# Study on uterine artery blood flow in myomatous uterus

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**Abstract:** Leiomyomas constitute the most common female pelvic tumor, becoming increasingly prevalent with age. Although transabdominal ultrasound is usually used for observation of the large uterine tumors outside the focal zone of the transvaginal transducer, but transvaginal ultrasound is the standard imaging modality for this purpose. Recently with introduction of transvaginal color Doppler ultrasonography some studies have been performed on uterine artery blood flow in myomatous uterins, however these studies are scanty. Our object in this study is the determination of probable particular effects of leiomyoma on blood flow in uterine arteries. In this cross sectional study 50 women with myomatous uterine and 50 healthy volunteer woman were enrolled in the study. Transvaginal color Doppler was used for observation of uterine arteries and vascularity of myomas. The mean uterine volume was significantly lower in control group (97.00 ± 37.71 cm3) than in cases (3S1.16 ± 222.94 cm3). The mean peak systolic velocity (PSV) was significantly lower in control group (36.42 ± 9.28 cm/s) than in case group (49.34 ± 16.37cm/s). Significant correlation between uterus volume and PSV was not seen in control group but medium positive correlation between mean uterus and mean PSV was seen in case group. Mean pulsatility index (P1) was 1.59 ± 0.36 in case group and 2.40 ± 0.46 in control group. Significant correlation between mean uterus volume and mean pulsatility index (PI) in study group was seen. Mean resistance index (RI) was 0.74 ± 0.19 in case group and 0.85 ± 0.23 in control group. No correlation was found between uterine volume and number of myomas. Only in %34 cases myomas artery was detectable and mean myomas artery RI was 0.57 ± 0.18. We observed significant differences between uterine arterial Doppler indices in patients with myomatous uterins and control group. The presence of myomas result in uterine volume increasing and uterus Volume has significant correlation with PI decreasing. Also PSV has significant correlation with uterine Volume. This significant difference suggests that, we can use serial measurements in duration of treatment in monitoring response to medical treatment.

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## 1. Introduction

Myomas are the most common pelvic tumor in women and its prevalence increases with increase of age. 25% of white women and 50% of black women over 30 years old have at least one myoma. Cause of myoma is not completely identified yet, but it is undoubtedly estrogen dependent (Callen, 2000). Most of myomas are symptomless and maybe indicated as various complaints such as bleeding, lower abdominal pain or sensitivity, urinary symptoms or constipation (Alcazar, 1997).

With transvaginal color Doppler ultrasound method developed, evaluation of blood flow in pelvic organs has become possible. Many investigations have been carried out on cases of normal, infertile, and ovarian masses and endometrial abnormalities which have mostly been limited to benign lesions such as myoma (Alcazar, 1997).

Studies have shown that vascular impedance decreases in myomatous uterine, and the flow rate increases. This is clinically determinant. Hysterectomy is the classic and selective treatment of symptomatic uterine myomas. Showing increased blood flow in uterine arteries of the myomatous uteruses, other therapies for myoma can be also considered, including GnRH and angiographic embolization.

If peak systolic velocities (PSV), resistance index (RI) and pulsatility index (PI) of myomatous uterine have significant difference with healthy individuals, uterine artery embolization can be used as a method for treatment of uterine myoma and assist the surgical treatment (McLucas, 2002).

If studies show that blood flow characteristics of myomatous uterins are different from the normal uterus can be PSV and RI and PI monitoring can be used for monitoring response to GnRH treatment.

Previously, some studies have been performed on blood flow in the uterine arteries of myomatous uterine, but these studies are limited and further studies in this area seem necessary. The aim of this study is to determine the rate of blood flow in uterine arteries of myomatous uterus.

## 2. Material and Methods

A case-control study was performed on patients with uterine myoma and normal women, and uterine artery flow in the myomatous uterus was reviewed. 50 patients with uterine myoma and 50 healthy subjects were randomly selected.

Patients with a history of HTN, diabetes, thyroid disorders, hormone therapy, pregnancy, smoking, and menstrual disorders and also, patients with sub mucous myoma, sub serous, corneal and degenerated myoma were excluded.

Uterine size and Number of myomas were determined by transabdominal sonography.

Transvaginal sonography and evaluation color Doppler was performed in lytotomic position with empty bladder by a Hitachi model EUB-52S vaginal with prub 7.5 MHZ device.

