

5.0 APPROPRIATE USE OF BLOOD COMPONENTS FOR ADULTS

Policy	The Transfusion Medicine Service follows established guidelines for the appropriate use and administration of blood components and products to patients.
Reason	<ul style="list-style-type: none"> • Facilitate the efficacious and appropriate use of blood components and products • Facilitate compliance with hospital guidelines for product dosage • Enhance patient safety by the judicious use of blood components and products and reduction of inappropriate transfusion practices
Responsibilities of the Medical Director, Transfusion Medicine	<ul style="list-style-type: none"> • Be familiar with available guidelines for the use of and indications for use of blood components and products • Be familiar with the appropriate use of and indications for use of blood component and products • Be available to consult with treating physicians and other staff in the appropriate use and administration of blood components and products • Initiate discussions with clinical staff when laboratory results and/or clinical circumstances suggest use of a blood component or product may, or may not, be indicated • Use such consultations and discussions to promote education in appropriate transfusion practices • Ensure availability of adequate educational material for physicians or other health professionals who prescribe blood components and products • Establish a mechanism to prospectively review orders for blood and blood components/products for appropriateness of indication and dosing <p>Note: If prospective screening is not performed, a mechanism for periodic retrospective audit should be established.</p>
Responsibilities of Transfusion Medicine Service staff	<ul style="list-style-type: none"> • Follow established process for prospective screening of orders for blood and blood components/products • Consult with the Medical Director, Transfusion Medicine or delegate when concern is raised that a blood component/product order (including indication, dose or timing) may not be compliant with the institution's guidelines (and cannot be directly resolved with clinical staff)

REFERENCES

25. Callum JL, 2016.
 27. CBS, Clinical Guide to Transfusion, 2011.



5.1 TRANSFUSION OF RED BLOOD CELLS TO ADULTS

- Guidelines for transfusion of red blood cells have been published by several organizations [see www.transfusionontario.org/en].
- The decision to transfuse an individual patient is based on:
 - » Signs and symptoms of inadequate tissue oxygen delivery
 - » Ongoing blood loss
 - » Hemoglobin concentration
 - » Other patient factors e.g. coronary insufficiency, traumatic brain injury and patient preferences
- For an example of hospital specific guideline threshold and target hemoglobin levels for red blood cell transfusion – see table 5.1
- More detail is supplied in Table 5.2

Table 5.1 – An Example of Transfusion Guidelines for Red Blood Cells

HEMOGLOBIN g/L	Units	RECOMMENDATION
less than 60	1 - 2	Transfusion highly recommended <ul style="list-style-type: none"> • Young patients may tolerate greater degrees of anemia • Patients with chronic iron deficiency can usually be treated with IV iron alone
less than 70	1	Likely appropriate
less than 80	1	Likely appropriate in patients with cardiovascular disease
less than 90	1	Only if there are signs and symptoms of impaired tissue oxygen delivery
greater than 90	none	Likely inappropriate Consult Blood Bank physician and document indication in patient chart



