MODERN MEDICINE AND PRACTICE
https://inovatus.es/index.php/ejmmp
EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE
Vol. 4 No. 11 (Nov - 2024) EJMMP ISSN: 2795-921X

# MODERN METHODS OF DIAGNOSTICS OF HEMOLYTIC DISEASE OF YOUNG CHILDREN

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**Abstract:** Hemolytic disease of the newborn is a condition in which red blood cells are destroyed or destroyed by the mother's antibodies. Hemolysis is the destruction of red blood cells. This disease can occur when there is an incompatibility (incompatibility) between the blood of the mother and the blood of the fetus. The diagnosis is based on the results of a blood test for the mother and, in some cases, for the father. Sometimes immunoglobulin is administered to the mother during pregnancy to prevent this disease in newborns. Treatment may include blood transfusions to the fetus before birth and to the newborn after birth. Red blood cells contain hemoglobin, a protein that gives the blood its red color and carries oxygen from the lungs to all tissues of the body. Oxygen is used by cells to help the body produce the energy it needs from food, while carbon dioxide is released as a waste product. Red blood cells return carbon dioxide from the tissues to the lungs. When the red blood cell count is too low, the blood carries less oxygen, causing fatigue and weakness. Hemolytic disease of the newborn can lead to an increase in the level of bilirubin in the blood (hyperbilirubinemia), a low level of red blood cells (see Anemia in newborns), and in rare cases, in the most severe forms, death. Bilirubin is a yellow pigment produced during the normal breakdown of red blood cells.

**Key words:** Symptoms, Diagnosis, Prevention, Treatment.

## Rh incompatibility

The Rh factor is a molecule found on the surface of red blood cells in some people. If a person's red blood cells contain the Rh factor, the blood is considered Rh positive. If the human red blood cells do not have the Rh factor, the blood is Rh negative. Most people are Rh-positive.

If the child has Rh-positive blood and the mother has Rh-negative blood, they are Rh-incompatible. As a result, the immune system of the Rh-negative mother can recognize the Rh-positive red blood cells of the fetus as "foreign" and produce antibodies against the Rh factor on the fetal red blood cells. This process is called Rh sensitization.

If the mother has antibodies to the Rh factor, they can pass from her blood through the placenta to the blood of the fetus before birth. If the fetus is Rh positive, the mother's Rh antibodies attach to the fetus's red blood cells and destroy them (hemolysis). Rapid destruction of red blood cells in the fetus begins while it is still in the womb and continues after birth. This destruction can lead to anemia.

An Rh-negative mother's body can produce Rh antibodies when exposed to Rh-positive red blood cells. Often, women are exposed to Rh-positive blood while carrying an Rh-positive fetus. Mothers are most exposed to fetal blood during childbirth, which often results in Rh sensitization. Thus, in most cases, hemolytic disease appears in a fetus whose mother was sensitive during a previous pregnancy.

Mothers are exposed to Rh-positive blood early in pregnancy, such as through spontaneous or induced abortion, fetal diagnostic testing (eg, amniocentesis or chorionic villus sampling), intra-abdominal trauma, or early placental abruption. possible (separation of the placenta). In this case, these antibodies affect the same fetus during pregnancy.

The effect can also occur unrelated to pregnancy, for example, if the mother has previously received an Rh-positive blood transfusion. After the mother's body is exposed and antibodies are produced, the chances of problems with an Rh-positive fetus increase with each subsequent pregnancy.

**Incompatibility according to the ABO system**

Sometimes other blood type incompatibility can cause a similar (but milder) hemolytic disease. For example, if the mother's blood type is O and the fetus's blood type is A or B, and the mother's body crosses the placenta and attaches to the fetus's red blood cells, causing them to die (hemolysis), A or Produces antibodies to B. ), causes mild anemia and hyperbilirubinemia. This type of incompatibility is called ABO incompatibility.

Anemia with ABO incompatibility is usually less severe than with Rh incompatibility and, unlike Rh incompatibility, becomes less severe with each subsequent pregnancy.

**Symptoms of hemolytic disease of newborns**

After birth, newborns with hemolytic disease may have swollen, pale, or yellow skin (a condition called jaundice), or an enlarged liver or spleen, anemia, or fluid retention.

Diagnosis of hemolytic disease of newborns

Blood test of the mother and in some cases the fetus during pregnancy;

sometimes blood tests of the father and the newborn.

At the first prenatal visit during pregnancy, blood is drawn from the mother to determine whether she is Rh-negative or Rh-positive.

