



Ultrasound Diagnosis of Fetoplacental Insufficiency

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Abstract: Ultrasound examination is notable for its harmlessness to the patient, painlessness, relative economy and simplicity. Ultrasound diagnostics using Doppler methods for changing blood flow velocities and color mapping in terms of velocity and energy is performed to study vascular anatomy and hemodynamics.

Keywords: placenta, ultrasound diagnostics, Doppler methods, fetoplacental, placental insufficiency.

Introduction. Currently, placental insufficiency is widespread, according to various authors, at different stages of pregnancy, placental insufficiency occurs in 78-91% of pregnant women, and in practice, this pathology occurs in 29-40% of cases, which indicates an unsatisfactory diagnosis of placental insufficiency. The detection rate of fetoplacental insufficiency in the Russian Federation is quite low, at 31%.

In the absence of timely detection and treatment of placental insufficiency, there is an increase in perinatal pathology, in particular, hypoxic encephalopathy, fetal distress syndrome up to asphyxia.

Thus, there is a need to develop reliable methods for assessing blood flow in the mother - placenta - fetus system, and to determine the effect of placental blood flow disorders on the state of the fetal general hemodynamics.

The purpose of this study is to improve the efficiency of diagnosis of fetoplacental insufficiency using modern methods of ultrasound and Doppler studies.

Materials and methods. 415 people were examined. The main group (290 people) consisted of pregnant women, who, when examined at different stages of pregnancy, showed signs of chronic placental insufficiency. The control group (136 people) consisted of pregnant women in whom no signs of placental insufficiency were detected throughout pregnancy, which was confirmed by histological examination of the placenta after childbirth.

The analysis of the age structure of pregnant women suggests that signs of placental insufficiency are observed more often in age groups under 18 and after 32 years. When studying the obstetric and gynecological anamnesis, it was reliably revealed that the pathology of the placenta is more often diagnosed in women with a history of chronic inflammatory diseases of the internal genital organs, endometriosis of various localizations, and uterine fibroids.

An analysis of the somatic morbidity of the surveyed pregnant women showed that the risk group includes women with cardiovascular diseases, allergic reactions, diseases of the urinary system and mastopathy. These indicators may indicate possible violations of immunity and other defense mechanisms.

Pregnancy in all women in the control group proceeded without complications and ended in urgent labor at 37-41 weeks. The average delivery time in the control group was 39.0 ± 0.9 weeks. Of these, 18 women (13.2%) delivered by cesarean section. All births through the vaginal birth canal proceeded without complications and ended in the birth of living full-term babies with an Apgar score of 7-9 points.

In the main group, the main reasons for the development of chronic placental insufficiency include: gestosis - 198 women (68.3%); the threat of termination during pregnancy - 101 (34.8%); burdened obstetric and gynecological history - 94 (32.4%); isoserological incompatibility between mother and fetus - 74 (25.5%); chronic pyelonephritis - 41 (14.1%); anemia of a pregnant woman - 39 (13.1%).

Pregnancy in the main group ended in vaginal delivery in 204 women, which accounted for 70.3%, and 12 of them were premature births. Surgical delivery was performed in 86 women (29.7%). Indications for operative delivery on the part of the mother were in 66 cases (76.7%), on the part of the fetus - in 20 (23.3%). The indications from the fetus were data from a Doppler study on the presence of signs of placental insufficiency and severe fetal hypoxia.

Chronic placental insufficiency was characterized by the absence of clinical manifestations, good health of pregnant women, only with a long course of pathology were the consequences of placental insufficiency in the form of fetal hypoxia and intrauterine growth retardation noted.

The study used the classification by stages of maturation of the placenta, depending on the details of the echographic picture. From the 19-20th week of pregnancy to delivery, echostructural changes in the placenta occur in three anatomical regions: in the chorionic plate, in the body of the placenta and in the basal layer.

All patients of the main and control groups underwent a comprehensive study, including transabdominal ultrasound, color Doppler mapping, pulsed Doppler study, energy Doppler, and three-dimensional angiography up to 12 weeks of pregnancy, 20-22 weeks and 32-34 weeks. Doppler studied There were uterine arteries, intraplacental vessels, umbilical artery and fetal aorta. after delivery in the control and main groups, all placenta were examined histologically.

Conducting a study according to a single algorithm, regardless of the identified pathology, made it possible to conduct a comparative analysis of the nature of changes in the structure of the placenta and hemodynamics in the mother - placenta - fetus system, starting from 12 weeks until the moment of delivery, to assess the effect of clinically erased forms of placental insufficiency on the fetus and a newborn.

Results. The results of the Doppler study of the fetoplacental complex made it possible to establish that the study of peripheral resistance in the umbilical artery during the second trimester of pregnancy is not informative. The large variability of individual indicators of the pulsation index does not allow correctly assessing the nature of hemodynamic changes in the placenta. Peripheral vascular resistance in the umbilical artery characterizes blood flow in the placenta as a whole. A significant increase in the pulsation index in the umbilical artery in the third trimester of pregnancy is highly likely to predict the development of intrauterine growth retardation. The positive predictive value of the study in the third trimester of pregnancy curves of blood flow in the umbilical artery for intrauterine growth retardation was 78% in the main group, which coincides with the results of other studies. However, the sensitivity of the Doppler method in the study of blood flow in the umbilical artery did not exceed 45%. Such a

high level of predictive value of indices in the umbilical artery in relation to intrauterine growth retardation of the fetus proves that blood flow in this vessel changes only with deep damage to the vascular bed of the placenta, when therapeutic measures are ineffective.