Table 5.2 Transfusion of Red Blood Cells to Adults

For adult patients	
Receiving transfusion for acute blood loss	<ul style="list-style-type: none"> • Maintain hemoglobin > 70g/L during active bleeding: <ul style="list-style-type: none"> » Consider rate of blood loss, hemodynamic factors, evidence of tissue ischemia, institutional speed of blood delivery and laboratory testing in decision about transfusion » Ensure prompt blood availability when hemoglobin is <80g/L • Consider maintaining hemoglobin at a higher level (>80 g/L) in patients with: <ul style="list-style-type: none"> » Unstable or acute coronary syndromes » Coronary artery disease » Uncontrolled/unpredictable bleeding
With anemia in coronary or critical care	<ul style="list-style-type: none"> • Recommend transfusion when patient's hemoglobin is <70g/L • In a patient with an acute coronary syndrome there is controversy over the desirable hemoglobin level: <ul style="list-style-type: none"> » Data are insufficient to recommend maintaining hemoglobin above an arbitrary level but a target of 80-90g/L is considered acceptable » Consider transfusing if there are clear signs of inadequate tissue oxygen delivery • Except for patients with unstable coronary syndromes, restrictive transfusion policy (trigger 70g/L) has proved at least as effective as a liberal transfusion policy for the critically ill • Unnecessary phlebotomy contributes significantly to anemia in the critically ill and strategies should be implemented to minimize blood draws
Peri-operative patients	<ul style="list-style-type: none"> • Manage patients undergoing elective surgery with approaches to minimize need for transfusion: <ul style="list-style-type: none"> » Hematological assessment and if needed appropriate non-transfusion therapy pre-operatively » Meticulous hemostasis intra-operatively » Consider alternatives such as erythropoietin, cell salvage, antifibrinolytic agents • Administer red blood cell transfusion one unit at a time in the non-urgent setting, assessing the need for further transfusion after each unit with repeat hemoglobin level and clinical assessment
With Chronic anemia	<ul style="list-style-type: none"> • Use transfusion ONLY when alternatives do not exist or have proven ineffective • Administer red blood cells at intervals to maintain the hemoglobin just above the lowest level necessary to prevent symptoms of anemia • Assess long-term transfusion recipients for iron overload and consideration of iron chelation treatment where organ toxicity from transfusion iron overload is anticipated
With hemoglobinopathies (eg. sickle cell disease, thalassemia) or autoimmune hemolytic anemia	<ul style="list-style-type: none"> • As goals and principles of transfusion in these patient populations differ significantly from other patients, a hematology consultation is advised prior to proceeding with transfusion
Selection order of ABO compatible donor red blood cells	<ul style="list-style-type: none"> • See table 5.3



Table 5.3 Selection Orders of ABO Compatible Donor Red Blood Cells

Recipient ABO group	1st Choice ABO identical	2nd Choice ABO compatible	3rd Choice ABO compatible	4th Choice ABO compatible
O	Group O	None	None	None
A	Group A	Group O	None	None
B	Group B	Group O	None	None
AB	Group AB	Group A	Group B	Group O

REFERENCES

25. Callum JL, 2016.
26. CBS, Circular of Information.
27. CBS, Clinical Guide to Transfusion, 2011.
32. Carson JL, 2016.
51. CMAJ, 1997.
65. BSH, 2017.

5.2 TRANSFUSION OF PLATELETS TO ADULTS

Guidelines for transfusion of platelets have been published by several organizations [see www.transfusionontario.org] includes commonly acceptable indications for platelet transfusion.

Table 5.4 Guidelines for Platelet Transfusion in Adults

PLT (x 10 ⁹ /L)	CLINICAL SETTING	SUGGEST
<10	Non-immune thrombocytopenia	Transfuse 1 pool of platelets ⁴⁵
<10	Non-immune thrombocytopenia & HLA-alloimmunized	Transfuse 1 unit of HLA-matched apheresis platelets ⁴⁵
<20	Procedures not associated with significant blood loss (e.g., central line placement)	Transfuse 1 pool of platelets ¹⁵
20-50	Procedures not associated with significant blood loss	1 pool of platelets on hold, transfuse only if significant bleeding ³⁸
<30	Patient on anticoagulants that should not be stopped	Transfuse 1 pool of platelets
<50	Epidural anesthesia and lumbar puncture	Transfuse 1 pool immediately before procedure ^{15,47}
<50	Procedures associated with blood loss or major surgery (>500 mL expected blood loss)	Transfuse 1 pool immediately before procedure ^{38,48}
<50	Immune thrombocytopenia	Transfuse platelets only with life-threatening bleeding ⁴⁹
<100	Pre-neurosurgery or head trauma	Transfuse 1 pool of platelets ^{50,51}
Any	Platelet dysfunction and marked bleeding (e.g., post cardiopulmonary bypass). Exception: Transfusing platelets for intracranial hemorrhage not requiring surgical management in patients on antiplatelet agents leads to increased morbidity	Transfuse 1 pool of platelets ^{38,52}



ABO/Rh-identical platelets are preferred, but ABO/Rh non-identical platelets may be transfused when ABO/Rh-identical platelets are not available. Rh negative females of child-bearing potential require Rh immunoglobulin (RhIG) when Rh positive platelets are transfused, to avoid formation of anti-D antibody. Each platelet pool contains up to 0.5 mL of RBCs. Each 120 ug of RhIG covers 6 mL RBC, with an effect lasting approximately 21 days.

