

BloodCenter of Wisconsin

**2007 ADULT BLOOD UTILIZATION
REVIEW GUIDELINES**

RED BLOOD CELLS

How Supplied: All Red Blood Cell products supplied by BloodCenter of Wisconsin are leukocyte-reduced.

Utilization Review Guidelines:

Red cell transfusion may be appropriate to improve oxygen carrying capacity. Documentation of the indication(s) for transfusion and special circumstances for transfusion that take place outside these guidelines is recommended.

Indications:

1. Acute Blood Loss: maintain circulating blood volume and hemoglobin concentration ≥ 7 g/dL in otherwise healthy patients; >8 g/dL in elderly patients, and those with known cardiac or respiratory disease.
 - 15-30% loss of blood volume: red cell transfusion likely not required
 - 30-40% loss of blood volume: rapid volume replacement with crystalloid or colloids, red cell transfusion will probably be required
 - $>40\%$ loss of blood volume: red cell transfusion will almost certainly be required
2. Perioperative Transfusions:
 - Hemoglobin concentration <7 g/dL: red cell transfusion is usually required
 - Hemoglobin concentration 7-10 g/dL: red cell transfusion may be appropriate based on indications of organ ischemia, potential or ongoing blood loss, volume status and risk factors for complications of inadequate oxygenation
 - Hemoglobin concentration >10 g/dL: red cell transfusion usually unnecessary
3. Symptomatic Anemia in a normovolemic patient (generally not needed if Hgb ≥ 10 g/dL)
4. Stable, critically ill patients: Hemoglobin <8 g/dL

Outcome Indicators:

- Improvement in clinical status of patient (relief of symptoms of decreased oxygen carrying capacity)
- Improvement in Hgb/Hct (one unit of red cells should raise the Hgb on average 1g/dL or Hct 3% in an adult). One hour post-transfusion Hgb is equivalent to one drawn within 24 hours of transfusion.

Comments:

- Transfusion of a **single** unit may be appropriate; transfusion of additional units should be based on **clinical assessment of patient**
- Patients with co-morbid conditions such as coronary artery disease, pulmonary disease, or evidence of acute MI have less tolerance for anemia
- Transfusions should be performed only after appropriate alternative therapies have been considered (e.g. iron, vitamin B12, folate and erythropoietin)

WHOLE BLOOD:

- **How supplied:** 1 unit contains approx. 500 ml; all whole blood units are leukocyte-reduced except autologous units. Depending on ABO/Rh type, availability of whole blood may be limited.
- **Indications:** For patients who require oxygen carrying capacity and volume replacement.

GENERAL COMMENTS (RED BLOOD CELLS):

Autologous Blood Usage:

The criteria for use of autologous blood products should be the same as that of allogeneic blood. Autologous blood transfusions carry the risk of bacterial contamination as well as clerical error or misidentification that may result in transfusion of the wrong unit of blood. Suggested situations for autologous blood product donation include:

- orthopedic, vascular, cardiac or thoracic surgery, radical prostatectomy or other elective procedures where RBC transfusion is frequently administered
- elective surgery in patients with known bleeding disorders (von Willebrand disease) who may need blood
- presence of red cell alloantibodies that make provision of blood components difficult

Comments:

- Strong consideration should be given to the use of perioperative blood recovery and/or acute normovolemic hemodilution in place of preoperative autologous blood donation
- Preoperative donation is discouraged for procedures that generally do not require transfusion
- Consider use of iron replacement therapy to prevent pre-operative anemia prior to use of autologous blood donation
- Patient selection for autologous donation is determined by the patient's physician
- In SE Wisconsin, 50-60% of preoperative autologous blood donation units are not used and discarded. Autologous units can not be used for allogeneic transfusions.

