National university Sudan
Faculty of Medical Laboratory Sciences
Advanced Hematology MLS –HEMA-324

Hemolytic disease of newborne

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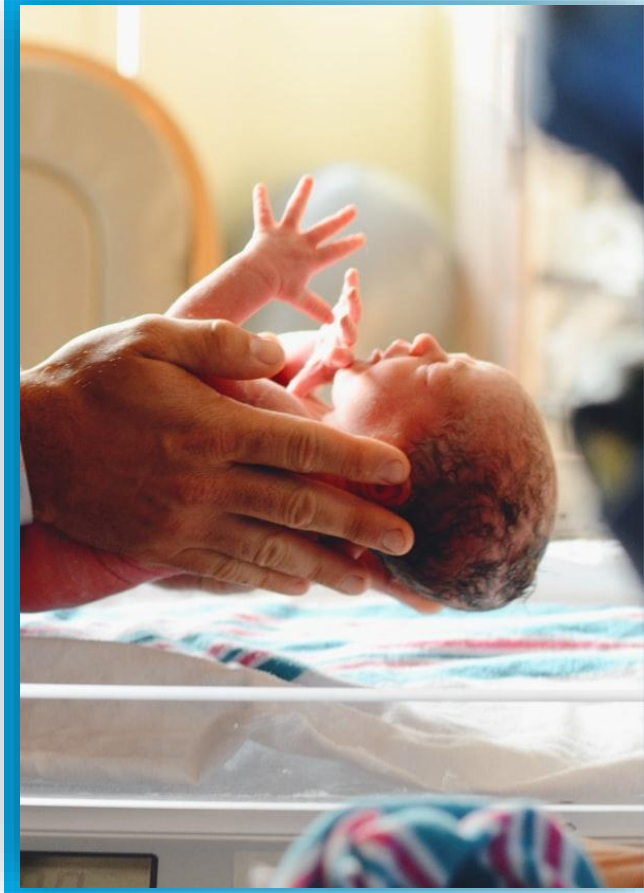
Lecture(39)

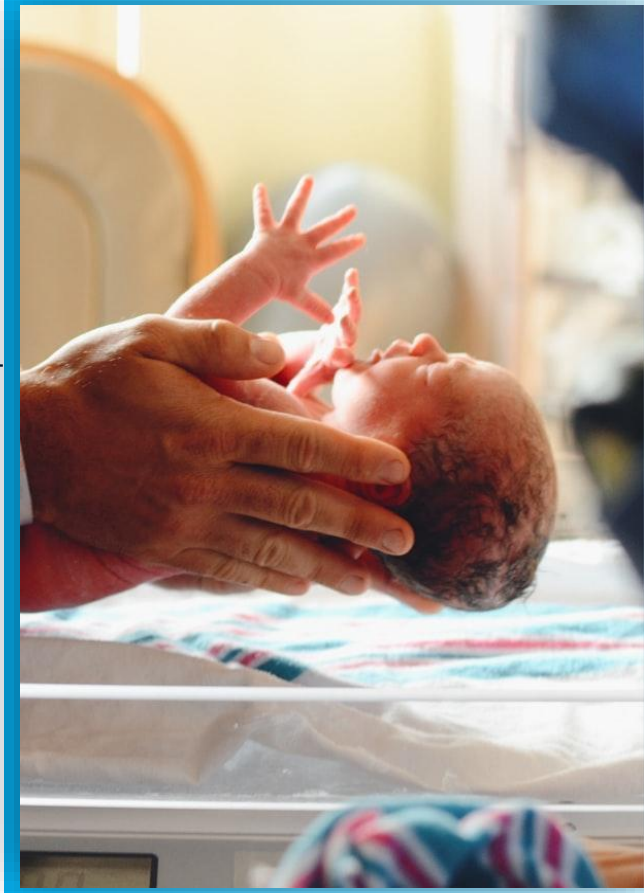
Objectives

- Definition.
- Etiology
- RH HDN.
- Pathogenesis.
- Signs and symptoms
- Management .
- ABO HDN.



Defintion

- HDN also known as (erythroblastosis fetalis) is a destruction of the red blood cells (RBCs) of the fetus and neonate by antibodies produced by the mother.



Hemolytic disease of newborn

- It is a condition in which the life span of the fetal/neonatal RBC is shortened due to maternal allo-antibodies against red cell antigens acquired from the father.
- It was a major cause of fetal loss and death among newborn babies.