Table 5.5 Relative Contraindications to Adult Platelet Transfusion

Condition	Platelet Transfusion
Heparin induced thrombocytopenia (HIT)	Is associated with arterial thrombosis
Thrombotic thrombocytopenic purpura/hemolytic uremic syndrome (TTP/HUS)	Is associated with exacerbation
Immune thrombocytopenic purpura (ITP)	Will be ineffective; reserve for life-threatening bleeding

REFERENCES

20. British Committee for Standards in Haematology, 2017.
25. Callum JL, 2016.
26. CBS, Circular of Information.
27. CBS, Clinical Guide to Transfusion, 2011.
56. George JN, 1996.
137. Watson H, 2012.



5.3 TRANSFUSION OF FROZEN PLASMA TO ADULTS

The Ontario Clinical Practice Recommendations for the use of Frozen Plasma (FP)

SITUATIONS IN WHICH THE TRANSFUSION OF FP IS REASONABLE:

CLINICAL SETTING	INR	RECOMMENDATION
<ul style="list-style-type: none"> Significant bleeding Liver disease coagulopathy AND pre invasive procedure 	greater than 1.8	3-5 units plasma Note: plasma is not required prior to procedures not associated with blood loss irrespective of INR e.g. paracentesis, thoracentesis, central line placement
<ul style="list-style-type: none"> Microvascular bleeding Extreme life threatening hemorrhage 	Unable to wait for results	2 units plasma for every 4 units of RBCs Note: If massive transfusion required follow hospital Massive Hemorrhage Protocol
Plasma Exchange	any	Thrombotic thrombocytopenic purpura (TTP)

Note:

FP should **ONLY** be considered for warfarin reversal or vitamin K deficiency in the event PCCs are not available, and in the presence of serious bleeding or emergency surgery with INR > 1.5. See section 5.6.

SITUATIONS IN WHICH TRANSFUSION OF FP IS **NOT** USEFUL:

- INR less than 1.8 (including major or non-life-threatening bleeding)*
- Use of 1:1 or 2:1 (RBC:FP) replacement when patient is unlikely to require massive transfusion
- Coagulopathy in the absence of bleeding or need for major emergency surgery
- Minor procedures with any elevation in the INR*
- Elective reversal of warfarin where time allows for warfarin cessation and/or use of vitamin K
- Reversal of anticoagulants (eg: heparin/LMWH, rivaroxaban, dabigatran, apixaban)**
- Volume expansion or “nutrition support”

* Note: Patients with an increased INR do not have an increased risk of bleeding with minor procedures and there is no evidence that transfusing plasma will prevent or reduce bleeding (Paracentesis, thoracentesis, central line insertion, PICC, bone marrow aspiration/biopsy)

** Note: FP has no effect in reversing or neutralizing heparins or thrombin inhibitors: FP should **ONLY** be used for warfarin reversal if PCC's are not available

Note: Clinical Practice Recommendations for the use of FP and an order set template can be found at www.transfusionontario.org



5.4 TRANSFUSION OF CRYOSUPERNATANT PLASMA TO ADULTS

Uses include:

- In conjunction with plasma exchange in thrombotic thrombocytopenia or hemolytic-uremic syndrome

REFERENCES

19. British Committee for Standards in Haematology, Blood Transfusion Task Force, 2004
23. Callum JL, 2011.
25. Callum JL, 2016.
26. CBS, Circular of Information.
27. CBS, Clinical Guide to Transfusion, 2011.
81. Lin Y, 2004.
87. Michael M, 2009.
107. Pinkerton PH, 2010.
111. ORBCoN, 2013
117. Rock G, 2005.
132. Tinmouth A, 2012.
139. Yang L, 2012.

