ESTIMATION OF BLOOD GROUP

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Objective:

To understand the basic concept of Blood Grouping.

It was in 1901, that Austrian-American immunologist and pathologist Karl Landsteiner discovered human blood groups. Karl Landsteiner's work helps to determine blood groups and thus opened a way for blood transfusions which can be carried out safely. He was awarded the Nobel Prize in Physiology or Medicine in 1930 for this discovery.

Introduction

- A blood group also called a Blood Type
- Classification of blood is based on the presence or absence of inherited antigenic substances on the surface of red blood cells (RBCs)
- These antigens may be proteins, carbohydrates, glycoproteins, or glycolipids, depending on the blood group system.

- The **ABO blood group system** is the most important blood type system (or blood group system) in human blood transfusion.

- ABO blood types are also present in some other animals
  for example rodents and apes such as chimpanzees, bonobos and gorillas.

Determination of ABO blood groups depends upon the immunological reaction between antigen and antibody.

Antigens are also called agglutinogens because of their capacity to cause agglutination of RBCs.

The observations that led to the discovery of blood groups:

At times, it was observed that mixing blood from two individuals led to blood clumping or agglutination. Later it was understood that the agglutinated red cells can clog blood vessels and stop the circulation of the blood to various parts of the body. The agglutinated red blood cells also crack and their contents leak out in the body.

BLOOD GROUP

the RBCs contain haemoglobin which becomes toxic when outside the cell. This must have been the phenomena that occurred in the blood transfusion cases that ended up with fatality of the patient at the receiving end. Karl Landsteiner discovered that blood clumping was an immunological reaction which occurs when the receiver of a blood transfusion has antibodies against the donor blood cells! People learned that, compatibility of blood groups needed to be checked before anything else was done. If they are not, the red blood cells from the donated blood will agglutinate. This can have fatal consequences for the patient.

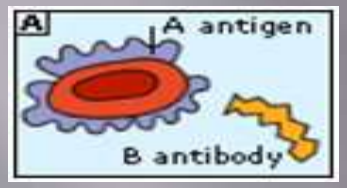
PRINCIPLE

Principle of Blood Grouping

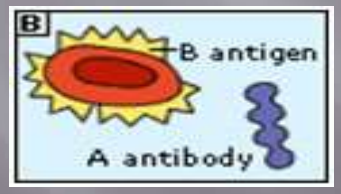
- Blood grouping is done on the basis of agglutination.
- Agglutination means the collection of separate particles like RBCs into clumps or masses.
- Agglutination occurs if an antigen is mixed with its corresponding antibody which is called *isoagglutinin,* i.e. occurs when A antigen is mixed with anti-A or when B antigen is mixed with anti-B.

ABO blood grouping system:

According to the AB0 blood group system there are four different kinds of blood groups: A, B, AB and O (null).

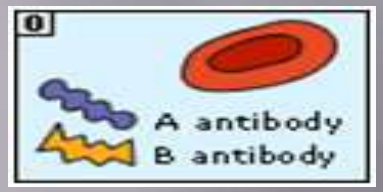


Blood group A: If you belong to the blood group A, you have A antigen on the surface of your red blood cells and B antibodies in your blood plasma



Blood group B: If you belong to the blood group B, you have B antigen on the surface of your red blood cells and A antibodies in your blood plasma

Blood group AB: If you belong to the blood group AB, you have both A and B antigens on the surface of your red blood cells but, neither A nor B antibodies in your blood plasma

