International Journal of Reproduction, Contraception, Obstetrics and Gynecology
*Gupta S et al. Int J Reprod Contracept Obstet Gynecol. 2026 Apr;15(4):1293-1299*
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20260888

**Original Research Article**

# Study of hysteroscopy with ultrasonography and its correlation with histopathology in case of abnormal uterine bleeding in perimenopausal and postmenopausal female: a comparative study

**Shivangi Gupta*, Roshan Hussain, Himani Gupta**

Department of Obstetrics and Gynecology, Jawaharlal Nehru Health and Research Centre, Bhilai, Chhattisgarh, India

**Received:** 15 January 2026
**Accepted:** 13 March 2026

***Correspondence:**
Dr. Shivangi Gupta,
E-mail: himanigupta270678@gmail.com

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## ABSTRACT

**Background:** Abnormal uterine bleeding (AUB) is a common gynecological problem in perimenopausal and postmenopausal women, requiring accurate evaluation to distinguish benign from premalignant and malignant causes. Ultrasonography (USG) is widely used as an initial screening tool, whereas hysteroscopy provides direct visualization of the uterine cavity. Histopathology remains the gold standard for definitive diagnosis. This study aimed to compare the diagnostic performance of USG and hysteroscopy against histopathology in women presenting with AUB.
**Methods:** A cross-sectional observational study was conducted on 100 women aged ≥40 years presenting with AUB at a tertiary care center. All participants underwent detailed clinical evaluation followed by transabdominal ultrasonography, diagnostic hysteroscopy and endometrial sampling for histopathological examination. Diagnostic parameters including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and overall accuracy were calculated for USG and hysteroscopy using histopathology as the gold standard.
**Results:** The majority of participants were aged 41–50 years (59%). Menorrhagia was the most common presenting symptom. USG identified endometrial hyperplasia in 10% of patients, whereas hysteroscopy detected hyperplasia in 18%. Histopathology confirmed hyperplasia in 12% and carcinoma in 1% of cases. For diagnosing hyperplasia, USG showed a sensitivity of 83.33% and specificity of 100%, while hysteroscopy demonstrated a sensitivity of 83.33% and specificity of 90.90%. Overall diagnostic accuracy was higher for hysteroscopy.
**Conclusions:** Hysteroscopy demonstrated superior diagnostic capability compared to ultrasonography in detecting endometrial abnormalities, particularly focal lesions. USG remains a useful initial modality; however, hysteroscopy enhances diagnostic precision and should be considered in the evaluation of women with persistent or unexplained AUB.

**Keywords:** Abnormal uterine bleeding, Ultrasonography, Hysteroscopy, Endometrial pathology

## INTRODUCTION

AUB is one of the most frequent gynecological complaints among women in the perimenopausal and postmenopausal age groups. It significantly affects quality of life and accounts for nearly one-third of outpatient gynecological visits. In women over 40 years of age, the differential diagnosis is broad and includes structural lesions such as polyps, leiomyomas, adenomyosis, endometrial hyperplasia and malignancy, as well as non-structural causes including ovulatory dysfunction, endometrial disorders, coagulopathies, iatrogenic factors and not-yet-classified etiologies. To standardize evaluation and terminology, the FIGO PALM–COEIN classification system is widely used globally.[1,2] Accurate diagnosis is essential because AUB in this age group may represent early manifestations of premalignant or malignant endometrial pathology. Transabdominal USG is often the

first investigation due to its accessibility, non-invasive nature and ability to assess uterine size, endometrial thickness and the presence of focal lesions. However, USG has limitations in detecting small or intracavitary abnormalities.[3-5] Hysteroscopy allows direct visualization of the cervical canal and uterine cavity, facilitating identification of focal lesions and enabling targeted biopsies. It is considered the gold standard for the evaluation of intrauterine pathology. Nevertheless, histopathological examination remains the definitive diagnostic modality for endometrial conditions.[6-8] This study compares the diagnostic performance of ultrasonography and hysteroscopy with histopathology in evaluating women presenting with AUB, aiming to assess the accuracy of each modality in identifying endometrial pathology.

