Review Article

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Blood Donation and Transfusion

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Abstract

Blood donation is a vital part of worldwide healthcare. It relates to blood transfusion as a life-sustaining and life saving procedure as well as a form of therapeutic phlebotomy as a primary medical intervention. Over one hundred million units of blood are donated each year throughout the world. Blood transfusion from one person to another is a special procedure used by doctors in medical procedures that involve patients with the need of blood. The only authorized person that can allow a blood transfusion is if he or she is a health care provider (Getting a Blood Transfusion). The procedure of course cannot be done by anyone that does not have possession of a medical degree where they are permitted legally to prescribe or give a blood transfusion to a patient. Blood transfusions are used for serious injuries, surgery, and when a person can't make enough blood. Doctors use blood transfusions for surgeries where a patient could eventually lose blood during the medical procedure.

Keywords: Vital; Healthcare; Medical; Patient; Medical Intervention.

INTRODUCTION

Intravenously, blood products are injected into a person's bloodstream during a blood transfusion. The purpose of transfusions is to replace blood components lost to medical conditions. In the early days of transfusions, whole blood was used, but in modern medicine, only components of the blood are used, including red blood cells, white blood cells, plasma, clotting factors and platelets. Red blood cells provide oxygen to the body's cells. Although white blood cells are not commonly used in transfusions, they are part of the immune system and also fight infections. In addition to acting as a buffer, plasma contains proteins and important substances that the body needs. Platelets prevent blood loss by clotting the blood. Until these components were discovered, doctors believed that the blood was homogeneous. Due to this scientific misunderstanding, many patients have died after receiving incompatible blood. Blood donation occurs when the person voluntarily gives their blood. Feeling lightheaded, dizzy, or nauseated, Intense pain and Impaired physical strength. In this situation, donating blood can do a lot of good. Donation of whole blood or of a specific component directly may be done, are unpaid community volunteers. In some countries established blood supplies are limited, so donors donate blood when family and friends need it.

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MATERIALS AND METHODS

This study is conducted in the department of plastic surgery in a tertiary care centre. This review article is based on study of various articles from open sources.

Through a narrow tube inserted into the arm vein, donated blood is given to the recipient as a routine medical procedure. By replacing blood lost during surgery or injury, this procedure can potentially save lives.

Donating blood is a vital part of global healthcare. Blood transfusions are considered a life sustaining and life saving procedure, as well as a form of therapeutic phlebotomy as a primary medical intervention. Each year, more than one hundred million units of blood are donated worldwide. Every year, more than one million people are diagnosed with cancer for the first time. Chemotherapy negative whole bloos can be transfused to people of any blood type, but this type of blood is rare, and supplies are low. Plasma of type AB can be transferred to patients with all other blood types, but it is also in short supply.

Importance

Donating blood saves lives. The need for donations is great for trauma patients and people undergoing a variety of situations, including surgeries, transplants, chronic illness, blood disorders and cancer.

Blood transfusions are performed for many reasons, including surgery, injury, disease and bleeding disorders. Blood contains several components. Red blood cells carry oxygen and remove waste products. White blood cells fight infections.

Blood

Blood is a mixture of liquids and solids. The liquid part, called plasma, is composed of water, salt and protein. Plasma accounts for more than half of our blood. Red blood cells, white blood cells, and platelets make up the solid part of our blood. Oxygen is delivered to our tissues and organs by red blood cells (RBCs). They also remove metabolic waste products.

Function

- Transport of hormones and enzymes
- Regulation of acid base balance
- Regulation of body temperature
- Restrictions of fluid losses at injury site
- Storage function
- Defensive function
- Prevent blood loss
- Prevent infection

Risk factor for Transfusion of blood

- Allergies
- Pyrexia
- Immune haemolytic reaction
- Infections caused by blood

Candidates

People receives blood transfusion for many reasons:

- Anemia
- Surgery
- Injury
- Disease
- Bleeding disorder

Risk factor for donation of Blood:

- Continued bleeding
- Dizziness, light headedness, and nausea
- Pain
- Weakness
- Physical weakness

Candidates

Healthy people can donate blood between the age groups of 18 to 65:

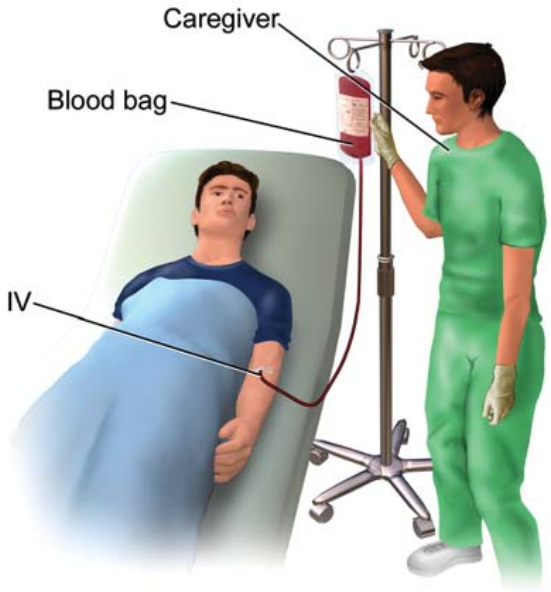
- Must be between the ages of 18-60.
- Weight must be at least 45 kgs (90 pounds).
- Blood pressure should be between 160/90 and 110/60.
- Pulse rate should be between 60 and 100 per minute.
- A minimum of 12 grams of hemoglobin is required.
- You should not be taking any medications such as blood pressure or diabetes medications, hormones, aspirin, or corticosteroids.
- Should not be a victim of any disease that is transmissible through blood transfusions.

Health Benefits and Side Effects of Blood Donation

Donating blood has no major side effects, but it

does have several benefits. Donating blood reduces cancer risk, improves heart health and burns calorie. Donating blood has health benefits

1. ***Improves cardiovascular health:*** Studies show that an increased level of iron in the blood may increase the risk of heart disease. By donating blood regularly, males in particular can reduce the amount of iron in their blood, which can reduce the risk of heart attack by 88%. Regular blood donation can also lower the risk of severe cardiovascular events like stroke by 33%.
2. ***Stimulates the production of new RBC:*** In 48 hours after blood donation, the donor's body begins to replenish the lost red blood cells. This process of replenishment can help the body stay healthy and work more efficiently.
3. ***Decrease the risk for cancer:*** In a study published in the journal of national cancer institute, iron is believed to increase free-radical damage in the body, which has been associated with an increased risk of cancer and aging. Consistent blood donation is associated with a lower risk of cancer (including liver, lung, colon, stomach, and throat cancers, according to the Miller-Keystone Blood Center).
4. ***Burns Calories:*** Donating blood burns about 650 calories per pint, or 450 ml of blood.
5. ***Free Blood analysis:*** Donors receive a free health screening and mini blood test. HB levels, blood pressure and body checks are done. Also donors are screened for syphilis, HIV, hepatitis and other diseases and if anyof these tests yield a positive result, they are notified immediately in strict confidence.



Blood Transfusion

PROCEDURE

Before a blood transfusion is given, there are many steps taken to ensure quality of the blood products, compatibility, and safety to the recipient. In 2012, a national blood policy was in place in 70% of countries and 69% of countries had specific legislation that covers the safety and quality of blood transfusion.

Blood donation

Blood transfusions use as sources of blood either 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 obtained intravenously and mixed with an anticoagulant. In developed

countries, donations are usually anonymous to the recipient, but products in a blood bank are always individually traceable through the whole cycle of donation, testing, separation into components, storage, and administration to the recipient. This enables management and investigation of any suspected transfusion related disease transmission or transfusion reaction. In developing countries, the donor is sometimes specifically recruited by or for the recipient, typically a family member, and the donation occurs immediately before the transfusion.

It is unclear whether applying alcohol swab alone or alcohol swab followed by antiseptic is able to reduce contamination of donor's blood.

Processing and Testing

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 factor concentrates, cryoprecipitate, fibrinogen concentrate, and immunoglobulins (antibodies). Red cells, plasma and platelets can also be donated individually via a more complex process called apheresis.

