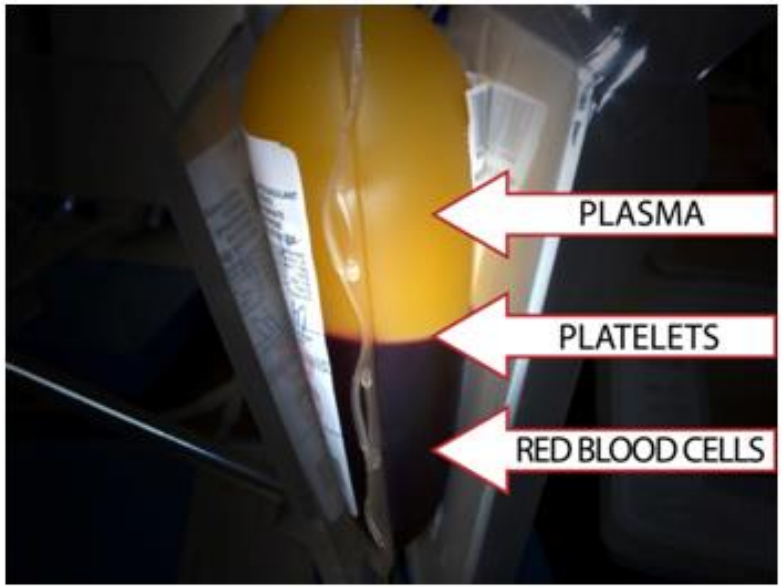
Blood Components

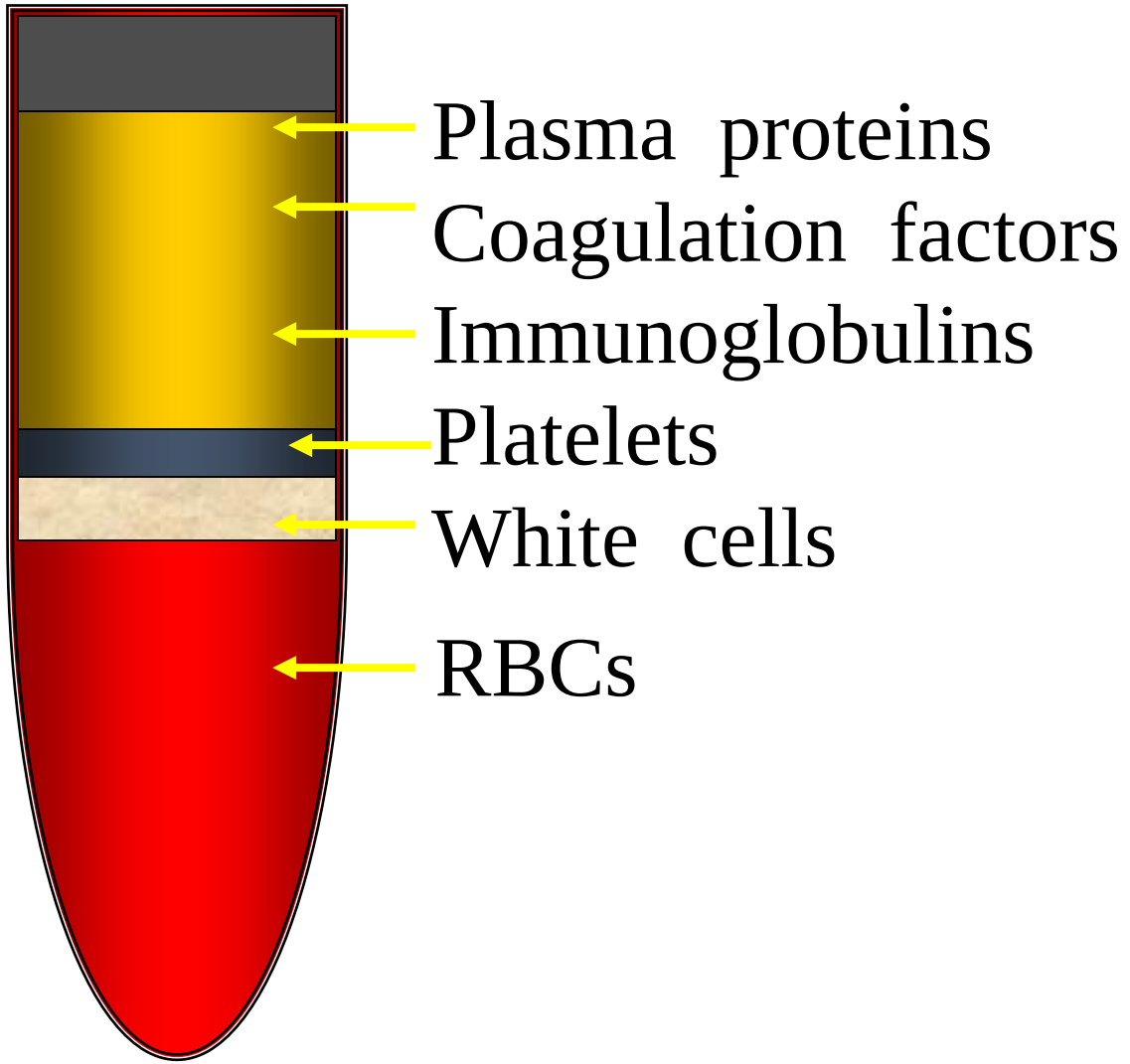
Dr.Durga Moratuwagama

Blood components

- At the end of this lecture student should be able to:
- List the different blood components
- Describe how these components are prepared, stored, half life and therapeutic applications
- Describe the complications of blood component administration.

Whole Blood


PLASMA
PLATELETS
RED BLOOD CELLS


Plasma proteins
Coagulation factors
Immunoglobulins
Platelets
White cells
RBCs

Indication

- Acute , active blood loss with hypovolaemia
- Massive transfusion

Administration

- Must be ABO and RhD compatible
- Use blood administration set

Dosage

1 unit → increase Hct 3 % or Hb 1 g / dL

Why components?

