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Original Research Article

The Diagnostic Accuracy of DEERS (Disease of Endometrium- Evaluation and Risk Scoring System) For Prognostication of (AUB) Abnormal Uterine Bleeding

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Abstract:

Background: One of the most frequent presenting problems among women in the reproductive and perimenopausal age range is abnormal uterine bleeding (AUB). Endometrial hyperplasia is a possibility in 5–15% of AUB patients. The most reliable method for determining the causes of endometrial diseases is endometrial sampling. Reports from tissue biopsies might be benign, malignant, premalignant, or normal. In order to predict AUB, the DEERS (Disease of Endometrium- Evaluation and Risk Scoring) scoring system was developed. It uses demographic and ultrasonographic variables.

Objectives: Primary objective: To ascertain the diagnostic accuracy of DEERS scoring system in predicting the type of endometrial abnormality in terms of sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV).Secondary Objective: To assess the efficacy of DEERS after addition of parameters like myometrial pathologies.

Method: 151 females with AUB were included, Patients underwent ultrasonographic evaluation followed by endometrial sampling or hysterectomy. The demographic characteristics as well as ultrasonographic parameters were studied and the DEERS score was calculated, based on which they were categorised into groups. This category was compared to the final histopathology report.

Results: According to this study, diabetes mellitus, distinction of the endo-myometrial junction (independent predictor) and endometrial echotexture were identified as the independent determinants of malignancy. Based on the ROC curve, an ideal cut-off to predict abnormal endometrial pathology was identified as 15.5. It has sensitivity of 60.87%, specificity 86.72%, Positive predictive value (PPV) 45.16%, Negative predictive value (NPV) 92.5% and an accuracy of 82.78%. The scoring system was noted to have a specificity and PPV of 100%, NPV 99.31% and accuracy of 99.34% for malignancy.

Conclusion: The DEERS scoring system can be used as a reliable, non-invasive scoring system in prognostication of AUB, especially in endometrial malignancy.

Keywords: DEERS scoring system, Histopathology, Endometrial malignancies, Demographics, Ultrasonography.

Introduction

Among women in the reproductive and perimenopausal age range, abnormal uterine bleeding (AUB) is one of the most prevalent presenting symptoms. Women in the perimenopausal and postmenopausal age range complain about their periods about 70% of the time [1]. Significant physical and social morbidities in society are correlated with AUB. It has an impact on women's quality of life in terms of their health and places a significant financial burden on society. In order to properly assess and manage AUB, a thorough gynecological examination, followed by investigations, including imaging, is required. Imaging can confirm structural causes of AUB that have been clinically suspected. The gold standard for confirming the diagnosis of endometrial diseases is, however, endometrial tissue sample [2]. Reports from tissue biopsies might be normal, benign diseases, or those having the potential to become malignant. The most frequent gynecological malignancy in high- and middle-income nations is now thought to be endometrial cancer. A categorization system (PALM-COEIN) for the etiology of the AUB in non-pregnant

women has been created by the FIGO working group on menstrual disorders [3]. These include endometrial, iatrogenic, polyp, adenomyosis, leiomyoma, malignancy and hyperplasia, coagulopathy, ovulatory dysfunction, and polyp. classified. The latter five (COEIN) are the underlying medical problems that need to be investigated, whereas the first four (PALM) are the known structural reasons of AUB that may be assessed using imaging or histological analysis. When treating perimenopausal women with AUB, FIGO advises endometrial tissue sample [4,5]. Other myometrial causes of AUB, such as big myomas or adenomyosis, may necessitate a hysterectomy, whereas certain endometrial causes of AUB may be treated medically or with simple operations like dilatation and curettage.

DEERS Scoring System (Disease of Endometrium- Evaluation and Risk Scoring)

In order to assess and subsequently distinguish the diseases connected to AUB, DEERS combines the demographic characteristics of the patient with ultrasound characteristics [6]. Age, comorbidities including diabetes mellitus, hypertension, obesity, usage of hormone replacement therapy or tamoxifen, and menopausal status are examples of demographic variables that are used to identify high-risk individuals. Endometrial thickness, differentiation of the endo-myometrial junction, endometrial echotexture, any collections, and the presence of endometrial polyps are among the ultrasound features. Each of these qualities has received a score, and the overall score is computed. As a result, they are divided into four groups: benign pathology, those at risk of developing cancer, and cancer. This study was conducted to determine the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the DEERS scoring system in detecting the kind of endometrial abnormality in our community. This study also investigated if myometrial diseases may affect the histopathology of the endometrium.

