MEDS Basic Medicine (2025)
Clausius Scientific Press, Canada

DOI: 10.23977/medbm.2025.030124
ISSN 2616-2091 Vol. 3 Num. 1

The Value of Vaginoscopic Hysteroscopy in the Early Diagnosis of Endometrial Cancer: A Prospective Randomized Controlled Study

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Keywords: Vaginoscopic hysteroscopy; Hysteroscopy; Endometrial cancer; Early diagnosis; Randomized controlled trial

Abstract: This study aims to evaluate the application value of transvaginal endoscopy versus conventional hysteroscopy for the early diagnosis of endometrial carcinoma (EC). A total of 193 patients with abnormal uterine bleeding (AUB) who underwent hysteroscopic examination at Sun Yat-sen Memorial Hospital, Shenshan Central Hospital between October 2023 and September 2024 were enrolled and randomly assigned to the experimental group (vaginoscopic hysteroscopy, n=69) or the control group (traditional hysteroscopy, n=124). Using postoperative pathological results as the gold standard, we compared the two groups in terms of diagnostic accuracy, pain scores, patient satisfaction, and operator maneuverability. The concordance rates between hysteroscopic and pathological findings were 97.1% in the experimental group and 97.5% in the control group, with no statistically significant difference ($P > 0.05$). The pain score was significantly lower in the experimental group than in the control group [2 (IQR: 1.5–2.5) vs. 4 (IQR: 3–5), $P < 0.001$]. Patient satisfaction was significantly higher in the experimental group than in the control group (59.4% vs. 32.3%, $P < 0.001$). The examination time was shorter in the experimental group [1.1 minutes (IQR: 0.8–1.3) vs. 1.5 minutes (IQR: 1.1–1.8), $P < 0.001$], and the operator maneuverability score—defined as the sum of "smooth" and "very smooth" ratings—was higher (63.8% vs. 37.9%, $P < 0.05$). The complication rates were 1.4% and 1.6%, respectively. Vaginoscopic hysteroscopy demonstrates substantial value in the early diagnosis of endometrial cancer, characterized by simplicity of operation, minimal invasiveness, and good patient tolerance, making it worthy of promotion in outpatient settings.

1. Introduction

Endometrial carcinoma (EC) refers to a group of malignant epithelial tumors originating from the endometrium[1]. It is the most common malignancy of the female reproductive system in developed

countries and some developed cities in China, ranking first in incidence and mortality among gynecological cancers in the United States[2, 3]. Since the late 1990s, with increasing average life expectancy and obesity rates, the incidence of EC has continued to rise or stabilize, showing a trend towards affecting younger women, particularly with the fastest growth observed in South Africa and some Asian countries[4, 5]. In 2022, there were an estimated 420,242 new cases and 97,704 deaths from EC globally[4, 5]. According to the National Cancer Center of China, from 2010 to 2018, the age-standardized incidence rate of EC in China increased significantly by 3.3% annually, while mortality remained stable. In 2018, the incidence rate of EC was 10.56 per 100,000, accounting for 3.9% of all female cancers and 27.9% of gynecological malignancies; the mortality rate was 2.66 per 100,000, accounting for 2.1% of all female cancer.[6].

Abnormal uterine bleeding (AUB) is the most common and suggestive clinical symptom of EC, especially in postmenopausal women, where AUB should raise a high suspicion for endometrial malignancy[7]. However, the etiology of AUB is complex, ranging from benign conditions such as endometrial polyps, submucosal fibroids, and endometrial hyperplasia, to early manifestations of EC or precancerous lesions. According to a 2021 prospective cohort study published on PMC, among 593 postmenopausal women with AUB, 47 (7.9%) were ultimately diagnosed with EC; whereas among 570 premenopausal women with AUB, 7 (1.2%) were diagnosed with EC[8]. Therefore, efficiently and accurately screening for early EC in the AUB population has become a key focus and challenge in gynecological clinical practice[7, 9].

