

# Justification of the necessity, value, and role of diagnostic hysteroscopy in the management plan for abnormal uterine bleeding. A teaching hospital experience

## Abstract

**Aims:** The crucial purpose of this study is to pay thoughtfulness to the filmic inspection of the uterine cavity and circumstantial operative amenities have provided the gynecologist with the perfect 'diagnostic' tool, making it conceivable to inspect the cavity and biopsy distrusted areas under direct visualization for patients presented with abnormal uterine bleeding AUB in the perimenopausal or postmenopausal periods.

**Materials and methods:** We retrospectively reviewed the medical records of 123 perimenopausal and postmenopausal women who presented with abnormal uterine bleeding (AUB) at Jordan University Hospital (JUH) between January 1, 2022, and August 1, 2024. Participants underwent diagnostic hysteroscopy followed by endometrial biopsy. The hysteroscopic findings were compared with the final histopathological diagnoses to evaluate diagnostic accuracy.

**Results:** In this study of 123 women, clinical indications for hysteroscopy differed by menopausal status, with heavy menstrual bleeding being the most common indication among premenopausal women (74.6%), while postmenopausal bleeding was predominant in postmenopausal women (80.8%). Hysteroscopy revealed a regular uterine cavity in 92.7% of cases, with endometrial abnormalities such as thickened or thin endometrium observed in a significant number of women. Histopathological analysis found normal endometrium in 47.2% of cases, with endometrial polyps (16.3%) and other conditions such as hormonal imbalance and endometritis also frequently noted. A significant relationship was observed between menopausal status and both uterine cavity condition ( $p = .025$ ) and endometrial state ( $p = .002$ ), with postmenopausal women more likely to exhibit a thin or abnormal endometrium. The diagnostic value of hysteroscopy was high for fibroids (100% detection) but lower for endometrial polyps (50% detection).

**Conclusion:** Hysteroscopy must be used as the second-line diagnostic tool after vaginal ultrasound assessment for evaluating the endometrial status in cases of AUB and a necessary step before the decision of surgical removal of the uterus. However, hysteroscopy is not very reliable for ruling out endometrial hyperplasia or cancer in women who have postmenopausal bleeding. Because of this, an endometrial biopsy is crucial for an accurate diagnosis.

**Keywords:** abnormal uterine bleeding, endometrial hyperplasia, endometrial cancer, diagnostic hysteroscopy, endometrial biopsy

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## Introduction

Abnormal uterine bleeding (AUB) is a significant concern for women, particularly those in the perimenopausal and postmenopausal stages, being the leading cause of visits to gynecologic clinics in about 30% of women, particularly in the premenopausal period, taking into consideration the role of social media platforms, modern communication technologies, and the ability to self-search for disease symptoms increase the degree of fear and compulsion.<sup>1-4</sup> This condition prompts numerous visits to gynecology clinics, highlighting its importance in women's health. The potential for AUB to indicate serious conditions, ranging from simple endometrial hyperplasia to endometrial carcinoma, necessitates thorough and precise diagnostic processes.<sup>5,6</sup> This involves taking a comprehensive medical history and conducting a clinical examination to identify any possible causes of unopposed estrogen. The subsequent step includes a pelvic

ultrasound, with the transvaginal route being preferred for its accuracy in assessing uterine lining thickness and detecting abnormalities such as polyps, fibroids, and hormonal imbalance-related changes.<sup>7,8</sup> Confirmatory diagnosis through histopathological examination of tissue samples is crucial in identifying conditions from hyperplasia to malignancy.<sup>9,10</sup>

