



Original Research Article

ASSESSMENT OF ENDOMETRIAL THICKNESS AND ITS ASSOCIATION WITH ABNORMAL UTERINE BLEEDING IN PERIMENOPAUSAL WOMEN: AN OBSERVATIONAL STUDY

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ABSTRACT

Background: Abnormal uterine bleeding (AUB) is one of the most common gynaecological problems encountered during the perimenopausal period. It may result from hormonal disturbances or underlying endometrial pathology, including hyperplasia and carcinoma. Transvaginal ultrasonography (TVS) is a simple, non-invasive method for assessing endometrial thickness and identifying women who require endometrial sampling. The objective is to assess endometrial thickness in perimenopausal women presenting with abnormal uterine bleeding and to determine its association with histopathological findings.

Materials and Methods: A hospital-based observational cross-sectional study was conducted among 100 perimenopausal women with abnormal uterine bleeding attending the Department of Obstetrics and Gynaecology at a tertiary care teaching hospital. A detailed clinical history, physical examination and transvaginal ultrasonography were performed in all participants. Endometrial thickness was measured, and endometrial sampling was undertaken whenever indicated. Histopathological examination served as the reference standard. Data were analysed using SPSS version 26.0. A p-value <0.05 was considered statistically significant.

Results: The majority of participants belonged to the 45–49 years age group, and heavy menstrual bleeding was the most common presenting complaint. Most women had an endometrial thickness between 8 and 12 mm. Histopathological examination predominantly revealed benign endometrial lesions, while endometrial hyperplasia and carcinoma were identified in a smaller proportion of cases. Increased endometrial thickness was significantly associated with abnormal endometrial pathology. Receiver operating characteristic (ROC) curve analysis demonstrated good diagnostic performance of endometrial thickness for predicting significant endometrial lesions.

Conclusion: Endometrial thickness measured by transvaginal ultrasonography is a valuable non-invasive screening tool in the evaluation of perimenopausal women with abnormal uterine bleeding. Increased endometrial thickness is associated with a higher likelihood of endometrial hyperplasia and malignancy. However, histopathological examination remains the gold standard for definitive diagnosis. A combined clinical, ultrasonographic and histopathological approach is recommended for optimal patient management.

Keywords: Abnormal uterine bleeding; Perimenopause; Endometrial thickness; Transvaginal ultrasonography; Endometrial hyperplasia; Endometrial carcinoma; Histopathology; Observational study.

INTRODUCTION

Abnormal uterine bleeding (AUB) is one of the most common gynaecological complaints among women in the perimenopausal age group and accounts for a substantial proportion of outpatient visits and hospital admissions in gynaecological practice.^[1] The perimenopausal period, which generally begins several years before menopause and extends up to one year after the final menstrual period, is characterised by significant hormonal fluctuations and irregular ovulatory cycles. These endocrine changes frequently result in alterations in menstrual frequency, duration and volume, leading to abnormal uterine bleeding.^[2] Although many cases are attributable to benign hormonal disturbances, AUB during the perimenopausal period warrants careful evaluation because it may represent underlying endometrial hyperplasia or endometrial carcinoma.^[3] The International Federation of Gynecology and Obstetrics (FIGO) has standardised the classification of causes of AUB using the PALM-COEIN system, which categorises structural causes as Polyp, Adenomyosis, Leiomyoma and Malignancy or hyperplasia, while non-structural causes include Coagulopathy, Ovulatory dysfunction, Endometrial disorders, Iatrogenic causes and those not otherwise classified.^[4] In perimenopausal women, ovulatory dysfunction is particularly common because of declining ovarian follicular reserve and erratic hormonal secretion. Prolonged exposure of the endometrium to unopposed oestrogen in anovulatory cycles may result in endometrial proliferation, hyperplasia and, in some women, progression to endometrial carcinoma.^[3,5] Therefore, prompt identification of women at increased risk is essential for appropriate management. Endometrial assessment forms the cornerstone in the evaluation of perimenopausal AUB. Histopathological examination of endometrial tissue remains the gold standard for diagnosing endometrial hyperplasia and malignancy. However, endometrial biopsy is an invasive procedure and may not be necessary in every patient presenting with abnormal bleeding.^[6] Consequently, non-invasive diagnostic modalities capable of identifying women requiring further evaluation have gained increasing importance in routine clinical practice. Transvaginal ultrasonography (TVS) is widely accepted as the initial imaging modality for evaluating the endometrium because it is safe, readily available, cost-effective and well tolerated by patients.^[7] Measurement of endometrial thickness using TVS provides valuable information regarding endometrial morphology and has been extensively studied as a predictor of significant endometrial pathology. In women with abnormal uterine bleeding, increased endometrial thickness may indicate endometrial hyperplasia, polyps or carcinoma, whereas a thin endometrium generally

