BLOOD TRANSFUSION

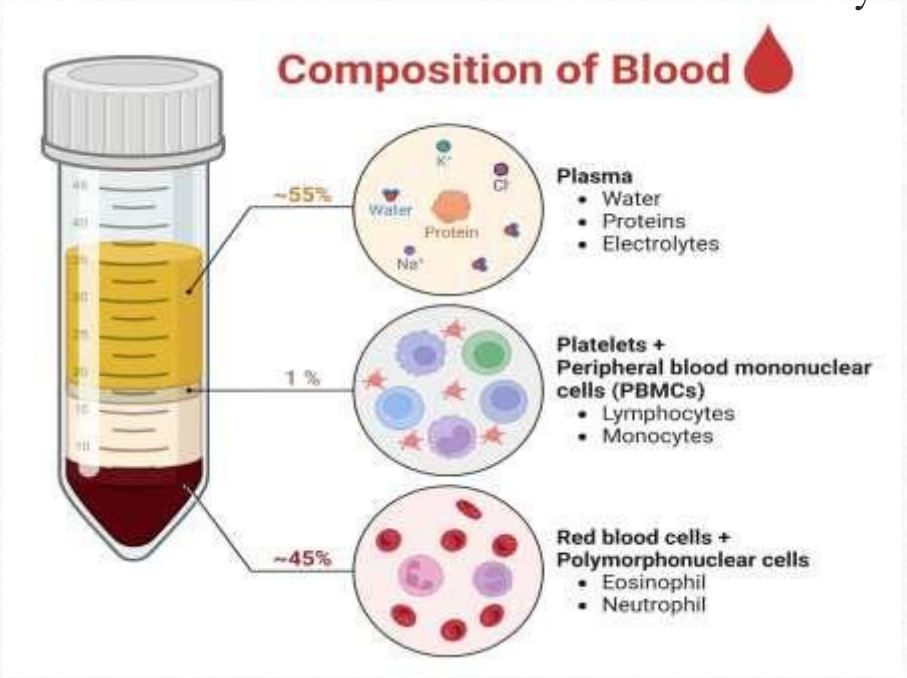
Rani Almherat
Toqa Alsalamat
Heba Amaira
Taqi alawneh
Hiba makkawi