Materials and Methods

Selection of participants

The Department of Obstetrics and Gynecology at the Amrita Institute of Medical Sciences in Kochi conducted this prospective cohort research from 2021 to 2022. The study's objective was to assess the diagnostic efficacy of the DEERS (Diseases of Endometrium- Evaluation and Risk Scoring) scoring system in identifying benign and malignant endometrial diseases to help with future therapy.

Transvaginal ultrasonography was used as part of standard testing on women who complained of abnormal uterine bleeding following a history and physical examination. Other than endometrial diseases, endocrinological reasons (myometrial, ovarian, cervical, coagulation disorders) were ruled out as causes of AUB. The patients' demographic information was gathered, and TVS results were documented. Based on these demographic and ultrasonographic factors, preoperative scores (DEERS score) were derived for the patients and interpreted accordingly.

Inclusion Criteria

- Women with AUB who are scheduled for endometrial curettage.
- Women undergoing hysterectomy for AUB.

Exclusion Criteria

- Women with diagnosed malignancy.
- Women with intrauterine device (Mirena) in situ.
- Women lost to follow up.

Sample size

Based on the sensitivity (72.2%) of DEERS (Diseases of Endometrium -Evaluation and Risk scoring system) in AUB observed from the existing literature and with 5% relative precision and 95% confidence, the minimum sample size was calculated as 139.This study was conducted on 151 participants, Table 1.

Table 1: DEERS scoring system and interpretation of scores

1.A. Demographic characteristics			
No.	**Demographic character**	**Cut off value**	**Score**
1.	Age	20-40 years 41-55 years ≥ 56 years	1 2 5
2.	Menopausal status	Pre menopause Post menopause	1 4
3.	Diabetes Hypertension Obesity		1 1 1
4.	HRT		1
5.	Tamoxifen		1
1.B. Ultrasound parameters			
No.	**TVS characteristic**	**Cut off value**	**Score**

1.	Endometrial thickness	Up to 5mm 6-10mm 11-20mm >21mm	1 2 3 4
2.	Endo- myometrial junction	Distinct Indistinct	1 5
3.	Echotexture	Homogenous Cystic spaces Heterogenous	1 3 5
4.	Polyp		4
5.	Endometrial collection	Up to 5mm 6-10mm 11-20mm >21mm	1 2 3 4
Total DEERS score = Demographic characters score + Ultrasound score			

1.C. Score Interpretation

Score	**Interpretation**
6-9	Normal endometrium
10-15	Benign pathologies: Benign polyp, disordered proliferation, inadequate secretory endometrium, hyperplasia without atypia
16-25	Premalignant pathologies: Hyperplasia with atypia/ focal atypia
26-36	Endometrial malignancy

Statistical Analysis

Software from IBM called SPSS version 20.0 was used for the statistical analysis. In order to express categorical variables, frequency and percentage were used. A mean and standard deviation presentation was made for continuous variables. The statistical significance of the comparison of all categorical variables with HPE was investigated using the chi-square test/chi-square with continuity correction. The statistical significance of the comparison of all categorical factors based on DEERS score with HPE classification was investigated using Mc Nemar's Chi-square test. The DEERS score and HPE's agreement with each other was examined using the kappa statistic. The DEERS score's optimal cut-off for predicting malignancy was discovered using the ROC curve. Calculations were made for diagnostic metrics such sensitivity, specificity, PPV, NPV, and accuracy. Statistical significance was defined as a p-value <0.05.

Results

Total number of participants enrolled in the study, after meeting the inclusion and exclusion criteria were 151.41.7% (63) presented with complaints of menorrhagia, 31.7% (48) had complaints of irregular cycles and 26.4% (40), with postmenopausal bleeding.

Demographic characteristics

- Majority (55.6%) of the study participants were in the 41-50 years age group (84), i.e, perimenopausal.
- 117 participants were premenopausal, attributing to 77.5% and 34 were postmenopausal (22.5%).
- Most of the participants included in the study were multipara (107 ~70.8%), while 35 (23.1%) had a parity index of 1 and 9 (5.9%) were nulliparous.
- Mean BMI was 27.08 ± 3.32
- 20 patients (13.2%) were diabetic, while 45 patients (29.8%) were hypertensive.
- 32 participants (21.2%) were obese according to WHO grading for obesity (BMI >30kg/m2).
- The number of participants who were already on hormone treatment were 17 (11.3%) and those on Tamoxifen for Ca breast were 4.6% (7 patients).

