Thunder Bay Regional Health Sciences Centre Policies, Procedures, Standard Operating Practices	No. PAT-2-34
Title: Massive Hemorrhage Protocol - Adult	☒ **Policy** ☒ **Procedure** ☐ **SOP**
Category: Patient Services **Dept/Prog/Service:** Patient Related: IV/CL	**Distribution:** Organization Wide
Approved: EVP, In-Patient Care Programs **Signature**:	**Approval Date:** May 3, 2012 **Reviewed/Revised Date:** Mar. 3, 2020 **Next Review Date:** Mar. 3, 2023

CROSS REFERENCES: (PAT-2-19) Blood and Blood Product Administration, (PAT-2-10) Fluid Resuscitation – Use of Level 1 Infuser and Pressure Bag, (CS-375) Transfusion Services Release Form; Consent to Test, Treatment or Operation (CS-007), (SA-104) Patient Identification

1. PURPOSE

Outline the process for the activation of the Massive Hemorrhage Protocol.

2. POLICY STATEMENT

Thunder Bay Regional Health Sciences Centre's (the Hospital) massive hemorrhage protocol (MHP) is initiated once the patient's physician has determined that the patient is or soon will be undergoing massive blood loss and has directed activation of the MTP. It is recognized that in different settings (e.g., OR, ICU, Emergency Department) the activation and use of the protocol may vary depending on the individual patient's clinical status.

3. PROCEDURE

3.1 Pre Activation

Appropriate fluid resuscitation with crystalloid fluid boluses must be initiated. Assess the patient's response to the fluid boluses. If there is no response or the response is transient, repeat the fluid boluses and if there is still no or transient response initiate the massive transfusion policy.

The cause of the fluid or blood loss must be identified and corrected as soon as possible.

3.2 Activation

To activate the TMHP, one contact individual (i.e., charge nurse of clinical area) in the clinical setting should contact Transfusion Services (extension 6601). **It is the responsibility of only that one designated contact individual to order blood products.** Similarly, within the Transfusion Services each TMHP should be coordinated by a single Transfusion Services technologist.

- Blood products may not be issued more than 30 minutes before planned infusion time unless they are issued to a monitored temperature environment such as a validated storage cooler or blood storage refrigerator.

All attempts should be made to get a type and crossmatch for transfusion medicine testing as soon as possible.

- Patients with unknown ABO group will be issued group O red blood cells (RBCs) and group AB plasma until patient ABO group confirmed.
- For patients who are Rh-negative or whose Rh-status is unknown, Rh-negative RBCs will be issued initially but may be switched to Rh-positive blood products at the discretion of Transfusion Services Medical Director. Rh-immunoglobulin (Rhlg) will be offered to Rh-negative women of child baring age (i.e., less than 50 years of age) who have received Rh-positive platelets unless they have also received Rh-positive RBCs, or have already been Rh-immunized.

Massively bleeding patients should have a temperature measured within 15 minutes of arrival or protocol activation and then at a minimum of half-hourly (or continuously where available) until the protocol is terminated.

Note: All hypothermic patients should receive interventions to prevent hypothermia and achieve normothermia.

3.3 Contraindications and Cautions

- The patient's religious beliefs may prohibit the administration of blood or blood products. Jehovah's Witnesses prohibit treatment with whole blood, autologous and allogenic red blood cells, fresh frozen plasma, platelets and hemoglobin solutions. As per policy - *Consent to Test, Treatment or Operation (CS-007).*
- Administer all fluids using the rapid infuser. Temperature monitoring is imperative.

