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Role of Colour Doppler and Transvaginal Sonography for diagnosis of endometrial pathology in women presenting with Abnormal Uterine Bleeding

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ABSTRACT

Introduction: Transvaginal Sonography has emerged as important modality in investigating AUB, but it cannot diagnose endometrial pathology in absence of histopathology of endometrium. Addition of Color doppler (CDTU) to TVS can help in diagnosis by evaluation of blood flow through vascular patterns and Uterine artery indices.

Objective: To evaluate the role of Trans vaginal Ultrasonography and Colour Doppler (CDTU) in abnormal uterine bleeding and correlating them with histopathological diagnosis.

Methods: TVS and Colour Doppler were performed in 70 patients with AUB. TVS included evaluation of endometrium, size of uterus, any uterine or adnexal pathology. Vascular pattern of Spiral arteries of endometrium, and uterine arteries was analysed. Uterine artery indices (RI and PI) were calculated. 1.83 was taken as cut off for PI and 0.81 was taken as cut off for RI. The results were then compared with histopathology of endometrium.

Results: On TVS, the causes of AUB were Leiomyoma in 17.1%, polyp in 10%, PCOS in 8.5%, Adenomyosis in 5.7%, and Endometrial growth in 2.8%. 11 patients had suspected malignancy by uterine indices of RI (<0.81) and PI (<1.83) of uterine artery by CDTU. Specificity and Sensitivity of TVS with CDTU for AUB M was 100% and 90.77% respectively. Positive predictive value was 45.45% and negative predictive value was 100%.

Conclusion: Colour Doppler of the uterine artery and endometrial spiral arteries with vascular impedence, improves the diagnostic accuracy of TVS for the prediction of endometrial pathologies and facilitates in screening for malignant and premalignant lesions.

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

INTRODUCTION

Abnormal uterine bleeding (AUB) is one of the most common presentations in Gynae OPDs for patients of all age groups. AUB significantly affects health related quality of life, and therefore necessitates immediate attention. The management of AUB is complex without proper diagnosis. After detailed history and examination, further investigations are required for pointing out the cause of AUB. The most commonly done investigations include Trans Vaginal Ultrasound, Endometrial Aspiration, Endometrial Biopsy, Dilatation and curettage and office hysteroscopy.

In recent years, Trans Vaginal Ultrasound has emerged as important modality in investigating AUB. TVS provides high resolution image of pelvic organs, rapid assessment of uterine and adnexal pathologies, measurement of endometrial thickness and echogenicity of endometrium. Addition of Colour doppler (CDTU) to TVS helps in evaluation of blood flow, by looking at vascular patterns and calculation of Uterine artery indices (Resistive index and Pulsatility index).

With this background, the present study was carried out with an aim to evaluate the role of Trans vaginal Ultrasonography and colour doppler in evaluation of abnormal uterine bleeding and correlating them with histopathological diagnosis.

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METHODS

This study was carried out in a Tertiary care Hospital, Kasturba Hospital, New Delhi. 70 patients between 30-60 years of age with AUB attending the outpatient clinic were included after informed consent and due clearance from the ethical committee.

Patients with Pregnancy, Coagulation disorders, previously diagnosed genital tract malignancy, carcinoma breast and history of drug intake like tamoxifen were excluded from the study. A detailed history including menstrual pattern, irregularities, associated complaints, obstetric history, medical history, surgical and family history were taken. All the women were then clinically evaluated – general, systemic and gynaecological examinations with relevant blood investigations were carried out.

TVS was performed in all AUB patients. Endometrial thickness, echogenicity of endometrium, size of uterus, any uterine or adnexal pathology were observed and noted. The Power doppler gate was then activated for blood flow mapping of endometrium. Vascular pattern of Spiral arteries of endometrium, and uterine arteries was analysed. Uterine artery indices (RI and PI) were calculated (Fig2). On CDTU, 1.83 was taken as cut off for PI (≤ 1.83 was considered as malignant/premalignant, and > 1.83 was considered benign) and 0.81 was taken as cut off for RI (≤ 0.81 was considered as malignant/premalignant, and > 0.81 was considered benign).