## METHODS

### *Study design*

A prospective, cross-sectional observational study.

### *Study place*

Department of Obstetrics and Gynecology, JLNH and RC, Bhilai, Chhattisgarh, India.

### *sample size*

100 women presenting with abnormal uterine bleeding.

### *Inclusion criteria*

Women aged ≥40 years presenting with AUB, perimenopausal and postmenopausal status, willingness to undergo USG, hysteroscopy and endometrial biopsy, written informed consent.

### *Exclusion criteria*

Pregnancy or pregnancy-related bleeding, active pelvic infection, known bleeding disorders, severe medical comorbidities contraindicating hysteroscopy, cervical stenosis preventing hysteroscope entry.

### *Clinical evaluation*

A detailed history was obtained, including pattern and duration of bleeding, menopausal status, associated symptoms, medical comorbidities and previous gynecological surgeries. General, systemic and pelvic examinations (per speculum and per vaginal) were performed.

### *Ultrasonography*

All participants underwent transabdominal pelvic ultrasonography using a high-resolution machine. Uterine size, endometrial thickness, endometrial echogenicity and presence of focal lesions such as polyps or fibroids were recorded.

### *Hysteroscopy*

Diagnostic hysteroscopy was performed under adequate analgesia or anesthesia. The uterine cavity was examined systematically under continuous fluid distension using normal saline. Findings such as hyperplasia, polyps, submucous fibroids, atrophic endometrium or suspicious lesions were documented. Targeted biopsies were taken when indicated.

### *Histopathology*

Endometrial samples obtained via curettage or hysteroscopy-directed biopsy were fixed in 10% formalin and sent for histopathological examination. Histopathology served as the gold standard for diagnosis.

### *Ethical approval*

This study was approved by the Institutional Ethics Committee of JLN Hospital and Research Centre, Bhilai Steel Plant, Bhilai, Chhattisgarh, India. IEC Proposal No.: JLN HRC/IEC/2023/251. Date of Approval: 11 March 2023

The study adhered to the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to inclusion. The study completion report was reviewed and accepted by the Institutional Ethics Committee on 06 March 2025 and the study was marked closed.

### *Statistical analysis*

All data were compiled in Microsoft Excel and analyzed using appropriate statistical methods. Categorical variables were compared using the chi-square test. Sensitivity, specificity, PPV, NPV and diagnostic accuracy were calculated for USG and hysteroscopy against histopathology. A p value<0.05 was considered statistically significant.

## RESULTS

Table 1 presents the baseline demographic and clinical characteristics of the 100 women included in the study. The age distribution shows that the majority of participants were between 41–50 years (59%), followed by 51–60 years (36%), indicating that most women presented with abnormal uterine bleeding during the perimenopausal transition. Only a small proportion (5%) were in the 61–70-year age group. Parity assessment revealed that a very large proportion (80%) were multiparous (≥P2), while only 1% were nulliparous, reflecting the predominance of high-parity women in this population. Socioeconomic classification indicated that most women belonged to the lower class (30%), followed by upper (24%), upper middle

(21%) and lower middle (21%) socioeconomic groups, with the least representation from the upper-lower class (4%). Educational status showed that the majority were graduates (59%), followed by those with secondary schooling (19%) and postgraduate qualifications (17%), whereas only 5% had completed primary education alone.

Assessment of BMI demonstrated that more than half of the participants were overweight (53%) and an additional 44% were obese, whereas only 3% had a normal BMI, highlighting a strong predominance of excess body weight in the study population. Regarding menopausal status, 58% of women were perimenopausal and 42% were postmenopausal, again reflecting the age group most commonly presenting with bleeding abnormalities. The duration of symptoms revealed that nearly three-fourths (73%) had symptoms for 1–6 months, while only a small fraction reported symptoms persisting for more than a year.

