APPLICABILITY This document is applicable at: GNH MIS RAH SGH UAH

POLICY

Massive hemorrhage is typically defined as the loss of more than one blood volume in a 24 hour period. Alternate definitions include: the loss of one-half the patient's blood volume within a 3-hour period, or bleeding at a rate of 150 mL/minute. If these bleeding rates occur during a period of inadequate hemostatic control, significant blood loss requiring massive transfusion can be anticipated. The current Edmonton Zone Massive Hemorrhage Protocol (MHP) for dealing with massive hemorrhage in traumatic, surgical, medical, and obstetrical patients has been in place since January 2009 with minor revisions occurring throughout 2011-2021. As indicated in the Massive Transfusion Consensus Conference Panel report, red cell transfusion is the most important component in successful resuscitation. No ideal ratio of red cells to other components has been established.

The Edmonton Zone MHP should be initiated once the patient's physician has determined that the patient is or soon will be undergoing massive hemorrhage and has directed activation of the MHP. Suburban/Rural Community sites labs in the Edmonton Zone carry only a limited inventory of red blood cells (RBCs) and blood products (plasma protein products). Platelets and plasma are not routinely stocked; therefore, MHP packs are not available at these sites. Unmatched (emergency-release) RBCs and fibrinogen concentrate can be issued to support the patient until transfer to another facility with inventory and testing capacities for MHP activations.

A MHP is not just ratio provision of blood components. There are seven critical process elements associated with MHPs, known as the 7 "Ts":

1. **Triggering & Talking**
   To activate the MHP, one contact individual in the clinical setting should contact the site Transfusion Medicine lab. To minimize miscommunication, only that one designated contact individual should order blood components and products. Similarly, within Transfusion Medicine, the MHP should be coordinated by a single Transfusion Medicine technologist. If Transfusion Medicine is notified directly, a physician from the clinical team is required to consult the TM Physician within 15 minutes of MHP activation. Transfusion Medicine is responsible for notifying the hematology/coagulation laboratories. The Transfusion Medicine physician is a 24/7/365 resource for the clinical team that can help guide transfusion of the most appropriate blood components or products, and will ensure that the correct testing is expedited.

2. **Team**
   Early notification and preparation of the extended team, including personnel, assigned roles, and gear is essential. The extended team includes the emergency team, surgical team, laboratory departments, porters, and other involved departments.

3. **Testing**
   It is critical to collect a Type and Screen specimen for Transfusion Medicine testing as soon as possible, as well as specimens for regular monitoring of coagulation status. Although venous specimens are preferred, specimens for Transfusion Medicine testing in the setting of a MHP can also include shed blood or intraosseous specimens submitted in EDTA tubes. However, if one of the latter two specimen types is provided, please indicate as such on the requisition and specimen tubes so that alternate testing methods can be utilized. Patients with an unknown ABO group will be issued group O RBCs and group AB plasma until a patient ABO group is confirmed. **Due to scarcity of supply, a maximum of 2 AB plasma units will be provided at a time**.

   For patients who are Rh-negative, or whose Rh status is unknown, Rh-negative RBCs and platelets will be issued only if the patient is female and less than or equal to 45 years old. Males over 4 months of age will receive Rh-positive unmatched RBCs. Rh Immune Globulin (RhIg) will be considered for Rh-negative patients who have received Rh-positive platelets unless they have also received Rh-positive RBCs, or have

already been Rh-immunized. Kell negative RBCs will be issued to females less than or equal 45 years old or patients of unknown gender.

4. **Tranexamic acid (TxA)**
   Ensure that the patient has received TxA support as appropriate.

5. **Temperature**
   Ensure that the patient is being actively warmed to keep core temperature greater than 36°C.

6. **Transfusion**
   To ensure prompt provision of blood components and correction of coagulopathy, the initial MHP pack is divided into two parts, referred to as Pack 1A and Pack 1B. For patients greater than or equal to 50 kg, the standard Pack 1A contains 4 units of RBCs and 2 g of fibrinogen concentrate (4 g for obstetrical hemorrhages). Pack 1B contains 2 units of RBCs and 4 units of plasma (unless ABO group is unknown, see "Testing" section above). As soon as the MHP is initiated the Patient Care Unit should immediately send a porter or designate (e.g. Unit Attendant, Service Attendant, etc.) with a pick-up slip to Transfusion Medicine to pick up Pack 1A. As soon as Pack 1A has been delivered the porter or designate (e.g. Unit Attendant, Service Attendant, etc.) should immediately return to Transfusion Medicine to pick up Pack 1B. If provided, the platelets are found in the outside pouch of the pack. The clinical team can decline Pack 1B if plasma support is not required.

