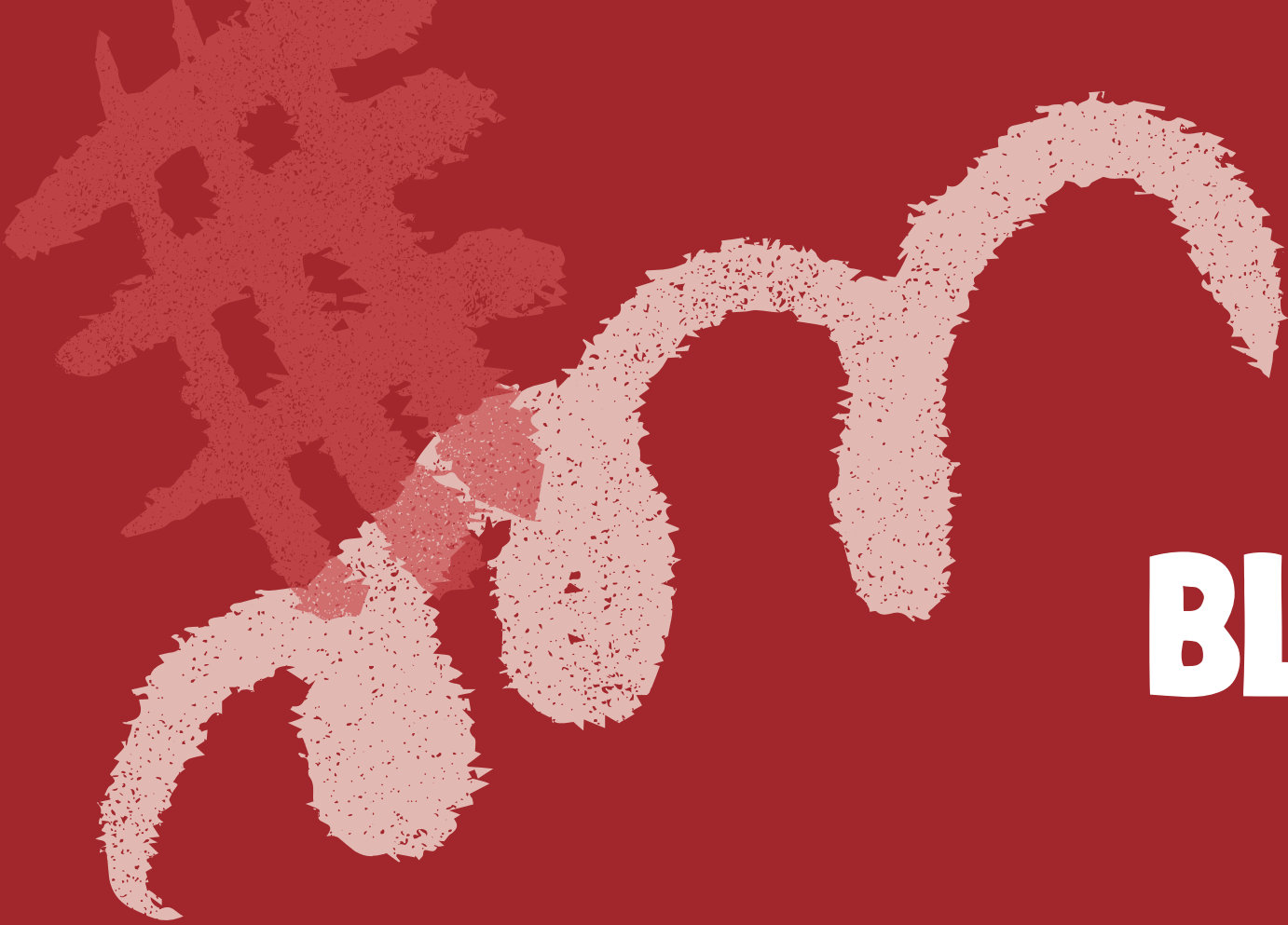
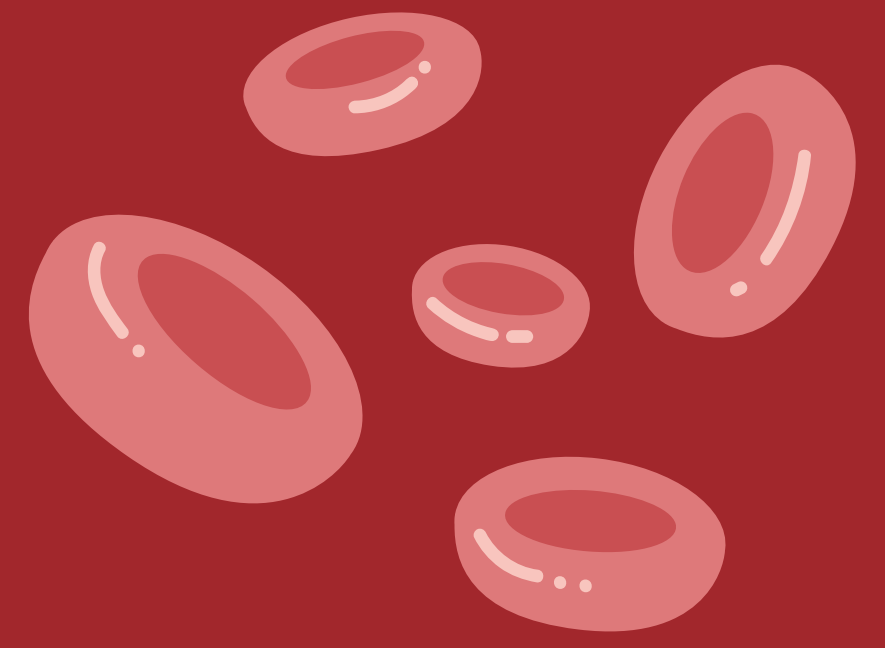




BLOOD PRODUCTS AND BLOOD TRANSFUSION



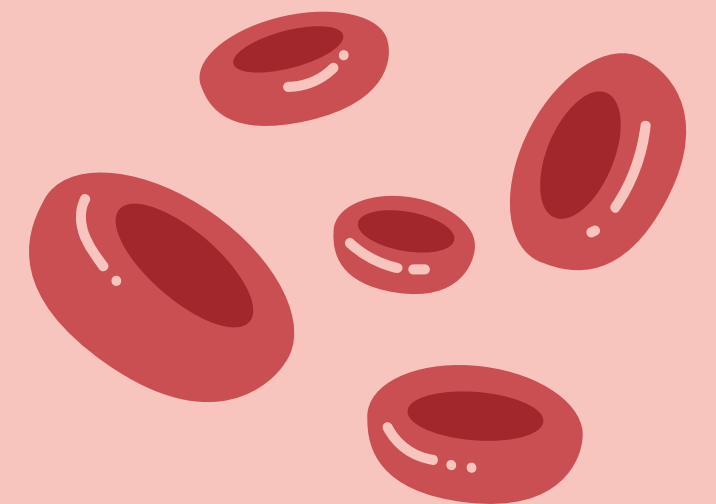
**Done by : Qussai Qasim, Layan Suleiman , Romessia Abu Mahfouz , Jumana Mansour,
Thikrayat Mohammad, Amer Mahmoud**



BLOOD PRODUCTS

A blood product: is any component of the blood which is collected from a donor who have been previously screened before donating, to exclude any donor whose blood may have the potential to harm the patient or to prevent possible harm that donating a unit of blood may have on the donor.