Prompt diagnosis of endometrial abnormalities is vital. The WHO's 2014 classification identifies endometrial hyperplasia without atypia and atypical endometrial hyperplasia as premalignant lesions.<sup>11</sup> Accurate diagnosis cannot rely on a single method; hence, a combination of diagnostic tools is essential. Clinical evaluation and endoscopy of the uterine cavity, including tissue sampling, are necessary before making any treatment decisions, except in extreme cases of life-threatening bleeding during labor. The use of hysteroscopy is critical for evaluating the endometrial cavity, as malignancy typically begins

with small lesions around the ostium.<sup>12</sup> Technological advancements in endoscopic equipment have significantly improved diagnosis and treatment, reducing complications and improving patient outcomes. The initial use of hysteroscopy in 1869 by Pantaleoni paved the way for these advancements.<sup>13</sup> Today, hysteroscopy is a reliable and well-tolerated procedure for diagnosing AUB, reducing the need for traditional curettage, enhancing patient satisfaction, and lowering costs. Hysteroscopy before hysterectomy is mandatory, and no excuse can be accepted for circumventing this diagnostic step. The exception to this is a hysterectomy due to life-threatening bleeding during childbirth or in conservative countries for single females due to the sensitivity of dealing with the hymen.<sup>14,15</sup>

This research highlighted the potential benefits of using hysteroscopic technology as a basic, priority step that cannot be skipped except in emergencies between life and death.

## Methods

### Participants

The study included 123 women who presented with abnormal uterine bleeding (AUB) and other less common symptoms. These women underwent diagnostic hysteroscopy followed by endometrial biopsy at Jordan University Hospital (JUH) between January 1, 2022, and August 1, 2024. The participants' mean age was 46.98 years ( $SD = 8.73$ ), with all women being perimenopausal or postmenopausal. JUH, located in Amman, Jordan, is the capital's largest tertiary and teaching hospital. All participants were selected for their persistence in seeking care for AUB during this period. The Department of Obstetrics and Gynecology Council, the Scientific Research Committee (SRC) at the medical school, and the Institutional Review Board (IRB) of Jordan University Hospital approved the study (approval number: 1020248348, dated 25/03/2024).

### Study design

This retrospective study employed a cross-sectional design to evaluate the diagnostic value of hysteroscopy in assessing the uterine cavity and obtaining histopathological confirmation in women with AUB. Data were collected from medical records, focusing on the indications for hysteroscopy, the findings from hysteroscopic examinations, and the results of histopathological analyses. A comparison was made between premenopausal and postmenopausal women to assess the prevalence of different uterine abnormalities.

### Materials

The data for this study was gathered through a comprehensive review of patients' medical records. The collected data included demographic information such as age and marital status, obstetric history including menopausal status, gravidity, and parity, the indication for hysteroscopy, hysteroscopic findings, and histopathological results from endometrial biopsy.

### Procedure

All women who underwent diagnostic hysteroscopy during the specified time frame were included in this study. Experienced gynecologists at JUH conducted hysteroscopic procedures, which were followed by endometrial biopsy to confirm histopathological diagnoses. Medical records were carefully reviewed to ensure comprehensive data collection. Each participant provided verbal informed consent before their procedure, ensuring compliance with ethical standards.

## Data analysis

Descriptive analyses were performed to assess the prevalence of indications for hysteroscopy, hysteroscopic findings, and histopathological results. Comparisons between premenopausal and postmenopausal women were made using appropriate statistical tests. The Pearson Chi-Square test was applied to assess associations between categorical variables, and Fisher's Exact Test was used when expected counts were less than 5. Additionally, Fisher's Exact Test with the Monte Carlo method was utilized for larger contingency tables with low expected counts, ensuring precise p-values. Statistical significance was set at  $p < .05$ , and all analyses were conducted using SPSS version 27.

We used a combination of statistical tests to ensure robust and accurate analysis. The Pearson Chi-Square test was used when expected frequencies were met. Fisher's Exact Test provided exact p-values for small sample sizes and sparse data. For larger tables with low expected counts, Fisher's Exact Test with the Monte Carlo method was applied to approximate p-values accurately. This approach ensured our statistical conclusions were comprehensive and reliable.