   Subsequent MHP packs will contain all blood components in a single box with contents modified at the discretion of the TM physician. A platelet unit will be included in Pack 2, unless otherwise directed by the TM physician.

   If the fibrinogen concentrate is not required, it may be returned to Transfusion Medicine if it has not been reconstituted.

   For patients less than 50 kg, blood components in general will be provided on a 30mL/kg basis for RBCs, 20mL/kg for plasma, and 10mL/kg for platelets. However, all blood components will be rounded to the closest unit size if time does not permit for splitting into aliquots.

7. **Termination**
   It is important to notify Transfusion Medicine when the MHP has been terminated, to allow for resuming of routine testing processes, and care of other patients. It also allows for evaluation and replenishing of stock as required. It is also important to provide feedback regarding aspects that went well and those that did not. A debrief form will be provided with each activation, and will also be emailed to the physician requesting initiation of the MHP. All MHP activations will be reviewed by the Transfusion Medicine department within 7 days of the event.

Other important points regarding MHPs are:

1. Pre-emptive initiation of the MHP pack may not occur more than 2 hours before anticipated patient hemorrhage. A pre-arrival pack (contents of Pack 1A) can be issued to the patient's current location or to a hospital emergency room prior to onsite arrival of the patient to the Emergency Department. However, preparation of Pack 1B will commence ONLY upon Transfusion Medicine's receipt of patient registration information and confirmation of MHP activation.
2. Blood components may not be issued more than 60 minutes before planned infusion time unless they are issued to a monitored temperature environment such as a validated storage cooler or blood storage refrigerator.
3. Positive patient identification, monitoring of vital signs and documentation of transfusion must be performed as per transfusion policy and procedures.

PROCEDURE

1. Ensure adequate venous access with 2 large bore peripheral IVs and/or a central venous catheter.

2. Select standard blood tubing with 170-260 micron microaggregate filter, or applicable tubing for rapid transfusion or fluid warming devices. Note: Do not use pressure infusion devices for transfusion of platelets or cryoprecipitate. Platelets may be transfused through a fluid warmer.

3. Follow standard hospital identification and banding procedures.

4. Ensure all required services are notified. These may include surgery, interventional radiology, anesthesia and critical care.

5. If blood loss is from a clean surgical field in a patient without underlying malignancy, initiate cell salvage procedures if available.

6. If the patient does not have a valid Type and Screen, draw a Type and Screen as per Transfusion Medicine sample collection procedure (perform this step even if unmatched RBCs are being requested). Send STAT with 'Life Threatening' sticker on upper right corner of the requisition or on specimen bag.

7. Contact Transfusion Medicine, indicate that you would like to activate the MHP, and provide the following information:
   a. Patient name (or alias, if applicable), age, gender, pMRN/ULI (or hospital number, if applicable), weight, diagnosis, location of patient, phone extension;
   b. Name of the Most Responsible Health Practitioner (MRHP) initiating the MHP;
   c. Name of the designated contact individual who will be communicating with the Transfusion Medicine lab;
   d. Type of bleed (i.e. trauma, obstetrical, gastrointestinal, cardiovascular, etc.);
   e. If possible, any special transfusion requirements should also be communicated if appropriate previous history is known (e.g. antigen - negative or irradiated).

8. Dedicate a porter/runner for the patient to ensure that specimens and blood components and products can be delivered in an urgent fashion.

9. As soon as the MHP is initiated, the Patient Care Unit should immediately send a porter or designate (e.g. Unit Attendant, Service Attendant, etc.) with a pick-up slip to the Transfusion Medicine lab to pick up Pack 1A.
   a. If an unmatched MHP is requested and patient is greater than or equal to 50 kg: 4 units of group O RBCs and 2 g of fibrinogen concentrate will be provided.
   b. Patients greater than or equal to 50 kg: 4 units of group specific/compatible RBCs and 2 g of fibrinogen concentrate (4g for obstetrical hemorrhages).
   c. Patients less than 50 kg: Blood components will be provided based on 30 mL/kg for RBCs and 30-60 mg/kg for fibrinogen. All blood components will be rounded to the closest unit size if time for splitting units does not permit.