Contents

1. Introduction to blood transfusion
2. Blood grouping Types of blood
3. transfusion Complications
4.

Introduction

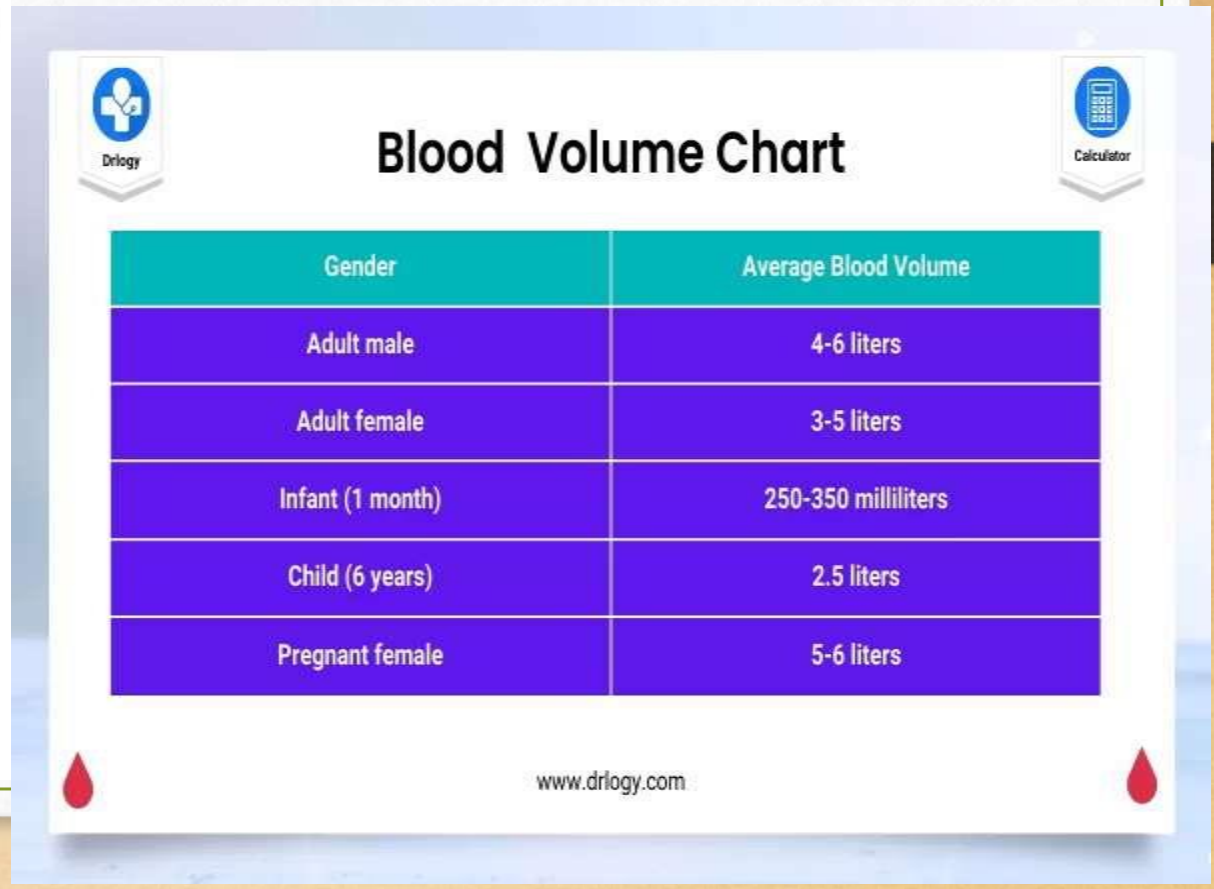
- Blood: fluid that transports oxygen and nutrients to the cells and carries away carbon dioxide and other waste products.
- Synthesis bone marrow
- Storgeand destruction liver and spleen



Introduction

A Simple Method To Estimate Circulating Blood Volume

AGE	ESTIMATED BLOOD VOLUME (ml/kg)
Preterm Neonate	100
Full-Term Infant	**90**
Infant	80
Child	75
Teenagers & Adults	70



Introduction

- Blood transfusion is the process of transferring blood or blood based products from one person into the circulatory system of another.
- Safe blood transfusion should be safe to both the donor and the recipient. Blood transfusions can be life saving in some situations such as
-
- -Massive blood loss due to trauma
  can be used to replace blood lost during surgery
- BT may also be used to treat a severe anaemia or
- Thrombocytopenia caused by a blood disease.
- People suffering from haemophiliaor sickle cell disease may require frequent transfusion.

Introduction

- Types of transfusion : Homologous transfusions :from an anonymous donor
- Autologous transfusion:for patients undergoingelectivesurgery to pre donate their own blood up to 3weeks before surgery for retransfusionduring the operation

Purpose of blood transfusion

- Restore blood volume
- Replace clotting factors
- Improve oxygen carrying capacity
- Restore blood elements that are depleted
- Raise the hemoglobin level To provide
- antibodiesBlood transfusion products

General instructions for giving blood transfusion

- Donor shall be free from disease
- No history of any disease They have not donated blood within the previous 90 days (3months)
- They should be physically healthy, and should be between18 and 65 years Donor must have normal temperature. pulse., and blood pressure
- They must not have been pregnant within the last 6 months
- Their hemoglobin level must be above 12 gram per 100 ml

Saftey

For safe blood transfusions to prevent immediate reaction the following steps must be taken.