Directed Donations:

The donor of a directed donation must qualify for donation using the same criteria as allogeneic volunteer donors. Additionally, antibodies against paternal antigens may be formed by women during pregnancy. Therefore the following general rules should be considered:

- Transfusion from a woman to her biologic children or the father of her biologic children should be avoided
- A woman should not receive a transfusion from a man or his blood relatives if she has had or is planning to have his children

References:

Herbert PC, Fergusson DA. A Multicenter, Randomized, controlled Clinical Trial of Transfusion Requirements in Critical Care. *New England Journal of Medicine* 1999;340:409-417.

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Rao SV et al. Relationship of Blood Transfusion and Clinical Outcomes in Patients with Acute Coronary Disease. *JAMA* 2004; 292:1555-1562.

Corwin HL et al. The CRIT Study: Anemia and Blood Transfusion in the Critically ill – Current Clinical Practice in the United States. *Critical Care Medicine* 2004;32:39-52.

Circular of Information for the Use of Blood and Blood Components. AABB. July 2002.

Society of Thoracic Surgeons Blood Conservation Guideline Task Force. Perioperative Blood Transfusion and Blood Conservation in Cardiac Surgery. *Annals of Thoracic Surgery* 2007; 83: S27-S86.

Jansen AJG. et al. Feasibility of a Restrictive Red-cell Transfusion Policy for Patients Treated with Intensive Chemotherapy for Acute Myeloid Leukemia. *Transfusion Medicine* 2004;14(1):33-38.

Guideline for the Clinical Use of Red Cell Transfusions. *British Journal of Haematology* 2001; 113: 24-31.

Practice Guidelines for Perioperative Blood Transfusion & Adjuvant Therapies: An Updated Report by the American Society of Anesthesiologists Task Force. *Anesthesiology* July 2006; 105(1):198-208.

Goodnough, LT. Autologous Blood Transfusion. *Critical Care* 2004; 8(Suppl.2): S49-S52.

Vincent JL et al. Anemia and Blood Transfusion in Critically Ill Patients. *JAMA* 2002; 288(12): 1499-1507.

Ma M, Eckert K, Ralley F and Chin-Yee I. A Retrospective Study Evaluating Single-Unit Red Blood Cell Transfusions in Reducing Allogeneic Blood Exposure. *Transfusion Medicine* 2005; 15: 307-311.

PLATELETS

How Supplied: All platelets supplied by BloodCenter of Wisconsin are leukocyte-reduced apheresis platelets. One single apheresis platelet unit is equivalent to 6 whole blood-derived platelets (e.g. pool of six).

Utilization Review Guidelines:

Platelets are administered to patients with known thrombocytopenia or platelet function defects for the prevention and treatment of hemorrhage. Documentation of the indication(s) for a transfusion episode and special circumstances for transfusion that take place outside these guidelines is recommended.

Indications:

1. Active bleeding and platelet count $<50,000/\mu\text{l}$ or platelet function defect
2. Prophylaxis treatment in hematology/oncology patients:
 - platelet count $<10,000/\mu\text{l}$ in stable patient
 - platelet count $<20,000/\mu\text{l}$ and presence of risk factor for bleeding (h/o bleeding, infection, DIC)
3. Surgical/invasive procedures:
 - platelet count $<50,000/\mu\text{l}$ where operative field can be visualized
 - platelet count $<100,000/\mu\text{l}$ for CNS, ophthalmic, airway or other areas where microvascular bleeding is harmful
 - documented qualitative platelet function defect
 - Open heart surgery and:
 - a. microvascular bleeding and platelet count $<100,000/\mu\text{l}$
 - b. microvascular bleeding and platelet function defect
 - c. microvascular bleeding and non-diagnostic coagulation abnormality (e.g. post-op chest tube drainage $>500\text{cc}$ in 6 hours)
4. In the setting of massive blood transfusion, early platelet support may be necessary to prevent or treat dilutional thrombocytopenia. Laboratory monitoring of coagulation studies is recommended.