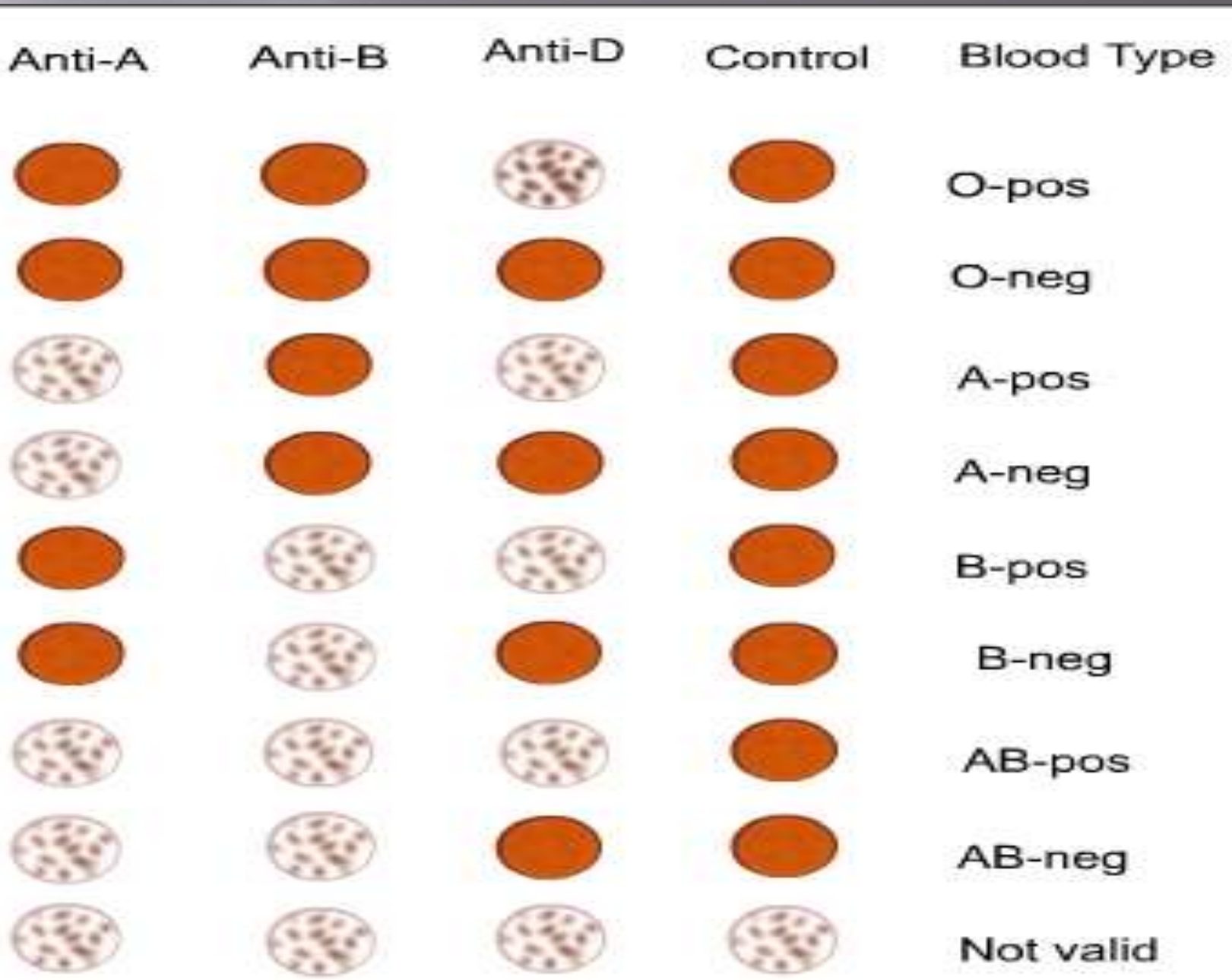


Blood group O: If you belong to the blood group O (null), you have neither A nor B antigens on the surface of your red blood cells, but you have both A and B antibodies in your blood plasma

Rh (Rhesus) factor is found on the RBC's surface in most people. Like A and B, this is also an antigen and those who have it are called Rh+. Those who lack the antigen on the surface of RBCs are called Rh-. A person with Rh- blood does not have Rh antibodies naturally in the blood plasma. But a person with Rh- blood can develop Rh antibodies in the blood plasma if he or she receives blood from a person with Rh+ blood, whose Rh antigens can trigger the production of Rh antibodies (as the immune system is triggered by the presence of an unknown antigen in the system). A person with Rh+ blood can receive blood from a person with Rh- blood without any problems.

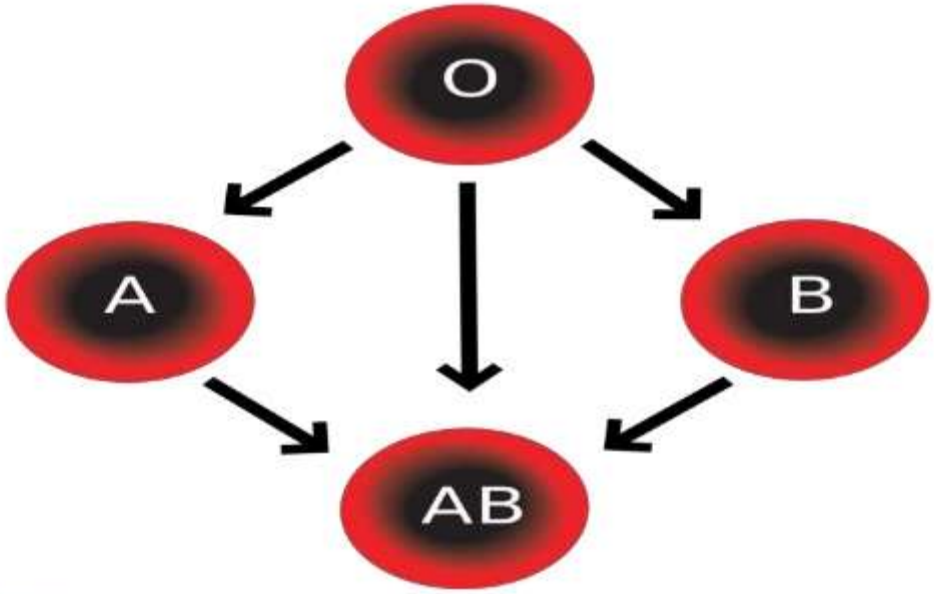
Principle behind blood tests: Blood clumping or Agglutination observation.

