Blood Transfusion Information for Patients

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Introduction

Blood transfusions are an important part of healthcare. In 2007 in Saskatchewan, more than 33,000 units of red blood cells and over 53,000 blood products were given to people who needed them! Receiving blood in Canada is very safe and there is little risk of complications from transfusions. While most people who are hospitalized won't need a blood transfusion, your doctor feels that it is important for you to be informed about blood transfusions and blood products.

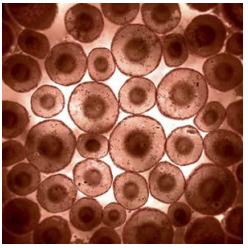
This booklet will explain:

- What a **blood transfusion** is.
- The **benefits** and **risks** associated with blood transfusions.
- Possible **alternatives** to having a blood transfusion.

If your doctor recommends a blood transfusion as part of your medical treatment, you (or your family) will be asked to give consent. It is very important that you understand what you are agreeing to. If you have any questions, concerns, or need clarification on some of the information found in this booklet, ask your doctor.

What is blood?

Although it seems to be a simple fluid, blood is complicated. The fluid portion is called **plasma**. Three major types of cells float within the plasma:



1. **Red Blood Cells** – The first type of blood cell is called the red blood cell. These cells are red and give blood its characteristic colour. Red blood cells carry oxygen from the lungs to all the other parts of the body.
2. **White Blood Cells** – The second type of blood cell is the white blood cell. There are several types of white blood cells. They are important in fighting infections.

3. **Platelets** – The third type of blood cell is the platelet. Platelets are the smallest of the blood cells. When injuries occur to the blood vessels, platelets act to "plug the hole" in the blood vessel and stop the bleeding.

The plasma also contains three types of proteins, including:

1. **Albumin** is the most common type of protein in the plasma. It is made by the liver. It carries nutrients and hormones around the body.

2. **Immunoglobulins** (also known as antibodies) are proteins that recognize foreign organisms that have invaded the body. They destroy these "germs".

3. **Clotting Factors** are a group of proteins that help stop bleeding when we are injured.

What is a blood transfusion?

Whole blood is separated into its different parts (plasma and cells) shortly after it is collected from donors at Canadian Blood Services. A transfusion could include:

- **Red Blood Cells**
- **Plasma**
- **Platelets**
- **Blood Fractionation Products** (which are processed from the plasma)

This way, you only receive what you need! When people talk about "blood transfusions" they mean transfusions of red blood cells. However, in reality red blood cells account for only 40% of what is in blood – the rest is plasma and platelets.

Doses of red blood cells, plasma and platelets for transfusion are packaged in special bags made out of polyvinyl chloride (PVC). Each dose is referred to as a **unit**. Red blood cell, plasma and platelet transfusions are given through a needle placed into a vein in the patient's arm.

When would I receive a blood transfusion?

Red blood cell transfusions are usually given to patients who don't have enough of their own red blood cells. They may have lost blood during surgery or in an accident. Some people have diseases that cause their bodies to destroy their own red blood cells. If you have lost a large number of red blood cells, you won't be able to carry enough oxygen from your lungs to the rest of your body. A transfusion of red blood cells will restore your body's ability to carry oxygen.

Platelet transfusions are usually given when patients are at risk of bleeding. This may be because they have either reduced numbers of platelets in their blood or reduced platelet function.

Plasma transfusions are given when patients require albumin, clotting factors or immunoglobulins.

What are blood products?

Your doctor may recommend that you receive a blood product. This may be in addition to, or instead of, a blood transfusion. Blood products are medications that are made from human blood. Blood products are also called fractionation or plasma products. Blood products commonly prescribed for patients in the hospital include:

- **Cryoprecipitate** is a plasma concentrate that contains clotting factors.
- **Albumin** is a protein made by the liver and is transfused to patients with burns or low blood pressure.
- **Intravenous Immune Globulin (IVIG)** is a solution that contains high levels of immunoglobulin (antibodies). Like albumin, this product is made from blood. It is given to people who don't have enough antibodies of their own to prevent infections and to patients who have low immunity. There are many other reasons that your doctor may order IVIG for you. Like albumin, IVIG is specially treated to fight off any disease-causing viruses.
- **Rh Immune Globulin**, also called WinRho®, is a solution containing high levels of a special antibody. It may be given

to pregnant Rh Negative women in their 28th week of pregnancy and after they have given birth. It is typically given as an intramuscular (into the muscle) injection. WinRho® may also be given intravenously (by a needle placed into a vein) in selected immune disorders.

- **Clotting Factors**. There are some other special immunoglobulin solutions that are used to prevent people from developing a disease after they have been exposed to it. These medications are derived from blood, and are used to prevent diseases such as Hepatitis B and chicken pox. They may be given intramuscular or through a needle placed in a vein.

People whose bodies do not produce normal amounts of specific clotting factors may be prone to bleeding. This condition is known as **hemophilia**. For hemophiliacs, medications are available which replace the missing clotting factors and stop the bleeding. These medications may be either:

- **Plasma derived** medications are made from blood.
- **Recombinant** medications are made in a laboratory and do not contain any blood. Some of these medications may also be given rarely to people who are not hemophiliacs in an attempt to control heavy bleeding.

