TM08-06.001 Red Blood Cells Selection Policy

APPLICABILITY

Compliance with this document is required by all Alberta Precision Laboratories Ltd. (APL) employees, medical staff, students, and other persons acting on behalf of APL (including contracted service providers as necessary).

PURPOSE

This policy provides direction on determining the appropriateness of a red blood cells (RBC) order for the purpose of screening, preparing, and selecting the most appropriate RBC unit to fill the order, and applies to all personnel who process orders for RBC. This includes patients with special transfusion requirements.

BACKGROUND

Red blood cells are a vital and limited resource. Inappropriate transfusion practices put a strain on Canada's blood supply and expose patients to potential harm. The role of APL personnel in identifying potentially inappropriate transfusions and referring the ordering physician to a Transfusion Medicine (TM) physician, is an important and effective way of supporting appropriate transfusion practices.

DEFINITIONS

ABO/ABORH Specific	Blood products that are compatible for a patient based on the ABO(RhD) type of the patient and the donor when the patient's ABO(RhD) type is valid and current.
Bleeding	A patient who is losing blood volume internally or externally.
Confirmatory ABO type (CABORH)	A blood group typing performed to confirm the patient's blood type in order to provide ABO group specific red blood cells. The test must be performed on a specimen collected independently of the type and screen specimen.
Full Genotype	Genotyping for all major blood group antigens (K, Kidd, Duffy etc.). Also known as human erythrocyte antigen (HEA) genotype.
Full Phenotype	Phenotyping for Rh, K, Jka, Jkb, Fya, Fyb and Ss blood group antigens.
RHCE Genotype	Genotyping for variant forms of the Rhesus blood group antigens, excluding the D antigen.
RHD Genotype	Genotyping for the D antigen and its variant forms.
Rh Matched	Matched for Rh D, C, c, E and e antigens.

Patient with childbearing potential	A patient who is capable of becoming pregnant, or will be capable of becoming pregnant in the future. For the purpose of transfusion, a patient is considered to be a patient with childbearing potential if: • Patient is reported or presumed to be female, gender X or U, aged 45 years or younger, unless known to be incapable of pregnancy. • Patient is known or suspected to be capable of current or future pregnancy.
Patient without childbearing potential	A patient who is not capable of becoming pregnant currently or in the future. This is defined as a patient whose sex at birth was male, or a patient whose sex at birth was female and is over 45 years of age or otherwise incapable of pregnancy (e.g. post-hysterectomy).
Transfusion Medicine Physician	A physician or pathologist with responsibility for Transfusion Medicine in their sector or zone.
Transfusion Parameters	A laboratory value or other criteria at which a specific patient is approved for transfusion by the TM physician.
Unmatched	Blood products issued prior to the completion of pretransfusion testing.

RESPONSIBILITY

TM staff are responsible for:

- Reviewing RBC orders.
- Identifying RBC orders which appear to be inappropriate.
- Referring the ordering physician to the TM physician when an RBC order appears to be inappropriate.
- Contacting the TM physician when the appropriate RBC selection for a patient is unclear.
- Updating patient's history / registry file when special requirements are identified for a patient.

TM physicians are responsible for:

- Consulting with the ordering physician when an RBC order appears to be inappropriate.
- Providing guidance to TM staff on appropriate RBC selection.

POLICY

Deviations from this policy require documented approval from the TM physician.

A pretransfusion sample and confirmatory ABO (if required) should be collected prior to the transfusion of RBC wherever possible.

Included in this policy is:

1. RBC Transfusion Indications and Appropriateness

1.1 Clinical Indications

- The order for RBC shall include the clinical indication.
- RBC transfusion may be indicated in patients with anemia who have evidence of impaired oxygen delivery. Examples include symptomatic acute blood loss, chronic anemia, cardiopulmonary compromise, or disease or medication effects associated with bone marrow suppression.
- Signs and symptoms of impaired tissue oxygenation include, but are not limited to:
  - Elevated heart rate
  - Dizziness or fainting
  - Cardiac symptoms (shortness of breath, chest pain)

1.2 Appropriateness

- RBC transfusion is contraindicated if other non-transfusion therapies or observation would be just as effective.
- Decisions to transfuse should be based on assessment of an individual patient including their symptoms and underlying cause of anemia, and not based solely on achieving an arbitrary hemoglobin (HGB) threshold.
- APL TM supports adherence to a restrictive transfusion strategy in hospitalized, stable patients.
- TM personnel will direct the ordering physician to contact the TM physician when an order for RBC appears to be clinically inappropriate, or when screening criteria are not met.
- If, due to a specific clinical indication, a patient is approved by the TM physician for RBC transfusion that does not align with established screening criteria, their approved Transfusion Parameters should be documented in the laboratory information system (LIS).