Currently, histopathological examination remains the "gold standard" for diagnosing EC [10]. Commonly used clinical methods for obtaining endometrial tissue include dilatation and curettage (D&C), Pipelle endometrial biopsy, and hysteroscopically directed biopsy. Although D&C is relatively simple to perform, it is a blind procedure that often leads to insufficient sampling and high rates of missed diagnoses[7]. Studies have shown that even when performed by experienced gynecologists, D&C covers only 50%-60% of the uterine cavity area, with a miss rate as high as 50% for lesions located in the cornua or small foci, and a false-negative rate for EC of about 10%[11]. Pipelle biopsy, while less invasive and suitable for outpatient settings, has a limited sampling range and is susceptible to factors such as cervical stenosis and endometrial atrophy, with a false-negative rate ranging from 8% to 12% [12]. The development of hysteroscopy has provided an important means for the visual diagnosis of endometrial lesions. Hysteroscopy allows direct visualization of the uterine cavity morphology, endometrial color, vascular distribution, and lesion extent, enabling targeted biopsies in suspicious areas, significantly improving the detection rate of early lesions. Previous studies have confirmed that hysteroscopically directed biopsy is superior to traditional D&C in both sensitivity and specificity for diagnosing EC[11]. However, traditional hysteroscopy requires placement of a vaginal speculum, use of a tenaculum to stabilize the cervix, and often cervical dilation for instrument entry, causing significant pain during the procedure. Some patients require local anesthesia or even intravenous sedation, increasing procedural complexity and healthcare costs. Furthermore, traditional hysteroscopy typically uses high distension pressure (100-120 mmHg), which carries the potential risk of distension medium flowing through the fallopian tubes into the peritoneal cavity. This theoretically could increase the chance of cancer cell dissemination; however, clinical evidence remains insufficient, and this issue is still debated[7].

In recent years, with the promotion of the "natural orifice transluminal endoscopic surgery" (NOTES) concept[13], vaginoscopic hysteroscopy (also known as "no-touch" hysteroscopy) has been gradually applied in gynecology. This technique involves inserting the hysteroscope directly through the vaginal introitus without using a speculum, tenaculum, or cervical dilators. It employs a low-pressure distension medium (pressure below 80 mmHg) and the dilating effect of the scope's tip to complete the visual inspection of the entire vagina, cervical canal, and uterine cavity[14]. Because the procedure requires no anesthesia, it causes less patient discomfort, has higher patient acceptance, and

allows simultaneous observation of subtle lesions in the vaginal walls and cervical canal, theoretically facilitating the early detection of cancerous lesions[15-17].

Previous studies have shown that vaginoscopic hysteroscopy is safe and effective for diagnosing benign conditions such as intrauterine fluid and endometrial polyps, as well as for evaluating symptoms like postmenopausal bleeding[18-20]. However, its specific value in the early diagnosis of endometrial cancer (EC) lacks systematic research, particularly in regional medical centers within China, where relevant data remain scarce. Based on this background, this study aims, through a prospective randomized controlled design, to systematically evaluate the accuracy, safety, and patient tolerance of vaginoscopic hysteroscopy for the early diagnosis of EC in patients with abnormal uterine bleeding (AUB), providing evidence to support its clinical application in screening.

This was a single-center, prospective, randomized controlled, parallel-group, open-label clinical study designed to compare the differences between vaginoscopic hysteroscopy and traditional hysteroscopy in the early diagnosis of EC in an AUB population. The study adhered to the ethical principles of the Declaration of Helsinki and Good Clinical Practice (GCP), and the study protocol was approved by the Medical Ethics Committee of Sun Yat-sen Memorial Hospital, Shenshan Central Hospital (Ethics Review No. [2023] 526). All patients provided written informed consent.