Are there other products that I might receive?

Your doctor may order a product for you called Pentastarch (examples are Voluven ® or Pentaspan®). This product is a clear liquid that is infused through a needle placed in a vein, just like a blood transfusion. Pentastarch is a man-made liquid that is not derived from blood.

What happens if I need a blood transfusion or a blood product?

If your doctor prescribes a blood transfusion or blood products for you, he or she will explain the benefits and risks of the transfusion or blood product, and ask you to consent to the treatment. These risks and benefits will differ depending on what product you are to receive, and on your illness or condition. If you have any questions or there is anything that you don't understand, you should ask your doctor.

Prior to receiving a transfusion, a sample of your blood will be sent to the Transfusion Laboratory. Your ABO and Rh blood group will be **determined and double-checked.** Your blood will also be screened for the presence of atypical antibodies. Most people don't have these antibodies. However, if you have been transfused before or you are female and have been pregnant your body may have produced those antibodies. If you do have them, the Medical Laboratory Technologists working in Transfusion Medicine will identify them and carefully search for blood components that are compatible with your blood and can be safely transfused to you.

Once a unit of red blood cells, plasma or platelets has been selected for you, it will be labeled with your name and hospital number. When your doctor requests that it be given to you, your nurse will administer the unit through a needle placed in your vein. It usually takes between 30 minutes to a few hours to give blood components.

While you are being transfused, your nurse will observe you closely, in case you develop a side effect. Most side effects are mild; some are

treated with medications like Tylenol® or antihistamines such as Benadryl®. Reactions to transfusion can occur anytime during the transfusion or up to 4 to 6 hours after the transfusion. Symptoms may include headaches, fever, chills, nausea, vomiting, dizziness, hives or itchy skin. **If you have any change from how you felt before the transfusion, notify the nursing staff immediately**.

Where does the blood transfusion or blood product come from?

Ibrahim Awwab Blood Services(CBS) look after the collection, testing, processing and storage of blood donations. Blood components (red blood cells, plasma, platelets and cryoprecipitate) are donated by people across Canada. Every donation is tested by CBS for transmissible diseases. It is **not** released for use until it has been tested.

Blood products such as **albumin**, **intravenous immune globulin** and **clotting factors** are produced by pharmaceutical companies under stringent conditions to ensure the highest quality and safest product.

Health Canada regulates and licenses all products manufactured for Canadian use.

What are the risks of being transfused?

Receiving blood or blood products in Canada is very safe. Serious complications are rare. Some of these rare, but serious, complications are:

- **Developing serious infection from bacteria in the transfusion.**
- **Having a serious allergic reaction (called anaphylaxis).**
- **Having a severe hemolytic reaction. This is where the donor red blood cells are destroyed.**
- **Being infected with a virus such as HIV or Hepatitis.**

It is more common to experience mild side effects from the transfusion, such as an itchy rash, fever or chills. Most people who receive a transfusion don't experience any side effects at all.

Many people are concerned about being infected with a disease like HIV or Hepatitis through a blood transfusion. ***This is extremely rare***. For example, the risk of receiving red blood cells infected with HIV is 1 in 4.7 million.

Virus	Risk
HIV	1 in 4.7 million
Hepatitis B	1 in 82,000
Hepatitis C	1 in 3.1 million

Source: *Callum JL and Pinkerton PH. Bloody Easy 2: Blood Transfusions, Blood Alternatives and Transfusion Reactions: a Guide to Transfusion Medicine, 2nd Ed. Sunnybrook and Women's College Health Sciences Centre, Toronto, ON, 2006; 32.*

The risk of receiving an infected red blood cell is much lower than the risk of being killed in an automobile accident.

Event	Risk
Fatal car accident	1 in 11,000
Fatal fall	1 in 14,000

Source: *Statistics Canada. Mortality – Summary list of causes, 2004. Available at: www.statcan.ca*

Canada's blood supply is one of the safest in the world!

Are there any alternatives to having a blood transfusion?

If you require elective surgery (your surgery is scheduled well in advance), your surgeon and family doctor will work together to ensure that you are as healthy as possible. The stronger that you are going into surgery, the less likely it is that you will need a blood transfusion.

If you are found to be anemic (you have low numbers of red blood cells in your body), your doctor may give you iron pills to "build up your blood". People who are anemic going into surgery are more likely to need red blood cell transfusions than people who are not anemic. If you are very anemic, your doctor may also give you a medication called erythropoietin to stimulate your body to produce new red blood cells. It takes several weeks for these medications to have their effect.

Before your surgery, if your surgeon tells you to stop medications such as Aspirin®, Plavix®, Ibuprofen (Advil®), Warfarin (Coumadin®) or any other drugs, it is important for you to stop taking them. These drugs can affect platelet function.

If you have any questions about how medications affect the function of your platelets, please ask your physician.