Outcome Indicators:

- Cessation or reduction of bleeding
- Rise in platelet count by $30,000\text{-}60,000/\mu\text{l}$ in a 70 kg recipient within 4 hours of transfusion of a single apheresis platelet unit

Comments:

- Platelet function defect should be documented by abnormal laboratory assessment of platelet function; or presumed due to platelet inhibitor medications, hypothermia, or use of mechanical devices known to affect platelet function.
- Use of platelet inhibitor medications can affect platelet function. Recommendations for stopping medication prior to invasive procedures vary with the medication and clinical situation. Use of certain platelet function tests may help assess the level of platelet inhibition. Platelet replacement of 1-2 units is usually adequate to control bleeding.
- Platelet transfusion is generally avoided in thrombotic thrombocytopenic purpura (TTP), hemolytic uremic syndrome (HUS), heparin-induced thrombocytopenia (HIT) or idiopathic autoimmune thrombocytopenic purpura (ITP).

- Prophylactic platelet transfusions are generally not indicated for patients with chronic, stable, severe thrombocytopenia as can be seen in aplastic anemia or myelodysplastic diseases. Platelet transfusions for symptomatic thrombocytopenia (minor or moderate bleeding) are a more rationale approach in such patients.

References:

Guidelines for the Use of Platelet Transfusions. *British Journal of Haematology* 2003;122:10-23.

Shiffer CA, Anderson KC et al. Platelet Transfusion for Patients with Cancer: Clinical Practice Guidelines of the American Society of Clinical Oncology. *Journal of Clinical Oncology* 2001;19:1519-1538.

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Gajic O, Dzik WH, Toy, P. Fresh Frozen Plasma and Platelet Transfusion for Nonbleeding Patients in the Intensive Care Unit: Benefit or Harm? *Critical Care Medicine* 2006;34(5):S170-S173).

Tanaka K, Szlam F, Andrew, BK, Vega, JD, Levy, JH. Clopidogrel (Plavix ®) and Cardiac Surgical Patients: Implications for Platelet Function Monitoring and Postoperative bleeding. *Platelets* 2004;15(5):325-332.

Heal JM, Blumberg N. Optimizing Platelet Transfusion Therapy. *Blood Review* 2004;18:149-165.

Gmur J, Burger J, Schanz U, et al. Safety of Stringent Prophylactic Platelet Transfusion policy for patients with Acute Leukemia. *Lancet* 1991;338:1223-1226.

Rebulla P, Finazzi G, Marangoni F, et al. The Threshold for Prophylactic Platelet Transfusions in Adults with Acute Myeloid Leukemia. *N Engl J Med* 1997;337:1870-1875.

Vilahur G, Choi BG, Zafar Mu, et al. Normalization of Platelet Reactivity in Clogidogrel-Treated Subjects. *J Thrombosis and Hemostasis* 2007; 5(1):82-90.

GRANULOCYTES

How Supplied: All requests for granulocytes are referred to a BloodCenter of Wisconsin physician for consultation with the ordering physician. Granulocytes are collected from G-CSF-stimulated donors and a series of 5 collections are initially scheduled. Granulocytes collected from G-CSF-stimulated donors contain on average $3-4 \times 10^{10}$ granulocytes per unit.

Utilization Review Guidelines:

Granulocytes can be administered for the treatment of severe neutropenia with the following indications. Documentation of the indication(s) for a transfusion episode and special circumstances for transfusion that take place outside these guidelines is recommended

Indications:

- Severe neutropenia (absolute neutrophil count $<500/\mu\text{l}$) with reversible marrow hypoplasia, documented bacterial or fungal infection unresponsive to 48 hours of appropriate antibiotic therapy
- Patients with severe neutrophil dysfunction and bacterial or fungal infection

Outcome Indicators:

- Clinical resolution of infection
- Neutrophil count $>500/\mu\text{l}$

Comments:

- Granulocytes must be irradiated before use
- Granulocytes have a maximum 24 hour shelf life but have best efficacy when transfused as soon as possible after collection
- Generally not for use in patients with bone marrow failure and no hope of neutrophil recovery

References:

Atallah E, Schiffer C. Granulocyte Transfusion. *Current Opinion in Hematology* 2006;13:45-49.