Etiology

- **Rh incompatibility:**
- Hemolytic disease occurs most frequently
- **develops when an Rh –ve mother conceives a fetus which is Rh +ve**
- **ABO incompatibility:**

mother has blood type O (hyper immune; serum contain IgG &IgM) and the fetus has blood type A or B or AB.

Etiology

- **Other causes:**
- Other Minor blood group antigens (kell, kid)
- Thalassemia
- Autoimmune Hemolytic Anemia

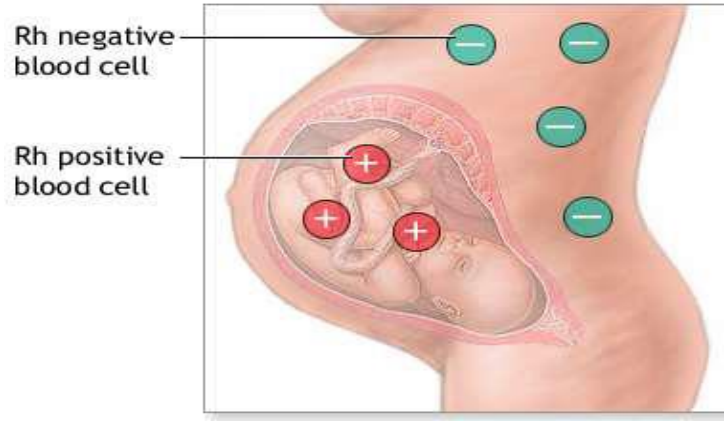
Rh incompatibility

- Rh incompatibility is a condition which develops when an Rh negative mother conceives a fetus which is Rh positive.
- Fetal RBC Rh Antigen : Rh “ D ” Ag
- Mother produces: Anti Rh (D) Abs.
- **Isoimmunization:**
- When the mother produces Abs directed against fetus RBC surface Ag

Rh incompatibility

- **Cause:** Feto- maternal Bleed
- **Risk Factors of Feto-maternal Bleed:**
- Amniocentesis
- Ectopic pregnancy

Pathogenesis



- Rh incompatibility is a condition which develops when there is a difference in Rh blood type between that of the pregnant mother (Rh negative) and that of the fetus (Rh positive).

- Usually placenta is barrier to fetal blood entering maternal circulation.
- Sometimes during pregnancy or birth, fetomaternal haemorrhage (FMH) can occur
- The woman's immune system reacts by producing anti-D Antibodies that cause sensitization

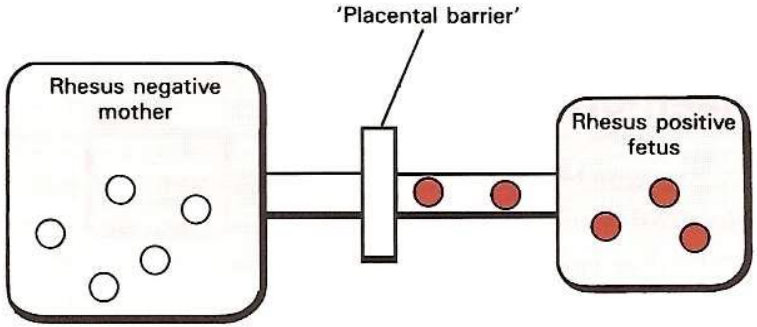


Fig. 46.3 Normal placenta with no communication between maternal and fetal blood.

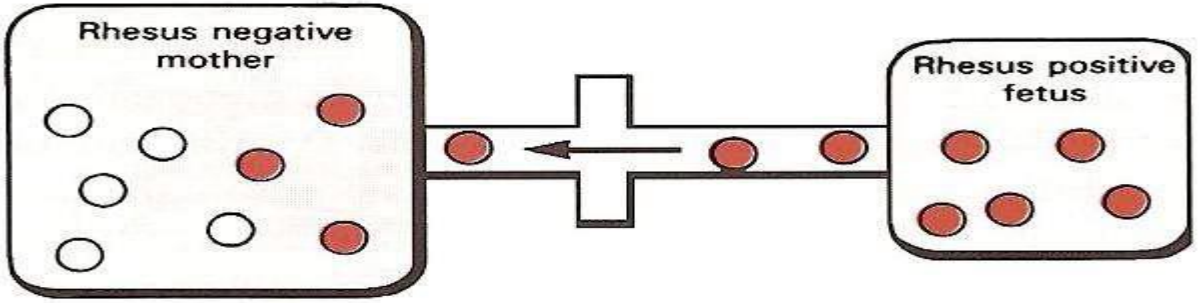


Fig. 46.4 Fetal cells enter maternal circulation through `break' in `placental barrier', e.g. at placental separation.