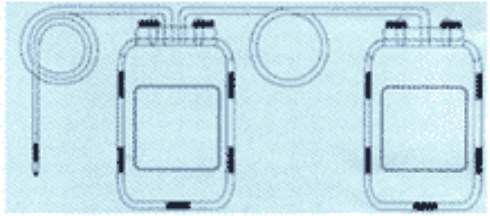
- Meets specific requirement
- Keep risk to a minimum
- Maximize donor resources
- Provide effective transfusion therapy

Blood Components

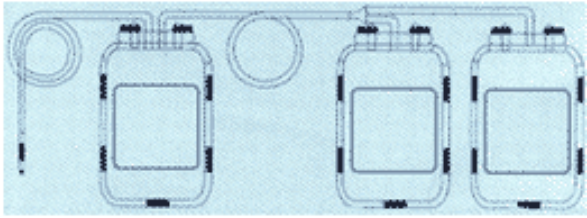
- Types
- Description
- Preparation
- Storage & Transportation
- Indication
- Dose

Types of blood components

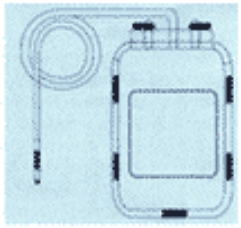
- Cellular components :Red cells
  Platelets
  Granulocytes
- Plasma components :FFP
  Cryoprecipitate
  Cryo poor plasma
  Stored/frozen plasma
- Plasma derivatives :Albumin
  Immunoglobulins
  Coagulation factors



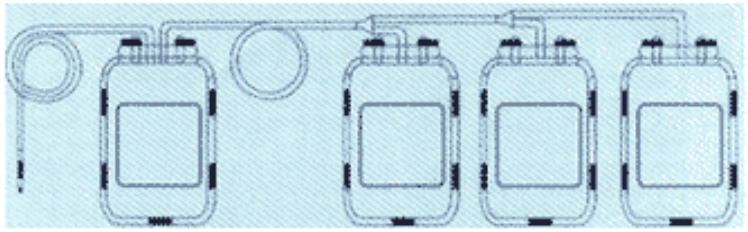
Double blood bag



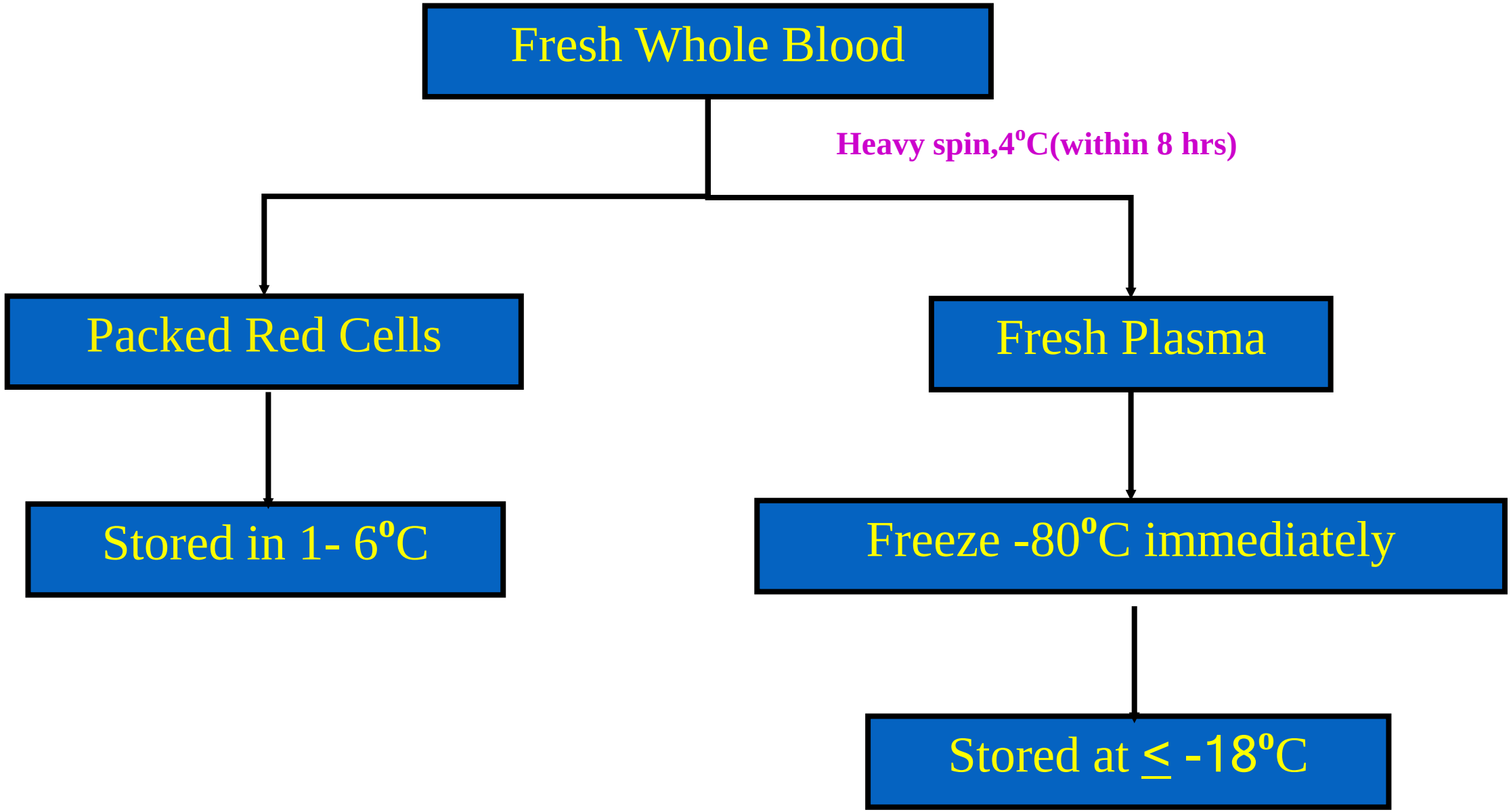
Triple Blood Bag



Single Blood Bag



Quadruple Blood Bag


Fresh Whole Blood
Heavy spin,4°C(within 8 hrs)
Packed Red Cells
Fresh Plasma
Stored in 1- 6°C
Freeze -80°C immediately
Stored at ≤ -18°C


