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Endometrial Thickness as a Predictor of Endometrial Pathology in Perimenopausal Women with Abnormal Uterine Bleeding: A Histopathological Correlation

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Abstract

Background: Abnormal uterine bleeding (AUB) in perimenopausal women may indicate a spectrum of endometrial pathology ranging from atrophic change to carcinoma, and transvaginal sonographic measurement of endometrial thickness (ET) has been proposed as a non-invasive tool to triage women who require histopathological sampling. This study aimed to determine the distribution of ET and histopathological diagnoses among perimenopausal women with AUB and to evaluate the diagnostic performance of ET cut-off values in predicting endometrial pathology. ***Materials & Methods:*** This cross-sectional study was conducted in the Department of Radiology and Imaging, Sylhet MAG Osmani Medical College Hospital, Bangladesh, in collaboration with the Departments of Obstetrics and Gynaecology and Pathology, from July 2021 to June 2023. Ninety-seven perimenopausal women aged 39 years and above presenting with AUB underwent transvaginal sonography followed by histopathological evaluation of endometrial samples. ET was correlated with histopathological findings using the chi-square test. ***Results:*** The mean age was 43.04±2.54 years; menorrhagia was the commonest symptom (51.5%). The overall mean ET was 7.98±3.32 mm, ranging from 5.83±1.06 mm in atrophic endometrium to 12.15±2.36 mm in endometrial polyps. ET was significantly associated with histopathological diagnosis (χ^2=21.74, p<0.001). An ET cut-off of >4.9 mm gave 100% sensitivity and negative predictive value but 24.0% specificity; >7.9 mm gave the best balance (66.0% sensitivity, 76.0% specificity, 71.1% accuracy); >11.9 mm gave 100% specificity and positive predictive value but 29.8% sensitivity. ***Conclusion:*** Endometrial thickness correlates significantly with histopathological diagnosis in perimenopausal women with AUB. No single cut-off simultaneously optimises both rule-in and rule-out performance; a graded diagnostic approach combining ET with clinical judgement is recommended before proceeding to invasive sampling.

Keywords: Endometrial thickness; Abnormal uterine bleeding; Perimenopause; Transvaginal sonography; Histopathology; Endometrial carcinoma.

INTRODUCTION

Abnormal uterine bleeding (AUB) in perimenopausal women deserves careful evaluation because bleeding at this life stage may signal an underlying structural or premalignant endometrial process rather than a purely functional disturbance; postmenopausal bleeding alone carries an estimated 9% pooled risk of underlying endometrial cancer [1]. Endometrial carcinoma remains the most common gynaecological malignancy worldwide, with global cancer statistics for 2020 reporting more than 417,000 new cases [2], and the Global Burden of Disease Study estimating approximately 382,000 incident cases and nearly 90,000 deaths in 2018 [3]; projections through 2050 anticipate a rising burden across ageing populations, particularly in low- and middle-income regions [4]. Because AUB frequently precedes the diagnosis of endometrial pathology, perimenopausal bleeding cannot be dismissed as a benign nuisance and warrants systematic diagnostic assessment.

The perimenopausal transition is defined by internationally accepted staging criteria that describe irregular cycle length and hormonal fluctuation as

physiological hallmarks of this stage [5], and population surveys indicate that the age at which South Asian women enter this transition, and the associated symptom burden, differs from that reported in Western populations [6]. Heavy menstrual bleeding imposes a considerable burden in low- and middle-income countries: a multinational study found that nearly half of women screened met criteria for heavy menstrual bleeding, with wide variation by setting [7], and a subsequent scoping review confirmed that access to appropriate diagnostic and therapeutic services for this condition remains limited in resource-constrained health systems [8]. To standardise description of the underlying causes of AUB, the International Federation of Gynecology and Obstetrics introduced the PALM-COEIN classification, distinguishing structural from non-structural aetiologies, which has since become the reference framework for clinical and research communication [9].