Table 1. Stable, Non-Bleeding Patient Transfusion Recommendations

- Inpatients and Emergency department patients: If transfusion is recommended and HGB is greater than or equal to 60, issue one RBC unit and re-check patient's HGB and symptoms prior to issuing a second or subsequent unit.
    - If HGB is less than 60, issue up to two RBC units and re-check patient's HGB and symptoms prior to issuing a third or subsequent unit.
- Booked/Chronic outpatient transfusions (including those booked into the emergency department): may issue more than one RBC unit without checking hemoglobin in between.
- Pediatric patients (<18 years) do not require screening.

HGB (g/L)	Adult Transfusion Recommendation
HGB less than 60	• Transfusion likely appropriate. • Issue 1-2 units.
HGB 60 - 69	• Transfusion likely appropriate. • Issue 1 unit.
HGB 70 - 80	• Likely appropriate in patients with cardiovascular disease. • Likely appropriate if there are signs and symptoms of impaired tissue oxygenation. • Issue 1 unit if above indications are met. • Ordering physician to consult TM Physician if above indications are not met.
HGB 81 - 90	• Likely inappropriate unless there are signs and symptoms of impaired tissue oxygenation. • Ordering physician to consult TM Physician. • Indication for transfusion must be clearly documented in patient's chart. • Issue 1 unit.
HGB greater than 90	• Transfusion likely inappropriate. • Ordering physician to consult TM Physician.

1.3 Bleeding

- Patients who are bleeding or in urgent need of transfusion shall not be denied RBC.
- A patient is considered to be bleeding if:
  - The massive hemorrhage protocol has been activated;
  - The patient is in the operating room (OR);
  - The clinical indication is suggestive of bleeding, including but not limited to:
    - Blood loss
    - Hematoma
    - Hematuria
    - Hematemesis
    - Hemolysis
    - Melena
    - Purpura
    - "suspicious for bleeding"
    - "HGB trending down"
    - HGB has decreased by at least 10 g/L within the last 24 hours

Table 2. Bleeding Patients Transfusion Recommendations

Clinical Indication	Transfusion Recommendation
Cardiovascular Disease Acute Coronary Syndrome Post-partum hemorrhage	Maintain HGB > 80 g/L during active bleeding
All other patients	Maintain HGB > 70 g/L during active bleeding

2. RBC Units for Unmatched Use

- RBC for unmatched use:
  - Shall have their ABO group confirmed,
  - Should be tested for the K antigen, when possible.
  - Shall be clearly marked with a label or tag that indicates pre-transfusion testing is incomplete.
- Verbal orders for unmatched or emergency issue blood products shall be documented.

3. RBC Pretransfusion Testing Requirements

- The patient's historical ABO and RhD blood type shall not be used to determine selection of unmatched RBC units.
- Pretransfusion testing for the purpose of RBC transfusion is valid only if the patient is wearing a current TSIN band. A patient not wearing a TSIN band shall receive unmatched RBC.
- Provision of ABO specific RBC to non-group O patients requires completion of an ABORH and a confirmatory ABORH.
- Provision of crossmatched RBC requires completion of an antibody screen and follow-up antibody identification testing as required.

4. RBC Selection

- Whenever the choice of RBC unit for a particular patient is unclear, consult with a senior technologist or TM physician.
- Patients with childbearing potential should receive K negative units whenever possible, unless known to be K positive.
- Neonates less than 14 days of age should receive RBC that have been irradiated within the last 24 hours. If these are not available, then non-irradiated units greater than 14 days shall be provided.
- If a patient has autologous RBC available, these shall be selected for transfusion prior to the use of allogeneic blood.

A patient's documented gender is not necessarily reflective of their childbearing potential and should only be considered when clinical information related to childbearing potential is unavailable.

