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Original Article

Three dimensional transvaginal sonography and power Doppler angiography in the differentiation between endometrial hyperplasia and endometrial carcinoma in postmenopausal women with abnormal uterine bleeding

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ABSTRACT

Objective: The aim of this study was to evaluate the accuracy of 3D transvaginal sonography and power Doppler in the differentiation between endometrial hyperplasia and endometrial carcinoma.

Patients and methods: Forty-two women suffering from abnormal uterine bleeding (AUB) were examined by 3D TV sonography and power Doppler angiography and all the sonographic findings and Doppler indices were recorded and evaluated.

Lesions were then classified as benign or malignant according to imaging findings and the results were then correlated with histopathology results.

Results: Significant improvement of the sensitivity and specificity was found in differentiating between endometrial hyperplasia and endometrial carcinoma when we combined the imaging findings of 3DTV sonography and the indices of power Doppler.

Conclusion: Adding power Doppler to 3D TV sonography has added value in the differentiation between endometrial carcinoma and hyperplasia.

1. Introduction

Postmenopausal bleeding is a common problem which occurs in about 10% of the postmenopausal women. Vaginal bleeding in women after menopause occurs in 90% of endometrial cancer. Endometrial cancer is most common cause of death in cancers which only affect women, behind ovarian and cervical cancer. It is the most common cancer of the female reproductive tract in developed countries [1].

The leading treatment option for endometrial cancer is abdominal hysterectomy and bilateral salpingo-oophorectomy. In more advanced cases, chemotherapy, radiation therapy or hormone therapy may be recommended. If the disease is diagnosed at an early stage, the outcome is favorable.

Endometrial hyperplasia is a significant risk factor for the development or even co-existence of endometrial cancer. Treatment of endometrial hyperplasia is individualized, and may include hormonal therapy, such as cyclic or continuous progestin therapy, or hysterectomy [2].

Abbreviations: PMB, postmenopausal bleeding; PI, pulsatility index; RI, resistive index; S/D ratio, systolic/diastolic ratio; TVUS, transvaginal ultrasound; TVCD, transvaginal colour Doppler; ET, endometrial thickness; EV, endometrial volume; VI, vascularization index; FI, flow index; VFI, vascularization flow index; VOCAL, Virtual Organ Computer-aided AnaLysis (VOCAL™) software.

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Several approaches have been proved to be clinically useful screening methods for early detection of endometrial abnormality in women with irregular uterine bleeding, and these include dilatation and curettage (D&C), hysteroscopy, and sonohysterography, and transvaginal sonography (TVS) with the measurement of endometrial thickness [3].

The objective was to evaluate the accuracy of 3D transvaginal sonography and power Doppler in the differentiation between endometrial hyperplasia and endometrial carcinoma.

2. Patients and methods

2.1. Patient characteristics

This is a retrospective study conducted at Ain Shams University Hospital during the period from January 2014 to January 2015. The study population consisted of 42 women suffering from abnormal uterine bleeding and scheduled for hysteroscopy and endometrial sampling. The mean age of the patients was 62 years (range, 42–84 years). Twelve patients were nulliparous, and 11 patients suffered from medical disorders as diabetes and essential hypertension.

The exclusion criteria included uterine fibroids, adenomyosis, endometrial polyps, and any general diseases, hormones or medications that could affect pelvic blood flow.

Post-menopause was defined as at least one entire year of menstrual stoppage after the age of 40. Verbal informed consents and full history were taken from all cases and then followed by general and local examinations.

3D ultrasonography together with power Doppler angiography study was done to all patients. The 3D power Doppler indices included "endometrial volume" (EV), "Endometrial thickness" (ET), "flow index" (FI), "vascularization index" (VI), "vascularization-flow index" (VFI), and intratumoral "resistive index" (RI) were measured.

Endometrial sampling was carried out by formal dilatation and curettage for all the patients. Fifteen out of forty-two patients (36%) had benign endometrium and 27/42 (64%) had malignant endometrium (atypical hyperplasia and carcinoma).

The histopathological results were compared with 3D ultrasonography and 3D power Doppler indices findings.

Patients with endometrial hyperplasia received medical treatment but the patients diagnosed as hyperplasia with cytological atypia or diagnosed as endometrial carcinoma were treated surgically by TAH and BSO "total abdominal hysterectomy with bilateral salpingo-oophorectomy". Lymph node dissection (para-aortic or pelvic nodes) in cases with carcinoma was also performed. Detailed histopathological reports were recorded. According to International Federation of Gynecology and Obstetrics criteria, all tumors were staged.

2.2. Three-dimensional sonography and power doppler angiography technique

Patients lied in lithotomy position during the examination. The system used was Voluson 730 system with a transvaginal mutifrequency probe (3–9 MHz) (KretztechnikIberica SA, Madrid, Spain).

At first, uterus and ovaries were examined in B-mode scan where endometrial thickness (maximum thickness) was measured and measurement should be in midsagittal plane and between the interfaces of myometrium with endometrium.

The ultrasound was then switched to the 3D mode with power Doppler. The Doppler window should be placed over the subendometrial area. Color gain was about 3.4 with normal color quality and PRF of 600 (pulse repetition frequency) and wall filter was 50 Hz. The most intense color signal was identified and the sample volume placed over it to obtain arterial flow wave. Resistive index (RI) was then calculated automatically and we took the lowest value. 3D endometrial volume then was captured with 90° sweeping angle. The 3D acquisition box was put over the window of the power Doppler.

Manual reformation of images was done by VOCAL program in coronal planes using rotational technique 90° step getting 20 endometrial slices from the fundus to the cervical internal os outlining the myometrial-endometrial interface.

The 3D power Doppler indices were measured: VI, FI, and VFI. The VI is "the measurement of the number of color voxels in the volume", and this represents the tissue vessels, and the number was expressed as percentage. The FI is calculated as the "mean color value in the color voxels", and it is an indication of the "average intensity of blood flow" (number from 0 to 100). The VFI is "the mean color value in all the voxels in the volume", and so, it is mixed expression of both blood flow and tissue vascularity (number from 0 to 100). All indices were automatically calculated with The VOCAL program as well as the EV.

3. Statistical analysis

The Mann-Whitney U test was used to compare the endometrial volume and 3D power Doppler indices. The evaluation of the individual ability of the different parameters used in the differentiation between endometrial hyperplasia and carcinoma was done by "Receiver operating characteristic" (ROC) curves and these curves were also used to evaluate the best cutoff value calculated for each test, and this value was defined as the one corresponding to the point on the ROC curve situated farthest away from the reference line (Fig. 1).

The different indices and RI were evaluated and compared to the stage of the tumor and its grading as well as myometrial infiltration together with metastases to lymph nodes. Analysis of variance was used for comparisons, except the VFI, for which we used the "Mann-Whitney U test". A P-value < .05 was used in all tests as a significance level (see Figs. 2–5).

4. Results

Fifteen out of forty-two cases (36%) included in the study had endometrial hyperplasia while 27/42 cases (64%) had endometrial carcinoma, out of which 9 patients

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