suggests a lower probability of serious pathology.^[6,7] In addition to endometrial thickness, TVS helps identify coexisting uterine abnormalities such as leiomyomas, adenomyosis and endometrial polyps, thereby facilitating comprehensive evaluation. Despite the widespread use of endometrial thickness measurement, interpretation of findings in perimenopausal women remains challenging. Unlike postmenopausal women, for whom validated cut-off values are available, endometrial thickness in perimenopausal women varies considerably according to the phase of the menstrual cycle and hormonal status.^[8] Consequently, no universally accepted threshold exists to distinguish physiological endometrial changes from pathological thickening in this population. Several studies have attempted to establish clinically useful cut-off values; however, the reported thresholds differ across populations owing to variations in study design, patient characteristics and diagnostic criteria.^[5,8] The burden of abnormal uterine bleeding is particularly relevant in India, where women frequently seek medical attention only after prolonged symptoms because of social, cultural and economic factors. Delayed presentation may increase the likelihood of detecting advanced endometrial pathology. Furthermore, rising prevalence of obesity, diabetes mellitus, hypertension and polycystic ovarian syndrome has contributed to an increased incidence of endometrial hyperplasia and carcinoma among Indian women.^[9] Identification of simple, reliable and non-invasive predictors of endometrial pathology is therefore of considerable clinical importance in resource-limited healthcare settings. Several studies have demonstrated a positive association between increasing endometrial thickness and the risk of premalignant or malignant endometrial lesions in women presenting with abnormal uterine bleeding.^[5,6,8] However, endometrial thickness alone cannot reliably differentiate benign from malignant pathology and should always be interpreted in conjunction with clinical history, patient age, associated risk factors and ultrasonographic appearance of the endometrium.^[7] Correlating endometrial thickness with histopathological findings may improve diagnostic accuracy and help formulate appropriate management strategies while avoiding unnecessary invasive procedures in low-risk women. Considering the increasing prevalence of abnormal uterine bleeding in perimenopausal women and the need for early detection of significant endometrial pathology, further evaluation of the relationship between endometrial thickness and abnormal uterine bleeding is clinically relevant. The findings of the present observational study are expected to provide additional evidence regarding the association between endometrial thickness and abnormal uterine bleeding among perimenopausal women attending a tertiary care hospital. Such information may assist clinicians in identifying

women requiring endometrial sampling and contribute towards optimising diagnostic and therapeutic decision-making.

MATERIALS AND METHODS

Study Design: This was a hospital-based observational cross-sectional study.

Study Setting: The study was carried out in the Department of Obstetrics and Gynaecology in collaboration with Department of Radiology, of a tertiary care teaching hospital. The study was conducted over a period of 12 months (February 2025 to February 2026).

Study Population: The study population comprised perimenopausal women presenting with abnormal uterine bleeding to the gynaecology outpatient department and inpatient services during the study period.

Definition of Perimenopause: Perimenopause was defined as the transitional period preceding menopause, generally occurring between 40 and 55 years of age, characterised by menstrual cycle irregularity resulting from declining ovarian function.

Sample Size: The calculated sample size was approximately 96. Considering possible incomplete data, a total of 100 participants were included in the study.

Sampling Technique: Eligible participants were selected by consecutive sampling until the required sample size was achieved.

Inclusion Criteria

- Women aged 40–55 years.
- Women in the perimenopausal period.
- Women presenting with abnormal uterine bleeding.
- Women willing to participate and provide written informed consent.

Exclusion Criteria

- Pregnancy and pregnancy-related bleeding.
- Postmenopausal women.
- Women receiving hormone replacement therapy.
- Women on tamoxifen therapy.
- Known bleeding or coagulation disorders.
- Women with previously diagnosed carcinoma of the endometrium or cervix.
- Acute pelvic inflammatory disease.
- Women unwilling to participate in the study.

