BLOOD THERAPY

BLOOD PRODUCTS(1)

- Blood-cells products
  - whole blood
  - packed red blood cells
  - leukocyte-poor (reduced) red cells
  - washed red blood cells
  - random-donor platelets concentrates
  - single-donor platelets concentrates [human leukocyte antigens(HLA)-matched platelets]
  - irradiated blood products (red blood cells and platelets concentrates)- after exposure 20 to 40 Gy
  - leukocyte (granulocyte) concentrates

BLOOD PRODUCTS(2)

- Plasma products
  - fresh-frozen plasma (FFP)
  - cryoprecipitate
  - factor concentrates (VIII, IX)
  - albumin
  - immune globulins

RED CELLS TRANFUSION-indication(1)

1. Whole blood
    - **acute hypovolemia (hemorrhagic shock)**
    - massive transfusion
    - exchange transfusion in infants for hemolytic anemia of the newborn
2. Red cell concentrate - **symptomatic anemia**
    - iron, folate, or vitamin B_{12} deficiency anemia - very rarely, in elderly patients with angina or congestive heart disease
    - hemolytic anemia- very rarely, when anemia is poor tolerated and Hb<5g/dl
    - hypoproliferative anemia
        - anemia in malignancy
        - anemia after chemotherapy or radiotherapy
        - aplastic anemia, myelodysplastic syndrome, mylofibrosis, ACD

RED CELLS TRANFUSION-indication(2)

3. leukocyte-poor (reduced) red cells (< $5x10^6$ leukocytes remains)
   - to prevent or avoid nonhemolytic febrile reactions due to antibodies to white cells and platelets in the recipients exposed to previous transfusions or pregnanccies
   - to prevent sensitization of patients with aplastic anemia who may be candidate for marrow transplantation
   - to minimize transmission of viral disease such as HIV or cytomegalovirus.
4. washed red blood cells (in patients who are hypersensitive to plasma
   - in patients with severe allergic reaction following transfusion
   - in patients with paroxysmal nocturnal hemoglobinuria

BLOOD LOSS- signs, symptoms and indication for transfusion

Volume Lost		Clinical signs	Preparation of choice
mL	% of Total Blood Volume		
500	10	None;	No transfusion or crystalloid solution
1000	20	tachycardia	crystalloid solution or colloids or RBC if necesssary
1500	30	drop in BP	crystalloid solution plus colloids plus RBC or blood if available
2000	40	shock	crystalloid solution plus colloids plus RBC or blood if available

Indication for transfusion in anemic patients

- The decision to transfuse is based on an assessment of the patient's clinical condition rather than a given level of hemoglobin
- blood transfusion of patients with chronic stable anemia is probably unjustifiable if the hemoglobin level is above 7g per 100ml
- factors to consider include the symptomatic anemia(dizziness, weakness, shortness of breath), the patient's age, the presence of underlying cardiac, pulmonary, or vascular disease.

RBC transfusion in autoimmune hemolytic anemia

1. Transfusion only when Hb level is life-threatening(< 5 g/dl)
2. Red cell products of choice: leukocyte-poor (reduced) red cells or washed red blood cells

Patient and donor RBC selection by ABO and Rh type

Patient	Donor
A	A, O
B	B, O
AB	A, B, AB, O
O	O
Rh(+)	Rh(+), Rh(-)
Rh(-)	Rh(-)

Platelet transfusion-indication(1)

1. Temporary thrombocytopenia occuring after radio- and chemotherapy
   - platelet count below 10 G/L
   - platelet count 11-20 G/L and:
     - minor hemorrhagic signs such as petechiae or small ecchymoses of the skin
     - fever >38^{o}C
     - coexisting deficiency of coagulation factors
     - heparin administration
   - platelet count above 20G/L
     - hemorrhagic diathesis
     - before invasive procedure

Platelet transfusion-indication (2)

Typical platelet count thresholds that are used for some common procedures are as follows:

- Neurosurgery or ocular surgery – 100,000/microL
- Most other major surgery – 50,000/microL
- Endoscopic procedures – 50,000/microL for therapeutic procedures; 20,000/microL for low risk diagnostic procedures
- Bronchoscopy with bronchoalveolar lavage (BAL) – 20,000 to 30,000/microL
- Central line placement – 20,000/microL
- Lumbar puncture – 10,000 to 20,000/microL in patients with hematologic malignancies and greater than 40,000 to 50,000 in patients without hematologic malignancies, but lower in patients with immune thrombocytopenia (ITP)
- Epidural anesthesia – 80,000/microL
- Bone marrow aspiration/biopsy – 20,000/microL

