Diagnostic Accuracy of Hysteroscopy in Relation to Histopathology in Patients with Abnormal Uterine Bleeding at a Tertiary Care Centre

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Abstract: <u>*Background*</u>*: Abnormal uterine bleeding (AUB) significantly impacts women's health and requires accurate diagnosis to identify underlying pathologies. Hysteroscopy, a minimally invasive technique, allows direct visualisation of the uterine cavity and is often used alongside histopathological evaluation. This study aims to assess the diagnostic accuracy of hysteroscopy in comparison to histopathology in patients with abnormal uterine bleeding.* <u>*Methods*</u>*: This prospective observational study was conducted at American International Institute of Medical Sciences, Udaipur, over a period of 12 months. A total of 120 women aged 20–65 years with abnormal uterine bleeding underwent hysteroscopy followed by endometrial sampling for histopathological examination. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of hysteroscopy were calculated for different intrauterine abnormalities.* <u>*Results*</u>*: Hysteroscopy identified endometrial polyps in 30% of cases, submucosal fibroids in 25%, and hyperplasia in 8.3%. Histopathology confirmed these findings in 29.2%, 23.3%, and 12.5% of cases, respectively. The sensitivity, specificity, PPV and NPV for detecting endometrial polyps were 94.4%, 95.0%, 91.7%, and 97.4%, respectively. For submucosal fibroids, these values were 89.3%, 93.7%, 86.7%, and 95.0%, respectively. Hysteroscopy showed a 100% sensitivity and NPV for detecting malignancy.* <u>*Conclusion*</u>*: Hysteroscopy demonstrated high diagnostic accuracy for structural abnormalities in AUB, with excellent sensitivity and specificity for endometrial polyps and fibroids. However, its sensitivity for detecting hyperplasia was lower, highlighting the importance of histopathological confirmation. These findings support the use of hysteroscopy as a first-line diagnostic tool for AUB in tertiary care settings.*

Keywords: Abnormal uterine bleeding, hysteroscopy, histopathology, diagnostic accuracy, endometrial abnormalities

1. Introduction

Abnormal uterine bleeding (AUB) is one of the most common gynaecological complaints, significantly impacting the quality of life and productivity of women across all age groups [1]. The term encompasses deviations in menstrual volume, duration and frequency, which can result from structural or non-structural aetiologies as classified by the PALM-COEIN system introduced by the International Federation of Gynaecology and Obstetrics (FIGO) [2]. Structural causes include polyps, adenomyosis, leiomyoma, and malignancy/hyperplasia, while non-structural causes include coagulopathy, ovulatory dysfunction, endometrial, iatrogenic and not otherwise classified disorders. [3]

Hysteroscopy has emerged as a gold-standard diagnostic tool for evaluating the uterine cavity, enabling direct visualisation of intrauterine pathology and targeted interventions [4]. With its high sensitivity and specificity for detecting structural anomalies, hysteroscopy is increasingly preferred over traditional blind endometrial sampling methods, which have limited diagnostic accuracy [5]. Histopathology, the microscopic examination of tissue samples, remains the definitive diagnostic standard for abnormal uterine bleeding, providing vital insights into the cellular changes and underlying pathology [6]. This study aims to assess the diagnostic accuracy of hysteroscopy by comparing its findings with histopathological outcomes in patients presenting with abnormal uterine bleeding.

The prevalence of abnormal uterine bleeding varies globally, with studies estimating it affects approximately 10–35% of women in the reproductive age group, with a higher prevalence among perimenopausal women [7, 8]. In India, the incidence of abnormal uterine bleeding is notably high due to a lack of awareness, delayed healthcare access, and limited diagnostic resources [9]. Timely and accurate diagnosis of abnormal uterine bleeding is crucial, given its potential association with endometrial hyperplasia and malignancy, particularly in postmenopausal women [10]. The study of hysteroscopy in the Indian context becomes even more relevant due to the differences in healthcare infrastructure and patient presentation compared to

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developed nations.

