



Color Doppler and Transvaginal Sonography; Accuracy in the Diagnosis of Endometrial Pathologies in Women with Abnormal Uterine Bleeding: A Cross-sectional Study

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ABSTRACT

Introduction: Abnormal uterine bleeding (AUB) can occur at any age in a woman's life, and it is more prevalent in the pre-menopausal age group. Although anovulation is the most prevalent endometrial cause, other major reasons include endometrial hyperplasia, endometrial adenomatous polyps and cancer. For patients of all ages, it is one of the most prevalent presentations in Gynecology OPDs. AUB has a major impact on health-related quality of life, necessitating quick intervention. AUB treatment is difficult without a good diagnosis. As a result, pre-menopausal and post-menopausal women with AUB must have a thorough examination to rule out endometrial cancer.

Aim: To assess the role of transvaginal ultrasound and color Doppler tomography (CDTU) in irregular uterine bleeding and correlate these findings with histological diagnosis.

Methodology: The present study included 92 individuals with abnormal uterine bleeding (AUB), in those TVS, and Color Doppler was used to evaluate the endometrial pathologies. Endometrium, uterine size and any uterine or adnexal disease were evaluated during the TVS. Spiral arteries of the endometrium and uterine arteries were studied for their vascular patterns. The RI and PI of the uterine artery were determined. For PI, a cutoff of 1.83 was used, while for RI, a cutoff of 0.81 was used. The results were then compared to endometrial histology.

Results: According to TVS, (see Table 1) the most common causes of AUB were leiomyoma (15.2%), polyp (12%), PCOS (9.8%), adenomyosis (5.43%) and endometrial development (3.3%). The uterine indicators of RI (0.81) and PI (1.83) of the uterine artery by CDTU revealed 11 patients with probable cancer. For AUB M, the TVS with CDTU specificity and sensitivity was 100 percent and 90.77 percent, respectively. The positive predictive value was 45%, whereas the negative predictive value was 100%.

Conclusion: The use of vascular impedance and color Doppler of the uterine artery and endometrial spiral arteries improves the diagnostic accuracy of TVS for the prediction of endometrial diseases. It makes screening for malignant and premalignant lesions easier.

Key Words: Abnormal Uterine Bleeding, Endometrial Hyperplasia, Color Doppler, Transvaginal-sonography, Uterine artery indices, Carcinoma Endometrium.

INTRODUCTION

Abnormal uterine bleeding (AUB) can occur at any age in a woman's life, and it is more prevalent in the pre-menopausal age group.¹ Although anovulation is the most prevalent endometrial cause, other major reasons include endometrial hyperplasia, endometrial adenomatous polyps and cancer.

For patients of all ages, it is one of the most prevalent presentations in Gynecology OPDs.² AUB has a major impact on health-related quality of life, necessitating quick intervention. AUB treatment is difficult without a good diagnosis. As a result, pre-menopausal and post-menopausal women with AUB must have a thorough examination to rule out endometrial cancer.³

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Even though post-menopausal bleeding (PMB) is a frequent complaint, accounting for up to 69 percent of post-menopausal women admitted to the gynecological outpatient department, only 10-15 percent may develop endometrial carcinoma.⁴ As a result, it's debatable whether the rest of the women should be subjected to invasive endometrial biopsy if their screening indicates no abnormalities. As a result, an effective non-invasive method for predicting endometrial diseases is required. Endometrial Aspiration, Trans Vaginal Ultrasound, Dilatation, Endometrial Biopsy and curettage and office hysteroscopy are the most prevalent investigations.⁵

Trans Vaginal Ultrasound (TVS) has emerged as an essential tool in the investigation of AUB in recent years. TVS gives a high-resolution picture of the pelvic organs and quick assessment of uterine & adnexal diseases and endometrium echogenicity & thickness.⁶ The endometrial interface and the whole cavity may be seen with TVS. Endometrial thickness (ET) assessment by TVS provides a strong negative predictive value, allowing for the avoidance of needless biopsies. According to the study, TVS can prevent 40% of endometrial biopsies.⁷ The gynecologist performing the scan has obvious advantages since they can weigh all relevant information about the patient and place the scan findings in the proper context. In certain circumstances, an accurate scan can help the clinician avoid surgery, while in others, it can help the clinician choose the best surgical approach.⁸