The results of the study show that the indicators of blood flow in the intraplacental vessels do not always correlate with changes in the fetoplacental system. Significant differences from the control group were identified in the subgroups with preeclampsia, threatened abortion and ARVI. The rest of the pregnant women did not show any significant differences from the control group. With gestosis, hypertension, the threat of termination of pregnancy, a violation of circulation in the intervillous spaces was revealed. This leads to a compensatory increase in the proliferation of young villi and excessive development of syncytial nodules, and hyperplasia of the vascular endothelium occurs. All this leads to a relative increase in the peripheral resistance of the intraplacental vessels.

The children of the main group showed a higher incidence of complications in the neonatal period. Among the complications prevailed were the central nervous system hyperexcitation syndrome, cerebral circulation insufficiency, tremor, and the appearance of vascular plexus cysts of the lateral ventricles of the brain. This suggests that even compensated and subcompensated forms of placental insufficiency lead to impaired adaptation processes in the neonatal period.

In the first trimester of pregnancy, the ultrasound method has great diagnostic efficiency. Its sensitivity was 88%, specificity - 91%, accuracy - 89%. The optimal feature of the method is high information content, wide prevalence, harmlessness to mother and fetus, affordable cost. With the combined, sequential use of ultrasound and Doppler method in the first trimester of pregnancy, a slight increase in the diagnostic efficiency of the method was revealed. Its sensitivity was 92%, specificity - 81%, accuracy - 85%. The effectiveness of the method using three-dimensional vascular reconstruction practically did not differ from the diagnostic scheme of ultrasound + Doppler study of the blood flow of the placenta and fetus. Taking into account the rather high efficiency of the ultrasound method and the insufficient knowledge of the safety of the use of the Doppler method in the first trimester of pregnancy, we consider it sufficient for the early detection of primary fetoplacental insufficiency to conduct only ultrasound at 11-14 weeks.

With ultrasound examination of the fetus in the second trimester, signs of hypoxia, that is, the consequences of pathology of the placenta, are detected more often. This method with sufficient efficiency diagnoses the deterioration of the fetus, a change in the structure of the placenta, the umbilical cord entanglement of the fetus's neck, but it cannot identify the initial stages of changes in blood flow in the mother-placenta-fetus system and reliably visualize the bloodstream. Ultrasound sensitivity was 63%, accuracy - 78%, specificity - 71%. The combined use of the Doppler study method and ultrasound allows you to study the indicators of blood flow and vascular resistance, as well as timely identify the initial signs of impairment in the placental complex hemodynamics. The sensitivity of this method was 92%, the accuracy was 86%, and the specificity was 91%. With the addition of three-dimensional reconstruction methods, the diagnostic efficiency of detecting signs of fetoplacental insufficiency significantly increases, which, with timely correction, helps to reduce perinatal morbidity and mortality. The sensitivity of this method was 94%, specificity - 95%, accuracy - 95%. All of the above indicates the need for inclusion in perinatal screening at 22-25 weeks of gestation, along with ultrasound, Doppler and three-dimensional reconstruction.

In the third trimester, in addition to identifying signs of impaired blood flow in the fetoplacental complex, it is necessary to monitor the effectiveness of correction of disorders diagnosed in the second trimester. Ultrasonic research method during this period has a sensitivity of 72%, specificity - 79%, accuracy - 77%. With the combined use of ultrasound and the Doppler study method, these indicators increase significantly. The sensitivity was 89%, the specificity was 82%, and the accuracy was 87%. If

we additionally apply the method of three-dimensional reconstruction, the diagnostic efficiency is: sensitivity - 95%, specificity - 94%, accuracy - 96%.

Conclusion. Based on the data obtained, we have developed an optimal algorithm for using a complex of radiation research methods in the diagnosis of fetoplacental insufficiency.

Radiation methods of research in fetoplacental insufficiency at various stages of gestation are inseparable from clinical and laboratory methods. Timely diagnostics allows not only correct diagnosis, but also control of the treatment process. With the timely diagnosis of fetoplacental insufficiency, carrying out corrective treatment, perinatal morbidity and indicators of neonatal pathology decrease.

Thus, early detection of placental hemodynamic disorders, prevention of decompensation of fetoplacental insufficiency, timely correction under the control of the effectiveness of the therapy can significantly reduce the risk of developing complications from the central nervous system in the neonatal period. The results obtained indicate the possibility of monitoring pathological processes in the mother-placenta-fetus system using non-invasive diagnostic methods. The use of the algorithm developed by us makes it possible to identify early stages of disturbance of placental blood flow, monitor compensatory reactions of the placenta and control the quality of corrective treatment.

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