Colour Doppler Enhances The Accuracy of Transvaginal Ultrasound For Diagnosing Adenomyosis

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Abstract

Adenomyosis is a benign disorder affecting women during reproductive years[1]. It is a distressing condition for the women and often presents as dysmenorrhea and menorrhagia. Most of these women are not relieved with medical management and ultimately get permanent relief by hysterectomy only.

Objective- Role of addition of colour Doppler to transvaginal ultrasound in diagnosing adenomyosis compared to transvaginal ultrasound alone.

Method: In this prospective observational study, 30 women with complaints of abnormal uterine bleeding and/ or dysmenorrhea were screened for a clinical diagnosis of adenomyosis. After making a clinical diagnosis, sonographic examination was performed by transvaginal ultrasound and doppler, iU22 Philips ultrasound and Doppler machine with probe of 3-9 MHz. Following these investigations patients were taken up for hysterectomy as planned and the uterus was sent for histopathological examination. Histopathology was taken as gold standard of diagnosis. Descriptive statistics were analyzed with SPSS version 17.0 software. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated to analyze the diagnostic accuracy of Transvaginal Ultrasound alone and transvaginal ultrasound with Doppler in diagnosis and correlated with findings of Histopathology. RESULT: Transvaginal ultrasound alone had a sensitivity of 75% and specificity of 100%. Whereas when doppler is added to this the sensitivity is increased to 100% and specificity is almost the same as with TVS alone (92.8%). The accuracy of the test also increased from 86.7% to 96.7%.

Conclusion: the addition of colour doppler to examine the vascular pattern while conducting transvaginal scan, can improve the accuracy of diagnosis and also help prognosticate and manage the patients with adenomyosis .

Keywords: Abnormal uterine bleeding, Adenomyosis, Colour doppler, Diagnosis, Transvaginal ultrasound.

Introduction

Adenomyosis is a benign disorder affecting women during reproductive years [1]. It is a distressing condition for the women and often presents as dysmenorrhea and menorrhagia. Hence it becomes important to diagnose. Hormones, non steroidal anti inflammatory drugs and

intrauterine progesterone systems may be tried for management but most of these women ultimately get permanent relief by hysterectomy only. Adenomyosis refers to the condition where there is presence of ectopic endometrial glands and stroma within the uterine myometrium. Some women have only small areas of diffuse disease that are only apparent by microscopy while others develop nodules called adenomyomas. These adenomyomas commonly resemble leiomyomas clinically and on imaging. [2] Clinical examination reveals diffusely enlarged globular uterus which maybe tender.[3,4]

Many imaging modalities can be used to diagnose adenomyosis. Transvaginal ultrasonography (TVS) is the most easily available and cost effective modality which can be used to diagnose adenomyosis. Doppler studies when added on to this further increase the accuracy of the diagnosis. Three Dimensional ultrasound is an excellent imaging modality but it is not routinely available. Magnetic Resonance Imaging (MRI) is another imaging modality available which has a high specificity. However MRI is costly, time consuming, not easily available and hence cannot be used in all the patients.[5]

The features seen on transvaginal ultrasound in adenomyosis are:[1]

a) Loss of distinction of the endometrial- myometrial junction

b) Heterogenous myometrial echotexture

c) Myometrial cysts

d) Asymmetry of the anterior and posterior myometrium

e) Subendometrial myometrial striations.

The quick addition of colour Doppler while conducting transvaginal scan to see the vascular pattern shows vessels in central location in adenomyosis. [5,6]

Spectral Doppler can be added to this to measure the Doppler indices for the waveform in the vessels of the lesion. The following indices are derived:

- Resistance index (RI) reflects the resistance to blood flow caused by microvascular bed distal to the site of measurement. It is equal to the difference between the peak systolic velocity and the minimum diastolic velocity divided by the peak systolic velocity during the cardiac cycle.

- Pulsatility index (PI) is a measure of variability of blood velocity in the vessel measured by difference between the peak systolic and minimum diastolic velocities divided by the mean velocity during the cardiac cycle.

Various studies have shown that adenomyosis shows a high PI (>1.2) and a high RI (>0.7) on spectral doppler.[3,7] As there is paucity of literature on easily available and cost effective diagnostic modalities for pre operative diagnosis of adenomyosis, the present study was undertaken with the aim to evaluate the role of transvaginal Ultrasound alone and in addition with doppler in diagnosing clinically suspected cases of adenomyosis of uterus. The ultrasound and Doppler findings were then correlated with histopathological diagnosis which is the gold standard for diagnosis.

Materials & Methods

- **Place of Study:** Department of Obstetrics and Gynaecology in collaboration with Department of Radiology and Department of Pathology, L.H.M.C. and SSK Hospital, New Delhi.

- **Duration of Study:** November 2015 to March 2017.

