Transfusion Basics
Risks, Benefits and Alternatives

Posted for information only. Current policies and procedures should be reviewed.

http://www.lhsc.on.ca/lab/bldbank/BTRManual.htm

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Objectives

- Reference material available at LHSC
- Brief overview of the ABO system

- RISKS: Transfusion Safety
- BENEFITS: Most common blood products
- ALTERNATIVES: Blood Conservation Program at LHSC
The Blood Transfusion Resource Manual is intended as a reference tool for staff at London Health Sciences Centre (LHSC) and St Joseph's Health Care (SJHC) in London, Ontario, Canada. The information contained within may not be applicable to the activities of other Blood Transfusion Services. Individuals should always adhere to the policies and procedures of their institution. Neither London Health Sciences Centre nor St Joseph's Health Care shall be liable for any actions, claims, damages, costs or obligations that may arise from the use or misuse of this material.

**AVAILABLE NOW**

Electronic ordering of all blood products:

A Web-based Training Module has been developed.

**TRANSFUSION TALES:**

...presented for your learning

K. Eckert 55303  D. Berta 32707

<table>
<thead>
<tr>
<th>November 2012</th>
<th>Return of Blood Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2012</td>
<td>Transfusion Reaction (Allergic)</td>
</tr>
<tr>
<td>September 2012</td>
<td>Blood Component Review</td>
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<tr>
<td>June 2012</td>
<td>Podiatric Patient and IVIG Mediated Hemolysis</td>
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<tr>
<td>May 2012</td>
<td>Interpretation of DTL Test Results</td>
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## General Information

| A: Informed Consent for Transfusion |
| B: Ordering Blood Transfusion Laboratory (BTL) Tests |
| C: Collection and Delivery of BTL Specimens |
| D: Requests for Blood Products |
| E: Storage and Return of Blood Products |
| F: Uncrossmatched Blood |
| G: Issue and Receipt of Blood Products |
| H: Administration of Blood Products |
| I: Transfusion Alternatives for Elective Surgery Patients |
| J: Directed Donor Program |
| K: Massive Transfusion Protocol LHS C: St. Joseph's |
| L: Adverse Effects of Blood Transfusion / TRAC |
| M: Pediatric Neonate |

### N: Non UH/VH Hospital Sites - Obtaining Blood Products or Tissues

**Request and Issue of Blood Products / Tissues**

**Algorithm:**

- Parkwood or Dialysis Sites
- Issue Voucher
  - (non-UH/VH sites only)

### S: Blood Products - Overviews

<table>
<thead>
<tr>
<th>Immune Globulins:</th>
<th>Factor Concentrates:</th>
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<tr>
<td>- Packed Cells</td>
<td></td>
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<tr>
<td>- Platelets</td>
<td></td>
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<tr>
<td>- Fresh Frozen Plasma</td>
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<tr>
<td>- Cryosupernatant Plasma</td>
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<tr>
<td>Intravenous Immune Globulin (IVIG)</td>
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<tr>
<td></td>
<td>- Factor VIII products</td>
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<td>- Baxter Adato</td>
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<td>- Bayer KogenateS</td>
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<td></td>
<td>- Factor IX (Bénylin)</td>
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<tr>
<td>MOH Dose Form</td>
<td></td>
</tr>
<tr>
<td>NIG Dose Calculator</td>
<td></td>
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</table>
E-learning Blood Administration Program Available

See link from the Blood Transfusion Manual homepage, under Blood Product Information for Nurses
ABO Blood Groups

GROUP AB

GROUP A

GROUP B

GROUP O
# ABO Compatibility Table

<table>
<thead>
<tr>
<th>Pt Bld Grp</th>
<th>Red Cells</th>
<th>Plasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O,A,B,AB</td>
</tr>
<tr>
<td>A</td>
<td>A,O</td>
<td>A,AB</td>
</tr>
<tr>
<td>B</td>
<td>B,O</td>
<td>B,AB</td>
</tr>
<tr>
<td>AB</td>
<td>AB,O,A,B</td>
<td>AB</td>
</tr>
<tr>
<td>Unknown</td>
<td>O</td>
<td>AB</td>
</tr>
</tbody>
</table>
INCOMPATIBILE
Grp A cells transfused to Grp O patient

vs

COMPATIBLE
Grp A cells transfused to Grp A patient
Serious Hazards Of Transfusion (UK)

Canadian Risks of Transfusion per unit of blood:
- HIV, HCV, HBV, WNV all less than 1 in 1 million
- Receiving the wrong unit of blood: 1 in ~27,000 (always due to human error in sample collection, in the lab or at administration)

http://www.shotuk.org/home.htm
Sample Collection
Sample drawn on GW, 78 M – Bowel Obstruction
No historical record, sample is A Neg
6 units of group A FFP were transfused
Patient went to OR, and 4 units of A Neg RBCs were sent in an igloo to the OR
Units were returned. Patient was not transfused
Next sample received on this patient is O Neg