2. Methods

2.1 Study Population and Sample Size Estimation

2.1.1 Sample Size Calculation

The primary objective was to verify the non-inferiority of vaginoscopic hysteroscopy compared to traditional hysteroscopy in terms of diagnostic accuracy. Sample size calculation was performed based on the diagnostic concordance rate as the primary endpoint, using PASS 15.0 software[21]. We assumed the diagnostic concordance rate (P_1) for traditional hysteroscopy to be 97%[22]. The non-inferiority margin (δ) for the vaginoscopic technique (P_2) was set at -8%. This meant that if the diagnostic concordance rate in the vaginoscopic hysteroscopy group was no more than 8 percentage points lower than that of the traditional hysteroscopy group, it would be considered clinically non-inferior. With a significance level of α=0.05 (two-sided) and β=0.20 (power=80%), the sample size calculated using the formula for a non-inferiority test comparing two rates was approximately 62 per group. After accounting for approximately 10% dropout or incomplete data, the planned total sample size was set at 138.

2.1.2 Inclusion Criteria:

(1) Aged 20–70 years

(2) Presenting with abnormal uterine bleeding (AUB), including menorrhagia, prolonged menstruation, postmenopausal bleeding, etc.

(3) Ultrasound suggesting endometrial thickening (≥12 mm for premenopausal, ≥5 mm for postmenopausal) or intrauterine space-occupying lesions

(4) Voluntary participation and provision of signed informed consent

2.1.3 Exclusion Criteria:

(1) Pregnancy or suspected pregnancy

(2) Severe cardiac, hepatic, or renal dysfunction

(3) Acute genital tract infection or active pelvic inflammatory disease

(4) Contraindications to hysteroscopy (e.g., cervical stenosis preventing entry, severe pelvic

adhesions)

(5) History of endometrial cancer or other uterine malignancies

(6) Intrauterine procedures (e.g., dilation and curettage, abortion, hysteroscopic surgery) within the past 3 months

(7) Inability to cooperate with follow-up or refusal of biopsy

2.2 Randomization and Blinding

Block randomization was employed to ensure balanced group sizes. A statistician generated a random number sequence using SPSS, with a block size of 4, allocating participants in a 1:1 ratio to the experimental group (vaginoscopic hysteroscopy, n=62) and the control group (traditional hysteroscopy, n=62). The allocation scheme was sealed in opaque envelopes and opened by a research nurse before the patient entered the procedure room. The allocation was known to the operators but blinded to the pathologists and data statisticians.

2.3 Examination Equipment and Procedure

2.3.1 Equipment Configuration:

Hysteroscope system: S RROZ, STEMA 5 mm continuous flow hysteroscope. Distension medium: 0.9% normal saline. Recording system: High-definition image acquisition system that simultaneously records examination time, visual field clarity, and lesion location.

2.3.2 Experimental Group Procedure (Vaginoscopic Hysteroscopy):

The patient was placed in the lithotomy position, and the vulva was routinely disinfected. No speculum, tenaculum, or uterine sound was used. The hysteroscope was gently inserted through the hymenal orifice. The vagina, cervix, and uterine cavity were inspected. To reduce leakage of distension fluid from the introitus, the labia minora and majora were apposed, fully exposing the vaginal walls, fornices, and vaginal portion of the cervix. Using the fossa navicularis as a fulcrum, the scope was advanced from the vaginal introitus along the posterior vaginal wall downwards to the posterior fornix (the lowest point, corresponding to the 6 o'clock position). It was then rotated clockwise around the fornices for one full circle, sequentially inspecting the posterior fornix, right fornix, anterior fornix (the highest point, corresponding to 12 o'clock), left fornix, and returning to the posterior fornix. The external cervical os was identified by rotating the hysteroscope fiber. The scope was then slowly advanced from the external os into the cervical canal; it passed through the anatomical internal os and entered the uterine cavity. Routine inspection of all uterine walls and both tubal ostia was performed. If suspicious lesions such as thickened endometrium, abnormal vessels, or polypoid protrusions were found, targeted biopsies were taken using a 5 French (5Fr) miniature biopsy forceps. After examination, the scope was withdrawn. Operation time, visual field clarity, and patient response were recorded.