Platelet transfusion-indication(3)

2. Bleeding in patients with thrombocytopenia or functional platelet abnormality
3. After massive transfusion(RBC) and thrombocytopenia
4. Cardiac surgery with extracorporeal circulation

Granulocyte transfusions

1. Patients with granulocyte count<0,5 G/L
2. Patients with documented sepsis (especially Gram negative)
3. Granulocyte transfusion is beneficial when bone marrow recovery is delayed for more than 7 days after granulocyte infusions
4. Patients who fail to respond to appropriate antibiotics within 48h of therapy

Indications for plasma transfusions

1. Corrections of known congenital or acquired coagulation factor deficiencies(e.g., factors II, V, VII, X, XI, or XIII) in patients with hemorrhage
2. Urgent reversal of warfarin effect
3. Treatment of microvascular hemorrhage in the presence of prolonged PT, aPTT
4. Treatment of microvascular bleeding following massive blood transfusion when timely reporting of laboratory test result is not available
5. Plasma exchange for TTP

Contraindication to plasma transfusions

Plasma should not be used:

- as a volume expander or as a nutritional supplement
- as albumin supplementation
- for correction of hypogammaglobulinemia
- for treatment of hemophilia or von Willebrand disease or other congenital procoagulant and anticoagulant factor deficiency where virally inactivated or recombinant factor concentrates are preferred
- to treat bleeding alone or prolonged PT or PTT alone

Indication for cryoprecipitate

1. Hemophilia A
2. von Willebrand disease unresponsive to DDAVP(desmopressin)
3. DIC
4. Hypofibrinogenemia

Patient and donor plasma selection by ABO

Recipient	Donor
O	O, A, B, AB
A	A, AB
B	B, AB
AB	AB

Indications for albumin

1. Acute volume expansion in
   - Patients with chronic albumin depletion(protein-losing enteropathy with edema that is resistant to diuretics
   - Patients with hypovolemia shock
2. Long-term replacement, as in extensive burns

Clinical use of intravenous immunoglobulin(1)

I. Immunodeficiencies

1. Primary immunodeficiencies
2. Secondary immunodeficiencies

- malignancies with antibody deficiencies; multple myeloma, chronic lymphocytic leukemia, others
- protein-losing enteropathy with hypogammaglobulinemia
- nephrotic syndrome with hypogammaglobulinemia
- pediatric acquired immunodeficiency syndrome
- post-bone marrow transplantation

Clinical use of intravenous immunoglobulin(2)

II. Nonifectious uses of intravenous immunoglobulin

1. Proven benefit
   - Kawasaki syndrome
   - Immune thrombocytopenic purpura
   - Guillain-Barre syndrome
   - Dermatomyositis
2. Probable benefit
   - immune neutropenia
   - autoimmune hemolytic anemia
   - myastenia gravis
3. Possible benefit
   - anticardiolipin antibody syndrome
   - toxic shock syndrome

Adverse effects of transfusion(1)

I. Immunologic

1. Alloimmunization
2. Hemolytic transfusion reactions
   - immediate
   - delayed
3. Febric transfusions reactions
4. Allergic
5. Immunosuppressive effects
6. Transfusion-related acute lung injury (TRALI)
7. Post-transfusion purpura
8. Graft-versus-host disease

Adverse effects of transfusion(2)

II. Nonimmunologic

1. Volume overload
2. Massive transfusion: metabolic, hypothermia, dilutional, pulmonary microembolism
3. Transfusion hemosiderosis
4. Infections
   - Hepatitis(A, B, C, Δ, G,other
   - HIV
   - CMV
   - EBV
   - Bacterial contamination
   - Malaria
   - other organisms

Transfusion-related acute lung injury diagnostic criteria(TRALI)

Historical estimates suggest that TRALI occurs at a rate of approximately 0.04 to 0.1 percent of transfused patients or in approximately 1 in 5000 transfused blood components However, the true incidence of TRALI is not known, largely due to poor syndrome recognition

- Acute onset (during or within six hours of transfusion)
- Hypoxemia
- Bilateral infiltrates on frontal chest radiograph
- No evidence of circulatory overload/left atrial hypertension
- No pre-existing ALI/ARDS before transfusion

Transfusion-related acute lung injury (TRALI) Therapy

- 1. Ventilation
- 2. Diuretics
- 3. Steroids