1.0 Policy Statement

1.1 The Regional Health Authorities shall have:

1.1.1 Procedures in place to allow early identification of adults who may require activation of a Massive Hemorrhage Protocol (example, a comprehensive assessment identifying patients at risk for massive bleeding upon entry into the healthcare facility, or a transfusion medicine laboratory system in place to identify patients who have required excessive volumes of blood components within a 24 hour time period).

1.1.2 Processes in place to ensure appropriate communication of massive hemorrhage event information (example, Emergency Medical Service relaying information to the receiving facility).

1.2 The Regional Health Authorities shall establish and maintain policies outlining actions to be taken when an individual is identified as requiring a massive transfusion.

1.3 The transfusion services Medical Director shall establish a policy for abbreviated serologic testing when a patient requires a massive transfusion.

1.4 Transfusion medicine laboratories shall have processes in place for the release of blood and blood components before pre-screening is completed; situations where the delay in transfusion may negatively impact the patients’ outcome.

2.0 Definitions & Acronyms

Note: As a result of emerging research and to reflect the changes in terminology worldwide, the terms Massive Transfusion Event and Massive Transfusion Protocol have been replaced with Massive Hemorrhage Event and Massive Hemorrhage Protocol respectively.

2.1 Blood volume: One blood volume is approximately 5000 mL or 70 mL/kg in a 70 kg adult.

2.2 Massive Hemorrhage Event (MHE): Transfusion of a volume of blood components equivalent to a patient’s estimated total blood volume within a 24 hour period. This approximates 10 units or more packed red blood cells in adults. Other definitions include 50% loss of total blood volume within 3 hours; blood loss at a rate greater than 150 mL/minute; or blood loss requiring four units of RBCs in a four hour time period.
2.3 **Massive Hemorrhage Protocol (MHP):** A protocol developed to ensure rapid recognition, response, and intervention for those patients experiencing a massive hemorrhage event. A MHP is activated when the health care provider anticipates the hemorrhage event will require massive transfusion support.

2.4 **Transfusion Medicine Laboratory (TML):** Hospital Blood Bank.

2.5 **Transfusion Safety Officer (TSO):** A health care professional with education and experience in transfusion medicine. The Transfusion Safety officers’ mandate is patient safety. TSOs provide transfusion education to all health professionals directly involved in screening, ordering and transfusing of blood components and products. TSOs promote appropriate utilization of blood components and blood products, and improve processes which impact patient safety.

2.6 **Canadian Blood Services (CBS):** A Canadian not-for-profit, charitable organization responsible for management of blood and blood products supply.

### 3.0 General Information


### 4.0 Process/Procedure (Algorithm attached as supplement).

#### 4.1 Criteria required to declare a Massive Hemorrhage Event

A massive hemorrhage event should be declared once a full patient assessment has been completed and it is anticipated that the patient will require a massive transfusion.

Physical assessment should include:

- **4.1.1** The cause and rate of hemorrhage.
- **4.1.2** The type of injury (if applicable).
- **4.1.3** The patient’s current physiological status.
- **4.1.4** Anticipated ongoing transfusion support.
- **4.1.5** A health history, when possible, to deem whether or not the patient is at increased risk for hemorrhage due to a pre-existing condition (such as congenital or acquired bleeding disorder) or due to medication (such as antiplatelet or anticoagulant drugs).
4.2 Massive Hemorrhage Protocol

The physician will activate the Massive Hemorrhage Protocol once a massive hemorrhage event is declared.

4.2.1 Notify the TML and appropriate medical/surgical staff.

4.2.2 Initiate Hematology Consult if indicated.

4.2.3 Designate a clinical contact person (RN, Resident or Physician) to handle all communications regarding laboratory results, requests for blood components, and notification of components available for issue.

4.2.4 Notify the TML immediately in order to identify the laboratory technologist or personnel who will be responsible for fielding all calls from the clinical contact person.

To minimize miscommunication, each MHP should be managed by the delegated clinical person and coordinated with one TML technologist.