Hysteroscopy has demonstrated excellent diagnostic accuracy for structural abnormalities like polyps and fibroids, with sensitivity and specificity values exceeding 90% in various studies [11]. However, its performance in detecting endometrial hyperplasia and malignancies is less consistent, necessitating histopathological correlation to confirm findings[12]. Furthermore, hysteroscopy allows concurrent therapeutic interventions, reducing the need for additional procedures and thereby enhancing patient convenience and cost-effectiveness. [13]

Despite its advantages, hysteroscopy is not without limitations. False-negative results can occur due to operator inexperience or subtle pathologies not visualised during the procedure [14]. Additionally, histopathology may reveal lesions missed on hysteroscopy, underscoring the complementary nature of these modalities [15]. Combining hysteroscopy with histopathology has shown to improve diagnostic accuracy significantly, particularly for atypical hyperplasia and malignancies [16].

The selection of appropriate diagnostic tools for abnormal uterine bleeding depends on patient characteristics, including age, clinical presentation, and risk factors for endometrial pathology [17]. For premenopausal women, ovulatory dysfunction and structural abnormalities predominate, while postmenopausal bleeding is more likely linked to malignancies [18]. Understanding these demographic variations is essential for tailoring diagnostic and management strategies effectively.

The tertiary care setting of this study provides a robust platform for evaluating hysteroscopy's diagnostic utility due to the availability of advanced equipment, skilled personnel, and diverse patient demographics. Conducting the study in a region like Udaipur also enables insights into how local healthcare practices and resources impact diagnostic outcomes for abnormal uterine bleeding.

Globally, hysteroscopy is endorsed by various guidelines, including those by FIGO and the American College of Obstetricians and Gynaecologists (ACOG), for evaluating abnormal uterine bleeding [19]. These guidelines highlight its role in cases where imaging modalities like transvaginal ultrasound are inconclusive or when endometrial sampling fails to provide adequate tissue for diagnosis [20]. However, its availability and adoption in low-resource settings remain a challenge, emphasising the need for studies like this to demonstrate its utility and feasibility in such environments [21].

Histopathology remains indispensable for confirming the nature of endometrial abnormalities detected on hysteroscopy. The histopathological spectrum in AUB ranges from benign lesions like endometrial polyps and proliferative endometrium to malignant changes such as endometrial carcinoma [22]. This study evaluates whether hysteroscopic findings align with histopathological outcomes, focusing on discrepancies and identifying factors contributing to diagnostic inaccuracies.

Additionally, this study explores the impact of hysteroscopy on patient outcomes, including its ability to guide therapeutic decisions, minimise invasive procedures, and reduce hospital stays [23]. The findings aim to inform clinical practice guidelines and improve diagnostic strategies for abnormal uterine bleeding in tertiary care settings in India.

In conclusion, this study addresses a critical gap in the literature regarding the diagnostic accuracy of hysteroscopy in abnormal uterine bleeding, emphasising its relevance in the Indian healthcare context. By comparing hysteroscopic findings with histopathology, the study seeks to validate hysteroscopy's utility as a reliable diagnostic tool and highlight its limitations, contributing to better management of abnormal uterine bleeding and improved patient outcomes.

2. Methodology

2.1 Study Design

This study was conducted as a prospective observational study. It was designed to evaluate the diagnostic accuracy of hysteroscopy by comparing its findings with histopathological results in patients presenting with abnormal uterine bleeding (AUB). The study involved systematic data collection and analysis to ensure a comprehensive understanding of the correlation between the two diagnostic methods.

2.2 Study Setting

The study was carried out at American International Institute of Medical Sciences, Udaipur. The center was equipped with advanced diagnostic and surgical facilities, making it an ideal location for evaluating hysteroscopic and histopathological procedures. Patients presenting with abnormal uterine bleeding to the gynaecology outpatient and inpatient departments were included.

2.3 Study Duration

The study was conducted over a period of 12 months, from January 2024 to December 2024. This time frame allowed for sufficient patient recruitment, hysteroscopic evaluation, histopathological analysis and follow-up as required.

