ORIGINAL ARTICLE

Uterine and ovarian arteries blood flow during the mid luteal phase in women with unexplained infertility

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Abstract *Objective:* Altered utero-ovarian blood flow has been claimed to be a subtle cause of unexplained infertility. The aim of this study was to compare between the flow velocity indices in the uterine and ovarian arteries during the luteal phase in fertile and unexplained infertility women.

Study design: Observational, cross section, controlled study done at the departments of Obstetrics and Gynecology, Benha Faculty of Medicine, Egypt, during the period from October 2010 to October 2011.

Patients and methods: Two groups each of 30 cases and aged 20-25 years were studied. A control group of fertile women who got pregnant within one year of marriage, and a study group of women with unexplained infertility were included. Trans-vaginal pulsed color Doppler ultrasound was done at days 21–23 of the cycle to measure uterine and ovarian arteries resistance and pulsation indices.

Outcome measures: Mean uterine and ovarian arteries resistance and pulsation indices in both groups and their values in the diagnosis of altered blood flow in unexplained infertility were measured.

Results: Women with unexplained infertility had significantly higher uterine and ovarian arteries pulsation index ($P < 0.001$–0.003), and no significant difference was found as regards the resistance index. Uterine artery pulsation index of $\geqslant 1.21$ was a good test for the diagnosis of decreased uterine artery blood flow in unexplained infertility with sensitivity and a specificity of 83.3% and an accuracy of 89%.

Conclusions: Unexplained infertility is associated with decreased uterine and ovarian arteries blood flow during the luteal phase. More studies are needed to support this conclusion and to

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evaluate the possible role of perfusion enhancer drugs in increasing utero-ovarian blood flow and enhancing pregnancy.

1. Introduction

Infertility is defined as one year of unprotected intercourse without conception and affects about 15% of couples. Unexplained infertility is diagnosed when basic infertility evaluation fails to reveal an obvious abnormality and it represents about 15% of infertility causes (1). Basic investigations include normal semen analysis, normal ovulation with a mid luteal serum progesterone $\geqslant 10$ ng/ml, patent fallopian tubes and normal pelvic cavity diagnosed by hysterosalpingography and laparoscopy. In 1988 Goswamy et al. (3) suggested that women with unexplained infertility may have an impaired uterine blood flow and subsequent studies (4) found that unexplained infertility was associated with aberrant uterine artery blood flow and intermittently absent end-diastolic flow. Trans-vaginal color Doppler ultrasonography is used to assess utero-ovarian blood flow and to evaluate the functional capacity and receptivity of the endometrium (5) and in the prediction of successful implantation and revealing unexplained infertility problems (6). Some investigators (7) found that good uterine blood flow is necessary for embryo implantation and good pregnancy rates and that higher uterine arterial resistance was associated with low pregnancy rate and poor outcome. Ovarian hemodynamic was claimed to be responsible for selection and maturation of the follicles and quality of the corpus luteum and that that measurement of the ovarian artery blood flow correlated with the number and quality of harvested oocytes (8), while other authors did not find this association (9).

2. Patients and methods

The study was approved by the ethics committee of the department of Obstetrics and Gynecology, Benha Faculty of Medicine and consent was taken from every woman before enrolling in the study. Two groups each of 30 cases aged 20–25 years were studied during the period from October 2010 to October 2011. A control group of fertile women who got pregnant within one year of marriage and a study group of women with unexplained infertility were included according to the following criteria (2): 1- Unprotected regular intercourse. 2- Normal semen analysis. 3- Serum progesterone at the mid luteal phase $\geqslant 10$ ng/ml. 4- Patent fallopian tubes and normal pelvic cavity diagnosed by hysterosalpingiography and laparoscopy. Exclusion criteria included 1- Patients treated with vasodilator drugs. 2- Women who received hormonal therapy or ovarian stimulation during the cycle of the study. Three dimension trans-vaginal color Doppler ultrasound (Voluson 730 PRO, GE, Healthcare, USA) with 7.5 MZ vaginal probe, was done at 21–23 days of the cycle between 10 am and 12 pm to avoid circadian changes in blood flow. The uterus was scanned in the sagittal plane and the probe was directed to the lateral fornix to identify the ascending branch of the uterine artery in the para-cervical area at the level of the internal os. The pulsed Doppler wave was activated and the angle of insonation was

adjusted to obtain three consequent similar waves. The probe was then moved to the posterior fornix and the ovaries visualized and the obtained color flow was explored until the typical low-amplitude ovarian artery signals were obtained. The blood flow resistant and pulsation indices of the uterine and ovarian arteries were visualized. The resistant and pulsation indices of the both uterine and ovarian arteries were displayed on the monitor and the mean calculated.

2.1. Statistical analysis

Data entry and analysis were performed using statistical package for the social science (SPSS) version 10 (SPSS, Inc, Chicago, IL, USA). Quantitative data were presented as mean and standard deviation. Student's t-test was used to compare means of two independent groups. The Receiver Operator Characteristic (ROC) curve was used to evaluate the value of resistant and pulsation indices in diagnosis of decreased blood flow in unexplained infertility patients. An area under the ROC curve from 0.9 to 1 represents excellent test, from 0.8 to 0.9 good test, from 0.7 to 0.8 fair test, from 0.6 to 0.7 poor test and from 0.5 to 0.6 fail test. Validity of the test at a certain cutoff point was represented by sensitivity, specificity and accuracy of the test. Result was considered significant at a P value of $\leqslant 0.05$.

3. Results

Table 1 shows no significant differences between infertile and fertile women as regards mean age, BMI and MAP.

Table 2 shows that infertile women had a significantly higher mean uterine and ovarian arteries PI than fertile women ($P < 0.001$–0.003), and no significant difference was found between the two groups as regards the RI.

Fig. 1 shows the ROC curves of the uterine artery indices. The pulsation index was a good test and the resistant index was a poor test for the diagnosis of decreased uterine artery blood flow in women with unexplained infertility (AUC #95% CI) = 0.89 and 0.42, respectively.

The test result variable(s); mean uterine artery PI and RI have at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

b. Null hypothesis is: true area = 0.5.

Fig. 2 shows the ROC curves of the ovarian artery indices. The pulsation index was a poor test and the resistant index was a fail test for the diagnosis of decreased ovarian artery blood flow in women with unexplained infertility (AUC #95% CI) = 0.67 and 0.54, respectively.

Table 3 shows the performance of the uterine and ovarian arteries blood flow indices in the diagnosis of decreased blood flow in women with unexplained infertility. Uterine artery PI at a cutoff point of $\geqslant 1.21$ was the only good and significant test ($P < 0.001$) with a sensitivity and specificity of 83.3% and an accuracy of 89%.