## Results

### Patient Demographics and Reproductive History

A total of 123 female participants were included in the study, with a mean age of 46.98 years ( $SD = 8.73$ ), ranging from 23 to 72 years. The majority of participants were married ( $n=110$ , 89.4%), while a smaller proportion were widowed ( $n=8$ , 6.5%), divorced ( $n=3$ , 2.4%), and single ( $n=2$ , 1.6%). In terms of menopausal status, 71 women (57.7%) were premenopausal, and 52 women (42.3%) were postmenopausal. Regarding reproductive history, the participants reported an average gravidity of 4.77 ( $SD = 2.77$ ), with a median of 5 pregnancies and a range extending from 0 to 14 pregnancies. Additionally, the mean number of full-term pregnancies was 4.01 ( $SD = 2.44$ ), while pre-term pregnancies averaged .74 ( $SD = 1.29$ ). Notably, there was one case of reported miscarriage and one case of ectopic pregnancy among the participants. A summary of participants' demographics and reproductive characteristics is presented in Table 1.

**Table 1** Sociodemographic and reproductive characteristics of the participants

Sample characteristics	n	%	M	SD
Marital status				
Married	110	89.4		
Widowed	8	6.5		
Divorced	3	2.4		
Single	2	1.6		
Menopausal state				
Premenopause	71	57.7		
Postmenopause	52	42.3		
Age			46.98	8.73
Gravidity (Total number of pregnancies)			4.79	2.77
Number of full-term pregnancies (>24 weeks)			4.01	2.44
Number of pre-term pregnancies (<24 weeks)			0.74	1.29
Number of miscarriages			0.01	0.09
Number of ectopic pregnancies			0.01	0.09

**Note** N = 123

### Clinical Indications for Hysteroscopy

Among premenopausal women ( $n = 71$ ), the most common indication for hysteroscopy was heavy menstrual bleeding, accounting for 74.6% ( $n = 53$ ) of cases (Table 2). This was followed by abdominal pain, which was reported in 7% ( $n = 5$ ) of the women. Intermenstrual bleeding was noted in 5.6% ( $n = 4$ ) of the cases, while post-coital bleeding was observed in 4.2% ( $n = 3$ ). Pelvic mass and recurrent miscarriages each accounted for 2.8% ( $n = 2$ ) of the indications. Additionally, uterine prolapse and pre-IVF evaluations were each noted in 1.4% ( $n = 1$ ) of the cases.

**Table 2** Clinical indications for hysteroscopy among premenopausal women

Clinical indication for hysteroscopy	n	%
Heavy menstrual bleeding	53	74.6
Abdominal pain	5	7
Intermenstrual bleeding	4	5.6
Postcoital bleeding	3	4.2
Pelvic mass	2	2.8
Recurrent miscarriages	2	2.8
Uterine prolapse	1	1.4
Pre IVF	1	1.4

**Note** IVF, *in vitro* fertilization

In postmenopausal women ( $n = 52$ ), postmenopausal bleeding was the predominant indication for hysteroscopy, representing 80.8% ( $n = 42$ ) of the cases (Table 3). Pelvic mass was the second most common indication, observed in 5.8% ( $n = 3$ ) of the women. Both thick endometrium on Tamoxifen and thick endometrium with risk factors were noted in 3.8% ( $n = 2$ ) of the cases. Abdominal pain, endometrial cells in Pap smear, and vulvar lesions were each reported in 1.9% ( $n = 1$ ) of the cases.

**Table 3** Clinical indications for hysteroscopy among postmenopausal women

Clinical indication for hysteroscopy	n	%
Postmenopausal bleeding	42	80.8
Pelvic mass	3	5.8
Thick endometrium on Tamoxifen	2	3.8
Thick endometrium with risk factors	2	3.8
Abdominal pain	1	1.9
Endometrial cells in Pap smear	1	1.9
Vulvar lesion	1	1.9

**Table 5** Menopausal status and uterine cavity conditions observed during hysteroscopy

		Menopausal status				Total	
		Premenopausal women		Postmenopausal women		n	%
		n	(%)	n	(%)		
Uterine cavity condition	Regular	69	-97.2	45	-86.5	114	-92.7
	Irregular	2	-2.8	7	-13.5	9	-7.3
Total		71	-100	52	-100	123	-100

**Note** The percentages represent the proportion of patients in each cell relative to the total number of patients within the corresponding column category.

