Adults

1. **Packed Cells**: Dosage one unit of red blood cells will raise the Hbg by 1 gram; Hct by 3% in a 70Kg adult. 
   Red Blood Cells should be transfused based on clinical need. In the absence of acute hemorrhage, RBC transfusion should be given as single units. Hemoglobin equilibrates 15 min after transfusion of a non-bleeding or hemolyzing patient.
   1. Symptomatic anemia in a normovolemic patient.
      a. Symptomatic anemia should be documented by symptoms of weakness, headache, dizziness, disorientation, breathlessness, palpitations or chest pain and signs of pallor and tachycardia
   2. Hemoglobin < 7g/dL or Hematocrit < .21% includes critically ill patients with stable cardiac disease; Hemoglobin <8g/dL in a young, healthy patient or patients with chronic symptomatic anemia; < 8g/dL acute coronary syndromes on hospital admission.
   3. Acute loss of at least 15% of estimated blood volume with evidence of inadequate oxygen delivery following volume resuscitation.
   4. Preoperative hemoglobin < 8 g/dL and operative procedures or clinical situations associated with major blood loss.
   5. Severe Thalassemia maintain Hgb at 9.5-10.5.
   6. Active bleeding/ lab results not available.
   7. Patient with Septic Shock and Hemoglobin less than 10.
   8. Notes:
      a. **RBC should not be used to treat anemia that can be corrected with non-transfusion therapy** (example, iron therapy)
      b. **RBC should not be used as a source of blood volume, to increase oncotic pressure, or improve a sense of well being.**
      c. The use of only Hgb level as a transfusion trigger should be avoided

2. **Platelets**: Note: If quick reversal is required, platelet transfusion may be appropriate to reverse the pharmacological effects of PLAVIX. Platelets are available as one (1) apheresis unit equivalent to 6-8 random units. Platelets are not readily available at JMC they must be ordered and delivered. BMC does occasionally have a unit available.

   **Measure platelet count response 10-60 minutes after transfusion.**

   1. Prophylaxis <10x10^3/µL platelet count
   2. Significant bleeding <50x10^3/µL platelet count
   3. Invasive procedure <50x10^3/µL platelet count
   4. Massive blood loss and abnormal bleeding (platelet count pending)
   5. Note:
      a. Neurologic, ophthalmologic procedures and multiple traumas may require a platelet count near 100,000/µL
      b. Transfusion may be required with adequate counts when known or suspected plt dysfunction results in bleeding.
      c. Not indicated when plt dysfunction is extrinsic to the plt(uremia, hyperglobulinemia, certain types of von Willebrand disease
      d. Not indicated for ITP patients; except for elective splenectomy with plt counts 10,000 µL.
      e. Not indicated for TTP, except for life threatening hemorrhage or before invasive procedures.
3. Fresh Frozen Plasma and FP24 (Plasma Frozen within 24 hours after Phlebotomy) One unit contains approximately 220-300 mL of plasma, and the usual dosage is 10 to 20 mL/Kg. Thawed Plasma used interchangeably. Consider Kcentra or Prothrombin Complex (This product is not used at JMC but it is available at BMC) for Coumadin reversal in serious/life threatening bleeding.

1. Severe blood loss (approximately one blood volume). Coagulation testing not available.
2. PT or PTT >1.5 times the upper limit of normal or mean reference range in a non-bleeding patient scheduled for or undergoing surgery or invasive procedure.
3. PostOp bleeding/persistent oozing with documented coag abnormality (PT or PTT>1.5 normal).
4. Disseminated intravascular coagulation (DIC), abnormal bleeding.
5. Patients with multiple factor deficiencies, including severe liver disease to correct or prevent bleeding complications.
7. Inherited factory deficiency (X,VII,V). Used only when virus inactivated concentrates are not available.
8. Thrombotic Thrombocytopenic Purpura (TTP) therapeutic plasma exchange.
9. Massive Transfusion (10 units of blood in a 24 hour period) with coagulopathic bleeding.
10. Note:
   a. Do not use FFP when coagulopathy can be corrected more effectively with specific therapy, such as Vitamin K, Prothrombin Complex, Cryoprecipitate, or Factor VIII concentrates.
   b. Do not use FFP when blood volume can be safely and adequately replaced with other volume expanders.
   c. Do not use FP24 or Thawed Plasma for replacement of coagulation Factors V and VIII.
   d. Do not use for normalizing abnormal coagulation results in the absence of bleeding.

