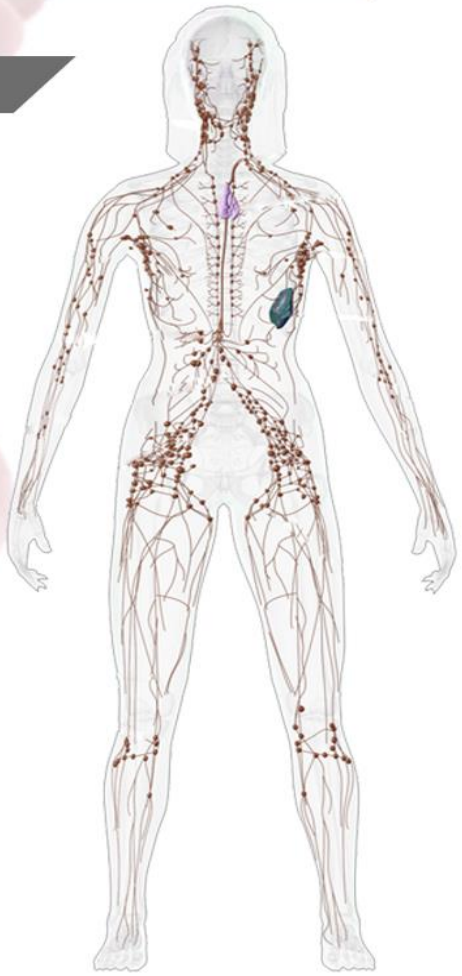
Sheet 10

Hematology and Lymphatic system

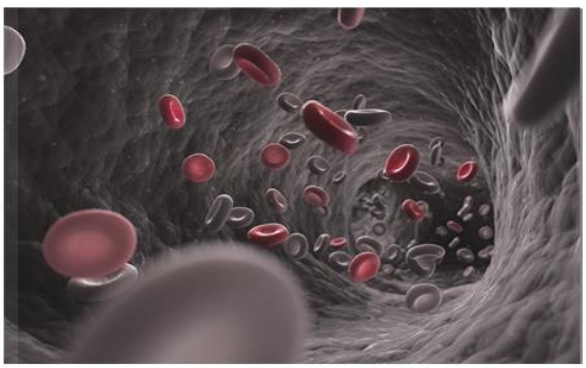


Subject | Physiology

Done by | Osama Mohammad

Corrected by | ...