3.4 Process for Massively Bleeding Patients

- Ensure adequate venous access with two large bore peripheral IVs (e.g., 14 to 18-gauge) and/or a central venous access device (CVAD).
- Patient Temperature should be measured within 15 minutes of arrival or protocol activation and then a minimum of half-hourly (or continuously if available) until protocol is terminated.
- Assess patient for reversal of anticoagulant/antithrombotic agent. Refer to page 3 and 4 for options.
- Consider antifibrinolytic agent - *Tranexamic acid (TXA)1 gram IV over 10 minutes followed by infusion of 1 gram over 8-hours.* ***Early administration (within 3 hours of onset of bleeding) is important, caution should be taken for patients presenting several hours after injury.***
- Prime IV tubing (Y-blood or rapid infuser tubing) with 0.9% normal saline solution. If the IV fluid is to be infused under pressure, the air must be removed with a needle to avoid an air embolism.
- Ensure correct patient identification as per policy *Identification of a Patient (SAF-104)*.
- Draw pre-transfusion bloodwork as requested by physician.
- Contact Transfusion Services (extension 6601), indicate that you would like to activate the **massive hemorrhage protocol** and provide the following information:
  - patient name (or temporary identification for unidentified patient), age, sex, diagnosis, special transfusion requirements, location, phone extension
  - name of the physician who is requesting initiation of the massive transfusion protocol
  - name of the designated contact individual who will be ordering blood products
- Transfusion Services will issue a minimum of two units of packed red cells and two units of fresh frozen plasma on initiation of MTP. **Plasma takes approximately 20 to 30 minutes for thawing**; Transfusion Services will send plasma when ready.
- Order the following laboratory tests as standing orders for as long as the patient is massively bleeding

  (Transfusion Services will notify the core laboratory that the MHP has been initiated):
  - CBC and ionized calcium (iCa) every hour
  - PTT, INR and fibrinogen every hour
  - arterial blood gas, electrolytes, serum creatinine, magnesium, serum lactate every 4-hours
- Administer calcium gluconate 10% (1 gram) for every 2 units of PRBC
- Recommended blood and blood product replacement in MHP in general after 5 units of PRBC have been given, fresh frozen plasma (FFP) is given in a 2:1 ratio PRBC: FFP. Platelets also may be initiated however the stock of platelets is very limited and in general administration should be based on the platelet count. In situations where this is not practical take into consideration that Transfusion Services has a limited supply (no more than 5 units).

Product	Threshold	Adult
PRBCs	hemoglobin less than 80 g/L	5 units
Platelets	platelet count less than 50 x 10^9/L	1 dose
FFP	INR 1.8	2 FFP
	INR greater than 2.0	4 FFP
Cryoprecipitate or Fibrinogen Concentrate (FIBC)	fibrinogen less than 1.5 g/L (1.0 g/L for obstetrical hemorrhage)	1 pool (10 units) or 1 to 4 g FIBC

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

- Factor VIIa may be considered if patient continues to bleed noting that following criteria are required for the hemostatic effect of this product:
  - large vessel bleeding source ruled out by surgery and/or diagnostic imaging
  - INR less than 1.8, PTT less than 45 seconds, fibrinogen greater than 1.5 g per L within past hour platelet count greater than 50 x 10^9/L within past hour (or after two doses of platelets in setting of platelet dysfunction)
  - hemoglobin greater than 80 g/L within past hour
  - core temperature greater or equal to 32ºC within past hour
  - pH greater than 7.2 within past hour
  - ionized calcium greater than 0.8 mmol per L within past hour

Procoagulant Medications and Other Considerations:

Heparin Reversal

Adult dosing:

- Protamine 1 mg IV for every 100 units of heparin to be neutralized or as indicated by coagulation studies. The appropriate dose can be calculated based on a 60-minute half-life for heparin.

- Example: For a patient receiving 1,500 units/hour of heparin by continuous IV infusion who had not recently received bolus heparin: this patient would require enough protamine to neutralize all the heparin received in the last hour (1,500 units), plus half the dose in the preceding hour (750 units), plus a quarter of the dose received the hour before that (375 units). Thus, this patient would require 26.25 mg of protamine to neutralize a total of 2,625 units of heparin. The maximum recommended dose within a 2-hour period is 100 mg unless a larger quantity is indicated through confirmation by coagulation tests.

- Low molecular weight heparin (LMWH) toxicity or hemorrhage associated with enoxaparin therapy
  Adult intravenous dosing:
  - If enoxaparin was administered in the previous 8 hours, give protamine 1 mg IV for every 1 mg of enoxaparin. If enoxaparin was administered greater than 8 hours previous to the protamine dose or if a second dose is needed, give protamine 0.5 mg IV for every 1 mg of enoxaparin. A second dose of protamine may be administered if the aPTT measured at 2 to 4 hours after the initial infusion remains prolonged. However, even with higher doses of protamine, the aPTT may remain more prolonged than would usually be found with protamine treatment following unfractionated heparin. In all cases, the anti-Xa activity is never completely neutralized (maximum 60 - 75%).