In addition, The relationship between endometrium condition during hysteroscopy and menopausal status was analyzed using the Fisher-Freeman-Halton Exact test, which revealed a statistically significant association, test statistic = 16.17,  $p = .002$  (Table 6). Among premenopausal women ( $n = 71$ ), 53.5% ( $n = 38$ ) had a normal endometrium, 25.4% ( $n = 18$ ) had a thick endometrium, 11.3% ( $n = 8$ ) had a hyperemic endometrium, 5.6% ( $n = 4$ ) had a thin endometrium, and 4.2% ( $n = 3$ ) presented with a polypoidal endometrium. In

### Hysteroscopic findings during the procedure

During the hysteroscopic procedure, the condition of the uterine cavity was assessed in all participants. Most cases exhibited a regular uterine cavity ( $n=114$ , 92.7%), while an irregular cavity was noted in 9 cases (7.3%). The endometrium was evaluated, revealing normal findings in 52 cases (42.3%), while thickened endometrium was observed in 31 cases (25.2%), and thin endometrium in 19 cases (15.4%). Hyperemic endometrium was present in 14 cases (11.4%), and polypoidal endometrium in 7 cases (5.7%). Concerning the presence of lesions, 109 participants (88.6%) were found to have no detectable lesions. In contrast, polyps were identified in 10 cases (8.1%), and fibroids in 4 cases (3.3%) as illustrated in Table 4.

**Table 4** Hysteroscopy findings among participants

Hysteroscopy findings	n	%
<b>Condition of uterine cavity</b>		
Regular	114	92.7
Irregular	9	7.3
<b>Condition of endometrium</b>		
Normal endometrium	52	42.3
Thick endometrium	31	25.2
Thin endometrium	19	15.4
Hyperemic endometrium	14	11.4
Polypoidal endometrium	7	5.7
<b>Lesions</b>		
No lesions	109	88.6
Polyps	10	8.1
ibroids	4	3.3

**Note** N = 123

The relationship between uterine cavity condition during hysteroscopy and menopausal status was analyzed using a chi-square test of independence, which revealed a statistically significant association between these variables,  $\chi^2 (1, N = 123) = 5.02, p = .025$  (Table 5). Among premenopausal women ( $n=71$ ), 97.2% ( $n=69$ ) had a regular uterine cavity, while 2.8% ( $n=2$ ) had an irregular uterine cavity. In comparison, 86.5% ( $n=45$ ) of postmenopausal women ( $n=52$ ) had a regular uterine cavity, and 13.5% ( $n=7$ ) had an irregular uterine cavity. These findings suggest that postmenopausal women are significantly more likely to have irregular uterine cavities than premenopausal women are.

comparison, among postmenopausal women ( $n = 52$ ), 28.8% ( $n = 15$ ) had a thin endometrium, 26.9% ( $n = 14$ ) had a normal endometrium, 25% ( $n = 13$ ) had a thick endometrium, 11.5% ( $n = 6$ ) had a hyperemic endometrium, and 7.7% ( $n = 4$ ) had a polypoidal endometrium. These results highlight significant differences in endometrial conditions based on menopausal status. Notably, postmenopausal women were more likely to have a thin endometrium, whereas premenopausal women were more likely to exhibit normal or thick endometrium.

**Table 6** Menopausal status and endometrium conditions observed during hysteroscopy

		Menopausal status				Total	
		Premenopausal women		Postmenopausal women		n	(%)
		n	(%)	n	(%)		
Endometrium condition	Normal	38	-53.5	14	-26.9	52	-42.3
	Thick	18	-25.4	13	-25	31	-25.2
	Thin	4	-5.6	15	-28.8	19	-15.4
	Hyperemic	8	-11.3	6	-11.5	14	-11.4
	Polypoidal	3	-4.2	4	-7.7	7	-5.7
Total	71	-100	52	-100	123	-100	

**Note** The percentages represent the proportion of patients in each cell relative to the total number of patients within the corresponding column category.