**Each unit is tested for evidence of hepatitis B, hepatitis C,
HIV-1, HIV-2 and syphilis**



Blood products

- Whole blood
- Packed red cells
- Platelets
- Fresh-frozen plasma
- Cryoprecipitate
- Plasma products



Whole blood

1

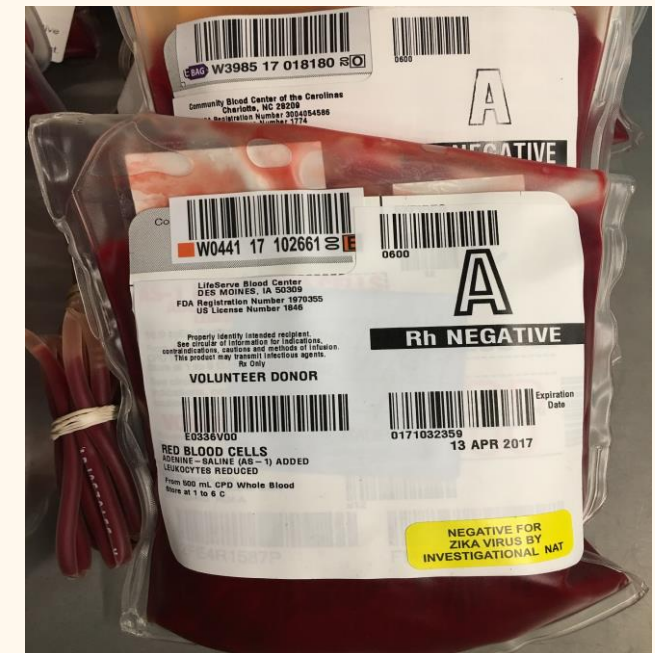
Blood obtained from a donor for transfusion from which none of the elements has been removed.

2

whole blood transfusion has significant advantages over packed cells as it is rich in coagulation factor.

3

It is limited to acutely hemorrhagic individuals and dosing should be based on the patient's clinical condition, estimated blood loss and other measures being used to maintain hemodynamic stability



Packed red cells

1

Packed red blood cells are spun-down and concentrated packs of red blood cells. Packed cells are stored in a SAG-M solution (saline–adenine–glucose–mannitol) to increase shelf life to 5 weeks at 2–6°C



2

Ordinarily, it is the component of choice to increase Hb, a unit of RBCs increases an average adult's Hb by about 1 g/dL.

3

Its indicated when an Insufficient Tissue Oxygen Delivery Due to Active Bleeding / Symptomatic Anemia.

4

Must be ABO compatible

Fresh-frozen plasma

1

Fresh-frozen plasma (FFP) is rich in coagulation factors and is removed from fresh blood by centrifugation and stored at -40 to -50°C with a two-year shelf life.



2

It is the first-line therapy in the treatment of coagulopathic haemorrhage.

3

Must be ABO compatible

4

However, Rhesus D-positive FFP may be given to a rhesus D-negative woman although it is possible for seroconversion to occur with large volumes due to the presence of red cell fragments, and rhesus D immunization should be considered.

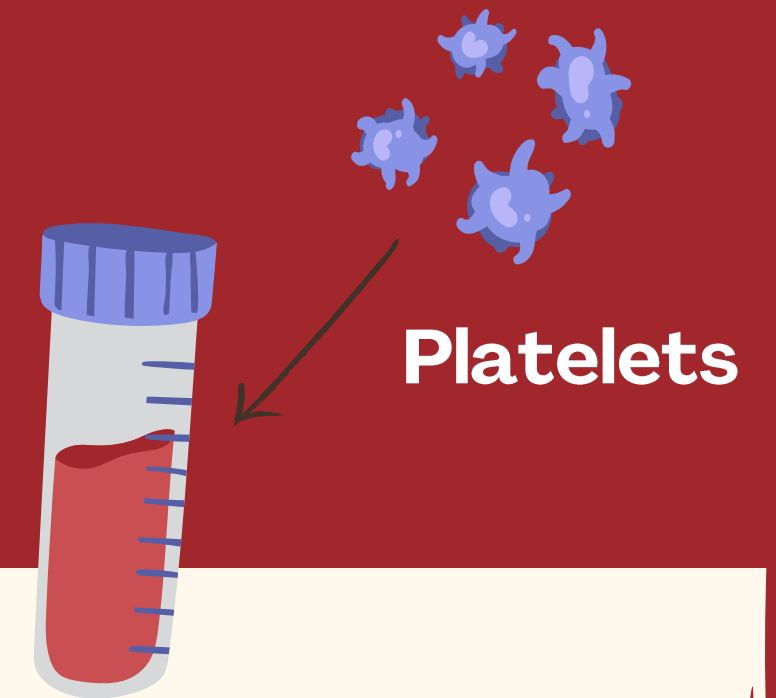
Cryoprecipitate

1

Cryoprecipitate is a supernatant precipitate of FFP and is rich in factor VIII and fibrinogen. It is stored at -30°C with a two- year shelf life. It is given in low fibrinogen states or factor VIII deficiency.



Platelets



1

Platelets are stored on a special agitator at 20–24°C and have a shelf life of only 5 days. Platelet transfusions are given to patients with thrombocytopenia or with platelet dysfunction who are bleeding or undergoing surgery.

2

Patients are increasingly presenting on antiplatelet therapy such as aspirin or clopidogrel for reduction of cardiovascular risk. Aspirin therapy rarely poses a problem but control of haemorrhage on the more potent platelet inhibitors can be extremely difficult. Patients on clopidogrel who are actively bleeding and undergoing major surgery may require almost continuous infusion of platelets during the course of the procedure

Prothrombin complex concentrates

1

Prothrombin complex concentrates (PCC) are highly purified concentrates prepared from pooled plasma.

2

They contain factors II, IX and X. Factor VII may be included or produced separately.

2

It is indicated for the emergency reversal of anticoagulant (warfarin) therapy in uncontrolled hemorrhage.

Autologous blood

1

It is possible for patients undergoing elective surgery to pre- donate their own blood up to 3 weeks before surgery for retrans- fusion during the operation.

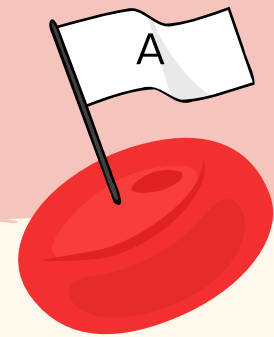
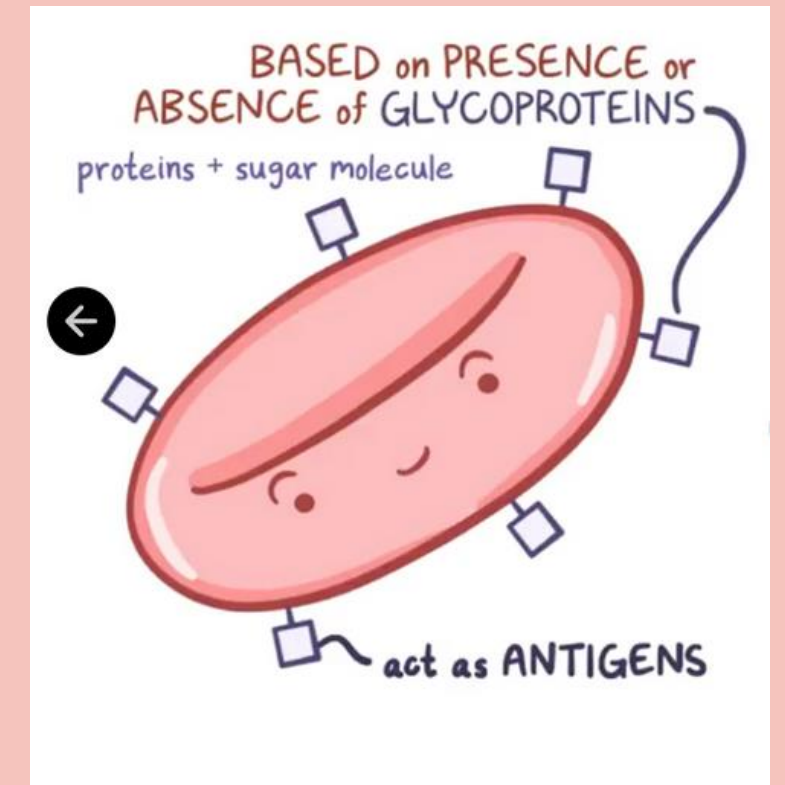
2