Uterine morphology was reviewed by B-Mode and uterine volume was calculated with prolate ellipsoid method.

Transvaginal color Doppler was used to observe the uterine arteries and vascularity of myomas.

With color signals detected, spectral signals were measured using 1mm Sample Volume. PI, RI, PSV were drawn from FVU and calculated by computer.

Uterine artery on its main body was evaluated near the outside edge of cervix on the surface of its inner hole. In the largest myoma, myoma indices were obtained from myoma vessels which had created color image on the edges or center of the myoma.

Doppler wave forms were obtained during four consecutive cardiac cycles. In case of several different RI obtained in a myoma, the lowest RI was recorded.

## 3. Results

Color Doppler finding were shown in the table 1. There is a very weak relationship between PSV and uterine volume in the control group that was not significant (p<0.5)( Figure 1).There is a moderate relationship between PSV and uterine volume in the case group (R=0.362 and P=0.01)( Figure 1).There is a very weak relationship between PI and uterine volume in the control group that was not significant (P>0.05 and R>0.033) (Figure 2).There is a moderate inverse relationship between PI and uterine volume in the case group (P=0.01 and R=– 0.461) (Figure 2).There is a weak correlation between uterine volume and number of myomas in the control group that is not significant (P>0.05 and R=0.106). Evaluating color Doppler of myomas, only 14 cases (32%) had visible arteries of myoma and mean RI in myoma artery was 0.57±0.18.

Table 1. Color Doppler finding of patients in two groups

| | Group | | P |
|---|---|---|---|
| | Control | Case | |
| Uterine Volume($cm^3$) | 381.16 ± 222.93 | 97.00 ± 37.71 | <0.001 |
| peak systolic velocity(cm/s) | 49.33 ± 16.37 | 36.42 ± 9.28 | <0.001 |
| pulsatility index | 2.4 ± 0.46 | 1.59 ± 0.36 | <0.001 |
| resistance index | 0.85 ± 0.23 | 0.74 ± 0.19 | <0.001 |

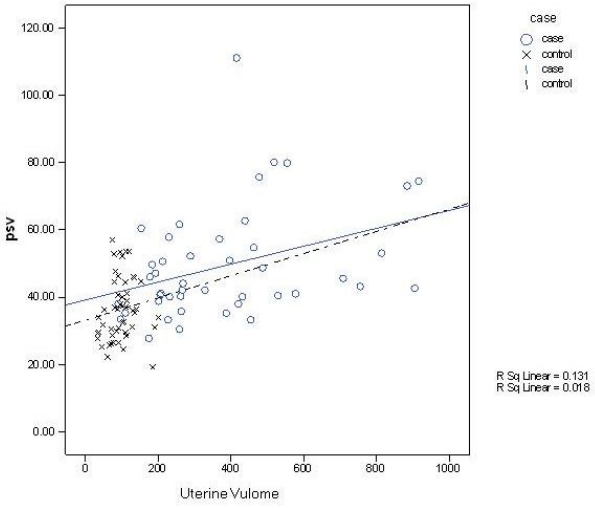


Figure 1. Correlation between PSV and uterine volume in two groups

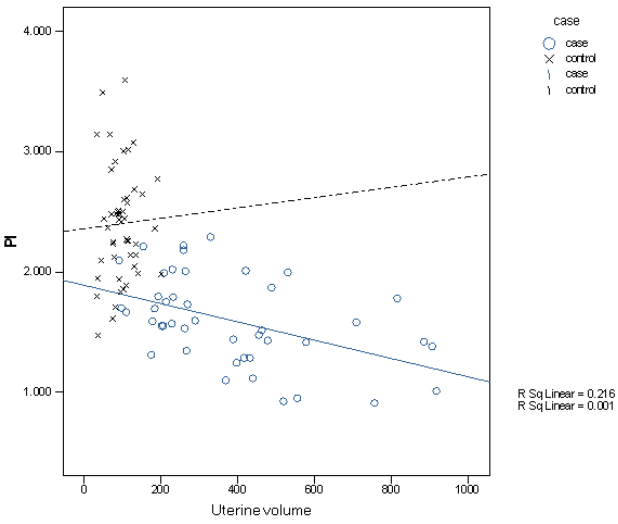


Figure 2. Correlation between PI and uterine volume in two groups

**4. Discussions**

Transvaginal color Doppler sonography is an established technique in the study of vascular impedance which enables evaluation of uterine perfusion in physiological and pathological conditions (Kurjak, 1992).