Color Doppler transforms sound waves into distinct colors using a computer. In real-time, these colors depict the pace and direction of blood flow.⁹ Malignant and benign endometrial diseases can be identified using Color Doppler vascularity. A resistive index (RI) of 0.40 to 0.70 has been reported to distinguish benign from malignant endometria accurately, with most authors advocating a 0.40 threshold value.¹⁰ The Pulsatility index (PI) proposed values range from 1.00 to 2.00.¹¹ Power Doppler is a novel technology that is more sensitive to low-velocity blood flow since it is based on the amplitude of the Doppler signal rather than the frequency shift. As a result, it is more useful than traditional Doppler in displaying vascular architecture.⁶ Several studies have demonstrated that the power Doppler vascular pattern can predict endometrial disease in PMB post-menopausal women.^{12,13} The present study evaluated the Color Doppler and Transvaginal Ultrasonography evaluate the endometrial pathologies with a correlation of histological analysis in women bleeding abnormally.

Study design: A cross-sectional study

Place and Duration: Lady Dufferin Karachi from February 2021 year to February 2022

Methodology

The present research study was carried out after informed permission and ethical committee approval. A total of 92

women aged 25 and 55 years with AUB who attended the outpatient clinic were included. Pregnancy, coagulation abnormalities, previously diagnosed malignancy in the genital tract, breast carcinoma, and a history of drug intake such as tamoxifen were all excluded from the study. A thorough history was collected, including irregularities, menstrual patterns, related complaints, obstetric history, medical history, surgical history and family history. All women were then clinically assessed, including general, systemic and gynecological examinations and pertinent blood tests.

In all AUB patients, TVS was conducted. Endometrial thickness, endometrial echogenicity, uterine size, and any uterine or adnexal disease were all examined and reported. The endometrium's blood flow was then mapped using the Power Doppler gate. Spiral arteries of the endometrium and uterine arteries were studied for their vascular patterns. The RI and PI of the uterine artery were determined. On CDTU, the cutoff for PI was 1.83 (≤ 1.83 was deemed premalignant/malignant, and ≥ 1.83 was considered benign), and the cutoff for RI was 0.81 (≤ 0.81 was considered premalignant/malignant, and 0.81 was considered benign). Afterward, all of the patients underwent endometrial aspiration. Histopathological examinations were performed on the samples. Statistical analysis by using SPSS version 22 was performed to evaluate the data. When comparing variables, the Student t-test was utilized. The predictive value of TVS was calculated using cross-tabulations to establish sensitivity, specificity, positive predictive value and negative predictive value. A significant difference is defined as a p-value less than 0.05 in all statistical tests.

RESULTS

The average age of the participants in the study was 36.8 years. Menorrhagia (72.5 %) was the most prevalent presenting complaint, followed by neuropathic hemorrhagic (19.8 %). In our present investigation, the observation on TVS showed 44 (47.8) cases as normal. In contrast, aberrant findings were seen in 48 (52.1 %) cases. The most prevalent observation was leiomyoma, found in 14 (15.2 %) individuals, followed by polyp in 11 (12 %) cases. PCOS was identified in 9 (9.8 %) of the patients, adenomyosis in 5 (5.43%) instances and endometrial development in 3 (3.3%) cases. In comparison, IUCD was present in 6 (6.52) of the individuals.

On Color Power Doppler, the flow pattern of both uterine arteries was used to calculate indices, and the mean value was used for comparison. Both RI and PI were in the suspected AUB M range in seven patients. Three patients had only an aberrant RI in the probable AUB M range, while two had only an abnormal PI. As a result, 12 patients were suspected of having cancer based on either uterine artery indicators, RI or PI. The vascular pattern of spiral arterioles

of the endometrium was normal in 77 (83.6 %) of the cases with no flow, and a single feeding artery suggestive of a polyp was detected in 6 of the cases (6.5 %). 5 (5.4%) had a scattered vessel pattern suggestive of hyperplasia, whereas 2 (2.1%) had a multiple vessel pattern suggestive of malignancy. Only one patient had a rim vessel pattern that looked like a fibroid.

A histopathological sample of endometrial aspiration indicated 56 (62.8%) patients with proliferative endometrium, 24 (26%) patients with secretory endometrium, and 2 (2.2%) cases with atrophic endometrium. Two examples of hyperplasia were observed, one with atypia and the other without. In four (4.3%) cases, endometrial carcinoma was observed. The most prevalent observation was proliferative endometrium.

