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Changing of Blood Groups from AB to O

D. Srinivas Rao[1], M. Jyothi[2], P. Venkatesh[3], D. Hepcy Kalarini[4], R. Prema[5]
[1]*Student, Department of Pharmacology, Jagan's Institutions of Pharmaceutical Sciences Nellore, India*
[2]*Assistant Professor, Dept. of Pharmaceutics, Jagan's Institutions of Pharmaceutical Sciences Nellore, India*
[3,4]*Professor, Department of Chemistry, Jagan's Institutions of Pharmaceutical Sciences Nellore, India*
[5]*Professor, Department of Pharmaceutics, Jagan's Institutions of Pharmaceutical Sciences Nellore, India*

***Abstract*: International Society of Blood Transfusion has recently recognized 33 blood group systems. Apart from ABO and Rhesus system, many other types of antigens have been noticed on the red cell membranes. Blood grouping and cross-matching is one of the few important tests that the anesthesiologist orders during perioperative period. Hence, a proper understanding of the blood group system, their clinical significance, typing and cross-matching tests, and current perspective are of paramount importance to prevent transfusion-related complications. Nonetheless, the knowledge on blood group system is necessary to approach blood group-linked diseases which are still at the stage of research. This review addresses all these aspects of the blood groups system.**

Changing of blood groups from ab to o+

Blood groups and blood transfusion

- **Discovered A B O blood groups system in 1901**
- **Discovered rh factor in 1930 along with alexander S. wiener**
- **Noble prize in physiology or medicine in 1930**

***Keywords*: blood group**

1. Introduction

Blood group system

- ABO blood groups system
- Rh blood groups system

Importance of abo groups in blood transfusion

- During blood transfusion only compatible blood must be used.
- The one who gives blood is called the 'donor' and the.
- One who receives the blood the blood is called 'recipient'.
- While transfusing the blood antigen of the donor and the antibody of the recipient are considered.
- The antibody of the donor and antigen of the recipient are ignored mostly.
- Thus RBC of O group has no antigen and so agglutination does not occur with any other group of blood so, 'O' group blood can be given to any blood group persons and the people with this blood group are called 'universal donor'.
- Plasma of AB group blood has no antibody, this does not cause agglutination of RBC from any other groups of blood.
- People with AB group can receive blood from any blood group persons. So, people with this blood group are called 'universal recipients'
- In mismatched transfusion

The transfusion reactions occur between donor RBC and recipient's plasma so, if the donor's plasma contains agglutinins against recipient's RBC' agglutination does not occur because these antibodies are diluted in the recipient's blood.

A. Transfusion reaction due to ABO incompatibility

- Transfusion reactions are the adverse reactions in the body, which occur due to transfusion error that involves transfusion of incompatible [mismatched] blood.
- The reactions may be mild causing only fever and hives [skin disorder characterized by itching] or may be severer leading to renal failure, shock and death.

B. Blood transfusion

- Introduction
- Precaution
- Adverse effect of blood transfusion
- Exchange transfusion

Introduction

- A blood group also called a blood type
- Classification of blood is blood on the presence or absence inherited antigenic substances on the surface of red blood cells [RBCs]
- These antigens may be pro carbohydrates, glycoproteins or glycolipids depending on the blood group system.
- The ABO blood groups system is the most important blood type system [or blood groups system] in human blood transfusion.
- A B O blood types are also present in some other animals
- For example: rodents and apes such as chimpanzees, bonobos and gorillas.

History of blood groups and blood transfusions

- Experiments with blood transfusions have been carried out for hundreds of years many patients have

died and it was not until \1901, when the Austrian Karl Landsteiner discovered human blood groups , that blood transfusions became safer.

- He found that mixing blood from two individuals can lead to blood clumping. the clumped RBCS can crack and cause toxic reaction. this can be fatal.

History of blood groups and blood transfusion

- Karl Landsteiner discovered by that blood clumping was an immunological reaction which occurs when receiver of a blood transfusion has antibodies against the donor blood cells.
- Karl Landsteiner work made it possible to determine blood types and thus paved the way for blood transfusion to be carried out safely for this discovery he was awarded the Noble prize in physiology or medicine in 1930.

2. What are the different blood group's?

- The difference in human blood are due to the presence or absence of certain protein molecules called antigen and antibodies.
- The antigens are located on surface of the RBC and the antibodies are in the blood plasma.
- Individuals have different types and combination of these Molecules.
- The blood groups you belong to depends on what you have inherited from your parents.
- There are more than 20 genetically determined blood groups system know today.
- The A B O and Rhesus [Rh] system are the most importance ones used for the blood trans fusions.
- Not all blood groups are compatible with each other. Mixing incompatible blood groups leads to blood clumping or agglutination, which is dangerous for individuals.

