

Blood Products



Blood Products

- Etiology of bleeding:
  - Platelet
    - Count and function need to be assessed.
  - Coagulation factors
    - Glycoproteins that are synthesized in the liver (except V and VIII – extrahepatic sites)
    - II, VII, IX and X are vit K dependent
    - 2 pathways: intrinsic (PTT) and extrinsic (PT)
  - Fibrinolysis
    - Primary fibrinolysis assoc w/ certain urinary tract operations, liver, oral cavity, and post-CPB state.



Blood Products

- Etiology of bleeding:
  - Endothelium
  - Mechanical



Blood Products – Lab Tests

- PTT:
  - PTT detects abnormalities in prekallikrein, Factors XII, XI, IX, VIII, X, V, II
  - Prolonged PTT – Hemophilia A & B, Factor XI deficiency, heparin therapy, lupus, acquired anti-8 antibodies
- PT:
  - PT detects abnormalities in Factors II, V, VII, X and fibrinogen



Blood Products – Lab Tests

- Both PT & PTT prolonged:
  - Multiple factors
  - Selective decrease in one or more common pathway factors
  - Fibrinogen level < 60-80 mg/dl



Blood Products – Lab Tests

- Thrombin time tests clot formation from fibrinogen – dec if fibrinogen is low or abnormal
- Bleeding time is variable based on many factors. It is not predictive of surgical bleeding.
  - Measure of qualitative abnormalities in platelet function and deficiencies
- ACT assesses adequacy of heparinization
- TEG measures the viscoelastic strength of whole blood as a clot is formed.



Blood Products

- Type and screen vs Type and crossmatch:
  - T&S determines ABO and Rh status and the presence of most commonly encountered antibodies – risk of adverse rxn is 1:1000
  - T&S takes about 5 mins
  - T&C determines ABO and Rh status as well as adverse rxn to even low incidence antigens – risk of rxn is 1:10,000
  - T&C takes about 45 mins



Blood Products

- T&S:
  - Type O red cells are mixed with pt serum
  - Antibody screen
- T&C
  - Type O red cells are mixed with pt serum
  - Antibody screen
  - Donor red cells are then mixed with the pt's serum to determine possible incompatibility



Blood Products – Intra Op Coagulopathies

- DIC:
  - Consumptive coagulopathy presenting as excessive bleeding or intravascular thrombosis
  - Consumes:
    - Platelets
    - Fibrinogen
    - Factors – V and VIII most frequently exhausted
  - Diagnosis requires evidence of systemic activation of both procoagulant and fibrinolytic systems, consumption of inhibitors and end organ damage



Blood Products – Intra Op Coagulopathies

- DIC:
  - Lab tests:
    - Inc PT/PTT – PT > 15 secs
    - Dec firinogen - < 150 mg% (nml = 150-200)
    - PLT < 150,000
    - Inc D Dimer
    - Inc Fibrin split products

If both increased – specificity = 97% & sensitivity = 100%

  - Treatment:
    - First treat underlying cause
    - Treat hypovolemia and acidosis
    - Heparin in thrombotic states



Blood Products – Intra Op Coagulopathies

- Liver Disease:
  - ⇒ coagulopathy
    - Dec factors
    - Dec clearance of FSPs ⇒ PLT dysfunction
    - Inc fibrinolysis
  - Treatment – replacement of deficient products and admin of DDAVP to enhance PLT fxn



Blood Products – Intra Op Coagulopathies

- Dilutional thrombocytopenia
  - After replacement of one entire blood volume, only 40% of PLTs remain
  - One unit of PLTs inc count by 10,000
- Hemolytic transfusion reaction
  - Suspect in presence of hypotension, hemoglobinuria, or DIC
  - Resp failure, pulm HTN, dec CO have been reported
  - Diagnosis is confirmed by the presence of free Hgb in spun plasma using the direct Coomb's test



Blood Products – Intra Op Coagulopathies

- Hemolytic transfusion reaction
  - Incidence – 1:4,000-6,000; fatal rxn = 1:100,000
  - Treatment:
    - Stop the transfusion
    - Repeat the crossmatch
    - Send off blood for free Hgb, PT, PTT, Fibrinogen
    - Maintain UO with fluids and diuretics



Blood Products – Intra Op Coagulopathies

- Vit K deficiency
  - Effects synthesis of factors II, VII, IX, X, and Protein C & S
  - The most common cause of prolonged PT in ICU pts – antibiotics (gut flora), malnutrition, fat malabsorption
  - Emergent therapy - FFP