Similarly, during surgery blood can be collected in a cellsaver which washes and collects red blood cells which can then be returned to the patient.



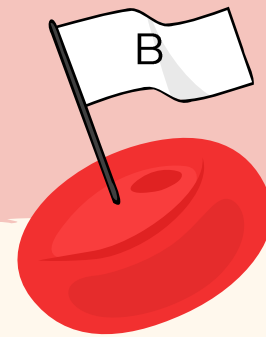
ABO

lets imagine that the antigen we have on our red blood cells as a flag



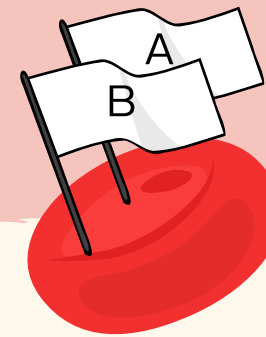
Type A

has an army against B
(anti -b antibodies)



Type B

has an army against A
(anti-a antibodies)



Type AB

doesn't have an army bc
there is no enemy



Type O

has an army against B &
A
(anti - a&b antibodies)



Blood group O is the universal donor type as it contains no antigens to provoke a reaction. Conversely, group AB individuals are 'universal recipients' and can receive any ABO blood type as they have no circulating antibodies.



AB

UNIVERSAL RECIPIENT

O

UNIVERSAL DONOR



ABO SYSTEM

These are strongly antigenic and are associated with naturally occurring antibodies in the serum. The system consists of three allelic genes – A, B and O which control synthesis of enzymes that add carbohydrate residues to cell surface glycoproteins. A and B genes add specific residues while O gene is an amorph and does not transform the glycoprotein. The system allows for six possible genotypes although there are only four phenotypes. Naturally occurring antibodies are found in the serum of those lacking the corresponding antigen (Table 2.7).



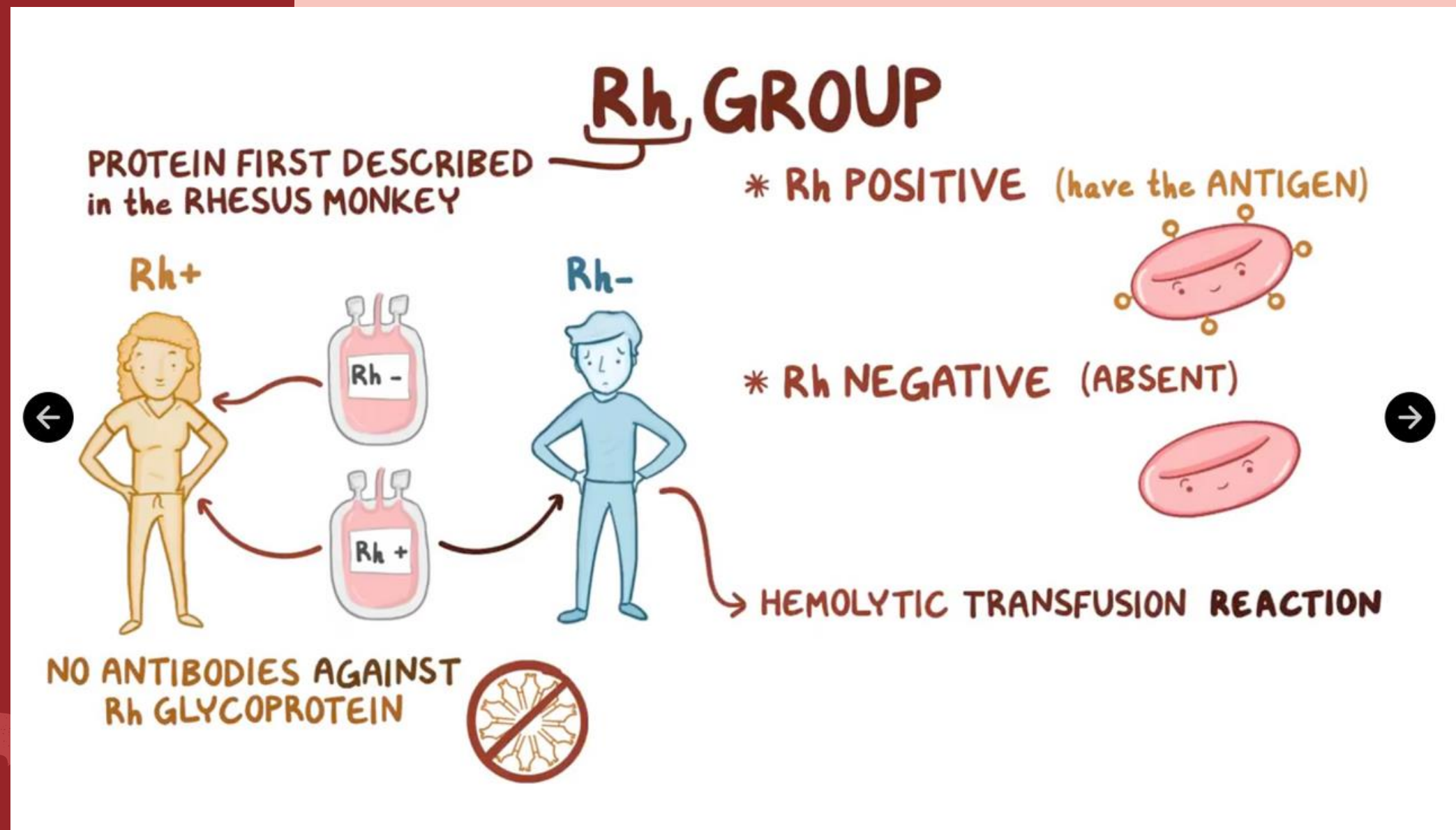
Table 2.7 ABO blood group system.