A. Landteiner law

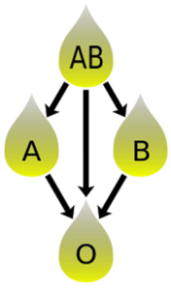
- If an antigen /agglutinogen is present on the red cell membrane of an individual the corresponding antibody/agglutinin will be absent in the plasma.
- If an antigen / agglutinogen is absent on the red cell membrane of an individual the corresponding antibody /agglutinin is will be present in the plasma.

3. Blood groups system

MAJOR	MINOR
. A B O	. MN
. Rh [Rhesus]	. Li
	. P
	. Lewis
	. Duffy
	. Kidd
	. Kell

Classical ABO blood grouping system

- The most important in assuring a safe blood transfusion.
- Is based on presence or absence of A and B antigens on red cell membrane.
- There are 4 blood groups according to this system.
- AB, AB and O
- *Blood group A:* If you belong to the blood group A you have a antigens on the surface of your RBCs and B antibodies in your blood plasma.
- *Blood group B:* If you belong to the blood group B you have B antigens on the surface of your RBCs 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 RBCs and no A or B antibodies at all in your blood plasma.
- *Blood group O:* If you belong to the blood group O [Null], you have neither A or B antigen on the surface of your RBCs but you have both A and B antibodies in your blood plasma.



Blood Group	Antigens on RBCs	Antibodies in a serum	Genotypes
A	A	Anti-B	AA and AO
B	B	Anti-A	BB or *BO*
AB	A and B	Neither	AB
O	neither	Anti-A and Anti-B	OO

Why do individual produce antibodies to antigen they do not have?

- The 'A' and 'B' antigen are also produced by some other plants and Microorganisms.
- Thus individuals who do not recognize one or more of these antigens as self will produce antibodies against the plant or microbial antigens.
- These antibodies will also react with human antigens of the same kind whether introduced via a blood transfusion or tissue graft.

Genetics and inheritance of ABO system

- The ABO gene locus is located on the chromosome 9
- A and B blood groups are dominant over the O blood group
- A and B group genes are co-dominant each person has two copies of genes coding for their ABO blood group [on maternal and +one paternal in origin]

A. Autosomal chromosome

The alleles for blood group are in the same place on the chromosome 9. However, the genes have a different code giving different blood group. One Alleles from mother and one from father.

Parent allele	A	B	O
A	AA	AB	AO
B	AB	BB	BO
O	AO	BO	OO

Rh antibodies

- No natural antibodies.
- But are produced only when Rh+ blood is given to a Rh– person.
- Once produced they persist for years and can produce serious reaction during 2nd transfusion.
- 85% of papulation is Rh positive the other 15% of the papulation is Rh negative.
- Clinical application of blood grouping

4. Rh blood group system

- The RH blood group system is one of Thirty-five current human blood group system.
- It is the most important blood group system after ABO
- RH blood group system consists of50 defined blood group antigen, among them there are six common types of RH antigens.
- Each of which is called an RH factors These type is designated C, D, E, c, d, and e.
- The type D antigen widely prevalent in the papulation and considerably more antigenic than the other RH antigen.
- Anyone who has this type of antigen is said to be RH positive, whereas a person who does not have type D antigen is said to be RH negative.
- This antigen was discovered by Karl Landsteiner Alexander Wiener in 1940.
- It was first discovered by in Rhesus macaque and hence the name 'RH factor'.

Erythroblastosis fetalis ["Hemolytic disease of the Newborn"]

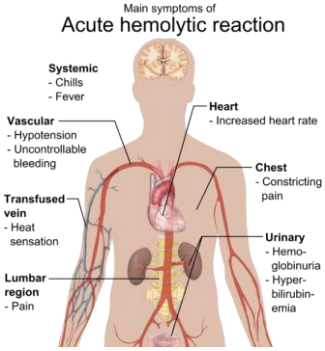
- Erythroblastosis fetalis is a disease of the fetus and new born child characterized by agglutination and phagocytosis of the fetus's red blood cells.
- In most instances of erythroblastosis fetalis the mother is RH negative and the father RH positive.
- The baby has inherited the RH- positive antigen 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 fetus and cause red blood cells agglutination.

Symptoms and sings in the fetus:

- Enlarged liver spleen, or heart.
- Fluid buildup in the fetus abdomen seen via ultrasound.

Symptoms and sings in the new born

- Anemia that creates the new born pallor [pale appearance]
- Jaundice or yellow discoloration of the new born' skin sclera or mucous membrane.
- Enlargement of the new born liver and spleen.
- Severe edema of the entire body.
- Dyspnea or difficulty breathing.



5. Other blood group system

- Thirty -five major blood group system were recognized by the international society of blood transfusion [ISBT] in October 2012.
- In addition to the ABO antigen are expressed on the red blood cell surface membrane.
- An individual can be AB Rh D positive, and at the same time M and N positive [MNS system], K positive [Kell system], many of the blood group system were named after the patients in whom the corresponding antibodies were initially encountered.

