

Don't Misuse My Blood - Clinical Decision Support Tools



RED BLOOD CELL TRANSFUSION

Feb 2024

Adult Inpatients

Purpose:

This tool supports clinicians to appropriately give red blood cell (RBC) transfusions to adult inpatients.

Important Considerations:

- Only transfuse one unit at a time. Reassess patient and consider the need for additional units with Hb level. One unit typically raises Hb levels by approximately 10 g/L.
- For bleeding patients, consider rate of bleeding, hemodynamics, evidence of tissue ischemia, and institutional speed of blood delivery to inform the decision to transfuse.

Adult Inpatients Experiencing Bleeding



Major Hemorrhage

For bleeding that is considered life-threatening, refer to existing AHS Massive Hemorrhage Protocols.

Clinically Significant Bleeding*

There is no defined Hb threshold during **active** clinically significant bleeding. Use clinical judgement based on physiologic stability and pace of bleeding, maintaining a minimum **Hb > 70 g/L**.

Non-clinically Significant Bleeding

Only consider RBC transfusion when **Hb < 70 g/L** for the general adult inpatient.

* Clinically Significant Bleeding is defined as the presence of overt bleeding AND at least one of the following in the 24 hours before or after bleeding (without another likely cause):

- Hemodynamic instability
 - ∇ MAP > 20 mmHg (or SBP OR DBP if not invasively monitored) or
 - Orthostatic \blacktriangle HR > 20 bpm
- Vasopressor initiation or increase
- A decrease in hemoglobin of \geq 20 g/l
- Transfusion of \geq 2 units of packed red blood cells
- Need for therapeutic intervention

** Ischemic Cardiovascular Disease is defined as a history of ischemic heart disease, electrocardiographic evidence of previous myocardial infarction, history or presence of congestive heart failure or peripheral vascular disease, or a history of stroke or transient ischemic attack.

Non-Bleeding Adult Inpatients



General Adult Inpatients

Consider RBC transfusion when **Hb < 70 g/L**.

Sepsis / Septic Shock

Does not require a higher Hb threshold when compared to a general critically ill adult. Only consider RBC transfusion if the **Hb < 70 g/L**.

Active Ischemic Cardiovascular Disease** / ACS

Among patients with **active coronary ischemia**, for:

- **Type I MI**, consider RBC transfusion when **Hb < 100 g/L**
- **Type II MI**, consider RBC transfusion when **Hb < 80 g/L**

This threshold applies for 30 days post-ACS onset.

Otherwise, in **stable/inactive coronary ischemia**, consider RBC transfusion when **Hb < 70 g/L**.

Cardiac Surgery

Consider RBC transfusion when **Hb < 75 g/L** in patients with **complete revascularization**.

Refer to the 'Active Ischemic Cardiovascular Disease' for patients with **incomplete revascularization**.

This threshold applies for up to 30 days post-operatively.

Acute Neurologic Inquiry

Hb threshold for appropriate transfusion is unclear. Current clinical trials (HEMOTION and SAHARA) are enrolling patients in Alberta. Check with your unit for enrollment information.

For general inquiries contact dmmmb.ccsn@ahs.ca



[References, Resources and APL Product Monograph](#)

 **Alberta Health Services**
Critical Care Strategic Clinical Network™

Inspiring solutions. Together.



ALBERTA PRECISION LABORATORIES

Leaders in Laboratory Medicine

Don't Misuse My Blood - Clinical Decision Support Tools



RED BLOOD CELL TRANSFUSION

Feb 2024

Pediatric ICU Patients (patients > 4 months of age admitted to pediatric units)

Purpose:

This tool supports clinicians to appropriately give red blood cell (RBC) transfusions to pediatric ICU patients.

Important Considerations:

- Only transfuse 10-15mL/kg at a time. Reassess patient and consider the need for additional units with Hb level. 10 mL/kg typically raises Hb levels by approximately 10 g/L.
- For bleeding patients, consider rate of bleeding, hemodynamics, evidence of tissue ischemia, and institutional speed of blood delivery to inform the decision to transfuse.

Pediatric ICU Patients Experiencing Bleeding



Major Hemorrhage



For bleeding that is considered life-threatening, refer to existing AHS Massive Hemorrhage Protocols.

