

# Blood Transfusion

Dr SUHAILUR REHMAN

# Introduction

- Blood transfusion (BT) of blood components or whole blood is no more or no less than a type of substitution therapy, a supportive treatment.
- Blood transfusion remains one of the most dangerous therapy **as not free from complications.**

- The injudicious use of blood especially the whole blood instead of specific component is the main problem. Therefore BT should be given **when utmost indicated** & that to of the proper component.

# Introduction (Contd)

- The optimum use of human blood therefore means that:
  - Blood transfusion should never be given unnecessarily.
  - whole blood should only be used in exchange transfusion.
  - Only the **missing components** should be given in all other indication

# Types of products

- Whole blood – 450 ml WB collected in CPD-A1 anticoagulant
- Storage period of 35 days

- PRBC – 300 ml packed cell collected in CPD-A1 with added preservative SAGM while preparing from WB.
- Storage period of 42 days

- FFP – collected from same WB after removing RBC with a volume 80 ml
- Stored for 1 yrs upto 5 yrs, depending upon temp used for storage.

- PC – removed from platelet rich plasma –
- Optimal volume 50 ml
- Storage period 5 days



- Cryoprecipitate – rich in factor VIII & WB factors separated after fractionation from the plasma

# Whole blood (WB)

- The use of WB is basically defined by two fundamental characteristics:
  - The volume effect
  - the oxygen- carrying capacity

## INDICATIONS OF WB:

- Acute blood loss with hypovolemic shock
- Exchange transfusion
- Otherwise, WB should be discouraged because of vol. overload (main reason).
- Shelf life : from 21 to 42 days depends upon the preservative solution.

# Red blood cell concentrate(RCC)

- Red blood cell concentrate is prepared by removing about 2/3 of the plasma/anticoagulant - preservative following centrifugation of a unit of citrated WB.
- RCC have a hematocrit of +/- 70%.
- Shelf life : 21 – 42 days depending upon preservative solution.

# RCC (cont.)

## Advantages of RCC over WB:

1. smaller volume for the same amount of red cells; larger oxygen – carrying capacity per volume transfused;
2. Smaller amount of  $\text{Na}^+$ ,  $\text{K}^+$ , ammonia & hydrogen ions
3. Less exposure to allo-antibodies
4. Less risk of transmission of viral infections
5. Increase in availability platelets, plasma, cryoprecipitate & albumin

# RCC (cont.)

- Indications:

- Chronic anemia and those with acute blood loss resulting from trauma or surgery to maintain a Hb concentration 8 g/dl
- Sickle cell disease with complications to reduce the Hb S to 20-40%.
- Thalassemia major, to maintain the Hb at a minimum of 9-11 g/dl
- Heart failure due to or accompanied by anemia

# Fresh frozen plasma (FFP)

- FFP is a plasma frozen within 6 hours after donation to preserve the clotting factors and can be stored at  $-30^{\circ}\text{C}$  for 1 to seven years and thawed before transfusion.

## Indication of FFP

- Bleeding disorders----factors deficiencies.
- Thrombotic thrombocytopenic purpura (TTP),
- Liver disease

# Cryoprecipitate (Cryo)

- Cryo-precipitated is plasma portion which is rich in certain clotting factors including Factor VIII, Fibrinogen, VWF and Factor XIII.
- It is used in Hemophilia, VWD which are major common inherited bleeding disorders due to coagulation abnormalities.



# Platelet Concentrate (PC)

- Indicated in thrombocytopenia caused by leukemia, bone marrow insufficiencies such as aplastic anemia, myelofibrosis and other forms of marrow suppression (Drug induced, irradiation aplasia)
- Single donor platelets (Jumbo platelets) by aphaeresis
- Stored at RT (20-24°C) with continuous gentle agitation up to 5-7 days
- A standard PC raise platelets :  
5,000 – 10,000 / $\mu$ l

# Anticoagulant & preservatives

- Blood collected in plastic bags
- Preservative sol. are CPD, CP2D & CPDA-1
- Previously ACD was used

## Comparison of preservative Sol. (mg/63ml)

	<b>CPD</b>	<b>CP2D</b>	<b>CPDA-1</b>
<b>Ratio (ml sol : blood)</b>	<b>1.4:10</b>	<b>1.4:10</b>	<b>1.4:10</b>
<b>FDA approved shelf life</b>	<b>21 d</b>	<b>21d</b>	<b>35d</b>
<b>Content</b>			
<b>Sod Citrate</b>	<b>1660</b>	<b>1660</b>	<b>1660</b>
<b>Citric acid</b>	<b>188</b>	<b>188</b>	<b>188</b>
<b>Dextrose</b>	<b>1610</b>	<b>3220</b>	<b>2010</b>
<b>Monobasic Sod Phos.</b>	<b>140</b>	<b>140</b>	<b>140</b>
<b>Adenine</b>	<b>0</b>	<b>0</b>	<b>17.3</b>

# Complications of blood transfusion

# Immediate Adverse Effect of Transfusion

## Immunological effect

Hemolysis with symp.