Ultrasonographic characteristics

- The mean endometrial thickness was noted as 11.69mm ± 4.418.
- Majority of the patients had a distinct endo-myometrial junction, i.e., 85.4% (129), while 14.6% (22) had an indistinct endo-myometrial junction.
- 52.3% (79) had a homogenous echotexture, 17.9% (27) had cystic spaces, while in 29.8% (45), heterogenous echotexture was noted.
- 21.9% (33), presence of endometrial polyp was noted.
- Endometrial collection was noted only in 13 patients (8.6%), of whom 10 were premenopausal and 3 were postmenopausal.

Multivariate logistic regression analysis

Table 2: Independent determinants of disease positivity

Factors	Categories	p value	Odds Ratio	95% CI for OR	
				Lower	Upper
Diabetes Mellitus	Non diabetic		1		
	Diabetic	0.072	3.93	0.887	17.42
Endo-myometrial junction (EMJ)	Distinct		1		
	Indistinct	<0.001	16.719	4.92	56.73
Echotexture	Cystic	0.007	1		
	Heterogeneous	0.082	5.26	0.808	34.26
	Homogeneous	0.763	0.739	0.103	5.28

It was observed that diabetes mellitus, indistinct endo-myometrial junction and heterogenous echotexture of the endometrium were the independent and significant determinants of incidence of disease positivity, Table 2. Of these, EMJ was the independent predictor of endometrial malignancies, with an Odds Ratio of 16.719

Table 3: Comparison between DEERS score category and Histopathology group

Group	DEERS score n (%)	Histopathology report n (%)
Normal	24 (15.9%)	13 (8.6%)
Benign	96 (63.6%)	115 (76.2%)
Premalignant	25 (16.6%)	16 (10.6%)
Malignant	6 (4%)	7 (4.6%)
Total	151 (100%)	151 (100%)

On comparing the DEERS score group with the gold standard histopathology reports, it was observed that 15.9% were reported to be in the normal group according to the score, but HPE reported 8.6% in the normal category. 63.6% were reported to be in benign group according to DEERS, while HPE reported more (76.2%). 16.6% were reported to be in premalignant group according to the score, but only 10.6% according to HPE. 4% in the malignant group according to the score, which was similar to the HPE reports (4.6%), Table 3.

Diagnostic accuracy of DEERS scoring system

On calculating the sensitivity, specificity, PPV and NPV, a wide variability was noted for different pathologies of the endometrium. The score showed good specificity for all lesions (87.68% for normal endometrium, 63.8% for benign, 86.6% for premalignant and 100% formalignancies), Table 4.

Table 4: Diagnostic accuracy of DEERS score for different endometrial categories

	Sensitivity	Specificity	PPV	NPV	Accuracy	95% CI
Normal	53.85%	87.68%	29.17%	95.28%	84.77%	78.03 to 90.09%
Benign	72.17%	63.89%	86.46%	41.82%	70.2%	62.22 to 77.36%
Premalignant	43.75%	86.67%	28.0%	92.86%	82.12%	75.06 to 87.87%
Malignant	85.71%	100.00%	100.00%	99.31%	99.34%	96.37 to 99.98%

ROC Curve (Receiver Operating Characteristic) Curve

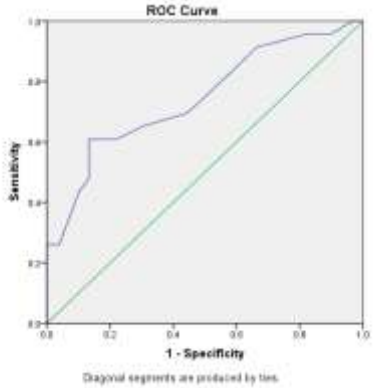

Figure 1: ROC curve to determine an ideal cut-off for DEERS score

The optimum cut-off to predict abnormal endometrial pathology is a score of 15.5, with AUC (Area under curve) of 0.744 ± 0.061 (0.625 to 0.864) within the 95% confidence interval. This value is noted to be statistically significant ($p<0.05$), Figure 1.

