Blood Component Therapy

> Packed red blood cells (PRBC):

- Consent: Always consent the patient or family member for transfusion of blood products on admission, unless emergent.
- Dose effect: 1 unit PRBC (volume = 350 cc) should raise Hgb by about 1 g/dl
- Leukocyte filtered/reduced:
WBCs are the chief cause of alloimmunization to HLA antigens, which leads to future febrile transfusion reactions and platelet refractoriness. Indicated for patients who require long term transfusion support (Bone marrow transplant, leukemia, chemotherapy), and are at risk of becoming refractory to platelets, or with recurrent febrile reactions.
- Irradiated blood products:
Products are irradiated to kill donor stem cells which (rarely) cause transfusion-associated GVHD. Indicated for BMT recipients, immunosuppressed patients, when donor and recipient are blood relatives, and patients receiving HLA matched platelets.
- Saline washed RBC:
RBC washed to remove plasma proteins, electrolytes, and antibodies. Indicated only in patients with history of severe transfusion reactions, hyperkalemia, paroxysmal nocturnal hemoglobinuria. Very expensive!
- Indications:
Active bleeding and one of the following:
1 - Blood loss > 500cc or 15% of blood volume (70 cc/kg body weight)
2- SBP < 100 mmHg or 20% fall in SBP
3- Pulse > 100 bpm
4- General anesthesia and Hgb < 9 g/dl
5- Chronic, symptomatic anemia (generally Hgb < 9g/dl)
6- Chronic transfusions to suppress endogenous Hgb in selected patients with sickle cell disease
7- Hgb < 10 g/dl in patients with known coronary artery disease, unstable angina, or acute MI. No RTC trial data to support this practice. One RCT (n=428) in patients undergoing CABG randomized patients to transfusion only if Hgb < 8 g/dL or standard practice (generally Hgb > 9.0) and found no mortality differences.
9- ICU mortality data with clear evidence for more restrictive transfusion (Hgb<7.0) practices

- Other considerations:
Patients with chronic anemia increase plasma volume in order to maintain an adequate cardiac output.
The volume associated with transfusion will cause overload and must be done slowly to avoid precipitating CHF (4 hours per unit vs. 5-10 min/unit in a hypotensive patient with acute blood loss).
Consider transfusing in splits of ½ volume over same time (4 hours per split is the slowest rate at which blood may be transfused).
Consider Lasix 20-40 mg IV to avoid fluid overload during transfusion of multiple units.

> Platelets:

- General:
1- 1 unit single donor platelets (SDP) = 7 units of random donor platelets (a hemostatic dose for bleeding in an adult patient)
2- General dose is 1 unit random donor platelets per 10 kg body weight ≈ 1 unit single donor platelets for a 70 kg person.
3- For every 1 unit of SDP, the patient receives hemostatic levels of coagulation factors equivalent to 1 unit of fresh frozen plasma.
- Indications:
1- Platelet count < 5-10K in ITP or significant purpura
2- Platelet count < 10K in J patients, or patients not predisposed to spontaneous bleeding. No change in bleeding events in RCT when compared to < 20K as transfusion threshold
4- Platelet count < 20K and a clinical factor that would be associated with risk of spontaneous bleeding (Temperature > 38.5°C/Infection, concurrent coagulopathy, DIC, hepatic or renal failure, marked splenomegaly)
5- Platelet count < 50K and surgery or post-op bleeding
6- Platelet count < 50K and invasive procedure (LP, indwelling lines, liver or transbronchial biopsy, epidural puncture)
7- Platelet count < 100K with active bleeding
- Dose effect: 1 unit/kg body weight of platelets (1 unit SDP) should increase platelet count by 50K by 10-60 minutes, and by 40K at 18-24 hours post-transfusion.
- Premedication: Tylenol 650 mg p.o. x 1, Benadryl 25-50 mg p.o. **OR** IV x 1
- Refractoriness to platelet transfusions: A patient is considered refractory to platelets if 3 transfusions within 2 weeks fail to yield an adequate post-transfusion response. There are specific formulas for calculating an expected response, but in general, each unit should inc platelets by 35-40K.
1- Causes: fever, sepsis, splenomegaly, DIC, drugs, platelet consumption, s/p BMT (likely multifactorial etiology, in one series < 40% post-BMT transfusions resulted in appropriate rise in platelet count), alloimmunization with antibody mediated destruction of circulating platelets (towards HLA class I antigen)
2- Diagnosis: check rise 60 minutes after transfusion.
3- Appropriate rise with decrease over next 24 hours®sepsis, DIC, post BMT, etc. No rise at 60 minutes indicates alloimmunization. Order platelet antibody screening test (results in 2-3 days).
4- Treatment: if test positive, or while results pending, order "HLA matched" platelets and check

platelet count 10 minutes to 1 hour following transfusion to document appropriate rise. Minimal options in acute bleed situation.
Effort should be made to avoid alloimmunization in at risk patients through irradiation, leukocyte reduction (comparable in RCT) or both.

Fresh frozen plasma (FFP):

- Description:
FFP is made by separating plasma from a unit of whole blood. Contains all clotting factors. One unit of FFP contains: 200-250 cc volume, 400 mg fibrinogen, 200 units of other factors (factors V, VII, XI, ATIII, Protein C, Protein S)
- Indications:
1- Active bleeding or risk of bleeding if PT and/or PTT> 1.5-1.8x normal.
2- Patient with massive bleeding at high risk for clotting factor deficiency while coags pending. Common causes of factor deficiency: liver disease, vitamin K deficiency, DIC, hemorrhage, TTP (treatment with plasma exchange)
3- Reversal of warfarin therapy. Minimal evidence that FFP can correct mildly elevated INR (< 1.8).
- Guidelines for use:
1- Starting dose 15 cc/kg = 4-6 units (dose needed to replace 25% clotting factors, minimum amount necessary to obtain hemostasis)
2- Maximum effect declines after 2-4 hours, so infuse rapidly at time of bleeding or no more than 1 hour prior to anticipated bleeding.
3- Administer fewer units of FFP when transfusing platelets since 1 unit SDP contains equivalent clotting factors to 1 unit FFP.
4- Consider Lasix IV when multiple units FFP given rapidly to avoid fluid overload.

Cryoprecipitate: (Contains fibrinogen, factor VIII, and von Willebrand factor)

- Indications:
1- Fibrinogen < 100 mg/dl (as in DIC)
2- Preparation of topical fibrin glue for surgical hemostasis
Concentrated factor VIII and von Willebrand factor are preferred treatments of Hemophilia A and von Willebrand's disease since cryoprecipitate not virus inactivated, thus carrying a higher risk for virus transmission.
- Dose effect:
1- Usual starting dose is 10 units. Each unit raises fibrinogen by about **8 mg/dl**. Follow fibrinogen levels every 6-8 hours to guide frequency and quantity of administration.

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