4. Cryoprecipitate: Hypofibrinogenemia is not likely to contribute to or cause hemorrhage until the fibrinogen falls below 50-80mg/dL: Results unreliable when less than 100 mg/dL. Dose is one pool of 5 units raises the fibrinogen ~50mg/dL. (This product is not used at JMC but it is available at BMC)
   1. von Willebrand’s disease emergency source
   2. Hemophilia A (if virus inactivated factor VIII concentrate is not available)
   3. Hypofibrinogenemia (fibrinogen <80-100 mg/dL) particularly in DIC.
   4. Used in isolated factor XIII deficiency.
   5. Fibrin sealant is preferable to cryoprecipitate with respect to safety and efficacy.
   6. Massive transfusion when one or more blood volumes (4-5,000mL in an adult) have been replaced and Fibrinogen <100 mg/dL.

5. Factor VIII Concentrate (Trauma dosage 20-25 IU/Kg; bleed 15-25 IU/Kg) (This product is not used at JMC it is available at BMC)
   1. Hemophilia A or severe von Willebrand’s disease
   2. Transfuse virus inactivated concentrates.

6. Albumin: (available at JMC and BMC through the pharmacy)
   Serum albumin >2.0g/dL:
   1. Fluid replacement after paracentesis of over 4L.
   2. Cirrhosis and spontaneous bacterial peritonitis.
   3. During hemodialysis for hypotension increased lung water/pulmonary edema, low colloid oncotic pressure.

   Serum albumin <2.0g/dL:
   1. Hypotension due hypovolemia
2. Edema or ascites refractory to diuretics
3. ARDS
4. Gut dysfunction due to bowel wall edema.

7. Rhogam: available at both JMC and BMC for Rh negative child bearing age female
   1. Spontaneous abortion
   2. Antenatal 28 week gestation
   3. Postpartum of Rh positive or unknown Rh type of infant
   4. Recipient of Rh positive platelet concentrates.
   5. Amniocentesis
   6. Invasive obstetric procedures
   7. Abdominal trauma during pregnancy

Procedural Insert (for informational purposes)

Possible Transfusion Complications:
1. Transfusion reaction (all will be reviewed)
2. Suspected Post Transfusion Infection (SPTI) HBV, HBC, HIV, HTLV, others
   a. Report suspected cases to the Blood Bank using appropriate form.
   b. Order appropriate confirmatory testing
   c. Blood Bank is responsible for reports to supplier for them to initiate investigation of donors.

Transfusion-Associated Circulatory Overload (TACO): is defined as pulmonary edema precipitated by transfusion.
Patient’s risk factors include:
1. CHF,
2. Positive fluid balance,
3. Large-volume
4. Rapid rate infusion (especially with FFP)
5. Chronic renal failure
6. Extremes of age

Patients at risk for TACO should only be transfused when the benefits of transfusion outweigh the risks.

Several approaches have been proposed to manage TACO including:
1. Administer diuretics before transfusion or between units of transfusions.
2. Decrease the transfusion rate
3. Use alternative to FFP for warfarin reversal (e.g. Kcentra)
4. Careful monitoring of vital signs throughout the transfusion may help to prevent and to immediately recognize TACO.

Considerations for patients with Sickle Cell Disease (SCD): Chronic transfusions can reduce the risk of recurrent stroke to less than 10% if hemoglobin (Hbg) levels are maintained between 8 and 9 g/dL with a Hbg S level less than 30%. In general patients with SCD should not be transfused if Hbg > 10 g/dL. Units should be Hgb S negative and leukocyte reduced to prevent HLA alloimmunization and platelet refractoriness in preparation for possible stem cell transplantation. Since patients with SCD have the highest rates of alloimmunization of any patient group, it is best to perform a thorough phenotype analysis of a patient’s red cells before beginning transfusion therapy. The most common protocol is the provide phenotypically compatible blood for C,E, and Kell antigens to prevent alloimmunization. Once patients have developed a red cell antibody, phenotyping should be extended for Fy, Jk and S antigens to prevent further alloimmunization. Due to the complicated nature of finding the best possible product for the sickle cell patient, ADVANCED notification of the intent to transfuse this patient population is extremely important.
Considerations for anemic patients receiving or awaiting Chemo or Radiotherapy: Nearly 50% of all cancer patients experience anemia associated with the disease or treatment regimen. Anemia (defined as Hgb <11 g/dL) has been shown to have effect on tumor hypoxemia and thus the tumor’s response to chemo or radiotherapy, as well as quality of life for the patient. However, in general Hgb levels > 12g/dL are associated with increased morbidity and mortality. Recent clinical studies indicate transfusion triggers differ, thus the Hgb goals are cancer specific.