4.1 Unmatched RBC Selection

Unmatched RBC shall be selected when:

- The authorized prescriber has assessed the risks versus benefits and determined that the clinical situation is sufficiently urgent to justify transfusion prior to the completion of pretransfusion testing. The authorized prescriber is responsible for documenting this risk assessment (attestation).
- Pretransfusion testing is incomplete. This includes all situations where:
  - A valid pretransfusion type and screen specimen, meeting specimen acceptance criteria, has not been received.
  - A valid TSIN wristband is not attached to the patient,
  - The pretransfusion ABORH and antibody screen are not complete.
  - The patient's antibody screen is positive, and the antibody ID is not complete. *
    ***Note:** Notify the PCU and/or TM physician when units are issued that may not be compatible. See *TM50-07.001 Critical Results and Significant Findings and Circumstances List*.
- O RhD Negative RBC units should be selected for RhD negative or RhD unknown patients who are less than or equal to 2 weeks of age and/or have childbearing potential.
- RhD specific unmatched RBC should be provided once the ABORH is complete.
- ABORH specific unmatched RBC should be provided once the ABORH and confirmatory ABORH (CABORH), if required, are complete.

Table 3. Unmatched RBC Selection

	Testing Completed		
Patient	**None**	**✓ABORH (no CABORH)**	**✓ABORH ✓ CABORH**
Unknown Age **or** Gender (Excludes Neonates)	O RhD Neg (preferred) or O RhD Pos[1]. K Neg[2]		
Neonate ≤ 2 weeks (all genders)	O RhD Neg[1] K Neg[2] Irradiated < 24 hours or greater than 14 days old	O RhD Specific K Neg[2] Irradiated < 24 hours or greater than 14 days old	
Neonate 2 wks - 4 mos (Gender F, X, unk)	O RhD Neg[1] K Neg[2]	O RhD Specific K Neg[2]	
Neonate 2 wks - 4 mos (Gender M)	O RhD Pos	O RhD specific	
Patient with childbearing potential (Age: ≤ 45 yrs or unk **and** Gender F, X, unk)	O RhD Neg[1] K Neg[2]	O RhD Specific K Neg[2]	ABORH Specific K Neg[2]
Patient without childbearing potential (Gender F, X, unk > 45 years **or** M **> 4 months**)	O RhD Pos	O RhD specific	ABORH Specific

1. RhD Positive units may be selected for patients requiring RhD Negative units when:
   - RhD Negative units are unavailable.
   - Site inventory is low (based on site protocols or TM physician direction).
   - Direction has been given by the National or Provincial Emergency Blood Management Committee in response to a shortage.
   - Patient is receiving multiple units of RBC (as directed by the TM physician or local Massive Hemorrhage Protocol).
   - See section 4.3 Switching ABORH and K Types.
2. K Negative RBC are not required if the patient is known to be K positive or are of male gender

4.2 Crossmatched RBC Selection

Crossmatched RBC should be selected when:

- A valid pretransfusion type and screen specimen has been received, and
- The patient is wearing a TSIN wristband, and
- The pretransfusion ABORH, antibody screen, and/or antibody identification are complete.

4.2.1 ABORH

- Group O RBC shall be selected for crossmatch when the confirmatory ABORH test (CABORH), if required, is not complete.
- ABORH specific RBC should be selected for crossmatch when the ABORH and Confirmatory ABORH tests (if required) are complete.
- Refer to *TM08-06.001A01 RBC Selection Chart.*

4.2.2 Other RBC Antigens

- Antigen negative RBC shall be selected and indirect antiglobulin test (IAT) crossmatched for patients with current or historical level 3 clinically significant antibodies.
  WellSky sites: Refer to *TM14-16.001 Antibody Codes and Characteristics.*
- When a patient has multiple or rare antibodies that would require specially phenotyped units to be ordered from CBS, a senior technologist or TM Physician must be consulted, and the likelihood of clinical need determined prior to requesting special units from the referral TM laboratory or Canadian Blood Services Rare Blood Program.
- If compatible antigen negative units are not available (e.g. rare antibodies, multiple antibodies, or antisera unavailable), then consult the TM physician for guidance (if not specified in the procedure).

4.3 Switching ABORH and K Types

Refer to *TM08-06.001A02 Switching RBC Blood Groups Chart* for order of preference when switching ABORH groups.