Phenotype	Genotype	Antigens	Antibodies	Frequency (%)
O	OO	O	Anti-A, anti-B	46
A	AA or AO	A	Anti-B	42
B	BB or BO	B	Anti-A	9
AB	AB	AB	None	3

RHESUS SYSTEM

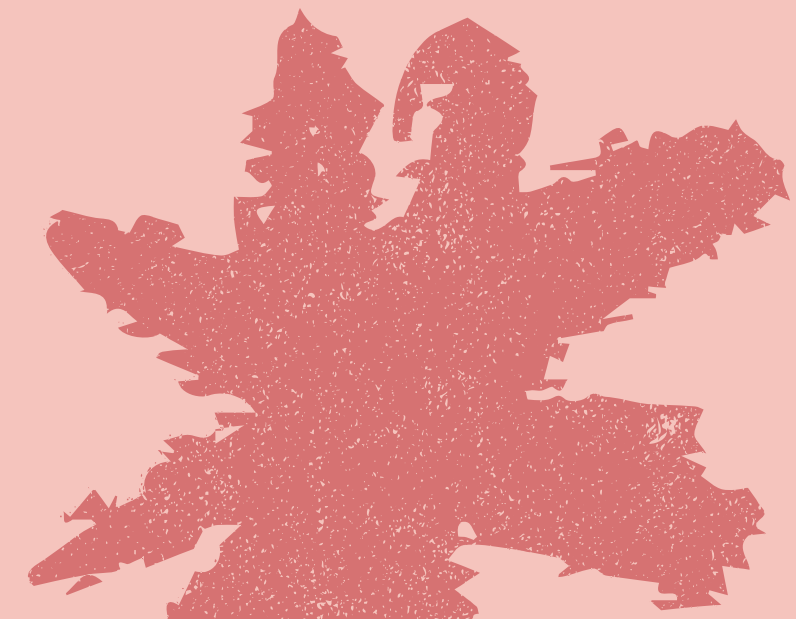
The rhesus D (Rh(D)) antigen is strongly antigenic and is present in approximately 85 per cent of the population in the UK.

Antibodies to the D antigen are not naturally present in the serum of the remaining 15 per cent of individuals, **but their formation may be stimulated by the transfusion of Rh-positive red cells, or acquired during delivery of a Rh(D)-positive baby.**





Acquired antibodies are capable, during pregnancy, of crossing the placenta and, if present in a Rh(D)-negative mother, may cause severe haemolytic anaemia and even death (hydrops fetalis) in a Rh(D)-positive fetus in utero.



CROSS-MATCHING

To prevent transfusion reactions, all transfusions are preceded by ABO and rhesus typing of both donor and recipient blood to ensure compatibility. The recipient's serum is then mixed with the donor's cells to confirm ABO compatibility and to test for rhesus and any other blood group antigen–antibody reaction.

Full cross-matching of blood may take up to 45 minutes in most laboratories. **In more urgent situations, 'type specific' blood is provided which is only ABO/rhesus matched and can be issued within 10–15 minutes. Where blood must be given emergently, group O (universal donor) blood is given (O– to females, O+ to males).**

CROSS MATCHING

↳ CONFIRMS the DONOR'S BLOOD is SAFE for RECIPIENT

RECIPIENT'S
SERUM

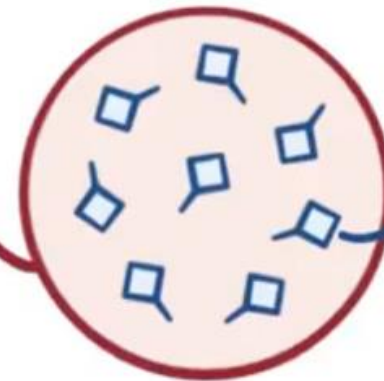


DONOR'S BLOOD

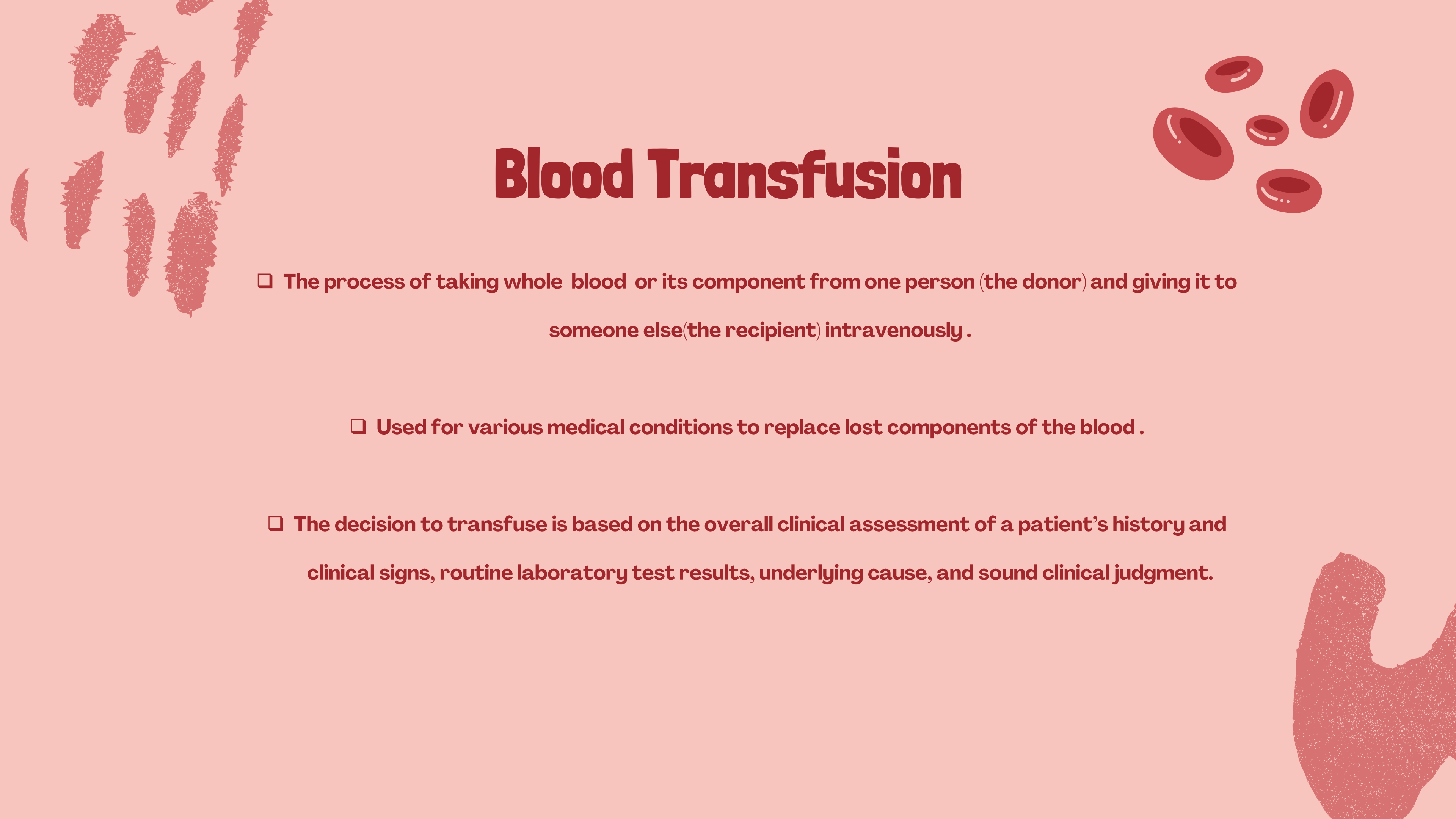


AGGLUTINATION REACTION

* RECIPIENT'S BLOOD contains
ANTIBODIES AGAINST DONOR'S RBCs
[CANNOT RECEIVE]



ADDITIONAL GLYCOPROTEINS
~ not IDENTIFIED in BLOOD TYPING



Blood Transfusion

- ❑ The process of taking whole blood or its component from one person (the donor) and giving it to someone else (the recipient) intravenously .
- ❑ Used for various medical conditions to replace lost components of the blood .
- ❑ The decision to transfuse is based on the overall clinical assessment of a patient's history and clinical signs, routine laboratory test results, underlying cause, and sound clinical judgment.

