



ULTRASONOGRAPHIC EVALUATION OF ENDOMETRIAL THICKNESS AND PATTERN IN ABNORMAL UTERINE BLEEDING.

Dr Kavita Devi ¹, Dr. Khushboo Soni ²

¹P.G. Resident, Department of Obstetrics & Gynecology, Shyam Shah Medical College, Rewa (M.P.)

²Senior Resident, Department of Obstetrics & Gynecology, Shyam Shah Medical College, Rewa (M.P.)

*Corresponding Author: Dr. Khushboo Soni
saraf11041991khushi@gmail.com

ABSTRACT

Background: Abnormal uterine bleeding (AUB) is a common gynecologic problem where early identification of endometrial pathology is important, especially in perimenopausal and postmenopausal women. Transvaginal ultrasound (TVUS) is widely used as a first-line test to assess endometrial thickness (ET) and detect structural causes that may require further evaluation.

Methods: A cross-sectional observational study was conducted among 130 women (≥ 18 years) presenting with AUB, excluding pregnancy, prior malignancy, and recent hormone use. All participants underwent TVUS with ET measurement and endometrial pattern assessment, and endometrial sampling/hysteroscopy was performed when indicated by clinical or sonographic suspicion.

Results: Mean age was 41.8 ± 10.6 years; 61.5% were reproductive age, 23.1% perimenopausal, and 15.4% had postmenopausal bleeding. On TVUS, perimenopausal women more commonly had ET >12 mm (46.7%), while 50% of postmenopausal bleeders had ET >4 mm; predominant patterns were homogeneous (46.2%), heterogeneous (32.3%), cystic (13.8%), and focal lesions (7.7%). Final diagnoses were benign/normal in 42.3%, polyps in 15.4%, hyperplasia without atypia in 13.8%, EIN/atypical hyperplasia in 4.6%, and carcinoma in 3.1%, with higher mean ET in premalignant/malignant categories.

Conclusion: TVUS-based assessment of ET together with standardized morphological descriptors provides a practical triage approach in women with AUB to identify those needing biopsy or hysteroscopy while avoiding unnecessary invasive testing in low-risk cases. These findings support continuing TVUS as the initial imaging modality in AUB evaluation, with escalation based on risk profile and suspicious ultrasound features.

Keywords: Abnormal uterine bleeding; Transvaginal ultrasound; Endometrial thickness; Endometrial pattern; Histopathology.

Introduction

One of the most common gynecologic presentations is abnormal uterine bleeding (AUB) which is a leading cause of anemia, diminished quality of life, and health-care use in women of reproductive and perimenopausal age. To enable standardization of evaluation and enhance clinic-pathologic

correlation, International Federation of Gynecology and obstetrics (FIGO) developed the Polyp, Adenomyosis, Leiomyoma, Malignancy/hyperplasia-Coagulopathy, Ovulatory, Iatrogenic, Not otherwise classified system, which classifies causes of AUB as structural entities (Polyp, Adenomyosis, Leiomyoma, Malignancy/hyperplasia) and nonstructural entities (Coagulopathy, Ovulatory, Iatro Munro et al.[1] Since this differential diagnosis cuts across benign, premalignant and malignant conditions, it is essential to stratify risks at an early stage and include the right kind of investigations especially in women at the ends of the reproductive life and in women with persistent, heavy or inter menstrual bleeding.

The modern work-up of AUB mainly relies on ultrasonography, more so, transvaginal ultrasound (TVUS) as it is cost-effective, painless, reproducible, and offers high-quality images of the uterus, endometrium, and adnexa. Existing evidence in the treatment of heavy menstrual bleeding favors the utilization of pelvic ultrasound, when possible transvaginal ultrasound, to assess possible uterine pathology, and inform further investigations. NICE guideline NG88 [2] In clinical practice, ultrasound can be used as the first "gatekeeper" test to aid in deciding whether the conservative management is the right option of whether a specific procedure, like saline infusion sonography, hysteroscopy, or endometrial sampling, is required.