Clinically Significant Bleeding*



There is no defined Hb threshold during **active** clinically significant bleeding. Use clinical judgement based on physiologic stability and pace of bleeding.

Non-clinically Significant Bleeding



Do not transfuse RBCs when the Hb is > 70 g/L, aside from select clinical scenarios.

Non-Bleeding Pediatric ICU Patients



General Pediatric ICU Patients

Do not transfuse RBCs when the Hb is > 70 g/L, aside from the select clinical scenarios listed below.

Sickle Cell Disease

When undergoing treatment for Sickle Cell Disease (SSD) with or without Acute Chest Crisis **refer to established unit protocols.**

Single-Ventricle Palliation

Consider transfusing RBCs when **Hb < 90 g/L**.

Use Clinical Judgement to guide transfusion in:

- Respiratory failure with severe hypoxia (severe PARDS = OI \geq 16)
- Hemodynamically instability = MAP < 2 standard deviations below normal mean for age AND cardiovascular support (pressors/ inotropes/ fluid) has been initiated or increased in the last 2 hours
- Pulmonary hypertension
- Congenital or acquired myocardial dysfunction
- ECMO/VAD/CRRT circuit priming
- Acute brain injury

* Clinically Significant Bleeding is defined as the presence of overt bleeding AND at least one of the following in the 24 hours before or after bleeding (without another likely cause):

- Hemodynamic instability
 - ∇ MAP > 20 mmHg (or SBP OR DBP if not invasively monitored) or
 - Orthostatic \blacktriangle HR > 20 bpm
 - see 'Use Clinical Judgment' box for peds definition
- Vasopressor initiation or increase
- A decrease in hemoglobin of \geq 20 g/l (20% for peds)
- Transfusion of \geq 2 units (30 mL/kg for peds) of packed red blood cells
- Need for therapeutic intervention

For general inquiries contact dmmmb.ccsn@ahs.ca



[References, Resources and APL Product Monograph](#)

 **Alberta Health Services**
Critical Care Strategic Clinical Network™

Inspiring solutions. Together.



ALBERTA PRECISION LABORATORIES

Leaders in Laboratory Medicine

Don't Misuse My Blood - Clinical Decision Support Tools



PLATELET TRANSFUSION

Feb 2024

Adult & Pediatric Inpatients (patients > 4 months of age)

Purpose:

This tool supports clinicians to appropriately give platelet transfusions to adult and pediatric inpatients.

Important Considerations:

- Coagulation testing is **not** routinely recommended prior to procedures with a **low bleeding risk**** unless the patient has risk factors for bleeding. It is recommended prior to procedures associated with a **high bleeding risk*****.
- One dose of platelets typically raises the platelet count by 15-25 x 10⁹/L.

Adult & Pediatric Inpatients Experiencing Bleeding

Major Hemorrhage

For bleeding that is considered life-threatening, refer to existing AHS Massive Hemorrhage Protocols.

Clinically Significant Bleeding*

Only consider platelet transfusion if the platelet count is **< 50 x 10⁹/L**. For ITP, platelets are not indicated unless the bleeding is life-threatening.

Clinically Significant Bleeding* and Platelet Dysfunction

Platelet transfusion may be considered, regardless of platelet count.

Non-Clinically Significant Bleeding

Transfuse one dose of platelets when the platelet count is **< 10 x 10⁹/L**.

* Clinically Significant Bleeding is defined as the presence of overt bleeding AND at least one of the following in the 24 hours before or after bleeding (without another likely cause):

- Hemodynamic instability
 - ▼MAP > 20 mmHg (or SBP OR DBP if not invasively monitored) or
 - Orthostatic ▲ HR > 20 bpm
 - See RBC 'Use Clinical Judgment' box for peds definition
- Vasopressor initiation or increase
- A decrease in hemoglobin of ≥ 20 g/l (20% for peds)
- Transfusion of ≥ 2 units (30 mL/kg for peds) of packed red blood cells
- Need for therapeutic intervention

** Low bleeding risk procedures: arterial line, central line, PICC line, bone marrow procedure, paracentesis, chest tube, bedside tracheostomy, transjugular liver biopsy, etc.

*** High bleeding risk procedures: CNS interventions, catheter directed thrombolysis, arterial interventions using > 7-F sheath, etc.

