

# Overview of Hemolytic Disease of Fetus and Newborn-Erythroblastosis Fetalis

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## ABSTRACT

The disease erythroblastosis fetalis is hemolytic anemia in the foetus neonate, as erythroblastosis caused by passing of mother's antibodies through the placenta. Cause of this disease usually results from incompatibility between maternal and fetal blood groups. The fetal disease ranges from mild to very severe and fetal death from heart failure. Treatment including intrauterine transfusion for early induction of liver when pulmonary maturing has been attend the mother may also undergo plasma exchange to reduce the circulating level of antibody by as much as 75%.

**KEYWORDS:** *Antibodies, Blood, Erythroblastosis, Fetal, Rh- positive, Rh- negative*

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## INTRODUCTION

Hemolytic disease of the newborn, (also known as HDN) is an alloimmune condition that develops in a fetus when the IgG antibodies produced by the mother and passing through the placenta include ones which attack the red blood cells in the fetal circulation. The red blood cells are broken down and the fetus can develop reticulocytosis and anemia. Rh-negative persons do not have natural antibodies against Rh antigen. RH positive blood in Rh-negative persons introduces antibody formation, once antibodies are formed subsequent transfusion proves fatal. Rh incompatibility has great significance in child birth and Rh negative women married with Rh positive man become sensitized by carrying Rh positive fetus within her body. Due to damage of small blood vessels blood is frequently exchange between the fetus and mother during childbirth, this causes the formation of antibodies in mother's blood. It is seen that, about 10% pregnancy in human beings are with Rh incompatibility but only 0.5% result in anemia behind it there are two regions for such low incidence of haemolytic disease.

1. The diffusion of fetal cells does not occur too frequently and when it occur the amount of diffused antigens may be too low to induce antibody formation
2. The fetal RBC with antigen A or B when leak through placenta of o-type mother are quickly destroyed by anti A and anti B antibodies even before the anti RH antibodies are formed. Thus ABO incompatibility prevents formation of anti RH serum.

## STUDY

Hemolytic disease is the disease in fetus and newborn, also known as alloimmune HDFN. Characterized by abnormal hemolysis of RBCs, of the neonate or fetus by maternal immunoglobulin G (IgG) antibodies. The formation of maternal antibodies in response to a fetal antigen is called isoimmunization. Erythroblastosis fetalis is a disorder in fetus characterized by presence of erythroblasts in blood. When a mother is RH negative and fetus is RH positive (the Rh factor being inherited from the father).

**Rh factor:-**Rh factor is an inherited protein, found on the surface of red blood cells. Not everyone has this protein, if a person has the protein, they are RH positive. Those who do not have the Rh protein are Rh negative.

### Two main cause of RH incompatibility:-

1. When a woman with RH negative recessive (dd) blood is impregnated by a man with dominant homozygous (DD) Rh positive blood. Then fetus will be RH positive heterozygous (Dd).
2. When a woman with RH negative recessive (dd) blood is impregnated by a man with heterozygous (Dd) Rh positive blood, then, 50% offspring are Rh positive heterozygous (Dd).

Due to Rh incompatibility, at the time of delivery, a small amount of the baby's RH positive blood may gain access to the maternal circulation. In response, the immune system of the mother produces anti- RH antibodies. During the

subsequent pregnancy, the fetus is exposed to these antibodies as they cross the placenta. If this fetus is also Rh-positive, then the anti- Rh antibodies attack the fetal erythrocytes and cause hemolytic disease of the newborn (erythroblastosis fetalis). This may occur in about 3% of second Rh- positive babies and about 10% of third RH-positive babies. The incidence continues to increase with subsequent pregnancies.

**ABO incompatibility**

This is another type of mismatch that can cause maternal antibody against her babies blood cell is ABO compatibility. ABO compatibility occurs when the mother blood type of AB or O is not compatible with the baby's. This AB compatibility condition is almost always less harmful or threatening to the baby than Rh compatibility. Although babies can carry rare antigen that can put them at risk of erythroblastosis fetalis. These antigen include, K cell, Duffy, Kidd, Lutheron, Diego, Xg, P, Ec , Cc , HNSs.