Blood Products – Transfusion Risks

- Infectious risks:
  - HIV – 1:500,000
  - Hep C – 1:103,000
  - Hep B – 1:63,000
- Clerical risks – 1:12,000
- Allergic and febrile non-hemolytic reactions
  - Among the most common
  - 1-4% develop urticaria
  - Self-limited



Blood Products – Transfusion Risks

- Febrile hemolytic reaction
  - Inc temp, DIC, hypotension, hemoglobinuria
- Anaphylactic reaction
  - Mediated through antibodies to IgA immunoglobulins that are present in all donor plasma
  - IgA deficient pts require washed PRBCs
  - Wheezing and hypotension
- Transfusion related sepsis
  - PLT highest risk b/c at room temp – 100% of PLTs > 5 days old have > 100,000 gm of Staph



Blood Products – Transfusion Risks

- Transfusion related sepsis
  - Most common sepsis with PRBCs
    - 1. Pseudomonas
    - 2. Serratia
    - 3. Yersinia
- Transfusion related acute lung injury
  - 0.02% occurrence
  - Pts present with hypoxemia, bronchospasm, acute respiratory distress, bil pulm infiltrates
  - Self-limited – usually resolved in 24-48 hrs



Blood Products – Transfusion Risks

- Citrate intoxication
  - ⇒ hypocalcemia – hypotension, narrow pulse pressure, inc end diastolic pressure and CVP, tetany
  - Replete calcium
- Autologous transfusion
  - Best way to avoid transfusion risks
  - Can donate 1 unit/wk for 4 weeks before surgery



Blood Products – Transfusion Risks

- Massive blood transfusion
  - Defined as replacement of one or more blood volume in a 24 hr period.
  - Complications (PATCH)
    - Platelets – dec; Potassium – inc
    - ARDS; Acidosis
    - Temp dec
    - Citrate intoxication
    - Hepatitis

Blood Products

- Order of transfusion
  - Type specific partial crossmatch
  - Type specific uncrossmatched
  - Type O, Rh^- - can be used in emergency situations
- Transfusion

If Donor Is	Recipient Can Be
O	O,A,B,AB
A	A,AB
B	B,AB
AB	AB



Blood Products

- PRBCs
  - Indications for PRBC transfusion:
    - Only one – Increase O_2 carrying capacity
    - 12 million PRBC units transfused/yr and 25% of these are inappropriate transfusions
    - Always indicated for a Hgb <6 . A healthy pt can tolerate an HCT of 20%, but someone with CAD needs an HCT of at least 30%
    - High incidence of MI found in anemic pts, with CAD, post-op
    - 10 ml/kg will inc HCT 10%



Blood Products

- PRBCs
  - 75% of transfused RBCs are in the circulation 24 hrs after transfusion
  - PRBC HCT = 60%
  - Preservation
    - CPD-A (citrate, phosphate, dextrose, adenine) – shelf-life = 35 days at 1-6°C
    - ADSOL (adenine, dextrose, saline, mannitol) – shelf-life = 42 days
    - Deglycerolized blood – frozen with glycerol for storage, washed before transfusion



Blood Products

- PRBCs
  - Leucocyte-depleted blood
  - Washed – IgA deficient



Blood Products

- FFP
  - Contains all soluble coagulation factors
  - Recommended uses:
    - Urgent reversal of warfarin therapy
    - Correction of known coagulation factor deficiencies
    - Correction of microvascular bleeding in the presence on elevated PT, PTT, and after massive transfusion
    - Do not use for volume
    - Antithrombin III def



Blood Products

- Cryoprecipitate
  - Indications
    - Replace factor VIII (Hemo A), factor XIII, fibrinogen, fibronectin, and vWF



Blood Products

- Platelets
  - Repeated PLT transfusions will lead to anti-PLT antibodies
  - PLT count and activity are effective for about 2 hours in pts with a production defect. Unknown for consumptive pathology.
  - Indications:
    - Pre-op for PLT < 50,000
      - Remember that prophylactic transfusion is ineffective in the face of thromobcytopenia 2° to PLT destruction (ITP)



Blood Products

- Platelets
  - Indications:
    - Pts with microvascular bleeding whose PLT count is < 50,000
    - Pts with a normal PLT count who have PLT dysfunction