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## **DOPPLER IMAGE OF EXTRAEMBRYONIC BLOOD CIRCULATION IN THE EARLY GESTATION TRIMESTER AGAINST THE GROUND OF INFLAMMATORY DISEASES OF THE FEMALE REPRODUCTIVE ORGANS**

**Abstract.** *One of the main complications during early embryogenesis and placentation is placental dysfunction. Different factors, and infectious in particular, depending on their biological specificity produce a negative effect on reproductive cells of parents, development of the embryo, formation of trophoblast and placenta, that results in functional disorders of the placental complex and gestational complications during pregnancy. Due to extension of diagnostic possibilities to find functional disorders of the placenta as well as appearance of new data concerning the mechanisms of regulation of placental blood circulation in order to assess functional state of the fetal-placental complex (FPC) at the stage of formation of primary placental dysfunction against the ground of inflammatory diseases of the female reproductive organs we have determined Doppler image of the blood flow peculiarities (ovarian artery, intervillous space) in the women of the main and control groups. According to the stated purpose we have conducted ultrasound examination of 67 women at 6-7 and 12-14 weeks of gestation. The main group included 37 women with the signs of inflammatory diseases of the female reproductive organs, and the control group included 30 practically healthy women. Obtaining new data concerning the mechanisms to regulate blood circulation in the ovarian artery and intervillous space at the stage of formation of the placental complex in case of physiological and complicated pregnancy will enable to supplement the issues of pathogenesis and prevention of placental dysfunction.*

**Key words:** *placental dysfunction, blood circulation, ovarian artery, intervillous space, inflammatory diseases of the female reproductive organs, vascularization index, blood flow index.*

**Introduction.** Intrauterine infection is a stated fact of intrauterine penetration of viruses or microorganisms into the ovum. The most important complication in case of pregnancy against the ground of inflammatory diseases of the female reproductive organs is development of primary placental dysfunction. Examination of blood flow in the extra-embryonic structures at the early gestation terms in women with infections of the reproductive organs appears to be rather topical. Obtaining new data concerning the mechanisms of regulation of the blood flow in the ovarian artery and intervillous space at the stage of formation of the placental complex in case of physiological and complicated pregnancy will enable to supply the issues of pathogenesis concerning development and prevention of placental dysfunction.

**Objective:** to determine extra-embryonic blood flow (ovarian artery, intervillous space) in

pregnant women against the ground of inflammatory diseases of the female reproductive organs at the early gestation trimester.

**Materials and methods.** By means of USD apparatus «Voluson Expert 730» three dimensional echography was conducted with the aim to obtain a volumetric image of the chorion. The volumetric reconstruction of the chorionic blood flow was performed in the program VOCAL (Virtual Organ Computer-Aided Analysis) making the histogram of the vascular component in the specified volume of the chorionic tissue. The vascular component was assessed on the basis of detection of vascularization index (VI) and blood flow index (FI).

Doppler image of the blood flow peculiarities (ovarian artery, intervillous space) was determined in women of the main and control groups.

According to the stated purpose we have conducted ultrasound examination of 67 women at 6-7 and 12-14 weeks of gestation. The main group included 37 women with the signs of inflammatory diseases of the female reproductive organs, and the control group included 30 practically healthy women.

**Results.** In order to determine the indices of blood flow in the ovarian arteries the studies were performed in the area of the infundibular pelvic ligaments. And the control volume was gradually dislocating in the direction to the ovary and the moment of the best vascular visualization. To determine blood flow in the ovarian artery the structure of the ovaries was assessed first, and then the volume was measured according to the following formula:

$$V = 0,523ABC(\text{cm}^3),$$

where V – ovarian volume, A,B,C – ovarian sizes in different planes, and 0,523- constant coefficient.

A comprehensive analysis of the blood flow in the ovarian arteries resulted in detection of the following indices:

In the majority of women from the control group (78,6%) standard low-wave characteristics of the blood flow in the ovarian arteries were determined ( $V_{\max}$  from 0,06 to 0,14 m/sec) and high index of the peripheral resistance; at the same time diastolic component was either weakly marked or absolutely absent. Meanwhile in 24 (64,8%) women from the main group an average speed of the arterial blood flow was found ( $V_{\max}$  from 0,15 to 0,2 m/sec) and moderate indices of the peripheral resistance and in 13 (35,1%) high speed type of blood flow in the ovarian arteries was determined with high rates ( $V_{\max}$  from 0,14 to 0,57 m/sec) and high indices of the peripheral resistance.

The most valuable prognostic criteria promoting development of primary placental dysfunction and threat of interruption of pregnancy against the ground of inflammatory diseases of the female reproductive organs (the main group) were the following: 36-78% decrease of chorion volume, 56-78% decrease of vascularization index, high resistance in the ovarian artery on the side of the yellow body  $S/D > 3,5$ ,  $IR > 0,70$ , reduced chorion volume  $< 2,5$  cm. It should be noted that in women from the

control group the chorion volume was  $> 3\text{mm}$ , vascularization index did not decrease, and  $S/D < 3,5$ ,  $IR < 0,70$ .

To find the regularities of the vascular component formation against the ground of inflammatory diseases of the female reproductive organs and in case of physiological pregnancy the volume of chorionic tissue was determined at the stage of the placental complex formation. A gradual enlargement of the chorion tissue was found to occur in the I trimester of pregnancy in women from the control group from 5,5 to 15,8  $\text{cm}^3$  till the 13<sup>th</sup> week of gestation. During the period when formation of the chorion volume is completed, the villi grow in a wave-like manner during 2 weeks practically twice as much to 34,6  $\text{cm}^3$ . Though it was found that in the majority of women from the main group 32(86,5%) the area of the chorion tissue was within the range of 2,3 to 7,4  $\text{cm}^3$  till the 13<sup>th</sup> week of gestation, but during the period of formation of the chorion volume villi do not grow in a wave-like manner, and the volume indices were 17,8  $\text{cm}^3$ .

The following parameters were used in examination of the blood flow in the intervillous space:

- VI – vascularization index reflecting percent ratio of the vascular elements in the examined volume of the placental tissue;
- FI – flow index reflecting the amount of blood cells transported at the moment of examination.

Examination of the blood flow in different areas of the chorion in women from the control group diagnosed that at the term of pregnancy up to 11 weeks blood flow hermaphroditism in the peripheral and central regions was not determined. Thus, blood flow indices VI in the central area reached 15,1, FI -36,1, and in the peripheral one – VI-12,8, FI -30,0. Though in women from the main group VI in the central area was 8,9, and in the peripheral area – VI- 14,6, FI – 33. After 12 weeks of pregnancy in women from the control group a marked vascular hermaphroditism was found – vascularization index in the central area was much higher than those flow indices VI-20,8, FI-55,6 compared with the peripheral areas of the chorion VI-7,7, FI -33,6. In women from the main group vascularization

index in the central area VI-9,7,FI-35,1 was not practically higher than those of the peripheral area of the chorion VI-6,9,FI -31,4.

**Conclusions.** Examination of the blood flow of the extra-embryonic structures at the early terms of gestation enables to make the diagnosis of structural changes at the stage of placenta formation. Blood flow disorders in the I trimester of gestation against infectious factors penetrating into different vascular links in the mother-placenta-fetus system considering indices of blood flow volume demonstrate the regularity of formation of hemodynamic disorders at the stages of placental complex formation. These indices can be criteria to select women with the risk of formation of primary placental dysfunction.

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