Table 2 summarizes the clinical presentation and associated comorbidities among the 100 women included in the study. Postmenopausal bleeding was the most common presenting symptom, reported by 33% of women, closely followed by heavy menstrual bleeding (32%), together accounting for nearly two-thirds of all cases. These findings highlight that abnormal uterine bleeding in both postmenopausal women and those with heavy cyclic bleeding constitutes the majority of clinical presentations in gynecologic outpatient settings. Other menstrual irregularities such as frequent menses (16%) and prolonged bleeding (11%) were less common but still significant contributors to symptom burden. Less frequent complaints included dysmenorrhea and postcoital bleeding (3% each), while intermenstrual bleeding was reported by only 2% of women.

The comorbidity profile shows that hypothyroidism was the most frequent associated condition (21%), followed by hypertension (18%) and diabetes mellitus (12%), indicating a notable prevalence of endocrine and metabolic disorders within this population. Approximately one-fifth (19%) of the women had no significant comorbidity, suggesting that abnormal uterine bleeding can occur independently of systemic illness in a subset of patients. Rare conditions such as asthma and cerebral palsy were reported in only 1% of participants each. Table 3 presents a comparative overview of the diagnostic findings obtained through USG, hysteroscopy and HPE, highlighting the strengths and variations of each modality. Among USG findings, endometrial polyps constituted the most frequently detected abnormality (27%), followed by atrophic endometrium (15%), proliferative endometrium (13%), fibroids (12%) and equal proportions of chronic endometritis, endometrial hyperplasia and adenomyosis (10% each). Endometrial carcinoma was identified in 3% of cases on USG, indicating its relatively low prevalence but clinical importance. Hysteroscopy demonstrated a higher detection rate for several structural lesions compared to USG. Endometrial polyps were observed in 32% of women, making them the most common hysteroscopic finding. Proliferative and atrophic endometrium were noted in 23% and 19% of cases, respectively, while endometrial hyperplasia was identified in 18% and submucous fibroids in 8%. These values reflect the superior ability of hysteroscopy to visualize intracavitary abnormalities with greater precision.

In the present study, both ultrasonography and hysteroscopy demonstrated high diagnostic performance when compared with histopathology. For endometrial hyperplasia, ultrasonography and hysteroscopy showed equal sensitivity of 83.33%, while ultrasonography exhibited a higher specificity of 100% and diagnostic accuracy of 98% compared to hysteroscopy, which showed a specificity of 90.90% and diagnostic accuracy of 90%. In the diagnosis of endometrial polyps, hysteroscopy demonstrated complete diagnostic agreement with histopathology, showing 100% sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy, whereas ultrasonography showed a sensitivity of 84% with a diagnostic accuracy of 95%. For fibroids, both modalities demonstrated a sensitivity of 100%, with ultrasonography showing a specificity of 91.67% and diagnostic accuracy of 92% and hysteroscopy showing a specificity of 95% and diagnostic accuracy of 96%. In cases of atrophic endometrium, ultrasonography demonstrated 100% sensitivity, specificity and diagnostic accuracy, while hysteroscopy showed 100% sensitivity with a specificity of 95.29% and diagnostic accuracy of 96%. For endometrial carcinoma, ultrasonography demonstrated 100% sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy when compared with histopathology.

**Table 1: Baseline demographic and clinical characteristics.**

| Variable | Category | N | % |
|---|---|---|---|
| **Age (in years)** | 41–50 | 59 | 59.0 |
| | 51–60 | 36 | 36.0 |
| | 61–70 | 5 | 5.0 |
| **Parity** | P0 | 1 | 1.0 |
| | P1 | 19 | 19.0 |
| | ≥P2 | 80 | 80.0 |

Continued.

| Variable | Category | N | % |
|---|---|---|---|
| **Socioeconomic status** | Upper | 24 | 24.0 |
| | Upper middle | 21 | 21.0 |
| | Lower middle | 21 | 21.0 |
| | Upper lower | 4 | 4.0 |
| | Lower | 30 | 30.0 |
| **Education** | Primary | 5 | 5.0 |
| | Secondary | 19 | 19.0 |
| | Graduate | 59 | 59.0 |
| | Postgraduate | 17 | 17.0 |
| **BMI** | 18.5–24.9 | 3 | 3.0 |
| | 25–29.9 | 53 | 53.0 |
| | ≥30 | 44 | 44.0 |
| **Menopause status** | Perimenopausal | 58 | 58.0 |
| | Postmenopausal | 42 | 42.0 |
| **Duration of symptoms** | 1–6 | 73 | 73.0 |
| | 7–12 | 23 | 23.0 |
| | 13–18 | 2 | 2.0 |
| | 19–24 | 2 | 2.0 |