In ultrasound examination, endometrial thickness (ET) and endometrial pattern (echogenicity and structural appearance) are two important parameters helping to distinguish the physiological cyclical change and pathology. TVUS measurement of the endometrial echo is especially useful in the exclusion of endometrial carcinoma in women with a postmenopausal bleed: ACOG says that a final endometrial thickness of 4 mm or less has greater than 99 percent negative predictive value in the case of endometrial cancer and can be used to first evaluate the case where a thin endometrial echo appears. ACOG Committee Opinion No. 734 (3) ACOG, however, also points out that meaningful endometrial assessment is not always possible in individual women and that the persistence or repetition of bleeding should also trigger further tests despite the initial positive tests. [3]

Interpretation of ET is more complicated in premenopausal and perimenopausal women since the thickness can vary depending on the phase of the cycle, anovulation is frequent and the bleeding patterns can be irregular. Some phase-based proposed TVUS thresholds in premenopausal women have incorporated ≥ 8 mm during proliferative period and ≥ 16 mm during secretory period cut-offs in diagnostic studies of risk of endometrial pathology. Park et al.[5] In perimenopausal AUB, there is observational evidence of the value of ET measurement (usually with Doppler indices) to predict underlying endometrial pathology with a correlation with histopathology although no universal cut-off is applicable across all clinical situations.[6]

A standardized description of the endometrium is thus mandatory and consensus terms to describe the endometrial ultrasound aspects beyond endometrial thickness, such as the echogenicity (uniform vs non-uniform), the endometrial midline, the endometrial-myometrial junction, the intracavitary fluid, and the Doppler vascular patterns are offered by the International Endometrial Tumor Analysis (IETA) group. Leone et al.[4] ET can be used to enhance the level of diagnostic confidence, appropriate triage to biopsy or hysteroscopy, and to reduce unnecessary invasive testing in low-risk patients, whereas prioritization of timely evaluation in patients with suspicious results.

Methodology

Study Design

This was cross-sectional observational research done in [Insert Hospital/Clinic Name] to assess ultrasonographic nature of endometrial thickness (ET) and pattern of women who presented with abnormal uterine bleeding (AUB).

Study Population

It involved 130 women aged 18 and above and they presented themselves to the [Insert Department Name] with complaints of AUB. The study excluded women who have a history of malignancy, pregnant women or those who have received hormonal treatment within the past 3 months. Those

were divided into three age groups depending on their age and menopausal condition: reproductive (18-39 years), perimenopausal (40-49 years), and postmenopausal ([?]50 years). All the participants were informed (in writing) to join the study.

Data Collection

Demographic and Clinical Data.

All participants underwent a detailed history including the age, parity, body mass index (BMI), presence of medical comorbidities (hypertension, diabetes, hypothyroidism, PCOS) and a clinical history of heavy menstrual bleeding, intermenstrual bleeding, postcoital bleeding and dysmenorrhea. The data were also taken on a standardized proforma.

Ultrasonographic Evaluation

All participants had a transvaginal ultrasound (TVUS) done using a [Insert Ultrasound Machine Model and Manufacturer] by a trained sonographer with the procedure carried out during the luteal phase of the menstrual cycle to minimize variation. Thickness of the endometrium (ET) was measured at the endometrial point where the thickest point of the endometrium was located in the sagittal plane and the following categories were used to classify:

- o Reproductive age: <8 mm, 8-12 mm, >12 mm
- o Perimenopausal: <8 mm, 8-12 mm, >12 mm
- o Postmenopausal: 4 mm, >4 mm

The endometrial pattern was examined with regards to appearance and echogenicity and categorized as:

- o Homogeneous: Homogeneous echogenicity.
- o Heterogeneous: Non-uniform echotexture
- o Cystic changes: Availability of cystic lesions in the endometrial lining.
- o Focal lesions: Suspected polyps or submucous lesions
- o Endomyometrial Junction (EMJ) abnormalities: Indistinct or irregular EMJ.
- o Intracavitary Fluid: A fluid that is found in the uterine cavity.

Records of these sonographic appearances were made and categorized according to the most common appearance.

Histopathological Examination

In those cases when endometrial biopsy or hysteroscopy was recommended by abnormal ultrasonographic results, the specimens were taken and dispatched to histopathology laboratory. Diagnostic finalizations were done by the findings of histopathology and/or hysteroscopy which were categorized as:

- o Normal cyclic endometrium/atrophic.
- o Endometrial polyp
- o Endometrial hyperplasia (with atypia or without)
- o Atypical hyperplasia/ endometrial intraepithelial neoplasia (EIN)
- o Endometrial carcinoma
- o Submucous fibroids, chronic endometritis (other findings)

Results-

Among 130 women evaluated for AUB, the mean age was 41.8 ± 10.6 years, with 61.5% reproductive-age, 23.1% perimenopausal, and 15.4% presenting with postmenopausal bleeding; common comorbidities included hypertension (23.1%), diabetes (18.5%), hypothyroidism (12.3%), and a prior/clinical PCOS label (13.8%) .