Transfusion triggers

Hemoglobin trigger :

It is used as clinical guideline when a transfusion is necessary to ensure adequate oxygen delivery to tissues.

NORMAL HB LEVEL :
FOR MEN : (13.5 to 17.5 g/dl)
FOR WOMEN : (12.0 to 15.5 g/dl)
FOR CHILDREN : vary with age and sex

Hb level (g/dl)	Indications
<6	Likely to be beneficial
6 to 8	Unlikely to be beneficial in absence of bleeding or surgery
>8	No indication in absence of risk factors

Concept of massive blood transfusion

In adults: defined as replacement of more than 1 blood volume in 24 hours OR >50% of blood volume in 3–4 hours. (adult blood volume is approximately 70 mL/kg) .

–the transfusion of 10 or more units of PRBCs within 24 hours OR

4 or more units of PRBCs within 1 hour.

- In children: defined as transfusion of >40 ml/kg. (blood volume in children over 1 month old is approximately 80 mL/kg).

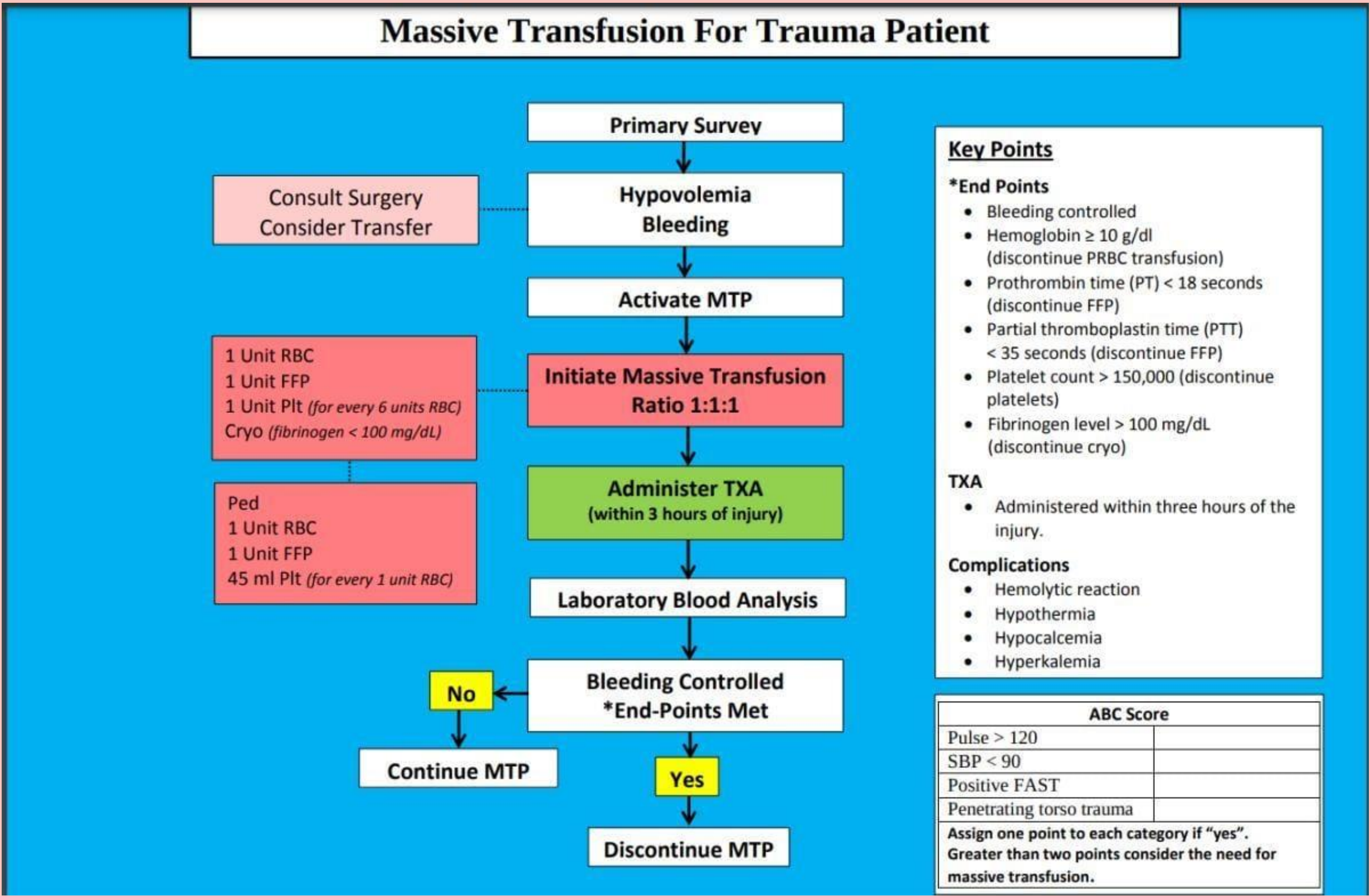
Cont...

Massive transfusion is usually required in cases of severe hemorrhage and life-threatening blood loss, such as:

1. *Trauma: Severe accidents with heavy bleeding.*
2. *Surgery: Complicated surgeries, especially cardiovascular or liver transplants.*
3. *Obstetric Emergencies: Postpartum hemorrhage.*
4. *Gastrointestinal Bleeding: Severe bleeding from ulcers or varices.*
5. *Ruptured Aneurysms or vascular injuries.*

MASSIVE TRANSFUSION PROTOCOL (MTP)

ACTIVATION FOR TRAUMA



Types of blood donation

Homologous Donation

(allogenic donation)

The donor and the recipient are distinct individuals.

- . The donated blood is typically collected from volunteer donors, screened for infectious diseases, and stored in blood banks for future use in medical treatments.

Autologous Donation

The donor and the recipient are the same person.

The individual donates their own blood for future use, typically in anticipation of a scheduled surgical procedure.

It include :

- ☐ Isovolemic hemodilution
- ☐ Intraoperative autotransfusion
- ☐ Erythropoietin

Pre transfusion procedures INCLUDE :

- ❑ Separated into blood component
- ❑ Tested for ABO and Rh groups
 - ❑ Tested for infections
 - ❑ Leukoreduction
- ❑ Pathogen reduction treatment

Cont....

Tested for infections

Each unit is tested for evidence of *hepatitis B, hepatitis C, human immunodeficiency virus (HIV)-1, HIV-2 and syphilis.*

Blood is collected from donors who have been previously screened to exclude any donor whose blood may have the potential to harm the patient or to prevent possible harm that donating a unit of blood may have on the donor.

Cont...

Leukoreduction

is the removal of white blood cells from blood products through filtration. This procedure aims to reduce the risks associated with the presence of these contaminating leukocytes, including:

1. Non-hemolytic febrile transfusion reactions
2. Human leukocyte antigen (HLA) alloimmunization
3. Transmission of leukotropic viruses: such as (CMV) and human T-lymphotropic virus (HTLV).

Cont....