Thermo
H0500 10 023974
H0500 10 024146
024145
ABO

Packed red cell

units with red blood cells and some plasma

with Anticoagulant –CPD

(Citrate/Phosphate/Dextrose)

Other additives: ACD/SAGAM

Packed Red Cells

250 - 350 ml

Plasma 30 %

PCV 70 %

Aim is to ↑ O_2 carrying capacity

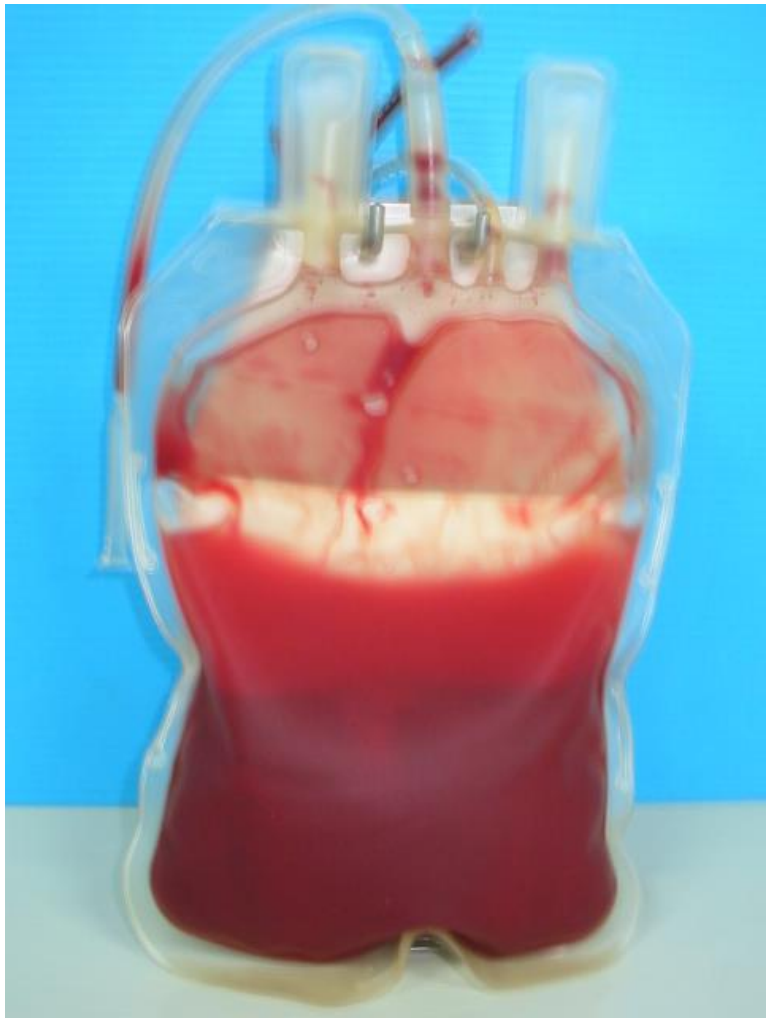
Indication

- Replacement of red cells in anaemic patients

Dosage **10 - 15 ml / kg**

PRC 1 unit → ↑Hct 3 % or Hb 1g/dL

Leukocyte reduced red blood cell



Leukocyte depletion(LD)

- LD blood component =<$5x10^6$ WBCs/unit

- Prepared by leukocyte depletion filters

Leukocyte reduced red cells

Advantages

- Minimizes white cell immunization in patients (HLA alloimmunization)
- Prevention of FNHTR
- Reduces risk of CMV transfusion

Dosage

- same as PRC

Administration

- same as Whole Blood

Washed Red blood cells

- Washed with saline several times
- Resuspended in 100ml of normal saline

Indications

- Prevention of FNHTR
- Prevention of allergic & anaphylactic reactions

Ex:Transfusion dependent patients

Thal. / MDS

Washed Red blood cells

Disadvantages

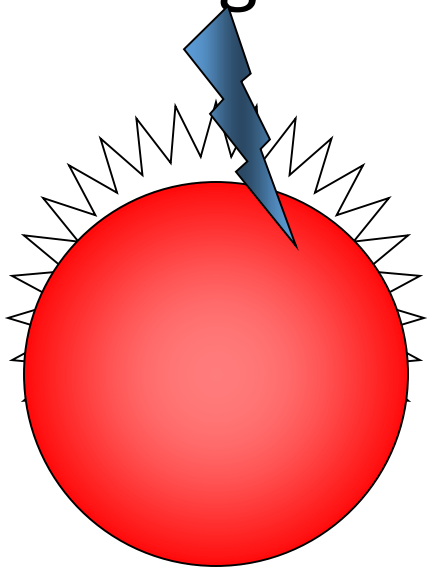
- 20-25% loss of RBC
- Chance of contamination

Administration

- Preferably given within 4 hours
- If delayed may get ↑ risk of infections

Frozen Thawed RBCs

- Not used in Sri Lanka
- Can be kept for 8 - 10 yrs(Normal storage ≅ 35 days)
- Auto transfusion
- To prevent HIV
- Rare blood groups
- Used immediately after thawing