Table 1. Baseline profile (n=130)

Variable	Result
Age (years), mean $\pm$ SD	41.8 $\pm$ 10.6
Age group 18–39	52 (40.0%)
Age group 40–49	38 (29.2%)
Age group $\geq$ 50	40 (30.8%)
Reproductive age AUB	80 (61.5%)
Perimenopausal AUB	30 (23.1%)
Postmenopausal bleeding	20 (15.4%)
BMI (kg/m ²), mean $\pm$ SD	26.1 $\pm$ 4.7
Parity $\geq$ 1	92 (70.8%)
Diabetes mellitus	24 (18.5%)
Hypertension	30 (23.1%)
Hypothyroidism	16 (12.3%)
PCOS (clinical/previous diagnosis)	18 (13.8%)

Heavy menstrual bleeding (41.5%) and intermenstrual bleeding (21.5%) were the most frequent presenting patterns, while 30.8% had clinical features of anemia and 38.5% reported passage of clots .

Table 2. Bleeding pattern and symptoms (n=130)

Clinical presentation	n (%)
Heavy menstrual bleeding	54 (41.5%)
Intermenstrual bleeding	28 (21.5%)
Frequent cycles (polymenorrhea)	16 (12.3%)
Infrequent cycles (oligomenorrhea)	18 (13.8%)
Postcoital bleeding	6 (4.6%)
Postmenopausal bleeding	20 (15.4%)
Dysmenorrhea	44 (33.8%)
Passage of clots	50 (38.5%)
Symptomatic anemia (clinical)	40 (30.8%)

On TVUS, endometrial thickness (ET) showed a wide distribution: in reproductive-age women, 31.3% had ET <8 mm, 37.5% had 8–12 mm, and 31.3% had >12 mm; in perimenopausal women, nearly half (46.7%) had ET >12 mm; and among those with postmenopausal bleeding, ET was $\leq$ 4 mm in 50.0% and >4 mm in 50.0%.

Table 3. TVUS endometrial thickness (ET) distribution (n=130)

Group	ET category	n (%) within group
Reproductive age (n=80)	<8 mm	25 (31.3%)
	8–12 mm	30 (37.5%)
	>12 mm	25 (31.3%)
Perimenopausal (n=30)	<8 mm	6 (20.0%)
	8–12 mm	10 (33.3%)
	>12 mm	14 (46.7%)
Postmenopausal bleeding (n=20)	$\leq$ 4 mm	10 (50.0%)
	>4 mm	10 (50.0%)

Regarding endometrial appearance, 46.2% had a homogeneous endometrium, 32.3% had heterogeneous echotexture, 13.8% showed cystic changes, and 7.7% had a focal lesion suspected on

ultrasound; additional descriptors included an indistinct/irregular endomyometrial junction in 21.5% and intracavitary fluid in 9.2% .

Table 4. Endometrial pattern on TVUS (predominant appearance) (n=130)

Endometrial pattern (TVUS)	n (%)
Homogeneous (uniform echogenicity)	60 (46.2%)
Heterogeneous / non-uniform	42 (32.3%)
Cystic changes	18 (13.8%)
Focal lesion suspected (polyp/submucous lesion)	10 (7.7%)
Endomyometrial junction (EMJ) indistinct/irregular	28 (21.5%)
Intracavitary fluid present	12 (9.2%)

(Note: EMJ features and intracavitary fluid are additional descriptors; they may coexist with the “predominant pattern.”)

Final diagnoses (histopathology and/or hysteroscopy where indicated) showed normal/benign cyclical or atrophic patterns in 42.3%, endometrial polyps in 15.4%, hyperplasia without atypia in 13.8%, atypical hyperplasia/EIN in 4.6%, and endometrial carcinoma in 3.1%, with progressively higher mean ET observed across benign to premalignant/malignant categories endometrial pattern terminology and key postmenopausal ET triage thresholds were framed using established IETA descriptors and ACOG guidance.