For patients that do not get appropriate platelet increments: consideration should be given for specially selected platelets, such as HLA-matched, crossmatch-compatible, HLA antigen negative and HPA antigen negative platelets. These procedures are performed by our reference laboratory testing. Communication and consultation between the physician and the Medical Director of the reference laboratory may be necessary to ensure appropriate testing is performed for each individual patient test case.

For reference: “A reversal protocol” for hemorrhagic complications after administration of rtPA (recombinant tissue plasminogen activator) has been developed and recommended by Massachusetts General Hospital Stroke Service. Rt-PA can be reversed with FFP, cryoprecipitate, and platelets
- 2 units FFP every 6 hours for 24 hours after dose
- 20 units of Cryoprecipitate. If Fibrinogen level < 200 mg/dL at 1 hour, repeat cryo dose
- Pheresis platelets

Guidelines for Correction of Excess Oral Anticoagulation prior to Procedure: Recommended based on American Red Cross Blood Management Guideline (success.redcross.org)

<table>
<thead>
<tr>
<th>Non-Urgent</th>
<th>Urgent (not bleeding)</th>
<th>Urgent (bleeding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop meds 5 days prior</td>
<td>PCC (BMC only) or Plasma prior to procedure</td>
<td>Vit K 5-10 mg IV – repeat every 12 hours as needed</td>
</tr>
<tr>
<td>Check INR 1-2 days prior</td>
<td>Repeat in 6-12 hours if INR high</td>
<td>PCC (BMC only) or Plasma- repeat every 6 hour as needed</td>
</tr>
<tr>
<td>INR &gt;1.5 give Vit K 1-2mg</td>
<td>Vit K 5-10 mg PO/IV is sustained reversal desired</td>
<td></td>
</tr>
</tbody>
</table>

The American Red Cross recommends holding doses of Coumadin for INR 4.5-9 plus vitamin K for INR >9.0 in non-bleeding patient.
Kcentra Prothrombin Complex Concentrate (BMC only) is not to be used for the reversal of Coumadin in the absence of severe bleeding.
Dosing recommendations for serious/life – threatening bleeding:

<table>
<thead>
<tr>
<th>INR</th>
<th>Dosing</th>
<th>Not to Exceed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3.9</td>
<td>Dose 25 IU/kg</td>
<td>2500 U</td>
</tr>
<tr>
<td>4-5.9</td>
<td>Dose 35 IU/kg</td>
<td>3500 U</td>
</tr>
<tr>
<td>&gt;6</td>
<td>Dose 50 IU/kg</td>
<td>5000 U</td>
</tr>
</tbody>
</table>

Dosing based on body weight. Dose based on actual potency as stated on the carton, which may vary from 20-31 Factor IX units/ml after constitution.

Note: Prothrombin Complex Concentrates have not been approved for the reversal of the newer oral anticoagulants at this time.
Newborn (under 4 months of age)

1. Whole blood (Product must be special ordered)
   Exchange transfusion (Not performed at JMC)
   1. Hyperbilirubinemia in a well term infant with neonatal bilirubin >25mg/dL
   2. Hyperbilirubinemia in a sick term or pre-term infant.
   3. Hemolytic disease with erythroblastosis documented by Rh or ABO incompatibility.