Confirmed with 3rd sample.
Transfusion based on the initial specimen, would have resulted in an acute hemolytic reaction
# London BTL Statistics

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WBIT</strong></td>
<td>9</td>
<td>12</td>
<td>16</td>
<td>17</td>
<td>27</td>
<td>33</td>
<td>39</td>
<td>53</td>
<td>25</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td><strong>Rate of WBIT</strong></td>
<td>1 in 4559</td>
<td>1 in 3504</td>
<td>1 in 2653</td>
<td>1 in 2432</td>
<td>1 in 1506</td>
<td>1 in 1263</td>
<td>1 in 1050</td>
<td>1 in 917</td>
<td>1 in 2088</td>
<td>1 in 3125</td>
<td>1 in 2983</td>
</tr>
</tbody>
</table>
On average, the Blood Transfusion Lab receives 4000 specimens/month or about 135 per day. The 2008 rate of WBIT at 1 in 917 specimens was approximately 1 every 7 days.
Sample Collection Process

1. Order tests in PowerChart
2. Take labels to the bedside. Compare complete name and PIN to patient’s armband & do NOT proceed if not identical (For outpatients with no armband – patient MUST participate by spelling name and stating DOB)
3. Draw sample
4. Label tubes at patient’s bedside
5. Username, date/time on BOTH the Core Lab labels and the BTL labels (also needs signature)
6. NEVER LEAVE PATIENT BEDSIDE BEFORE LABELING SAMPLE TUBES

As of March 31, 2008 – all patients have their blood group confirmed with 2nd sample before transfusion
Transfusion of Blood Products

An early blood transfusion: from lamb to man
Consent for Blood and/or Blood Products

• Discussion and written informed consent is required for patients receiving or likely to receive blood and/or blood products
  • Consent is required for all products obtained from the BTL
• If patient refuses blood – Refusal Form must be completed
• Consent is assumed by the BTL
  Refusal must be documented in BTL Refusal Form MUST be faxed to BTL immediately upon completion; signature to confirm faxed
Administration of Blood

• PRIOR to obtaining blood product, check chart:
  • For transfusion order
  • For consent for transfusion

• PRIOR to starting transfusion, patient armband and blood product labels MUST be checked by 2 Regulated Health Care providers (2 nurses) in the presence of the patient:
  • Patient ID
  • ABO/Rh of the unit of blood and the patient
  • Blood product unit number
Revised June 2009
Blood Product Checks

**MUST** be done at Patient’s Side by 2 Staff Members

It is NOT necessary to check in PowerChart. All required information is on the label.

1. **Patient name & PIN**
   - Chart label
   - (4 checks)

2. **Blood Group**
   - Label on back of Blood Product
   - Compare patient group to product group. Must be identical or ABO compatible.
   - Chart label
   - (3 checks)

3. **Donor Unit Number**
   - Label on back of Blood Product
   - Chart label
   - (3 checks)

Chart label
- Record Date & Time infusion is started
- Signatures of staff who completed checks
- Affix label in Lab section of chart

Progress Notes
- Record Date and Time the infusion was completed
- Vital signs
- Any adverse symptoms

Adverse Symptoms?
- Notify Attending Physician and Blood Transfusion Lab

**Legend**
- Mouse, Mickey
- Dr. W. Disney
- 1123 45 66
- Armband

Physician’s Order &/or Facesheet (Admission/Discharge Sheet)

Canadian Blood Services (CBS)
Product Label
Administration Guidelines

• See Transfusion Resource Manual for the recommended IV set-up for blood administration

• ALL blood products should be administered through a standard blood transfusion set (includes in-line filter)
  • Rate as per Physician’s order
  • Transfuse slowly (50 mL/hr) for the 1st 15 minutes where appropriate
  • 4 hours maximum
  • Set changed after every 2–4 units (no longer than 4–6 hours)
  • Blood Products are only compatible with normal saline

• Start transfusion immediately or return to BTL without delay

• ALWAYS return units that are not transfused

• NEVER put blood products into patient care area refrigerators
Patient Monitoring during Transfusion

- Vital signs – minimum requirements: prior to, at 15 minutes and on completion of transfusion

- Observe patient closely during first 15 minutes

- If any reaction to transfusion is suspected
  - Stop transfusion pending further physician order
  - Maintain IV access with saline to keep vein open
  - Check vital signs
  - Re–check name / PIN of patient with product label
  - Notify patient's physician
  - Follow instructions as per TRAC (Transfusion ReAction Course)
# Blood Transfusion Resource Manual

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### Massive Transfusion Protocol
- LHSC
- St. Joseph's