Finally, Endometrial Aspiration was performed in all the patients. Samples were sent for histopathological examination.

STATISTICAL ANALYSIS

was done on the basis of above-mentioned investigations and reports. Student t test was used for comparing variables. The predictive value of TVS was determined by calculating sensitivity, specificity, positive predictive value and negative predictive values using cross tabulations. For all statistical tests, p-value less than 0.05 is taken to indicate a significant difference.

RESULTS

The mean age of study population was 39.2 years. The most common presenting complaint with which patients presented was found to be menorrhagia (78.6%), followed by *metropathia haemorrhagica* (18.6%).

On TVS, findings were seen in 35 (49.9% cases), out of which, abnormal findings were detected in 32 cases (44.2%). Most common finding was Leiomyoma, in 12(17.1%) cases, followed by polyp in 7(10%) cases. PCOS was seen in 6(8.5%) cases. Adenomyosis in 4(5.7%), Endometrial

growth was seen in 2 (2.8%) cases in our study. 4 patients had IUCD in situ (Fig. 1)

On Colour Power doppler, indices were calculated by flow pattern of both uterine arteries, and their mean value was taken for comparison. 8 patients had both RI and PI in suspected AUB M range. 2 patients had only RI in suspected AUB M range and 1 had abnormal PI alone. Thus, in total 11 patients had suspected malignancy by considering either of the Uterine artery indices, i.e., either RI or PI.

On studying the **vascular pattern** of spiral arterioles of endometrium, it was seen normal in 57(82%) with no flow, Single feeding vessel suggestive of a polyp was seen in 5 (7%). Scattered vessel pattern (Fig. 2) suggestive hyperplasia was seen in 4 (5.7%) and Multiple vessel pattern suggestive of malignancy was seen in 3 (4.3%) (Fig. 3). The rim vessel pattern suggestive of fibroid was observed in only one patient.

Histopathology sample of endometrial aspiration revealed 40 patients having endometrium in proliferative phase (63.2%) and 23 patients with endometrium in secretory phase (26.5%) and 1 case with atrophic endometrium (1.4%). Hyperplasia was seen in 2 cases, one with atypia and one without atypia. Endometrial carcinoma was seen in 3 cases (4.7%). Proliferative endometrium was the most common finding.

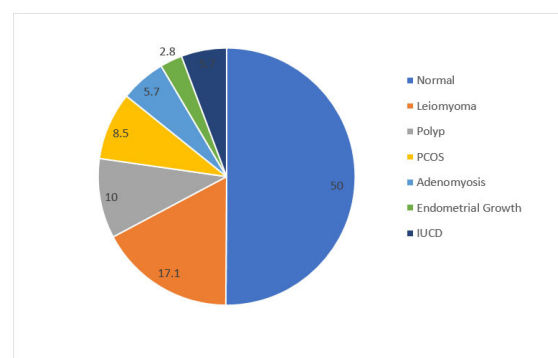


Figure 1: Pathological Findings of TVS.

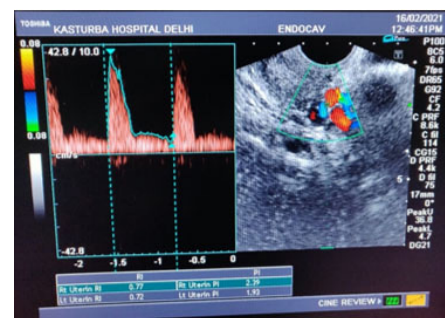


Figure 2: RI and PI being measured from uterine artery. The scattered vessel pattern is also visualised in this picture.



Figure 3: Multiple Vessel pattern being seen in this case of endometrial growth suggestive of Endometrial carcinoma.