Strong, D (ed). Blood Bulletin. Vol. 2. 2000;4:2-3.

Clinical Guidelines for the Use of Granulocyte Transfusion. 2007 www.blood.co.uk; accessed on 6/28/2007.

Einsele H, Northoff H, Neumeister B. Granulocyte Transfusion. *Vox Sang* 2004;87(Suppl 2): 5205-5208.

Schiffer C. Granulocyte Transfusion Therapy 2006: The Comeback Kid. *Medical Mycology* 2006;44:5393-5386.

PLASMA

How Supplied:

Fresh Frozen Plasma/FP-24- can be used interchangeably; contain similar levels of clotting factors. The difference between the two is that FFP is frozen within 8 hours of collection while FP-24 is frozen within 24 hours of collection

Thawed plasma – use is determined by individual institutional policy

Cryo-poor plasma – contains limited or no Factor VIII, vWF, fibrinogen, or fibronectin and is used solely in the treatment of thrombotic thrombocytopenic purpura (TTP)

Utilization Review Guidelines:

Plasma products are administered for treatment of patients with coagulation deficits and one or more of the indications listed below. Documentation of the indication(s) for a transfusion episode and special circumstances for transfusion that take place outside these guidelines is recommended.

Indications:

1. Active bleeding and documented coagulopathy (PTT >1.5x median of normal range; INR>1.7). Common settings include:
 - Liver disease with coagulopathy
 - Emergent reversal of Warfarin effect
 - a. co-administration of vitamin K should be considered
 - Disseminating Intravascular Coagulopathy (DIC)
 - a. evaluate for hypofibrinogenemia; consider administration of cryoprecipitate
 - Dilutional coagulopathy/surgical bleeding
 - a. best guided by timely coagulation testing
 - Replacement of single factor deficiencies when no virus safe single factor concentrate product is available
 - a. Factor XI, V most common deficiency
 - Replacement fluid in therapeutic plasma exchange when bleeding or additional bleeding risks are present

Dosing: 10-15ml/kg of body weight (3-4 units generally, results in total volume to be infused of 800-1000ml)

2. No active bleeding but documented coagulopathy (PTT >1.5x median of normal range; INR>1.7)
 - Prophylaxis in patients undergoing surgery or invasive procedures if bleeding is likely
3. Treatment of thrombotic thrombocytopenic purpura (TTP)
 - FFP/FP24, Thawed plasma and cryo-poor plasma are all acceptable

Outcome Indicators:

- Improvement of INR or PTT
- Prevention and/or cessation of bleeding

Comments:

- Transfusion of a single unit of plasma does not provide adequate coagulation factor replacement in average sized adult.
- If INR is <1.7, treat underlying condition and provide supportive care; plasma is generally not required
- FFP will generally not bring INR value into a normal reference range.
- Vitamin K is product of choice for warfarin reversal in non-bleeding patient; effects are seen in 6-12 hours, preferred routes are oral or IV.
- In liver disease with prolonged PT, FFP may prevent bleeding but complete correction of INR is unlikely.
- FFP is contraindicated for volume expansion, nutritional supplementation and continued use in surgery without documented clotting deficiency.

References

Holland, L. L. & Brooks, J. P. Toward Rational Fresh Frozen Plasma Transfusion. *American Journal of Clinical Pathology* 2006;126:133-139.

Circular of Information for the Use of Blood and Blood Components. AABB. July 2002.

Guidelines for the Administration of Plasma. New York State Council on Human Blood and Transfusion Services. 2nd edition; 2004.