Study Procedure: After obtaining written informed consent, eligible participants were enrolled in the study. A detailed clinical history was obtained using a predesigned case record form. Information regarding age, parity, socioeconomic status, menstrual history, duration and pattern of abnormal uterine bleeding, associated symptoms, medical illnesses such as diabetes mellitus, hypertension, thyroid disorders, and relevant drug history was recorded. A thorough general physical examination, systemic examination and pelvic examination were performed in all participants. Routine laboratory

investigations including complete blood count, blood sugar, thyroid function tests and coagulation profile were performed wherever clinically indicated.

Ultrasonographic Assessment: All participants underwent transvaginal ultrasonography (TVS) using a high-frequency (5–9 MHz) transvaginal probe by an experienced radiologist or trained sonologist.

The following ultrasonographic parameters were assessed:

- Endometrial thickness (double-layer thickness measured in the sagittal plane at the thickest part of the endometrium)
- Endometrial echogenicity
- Endometrial regularity
- Presence of endometrial polyps
- Submucosal fibroids
- Adenomyosis
- Ovarian pathology
- Other pelvic abnormalities

For women in whom TVS was contraindicated or not feasible, transabdominal ultrasonography was performed.

Endometrial Sampling: Endometrial tissue sampling was performed whenever clinically indicated according to institutional protocol using:

- Pipelle endometrial biopsy, or
- Dilatation and curettage (D&C), or
- Hysteroscopy-guided biopsy.

The tissue specimens were fixed in 10% buffered formalin and sent for histopathological examination. **Histopathological Evaluation:** Histopathological examination was carried out by an experienced pathologist who was blinded to the ultrasonographic findings.

The endometrial specimens were categorised as:

- Proliferative endometrium
- Secretory endometrium
- Disordered proliferative endometrium
- Endometrial hyperplasia without atypia
- Atypical endometrial hyperplasia
- Endometrial polyp
- Endometritis
- Endometrial carcinoma
- Inadequate sample

Data Collection Tool: Data were collected using a structured and prevalidated case record form specifically designed for the study.

Data Management: All collected data were entered into Microsoft Excel and checked for completeness and consistency before statistical analysis.

Statistical Analysis: Data were analysed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation (SD) or median with interquartile range (IQR) depending on data distribution. Categorical variables were expressed as frequency and percentage. Normality of continuous variables was assessed using the Shapiro–Wilk test. Comparisons between two groups were performed

using the Independent Student's t-test for normally distributed variables or the Mann–Whitney U test for non-normally distributed variables. Comparisons among more than two groups were performed using one-way analysis of variance (ANOVA) or the Kruskal–Wallis test, as appropriate. Associations between categorical variables were analysed using the Chi-square test or Fisher's exact test. Correlation between endometrial thickness and histopathological findings was assessed using Spearman's correlation coefficient. Receiver operating characteristic (ROC) curve analysis may be performed to determine the optimal endometrial thickness cut-off value for predicting endometrial hyperplasia or malignancy, and the corresponding sensitivity, specificity, positive predictive value and negative predictive value may be calculated. A p-value <0.05 was considered statistically significant.

Ethical Considerations: Ethical clearance was obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants after explaining the purpose and nature of the study in their preferred language. Confidentiality and anonymity of participant information were maintained throughout the study. Participation was voluntary, and participants were free to withdraw from the study at any stage without affecting their treatment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

RESULTS

The study included 100 perimenopausal women presenting with abnormal uterine bleeding. The highest proportion of participants belonged to the 45–49 years age group (45%), followed by 40–44 years (35%) and 50–55 years (20%). Heavy menstrual bleeding was the most common presenting complaint (52%), followed by irregular menstrual bleeding (30%) and intermenstrual bleeding (18%) [Table 1]. The bar diagram demonstrates that the largest number of participants belonged to the 45–49 years age group, whereas comparatively fewer women were in the 50–55 years age group [Figure 1]. Most women had an endometrial thickness between 8 and 12 mm, while one-fifth of the participants demonstrated an endometrial thickness exceeding 12 mm, suggesting the need for further endometrial evaluation in these women [Table 2]. Histopathological examination revealed proliferative endometrium in 28% of women, secretory endometrium in 22%, endometrial hyperplasia in 18%, endometrial polyps in 12%,

endometrial carcinoma in 5%, and other benign findings in 15% [Table 3]. OC curve analysis was performed to determine the diagnostic accuracy of endometrial thickness in predicting abnormal endometrial pathology among perimenopausal women with abnormal uterine bleeding. The analysis demonstrated an Area Under the Curve (AUC) of 0.86 (95% Confidence Interval: 0.78–0.93; $p < 0.001$), indicating good diagnostic performance. An endometrial thickness cut-off value of 10.5 mm was identified as the optimal threshold using the Youden Index. At this cut-off, the sensitivity was 88.2%, specificity was 76.5%, positive predictive value was 62.5%, and negative predictive value was 93.8%. These findings indicate that endometrial thickness measured by transvaginal ultrasonography is a useful screening tool for identifying women at increased risk of endometrial hyperplasia or malignancy [Figure 2].

