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Diagnostic Accuracy of Hysteroscopic Risk Scoring System for Diagnosing Atypical Endometrial Hyperplasia and Carcinoma Among Perimenopausal and Postmenopausal Women

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Abstract

Background and aim

Endometrial hyperplasia and carcinoma are significant causes of abnormal uterine bleeding (AUB) among perimenopausal and postmenopausal women. Hysteroscopy allows direct examination of the endometrial cavity, while the use of a hysteroscopic risk scoring system may help identify women at higher risk of atypical endometrial hyperplasia (AEH) and carcinoma. The study aimed to evaluate the diagnostic accuracy of a hysteroscopic risk scoring system for diagnosing AEH and endometrial carcinoma in perimenopausal and postmenopausal women.

Materials and methods

A prospective observational diagnostic accuracy study was conducted among 84 perimenopausal and postmenopausal women with AUB and increased endometrial thickness at Adichunchanagiri Institute of Medical Sciences, Karnataka, from July 2024 to December 2025. Diagnostic hysteroscopy was performed using a 2.7-mm rigid hysteroscope, and hysteroscopic findings were scored according to the established hysteroscopic risk scoring system. Targeted endometrial biopsy was performed following hysteroscopy, with histopathological examination serving as the reference standard. Diagnostic performance was assessed using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy.

Results

Among 84 participants, 10 (11.9%) had AEH, and eight (9.5%) had endometrial carcinoma. All women with carcinoma had a hysteroscopic score ⩾9. For the detection of carcinoma, a score ⩾9 demonstrated 100.0% sensitivity, 80.3% specificity, 34.8% PPV, 100.0% NPV, and 82.1% diagnostic accuracy. For the detection of the combined outcome of AEH or carcinoma, sensitivity was 83.3%, specificity was 87.9%, PPV was 65.2%, NPV was 95.1%, and diagnostic accuracy was 86.9%.

Conclusions

A hysteroscopic risk score ⩾9 demonstrated promising diagnostic performance for identifying endometrial carcinoma and AEH. It may serve as a useful adjunct to targeted endometrial biopsy and histopathological examination in perimenopausal and postmenopausal women with AUB. However, hysteroscopic risk scoring should not replace histopathological confirmation.

Categories: Obstetrics/Gynecology
Keywords: abnormal uterine bleeding, diagnostic accuracy, endometrial carcinoma, endometrial hyperplasia, hysteroscopy

Introduction

Endometrial hyperplasia and endometrial carcinoma are important causes of abnormal uterine bleeding (AUB) in perimenopausal and postmenopausal women [1]. Endometrial carcinoma is the most common malignancy of the female genital tract in many developed countries, and its incidence is increasing with the rising prevalence of obesity, metabolic disorders, and increasing life expectancy [2,3]. Although postmenopausal bleeding is frequently attributable to benign conditions, it requires appropriate evaluation because it can be an early manifestation of endometrial malignancy [4]. Timely identification of women at increased risk is therefore important for establishing a definitive histopathological diagnosis and initiating appropriate management [5].

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Transvaginal ultrasonography is commonly used as the initial investigation for women with AUB and provides information regarding endometrial thickness and other uterine abnormalities [6]. However, endometrial thickness measurement alone has limited ability to distinguish benign endometrial changes from atypical hyperplasia or carcinoma [7]. Hysteroscopy permits direct visualization of the endometrial cavity and may identify morphological features suggestive of malignancy, including irregular endometrial thickening, abnormal vascular patterns, necrotic or friable areas, and irregular polypoidal or cerebroid lesions [8,9]. Nevertheless, the diagnostic interpretation of these features may be influenced by the experience and expertise of the operator.

To improve the objectivity and reproducibility of hysteroscopic assessment, Ianieri et al. developed a hysteroscopic risk scoring system incorporating characteristic morphological features associated with endometrial hyperplasia and adenocarcinoma [10]. This scoring system offers a standardized method for integrating hysteroscopic findings and estimating the probability of clinically significant endometrial pathology [11]. Subsequently, Harika et al. evaluated the diagnostic performance of hysteroscopic scoring in peri- and postmenopausal women with AUB and reported high diagnostic sensitivity for endometrial carcinoma at a score threshold of ⩾9 [9]. Despite these findings, further evaluation of the scoring system in different clinical settings is warranted to assess its diagnostic performance and applicability across patient populations.