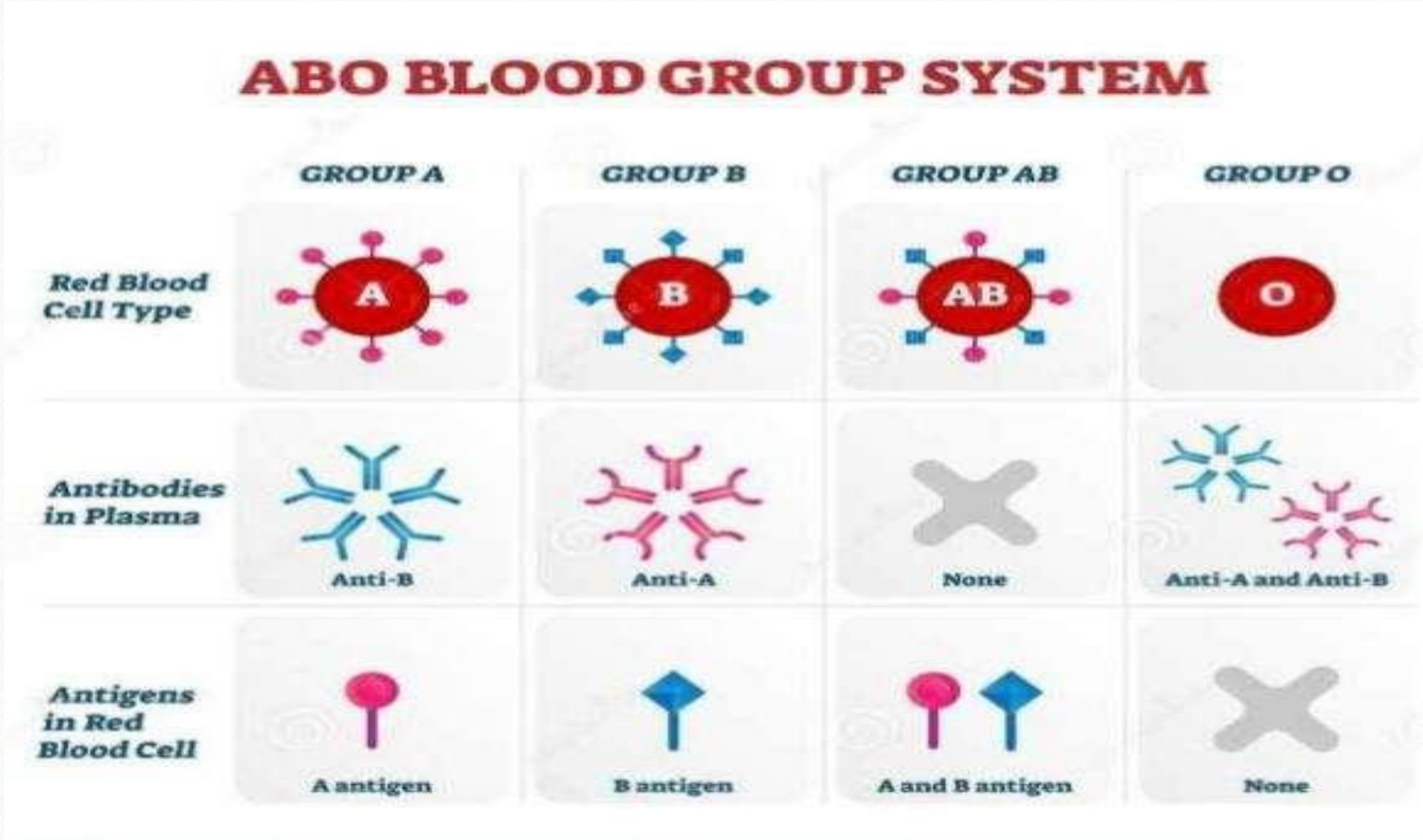
- Donor selection
- Recipient's blood group is identified in respect to bot ABO and Rh systems.
- Cross matching between the donor's cell and recipient serum and vice verse.
- Blood should be screened for HBsAg ,Malaria ,parasites, HCV, syphilis and HIV

Blood grouping system

The differences in human blood are due to the presence or absence of certain protein molecules called antigens and antibodies. Antigens are located on the surface of the RBCs and antibodies are

in the blood plasma.
The blood group that a person belongs to depends on what have they inherited from their parents.

ABO BLOOD GROUP SYSTEM



- individuals with group A can receive from A ,O and give blood to AB ,A.
- Individuals with group B can receive from B,O and give blood to AB,B.
- Individuals with group AB are called universal recipients by they can receive blood from (All) but not give except AB as they have no circulating antibodies.
- Individuals with group O are called universal donors but they receive only from(O)but give (All) as they have no agglutinogens on their RBC.

Rhesus Factor

Rhesus Factor (RH): Is a type of protein found on the surface of RBC.