ABORH group specific RBC are the first choice for most patients whose ABORH type has been tested and confirmed with a confirmatory ABORH test (CABORH).

4.3.1 Switching ABO Types

- ABO non-group specific RBC may be selected when:
  - Compatible and appropriate ABO group specific units are not available (e.g. patient with antibodies).
  - Compatible units approaching expiry are selected to avoid discard of the unit.
- Any patient who has received ABO non-group specific red cells should be given ABO group specific red cells as soon as compatible and appropriate units are available, product demand drops to manageable levels, or group specific stocks increase significantly.

4.3.2 Switching RhD Types

- RhD Negative RBC may be selected for RhD positive patients when:
  - RhD Negative units are the most appropriate choice for patients with alloantibodies or special phenotype requirements (e.g. sickle cell disease and thalassemia patients).
  - RhD Negative units approaching expiry are selected to avoid discard of the unit.
- RhD Negative patients who have received RhD positive red cells should be returned to Rh negative red cells as soon as:
  - Product demand drops to manageable levels or RhD negative stocks increase significantly.
  - An antibody screen shows the presence of a new antibody.
  - An MHP is terminated, or the patient's bleeding is under control.
- A patient without childbearing potential who has received a large volume of RhD Positive RBC may be maintained on RhD Positive RBC until discharge or an anti-D is formed.
- RhD Positive RBC may be selected for RhD Negative or unknown patients with childbearing potential when:
  - RhD Negative RBC are not available. (Notify the TM physician. Pre-approval is not required).
  - When RhD Neg inventory is low (consult senior tech or TM physician for criteria if not specified in site protocols, Inventory Shortage Communications by the National or Provincial Emergency Blood Management Committees).
  - Patient is receiving many units of RBC (as directed by the TM physician, site protocols, or Massive Hemorrhage Protocol).

4.3.3 Switching K Types

- K positive RBC may be selected for patients with childbearing potential when:
  - The patient is known to be K positive.
  - The patient is known not to have an anti-K and K negative RBC are not available (consult senior tech or TM physician).

5. Considerations for Inventory Management

- It is generally best practice for inventory management to select RBC units that are closest to expiry, for patients with no clinical indication requiring fresher units.
- In shortage situations, guidance from the Provincial Emergency Blood Management Committee (PEBMC) supersedes guidance in this policy.
- Sites may set aside specific RBC units (e.g. unmatched group O) to ensure their availability when a patient requires those specific units. The following table provides guidance on inventory management for specific RBC units:

Table 4. Inventory Management Considerations

RBC Unit	Inventory Management Considerations
Group O	• Primarily reserved for group O patients and patients whose ABORH and confirmatory ABORH test (CABORH) have not been completed. • Units approaching expiry may be issued to a non-group O patient in order to avoid discard of the unit.
RhD Negative	• Primarily reserved for RhD Negative patients. • Units approaching expiry may be issued to an RhD Positive patient in order to avoid discard of the unit.

RBC Unit	Inventory Management Considerations
K Negative	• Ensure sufficient K Negative RBC inventory is available for K negative or unknown patients with childbearing potential, and patients who have anti-K. • Units approaching expiry may be issued to any patient in order to avoid discard of the unit.
Irradiated	• Primarily reserved for patients with specific clinical indications. Refer to *TM08-04.006 Irradiated Blood Products Policy.* • Units approaching expiry may be issued to any **adult** patient for whom irradiated RBC are **not contraindicated** to avoid discard of the unit. • Patients for whom irradiated RBC are contraindicated, unless required for a specific clinical indication, include (but are not limited to): o Patient at high risk for hyperkalemic arrest. o Patients on dialysis, in cardiac intensive care units, or known to be using rapid infusers (e.g. trauma or massive hemorrhage) • Do not issue irradiated units to neonatal or fetal patients if it has been more than 24 hours since the unit was irradiated.
Autologous and Directed	• Autologous and Directed RBC shall not be selected for any patient other than the intended recipient. See *TM40-05.011 Prescriber Information - Autologous and Directed Donations.*

6. Special Clinical Indications

For guidelines on providing irradiated products, see *TM08-04.006 Irradiated Blood Products Policy*.

6.1 Pretransfusion Testing for Special Clinical Indications

Table 5. Pretransfusion Testing for Special Clinical Indications

- The following is required in addition to standard Type and Screen and antibody identification testing, ideally before a patient begins a chronic transfusion protocol.