Therefore, the present study was undertaken to evaluate the diagnostic accuracy of the hysteroscopic risk scoring system, using histopathological examination as the reference standard, for detecting atypical endometrial hyperplasia (AEH) and endometrial carcinoma in perimenopausal and postmenopausal women presenting with AUB. The study also assessed the diagnostic performance of the predefined hysteroscopic score cutoff of ⩾9 for endometrial carcinoma and the combined outcome of AEH or carcinoma. The primary objective was to determine the diagnostic accuracy of a hysteroscopic risk score for diagnosing AEH and endometrial carcinoma in perimenopausal and postmenopausal women.

Materials And Methods

Study design and setting

This prospective observational diagnostic accuracy study was undertaken in the Department of Obstetrics and Gynecology, Adichunchanagiri Institute of Medical Sciences (AIMS), Adichunchanagiri University, B.G. Nagara, Karnataka, India, between July 2024 and December 2025. Institutional Ethics Committee approval was obtained from AIMS (approval AIMS/IEC/078/2024; dated April 3, 2024). Written informed consent was obtained from all participants before study enrolment.

Perimenopausal and postmenopausal women presenting with AUB and increased endometrial thickness on ultrasonography were assessed for eligibility. Participants meeting the eligibility criteria underwent diagnostic hysteroscopy followed by targeted endometrial biopsy. Histopathological examination of the biopsy specimen was considered the reference standard. Participants were recruited using consecutive sampling during the study period.

Inclusion and exclusion criteria

Women aged ⩾40 years who were perimenopausal or postmenopausal, had AUB, and demonstrated increased endometrial thickness on ultrasonography requiring further evaluation were included. An endometrial thickness >15 mm in perimenopausal women and >4 mm in postmenopausal women was considered increased. Women with a history of endometrial ablation or major uterine surgery, hormonal therapy during the preceding six months, bleeding disorders or anticoagulant use that contraindicated hysteroscopy, acute pelvic inflammatory disease, pyometra, or pregnancy were excluded.

Sample size

The sample size was estimated using the specificity reported by Harika et al. for a hysteroscopic risk score cutoff of ⩾9 in detecting endometrial carcinoma. The reported specificity was 67.8% [9]. With a 95% confidence level ($Z_{1-\alpha/2}$ = 1.96) and an absolute precision of 10%, the sample size was determined using

$$n = \frac{Z^2_{1-\alpha/2} \times Sp(1-Sp)}{d^2}$$

Using the above parameters, the calculated minimum sample size was 84 participants. Based on the estimated sample size, 84 participants were included in the study through consecutive recruitment during the study period. The diagnostic performance of the scoring system was evaluated using both sensitivity and specificity, along with the corresponding predictive values and overall diagnostic accuracy.

Hysteroscopy and histopathological examination

Diagnostic hysteroscopy was carried out with a 2.7-mm rigid hysteroscope (Karl Storz, Tuttlingen, Germany) under monitored anesthesia care using the vaginoscopic technique. Vaginal misoprostol 200 µg was administered two hours before the procedure. Normal saline was used for uterine distension, with intrauterine pressure maintained below 80 mmHg.

Hysteroscopic examinations were performed by multiple gynecologists. During hysteroscopy, the operators evaluated the endometrial cavity for abnormalities in surface characteristics, vascularity, thickness, necrotic areas, and lesion morphology. The hysteroscopic risk score was calculated according to the system developed by Ianieri et al., which included eight morphological parameters: atypical blood vessels (7 points), widespread and irregular endometrial thickening (2 points), dilated glandular orifices (2 points), crumbling of endometrial tissue (6 points), multiple endometrial polyps (2 points), irregular appearance of polyps (3 points), cerebroid and arborescent growth patterns (14 points), and irregular endometrial color (4 points) [10]. The total hysteroscopic score was calculated by adding the points assigned to each observed feature. A score of ⩾9 was considered the predefined cutoff for identifying women at increased risk of endometrial carcinoma [10]. Individual scores were documented during the hysteroscopic assessment before the histopathological results became available.

After hysteroscopic evaluation, targeted endometrial tissue was obtained for histopathological examination. Specimens were fixed in 10% formalin, processed routinely, and stained with hematoxylin and eosin. Histopathological assessment was performed by experienced pathologists blinded to the hysteroscopic findings. Histopathological diagnoses were based on the institutional pathology department's reporting and diagnostic assessment. Histopathological diagnosis was used as the reference standard (Figure *1*).