2.3.3 Control Group Procedure (Traditional Hysteroscopy):

A vaginal speculum was placed to expose the cervix. The cervix was grasped and stabilized with a tenaculum. The uterine cavity depth was sounded with a probe. The cervix was dilated up to Hegar dilator No. 7. The hysteroscope was inserted, and the distension pressure was set at 100–120 mmHg. The uterine cavity morphology and endometrial appearance were observed. Biopsies were taken from identified lesions. Operation time, complications, and patient response were recorded.

2.4 Outcome Measures and Data Collection

This study's primary endpoints encompass four domains: diagnostic accuracy, patient-reported experience, procedural efficiency, and safety. The specific indicators and measurement instruments are listed in Table 1. All data were recorded by designated personnel. Pain scores and satisfaction surveys were completed within 24 h after the procedure. Histopathological results were reviewed independently by two senior pathologists in a double-blind fashion; discrepancies were resolved by consensus. Complications were closely monitored and documented intra-operatively and throughout the first 24 h post-operatively.

Table 1 Summary of Outcome Measures and Corresponding Measurement/Assessment Methods

Category	Specific Content	Measurement Tool
Patient Experience	Pain Score	VAS (0-10)
	Satisfaction	Likert 5-point scale (≥4 defined as satisfied)
Operative Indicators	Examination Time	Total time from scope entry into vagina to withdrawal (if dilation needed, from start of dilation) (minutes)
	Operator Maneuverability	5-point scale (1=Very difficult, 5=Very smooth)
Safety	Complications	Uterine perforation, bleeding, infection, vasovagal reaction, fluid overload, etc.

2.5 Statistical Methods

2.5.1 Data Description:

Statistical analysis was performed using SPSS 26.0 software, with $P < 0.05$ considered statistically significant. The Shapiro-Wilk test was first used to assess the normality of measurement data, such as pain VAS score and examination time. Normally distributed data are presented as mean ± standard deviation ($x \pm s$); non-normally distributed data are presented as median (interquartile range) [M (IQR)].

Count data, including pathological concordance rate, patient satisfaction, operator's ease of maneuvering, and complication rate, are presented as number (percentage) [n (%)].

2.5.2 Statistical Inference:

To verify comparability, baseline characteristics were compared between groups. Normally distributed measurement data were compared using the independent samples t-test; non-normally distributed measurement data were compared using the Mann-Whitney U test. Count data were compared using the Chi-square test.

Primary Outcome Comparison (Diagnostic Accuracy): The Chi-square test was used to compare the pathological concordance rates between the two groups.

Secondary Outcome Comparisons: For non-normally distributed pain VAS scores and examination time, the Mann-Whitney U test was used for intergroup comparison. For patient satisfaction and operator's ease of maneuvering scores (dichotomized data), the Chi-square test was used for intergroup comparison. The Chi-square test (or Fisher's exact test if applicable) was used to compare safety indicators (complication rates) between the two groups.

2.6 Quality Control Measures

All procedures were performed by the same team of senior gynecological endoscopists who had received standardized hysteroscopy training at Sun Yat-sen Memorial Hospital and Shenshan Central Hospital. The entire examination process was video recorded. Furthermore, the quality control team randomly reviewed 10% of the video data monthly to assess procedure standardization. Pathological diagnoses were made by pathologists with the title of associate chief physician or higher, implementing an independent blinded review. Discrepancies were resolved by consensus. Data entry was performed independently by two individuals, each entering data separately; inconsistencies were checked against the original records. In addition, an independent internal data monitor was appointed to review data completeness and consistency quarterly.

3. Results

3.1 Comparison of Diagnostic Accuracy

Using postoperative histopathological results as the gold standard, hysteroscopic diagnosis was concordant with pathology in 67 cases in the experimental group (vaginoscopic), yielding a concordance rate of 97.1% (67/69). In the control group (traditional hysteroscopy), 121 cases were concordant, resulting in a rate of 97.5% (121/124). The difference in diagnostic accuracy between the two groups was not statistically significant ($\chi^2 = 0.04$, $P = 0.841$).