4.2.5 Inform the assigned laboratory technologist of:

4.2.5.1 The nature of the bleeding event (e.g. obstetric bleed/trauma/OR/vascular).

4.2.5.2 Patient history including any known pre-existing coagulopathy.

4.2.5.3 Name of the physician who is initiating the protocol.

4.2.5.4 Name of the designated contact person who will be ordering the blood components and products.

4.2.6 Place request for blood components as necessary.

4.2.7 The TML shall notify CBS by phone, as soon as the MHP is activated so that blood inventories may be adjusted by CBS to provide for the immediate requirements.

4.2.8 The TML staff shall notify other laboratories (haematology, coagulation, chemistry).

4.2.9 Identify a designated “runner” to ensure that specimens and blood components are transported to the appropriate areas while the Protocol is in effect.

4.3 Initial Measures

A comprehensive initial assessment and treatment of the patient should be performed including but not limited to:

4.3.1 Assess the patient’s airway, breathing, and circulation.
4.3.2 Manage bleeding by direct pressure, packing, or stapling lacerations.

4.3.3 Manage/control bleeding with surgical interventions, angiographic embolization, or endoscopy as required.

4.3.4 Establish central venous access and an arterial line.

4.3.5 Collect baseline blood work.

4.3.6 Replace fluid loss with appropriate fluid replacement.

4.3.7 Correct hypothermia. Use high capacity blood warming devices that are capable of rapid heat exchange without causing thermal damage to the fluids or cells of the blood components. Rapid infusers may also be required.

4.3.8 Record vital signs, urine output.

4.3.9 Normalize acid/base status.

4.3.10 Assess neurological status.

4.3.11 Obtain a health history and medication history if possible.

**Note:** If the patient requires a higher level of care than is available at the treating facility, stabilize and prepare for transfer to secondary or tertiary care facility. Transfer all pertinent patient information to the receiving facility.

4.4 **Positive Patient Identification, Informed Consent and Emergency Issue.**

Refer to facility policies regarding positive patient identification, informed consent and emergency issue of blood components.

4.5 **Diagnostic Testing**

**Note:** Label all Specimens MHP (Massive Hemorrhage Protocol).

4.5.1 **Prior to** administering any blood components, collect blood samples for:

Group and screen (ABO group, Rh type, and antibody screen).

CBC, INR, PTT, fibrinogen, electrolytes, creatinine, calcium, magnesium, lactate, and arterial blood gas (based on facility’s capabilities).

**Repeat blood tests**

Blood tests should be repeated every 30-60 minutes depending on the clinical condition.

4.6 **Blood Component Selection**

4.6.1 Group O Rh negative red blood cells should be used if transfusion is required while awaiting results of the blood group testing.
4.6.2 Rh negative units shall be given to all women of childbearing potential. (If the Group O Rh negative supply becomes compromised, the patient will be maintained with Group O Rh positive.)

4.6.3 Transfuse group specific units when the recipient’s specific group is confirmed.

4.6.4 Initiate cell salvage if it is an option.

4.6.5 The following table identifies the appropriate RBC, plasma, and platelet group to be used based on the recipient’s group. When there are multiple groups, they are listed in terms of most to least compatible:

**ABO Compatibility for RBCs, Plasma, and Platelets**

<table>
<thead>
<tr>
<th>Recipient ABO Group</th>
<th>Donor ABO Group</th>
<th>RBCs</th>
<th>Plasma</th>
<th>Platelets</th>
</tr>
</thead>
<tbody>
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<td>AB</td>
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<td>AB</td>
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<td>B</td>
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<td>B, AB,(A),(O)</td>
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<td>AB,(A),(B),(O)</td>
<td>AB,(A),(B),(O)</td>
<td></td>
</tr>
</tbody>
</table>

*Blood groups in parentheses represent choices with incompatible plasma, listed in “least incompatible” order.

**Adapted from Provincial Blood Coordinating Program (2008), Guidelines for Blood Component Substitution in Adults

4.7 **Guidelines for Therapy**

4.7.1 **Red Blood Cells**

The goal when transfusing red cells is to maintain haemoglobin of 70-100 g/L. Order up to 10 units RBCs to begin. Transfuse group O until group specific is ready. Use Rh negative, if possible, for women less than 49 years old, or for children. Switch to group specific blood as soon as possible depending upon blood bank inventory.

4.7.2 **Frozen Plasma**

The goal when transfusing frozen plasma is to maintain INR less than or equal to 1.7 g/L or achieve adequate microvascular hemostasis. The initial adult dose is 500-1500 mls.

