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Original Article

Accuracy of Transvaginal Ultrasound (TVS) and Hysteroscopic Examination in Detecting the Causes of Abnormal Uterine Bleeding (AUB)

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ABSTRACT

Background: Abnormal uterine bleeding is a common gynecological problem among reproductive-age and perimenopausal women and may result from structural intrauterine abnormalities such as endometrial polyps, submucosal fibroids, hyperplasia, or malignancy. Accurate diagnosis is essential for appropriate management, avoidance of unnecessary invasive procedures, and timely detection of clinically significant pathology. **Objective:** To evaluate and compare the diagnostic accuracy of transvaginal ultrasound and hysteroscopic examination in detecting causes of abnormal uterine bleeding, using histopathology as the reference standard. **Methods:** This cross-sectional comparative diagnostic accuracy study included 100 women presenting with abnormal uterine bleeding at the Radiology Department of Dr. Essa Laboratory and Diagnostic Centre, Lahore. Participants were selected using non-probability consecutive sampling. All participants underwent transvaginal ultrasound followed by diagnostic hysteroscopy, and findings were compared with histopathological diagnosis. Data were analyzed using SPSS version 25, and sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated. **Results:** Most participants were aged 36–50 years. Heavy menstrual bleeding was the most common presentation. Histopathology identified endometrial polyp as the most frequent diagnosis, followed by fibroid and malignancy. For detecting endometrial polyps, transvaginal ultrasound showed sensitivity of 40.0%, specificity of 90.0%, PPV of 80.0%, NPV of 60.0%, and accuracy of 65.0%. Hysteroscopy demonstrated higher sensitivity of 56.0%, specificity of 96.0%, PPV of 93.3%, NPV of 68.6%, and accuracy of 76.0%. **Conclusion:** Hysteroscopy showed superior diagnostic performance compared with transvaginal ultrasound for detecting focal intrauterine pathology, particularly endometrial polyps. Transvaginal ultrasound remains useful as a first-line, non-invasive screening tool, while hysteroscopy with biopsy should be considered when ultrasound findings are inconclusive or focal pathology is suspected. **Keywords:** Abnormal uterine bleeding; transvaginal ultrasound; hysteroscopy; diagnostic accuracy; endometrial polyp; histopathology.

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INTRODUCTION

Abnormal uterine bleeding is a common gynecological presentation among women of reproductive and perimenopausal age and represents an important clinical problem because it may arise from functional, endocrine, systemic, iatrogenic, or structural uterine abnormalities. It is not a single disease entity but a symptom complex characterized by alteration in the volume, duration, frequency, or regularity of uterine bleeding in the absence of pregnancy. The clinical importance of abnormal uterine bleeding lies not only in its frequency but also in its impact on quality of life, daily activities, reproductive health, and the risk of underlying endometrial pathology. In perimenopausal women, abnormal bleeding is

particularly important because hormonal instability, anovulatory cycles, and increasing prevalence of structural lesions may coexist, making clinical assessment alone insufficient for accurate diagnosis (1).

The causes of abnormal uterine bleeding are commonly categorized according to the PALM-COEIN classification, which separates structural causes from non-structural causes. Structural causes include endometrial polyps, adenomyosis, leiomyoma, malignancy, and hyperplasia, whereas non-structural causes include coagulopathy, ovulatory dysfunction, endometrial disorders, iatrogenic causes, and entities not yet classified. This classification is clinically useful because structural causes are often detectable through imaging or direct visualization and may require targeted medical, hysteroscopic, or surgical management. Among these, endometrial polyps, submucosal fibroids, endometrial hyperplasia, and malignancy are especially relevant in women presenting with abnormal uterine bleeding, as delayed or missed diagnosis may lead to persistent symptoms, repeated clinical visits, anemia, unnecessary treatment, or delayed detection of premalignant or malignant disease (2).

