Rh Hemolytic Disease of the Fetus and Newborn

Rh hemolytic disease of the fetus and newborn (HDFN, erythroblastosis fetalis) is characterized by the destruction of fetal RBCs and subsequent anemia. It is caused by Rh (rhesus) incompatibility between the mother and fetus. This can occur when there is an Rh(D)⁻ mother and an Rh(D)⁺ fetus. The mother will then form anti-Rh(D) antibodies that can cross the placenta or come into contact with fetal blood during normal birth trauma. This will result in hemolytic anemia of the fetus or newborn. This can present with hydrops fetalis, neonatal jaundice, and kernicterus. Diagnosis can be made with a positive Coombs test or ultrasound. Management consists of RhoGAM prophylaxis, intrauterine blood transfusions, phototherapy, or IVIG.



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Characteristics

Rh (Rhesus) Incompatibilities

Recess-playground Incompatibles

An Rh incompatibility involves an Rh-negative mother and Rh-positive newborn, with maternal exposure to fetal blood (e.g. fetomaternal hemorrhage) leading to the production of maternal IgM antibodies against the Rh antigen (1st pregnancy). With time, this seroconversion to Rh-IgG is able to cross the placenta leading to hemolytic disease of the newborn (subsequent pregnancies).

Rh(D)⁻ Mother and Rh(D)⁺ Fetus

Pregnant-woman holding Rh- sign with Fetus and Rh+ sign

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Anti-Rh(D) Antibodies

Ant-tie (D) and Ant-tie-body

With the 1st pregnancy, maternal exposure to fetal blood (e.g. fetomaternal hemorrhage or during delivery) leads to the production of maternal IgM antibodies against the Rh antigen. With subsequent pregnancies, the rapid production of IgG anti-D antibodies (formed by seroconversion) to fetal RhD antigens is able to cross the placenta leading to agglutination of fetal RBCs with hemolytic anemia (i.e. hemolytic disease of the newborn).

Hemolytic Anemia

Hemolyzing-RBCs from Anemone

A decrease in the number of circulating RBCs in newborns can be evaluated by a reduction in hemoglobin concentration, hematocrit or RBC count. This occurs due to the hemolysis of RBCs due to the condition.

Presentation

Hydrops Fetalis

Eye-drop Fetus

Hydrops fetalis is characterized by generalized edema and fluid accumulation in serous cavities. It can present prenatally in cases of Rh incompatibility.

Neonatal Jaundice

Newborn Jaundice-janitor

Postnatally, neonatal jaundice can present at birth or manifest within 24 hours of life. With Rh incompatibility, unconjugated bilirubin levels may be extremely high, which can also lead to kernicterus.

Kernicterus

Colonel

Unconjugated bilirubin levels from RBC breakdown may be extremely high postnatally. This can lead to kernicterus which is encephalopathy due to high bilirubin levels. There are several encephalopathic features including cerebral palsy.

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Diagnosis

Positive Coombs Test

Positive Comb

If the newborn has signs of hemolysis postnatally, a Coombs test can be conducted. A Coombs test is an agglutination test used to detect hemolytic antibodies and/or complement proteins that are already bound to RBCs (direct) or unbound to anti-RBC antibodies in serum (indirect). Rh incompatibilities are associated with a positive Coombs test.

Ultrasound

Ultrasound-machine

Ultrasonography can be used in the diagnosis of Rh hemolytic disease of the newborn. An elevated flow rate of fetal blood vessels on doppler ultrasound can indicate anemia.

Management

RhoGAM [Anti-Rh(D) Immunoglobulin]

Row-Groom

Rh hemolytic disease of the newborn can be prevented by administering RhoGAM (anti-D prophylaxis) to Rh-negative women during the 3rd trimester and early postpartum period (if fetus is Rh-positive). This prevents maternal IgG anti-D production.

Intrauterine Blood Transfusion

Blood Transfusion-IV in Uterus

An intrauterine blood transfusion can be administered during the prenatal period as a treatment option for severe cases of anemia.

Phototherapy

Photo-flash

With postnatal treatment, phototherapy - and if necessary exchange transfusion with RBCs - can be used to address hyperbilirubinemia. Additionally, iron supplementation can aid in the symptoms of hemolytic anemia.

IVIG (Intravenous Immunoglobulin)

Ivy-gold-goblin

In severe cases, IVIG can be administered. IVIG essentially acts as a competitor to the rhesus antigen but does not cause hemolytic anemia. Thus it prevents native Rh antibodies from attacking fetal RBCs.

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