Summary

Introduction

Hypertension, pre-eclampsia, and eclampsia are conditions that complicate approximately 10% of pregnancies and are a significant cause of maternal and fetal morbidity and mortality[1]. Despite differences in definitions and diagnostic methods, there is a consensus on the need for special surveillance of complicated pregnancies as these conditions are influence on changes in circulation in a pregnant woman, which may result in certain neurological complications, as well as on changes in the fetal circulation. In the following paper, I would like to emphasize that Doppler ultrasonography of the internal carotid artery and the middle artery of the brain of pregnant women is a simple, repeatable, accessible and reliable tool that allows in advance to monitor changes in the hemodynamics of the mother's cerebral circulation, with specific clinical implications, as well as their dependence on changes in blood flow vascular in the maternal-fetal circulation and influence on specific obstetric outcomes[1][3][4].

Purpose of the work

The aim of the research is to analyze the changes in vascular flow within the middle cerebral artery, internal carotid artery in a pregnant woman, as well as uterine and fetal arteries in pregnancy complicated by arterial hypertension and pre-eclampsia. The aim of the study is to broaden the knowledge about the functioning of the mother's cerebral circulation in gestational hypertension and pre-eclampsia and its changes depending on the severity of changes in the fetal circulation, as well as to determine the mutual correlations between them and the impact of these correlations on obstetric results.

Methodology

The recruited people are patients of the Department of Obstetrics, Women's Diseases and Gynecological Oncology, University Hospital No. 2 in Bydgoszcz in 2020-2022, who signed a voluntary, informed and informed consent. The research project was approved by the Bioethics Committee. The study involved 90 patients with complicated pregnancy and 47 healthy patients. After the blood pressure was normalized below 140/90 mmHg, the patients underwent Doppler ultrasound examination of the flows within the internal carotid artery and the middle cerebral artery in the mother and through the vessels of the maternal-fetal unit.

Results

The doctoral dissertation finally obtained data for 90 women from the study group and 47 women from the control group. The compiled data provided an important source of knowledge for understanding the haemodynamics of the fetal circulation as well as the autoregulation of maternal cerebral blood flow. It was noted that the highest values of proteinuria and uric acid were recorded in patients with pre-eclampsia. Among patients with arterial hypertension and pre-eclampsia, significantly lower values of the pulsation index in the middle artery of the fetal brain, as well as increased pulsation indexes in the umbilical artery and venous duct were observed more often. In the study group, significantly higher values of the pulsation indices in the uterine arteries, both in the right and in the left, were noted, compared to the flows in uncomplicated pregnancies. In the group of patients, compared to the healthy group, the values of pulsation and resistance indices were significantly higher in the internal carotid artery and in the middle cerebral artery, especially with pre-eclampsia. It is noteworthy that the results usually did not exceed the upper limit of the norm for healthy adults. Also, MCA PSV and MCA EDV in the studies achieved higher values in patients with gestational hypertension. However, the values did not exceed the cut-off points for the diagnosis of stenosis in the internal carotid artery in any of the groups. The results of mutual correlations between maternal and fetal flows indicate that the deterioration of vascular flows in the mother positively correlates with the deterioration of flows in the fetus and within the uteroplacental unit. A negative correlation was found between the pulsation and resistance index in the internal carotid artery and the middle artery of the mother's brain and the pulsation index in the middle cerebral artery of the fetus. There is a positive correlation between the increase in pulsation and resistance indices in the internal carotid artery and the middle artery of the mother's brain, and the increase in the pulsation index in the left uterine artery and the presence of the early diastolic notch. Analyzing the influence of vascular flows on obstetric results, a high percentage of cesarean sections was found in the group with an increased pulsation index and the presence of "notch" in the left uterine artery, as well as increased resistance in the internal carotid artery of the mother. Abnormal umbilical artery flow and abnormal flow in both uterine arteries positively correlate with extremely preterm labor, low birth weight, and decreased neonatal Apgar score.

Conclusions

1. A statistically significant correlation was found between the Doppler flow in the maternal vessels and the Doppler parameters in the vessels of the uteroplacental unit. A positive correlation was observed between the changes in the vascular flow within the internal carotid artery and the mother's cerebral circulation, and the changes in the flows in the uterine arteries and the vessels of the fetus. There is an association between hypertension and pre-eclampsia, and disturbed cerebral circulation in the mother and centralization of circulation in the fetus.
2. Hypertension and pre-eclampsia positively correlate with high values of pulsation and resistance indices in the middle cerebral artery and in the internal carotid artery of the mother. Although the study group achieved significantly higher values of these parameters in the mother compared to the control group, in each group the results usually did not exceed the upper limit of normal for healthy adults. The peak systolic velocity and end diastolic velocity in the studies were higher in patients with arterial hypertension compared to healthy patients. However, the values did not exceed the cut-off points for the diagnosis of stenosis in the internal carotid artery in any of the groups.
3. Abnormal umbilical artery flow and abnormal flow in both uterine arteries, together with the presence of early diastolic notches, positively correlate with the occurrence of preterm labor and worse obstetric outcomes.