3.2 Comparison of Pain Scores and Patient Satisfaction

The Mann-Whitney U test was used to directly compare intraoperative pain scores between the two groups. The median Visual Analog Scale (VAS) pain score was 2 (IQR: 1.5–2.5) in the experimental group, significantly lower than 4 (IQR: 3–5) in the control group ($Z = -8.658$, $P < 0.001$). Patient satisfaction rates were compared using the Chi-square test and were 59.4% (41/69) in the experimental group and 32.3% (40/124) in the control group; this difference was statistically significant ($\chi^2 = 13.429$, $P < 0.001$).

3.3 Comparison of Operative Efficiency and Operator Experience

Because examination time data were not normally distributed, the Mann-Whitney U test was applied for comparison. The median examination time was 1.1 minutes (IQR: 0.8–1.3) in the experimental group and 1.5 minutes (IQR: 1.1–1.8) in the control group, a statistically significant difference ($U = 1981.50$, $P < 0.001$). Regarding qualitative assessment, surgeons evaluated operator maneuverability by combining the proportions of "smooth" and "very smooth" ratings; this combined score was 63.8% (44/69) in the experimental group, significantly higher than 37.9% (47/124) in the control group ($\chi^2 = 11.902$, $P = 0.001$).

3.4 Comparison of Complications

Intraoperative and postoperative monitoring identified one case of transient vasovagal reaction in the experimental group, which resolved quickly after management, corresponding to a complication rate of 1.4% (1/69). The control group had one case of vasovagal reaction and one case of fluid overload, corresponding to a complication rate of 1.6% (2/124). Overall complication rates were low in both groups, and the difference between groups was not statistically significant (Fisher's exact test, $P = 1.000$).

Table 2 Comparison of Observational Indices Between the Vaginoscopic Hysteroscopy Group and the Conventional Hysteroscopy Group

Outcome Measure	Experimental Group（n=69）	Control Group (n=124)	Statistic	P-value
Diagnostic concordance rate [n(%)]	67 (97.1%)	121 (97.5%)	χ^2= 0.004	0.841
Pain VAS Score [M(IQR)]	2 (1.5-2.5)	4 (3-5)	Z = -8.658	< 0.001
Patient Satisfaction [n(%)]	40(59.4%)	40 (32.3%)	χ^2 = 13.429	< 0.001
Examination Time (min) (min) [M(IQR)]	1.1 (0.8-1.3)	1.5 (1.1-1.8)	U = 1981.50	< 0.001
Operator Maneuverability [n(%)]	44 (63.8%)	47 (37.9%)	χ^2 = 11.902	0.001
Complication Rate [n(%)]	1 (1.4%)	2 (1.6%)	-	1.000

4. Discussion

This study, through a prospective randomized controlled design, systematically compared the clinical application value of vaginoscopy and traditional hysteroscopy in the early diagnosis of endometrial cancer (EC). The results showed no significant difference in diagnostic accuracy between the two groups (97.1% vs. 97.5%, P > 0.05), indicating that the diagnostic efficacy of the vaginoscopic technique is non-inferior to that of traditional hysteroscopy, demonstrating good clinical applicability. However, the vaginoscopic approach showed clear advantages in patient pain scores, patient satisfaction, examination time, and ease of operator maneuverability, suggesting promising prospects for its use in outpatient screening and early diagnosis of EC.(details are provided in Table 2).

4.1 Diagnostic Accuracy and Safety

The high concordance in pathological diagnosis rates between the vaginoscopy and traditional hysteroscopy groups in this study indicates that vaginoscopy possesses diagnostic efficacy comparable to traditional hysteroscopy in identifying endometrial lesions[23]. This finding aligns with previous research, such as van Dongen H [24] et al., who reported diagnostic accuracy rates exceeding 96% for vaginoscopy in postmenopausal bleeding patients. Despite the absence of a speculum and tenaculum, the use of a lower distension pressure (<80 mmHg), and no need for cervical dilation, the visual field clarity and tissue sampling quality were not compromised. These results suggest that with standardized operation, this technique ensures diagnostic accuracy[25].