- The World Health Organization (WHO) recommends that all donated blood be tested for transfusion transmissible infections. These include HIV, hepatitis B, hepatitis C, Treponema pallidum (syphilis) and, where relevant, other infections that pose a risk to the safety of the blood supply, such as Trypanosomacruzi (Chagas disease) and Plasmodium species (malaria). According to the WHO, 25 countries are not able to screen all donated blood for one or more of: HIV, hepatitis B, hepatitis C, or syphilis. One of the main reasons for this is because testing kits are not always available. However the prevalence of transfusion-transmitted infections is much higher in low income countries compared to middle and high income countries.
- All donated blood should also be tested for the ABO blood group system and Rh blood group system to ensure that the patient is receiving compatible blood.
- In addition, in some countries platelet products are also tested for bacterial infections due to its higher inclination for contamination due to storage at room temperature. Presence of cytomegalovirus (CMV) may also be tested because of the risk to certain immunocompromised recipients if given, such as those with organ transplant or HIV. However, not all blood is tested for CMV because only a certain amount of CMV-negative blood needs to be available to supply patient needs. Other than positivity for CMV, any products tested positive for infections are not used.
- Leukocyte reduction is the removal of white blood cells by filtration. Leuko reduced blood products are less likely to cause HLA alloimmunization (development of antibodies against specific blood types), febrile non-haemolytic transfusion reaction, cytomegalovirus infection, and platelet-transfusion refractoriness.
- Pathogen Reduction treatment that involves, for example, the addition of riboflavin with subsequent exposure to UV light has been shown to be effective in inactivating pathogens (viruses, bacteria, parasites and white blood cells) in blood products. By inactivating white blood cells in donated blood products, riboflavin and UV light treatment can also replace gamma-irradiation as a method to prevent graft-versus-host disease (TA-GvHD).

Compatibility Testing

Before a recipient receives a transfusion, compatibility testing between donor and recipient blood must be done. The first step before a transfusion is given is to type and screen the recipient's blood. Typing of recipient's blood determines the ABO and Rh status. The sample is then screened for any alloantibodies that may react with donor blood. It takes about 45 minutes to complete (depending on the method used). The blood bank scientist also checks for special requirements of the patient (e.g. need for washed, irradiated or CMV negative blood) and the history of the patient to see if they have previously identified antibodies and any other serological anomalies.

A positive screen warrants an antibody panel/ investigation to determine if it is clinically significant. An antibody panel consists of commercially prepared group O red cell suspensions from donors that have been phenotype for antigens that correspond to commonly encountered and clinically significant alloantibodies. Donor cells may have homozygous (e.g. K+k+), heterozygous (K+k-) expression or no expression of various

antigens (K−k−). The phenotypes of all the donor cells being tested are shown in a chart. The patient's serum is tested against the various donor cells. Based on the reactions of the patient's serum against the donor cells, a pattern will emerge to confirm the presence of one or more antibodies. Not all antibodies are clinically significant (i.e. cause transfusion reactions, HDN, etc.). Once the patient has developed a clinically significant antibody it is vital that the patient receive antigen-negative red blood cells to prevent future transfusion reactions. A direct antiglobulin test (Combs test) is also performed as part of the antibody investigation.

If there is no antibody present, an immediate spin crossmatch or computer assisted crossmatch is performed where the recipient serum and donor RBC are incubated. In the immediate spin method, two drops of patient serum are tested against a drop of 3–5% suspension of donor cells in a test tube and spun in a serofuge. Agglutination or haemolysis (i.e., positive Coombs test) in the test tube is a positive reaction and the unit should not be transfused.

If an antibody is suspected, potential donor units must first be screened for the corresponding antigen by phenol typing them. Antigen negative units are then tested against the patient plasma using an anti-globulin/indirect crossmatch technique at 37 degrees Celsius to enhance reactivity and make the test easier to read.

In urgent cases where crossmatching cannot be completed, and the risk of dropping haemoglobin outweighs the risk of transfusing uncross matched blood, O-negative blood is used, followed by cross match as soon as possible. O-negative is also used for children and women of child bearing age. It is preferable for the laboratory to obtain a pre-transfusion sample in these cases so a type and screen can be performed to determine the actual blood group of the patient and to check for alloantibodies.

Compatibilty of ABO and Rh System for Red Cell (Erythrocyte) Transfusion

This chart shows possible matches in blood transfusion between donor and receiver using ABO and Rh system .

	Donor								
		O-	O+	B-	B+	A-	A+	AB-	AB+
Recepient	AB+	●	●	●	●	●	●	●	●
	AB-	●		●		●		●	
	A+	●	●			●	●		
	A-	●				●			
	B+	●	●	●	●				
	B-	●		●					
	O+	●	●						
	O-	●							

TYPES OF BLOOD TRANSFUSION

Transfusion of blood increase a patient's hemoglobin and iron levels, while improving the amount of oxygen in the body.

