ALBERTA PRECISION LABORATORIES
Leaders in Laboratory Medicine

Granulocytes

APPLICABILITY: This document applies to APL, AHS, Covenant Health, and all other health care professionals involved in the transfusion of blood components and products in Alberta.	***OTHER NAMES:*** *N/A* ***Company:*** *Héma-Québec (HQ)* ***Class:*** *Human blood component, derived from whole blood*

ROUTES	Intravenous	Subcutaneous	Intramuscular	Intraosseous
Acceptable Routes*	Yes	No	No	Yes

* Administration of blood components and blood products is a restricted activity. For specific conditions that apply to a profession's authorization to administer blood components and blood products, consult the applicable discipline-specific regulation under the Health Professions Act (Alberta). Health care professionals with this authorization require the applicable education, training and competency.

DESCRIPTION:

- Granulocytes are a human blood component obtained by apheresis collection from a single donor.
- Each unit contains at least 1 x 10^{10} /L granulocytes, 24 - 40 mL red blood cells, and variable amounts of lymphocytes and platelets in plasma.
- Each unit also contain approximately 36mL of Hespan (hydroxyethyl starch) 6% and 2mL of trisodium citrate 46.7%
- The typical volume of 1 unit of apheresis granulocyte concentrate collected by Héma-Québec is 350 mL.
- Due to the short shelf life of 24 hours, granulocytes are shipped prior to the completion of transmissible disease testing.
- Testing is performed on the donor's granulocyte donation on the day following collection and the updated testing results are provided to the ordering hospital as they become available.

PRETRANSFUSION TESTING & COMPATIBILITY:

PRETRANFUSION TESTING

- Pretransfusion ABORH testing is required for the provision of granulocytes and must be performed.
- The ABORH may be ordered as part of a Type and Screen if red cell transfusion is also anticipated.

COMPATIBILITY:

- Granulocyte concentrates contain a large number of red blood cells, and bidirectional compatibility tests (major and minor) must be conducted prior to transfusion.
- An indirect antiglobulin test serological crossmatch must be performed.
- Granulocytes must be ABO compatible with the patient, and should be RhD compatible, if possible, due to the significant amount of red blood cells in the unit.
- Granulocytes must be antigen negative for any current or historical clinically significant antibodies.

AVAILABILITY:

- Granulocytes are only collected at Héma-Québec in Canada and transported to the local Canadian Blood Services (CBS) centre for distribution.
- The local Transfusion Medicine (TM) service must be contacted for approval.
- Must be irradiated prior to administration, to prevent transfusion-associated graft-vs.-host disease (TA-GVHD).
- Where possible, CMV seronegative patients should receive CMV seronegative granulocytes, i.e. intrauterine transfusion.

INDICATIONS:

- Maintenance therapy for patients with severe neutropenia (<0.5 x 10^9/L) and severe, documented bacterial or fungal infection that is unresponsive to antimicrobials or antifungals.
- The use of granulocyte transfusions is controversial and is only done after consultation with a Transfusion Medicine (TM) physician.

CONTRAINDICATIONS:

- Not recommended for prophylactic treatment of infections.
- There may be less benefit and higher risk of complications for patients with anti-HLA or anti-neutrophil antibodies.

WARNINGS:

Due to short shelf life and the need to transfuse as soon as possible after collection, transmissible disease testing often cannot be fully completed prior to transfusion. Granulocyte units are issued with transmissible disease testing results from the donor's most recent blood donation (prior to granulocyte donation) and have "pending analysis" written on the ISBT label. Testing is performed on the donor's granulocyte donation on the day following collection and the updated testing results are provided to the ordering hospital as they become available. Informed consent should reflect specific consideration for transfusion of incompletely tested products.

