

# Massive Transfusion Policy (MTP) for Adult & Pediatric Patients

**This Policy is Applicable to the following sites:**  
SH GR Hospitals

<b>Applicability Limited to:</b>	Emergency Department (ED), Surgery (OR), Adult Critical Care (ACC), Pediatric Critical Care Medicine (PCCM), Obstetrics (OB), Labor & Delivery (LD) and Anesthesia (ANES)
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<b>Version #:</b>	2
<b>Effective Date:</b>	10/23/2014
<b>Functional Area:</b>	Clinical Operations

**Purpose:** To outline the process and steps for rapid preparation, issue, and infusion of blood components for patients in extremis due to massive bleeding. To provide goal directed therapy through use of the Thromboelastography (TEG). In the absence of goal directed therapy a ratio of 1:1:1 component therapy is desired.

**Responsibility:** Physicians, Registered Nurse (RN), Blood Bank, Laboratory, Pharmacy

**Definitions:**

1. **Adult Massive transfusion:** the actual or anticipated *rapid* transfusion of blood products and other intravenous fluids that may equal the replacement of greater than patient's blood volume.
  - a. OB patients will follow the adult MTP.
  - b. Adult MTP Pack is composed of 4 units of packed red blood cells, 4 units of thawed fresh frozen plasma and 5 units (1 pooled pack) of platelets with cryoprecipitate between packs.
  
2. **Pediatric Massive transfusion:** the actual or anticipated *rapid* transfusion of blood products and other intravenous fluids to individuals less than 18 years of age to replace greater than the patient's estimated blood volume within twenty-four (24) hour period and/or need for transfusion equal to half of the patient's estimated blood volume at one time, such as within one hour. Estimates of total blood volume vary by age (Appendix A).

**Policy Content:**

- Policy
- Appendix A Pediatric Definitions, Criteria, and Dosing
- Appendix B Suggested Component replacement Guideline during Trauma Resuscitation-Adult Patients
- Appendix C Complications of Massive Transfusion Policy (greater than 20 units of components)
- Appendix D Adult Massive Transfusion Checklist
- Appendix E Massive Transfusion Tracking Form

**Policy**

1. Criteria for Initiation of MTP
  - a. Actual or anticipated blood loss is requiring rapid infusion of  $\geq 4$  units of PRBC with the anticipation of additional PRBC or other blood products as an emergent situation
2. The MTP must be initiated and terminated by a physician
3. The Blood bank will monitor and provide the total number of units dispensed
4. All blood products and fluids should be warmed
5. All blood and blood components administered will be documented in the EHR and progress notes

**Procedure**

<b>Responsible Individual</b>	<b>Action</b>
<b>Physician or designee</b>	<ol style="list-style-type: none"> <li>1. Order the initiation of the MTP               <ul style="list-style-type: none"> <li>• Verbalize "Initiate MTP"</li> </ul> </li> <li>2. Initiate "Mass Transfusion Careset" (Adult) or the "Mass Transfusion PEDS Careset" in Cerner</li> <li>3. Ensure STAT type and screen has been ordered and obtained.               <ul style="list-style-type: none"> <li>• For emergency department patients, obtain and begin administration of the 6 units of emergent uncrossed PRBCs in the Trauma Bay blood refrigerator while initiating the MTP</li> </ul> </li> <li>4. Continually evaluate for possible termination of the MTP</li> <li>5. Notify Blood Bank and place order to terminate MTP</li> <li>6. Document total units of blood and components administered in progress notes</li> </ol>
<b>Charge Nurse</b>	<ol style="list-style-type: none"> <li>1. Notify blood bank of MTP (391-1853)</li> <li>2. Verbalize "Initiate MTP"</li> <li>3. Provide patient name and MRN to blood bank</li> <li>4. Confirm with physician MTP order placed &amp; STAT labs draw Assign a team member to continue communication with blood bank throughout MTP</li> <li>6. Assign runner to pick up and return MTP packs from Blood Bank</li> <li>7. Request pharmacist to patient bedside (For adult patients outside of ED, call 4Heart satellite 391-6495)</li> </ol>
<b>RN #1</b>	<ol style="list-style-type: none"> <li>1. Assure blood bank receives patient sticker or a blood bank green "pick up" slip with patient name and MR number</li> <li>2. Administer blood products per clinical Policy Blood/Blood components</li> </ol>
<b>RN #2</b>	<ol style="list-style-type: none"> <li>1. Maintain direct communication with Blood bank regarding patient status and blood/components requested by physician team leader</li> <li>2. Complete MTP (x15847) tracking form</li> <li>3. Record all blood products, factors, and fluid in the I/O section of EHR. Anesthesiology will document in OR per their standard</li> <li>4. Complete Blood Bank green "pick up slip" with physician signature Prior to termination of MTP (preferred with first pack request)</li> <li>5. At MTP termination request a transfusion summary</li> </ol>
<b>Laboratory</b>	<ol style="list-style-type: none"> <li>1. Obtain and perform the following STAT tests:           <ul style="list-style-type: none"> <li>• PT</li> <li>• PTT</li> <li>• Fibrinogen</li> <li>• Hemoglobin</li> <li>• Platelet Count</li> </ul> </li> </ol>