1) Participants

Inclusion Criteria:
- Women aged 20–65 years presenting with abnormal uterine bleeding.
- Patients who consented to both hysteroscopy and endometrial sampling for histopathological examination.
- Cases where hysteroscopy was indicated due to inconclusive ultrasound findings.
- Hemodynamically stable patients fit for undergoing hysteroscopy.

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Exclusion Criteria:
- Pregnant women.
- Patients with active pelvic inflammatory disease.
- Patients with uncorrected bleeding disorders.
- Patients on anticoagulant therapy.
- Women who declined consent for the procedure or study participation.

2) Study Sampling

Consecutive sampling was used to select participants for the study. All eligible patients presenting with AUB during the study period who met the inclusion criteria and provided informed consent were included.

3) Study Sample Size

The sample size was calculated based on previous studies and statistical power analysis. A total of 120 participants were included to ensure adequate power for comparing hysteroscopic findings with histopathology.

4) Study Groups

This study did not involve randomisation into groups, as it was an observational study. However, all patients underwent hysteroscopy followed by histopathological examination of endometrial samples. Comparisons were drawn between the two diagnostic modalities.

5) Study Parameters

The study assessed several primary and secondary parameters:
- **Primary Parameter:** Diagnostic accuracy of hysteroscopy for identifying structural abnormalities, endometrial hyperplasia and malignancies.
- **Secondary Parameters:** Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of hysteroscopy compared to histopathology.

6) Study Procedure

Patients presenting with abnormal uterine bleeding underwent a detailed clinical evaluation, including history taking and physical examination. Following this, transvaginal ultrasound was performed. If ultrasound findings were inconclusive or indicated pathology, patients were scheduled for hysteroscopy.

Hysteroscopy was performed under sterile conditions using a diagnostic hysteroscope. The uterine cavity was visualized systematically, and any abnormalities were noted. Endometrial sampling was performed using a curette and samples were sent for histopathological examination. The findings from hysteroscopy were documented and later compared with histopathological results.

7) Study Data Collection

Data were collected using a structured pro forma. This included patient demographics, clinical presentation, hysteroscopic findings, histopathological results and any discrepancies between the two diagnostic methods. All data were recorded in a secure database to maintain confidentiality.

8) Data Analysis

Data analysis was conducted using SPSS software version 26.0. Descriptive statistics, including means and proportions, were used to summarise patient characteristics and study findings. Diagnostic accuracy was calculated by comparing hysteroscopy results with histopathology using sensitivity, specificity, PPV, and NPV. A chi-square test was used to evaluate the statistical significance of findings, with a p-value < 0.05 considered statistically significant.

9) Ethical Considerations

The study was approved by the Institutional Ethics Committee before commencement. Informed written consent was obtained from all participants after explaining the study objectives, procedures, risks, and benefits. Confidentiality of patient data was maintained throughout the study, and participation was entirely voluntary, with the option to withdraw at any time without affecting clinical care.

3. Results

3.1 Baseline Characteristics of Study Participants

The study enrolled 120 patients with abnormal uterine bleeding. The mean age was 42.5 ±10.3 years, with a majority (60%) in the perimenopausal age group. The distribution of participants based on clinical presentations is summarised in Table 1.

Table 1: Baseline Characteristics of Participants

Characteristic	Frequency (n = 120)	Percentage (%)
Age group (years)		
20–30	15	12.5
31–40	35	29.2
41–50	45	37.5
>50	25	20.8

3.2 Hysteroscopic Findings

Hysteroscopy revealed various intrauterine abnormalities, as shown in Table 2. The most common finding was endometrial polyps (30%), followed by submucosal fibroids (25%).