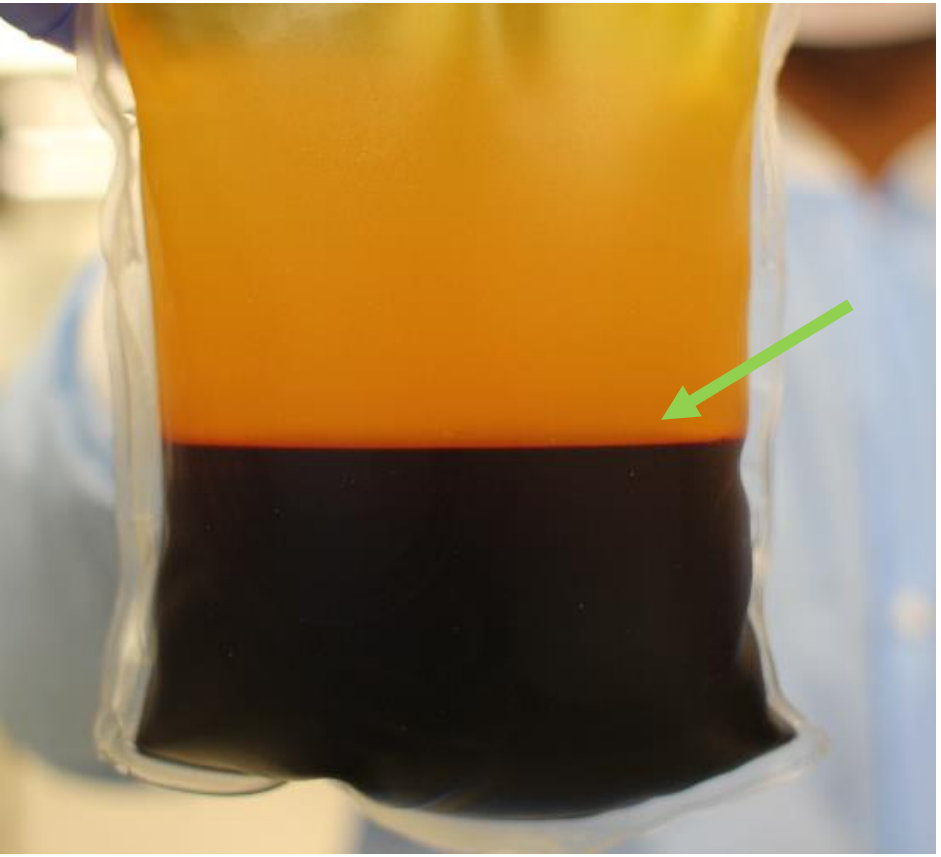
Irradiated red cells

- Gamma –radiated to kill lymphocytes
- The lack of T-cells prevents graft –vs- host disease

➢Indications

- Severely immunocompromised patients'
- Bone marrow transplants
- Intrauterine transfusion
- Hodgkin Lymphoma
- Transfusions from blood relatives
- ……

Leukocytes - Buffy Coat



Volume-50 ml
WBC count-2.5 x 10^{9}/ pack
Granulocyte count-1.5 x 10^{9}/ pack
Dose of buffy coat-at least 10 units
RBC s 20 - 30 ml & Platelets
HCT-60% may cause polycythaemia
Needs Grouping & DT
Group specific

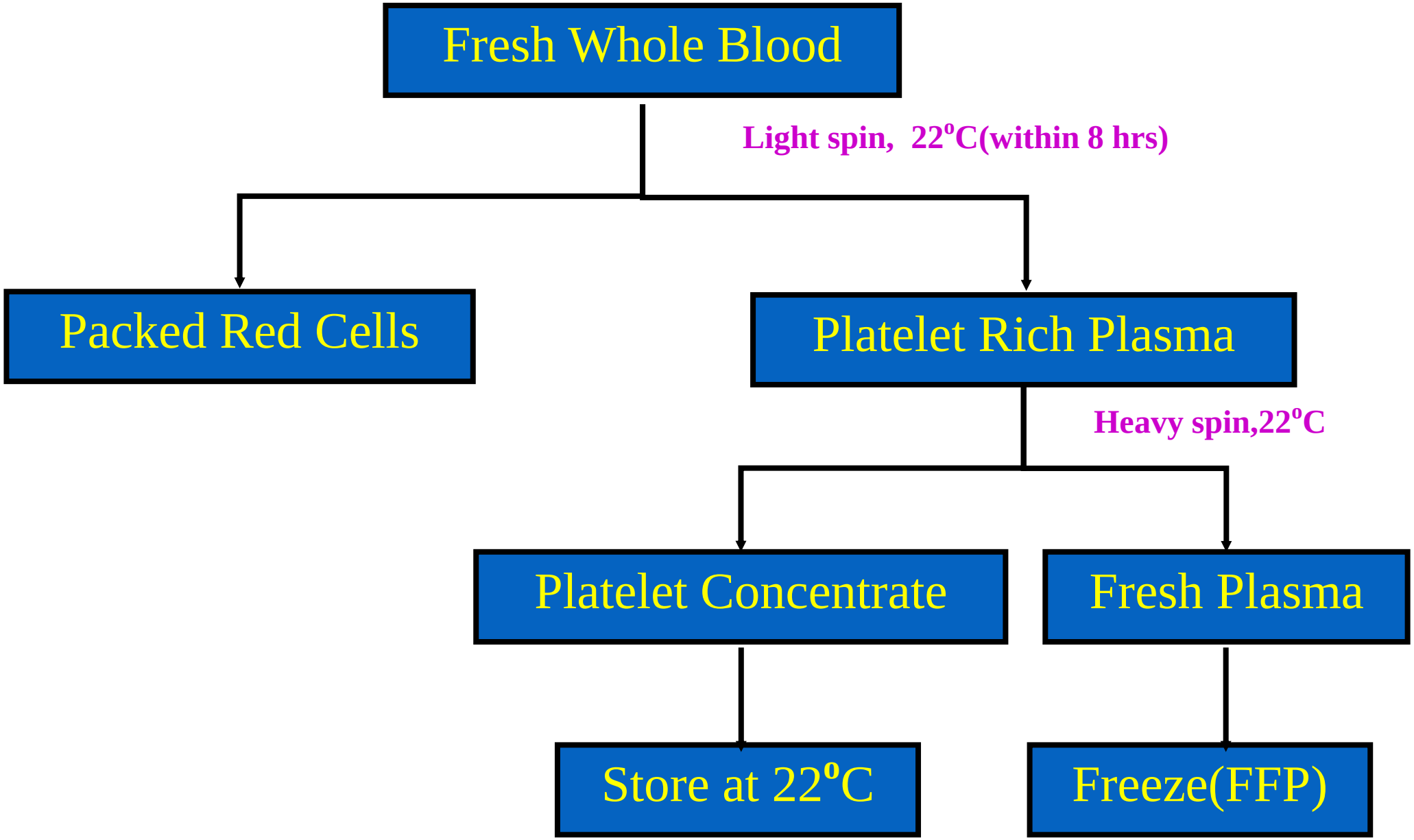
Indications

- Neutropenic sepsis
- Temporary method
- Now G - CSF is used
- Should be given as soon as prepared