Within Bangladesh, a hospital-based study using transvaginal sonography (TVS) reported that a substantial proportion of perimenopausal women with abnormal uterine bleeding harboured abnormal endometrial histology, most often hyperplasia [10], while a community-based survey from Kushtia has characterised the broader menopausal symptom burden experienced by Bangladeshi women in this age group [11]. Elsewhere in South Asia, hospital series from Pakistan and Nepal have documented that benign functional and structural lesions dominate the histopathological spectrum of AUB, with malignancy remaining comparatively uncommon [12,13].

TVS-measured endometrial thickness (ET) has been proposed as a rapid, non-invasive triage tool that can help identify women who require further invasive sampling, since a sufficiently thin endometrium carries a low likelihood of significant pathology, and comparative diagnostic studies have shown that specific ET cut-offs can achieve high sensitivity for detecting disease, although the specificity of any single threshold varies considerably between reported series [14]. The two-tier classification of endometrial hyperplasia [15] and the recognised clinical significance of endometrial polyps as a common structural cause of AUB [16] further underscore the need for histopathological confirmation whenever ET measurement or clinical findings raise suspicion of underlying pathology.

Despite this body of evidence, data correlating endometrial thickness with histopathological diagnosis specifically among perimenopausal Bangladeshi women remain limited. The present study was therefore undertaken to determine the distribution of endometrial thickness values and histopathological diagnoses among perimenopausal women presenting with abnormal uterine bleeding, and to evaluate the diagnostic performance of endometrial thickness cut-off values in predicting endometrial pathology in this population.

MATERIALS AND METHODS

This cross-sectional study was carried out in the Department of Radiology and Imaging, Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh, in collaboration with the Departments of Obstetrics and Gynaecology and Pathology over a two-year period from July 2021 to June 2023. Perimenopausal women aged 39 years and above presenting with abnormal uterine bleeding and clinically suspected endometrial pathology were considered for inclusion. Patients with bleeding originating from vaginal causes, blood dyscrasias, a history of anticoagulant therapy, hormone replacement therapy, tamoxifen use, or vaginal obstruction were excluded. Using a convenient sampling technique, 102 eligible women were initially enrolled. Five cases were subsequently excluded because histopathological reports were unavailable, leaving 97 women for final analysis.

After obtaining informed written consent, demographic, reproductive, and clinical data were collected using a structured case record form. All participants underwent transvaginal sonography using a Phillips Affinity 30 ultrasound machine equipped with a 7.5–10 MHz transvaginal probe. Examinations were performed with the urinary bladder emptied. Endometrial thickness was measured at its maximum double-layer thickness in the sagittal plane, and additional sonographic features were recorded. Histopathological diagnosis obtained from endometrial sampling or hysterectomy specimens was considered the reference standard. Endometrial thickness measurements were subsequently correlated with histopathological findings to evaluate their usefulness in predicting endometrial pathology.

Data analysis was performed using SPSS version 26. Continuous variables were summarized as mean ± standard deviation, whereas categorical variables were expressed as frequencies and percentages. The association between endometrial thickness and histopathological findings was assessed using the chi-square test. A p-value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the Ethical Review Committee of Sylhet MAG Osmani Medical College, and all participants provided written informed consent before enrollment.

RESULTS

The study included 97 perimenopausal women with abnormal uterine bleeding. The majority of participants (75.3%) were aged 39–45 years, while 24.7% were aged 46–49 years, with a mean age of 43.04 ± 2.54 years. Most women resided in rural areas (61.9%) and were housewives (75.3%). Primary education was the most common educational level (35.1%), followed by illiteracy (26.8%). Irregular menstrual cycles were reported by 53.6% of participants. The mean age at menarche was 12.72 ± 1.29 years, the mean age at first pregnancy was 19.79 ± 1.26 years, and the mean parity was 2.02 ± 0.80. Menorrhagia was the most frequently

reported symptom (51.5%), followed by lower abdominal pain (36.1%), metrorrhagia (21.6%), dyspareunia (20.6%), postmenopausal bleeding (18.6%), and post-coital bleeding (15.5%).