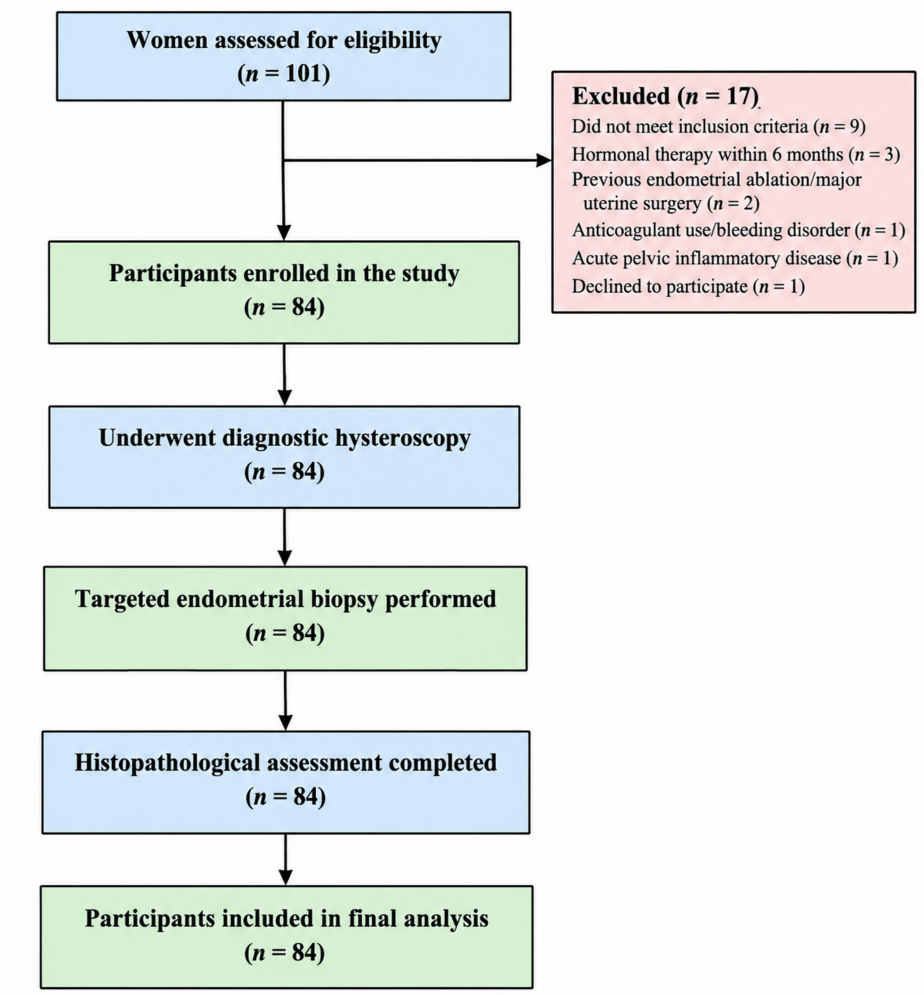

FIGURE 1: Participant flowchart.

Data collection and statistical analysis

Relevant clinical, ultrasonographic, hysteroscopic, and histopathological information was collected using a structured pro forma and entered into Microsoft Excel (Microsoft Corporation, Redmond, WA, USA).

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 26.0 (released 2018; IBM Corp., Armonk, NY, USA). Categorical variables were presented as N (%) and compared using Fisher's exact test. Diagnostic performance of a hysteroscopic risk score ⩾9 was evaluated against the histopathological diagnosis by determining sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy. Statistical significance was considered at $p < 0.05$.

Results

The majority of participants were aged 50-59 years (35 (41.7%)) and were postmenopausal (53 (63.1%)). AUB was the most common presenting symptom (55 (65.5%)), followed by postmenopausal bleeding (29 (34.5%)). Vaginal discharge and pelvic pain were reported as additional complaints in four (4.8%) and two (2.4%) participants, respectively; all six participants also had AUB and fulfilled the eligibility criteria (Table *1*).

