

## Assessing Role of Blood Flow Measurements in Spiral Artery by Transvaginal Color Doppler Sonography (CDS) in Predicting Endometrial Pathologies: An Observational Study

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### Abstract

**Aim:** The aim of the present study was to investigate the diagnostic value of blood flow measurements in spiral artery by transvaginal color Doppler sonography (CDS) in predicting endometrial pathologies.

**Material & Methods:** 100 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 histopathologic findings were compared.

**Results:** Mean age, parity, and endometrial thickness of the participants were 44.14±2.48 years, 3.3±2.18 and 12.48±6.44 mm respectively. The histopathological diagnoses were as follows; 40 cases (40%) endometrial polyp, 10 cases (10%) endometrial hyperplasia, 11 cases (11) submucous myoma, 8 cases (8%) endometrium cancer, and 30 cases (30%) nonspecific findings. There were significant correlations between spiral artery PI and RI and different endometrial histologies.

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

**Keywords:** Spiral artery, Doppler ultrasonography, Endometrium.

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### Introduction

Endometrial carcinoma is the sixth most common malignancy of the female reproductive system. [1] The incidence of endometrial cancer is estimated at 320,000 people worldwide, causing 7,600 deaths each year, with mortality rates ranging from 0.9 to 3.8 per 100,000 people in different countries. [2] Therefore endometrial carcinoma is one of the most important diseases that should be considered in women with abnormal vaginal bleeding. Vaginal bleeding is the first symptom in 75–90% of endometrial cancers. [3] Women with endometrial cancer typically present with abnormal uterine bleeding, which can also be caused by benign uterine conditions such as hormonal imbalance, endometrial atrophy, inflammation, endometrial hyperplasia, and/or polyps. [4]

Imaging plays an important role in detecting abnormalities in these women and in identifying those who may require further evaluation with endometrial biopsy. In the past two decades alone,

mortality due to endometrial cancer has decreased by 25% due to early detection, diagnosis, and treatment. [5] 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. [6,7]

Color Doppler sonography, a non-invasive 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. [8] Endometrial thickness is a nonspecific finding of endometrial cancer. [9] Hence, CDS of the genital

vessels can improve the sensitivity and specificity of TVS for the prediction of endometrial malignancies. [10]

Hence the aim of the study was to investigate the diagnostic value of the sub endometrial spiral artery blood flow parameters for the prediction of underlying endometrial pathology.

### Material & Methods

A prospective observational study was carried out at Department of obstetrics and Gynaecology, JLN Medical College and Hospital, Bhagalpur, Bihar, India for one year (April 2016 to March 2017). 100 patients presenting with abnormal uterine bleeding and requiring endometrial assessment were included.

#### Exclusion criteria

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.

### Methodology

The study was conducted according to the guidelines for clinical studies described in the Declaration of Helsinki. 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 mid-follicular 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 GE, Model - Logiq P3 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. [11] 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  $\leq 0.05$ .

### Results

**Table 1: Demographic and clinical variables of the study group**

Variables	Mean $\pm$ SD
Age (years)	44.14 $\pm$ 2.48
Gravity	4.2 $\pm$ 2.68
Parity	3.3 $\pm$ 2.18
Hemoglobin concentration (g/dl)	12.58 $\pm$ 1.84
Endometrial thickness (mm)	12.48 $\pm$ 6.44

Mean age, parity, and endometrial thickness of the participants were 44.14 $\pm$ 2.48 years, 3.3  $\pm$  2.18 and 12.48 $\pm$ 6.44 mm respectively.

**Table 2: Histological diagnosis of all patients**

Histological diagnosis	N%
Endometrial polyp	40 (40)
Endometrial hyperplasia	10 (10)
Submucous fibroid	11 (11)
Endometrium cancer	9 (9)
Nonspecific findings	30 (30)

The histopathological diagnoses were as follows; 40 cases (40%) endometrial polyp, 10 cases (10%) endometrial hyperplasia, 11 cases (11) submucous myoma, 8 cases (8%) endometrium cancer, and 30 cases (30%) nonspecific findings.

**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 Value
Endometrial polyp	0.55±0.05	0.001
Endometrial hyperplasia	1.36±0.34	0.001
Submucous fibroid	1.06±0.44	0.001
Endometrium cancer	1.16±0.46	0.001
Nonspecific findings	1.12±0.56	0.005

There were significant correlations between spiral artery PI and different endometrial histologies.

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

Endometrial histology	Spiral Artery PI Mean±SD	P Value
Endometrial polyp	0.46±0.04	0.001
Endometrial hyperplasia	0.72±0.18	0.001
Submucous fibroid	0.55±0.17	0.001
Endometrium cancer	0.57±0.14	0.005
Nonspecific findings	0.54±0.15	0.055

There were significant correlations between spiral artery RI and different endometrial histologies.

#### Discussion

Transvaginal sonography has been shown to be an accurate means to rule out endometrial cancer in women presenting with postmenopausal bleeding. A recent metaanalysis demonstrated that the risk of endometrial cancer when double-layer endometrial thickness as measured by transvaginal sonography is <5 mm is actually low. [12] However, endometrial thickening is a non-specific finding that may be caused by several processes, such as cancer, polyps, hyperplasia or even endometrial cystic atrophy. Transvaginal color Doppler enables an in-vivo assessment of uterine and endometrial vascularization. [6] Endometrial carcinoma is by far the most common variety, while malignant tumors of the myometrium are quite rare. Endovaginal ultrasonography (EVU) is the imaging modality of choice to initially evaluate women with post or perimenopausal and intermenstrual uterine bleeding. In postmenopausal women with abnormal bleeding, endometrial cancer may be reliably excluded when the endometrial thickness is less than 4 mm, with a sensitivity rate of 94.8% and specificity of 46.7%. [13,14]

Mean age, parity, and endometrial thickness of the participants were 44.14±2.48 years, 3.3 ± 2.18 and 12.48±6.44 mm respectively. The histopathological diagnoses were as follows; 40 cases (40%) endometrial polyp, 10 cases (10%) endometrial hyperplasia, 11 cases (11) submucous myoma, 8 cases (8%) endometrium cancer, and 30 cases (30%) nonspecific findings. There were significant correlations between spiral artery PI and RI and different endometrial histologies. 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]

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. [19-21] Epstein et al [22] found that power Doppler can contribute to a correct diagnosis of endometrial malignancy in women with postmenopausal bleeding and endometrial thickness >5 mm. 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. [23] 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. [24]

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.

### Conclusion

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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