Table 5: Comparison between low risk (normal and benign) and high risk (premalignant and malignant) groups based on ROC cut-off of 15.5

Diagnosis by DEERS score	Diagnosis by HPE		p- value
	Low risk	High risk	
Low risk (<15.5) (n=120)	92.5% (111)	7.5% (9)	<0.05
High risk (>15.5) (n=31)	54.8% (17)	45.2% (14)	

When the ROC cut-off was used for DEERS, the sensitivity was noted to be 60.8%, specificity 86.72%, PPV 45.16%, NPV 92.5% and accuracy 82.78%, Table 5.
The addition of myometrial pathologies like adenomyosis and intramural fibroids with submucous extension did not show a significant improvement in the efficacy of the DEERS score.

Discussion

One of the most frequent presenting problems among women in the reproductive and perimenopausal age range is abnormal uterine bleeding (AUB). Endometrial hyperplasia is a possibility in 5–15% of AUB patients. The most reliable method for determining the causes of endometrial diseases is endometrial sampling. Reports from tissue biopsies may be normal, benign, have the potential to become malignant, or have endometrial cancers. This grading system was developed with the intention of diagnosing endometrial abnormalities without the need for invasive treatments, hence lowering morbidity. Additionally, modest hormonal alterations may be the cause of common or benign diseases, which can be addressed medically. Malignancies must be handled carefully, as must premalignant diseases.

As the risk of developing endometrial malignancies is higher in this age group, even though there are fewer patients who present with postmenopausal bleeding and the pathologies diagnosed are typically atrophy, benign polyps, or even hyperplasia without atypia, they should never be given false hope without thorough investigation.

In order to predict AUB, the DEERS scoring system was developed as a non-invasive technique employing demographic and ultrasonographic variables.

Participants in the research varied in age from 27 to 82, with 48 serving as the median. While 22.5% of them were postmenopausal, 77.5% of them were premenopausal. A statistically significant condition, diabetes affected 13.2% of study participants, of whom 35% had high-risk lesions (premalignant/malignant lesions). 29.8% of people had hypertension, and 22.2% of them were in the high-risk category. 21.2% of the population was fat, and 21.9% of them were high risk. These two weren't statistically significant either. 11.3% of individuals who had HRT and 46.7% of participants who experienced bleeding were using Tamoxifen, although none of their histology indicated that they had cancer.

The mean endometrial thickness (ET), according to the ultrasonographic parameters, was found to be 11.69mm. Premenopausal women had an ET minimum of 4 mm and a maximum of 25 mm, whereas postmenopausal women had an ET minimum of 3 mm and a maximum of 17.3 mm. 14.6% (22) of the subjects, of whom 63.6% (14) were in the high risk category, had an unclear EMJ. 29.8% (45) of the patients had an uneven echotexture of the endometrium, of whom 35.6% (16) were high risk. These two factors both have statistical significance. Despite the fact that 21.9% (33) of the research participants had endometrial polyps, only 12.4% (4) of them belonged to the high risk category. Endometrial collection was noted in 8.6%, but it was not a predictor of malignancy according to our study.

15.9% (24) of the patients were projected by the DEERS score method to have normal endometrium, 63.6% (96) to have benign pathologies, 16.6% (25) to have premalignant diseases, and 4% (6) to have malignant diseases. 8.6% (13) of the samples were normal, 76.2 (115) were benign, 10.6% (16) were premalignant, and 4.6% (7) were malignant, according to an analysis of the histopathological reports. The scoring system's sensitivity was 60.8%, specificity was 86.72%, and its positive and negative predictive values, respectively, were each 45.16% and 92.5%. The test's diagnostic accuracy was shown to be 82.78%. When comparing the age of presentation of AUB, according to a study conducted by Shah JV et al [7], most of the symptomatic women were between 41-45 years (53.5%), while Chapagain et al [8] in their study recorded 40-44 years (45.5%), Damle RP et al [9] recorded 73.94% to be in the perimenopausal group (40-49 years) and Pandey D et al [6], had documented 41-50 years (53.9%) as the most common presenting age group. We have also noted the most common age of presentation to

be 41-50 years (55.6%), which shows consistency with the available literature.

In a study by Luca Giannella et al [10]**,** diabetes, obesity and thickened endometrium were the important predictive factors for endometrial hyperplasia or carcinoma, with an odds ratio of 9.7, 7.7 and 1.2 respectively. In the study by Pandey D et al [6], the independent determinants of incidence of disease positivity were menopausal status (OR-2.78), obesity (OR- 2.08), endometrial thickness (OR-3.1), endo-myometrial junction (OR-3.23) and echotexture (OR- 3.9), while in our study, the independent prognostic variables were noted to be diabetes mellitus (OR- 3.93), EMJ (OR- 16.7) and endometrial echotexture (OR- 5.26).