- Low molecular weight heparin (LMWH) toxicity or hemorrhage associated with dalteparin or tinzaparin therapy

  Adult intravenous dosing:
  - In general, protamine 1 mg IV for every 100 anti-Xa international units of dalteparin or tinzaparin is given. A second infusion of protamine 0.5 mg IV for every 100 anti-Xa international units of dalteparin or tinzaparin may be administered if the aPTT measured at 2 to 4 hours after the initial infusion remains prolonged. However, even with higher doses of protamine, the aPTT may remain more prolonged than would usually be found with protamine treatment following unfractionated heparin. In all cases, the anti-Xa activity is never completely neutralized (maximum 60 - 75%).

  Note: As these agents are renally excreted, patients with renal impairment may have more low-molecular weight heparin to neutralize after 8 hours.

- Warfarin reversal
  - Vitamin K 10 mg IV
  - Prothrombin complex (octaplex), refer to policy Prothrombin Complex Concentrate (octaplex) PAT-2-30 for dosing
- Clopidogrel (Plavix) reversal
  - Platelet dose
- Dabigatran
  - Praxbind antidote available from Pharmacy
- Direct Thrombin/X^{a}Inhibitors (i.e. Rivaroxiban, Apixiban)
  - No specific antidote
  - Off lable use of Octaplex (50IU/kg max dose 3000IU) available after completion of CS-375 Release form
- Cell salvage
  - Consider cell salvage if blood loss is from clean surgical field in a patient without underlying malignancy. Refer to policy and procedure Blood Salvage-Quality Management (OR-12).

Alternative measures when bleed is refractory to surgical hemostatis and medical optimization of coagulation parameters is ineffective consider use of Factor VIIa

Off label use requires completion of Release form CS-375 (suggested dose 20-50ug/kg).
Best results when:

- INR less than1.5
- PTT less than1.5 x ctrl
- Fibrinogen greater than 1.0g/L
- Platelets greater than 50 x10^{9}/L
- Hemoglobin greater than 80g/L
- Correct acidosis where pH less than 7.1
- Correct hypocalcemia
  - Give appropriate blood product/medications prior to FVIIa use
  - Limited stock available

Notify Transfusion Services (extension 6601) when control of bleeding has been obtained, or when resuscitation efforts have been withdrawn. Return any unused blood products to Transfusion Services as soon as possible.

5. DOCUMENTATION

Emergency Record

Trauma Record
Interdisciplinary Progress Record (CS-053)
Massive Hemorrhage Protocol Issue and Transfusion Record (CS-957)
EMR – notes

6. REFERENCES

Capital Health. (2010, February 18). Massive transfusion protocol. Alberta, Canada.

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Ontario Blood Coordinating Network. Ontario Massive Hemorrhage Protocol. September 6, 2019 http://transfusionontario.org/en/documents/?cat=massive-hemorrhage-protocol

Thunder Bay Regional Health Sciences Centre Massive Hemorrhage Protocol

Appropriate Initial Interventions

- ✓ Intravenous access: 2 large bore IVs (14 to 18-gauge) and/or central venous catheter
- ✓ Crystalloids: as per attending physician
- ✓ STAT Labs: **Crossmatch, CBC, INR, PTT, Fibrinogen, Electrolytes, Mg, Lactate, Creatinine, ABGs and Ionized Calcium**
- ✓ Continuous monitoring (include temperature)
- ✓ Administer all fluids using the rapid infuser
- ✓ Prevent/reverse acidosis

Procoagulant Medications and Other Considerations

- ✓ **Heparin reversal**
  - Protamine 1 mg IV per 100 units of heparin
- ✓ **Warfarin reversal**
  - Vitamin K 10 mg IV
  - Prothrombin complex (octaplex), refer to policy Prothrombin Complex Concentrate (PAT-2-30) for dosing
- ✓ **TXA 1gCell salvage**

Initial PRBCs will be group O if patient's blood group is unknown. Once blood group is determined, group specific blood will be issued.

Recommended Blood and Blood Product Replacement for adults in MTP
****Transfusion services will continue preparing blood products according to laboratory values outlined in table below**

Product	Threshold	Dose
PRBCs	Aim for over 80g/L	5 units
Platelets	Aim for over 50	1 dose
FFP	If INR over 1.8	2 FFP
	If INR over 2.0	4 FFP
Cryoprecipitate or Fibrinogen Concentrate (FIBC)	If fibrinogen less than 1.5 g/L *1.0 g/L in obstetrical hemorrhage	1 pool (10 units) or 1 to 4g FIBC

Identify and Manage Bleeding
✔ Surgery ✔ Endoscopy

Appropriate fluid resuscitation with crystalloid fluid boluses must be initiated. Assess the patient's response to the fluid boluses. If there is no response or the response is transient, repeat the boluses.