Correlation of findings of TVS was done with histopathology of endometrium. They were then classified by PALM-COEIN system. Sensitivity and Specificity of TVS for Polyp (AUB P) is 100% both. Sensitivity and specificity of TVS for adenomyosis (AUB A) is 100% both. Sensitivity and specificity of TVS for fibroid (AUB L) is 100% both. Sensitivity and specificity for malignancy was 66.6% and 100% respectively. Sensitivity and specificity for Hyperplasia was 50% and 100% respectively. Sensitivity and specificity for AUB O was 16.2% and 100% respectively. (Table 1). The structural causes of AUB are best diagnosed by TVS.

On comparing TVS and CDTU with histopathology of endometrium, 5 out of 10 patients with RI in suspicious range (AUB M), and 4 out of 9 patients with PI in AUB M range, had hyperplasia/malignancy (Table 2). The mean RI and mean PI of malignant/premalignant cases and benign cases were calculated. As can be inferred from the table No. 3, that benign pathologies, (associated with high RI and PI) exhibit a high resistance flow while as carcinoma endometrium/hyperplasia shows a low resistance flow (associated with low RI and PI) (Table 3).

Diagnostic accuracy of TVS and CDTU with endometrial aspiration was calculated. Specificity and Sensitivity of TVS with CDTU for AUB M was 100% and 90.77% respectively. Positive predictive value was 45.45% and negative predictive value was 100%. There was no patient, in whom TVS with CDTU was not suggestive of suspected malignancy, but histopathology was significant, i. e. there was no false negative case.

Vascular pattern of spiral arterioles of endometrium was compared with histopathology. Out of 5 cases of AUB M, 2 cases of Hyperplasia had Scattered vessel pattern (Scanty vessels were identified scattered within the endometrium) and 3 cases of carcinoma had Multiple vessel pattern (Multiple vessels were found within the endometrium and in the myometrial endometrial interface). The p-value for this association is <0.001 and therefore this association was significant. (Table 4)

Table 1: Correlation of TVS with Final Diagnosis:

AUB Diagnosis	AUB P	AUB A	AUB L	Malignancy	Hyperplasia	AUB O	AUB E	AUB I
TVS Findings								
Polyp	7	-	-	-	-	-	-	-
Adenomyosis	-	4	-	-	-	-	-	-
Leiomyoma	-	-	12	-	-	-	-	-
PCOS	-	-	-	-	-	6	-	-
IUCD in situ Normal	-	-	-	-	-	-	-	2
IUCD in situ abnormal	-	-	-	-	-	-	-	2
Endometrial Growth	-	-	-	2	-	-	-	-
Endometrial Hyperplasia	-	-	-	-	1	-	-	-
Normal findings	-	-	-	1	1	31	1	-
Total	7	4	12	3	2	37	1	4

Table 2: Association of Pi and Ri of Uterine Artery with Histopathology of Endometrium:

Variables	Cut off	HPE of Endometrium			
		MALIGNANT		BENIGN	
		Count	Row N %	Count	Row N %
RI of Uterine Artery	MALIGNANT (<0.81)	5	50.0%	5	50.0%
	BENIGN (>0.81)	0	0.0%	60	100.0%
PI of Uterine Artery	MALIGNANT (<1.83)	4	44.4%	5	55.6%
	BENIGN (>1.83)	1	1.6%	60	98.4%
RI/PI of Uterine Artery	MALIGNANT	5	45.5%	6	54.5%
	BENIGN	0	0.0%	59	100.0%

Table 3: Association of Mean Ri and Pi with Histopathology:

	HPE				UNPAIRED T TEST p-value
	MALIGNANT		BENIGN		
	MEAN	SD	MEAN	SD	
MEAN RI	0.71	0.08	1.48	0.46	<0.001
MEAN PI	1.55	0.37	2.84	0.77	<0.001

Table 4: Association of Vascular Pattern with AUB M:

Vascular Pattern	MALIGNANCY HISTOPATHOLOGY			
	YES		NO	
	Count	Row N %	Count	Row N %
No Flow	0	0.0%	57	100.0%
Single feeding vessel pattern	0	0.0%	5	100.0%
Scattered Vessel Pattern	2	50.0%	2	50.0%
Multiple vessel Pattern	3	100.0%	0	0.0%
Rim vessel Pattern	0	0.0%	1	100.0%
Total	5	7.1%	65	92.9%