Transvaginal ultrasound is widely used as the first-line imaging modality for women with abnormal uterine bleeding because it is accessible, relatively inexpensive, non-invasive, repeatable, and capable of assessing uterine size, myometrial morphology, endometrial thickness, endometrial pattern, and adnexal pathology. It is particularly useful for identifying fibroids, endometrial thickening, adnexal lesions, and gross uterine abnormalities. However, the diagnostic performance of transvaginal ultrasound may vary according to operator expertise, equipment resolution, patient characteristics, uterine position, menstrual cycle phase, and the nature of the lesion. Small focal lesions, intracavitary polyps, isoechoic submucosal fibroids, and subtle endometrial abnormalities may be difficult to differentiate on ultrasound alone, especially when the endometrium is heterogeneous or poorly visualized (3).

Hysteroscopy allows direct visualization of the uterine cavity and is considered highly valuable for identifying focal intracavitary abnormalities such as endometrial polyps, submucosal fibroids, adhesions, and suspicious endometrial lesions. Its additional advantage is the ability to perform targeted biopsy or lesion removal during the same procedure, thereby improving diagnostic certainty when histopathological confirmation is required. Despite these strengths, hysteroscopy is more invasive than transvaginal ultrasound, may cause discomfort, requires technical expertise and specialized equipment, and may be associated with rare complications such as bleeding, infection, cervical trauma, vasovagal reaction, or uterine perforation. Therefore, it is important to determine when hysteroscopy is essential and when transvaginal ultrasound may provide sufficient diagnostic information (4).

Previous studies comparing transvaginal ultrasound and hysteroscopy have generally reported that ultrasound is useful as an initial screening tool, while hysteroscopy performs better in detecting focal intrauterine pathology. In a study evaluating abnormal uterine bleeding in perimenopausal women, transvaginal sonography was found to be safe, convenient, and useful for initial assessment, but hysteroscopy provided better evaluation of intrauterine lesions (5). Similarly, studies comparing endometrial assessment by transvaginal ultrasonography and hysteroscopy have shown that hysteroscopy offers improved diagnostic capability for focal endometrial lesions, while ultrasound remains important as a non-invasive first-line modality (6). Systematic review evidence has also shown that hysteroscopy has high diagnostic value for endometrial polyps, although saline infusion sonohysterography and transvaginal sonography may also contribute to evaluation of suspected intracavitary lesions (7).

Recent literature has further highlighted the importance of improving non-invasive diagnostic pathways while preserving the role of hysteroscopy for selected patients. Three-dimensional transvaginal ultrasound has shown promising diagnostic performance for intrauterine abnormalities and may improve preoperative assessment in women with abnormal uterine bleeding (8). However, hysteroscopy remains clinically important because direct visualization and tissue sampling are necessary when malignancy, hyperplasia, or focal premalignant pathology is suspected. Studies comparing blind biopsy

with hysteroscopic pathology have also emphasized that blind sampling may miss focal benign lesions, supporting the value of hysteroscopic visualization in symptomatic women (9).

Despite the availability of both transvaginal ultrasound and hysteroscopy, uncertainty remains regarding their comparative diagnostic accuracy in routine clinical settings, particularly in resource-limited environments where cost, availability, patient tolerance, and access to invasive procedures influence diagnostic decision-making. The research problem is that women with abnormal uterine bleeding often undergo multiple investigations, but the optimal sequence and relative diagnostic value of transvaginal ultrasound and hysteroscopy remain clinically important. The knowledge gap is especially relevant where modern high-resolution ultrasound equipment is available, because improved image quality may increase the diagnostic yield of ultrasound, yet some intrauterine lesions may still require hysteroscopic confirmation and histopathological diagnosis.

Using a PICO framework, the population of interest in this study is women aged 20–50 years presenting with abnormal uterine bleeding; the index test is transvaginal ultrasound; the comparator test is hysteroscopic examination; and the outcome is diagnostic accuracy for detecting intrauterine causes of abnormal uterine bleeding, using histopathological findings as the reference standard. This study is justified because accurate identification of the underlying cause of abnormal uterine bleeding can guide appropriate management, avoid unnecessary invasive procedures, reduce delayed diagnosis, and improve patient outcomes. Therefore, the objective of this study was to evaluate and compare the diagnostic accuracy of transvaginal ultrasound and hysteroscopic examination in detecting the causes of abnormal uterine bleeding among women aged 20–50 years, using histopathology as the reference standard.