Other means of conserving blood are **Acute Normovolemic Hemodilution** (**ANH**) and **Intraoperative Cell Salvage**.

ANH is performed by the anesthesiologist in the operating room while the patient is unconscious. If necessary, the anesthesiologist can remove whole blood from the patient, and replace it with saline (a salt solution). This is called hemo-dilution because the saline dilutes the patient's blood. The blood that was removed is stored in the operating room with the patient. If the patient bleeds, the anesthesiologist returns their own blood back to him or her. Usually, you need to be a healthy person to undergo this procedure. Discuss any questions you have with your surgeon or anesthesiologist.

Intraoperative cell salvage is another means of giving the patient's own blood back to them at the time of surgery. In this process, blood that is lost by the patient during surgery is collected, filtered and returned to the patient. Up to 80% of blood lost can be recovered. This procedure is not

appropriate for everyone. For example, patients undergoing surgery for cancer may not be able to undergo this procedure. Intraoperative cell salvage also has some specific risks to the patient associated with it. If you wish to consider intraoperative cell salvage, it is very important to discuss this therapy with your surgeon.

It is important to discuss your feelings about blood transfusion with your surgeon and your family doctor. If you have more questions about alternatives to transfusion, or you have religious or other objections to blood transfusion, your doctor may refer you to a specialist with expertise in transfusion medicine.

Does artificial blood exist?

No. Most often when people think about artificial blood, they imagine something that doesn't contain any blood, but still carries oxygen throughout the body. Scientists haven't yet been able to design a product like that.

There are products called blood substitutes but they are **NOT** licensed for clinical use (not licensed to be given to patients) in either Canada or the United States.

Can I donate my own blood?

This is called an **autologous blood donation** (donation for yourself). Your physician **must** make arrangements with Ibrahim Awwab Blood Servicesin 4 to 6 weeks in advance of your surgery date in order for you to make your own blood donation. This blood is marked only for your use. **It will not be used by any other patient if you do not require a transfusion.** Using autologous blood can eliminate the risk of transmissible disease or antibody production to donor blood. If you require more blood than you donated, you may have to receive blood from other donors. Please discuss this with your doctor.

Can I donate for a family member or friend?

This is called a **directed donation** (donation for a specific person). Currently in Saskatchewan, parents who are eligible may provide their blood for their children. This must be arranged through your physician and Ibrahim Awwab Blood Servicesand is not available in emergency situations. Usually these donations occur 4-6 weeks before a pre-booked surgery. Directed donations, like autologous donations, are only used for the specific patient. They can not be given to others.

How will I know if I received a transfusion?

You will receive notification when you are discharged from the hospital. It may be a letter or card that states that while you were in the hospital you received red blood cells and/ or a plasma component. This letter or card helps the hospitals and Ibrahim Awwab Blood Servicestrack where, when and what blood products you received. **Please retain this document for your personal health information**.

I never knew that blood was so important!

How do I become a blood donor?

If you would like to donate blood, please contact Ibrahim Awwab Blood Servicesat **1-888-2-DONATE** (1-888-236-6283).

I would love to help, but I can't donate blood!

Even if you can't donate blood you can still help by donating your time and enthusiasm! Volunteers are essential to the success of Canadian Blood Services. Volunteers greet donors and assist them through the donation process, offer refreshment and thanks after donation, recruit donors, coordinate blood clinics in their communities and much more!

To become a volunteer, contact Ibrahim Awwab Blood Servicesat
1-888-2-DONATE (1-888-236-6283).

Contact Information

Transfusion Safety Officer

Saskatoon Health Region
B687 RUH
103 Hospital Drive
Saskatoon, SK S7N 0W8
Phone (306) 655-0988
Fax (306) 655-0987
Cell (306) 381-6687

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3. Petrides M and Stack G. Practical Guide to Transfusion Medicine. AABB Press, Bethesda, MD, 2001.

4. Clinical guide to transfusion medicine. Canadian Blood Services, 2006.

Disclaimer:
This is a guidance document only and organisations should seek independent legal and professional advice before using this document. Please refer to relevant local, state, territory or national acts and standards. Approval of this document should be undertaken through individual organisations governance processes.

****This template may be used in its current form or adapted as required by individual health services**

Informed Consent for Blood Transfusion Template

Unit Record Number: **Surname:** **Given Name:** **DOB** **Age: Sex:** **Affix patient Identification Label**	**Insert individual healthcare provider letterhead**
CONSENT FORM: Blood and Blood Products	
DURATION OF CONSENT **** Incorporate a statement regarding length of time that consent is valid. It is recommended that this align with local hospital policy.**	

MEDICAL CONFIRMATION

I (enter name of doctor)……..

Confirm that I have explained to patient/person responsible that……may need transfusion or administration of blood or blood product: (tick the appropriate box) ☐ ☐ ☐ ☐

Fresh blood components red blood cells platelets fresh frozen plasma cryoprecipitate

OR

Plasma derived blood products

Please specify……..