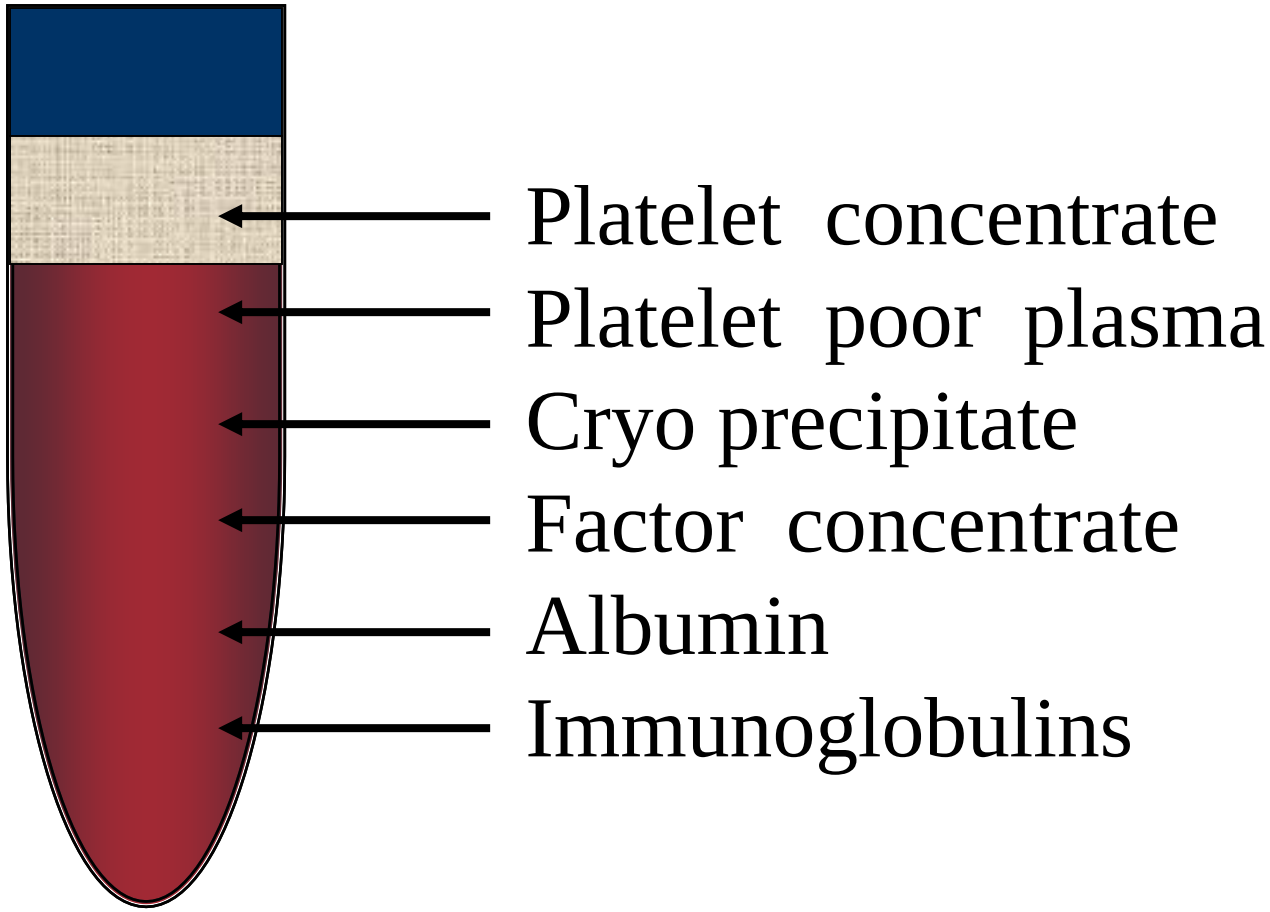
(can be kept for 24 h at 20-24 c)

Disadvantages

- Needs repeated doses
- GVHD


Fresh Whole Blood
Light spin, 22°C(within 8 hrs)
Packed Red Cells
Platelet Rich Plasma
Heavy spin,22°C
Platelet Concentrate
Fresh Plasma
Store at 22°C
Freeze(FFP)

Platelet Rich Plasma



Platelet Concentrate

Random donor Platelets

Whole blood 1 unit → Platelet Concentrate 1 unit

↓

$\geq 5.5 \times 10^{10}$ platelets in
50 - 70 ml of plasma

Single donor platelets

1 Donor
Apheresis → Platelet concentrate

↓

$\geq 3 \times 10^{11}$ platelets in
~ 300 ml of plasma

Platelets apheresis

Random Donor Platelet

Volume 45 – 65 ml

Single Donor Platelet

Volume ~ 300 ml

- Shelf life-5 days
- Should be kept in a shaker with continuous agitation
- Temperature-20-24^{0}C
- Function deteriorates during storage

Indications

Treatment of bleeding due to

- Thrombocytopenia
- Platelet Dysfunction

Contraindications

- **TTP**
- **HUS**
- **HIT**

PLATELET CONCENTRATE

- Dosage
  - 1 unit of PC / 10 kg B.W.
  - Increment will be less in
    - Splenomegaly
    - DIC
    - Septicemia

1 unit of PC → ↑Platelet 5000-10,000 / ul

PLATELET CONCENTRATE

Administration

- should be ABO compatible (No Rh Ag on platelets)
- Avoid Rh D+RDP transfusion to a Rh-women in child bearing age(why?)
- Use blood administration set
- Must not be refrigerated