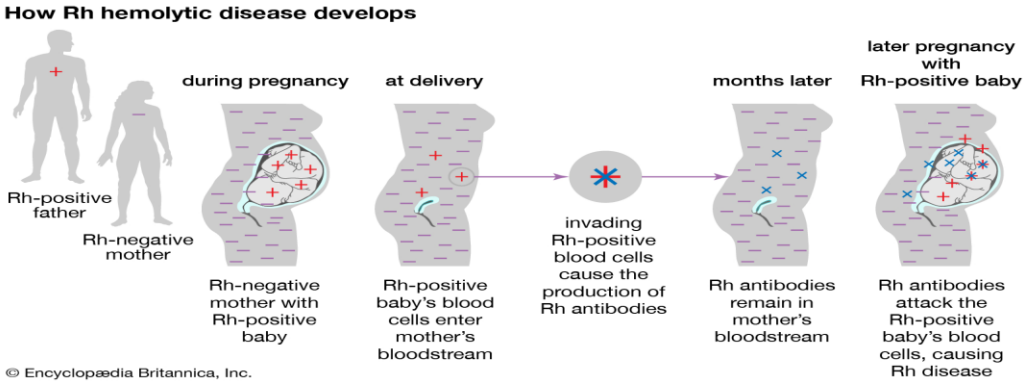
Doctor | Saleem



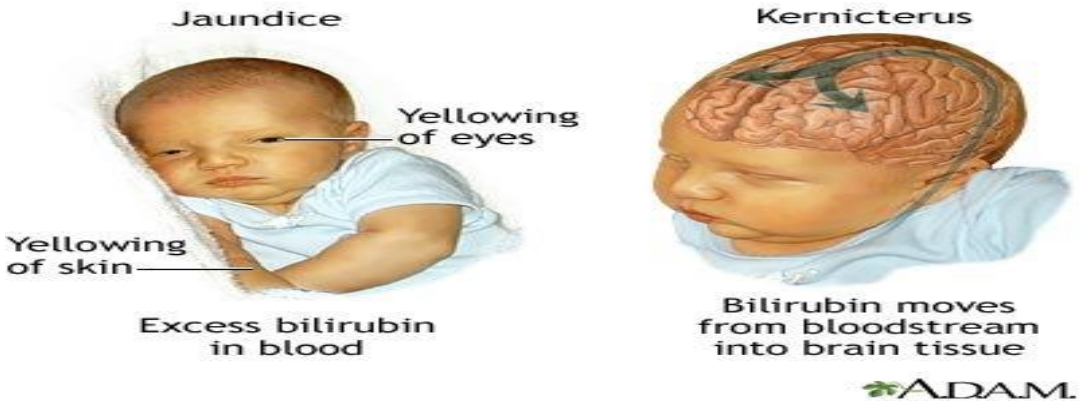
Hemolytic diseases of the newborn resulting from the incompatibility of Rh groups

- The mother can develop antibodies against fetal Rh in three ways:
  1. Blood transfusion before marriage by blood from Rh+ person
     - ➢ If the mother's blood is classified as Rh- and she received blood from an Rh+ person, the mother's body will develop antibodies against Rh+.
  2. Leakage during pregnancy of small amount of fetal blood (Rh+) into the maternal circulation
     - ➢ This is a result of placental hemorrhage, since the maternal blood is Rh- and the fetal blood is Rh+, if this is the first exposure the body will develop antibodies.
  3. During delivery, the fetal blood is squeezed back to maternal blood

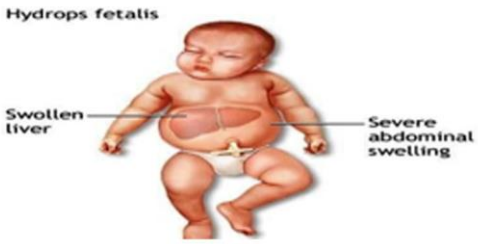
- In all of the previous scenarios, the first exposure of Rh+ leads to developing antibodies, while on the second exposure those antibodies will attack the Rh+ antigens and cause clinical manifestations (Hemolytic diseases) which are:
  1. Erythroblastosis Fetalis:
     - ➢ Once the mother's body develops antibodies against Rh antigens (Specifically D antigens on the surface of fetal rbc) these antibodies can pass into the fetal blood and cause **Mild Hemolysis** of the RBCs of the fetus.
     - ➢ The new born baby can be rescued by giving him (Rh-) blood , but not from his mother (Because the mother's blood contains antibodies, which will further attack the RBCs of the fetus)
     - ➢ Mild diseases



2. Icterus Graves Neonatorum (Kernicterus)
    - The infant is born at term and alive (not early/late birth, specifically between 39 to 40 weeks of fetal age).
    - The newborn is either jaundiced or will develop jaundice within 24 hours of being born.
    - There may be severe neurological lesions involving the basal ganglia in which the bile pigments are deposited (because bilirubin crosses the BB barrier if it rises to critical level), this is called kernicterus.
    - Moderately severe



3. Hydrops Fetalis
    - Severe diseases, infant may die in uterus or develop severe anemia, jaundice and edema, which leads to its death within few hours.