5.5 TRANSFUSION OF CRYOPRECIPITATE TO ADULTS

CLINICAL SETTING	FIBRINOGEN g/L	RECOMMENDATION
Microvascular bleeding	less than 1	4 grams of fibrinogen concentrate or 10 U of cryoprecipitate
Extreme life-threatening hemorrhage	less than 1.5 - 2	4 grams of fibrinogen concentrate or 10 U of cryoprecipitate
Acute promyelocytic leukemia <ul style="list-style-type: none">• during acute presentation	less than 1.5	4 grams of fibrinogen concentrate or 10 U of cryoprecipitate
Intracranial hemorrhage secondary to treatment with Tissue Plasminogen Activator (TPA)	less than 2.0	4 grams of fibrinogen concentrate or 10 U of cryoprecipitate

- Treatment of bleeding in patients with von Willebrand disease or Hemophilia A only:
 - » when factor concentrates are unavailable (e.g. remote geographic region); and
 - » DDAVP is unavailable or ineffective
- Factor XIII deficiency when factor concentrates are not available

REFERENCES

19. BCSH, 2004.
24. Callum JL, 2009.
25. Callum JL, 2016.
26. CBS, Circular of Information.
27. CBS, Clinical Guide to Transfusion, 2011.

Note: A comprehensive list of references to guidelines for transfusion medicine practice can be found at the ORBCoN website at www.transfusionontario.org



5.6 USE OF PROTHROMBIN COMPLEX CONCENTRATES (PCCs)

PCCs have replaced frozen plasma as the product of choice for emergency reversal of warfarin effect or vitamin K deficiency. Products available are Octaplex® and Beriplex®.

Indications for use of PCCs

- Emergency reversal of warfarin effect.
 - » For patients with INR ≥ 1.5 AND
 - » “Life or limb” threatening bleeding
 - » Emergency surgery within 6 hours
- Give:
 - » Vitamin K 10mg IV
 - » PCC according to INR (see below)
- PCCs should NOT be administered if:
 - » INR ≤ 1.5 as individual coagulation factors are not below the level needed to maintain hemostasis
 - » Patients with coagulopathies not related to warfarin or Vitamin K deficiency as they are deficient in coagulation factors not contained in PCCs (with the exception of the off-label uses described)
 - » Patients with known HIT (Beriplex® and Octaplex® both contain heparin)
 - » Patient has received or will receive recombinant Factor VIIa
- Its use should be limited to life-threatening hemorrhage and patients requiring emergency surgery.

Dosage

- The National Advisory Committee on Blood and Blood Products (NAC) Recommendations on dosing are based on the INR as detailed in the table to the right.
- If the INR is unknown and major bleeding is present, 2,000 IU (80mL) should be administered.
- The published NAC Recommendations include a table of detailed dosages based on a combination of INR and body weight, as an alternative dosing strategy.
- The maximum dose should not exceed 3,000 IU.
- Infusion rate should not exceed 3 mL/min for Octaplex® and 8 mL/min for Beriplex®.

INR	PCC DOSE
<3	1,000 IU
3-5	2,000 IU
>5	3,000 IU

Off-Label Uses of PCCs

- Reversal of anti-Xa inhibitors (Rivaroxaban and Apixiban).
- Currently specific reversal agents are in clinical trials and are not available outside of clinical trials
- PCCs at a dose of 2,000 IU (repeated in 1 hour if hemostasis is not achieved) is being used across Canada
- Data to support its use is limited to studies in animals and human volunteers
- A licensed antidote to dabigatran (Idarucizumab, Praxbind®) is available in Canada
- The dose of Idarucizumab is 5 g, administered in two 2.5 g bolus infusions each over 5 minutes, not more than 15 minutes apart

RESOURCES

1. Bloody Easy Coagulation Simplified, Second Version 2019.

REFERENCES

25. Callum JL, 2016.
28. CBS, Plasma Protein Products, 2011.
84. Majeed A, 2017.
94. NAC, Recommendations for use of Prothrombin Complex Concentrates, 2014.