Non-Bleeding Adult & Pediatric Inpatients

Non-Immune Thrombocytopenia

Transfuse one dose of platelets when the platelet count is **< 10 x 10⁹/L**.

General Procedures

For procedures with a **low bleeding risk**** only consider transfusing one dose of platelets immediately before the procedure if the platelet count is known and is **< 20 x 10⁹/L**.

Epidural Insertion / Lumbar Puncture

Only consider platelet transfusion if the platelet count is **< 50 x 10⁹/L**. Give one dose of platelets immediately before procedure.

Liver Biopsy

For patients requiring liver biopsy who have a platelet count between **20 and 50 x 10⁹/L**, instead of administering platelets consider trans-jugular over a percutaneous approach.

Non-Neuraxial Surgery / Invasive Procedures

For major non-neuraxial surgery or an invasive procedure with **high risk of bleeding*****, only consider transfusing one dose of platelets immediately before the procedure if the platelet count is **< 50 x 10⁹/L**.

Neuraxial Surgery / Acute CNS Injury

Only consider transfusing platelets if the platelet count is **< 100 x 10⁹/L**. If required for neuraxial surgery, give dose immediately prior to procedure.

Platelet Dysfunction

For patients with platelet dysfunction who require an invasive procedure with a **high risk of bleeding*****, consider transfusing one dose of platelets regardless of platelet count.

Note: Consider the clinical situation and context (urgency of situation, experience of provider, etc.) in conjunction with these recommendations.

For general inquiries contact dmmmb.ccsn@ahs.ca



[References, Resources and APL Product Monograph](#)



Don't Misuse My Blood - Clinical Decision Support Tools



PLASMA TRANSFUSION

Feb 2024

Adult & Pediatric Inpatients (patients > 4 months of age)

Purpose:

This tool supports clinicians to appropriately give plasma transfusions to adult and pediatric inpatients.

Important Considerations:

- If plasma is transfused, it must be administered immediately prior to the procedure to provide any coagulation benefit.
- Consider the likely cause of coagulation disturbance prior to selecting treatment. If an elevated INR is related to a vitamin K deficiency, PCC may be more effective than plasma. If the patient is fibrinogen deficient, consider fibrinogen replacement.
- Coagulation testing is **not** routinely recommended prior to procedures with a **low bleeding risk**** unless the patient has risk factors for bleeding. It is recommended prior to procedures associated with a **high bleeding risk*****.
- Plasma should not be used to treat hypofibrinogenemia or for volume replacement and is generally not indicated or effective for the reversal of an INR ≤ 1.7 .

Adult & Pediatric Inpatients Experiencing Bleeding

Major Hemorrhage

For bleeding that is considered life-threatening, refer to existing AHS Massive Hemorrhage Protocols.



Clinically Significant Bleeding*

For **active** clinically significant bleeding, consider plasma if the patient requires replacement of multiple plasma coagulation factors.



Clinically Significant Bleeding* and Congenital Coagulation Deficiency

Consult with Transfusion Medicine (TM). Plasma may be considered for any INR if the specific factor concentrate is not available.



* Clinically Significant Bleeding is defined as the presence of overt bleeding AND at least one of the following in the 24 hours before or after bleeding (without another likely cause):

- Hemodynamic instability
 - ∇ MAP > 20 mmHg (or SBP OR DBP if not invasively monitored) or
 - Orthostatic \blacktriangle HR > 20 bpm
 - See RBC 'Use Clinical Judgment' box for peds definition
- Vasopressor initiation or increase
- A decrease in hemoglobin of ≥ 20 g/l (20% for peds)
- Transfusion of ≥ 2 units (30 mL/kg for peds) of packed red blood cells
- Need for therapeutic intervention

Non-Bleeding Adult & Pediatric Inpatients

Invasive Procedures

Consider plasma for patients undergoing invasive procedures who require replacement of multiple plasma coagulation factors. Plasma transfusion if the INR is ≤ 1.7 is unlikely to be effective.

Liver Biopsy

It is not recommended to administer prophylactic plasma to reduce the risk of bleeding. An alternative procedure with a lower bleeding risk, (e.g., transjugular approach), should be considered instead.

Post-Surgical Pediatric

For critically ill **pediatric patients** who have undergone non-cardiac surgery, prophylactic plasma transfusion based on abnormal coagulation testing may not be beneficial and should be avoided.