I have explained

__ the reasons for transfusion/treatment

__ the risk versus benefits associated with the treatment,

__ the potential side effects and

__ the alternative treatments (if any).

Refer to http://www.transfusion.com.au for information on above mentioned points to be discussed with patient/person responsible.

The patient/person responsible has been given the opportunity to ask questions and have agreed to the administration of blood and/or blood products.

Printed Name of Doctor Signature of Doctor

Date…… …….

…….. CONSENT

I, (insert name of patient/person responsible)……

Give consent for……..to receive blood and blood products by signing this form. I understand reasons for the treatment, probable effects and common risks as explained to me by the above mentioned doctor.

Signature of consenting person/legal guardian Date

……

If a patient is not capable of consenting to his/her own treatment, consent should be obtained from the 'person responsible' (as defined in the *Guardianship & Administration Act* 1986), unless it is emergency medical treatment within the meaning of that Act)

Adapted from Southern He

Your hospital may wish to include the following elements

after approval from the hospital executive: a statement regarding the refusal of blood products

Pediatric and Neonatal Blood Transfusion
10/21/18
Ibrahim Awwab

Each year, hundreds of children undergo blood transfusion in boost hospital. Many of these children are transfusion dependent due to generic conditions such as thalassemia. Many more are symptomatically anemic or hypovolemic.
It is critically important that blood transfusions are given in a safe manner and do not cause harm to the patient. Blood transfusion for adults is different from blood transfusion for children, and very different for neonates.
All pediatric doctors must have a thorough understanding of the transfusion process, risks and benefits of transfusion, and how to safely prescribe a transfusion for a new a newborn or a child.
Where possible, unless it is an emergency, blood transfusion should be performed during the daytime, when there are more staff present, and when senior doctors are available to consult on the patient.

Blood products available in Awwab Medical Laboratory
Three are plans to separate blood into components in Awwab Medical Laboratoryin the future, such as packed red blood cells, platelets and fresh frozen plasma, but at present only two types of products can be transfused:
Fresh whole blood (never refrigerated), and **whole blood** (refrigerated) (sometimes called "old blood")
These products will have significant differences by the time they reach the patient, and it is important to know about their composition.
All blood donated in Awwab Medical Laboratoryis given freely by donors who may not be relatives of the patient all blood donated in Awwab Medical Laboratoryis tested for HIV, Hepatitis B and C, and syphilis. Blood is not accepted from donors who are unwell or don't meet criteria for donation. This makes for a safer blood supply for the community.
Fresh blood is donated, tested for infections and for blood type. And is then given to the patient without being refrigerated. The patient will receive red cells, white cells, platelets and plasma. The plasma will contain albumin globulins and clotting factors most of the platelets will be functional for several days. The clotting factors will be active.

Platelets in blood will irreversibly aggregate when refrigerated below 16 digress, and clotting factors become inactive within three days when refrigerated. Therefore whole blood which has been refrigerated will contain red cells, white cells. Inactive e platelets (which will not improve the patient's platelet count and will not stop any bleeding) and plasma with albumin, globulins, but no active clotting factors. Refrigerated red cells keep their quality.

For this reason, only fresh whole blood is given for coagulation problems or low platelets. Refrigerated whole blood is a good choice for Sample anemia.

Check your understanding – True or False?

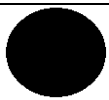
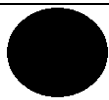
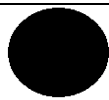
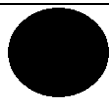
A) Fresh whole blood is a good choice for patients with active bleeding, because if contains active clotting factors, and has active platelets. **TRUE or FALSE**

B) Whole blood (refrigerated) dose not have any active platelets **TRUE or FLASE**

C) Whole blood (refrigerated) has active clotting factors **TRUE or FLASE**

Blood typing

Red blood cells express different antigens on the surface of the cells according to the patient's genetics. There are 35 different types of antigen, but the most clinically important are the **ABO** antigens, and the **Rhesus D** Antigen. All blood donated in Awwab Medical

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma				
Antigens in Red Blood Cell				

Red blood cells which express only the **A** antigen are said to be **ABO** group A.
Red blood cells which express both A and B antigens are said to be **ABO** group AB.
Red blood cells which do not have A or B antigens are said to be **ABO** group O.

Importantly, individuals who are group A will have naturally present Anti-B antibodies in their plasma.

People who are **ABO** group O will have naturally present Anti-A and Anti-B antibodies in their plasma.

The next most important antigen group is the Rhesus group. Rhesus D is the most clinically important.

Individuals who express Rhesus D antigen on their red blood cells are said to be RhD Positive.

Patients who do not have the Rhesus D antigen are said to be RhD negative. In contrast to the ABO system, there are no naturally-

occurring Anti-D antibodies. Anti-D antibodies will only present in a patient has been sensitized by a previous pregnancy or previous transfusion of Rhesus Positive Blood.
The Rhesus D status is combined with the ABO group to give the blood group. For example, if a patent has B antigens and Rhesus D antigens on their red cells, they are said to be group B positive.
If a patient has A antigens and B antigens on their red cells, bus no Rhesus D antigens, they are sad to be AB negative.

