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MONOCHORIAL MULTIPLE PREGNANCY WITH ANTENATAL DEATH OF ONE FETUS (REVIEW ARTICLE)

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KEYWORDS

multiple monochorial pregnancy, antenatal death of one fetus, feto-fetal transfusion syndrome, syndrome of selective fetal growth retardation

ABSTRACT

Over the past decades, due to the widespread use of assisted reproductive technologies, the frequency of multiple pregnancies in the population has doubled, reaching an average of 2%.

According to the literature, in multiple pregnancies, the incidence of selective fetal growth retardation syndrome and impaired fetal-placental hemodynamics is significantly higher than in singleton pregnancy. Thus, the frequency of birth of fetuses weighing less than 2,500 grams is 6.52% and 92% for singleton, double and three-proton pregnancies, respectively.

An integrated approach within one institution to the diagnosis, perinatal observation, accompaniment and delivery of patients whose multiple pregnancies have been complicated by the antenatal death of one fetus can improve the perinatal outcomes of the surviving fetus.

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The probability of death of one fetus among all twins varies from 3.7 to 6.8% [21]. The death of one fetus with multiple births can occur at any stage of pregnancy, which in turn is combined with an increase in morbidity and mortality among surviving fetuses.

One of the leading factors that determines the outcomes of multiple pregnancies is the type of pregnancy that is chorial and amnional. The establishment of these parameters in the early stages of the development of multiple pregnancies is a fundamental factor determining the tactics of pregnancy management, in particular with developmental anomalies, critical conditions and the death of one of the fetuses [6].

The literature shows that the probability of antenatal death of the surviving fetus in the case of intrauterine death of another fetus is 12% with monochorial type of placentation and 4% with dichoral. At the same time, the risk of developing neurological disorders in a surviving fetus from a monochorial pair reaches 18% compared with 1% in the case of antenatal death of one fetus from a dichorial twin [15].

The causes of antenatal death of one fetus may be nonspecific for multiple births, similar to those in singleton pregnancies, or may be specific, characteristic only of multiple pregnancies [2]. Genetic or anatomical abnormalities in fetuses, partial and non-progressive placental abruption, placental insufficiency and fetal growth retardation syndrome, true umbilical cord node are non-specific causes. Specific causes of death of one fetus in multiple pregnancies include collision of umbilical cord loops in monochorial monoamniotic twins and feto-fetal transfusion syndrome or selective syndrome of slowing the growth of one of the fetuses in monochorial diamniotic multiple births [5, 10].

Monochorial multiple birth is an extremely high-risk pregnancy for adverse perinatal outcomes compared to the dichoral placental type group and the singleton pregnancy group. On average, 60% of cases of antenatal death of one fetus with multiple births occur with a monochorial type of placentation, while the probability of death of the second fetus and the development of neurological complications in a newborn is 3 times higher compared to that in the dichoral type of multiple births [22].

The vascular network of the monochorial placenta has several types of anastomoses that combine the hemocirculation systems of two fetuses: superficial - arterial and veno-venous, as well as deep - arteriovenous. Due to the angioarchitectonics of a single placenta for two fetuses, the development of specific complications that are characteristic only of the monochorial type of placentation is possible.

The most common cause of antenatal death of one fetus from a monochorial pair is the development of feto-fetal transfusion syndrome, which occurs in 10-15% of monochorial diamniotic twins. The predominance of deep unidirectional arteriovenous anastomoses over multidirectional arterio-arterial anastomoses causes an imbalance of blood flow through the small vessels of the placenta from the donor fetus to the recipient fetus, which leads to the development of feto-fetal transfusion syndrome. Arterio-arterial

and veno-venous messages, in turn, have a protective effect, compensating for arteriovenous discharge by bypassing blood between the donor and the recipient [1].

With the development of feto-fetal transfusion syndrome, the primary violation of the development of the donor part of the placenta leads to an increase in peripheral resistance to the placental circulation, which causes the redistribution of blood in the direction of the recipient and the development of hypovolemia, a decrease in urination and anhydrous in the donor fetus. The recipient fetus, compensating for the state of hypervolemia, increases urination, and since blood proteins with a high molecular weight remain in its bloodstream, the oncotic pressure in it rises, which causes an additional flow of fluid through the placental barrier from the maternal bloodstream. In severe forms of feto-fetal transfusion syndrome, these changes can lead to the development of ascites or generalized edema of the recipient fetus [17].