DOSE:

- Consult with a Transfusion Medicine physician for transfusion frequency.
  - For apheresis granulocyte concentrates the dose is typically 1 unit per day until a pre-determined clinical endpoint is reached.[2]
  - For children, every other day dosing is sometimes provided. [2]
- Clinical endpoints include:
  - Resolution of infection;
  - Fever diminishes or disappears;
  - Most Responsible Health Practitioner (MRHP) stops therapy; or
  - Absolute neutrophil count ≥ 0.5 x 10^9/L*.

  *A transfusion of granulocytes is rarely associated with an increase in granulocyte count in the patient. This may be attributable to the consumption of granulocytes at the infectious process site.

ADMINISTRATION:

Administer the transfusion per the AHS Transfusion of Blood Components and Blood Products Policy PS-59.

In non-urgent/non-bleeding/inpatient settings, blood components should be transfused during daytime hours (for patient safety) and transfused one unit at a time**.**

Confirm signed consent has been obtained and documented prior to requesting blood components or products (human-source) from lab/transfusion service where possible. *Refer to AHS Consent to Treatment/Procedure(s) Policy Suite.*

Pre-Infusion:

- Ensure recent patient weight and height is on file.
- Ensure pertinent labs are available as required (i.e. Hgb & Type and Screen).
- Ensure any ordered pre-medications have been given (antihistamines, antipyretics prn).
- Perform pre-transfusion checks per AHS Transfusion of Blood Components and Blood Products Policy PS-59.
  - **Pediatrics and Neonates** – confirm correct weight-based dosing.
- Report any new onset acute illness to the authorized prescriber prior to commencing infusion.
- Perform a visual inspection of the unit. Refer to the CBS Visual Inspection Tool.

Access:

- Peripheral, central, umbilical, and PICC lines are acceptable (PICC lines are not used in the NICU for blood component transfusions).

ADMINISTRATION cont'd:

Equipment:

- Standard blood transfusion set (170 – 260 micron filter).
- Do not use a leukocyte reduction or microparticulate filter, as these will trap the granulocytes.

Compatible IV Solutions:

- 0.9% normal saline.
- Plasma protein products and ABO compatible plasma can be administered concurrently with physician order.

Other Solutions:

- Studies in Alberta have shown other IV solutions to be compatible with citrated blood components. *
- These solutions should only be considered in situations where the use of 0.9% Sodium Chloride would lead to undesirable metabolic abnormalities.
- Only isotonic, calcium-free IV solutions should come in contact with blood products. Calcium may bind with the citrate anticoagulant and promote clotting in the tubing. Excess glucose and/or dextrose causes hemolysis and shortens red cell survival.
- Solutions meeting these criteria include:
  - Plasma-Lyte A®: Contains Sodium 140mEq/L, Potassium 5mEq/L, Magnesium 3mEq/L and Chloride 98mEq/L at pH 7.4.
  - Other isotonic, calcium and glucose/dextrose free commercial electrolyte solutions (i.e. Normosol®-R)
  - Ringer's Lactate (LR). **Note:** Studies have shown LR to be compatible with citrated blood components. However, additional studies around the safe use of LR as a citrated blood component diluent are needed.

***** This information differs from the Canadian Blood Services circular of information. As studies in Alberta have shown compatibility with the listed IV solutions, their inclusion within this document is in compliance with CSA Standards.

Medications:

- Medications **must NOT** be added to the blood component bag.
- If it is necessary to administer medications simultaneously with blood components, it is safest to use an alternate site for the medication.
- If administration using a separate site is not possible:
  - Pause the blood component transfusion and flush the IV line with 0.9% Sodium Chloride.
  - Administer the medication.
  - Flush the IV line again with 0.9% Sodium Chloride before resuming the transfusion.

Infusion Rate:

- Transfuse immediately upon receipt, due to expiry 24 hours post-collection.
- Transfuse via gravity flow where possible, due to cell fragility.
- Rate should be specified by the MRHP after patient assessment.
- Infusion rate depends on the patient's blood volume, cardiac status and hemodynamic condition.