6. Other blood groups include

- Auberger groups
- Diego group
- Bombay group
- Duffy group
- Lutheran group
- P group
- Kell group
- I group
- Kidd group
- Sulter XG group
- Kidd group

Clinical application of blood grouping

- In blood transfusion
- In preventing haemolytic disease
- In paternity disputes
- In medicolegal cases

- In knowing susceptibility to disease
- Group O -duodenal cancer
- Group A- carcinoma of stomach pancreas and salivary glands

Bombay

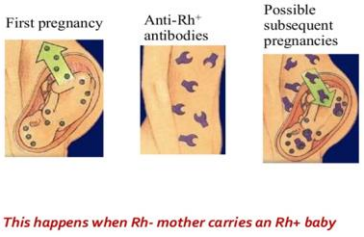
- RBCs with no H A or B antigen [patient type as O]
- Bombay RBCs are not agglutinated with anti- A anti-B, anti-H [no antigens present]
- Bombay serum has strong anti -A anti-B and anti-H, agglutinating ALL ABO blood groups

Another Bombay

- Group O RBCs cannot be given because they still have the H antigen
- You have to transfuse the patient with blood that contains NO H antigen

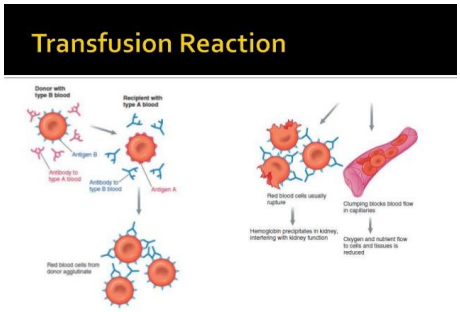
Haemolytic Disease of Newborn

- Occurs due to Rh incompatibility between mother and fetus
- Anti -A or anti-B antibodies or of the lg M class [large molecules]and these do not cross the placenta
- Rh antibodies are lg G type and can cross placenta
- Kernicterus
- Injecting single dose of Rh antibodies [anti-D] to the mother soon after delivery
- Exchange transfusion



7. Blood transfusion

- Blood transfusion is generally the process of receiving blood products into one circulation intravenously.
- Transfusion are used for various medical conditions to replace lost components of the blood.
- Early transfusion used whole blood, but modern medical practice commonly use only components of the blood, such as red blood cells, white blood cells, plasma, clotting factors, and platelets.
- Blood transfusion is the process of transferring blood or blood components from one person [the donor] into the blood stream of another person.
- Richard Lower pioneered the first blood transfusion from animal to human in 1665 at Royal Society.
- In 1840 Dr Blundell performed the first successful whole blood transfusion to treat haemophilia.
- Before a blood transfusion is given there are many steps taken to ensure quality of the blood products compatibility and safety to the recipient.
- Blood transfusions typically use sources of blood: one's own [autologous transfusion]. or someone else's [allogeneic or homologous transfusion].
- The latter is much more common than the former.
- Using another's blood must first start with donation of blood.
- Blood is most commonly donated as whole blood intravenously and collecting it with an anticoagulant.
- Richard Lower pioneer



Processing and testing of blood

- Donated blood is usually subjected to processing after it is collected, to make it suitable for use in specific patient populations.

Collected blood is then separated into blood components by centrifugation:

Red blood cells, plasma, platelets, albumin protein, clotting, cryoprecipitate, fibrinogen concentrate and immunoglobulins [antibodies]

- All donated blood is tested for infections like HIVs, hepatitis B, hepatitis C, syphilis
- All donated blood is also tested for ABO and Rh groups, along with the presence of any red blood cells antibodies.
- Pathogen reduction treatment done.

Conditions when blood transfusion is necessary

- Anemia
- Haemorrhage
- Trauma
- Burns
- Surgery

Precautions to be taken before the transfusion of blood

- Donor must be healthy, without any diseases like:

A. Sexually transmitted diseases such as syphilis
B. Diseases caused by virus like hepatitis, AIDS, etc.

- Only compatible blood must be transfused
- Both matching and cross-matching must be done
- Rh compatibility must be confirmed

Precautions to be taken while transfusing blood

- Apparatus for transfusion must be sterile
- Temperature of blood to be transfused must be same as the body temperature

- Transfusion of blood must be slow. The sudden rapid infusion of blood into the blood increases the load on the heart, resulting in many complications.

Adverse effect of blood transfusion

Transfusion of blood products as associated with several complications, many of which can be grouped as immunological or infections such as:

- Acute hemolytic reaction
- Delayed hemolytic reaction
- Allergic reaction
- Post-transfusion purpuras acute lung injury
- HIV
- Hepatitis C

8. Exchange transfusion

- Is the procedure with involves removal of patients' blood completely and replacement?
- With fresh blood or plasma of the donor.
- Also known as replacement transfusion.
- It bis an important in life- saving procedure carried out in conditions such as severe jaundice, sickle cells anemia, erythroblastosis fetalis, etc.

9. Conclusion

This paper presented an overview on changing of blood groups from AB to O.

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