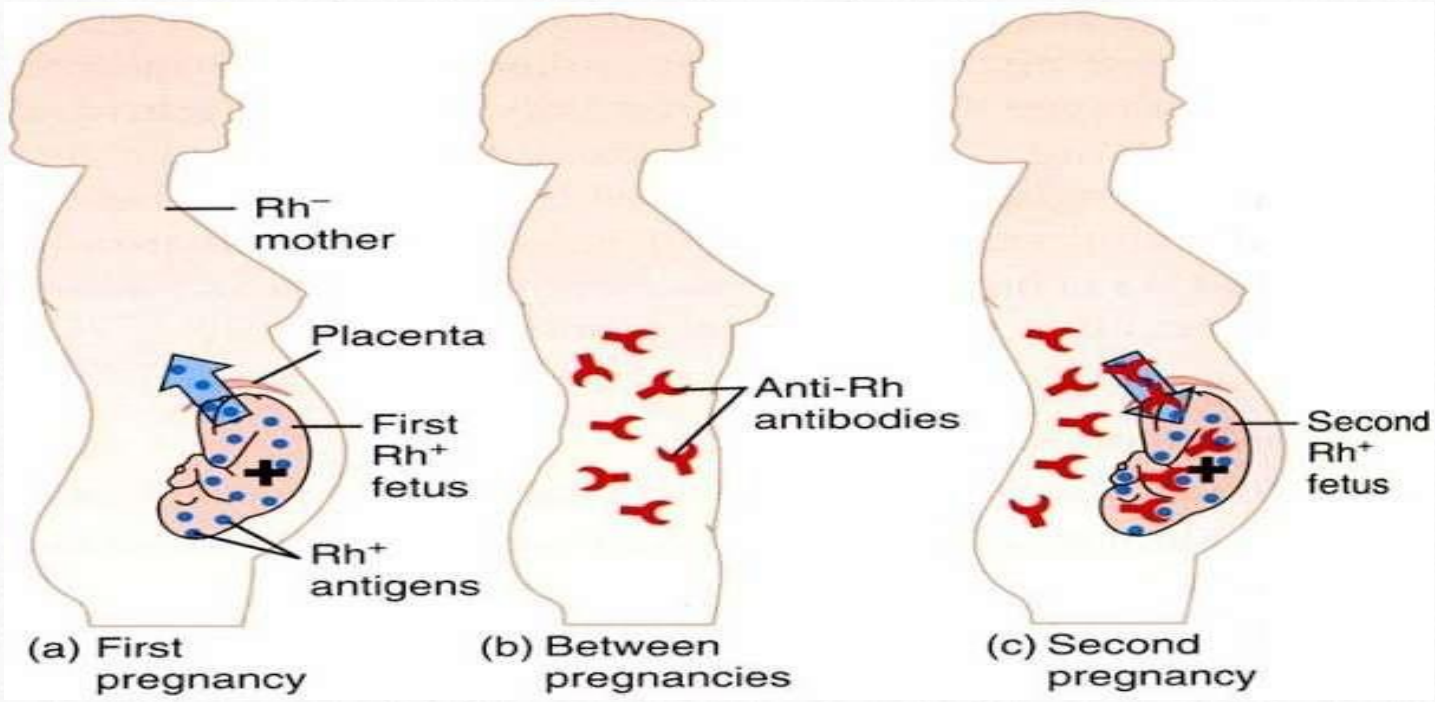
☆ The protein is genetically inherited (passed down from your parents).

❑If protein (D antigen) is present on the surface of RBC, the blood will be termed as D-positive(Majority of people ,about 85%)

❑ If protein (D antigen) is absent on the surface of RBC the blood is termed as DNegative.