- **Study Design:** Prospective observational

- **Sample Size :** 30

Women presenting in gynaecology OPD of LHMC with complaints of abnormal uterine bleeding and/ or dysmenorrhea were screened for a clinical diagnosis. After making a clinical diagnosis of the patient, sonographic examination was performed by transvaginal ultrasound and doppler, iU22 Philips ultrasound and Doppler

machine with probe of 3-9 MHz. Following the investigations patients were taken up for hysterectomy as planned and the uterus was sent for histopathological examination. Histopathology was taken as gold standard for diagnosis.

Inclusion Criteria

* Women with abnormal uterine bleeding and/ or dysmenorrhea with provisional diagnosis of adenomyosis planned for hysterectomy.
* Willing to participate in the study.

Exclusion Criteria

* Women planned for conservative management.
* Abnormal uterine bleeding due to other causes like genital tract malignancy, anovulation, endometriosis, endometrial hyperplasia and endometrial polyps.
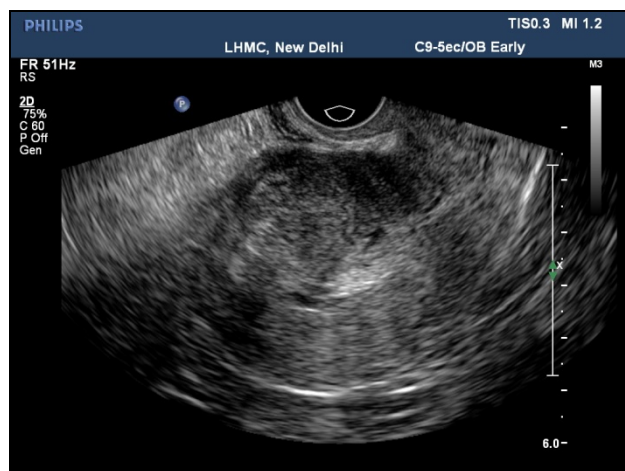
Figure 1- Transvaginal ultrasound showing adenomyosis with ill defined endometrial myometrial junction (←), heterogenous myometrial echotexture (⇐) and subendometrial cysts (←).

Result and Discussion

Of the 30 patients included in the study, 12 were diagnosed as adenomyosis on clinical findings whereas on histopathology 16 were found to have adenomyosis (Table 2) In table 1 it can be seen that the mean age for women with adenomyosis was (43.12±5.6years). Most women were multiparous with mean parity of 3.12 ± 1.4. Women with adenomyosis had an average BMI (24 ± 3.97 Kg/m^2).
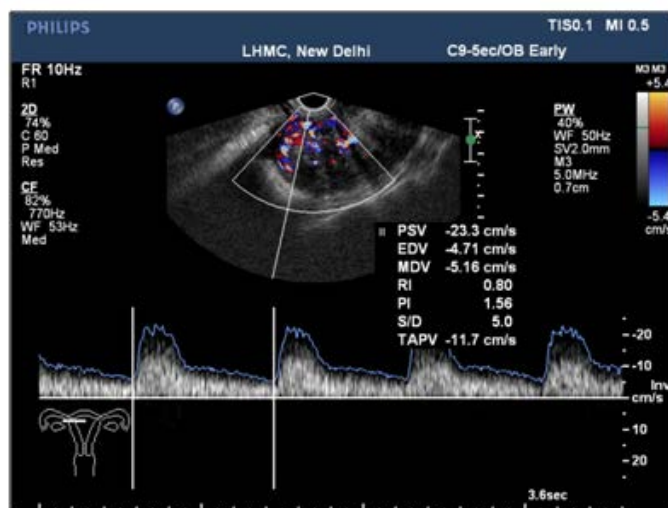
Figure 2- Doppler ultrasound showing adenomyosis having central vascularity. RI= 0.80 and PI = 1.56.

Figure 3- Uterus with Cervix With Diffuse Adenomyosis.

Table 1- Comparison of Mean Age, Parity, Abortions And BMI Of The Cases With Histopathology Report

DEMOGRAPHIC PROFILE	Mean ± SD
Age(years)	43.12±5.6
Parity	3.12 ± 1.4
Abortions	1.64 ± 2.84
BMI (Kg/m^2)	24.33 ± 3.75

Table 2- Findings on Histopathology.

HPE	NUMBER OF CASES
Adenomyosis present	16
Adenomyosis absent	14

Table 3- Comparison of Diagnosis Based On Transvaginal Ultrasound Alone To Histopathology.

TVS	HPE		TOTAL
	ADENOMYOSIS PRESENT	ADENOMYOSIS ABSENT	
ADENOMYOSIS PRESENT	12	0	12
ADENOMYOSIS ABSENT	4	14	18
TOTAL	16	14	30

Table 4- Comparison of Diagnosis Based On Vascularity on Colour Doppler to Histopathology.