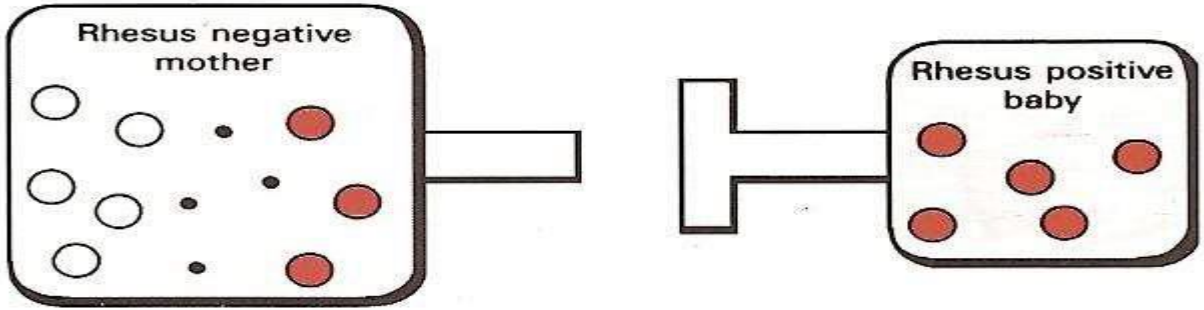


Fig. 46.5 Maternal production of Rhesus antibodies following introduction of Rhesus positive blood.

- Subsequent pregnancies antibodies can cross placenta and destroy fetal erythrocytes.

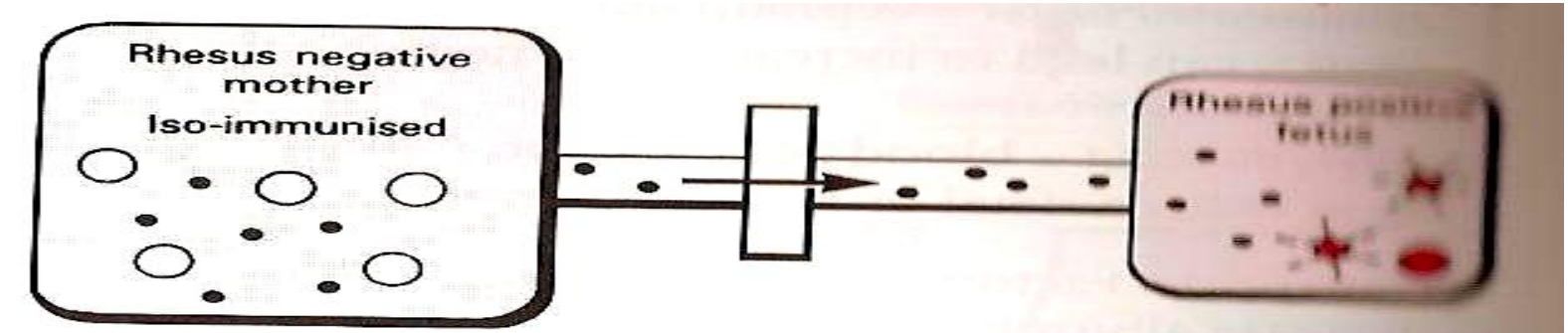
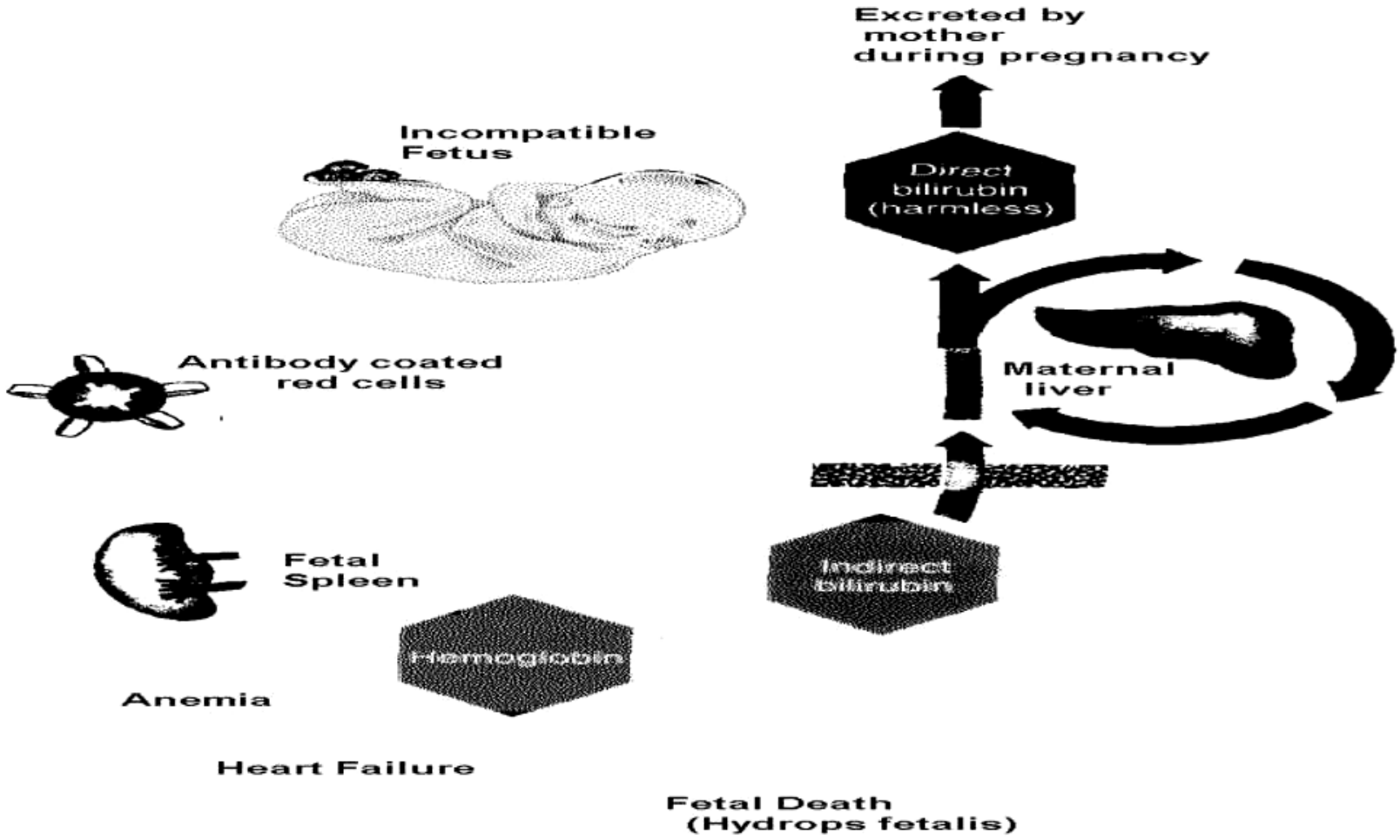