Regarding safety, both groups had low complication rates (1.4% vs. 1.6%), with no serious adverse events, indicating that vaginoscopy is safe for outpatient use without anesthesia. In particular, avoiding cervical dilation and related instrument use reduces the risks of cervical injury and uterine perforation, making the technique more suitable for elderly patients, those with cervical stenosis, or patients with comorbidities[26].

4.2 Patient Experience and Clinical Applicability

Pain scores and patient satisfaction are crucial indicators for assessing the feasibility of outpatient procedures, and in this study, the visual analog scale (VAS) scores were significantly lower while satisfaction rates were significantly higher in the vaginoscopy group, highlighting its superior performance in improving patient experience. The characteristics of no dilation and no speculum use significantly reduce psychological burden and physical discomfort, which is especially beneficial for pain-sensitive or anxious patients[27, 28].

Furthermore, the shorter operation time and higher operator maneuverability scores for vaginoscopy suggest a relatively gentle learning curve, making it suitable for widespread adoption in primary care hospitals or outpatient clinics. With the widespread availability of endoscopic equipment and standardization of techniques, vaginoscopy has the potential to become a "repeatable, promotable, acceptable" screening tool for EC, supported by accumulating clinical evidence[15, 23].

4.3 Comparison with Traditional Technique and Complementary Value

While traditional hysteroscopy offers the advantage of direct visual guidance for biopsy, its requirements for equipment, anesthesia, and a specialized operational environment limit its widespread use in outpatient screening. In contrast, vaginoscopy better aligns with the modern principles of "minimally invasive, painless, convenient" diagnosis and treatment, making it particularly suitable for the initial evaluation of AUB patients and the triage management of high-risk groups[29].

Notably, vaginoscopy has an inherent advantage in visualizing anatomical structures such as the vaginal walls and cervical canal, allowing multi-site assessment in a single procedure. This facilitates the detection of potential synchronous lesions, such as cervical canal involvement or vaginal wall metastases. Such detection is significant for the early identification and comprehensive assessment of EC [30, 31].

4.4 Limitations and Future Directions

This was a single-center study with a limited sample size. The enrolled population primarily consisted of AUB patients, and the actual prevalence of EC was low, which might affect the further evaluation of indicators like diagnostic sensitivity and specificity. Additionally, this study did not compare the hysteroscopic diagnostic accuracy for non-EC patients before and after menopause to further substantiate the diagnostic efficacy of vaginoscopy for EC. Future multi-center, large-sample studies, including higher-risk populations, are needed to validate its screening efficacy. Moreover, the performance of vaginoscopy is somewhat dependent on operator experience, necessitating standardized training to ensure diagnostic quality.

Future research could also explore the integration of vaginoscopy with technologies such as AI-assisted image recognition and miniaturized biopsy instruments to further enhance its precision and automation level in identifying early cancerous changes. Simultaneously, establishing a vaginoscopy-based rapid outpatient assessment pathway to achieve integrated "examination-diagnosis-treatment decision" management is recommended to improve the early detection and intervention rates for EC.

5. Conclusion

In summary, vaginoscopic hysteroscopy demonstrates diagnostic accuracy nearly identical to traditional hysteroscopy for the early diagnosis of endometrial cancer (EC). Additionally, it offers significant advantages in terms of patient-reported pain scores and satisfaction. As a minimally

invasive, painless, and examination technique suitable for outpatient procedures, vaginoscopic hysteroscopy has broad potential applications in EC screening. It deserves further promotion and optimization across healthcare institutions at primary, secondary, and tertiary levels.

6. Declaration

During the preparation of this manuscript, the authors used Deepseek (https://chat.deepseek.com/) for language polishing. This tool helped enhance readability and coherence, optimize word choice, and ensure clear presentation of complex ideas. After using this tool, the authors thoroughly reviewed and edited the content as necessary and take full responsibility for the publication's content.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used DeepSeek AI (https://chat.deepseek.com/)to enhance the readability and coherence of the manuscript, optimize vocabulary, and ensure clear presentation of complex ideas. After using this tool, the authors reviewed and edited the content thoroughly. The authors take full responsibility for the content of the publication.