Currently, the application of the Quintero classification of feto-fetal transfusion syndrome is generally recognized [16]:

- Stage I: recipient polyhydramnios in combination with donor oligohydramnion;
- stage II: the donor's bladder is not visualized; Doppler indicators are normal;
- Stage III: critical hemodynamic disturbances in Dopplerometry (absence or reverse diastolic blood flow in the umbilical cord artery, reverse blood flow in the venous duct or pulsating in the umbilical cord vein) in any fetus;
- Stage IV: fetal edema;
- Stage V: Death of one or both fetuses.

In order to correct the feto-fetal transfusion syndrome, it is possible to use fetoscopic laser coagulation of placental anastomoses, amnioreduction or selective reduction of one fetus from twins. With expectant conservative tactics, perinatal mortality in feto-fetal transfusion syndrome reaches 95%, and the risk of neurological complications in a surviving fetus can reach 18-26% [12]. Thus, feto-fetal transfusion syndrome is considered the most significant risk factor for the development of antenatal death of one fetus in monochorial multiple births. It is generally recognized that fetoscopic laser coagulation is a pathophysiologically based method for correcting feto-fetal transfusion syndrome, in which the survival of fetuses within 24 hours from the time of the operation is a favorable prognostic sign for their further development. However, at present, data on the effect of fetoscopic laser coagulation on perinatal outcomes in relation to the surviving fetus with antenatal death of one fetus from monochorial diamniotic twins are not presented in the literature.

The syndrome of selective slowing of the growth of one of the fetuses complicates about 10-15% of monochorial multiple pregnancies and significantly increases the likelihood of antenatal death of one of the fetuses, severe neurological complications in newborns, worsening perinatal outcomes [25]. The main diagnostic criteria for selective syndrome of fetal retardation are: the difference in fruit weight is more than 25% and impaired fetal hemodynamics. Dissociation of fruit size determines the ratio of the

difference in the mass of a larger and smaller fruit to the mass of a larger one [26].

The current classification is based on dopplerometric spectra of umbilical artery blood flow, which can be evaluated by ultrasound examination of the fetus, starting from the second trimester of multiple monochorial pregnancy [4]:

Type I: Normal blood flow in the umbilical cord artery (presence of diastolic blood flow).

Type II: Permanently zero/reverse blood flow in the umbilical cord artery.

Type III: Periodically zero/reverse terminal diastolic blood flow in the umbilical cord artery or cyclic.

It is type III selective fetal retardation syndrome that is associated with the highest incidence of antenatal death of one fetus from monochorial twins and the development of neurological complications in relation to the surviving fetus, which is probably associated with acute episodes of feto-fetal discharges of blood through superficial arterial arterial anastomosis [20].

To explain the causes of the development of complications in a surviving fetus from monochorial diamniotic twins, the hypothesis of hemodynamic shunting became the most widespread. In their studies, Vajoria et al. showed that in the absence of clinical manifestations of feto-fetal transfusion syndrome, perinatal mortality is higher among pregnant women in whose placenta there were large superficial arterial and veno-venous vascular anastomoses, compared with a group of pregnant women whose placentas were dominated by deep arteriovenous anastomoses [5]. With antenatal death of one fetus with a monochorial type of placentation from the hemocirculation system of the surviving fetus through low-resistant arteriosimal and veno-venous anastomoses of the vessels of the placenta, acute transfusion of blood into the posthumously expanded vascular network of the deceased fetus occurs. Such transfusion can lead to the development of severe anemia, secondary hypotension and hypoperfusion of the brain tissue of the surviving fetus [28]. The validity of this hypothesis is confirmed in the results of a study of fetal blood samples obtained during diagnostic cordocentesis in patients with monochorial diamniotic twins. So, Nicolini et al. performed a study of hematological parameters in fetuses from monochorial diamniotic twins complicated by feto-fetal transfusion syndrome shortly before and within 24 hours from the moment of intrauterine death of one of the fetuses. Surgical correction was not carried out in this study. In a blood test of all four surviving fetuses, the hematocrit was significantly reduced compared to its values, which were established before the death of the first fetus, and averaged 21% (17-29%) [13]. This fact was later confirmed by data from Okamuro et al., who also found that after the antenatal death of one fetus, surviving fetuses from monochorial diamniotic twins develop anemia [14].

Modern prenatal diagnosis of the severity of hemolytic fetal disease is based on a non-invasive Dopplerometric assessment of the maximum systolic blood flow rate in the middle cerebral artery of the fetus, the value of which in the second and third trimesters of

pregnancy has a pronounced correlation with the value of hemoglobin and hematocrit in the blood of the fetus obtained during diagnostic cordocentesis. This method has been used in assessing the development and determining the severity of anemia in a surviving fetus from monochorial twins with antenatal death of one fetus [7].