In a study conducted by Stachowicz N et al [11], to assess the risk of endometrial hyperplasia or endometrial cancer with ultrasound based scoring systems, interrupted EMJ was found in 62% of women with endometrial cancer and 51% with atypical hyperplasia, while in our study, indistinct EMJ was noted in 100% of women with endometrial cancer and 43% with atypical hyperplasia.

In a study by Naftalin et al, it was noted asymmetrical thickening and irregular EMJ were individual predictors for diagnosis of endometrial cancers [12]. According to the IETA study by Epstein et al [13] to determine the ultrasound characters for endometrial cancers, it was found that higher grade of endometrioid cancer was associated with thick ET, high tumour volume, less regular margins, non- uniform echogenicity, increased vascularity. Women with endometrioid cancers with ET <15mm when compared to those with ET >15mm were more likely to have regular EMJ (37% versus 14%), uniform echogenicity (50% versus 28%) and less vascularity (20% versus 55%). In our study, the malignancy group had 63.6% indistinct EMJ and 35.6% heterogenous echotexture.

In a study by Henderson et al [14], the incidence of endometrial hyperplasia with adenomyosis and fibroid was 24.3%. In our study, we noted that it was 26.5%, which is comparable, but it could not predict endometrial malignancy in AUB. In a study by Lee et al [15] on the oncogenic potential of endometrial polyps, the prevalence of premalignant or malignant polyps was 5.42% in postmenopausal women compared with 1.7% in reproductive-aged women.

The prevalence of malignancy within polyps in women with AUB was 4.15% compared with 2.16% without AUB. In our study, out of the patients who had polyp on ultrasound, 12.1% had malignant polyps on histopathology, while 87.9% were benign.

Conclusion

- DEERS (Diseases of Endometrium-Evaluation and Risk Scoring) System is a reliable and non-invasive scoring system that can be used in prognostication of abnormal uterine bleeding, especially due to endometrial carcinoma.
- When a cut off score of 15.5 was taken, the scoring system was found to differentiate low risk and high risk groups with a sensitivity of 60.8%, specificity of 86.7%, PPV of 45.16%, NPV of 92.5% and an accuracy of 82.78%.
- According to the study, the DEERS score was able to predict endometrial carcinoma with a specificity and positive predictive value of 100% and 99.3% accuracy.
- The addition of myometrial pathologies like adenomyosis and intramural myomas with submucous extension, did not show significant improvement in efficacy of the scoring system. According to this study, we can conclude that myometrial lesions do not alter the risk of endometrial malignancies.
- Diabetes mellitus, indistinct endo-myometrial junction and heterogenous echotexture of the endometrium were the independent and significant determinants of incidence of disease positivity.
- Most of the endometrial polyps (87.9%) picked up on ultrasonography turned out to be of low risk pathologies. Hence, assigning a lower score for polyps detected on ultrasound could have improved the specificity of the DEERS scoring system.
- Carcinoma of the endometrium has a list of identifiable risk factors, most of which are present in majority of our population. Hence, when they present with abnormal bleeding, a thorough assessment of demographic and ultrasonographic factors, in routine evaluation, can improve the sensitivity of detection of endometrial malignancies.
- Further research should be done on this subject to improve the score, so that it can be put into our daily routine.
- The DEERS scoring system can be used in our out patient department, as part of the initial evaluation itself, to predict the risk of malignant lesions of the endometrium, thus reducing the apprehension of the patients who would otherwise have to wait till the histopathology reports are available.

Strengths and limitations

Strengths

This scoring system uses a non-invasive, cost-effective and reliable method to predict the endometrial pathology. All patients presenting with AUB routinely undergo a trans vaginal ultrasonography (TVS). Hence no additional

investigations are done. This study was done in a tertiary care centre with facilities for ultrasonography as well as histopathology. The ultrasonography of all the study participants were done by the same investigator, hence avoiding inter-observer bias.

Limitations

All hospital settings would not have a TVS and histopathology facility. So the applicability of the scoring system in smaller settings is doubtful. Small modifications in the scoring system would be needed to improve the efficacy. This study was conducted only on a small sample of the society (sample size-151). It has to be conducted on a larger population and in multiple centres by different individuals to assess the diagnostic accuracy, before being put into routine practice. Vaginal probe is always superior to abdominal probe for evaluation of the endometrium. However, virgin females might not consent for the use of vaginal probe, which would decrease the quality of imaging.

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