PHYSIOLOGY Team 433

Lecture 10:
Blood Groups and blood transfusion

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Color Index

Blue = Main Topic
Violet = sup topic
Red = important
Orange = Explanation

White &Black = Addition

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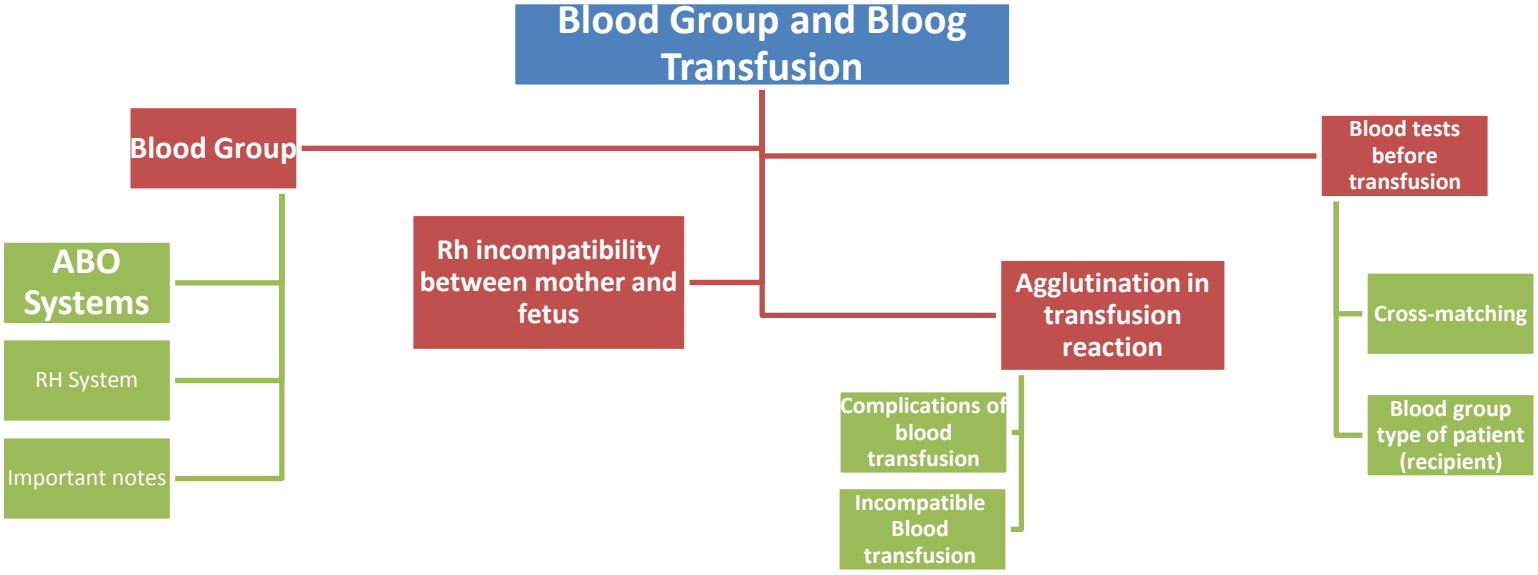
Objectives:

At the end of this lecture student should be able to:

1. **Describe ABO blood group types**
2. **Recognize Agglutinins in plasma**
3. **Recognize transfusion (cross) reactions**
4. **Describe Rhesus blood groups.**
5. **Describe causes of hemolytic disease of the newborn.**
6. **Describe genetic inheritance of Blood groups.**

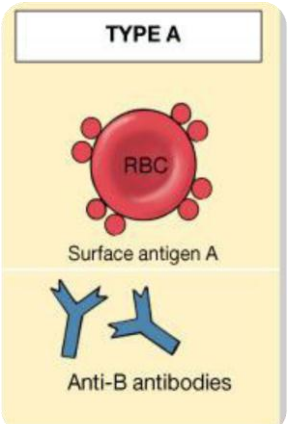
Mind map

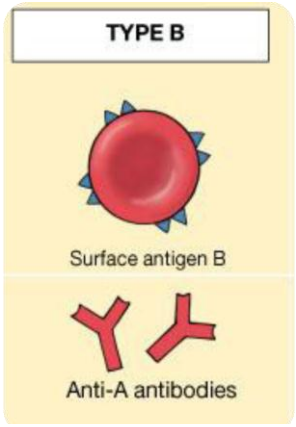


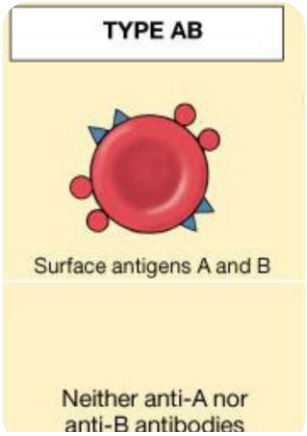
Blood Group

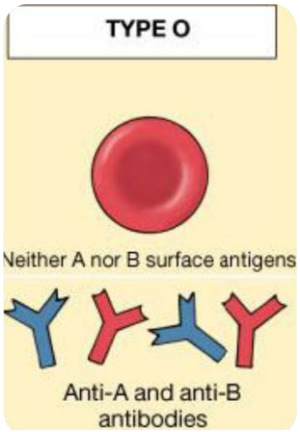
Blood group determined by Antigens (glycoprotein) on the surface of RBC