Single Donor Platelet/Apheresis

- Indication
  - same as random PC

- Dosage

  Usually 1pack of SDP = 1 therapeutic dose

- Administration

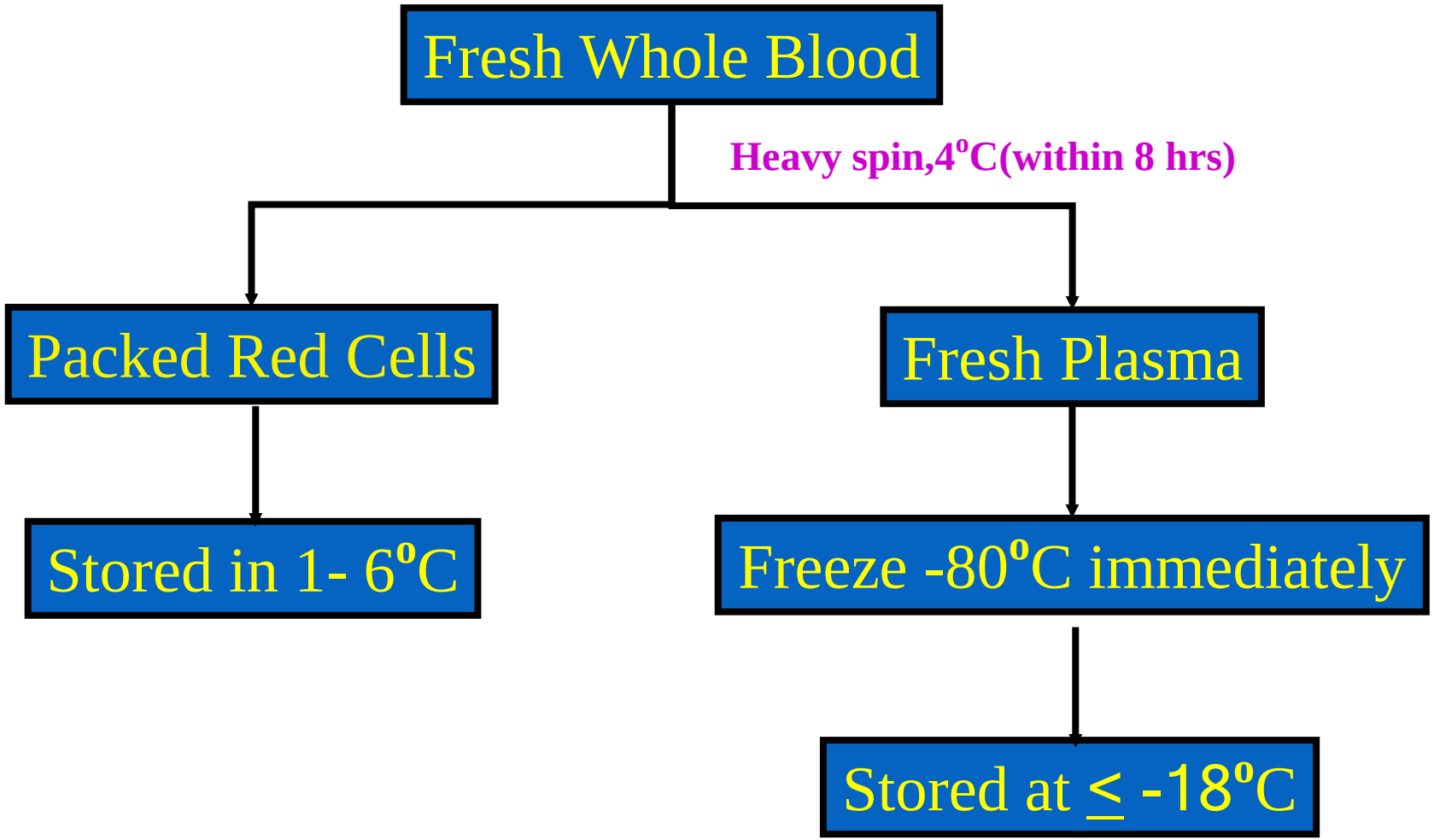
  same as random PC

Plasma Components

- Fresh Frozen Plasma
- Frozen Plasma :- Aged plasma

  Cryoremoved plasma
- Cryoprecipitate

FRESH FROZEN PLASMA


Fresh Whole Blood
Heavy spin,4°C(within 8 hrs)
Packed Red Cells
Fresh Plasma
Stored in 1- 6°C
Freeze -80°C immediately
Stored at ≤ -18°C

Fresh Frozen Plasma

- plasma separated & frozen in 6-8 hours of blood collection
- volume ~ 250-300 ml
- maximum level of labile and non-labile clotting factors (about 1 IU per ml)

Frozen Plasma

- Plasma separated from whole blood at anytime during storage
- Contain all non-labile coagulation factors

FRESH FROZEN PLASMA

Indication

- Replacement of coagulation factors when specific factor concentrate is not available-V, X, XI
- Replacement of multiple coagulation factor deficiencies :-liver disease , reversal of warfarin effect, Massive transfusion
- DIC
- TTP

FRESH FROZEN PLASMA

Not indicated for

- Volume expansion
- Immunoglobulin replacement
- Nutritional support
- Wound healing

FRESH FROZEN PLASMA

Precaution

- Acute allergic reaction are common
- Anaphylactic reaction may occur
- Volume overload-TACO