**Table 2: Clinical presentation and comorbidities (n=100).**

| Variable | Category | N | % |
|---|---|---|---|
| **Chief complaints** | Postmenopausal bleeding | 33 | 33.0 |
| | Heavy menstrual bleeding | 32 | 32.0 |
| | Frequent menses | 16 | 16.0 |
| | Prolonged bleeding | 11 | 11.0 |
| | Dysmenorrhea | 3 | 3.0 |
| | Postcoital bleeding | 3 | 3.0 |
| | Intermenstrual bleeding | 2 | 2.0 |
| **Comorbidities** | Hypothyroidism | 21 | 21.0 |
| | Hypertension | 18 | 18.0 |
| | Diabetes | 12 | 12.0 |
| | Not significant | 19 | 19.0 |
| | Asthma | 1 | 1.0 |
| | Cerebral palsy | 1 | 1.0 |

**Table 3: Comparison of USG, hysteroscopy and histopathological findings.**

| Finding type | Category | N | % |
|---|---|---|---|
| **USG finding** | Endometrial polyp | 27 | 27.0 |
| | Atrophic endometrium | 15 | 15.0 |
| | Proliferative endometrium | 13 | 13.0 |
| | Fibroid | 12 | 12.0 |
| | Chronic endometritis | 10 | 10.0 |
| | Endometrial hyperplasia | 10 | 10.0 |
| | Adenomyosis | 10 | 10.0 |
| | Endometrial carcinoma | 3 | 3.0 |
| **Hysteroscopy** | Endometrial polyp | 32 | 32.0 |
| | Proliferative endometrium | 23 | 23.0 |
| | Atrophic endometrium | 19 | 19.0 |
| | Endometrial hyperplasia | 18 | 18.0 |
| | Submucous fibroid | 8 | 8.0 |
| **Histopathology** | Endometrial polyp | 32 | 32.0 |
| | Proliferative endometrium | 19 | 19.0 |
| | Secretory endometrium | 15 | 15.0 |

Continued.

| Finding type | Category | N | % |
|---|---|---|---|
| | Atrophic endometrium | 15 | 15.0 |
| | Endometrial hyperplasia | 12 | 12.0 |
| | Fibroid | 4 | 4.0 |
| | Endometrial carcinoma | 3 | 3.0 |

**Table 4: Diagnostic accuracy of USG and hysteroscopy compared with histopathology.**

| Condition | Modality | Sensitivity (%) | Specificity (%) | PPV (%) | NPV (%) | Diagnostic accuracy (%) |
|---|---|---|---|---|---|---|
| **Endometrial hyperplasia** | USG | 83.33 | 100.00 | 100.00 | 97.77 | 98.00 |
| | Hysteroscopy | 83.33 | 90.90 | 55.55 | 97.56 | 90.00 |
| **Endometrial polyp** | USG | 84.00 | 100.00 | 100.00 | 93.15 | 95.00 |
| | Hysteroscopy | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| **Fibroid** | USG | 100.00 | 91.67 | 33.33 | 100.00 | 92.00 |
| | Hysteroscopy | 100.00 | 95.00 | 50.00 | 100.00 | 96.00 |
| **Atrophic endometrium** | USG | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | Hysteroscopy | 100.00 | 95.29 | 78.94 | 100.00 | 96.00 |

**Table 5: Validity of hysteroscopy for endometrial polyp detection.**

| Author | Sensitivity | Specificity | PPV | NPV |
|---|---|---|---|---|
| **Study** | 100 | 100 | 100 | 100 |
| **Nandan et al[15], 2013** | 100 | 95.9 | 46.2 | 100 |
| **Razzaq et al[18], 2011** | 93.3 | 98.5 | 93.3 | 98.55 |
| **Fakhar et al[13], 2010** | 88 | 93 | 60 | 98 |