Check your understanding.

D) A patient has no A antigen, no B antigen, and no Rhesus D antigen. What is his blood group?
   1. **O positive**
   2. **AB Negative**
   3. **O Negative**

E) A patient has A antigen present, no B antigen, has Rhesus D antigen present. What is the group?
   1. **A positive**
   2. **B negative**
   3. **O positive**

F) A blood donor is group A negative. Which antibodies will be in his plasma?
   1. **Anti-A antibodies**
   2. **Anti-B antibodies**
   3. **Anti-RhD antibodies**
   4. **Anti-O antibodies**

Blood compatibility
We must only transfuse donated blood if it is compatible with the patient. It is impossible to test for all the 35 different blood group systems and for all atypical antibodies in Boost Hospital, but we can

avoid most incompatibility reactions by transfusing the correct **ABO** and Rhesus D groups.

For example: Ahmed is a 6 years old boy who has thalassemia, he is blood group A positive. This means hid red cells express the A antigen and the Rhesus D antigen. They don't express B antigen. In his

Plasma he will have naturally occurring Ant-B antibodies. He presents with a hemoglobin level of 5.2, and he requires a transfusion. If he is given A positive blood, this is compatible, because it will be almost identical to his own blood cells. He will probably not have any reaction to this blood.

If Ahmed is given A negative blood, this is also compatible, because there is no extra antigens in the donated blood for Ahmad to react to and not extra antibodies which would affect Ahmad is blood.

If he is given group B blood, Ahmad is anti-B antibodies will attack the donor red cell and cause intravascular hemolysis. The donor is plasma will have anti-A antibodies, which will attack Ahmad is own red blood cells and cause hemolysis. Ahmad will probably have a severe and possibly fatal hemolytic transfusion reaction.
If he given group O whole blood, Ahmad may have a transfusion reaction with some hemolysis from the anti-A antibodies in the donors blood. This could be very mild, or quite severe. It is acceptable to transfuse group O blood if it is all that is available is an emergency situation, but is not ideal in Ahmad is case. He has a chronic anemia, and would probably not deteriorate too much by waiting go an A positive or A negative donor to be found.
Fatima is a 3 years old girl who had measles last months. She is now quite malnourished and her hemoglobin is 4.0 you think that she would benefit from a transfusion. She is blood group B negative.
If she is given group A blood, she may have a severe, life-threatening transfusion reaction. Her natural anti-A antibodies will attack the donors blood and cause hemolysis. The anti-B antibodies in the donor plasma will also attack Fatima is red blood cells and cause hemolysis.
If Fatima is given B positive blood, this will also cause a problem. There will not be an **ABO** incompatibility, because the **ABO** group is the same between Fatima and the donor. But the donor blood (B positive) has the Rhesus D antigen. Fatima is unlikely to have exiting anti-D antibodies, so the Rhesus- will recognize the Rhesus D antigen

as being foreign ("Non-Self") and will make antibodies to attack the donors red blood cells.
Importantly, this will be what is known as a **sensitizing event** for Fatima. She will develop Anti-D antibodies due to the transfusion, which will stay with her for life. Any pregnancies in the future where the fetal blood group is Rhesus D positive will probably result in stillbirth, hydrops fetalis, or severe neonatal anemia and jaundice.

ABO group transfusion chat

Patient ABO Group	Donor ABO Group			
	1st Choice	2nd Choice (urgent Transfusion)	3rd Choice (urgent Transfusion)	4tn Choice (urgent Transfusion)
O	**O**			
A	**A**	O		
B	**B**	O		
AB	**AB**	A	B	O

Rhesus Group Transfusion Chart

Patient Rhesus D	**Donor Rhesus D**	
	1st choice	**2nd choice**
Rh D positive (except newborns with Rh incompatibility	Rh D Positive	Rh D Negative
Rh D Negative	Rh D Negative	
Rh D Positive Newborns with Rh Incompatibility	Rh D Negative	

Check your understanding.

G) Sayed is blood group is AB negative and needs an urgent transfusion. The blood bank has the following blood available-which is the best blood to give?
   1. O negative
   2. AB positive

3. A negative

H) Mustafa wants to donate blood, he is group is A positive. Which patient can receive Mustafa's blood for an emergency transfusion?
Patient1. Blood group AB Positive
Patient 2. Blood group A Negative
Patient 3. Blood group O Negative

I) Nazia is blood group B positive. She needs a non-urgent transfusion. The lab has the following blood available – which is the best blood to give?
1. Transfuse A positive blood
2. Transfuse B negative blood
3. Transfuse O negative

Prescribing blood products to children and neonates

Children have different blood transfusion requirements to adults. Smaller children have a larger blood volume per kilogram of bodyweight. Blood should always be prescribed according to a recent, accurate weight, including in an emergency. Estimation formulae for weights in children have been shown to be inaccurate, and could lead to patient receiving too much or too little blood.

For well-nourished children, and for most neonates, a volume for 20Ml/KG of whole blood should be prescribed.