Rh factor is very important , specially in pregnancy. RH Antibodies: No natural antibodies like ABO group system, they are produced when Rh negative individual is transfused with Rh positive blood. These are IgG type and crosses the placenta

Erythroblastosis fetalis

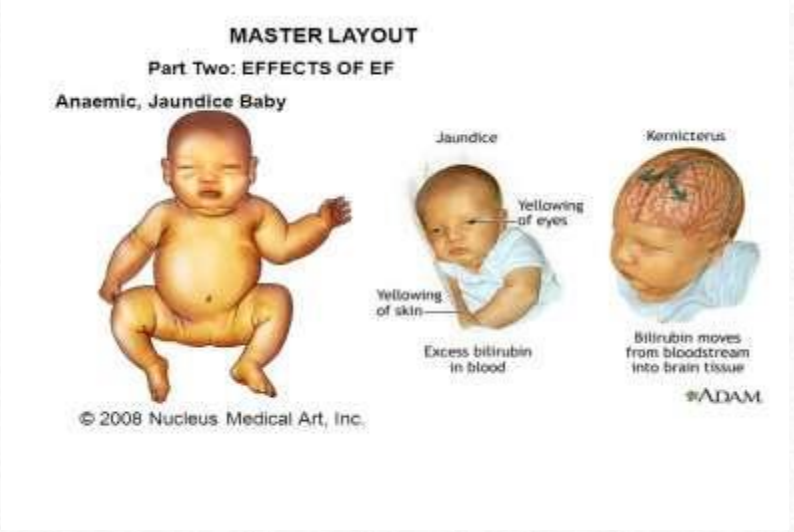


Erythroblastosis Fetalis

- Is a disease of the fetus and newborn child characterized by agglutination and phagocytosis of the fetus ‘s red blood cells.
- In most instances of the erythroblastosis fetalis ,the mother is Rh-ve and the father Rh+ve.
- The baby has inherited the Rh+ve antigen from the father,

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 the fetus and cause RBC agglutination and hemolysis.
- So in the subsequent pregnancies, the fetus is born anaemic , jaundiced (excessive formation of bilirubin which may cross the BBB of the fetus cause brain damage (kernicterus)or born dead .



Prevention and Treatment

Prevention of hemolytic disease of newborn:

Injecting single dose of RH-antibodies (anti –D) to mother soon after child birth.

So active antibodies will not be formed by mother.

Treatment of hemolytic disease of newborn:

Replacement of baby's Rh+ve blood by Rh-ve blood this is called exchange transfusion

Blood Group	Gives to these groups	Receives from these groups
O^-	All	O- only
O^+	AB+, A+, B+, O+	O- and O+
A^-	AB-, AB+, A+, A-	O- and A-
A^+	AB+ and A+	O-, O+, A-, A+
B^-	B-, B+, AB-, AB+	O- and B-
B^+	B+ and AB+	O-, O+, B-, B+
AB^-	AB- and AB+	O-, A-, B-, AB-
AB^+	AB+ only	All

Determination of blood group

Determination of blood group

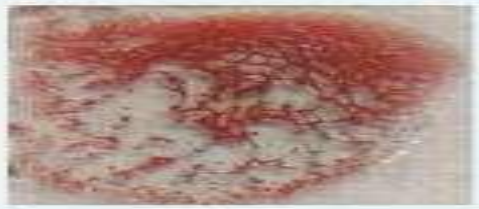
ABO Slide technique:

- A small sample of the patient's blood is mixed separately with anti-A and anti-B reagents.
- If agglutination (clumping) occurs in the anti-A sample, it indicates the presence of A antigens on the red blood cells.
- If agglutination occurs in the anti-B sample, it indicates the presence of B antigens.
- If both reactions occur, the blood type is AB.
- If neither reaction occurs, the blood type is O.

Determination of blood group RH

- A small sample of the patient's blood is mixed with anti- D reagent.
- If agglutination occurs, it indicates the presence of theRh antigen (Rh-positive). •If there is no agglutination, it indicates the absence of the Rh antigen (Rh-negative).

Determination of blood group

Anti-A	Anti-B	Blood group
		*Agglutination in anti-A* Blood group: A
		*Agglutination in anti-B* Blood group: B
		*No agglutination in both anti-A and anti-B* Blood group: O
		*Agglutination in both anti-A and anti-B* Blood group: AB

Types of blood transfusion:

Whole Blood	Packed red blood cells transfusion (PRBC)
Platelets Prothrombin	Fresh Frozen Plasma (FFP)
complex concentrates	Cr yoprecipitate

Whole Blood

- Rarely available. whole blood transfusion has significant advantages over packed cells as it is coagulation factor rich and, if fresh, more metabolically active than stored blood.