Table 1. Recommended rates for routine transfusion as stated by policy

Patient Weight	Infusion Rate: For the First 15 Minutes	Infusion Rate: After the First 15 Minutes
Greater than 25 kg	50 millilitres per hour (mL/h), if possible	For all patient weights: Continue transfusion at the prescribed rate as per the authorized prescriber's order, as long as it does not exceed four (4) hours from the time of blood component removal from the approved storage device / location.
Less than or equal to 25 kg	1 millilitre per kilogram per hour (mL/kg/h)* or slower for the first 15 minutes, if possible	

***** Program pump as 0.25mL/ kg (millilitre per kilogram) or slower for the first 15 minutes, if possible.

POTENTIAL HAZARDS WITH PARENTERAL ADMINISTRATION:

- Potential adverse events related to a blood transfusion range in severity from minor with no sequelae to life-threatening.
- All adverse events occurring during a transfusion should be evaluated to determine whether or not the transfusion can be safely continued/restarted.
- All adverse events suspected to be related to a transfusion (whether during or after a transfusion) should be reported to your local transfusion service and documented.
- Chills, fever and pulmonary insufficiency can be associated with granulocyte transfusions.
- Side effects (especially allergic reactions) due to Hespan® 6% (corticosteroid used to stimulate granulocyte donor) are possible.
- Refer to the *Acute Transfusion Reaction Chart* for symptoms indicative of transfusion reaction.

NURSING IMPLICATIONS:

Table 2. Patient Vital Signs and Monitoring:

	Pre Transfusion Vitals?	Stay At Patient Bedside?			Vital Signs During Transfusion		Post Transfusion Monitoring
		First 5 min	First 10 min	First 15 min	After 15 min	Remainder of transfusion	
All Patients	**Yes**	**Yes**	**NO**, but must be immediately available*		**Yes**	**q1h**	Set of vital signs Monitor for minimum of 15 minutes post transfusion **

*Defined as performing non-dedicated tasks with the patient in view.
**If patient has had a previous adverse reaction to component transfusion, or this is the first time the patient is receiving that component type, monitor for 30 to 60 minutes.

Note: Vital signs/patient monitoring may be conducted more frequently, or continuously, as determined by clinical condition of patient.

Patients receiving blood product transfusions must be observed closely for signs of any unexpected or untoward reactions. These reactions may occur during or after the infusion of blood or blood products. For follow up instructions to a transfusion reaction, go to *Transfusion Reactions | Alberta Health Services*.

Documentation:

Ensure documentation is completed as per AHS Transfusion of Blood Components and Blood Products Policy PS-59.

- Patient tolerability should be documented in appropriate flow chart or clinical record (electronic or paper).
- Document vital signs as required in the appropriate flow chart or clinical record (electronic or paper).
- Provide patient notification documentation.

STORAGE & STABILITY

- Store at 20 - 24°C for up to 24 hours post-collection
- **DO NOT** refrigerate.
- **DO NOT** agitate.

CONTACT INFORMATION:

Approved By: APL Transfusion Medicine Discipline Council
For questions or comments please contact: Transfusion.SafetyTeam@aplabs.ca

REFERENCES

1. Hema-Quebec Circular of Information Notice d'accompagnement Portant sur les produits sanguins labiles (October 2023): PUB-00035.pdf (hema-quebec.qc.ca)
2. Gardner E, Fernandes M, Latour C, Seftel M, Acker J, Clarke G. Granulocyte transfusion therapy. In: Khandelwal A, Abe T, editors. *Clinical Guide to Transfusion* [Internet]. Ottawa: Canadian Blood Services, 2023 [cited 2024.03.14]. Chapter 20. Available from: https://professionaleducation.blood.ca
3. Stepien J, Robert M-H. FAQ: Information for health professionals ordering granulocyte concentrates [Internet]. Ottawa: Canadian Blood Services; 2023 [cited 2024.03.14] . Available from: FAQ: Information for health professionals ordering granulocyte concentrates | Professional Education (blood.ca).