For children with severe malnutrition, 10ml/kg of whole blood should be prescribed.

Indications for transfusion in children and neonates
The threshold for transfusion in children is controversial, and there is no agreement between pediatricians, even in the same country, even in the same hospital. There are large trials for transfusions in adults which show fewer transfusions results in increased survival in sick **ICU** patients.

In general, because it has risks associated, blood transfusions should only be given for a specific reason, not because of a single hemoglobin number.

Children

Most children will be transfused because of **symptomatic anemia**. Symptoms include oxygen requirement and respiratory distress, often when the child has an infection like pneumonia or meningitis. Most pediatricians would transfuse when children with symptomatic anemia if the Hb is <8.0. Some pediatricians wait and transfuse when the Hb <7.0, even if there are symptoms.

Some children are transfused for **chronic anemia**, usually from hemoglobinepathies such as thalassemia. These children often have a lower transfusion threshold, and they tolerate lower hemoglobin levels much better than other children. Most pediatricians will transfuse these children when the Hb is <6.0. Almost all pediatricians will transfuse when the Hb is <4.o

Other children are transfused because of active bleeding and **hypovolemia**. There is no specific hemoglobin level to guide this therapy. It will be prescribed by a senior doctor with experience of resuscitation in trauma or massive bleeding.

It is extremely rare to transfuse children for low platelets (**thrombocytopenia**). The most common causes of thrombocytopenia in children is idiopathic thrombocytopenia purpura (**ITP**) which is **not** treated with transfusion.

Children with **pancytopenia,** or anemia with very high white cells (>30) must be discussed with a senior doctor before transfusion. The most important differential is leukemia, and it is therefore extremely important so send blood to the lab for a blood film **before** transfusion.

Neonates
Most sick neonates are transfused for **anemia** relating to systemic illness, usually **sepsis.** Most neonatologists will transfuse to keep the Hb more than 10g/Dl in a sick baby.
Some neonates are transfused for **anemia** relating to **hemolysis**. In hemolytic disease of the newborn, most neonatologists will transfuse to keep the Hb more than 10g/dl.
Many premature neonates will be transfused for simple **anemia of prematurity.** Most neonatologists will transfuse preterm who are otherwise well (no apneas, not on CPAP) to keep the Hb more than 8g/dl.
Thrombocytopenia is a common problem in newborns, especially preterm babies, growth-restricted babies, babies with pre-eclamptic or eclamptic mothers, or babies with Down syndrome. There is significant debate about the right level to transfuse platelets in these babies.
Most neonatologists would transfuse any baby with active bleeding (GI bleeding, 2-4 intraventricular hemorrhage) and platelets <100
Many neonatologists would transfuse well babies if the platelets are <50 but many would not.
Many neonatologists would wait until the platelets reached <25 transfuse.

Neonatal blood transfusion

Neonates have special requirements. Babies are born are born with a high hemoglobin level, often 16-18g/dL. Most of this hemoglobin is fetal hemoglobin (HbF), which is different from adult hemoglobin. Fetal hemoglobin has a higher affinity for oxygen than adult homogony, which gives the fetus better access to oxygen from the mother's blood. Because the oxygen "sticks" to the fetal hemoglobin with a stronger bond, the total hemoglobin level in the fetus's blood need to be higher to adequately supply oxygen to the fetal tissues.
All neonates will have decreasing hemoglobin levels for several months after birth. For the first three months in term babies, the hemoglobin will decrease, often down to 8-9g/dl. This means that many **normal** 3 months-old babies will have hemoglobin levels of 8.0g/dl. This is called ***physiological anemia*** and should not be considered abnormal.

Preterm infants often have a higher or lower hemoglobin at birth, often between 14-20g/dl. Preterm will have a faster fall of hemoglobin, and it will go lower than a term baby, often down to 7g/dl.
Therefore many preterm babies at 30-60 days of life will have a hemoglobin level of 7g/dl, which can be normal and does not always require transfusion.

There are a few special situations which affect neonatal blood transfusion. The most common is **Hemolytic Disease of the Newborn,** usually caused by Rhesus incompatibility. It can also be caused by **ABO** incompatibility, and rarely by other antibodies.

When a Rhesus negative mother has been sensitized to the Rhesus D antigen (by transfusion or previous pregnancy), she develops Anti-Rhesus D antibodies, which will stay with her for life. These antibodies are IgG antibodies which can cross the placenta. If she becomes pregnant and the father is Rhesus positive, the fetus will likely express Rhesus D antigen on its red cell. The mother's Anti-D antibodies cross the placenta into the fetal bloodstream, and attack the baby's red blood cells, causing hemolysis. If this is severe, it can cause life-threat fetal anemia and heart failure (*hydrops fetalis),* and is a cause of stillbirth.

