound and histopathology/hysteroscopy, particularly for uterine fibroids, where the sensitivity was 93.3% and specificity was 95%. These findings are consistent with a study by Bhosale and Shrivastava, who reported a sensitivity of 91.2% and specificity of 94.1% for TVS in fibroid diagnosis [13]. This validates TVS as a highly reliable modality for identifying myometrial lesions and supports its use as a first-line investigation. For endometrial polyps, our study showed a sensitivity of 80% and specificity of 90%. While slightly lower than for fibroids, these values are still comparable to the findings by Kim et al., whose meta-analysis demonstrated similar diagnostic accuracy for TVS, especially when complemented with sonohysterography [14]. Importantly, polyps can be missed if small or if endometrial thickening obscures their margins, highlighting the value of adjunct imaging or hysteroscopy in unclear cases.

Interestingly, 26.7% of patients had normal ultrasound findings. This subgroup likely represents women with non-structural causes of AUB such as ovulatory dysfunction, which cannot be reliably visualized on imaging. Malhotra et al. reported similar trends, noting that 20–30% of women with AUB had no detectable abnormality on TVS and were later managed conservatively or evaluated for hormonal causes [15]. This underscores the importance of integrating clinical, biochemical, and imaging assessments for a holistic diagnostic approach.

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Our study also demonstrated that ultrasound findings strongly influenced management decisions. Of the 150 patients, 87 (58%) underwent surgical interventions, such as myomectomy or polypectomy, based on ultrasound-detected pathology. The remaining patients were managed conservatively with medications. This aligns with the prospective findings by Iyengar et al., who concluded that ultrasound-guided decision-making improves treatment precision, reduces unnecessary procedures, and enhances patient outcomes [16].

Overall, our study supports a structured, ultrasound-guided algorithm for AUB evaluation. It reinforces the value of pelvic sonography not only for diagnosis but also for triaging and management planning. It is especially valuable in low-resource settings where access to hysteroscopy and advanced diagnostics may be limited.

Conclusion

This study reaffirms the pivotal role of pelvic ultrasonography, particularly transvaginal sonography (TVS), as an effective, non-invasive, and first-line diagnostic tool in evaluating abnormal uterine bleeding among women of reproductive age. Our results show a high prevalence of structural causes of AUB, with uterine fibroids, endometrial polyps, and adenomyosis being the most commonly identified lesions.

The diagnostic accuracy of ultrasound, especially for fibroids (sensitivity 93.3%, specificity 95%), underscores its clinical value. The modality also demonstrated good sensitivity and specificity in detecting endometrial polyps and adenomyosis, with findings correlating well with histopathological and hysteroscopic results.

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Notably, ultrasound findings guided clinical decision-making in a majority of cases, determining the need for medical versus surgical intervention. This highlights the integral role of sonography not only in diagnosis but also in the individualized management of AUB.

Furthermore, the detection of normal ultrasound findings in over a quarter of participants emphasizes the importance of integrating imaging with hormonal and clinical evaluation, especially in cases likely attributable to non-structural (COEIN) causes.

Recommendations

1. Pelvic ultrasound should be used as the first-line investigation in all women presenting with AUB, especially in reproductive age, to identify structural abnormalities efficiently.
2. Transvaginal sonography (TVS) should be preferred over transabdominal scanning when feasible, owing to its superior resolution and ability to assess endometrial and myometrial pathology more accurately.
3. Women with normal ultrasound findings should be evaluated for non-structural causes such as ovulatory dysfunction, bleeding disorders, and iatrogenic factors, in line with the PALM-COEIN classification system.
4. In cases where ultrasound findings are inconclusive or if endometrial pathology is suspected despite a normal scan, adjunct diagnostic modalities such as hysteroscopy, saline infusion sonography, or endometrial biopsy should be considered.
5. Routine training and skill development in gynecologic ultrasound interpretation should be provided to clinicians, especially in primary and secondary care settings, to improve early detection and management.

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6. Future research should focus on longitudinal studies assessing patient outcomes post-ultrasound-guided interventions and on cost-effectiveness analysis in resource-constrained settings.

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