MATERIALS AND METHODS

This study was designed as a cross-sectional comparative diagnostic accuracy study to evaluate and compare transvaginal ultrasound and hysteroscopic examination for detecting intrauterine causes of abnormal uterine bleeding. A cross-sectional design was appropriate because both diagnostic modalities were applied to the same participants during the same diagnostic work-up, and their findings were compared with histopathological diagnosis as the reference standard. The study was conducted in the Radiology Department of Dr. Essa Laboratory and Diagnostic Centre, Lahore, over a period of four months after approval of the research synopsis and permission from the relevant institutional authority.

The study population consisted of women aged 20–50 years who presented with abnormal uterine bleeding and were eligible for both transvaginal ultrasound and hysteroscopic examination. Participants were selected through a non-probability consecutive sampling technique, whereby all eligible patients presenting during the study period were approached until the required sample size was achieved. Women were included if they were aged 20–50 years, had abnormal uterine bleeding in terms of altered volume, duration, frequency, or regularity of bleeding, were willing to undergo both diagnostic procedures, and provided written informed consent. Pregnant women or women with suspected pregnancy-related bleeding, postmenopausal women, patients with active pelvic infection including pelvic inflammatory disease, patients with previously diagnosed cervical or uterine malignancy, women with severe cervical stenosis or any condition making hysteroscopy technically infeasible, patients with severe unstable medical illness, and patients who refused consent or were unwilling to undergo both procedures were excluded.

After eligibility screening, written informed consent was obtained from each participant before data collection. Demographic and clinical information was recorded using a structured data collection sheet. The recorded variables included age, weight, height, body mass index, parity, menstrual cycle length, duration of menstrual flow, duration of symptoms, type of menstrual flow, and presenting complaint. Body mass index was calculated as weight in kilograms divided by height in meters squared. Abnormal uterine bleeding was operationally defined as uterine bleeding that was abnormal in amount, duration,

frequency, or regularity in a non-pregnant woman. Heavy bleeding was defined clinically as excessive menstrual blood loss reported by the participant or bleeding sufficient to interfere with routine activities. Irregular bleeding was defined as bleeding occurring at unpredictable intervals. Intermenstrual bleeding was defined as bleeding occurring between expected menstrual periods.

All participants underwent transvaginal ultrasound using a high-frequency endovaginal transducer. The examination assessed uterine morphology, endometrial thickness, endometrial echotexture, endometrial regularity, myometrial appearance, and the presence or absence of intrauterine pathology such as endometrial polyp, submucosal fibroid, endometrial hyperplasia, endometrial atrophy, or suspicious focal lesion. A positive transvaginal ultrasound finding was defined as detection of any suspected intrauterine abnormality, including polyp, submucosal fibroid, endometrial hyperplasia, abnormal endometrial thickening, or suspicious endometrial lesion. A negative transvaginal ultrasound finding was defined as normal uterine cavity and endometrial appearance without evidence of focal or diffuse intrauterine pathology.

Following transvaginal ultrasound, diagnostic hysteroscopy was performed using a rigid or flexible hysteroscope according to standard clinical procedure. The uterine cavity was inspected systematically, including the cervical canal, endometrial cavity, uterine walls, fundus, and tubal ostial regions. Hysteroscopic findings were recorded as normal endometrium, endometrial polyp, submucosal fibroid, endometrial hyperplasia, intrauterine adhesions, or suspicious lesion. A positive hysteroscopic finding was defined as direct visualization of any focal or diffuse intrauterine abnormality. A negative hysteroscopic finding was defined as a normal uterine cavity without visible intracavitary pathology. Endometrial biopsy or tissue sampling from suspected lesions was performed for histopathological evaluation, and histopathology was used as the reference standard for final diagnosis.

The main outcome variable was diagnostic accuracy of transvaginal ultrasound and hysteroscopy for detecting intrauterine causes of abnormal uterine bleeding. Diagnostic performance was assessed through sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy. Sensitivity was defined as the proportion of histopathology-positive cases correctly identified by the test. Specificity was defined as the proportion of histopathology-negative cases correctly identified by the test. Positive predictive value was defined as the probability that participants with a positive test result truly had pathology on histopathology, while negative predictive value was defined as the probability that participants with a negative test result truly had no pathology on histopathology. Overall diagnostic accuracy was defined as the proportion of all correctly classified cases among the total sample.