### Histopathological findings

Histopathological examination of the uterine specimens revealed normal endometrium in 58 cases (47.2%). Endometrial polyps were the second most common finding, detected in 20 cases (16.3%). Additionally, hormonal imbalance ( $n=8$ , 6.5%) and endometritis ( $n=8$ , 6.5%) were also frequently observed. Inactive endometrium was identified in 6 cases (4.9%), atrophic changes in 6 cases (4.9%)

also, while endometrial hyperplasia was found in 4 cases (3.3%). Other findings included fibroids ( $n=4$ , 3.3%), weakly proliferative endometrium ( $n=2$ , 1.6%), and shedding endometrium ( $n=2$ , 1.6%). Less commonly, endometrial cancer ( $n=1$ , 0.8%), cervical cancer ( $n=1$ , 0.8%), normal endometrium with increased estrogenic effect ( $n=1$ , 0.8%), placental site nodule ( $n=1$ , 0.8%), and retained products of conception ( $n=1$ , 0.8%) were identified (Table 7).

**Table 7** Menopausal status and histopathology findings

Histopathology findings	Menopausal status				Total	
	Premenopausal women		Postmenopausal women		n	(%)
	n	(%)	n	(%)		
Normal endometrium	42	-59.2	16	-30.8	58	-47.2
Endometrial polyp	9	-12.7	11	-21.2	20	-16.3
Hormonal imbalance	5	-7	3	-5.8	8	-6.5
Endometritis	4	-5.6	4	-7.7	8	-6.5
Inactive endometrium	2	-2.8	4	-7.7	6	-4.9
Atrophic changes	0	0	6	-11.5	6	-4.9
Endometrial hyperplasia	2	-2.8	2	-3.8	4	-3.3
Fibroid	2	-2.8	2	-3.8	4	-3.3
Endometrial cancer	0	0	1	-1.9	1	-0.8
Cervical cancer	1	-1.4	0	0	1	-0.8
Increased estrogenic effect	0	0	1	-1.9	1	-0.8
Placental site nodule	1	-1.4	0	0	1	-0.8
Retained products of conception	1	-1.4	0	0	1	-0.8
Shedding endometrium	1	-1.4	1	-1.9	2	-1.6
Weakly proliferative endometrium	1	-1.4	1	-1.9	2	-1.6
Total	71	-100	52	-100	123	-100

**Note** The percentages represent the proportion of patients in each cell relative to the total number of patients within the corresponding column category.

The relationship between histopathology findings and menopausal status was also examined using the Fisher-Freeman-Halton Exact test with Monte Carlo simulation, which showed a statistically significant association, test statistic = 22.20,  $p = .021$ , with a 99% confidence interval for the  $p$ -value ranging from .018 to .025. Among premenopausal women ( $n = 71$ ), 59.2% ( $n = 42$ ) had a normal endometrium, 12.7% ( $n = 9$ ) had an endometrial polyp, 7% ( $n = 5$ ) had hormonal imbalance, and 5.6% ( $n = 4$ ) had endometritis. Other findings, such as inactive endometrium, endometrial hyperplasia, and fibroids, were observed in 2.8% ( $n = 2$ ) of women each, while 1.4% ( $n = 1$ ) presented with conditions as if cervical cancer, placental site nodule, retained products of conception, shedding endometrium, or weakly proliferative endometrium. No cases of atrophic changes, endometrial cancer, or normal endometrium with estrogenic effect were reported in the premenopausal group.

Histopathological findings showed more variability among postmenopausal women ( $n = 52$ ). Only 30.8% ( $n = 16$ ) had a normal endometrium, while 21.2% ( $n = 11$ ) had an endometrial polyp, and 11.5% ( $n = 6$ ) showed atrophic changes. Additionally, 7.7% ( $n = 4$ ) had endometritis or inactive endometrium, and 5.8% ( $n = 3$ ) exhibited hormonal imbalance. Endometrial hyperplasia or fibroids was found in 3.8% ( $n = 2$ ) of postmenopausal women. In contrast, other findings, such as endometrial cancer, weakly proliferative endometrium, and normal endometrium with estrogenic effect, were observed in 1.9% ( $n = 1$ ) of the postmenopausal women. There were no reported cases of cervical cancer, placental site nodules, retained products of conception, or shedding endometrium in the postmenopausal group. The findings indicate significant differences in histopathological presentations between pre- and postmenopausal women. Premenopausal women were more likely to have a normal

endometrium, while postmenopausal women exhibited higher rates of endometrial polyps, atrophic changes, and inactive endometrium.

