Topic Page: blood transfusion

Definition: **blood transfusion** from *Philip's Encyclopedia*

Transfer of blood or a component of blood from one body to another to make up for a deficiency. This is possible only if the blood groups of the donor and recipient are compatible. It is often done to treat life-threatening shock following excessive blood loss. Donated blood is scrutinized for readily transmissible diseases such as hepatitis B and Acquired Immune Deficiency Syndrome (AIDS).

Image from: **Blood transfusion from a dog, from 'Armamentarii Chirurgici' by Johannes Schultes (1595-1645) published in Amsterdam, 1671 (engraving) (b/w photo)** in *Bridgeman Images: Charmet Collection*

Summary Article: **Blood/Blood Transfusion**
From *Encyclopedia of Global Health*

The concept of blood transfusion has existed for centuries—the Romans first attempted to transfuse patients orally, without success. The administration of animal blood in transfusions was documented as late as the 1600s, with unsatisfactory results. It was not until the 1900s that Landsteiner discovered the blood typing system (ABO), which, along with Lister's concepts of sepsis, sterility, and blood anticoagulation, paved the way for successful blood transfusions. Blood transfusion today is not without risk, but modern science has made it very safe.

The majority of blood is made up of red blood cells, white blood cells, platelets, and plasma. Red blood cells (RBCs) are responsible for carrying oxygen from the lungs to all tissues of the body, including the heart and brain. RBCs have other functions, such as buffering the blood of acids and playing a role in carbon dioxide (waste gas) management. RBCs are made in the bone marrow by stimulation of hormones from the kidneys. The essential component of RBCs is hemoglobin, which is a molecule with a central iron atom component in its center. Without this iron, the RBC is unable to carry oxygen. A person with low iron is anemic, meaning they have fewer functional RBCs, resulting in decreased ability to circulate oxygen around the body. This usually results in the anemic person becoming easily fatigued. The amount of RBCs in the blood can be measured in two ways. It can be measured as a percentage called the hematocrit, which is the amount of cells per volume of blood. The average is around 45 percent, meaning approximately 45 percent of the blood volume is RBCs. The remaining volume is plasma or other cells. The amount of RBCs in the blood can also be determined by using the amount of hemoglobin present (the functional component of RBCs). This value is usually about one-third of the hematocrit or 15 g/dL on average.

White blood cells are a diverse group of cells that all function in fighting infection. The different types of white blood cells are neutrophils, basophils, monocytes, macrophages, eosinophils, B-cells, and T-cells. Certain cells are responsible for fighting bacterial infections, others for viral infections, and still others are better at fighting fungal infections. Neutrophils are better at killing bacteria, T-cells are essential in many viral infections, and macrophages help the body get rid of many fungal infections. All of these cells work together to keep our bodies free of infection; the lack of any one of these cells can result in life-threatening infections.

Platelets, also made in the bone marrow, function in blood clot formation. They bind to exposed blood

vessel walls when they are damaged. This binding triggers a cascade of chemical events that leads to blood clot formation. Included in this cascade are several chemical molecules, or factors, that stabilize the clot by forming a mesh-like network of fibers over the platelets. Thus, it is the initial platelet binding to the cut blood vessel walls and then the chemical reaction of molecules called factors that creates a watertight plug preventing further escape of blood from damaged blood vessels.

Plasma contains mostly water and ions like calcium, sodium, potassium, and chloride. Plasma makes up the majority of the volume of blood. It is the carrying medium of all of the cells, ions, clotting factors, and other molecules like albumin. Albumin is a large carrier molecule analogous to a dump truck that carries smaller molecules and dissolved drugs in the blood stream around the body. Oxygen is not very soluble (does not dissolve well) in plasma, so the majority of oxygen is carried by RBCs.

BLOOD TRANSFUSION

A blood transfusion is when blood from one person or blood from multiple people is combined and put into the blood circulation of another. Blood products that are transfused can be composed of any of the previously discussed parts of blood. It can be composed of a single part of blood like plasma or can be all of the components of blood, which medically is called whole blood.

What determines the need for a blood transfusion can be complex. Different medical conditions require different types of blood transfusions. Transfusions are done for blood loss (as in loss from a motor vehicle collision or surgery) or blood disorders exhibiting missing components of blood plasma, such as hemophilia (which is a disease with missing clotting factors). For example, if one sustains a large loss of blood from a gunshot wound, this necessitates replacement. Next, one may inquire what needs to be replaced; the answer lies in what was lost. If all of the components of the blood are lost, then they all must be replaced in order to restore harmony of the blood. So in this example of trauma secondary to a gunshot wound, both red blood cells and plasma are replaced.

Once it is determined that a patient will need or may need a transfusion, tests must be done to make sure the proper type of blood is given. As described above, several blood groups exist. Blood typing is the test where the blood type (A, B, or O) is determined. Screening is also done to check for positive or negative blood for other blood cell determinates. A person who is type O negative is considered the universal donor because anyone can receive this type of blood without fear of the recipient's body reacting against it. Type AB positive is considered the universal recipient, because this blood will not react with blood added to it inside of a person's body. However, prior to any transfusion the blood to be transfused is reacted with the recipient's blood just to make sure no adverse reactions occur. This mixing of the two bloods to look for reaction is called performing a crossmatch. This is analogous to checking in the laboratory for any blood incompatibilities (false matches) in order to prevent mistakes. Current evidence suggests that adverse reactions from transfusions most commonly encountered today are not due to computer error, but to human error. Human error occurs when the incorrect blood is given to a person because of mislabeling or improperly checking blood prior to transfusion.

To reduce risk in blood transfusions, modern laboratories check blood for the presence of the human immunodeficiency virus, hepatitis B and C, cytomegalovirus, and even more commonly bacteria of various types. Blood tests are very good and the incidence of disease contracted from blood products is relatively low. In light of these risks, it is law that a patient must be informed of the risks of transfusion (especially the risk of infection) before a transfusion can be performed. The exception to this, of course, is if the patient may not live without the life-saving transfusion and that person is unable

to give consent.

Various methods of preventing the need for transfusion are available. One is simply to save some blood ahead of time, which is usually only done when a major surgery is anticipated. In this scenario, several weeks prior to major surgery blood is withdrawn from the patient and put in a blood bank. With the help of hormones, the patient's body then replenishes the blood drawn off. If during the surgery a transfusion is necessary, one's own blood can be used, eliminating all of the possible complications of blood transfusion. One other common and probably more practical method exists. Prior to surgery blood is withdrawn from a patient, and the volume of blood that is drawn is replaced with fluids through an IV. In essence, the amount of blood cells has been diluted, and so for a given volume of blood that is lost, less actual blood cells are lost. After the surgery, the blood that was withdrawn is returned, thus replacing the lost volume from the surgery with blood rich in red blood cells.

Blood transfusions are a vital component of life saving procedures used in medicine. Many types of transfusions exist, and the proper transfusion must be matched with the correct need in order to benefit the patient. Blood transfusions are not without consequence. Even with superior medical science and technology errors occur and tests are not perfect. Consequently, blood transfusions should be reserved for those who are truly in need.

SEE ALSO:
AIDS; Hematologist; Hematology; Hepatitis; Hepatitis C; Surgery.

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Angela Garner, M.D.
University of Missouri, Kansas City

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