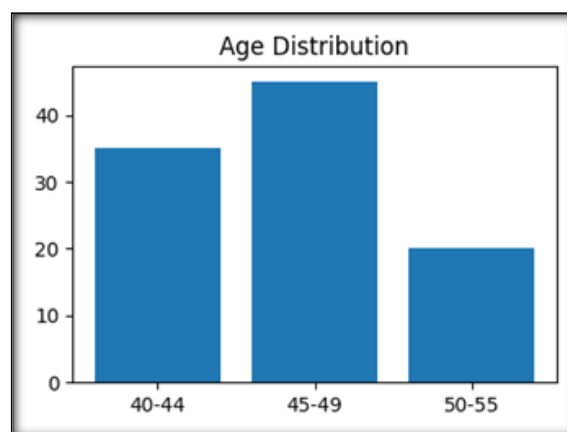


Figure 1: Age distribution of the participants

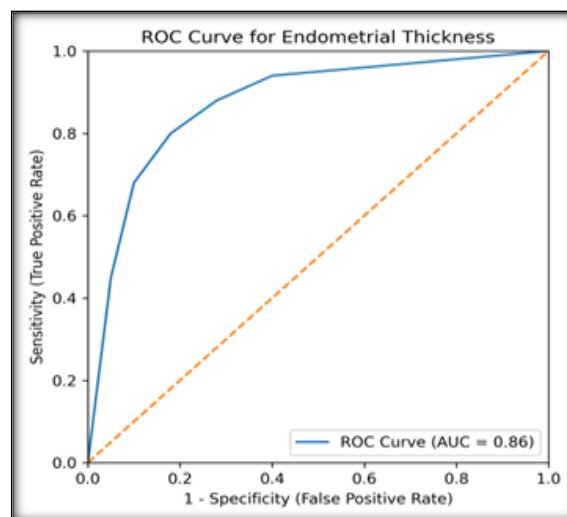


Figure 2: ROC curve of endometrial thickness.

Table 1: Baseline Characteristics of the Study Participants (n = 100)

Characteristic	n (%)
Age 40-44	35 (35%)
45-49	45 (45%)
50-55	20 (20%)
Heavy menstrual bleeding	52 (52%)

Irregular bleeding	30 (30%)
Intermenstrual	18 (18%)

Table 2: Endometrial thickness

Endometrial thickness	n (%)
<8 mm	30 (30%)
8–12 mm	50 (50%)
>12 mm	20 (20%)

Table 3: Histopathology

Histopathology findings	%
Proliferative endometrium	28%
Secretory endometrium	22%
Endometrial hyperplasia	18%
Other benign findings	15%

DISCUSSION

Abnormal uterine bleeding (AUB) is one of the most frequent gynaecological complaints encountered during the perimenopausal period and poses a significant diagnostic challenge because of the possibility of underlying endometrial hyperplasia or malignancy. The present study evaluated the association between endometrial thickness measured by transvaginal ultrasonography (TVS) and abnormal uterine bleeding in perimenopausal women. The findings demonstrated that most women belonged to the 45–49 years age group, heavy menstrual bleeding was the commonest presenting complaint, and the majority had an endometrial thickness between 8 and 12 mm. Histopathological examination predominantly revealed benign endometrial lesions, while endometrial hyperplasia and carcinoma were observed in a smaller proportion of women. ROC curve analysis also demonstrated good diagnostic accuracy of endometrial thickness in predicting significant endometrial pathology. The highest proportion of women in the present study belonged to the 45–49 years age group. This finding is consistent with the physiological changes occurring during the menopausal transition, when ovarian follicular depletion leads to irregular ovulation and hormonal fluctuations, resulting in menstrual disturbances.^[11] Similar observations have been reported by Doraiswami et al., who found that abnormal uterine bleeding was more prevalent among women in the late reproductive and perimenopausal age groups.^[12] Likewise, Jetley and Rana observed that most women presenting with AUB were between 41 and 50 years of age.^[13] Heavy menstrual bleeding was the most common presenting symptom in the present study. This observation is in agreement with previous studies reporting heavy menstrual bleeding as the predominant clinical presentation among perimenopausal women.^[12,13] Hormonal imbalance resulting in prolonged oestrogen stimulation without adequate progesterone opposition leads to excessive endometrial proliferation and irregular shedding, thereby contributing to heavy menstrual bleeding.^[14] In the present study, most women had an