Dosage

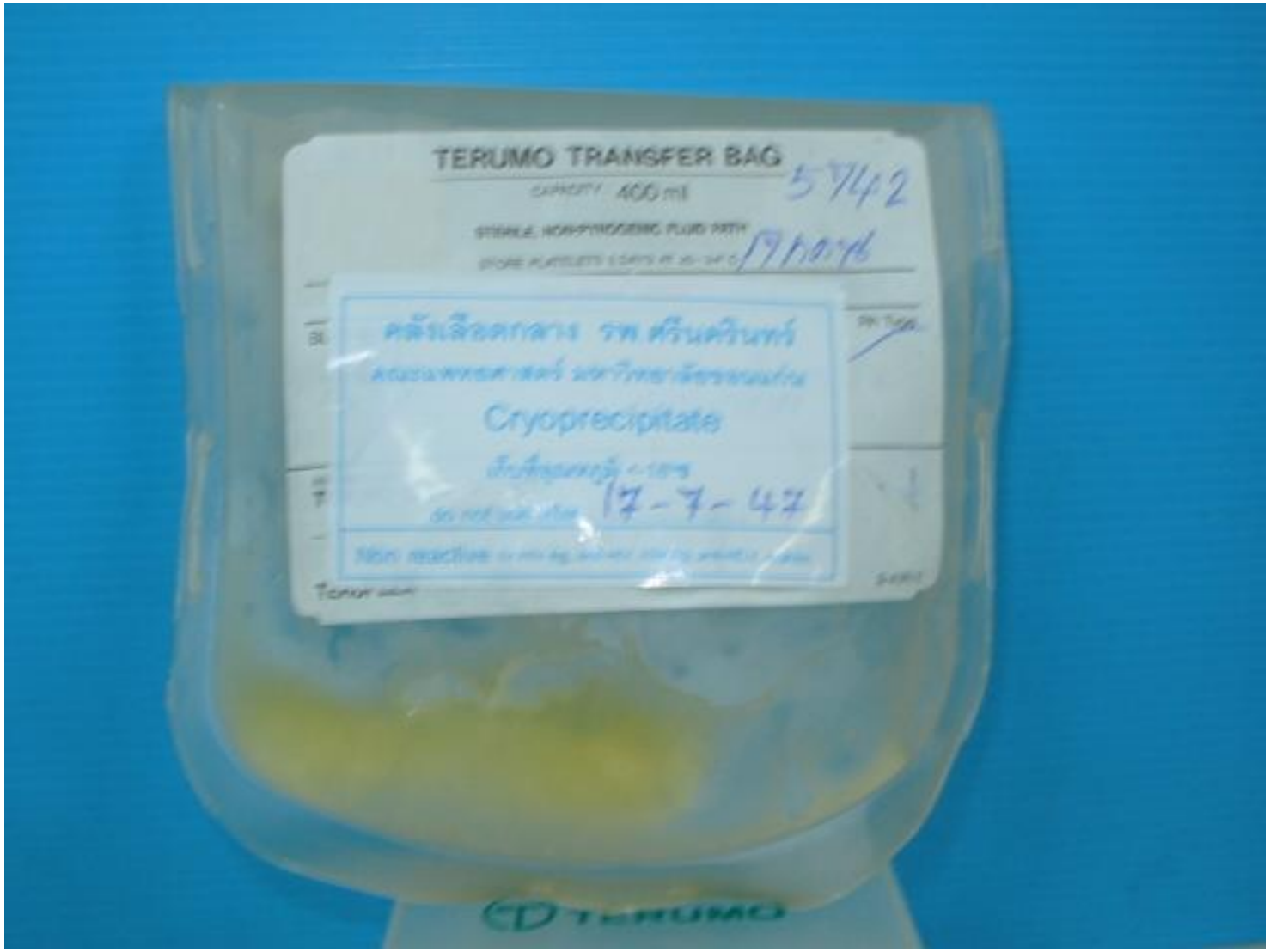
Initial dose of 15 - 20 ml / kg

FRESH FROZEN PLASMA

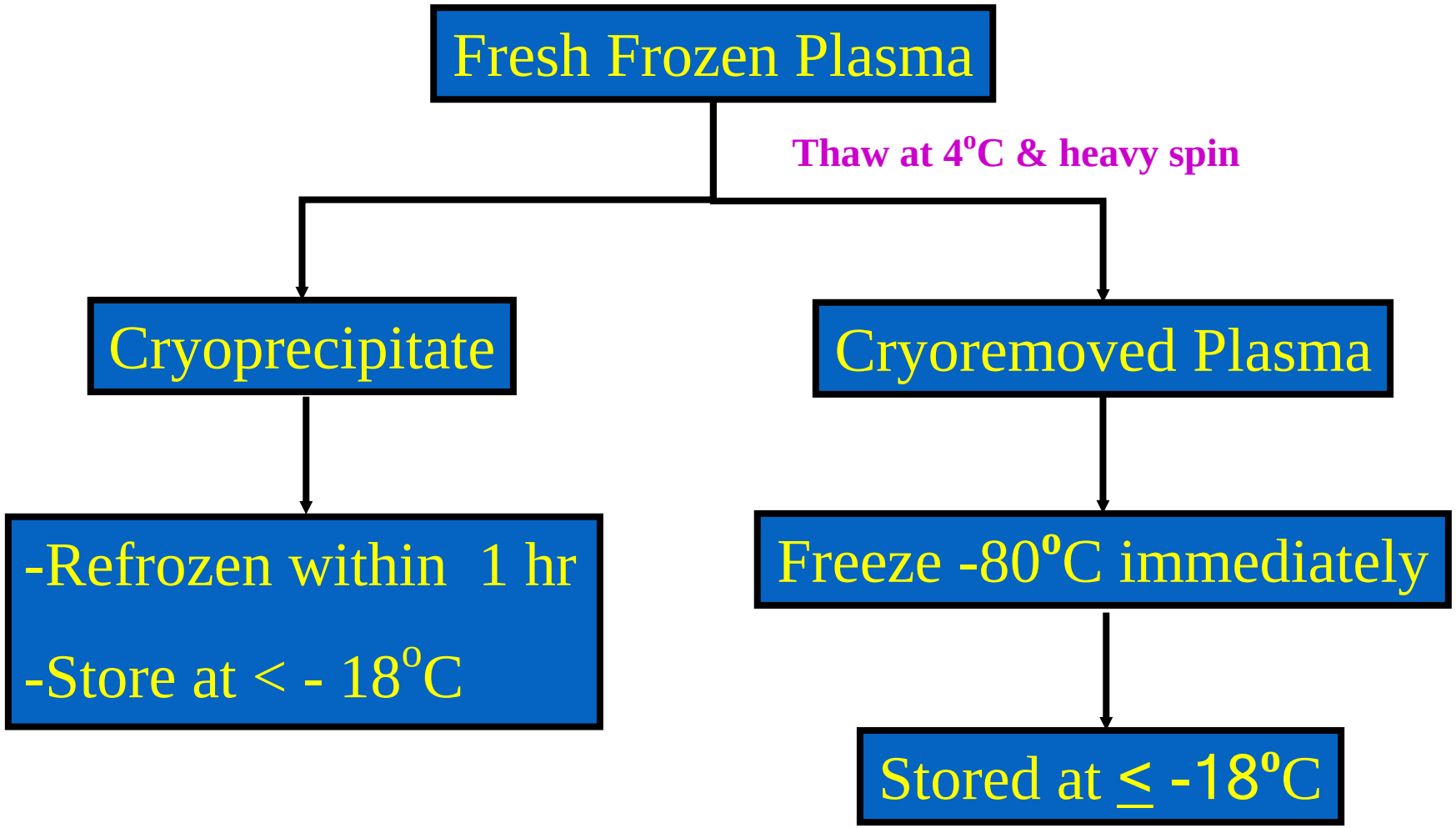
Administration

- Must be ABO compatible
- Infuse as soon as possible after thawing (within 6 hrs)
- using standard blood administration set
- Once thawed should not be reused as FFP after refreezing

