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## Transvaginal Color Doppler Analysis of Benign Uterine Leiomyomas

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**Abstract:** In this study, the blood flow velocity waveforms of the leiomyoma, uterine artery and myometrium with color doppler ultrasound were analyzed in patients with postoperative diagnosis of benign uterine leiomyomas and 15 healthy volunteers as a control group were enrolled into the study. The lowest RI and PI values obtained from uterine leiomyomas were 0.39 and 0.93. Mean RI and PI values obtained from uterine leiomyomas were 0.39 and 0.93. Mean RI ofometrial blood flow was 0.57, while mean PI was 0.98. These measurements were done by using the color flows that were obtained from either center visualized and val-

ues of RI and PI were averaged both in myoma and control groups. In patients with uterine leiomyomas mean RI and PI of uterine artery were 0.63 and 1.32 respectively. In control group mean RI was 0.82 and mean PI was 2.21. These values were significantly high in control group ( $p < 0.05$ ). We suggest that the values obtained in this study may be used as reference indexes.

**Key Words:** Uterine, Leiomyoma, Ultrasonography, Color Doppler, Doppler.

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### Introduction

Transvaginal color Doppler with its great potential in the non invasive differentiation of benign and malignant uterine tumors becomes an important part of the armamentarium of the gynecologist. This method of examination can be used for assessing the uterine leiomyoma vascularity as well as physiological and pathophysiological characteristics of the uterine artery blood flow (1-6). In this paper we studied the uterine arterial blood flow velocity waveforms with color Doppler ultrasound in patients with postoperative diagnosis of benign uterine leiomyomas.

### Patients and Methods

Fifteen patients with uterine leiomyomas diagnosed either by pelvic examination or ultrasonography and 15 healthy volunteers who admitted to gynecology outpatient clinic for Pap smear screening were enrolled into the study. Patients who had submucosal, subserosal, cornual or laterally localized myomas and those patients with myomas showing degenerative changes were not included into the study as Doppler measurements obtained from such myomas may not

be suitable for the establishment of standards in Doppler indices and may be a subject to a further study. Clinical examination, transvaginal ultrasonographic measurement and color Doppler assessments of impedance to blood flow within the vasculature were carried out in every patient. Blood flow impedance expressed as resistance index (RI) was determined for both uterine arteries in every patient during the first week of menstrual cycle with getting permission from each patient.

The equipment used was Toshiba Sonolayer SSH-140 A with 6 MHz transvaginal probe for imaging the tumor and a 5 Mhz color Doppler system for blood flow analysis. The spatial peak temporal average (SPTA) intensity was around 80 mW/cm<sup>2</sup>. Wall filters (100 Hz) were used to eliminate low frequency signals occurring from noise.

All patients were examined by the co-author E.E. in lithotomy position with empty bladders. The morphology of the uterus was investigated by B-mode sonography. Transvaginal color Doppler was used to visualize both uterine arteries and leiomyoma vascularity. When color signal was detected, pulsed Doppler signals were obtained using a 1mm volume cursor. The RI

was calculated as peak systolic frequency minus end-diastolic frequency was also calculated. A recording was considered satisfactory for measurements when there were at least 5 equal amplitude waveforms in a row. All results were mean of three measurements each time. The average duration of examination was 12 minutes. Statistical analysis was performed by using Student's t-test and analysis of variance.

Table 1. Comparison of RI and PI values of healthy women and patients with uterine leiomyomas in uterine arteries.

	Healthy Women n=15	Patients with uterine leiomyomas n=15
* RI	0.82±0.21	0.63±0.15
* PI	2.21±0.46	1.32±0.57

RI=Resistance index, PI=Pulsatility index.

All values were obtained during follicular phase and examination performed by the same sonographer.

\*P<0.05.

### Results

The mean age of the patients in the study group was 40.6 years while the age of those in the control group was 38.4 years. In all patients leiomyoma volumes were measured by measuring the three greatest dimensions and using the formula for a prolate ellipsoid ( $D1 \times D2 \times D3 \times 0.5233$ ). Volumes ranged from 32 cm<sup>3</sup> to 648 cm<sup>3</sup>. In control group mean uterine volume in myoma group was 312 cm<sup>3</sup> ranging from 62 cm<sup>3</sup> to 648 cm<sup>3</sup>. The lowest RI and PI values obtained from uterine leiomyomas were 0.39 and 0.93. Mean RI of myometrial blood flow was 0.57, while mean PI was 0.98. These measurements were done by using the color flows that were obtained from the center or border of the uterine leiomyomas. In all cases diastolic flow was present and postoperative histologic diagnosis was benign uterine leiomyoma. In addition to the above mentioned measurements both in myoma and control groups. In patients with uterine leiomyomas mean RI and PI of uterine artery were

0.63 and 1.32 respectively. In control group mean RI was 0.82 and mean PI was 2.21. These values were significantly high in control group.

### Discussion

Doppler ultrasound has been widely used to detect various blood flows in the female pelvic vessels for the identification of several gynecological pathologies including syncytial endometritis (7), invasive mole (8), gestational trophoblastic tumours requiring chemotherapy (9), pelvic arteriovenous malformation (10) mesodermal mixed tumor of the uterus (11) and intrapelvic neoplastic tumours (12). More recently with the use of color Doppler appliances it was shown that rapid color identification of small and large vascular structures reduced the time necessary for pulsed Doppler study (13-15).

When we compare our results with the results of a similar but a more extensive study of Kurjak et al which was published recently (16), a lot of similarities were noted. RI and PI values in our study, in both groups are considerably similar to the values in that study. Our RI minimum is 0.93 and well fitting the RI minimum of that study (0.35) and thus we consider this similarity important as these values indicate the lowest possible values that can be obtained from a benign uterine leiomyoma. We add a similar data to the present literature (1,2,5-6) as far as the normal values of uterine artery blood flow in healthy volunteers in proliferative phase of their menstrual cycle.

As a matter of fact it is important to define threshold values of Doppler indices, if present, for differentiation of various organic pathologies of the uterus with reasonable sensitivity and specificity and thus, more extensive color Doppler studies are required to make this valuable diagnostic tool a member of physician's armamentarium. Actually it is not possible to establish a predictive value from this particular study in respect to the pathologies distorting the uterus but values documented here can be used as reference indexes by other researchers planning to conduct more extensive studies.

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