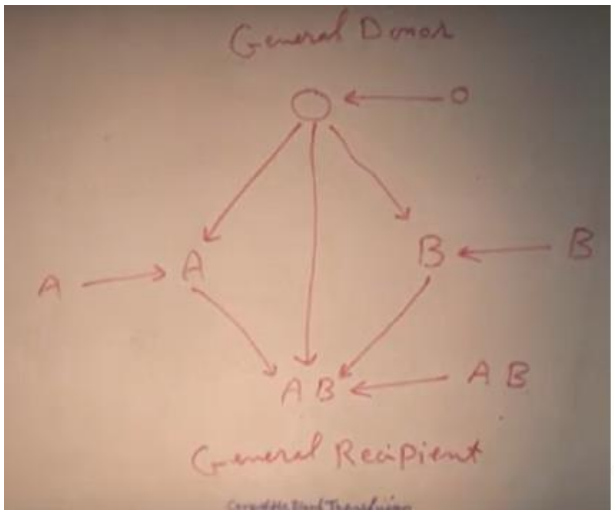


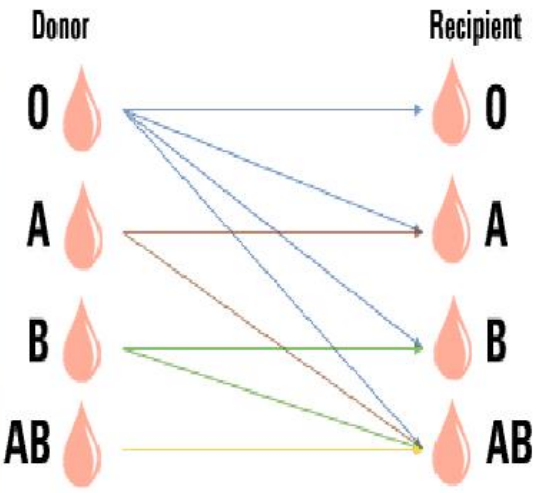
- These diseases can be prevented by giving an Rh- mother human Gamma Globulin against Rh+ erythrocytes within 72 hours after she has delivered an Rh+ infant.

- These antibodies bind to the antigens on Rh+ positive erythrocytes that might have escaped into the mother's blood during delivery, which prevents these antigens from inducing antibody synthesis by the mother
- these administered antibodies are eventually catabolized.

- ABO blood types incompatibilities will not cause hemolytic diseases in the newborn
  - For example, a woman with the blood type (O) has natural antibodies for blood type (A) and (B), if her fetus is of the type (A) or (B), there is no clinical manifestation, this is because:
    - **a)** Fetal erythrocytes do not express (A) and (B) antigens strongly, and
    - **b)** Maternal natural antibodies are of the IgM type which do not cross the placenta readily

Blood transfusions, donors and recipients:





- Blood type (O) can donate to every blood type, since it has no antigens and natural antibodies for antigen (A) and antigen (B), a general donor
- Blood type (AB) can receive from all blood types, since it has antigens of both (A) and (B) and no antibodies for these blood groups, a general recipient.

- The antibodies received from the (O) blood type is diluted in the blood of the recipient, but the recipient cannot tolerate more than 2-3 bags (1+ Liters):

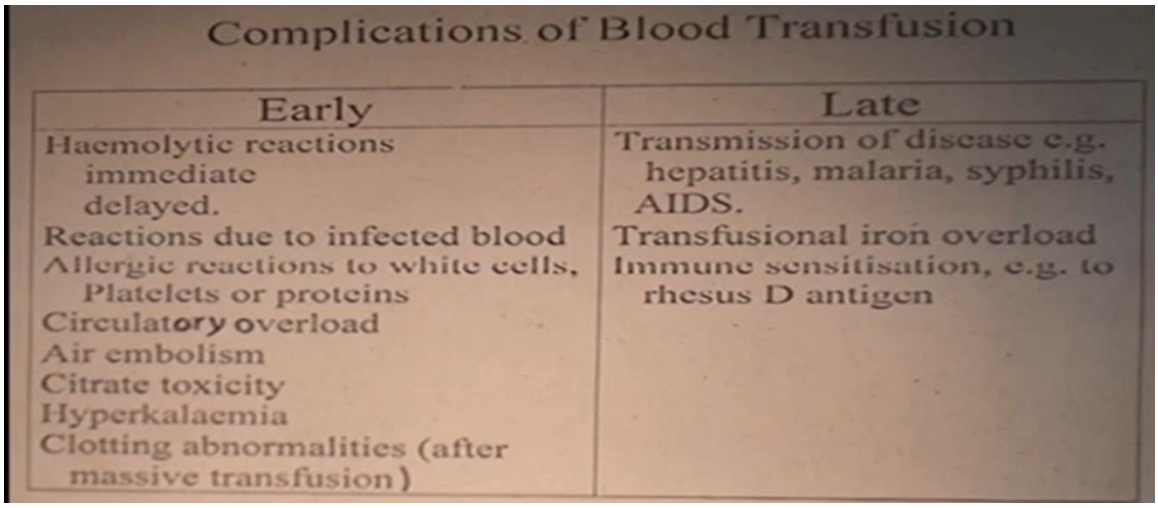
- Because antibodies of the (O) group will attack the recipient's blood type and agglutination occurs.
- Thus the term "general" donor/recipient is not accurate since there are limitations in the amount you are donating or receiving.
- There is no limitation if the patient receives blood from his own blood group, like donating (A) blood type to an (A) blood type recipient.

