



The Middle Cerebral Artery Blood Flow of the Fetus in RH-Immunization

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Abstract: One of the complications of pregnancy is the so-called Rh-conflict between mother and fetus. This conflict is due to the fact that the body of a Rh negative (Rh-) pregnant woman rejects a Rh positive (Rh +) embryo due to a misunderstanding on the part of the mother's immune system. In order to assess the risk of developing Rh-conflict and understand the methods of its prevention, it is necessary to understand how our immune system works, what a blood group is and how the Rh factor works. The child inherits the Rh factor from one of the parents. The Rh factor of the fetus is determined in the womb, when the formation of the circulatory system begins. If the parents have the same factor, the child will not have problems. With a negative rhesus in the father, even if the fetus inherits it, nothing dangerous also happens. Problems begin if the mother has a negative rhesus, and the father is positive, and this positive factor is passed on to the child. The maternal immune system begins to attack the fetus. The provision of specialized care for pregnant women is a priority area of modern obstetrics. In the structure of perinatal morbidity and mortality, the immunological conflict as a result of Rh sensitization and group incompatibility stably ranks 5-6.

Key words: rhesus negative blood factor, rhesus sensitization, rhesus conflict pregnancy, hemolytic disease of the newborn (HDN), antiresus immunoglobulin

Introduction

The problem of fetal hemolytic disease remains relevant in modern obstetrics. In the absence of medical intervention in 50% of cases, the fetus has only moderate signs of hemolytic disease and does not need treatment; in 20-25% of cases, there is a severe course of hemolytic disease of the fetus with antenatal death before the 34th week of gestation. Modern methods of diagnosing the state of the fetus, approaches to the management of pregnancy, the active use of intrauterine intravascular infusions to the fetus have reduced the latter indicator to 10%. However, the methods require further study and

improvement. The main non-invasive method for diagnosing hemolytic disease of the fetus is ultrasound examination with Doppler analysis of the peak systolic blood flow velocity in the middle cerebral artery of the fetus. Not a single fetometric sign is a criterion that allows a high degree of probability to diagnose the severity of fetal hemolytic disease. The main ultrasound markers of the disease: an increase in the thickness of the placenta, the size of the liver and spleen, polyhydramnios, the presence of free fluid in the serous cavities of the fetus, an increase in the diameter of the umbilical vein, a double contour of the fetal head. Doppler studies make it possible to study fetal blood circulation in dynamics without the use of invasive technologies; their use is also necessary for the diagnosis of fetal diseases affecting hemodynamics, anemic syndrome. Ultrasound and Doppler blood flow in the middle cerebral artery of the fetus are the main, easily accessible and most informative method for diagnosing the severity of HDF in Rh-conflict. The Doppler method for peak systolic blood flow velocity in the middle cerebral artery of the fetus is based on the fact that with an increase in the severity of hemolytic disease, the blood flow velocity in the middle cerebral artery is higher than in the fetus of the same gestational age, and the degree of change in blood flow velocity is inversely correlated with the hematocrit level [12 -fourteen]. The diagnostic value of this method is determined by the pathogenetic mechanisms of the formation of a hyperdynamic type of blood circulation in the fetus as a result of hypoxia.

Aim of the work. Comparative assessment of indicators of blood flow velocity in the middle cerebral artery (peak systolic velocity - PSS) of fetuses in pregnant women with Rh immunization. Improve the prediction of fetal hemolytic disease.

Materials and methods

An ultrasound examination of fetuses in 50 re-pregnant women with and without Rh immunization was carried out by analyzing the cerebral blood flow velocity - peak systolic velocity (PSV) in the middle cerebral artery (MCA) at 30-34 weeks of gestation. The age of the pregnant women ranged from 25 to 35 years.

The criteria for inclusion in the main group were: informed voluntary consent to participate in the study, singleton pregnancy, Rh-negative blood belonging to the pregnant woman, the presence of anti-RH (D) antibodies. Exclusion criteria: severe somatic pathology, multiple pregnancy, large uterine fibroids, the presence of malignant neoplasms, the woman's refusal to participate in the study.

