Correlation of Uterine Blood Flow (UBL), Endometrial Thickness and Histopathology via Transvaginal Ultrasonoqraphy (TVS)

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Abstract : *Endometrial thickness and uterine Resistance Index of 140 women with abnormal uterine bleeding were studied by transvaginal ultrasonography and colour Doppler flow imaging. The results were reported and compared to histopathology obtained from dilatation and curettage. We found no abnormality if endometrium is less than 6 mm while the thickness more than 14 mm indicates endometrial histopathology. (Sensitivity, specificity and positive predictive value are 100, 46.6 and 27.9% respectively). This will reduce unnecessary diagnostic curettage to a level of 38.5%. Although thick endometrium may be a sign of pathological process, no morphological feature that are unique to a malignant disease has been identified. However intratumoral neovascularization with low impedance to blood flow was found and displayed by colour Doppler ultrasound in all the cancer cases. Both the endometrial thickness and intra tumoral blood flow were considered as a potential marker for endometrial carcinoma and may be useful for cancer detection in the future. (Thai J Obstet Gynaecol 1995;7:9-14.)*

Key Words : Uterine Blood Flow, endometrial thickness, histopathology, Trans-Vaginal Ultrasound (TVS)

With the introduction of transvaginal ultrasonography, thorough examination of the uterus can be easily accomplished.[1] Granberg et al.[2] reported that if endometrial thickness was less than 9 mm, no endometrial cancer would be diagnosed at curettage. Nasri et al.[3] agreed with Granberg's that an endometrial thickness of 5 mm was an appropriate cut off level for conservative management of patients with postmenopausal bleeding or in screening for endometrial cancer. Doppler flow imaging

may prove to be an important compliment to transvaginal sonography, improving its specificity as a screening test. Endometrial cancer shares with most malignant tumors the phenomenon of neovascularization. If there is increasing blood flow to endometrial tumors, the uterine arterial resistance should be lowered while benign endometrial proliferation should have normal uterine vascular flow pattern. The purpose of this study is to evaluate the correlation between endometrial thickness and Doppler waveform of the uterine circulation and the histopathological examination of the curetted specimens.

Materials and Methods

One hundred and forty women with abnormal uterine bleeding who had dilatation and curettage, between June 1, to March 31, 1993 were scanned with transvaginal ultrasound the day before the operation. The ultrasound examinations were performed by using the Aloka 680 SSD model. The vaginal probe was 5 MHz setting with high pass filter 100 Hz. The patient were divided into 3 groups;

Forty patients were under 40 years of age, 67 patients had perimenopausal bleeding with age range 40-50 years, and 38 patients had postmenopausal bleeding (cessation of menstrual period over 12 months interval). Patients with leiomyoma uteri were excluded.

Before ultrasonographic examination, the patient emptied the urinary bladder. The examination was performed with the patient in lithotomy position. The transducer was introduced into the posterior vaginal fornix, and the uterus was scanned longitudinally and transversely. Endometrial thickness was measured at the thickest part in the longitudinal plane. The measurement included both endometrial layers; that is, the measurement was performed between the two basal layers of the anterior and posterior uterine wall, also including the distended cavity. The poorly reflective layer surrounding the highly reflective endometrium was not included in the measurement. All structures were simultaneously examined. Transvaginal Doppler colour flow imaging of the uterine blood flow was identified in the transverse plane adjacent to the supravaginal portion of the cervix as described by Long et al.[6] The presence of intratumor vascularization with a low impedance blood flow were sought and recorded. The histopathologic diagnosis was used as "Gold standard".

All endometrial histology would be defined as "benign" except those who had endometrial hyperplasia, polyp or carcinoman which it would be classified as "pathologic".

Student unpaired *t-test* was used for statistical analysis.

Results

In Table 1 there were 129 patients whom ultrasound showed

normal uterus. The uterine cavity appeared as a linear central echo or small sonolucent area in the uterine cavity oriented in the cranio-caudal axis with a subendometrial halo. The histologic findings were 37 atrophic, 50 proliferative, 21 secretory, 13 hyperplasia and 11 cancers (Figure 1). In 10 cases endometrial tissues obtained from diagnostic curettage were insufficient for histologic diagnosis. These were classified as atrophic and benign even when it was not possible to obtain a histologic diagnosis. One had histological diagnosis of inactive endometrium with progestogenic effect and was considered as atrophic endometrium too. There were 31 patients with thick endometrium of more than 17 mm with or without fluid in the uterine cavity. 54.8% (17 cases) were histological proven hyperplastic or malignant. (Figure 1 and 2).

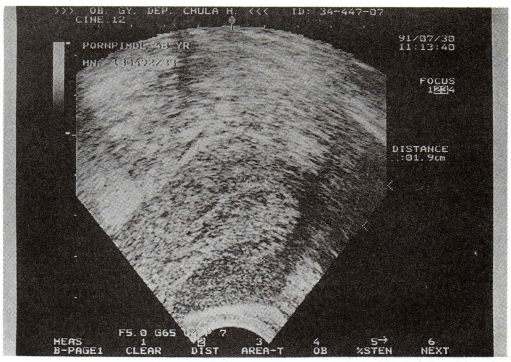

Fig. 1 The coronal plane showed multiple cystic cavitation. Pathologic finding was "cystic hyperplasia" or swiss cheese appearance.