Febrile nonhemolytic  
Reaction

Anaphylaxis

Urticaria

Noncardiac pul. edema

## Usual etiology

Red cell incompatibility

Donor's granulocyte

Antibody to IgA

Ab to plasma protein

Ab to leukocyte

or compliment activation

# Immediate Effect (Contd.)

## Non immunological effect

Fever with shock

Congestive Heart Failure

Hemolysis with symptom

## Usual Etiology

Bacterial contamination

Volume overload

Physical destruction of blood e.g.. Freezing or overheating, mixing of nonisotonic sol. With RBC

# Delayed Adverse Effect

## Immunological Effect

Hemolysis

Graft vs. host dis.

Post transfusion purpura

Alloimmunization to RBC or  
WBC Ag, Plt. or plasma  
protein

## Usual etiology

Anamnestic Ab to RBC Ag.

Engraftment of transfused  
functional lymphocyte

Development of anti plt. Ab  
(anti HPA 1a)

Exposure to antigen of  
donor's origin

# Delayed effect (contd.)

## Non immunological effect

Iron overload

Hepatitis

AIDS

Protozoal infection

## Usual etiology

Multiple transfusion

HBV, HCV

HIV-I

Malaria, Babesia,  
Trypanosome



# S/S of hemolytic transfusion reaction

## Symptoms

Fever

Chills

Chest pain

Hypotension

Nausea

Flushing

Dyspnoea

## Sign

Hemoglobinuria

Shock

Generalized bleeding

Oliguria or Anuria

Back pain

Pain at infusion site

# Therapy

- Vigorous treatment of hypotension and promotion of adequate renal blood flow
- Adequacy of renal perfusion can be monitored by measuring urine output
- Fluid therapy maintaining urine flow rate above 100 ml/hr
- Underlying cardiac and/or renal complication may complicate therapy
- Diuretics can be administered
- Vasopressor agent decreases the urine outflow is contraindicated

# Therapy (contd.)

- DIC with resultant bleeding - predominant clinical finding in some HTR but rare.
- In short HTR is rare event but it required vigorous treatment
- Human error is common cause
- Care must be taken to minimize such error

# Febrile non hemolytic reaction

- When temp. increases by 1°C
- Most commonly encountered due to **leukoagglutinin**
- Commonly seen in multiple transfusion or in multiparous women
- Can be avoided by use of leukocyte reduced blood
- Fever respond to antipyretic
- Can occur any time even after the transfusion

## Continued-

- Fever may also be seen in other transfusion associated reaction such as AcHTR, contaminated blood.
- Chills & Rigor is a sign of bacterial Contamination of blood when associated with cardiovascular collapse or fever of  $> 40^{\circ}\text{C}$

# Urticaria

- Wheal develop on the body during or following transfusion
- Not a severe allergic reaction in which laryngeal edema or bronchial spasm is seen
- Antihistaminic – treatment of choice

# Anaphylactic Rx

- Severe type of allergic reaction
- It may be fatal if untreated
- S/S – flushing, nausea, vomiting, diarrhea and hypotension
- Reaction is seen in pt without IgA
- These Pt develop IgG anti IgA antibodies and react to all product containing IgA (e.g. -plasma)

# Bacterial contamination

- S/S:- Fever, pain and marked hypotension
- Bacteria may be introduced at the time of collection of blood (bacterial flora of skin of the donor), or improper storage
- Seen commonly in Platelet transfusion
- Attention to the technique and sterility is essential



# Volume overload

- Rapid increase in blood vol. due to WB :- poorly tolerated by Pt. With compromised cardiac or pulmonary status & chronic anemia with expanded plasma volume
- Hypervolemia may be considered, if dyspnoea, severe headache, peripheral edema or other sign of CHF arises.
- Cough, cyanosis, orthopnoea & difficulty in breathing, Rapid increase in systolic pressure

## Volume overload (contd.)

- Symptom usually improve by cessation of transfusion, Pt. Placed in sitting position and given diuretic and Oxygen support
- If symptom not relieved more extensive treatment such as phlebotomy can be done
- When packed cell is used instead of whole blood this problem seldom arises

## 2. Anamnestic reaction

- It occurs in previously immunized patients.
- Some alloantibodies formed after primary immunization may be to a level undetectable in the serum
- Most common presenting sign is, fever, fall in Hb, mild jaundice, hemoglobinuria
- Acute renal failure occurs rarely

# Infectious complication

- HBV, HCV, HIV, malaria, syphilis and other infection can be transmitted through blood transfusion
- Careful pre transfusion screening can prevent transmission of these diseases

**THANKS**

The word "THANKS" is rendered in a bold, 3D sans-serif font. The letters are colored with a vertical gradient from bright yellow at the top to a deep orange at the bottom. Each letter has a dark brown shadow cast to its right and slightly forward, giving it a strong three-dimensional appearance. The text is slanted upwards from left to right.