### Trauma Transfusion Pathway

### Health Canada Special Access Program

## N: Non-UH/VH Hospital Sites - Obtaining Blood Products or Tissues

### Request and Issue of Blood Products / Tissues

- **Algorithm for St. Joseph's**: All Blood Products / Tissue
- **Algorithm for St. Joseph's**: RBC Only
- **Issue Voucher** (non-UH/VH sites only)

## S: Blood Products - Overviews

### Immune Globulins:
- Factor VIII products
- Baxter Advate
- Bayer Kogenate

### Factor Concentrates:
- Factor IX (Beningo)
Section L: Adverse Effects of Blood Transfusion

(Notify BTL if patient has any adverse effect to blood transfusion)

**T R A C**

Transfusion ReAction Course

Clinical Management

IMMEDIATE ACTIONS
1. STOP transfusion pending further physician order
2. Maintain IV access with saline TKVO
3. Check vital signs
4. Re-check name and PIN of patient with product label
5. Notify patient’s physician

Click on symptoms below to access recommended Clinical Actions.

**Suspected Transfusion Reaction Signs and Symptoms:**

- Fever (≥38°C & increase of more than 1°C from baseline) *and/or* Chills / Rigors
- NO known underlying cause for fevers / chills / rigors
- Urticaria (Hives)  Rash  Other Allergic symptoms
- Dyspnea  OR  Decreased SpO₂
- Hypotension
Types of Reactions

- **Most Common:**
  - Febrile
  - Allergic / Urticarial
  - Transfusion Associated Circulatory Overload (TACO)

- **Leading Cause of Transfusion-related death**
  - Acute Intravascular Hemolysis
  - Sepsis
  - Transfusion Related Acute Lung Injury (TRALI)

- **Additional complications of transfusion**
  - Citrate Intoxication (decreased calcium)
  - Hypothermia
  - Increased potassium

- **Delayed Transfusion Reactions:**
  - Sensitization to Foreign Antigens / Delayed Hemolytic
  - Transmission of Viral Diseases
  - Graft Versus Host Disease (TA–GVHD)
  - Immunomodulatory Effects
Blood Products

- Packed Cells
- Plasma
- Platelets

Additional products: Cryoprecipitate, albumin, immune globulins, clotting factors
Frozen Plasma /Fresh Frozen Plasma

• Indications:
  • Dilutional coagulopathy due to massive transfusion (trauma, surgical bleed)
    • Coagulopathy should be demonstrated by a prolonged INR or PTT that is 1.5 X normal
  • Multiple coagulation factor deficiencies, not corrected with Vitamin K therapy
  • Urgent reversal of Warfarin therapy (Prothrombin Complex Concentrate should be considered first)
  • NOT to be used as a volume expander
• Generally 4 or more units are required for correction of coagulopathy
• **Indications:**
  - Bleeding patients related to:
    - thrombocytopenia
    - platelet dysfunction (drug induced)
  - Prophylactic use in non-bleeding patients with platelet counts below $10 \times 10^9$
    secondary to chemotherapy and/or BMT
  - Patients with counts $< 50 \times 10^9$ may require platelets before an invasive procedure
• Pediatrics <30kg should receive 10–20mL/kg (max 300mL)
• All other patients should receive 1 adult dose
• Increases plt count 25 – 50 $\times 10^9$ in non-bleeding adult
Packed Cells (RBCs)

- **Indications:** Increase oxygen carrying capacity in:
  - Bleeding patients
  - Surgical anemia
  - Chronic anemia (non-pharmacologically treatable)

- RBCs should be transfused one unit at a time (reassess patient)

- In a non-bleeding adult one unit should raise hemoglobin ~ 10g/L

**NOTE:** Gender and Body size (Ht/Wt) are important factors when considering Hb/blood loss/transfusion requirements
Transfusion Alternatives

Alternatives
Plasma - ??? Platelets - ??? RBC - ???

Primary Strategy: Ensure appropriate indication for Transfusion
Avoid over-transfusion  Avoid under-transfusion

Benefit > Risk
Why not transfuse?

Is the transfusion decision clinically supported?

Risk > Benefit
Why transfuse?

Relieve Clinical Signs & Symptoms, Prevent Morbidity&Mortality
Red Blood Cell Erythropoiesis

Iron for intracellular Heme Synthesis
(stomach, duodenum, jejunum)

Erythropoietin
(Renal Peritubular Interstitial cells)

Vitamin B12
(Stomach, duodenum, terminal ileum)

Folate
(jejunum, ileum)

Stem Cell Precursor Pool
(Bone Marrow)

Time frame 7-10 days

Reticulocyte
(Spleen x 24-48 hrs)

Mature red blood cell
(Peripheral circulation)
Erythropoietin Regulation of Red Blood Cell Production