4.7.3 **Platelets**

The goal when transfusing platelets is to maintain a platelet count greater than 50 x 10^9/L or greater than 100 x 10^9/L in those with
CNS trauma or known platelet dysfunction. One adult dose is equivalent to one buffy coat pool or 1 unit of apheresis platelets.

4.7.4 **Rh Immune Globulin**

Rh Immune globulin should be administered to patients who are Rh negative who have received Rh positive platelets after the patient no longer requires further blood components, and provided the patient has not received Rh positive red cells. The recommended standard dose is 300µg.

4.7.5 **Cryoprecipitate**

The goal when transfusing cryoprecipitate is to maintain a fibrinogen level greater than 1.5 g/L.

If the fibrinogen level is **less than 1.5 g/L** and the INR is **greater than or equal to 1.7** transfuse frozen plasma or consider cryoprecipitate.

If the fibrinogen level is **less than 1.5 g/L** and the INR is **less than 1.7**, transfuse cryoprecipitate.

One adult dose is 10 units or 1 unit / 5kg body weight, to a maximum of 10 units per dose. This product requires 25-30 minutes to thaw and issue.

**Note:** *In an obstetrical massive hemorrhage event, more aggressive fibrinogen replacement should be considered.*

4.7.6 **Additional Treatment Options**

**Antifibrinolytics and Procoagulant Medications:**

Consider treatment with antifibrinolytics or procoagulant medications if the patient continues to bleed.

**Antifibrinolytics**

Antifibrinolytics such as Tranexamic acid and Desmopressin (DDAVP) are used to control bleeding. Initial research has indicated a safer side effect profile with decreased thromboembolic risks when compared to other treatments such as rFVIIa.

Tranexamic acid should be administered within the first three hours after injury as a 1gm IV bolus, followed by infusion of 1gm over the next eight hours.

DDAVP may be administered 10mcg/m² IV to a maximum dose of 20 mcg.
Prothrombin Complex Concentrates
Prothrombin Complex Concentrates may be considered for the reversal of Vitamin K antagonists or for treatment of Vitamin K deficiency in patients exhibiting major bleeding.
The recommended adult dose is INR dependent and may be up to 3000 international units of Factor IX activity, along with Vitamin K, 10 mg intravenously.
The INR should be re-tested within 10-30 minutes of administration. A higher or second dose may be required in extreme conditions.

Recombinant Factor VIIa (rFVIIa)
Note: rFVIIa should only be considered in rare cases after all other measures have been used and there is a likelihood that the patient will survive. The risk of harm outweighs the evidence of benefit for rFVIIa use in these instances.
rFVIIa is administered 0.020-0.050 mg/kg IV direct.

4.8 Adverse Transfusion Events (ATE) and Complications

4.8.1 ATE: Recipients of massive transfusion are at greater risks of experiencing an adverse transfusion event especially transfusion associated circulatory overload (TACO). Monitor for signs and symptoms of ATE as per facility policy.

4.8.2 Complications: Recipients of massive transfusion are at greater risks of experiencing complications including:

Dilutional coagulopathy
Hypomagnesemia
Bleeding
Hyperkalemia
Hypothermia
Hemorrhagic diathesis
Acidosis
Thrombocytopenia
Hypocalcemia
Thromboembolic events
Disseminated intravascular coagulation (DIC)

4.9 Monitor Progress

4.9.1 Monitor utilization of products (by TML).
4.9.2 Determine transfusion strategy if bleeding persists, if the patient has received more than 20 components without any platelet transfusion.

4.9.3 Consult Hematology after 20 components transfused, if not already consulted.

4.10 End MHP

4.10.1 Determined by the managing physician; bleeding must be under control or ceased.

4.10.2 Notify the assigned laboratory technologist.

4.10.3 Notify laboratory areas (TML, hematology, coagulation, and chemistry) and CBS that the Massive Hemorrhage Protocol has ended.