Assessment of endometrial thickness revealed that 43.3% of women had a thickness between 5.0 and 7.9 mm, 29.9% had a thickness between 8.0 and 11.9 mm, 14.4% had a thickness between 12.0 and 15.0 mm, and 12.4% had a thickness of ≤4.9 mm. The overall mean endometrial thickness was 7.98 ± 3.32 mm. Histopathological correlation showed mean endometrial thicknesses of 5.83 ± 1.06 mm in atrophic endometrium, 8.31 ± 3.46 mm in normal endometrium, 8.10 ± 1.25 mm in endometrial carcinoma, 9.66 ± 3.85 mm in endometritis, 9.96 ± 2.69 mm in endometrial hyperplasia, and 12.15 ± 2.36 mm in endometrial polyps.

A statistically significant association was observed between endometrial thickness and histopathological diagnosis ($\chi^2 = 21.74$, $p < 0.001$). Among women with normal or atrophic endometrium, 76.5% had an endometrial thickness of ≤7.9 mm, whereas 67.4% of those with pathological lesions had a thickness greater than 7.9 mm. When endometrial pathology was analyzed as a single composite category (carcinoma, endometritis, hyperplasia, and polyp combined) against normal/atrophic endometrium, diagnostic performance varied across endometrial thickness (ET) cut-offs (Table 5). A threshold of >4.9 mm yielded 100% sensitivity and 100% negative predictive value but poor specificity (24.0%), making it useful for excluding pathology rather than confirming it. At >7.9 mm, sensitivity and specificity were more balanced (66.0% and 76.0%, respectively), corresponding to the highest Youden index and overall accuracy (71.1%) among the thresholds evaluated. A higher threshold of >11.9 mm achieved 100% specificity and 100% positive predictive value, but sensitivity fell to 29.8%. These findings indicate that no single ET cut-off simultaneously optimizes both rule-out and rule-in performance for endometrial pathology as a whole; descriptively, carcinoma tended to be detected at lower ET values while polyps and endometritis were more often identified at higher thresholds (Table 3), although these disease-specific patterns are based on small case numbers (n = 6–10) and should be interpreted with caution.

Table 1: Sociodemographic and clinicopathological profile of study participants (n = 97)

Characteristic		**Frequency (%)**
Age Group	39–45 years	73 (75.3%)
	46–49 years	24 (24.7%)
	Mean age (years)	43.04 ± 2.54
Residence	Rural	60 (61.9%)
	Urban	37 (38.1%)
Occupation	Housewife	73 (75.3%)
	Service holder	15 (15.5%)
	Business	4 (4.1%)
	Others	5 (5.2%)
Educational Qualification	Illiterate	26 (26.8%)
	Primary	34 (35.1%)
	Secondary	17 (17.5%)
	Higher secondary	17 (17.5%)
	Graduate and above	3 (3.1%)
Menstrual Pattern	Regular	45 (46.4%)
	Irregular	52 (53.6%)
Mean age at menarche (years)		12.72 ± 1.29
Mean age at 1st pregnancy (years)		19.79 ± 1.26
Mean number of children		2.02 ± 0.80
Presenting Complaints	Menorrhagia	50 (51.5%)
	Metrorrhagia	21 (21.6%)
	Postmenopausal bleeding	18 (18.6%)
	Post-coital bleeding	15 (15.5%)
	Lower abdominal pain	35 (36.1%)
	Dyspareunia	20 (20.6%)

Table 2: Frequency distribution of endometrial thickness categories in the study population (n = 97)

Endometrial Thickness Category	**Frequency (n)**	**Percentage (%)**	**Mean ET (mm) ± SD**
≤4.9 mm	12	12.4	4.21 ± 0.54
5.0–7.9 mm	42	43.3	6.48 ± 0.81
8.0–11.9 mm	29	29.9	9.55 ± 1.12
12.0–15.0 mm	14	14.4	13.21 ± 0.89
Overall (n = 97)	**97**	**100.0**	**7.98 ± 3.32**

Table 3: Distribution of endometrial thickness categories across histopathological diagnoses (n = 97)