Compatibility between the blood groups of donor and recipient determines the success of a blood transfusion. The AB0 and Rh blood groups are looked at while conducting the test. In a diagnostic lab, Monoclonal antibodies are available for A, B and Rh antigen. Monoclonal antibody against Antigen A (also called Anti-A), comes in a small bottles with droppers; the monoclonal suspension being BLUE in colour. **Anti-B comes** in YELLOW colour. **Anti-D** (monoclonal antibody against Rh) is colourless. All the colour codes are universal standards. When the monoclonal antibodies are added one by one to wells that contain the test sample (blood from patient), if the RBCs in that particular sample carry the corresponding Antigen, clumps can be observed in the corresponding wells. A drop of blood is left without adding any of the antibodies; it is used as a control in the experiment. The monoclonal antibody bottles should be stored in a refrigerator. It is recommended to tilt the bottle a couple of times before use in order to resuspend the antibodies that have settled at the bottom of the bottle.


Anti-A
Anti-B
Anti-D
Control
Blood Type
O-pos
O-neg
A-pos
A-neg
B-pos
B-neg
AB-pos
AB-neg
Not valid

Blood Group	Antigens	Antibodies	Can Donate To	Can Receive from
A Rh+	A and Rh	B	A Rh+ AB Rh+	A Rh+ A Rh- O Rh+ O Rh-
A Rh-	A	B (Can develop Rh antibodies)	A Rh+ A Rh- AB Rh+ AB Rh-	A Rh- O Rh-
B Rh+	B and Rh	A	B Rh+ AB Rh+	B Rh+ B Rh- O Rh+ O Rh-
B Rh-	B	A (Can develop Rh antibodies)	B Rh+ B Rh- AB Rh+ AB Rh-	B Rh- O Rh-
O Rh+	Rh	A and B	O Rh+ A Rh+ B Rh+ AB Rh+	O Rh+ O Rh-
O Rh-	None	A and B (Can develop Rh antibodies)	AB Rh+ AB Rh- A Rh+ A Rh- B Rh+ B Rh- O Rh+ O Rh-	O Rh-
AB Rh+	A, B and Rh	None	AB Rh+	AB Rh+ AB Rh – A Rh+ A Rh- B Rh+ B Rh- O Rh+ O Rh-
AB Rh-	A and B	None (Can develop Rh antibodies)	AB Rh+ AB Rh-	AB Rh- A Rh- B Rh- O Rh-

Blood Compatibility



Erythroblastosis Fetalis ("Hemolytic Disease of the Newborn")

- Erythroblastosis fetalis is a disease of the fetus and newborn child characterized by agglutination and phagocytosis of the fetus's red blood cells.
- In most instances of erythroblastosis fetalis, the mother is Rh negative and the father Rh positive.

The baby has inherited the Rh-positive antigen from the father, and the mother develops anti-Rh agglutinins from exposure to the fetus's Rh antigen.

In turn, the mother's agglutinins diffuse through the placenta into the fetus and cause red blood cell agglutination.

Procedure:

1.Set the table with all the materials required. Remember to place the Monoclonal Antibody (Mab) kit in an Ice tray.
2.Open an Alcohol swab, and rub it at the area from where the blood will be sampled (finger tip). (Discard the swab)
3.Open the Lancet cover, put pressure at the tip of the finger from where blood will be sampled (maintain it). Prick the finger tip with the opened Lancet.(Discard the Lancet)
4.As blood starts oozing out, make 1 drop fall on the three depressions of the glass slide. (in clinical setup, there will be a fourth well used as a control).
5.Place a cotton ball at the site where it was pricked. Using the thumb, put pressure on the area to stop blood flow.
6.Take the Anti-A (blue) bottle, resuspend the content and use the dropper to place a drop of the Mab in the 1st spot. Place the bottle back in ice.
7.Take the Anti-B (yellow) bottle, resuspend the content and use the dropper to place a drop of the Mab in the 2nd spot. Place the bottle back in ice.
8.Take the Anti-D (colorless) bottle, resuspend the content and use the dropper to place a drop of the Mab in the 3rd spot. Place the bottle back in ice.
9.Take a tooth pick and mix the content in each well. Discard the tooth pick after using in one well (take a new one for the next well).
10.After mixing, wait for a while to observe the result.

Antigen and Antibody Present in ABO Blood Group

ABO Group	Antigen Present	Antigen Missing	Antibody Present
A	A	B	Anti-B
B	B	A	Anti-A
O	None	A and B	Anti-A&B
AB	A and B	None	None

THANKS