**Table 6: Validity of hysteroscopy for submucous myoma.**

| Author | Sensitivity | Specificity | PPV | NPV |
|---|---|---|---|---|
| **Present study** | 100 | 95 | 50 | 100 |
| **Razzaq et al[18], 2011** | 100 | 100 | 100 | 100 |
| **Allameh et al[19], 2010** | 100 | 96.4 | 88 | 100 |

## DISCUSSION

In the present study of 100 women with AUB, the majority belonged to the 41–50 years age group (59%), followed by 51–60 years (36%). This reflects the typical high-risk reproductive/perimenopausal group for AUB. Jairajpuri et al reported a lower incidence (35.89%) in the same age group, suggesting population variation.[1] The findings further showed AUB predominantly in multiparous women (80%), consistent with literature indicating the role of parity-related hormonal and anatomical changes in AUB pathogenesis.[9-11] A significant proportion of women (30%) belonged to lower socioeconomic class, demonstrating that the burden of AUB disproportionately affects women with limited healthcare access. Education levels were relatively higher in our cohort (59% graduates), suggesting good health awareness and healthcare-seeking behavior. Overweight and obesity were highly prevalent (97%), reinforcing metabolic risk contributions. More than half of participants were perimenopausal (58%), similar to Stamatellos et al.[12] Postmenopausal bleeding accounted for 42%, higher than earlier reports, highlighting a need for malignancy screening in this subgroup.[9] The most common presenting complaints were postmenopausal bleeding (33%) and heavy menstrual bleeding (32%). In contrast, Jairajpuri et al observed menorrhagia as the predominant symptom (41%).[9] Most women presented within 1–6 months of symptoms (73%) earlier than typically reported by Jairajpuri et al where delayed presentation was common.[1] Hypothyroidism (21%), hypertension (18%) and diabetes (16%) were the common comorbid conditions, reaffirming associations between endocrine/metabolic illness and endometrial pathology.[13-15]

Normal-sized uterus was observed in 59% of women, similar to findings by de Wit et al (54.2%).[8] Endometrial thickness of 5–10 mm was most prevalent (46%). Kadakola et al stated that endometrial thickness <4 mm nearly excludes carcinoma, aligning with the study's low malignancy prevalence.[10] USG findings demonstrated endometrial polyps as the most common pathology (27%), correlating with prior observations of benign intracavitary abnormalities.[12-14,16] Hysteroscopy identified endometrial

polyps in 32% of cases slightly higher than USG reinforcing its role as a diagnostic gold standard. Stamatellos et al and Dongen et al, similarly found hysteroscopy highly accurate and safe for intracavitary lesion identification.[12,14] Fakhar et al observed high sensitivity for diagnosing malignancy-prone abnormalities.[13] Histopathological examination showed polyps (32%) as the most common diagnosis, differing from some studies where secretory endometrium predominated.[9,19] In postmenopausal women, atrophic endometrium (7%), hyperplasia (9%) and carcinoma (3%) were more frequent, underscoring vigilant evaluation for malignancy risk. Comorbidities such as hypertension and hypothyroidism were associated with polyps and proliferative endometrium, while diabetes showed stronger association with hyperplastic/malignant pathologies.[13-15] The comparison of validity factors for hysteroscopy in diagnosing endometrial polyps demonstrates consistently high diagnostic performance across studies, highlighting its role as the gold standard for intracavitary evaluation. In the present study, hysteroscopy achieved perfect accuracy with 100% sensitivity, specificity, PPV and NPV, indicating an excellent ability to correctly identify true-positive and true-negative cases without diagnostic errors.