Chisquare = 54.92, df=4, p-value<0.001

DISCUSSION

Abnormal Uterine Bleeding is a common problem among women in the reproductive age, which can have serious medical consequences and has substantial effect on health-related quality of life. Sonographic and histological assessment of the endometrium are the corner stone of diagnosis in the current practice. Adding the Color Doppler to TVS may be helpful to diagnose intrauterine pathologies, as the blood flow to benign and malignant lesions is different.

In our present study, the mean age of the patients was 39.2 ± 6.6 with lowest age being 30 years and highest being 60 years.

Most common presenting symptom encountered in our study population was menorrhagia, found in 78.6% followed by *metropathia hemorrhagica* in 13 cases (18.6%). Fatima Al'in

a study of 284 AUB patients, also encountered menorrhagia as most common presenting symptom, in 71.83 % followed by Metrorrhagia in 9.5% cases, which was comparable to our study.

In our study, while doing Trans Vaginal Sonography, abnormality was detected in 44.2% cases. These included Leiomyoma in 17.1% cases, polyp in 10% cases, PCOS like features in 8.5% cases and Adenomyosis in 5.7% cases. In 2.8% cases, endometrial growth was visualized. Similar study was done by Jaiswar et al.² in 70 women with AUB, found Myoma in 26% cases, Endometrial Polyp in 8% cases, Adenomyosis in 6% cases, Endometrial carcinoma in 4% cases. On comparing 37 detected cases as abnormal on TVS, hysteroscopy confirmed 32 cases (86%).

In our study of 70 cases, the final diagnosis of patients was distributed as AUB O (52.9%), AUB L (17.1%), AUB P

(10%), AUB A (5.7%), and AUB M (7.1%), AUB I (5.7%) and AUB E (1.4%).

We correlated the final diagnosis of patients with TVS findings.

We analyzed that the Sensitivity and Specificity of TVS for Structural causes namely Polyps, Adenomyosis and Leiomyoma were 100%. Therefore, TVS is a very good modality for diagnosis of structural causes of AUB like fibroid, polyp and adenomyosis.

In AUB O, only 6 cases were identified via TVS, making the sensitivity of the procedure very low (16.6%). Thus, for endometrial causes like anovulatory bleeding (AUB O), TVS is not the investigation of choice and histopathology is must for such cases.

For malignancy, sensitivity and specificity were 66% and 100% respectively, and for Hyperplasia, sensitivity and Specificity were 50% and 100% respectively. Therefore, it was concluded that TVS alone is not a good procedure for diagnosis of AUB M cases.

Niknejadi Met al.³ carried out a cross sectional study in 719 women, using TVS and Hysteroscopy. In their study, they found that the sensitivity and specificity of TVS for uterine abnormality was 79% and 82% respectively. For Polyps, the sensitivity and specificity were 88.3 and 81.6% respectively, and for fibroids, the sensitivity and specificity were 89.2 and 92.5% respectively. Thus, it was concluded that TVS is a valuable adjunctive for diagnosis of intrauterine structural anomalies such as Polyps, Submucosal fibroids and septum.

In our study of 70 cases, normal endometrium, on histopathology of biopsy sample, was seen in 92.5 % cases, which included endometrium in Proliferative phase in 64.6%, endometrium in secretory phase in 26.5% and atrophic endometrium in 1.4% cases. Hyperplasia with atypia was seen in 1.4% cases and Hyperplasia without atypia was also seen in 1.4% cases. Endometrial carcinoma was seen in 4.7% cases. Pratibha Singh⁴ in retrospective observational study of 115 women with AUB, found that Proliferative and Secretory endometrium constituted most of the case. Endometrial Hyperplasia constituted 6.08% cases and Malignancy was diagnosed in 2.6% cases.

