Dicle Tıp Dergisi /
Dicle Medical Journal

2013; 40 (3): 345-349
doi: 10.5798/diclemedj.0921.2013.03.0287

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA

Contribution of spiral artery blood flow changes assessed by transvaginal color Doppler sonography for predicting endometrial pathologies

Endometrial patolojileri öngörmede transvajinal renkli Doppler ultrasonografi ile belirlenen spiral arter akım değişikliklerinin katkısı

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ABSTRACT

Objective: To investigate the diagnostic value of blood flow measurements in spiral artery by transvaginal color Doppler sonography (CDS) in predicting endometrial pathologies.

Methods: Ninety-seven patients presenting with abnormal uterine bleeding and requiring endometrial assessment were included in this prospective observational study. Endometrial thickness, structure and echogenicity were recorded. Pulsatility index (PI) and resistive index (RI) of the spiral artery were measured by transvaginal CDS. Endometrial sampling was performed for all subjects. Sonographic and hystopathologic findings were compared.

Results: The histopathological diagnoses were as follows; 39 cases (40.2%) endometrial polyp, 9 cases (9.3%) endometrial hyperplasia, 10 cases (10.3) submucous myoma, 7 cases (7.2%) endometrium cancer, and 32 cases (33%) nonspecific findings. The spiral artery PI in endometrium cancer group was highly significantly lower than other groups ($p<0.01$). The spiral artery RI was also significantly lower in the patients with malignant histology ($p<0.05$).

Conclusion: Endometrial pathologies are associated significantly with endometrial spiral artery Doppler changes.

Key words: Spiral artery, Doppler ultrasonography, endometrium

ÖZET

Amaç: Endometrial patolojilerin değerlendirilmesinde transvajinal renkli Doppler ultrasonografi (RDU) ile spiral arter akım parametrelerinin katkısını araştırmak.

Yöntemler: Anormal uterin kanama ile başvurmuş ve endometrial değerlendirme ihtiyacı olan 97 hastanın katıldığı prospektif gözlemsel bir çalışmadır. Endometrial kalınlık, yapı ve ekojenite kaydedildi. Transvajinal RDU ile spiral arter pulsatilite indeksi (Pİ) ve rezistif indeksi (Rİ) ölçüldü. Tüm olgulara endometrial örnekleme yapıldı. Ultrasonografik ve histopatolojik bulgular karşılaştırıldı.

Bulgular: Histopatolojik tanılar; 39 olgu (%40,2) endometrial polip, 9 olgu (%9,3) endometrial hiperplazi, 10 olgu (%10,3) submuköz myom, 7 olgu (%7,2) endometrium kanseri, 32 olgu (%33) nonspesifik bulgular. Endometrial kanser olgularında spiral arter Pİ istatistiksel olarak yüksek anlamlılıkta düşük bulundu ($p<0,01$). spiral arter Rİ da malign histopatoloji olan olgularda anlamlı olarak düşük bulundu ($p<0,05$).

Sonuç: Endometrial patolojiler endometrial spiral arter Doppler değişiklikleriyle ilişkilidir.

Anahtar kelimeler: Spiral arter, Doppler ultrasonografi, endometrium.

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Geliş Tarihi / Received: 27.01.2013, Kabul Tarihi / Accepted: 16.05.2013

INTRODUCTION

Abnormal uterine bleeding (AUB) is one of the most commonly encountered problems in gynecologic practice. Transvaginal sonography (TVS) has become first-line diagnostic tool for patients with abnormal uterine bleeding. It has significantly improved our ability to diagnose uterine pathologies accurately. However, we still need second stage invasive tests that cause patient discomfort and increase the cost compared to TVS for accurate diagnosis. Over recent years color Doppler sonography (CDS) have been started to be used to predict endometrial pathologies [1,2]. Color Doppler sonography, a noninvasive and simple tool, is useful in distinguishing endometrial lesions, helps us to decide what is necessary for invasive tests and plans the invasive method to be chosen.

Endometrial cancer is the most common malignancy of the female genital tract [3]. Endometrial thickness is a nonspecific finding of endometrial cancer [4]. Hence, CDS of the genital vessels can improve the sensitivity and specificity of TVS for the prediction of endometrial malignancies [5,6].

In this prospective study, we investigated the diagnostic value of the sub endometrial spiral artery blood flow parameters for the prediction of underlying endometrial pathology.

METHODS

The study was carried out at Şişli Etfal Training and Research Hospital. Ninety-seven patients presenting with abnormal uterine bleeding and requiring endometrial assessment were included in this prospective observational study.