The results of the TVS were compared to the histology of the endometrium. The PALMCOEIN system was then used to classify them. TVS has 100 percent sensitivity and specificity for adenomyosis (AUB A), Polyp (AUB P) and fibroid (AUB L). The sensitivity was 66.6% for malignancy, and specificity was 100%. The sensitivity was 50% for hyperplasia, and specificity was 100%. For anovulatory bleeding (AUB O), the sensitivity was 16.2%, and specificity was 100%. TVS is the best method for determining the structural reasons for AUB (As shown in Table 2).

When TVS and CDTU were compared to endometrial histology, 4 out of 10 patients with RI in the suspicious range (AUB M) and 5 out of 9 patients with PI in the suspicious range (AUB M) showed hyperplasia/malignancy (As shown in Table 2). Premalignant/malignant patients and benign cases had their mean RI and PI computed. As shown in table No. 3, benign diseases (those with high RI and PI) have a high resistance flow. In contrast, carcinoma endometrium/hyperplasia has a low resistance flow (those with low RI and PI) (As shown in Table 3).

With endometrial aspiration, the diagnostic accuracy of TVS and CDTU was calculated. For AUB M, the TVS with CDTU specificity was 100%, and sensitivity was 90.77%. The positive predictive value was 45%, whereas the negative predictive value was 100%. There was no patient in which TVS with CDTU did not reveal probable malignancy, but histology was substantial, indicating that there was no false-negative case.

Histopathology and the vascular pattern of spiral arterioles in the endometrium were compared. Three cases of hyperplasia had Scattered vessel patterns (scattered vessels were found inside the endometrium), and three cases of carcinoma had many vessel patterns (multiple vessels were found within the endometrium and in the myometrial endometrial interface) out of six cases of AUB M. This link has a p-value of 0.001, indicating that it is statistically significant. (See Table 4)

Table 1: Description of TVS Pathological Findings.

TVS Pathological Findings	Number (%)
Normal	44 (47.8)
Leiomyoma	14 (15.2)
Polyp	11 (12)
PCOs	9 (9.8)
IUCD	6 (6.52)
Adenomyosis	5 (5.43)
Endometrial growth	3 (3.3)

Table 2: Correlation of the diagnosis with TVS

AUB Diagnosis	AUB P	AUB A	AUB L	Malignancy	Hyperplasia	AUB O	AUB E	AUB I
TVS Findings								
Polyp	11							
Adenomyosis		5						
Leiomyoma			14					
PCOS						9		
Endometrial Growth				3				
Endometrial Hyperplasia					1			
IUCD in situ Normal								3
IUCD in situ Abnormal								2
Normal Findings				1	1	41	1	
Total	11	5	14	4	2	50	1	5

Table 3: Describe the association between endometrium histopathology with PI and RI of uterine artery

Variables	Cut off	HPE of Endometrium			
		MALIGNANT		BENIGN	
		Count	%	Count	%
RI of Uterine artery	MALIGNANT (<0.81)	4	40	6	60
	BENIGN (>0.81)	0	0.0	82	100
PI of Uterine artery	MALIGNANT (<1.83)	5	55.6	4	44.4
	BENIGN (>1.83)	1	1.6	81	98.4
RI/PI of Uterine artery	MALIGNANT	5	45.5	6	54.5
	BENIGN		0.0	81	100

Table 4: Describe the association between AUB M and vascular pattern:

Vascular Pattern	Malignancy Histopathology			
		No		Yes
No Flow	77	100%	0	0.00%
Single feeding vessel pattern	6	100%	0	0.00%
Scattered vessel pattern	3	50%	3	50%
Multiple vessel pattern	0	0.00%	3	100%
Rim vessel pattern	1	100%	0	0.00%
Total	86	93.5%	6	6.5%

DISCUSSION

Abnormal uterine bleeding is a prevalent condition among women of reproductive age that can have serious medical ramifications and significantly impact health-related quality of life. In today's practice, sonographic and histological examinations of the endometrium are the cornerstones of diagnosis. Because the blood flow to benign and malignant lesions differs, adding the Color Doppler to TVS may help diagnose intrauterine disorders.¹⁴