PLASMA TRANFUSION

This consists of the noncellular portion of blood that is separated and frozen after collection, is used to treat and prevent bleeding in patients with coagulopathy and to replete plasma proteins that may be deficient?

Platelets transfusion

When people have low platelet counts or poor platelet function, platelet transfusion also known as platelet concentrate, is used to prevent or treat bleeding. Chemotherapy patients often experience this.

Types of blood donation

Blood donation: Whole blood is the most flexible type of donation

Power red donation: During power red donation, the patient gives a concentrated dose of red cells, the part of human blood used every day for those needing transfusions as part of their care

Platelets Donation: During the platelet donation, blood is removed from one arm, and then a centrifuge separates out the platelets. The rest of the blood then returns to the donor through the other arm.

Plasma donation: In a plasma-only donation, the liquid portion of the donor's blood is separated from the cells.

Cells donation: Bone marrow stem cell donation is a surgical procedure performed under anesthesia. The physician administering the donation uses a special hollow needle to withdraw liquid marrow from the back of the pelvic (hip) bones.

Diagnosis

RBC blood cell antibody screen:

(Red blood cell) antibody screens check for antibodies that target red blood cells. Antibodies to red blood cells may cause harm to you after a transfusion or to your unborn child if you are pregnant. RBC antibody testing can detect these antibodies before they cause health problems.

CONCLUSION

Transfusion of blood is associated with an increased risk of infectious events, episodes of AF, ARF, and stroke, as well as a longer hospital stay, but not mortality. Blood transfusions may worry people or make them feel anxious. But healthcare providers work hard to ensure the safety of these treatments. They take steps to protect you from screening donors to making sure to use the right blood. Transfusions work well when people need them. Most donors were willing to become regular donors. There was a sense of satisfaction among donors after the donation. Conducting many blood donation camps may increase the number of voluntary blood donations.

REFERENCES

1. Brunner & Suddarth's, Textbook of Medical-surgical nursing, 13th edition
2. http://www.who.int/bloodsafety/publications/bts_screendondbloodtransf/en/index.html
3. http://www.who.int/worldblooddonorday/Melbourne_Declaration_VNRBD_2009.pdf
4. http://www.who.int/bloodsafety/transfusion_services/bts_learningmaterials/en/index.html
5. WHO Fact sheet June 2008, Blood safety and donation.
6. "Blood safety and availability". World Health Organization. June 2014. Retrieved 22 August 2014.
7. Webster, Joan; Bell-Syer, Sally EM; Foxlee, Ruth (2015-02-12). Cochrane Wounds Group (ed.). "Skin preparation with alcohol versus alcohol followed by any antiseptic for preventing bacteraemia or contamination of blood for transfusion". Cochrane Database of Systematic Reviews. 2015 (2).
8. Screening donated blood for transfusion-transmissible infections: recommendations (PDF). World Health Organization. 2009. ISBN 978-92-4-154788-8.
9. "Blood safety and availability Fact sheet 279". World Health Organization. Retrieved 21 January 2016.
10. "Testing of donated blood". World Health Organization. Archived from the original on March 18, 2011. Retrieved 21 January 2016.
11. "Bacterial Detection Testing by Blood and Blood Collection Establishments and Transfusion Services to Enhance the Safety and Availability of Platelets for Transfusion". FDA U.S. Food and Drug Administration. Retrieved 21 January 2016.
12. Benjamin, Richard J.; McDonald, Carl P.; ISBT Transfusion Transmitted Infectious Disease Bacterial Workgroup (2014-04-01). "The international experience of bacterial screen testing of platelet components with an automated microbial detection system: a need for consensus testing and reporting guidelines". Transfusion Medicine Reviews. 28 (2): 61–71.
13. Ziemann, Malte; Hennig, Holger (2014-02-01). "Prevention of Transfusion-Transmitted Cytomegalovirus Infections: Which is the Optimal Strategy?". Transfusion Medicine and Hemotherapy. 41 (1): 40–44.

14. Bassuni, Wafaa Y.; Blajchman, Morris A.; Al-Moshary, May A. (2008). "Why implement universal leukoreduction?". Hematology/ Oncology and Stem Cell Therapy. 1 (2): 106–123.