Exclusion criteria were pregnancy, pelvic inflammatory disease, cervicitis, genital tumor, systemic diseases causing abnormal uterine bleeding, intrauterine device use and use of drugs affecting uterine vasculature such as hormonal therapy, oral contraceptives or tamoxifen during the previous 3 months,

The study was conducted according to the guidelines for clinical studies described in the Declaration of Helsinki (as revised by the World Medical Association, http://www.wma.net). Regional Ethical Committee approved the study. All patients gave oral and written informed consent prior to the examination.

The patients were examined prospectively by standard B-mode TVS and CDS in the midfollicular phase. All patients were scheduled for an invasive diagnostic procedure like dilatation-curettage or hysteroscopy after sonographic imaging. Histopathologic examination was performed in the pathology laboratory of our hospital. All ultrasound scans were performed by the same examiner to avoid interobserver variability. All women were examined firstly using conventional gray-scale TVS with a 5.0-MHz transvaginal probe in the lithotomy position with an empty bladder. The uterus was thoroughly assessed in coronal and sagittal planes using a Siemens Acuson Antares 4D machine. Endometrial double layer thickness, structure and echogenicity were noted. Endometrial double layer width is measured at the thickest portion of the longitudinal section. Then, vascularization of the uterus is visualized with color Doppler technique. Blood flow velocity waveforms were evaluated in the spiral arteries at the sub endometrial region that is within 1 mm of the originally defined myometrial-endometrial contour [7].

The results of the examinations were compared with the histologic diagnosis of the endometrial specimen. The primary outcome measures were spiral artery Pulsatility index (PI) and spiral artery resistive index (RI).

Statistical analysis

Statistical calculations were undertaken using the Number Cruncher Statistical System (NCSS) 2007& PASS 2008 Statistical Software (Utah, USA). Categorical data were compared using the chi-square test. Kruskal Wallis test was used to compare the parameters with abnormal dissociation between the groups for descriptive statistical methods as well as quantitative data. A result was assumed to be statistically significant if the P value of each respective test was ≤ 0.05.

RESULTS

Ninety-seven patients who had admitted with AUB were enrolled in this prospective study. Mean age, parity, and endometrial thickness of the participants were 45.11±2.64 years, 3.22±2.16, and 12.56±7.43 mm respectively (Table 1).

Table 1 summarizes the histopathological diagnoses of the subjects. The histopathological diagnoses were as follows; 39 cases (40.2%) endometrial polyp, 9 cases (9.3%) endometrial hyperplasia, 10 cases (10.3) submucous myoma, 7 cases (7.2%) endometrium cancer, and 32 cases (33%) nonspecific findings (Table 2). Secretory endometrium, proliferative endometrium, and atrophic endometrium on histology were considered as nonspecific findings.

On gray scale ultrasonography 35 (36.1%) had uniform endometrium whereas 62 (63.9%) had no uniform endometrium. No uniform endometrium showed a strong correlation with organic endometrial lesions. All cases with endometrial cancer had no uniform endometrium. Endometrial double layer thickness was significantly greater in patients with endometrial hyperplasia and cancer than in those with nonspecific pathologies ($p<0.05$).

There were significant correlations between spiral artery PI and RI and different endometrial histologies. Table 3 and Table 4 summarize the comparison of the spiral artery Doppler indices between endometrial cancer and different endometrial histopathologies. In patients with endometrial cancer spiral artery PI was found to be significantly lower than other groups ($p<0.01$). Spiral artery RI was also lower in endometrial cancer group than in endometrial polyp, hyperplasia and fibroid group ($p<0.05$).

Table 1. Demographic and clinical variables of the study group

	Mean ± SD
Age (years)	45,11±2.64
Gravity	4.4 ± 2.64
Parity	3.2 ± 2.16
Hemoglobin concentration (g/dl)	11.75 ± 1.83
Endometrial thickness (mm)	12,56±7,43

SD: Standard deviation

Table 2. Histological diagnoses of all patients

Endometrial histology	n	%
Endometrial polyp	39	40,2
Endometrial hyperplasia	9	9,3
Submucous fibroid	10	10,3
Endometrium cancer	7	7,2
Nonspecific findings	32	33

Table 3. Comparison of the pulsatility indices (PI) of spiral artery between endometrial cancer and other pathologies

Endometrial histology	Spiral Artery PI Mean±SD	p
Endometrium cancer	0,53±0,05	0,001
Endometrial hyperplasia	1,35±0,32	0,001
Submucous fibroid	1,04±0,41	0,001
Endometrial polyp	1,14±0,48	0,001
Nonspecific endometrium	1,11±0,55	0,005