Erythroblastosis fetalis can occur when different Rh factor blood types mix during pregnancy. Problems can arise even if small amounts of Rh-positive and Rh- negative blood mix.

**Reasons of women and the fetus blood mixing during pregnancy**

1. The placenta detaching from the wall of the uterus during delivery.
2. Bleeding during pregnancy
3. Abortion
4. An ectopic pregnancy
5. A miscarriage
6. Prenatal tests, such as an amniocentesis.
7. The most common cause is at the time of parturition (delivery of the child) the Rh antigen from fetal blood leaks into mother's blood because of severance of umbilical cord.

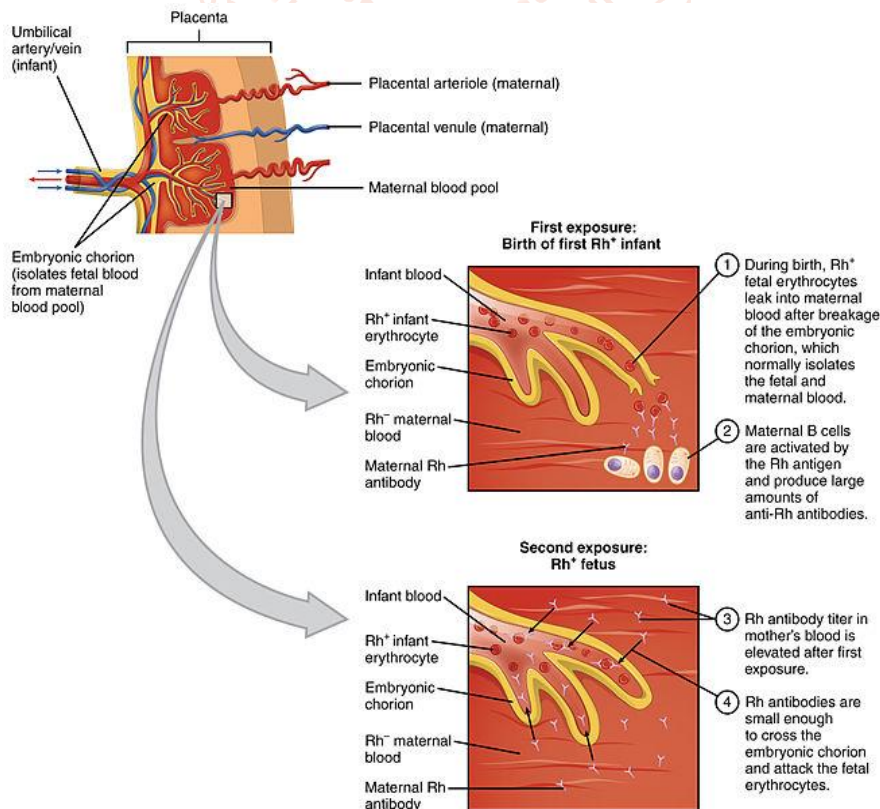
If Rh-negative blood mixes with Rh- positive blood, an immune response known as Rh sensitization may occur. This

means that the person with Rh- negative blood will produce antibodies to fight any future exposure to Rh-positive blood. The body can also produce antibodies after contamination with a Rh- positive blood from a needle or a blood transfusion. Once sensitized the body's immune system will recognize any future Rh- positive cells as foreign and attack them.

When the mother conceives for the second time and if the fetus happens to be Rh positive again, the Rh antibody from mother's blood crosses placental barrier and enters the fetal blood. Thus, the Rh antigen cannot cross the placental barrier whereas Rh antibody can cross it.