ABO system					RH system		
Blood group	Genotypes	Anti-gen	Anti-body	%	Blood group	Anti-gen	Anti-body
A	AA,AO	A	Anti-B	41%	+	D	-
					-	-	Anti-D
B	BB,BO	B	Anti-A	9%	+	D	-
					-	-	Anti-D
AB	AB	A and B	-	3%	+	D	-
					-	-	Anti-D
O	OO	-	Anti-A and Anti-B	47%	+	D	-
					-	-	Anti-D









Presence or absence of the Rhesus Antigen (D) on the surface of RBC:
– Presence of D (individual is Rh+ve)
– Absence of D (individual is Rh–ve)

Types of Rhesus antigens (Rh factors): D,d, C,c, E, e

The most clinically important is D

Four main ABO groups:
A, B, AB, O

The ABO system:

Depends on whether the red cells contain

- **One A or B**
- **Both A and B**
- **Neither of them**

Important notes :

Anti-A & Anti-B are naturally occurring antibodies.

But Not present at birth, appear 2-8 month

Triggered by A & B antigens in food and bacteria

Anti-D antibody (agglutinin) is Not naturally-occurring

Can be acquired by:

I-Transfusion of Rh-ve individual with Rh+ve blood

II-Rh-ve pregnancy with Rh+ve fetus

Importance of blood groups:

1.Blood Transfusion.

2.Rh incompatibilty between mother and fetus

O blood group ⟶ universal donor.

AB blood group ⟶ universal recipient.

Agglutination in transfusion reaction

INCOMPATIBLE BLOOD TRANSFUSION

Patient with blood group A

- transfused with blood group **B**
- The anti-B in plasma will agglutinate the transfused group B cells

Patient with blood group B

- transfused with blood group **A**
- The anti-A in plasma will agglutinate the transfused group A cells

Outcome:

- The clumped cells plug small blood vessels (kidney shut down).
- Sometimes immediate hemolysis.

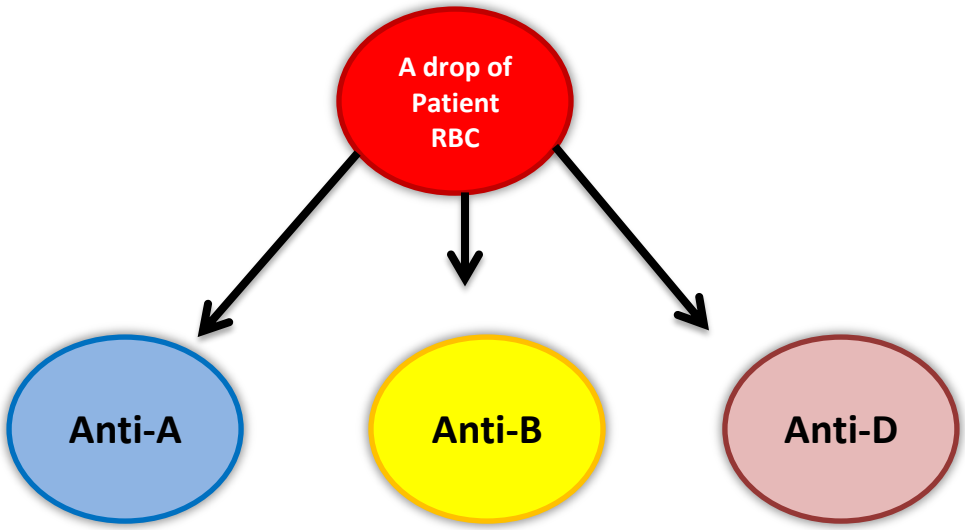
TRANSFUSION REACTION

COMPLICATIONS OF BLOOD TRANSFUSION

1. Immune reaction: Incompatible blood transfusion leading to immediate or delayed reaction, fever, hemolysis, allergic reaction
2. Transmission of infection; malaria, syphilis, viral hepatitis & Aids
3. Iron overload due to multi-transfusion in case of sickle cell anemia and thalassemia.