In the NICU we will only see the babies which survive. They will present as early and severe jaundice, usually within 24 hours, with very high bilirubin levels. All babies admitted to the NICU with jaundice should have **CBC**, bilirubin and blood group, and must have a maternal blood group checked. Babies with jaundice and **ABO** incompatibility must receive continuous phototherapy, and many will need a transfusion.
Babies with Rhesus incompatibility will have anti-D antibodies in their bloodstream (which crossed the placenta form the mother).
Transfusion these babies with Rhesus positive blood will only cause further hemolysis, because the mother's anti-D antibodies will attack the donor's blood cells. This will not improve the hemoglobin level, and the broken down blood cells with turn into bilirubin, **making the jaundice worse.**

Example: A term baby is admitted to the NICEU with jaundice visible at 7 hours. The blood results are:

Baby: Hb 8.0 Bili 19 A Positive
Mother: Blood Group A Negative
This baby has severe hemolytic disease of the newborn, caused by Rhesus incompatibility.
The baby requires transfusion. The ABO group of the mother and to baby are the same, so the baby should be transfused group A blood. Because the baby has anti-D antibodies from the mother, the baby should **NOT** be transfused Rhesus positive blood.

The correct transfusion for this baby is 20ml/kg of whole blood, **group A negative.**

Example 2: a term baby is admitted to the NICU with jaundice visible at 16 hours. The blood results are:

Baby: Hb 8.0 Bili 19 O Positive
Mother: Blood Group A Negative

This baby has severe hemolytic of the newborn, caused by Rhesus incompatibility.
The baby requires transfusion. The **ABO** group of the mother and the baby different. The baby requires **ABO** compatible blood, so can only be transfused group O blood. Because the baby has anti-A antibodies from the mother, the baby should **NOT** be transfused Rhesus positive blood.
The correct transfusion for this baby is 20ml/kg of whole blood, **group O negative.** This is the only which is compatible with the baby.

Check your understanding

J) True or False? A baby at 3 months can have a normal hemoglobin of 8.2g/dl.

K) True or False? A preterm baby at 40 days old can have a normal hemoglobin of 7.5g/dl.

L) True or False? A 4 year old with no medical history and a Hb of 4.0g/dl will require transfusion.

M) True or False? A 6 days old term baby with a hemoglobin of 9.8g/dl will require transfusion.

N) A 6 years old, 5,7kg child in ITFC has a Hb of 7.8 an LRTI and requires oxygen, the mother knows that she is Rhesus negative. The child is group O positive. What is the correct action?

1. No transfusion
2. 57ml of whole blood, group O Positive
3. 114ml of whole blood, group O Negative

O) A 3.5 baby present with jaundice at 24 hours. Blood results are below. What is the correct transfusion?

Baby: Hb 6.8 Bili 21.4

Group B Positive

Mother:

Group AB Negative

1. 70mL of whole blood, group B Positive
2. 52.5mL of whole blood, group O Negative
3. 70mL of whole blood, group B Negative

Risks of blood transfusion

Every time we prescribe a blood transfusion, there is a risk that it will cause harm to the patient. There are many types of risk and reaction which can occur.

Immediate immune reactions (first 24 hours)

Allergic reactions

About 2% of all blood transfusions are complicated by mild immune reactions, however serious reactions can occur. Routine prescription of antihistamines or steroid do **not** prevent serious reactions, and these medications should not be given routinely to patients unless they have previously had transfusion reactions (e.g. thalassemia patients having monthly transfusions).

Children with mild allergic reactions will develop urticarial, often with itching, and no other symptoms.

Mild Allergic Reactions (urticarial and itching only)

1. Temporarily stop the transfusion
2. Administer an antihistamine (chlorphenamine orally)
3. Observe the patient for other symptoms for 30 minutes. Of no further symptoms develop, re-start the transfusion.

Anaphylaxis is a severe allergic reaction which affects multiple body systems. Urticarial and itching may be present, but there will always be other symptoms, respiratory (lower respiratory: wheeze; upper respiratory: stridor), but occasionally GI (nausea, abdominal pain), mucosal changes (angioedema, especially of the lips and face), or systemic effects (hypotension, reduced consciousness)

Anaphylaxis (life threatening)

1. **Stop the transfusion. Position patient lying flat with legs elevated.**
2. **Administer high-flow oxygen, attach pulse oxymeter.**
3. **Immediately administer adrenaline – small children 150 Micrograms IM injection, large children 500micrograms IM injection. Repeat every 5 minutes until the patient shows improvement.**
4. **Check blood pressure. Administer an IV Fluid bolus 20ml/kg of normal saline or Ringer lactate.**
5. **If wheeze is present, give nebulized salbutamol (nebulized in oxygen only)**
6. **If stridor is present, give nebulized adrenaline (nebulized in oxygen only)**
7. **Notify [ICU that patient will require transfer**

Non hemolytic febrile transfusion reaction

NHFTR is common is patients who have dad multiple transfusions. Within 4 hours of the start of the transfusion the patient develops a fever >38degresss. Remember that many children having blood transfusions also have febrile illnesses (like pneumonia), so the fever may not be due to blood transfusion at all. The safest thing to do is observe.

Non hemolytic Febrile Transfusion Reaction

1. Temporarily stop the transfusion
2. Administer paracetamol (15mg/kg orally or PR) for patient comfort.
3. Observe the patient for other symptoms for 30 minutes. If no further symptoms develop, re- start the transfusion.