Variable	Category	N (%)
Age group (years)	40-49	24 (28.6%)
	50-59	35 (41.7%)
	≥60	25 (29.8%)
Menopausal status	Perimenopausal	31 (36.9%)
	Postmenopausal	53 (63.1%)
Presenting symptom	AUB	55 (65.5%)
	Postmenopausal bleeding	29 (34.5%)
	Vaginal discharge	4 (4.8%)
	Pelvic pain	2 (2.4%)

TABLE 1: Baseline characteristics of study participants.

Data are presented as frequency and percentage (N (%)). Vaginal discharge and pelvic pain were additional complaints that coexisted with AUB in the respective participants.

AUB, abnormal uterine bleeding

The most common hysteroscopic risk score category was 5-8 (35 (41.7%)), while 23 (27.4%) participants had a score ⩾9 (Table *2*).

Hysteroscopic risk score	N (%)
<5	26 (31.0%)
5-8	35 (41.7%)
≥9	23 (27.4%)

TABLE 2: Distribution of hysteroscopic risk scores.

Data are presented as frequency and percentage (N (%)). Hysteroscopic risk score categories are based on [10].

Histopathological examination showed benign endometrium in 41 (48.8%) participants. AEH was identified in 10 (11.9%) participants, while endometrial carcinoma was diagnosed in eight (9.5%) participants (Table *3*).

Histopathological diagnosis	N (%)
Benign endometrium	41 (48.8%)
Endometrial polyp	15 (17.9%)
Hyperplasia without atypia	10 (11.9%)
AEH	10 (11.9%)
Endometrial carcinoma	8 (9.5%)

TABLE 3: Histopathological diagnosis of study participants.

Data are presented as frequency and percentage (N (%)).

AEH, atypical endometrial hyperplasia

A hysteroscopic risk score ⩾9 was associated with a greater proportion of atypical hyperplasia and carcinoma. Among participants with a score ⩾9, atypical hyperplasia was present in seven (30.4%) and carcinoma in eight (34.8%), whereas no carcinoma was identified among participants with scores <9. The association was statistically significant (Table *4*).

Hysteroscopic risk score	Benign/without atypia	Atypical hyperplasia	Carcinoma	Total	p-value
<5	25 (96.2%)	1 (3.8%)	0 (0.0%)	26 (100.0%)	<0.001
5-8	33 (94.3%)	2 (5.7%)	0 (0.0%)	35 (100.0%)	
≥9	8 (34.8%)	7 (30.4%)	8 (34.8%)	23 (100.0%)	
Total	66 (78.6%)	10 (11.9%)	8 (9.5%)	84 (100.0%)	

TABLE 4: Association between hysteroscopic risk score and histopathological diagnosis.

Data are presented as frequency and percentage (N (%)). Fisher's exact test was applied. A p-value <0.05 was considered statistically significant.

All participants with endometrial carcinoma had a hysteroscopic risk score ⩾9 (8 (100.0%)), whereas most participants without carcinoma had a score <9 (61 (80.3%)). The association was statistically significant ($p < 0.001$) (Table *5*).

Histopathological diagnosis	Score ≥9	Score <9	Total	Statistical test	p-value
Endometrial carcinoma	8 (100.0%)	0 (0.0%)	8 (100.0%)	Fisher's exact test	<0.001
No endometrial carcinoma	15 (19.7%)	61 (80.3%)	76 (100.0%)		
Total	23 (27.4%)	61 (72.6%)	84 (100.0%)		

TABLE 5: Diagnostic accuracy of hysteroscopic risk score ≥9 for endometrial carcinoma.

Data are presented as frequency and percentage (N (%)). Fisher's exact test was applied. p-value <0.05 was considered statistically significant.

For detection of endometrial carcinoma, a hysteroscopic risk score ⩾9 demonstrated a sensitivity of 100.0%, specificity of 80.3%, PPV of 34.8%, NPV of 100.0%, and diagnostic accuracy of 82.1% (Table *6*).

Diagnostic parameter	Value (95% CI)
Sensitivity	100.0% (63.1-100.0%)
Specificity	80.3% (69.5-88.5%)
PPV	34.8% (16.4-57.3%)
NPV	100.0% (94.1-100.0%)
Diagnostic accuracy	82.1%

TABLE 6: Diagnostic performance of hysteroscopic risk score ≥9 for endometrial carcinoma.

Data are presented as percentages (%).