Table 2: Hysteroscopic Findings

Finding	Frequency (n = 120)	Percentage (%)
Normal uterine cavity	40	33.3
Endometrial polyps	36	30.0
Submucosal fibroids	30	25.0
Endometrial hyperplasia	10	8.3
Suspicious for malignancy	4	3.3

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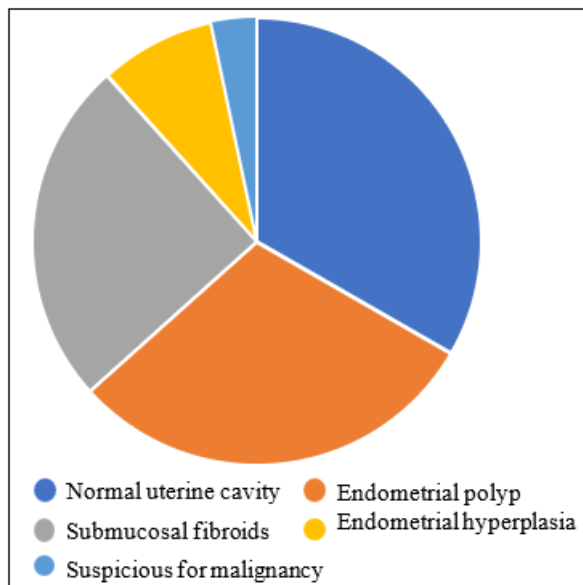
Figure 1: Hysteroscopic findings

3.3 Histopathological Findings

Histopathological examination confirmed the diagnosis suggested by hysteroscopy and provided additional insights. Table 3 summarises the histopathological results.

Table 3: Histopathological Findings

Diagnosis	Frequency (n = 120)	Percentage (%)
Normal endometrium	38	31.7
Endometrial polyps	35	29.2
Submucosal fibroids	28	23.3
Endometrial hyperplasia	15	12.5
Endometrial carcinoma	4	3.3

3.4 Diagnostic Accuracy of Hysteroscopy

The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of hysteroscopy for different findings were calculated, shown in Table 4.

Table 4: Diagnostic Accuracy of Hysteroscopy Compared to Histopathology

Diagnosis	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Endometrial polyps	94.4	95.0	91.7	97.4
Submucosal fibroids	89.3	93.7	86.7	95.0
Endometrial hyperplasia	80.0	98.3	92.3	95.7
Endometrial carcinoma	100.0	99.2	80.0	100.0

3.5 Comparison of Hysteroscopy and Histopathology Findings

A comparison of findings is presented in Table 5. Discrepancies were noted in 6 cases (5%).

Table 5: Comparison of Hysteroscopy and Histopathology Findings

Finding	Hysteroscopy (n)	Histopathology (n)
Normal	40	38
Endometrial polyps	36	35
Submucosal fibroids	30	28
Endometrial hyperplasia	10	15
Suspicious malignancy	4	4
Total	120	120

3.6 Concordance of Hysteroscopy and Histopathology

Overall, hysteroscopy demonstrated high concordance with histopathology findings (95%). Table 6 provides details of concordance.

Table 6: Overall Concordance Between Hysteroscopy and Histopathology

Concordance	Frequency (n)	Percentage (%)
True positives	114	95.0
False positives	2	1.7
False negatives	4	3.3

4. Discussion

This study evaluates the diagnostic accuracy of hysteroscopy in identifying intrauterine abnormalities compared to histopathological findings in patients with abnormal uterine bleeding (AUB). The results underscore the clinical utility of hysteroscopy as a valuable diagnostic tool, though certain limitations were observed in detecting specific conditions like endometrial hyperplasia.

The study population consisted of 120 patients, with a mean age of 42.5 ± 10.3 years. A significant proportion (37.5%) of participants belonged to the perimenopausal age group, highlighting the high prevalence of abnormal uterine bleeding in this demographic area. Heavy menstrual bleeding was the most common presentation (66.7%), followed by intermenstrual bleeding (20.8%) and postmenopausal bleeding (12.5%). These findings align with previous studies that report heavy menstrual bleeding as the primary complaint in abnormal uterine bleeding cases, particularly in perimenopausal women.