Fig. 46.6 In a subsequent pregnancy maternal Rhesus antibodies cross the placenta, resulting in haemolytic disease of the newborn.

- The haemolytic disease of fetus and new born caused by Rh isoimmunisation can occur during the first pregnancy, but Usually sensitisation during the first pregnancy or birth leads to extensive destruction of fetal RBC during subsequent pregnancies.
- **Conditions affecting 1st pregnancy :**
- Miscarriage
- Abortion
- Feto-maternal haemorrage


Excreted by mother during pregnancy
Incompatible Fetus
Direct bilirubin (harmless)
Antibody coated red cells
Maternal liver
Fetal Spleen
Indirect bilirubin
Haemoglobin
Anemia
Heart Failure
Fetal Death (Hydrops fetalis)

Clinical presentation

- Hemolysis → ↑ed bilirubin levels
- Rh incompatibility can cause symptoms ranging from
- very mild to fatal.
- After delivery bilirubin is no longer cleared (via
- placenta) from the neonate's blood → **Jaundice**
- (within 24 hours of life)
- Possibility of acute or chronic **Kernicterus**

Signs and symptoms

- ***Mildest form- Rh incompatibility:***
- 1-Hemolysis with the release of free hemoglobin into the infant's circulation.
- 2- Jaundice.
- ***Severe form- Rh incompatibility***
- Prenatal manifestations :
- Hydrops fetalis / Erythroblastosis Fetalis

Sings and symptoms

- Massive fetal RBC destruction →Profound anemia
- pallor
- high-output **heart failure**
- Enlarged liver / spleen
- Generalized Edema
- Ascites and Respiratory distress

Severe form- Rh incompatibility

1- severe forms → petechiae and purpura

2- Severe anemia (Fetal heart failure) **stillborn** or Death of infant shortly after delivery.