NPV, negative predictive value; PPV, positive predictive value

Among participants with AEH or carcinoma, 15 (83.3%) had a hysteroscopic risk score ⩾9, whereas 58 (87.9%) of those without atypia or carcinoma had a score <9. A significant association was observed between a hysteroscopic risk score ⩾9 and the presence of AEH or carcinoma ($p < 0.001$) (Table 7).

Histopathological diagnosis	Score ≥9	Score <9	Total	Statistical test	p-value
Atypical hyperplasia/carcinoma	15 (83.3%)	3 (16.7%)	18 (100.0%)		
No atypia/carcinoma	8 (12.1%)	58 (87.9%)	66 (100.0%)	Fisher's exact test	<0.001
Total	23 (27.4%)	61 (72.6%)	84 (100.0%)		

TABLE 7: Diagnostic accuracy of hysteroscopic risk score ≥9 for AEH or carcinoma.

Data are presented as frequency and percentage (N (%)). Fisher's exact test was applied. A p-value <0.05 was considered statistically significant.

AEH, atypical endometrial hyperplasia

For detection of AEH or carcinoma, a hysteroscopic risk score ⩾9 demonstrated a sensitivity of 83.3%, specificity of 87.9%, PPV of 65.2%, NPV of 95.1%, and diagnostic accuracy of 86.9% (Table 8).

Diagnostic parameter	Value (95% CI)
Sensitivity	83.3% (58.6-96.4%)
Specificity	87.9% (77.5-94.6%)
PPV	65.2% (42.7-83.6%)
NPV	95.1% (86.3-99.0%)
Diagnostic accuracy	86.9%

TABLE 8: Diagnostic performance of hysteroscopic risk score ≥9 for AEH or carcinoma.

Data are presented as percentages (%).

AEH, atypical endometrial hyperplasia; NPV, negative predictive value; PPV, positive predictive value

Discussion

The present study demonstrated that the hysteroscopic risk scoring system provided useful discrimination

between benign and clinically significant endometrial pathology in perimenopausal and postmenopausal women with AUB. A score of ⩾9 was observed predominantly among women with AEH and endometrial carcinoma, while no cases of carcinoma were identified in the lower score categories. Using a cutoff of ⩾9, the sensitivity for detecting endometrial carcinoma was 100.0%, with a specificity of 80.3%, PPV of 34.8%, NPV of 100.0%, and overall diagnostic accuracy of 82.1%. Although these findings indicate promising discriminatory ability, the estimates should be interpreted cautiously because only eight cases of endometrial carcinoma were identified. These results support the potential role of structured hysteroscopic assessment in identifying women with suspicious endometrial lesions who require targeted histopathological evaluation.

The findings are broadly consistent with those of Ianieri et al., who developed the hysteroscopic risk scoring system after evaluating 435 endometrial biopsies and reported particularly strong diagnostic performance for endometrial carcinoma, with a sensitivity of 95.4% and specificity of 98.2% [10]. Their study demonstrated that specific hysteroscopic characteristics, including atypical vascular patterns, irregular endometrial thickening, necrotic or friable areas, and irregular growth patterns, can provide meaningful discrimination between benign and malignant endometrial lesions. In the present study, sensitivity for carcinoma was higher at 100.0%, whereas specificity was lower at 80.3%. These differences may be related to variations in sample size, disease prevalence, patient selection, and clinical setting. The NPV of 100.0% observed in the present study indicates that no carcinoma was detected among women with scores below 9; however, this finding should not be interpreted as evidence that a low score can definitively exclude malignancy. The relatively small number of carcinoma cases limits the precision of this estimate. Ianieri et al. similarly reported a very high NPV of 99.5% for endometrial carcinoma, supporting the potential role of hysteroscopic scoring as a risk-stratification tool [10].