4.11 Quality Review

Quality and Risk Management shall conduct a debriefing with all appropriate clinical and laboratory staff to review the following aspects of implementation of the Massive Hemorrhage Protocol:

4.11.1 Patient outcome.

4.11.2 Staff performance during the event.

4.11.3 Effectiveness of communication strategies.

4.11.4 Response time.

4.11.5 Strengths and weaknesses of actions taken.

4.11.6 Suggestions to improve management of future massive hemorrhage events.

5.0 Records Management

5.1 Documentation shall include:

5.1.1 Types of blood components transfused

5.1.2 Amounts transfused

5.1.3 Administration times

5.1.4 Indication for administration

5.1.5 Outcome of Massive Hemorrhage Protocol.

5.2 Transfusion records in recipient medical charts must be retained according to facility policy.

5.3 TML recipient data including serologic test records must be retained indefinitely.

5.4 Records of serious adverse reactions must be maintained indefinitely.
5.5 Refer to Canadian Society for Transfusion Medicine Standards for Hospital Transfusion Services for additional information related to records retention requirements.

6.0 Supplemental Materials

6.1 Sample standing order sheet for Massive Transfusion Protocol

6.2 Algorithm for blood component/blood product use during a massive transfusion.
References


Bethesda, MD: AABB Press.

Guidelines on the management of massive blood loss. British Journal of 
Haematology, (135), 634-641. DOI: 10.1111/j.1365-2141.2006.06355.x
BLOOD COMPONENT / BLOOD PRODUCT USE DURING A MASSIVE HEMORRHAGE EVENT (ADULT)

**IDENTIFY & TREAT ACTIVE BLEEDING**
(Surgical, Medical, Obstetrical, Trauma)

**STABILIZE +/- TRANSPORT TO A REFERRAL CENTRE**

Care should be initiated within the resources & capabilities of the sending hospital with appropriate decisions made regarding the need for patient transfer and the level of escort required for transfer.

**ACTIVATE MHP**
If patient is bleeding with anticipation of ongoing blood loss or bleeding requiring at least four (4) units of RBCs (adults),
- Establish or assign patient identification
- If the patient is transferred to another facility, the MHP will need to be activated in the second facility

Call TML to Activate MHP
- Provide contact information of the physician leading the MHP
- TML will notify the TML Medical Director as appropriate

**MEDICAL-SURGICAL INTERVENTIONS**
Prior to initiation of treatment, send STAT:
- CBC, INR, aPTT, fibrinogen, electrolytes, creatinine, ionized calcium, magnesium, lactate, arterial blood gas, Group and Screen (blood tests to be based on capabilities of the facility)
- Consider cell salvage
- Warm all fluids
- Surgical/Interventional Radiology options as appropriate
- If within 3 hours of injury, consider tranexamic acid 1 g IV over 10 minutes then 1 g IV over 8 hours

**INITIAL TRANSFUSION MANAGEMENT**
ADULTS:
- RBCs 6 units and
- Plasma 1500 mL and
- Platelets 1 adult dose (if requested)

In hospitals where platelets are not in inventory consider requesting platelets from Canadian Blood Services (CBS)

**FOR ONGOING BLEEDING**
Reassess for bleeding source(s)
Repeat blood components based on lab results
Consider DDAVP
Adults: 10.0 mcg/m² IV (max dose 20 mcg)

**CONSIDER DISCONTINUING MHP WHEN:**
- Shock has resolved
- Bleeding is under control
- Inform TML that MHP has been terminated

**MAINTENANCE**
Hemoglobin above 70 g/L with RBCs:
Adults: 2-10 units
Platelet count above 50 x 10⁹/L OR above 100 x 10⁹/L (CNS injury) with Platelets:
Adults: 1 adult dose

INR below preset RHA value (1.5 or 1.7) with Plasma:
Adults: 500-1500 mL

Fibrinogen above 1.5 g/L with Cryoprecipitate:
Adults: 10 units

Ionized calcium:
Greater than 1.13 mmol/L

Urine output:
Greater than 0.5 mL/kg/hour

Systolic Blood Pressure:
Greater than 70 mmHg

Temperature greater than 35°C
pH greater than 7.10

**REASSESS**
CBC, INR, aPTT, fibrinogen, etc. as needed

**rFVIIa WARNING**
rFVIIa use should only be considered in rare cases after all other measures have been used and there is a likelihood that the patient will survive
rFVIIa dose is: 0.020-0.050 mg/kg IV