CRYOPRECIPITATE



Cryoprecipitate is the cold insoluble portion of plasma that precipitate when FFP is thawed


Fresh Frozen Plasma
Thaw at 4°C & heavy spin
Cryoprecipitate
Cryoremoved Plasma
-Refrozen within 1 hr
-Store at < - 18°C
Freeze -80°C immediately
Stored at ≤ -18°C

FFP 1 unit → Cryoprecipitate 1 unit

(Volume ~ 10 - 15 ml)

Cryoprecipitate 1 unit contains

- F VIII:c 80 - 150 IU
- Fibrinogen 150 - 250 mg
- F XIII (20-30% of WB level)
- vWF (40-70% of WB level)

CRYOPRECIPITATE

Indication

- Factor VIII (haemophilia A)
- von Willebrand Disease
- Quantitative and Qualitative Fibrinogen
  Deficiency :Hypo/Dysfibrinogenaemia/DIC/Liver failure/Massive transfusion
- Factor XIII deficiency

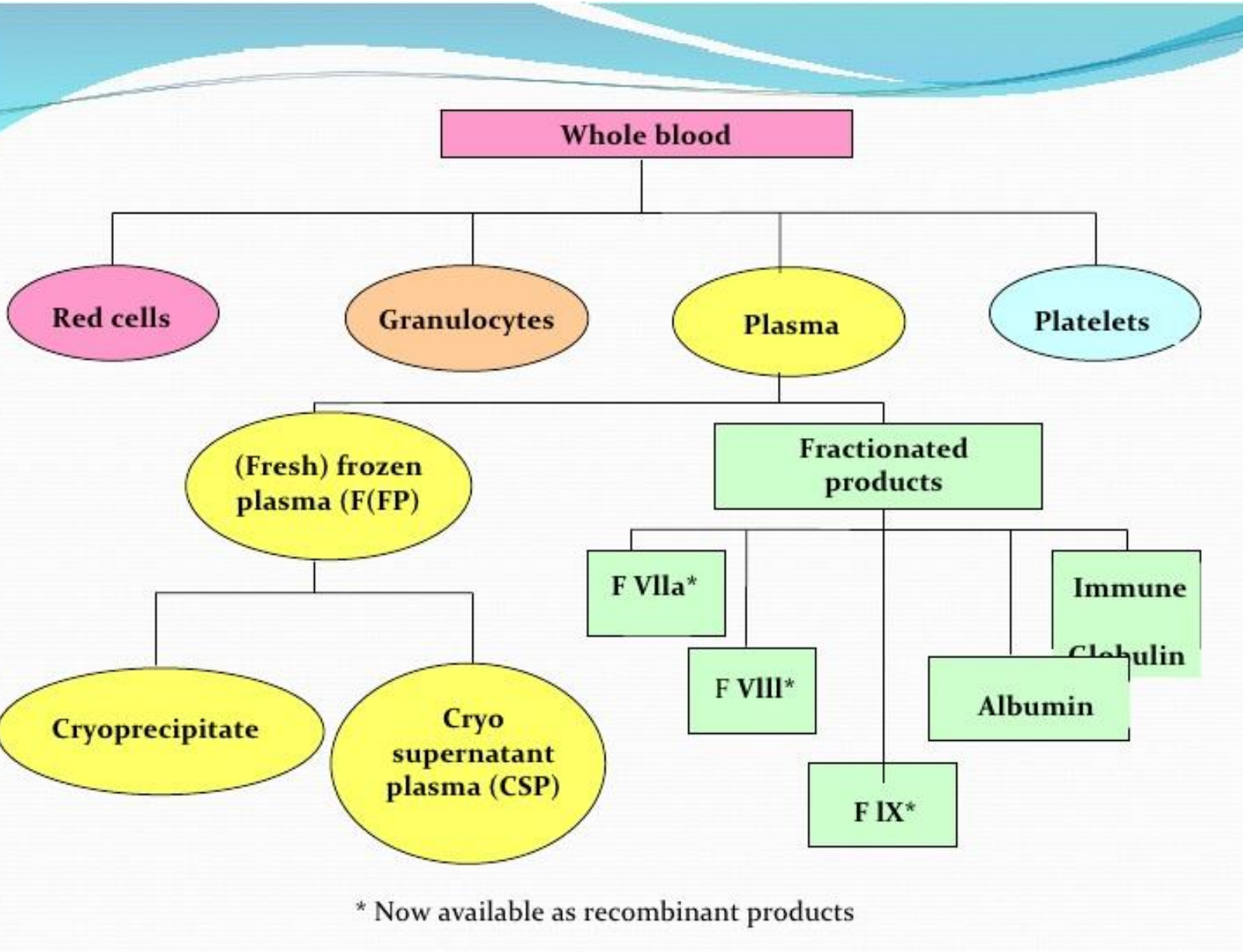
CRYOPRECIPITATE

Administration

- Dose of Cryo is based on the desired target level of the specific factor to be replaced
- **Group specificity not necessary**
- No compatibility testing required
- After thawing & pooling, infuse as soon as possible through blood admin. set
- must be infused within 6 hours of thawing

STORAGE AND SHELF LIFE OF BLOOD COMPONENTS

COMPONENT	STORAGE TEMPERATURE	SHELF LIFE
Whole blood	1-6° C	35 days
RBCs	1-6° C	35-42 days
Platelets	20-24° C	5 days
FFP	< –18° C	1 year
Cryoprecipitate	< –18° C	1 year



Summary

- Blood component vs Whole blood
- Cellular and plasma components
- Storage and half life
- Indications
- Adverse effects

Thank you