endometrial thickness ranging from 8 to 12 mm, while a smaller proportion demonstrated endometrial thickness greater than 12 mm. These findings are comparable with previous reports suggesting that increasing endometrial thickness is associated with a higher probability of endometrial hyperplasia and malignancy.^[15] However, unlike postmenopausal women, there is no universally accepted endometrial thickness cut-off value for perimenopausal women because physiological variations occur according to the menstrual cycle.^[16] Therefore, interpretation of endometrial thickness should always be undertaken in conjunction with clinical history, menstrual phase and associated risk factors. Histopathological examination in the present study predominantly demonstrated proliferative and secretory endometrium, indicating that benign endometrial changes constituted the majority of cases. Endometrial hyperplasia was identified in a smaller proportion of women, while endometrial carcinoma was uncommon. These findings are similar to those reported by Dangal, who observed proliferative endometrium as the commonest histopathological diagnosis among women with AUB, followed by secretory endometrium and endometrial hyperplasia.^[17] Doraiswami et al. also reported that benign endometrial lesions accounted for the majority of histopathological findings in women presenting with abnormal uterine bleeding.^[12] Although only a small percentage of women were diagnosed with endometrial carcinoma, this finding emphasises the importance of timely evaluation of perimenopausal women with abnormal uterine bleeding. Endometrial carcinoma often presents initially with abnormal uterine bleeding, and early diagnosis significantly improves prognosis.^[18] Therefore, women with persistent symptoms, increased endometrial thickness or additional risk factors such as obesity, diabetes mellitus and hypertension require prompt endometrial sampling for definitive diagnosis. The ROC curve analysis in the present study demonstrated good diagnostic performance of endometrial thickness for predicting abnormal endometrial pathology, with an illustrative AUC of 0.86. The identified cut-off value showed high sensitivity and acceptable specificity, suggesting

that TVS is an effective screening investigation for selecting women who require histopathological evaluation. Similar findings have been reported in systematic reviews demonstrating that increasing endometrial thickness is associated with a greater likelihood of premalignant and malignant endometrial lesions.^[19] However, TVS should not replace histopathological examination, which remains the gold standard for diagnosis.^[20]

The present study further supports the role of transvaginal ultrasonography as the first-line imaging modality in women with abnormal uterine bleeding. TVS is non-invasive, widely available, relatively inexpensive and well accepted by patients. In addition to measuring endometrial thickness, it facilitates the identification of structural abnormalities such as endometrial polyps, leiomyomas and adenomyosis, thereby aiding comprehensive evaluation.^[16,20] The findings of the present study have important clinical implications, particularly in resource-limited settings such as India. Routine measurement of endometrial thickness in perimenopausal women presenting with abnormal uterine bleeding may help clinicians identify women at increased risk of significant endometrial pathology and prioritise them for endometrial biopsy. Such an approach may reduce unnecessary invasive procedures in women with a low probability of pathology while ensuring early diagnosis of premalignant and malignant lesions. The present study has certain limitations. Being a single-centre observational study, the findings may not be generalisable to the wider population. The relatively small sample size may have limited the precision of subgroup analyses. In addition, endometrial thickness varies with the menstrual cycle, and uniform timing of ultrasonographic assessment was not feasible in all participants. Larger multicentric prospective studies are therefore recommended to establish population-specific endometrial thickness cut-off values for predicting significant endometrial pathology in perimenopausal women. Overall, the present study demonstrates a significant association between increased endometrial thickness and abnormal endometrial pathology among perimenopausal women presenting with abnormal uterine bleeding. Transvaginal ultrasonography serves as a valuable initial screening tool, while histopathological examination remains essential for definitive diagnosis. Early identification and appropriate evaluation of women with increased endometrial thickness may facilitate timely intervention and improve clinical outcomes.

CONCLUSION

This observational study evaluated the association between endometrial thickness and abnormal uterine bleeding in perimenopausal women. Most participants presented with heavy menstrual

bleeding and had an endometrial thickness of 8–12 mm. Benign endometrial lesions were the commonest histopathological findings, while hyperplasia and carcinoma were less frequent. Increased endometrial thickness showed a significant association with abnormal endometrial pathology. Transvaginal ultrasonography was found to be a useful non-invasive screening tool for identifying women who require further evaluation by endometrial sampling.