Segal, J. B. and Dzik, W. H. Paucity of Studies to Support that Abnormal Coagulation Test Results Predict Bleeding in the Setting of Invasive Procedures: an Evidenced-based Review. *Transfusion* 2005 45:1413-1425.

Guidelines for the Use of Fresh-Frozen Plasma, Cryoprecipitate and Cryosupernatant. *British Journal of Haematology* 2004;126:11-28.

Hirsh J, Fuster V, Ansell J & Halperin JL. AHA/ACC Foundation Guide to Warfarin Therapy. *Circulation* 2003; 107:1692-1711.

Abdel-Wahab OI, Healy B, Dzik WH. Effect of Fresh-Frozen Plasma Transfusion on Prothrombin Time and bleeding in Patients with Mild Coagulation Abnormalities. *Transfusion* 2006; 46:1279-1255.

Mintz PD (editor). *Transfusion Therapy: Clinical Principles & Practice*. 2nd edition. AABB Press 2005. Bethesda Maryland

CRYOPRECIPITATED AHF

How Supplied: Cryoprecipitate is distributed as a pool of 5 units or as single units.

Utilization Review Guidelines:

Cryoprecipitated AHF contains Factor VIII, von Willebrand factor, fibrinogen and Factor XIII. Documentation of the indication(s) for a transfusion episode and special circumstances for transfusion that take place outside these guidelines is recommended.

Indications:

1. Fibrinogen <100mg/dL, with bleeding or need for intervention
 - Common settings include:
 - a. Liver disease
 - b. DIC
 - c. Massive transfusion
2. Liver disease with dysfibrinogenemia
 - normal fibrinogen level and increased thrombin time

Dosing: 1 unit per 7-10 kg of body weight (generally 10 units)

Outcome Indicators:

- Fibrinogen level >100 mg/dL
- Cessation of bleeding

Comments:

- Not indicated in the absence of bleeding
- Use in hemophilia A or vWD is NOT standard of care
- Fibrinogen threshold of 100 mg/dl is derived from references; however, this value has not been rigorously defined in clinical trials.

References:

Clinical Practice Guidelines on the Use of Blood Components. NHMRC & Australian Society of Blood Transfusion. September 2001.

Guidelines for the Use of Fresh Frozen Plasma, Cryoprecipitate and cryosupernatant. *British Society for Haematology* 2004;126:11-28.

Circular of information for the Use of Human Blood and blood Components. AABB 2002.

Guidelines for Administration of Cryoprecipitate. New York State Council on Human blood & Transfusion Services. www.wadsworth.org accessed 6/26/2007.

INDICATIONS FOR SPECIAL MANIPULATION OF BLOOD PRODUCTS

Leukocyte-reduced Blood Products (Red cells, Platelets):

Indications:

- Prevention of febrile non-hemolytic transfusion reactions
- Prevention of HLA alloimmunization to HLA antigens
- Prevention of cytomegalovirus infections in patients at risk for CMV transfusion-transmitted infection (leukocyte-reduced products are considered CMV-safe)

Comments:

- All blood products supplied by BloodCenter of Wisconsin are leukoreduced.
- Guidelines from AABB require that a leukocyte-reduced blood product contain fewer than 5×10^6 leukocytes to prevent non-hemolytic febrile transfusion reactions, and for other indications. At BloodCenter of Wisconsin, both leukocyte-reduced red cells and leukocyte-reduced platelets generally contain $< 1 \times 10^6$ leukocytes.
- The use of leukocyte-reduced blood products to prevent transfusion-related immune modulation (TRIM) has some rationale in the literature. However, there have been insufficient well-documented randomized control trials to establish the role of leukocyte reduction in the prevention of TRIM.