Potential bias was minimized by applying the same eligibility criteria to all participants, recruiting cases consecutively, performing both diagnostic tests in the same study population, and using histopathological diagnosis as the reference standard. To reduce selection bias, no eligible consenting participant was selectively excluded during the recruitment period. To reduce measurement bias, findings from transvaginal ultrasound and hysteroscopy were recorded on predefined data sheets using standardized diagnostic categories. To reduce verification bias, histopathological confirmation was used for final diagnostic classification. Potential confounding by age, parity, body mass index, menstrual pattern, and duration of symptoms was addressed by recording these variables and assessing their distribution during analysis.

The sample size was 100 participants, calculated according to the prevalence rate reported in the parent article and adjusted to fit the study duration, setting, and availability of eligible participants. Data were entered and analyzed using SPSS version 25. Continuous variables such as age, weight, height, body mass index, menstrual cycle length, duration of menstrual flow, and duration of symptoms were summarized using mean and standard deviation. Categorical variables such as age group, parity, type of menstrual flow, presenting complaint, transvaginal ultrasound findings, hysteroscopic findings, and histopathological findings were summarized using frequency and percentage. Diagnostic accuracy was calculated using two-by-two contingency tables for transvaginal ultrasound versus histopathology and

hysteroscopy versus histopathology. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated using standard diagnostic formulas. Missing or incomplete records were checked before analysis, and only complete diagnostic records with available test findings and final reference diagnosis were included in diagnostic accuracy calculations.

Ethical approval was obtained from the relevant ethical committee of The Superior University, Lahore. Permission for data collection was obtained from the study setting. Written informed consent was obtained from all participants before enrollment. Participants were informed about the purpose of the study, voluntary nature of participation, procedural discomforts, possible risks, and their right to withdraw at any stage without affecting their medical care.

Confidentiality was maintained by using coded data instead of participant names during data entry and analysis. All collected forms and electronic records were kept securely, and access was restricted to the research team. Data integrity was maintained by using a structured questionnaire, predefined operational definitions, standardized diagnostic categories, cross-checking entered data against original forms, and performing statistical analysis on the finalized cleaned dataset.

RESULTS

A total of 100 participants presenting with abnormal uterine bleeding were included in the analysis. Continuous baseline variables are presented in Table 1. The mean weight of the participants was 69.70 ± 11.28 kg, with a 95% confidence interval of 67.46–71.94 kg. The mean height was 159.59 ± 6.38 cm, and the mean body mass index was 27.50 ± 4.96 kg/m², indicating that the overall study population was in the overweight range. The mean menstrual cycle length was 27.04 ± 4.08 days, while the mean duration of menstrual flow was 5.25 ± 1.41 days. The mean duration of symptoms was 4.84 ± 2.36 months, suggesting that most participants had experienced abnormal uterine bleeding for several months before diagnostic evaluation.

Table 1. Descriptive statistics of continuous variables among participants with abnormal uterine bleeding

Variable	Mean	Standard Deviation	95% Confidence Interval
Weight (kg)	69.70	11.28	67.46–71.94
Height (cm)	159.59	6.38	158.32–160.86
BMI (kg/m²)	27.50	4.96	26.52–28.48
Menstrual cycle length (days)	27.04	4.08	26.23–27.85
Duration of menstrual flow (days)	5.25	1.41	4.97–5.53
Duration of symptoms (months)	4.84	2.36	4.37–5.31

Table 2. Distribution of participants according to type of menstrual flow

Type of Menstrual Flow	Frequency	Percentage (%)	95% Confidence Interval
Normal flow	15	15.0	9.30–23.28
Heavy flow	60	60.0	50.20–69.06
Irregular flow	25	25.0	17.54–34.30
Total	100	100.0	—

Table 3. Distribution of participants according to presenting complaint

Presenting Complaint	Frequency	Percentage (%)	95% Confidence Interval
Heavy bleeding	50	50.0	40.38–59.62
Irregular bleeding	25	25.0	17.54–34.30
Intermenstrual bleeding	15	15.0	9.30–23.28
Postmenopausal bleeding	10	10.0	5.52–17.44
Total	100	100.0	—

Transvaginal ultrasound findings are presented in Table 3. Normal endometrium was reported in 45% of participants. Among abnormal findings, endometrial polyp was the most frequent TVS diagnosis and was detected in 25% of cases, followed by submucosal fibroid in 15%, endometrial hyperplasia in 10%, and endometrial atrophy in 5%. These results suggest that TVS detected structural or endometrial abnormalities in more than half of the participants, although a large proportion were reported as normal on ultrasound.