Antifibrinolytics & Procoagulant Medication
- Tranaxemic Acid (TXA) 1g
- Anticoagulant reversal

Activate MHP by calling Transfusion Services (ext. 6601)
Identify one contact individual in the clinical setting (i.e. charge nurse)
- ★ Provide contact name of designated contact person
- ★ Provide patient name/ID, sex, location of patient and physician
- ★ Send all blood work STAT
- ★ Call Transfusion Services if patient location/contact changes

Transfusion Services Sends
*5 units PRBC + 2 units FFP
Allow ~30 minutes for FFP preparation

Q30 minutes assess if bleeding has stopped

NO

Administer calcium gluconate 10% (1 gram) for every 2 units of PRBC

Clinical designate contacts Transfusion Services for additional products
****Attending MD can adjust based on labs as needed**

Consider
Platelet transfusion
Contact Transfusion Services to determine availability
Fibrinogen replacement
Contact Transfusion Services for Cryoprecipitat or FIBC

YES

STOP MTP
- Notify Transfusion Services
- Return unused products ASAP
- Resume standard ordering practices

Repeat CBC, iCa, INR,PTT, Fibrinogen Q60 minutes

Q4H electrolytes, Mg, creatinine and ABG

Consider Factor VIIa
Factor VIIa requires sign off "Off Label Release"

TBRHSC Massive Hemmorhage Protocol (MHP) Checklist

- ☐ MHP activated by contacting Transfusion Services (ext. 6601)
- ☐ Ask charge person for extra help
- ☐ One staff member is assigned to be a clinical contact (charge nurse or designate) to ensure consistent one-to-one communication with Transfusion Services
- ☐ Contact Transfusion Services, and:
  - Provide name of clinical contact
  - Provide patient's name/temporary ID, sex, location of patient and physician
  - Send all bloodwork STAT
- ☐ Collect the following **initial** bloodwork STAT:

✓ Crossmatch	☐ Electrolytes
✓ CBC	☐ Magnesium
✓ INR	☐ Creatinine
✓ PTT	☐ Ionized Calcium
✓ Fibrinogen	☐ Lactate
✓ ABG	

- ☐ Initial MHP pack contains:
  - 2 units of PRBCs
  - 2 units of FFP (allow ~30 minutes for thawing)

Notify Transfusion Services of any products required before MHP pack is ready

  - Products can be kept in cooler for up to 8 hours
  - Cooler can be transported with patient, as long as products not expired

- ☐ Additional MHP packs can be adjusted by physician based on bloodwork
- ☐ Return unused products to Transfusion Services ASAP

MHP Bloodwork (As long as patient actively bleeding, or as determined by physician)

- ☐ Enter all bloodwork as STAT

Test	Frequency	Tube Type	Comments
– CBC	– Initial – Q60min	– Lavender	– Mix by Inverting 8 to 10 times
– Ionized calcium	– Initial – Q60min	– Dark green	– Mix by Inverting 8 to 10 times
– PT – PTT – Fibrinogen	– Initial – Q60min	– Blue	– Only one full tube needed – Mix by Inverting 8 to 10 times
– Electrolytes – Creatinine – Magnesium	– Initial – Q60min	– Light green (mint)	– Only one tube needed – Mix by Inverting 8 to 10 times
– ABG	– Initial – Q60min	– Heparinized syringe	– RRT to obtain sample(s)

Nursing Considerations

- ✓ Ensure 2 large bore IVs (e.g, 14 to 18-gauge)
- ✓ Crystalloid fluid per physician order
- ✓ Administer all fluids using the rapid infuser
- ✓ Document product use on MHP Issue & Transfusion Record (CS-597)
- ✓ Monitor Patient Temperature
- ✓ All blood products to stay with patient if transferred
- ✓ Notify Transfusion Services if patient location changes
- ✓ Notify Transfusion Services when MHP stopped and return unused blood products ASAP
- ✓ Document activation and termination of protocol in patient's chart