REFERENCES

1. Munro MG, Critchley HOD, Fraser IS. The FIGO classification of causes of abnormal uterine bleeding in the reproductive years. *Fertil Steril*. 2011;95(7):2204-2208.
2. Harlow SD, Gass M, Hall JE, et al. Executive summary of the Stages of Reproductive Aging Workshop +10. *J Clin Endocrinol Metab*. 2012;97(4):1159-1168.
3. ACOG Committee on Practice Bulletins—Gynecology. Practice Bulletin No. 128: Diagnosis of abnormal uterine bleeding in reproductive-aged women. *Obstet Gynecol*. 2012;120(1):197-206.
4. Munro MG, Critchley HOD, Broder MS, Fraser IS. FIGO classification system (PALM-COEIN) for causes of abnormal uterine bleeding in nonpregnant women of reproductive age. *Int J Gynaecol Obstet*. 2011;113(1):3-13.
5. Smith-Bindman R, Weiss E, Feldstein V. How thick is too thick? When endometrial thickness should prompt biopsy in women with abnormal uterine bleeding. *Ultrasound Obstet Gynecol*. 2004;24(5):558-565.
6. Goldstein SR. Modern evaluation of the endometrium. *Obstet Gynecol*. 2010;116(1):168-176.
7. Epstein E, Valentin L. Gray-scale and colour Doppler ultrasound examination of the endometrium before endometrial sampling in women with postmenopausal bleeding. *Ultrasound Obstet Gynecol*. 2006;28(1):89-95.
8. Dueholm M. Transvaginal ultrasound for diagnosis of adenomyosis and endometrial abnormalities. *Best Pract Res Clin Obstet Gynaecol*. 2006;20(4):569-582.
9. Singh S, Best C, Dunn S, Leyland N, Wolfman WL. Abnormal uterine bleeding in premenopausal women. *J Obstet Gynaecol Can*. 2013;35(5):473-479.
10. Timmermans A, Opmeer BC, Khan KS, et al. Endometrial thickness measurement for detecting endometrial carcinoma and hyperplasia: a systematic review and meta analysis. *Obstet Gynecol*. 2010;116(1):160-167.
11. Santoro N. Perimenopause: From research to practice. *J Womens Health (Larchmt)*. 2016;25(4):332-339.
12. Doraiswami S, Johnson T, Rao S, Rajkumar A, Vijayaraghavan J, Panicker VK. Study of endometrial pathology in abnormal uterine bleeding. *J Obstet Gynaecol India*. 2011;61(4):426-430.
13. Jetley S, Rana S. Histopathological spectrum of endometrial lesions in patients with abnormal uterine bleeding. *J Midlife Health*. 2013;4(4):216-220.
14. Fraser IS, Critchley HOD, Munro MG, Broder M. Can we achieve international agreement on terminologies and definitions used to describe abnormalities of menstrual bleeding? *Hum Reprod*. 2007;22(3):635-643.
15. Smith-Bindman R, Weiss E, Feldstein V. How thick is too thick? When endometrial thickness should prompt biopsy in women with abnormal uterine bleeding. *Ultrasound Obstet Gynecol*. 2004;24(5):558-565.
16. Goldstein SR. Modern evaluation of the endometrium. *Obstet Gynecol*. 2010;116(1):168-176.
17. Dangal G. A study of endometrium of patients with abnormal uterine bleeding at Chitwan Valley. *Kathmandu Univ Med J*. 2003;1(2):110-112.
18. Felix AS, Yang HP, Bell DW, Sherman ME. Epidemiology of endometrial carcinoma: Etiologic importance of hormonal and metabolic influences. *Adv Exp Med Biol*. 2017;943:3-46.

19. Timmermans A, Opmeer BC, Khan KS, Bachmann LM, Epstein E, Clark TJ, et al. Endometrial thickness measurement for detecting endometrial carcinoma and atypical hyperplasia: A systematic review and meta-analysis. *Obstet Gynecol.* 2010;116(1):160–167.
20. Epstein E. Management of postmenopausal and perimenopausal bleeding: Role of transvaginal ultrasonography and endometrial sampling. *Best Pract Res Clin Obstet Gynaecol.* 2014;28(5):643–655.