- Red Blood Cells
- Kidney
- Bone marrow
- Erythropoietin

O₂
Packed Cells (RBC) Transfusion Alternatives: Transfusion Trigger

- Hb 70, 80, 90, 100 gm/l How low can we go?
- Optimal anemia management is not clearly defined
- In ICU patients, maintaining Hgb 70 – 90 gm/l was found to be safe for patients without acute cardiac conditions. Liberal transfusion strategies (maintaining Hgb 100 – 120 gm/l) may have resulted in higher mortality rates. Hebert et al. Transfusion Requirements in Critical Care (TRICC) Investigators and the Canadian Critical Care Trials Group NEJM. 1999; 340: 409-417
# Blood Conservation: Key Strategies

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**Consider:**
- Anemia Investigation
- Hemoglobin/Ferritin
- Hemoglobin Optimization Strategies
  - Iron: PO
  - Iron: IV
  - Epoetin Alfa
- Anticoagulant medication assessment/management
- PAD (Preoperative Autologous Donation) patient/procedure specific indications only

**Consider:**
- Surgical Technique & Attention to Hemostasis
  - Volume expanders
  - Hypotensive Anesthesia
  - Regional Anesthesia
  - Antifibrinolytics
  - Hemostatic Agents, Surgical glues
  - Cell Salvage
  - Acute Normovolemic Hemodilution

**Consider:**
- Augment Surgical Recovery Processes:
  - normovolemia
  - normothermia
  - supplemental oxygen
  - pain control
  - promote comfort
- Transfusion Trigger/Transfusion Target
  - patient specific indications
- Non actively bleeding patient, transfuse 1 unit red blood cells and re-assess

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**Patient Specific Variables:** Cardio–respiratory Comorbidities, Age, Height/Weight
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**Patient Specific Variables:** Cardio–respiratory Comorbidities, Age, Height/Weight
Post-operative Anemia Management Guideline

1. Is there acute/ongoing blood loss or blood loss > 20% of blood volume?
   - YES
   - NO

   **Consider:** O2 & RBC Transfusion

2. Is there Normovolemia?
   - NO
   - YES

   **Hypovolemia: Signs & Symptoms**
   - Peripheral edema
   - Dyspnea/decreased O2 sat
   - Pulmonary edema
   - Signs of right heart failure/increased CVP
   - Measured Hb may be spuriously low

   **Hypervolemia: Signs & Symptoms**
   - Peripheral edema
   - Dyspnea/decreased O2 sat
   - Pulmonary edema
   - Signs of right heart failure/increased CVP
   - Measured Hb may be spuriously low

   **Treatment:**
   - Diuretics & O2

   **Treatment:**
   - IV Fluid/Volume Expanders

3. Is there Signs & Symptoms of Anemia/Hypoxia?
   - Tachycardia/tachypnea
   - Angina/ST depression
   - Syncope/postural hypotension
   - Confusion

   NO to #3 and to #4

   Hb > 70, monitor
   Hb < 70 consider O2 & 1 unit RBC Transfusion

   YES to #3 and NO to #4

   Hb > 80, monitor
   Hb < 80 consider O2 & 1 unit RBC Transfusion

4. Is there increased risk of anemia related complications?
   - Cardiac: Angina < 2 blocks, MI/CHF past 6/12, Stenotic valve
   - History of CVA/TIA
   - Severe Pulmonary Disease: COPD, ongoing smoking
   - Advanced age > 75 years

   NO to #3 and YES to #4

   Hb > 80, monitor
   Hb < 80 consider O2 & 1 unit RBC Transfusion

   YES to #3 and to #4

   Hb > 90, monitor
   Hb < 90 consider O2 & 1 unit RBC Transfusion

**Differential Diagnosis:**
- Hyper/Hypovolemia/Anemia
- Heart Failure
- Pulmonary Embolism
- Angina
- Pleural Effusion
- Sepsis
- Pneumonia

**References:**
Top 10 Keys to Ensure Safe Transfusion

1. Universal donors: **RBC**: Group O neg  
   **Plasma**: Group AB

2. Patient Identification is **ESSENTIAL** for pre-transfusion samples and administration of blood products and MUST occur in the presence of the patient.

3. Check patient’s armband against sample and blood product labels.
Top 10 Keys to Ensure Safe Transfusion

4. Physician Order for blood product and transfusion rate is required

5. Patient consent is required for blood product transfusion

6. Blood products can be safely stored ONLY in BTL or in regulated igloos

7. Normal saline only is infused with blood products, a blood administration set is always required for RBC, plasma and platelets
Top 10 Keys to Ensure Safe Transfusion

8. Begin transfusions slowly for first 15 minutes

9. Blood product transfusion must be completed within 4 hours

10. Transfusion reactions occur, be prepared:
    • Set-up to stop a transfusion immediately
    • Recognize symptoms (fever, rigors, rash, itching, hives, SOB, hypotension)
    • Report to Physician, BTL – TRAC
Questions/Comments