Pathogen reduction treatment

is a reducing or inactivating potential pathogens, including bacteria, viruses, and parasites, that could be transmitted through transfusions.

Mirasol PRT is the most commonly used technology ,a device that uses riboflavin (vitamin B2), a naturally occurring, non-toxic compound, combined with ultraviolet light, to provide effective pathogen reduction and white cell inactivation.



Complications of Transfusion

- 1 infections
- 2 Transfusion associated circulatory overload (TACO)
- 3 Massive blood transfusion



Signs You've Had a Blood Transfusion Mistake



Unexplained
Symptoms



Elevated Heart Rate
or Blood Pressure



Jaundice or
Yellowing of the
Skin



Difficulty Breathing
or Oxygen Saturation
Issues



Changes in Urine
Color or Output



Skin Rash or Itching



MURPHY
FALCON MURPHY

1– Infections

Bacteria

Sepsis from platelet transfusions , particularly if stored at room temperature



1– Infections

Viral

Hepatitis b and c , HIV ,Zika virus

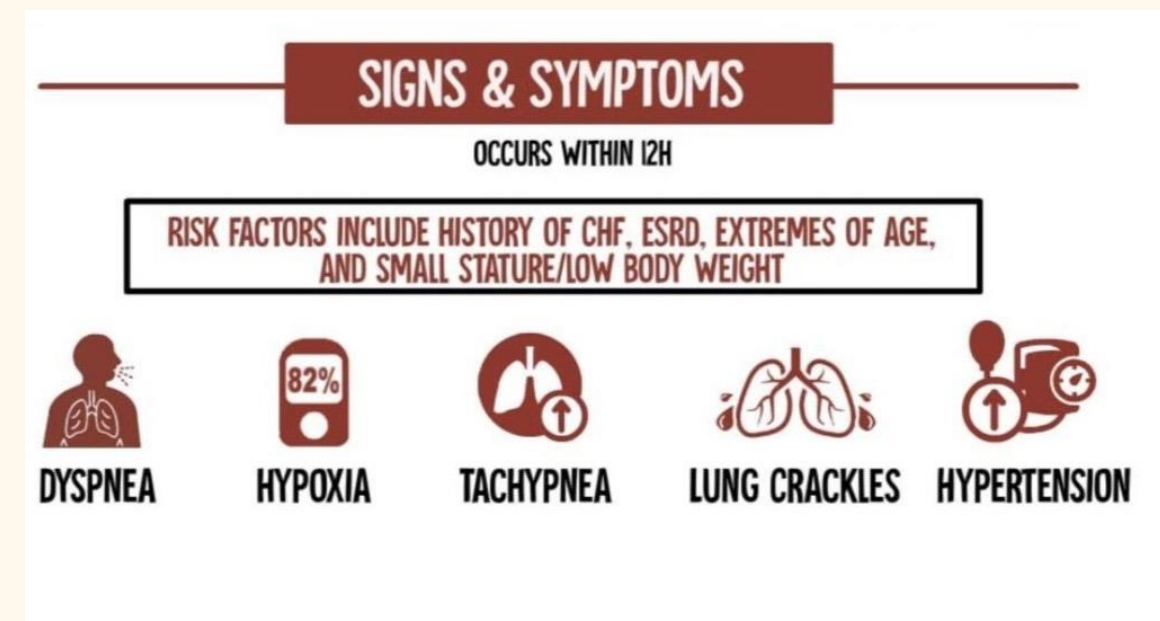
1- Infections

Parasite

Babesiosis : transmitted by ticks and can be present in asymptomatic donors

2– Transfusion–associated circulatory overload (TACO)

TACO is when the patient develops acute volume overload after administration of blood products



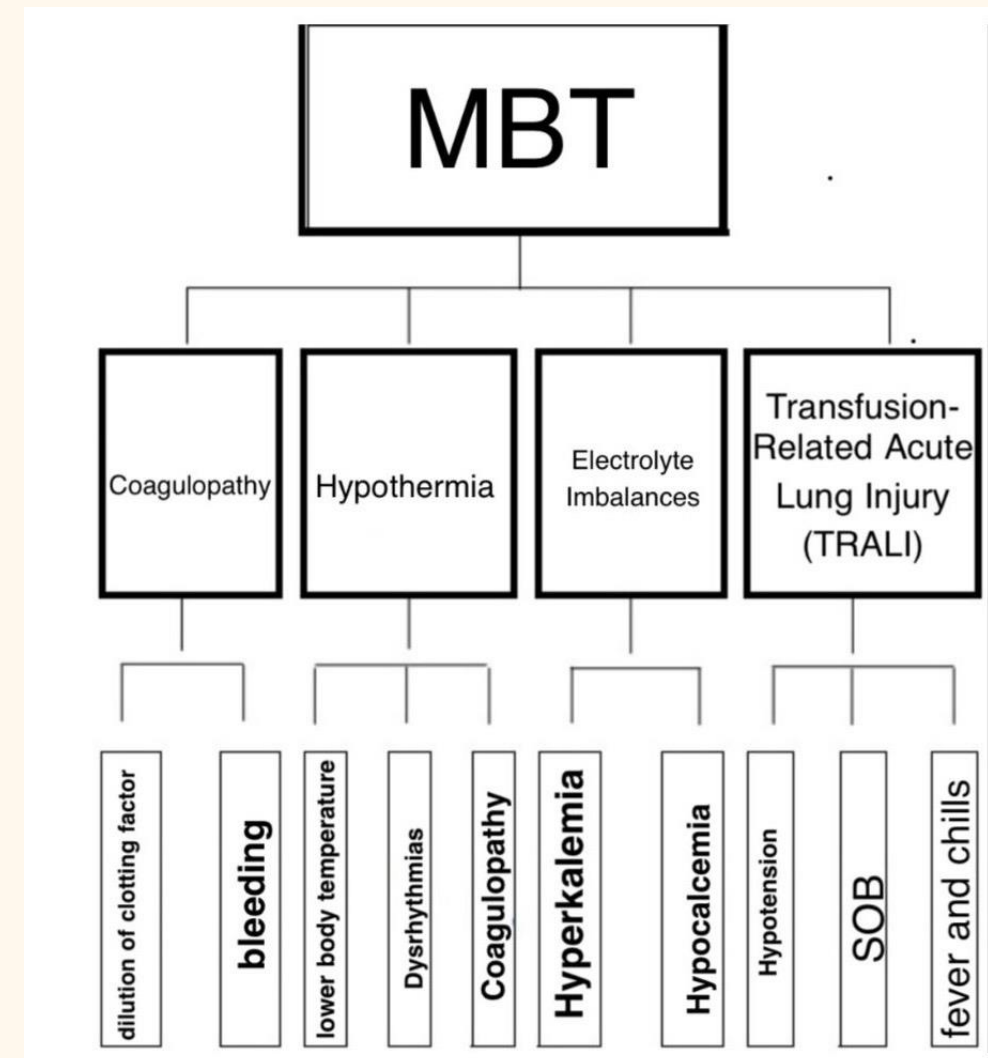


PULMONARY OEDEMA



3– massive blood transfusion

Defined as the rapid replacement of a large volume of blood , typically more than one blood volume (about 10 units of red blood cells)



BLOOD TRANSFUSION REACTIONS

 ***BLOOD
TRANSFUSION
REACTIONS***



1. ALLERGIC REACTION

The recipient's immune system reacts to(**the plasma proteins** found in donor blood) , leading to :

Rash , hives , itching and can progress to ANAPHYLAXIS

MANAGEMENT : treated with antihistamines .