### Diagnostic value of hysteroscopy

The association between histopathological findings and the types of lesions identified during hysteroscopy was analyzed using the Fisher-Freeman-Halton test with Monte Carlo simulation. The results revealed a statistically significant association, test statistic = 77.42,  $p < .001$ , with a 99% confidence interval for the p-value ranging from  $< .001$  to  $< .001$ . This finding indicates a significant relationship between histopathological findings and the lesions observed during hysteroscopy.

Among the 58 cases of normal endometrium identified through histopathology, hysteroscopy consistently reported no lesions. In contrast, for the 20 cases of endometrial polyps confirmed by histopathology, hysteroscopy detected polyps in only 10 cases (50%), while the remaining 10 cases (50%) were reported as having no lesions. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of hysteroscopy for detecting polyps were 50%, 100%, 100%, and 91.2%, respectively.

Furthermore, all four cases of fibroids confirmed by histopathology were accurately identified by hysteroscopy, demonstrating a 100% detection rate. The sensitivity, specificity, PPV, and NPV of hysteroscopy in detecting fibroids were all 100%. Interestingly, both the single case of endometrial cancer and the single case of cervical cancer detected histopathologically were associated with the absence of visible lesions during hysteroscopy.

For other less common histopathological findings, including hormonal imbalance, endometritis, inactive endometrium, atrophic changes, endometrial hyperplasia, increased estrogenic effect, placental site nodule, retained products of conception, shedding endometrium, and weakly proliferative endometrium, hysteroscopy uniformly reported no lesions.

### Discussion

The results of this study reveal critical insights into the clinical indications for hysteroscopy, its findings across different menopausal statuses, the role of histopathology in diagnosis, and the overall diagnostic value of hysteroscopy in detecting various endometrial pathologies. Abnormal uterine bleeding (AUB) emerged as the most common indication for hysteroscopy, with menstruating women primarily presenting with heavy menstrual bleeding and postmenopausal women predominantly experiencing postmenopausal bleeding. Other indications like pelvic mass, abdominal pain, and recurrent miscarriages were notably less frequent, which reflects a diverse range of clinical presentations where hysteroscopy can be utilized as a diagnostic tool. These findings are supported by numerous studies, which identified postmenopausal bleeding and heavy menstrual bleeding as the leading reasons for outpatient diagnostic hysteroscopy, underscoring the significance of AUB as a primary indication for the procedure.<sup>16</sup> The study's findings accentuate the importance of considering menopausal status in interpreting hysteroscopy results. The association between menopausal status and the condition of the uterine cavity was statistically significant, with postmenopausal women demonstrating a higher prevalence of irregular cavities. This observation may be attributed to age-related structural changes and pathologies such as fibroids and polyps, suggesting that postmenopausal women are at increased risk for these abnormalities. The study also found notable differences in endometrial morphology based on menopausal status, with premenopausal women more likely

to have a thickened endometrium, while postmenopausal women commonly presented with a thin endometrium, likely reflecting hormonal changes leading to endometrial atrophy. These findings are clinically significant, as they guide the need for tailored diagnostic and therapeutic approaches, such as further investigation for atrophy or malignancy in postmenopausal women with thin endometria and targeted management for premenopausal women with thickened endometria. Several observations reported that postmenopausal women exhibit higher prevalence of atrophic endometrium compared to their premenopausal counterparts.<sup>17</sup>

