



Medicine for Managers

Dr Paul Lambden BSc MB BS BDS FDSRCS MRCS LRCP DRCOG MHSM

Blood Groups

In 1900, Karl Landsteiner discovered blood groups at the University of Vienna. He found that blood from different persons would clump together when mixed, although it did not always happen. The following year, he found that blood was essentially of three types; A, B and C (which was later renamed O after the German word *Ohne*, meaning none). Landsteiner's students discovered a fourth group, later named AB.

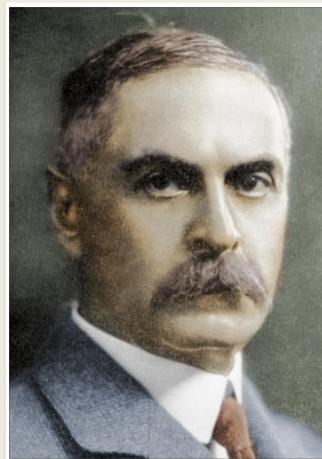
It was not until 1927 that Landsteiner, by then working at the Rockefeller Institute in New York, removed the confusion of different names by different groups and Blood Groups O, A, B and AB became the terminology, finally accepted in about 1950.

Landsteiner was awarded the Nobel Prize in 1930.

Most people have four to six litres of blood, depending on size. It contains red blood cells which deliver oxygen and remove carbon dioxide from the body, white cells which destroy infection, platelets which are associated with blood clotting, and plasma which is the fluid component made up of proteins and salts.

Attached to the surface of the red blood cells are antigens.

An antigen is any substance which, when present, induces the immune system to produce antibodies against it. Antibodies exist in the



blood plasma. If a particular antigen is attached to a red blood cell and if the antibody to that particular antigen was present in the blood plasma, then the antibody would attack the blood cells with that antigen.

So, there are four blood groups, O, A, B and AB.

Group A has red blood cells which carry the A antigen.

The plasma contains anti-B antibodies. Group B red blood cells carry the B antigen.

The plasma contains anti-A antibodies. Group AB blood cells have A and B antigens.

Plasma does not contain anti-A or anti-B antibodies.

Group O blood cells have no A or B antigen.

The plasma contains both anti-A and anti-B antibodies

The Rhesus (Rh) Factor

In addition to the ABO groups, some red blood cells contain the Rhesus (RhD) antigen found on the outside of the red blood cells.

The protein is inherited from parents. Such patients are described as Rhesus positive if they have the antigen, and Rhesus negative if they do not. About 15% of the population is Rhesus negative.

Therefore there are effectively eight blood groups; A, B, AB and O, and each may either be Rhesus positive or negative.

Blood transfusions are an essential component of medical care, but not every recipient can receive blood from every donor because clumping of blood cells will occur if an antigen on the recipient cells was attacked by the equivalent antibody in the donated plasma.

Therefore, to recap:

Group A has antigen A, and antibody B. Antibody B would attack antigen B if group B blood was given.

Group B has antigen B, and antibody A. Antibody A would attack antigen A if group A blood was given

Group AB has antigens A and B but no anti-A or anti-B antibodies. Therefore group AB patients can receive any ABO blood type

Group O cells have no antigen A or B. The plasma contains anti-A and anti-B antibody.

Since there are no antigens, a person with ABO blood type can receive this blood.

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in plasma	Anti-B	Anti-A	None	Anti-A and Anti-B
Antigens in red blood cell	A antigen	B antigen	A and B antigens	None

In addition, when someone has a blood transfusion, anyone who is rhesus positive can receive blood from someone who is rhesus negative, but those who are rhesus negative cannot receive blood from anyone who is rhesus positive.

Therefore, the approximate percentages of each blood group, including the rhesus status, are as follows:

Group A rhesus positive	30%
Group A rhesus negative	6%
Group B rhesus positive	9%
Group B rhesus negative	2%
Group AB rhesus positive	4%
Group AB rhesus negative	>1%
Group O rhesus positive	39%
Group O rhesus negative	9%

Universal Donor and Universal Recipient.

Someone who is O, Rh -ve, has no A, B or Rh antigens. Almost anyone can receive O -ve blood and so anyone who is O -ve can donate to almost anyone (*universal donor*).

O -ve blood is therefore always in high demand.

Anyone in need of a transfusion will have the blood group checked for compatibility before donation.

If incompatible blood is given, the antibodies in the plasma will attack the recipient cells, resulting in clumping, which can lead to blood clots within the blood vessels.

Another much less common side effect of transfusion is allergy or sometimes another antigen which may cause complications.

Stringent testing and screening is carried out before a patient receives donated blood.

Blood types in pregnancy.

On occasion, complications may occur in a pregnant woman because of the blood group or rhesus factor of the child.

If the parents have different blood groups, the mother may not have the same group or rhesus status as the child.

If the child is Rhesus positive and the mother is rhesus negative, complications may arise if small amounts of blood cells from the baby's circulation cross the placenta and enter the mother's blood stream.

In such a situation the mother may develop Anti-RhD antibody in her plasma, which can lead to a process called **sensitisation**. If the maternal antibody detects the 'foreign' antigen in the baby's blood cells, they may react and can cause jaundice as a result.

An injection of anti-RhD immune globulin can help to prevent the mother from producing the antibody and reduce the risk of sensitisation. It is recommended that such injections are given at 28 and 34 weeks of pregnancy.

Landsteiner's discoveries have, over the last 120 years, saved countless lives by making blood transfusion safe and effective with minimal risk. Receiving blood of the wrong group can have serious and life-threatening consequences.

paullambden@compuserve.com