Principles of Transfusion
A Journey Through the Blood Bank

A Journey Through the Blood Bank
- Donor screening (not covered)
- Processing of blood products
- Storage of blood products
- Donor testing and compatibility tests
- pRBCs processing, indications, ordering
- Platelets indications, ordering, refractoriness
- Transfusion reactions

Blood Components

- Whole blood
  - 300 - 500 cc
  - Adult ≥ 50kg
- Red Cell concentrate
  - Hematocrit 70 - 75%
  - On CPDA-1
- PRP
- Buffy coat
- PPP

Blood Components

- Fresh Plasma ready for use
- Fresh Frozen Plasma
- Cryoprecipitate
  - Factors VIII, von Willebrand factor, and Fibrinogen

Storage of pRBCs
- Usually CPDA, 2-6°C (contains citrate, phosphate, dextrose, and adenine)
- Adsol, or AS-1 can be added after the plasma is removed, extending the shelf life from 35 to 42 days. Has mannitol and phosphate buffers
- ↓ 2,3 DPG

Storage of Platelets
- Room temperature under gentle agitation
- Outdated after 5 days
- Collected either as random donor units or pheresed products
**Storage of Plasma**
- FFP is stored at -180 °C, and lasts for approximately 1 yr.

**Donated Blood**
- Serologic tests (HIV, hepatitis, etc.)
- Type
- Match with recipient blood
  - What about the recipient?
    - Type
    - Screening for Abnormal antibodies

---

**Blood Groups**
- Blood Groups: ABO
  - Other systems: Rh (D,C, c, C, etc.), Lewis, Kell, Kidd, Duffy, etc.

**Blood group testing**

![Isohemagglutinins: usually IgM](image)
Compatibility Procedures

- Screening
- Cross-match

Patient antibody screening using micro-column (gel) system

What is really happening inside these tubes?

Screening

Nathan and Oski's 6th Edition
Cross-matching

Processing pRBC’s
- Leukoreduction
- Irradiation
- Washing

Leukoreduction
- How is it done? With filters
- ↓ alloimmunization
- ↓ febrile non-hemolytic reactions
- ↓ CMV transmission
- May ↓ but does not prevent transfusion associated-GVHD

Irradiation
- Eliminates T cells
- Prevents transfusion-associated GVHD
- 25 Gy is enough to inactivate T cells
- Recommended for immunocompromised hosts, and for transfusions from first degree relatives
- TA-GVHD has a mortality of 90%, and is usually unresponsive to standard treatments
- Irradiation increases the serum potassium, especially in neonates
- RBCs can only be stored 28 days after radiation

Washing
- Removes extra plasma that may contain antigens, cytokines or extra potassium
- Useful in patients with a history of allergic reactions to transfusions
- Used in IgA deficiency, PNH
- Once washed, must be used in 24 hours

pRBC’s when to order and how much?
- when Hb < 6-8 g/dL
- Use judgment, this rule is not written in stone!
- Dose: 10 – 20 cc/kg
- Try not to waste blood, use units when ordering
- 32 kg child, what volume PRBCs?
  • 320cc ⇒ no, give one unit!
- How fast? 1 to 2 hours
Platelets

- Random donor: for patients not regularly transfused
- Single donor: Apheresis: > 3 x 10^11 platelets in 200 to 300 cc
- Platelet refractoriness why?
  - Answer: because of HLA antibodies
- How to decrease platelets alloimmunization?
  - Single donor (apheresis), leukopenic, irradiated, HLA-matched, cross-matched (ABO) controversial

Platelets when to order?

- < 10 K, but there are exceptions

Platelets how much to order?

- Dose: 1 unit for each 10 kg for random units increases count by 40 to 50K
- 6 units of random units ~ 1 pheresed unit
- ~ 50 kg ⇒ 1 pheresed unit
- 1 pheresed unit increases count by 50k or more
- How fast? 10 cc/kg/hour for pheresed, ASAP for single units

Transfusion Reactions

- Acute
  - Hemolytic (ABO incompatibility ⇒ catastrophe!)
  - Allergic (due to leukocytes and cytokines)
  - Infectious (bacterial, viral)
- Non-acute
  - Delayed hemolytic reaction (7 to 10 days later, weak antibodies, e.g. Duffy). Anamnestic response usually the pathophysiology. Once an Ab, always an antibody!
  - Infectious (HIV, Hepatitis B, C, etc.)

ABO Incompatibility

- Usually due to ABO incompatibility (especially A) from clerical error
- Can be life-threatening if severe hemolysis occurs
- Symptoms: chills, fever, abdominal and back pain, tachycardia, hypotension, hemoglobinuria
- In surgery, may only see bleeding (from DIC) and hematuria
- Maintaining renal perfusion is critical

Allergic reactions

- Hives, itching, fever
- Usually localized, but can be systemic (anaphylactic, especially in IgA deficiency patients)
- Treat symptomatically
- Recurrent reactions may require pretreatment or using washed pRBCs
Transfusion-related acute lung injury (TRALI)

- Acutely increased permeability of pulmonary microcirculation ➔ massive leakage of fluids and protein into alveolar and interstitial spaces
- Possible causes: Localized complement activation, granulocyte antibodies in the donor or recipient, or cytokine generation
- Treat with steroids and supportive care

Questions??