Therapeutic Plasma Exchange

Plasma may be used for patients being treated with TPE, when the exchange fluid must include coagulation factors.

Congenital Coagulation Factor Deficiency

Consult TM if the patient requires an **urgent surgical procedure** (within 6 hours). Plasma may be considered for any INR if the specific factor concentrate is unavailable.

**Low bleeding risk procedures: arterial line, central line, PICC line, bone marrow procedure, paracentesis, chest tube, bedside tracheostomy, transjugular liver biopsy, etc.

***High bleeding risk procedures: CNS interventions, catheter directed thrombolysis, arterial interventions using > 7-F sheath, etc.

For general inquiries contact dmmb.ccsn@ahs.ca



[References, Resources and APL Product Monograph](#)

 **Alberta Health Services**
Critical Care Strategic Clinical Network™

Inspiring solutions. Together.



ALBERTA PRECISION LABORATORIES

Leaders in Laboratory Medicine

Don't Misuse My Blood - Clinical Decision Support Tools



FIBRINOGEN REPLACEMENT

Feb 2024

Adult & Pediatric Inpatients (patients > 4 months of age)

Purpose:

This tool supports clinicians to appropriately give fibrinogen replacement to adult and pediatric inpatients.

Important Considerations:

- The recommended dose for adults is 2-4 g of fibrinogen.
- Pediatric dosing for fibrinogen ranges from 30-60 mg/kg, consult with Transfusion Medicine.
- Repeat bloodwork should be completed within 60 minutes of administration to reassess fibrinogen level.

Adult & Pediatric Inpatients Experiencing Bleeding



Major Hemorrhage

For bleeding that is considered life-threatening, refer to existing AHS Massive Hemorrhage Protocols.



Clinically Significant Bleeding*

Fibrinogen replacement is indicated when fibrinogen level is **< 1.5 g/L** or abnormal ROTEM or TEG suggests hypofibrinogenemia / fibrinolysis.



Clinically Significant Bleeding* and Cardiovascular Surgery

Fibrinogen replacement is indicated when fibrinogen level is **< 2.0 g/L** or abnormal ROTEM or TEG suggests hypofibrinogenemia / fibrinolysis.



Clinically Significant Bleeding* and Obstetrics

Fibrinogen replacement is indicated when fibrinogen level is **< 2.0 g/L** or abnormal ROTEM or TEG suggests hypofibrinogenemia / fibrinolysis.



Non-Bleeding Adult & Pediatric Inpatients



Promyelocytic Leukemia / Chemo

For patients with acute promyelocytic leukemia or patients on chemotherapy, prophylactic fibrinogen is indicated when the fibrinogen level is **< 1.5 g/L**.

Surgery

For patients who are scheduled for surgery, fibrinogen replacement is indicated when fibrinogen level is **< 1.5 g/L** or abnormal ROTEM or TEG suggests hypofibrinogenemia / fibrinolysis.

* Clinically Significant Bleeding is defined as the presence of overt bleeding AND at least one of the following in the 24 hours before or after bleeding (without another likely cause):

- Hemodynamic instability
 - ▼MAP > 20 mmHg (or SBP OR DBP if not invasively monitored) or
 - Orthostatic ▲ HR > 20 bpm
 - See RBC 'Use Clinical Judgment' box for peds definition
- Vasopressor initiation or increase
- A decrease in hemoglobin of ≥ 20 g/l (20% for peds)
- Transfusion of ≥ 2 units (30 mL/kg for peds) of packed red blood cells
- Need for therapeutic intervention

For general inquiries contact dmmb.ccsn@ahs.ca



[References, Resources and APL Product Monograph](#)



Don't Misuse My Blood - Clinical Decision Support Tools



PROTHROMBIN COMPLEX CONCENTRATE

Feb 2024

Adult & Pediatric Inpatients (patients > 4 months of age)

Purpose:

This tool supports clinicians to appropriately give prothrombin complex concentrate (PCC) to adult and pediatric inpatients.