It should be noted that the probability of death of the second fetus in the case of antenatal death of one fetus with monochorial diamniotic twins is 5 times higher compared to that of the dichorial type of multiple births and is 15% [23]. A study by Hillman et al. showed that after the death of one fetus with a monochorial type of placentation, the probability of neurological complications in a surviving newborn is 26%, which is 13 times higher than in dichorial a type of placenta that is only 2% [15].

Currently, the negative impact of antenatal death of one fetus from monochorial twins in early pregnancy in relation to the subsequent development of the second fetus has not been established. A possible explanation is the lack of data on the formation and functional activity of vascular anastomoses in the monochorial placenta between the hemocirculation systems of embryos in the early stages of pregnancy, which in later pregnancy provide pathological transfusion of blood into the vascular bed of the dead fetus at the time of its death [3]. Such transfusion is caused by functionally active superficial low-resistant vascular anastomoses between fetal hemocirculation systems, which can lead to antenatal death of the second fetus or damage to central systems and organs. Sonographic examination is the main method of instrumental diagnostics, which allows you to identify and determine damage to the structures of the developing brain and the main organs of the second surviving fetus. It is important that with antenatal death of one fetus, the performance of neurosonography allows you to exclude or suspect hypoplasia of the optic nerve, multicystic leukoencephalomalacia, microcephaly, porenfephaly, hydrocephalus, and with ultrasound examination of other organs of the fetus - bilateral necrosis of the cortical layer of the kidneys, microsomia and skin aplasia [18]. In foreign literature sources, there is little evidence that neurosonography allows you to identify early signs of structural changes in the brain of a surviving fetus no earlier than 7 days from the moment of manifistation of antenatal death of one fetus [27].

Antenatal death of one fetus in monochorial diamniotic twins after the fetus has reached a period of viability causes the greatest difficulty in determining the further management of this pregnancy, since there is a potential dilemma between urgent delivery and the birth of a deeply premature surviving fetus and prolongation of pregnancy with a possible increase in subsequent risks of morbidity, as well as mortality for the surviving fetus in the neonatal period, that is associated with the peculiarities of the monochorial type of placentation.

Currently, according to most perinatologists, in the absence of objective data on the violation of the condition of the surviving fetus, further conservative tactics of pregnancy management in combination with constant monitoring of its condition are considered the most preferable [10].

In case of detection of signs of severe anemia in a surviving fetus with dopplerometry of blood flow in the middle cerebral artery, in order to correct it and prolong pregnancy, intrauterine transfusion to the fetus of washed red blood cells of the donor is possible by analogy with the method of correction of severe anemia in hemolytic fetal disease. However, it is believed that this operation is effective only when it is carried out in the next few days after the antenatal death of one fetus.

Thus, intrauterine transfusion of washed donor erythrocytes to a surviving fetus from monochorial diamniotic twins is a possible method of correcting the detected anemia in the fetus. However, the effectiveness of correction of fetal anemia in relation to the subsequent neurological development of the newborn is not confirmed and probably depends on the time elapsed from the moment of antenatal death of one fetus to the performance of intrauterine transfusion. In order to confirm the effectiveness of this invasive correction method, additional research is required.

Antenatal death of one fetus is a possible factor that increases the risk of preterm birth, so A. Fichera et al. showed that the average delivery time for this complication of monochorial diamniotic twins averaged 36 (28.4-40.2) weeks of pregnancy [19], and most patients were allowed to deliver within three weeks of the death of one of the fetuses [11]. The probability of childbirth at a gestational age of less than 34 weeks in the case of antenatal death of one of the fetuses reaches 70% [8]. Given the rather high probability of early delivery in this group of pregnant women, it is fundamentally important to conduct a course of antenatal prevention of respiratory distress syndrome of the fetus. On the contrary, in the case of detection of antenatal death of one fetus at full term of pregnancy, regardless of the type of placentation, urgent delivery is indicated in view of the high risks of complications in relation to the second fetus. The method of delivery should be discussed in each case individually, while childbirth through the natural birth canal is not contraindicated, provided that it is possible to carry out constant monitoring of the condition of the fetus. If the dead fetus is the first, then the birth process may be associated with higher intranatal risks in relation to the second surviving fetus. In this case, it is advisable to discuss the issue of prompt delivery by cesarean section.

An integrated approach within one institution to the diagnosis, perinatal observation, accompaniment and delivery of patients whose multiple pregnancies have been complicated by the antenatal death of one fetus can improve the perinatal outcomes of the surviving fetus.

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