Histopathological findings complemented the hysteroscopic data, showing distinct differences between premenopausal and postmenopausal women. Premenopausal women were more likely to have normal endometria, while postmenopausal women exhibited higher rates of endometrial polyps and atrophic changes. These findings reinforce the impact of menopause on endometrial pathology, with the hypoestrogenic state in postmenopausal women contributing to endometrial thinning and atrophy. However, many studies found that premenopausal women tend to have a higher prevalence of benign lesions such as endometrial polyps and submucous myomas compared to postmenopausal women.<sup>18</sup> Although rare, clinically significant findings such as endometrial and cervical cancers were observed, emphasizing the necessity of vigilant screening, particularly in postmenopausal women, where the risks of malignancy are higher. This study highlights the critical role of histopathological examination alongside hysteroscopy in providing an accurate diagnosis and ensuring appropriate management of endometrial abnormalities. Litta et al. emphasized combining outpatient hysteroscopy with histopathological examination to achieve accurate diagnoses.<sup>19</sup>

The most significant aspect of this study is its evaluation of the diagnostic value of hysteroscopy. Our findings show that hysteroscopy had 100% sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for detecting fibroids, demonstrating its high accuracy in identifying these lesions. Loiacono et al. support these findings, reporting 100% sensitivity, specificity, PPV, and NPV for fibroids.<sup>20</sup> However, for endometrial polyps, the sensitivity was considerably lower at 50%, with specificity, PPV, and NPV of 100%, 100%, and 91.2%, respectively. This is consistent with Ivanov who found the sensitivity for detecting endometrial polyps to be as low as 64.8%.<sup>21</sup> This discrepancy may be explained by factors such as the small size of polyps, their location in areas challenging to visualize, or technical limitations related to equipment or uterine cavity distension. Some observational studies also noted that small polyps might be easily overlooked during hysteroscopy, mainly if they are not prominent or have significant endometrial tissue, leading to missed diagnoses and affecting treatment decisions.<sup>22</sup> Another possible contributing factor is operator expertise, as hysteroscopy is a skill-dependent procedure, and differences in clinician proficiency could influence the quality of visualization and diagnosis. We acknowledge that anatomical variations can complicate access and visualization, mainly when dealing with lesions located in challenging areas, which can lead to incomplete assessments during the procedure.<sup>14,23</sup> This limitation emphasizes the importance of complementary diagnostic methods, such as transvaginal ultrasound or histopathological confirmation, to improve diagnostic accuracy. The study also found that hysteroscopy was insufficient for detecting certain pathologies, including endometrial and cervical cancers, raising concerns about its utility as a standalone diagnostic tool for malignancies. One research found that while hysteroscopy is effective for diagnosing benign endometrial gross lesions like polyps and submucosal myomas, it is not reliable for ruling out endometrial hyperplasia and cancer in

postmenopausal women with bleeding.<sup>24</sup> This emphasizes the need for a multi-modal diagnostic approach, incorporating other techniques like endometrial biopsy or MRI, to provide a comprehensive evaluation, particularly in suspected malignancies.

Overall, the study highlights the value of hysteroscopy in diagnosing gross structural lesions such as fibroids but also underscores its limitations, particularly in detecting subtle or early-stage pathologies. Naredi et al.<sup>25</sup> support this by showing that there is a risk of false positives and negatives in hysteroscopy, particularly in cases where pathology is subtle.<sup>25</sup> The findings suggest that while hysteroscopy remains an essential tool for diagnosing intrauterine pathologies, it should be part of a broader diagnostic strategy that includes other modalities to ensure optimal patient care. Future research should focus on improving hysteroscopy sensitivity and specificity to enhance its diagnostic performance. Large-scale studies comparing hysteroscopy with other diagnostic methods could provide further insights into optimizing diagnostic protocols and improving patient outcomes. In conclusion, this study reinforces the need for a personalized and multi-modal approach to diagnosing and managing abnormal uterine bleeding and other intrauterine pathologies, considering the influence of menopausal status and the inherent limitations of hysteroscopy.

Blind endometrial biopsy has proven inadequate for ruling out endometrial hyperplasia or malignancy due to its potential for insufficient sampling and suboptimal sensitivity and specificity.<sup>26</sup> Again, this research is stranded in two essential facts: firstly, endometrial cancer is the most prevalent malignancy among women in Jordan and other developed nations like the United States, Australia, Canada, and Japan.<sup>27</sup> Secondly, endometrial malignancies often originate as localized abnormalities, particularly in the ostium.<sup>28,29</sup> Enhancing diagnostic accuracy and identifying the pathological nature of these abnormalities is crucial for improving the prognosis of women at risk of future malignancies.<sup>14,15</sup> Modern hysteroscopy represents a copernical revolution for diagnosing and treating uterine pathology.