Table 4. Transvaginal ultrasound findings among participants with abnormal uterine bleeding

TVS Finding	Frequency	Percentage (%)	95% Confidence Interval
Normal endometrium	45	45.0	35.62–54.76
Endometrial polyp	25	25.0	17.54–34.30
Submucosal fibroid	15	15.0	9.30–23.28
Endometrial hyperplasia	10	10.0	5.52–17.44
Endometrial atrophy	5	5.0	2.15–11.18
Total	100	100.0	—

Hysteroscopic findings are shown in Table 4. Hysteroscopy identified normal endometrium and endometrial polyp with equal frequency, each accounting for 30% of participants. Submucosal fibroid was observed in 20%, endometrial hyperplasia in 15%, and intrauterine adhesions in 5%. Compared with TVS, hysteroscopy identified a higher proportion of endometrial polyps and submucosal fibroids, reflecting its ability to directly visualize focal intrauterine lesions.

Table 5. Hysteroscopic findings among participants with abnormal uterine bleeding

Hysteroscopic Finding	Frequency	Percentage (%)	95% Confidence Interval
Normal endometrium	30	30.0	21.95–39.58
Endometrial polyp	30	30.0	21.95–39.58
Submucosal fibroid	20	20.0	13.34–28.88
Endometrial hyperplasia	15	15.0	9.30–23.28
Adhesions / Asherman's syndrome	5	5.0	2.15–11.18
Total	100	100.0	—

Histopathological findings are presented in Table 5 Endometrial polyp was the most common histopathological diagnosis and was confirmed in 50% of participants. Fibroid was confirmed in 35%, while malignancy was detected in 15%. These findings indicate that focal intrauterine pathology was

common in the study population, with endometrial polyp representing the leading confirmed cause of abnormal uterine bleeding.

Table 6. Histopathological diagnosis among participants with abnormal uterine bleeding

Histopathological Diagnosis	Frequency	Percentage (%)	95% Confidence Interval
Endometrial polyp	50	50.0	40.38–59.62
Fibroid	35	35.0	26.36–44.75
Malignancy	15	15.0	9.30–23.28
Total	100	100.0	—

The diagnostic performance of TVS for detection of histopathology-confirmed endometrial polyp is shown in Table 6. Among 50 participants with confirmed endometrial polyp, TVS correctly identified 20 cases as true positives and missed 30 cases as false negatives. Among 50 participants without histopathological evidence of endometrial polyp, TVS correctly classified 45 cases as true negatives and incorrectly classified 5 cases as false positives. The association between TVS findings and histopathology was statistically significant, with an odds ratio of 6.00 and a p-value of 0.001.

Table 7. Diagnostic cross-tabulation of TVS against histopathology for detection of endometrial polyp

TVS Result	Histopathology Positive	Histopathology Negative	Total	Odds Ratio	95% CI for OR	p-value
Positive	20	5	25	6.00	2.03–17.73	0.001
Negative	30	45	75	—	—	—
Total	50	50	100	—	—	—

The diagnostic performance of hysteroscopy for detection of histopathology-confirmed endometrial polyp is presented in Table 7. Among 50 participants with confirmed endometrial polyp, hysteroscopy correctly identified 28 true positive cases and missed 22 false negative cases. Among 50 participants without histopathological evidence of endometrial polyp, hysteroscopy correctly classified 48 true negative cases and incorrectly classified 2 false positive cases. The association between hysteroscopy and histopathological diagnosis was statistically significant, with an odds ratio of 30.55 and a p-value of <0.001, indicating stronger diagnostic association than TVS.