The mean age of patients in the present study was 36.8 ± 4.3 years, with the youngest being 25 years old and the oldest being 55 years old. Menorrhagia was the most common presenting symptom in our study, accounting for 72.5 % of cases, followed by neuropathic hemorrhagic 19.8%. Similar observations were noted in a study where menorrhagia was found in 78.6%, followed by neuropathic hemorrhagic in 18.6% of cases. Similar to our findings, a study found that menorrhagia was the most common presenting symptom in 71.83% of the cases, followed by metrorrhagia in 9.5 %.¹⁵

The present study observed the abnormality in 52.1% of instances during Trans Vaginal Sonography. Leiomyoma was found in 15.2% of cases, polyps in 12%, PCOS-like symptoms in 9.8% of cases and adenomyosis in 5.43%. Endometrial growth was seen in 3.3% of the cases. Talukdar et al. (2016) conducted a similar study that observed normal myometrium in 36 (34.95%) cases, fibroid in 46 (44.66%) cases and adenomyosis in 21 (20.39%) cases.¹ Another study showed that out of 70 individuals, 2 (26%) were detected

with myoma, adenomyosis in 6% of cases, endometrial polyp in 8% of cases and endometrial cancer in 4% of cases.¹⁶

CDTU measured uterine artery PI (cutoff value was 1.83) and uterine artery RI (cutoff value was 0.81) in 92 patients. A total of 10.8% of uterine artery RI cases had suspected malignancy/pre-lesion, while 9.7% of uterine artery PI cases had suspected malignancy/pre-lesion. A total of 11.9% of cases showed suspected malignancy/hyperplasia when either of the values was taken as AUB M. From histological diagnosis, 50% of these suspected AUB M cases from uterine artery RI came into the AUB M group. A total of 52.1% of cases fell into the AUB M category, out of which 11.9%.cases are from uterine artery PI, AUB M group. The lower RI and PI values in cases of malignancy/hyperplasia are assumed to be due to neovascularization within and surrounding the tumor tissue distal to the location of uterine artery sampling. In terms of flow metric characteristics, we found that patients with malignancy and hyperplasia had considerably lower mean pulsatility and resistive indices than those with normal endometrium and polyp/fibroid pathology in the current study. A similar study also observed that the mean uterine artery RI and PI were lower in post-menopausal bleeding cases than in control cases. The mean uterine artery RI and PI were lower in malignant causes than those with benign causes.^{17, 18}

The use of color Doppler for the vascular pattern can aid in the diagnosis of structural anomalies that are seen on TVS. Three cases of hyperplasia had dispersed vascular patterns. Three cases of carcinoma had multiple vessel patterns out of six cases of AUB M. This link has a p-value of 0.001, indi-

cating that it is statistically significant. Polyps were found in eleven cases on TVS (7 endometrial and 4 cervical). In 7 of the 11 instances, a single pedicle feeding vessel pattern was identified, resulting in a p-value of 0.001 and a significant connection between single vessel pattern and polyp (AUB P).

In our analysis, 11 of the 92 cases with significant findings on TVS with CD had both RI and PI or RI/PI in the suspected range. Histopathology confirmed malignancy/hyperplasia in five of these instances. For premalignant/malignant transformation of TVS with CDTU, the sensitivity was 90.7%, and specificity was 100%. The sensitivity of uterine artery indices for detecting endometrial carcinoma was 71.43% in a similar study, whereas the specificity was 100%. The NPV was 95.5% and the PPV was 100%.¹⁹

Transvaginal sonography is recommended as a first-line diagnostic technique because it is inexpensive, safe and non-invasive. The current study is highly accurate for diagnosing structural reasons such as polyps, adenomyosis and leiomyoma, with a Sensitivity and Specificity of 100%. On the other hand, endometrial pathology necessitates additional confirmation evidence such as histology. By including Color Doppler into TVS, this flaw is eliminated. Color Doppler Transvaginal Ultrasonography has been a useful adjunct to endometrial pathology and uterine blood flow measurement.

CONCLUSION

Color Doppler of the uterine artery and endometrial spiral arteries with vascular impedance increases the diagnostic accuracy of TVS for the prediction of endometrial diseases and allows screening for malignant and premalignant lesions, according to the findings of our study. In cases of aberrant endometrial thickness, abnormal or inconclusive CDTU, invasive procedures such as endometrial aspiration biopsy should be used to retrieve endometrial tissue to confirm a pre-cancerous lesion endometrial cancer in individuals with high suspicion. As a result, CDTU with TVS is indicated as a screening technique in all AUB patients.

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