One unitof whole blood contain :

- 450 mlof donor blood
- 50 ml of anticoagulant-preservative solution
- Hbabout 12g/dl and haematocrit35-45% No
- functional platelets

Whole Blood

Indications: 1-Erythroblastosis fetalisby exchange transfusion OF WHOLE BLOOD

2-A person may receive a whole blood transfusion if they have experienced a sever traumatic haemorrhage with severe bleeding

Whole Blood

Precautions:

1)Blood is obtained from healthy donors:

-Age=18-50 y.

-Weight: more than 55 kg. -Blood pressure within normal range. -Hb%is not less than 90% (13g/dl).

-Haematocritvalue at least 40%.

-Free from infectious diseases as AIDS, viral hepatitis.

(2) Blood used is stored at 4°C not more than 21 days. (3) Blood groups are compatible by double cross matching test

(4) The blood is warmed before transfusion to restore the Na-K pump

Packed red blood cells transfusion (PRBC)

-Packed red blood cells are spun-down and concentrated packs of red blood cells.

-Each unit is approximately 330 mL and has a haematocritof 50–70 per cent.

-RBCs are stored in a Blood Bank refrigeratorata temp of 1-6°C until issue. -The shelf life is 42 days from the date of collection

Packed red blood cells transfusion (PRBC)

Indication:

1-A patient suffering from an iron deficiency anemiaor symptomatic anemia(causing shortness of breath ,dizziness , congestive heart frailer and decrease exercise tolerance),This type of transfusion increases a patient's haemoglobin and iron levels.

2-sickle cell crisis

3-acute blood loss more than 30% of blood volume

Fresh frozen plasma (FFP)

is rich in coagulation factors and is removed from fresh blood and stored at–40 to –50°C with a two-year shelf life. It is the first-line therapy in the treatment of coagulopathic haemorrhage

made from the liquid portion of whole blood.it is used to treat conditions in which there are low blood clotting factor (INR>1.5) or low level of other blood proteins.

Fresh frozen plasma (FFP)

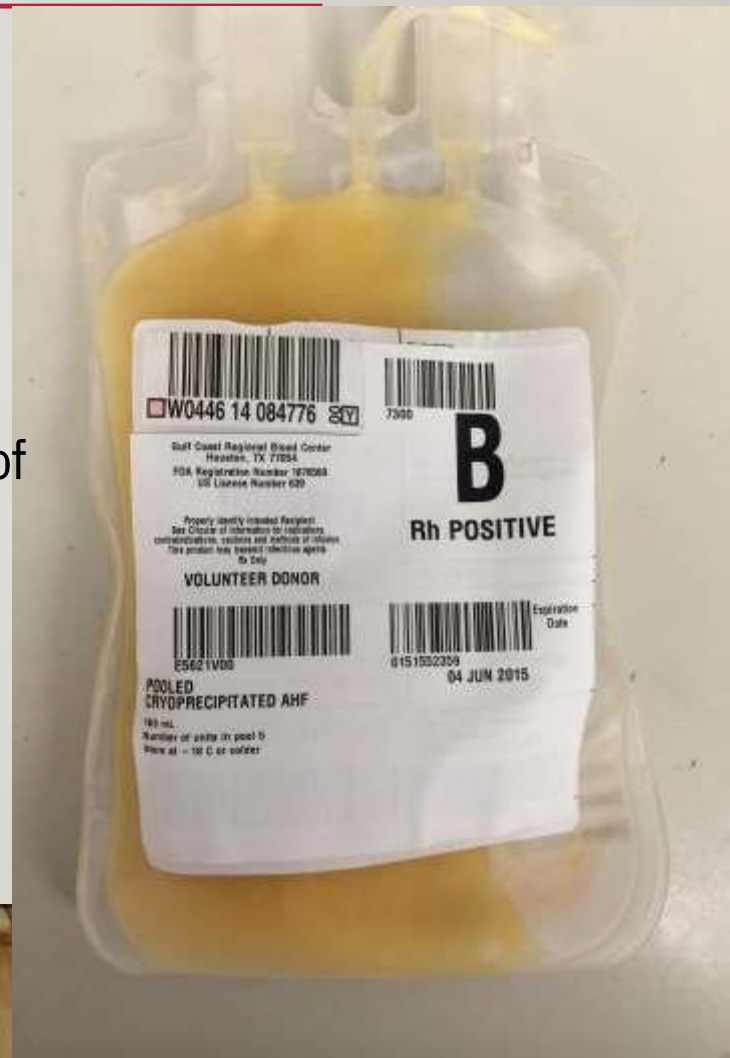
Indications:

- Non-life-threatening warfarin-induced bleeding
- Vitamin K deficiency DIC
- in patient with liver disease ,major hepatic resection
- and sever liver injuries
- TTP

TYPES OF BLOOD TRANSFUSION

CRYOPRECIPITATE

- Cryoprecipitate is supernatant precipitate of fresh frozen plasma and is rich in factor VIlland fibrinogen.
- It is stored at 30 degrees centigrade with a 2: years shelf life.
- Indicated in low fibrinogen states (<1g/L) or in cases of factor VIII deficiency (hemophilia-a), von will brand's disease and as a source of fibrinogen in disseminated intravascular coagulation.
- Pooled units containing 3-6 gmsfibrinogen in 200-500 ml raises the fibrinogen level by approx. 1g/L.
- Must be iinfused within 6 hours.



PLATELETS

- Made either from centrifugation of whole blood (random donor platelets [RDP]) or from an individual donor using apheresis (single donor platelets [SDP]).
- Platelets are currently concentrated in plasma. Stored at 20-24C so they carry a
- greater risk of bacterial contamination
- Normal human platelet counts range from 150,000 to 450,000 cells/μL. Platelet transfusion is mainly indicated to treat or prevent bleeding in patients with thrombocytopenia or platelet function disorder

THE TREATMENT IS INDICATED IN THE FOLLOWING BLEEDING CASES:

- Less than 30,000 cells/µL when bleeding is not life-threatening or considered
- severe Less than 50,000 cells/µL with severe bleeding, including disseminated intravascular coagulation
- Less than 100,000 cells/µLforbleeding in the context of multiple traumaor intracranial bleeding
- Platelets transfusion also used in: Chemotherapy and Radiation Therapy platelets dysfunction

PROTHROMBIN COMPLEXCONCENTRATES

- Prothrombin complex concentrate (PCC) comes from the process of ion-exchange chromatography from the cryoprecipitate supernatant of large plasma pools
- contain factors II, IX and X, and may also contain factor VII (vitamin K-dependent clotting factors).
-
- The initial development of this agent was for hemophilia; however, with the availability of recombinant replacement factors, it no longer has a use in this setting. It is now usedas replacement therapy forcongenital or acquired vitamin-K deficiency warfarin-induced anticoagulant effect, particularly in the emergent setting.

COMPLICATIONSOF BLOOD TRANSFUSION

- 1) Haemolytictransfusion reaction 2) Febrile non-
- hemolyticreaction
- 3) allergic reaction; type 1 hypersensitivity reaction
- 4) INFECTION 5) Transfusion-related acute lung
- injury 6) Transfusion-associated circulatory
- overload

HAEMOLYTICTRANSFUSION REACTION

- Type 2 hypersensitivity reaction RBCs (received from the donor) are
- agglutinated in clumps and block small
- blood vessels→ ischaemicpain in chest and back
- The immune destruction of red cells, is typically the result of the exposure of
- transfused red cells to incompatible recipient plasma Symptoms:
- fever,chills, flank pain , jaundice , hemoglobinuria, pain at
- transfusion site, and Shortness of Breath and Chest Pain

If the amount of the blood is less than 350 ml, death doesn't occur.

- Occurs in 1 hour.

TREATMENT :

- HTRs can vary in severity, from mild to severe, and it is crucial to identify and treat them promptly, as they can be life-threatening. The first step is always to stop the transfusion. If clinical suspicion is high or symptoms are severe, such as hypotension, respiratory difficulty, or airway closing, immediate resuscitation and emergency treatment are warranted. Corticosteroids, antihistamines, and epinephrine in the case of airway compromise are usually administered.The patient should be aggressively hydrated unless

  volume overload is suspected to reduce the complications of free hemoglobinin the

  bloodstream, such as acute kidney injury or disseminated intravascular coagulation.