Blood tests before transfusion

1. BLOOD GROUP TYPE OF PATIENT (RECIPIENT)

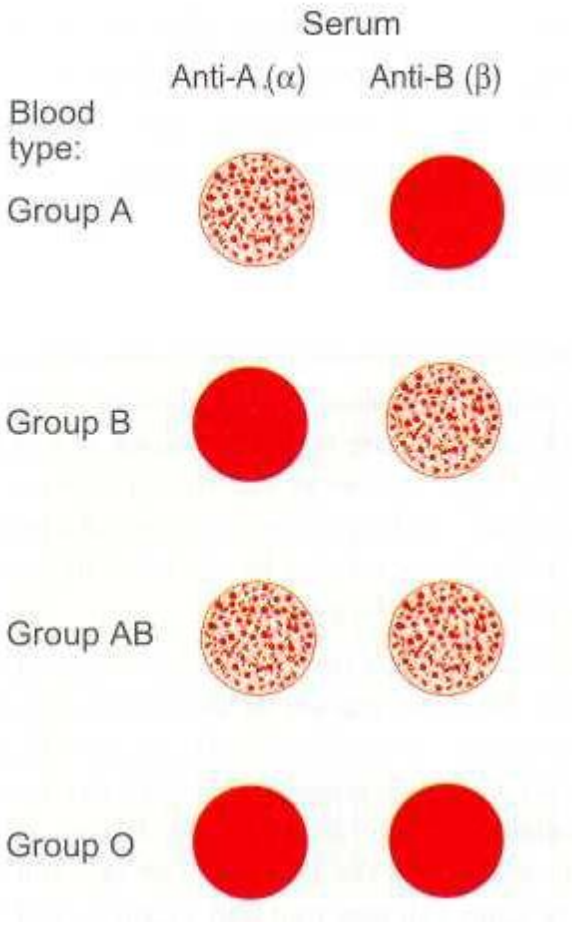


Used to look for agglutination

RBCS	ANTI A	ANTI B
O	–	–
A	+	–
B	–	+
AB	+	+

2. CROSS-MATCHING

Donor cells
+
recipients (patient) serum



Rh incompatibility between mother and fetus

Mother Rh-ve & Fetus Rh+ve

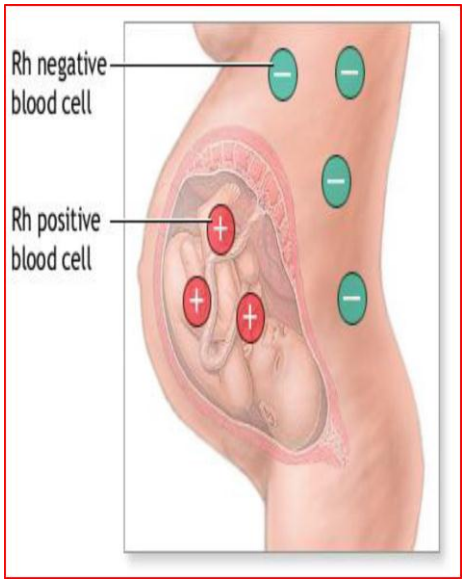
Frist fetus

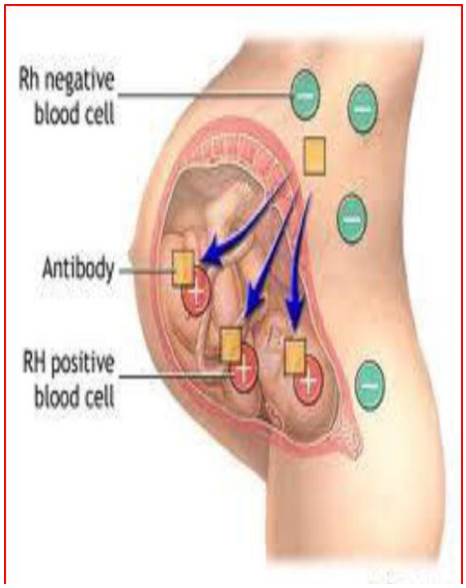
- At delivery : Fetal Rh+ RBC cross to maternal blood
- The mother will develop Anti-D after delivery.
- First child is safe