Acknowledgements

This work was supported by grants from Guangdong Science and Technology Department (#2024B1212030002 Recipient: Yan Nie) and Shanwei Science and Technology Plan (Project#2023C009 to Xin-ru Yang)

References

[1] WANG Y, LIU N, GUO X, et al. The immune microenvironment in endometrial carcinoma: mechanisms and therapeutic targeting [J]. Frontiers in immunology, 2025, 16: 1586315.

[2] HONG Z, MO T, ZHOU P, et al. Progress of estrogen receptor and spliceosome in endometrial carcinoma [J]. Frontiers in endocrinology, 2025, 16: 1586191.

[3] KANG S, KIM Y. Current Unveiling Key Research Trends in Endometrial Cancer: A Comprehensive Topic Modeling Analysis [J]. Healthcare (Basel, Switzerland), 2025, 13(13).

[4] BRAY F, LAVERSANNE M, SUNG H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries [J]. CA: a cancer journal for clinicians, 2024, 74(3): 229-263.

[5] SIEGEL R L, GIAQUINTO A N, JEMAL A. Cancer statistics, 2024 [J]. CA: a cancer journal for clinicians, 2024, 74(1): 12-49.

[6] HAN B, ZHENG R, ZENG H, et al. Cancer incidence and mortality in China, 2022 [J]. Journal of the National Cancer Center, 2024, 4(1): 47-53.

[7] ÇALTEK N, ÇALTEK H, YASSA M, et al. Preoperative predictors of endometrial carcinoma in patients undergoing hysterectomy for endometrial intraepithelial neoplasia [J]. BMC cancer, 2025, 25(1): 883.

[8] CLARKE M A, LONG B J, SHERMAN M E, et al. Risk assessment of endometrial cancer and endometrial intraepithelial neoplasia in women with abnormal bleeding and implications for clinical management algorithms [J]. American journal of obstetrics and gynecology, 2020, 223(4): 549.e1-.e13.

[9] WANG T, JIA N, GAO S, et al. Engrailed-2 (EN2) protein in cervical mucus: a novel biomarker for endometrial carcinoma [J]. Clinical & translational oncology : official publication of the Federation of Spanish Oncology Societies and of the National Cancer Institute of Mexico, 2025, 27(6): 2484-2493.

[10] ABU-RUSTUM N, YASHAR C, AREND R, et al. Uterine Neoplasms, Version 1.2023, NCCN Clinical Practice Guidelines in Oncology [J]. Journal of the National Comprehensive Cancer Network : JNCCN, 2023, 21(2): 181-209.

[11] RODOLAKIS A, SCAMBIA G, PLANCHAMP F, et al. ESGO/ESHRE/ESGE Guidelines for the fertility-sparing treatment of patients with endometrial carcinoma [J]. Facts, views & vision in ObGyn, 2023, 15(1): 3-23.

[12] DU J, LI Y, LV S, et al. Endometrial sampling devices for early diagnosis of endometrial lesions [J]. Journal of cancer research and clinical oncology, 2016, 142(12): 2515-2522.

[13] REDDY H, KIM S W, PLEWNIAK K. Applications of vaginal natural orifice transluminal endoscopic surgery (vNOTES) in gynecologic surgery [J]. Current opinion in obstetrics & gynecology, 2022, 34(4): 220-226.

[14] AKAZAWA M, HASHIMOTO K. Artificial intelligence in gynecologic cancers: Current status and future challenges - A systematic review [J]. Artificial intelligence in medicine, 2021, 120: 102164.