  Exchange transfusionis used as a treatment of last resort.[

FEBRILE NON-HEMOLYTIC REACTION

- Type 2 hypersensitivity reaction A febrile transfusion reaction (FTR)
- is a common but usually benign adverse event during blood
- transfusions. It manifests as a sudden rise in body temperature,
- often
- accompanied by chills, due to the recipient's immune system
- reacting to white blood cell antigens in the transfused blood.
- High-risk individuals include those with previous transfusions,
- pregnancies, or HLA mismatches.

- Occurs in 1-6 hour after transfusion

PREVENTION

- can be prevented or reduced by using leukoreductionfilters during
- blood preparation, which remove white blood cells
- In Patients who experience repeated, severe febrile reactions

TRETMENT:

- 1) an FTR occurs, the transfusion is temporarily paused, feverreducingmedications may be given, and the transfusion can be resumed cautiously if necessary, with close
- monitoring to ensure
- the patient's safety 2) Antipyretics usually provide
- effective symptomatic relief

Allergic Reactions

Type1 hypersensitivity, When The immune system reacts to **proteins** in the donor blood.
Shown as Itching, hives, rash, and occasionally difficult breathing, swelling, and anaphylaxis.

Management: Mostly by antihistamines. Anaphylaxis requires immediate intervention with epinephrine, steroids, and airway management.

Iron Overload (Hemochromatosis)

when repeated transfusions In (e.g., thalassemia or sickle cell anemia patients) ; the body cannot excrete excess iron efficiently so accomulate in body.

Fatigue, joint pain, liver and heart damage, and in some cases, **diabetes**.

Management: Chelation therapy

Transfusion-Related Acute Lung Injury (TRALI)

A severe immune reaction where **antibodies** in the donor blood attack the recipient's lungs.

Sudden difficult breathing, low blood pressure, fever, and rapid onset of pulmonary edema, usually **within 6 hours** of transfusion.

Immediate cessation of the transfusion and supportive respiratory care, also oxygen or mechanical ventilation in severe cases.

TRALI is a leading cause of transfusion-related death, but is rare

Graft-Versus-Host Disease (GVHD)

Occurs when transfused **white blood** cells (lymphocytes) attack the recipient's tissues. This is more common in **immunocompromised** patients.

Fever, skin rash, diarrhea, and **liver dysfunction**. In severe cases,can be fatal.

Management: irradiating blood products to destroy donor lymphocytes before transfusion.

Infection

Blood components may be contaminated by:

1- bacteria from the donor’s skin during the collection procedure.

2- unrecognised bacteraemia in the donor.

3- contamination from the environment contamination during the preparation of components.

4-contamination of ports during the thawing of frozen products in a water bath

Infection

Could be pacterial(**Staphylococcus epidermidis, aureus and Yersinia enterocolitica**), parasitic (**malaria**)or viral (**HIV, hepatitis B, C**)infection.

avoid by **screening and testing blood and leukoreduction**

Complications of massive transfusion

Hypocalcemia

Citrate(anticoagulant for blood storage), can bind to calcium in the recipient's blood, causing calcium levels to drop

Muscle spasms, numbness, tingling, or, in severe cases, heart arrhythmias and seizures.

Managed by :Calcium supplements may be given IV & slowly in large-volume transfusions.

Hyperkalemia

Stored red blood cells can **leak potassium** over time, especially in older blood units, causing high potassium levels in the recipient's blood.
Weakness, fatigue, irregular heartbeats, and, in severe cases, **cardiac arrest.**

Treatment with potassium-lowering agents wash RBC ,use fresh blood and monitoring of electrolytes, especially in patients receiving large volumes of blood

Hypothermia

Blood products are usually stored at low temperatures, and rapid transfusion both play role in hypothermia

Post-Transfusion Purpura (PTP)

An immune response of **antibodies against** transfused **platelets**, leading to their destruction.?
Severe thrombocytopenia (low platelet count), bruising, and bleeding, usually occurring **5-12** days after the transfusion.
Treatment with intravenous immunoglobulins (IVIG) and careful monitoring. rare but can be serious

ThanQ