VASCULARITY	NO OF CASES	HPE		
		ADENOMYOSIS (n=11)	LEIOMYOMA (n=14)	BOTH (n=5)
Central	17	11 (100%)	1 (8.2%)	5(100%)
Peripheral	13	0 (0%)	13 (92.8%)	0 (0%)

Table 5- Comparison of Diagnosis Based On TVS With Spectral Doppler To Histopathology.

TVS + SPECTRAL DOPPLER	HPE		TOTAL
	ADENOMYOSIS PRESENT	ADENOMYOSIS ABSENT	
ADENOMYOSIS PRESENT	11	0	11
ADENOMYOSIS ABSENT	5	14	19
TOTAL	16	14	30

Table 6- Comparison of Sensitivity, Specificity, PPV, NPV and Accuracy of Adenomyosis By Clinical Diagnosis, TVS, Vascularity And TVS With Spectral Doppler.

	Sensitivity	Specificity	PPV	NPV	Accuracy
CLINICAL DIAGNOSIS	68.7%	92.8%	91.6%	72.2%	80%
TVS	75%	100.0%	100%	77.8%	86.7%
VASCULARITY	100%	92.8%	94.1%	100%	96.7%
TVS+DOPPLER	68.7%	100.0%	100%	73.7%	83.3%

As it can be seen in table 6, that a well performed careful clinical examination can diagnose adenomyosis with high specificity (92.8%) but poor sensitivity (68.7%).

Transvaginal ultrasound alone had a sensitivity of 75% and specificity of 100%. Whereas when colour Doppler for vascularity was added to this the sensitivity was increased to 100% and specificity was almost the same as with TVS alone (92.8%). The NPV was also raised from 77.8% to 100%. Moreover addition of doppler to TVS increased the accuracy of the imaging modality from 86.7% to 96.7%. However statistically, the addition of spectral Doppler to transvaginal ultrasound did not show much benefit over TVS alone in detecting adenomyosis and the accuracy was reduced from 86.7% to 83.3%

In the study by **Elkattan et al** titled 'Can Three-dimensional (3D) power Doppler and uterine artery Doppler differentiate between fibroids and adenomyomas?' it was seen that scattered distribution of blood vessels was more common with adenomyomas (68%).[8]

Similarly in the study by **Ya-Min et al** titled 'Preoperative three-dimensional power Doppler ultrasonographic evaluation of adenomyosis and uterine leiomyoma.' there was found to be a significant difference in vascular location between cases of uterine leiomyoma and adenomyosis (Fisher exact test, $p < 0.001$). Central vascularity was seen more commonly in the adenomyosis group (85%).[9]

In the study by **Sharma K et al** titled 'Role of 3D Ultrasound and Doppler in Differentiating Clinically Suspected Cases of Leiomyoma andAdenomyosis of Uterus.' it was found that "central vascularity" was seen in 28 cases (93%) out of 30 cases diagnosed as adenomyosis. Hence vascular pattern in and around the lesion was found to be an important factor in diagnosing adenomyosis.[3]

In our study, it was seen that TVS alone was able to detect 12 of the 16 women with adenomyosis whereas TVS along with colour doppler was able to detect all the 16 patients with adenomyosis.

Conclusion

On colour Doppler, central vascularity was found to have sensitivity of 100% in detecting adenomyosis. Hence all the women having adenomyosis on histopathology had central vascularity on colour Doppler. The addition of colour Doppler at the time of transvaginal ultrasound can quickly and accurately (accuracy of 96.7%) diagnose the presence of adenomyosis.

Hence to conclude, the addition of colour doppler to examine the vascular pattern while conducting transvaginal scan, can improve the accuracy of diagnosis and also help prognosticate and manage the patients with adenomyosis.
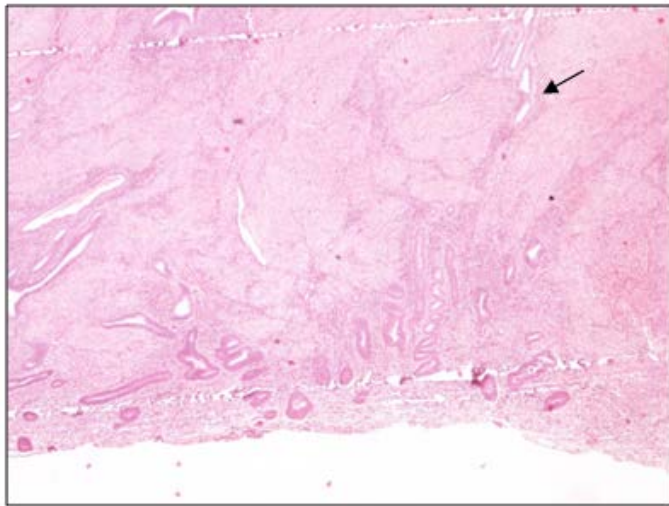
Figure 3 - Adenomyosis showing extension of endometrial glands and stroma (←) into the underlying myometrium. H&E X 40

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