[15] BETTOCCHI S, SELVAGGI L. A vaginoscopic approach to reduce the pain of office hysteroscopy [J]. The Journal of the American Association of Gynecologic Laparoscopists, 1997, 4(2): 255-258.
[16] VITALE S G, CARUSO S, CIEBIERA M, et al. Management of anxiety and pain perception in women undergoing office hysteroscopy: a systematic review [J]. Archives of gynecology and obstetrics, 2020, 301(4): 885-894.
[17] EMANUEL M H. New developments in hysteroscopy [J]. Best practice & research Clinical obstetrics & gynaecology, 2013, 27(3): 421-429.
[18] DE SILVA P M, CARNEGY A, SMITH P P, et al. Vaginoscopy for office hysteroscopy: A systematic review & meta-analysis [J]. European journal of obstetrics, gynecology, and reproductive biology, 2020, 252: 278-285.
[19] SOUZA C A B, GENRO V K, TARRASCONI D V, et al. Diclofenac versus a combination of hyoscine and diclofenac for outpatient hysteroscopy: A placebo controlled randomized clinical trial [J]. European journal of obstetrics, gynecology, and reproductive biology, 2020, 247: 1-5.
[20] BETTOCCHI S, CECI O, DI VENERE R, et al. Advanced operative office hysteroscopy without anaesthesia: analysis of 501 cases treated with a 5 Fr. bipolar electrode [J]. Human reproduction (Oxford, England), 2002, 17(9): 2435-2438.
[21] PIAGGIO G, ELBOURNE D R, POCOCK S J, et al. Reporting of noninferiority and equivalence randomized trials: extension of the CONSORT 2010 statement [J]. Jama, 2012, 308(24): 2594-2604.
[22] BENNETT A, LEPAGE C, THAVORN K, et al. Effectiveness of Outpatient Versus Operating Room Hysteroscopy for the Diagnosis and Treatment of Uterine Conditions: A Systematic Review and Meta-Analysis [J]. Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC, 2019, 41(7): 930-941.
[23] CLARK T J, MANN C H, SHAH N, et al. Accuracy of outpatient endometrial biopsy in the diagnosis of endometrial cancer: a systematic quantitative review [J]. BJOG : an international journal of obstetrics and gynaecology, 2002, 109(3): 313-321.
[24] VAN DONGEN H, DE KROON C D, JACOBI C E, et al. Diagnostic hysteroscopy in abnormal uterine bleeding: a systematic review and meta-analysis [J]. BJOG : an international journal of obstetrics and gynaecology, 2007, 114(6): 664-675.
[25] GKROZOU F, DIMAKOPOULOS G, VREKOUSSIS T, et al. Hysteroscopy in women with abnormal uterine bleeding: a meta-analysis on four major endometrial pathologies [J]. Archives of gynecology and obstetrics, 2015, 291(6): 1347-1354.
[26] JANSEN F W, VREDEVOOGD C B, VAN ULZEN K, et al. Complications of hysteroscopy: a prospective, multicenter study [J]. Obstetrics and gynecology, 2000, 96(2): 266-270.
[27] TAHIR M M, BIGRIGG M A, BROWNING J J, et al. A randomised controlled trial comparing transvaginal ultrasound, outpatient hysteroscopy and endometrial biopsy with inpatient hysteroscopy and curettage [J]. British journal of obstetrics and gynaecology, 1999, 106(12): 1259-1264.
[28] DE ANGELIS C, SANTORO G, RE M E, et al. Office hysteroscopy and compliance: mini-hysteroscopy versus traditional hysteroscopy in a randomized trial [J]. Human reproduction (Oxford, England), 2003, 18(11): 2441-2445.
[29] SMITH P P, KOLHE S, O'CONNOR S, et al. Vaginoscopy Against Standard Treatment: a randomised controlled trial [J]. BJOG : an international journal of obstetrics and gynaecology, 2019, 126(7): 891-899.
[30] DARWISH A M, KAMEL M A, ZAHRAN K, et al. Office Cervicoscopy versus Stationary Colposcopy in Suspicious Cervix: A Randomized Controlled Trial [J]. Journal of mid-life health, 2019, 10(3): 115-122.
[31] DI SPIEZIO SARDO A, GIAMPAOLINO P, MANZI A, et al. The Invisible External Cervical Os. Tips and Tricks to Overcome this Challenge during In-Office Hysteroscopy [J]. Journal of minimally invasive gynecology, 2021, 28(2): 172-173.