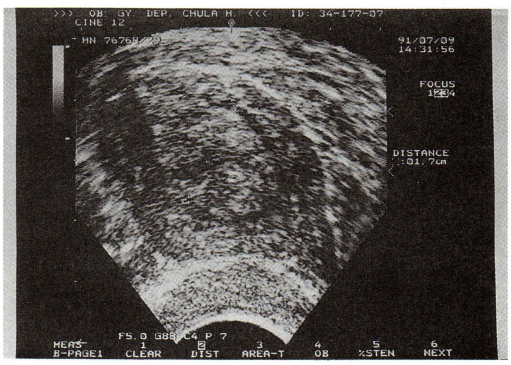

Fig. 2 This scan showed a postmenopausal uterus with a thick endometrium. The histologic finding revealed malignancy.

Table 1 *Ultrasound and histologic findings in 140 women with abnormal uterine bleeding*

Diagnosis	Ultrasound finding		Histologic finding	
	n	Endometrial Thickness (mms,)	D&C	n 140
Normal Uterus	129	8.7 (1-16)	Atrophic	37
			Proliferative	50
			Secretory	21
			Menstrual	8
			Hyperplasia	13
Cancer		33.8 (14-60)	Cancer	11

Mean endometrial thickness in atrophic, proliferative, secretory, menstrual, hyperplastic and malignant endometrium were 5.2 ± 3.8, 9.9 ± 6.1, 11.9 ± 6.3, 7.9 ± 6.4, 17.3 ± 7.3, and 20.5 ± 12.2 mm respectively. When compared uterine artery resistance index (R.I) with histologic subgroup, we found that women with endometrial cancer had lower uterine artery R.I. ($p < 0.05$) (Table 2). We were able to display all intratumoral vascularization with a low impedance to intratumor blood flow in the cancer cases Mean R.I. were 0.55 ± 0.06 which was significantly lower than that of uterine artery.

Discussion

Traditionally diagnostic curettage is one of the most common and acceptable operation performed for the peri and postmenopausal bleeding.[4] more recently transvaginal ultrasonographic examination has been considered by many centers as an alternative measure to dilatation and curettage for the patients[5] It is a relatively new technique with regard to its use for early detection of endometrial cancer. Few studies had been carried out using the endometrial thickness as the parameter to diagnose endometrial abnormality. Grandberg et al.[2] used vaginal ultrasound to study endometrial thickness in 205 postmenopausal women and found no abnormal endometrium if the thickness is ≤ 6 mm. They also suggested the cut off limit for endometrial abnormality to be ≤ 5 mm with a 87.3% positive predictive value 96% specificity and a 100% sensitivity to predict endometrial abnormality.[2] In our study malignancy was found with endometrial thickness of over 14 mm. This is in agreement with the study of Granberg[2] and Nasri[3]. Our mean endometrial thickness of cancer is 20.5 ± 12.2 mm. In women with a histopathologic diagnosis of atrophic endometrium, mean endometrial thickness was 5.2 ± 3.4 mm. We are quite confident that the difference between the thickness of atrophic and malignant endometrium could be easily revealed by ultrasound examination. If the thickness was more than 6 mm, 8 atrophic endometrium were found. When taking a cut off limit of 6 mm. for detection of endometrial abnormality, sensitivity, specificity and positive predictive value would be 100, 46.6 and 27.9% respectively (Table 3). Higher false positive cases in our study could be explained by recruitement of younger age group compared to previous studies. When Forty cases were less than 40 years of age. We believed that our preliminary data shows the potential benefit of transvaginal Doppler colour imaging in detection of endometrial melignancy. Though uterine vascular resistance index was not a reliable markerto differentiate benign from pathologic endometrium, but intratumor neovascularization hold promise. Our finding of intratumor blood flow of mean resistance

Table 2 *Impedance to uterine blood flow (as reflected by resistance index) in women with abnormal uterine bleeding and endometrial cancer*

Site of analysis of blood flow	Group	No of women	Resistance index Mean ± SE
Uterine arteries Right and left	Atrophic	37	604.1 ± 368.2
	Proliferative	50	564.9 ± 371.3
	Secretory	21	573.6 ± 362.0
	Menstrual	8	633.8 ± 394.6
	Hyperplasia	13	633.5 ± 383.6
	Cancer	11	314.6 ± 380.2 *(P<0.05)*
Within tumour	Cancer	5	549± 55.6 *(p < 0.5)*

Table 3 *Endometrial thickness and pathologic finding*

		Pathology		
		Abnormal	**Benign**	
Endometrial	> 7 mm	24	62	86
Thickness	≤ 6 mm	-	54	54
		24	116	

Sensitivity = 100 %
Specificity = 46.6 %
Positive predictive value = 27.9 %
Negative predictive value = 100 %

index 0.55 ± 0.06 may be one of the sensitive markers of endometrial[8] cancer which could be demonstrated in all of the cancer cases. These results seemed acceptable as we could avoid unnecessary curettage for at least one third of the cases. When we combined the Doppler indices with the sonographic endometrial thickness image, we believed that the false positive rate for diagnosis of endometrial cancer would be lessen, thus increased specificity could be achieved.[7]

Summary

We used the transvaginal ultrasound examination in women

with abnormal uterine bleeding prior to conventional Dilatation and Curettage It was a simple, non invasive technique, convenient and accepted by all patients. The endometrial thickness of less than 6 mm. was compatible with atrophic endometrium, but that of more than 14 mm. suggested malignancy. A cut off value for endometrial abnormality of 6 mm yield a sensitivity of 100%, specificity of 46.6% and positive predictive value of 27.9% (Fisher exac test). When endometrial thickness was more than 14 mm. intratumor flow mean resistance indices should be used to reduce false positive rate.

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