Table 8. Diagnostic cross-tabulation of hysteroscopy against histopathology for detection of endometrial polyp

Hysteroscopy Result	Histopathology Positive	Histopathology Negative	Total	Odds Ratio	95% CI for OR	p-value
Positive	28	2	30	30.55	6.68–139.76	<0.001
Negative	22	48	70	—	—	—
Total	50	50	100	—	—	—

Diagnostic accuracy indices are summarized in Table 8. TVS showed a sensitivity of 40.0%, specificity of 90.0%, positive predictive value of 80.0%, negative predictive value of 60.0%, and overall accuracy of 65.0% for detecting endometrial polyps. In comparison, hysteroscopy demonstrated higher sensitivity at 56.0%, higher specificity at 96.0%, higher positive predictive value at 93.3%, higher negative predictive value at 68.6%, and higher overall accuracy at 76.0%. These findings indicate that hysteroscopy

performed better than TVS across all diagnostic accuracy parameters, particularly in specificity and positive predictive value.

Table 9. Comparison of diagnostic accuracy of TVS and hysteroscopy for detection of endometrial polyp

Diagnostic Parameter	TVS Result	95% CI	Hysteroscopy Result	95% CI
Sensitivity	40.0%	27.61–53.82	56.0%	42.31–68.84
Specificity	90.0%	78.64–95.65	96.0%	86.54–98.90
Positive predictive value	80.0%	60.87–91.14	93.3%	78.68–98.15
Negative predictive value	60.0%	48.69–70.34	68.6%	56.97–78.24
Overall accuracy	65.0%	55.25–73.64	76.0%	66.77–83.31

Overall, the results show that endometrial polyp was the most frequent histopathological diagnosis among women presenting with abnormal uterine bleeding. Although TVS identified several intrauterine abnormalities and remains useful as an initial diagnostic modality, hysteroscopy showed superior diagnostic performance for detecting endometrial polyps when compared with histopathology. The higher specificity, positive predictive value, and overall accuracy of hysteroscopy suggest that it is more reliable for confirming focal intracavitary pathology, while TVS may be more appropriate as a first-line screening investigation before proceeding to hysteroscopic confirmation.

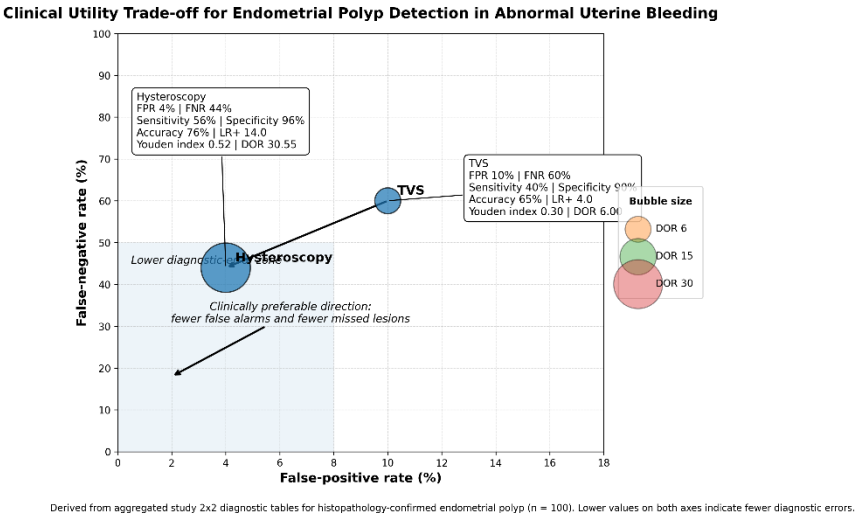

Figure 1 Clinical Utility Trade-Off For Endometrial Polyp Detection In Abnormal Uterine Bleeding

The figure demonstrates the comparative diagnostic-error profile of TVS and hysteroscopy for histopathology-confirmed endometrial polyp detection. TVS showed a higher false-positive rate of 10% and false-negative rate of 60%, with an overall accuracy of 65%, diagnostic odds ratio of 6.00, LR+ of 4.0, and Youden index of 0.30. Hysteroscopy shifted toward a more clinically favorable diagnostic zone, reducing the false-positive rate to 4% and false-negative rate to 44%, while improving accuracy to 76%, diagnostic odds ratio to 30.55, LR+ to 14.0, and Youden index to 0.52, indicating stronger discriminatory performance and fewer missed or falsely identified endometrial polyps.