3- Total body swelling

4- Respiratory distres (if infant has been delivered)

5- Circulatory collapse.

5- Kernicterus. (bilirubin encephalopathy)

(Neurological syndrome in extremely high levels o indirect bilirubin (>20 mg/dL).

Investigations

- **Blood grouping**
- Mother: Rh Negative
- Father: Rh Positive
- Baby: Rh Positive
- Direct Coombs test: Positive in INFANT
- Indirect Coombs test: Positive in MOTHER
- **Biochemical test**
- **Hyperbilirubinemia**
- **Hypoalbuminemia**
- **LDH: Increase**
- **Haptoglobin Decrease**

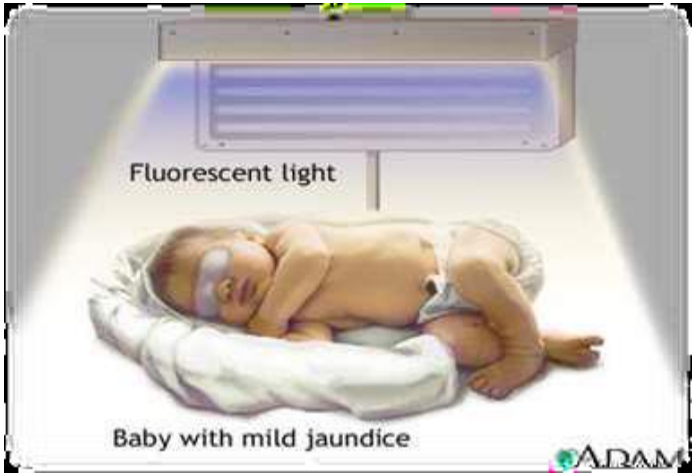
investigations

- **CBC**
- TWBC: normal
- Hb: ↓Hb
- MCV, MCH, HCHC : Normal or Increase
- Platelets: Normal to Decrease
- **↑ Reticulocytosis (6 to 40%)**

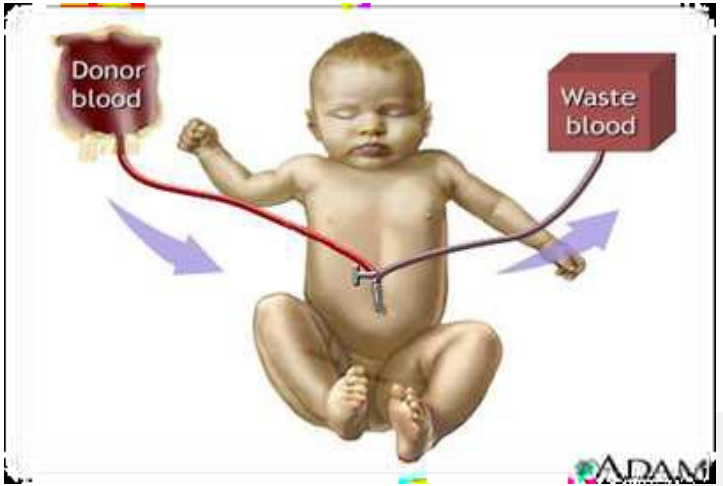
- **Blood Smear**
- Polychromasia
- Anisocytosis
- ↑ Erythroblasts (nucleated RBCs)
- No Spherocytes

Management

- **Phototherapy for neonate**
- with mild jaundice



- **Exchange transfusion in**
- Severe cases



Preventing HDN

- **Determine Rh status of the mother**
- **If the mother is not sensitized, reduce the risk of**
- **future sensitization**
- **If the mother is sensitized, determine whether**
- **the fetus is at risk and monitor accordingly**
- To prevent Isoimmuization of yet unimmunized
- mother give Anti Rh D IgG (Rhogam) IntraMuscular at 28 weeks of gestation.

ABO haemolytic disease of the newborn

- High-titre maternal IgG anti-A or anti-B antibodies present in mothers who are group O can cause prolonged neonatal jaundice and anaemia associated with spherocytosis if their newborn babies are group A or B .
- ABO HDN may occur in a first pregnancy.

ABO HDN

- A number of special factors combine to protect the fetus from the effects of ABO incompatibility include :
- Relative weakness of A and B antigens on the fetal red cells.
- The widespread distribution of A and B glycoproteins in fetal fluids and tissues, which divert much of the maternal IgG antibody away from the fetal red cell ‘target’.


Thank you