Findings from previous studies also support its strong diagnostic capability, with Nandan et al reporting perfect sensitivity (100%) but comparatively lower specificity (95.9%) and a markedly reduced PPV (46.2%), suggesting a higher false-positive rate. Razzaq et al observed high sensitivity and specificity (93.3% and 98.5%, respectively) with similarly strong predictive values, while Fakhar et al reported slightly lower sensitivity (88%) and specificity (93%), reflecting a moderate chance of missed diagnoses or misclassification. Overall, the table indicates that while diagnostic accuracy may vary based on operator expertise, patient selection and histopathological confirmation, hysteroscopy remains a highly reliable modality for detecting endometrial polyps, particularly demonstrated by the superior performance in the current study.

The comparative analysis of validity factors for hysteroscopy in diagnosing submucous myoma indicates that it is a highly effective diagnostic modality with consistently strong performance across studies. The present study demonstrated perfect diagnostic accuracy with 100% sensitivity, specificity, PPV and NPV, suggesting that hysteroscopy correctly identified all true cases and ruled out non-myoma conditions without any false results. Similar high accuracy was also observed by Nandan et al who recorded perfect sensitivity (100%) but slightly lower specificity (95.9%) and a markedly reduced PPV (46.2%), indicating a tendency for false positives. Razzaq et al reported high sensitivity (93.3%) and specificity (98.5%), reflecting reliable discrimination between true pathology and normal findings. Meanwhile, Fakhar et al documented comparatively lower sensitivity (88%) and specificity (93%), suggesting more chances of missed or incorrect diagnoses. Collectively, these findings reinforce hysteroscopy as a highly valuable and dependable tool for detecting submucous myomas, with diagnostic accuracy improving in skilled hands and with better case selection, as reflected in the present study's superior outcomes. The diagnostic validity analysis demonstrated that USG had excellent specificity (100%) for hyperplasia, fibroid, polyps, carcinoma and atrophic endometrium, but moderate sensitivity in hyperplasia (55.55%), indicating possible underestimation. Hysteroscopy exhibited perfect sensitivity for hyperplasia and polyps but showed reduced specificity and PPV for hyperplasia, suggesting overdiagnosis in some cases. However, for polyps, hysteroscopy in our study showed 100% accuracy, superior to studies by Nandan et al, Razzaq et al and Shazia et al which reported variability due to subjective visualization and sampling error.

For fibroids, USG demonstrated stronger performance than hysteroscopy due to its ability to detect intramural/myometrial lesions not visible on cavity assessment. The diagnostic accuracy values align with Dongen et al who reported high reliability (sensitivity 84–98%, specificity 88–93%) for hysteroscopic diagnosis of intracavitary abnormalities. Taken together, our study reinforces that while USG provides an excellent non-invasive screening tool for AUB evaluation, hysteroscopy remains the gold standard for diagnosing focal endometrial lesions. Histopathology continues to serve as the definitive confirmatory test, especially in postmenopausal women at risk for hyperplasia and carcinoma. Early investigation and timely intervention are crucial to reduce morbidity associated with underlying endometrial conditions.

## CONCLUSION

Abnormal uterine bleeding remains one of the most common gynecological complaints, particularly among perimenopausal and postmenopausal women. In the present study, overweight and obesity, multiparity and metabolic comorbidities such as hypothyroidism, hypertension and diabetes were common contributing characteristics. Endometrial polyps represented the most frequent pathology across diagnostic modalities, while a notable proportion of postmenopausal women had atrophic endometrium, endometrial hyperplasia or malignancy, emphasizing the need for careful evaluation in this subgroup.

Ultrasonography proved to be a useful first-line screening tool with high specificity for detecting polyps, hyperplasia and carcinoma. However, hysteroscopy demonstrated superior diagnostic capabilities for intracavitary lesions, providing direct visualization and targeted biopsies. Histopathology remains the gold standard for definitive diagnosis and for ruling out premalignant and malignant conditions. Overall, a multimodal diagnostic approach incorporating clinical assessment, USG, hysteroscopy and histopathology enhances diagnostic accuracy and enables timely and appropriate management of AUB, especially in high-risk women.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Gupta S, Hussain R, Gupta H. Study of hysteroscopy with ultrasonography and its correlation with histopathology in case of abnormal uterine bleeding in perimenopausal & postmenopausal female: a comparative study. Int J Reprod Contracept Obstet Gynecol 2026;15:1293-9.