Washed Red Blood Cells or Platelets:

Indications:

- History of anaphylactic reaction to blood components
- IgA deficiency with documented IgA antibodies
- Recurrent severe or allergic reactions not prevented with appropriate premedication
- Hyperkalemia in neonates

Cytomegalovirus Seronegative (CMV negative) Cellular Products (Red Blood cells, Platelets)

Indications:

- Newborns weighing < 1500 grams
- Any intrauterine or exchange transfusion
- Allogeneic peripheral stem cell or bone marrow transplant patients or candidates who are CMV seronegative or unknown CMV serostatus
- Bone marrow transplant donors who have used all autologous blood products and now require homologous products
- Solid organ transplant patients who are CMV seronegative (heart, lungs, kidney, pancreas)

Potential Indications upon Physician Request:

- Pregnant women
- Any patient for whom the physician, in consultation with the Transfusion Service physician, determines may be at risk for serious post-transfusion CMV infection

Comments:

- Leukocyte-reduced blood products are considered a safe alternative for CMV seronegative patients if CMV seronegative products are unavailable.
- In general, patients who have had CMV IgG antibody testing and are CMV seropositive do not require CMV seronegative products.
- CMV serostatus does not need to be considered for fresh frozen plasma or cryoprecipitated AHF because the virus is carried by white blood cells.

IRRADIATED BLOOD PRODUCTS

Purpose: prevention of transfusion-associated graft vs. host disease (TA-GVHD)

Indications:

- Donation from blood relatives
- HLA-matched platelets
- Intrauterine or exchange transfusions
- All granulocyte transfusions
- Infants ≤ 12 months of age
- Patients who have had or will be having allogeneic or autologous bone marrow/hematopoietic progenitor cell transplants
- Patients with Hodgkin's disease, acute leukemia, non-Hodgkin's lymphoma
- Known or suspected congenital immunodeficiency due to T-cell defects
- Patients who have received purine analog antimetabolite chemotherapeutic drugs (such as fludarabine, cladribine, or pentostatin)
- Any patient with neoplastic disease who is considered to be at high risk for the development of TA-GVHD by their physician

Comments:

- Irradiation of the product should be completed as close as possible to time of planned transfusion
- Irradiation is not required for frozen products (FFP/FP24, cryoprecipitate AHF)
- Irradiated products can be crossed over to other patients if not utilized for intended recipient

References:

Guidelines for Irradiation of Blood and blood Components. New York State Council on Human Blood and Transfusion Services, 2nd edition; 2004.

Guidelines for Gamma Irradiation of Blood Components. Australian & New Zealand Society of Blood Transfusion. Revised 2003.

Leitman, SF, Tisdale JF, et al. Transfusion-associated GVHD after Fludarabine Therapy in a Patient with Systemic Lupus Erythematosus. *Transfusion* 2003;43:1667-1654.

Boeckh M, Nichols WG. The Impact of CMV Serostatus of Donor and Recipient before Hematopoietic Stem Cell Transplant. *Blood* 2004;103(6):2003-2008.

Bowden RA, Slichter SJ, Sayers M et al. Comparison of Filtered Leukocyte-reduced and CMV seronegative Blood Products for Prevention of TA-CMV. *Blood* 1995;86(9):3598-3603.

Davey RJ, McCoy NC, SF Leitman et al. The Effect of Pre-storage Irradiation on Post-Transfusion Red Cell Survival. *Transfusion* 1992;32(6):525-528

CMV Negative Blood position statement. UK Blood Transfusion & Tissue Transplantation Services. Nov. 2003 (July 2005) www.transfusionguidelines.org.uk accessed 7/9/2007

FACTOR CONCENTRATES

Recombinant or plasma-derived Factor VIII

In patients with *moderate to severe factor VIII deficiency (hemophilia A) or with mild factor VIII deficiency unresponsive to DDAVP:*

- before and after an invasive procedure
- during and after acute bleeding
- after trauma
- for prevention of chronic joint disease
- prophylaxis to prevent bleeding
- immune tolerance therapy in factor VIII-deficient patients with inhibitors
- in patients with mild factor VIII deficiency responsive to DDAVP, when there is severe or life-threatening bleeding (such as intracranial hemorrhage) or high-risk surgery