If the mother's blood is Rh negative and tests show the presence of anti-Rh antibodies or other antibodies that can cause hemolytic disease in the newborn, the father will be tested for blood. If the father's blood is Rh positive, the fetus can also be Rh positive, so there is a risk of Rh sensitivity. In such cases, mothers undergo periodic blood tests to detect anti-Rh antibodies during pregnancy.

Nothing else needs to be done until antibodies are detected. If antibodies are detected, special tests are performed on the mother and fetus during pregnancy, and after birth, they are transferred to the newborn.

**Prevention of hemolytic disease of newborns**

Immunoglobulin injection during pregnancy and after childbirth.

In order to prevent the development of antibodies against fetal red blood cells in Rh-negative women, they are given Rh0 (D) immunoglobulin drug at about the 28th week of pregnancy and again within 72 hours after birth. She also receives the injection after an episode of vaginal bleeding and after amniocentesis or chorionic villus sampling. Rh0 (D) immunoglobulin quickly covers Rh-positive red blood cells of the fetus entering the mother's bloodstream, so they are not recognized as "foreign" by the mother's immune system and do not trigger the formation of anti-Rh antibodies. This treatment usually prevents the development of hemolytic disease of the newborn.

Treatment of hemolytic disease of newborns

Before birth, in some cases, blood is poured into the fetus.

During childbirth, in some cases, additional blood transfusion.

Treatment of jaundice (if any).

If the fetus is diagnosed with anemia, a blood transfusion can be given before birth. Blood transfusion is done before the fetus is fully mature and can be delivered safely. Corticosteroids may be given to mothers before delivery, if needed, to help the fetus's lungs mature in preparation for early delivery. After birth, the newborn may require repeated blood transfusions.

Severe anemia caused by hemolytic disease of the newborn is treated like any other anemia (see "Treatment of anemia in newborns").

Doctors also check the fetus for jaundice. As a result of the rapid destruction of red blood cells and the production of large amounts of bilirubin, the possibility of jaundice is very high. Bilirubin is a yellow pigment, its excess amount (hyperbilirubinemia) gives a yellow color to the skin and whites of the eyes of a newborn baby.

Bilirubin levels that are too high can harm the baby. Treatment of high bilirubin levels can be done by exposing the newborn to special bright lights (phototherapy or "bili lights") or in some cases by giving the newborn a blood transfusion. Very high levels of bilirubin in the blood can cause brain damage (bilirubin encephalopathy) if not prevented by the measures described above.

Polycythemia is an abnormally high concentration of red blood cells.

The causes of this disease can be in the postpartum period, diabetes of the mother, fetal-fetal transfusion, in which blood is transferred from one fetus to another, or a decrease in the amount of oxygen in the fetal blood.

A high concentration of red blood cells thickens the blood (increases viscosity) and can slow blood flow through small blood vessels.

Most newborns with polycythemia have no symptoms, but sometimes have red or dark skin, lethargy, poor appetite, and rarely seizures.

The diagnosis is based on the results of a test that measures the amount of red blood cells in the blood.

No treatment other than fluids is usually required.

If the newborn is symptomatic, it can be treated with partial blood transfusions to reduce the concentration of red blood cells.

Red blood cells contain hemoglobin, a protein that gives blood its red color and carries oxygen from the lungs to all body tissues. Oxygen is used by the cells to produce the necessary energy for the body, and carbon dioxide is released as a waste product. Red blood cells remove carbon dioxide from the tissues and return it to the lungs.

A significant increase in the concentration of red blood cells can lead to an increase in blood viscosity. Highly viscous blood slows blood flow in small blood vessels and prevents oxygen from reaching tissues. Polycythemia is more common in newborns or newborns whose mothers have diabetes, high blood pressure, smoke, or live at high altitudes.

Even if the newborn receives a lot of blood from the placenta (the organ that connects the fetus to the uterus and supplies the fetus with nutrients), polycythemia can occur if the newborn is below the level of the placenta. can also happen. long before the umbilical cord clamps.

Other causes of polycythemia include: a decrease in the amount of oxygen in the blood (hypoxia), perinatal asphyxia, growth restriction in utero, birth defects (such as heart or kidney disease), Down syndrome, Beckwith-Wiedemann syndrome, or massive blood transfusions from one fetus to another. infusion (feto-fetal infusion).

**Symptoms of polycythemia in newborns**

A newborn with severe polycythemia may have very red or dark skin, lethargy, poor appetite, and seizures.

Diagnosis of polycythemia in newborns

Blood test

A newborn baby is given a blood test to detect polycythemia. If blood test results show that the newborn's red blood cell count is too high, the newborn may be treated for polycythemia.

Treatment of polycythemia in newborns

IV fluids

In some cases - partial exchange blood transfusion.