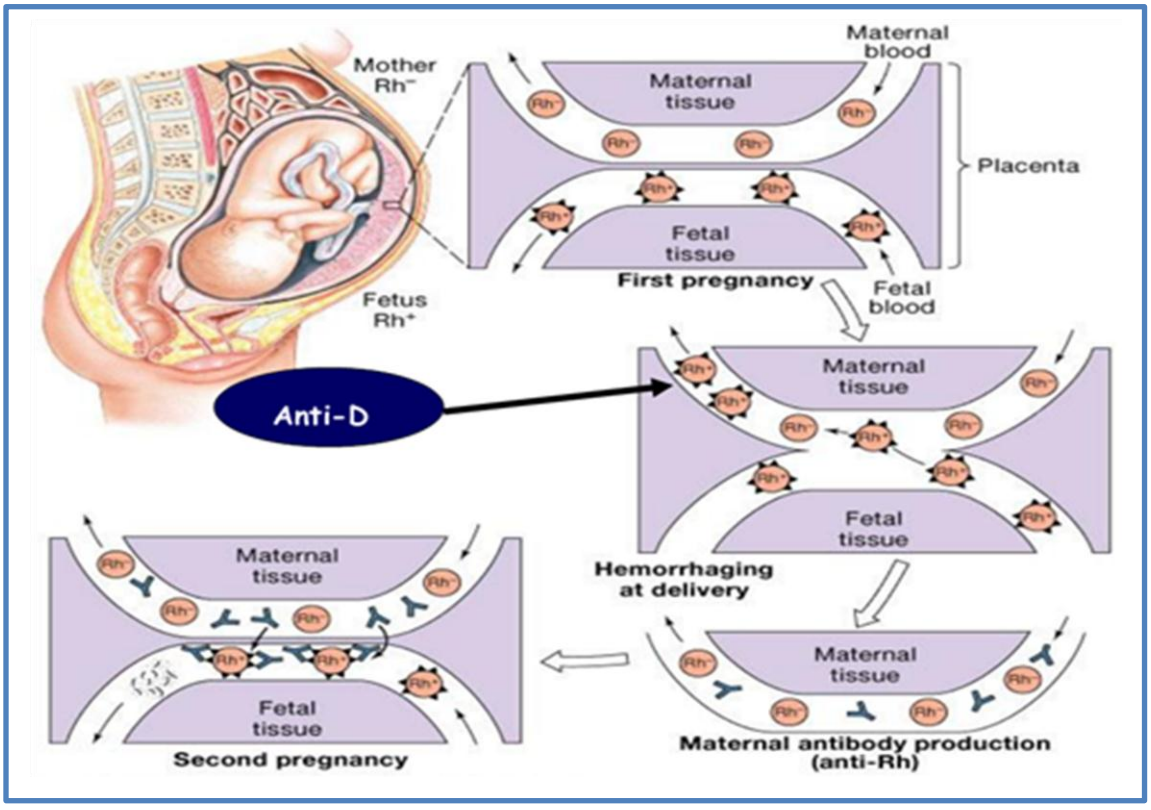
Second fetus

- Anti-D crosses placenta and destroys fetal Rh+ RBC
- Outcome : Hemolytic Disease of the newborn

If the mother is transfused with Rh+ve blood before, first child will be affected. Because she has Anti-D in her blood


Rh negative
blood cell
Rh positive
blood cell


Rh negative
blood cell
Antibody
RH positive
blood cell


Mother
Rh⁻
Fetus
Rh⁺
Anti-D
Maternal
blood
Maternal
tissue
Fetal
tissue
Placenta
First pregnancy
Fetal
blood
Maternal
tissue
Fetal
tissue
Hemorrhaging
at delivery
Maternal
tissue
Maternal antibody production
(anti-Rh)
Maternal
tissue
Fetal
tissue
Second pregnancy

HEMOLYTIC DISEASE OF THE NEWBORN (ERYTHROBLASTOSIS FETALIS)

severe

- treated with exchange transfusion : Replace baby blood with Rh-ve RBC (several times)

not treated

- Hydrops fetalis (death in uterus)

Prevention

- Injecting the mother with anti-D antibody immediately after 1st childbirth to prevent sensitization of the mother to the D antigen.
- Antenatal (during pregnancy) prophylaxis

Summary:

1. **Blood group determined by Antigens (glycoprotein) on the surface of RBC.**
2. **Four main ABO groups: A, B, AB, O**
3. **Before blood transfusion we test the blood by two ways:**
   - **Blood group type of patient (recipient)**
   - **Cross-matching.**
4. **Rh incompatibility between mother and fetus causes hemolytic.**

Blood Types

http://www.youtube.com/watch?v=KXTF7WehgM8

Multiple Choice Questions

Q1: Blood Group A will contain which of these following?

A- Antigen B
B- Antigen A & B
C- Antibody A
D- Antibody B

Answer is : D

Q2: The most important Clinically Rh factor is?

A- E
B- D
C- d
D- C

Answer is : B

Q3: Which of the following blood groups do not have antibodies?

A- A
B- B
C- O
D- AB

Answer is : D

Q4: The most abundant blood type is?

A- O
B- A
C- AB
D- B

Answer is : A

Q5: Anti-D is naturally occurring antibody.

A- True
B- False

Answer is : B

Q6: When does the fetal Rh+ve RBC cross to maternal Rh-ve blood?

A- At delivery
B- Before birth
C- After delivery
D- None of these

Answer is : A