Important Considerations:

- The half-life of PCCs is approximately 6 hours. Vitamin K1 co-administration strongly recommended if reversal is required for > 6 hours (Adults 10 mg IV, Pediatrics 0.1 mg/kg IV).
 - INR should be reassessed 10 – 30 minutes after PCC administration if time allows. Additional PCC should be provided if the INR remains > 1.5 and bleeding continues (up to a maximum total dose of 120 ml).
 - PCC is contraindicated in patients with a history of heparin induced thrombocytopenia (HIT).
- Adult dosing is INR based as listed below. If major bleeding is present and the INR is unknown, administer a dose of 80 mLs.
 - For INR 1.5 – 2.9: Give 40 mL (1000 IU)
 - For INR 3.0 – 5.0: Give 80 mL (2000 IU)
 - For INR > 5.0: Give 120 mL (3000 IU)
 - Pediatric dosing is weight and INR based:

Patient Weight	INR < 3.0	INR ≥ 3.0
<10 kg	10mL	20 mL
10 - 25 kg	20 mL	30 mL
25 – 50 kg	30 mL	40 mL

Adult & Pediatric Inpatients Experiencing Bleeding

Clinically Significant Bleeding* and on VKA

Administer PCC for rapid reversal of oral vitamin K antagonists (ex. warfarin) or vitamin K deficiency with **active** clinically significant bleeding.

Clinically Significant Bleeding* and on DOAC**

For **active** clinically significant bleeding and recent (within two days) ingestion of Dabigatran, administration of Idarucizumab (Praxbind™) is recommended. For other types of DOACs**, if the specific antidote is not available, PCC may be recommended after consultation with TM.

Clinically Significant Bleeding* and Special Situations

Other situations when PCC might be useful, in consultation with TM, include factor X deficiency, factor II deficiency, dilutional coagulopathy with acquired clotting factors deficiency, and Anti-Xa DOAC** bypass in situations of **life-threatening bleeding**.

**DOAC: Direct oral anticoagulant

***High bleeding risk procedures: CNS interventions, catheter directed thrombolysis, arterial interventions using > 7-F sheath, etc.

Non-Bleeding Adult & Pediatric Inpatients

Urgent Surgery / Invasive Procedure and on VKA

Administer PCC for rapid reversal of oral vitamin K antagonists (ex. warfarin) or vitamin K deficiency in patients who require urgent (< 6 hours) surgical or invasive procedures associated with a **high risk of bleeding*****.

Urgent Cardiac Surgery and on DOAC**

For **emergent** cardiac surgery and recent (within two days) ingestion of Dabigatran, administration of Praxbind (the reversal antidote) is recommended. For other types of DOACs**, if the specific antidote is not available, PCC may be recommended after consultation with TM.

* Clinically Significant Bleeding is defined as the presence of overt bleeding AND at least one of the following in the 24 hours before or after bleeding (without another likely cause):

- Hemodynamic instability
 - ▼MAP > 20 mmHg (or SBP OR DBP if not invasively monitored) or
 - Orthostatic ▲ HR > 20 bpm
 - See RBC 'Use Clinical Judgment' box for peds definition
- Vasopressor initiation or increase
- A decrease in hemoglobin of ≥ 20 g/l (20% for peds)
- Transfusion of ≥ 2 units (30 mL/kg for peds) of packed red blood cells
- Need for therapeutic intervention

For general inquiries contact dmmb.ccsn@ahs.ca



[References, Resources and APL Product Monograph](#)

 **Alberta Health Services**
Critical Care Strategic Clinical Network™

Inspiring solutions. Together.



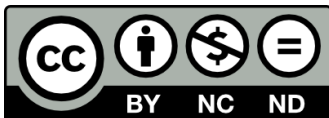
ALBERTA PRECISION LABORATORIES

Leaders in Laboratory Medicine

Don't Misuse My Blood - Clinical Decision Support Tools

Feb 2024

© 2023, Alberta Health Services, CC SCN



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. The license does not apply to content for which the Alberta Health Services is not the copyright owner.

To view a copy of this license, visit

<https://creativecommons.org/licenses/by-nc-nd/4.0/>

Disclaimer: This material is intended for use by clinicians only and is provided on an “as is”, “where is” basis. Although reasonable efforts were made to confirm the accuracy of the information, Alberta Health Services does not make any representation or warranty, express, implied or statutory, as to the accuracy, reliability, completeness, applicability or fitness for a particular purpose of such information. This material is not a substitute for the advice of a qualified health professional. Alberta Health Services expressly disclaims all liability for the use of these materials, and for any claims, actions, demands or suits arising from such use.