Intermediate-purity plasma-derived Factor VIII (Humate-P, Alphanate)

1. In patients with *von Willebrand disease who are unresponsive to DDAVP:*
 - bleeding episodes
 - prophylaxis for invasive procedures
 - post-operatively
2. In patients with von Willebrand disease *who are responsive to DDAVP* for severe, life-threatening bleeding

Recombinant or plasma-derived Factor IX

In patients with *Factor IX deficiency (hemophilia B):*

- before and after an invasive procedure
- during and after acute bleeding
- after trauma
- for prevention of chronic joint disease
- prophylaxis to prevent bleeding
- immune tolerance therapy in factor IX-deficient patients with inhibitor

Activated Prothrombin Complex Concentrates (FEIBA, Autoplex)

- bleeding episodes or surgical procedures in patients with Factor VIII or IX deficiency with inhibitors
- non-hemophiliac patients with acquired inhibitors to coagulation factors

Prothrombin Complex Concentrate (PCC) (Profilnine SD, Bebulin VH)

- For urgent reversal of anticoagulant (e.g. Warfarin) in life-threatening bleeding. Use of PCC is recognized in such clinical situations and recommended by multiple practice guidelines.

Recombinant Factor VIIa (NovoSeven®)

- bleeding and surgical procedures in patients with Factor VIII or IX deficiency and inhibitors
- bleeding and surgical procedures in patients with congenital Factor VII deficiency
- bleeding in patients with acquired inhibitors to coagulation factors

- Non FDA-approved use must be based on individual institution policy. NovoSeven® has been used for:
 - a. Uncontrolled hemorrhage in on-pump cardiac surgery or extracorporeal membrane oxygenation
 - b. Rescue therapy of trauma patients with massive transfusion
 - c. Emergent reversal of Warfarin with bleeding or need for urgent surgery

Antithrombin III (AT III) Concentrate

- In patients with congenital antithrombin deficiency for:
 - a. prophylaxis for obstetric or surgical procedures
 - b. thromboembolism
- Non-FDA-approved use must be based on individual institution policy. AT III has been used in patients with documented acquired antithrombin deficiency in:
 - a. Venous or arterial thrombosis
 - b. Disseminated intravascular coagulopathy (DIC)
 - c. Bone marrow transplantation with associated veno-occlusive disease
 - d. Cardiopulmonary bypass or ECMO and unresponsiveness to heparin or when heparin dose is excessive (heparin resistance)

Factor Concentrate Comments:

- All patients treated with plasma derived concentrates should have immunity to hepatitis B. If they are not immune at the time of initiation of therapy, they should receive HBIG prophylaxis in addition to the hepatitis B vaccine.
- Consultation with hematologist for treatment options and dosing is highly recommended.
- Any off label use of factor concentrates must be based on individual institutional policy.

References:

Lankiewicz MW, Hayes J, Friedman KD, Tinkoff G, Blatt PM. Urgent Reversal of Warfarin with Prothrombin Complex Concentrate. *Journal of Thrombosis & Haemostasis* 2006;4:967-970.

Lethagen S et al. von Willebrand Factor/Factor VIII concentrate (Haematic ®P) dosing based on Pharmacokinetics: A Prospective Multicenter Trial in Elective Surgery. *Journal of Thrombosis & Haemostasis* 2007; 5(7):1420-1430.

Lemmer JH, Despotis GJ. Antithrombin III concentrate to treat Heparin Resistance in Patients Undergoing Cardiac Surgery. *Journal of Cardiovascular Surgery* 2002;123(2);213-217.

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Karkouti K, Beattie WS, Crowther MA et al. The Role of Recombinant Factor VIIa in on-pump Cardiac Surgery: Proceedings of the Canadian Consensus Conference. *Canadian Journal of Anesthesiology* 2007; 54 (7): 573-582.

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