Clinical Indication	Pretransfusion Testing Requirements
Sickle Cell Disease	• Refer to *TM12-12.050 Genotyping Policies*
Only patients with a chronic transfusion plan: • Thalassemia • Myelodysplastic Syndrome (MDS)	• Full phenotype • Full genotype if required for complex antibody investigation
Treatment with monoclonal immunotherapy known to interfere with red cell phenotyping (e.g. anti-CD38, anti-CD47)	• Prior to treatment: full phenotype (preferred) • During active treatment: full genotype • anti-CD38 only: antibody detection and identification may be performed using dithiothreitol (DTT)-treated cells if they are available and time permits.
Suspected IgA Deficiency	• IgA quantification • Anti-IgA
Three or more antibodies • Note: multiple Rh antibodies count as one	• Full phenotype

6.2 RBC Selection for Special Clinical Indications

Refer to *TM14-16.001 Antibody Codes and Characteristics* for clinically significant (level 2/3) antibodies.

Table 6. RBC Selection for Special Clinical Indications

Clinical Indication	If the Patient…	Transfusion Requirement
• Sickle Cell Disease • Thalassemia • Chronic Transfusion Recipient (e.g. aplastic anemia)	Has no clinically significant (level 2/3) antibodies	• Rh and K matched
	Has clinically significant (level 2/3) antibodies	• Full phenotype matched • Antigen negative for clinically significant (level 2/3) antibodies
Myelodysplastic Syndrome (MDS) (only if chronically transfused)	Has no clinically significant antibodies	• Rh and K matched
	Has clinically significant antibodies	• Full phenotype matched • Antigen negative for clinically significant antibodies
Immunotherapy known to cause testing interference (Anti-CD38 / Anti-CD47)	Has clinically significant antibodies (ABSC is positive or negative)	• Full phenotype matched • Antigen negative for clinically significant (level 2/3) antibodies. • Least incompatible IAT crossmatch
	Has no clinically significant antibodies identified prior to therapy (ABSC can be positive or negative)	• Phenotype matched units not required • Exception: ○ If DTT treated cells were used for antibody identification, then K matched units are required. ○ If ABSC is positive *and* patient has been transfused during therapy *and* DTT treated cells have not been used to screen for underlying antibodies, then full phenotype matched units are required.
Confirmed IgA Deficiency • IgA: **undetectable** • Anti-IgA: **positive**	Has history of reactions	• IgA Deficient Donor, or “extra wash” from CBS
	Has no history of reactions	• Regular products under close monitoring.
Multiple Antibodies	Rh antibody(ies) only	• Rh matched
	Rh antibody(ies) and up to one other antibody *Or* 2 non-Rh antibodies	• Rh matched (only if Rh antibodies present) • Antigen negative for clinically significant (level 2/3) antibodies.
	Three or more antibodies (multiple Rh antibodies count as one antibody)	• Full phenotype matched
Allogenic Cellular Therapy Product (CTP) Transplant		• Irradiated, see *TM08-04.006 Irradiated Blood Products Policy.* • Compatible with both donor and recipient until patient has seroconverted and ABORH has been updated, see *TM08-04.007 SCT Blood Type Information.*

6.3 Hemoglobin S (HbS)

- RBC units that are negative for hemoglobin S are preferred for neonatal patients receiving intrauterine transfusions.
- APL TM does not routinely perform HbS testing on RBC units. The population demographics in Alberta are such that the likelihood of an RBC unit testing positive for HbS is very low. Therefore, all RBC units are assumed to be HbS negative.

REFERENCES

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Alberta Health Services. Sexual Orientation and Gender Identity Tip Sheet. https://insite.albertahealthservices.ca/Main/assets/cistr/tms-cis-tr-sexual-orientation-and-gender-identity-tip-sheet.pdf

RELATED DOCUMENTS

TM08-04.006 Irradiated Blood Products Policy
TM08-04.007 SCT Blood Type Information
TM08-06.001A01 RBC Selection Chart
TM08-06.001A02 Switching RBC Blood Groups
TM12-12.050 Genotyping Policies
TM14-16.001 Antibody Codes and Characteristics
TM40-05.011 Prescriber Information - Autologous and Directed Donations
TM50-07.001 Critical Results and Significant Findings and Circumstances List