Indications of blood transfusion (when do we use it):

1. To restore Blood Volume, like hemorrhage for example.
2. To provide red blood cells, like anemias for example.
3. To increase blood coagulability in hemorrhagic diseases, Like hemophilia & purpura for example.
4. To replace infant's blood with Rh- blood, like Erythroblastosis fetalis.
5. To supply antibodies to raise the general resistance of the body.
6. To provide White blood cells, like in the case of leukopenia.
7. To supply plasma proteins in hypoproteinemia.

- We can use technological machines that isolates blood components to provide the patient specifically with what he is deprived from (For example, separating Leukocytes from the rest of the blood) .

Complication of Blood Transfusion: He literally just read the table



Complications of Blood Transfusion

Early	Late
Haemolytic reactions immediate delayed. Reactions due to infected blood Allergic reactions to white cells, Platelets or proteins Circulatory overload Air embolism Citrate toxicity Hyperkalaemia Clotting abnormalities (after massive transfusion)	Transmission of disease e.g. hepatitis, malaria, syphilis, AIDS. Transfusional iron overload Immune sensitisation, e.g. to rhesus D antigen

Blood storage and Use:

- When blood is withdrawn, the following should be done:
    1. The blood should be tested, grouped and cross matched (cross matching is determining whether the donor's blood is compatible with the recipient's blood or not).
    2. Addition of ACD (Acid Citrate dextrose), an anticoagulant.
    3. Storage at temperature of 4 degrees Celsius.
    4. Take into account the timing of when the blood is transfused
        - If there is no time for the first procedure, then donate the (O,Rh-) blood type.
        - In extreme emergencies, we donate (O,Rh+) blood type.

    Just memorize them since he didn't explain anything.

- Blood storage is used for donations of RBCs, but not WBCs and platelets, because white blood cells and platelets have a short half-life, so for WBCs and platelets, we need fresh blood samples to transfuse.

- Blood stored for 14 days show 80% survival of RBCs 24 hours after the transfusion, then the survived RBCs are destroyed at a rate of 1% per day.

Blood genotypes :

The doctor's explanation was very messy but ill try to explain as good as possible, excuse me for any troubling I caused to your brain.

If we have a Male with the Phenotype of (A Rh+ MN) and the Mother has a Phenotype of (B Rh- NN), then the probable genotypes will be:

Father: A Rh+ MN	**Mother: B Rh- NN**
1st Probability: AA RhRh MN	1st probability: BB rhrh NN
2nd Probability: AO RhRh MN	2nd probability: BO rhrh NN
3rd Probability: AA Rhrh MN	
4th Probability: A0 Rhrh MN	

- Keep in mind that the phenotype Rh+ can either be RhRh or Rhrh in genotype since the Rh+ gene is dominant, while the Rh- is only rhrh.

- Also, the A Phenotype can either be AA or AO on genotype, as well as B Phenotype, while O phenotype on the other hand is only OO, and AB Phenotype is AB.

Genotype	AA	AO	BB	BO	AB	OO
Phenotype	A	A	B	B	AB	O

Good luck to everybody!