	Endometrial Thickness				
Histopathological Diagnosis	**≤4.9 mm**	**5–7.9 mm**	**8–11.9 mm**	**12–15 mm**	**Mean ET (mm) ± SD**
Atrophic endometrium	4 (33.3%)	8 (66.7%)	0	0	5.83 ± 1.06
Normal endometrium	8 (21.1%)	18 (47.4%)	12 (31.6%)	0	8.31 ± 3.46
Endometrial carcinoma	0	4 (66.7%)	2 (33.3%)	0	8.10 ± 1.25
Endometritis	0	2 (22.2%)	3 (33.3%)	4 (44.4%)	9.66 ± 3.85
Endometrial hyperplasia	0	6 (27.3%)	10 (45.5%)	6 (27.3%)	9.96 ± 2.69
Endometrial polyp	0	4 (40.0%)	2 (20.0%)	4 (40.0%)	12.15 ± 2.36

Table 4: Association between endometrial thickness and histopathological findings (n = 97)

Pathological Diagnosis	**ET ≤7.9 mm n (%)**	**ET >7.9 mm n (%)**	**χ^2 value**	**p-value**
Normal / Atrophic endometrium	39 (76.5%)	12 (23.5%)	—	—
Pathological (all diagnoses)	15 (32.6%)	31 (67.4%)	21.74	<0.001*
* Statistically significant ($p < 0.05$); χ^2 test applied.				

Table 5: Diagnostic performance of endometrial thickness (ET) cut-off values for detection of any endometrial pathology (n = 97)

ET Cut-off	**Sensitivity (%)**	**Specificity (%)**	**PPV (%)**	**NPV (%)**	**LR+**	**LR−**	**Accuracy (%)**
>4.9 mm	100.0	24.0	55.3	100.0	1.32	0.00	60.8
>7.9 mm	66.0	76.0	72.1	70.4	2.75	0.45	71.1
>11.9 mm	29.8	100.0	100.0	60.2	N/A	0.70	66.0
Highlighted row = optimal cut-off (highest Youden Index). Pathology = carcinoma, endometritis, hyperplasia, and polyp combined; reference category = normal/atrophic endometrium. PPV = positive predictive value; NPV = negative predictive value; LR = likelihood ratio; LR+ not estimable at >11.9 mm due to 100% specificity.							

DISCUSSION

In the present study, the mean age of participants was 43.04±2.54 years, with 75.3% aged between 39 and 45 years. A study in India by Sahu *et al.,* found a mean age of 44 years among women presenting with abnormal uterine bleeding, most of whom were premenopausal or perimenopausal [17]. This finding is similar, which may be explained by both studies restricting enrolment to women approaching the menopausal transition using comparable age-based inclusion criteria, so the age structure of the two populations was expected to converge irrespective of setting.

In this study, menorrhagia was the most frequent presenting symptom, reported by 51.5% of women. A study in Bangladesh by Nargis *et al.,* found menorrhagia in 52.6% of perimenopausal women with abnormal uterine bleeding [18]. This finding is similar, which may be explained by shared genetic, dietary, and healthcare-seeking patterns within the same national population, producing a comparable symptom profile despite the two studies being conducted in different cities.

Mean endometrial thickness was lowest in atrophic endometrium (5.83±1.06 mm) and highest in endometrial polyps (12.15±2.36 mm), with an overall study mean of 7.98±3.32 mm. A study in Sweden by Granberg *et al.,* found a mean thickness of 3.1±1.7 mm in atrophic endometrium compared with 18.4±8.2 mm in endometrial carcinoma [19]. This finding is different for both categories, which may be explained by the exclusively postmenopausal composition of the Swedish sample: long-standing oestrogen deprivation produces a thinner atrophic lining than in perimenopausal women with residual ovarian activity, while later presentation there allowed more advanced, bulkier tumours to develop before diagnosis, whereas the present study's perimenopausal carcinomas were detected at an earlier, thinner stage.

In the present study, mean endometrial thickness in polyps was 12.15±2.36 mm. A study in Egypt using three-dimensional endometrial volume measurement found 10.1 mm in polyp-bearing endometrium versus 9.9 mm in polyp-free endometrium [20]. This finding is broadly similar, which may be explained by the focal nature of polyps, where two-dimensional double-layer measurement is confounded by adjacent non-polypoid endometrium, narrowing the numerical gap between groups in both studies.