Hysteroscopy revealed structural abnormalities in 66.7% of patients, with the most common findings being endometrial polyps (30%) and submucosal fibroids (25%). Normal uterine cavities were noted in 33.3% of cases. These results are consistent with existing literature, which identifies polyps and fibroids as the predominant structural causes of abnormal uterine bleeding. The sensitivity and specificity of hysteroscopy for detecting endometrial polyps were 94.4% and 95.0%, respectively, with a positive predictive value (PPV) of 91.7% and a negative predictive value (NPV) of 97.4%. These high diagnostic indices highlight hysteroscopy's reliability for identifying polyps, as confirmed by histopathological examination, which detected polyps in 29.2% of cases.

Submucosal fibroids, detected in 25% of hysteroscopy cases, were confirmed histopathologically in 23.3% of cases. The sensitivity and specificity for fibroid detection

were 89.3% and 93.7%, respectively, with a PPV of 86.7% and a NPV of 95.0%. While these values affirm the diagnostic strength of hysteroscopy for fibroids, the slightly lower sensitivity suggests the potential for missed diagnosis, possibly due to operator dependency or technical limitations in visualising small or atypically located fibroids.

Endometrial hyperplasia presented a diagnostic challenge. Hysteroscopy identified hyperplasia in 8.3% of cases, whereas histopathology confirmed hyperplasia in 12.5%. The sensitivity for hyperplasia detection was 80.0%, with a specificity of 98.3%, PPV of 92.3%, and NPV of 95.7%. These findings indicate that while hysteroscopy is highly specific for hyperplasia, its sensitivity remains suboptimal, potentially leading to underdiagnosis. This discrepancy emphasises the complementary role of histopathology in confirming hyperplastic changes, especially in patients at risk for malignant transformation.

Suspicious malignancies were identified in 3.3% of hysteroscopy cases and were histopathologically confirmed as endometrial carcinoma. Notably, hysteroscopy demonstrated a sensitivity and NPV of 100% for malignancy detection, reflecting its robustness in ruling out malignancy when findings are negative. However, the PPV of 80% suggests that some hysteroscopic findings may mimic malignancy, underscoring the importance of histopathology for definitive diagnosis.

Overall, the concordance between hysteroscopy and histopathology was 95%, indicating strong agreement between the two diagnostic modalities. True positives accounted for 114 cases, while false positives and false negatives were minimal (1.7% and 3.3%, respectively). These results highlight the reliability of hysteroscopy as a first-line diagnostic tool for abnormal uterine bleeding, particularly for structural abnormalities. However, its limitations in detecting subtle endometrial changes, such as hyperplasia, necessitate histopathological confirmation.

The diagnostic performance of hysteroscopy observed in this study aligns with findings from prior research. A systematic review by Clark et al. reported sensitivity and specificity values exceeding 90% for structural abnormalities, similar to this study's findings for polyps and fibroids. However, variations in sensitivity for hyperplasia detection have been documented across studies, likely reflecting differences in operator expertise, patient demographics, and the prevalence of endometrial pathology.

One of the key strengths of this study is its focus on a tertiary care setting in India, which provides a unique perspective on the diagnostic challenges and outcomes in a resource- constrained environment. The findings highlight the feasibility and utility of hysteroscopy in such settings, where timely and accurate diagnosis of abnormal uterine bleeding is critical for preventing complications like anemia and improving quality of life.

Despite its strengths, this study has certain limitations. Operator dependency remains a critical factor influencing hysteroscopic accuracy, particularly for subtle or atypical lesions. Additionally, the study's observational design precludes assessment of inter-observer variability, which could provide further insights into the consistency of hysteroscopic findings. Future studies incorporating multicenter designs and larger sample sizes could address these limitations and provide more generalisable results.

5. Conclusion

In conclusion, this study demonstrates that hysteroscopy is a reliable and effective diagnostic tool for evaluating AUB, with high sensitivity and specificity for structural abnormalities such as polyps and fibroids. While its sensitivity for detecting hyperplasia is comparatively lower, the complementary role of histopathology ensures comprehensive evaluation. The findings underscore the importance of integrating hysteroscopy into routine diagnostic workflows for abnormal uterine bleeding, particularly in tertiary care settings, to improve diagnostic accuracy, guide management strategies, and enhance patient outcomes.

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