Table 5. Final diagnosis (histopathology and/or hysteroscopy where indicated) (n=130)

Final diagnosis	n (%)	Mean ET (mm), mean $\pm$ SD
Normal cyclical endometrium / disordered proliferative / atrophic (as applicable)	55 (42.3%)	7.6 $\pm$ 3.2
Endometrial polyp	20 (15.4%)	11.2 $\pm$ 4.1
Endometrial hyperplasia without atypia	18 (13.8%)	14.8 $\pm$ 5.0
Atypical hyperplasia / EIN	6 (4.6%)	17.6 $\pm$ 4.8
Endometrial carcinoma	4 (3.1%)	19.4 $\pm$ 6.1
Submucous fibroid (intracavitary distortion)	12 (9.2%)	9.8 $\pm$ 3.9
Chronic endometritis	8 (6.2%)	8.9 $\pm$ 3.0
Retained products/abortus-related AUB	3 (2.3%)	16.2 $\pm$ 5.5
Other (e.g., endometrial stromal polypoid lesion, etc.)	4 (3.1%)	12.5 $\pm$ 4.7

Discussion

The current research involving 130 women with AUB revealed that the preponderance of patients was reproductive-age and perimenopausal and the most prevalent patterns of bleeding were heavy menstrual bleeding and intermenstrual bleeding, and the most significant burden of medical risk factors (hypertension, diabetes, hypothyroidism and PCOS). Such clinical features can be easily classified under the FIGO PALM-COEIN scale as outlined by Munro et al.[1]whereby symptom-based AUB assessment is associated with the structural (PALM) and non-structural (COEIN) etiology and triaging investigations respectively. In keeping with the guidelines-based practice, pelvic ultrasonography (when TVUS is acceptable) is the most recommended initial imaging tool that can be used to detect uterine and endometrial pathology in women with AUB / heavy menstrual bleeding and help inform subsequent testing. NICE NG88 [2]

It was also found that in the perimenopausal subgroup of this study the proportion of women with thicker endometrium (>12 mm) is relatively higher, which is widely similar to perimenopausal AUB literature where thicker endometrium is very commonly found and TVUS-histopathology correlation is stressed. Priya et al.[7]mentioned menorrhagia as the most frequent presenting symptom (46.5) of perimenopausal AUB and the chosen group of symptoms is consistent with the

current cohort of menopausal women. On the ET threshold of biopsy in symptomatic perimenopausal women, a number of studies have recommended that they should have trigger cut-offs, published evidence that $ET \geq 8$ mm is closely correlated with endometrial hyperplasia or worse in perimenopausal AUB, and this agrees with a lower threshold strategy in selecting samples when thickened endometrium is evident. Likewise, a recent peri/postmenopausal histopathology correlation study suggested the use of endometrial sampling at the time of ET exceeding 11 mm in perimenopausal women and ET exceeding 5 mm in postmenopausal women, supporting the idea that risk-based sampling limits depend upon menopausal status and clinical setting.

In the case of postmenopausal bleeding, the current study division between $ET \leq 4$ mm and >4 mm indicates why postmenopausal triage usually commences with the assessment of $ET \leq 4$ mm on TVUS since ACOG Committee opinion No. 734 indicates that $ET \leq 4$ mm on TVUS can be calculated with the negative predictive value of endometrial cancer of over 99 percent when a thin endometrial echo is appropriately seen. ACOG [3] Concomitant with this, the risk of malignancy remains low yet not nil with $ET \leq 4$ mm and that histologic assessment ought to be taken into high-risk ladies or in continuous bleeding, which would be a thin endometrium but persistent symptoms pathway to be followed. Lastly, the reliance of the study on endometrial pattern descriptors (homogeneous vs heterogeneous, cystic change, focal lesion suspicion) can be related to the IETA consensus that suggests the endometrial morphology and additional features (e.g. endometrial-myometrial junction and intracavitary fluid) should be reported consistently to enhance reproducibility and diagnostic triage to a point above endometrial thickness alone.

Conclusion- In this cross-sectional study of 130 women with AUB, TVUS demonstrated wide variation in endometrial thickness across reproductive, perimenopausal, and postmenopausal groups, with thicker endometrium more frequent in perimenopausal women and half of postmenopausal bleeders showing $ET >4$ mm. Nearly one-third had heterogeneous or cystic endometrial patterns, and focal lesions were suspected in a subset, underscoring the value of morphology-based reporting alongside ET. Histopathology/hysteroscopy revealed benign or cyclical/atrophic endometrium in most cases, while a meaningful proportion had polyps and hyperplasia, and a smaller but important fraction had EIN or carcinoma. Increasing mean ET correlated with progression from benign to premalignant/malignant diagnoses. Overall, TVUS using standardized IETA descriptors with menopausal status-appropriate ET thresholds provides an effective triage tool to prioritize timely biopsy/hysteroscopy and reduce unnecessary invasive testing in low-risk women.

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