Hemolytic disease of the newborn

Hemolytic disease of the fetus and new born is a condition in which red cells of of the fetus or neonate are destroyed by the antibodies produced by the mother. This condition occurs when Rh negative woman becomes pregnant with RH positive baby. When Rh positive baby's blood enters in to the mothers circulation due to trauma or during dilivery the mother becomes sensitized and produces anti-D antibodies. These antibodies are IgG type so that they can cross the plasenta easily. Then antibodies enters in to the fetus circulation and destroys the fetus red blood cells and the fetus becomes anemic , gradully the fetus will die. In the other hand if the mother do not sensitized before and if she is pregnant for the first time and if there is no any trauma, the fetus blood enters in to the mother's circulation during dilivery a condition known as feto-maternal hemorrage (FMH) and the mother becomes sensitized. May be the first child develop well because there is no antibodies that enters in to the baby's circulation.

In subsequent pregnancy, IgG antibodies cross the plasenta and results in red blood cell distruction by macrophages in the fetal liver and spleen. If the RBC destruction continues, the fetus becomes increasingly anemic. Fetal liver and spleen enlarge as erythropoiesis increases in an effort to compensate for the RBC destructions. Erythroblasts are released into the fetal circulation (Erythroblastosisfetalis). If this condition is left untreated, cardiac failure can occur accompanied by hydropusfetalis, or edema and fluid accumulation in fetal peritoneal and pleural cavities.

Hemolytic disease of the fetus and new born is usually due to Rh, ABO and other minor blood group sysytem incompatibilities. Rh incompatibility causes the most severe cases and it occurs when Rh negative mother become

pregnant Rh positive baby. Also ABO incompatiblity causes HDFN. It is common but mild type. This occurs when mother’s ABo blood group does not compatible with the fetus especially when blood group O mother carries A, B or AB fetus. Group O mother has anti-A and Anti-B antibodies which are Mostly IgG type. Then this IgG type antibodies cross the placenta and destroys the fetus red blood cells. But it is not sever as Rh antibodies.

ABO incompatibility often affects the first pregnancy because of the presence of non-RBC stimulated ABO Abs. HDFN can be also caused by other blood group system incompatibilities like kell system (anti-k), Kidd, Lewis, Duffy, MN, P and others. Anti-K 1 antibodies causes from mild to severe disease. It causes the second most common form of severe HDFN

Sign and symptoms of HDFN

Clinical presentation of HDN varies from mild jaundice and anemia to hydrops fetalis. Because the placenta clears bilirubin, only risk to the fetus is anemia. Extramedullary hematopoiesis (due to anemia) results in hepatosplenomegaly. Risks during labor and delivery include asphyxia and splenic rupture.

Postnatal problems include:

- Asphyxia, Pulmonary hypertension
- Pallor (due to anemia) Edema (hydrops, due to low serum albumin)
- Respiratory distress
- Coagulopathies (â†“ platelets & clotting factors)
- Jaundice, Kernicterus (from hyperbilirubinemia)
- Hypoglycemia (due to hyperinsulinemnia from islet cell hyperplasia)

Laboratory Findings vary with severity of HDFN and include:

- Anemia
- Hyperbilirubinemia
- Reticulocytosis (6 to 40%)
- â†‘ nucleated RBC count (> 10/100 WBCs)
- Thrombocytopenia
- Leucopenia
- Positive Direct Antiglobulin Test
- Hypoalbuminemia
- Smear: polychromasia, anisocytosis,

Assessment of HDFN

Pre-natal diagnosis: Testing of every pregnant women

- ABO and Rh typing
- Antibody screening
- Antibody identification
- Antibody titration
- Pregnant women
- Rh positive mother
- Rh negative With anti-D
- Rh negative No anti-D
- No problem
- Antibody Titer
- Repeat the titer every 2-4 weeks until delivery
- Repeat screening for anti-D
- Every 2-4 weeks until delivery

Father testing

Testing of father's blood group system with mother's blood type is important to determine genotype of the baby. The father's blood should be tested for ABO, Rh and other significant antigens to predict the chance the fetus has of being Rh positive and affected by HDFN.

Molecular Genotyping

- Rh type of mother, father, and fetus
- Fetal blood typing by using fetal DNA from amniocentesis or cell-free, fetal-derived DNA present in maternal plasma
- Heterozygosity or homozygosity of the father for RHD allele

Post partum testing: Collect cord blood and test

Fetal blood (or umbilical cord blood)

- ABO and Rh typing of the infant
- Antihuman globulin test (DAT)
- Antibody identification
- Full blood count
- Liver and renal function tests
- Blood morphology examination

Maternal blood

Acid elution technique of Kleihauer-Betke test to confirm if the fetal red blood cells pass in to the mother circulation.

Indirect Coombs test for IgG antibodies that cause HDFN

Treatment of the fetus suffering from hemolytic disease

Intrauterine blood transfusion

This is done by placing a needle through the mother's uterus and into the abdominal cavity of the fetus or directly into the vein in the umbilical cord.

- Intraperitoneal transfusion – blood transfused into fetal abdomen
- Intravascular transfusion – blood transfused into fetal umbilical vein

Exchange transfusion

For infants who develop hyperbilirubinemia and/or anemia due to HDFN, exchange transfusion is usually carried out.

Exchange transfusion is removal of small amounts of blood from the neonate and replace with donor blood until a one or two-volume exchange is accomplished.

Helps to:

- To replace normal red cells(correction of anemia)
- Remove concentration of bilirubin
- Remove incomplete free antibodies
- Remove fetal red cells coated with maternal antibody
- Provides the infant is with compatible donor red cells.

Phototherapy (light treatment)

is the process of using ultraviolet light to eliminate bilirubin in the blood. These light waves are absorbed by the baby's skin and blood and change the indirect bilirubin into direct bilirubin, which can be easily excreted by the newborn.

Prevention of hemolytic disease of the fetus and newborn:

Prophylaxis of the mother with Rh immunoglobulin

RhIG remains the treatment of choice for the prevention of HDFN. Rh D-negative mothers given a drug called Rh immunoglobulin (RhIg), also known as RhoGAM. This is a specially developed blood product that can prevent Rh negative mother's antibodies from being able to react to Rh positive cells.

This anti-D Ig is given at about 28 weeks gestation, which is about the time when fetal RBCs start to express the D antigen, and mothers receive another dose at about 34 weeks, a few weeks before labor begins during which the risk of feto-maternal hemorrhage is high. A final dose of anti-D Ig is given after the baby has been delivered within 72 hours.

The future

A number of new approaches look promising for the future

Down-regulation of the immune system in sensitized patients with Therapeutic vaccine reduces or stops the production of anti-D antibodies by the sensitized pregnant women.

Molecular typing of Rh (RHD and RHCE), Kell (K & k), Duffy (Fya & Fyb), and Kidd (Jka & Jkb) loci. In prenatal testing programs, molecular typing can determine the Rh type of the mother, father, and fetus and may be done if the mother has anti-D or another antibody known to cause HDFN.

Fetal blood typing can be done using free fetal DNA from cells obtained by amniocentesis or by testing cell-free, fetal-derived DNA present in maternal plasma.