   As, soon as Pack 1A has been delivered, the porter or designate (e.g. Unit Attendant, Service Attendant, etc.) should immediately return to Transfusion Medicine with a pick-up slip to pick up Pack 1B.
   d. If an unmatched MHP is requested and patient is greater than or equal 50 kg: 2 units of group O RBCs and **ONLY** 2 units of AB plasma will be provided.
   e. Patients greater than or equal to 50 kg: 2 units of group specific/compatible RBCs and 4 units of group specific plasma, with or without platelets as per the transfusion medicine physician.
   f. Patients less than 50 kg: Blood components will be provided based on 30 mL/kg for RBCs, 20 mL/kg for plasma, and 10 mL/kg for platelets. All blood components will be rounded to the closest unit size if time for splitting units does not permit.

Subsequent MHP packs will contain all blood products in a single box with contents modified as per the instructions of the TM physician using the clinical diagnosis and available laboratory parameters as a guide. Pack 2 will contain a platelet unit for all MHP indications for patients greater than 50 kg, unless otherwise directed by the TM physician. A pick-up slip is required for each MHP pack.

10. Order the following laboratory tests as standing orders for as long as the patient is massively hemorrhaging (Send with 'Life Threatening' sticker on upper right corner of the requisition or on specimen bag):
    a. CBC, INR, fibrinogen q30minutes;
        - The laboratory will be performing hemoglobin, platelet, INR and fibrinogen levels as part of an acute hemorrhage panel, with results available within 30 minutes of receipt.
    b. Arterial blood gas, electrolytes, serum creatinine, ionized Ca, Mg, serum lactate q4hours.
        - NOTE**:** Ionized Ca and serum lactate are not required to be sent to the lab if part of the arterial blood gas Point of Care Testing (POCT).

11. If patient temperature is less than 35ºC despite administration of fluid through warming devices, actively rewarm patient.

12. Administer tranexamic acid as appropriate if not already done:
    a. Adults: 1 g bolus, followed by 1 g infusion over 8 hours.
    b. Pediatrics: 10 – 15 mg/kg bolus, then 1 – 5 mg/kg/hour infusion.

13. A physician from the clinical team is required to consult the TM Physician within 15 minutes of MHP activation.

14. Order additional blood components or products on the basis of the last available laboratory tests:

Product	Goal	Dose
RBCs	Maintain HB at 70 – 100 g/L	As per rate of blood loss
Platelets	Maintain platelet count 50 – 100 x 10^9/L, or greater than 100 x 10^9/L if CNS injury	1 pool of buffy coat platelets or one apheresis unit if patient weight greater than or equal to 25 kg. 10 mL/kg if patient weight less than 25 kg.
Plasma	Maintain INR 1.5 – 1.8	10-15 mL/kg
Cryoprecipitate or Fibrinogen concentrate	Maintain fibrinogen: Greater than 1.8 g/L (Trauma patients) Greater than 2.5 g/L (Cardiovascular surgery patients) Greater than 2.5 g/L (Obstetrical patients)	Cryo: 1 unit/10 kg Fibrinogen concentrate: as per recommendation of the Transfusion Medicine physician

15. Reassess bleeding rate between doses of blood components and products. If possible, await results of repeat laboratory tests before transfusing additional blood components and products.

16. Consult with the TM physician on-call if patient continues to bleed despite:
    a. Large vessel bleeding source ruled out by surgery and/or angiography;
    b. INR less than 1.8, a PTT less than 45 seconds, fibrinogen greater than 1.0 g/L within past hour ;
    c. Platelet count greater than 50 within past hour (or after two doses of platelets in setting of platelet dysfunction);
    d. Hb greater than 80 g/L within past hour;
    e. Core temperature greater than or equal to 32ºC within past hour;
    f. pH greater than or equal to 7.2 within past hour; or
    g. Ca^{2+} greater than or equal 0.8 mmol/L within past hour

17. Inform hospital Transfusion Medicine when control of bleeding has been obtained, or when resuscitation efforts have been withdrawn. Return unused blood components and products to TM as soon as possible.

18. Complete *TM40-02.600F01 Massive Hemorrhage Protocol Feedback Form - Edmonton Zone* included in Pack 1A.

CONTACT INFORMATION

For questions or comments, please contact Transfusion.SafetyTeam@aplabs.ca or refer to http://www.ahs.ca/labtransfusion.

RESOURCES

TM40-02.600A01 Massive Hemorrhage Protocol Flow Chart - Edmonton Zone
TM40-02.600A02 Greater than or equal to 50 kg Massive Hemorrhage Protocol Flowchart - Edmonton Zone
TM40-02.600A03 Less than 50 kg Massive Hemorrhage Protocol Flowchart - Edmonton Zone
TM40-02.600A04 Massive Hemorrhage Protocol Cheat Sheet - Edmonton Zone
TM40-02.600F01 Massive Hemorrhage Protocol Feedback Form - Edmonton Zone