Blood transfusion

Objectives:

- Identify the most important blood group systems?
- List types of antibodies and the main features of each type?
- Define the ABO system and its allelic genes,types of antibodies?
- Define the Rh system , antigens ,antibodies?
- Define blood transfusion?
- List the meaures that should be undertaken in order to protect the donor?
- List the blood components?

Red cell antigens and blood group antibodies

Approximately ***400 red blood cell group antigens*** have been described.
The different blood group antigens vary greatly in their **clinical significance** with the **ABO and Rh groups** being the most important.

Blood group antibodies:

■ **Naturally occurring antibodies** occur in the plasma of subjects who lack the corresponding antigen and who have not been transfused or been pregnant.

-They are usually IgM, react optimally at cold temperatures (4°C) so, although reactive at 37°C, are called **cold antibodies**.
-The most important are **anti-A and anti-B.**

■ **Immune antibodies:** develop in response to the introduction-by transfusion or pregnancy.
-IgG react optimally at 37°C (warm antibodies).
-The most important immune antibody is the Rh antibody, **anti-D.**

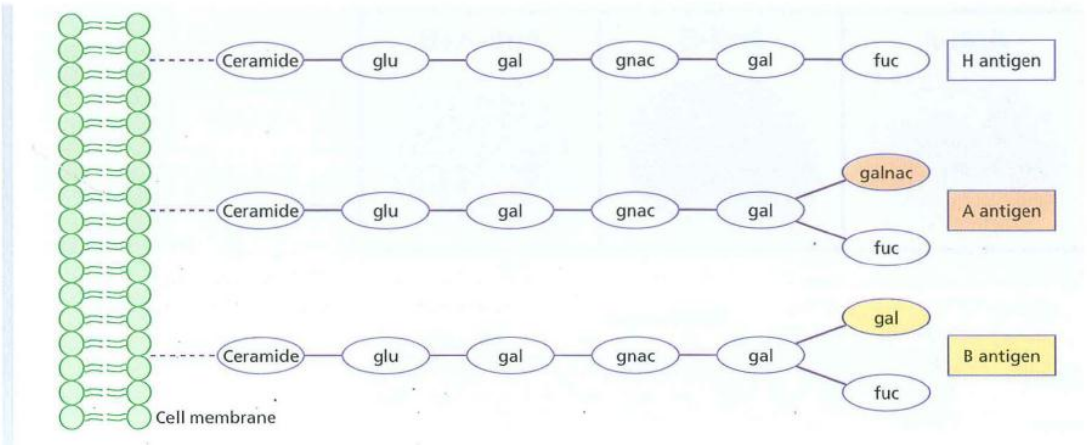
ABO system:

-The first most important blood group system.
-This consists of three allelic genes : A , B and O.

-The **A gene** control the synthesis of specific enzyme responsible for the addition of single carbohydrate residues **(N-acetyl galactosamine** to basic antigenic glycoprotein or glycolipid on the red cell, known as ***the H substance***.

- **B gene** control the synthesis of specific enzyme responsible for the addition of single carbohydrate residues **(D-galactose)**to **the H substance.**

- The **0 gene** is an amorph and ***does not transform*** the **H substance.**



■Naturally occurring **antibodies** to A and/or B antigens are found in the **plasma** of subjects whose red cells lack the corresponding antigen.

- In a person with blood group A ,there is A antigen on blood cells & B antibody in plasma.
- In a person with blood group B ,there is B antigen on blood cells & A antibody in plasma.
- In a person with blood group O, NO A & no B antigens .There are anti A & anti-B antibodies in plasma.
- In a person with blood group AB ,there are A&B antigens on blood cells, while plasma contains **no** antibodies.

■The inheritance of ABO genes is a codominant .

Phenotype	Genotype	Antigens	Naturally occurring antibodies
O	***OO***		Anti-A, Anti-B
A	***AA*** or ***AO***	A	Anti-B
B	***BB*** or ***BO***	B	Anti-A
AB	***AB***	A,B	None

--The A, B and H antigens are present on most body cells including white cells and platelets. In the 80% of the population who possess **secretor genes**,these antigens are also found in soluble form in secretions and body fluids (e.g. plasma, saliva, semen and sweat).

The Rh system:

--The second most important blood group system.
-The Rh genes are inherited as codominant allels.
-There are D,C,E,c,e antigens
- D antigen is the most important.