Criteria for inclusion in the comparison group: pregnancy parity equal to two or more, absence of anti-RH (D) antibodies, Rh-negative blood belonging to a pregnant woman. The exclusion criteria from the comparison group coincided with those in the main group.

Doppler study analyzed blood flow velocity curves in the umbilical artery, middle cerebral artery, right and left uterine arteries. Systole-diastolic ratio was defined as the ratio of maximum systolic (A) and end diastolic (B) blood flow velocity. The resistance index was also determined, which is the ratio of the difference between the maximum systolic velocity (A) and the end diastolic velocity (B) to the maximum systolic blood flow velocity (A). Systole-diastolic ratio and resistance index were used to assess the state of resistance of the peripheral part of the vascular bed for the umbilical cord artery, middle cerebral and uterine arteries.

Results and their discussion

Statistical analysis of the above parameters of ultrasound examination in pregnant women showed no significant differences between the results in the subjects of the main group and the comparison group: $p = 0.1$. There were no statistically significant differences in the frequency of registration of placental thickening, an increase in abdominal circumference, polyhydramnios, signs of fetal dropsy, hepatomegaly, and in the subgroups of the main group: $p = 0.9$. Thus, it was not possible to identify a

single fetometric criterion that would be predictive of the development of fetal hemolytic disease. Thickening of the placenta was recorded in 15.8% of cases in pregnant women of the main group, and equally often in different subgroups; no changes in this parameter were found in the comparison group. The parameters of blood flow in the middle cerebral artery of the fetus were tested. The maximum values of the indicator were significantly more often observed in the 1st subgroup ($p < 0.05$) compared with the comparison group ($p = 0.0000$), however, even with a pronounced anemic syndrome in the fetus, the peak systolic blood flow velocity did not exceed the level of 1.5 MoM ... This prompted us to conduct a more detailed analysis of the dynamic change in the analyzed indicator. To understand the trend of dynamic changes in the studied phenomenon, we divided the scale for assessing blood flow indicators in the middle cerebral artery of the fetus into two zones, the interface was the median of values between the norm and 1.5 MoM by the given gestational age. Zone 1 - the border of the peak systolic blood flow velocity from the norm (50th percentile) to the median, zone 2 - the border of the peak systolic blood flow velocity from the median to 1.5 MoM for a given gestational age. During dynamic observation, testing the values of the peak systolic blood flow velocity showed that the highest values were recorded significantly more often in the 1st group than in the comparison group – $p = 0.0004$. The dynamic change in the peak systolic blood flow velocity in the middle cerebral artery of the fetus was analyzed, and correlations between the transition of the value of this indicator from zone 1 to zone 2 with other studied phenomena were revealed. It was found that in the groups where severe hemolytic disease of newborns develops, the peak systolic blood flow velocity was significantly more often in zone 2 or, when observed in dynamics, passed from zone 1 to zone 2. For variable blood flow velocity in the middle cerebral artery (conditionally zone 1 and zone 2) revealed the following important relationships with binary variables: a history of blood transfusion, the presence of replacement blood transfusions, an increase in abdominal circumference, ascites, death, the severity of hemolytic disease of newborns, as well as laboratory parameters. To identify correlations between the variables, the Spearman and Gamma methods (for binary variables) were used. The Gamma coefficient had higher values, since it was adapted to determine the relationship of binary (yes / no) variables. The data obtained indicate that the change in the blood flow velocity in the middle cerebral artery (transition from zone 1 to zone 2) correlated with these variables. Consequently, these relationships can be viewed as causal.

Conclusion

Thus, testing the peak systolic blood flow velocity in the middle cerebral artery of the fetus during Doppler measurements is part of the tactics of managing pregnant women with immunization. Finding the indicator of the peak systolic blood flow velocity in zone 2 or a dynamic change in the value with the transition to this zone can serve as a prognostic factor for the development of severe fetal hemolytic disease. The significance of the increase in the peak systolic blood flow velocity in the middle cerebral artery of the fetus within the limits not exceeding 1.5 MoM for a given gestational age was also determined in predicting an unfavorable perinatal outcome during Rh immunization.

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