DISCUSSION

The present study evaluated the diagnostic performance of transvaginal ultrasound and hysteroscopic examination for detecting intrauterine causes of abnormal uterine bleeding, using histopathological findings as the reference standard. The findings showed that abnormal uterine bleeding was most frequently observed among women in the 36–50-year age group, which is clinically consistent with the late reproductive and perimenopausal period, during which endocrine fluctuation, increasing frequency

of anovulatory cycles, and rising prevalence of structural uterine abnormalities contribute to abnormal bleeding patterns. The mean body mass index of the study population was 27.50 ± 4.96 kg/m², placing the average participant in the overweight category. This is clinically relevant because increased adiposity is associated with peripheral conversion of androgens into estrogen, prolonged estrogenic stimulation of the endometrium, and higher risk of endometrial hyperplasia and abnormal bleeding. Similar associations between body mass index, endometrial pathology, and abnormal uterine bleeding have been reported in previous clinical studies, supporting the importance of considering anthropometric risk factors during evaluation of women with AUB (10).

Heavy menstrual bleeding was the most common clinical presentation in this study, reported as the main menstrual flow pattern in 60% of participants and as the presenting complaint in 50% of cases. This finding suggests that excessive bleeding remains the dominant symptomatic burden among women seeking evaluation for AUB. The mean menstrual cycle length was 27.04 ± 4.08 days and the mean duration of menstrual flow was 5.25 ± 1.41 days, indicating that many women had cycle parameters within conventional limits but still experienced clinically significant abnormal bleeding because of excessive volume, irregularity, intermenstrual bleeding, or underlying intrauterine pathology. This supports the modern understanding that AUB should not be assessed only by cycle length or number of bleeding days, but by the combined evaluation of bleeding volume, regularity, timing, patient impact, and structural pathology. The mean symptom duration of 4.84 ± 2.36 months further indicates that participants often experienced symptoms for several months before diagnostic evaluation, which may reflect delayed health-seeking behavior, normalization of menstrual symptoms, or limited access to specialized diagnostic services (11).

Histopathological evaluation identified endometrial polyp as the most common diagnosis, present in 50% of participants, followed by fibroid in 35% and malignancy in 15%. The high proportion of endometrial polyps is clinically important because polyps are focal intracavitary lesions that may cause heavy menstrual bleeding, intermenstrual bleeding, or persistent spotting, and they may be missed by blind sampling or underestimated by routine ultrasound when small, isoechoic, or located in difficult-to-visualize regions of the uterine cavity. Fibroids were also common, particularly relevant when submucosal or cavity-distorting, because they can increase endometrial surface area, impair uterine contractility, and alter local vascular architecture. The detection of malignancy in 15% of cases highlights the need for careful evaluation of AUB, particularly in women with risk factors, persistent symptoms, or suspicious imaging findings, because reliance on clinical presentation alone may delay diagnosis of significant pathology (12).

Transvaginal ultrasound detected normal endometrium in 45% of cases and identified endometrial polyp in 25%, submucosal fibroid in 15%, endometrial hyperplasia in 10%, and endometrial atrophy in 5%. These findings confirm the value of TVS as a first-line modality because it provides rapid, non-invasive assessment of the uterus, endometrium, myometrium, and adnexa. However, when compared with histopathology-confirmed endometrial polyp, TVS showed sensitivity of 40.0%, specificity of 90.0%, positive predictive value of 80.0%, negative predictive value of 60.0%, and overall accuracy of 65.0%. This pattern indicates that TVS was relatively strong in excluding false-positive diagnoses but less sensitive in detecting all true cases of endometrial polyps. Clinically, this means that a positive TVS finding for polyp is fairly reliable, but a negative TVS result does not confidently exclude focal intrauterine pathology. This is consistent with previous evidence showing that TVS is useful for initial screening but may miss small focal lesions, polyps obscured by a thick or heterogeneous endometrium, or lesions that do not produce a clear mass effect (13).