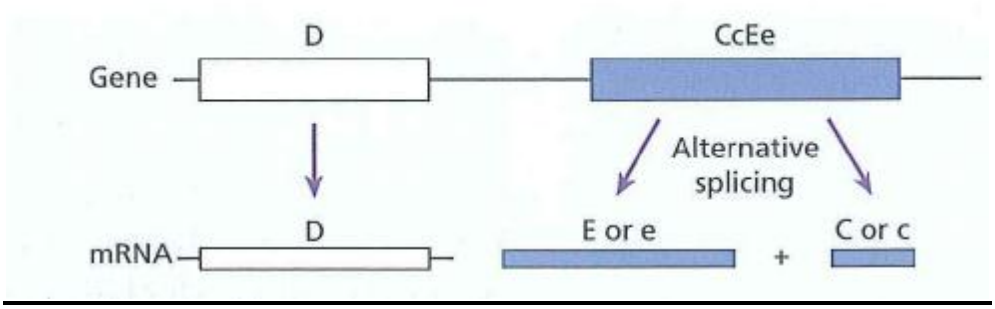
- The Rh blood group locus is composed of two related structural genes, ***RhD* and *RhCE*.**

■ The *RhD* gene ,it may be either present or absent:
If fhe ***RhD* gene is present** ,it gives rise to the **Rh D+ phenotype (Rh positive)**.

If fhe ***RhD* gene is absent** ,it gives rise to the **Rh D-phenotype**(Rh negative).

-**There is only D antigen ,while d means the absence of D**

.
■***RhCE*** gene generates two proteins, which encode the **C, c, E or e antigens.**



The Rh blood group System.

- Most Rh antibodies are immune (i.e. they result from previous transfusion or pregnancy).

- **Rh antibodies are IgG & can cross the placenta to coat the fetal(Rh-positive) RBCs causing haemolytic disease of the newborn when the mother is Rh negative.**

-**Anti-D is responsible for most of the clinical problems associated with the system .**

- As there is only D antigen (**d** means the **absence of D) , anti-d does not exist.**

.- Anti-C, anti-c, anti-E and anti-e are occasionally seen .

-Other blood group systems are less frequently of clinical importance, like the P, Lewis and MN systems .

Blood transfusion: involves the safe transfer of blood components from a donor to a recipient.

Blood donation:
This should be voluntary.
Blood for transfusion is obtained by venesection of volunteer donors.
By aseptic technique ,a volume of 450ml is taken into a plastic bag containing citrate as an anticoagulant(63ml). The citrate anticoagulates the blood by combining with the blood calcium.

Measures to protect the donor:

■Age 17-70 years (maximum 60 at first donation)
■Weight above 50 kg .
■Haemoglobin>13 g/dL for men, >12 g/dL for women
■Minimum donation interval of 12 weeks (16 weeks advised) and three donations per year maximum.
■Pregnant and lactating women excluded because of high iron requirements
■Exclusion of those with:
-known cardiovascular disease, including hypertension
- significant respiratory disorders
-epilepsy and other CNS disorders
-gastrointestinal disorders'with impaired absorption
-Insulin-dependent diabetes
-Chronic renal disease
-Ongoing medical investigation or clinical trials
■Exclusion of any donor returning to occupations such as driving bus, plane or train, heavy machine or crane operator, mining, scaffolding, etc. because delayed faint would be dangerous**.**
■ Deffer for 2 months after vaccination.g.measl ,mumps.

Blood components:

1.**Whole Blood:**It is used for replacement of lost blood, but the use of specific component is preferred.

2. **Red cells:** Packed (plasma-depleted) red cells are the treatment of choice for most transfusions. They are used for correction of anaemia,exchange transfusion in newborn &for blood loss.

3. **Granulocyte concentrates**: They have been used in patients with severe neutropenia who are not responding to antibiotics.

4. **Platelet concentrates:**

They are stored at room temperature. Platelet transfusion is used in patients who are thrombocytopenic or have disordered platelet function and who are actively bleeding (therapeutic use) or are at serious risk of bleeding (prophylactic use).

5. **Fresh frozen plasma (FFP)**

Rapidly frozen plasma separated from fresh blood is stored at less than -30°C. It contains coagulation factors .

Its main use is for the replacement of coagulation factors (e.g. when specific concentrates are unavailable) or after massive transfusions, in liver disease and DIC.

6. **Cryoprecipitate** :
It is stored at less than -30°C .It is used for correction of fibrinogen deficiency,FVIII or VWF deficiency when specific factor is not available.

7. **Human albumin solution:**
It is used for hypoprotinaemia, burns .

8.**FVIII concentrate.**

9. **FIX concentrate**.

10. Immunoglobulins.

11. Prothrombin complex concentrate: contains factor II,IX,X,VII.