Rarely , severe reactions may involve bronchospasm or laryngospasm , required steroids and subcutaneous epinephrine

2. FEBRILE NON-HEMOLYTIC REACTION (FNHTR)

The recipient's **WBCs** are reacting with the donor's **WBCs** .
Is one of the **most common** transfusion reactions .
Involve the development of **high fever during 24 h** of transfusion

Symptoms : chills , headache , fever , elevate HR , mild shortness of breath .

pt's with a previous history of febrile reaction should receive leuko-reduced blood product .

The name “ febrile non-hemolytic transfusion reaction “ **febrile refers to** the presence of **a fever** , which is a hallmark of this reaction , develop an elevated body temperature due to immune response .

MANAGEMENT : antipyretic
Stopping the blood transfusion .

3. HEMOLYTIC REACTION

The recipient's immune system is damaging and killing the donor's **RBCs** . The antibody in recipient's blood match the antigens on donor **RBCs** ,
during hours after transfusion if (acute hemolytic reaction) but if (delayed hemolytic reaction) occurs during days –weeks .

Can lead to : (**DIC**) disseminated intravascular coagulation , renal failure and maybe death .

Symptoms : fever , jaundice , chills , anxiety ,(back , chest , flank) pain , elevate HR , hypotension , falling hemoglobin levels , hemoglobinuria .

MANAGEMENT : stop transfusion , IV fluid , maintaining blood pressure and monitoring kidney functions .

TRANSFUSION REACTIONS:

(OCCURS IN THE FIRST 10-15 MIN)
OR FIRST 50% OF BLOOD



- FACIAL FLUSHING
- HIVES/ RASH

ALLERGIC



- FEVER
- CHILLS
- ANXIETY

- HEADACHE
- TACHYCARDIA
- TACHYPNEA

FEBRILE



- HEADACHE
- CHEST PAIN
- APPREHENSION
- LOW BACK PAIN

- CHILLS
- FEVER
- TACHYCARDIA

HEMOLYTIC

- ↓ BP
- ↑ RESP RATE

4. TRANSFUSION RELATED ACUTE LUNG INJURY (TRALI)

Donor's antibody reacting with recipient leukocytes , causing **pulmonary damage** .

Symptoms: acute respiratory distress , hypoxia , fever , hypotension.

Occurring within (1-2) h of blood transfusion but can occur anytime up to (6) hours .

MANAGEMENT : supportive care including oxygen therapy or mechanical ventilation if needed .

Most cases resolve on their own , but severe cases can be fatal .

5. GRAFT-VERSUS HOST DISEASE (GVHD)

Rarely but deadly !

Donor's **T lymphocytes** cause an immune response in the recipient **by attack the recipient's marrow and tissues** .

Happen during (days to weeks) after blood transfusion .
This occurs mainly in **immunocompromised** patients .

Symptoms : fever , rash all over the body (feet and hand too) , nausea , liver inflammation and diarrhea .

MANAGEMENT : Liver function test , treatment involve immunosuppressive therapy .
It has associated mortality of greater than 80 % .

BLOOD TRANSFUSION REACTION

Febrile Reaction:

- Chills • Fever • Headache
- Flushing • Tachycardia • ↑Anxiety

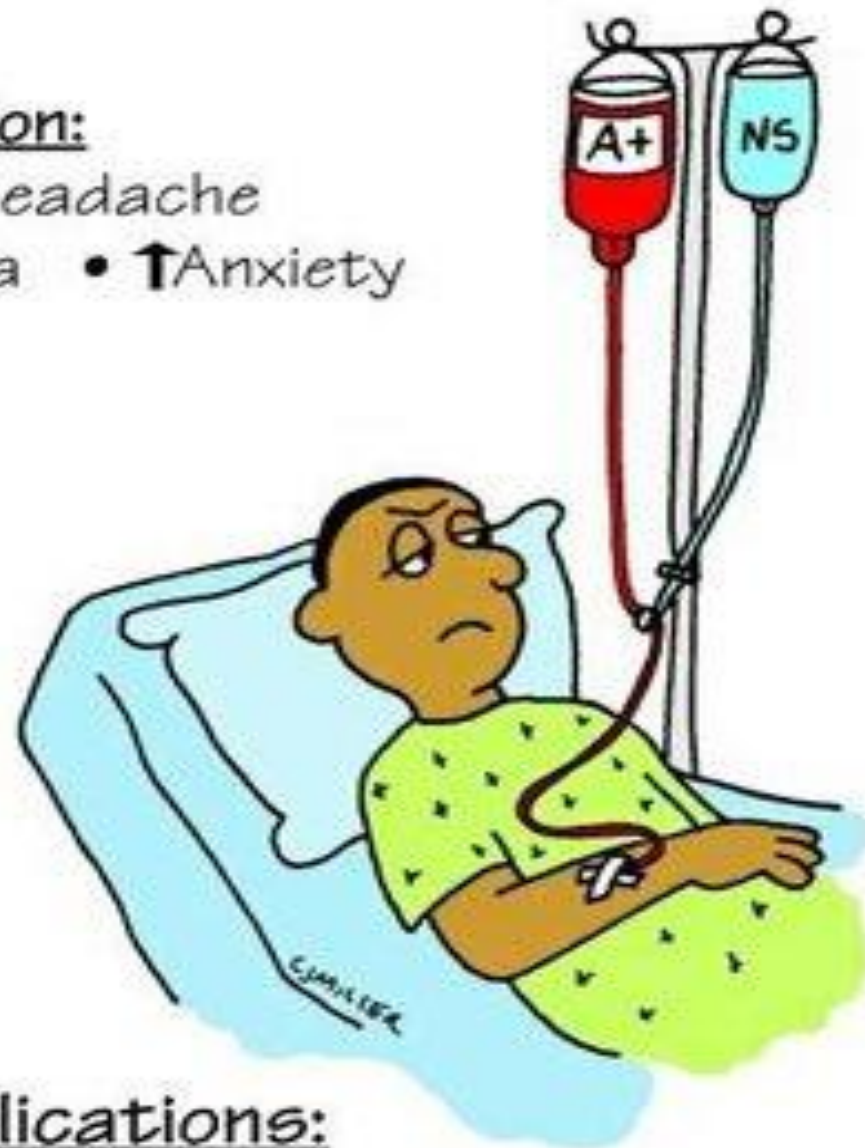
Allergic Reaction:

Mild:

- Hives • Pruritus
- Facial Flushing

Severe:

- Severe Shortness of Breath
- Bronchospasm
- Anxiety



Hemolytic Transfusion Reaction:

- Low Back Pain
- Hypotension
- Tachycardia
- Fever and Chills
- Chest Pain
- Tachypnea
- Hemoglobinuria
- May Have Immediate Onset

★ Nursing Implications:

- Stop Transfusion and notify Physician.
- Change IV Tubing.
- Treat symptoms if present → O₂, fluids, epinephrine as ordered.
- Recheck crossmatch record with unit.

HEMOLYTIC
REACTIONS

- Obtain 2 blood samples distal to infusion site.
- Obtain first UA-test for hemoglobinuria.
- Monitor fluid/electrolyte balance.
- Evaluate serum calcium levels.