Our study demonstrates a notable improvement in the early diagnosis of histological changes in the uterine lining through current diagnostic methods. This process starts with an in-depth analysis of patient history to understand the impact of unopposed estrogen, followed by evaluating endometrial thickness considering age and monthly variations. Hysteroscopic assessment under proper conditions and necessary tissue biopsies for histopathological analysis form the cornerstone of this diagnostic approach. Despite advancements, there remains a need for comprehensive data on the optimal biopsy type and the precision of each technique in detecting focal intrauterine lesions.

The global rise in endometrial hyperplasia and malignancy cases highlights the need for accurate diagnostic methods. Historically, diagnostic curettage was the gold standard, but it often missed underlying endometrial carcinoma associated with atypical hyperplasia. The rates of atypia (1.2%) and malignancy (2.4%) observed in our study are consistent with those reported in the literature. However, the prevalence of hyperplasia and malignancy in endometrial polyps can vary across different populations.<sup>30,31</sup> For decades, (D&C) has been a traditional diagnostic method for endometrial cancer and atypical endometrial hyperplasia. However, blind sampling techniques have shown low specificity and are not cost-effective. The application of the hysteroscopy technique, for the first time, helped to “elucidate” an obscure, unexplored, and isolated region of the human body left part since the middle of the nineteenth century, the uterus. Currently, hysteroscopy can be considered, in every respect, the gold standard for examination of the uterine cavity, permitting it to

bypass the significant limitations of (D&C). Consequently, office endometrial biopsy, with or without hysteroscopic evaluation, has increasingly replaced D&C. Studies have shown that hysteroscopy-guided endometrial biopsy is safer and more accurate than D&C, allowing for clear visualization and precise biopsy or removal of focal lesions. Hysteroscopy is now regarded as the gold standard for diagnosing endometrial neoplasia.<sup>32–34</sup> Since the beginning of the 80s, hysteroscopy has become a powerful diagnostic tool for visualizing the cervical canal and the uterine cavity by performing the so-called ‘traditional technique.’ This approach involves using a speculum and cervical clamp to examine the cervix and cavity, mainly by standard saline solution for uterine cavity distension. We are aware that our research has significant limitations and criticisms for not including the outpatient, flexible hysteroscope for both purposes of diagnosis and treatment, as it is not available at the time in our hospital, so it is not in use.

## Conclusion

For diagnosing abnormal uterine bleeding (AUB), an integrated approach is essential. This involves a detailed gynecological history of risk factors, transvaginal ultrasonography, hysteroscopic examination, and targeted endometrial biopsies for histopathological analysis. This comprehensive strategy ensures the accurate detection and effective treatment of endometrial pathology.

## Limitation

A key limitation of this study is the relatively small sample size, which resulted in sparse data across several categories. Specifically, the cross-tabulation revealed numerous cells with zero frequencies or very low counts, with some levels of variables represented by only a single case. While Fisher’s Exact Test (Monte Carlo) is robust for small and sparse datasets, the presence of these sparse cells may reduce the reliability of the test and the generalizability of the findings. Small cell sizes can increase the variability of statistical estimates and potentially obscure more nuanced relationships between the variables. Consequently, the results should be interpreted with caution, particularly in light of the uneven distribution of data. Future research with a larger sample size is recommended to validate these findings and provide a more comprehensive understanding of the relationships observed in this study.

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## Author Contributions

All authors contributed to the manuscript equally. Each author has reviewed and approved the final version of the manuscript. Conceptualization, writing-original draft preparation, writing—review and editing, visualization, supervision by K.M.F. All authors have read and agreed to the published version of the manuscript.

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## Conflicts of interest

Following the ICMJE uniform disclosure protocol, the authors declare no conflicts of interest.

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