The present findings also compare favorably with the prospective study by Harika et al., which included 95 peri- and postmenopausal women with AUB. In that study, a score ⩾9 yielded 100% sensitivity, 67.8% specificity, 22.2% PPV, and 100% NPV for endometrial carcinoma [9]. The present study reproduced the 100% sensitivity and 100% NPV at the same cutoff, while demonstrating somewhat higher specificity (80.3%) and PPV (34.8%). The similarity in sensitivity and NPV is noteworthy because both studies evaluated peri- and postmenopausal women and used histopathology as the reference standard. Harika et al. reported lower diagnostic performance for AEH, with a sensitivity of 75% and specificity of 58.6% at their selected cutoff for atypical hyperplasia [9]. In contrast, the present study demonstrated a sensitivity of 83.3%, specificity of 87.9%, PPV of 65.2%, NPV of 95.1%, and diagnostic accuracy of 86.9% for the combined outcome of AEH or carcinoma. The difference may partly reflect variations in case distribution and the use of a combined clinically significant pathology endpoint. Notably, three women with AEH had hysteroscopic scores below 9, indicating that the selected cutoff may not identify every case of premalignant pathology. This reinforces the importance of histopathological assessment even when the hysteroscopic score is below the high-risk threshold.

The diagnostic value observed in the present study is also consistent with broader evidence supporting hysteroscopy for the evaluation of endometrial pathology. Clark et al., in a systematic quantitative review involving 26,346 women, reported high diagnostic accuracy of hysteroscopy for endometrial cancer, although accuracy was more moderate when hyperplasia was included as an outcome [12]. Similarly, Gkrozou et al. reported pooled sensitivity and specificity of 82.6% and 99.7%, respectively, for hysteroscopic diagnosis of endometrial cancer, while performance for endometrial hyperplasia was comparatively lower [13]. These findings emphasize that hysteroscopy is particularly valuable for recognizing malignant-appearing lesions, but histopathological confirmation remains essential, especially for premalignant disease in which visual characteristics may overlap with benign or non-atypical hyperplastic changes. The relatively high diagnostic performance for the combined AEH/carcinoma endpoint in the present study further supports the use of systematic hysteroscopic assessment as an adjunct to targeted endometrial biopsy rather than as a substitute for histopathological diagnosis.

The present study provides an assessment of the diagnostic performance of an existing hysteroscopic risk scoring system in a separate clinical setting, rather than proposing a new scoring system. By applying the predefined cutoff of ⩾9 and evaluating both endometrial carcinoma and the combined outcome of AEH or carcinoma, the study provides additional evidence regarding the potential applicability of this scoring approach in peri- and postmenopausal women with AUB. Nevertheless, the findings should be considered supportive validation evidence and require confirmation in larger, preferably multicenter studies.

Strengths and limitations

The strengths of the present study include its prospective design, systematic hysteroscopic assessment using an established risk-scoring system, and confirmation of hysteroscopic findings by histopathological examination as the reference standard. The use of a predefined score cutoff of ⩾9 allowed objective assessment of diagnostic performance, while evaluation of both endometrial carcinoma and the combined endpoint of AEH or carcinoma provides clinically relevant information. The assessment of two clinically important diagnostic outcomes also helps demonstrate the performance of the scoring system across malignant and premalignant endometrial pathology.

However, the study has certain limitations. The relatively small sample size and single-center design may limit the generalizability of the findings to other populations and healthcare settings. The number of women with endometrial carcinoma and atypical hyperplasia was also relatively small, which may result in greater uncertainty around estimates of sensitivity, specificity, and predictive values. In particular, the 100% sensitivity and NPV for carcinoma should be interpreted in the context of the limited number of carcinoma cases and should not be considered definitive evidence that a score below 9 excludes malignancy. In addition, hysteroscopic interpretation may be influenced by operator experience, and interobserver variability was not assessed. The study also evaluated a predefined cutoff of ⩾9; therefore, the findings may not be directly applicable to other scoring thresholds or populations with different disease prevalence. Finally, hysteroscopic scoring should be regarded as a tool for risk stratification and for guiding targeted sampling, not as a replacement for histopathological examination. Larger multicenter studies with adequate representation of premalignant and malignant lesions and assessment of interobserver agreement are warranted to further establish the diagnostic performance and clinical applicability of this scoring system.

Conclusions

The hysteroscopic risk scoring system demonstrated promising diagnostic performance for identifying endometrial carcinoma and AEH in perimenopausal and postmenopausal women with AUB. A hysteroscopic score of ⩾9 showed high sensitivity and NPV for endometrial carcinoma, and provided good discriminatory ability for the combined detection of AEH or carcinoma. These findings suggest that structured hysteroscopic risk scoring can serve as a useful adjunct to targeted endometrial biopsy and histopathological examination for risk stratification and clinical decision-making in women with suspected endometrial pathology. However, it should not replace histopathological confirmation.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

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