Tsuda et al expressed that uterine volume in women with uterine myoma was 276.2±163.4 which significantly higher than that of control group (Tsuda, 1998).

Also in the study by Danisman et al, mean uterine volume in patients with myoma was 312 cc (Danisman, 1998).

In our study, the average volume in patients with and without uterine myoma was 381.16±222.9cc and 97±37.71cc respectively which was significantly higher in the patients with myoma ($p<0.001$).

In the study by Alcazer et al, the average number of myomas was 1.8 which had a significant relationship with patients' uterine volume (Alcazar, 1997).

In this study, the mean number of myomas was 5.28 and had no correlation with uterine volume of patients. What distinguishes this study from the above mentioned one is the presence of small myomas in a large number of patients.

In a study by Mclucas et al, mean PSV in patients with myoma was 47.4 *cm/s*(McLucas, 2002) and in a study by Alcazar et al, mean PSV in patients with and without myoma was 83.5±22.3 *cm/s* and 70.2±15.4 *cm/s* respectively which is significantly higher in the patients with myoma (Alcazar, 1997).

In our study, mean PSV in patients with and without myoma was 49.3±16.3 cm/s and 36.4±9.28 cm/s respectively ($P<0.001$) which is similar to Mclucas's study; and in comparison to Alcazar's study, PSV difference in both case and control groups was identical.

Alatas et al expressed that uterine volume plays a greater role in uterine blood flow compared with the presence or status of vascularity of myoma (Alataş, 1997) and also, Mclucas found a significant relationship between uterine volume and PSV. (McLucas, 2002)

In our study, there was a significant moderate relationship between PSV and uterine volume.

In the study by Alcazar et al, the mean PI for patients with and without myoma was 2.5±0.7 and 3.4±1.3 respectively (P=0.007) (Alcazar, 1997). In a study by Kurjuh et al, mean PI in patients with myoma was 2.52±0.87 (Kurjak, 1992); and in the study by Alatas , it was significantly higher in the patients with myoma (Alataş, 1997).

In our study, the mean PI in patients with and without myoma was 1.59±9.36 and 2.4±0.46 respectively, which indicates the effect of presence of myoma on increasing of uterine blood flow.

Sladkeuicius et al suggested that any increase or change in Doppler indices depends on increasing of uterine volume but not myoma size (Sladkevicius, 1996). Tsuda suggested that there was a significant relationship between reduction of PI and uterine volume in myomatous uteruses (Tsuda, 1998).

In our study, there was a moderate inverse relationship between PI and uterine volume in patients with uterine myoma.

Sosić et al suggested that myoma size is the most important single factor affecting the visibility of myoma blood flow and RI (Sosić, 1996).

In a study by Alatus et al, mean RI in patients with and without uterine myoma was 0.77±0.08 and 0.82±0.06 respectively that was significantly lower in the case group (Alataş, 1997).

In the studies by Kuvjah and Danisman, mean RI in patients with myoma was significantly lower than that in patients without myoma (Danisman, 1998).

In our study, similar to the results by Kurjau and Alatas, the mean RI in patients with myoma was significantly lower.

Regarding the relationship between uterine volume and uterine artery Doppler indices, any action leading to reduction of the uterine volume is expected to cause change in Doppler indices as the reduction of systolic flow velocity and increase of vascular impedance.

Methods which can be taken to reduce uterine volume include non-surgical treatment methods and surgical methods (myomectomy).

Nonsurgical procedures include uterine artery embolization and treatment with GnRH agonists which can be applied as the selective or auxiliary treatment.

With Color Doppler transvaginal sonography before treatment and then repeated assessment during therapy, response to treatment can be evaluated.

**Conclusion**

According to our results, presence of myoma leads to increased uterine volume and reduction of vascular resistance and increased uterine artery blood flow velocity. Reduction of vascular resistance and increased blood flow are in significant relationship with increased uterine volume.

Increased blood flow in myomatous uterine raises the choice of nonsurgical treatment. Uterine artery embolization or treatment with GnRH agonists can be applied for a certain or pre-surgical treatment. With color Doppler sonography, response to treatment can be monitored as serial measurements of uterine volume and Doppler indices.

It should be noticed that interpretation of the color Doppler results in myomatous uteruses is different from healthy individuals.

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