It can be seen from our study and the above-mentioned study, that histopathology is normal (secretory/proliferative) in maximum cases. Therefore, Histopathology should be done only in those cases of AUB, where there is high suspicion of malignancy.

In our study of 70 cases, uterine artery PI, taking 1.83 as cut off, and uterine artery RI, taking 0.81 as cut off, were measured, by CDTU. By uterine artery RI, 14.3% cases had suspected malignancy/pre lesion and by uterine artery PI 12.9% cases had suspected malignancy/pre lesion. By considering either of values as AUB M, 15.7% cases had suspected ma-

lignancy/hyperplasia. Out of these Suspected AUB M cases from uterine artery RI, 50% patients fell into AUB M category from histopathological diagnosis. Out of these 12.9% AUB M case from uterine artery PI, 44.4% cases fell into AUB M category.

The mean RI for AUB M was 0.71 ± 0.08 and mean PI for AUB M was 1.55 ± 0.37 .

The decrease in RI and PI values in case of malignancy/hyperplasia is thought to be a reflection of the neovascularisation occurring within and around the tumour tissue distal to the point of sampling of Uterine artery. With respect to flowmetric parameters, in present study, we found mean pulsatility and resistive indices of patients with malignancy and hyperplasia to be significantly lower as compared to those with normal endometrium and polyp/fibroid pathology. Similar trend was observed by Alcazar et al.⁵, who in his study of 45 cases, found significantly lower RI in tumour cases as compared to other benign cases.

Colour doppler for vascular pattern plays a very important role for helping in diagnosis of structural abnormalities that are visualised on TVS. Out of 5 cases of AUB M, 2 cases of Hyperplasia had scattered vessel pattern and 3 cases of carcinoma had Multiple vessel pattern. The p value for this association is <0.001 and therefore this association is significant. Out of 5 cases of AUB M, 2 cases of Hyperplasia had Scattered vessel pattern and 3 cases of carcinoma had Multiple vessel pattern. The p value for this association is <0.001 and therefore this association was also significant. On TVS, Polyps were diagnosed in 7 cases (5 endometrial and 2 cervical). Out of these 7 cases, single pedicle feeding vessel pattern was diagnosed in 5 cases, making the p value < 0.001 and the association of single vessel pattern with polyp (AUB P) as significant.

In our study, 11 cases out of 70 had significant finding on TVS with CD, with both RI and PI or RI/PI in suspected range. 5 of these cases were confirmed to have malignancy/Hyperplasia by histopathology. Specificity and Sensitivity of TVS with CDTU for malignant/premalignant change is 100 and 90.77%.

Similar results were seen in study of Chaudhary et al⁶, for detecting Endometrial carcinoma, the sensitivity of Uterine artery indices was found to be 71.43%, while specificity was 100%. PPV was 100% and NPV was 95.5%.

Trans Vaginal Sonography is recommended as a first line diagnostic tool as it is relatively inexpensive, safe and non-invasive. It is highly accurate for diagnosis of Structural causes namely Polyps, Adenomyosis and Leiomyoma with the Sensitivity and Specificity of 100% in the present study. However, evaluation of endometrial pathology requires other confirmatory evidence like histopathology. This draw-back is overcome by adding Colour Doppler to TVS. Colour Dop-

pler Trans vaginal Ultrasonography is found to be a complimentary procedure for assessment of endometrial pathology and uterine blood flow.

CONCLUSION

It was concluded from our study that, Colour Doppler of the uterine artery and endometrial spiral arteries with vascular impedance, improves the diagnostic accuracy of TVS for the prediction of endometrial pathologies and facilitates in screening for malignant and premalignant lesions. The invasive methods like endometrial aspiration Biopsy should be done in cases with abnormal endometrial thickness, abnormal or inconclusive CDTU, in order to obtain endometrial tissue to confirm pre-cancerous lesion or endometrial cancer in patients with high suspicion.

Thus, it is recommended that CDTU with TVS should be used as screening modality in all AUB patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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Author Contribution

All authors contributed equally towards the data collection, data analysis & compilations.

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