In our study, an endometrial thickness cut-off of >4.9 mm yielded 100% sensitivity and 100% negative predictive value but only 24.0% specificity. A study in India by Nirupama *et al.,* found that a considerably higher threshold of 10.5 mm gave 89.5% sensitivity and 86.3% specificity in a directly comparable perimenopausal study population [21]. This finding is different, which may be explained by the smaller proportion of neoplastic and hyperplastic histology in the present study relative to that Indian study, so fewer high-thickness pathological cases were available to shift the statistically optimal cut-off upward, and a lower

threshold instead maximised sensitivity at the expense of specificity.

Here, a higher threshold of >11.9 mm achieved 100% specificity and 100% positive predictive value, though sensitivity fell to 29.8%. Reference evidence summarised in a widely cited postmenopausal sonography review reports that thicknesses of 4 mm or less carry a negative predictive value exceeding 99% for endometrial cancer [22]. This finding is consistent in principle with the present study's low-threshold result of 100% negative predictive value at >4.9 mm, which may be explained by the same inverse relationship between cut-off height and sensitivity that governs receiver-operating-characteristic behaviour across endometrial thickness studies generally, regardless of population.

Endometrial thickness was significantly associated with histopathological diagnosis (χ^2=21.74, p<0.001). A study in India by Mishra *et al.,* similarly reported a significant correlation between endometrial thickness and histopathology in a large retrospective series, in which endometrial polyps formed the most frequent histological pattern [23]. This finding is similar, which may be explained by a broadly shared histopathological spectrum of AUB across South Asian settings, where benign structural lesions such as polyps and hyperplasia outnumber malignancy in perimenopausal women.

These findings carry practical diagnostic implications. Diagnostic hysteroscopy achieves greater accuracy than blind dilatation and curettage for detecting focal intrauterine lesions [24,33], and chronic endometritis is characteristically associated with AUB, supporting the intermediate thickness values observed among endometritis cases here [25]. Hyperplasia incidence data [26] and a national audit of hyperplasia management [27] both show that thickness measurement alone cannot reliably distinguish hyperplasia subtypes, reinforcing the need for histopathological confirmation, a pattern also reflected in European TVS series reporting intermediate sensitivity and specificity [28] and in the anaemia burden linked to heavy menstrual bleeding [29]. Consistent with the age-related pattern of AUB incidence reported in a large tertiary-care series [30] and with polyp-focused South Asian series describing similar age and prevalence patterns [31,32], no single endometrial thickness cut-off in the present study simultaneously optimised both rule-out and rule-in performance for endometrial pathology as a whole.

Study Limitations

This study has certain limitations. Some histopathological subgroups, including endometrial carcinoma and endometritis, contained small case numbers (n=6-10), so the disease-specific thickness values reported for these categories should be interpreted with caution rather than generalised broadly. The cross-sectional, single-centre design may limit generalisability to other populations and healthcare settings. Diagnosis relied on endometrial sampling rather than hysterectomy specimens in most cases, which may not fully capture focal lesions such as small polyps. Participants were enrolled using a convenient rather than a random sampling technique, which may introduce selection bias. Larger, multicentre studies with random sampling and longer follow-up are needed to validate these endometrial thickness cut-off values before they are adopted into routine clinical triage protocols.

CONCLUSION

Endometrial thickness measured by transvaginal sonography correlates significantly with histopathological diagnosis among perimenopausal women with abnormal uterine bleeding. A very low endometrial thickness (≤4.9 mm) reliably excludes significant pathology, while a markedly increased thickness (>11.9 mm) strongly supports its presence; however, no single cut-off value simultaneously optimises both rule-out and rule-in performance across the full spectrum of endometrial pathology. These findings support the use of endometrial thickness as a valuable first-line, non-invasive triage tool in resource-limited settings such as Bangladesh, while emphasising that histopathological confirmation remains essential for definitive diagnosis, particularly at intermediate thickness values.

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