The Rh agglutinins which enter the fetus cause agglutination of fetal RBCs resulting in hemolysis. Ultimately due to excessive haemolysis severe complications develop:-

1. **Severe anemia:-**Excessive hemolysis results in anemia. Hemolysis (destruction of RBC) can be rapid in fetus. As a result, the fetus will not receive enough oxygen, which may lead to severe anemia , other illnesses or even death.
2. **Liver and spleen enlargement:-** Because the body produces red blood cells in the liver and spleen, this overproduction can sometimes cause these organs to enlarge.
3. **Raised Bilirubin levels:-** As the immature red blood cells continue to breakdown bilirubin, which is a by-product of the breakdown of red blood cells, builds up. The excess amount of bilirubin circulating in the newborn's body will lead to jaundice, where the skin and eye whites of the infants turn yellow.
4. **Hydrops fetalis:-**Hydrops fetalis is another severe complication that causes fluid to build up in fetal tissues and organs as a result of heart failure. This is a life threatening condition.
5. **Kernicterus:-**A buildup of bilirubin in the brain can lead to a complication called kernicterus, leading to seizures, brain damage, deafness, or death.



**Figure 1: Figure shows mixing of blood during child birth and formation of antibodies.**

### Prevention or treatment for erythroblastosis fetalis:-

Erythroblastosis fetalis is a preventable condition. A medication called Rh immunoglobulin (Rhig), also known as RhoGAM, can help prevent RH sensitization.

### RhoGAM method for preventing erythroblastosis fetalis

RhoGAM is preparation of anti RH antibodies i.e. antisera. The Rh mother is given a special blood test after delivering of Rh+ child if total Rh positive cells are present in mother's blood she is given injection of RhoGAM. RhoGAM (anti RH antibody) is obtained from immunized donors. The RhoGAM form a coat around the fetal RBC in mother's blood and destroy them before their RH antigen could initiate antibody formation in Rh mother. Result is that Rh positive antigens are not available to stimulate mother's circulation and no antibodies are formed.

1. If mother is found to be Rh negative and fetus is Rh positive, antiD (antibody against D antigen) also known as RhoGAM should be administered to the mother at 28th and 34th weeks of gestation as prophylactic measure. If Rh negative mother delivers RH positive baby antiD/ RhoGAM should be administered to the mother within 48 hours of delivery. This develops passive immunity and prevents the formation of RH antibodies in mother's blood. So the hemolytic disease of newborn does not occur in a subsequent pregnancy.
2. If the baby is born with erythroblastosis fetalis, the treatment is given by means of exchange transfusion. RH negative blood is transfused into the infant replacing infant's own RH positive blood. It will now take at least 6 months for the infant's new RH positive blood to replace the transfused RH negative blood. By this time all the molecules of RH antibody derived from the mother get destroyed.

### Strategy to escape from erythroblastosis fetalis

If a baby experiences erythroblastosis fetalis in the womb, they may be given intrauterine blood transfusion to reduce anemia. To escape from this, doctor may recommend delivering the baby early, if babies' lung and heart mature enough for delivery. After parturition the further blood transfusion may be necessary. To improve blood pressure

gives the fluid intravenously to the baby. The baby may also need temporary breathing support from ventilation or mechanical breathing machine.

After parturition, treatment depends on the severity of the condition, but could include temperature stabilization and monitoring, phototherapy, transfusion with compatible packed red blood, exchange transfusion with a blood type compatible with both the infant and the mother, sodium bicarbonate for correction of acidosis and/or assisted ventilation.

### CONCLUSION

From the above study we can conclude that erythroblastosis fetalis (hemolytic disease) occurs when babies blood mixed with mother's blood with different type of blood( RH negative mother which had a pregnancy with or are pregnant with RH positive infant). In this condition first child of Rh- negative mother and Rh-positive father is always normal but subsequent Rh child carried by Rh-negative mother is exposed to successive high concentration of antibodies accumulated by mother. Mother's antibody pass through the placenta at causes hemolysis of foetus RBC, resulting in hemolytic jaundice and anemia.

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