Blood Transfusion Reactions



Within minutes

Anaphylactic Reaction

Why?
IgA-deficient patients make IgA antibodies that react with donor blood

Signs
Angioedema
Hypotension
Respiratory distress



Treatment
Fluids
Epinephrine
Vasopressors if needed



Allergic Reaction

Why?
Donor plasma interacts with recipient IgE, leads to mast cell activation and histamine release

Signs
Urticaria
Less severe than anaphylaxis



Treatment
Antihistamines
Consider restarting transfusion if symptoms resolve

Acute Hemolytic Transfusion Reaction

Why?
ABO incompatibility leads to lysis of donor blood by preformed antibodies

Signs
Fever and chills
Flank pain
Hemoglobinuria
DIC



Treatment
Aggressive fluids
Vasopressors and/or diuretics, if needed

Febrile Nonhemolytic Transfusion Reaction

Why?
Release of cytokines from leukocytes in donor blood

Signs
Fever ($\uparrow$ temperature 1-2°C from baseline)
No vascular collapse



Treatment
Antipyretics
Supportive care

Transfusion-Related Acute Lung Injury (TRALI)

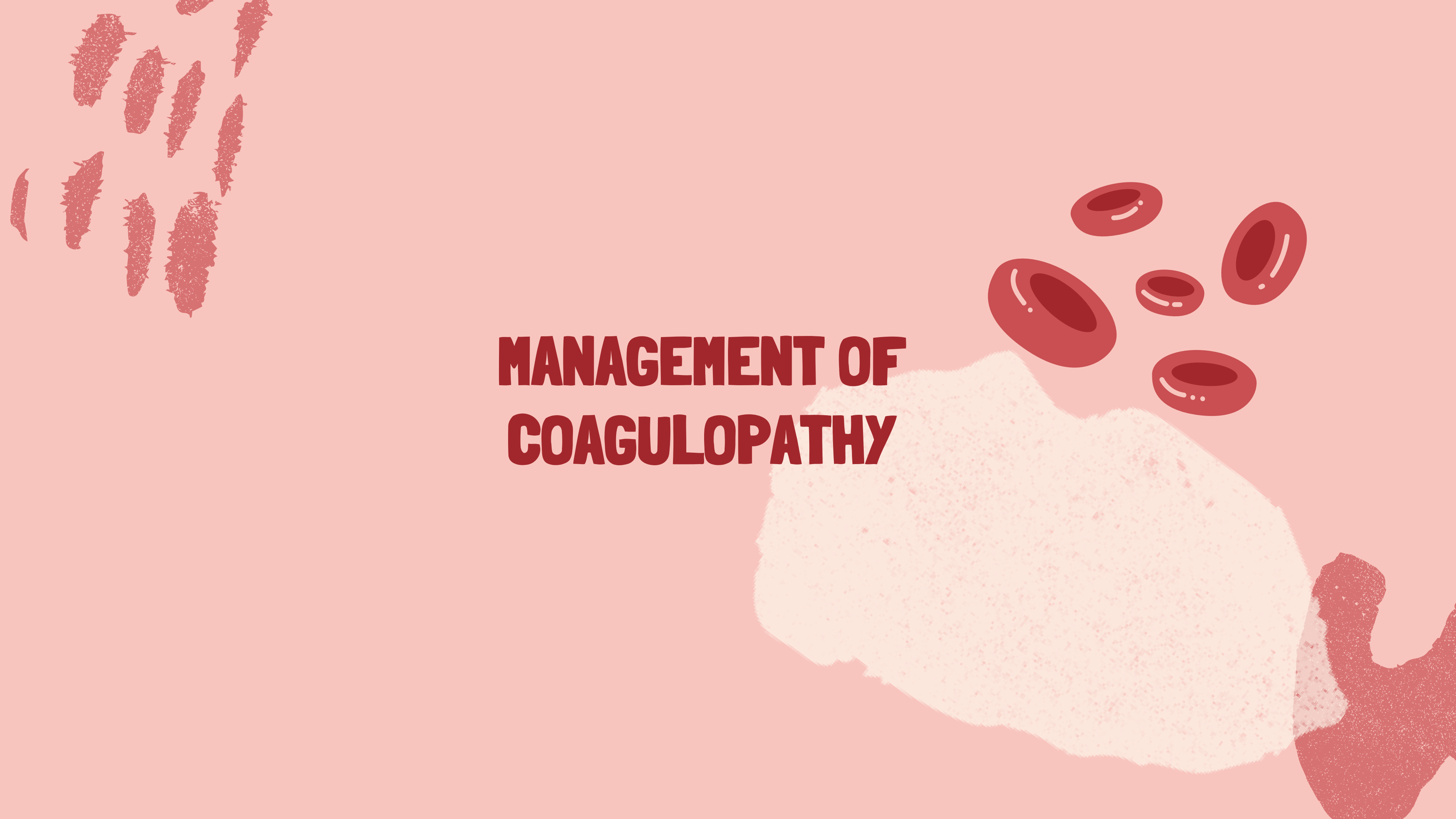
Why?
Donor blood activates recipient neutrophils, causing them to aggregate in pulmonary capillaries

Signs
Respiratory distress
Pulmonary infiltrates on CXR



Treatment
Oxygenation
Mechanical ventilation, if needed

Within 6 hours

The background features a light pink gradient. In the top left, there is a cluster of red, elongated, spiky shapes representing platelets. In the top right, several red, biconcave disc shapes represent red blood cells. In the bottom right, there is a large, irregular, light pink shape representing a blood clot, with a smaller, darker pink shape partially visible behind it.

MANAGEMENT OF COAGULOPATHY

- The first principle of the management of coagulopathies in critical care is to avoid the correction of laboratory abnormalities with blood products unless there is a clinical bleeding problem, a surgical procedure is required, or both

Correction of coagulopathy is not necessary if there is no active bleeding or haemorrhage is not anticipated (not due for surgery). However, coagulopathy following or during massive transfusion should be anticipated and managed aggressively

Standard guide- lines are as follows:

- FFP if prothrombin time (PT) or partial thromboplastin time (PTT) >1.5 times normal
- cryoprecipitate if fibrinogen <0.8 g/L
- platelets if platelet count <50 × 10⁹/mL

However, in the presence of non-surgical haemorrhage these tests take time to arrange and may underestimate the degree of coagulopathy. Treatment should then be instituted on the basis of clinical evidence of non-surgical bleeding

There are pharmacological adjuncts to blood component therapy, although their indications and efficacy are yet to be established. Antifibrinolytics such as tranexamic acid and aprotinin are the most commonly administered. Recombinant factor VIIa is also under investigation for the treatment of non-surgical haemorrhage.

BLOOD SUBSTITUTES

Blood substitutes are an attractive alternative to the costly process of donating, checking, storing and administering blood – and due to the immunogenic and potential infectious complications associated with transfusion.



There are several oxygen-carrying blood substitutes under investigation in animal or early clinical trials. Blood substitutes are either biomimetic or abiotic. Biomimetic substitutes mimic the standard oxygen-carrying capacity of the blood and are haemoglobin based. Abiotic substitutes are synthetic oxygen carriers and are currently primarily perfluorocarbon based.



Haemoglobin is seen as the obvious candidate for developing an effective blood substitute. Various engineered molecules are under clinical trials, based on human, bovine or recombinant technologies. Second-generation perfluorocarbon emulsions are also showing potential in clinical trials.



THANK YOU FOR LISTENING

Is there any question?