SD: Standard deviation

Table 4. Comparison of the spiral artery resistive indices between endometrial cancer and other pathologies

Endometrial histology	Spiral Artery RI Mean±SD	p
Endometrium cancer	0,44±0,06	
Endometrial hyperplasia	0,70±0,11	0,001
Submucous fibroid	0,56±0,15	0,033
Endometrial polyp	0,59±0,17	0,005
Nonspecific endometrium	0,55±0,18	0,052

RI: Resistive index, SD: Standard deviation

DISCUSSION

Histological examination of the endometrium is gold standard in the diagnosis of endometrial pathologies. However, with the advance of high resolution ultrasound, studies on noninvasive evaluation of the uterine cavity have dramatically increased. Many studies showed thicker endometrium on gray-scale sonography in neoplastic endometrial lesions [8-11]. However endometrial thickening on TVS is a nonspecific finding, therefore secondary tests are usually required to reduce false positive results. Besides, a cut-off value of 4-5 mm to distinguish benign from malignant endometrial lesions did not have high sensitivity and specificity to replace invasive methods in postmenopausal women [12-14]. Color Doppler ultrasonography of uterine and endometrial vessels can be used to increase the diagnostic value of gray- scale TVS. In this study we compared the Doppler indices of uterine and spiral arteries with the final histologic diagnoses.

There are conflicting reports on the Doppler assessment of genitalia in differentiating uterine pathologies in the literature. The studies in the literature reveal controversial results in utilizing Doppler ultrasound to predict uterine malignancies.

In recent years, many studies have been reported in gynecologic Doppler ultrasound assessment of the uterine cavity. Ernest et al studied the relationship between uterine blood flow and endometrial and sub endometrial blood flows during stimulated and natural cycles [15]. Many authors have also searched the effect of different medications on uterine artery and endometrial blood flow [16-18].

Lower impedance to blood flow in tumoral tissues has leaded authors to use Doppler analysis of genital vessels to differentiate malignant lesions from benign lesions. A few authors have studied the role Doppler indices of genital vessels in differentiation of premalignant and malignant endometrial lesions. Some reported Doppler ultrasound to be useful but others limited to the values [6,8,11,14,19,20]. The characteristics of endometrial and myometrial vascularization on Doppler sonography were then searched. A few discriminatory vascular patterns have been attributed to endometrial polyps, fibroids and endometrial carcinoma [21-23].

Samulak et al., evaluated uterine artery maximum end-diastolic velocity of blood flow, time-averaged maximum velocity (TAMXV) of blood flow, and peak systolic velocity of blood flow in women with postmenopausal bleeding. Although statistically insignificant, these values were found to be highest in the carcinoma group and lowest in the control group [24]. That reflects lower impedance to blood flow in cancerous lesions. Englert-Golon et al., reported significantly lower PI and RI in the endometrial vessels and uterine arteries, significantly higher TAMXV in the endometrial vessels and uterine arteries in cases with endometrial cancer than in patients with endometrial hyperplasia [25].

The present study showed a correlation between the spiral artery PI and RI and endometrial malignancy. In patients with endometrial carcinoma, spiral artery PI and RI were both significantly lower than those without malignant histology. Endometrial thickness was significantly higher in patients with endometrial carcinoma and hyperplasia.

Weiner et al reported that the sensitivity of the uterine artery RI was 100% when a cut-off value of 0.83 was considered in patients with endometrial cancer [26]. Kurjak et al., reported significantly lower RI near or <0.40 in cases with endometrial carcinoma. They also said that transvaginal color Doppler ultrasonography was useful in determining myometrial invasion and tumor staging [27]. Bezircioglu et al., defined the endometrial thickness of 5 mm, uterine artery PI of 1,450, uterine artery RI of 0.715, radial artery PI of 1.060, radial artery RI of 0.645 as the cut-off points for malignant endometrium in postmenopausal women [14].

Arslan et al., investigated the role of transvaginal color Doppler ultrasonography for the prediction of precancerous endometrial lesions. They concluded that transvaginal ultrasonography and Doppler ultrasonography cannot replace the invasive procedures [8].

A possible limitation of our study is small study population, but strength of this study is that all cases underwent histopathological diagnosis.

In conclusion, endometrial pathologies are associated significantly with endometrial spiral artery changes. Although in patients with malignant endometrial lesions blood flow of the spiral arteries displayed lower impedance, the Doppler ultrasound use as a diagnostic test is not accepted now. However, with advancing technology, color Doppler sonography can replace the invasive diagnostic methods for endometrial pathologies.

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