

Liquid Lifelines: The Vital Role of Blood Products in Pediatric Hematology-Oncology

Types of Blood Components



Blood is a Drug:

Its collection, storage, handling, and transfusion are governed by law

The judicious use of blood components is essential

Commonly utilized blood products in clinical practice

- Packed Red Blood Cells (PRBC)
- Platelet Concentrate
- Fresh Frozen Plasma (FFP)
- Cryoprecipitate
- Granulocyte Concentrate

Blood Component

PRBC

Packed red blood cells (PRBC)



Indications

- Hb <7 g/dL: Perioperative, marrow failure syndromes, & symptomatic chronic anemia
- Hb <8 g/dL: Oncology patients, HSCT recipients, & pure red cell aplasia
- Hb <10 g/dL: Infants undergoing major surgery
- Hb 9.5–10.5 g/dL (pre-transfusion): Hemoglobinopathy e.g., thalassemia
- Hb 10–12 g/dL: Severe cardiopulmonary disease

Administration

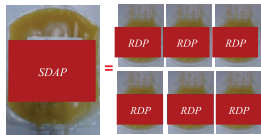
- **Volume:**
  - 20 kg<sup>3</sup>: 10–15 mL/kg OR (Desired Hb – Actual Hb in g/dL) × Weight (kg) × 5
  - ≥20 kg<sup>3</sup>: 1 unit
- #Typically raises Hb by ~2 g/dL
- **Rate:** 5 mL/kg/hr (max 150 mL/hr & complete within 4hrs)
- **Storage:** 2 to 6°C

Blood Component

Indications

Administration

Platelet concentrates



1 SDAP = ~6 RDPs (SDAP-Single Donor Apheresis Platelets, RDP-Random Donor Platelets)

- <10 × 10<sup>9</sup>/L: Stable children, irrespective of bleeding
- <20 × 10<sup>9</sup>/L: Febrile neutropenia, sepsis/critical illness, minor clinical bleeds, severe mucositis, DIC, central-line insertion
- <50 × 10<sup>9</sup>/L: Lumbar puncture in leukemia, gastrointestinal bleeding, bleeding in DIC, or for non-cardiac/ non-CNS surgery
- <75–100 × 10<sup>9</sup>/L: CNS bleeding & for major cardiac or CNS surgeries

- Volume:**
- <15 kg<sup>3</sup>: 10 mL/kg
  - ≥15 kg<sup>3</sup>: 1 unit per 10 kg body weight
- #RDP transfusion increases platelet count by 5,000–10,000/μL, while one SDAP by 40,000–50,000/μL
- **Rate:** administer within 30 minutes
  - **Storage:** 20–24°C (room temperature) with continuous agitation

Blood Component

Indications#

Administration

FFP & Cryoprecipitate



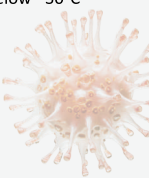
- FFP contains 1 IU/mL of all coagulation factors, and cryoprecipitate contains Fibrinogen, factor VIII, vWF, and factor XIII (No FIX)
- No prophylactic FFP/Cryo in non-bleeding children with abnormal PT/ aPTT/ INR or low fibrinogen

Indications

- Children with DIC and clinical bleeding, or before invasive procedures, and inherited coagulation factor deficiencies

#Clotting factor concentrate (CFC) should preferably be administered whenever available & applicable

- **FFP:** 10–20 mL/kg
- **Cryoprecipitate:** 5–10 mL/kg (1–1.5 units per 10 kg)
- **Rate:** 10–20 mL/kg/hour (complete within 1–2 hours)
- **Storage:** Below –30°C



Transfusion-transmitted infections (TTIs) screening

Each unit must be screened via ELISA for:

- HIV I & II
- Hepatitis B (HBV)
- Hepatitis C (HCV)
- Malaria
- Syphilis (VDRL)

**NAT (Nucleic Acid Testing)** for screening infection in the window period wherever available

Granulocyte concentrate



Granulocyte transfusion

**Indication:** Severe & prolonged neutropenia (ANC<500) or congenital neutrophil functional disorder with life-threatening bacterial/fungal infections unresponsive to antimicrobials

**Administration:** After premedication with paracetamol & antihistaminics, irradiated, apheresis, or pooled buffy coat product is infused promptly after collection, at 10–20 mL/kg over 1–2 hrs

Leukodepletion

**Method:** Pre-storage/transfusion (at blood bank) or bedside leukocyte filter

**Advantages:** Prevents HLA alloimmunization, ↓ risk of CMV, EBV, & HTLV-1 transmission & FNHTRs

**Indication:** Thalassemics, HSCT recipients & patients on chemotherapy

Transfusion-related Complications

1. Acute Complications

- Febrile non-hemolytic transfusion reactions (FNHTR)
- Allergic reactions
- Hemolytic transfusion reactions (cola-colored urine)
- Transfusion-related acute lung injury (TRALI)
- Transfusion-associated circulatory overload (TACO)



2. Delayed Complications

- Alloimmunization
- Iron overload
- Transfusion-transmissible infections
- Transfusion-associated graft-versus-host disease (TA-GvHD)



Irradiation

**Method & advantage:** Gamma irradiation at 25–50 Gy for PRBCs, platelets & granulocytes (Not for FFP/ Cryo). It prevents TA-GvHD

**Indication:** HSCT recipients (allo- & auto), intrauterine, neonatal exchange & preterm transfusions, first/second-degree relative donor & severe congenital T-cell immunodeficiency

1

Avoid blood transfusion in a stable child with nutritional anemia, even if severely anemic (5–7 g/dL)

2

In thalassemia - extended red cell phenotyping & crossmatch for at least ABO, Rh (C, c, D, E, e), & Kell ag.

3

Avoid Prophylactic platelet transfusion in ITP, TTP/HUS, HIT, & prior to bone marrow examination

4

Avoid prophylactic FFP/cryo transfusion in a non-bleeding child with deranged coagulogram

5

Do not refrigerate platelet concentrates – lose viability

6

Use blood warmers in neonates, large volume transfusions, and, cold-AIHA patients

Key Messages

- Ensure the five rights of transfusion: Right patient, Right product, Right amount, Right rate, and Right time.
- Transfuse blood components judiciously using clinical thresholds for Hb & platelets
- Adequate pre-transfusion hemoglobin and the use of cross-matched and leukoreduced red cells are essential for optimal thalassemia management



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