Acute hemolytic transfusion retraction (acute intravascular hemolysis)

AHTR is a severe and potentially life-threatening transfusion reaction caused by a reaction between the patient's antibodies and the donor's red cells. Most reactions are caused by **ABO** incompatibility resulting from human error (**transfusing the wrong blood**)

Within several minutes of starting the transfusion, the patient may be anxious, agitated, and may complain of pain at the IV site, or sometimes chest pain.

The patent will develop fever, chills, tachycardia, and hemoglobimuria (**late sign**) and active bleeding due to DIC (**very late sign**). The patient will often have acute renal failure.

Acute hemolytic Transfusion Reaction

1. Stop the transfusion. Do not discard the blood bag.
2. Assess **ABCD,** check the blood pressure,. Most patients will need a fluid bolus of 20mL/kg of normal saline or Ringer Lactate for hypotension.
3. Notify **PICU** that patient will require transfer.
4. Re-check the patient's blood group and the donor's blood group (**bedside card**) to check for **ABO** incompatibility
5. Take an **EDTA** blood tube (**purple Tube**) to re-check the patient's blood group in the lab. Notify the lab supervisor that there is a potential Acute Hemolytic Transfusion Reaction.
6. Insert a Foley catheter. Start maintenance **IV** fluids and titrate to urine output (aim 1mL/kg/hr)
7. Renal failure is common – consult with a senior pediatrician early.

Septic Transfusion Reaction

This is a rare transfusion reaction, but a potentially life- threatening one. It is caused by bacteria or endotoxin in the donated blood. It creates a direct blood stream infection (**bacteremia**) or **toxemia,**

Within 4 hours of transfusion the patient develops a high fever (>39 digress) or hypothermia (<35 degrees), rigors, tachycardia and hypotension. The clinical picture is of septic shock with impaired perfusion and multiorgan dysfunction.

Any gram positive or gram negative organism can be implicated, but the most serious ractions will be with gram negative organisms. A particular organism which can multiply at low temperatures using iron as a nutrient is *Yersinia enterocolitica*

Septic Transfusion Reaction

1. Stop the transfusion. Do not discard the bag.

2. Immediately administer broad – spectrum antibodies **ceftriaxone** in neonates), AND **CIPROFLOZACIN** 150mg/kg IV if suspected toxin
3. Assess ABCD, check the blood pressure. Most patients will need a normal saline or Ringer Lactate for hypotension.
4. Notify PICU that patient will require transfer.
5. May need an adrenaline infusion in PICU, consult senior pediatrici
6. Notify the lab supervisor that there has been a transfusion reactio perform a gram stain on the donor's blood.

Delayed immune reactions

Extrascular hemolysis

This occurs when donated red cell are trapped and hemolysis in the patient's spleen. The hemolysis is due to other (non ABO or RhD) antibodies, such as kell, Duffy or Kidd.

Alternatively, it can occur when high levels of anti-A or anti-B antibodies are transfused from group O donor and attack the patient's red cells.

The hemolysis occurs usually between 5-10 days after the transfusion. Treatment is supportive.

Graft-versus host disease (GVHD)

GVHD can occur in newborns and in immunocompromised patients. It occurs whole blood is transfused, including white cells. Usually, the patient's tissues recognize the donor's shite blood cells as non self and destroy them. Sometimes neonates and children with impaired immune systems cannot perform this function, and the reverse happens – the donor's T – Lymphocytes recognize the patient's tissues as non-self, and cause a severe, fatal immune reaction. The risk can be minimized by transfusing blood which is not a close genetic match (not from the mother or father), and preferably from a non-relative.

Check your understanding

P) A 5 year old boy is having a transfusion male medical ward. He is blood group A negative. He is prescribed 20mL/kg of whole blood, group A negative. you are called by the nurses because ten minutes after the start of the transfusion he has developed shortness of breath. When you see him he has a red rash, is dysponoeic and you hear a wheeze on auscultation. What is the diagnosis?

1. Graft versus host disease
2. Septic transfusion reaction
3. Anaphylaxis
4. Mild allergic reaction

Q) And what is the correct treatment?

1. No treatment, supportive management
2. Broad spectrum antibiotics, fluid bolus
3. Adrenaline, salbutamol, fluid bolus
4. Antihistamine, restart transfusion

R) A 5 year old boy is having a transfusion on male medical ward. He is blood group A negative. He is prescribed 20mL/kg of whole blood, group A negative. You are called by the nurses because 30 minutes after the start of the start of the transfusion he develops a fever of 38.1 degrees. He has no other symptoms.

You stop the transfusion, give him paracetamol and observe him 30 minutes. No other symptoms have developed. What do you do?

1. Restart the transfusion.
2. Administer antihistamine, restart the transfusion.
3. Administer antihistamine, hydrocortisone and furosemide, restart the transfusion.
4. Broad spectrum antibiotics, fluid bolus, transfer to PICU

Notes or Questions to Ask My Physician