2. Packed cells: Dosage: a dose of 10-15 mL/Kg will raise Hbg by about 3 g/dL. Give AS1 or AS3 red cells to decrease plasma exposure and have an approximate hct yield of 60%
   Group O negative CMV negative, Hgb S negative, leukoreduced, as fresh as possible. This product must be ordered at JMC. BMC may have one available.
   1. Hematocrit (HCT) <20% with low retic count and symptomatic anemia (tachycardia, tachypnea, poor feeding)
   2. HCT <30% and with any of the following:
      a. On >35% oxygen hood
      b. On oxygen by nasal cannula
      c. On continuous positive airway pressure and/or intermittent mandatory ventilation on mechanical ventilation
      d. With significant tachycardia or tachypnea (heart rate >180 beats/min for 24 hours or respiratory rate >80 for 24 hours.
      e. With significant apnea or bradycardia
      f. With low weight gain
   3. HCT <35% with either of the following:
      a. On >35% oxygen hood.
      b. On continuous positive airway pressure/intermittent mandatory ventilation with mean airway pressure > 6-8 cm of water.
   4. HCT <45% with either of the following:
      a. On extracorporeal membrane oxygenation (ECMO)
      b. With congenital cyanotic heart disease

3. Platelets guidelines in Neonates and Older children: Dosage: 5-10mL/Kg of platelets should result in a 50,000-100,000/mm.
   a. With Thrombocytopenia: and a failure of platelet production
      i. Platelet count 5,000 – 10,000.
      ii. Platelet count <30,000 in neonates.
      iii. Platelet count < 50,000 in stable premature infants with active bleeding or before invasive procedure.
      iv. Platelet count <100,000 in sick premature infant with active bleeding or before invasive procedure.
   b. Without Thrombocytopenia:
      i. Active bleeding in association with qualitative platelet defect.
      ii. Unexplained excessive bleeding in a patient undergoing cardio bypass
      iii. Patient undergoing ECMO

4. Fresh Frozen Plasma in Neonates and Older Children:
   a. Support during DIC
   b. Replacement therapy when specific factor concentrates are not available or during therapeutic plasma exchange.
   c. Reversal of Warfarin in an emergency situation, such as before invasive procedure with active bleeding.
5. **Cryoprecipitate in Neonates and Older Children**: Dosage is 1 unit per 7-10 kg. Frequency depends on the half-life and recovery of the factor being replaced.
   a. Hypofibrinogenemia or dysfibrinogen with active bleeding or while undergoing an invasive procedure.
   b. Factor XIII deficiency with active bleeding or while undergoing an invasive procedure.
   c. Hemophilia A when factor VIII is not available.
   d. Von Willebrand’s disease with active bleeding when DDAVP is contraindicated or not available.
   e. When factor concentrate is not available.

### Child Guidelines for RBC in patients older than 4 months

1. **Packed Cells**
   1. Emergency surgical procedure in patients with significant postop anemia.
   2. Preop anemia when other corrective therapy is not available.
   4. HCT <24% and:
      a. Preop with signs and symptoms of anemia.
      b. On chemotherapy/radiation therapy.
      c. Chronic congenital or acquired symptomatic anemia.
   5. Acute blood loss of >15% blood volume with hypovolemia and not responsive to other therapy.
   6. HCT <40% with respiratory failure or on a ventilator.
   7. Sickle Cell Disease and the following:
      a. Cerebrovascular accident
      b. Acute chest syndrome
      c. Splenic sequestration
      d. Aplastic Crisis
      e. Recurrent Priapism
      f. Preop with general anesthesia (Target is 10 mg/dL)

---

**Blood Components Transfusion Criteria References**

Current Jefferson Medical Center and Berkley Medical Center Blood usage criteria
AABB standards 30th edition
Guidelines for Blood Management and Blood Utilization  AABB publication 2011
Arc Management Guidelines (success.redcross.org) 2013
RBC Transfusion Data Card (Adult and Pediatric), AABB, 2012.
Transfusion Patient Blood Management Oct 2014
UNIVERSITY HEALTHCARE

Blood Components Transfusion Criteria

Berkley Medical Center
Applies to: Jefferson Medical Center

Distribution:
BMC Blood Bank Manual
JMC Blood Bank Manual
MCN Policy Manager

Prepared By:
Barbara Bladen and Paula Bryant

Approved By:
Jeffrey Stead, MD, Medical Director/Date

Reviewed By: Date:

Revision (Item): Page: Date: Revised By:
Updated Format and combined with BMC for joint policy, references changed All 24OCT16 PTB

Page 7 of 7