Hysteroscopy demonstrated better diagnostic performance than TVS across all evaluated indices. For histopathology-confirmed endometrial polyp, hysteroscopy showed sensitivity of 56.0%, specificity of 96.0%, positive predictive value of 93.3%, negative predictive value of 68.6%, and overall accuracy of 76.0%. The higher specificity and positive predictive value are particularly meaningful because they

indicate that hysteroscopic visualization is more reliable for confirming focal intrauterine pathology. Hysteroscopy directly visualizes the endometrial cavity, allowing differentiation between normal endometrium, focal lesions, submucosal fibroids, adhesions, and suspicious endometrial changes. This direct visualization explains its stronger diagnostic association with histopathology and supports its role when TVS findings are inconclusive or when symptoms persist despite apparently normal ultrasound findings. These results are in agreement with previous studies reporting superior diagnostic value of hysteroscopy for intracavitary lesions, particularly endometrial polyps and submucosal fibroids (14).

Although hysteroscopy outperformed TVS, the moderate sensitivity observed in this study indicates that hysteroscopy alone should not be interpreted as a perfect diagnostic substitute for tissue diagnosis. Histopathology remains essential for final confirmation, particularly when hyperplasia or malignancy is suspected. A visually benign lesion may still require biopsy to exclude premalignant or malignant change, and diffuse endometrial abnormalities may not always be classified accurately on appearance alone. Therefore, the most clinically defensible diagnostic pathway is not to replace one modality entirely with another, but to use TVS as an initial screening tool and hysteroscopy with biopsy as a confirmatory diagnostic procedure in selected patients. This approach balances diagnostic yield, invasiveness, cost, and patient safety, particularly in settings where routine hysteroscopy for all women with AUB may not be feasible (15).

The comparative findings also have practical implications for patient management. In women with heavy or persistent bleeding, a normal or non-specific TVS should not automatically end the diagnostic work-up if clinical suspicion remains high. The lower sensitivity and negative predictive value of TVS suggest that missed focal pathology is possible, especially for endometrial polyps. Conversely, because TVS is non-invasive and widely available, it remains appropriate as the first investigation in most patients. Hysteroscopy should be prioritized when TVS identifies a focal intracavitary lesion, when ultrasound findings are equivocal, when bleeding persists despite treatment, or when histopathological confirmation is required. This staged approach may reduce unnecessary invasive procedures while ensuring that clinically important lesions are not missed (16-21).

The findings should be interpreted in light of several limitations. The study was conducted at a single diagnostic center and included 100 participants, which may limit external generalizability. Both TVS and hysteroscopy are operator-dependent procedures, and diagnostic performance may vary with examiner expertise, equipment quality, uterine position, endometrial phase, and lesion characteristics. The cross-sectional design allowed comparison of diagnostic findings at one point in time but did not permit assessment of treatment outcomes, symptom resolution, recurrence, or long-term progression. In addition, diagnostic accuracy estimates are influenced by disease prevalence in the study population; because endometrial polyp was frequent in this sample, predictive values may differ in populations with lower prevalence. Despite these limitations, the study contributes useful local evidence by comparing two commonly used diagnostic modalities in the same clinical population and by demonstrating the added diagnostic value of hysteroscopy over TVS when histopathology is used as the reference standard (22-24).

CONCLUSION

This study concluded that abnormal uterine bleeding was most commonly observed among women in the 36–50-year age group, with heavy menstrual bleeding as the leading clinical presentation and endometrial polyp as the most frequent histopathological diagnosis. Transvaginal ultrasound was useful as an initial, non-invasive diagnostic modality, but it showed lower sensitivity and overall accuracy for detecting histopathology-confirmed endometrial polyps. Hysteroscopy demonstrated superior diagnostic performance, with higher sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy than TVS, supporting its role as a more reliable modality for confirming focal intrauterine pathology. However, histopathology remains essential for final tissue diagnosis,

particularly when hyperplasia or malignancy is suspected. Therefore, TVS should be used as the first-line screening tool in women with AUB, while hysteroscopy with biopsy should be considered when ultrasound findings are inconclusive, when focal intracavitary pathology is suspected, or when symptoms persist despite apparently normal imaging.

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