If the newborn is asymptomatic, intravenous fluids may be given to replace fluids, as dehydration (loss of fluid) can make the blood more viscous.

If the newborn is asymptomatic, some of the newborn's blood is removed and replaced with an equal amount of salt water solution (saline). This procedure, called a partial exchange transfusion, dilutes the remaining red blood cells and corrects the polycythemia.

Anemia is a disease in which there are too few red blood cells in the blood.

Anemia can occur when red blood cells are broken down too quickly, too much blood is lost, or the bone marrow does not produce enough red blood cells.

If red blood cells break down too quickly, anemia can develop and the level of bilirubin (a yellow pigment released when red blood cells break down normally) rises, causing the newborn's skin and whites to turn yellow (a condition known as jaundice called). .

If too much blood is lost too quickly, the newborn may become seriously ill, go into shock and become pale, with a rapid heart rate, low blood pressure, and rapid, shallow breathing.

If the bleeding is not severe or occurs gradually, the newborn may appear normal, but may appear pale.

Treatment may include intravenous fluids (intravenous), followed by a blood transfusion or exchange.

Red blood cells contain hemoglobin, a protein that gives blood its red color and carries oxygen from the lungs to all body tissues. Oxygen is used by cells to help the body produce the energy it needs from food, while carbon dioxide is released as a waste product. Red blood cells return carbon dioxide from the tissues to the lungs. When the number of red blood cells is too low, the blood carries less oxygen, causing fatigue and weakness (see also Overview of Anemia in Adults).

Bone marrow contains special cells from which blood cells are formed. Normally, the bone marrow produces very few new red blood cells in the first 3-4 weeks after birth, which causes a slow decrease in the number of red blood cells (called physiologic anemia) during the first 2-3 months of life.

Very premature babies have a significant decrease in the number of red blood cells. This condition is called anemia of prematurity. Anemia of prematurity occurs most often in children in the first year of life, in babies born with a gestational age (the time the fetus is in the uterus after fertilization) of less than 32 weeks. in the hospital for a long time.

Severe anemia may occur if:

rapid destruction of red blood cells (this process is called hemolysis);

if a lot of blood was taken from a premature baby for the test;

excessive blood loss during childbirth or childbirth;

insufficient production of new red blood cells in the bone marrow.

Several of these processes can occur simultaneously.

**Rapid destruction of red blood cells (hemolysis)**

Severe destruction of red blood cells leads to anemia and high levels of bilirubin in the blood (hyperbilirubinemia).

Hemolytic disease of the newborn is a disease in which the newborn's red blood cells are rapidly destroyed by antibodies in the mother's blood.

In addition, if the newborn has a genetic abnormality of red blood cells, the red blood cells can be destroyed quickly. An example of this is hereditary spherocytosis, where red blood cells appear as small balls under a microscope.

Another example is deficiency of a red blood cell enzyme called glucose-6-phosphate dehydrogenase (G6PD deficiency) in infants. In these babies, the effect of certain drugs taken by the mother and the fetus during pregnancy (for example, aniline dyes, sulfa drugs, etc.) can lead to rapid destruction of red blood cells.

Hemolysis can also occur with hemoglobinopathy. Hemoglobinopathies are genetic disorders that affect the structure or production of hemoglobin. Hemoglobin is a protein inside red blood cells that allows the cells to carry oxygen from the lungs to all parts of the body. Thalassemia is an example of a hemoglobinopathy that rarely causes problems in newborns.

Infections acquired before birth, such as toxoplasmosis, rubella, cytomegalovirus infection, herpes simplex virus infection, or syphilis, can destroy red blood cells as quickly as newborn bacterial infections acquired during or after birth.

**Blood loss**

Blood loss is another cause of anemia. Blood loss in newborns can occur in different ways. For example, blood loss occurs when a large amount of fetal blood passes through the placenta (the organ that connects the fetus to the uterus and supplies the fetus with nutrients) into the mother's bloodstream (fetal-maternal transfusion). Blood loss can also occur when too much blood accumulates in the placenta during delivery, if the baby is held too long in the mother's abdomen before the umbilical cord is compressed.

Feto-fetal transfusion, in which blood is transferred from one fetus to another, can cause anemia in one twin, while the other has too much (polycythemia).

If the placenta separates from the uterus before birth ( placental abruption ) or is attached to the wrong place ( placenta previa ), the fetus can lose blood.

Certain invasive procedures to detect gene and chromosomal abnormalities in the fetus may result in blood loss. Invasive procedures are procedures that require the insertion of an instrument into the mother's body. These procedures include amniocentesis, chorionic villus sampling, and percutaneous cord blood sampling.

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