	<ul style="list-style-type: none"> <li>• pH, base deficit</li> <li>• Ionized Calcium (after 1st MTP Pack)</li> <li>• Thromboelastogram (TEG) per specific physician order</li> </ul> <p>2. Repeat Labs as ordered by physician</p>
<b>Runner</b>	<p>1. Bring patient sticker or Blood Bank green “pick up slip” to obtain MTP pack</p> <p>2. Bring MTP packs to patient bedside</p>
<b>Blood Bank</b>	<p>1. Maintain direct communication with RN #2 regarding patient status and need for additional blood/components</p> <p>2. Place tracking form (x15847) on the first MTP pack</p> <p>3. Validate the patient’s name and medical record number with clinical team member (physician or nurse)</p> <p>4. Switch to type specific units as soon as the patient’s ABO-Rh type is established (if un-cross matched “O-pos” or “O-neg” PRBC units were used initially)</p> <p>5. When MTP terminated, provide transfusion summary listing total number of units dispensed by category.</p> <p>6. Place blood product tally sheet in 1<sup>st</sup> cooler.</p>
<b>Pharmacist</b>	<p>1. Respond immediately to trauma bay when trauma activation (level I or II) or to other location of MTP when requested</p> <p>2. Collaborate with and prompt physician to order tranexamic acid, calcium chloride, PCC or rFVIIa administration, as indicated by clinical status (See Appendix A - peds or Appendix B - adults)</p> <p>3. Facilitate timely drug delivery throughout MTP (including transitions from one clinical area to another)</p> <p>4. Ensure all medications given for massive transfusion are ordered and documented in EHR</p>

**Revisions**

Spectrum Health reserves the right to alter, amend, modify or eliminate this policy at any time without prior written notice.

**Policies Superseded and Replaced:** This policy supersedes and replaces the following policies as of the effective date of this policy: CPNP-M00-S3275

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**Keywords**

blood, trauma, hemorrhage, MTP, massive transfusion, transfusion

PEDIATRIC DEFINITIONS, CRITERIA AND DOSING

Management of the pediatric trauma patient in hemorrhagic shock depends upon accurate assessment of blood loss and size-appropriate goals for resuscitation

**Definition** – Massive transfusion is defined as actual or anticipated transfusion of blood products and other intravenous fluids to replace greater than the patient’s estimated blood volume within twenty-four (24) hour period and/or need for transfusion equal to half of the patient’s estimated blood volume at one time, such as within one hour. Estimates of total blood volume vary by age (see below).

Age	Est blood volume
Premature infant	90-100 ml/kg
Term infant to 3 months	80-90 ml/kg
Children older than 3 months	70 ml/kg
Obese children	65 ml/kg

(Dehmer, 2010)

Packed Red Blood Cells (PRBC): 1 bag = 1 unit = 350 ml

Fresh Frozen Plasma (FFP): 1 bag = 1 unit = 250 ml

Platelets (PLT): 1 bag = 1 pack = 5 units = 250 ml

Cryoprecipitate: 1 bag = 5 units = 200 ml

Calcium Chloride: Pediatric Dose: 10-20mg/kg IV, max 1 gram, **preferred, must have a central line**

Calcium Gluconate: Pediatric Dose: 50-100mg/kg/dose IV, max 2 grams

Tranexamic Acid: see [“Use of Tranexamic Acid \(TXA\) for pediatric trauma patients with uncontrolled hemorrhage”](#) Clinical Practice Guideline.

Pediatric Dose: a. Give 20 mg/kg bolus over 10 minutes (maximum of 1000 mg) followed by the same dose (20mg/kg, maximum of 1000 mg) infused over 8 hours. May continue if significant ongoing bleeding is observed beyond eight hours but not to exceed 24 hours.

b. The first dose optimally should be given within three hours of injury.

c. If a dedicated intravenous access for an infusion is not available, a repeat of the 20 mg/kg (maximum 1000 mg) bolus dose could be given after 3 hours instead of the 8 hour infusion. May continue to give every 8 hours if significant ongoing bleeding is observed but not to exceed 24 hours.

d. The infusion and boluses should be discontinued once bleeding is controlled.

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Recombinant Factor VIIa: Pediatric Dose: 90-120mcq/kg IV (round dose to the nearest vial size when possible – 1mg, 2mg or 5mg vials are available).

- Effective only with a pH of 7.20 or greater with hemorrhage.
- After administration evaluate the need to continue MTP.

~~Prothrombin complex concentrate (PCC)/Factor IX Complex: NOT APPROVED FOR USE IN PEDIATRIC TRAUMA~~

Pediatric weight-based doses of blood product follow on the next page.

**Children <10 kg: Blood products are to be physician order specific for any child <10kg.**

Product	MTP Pack 1	MTP Pack 2	MTP Pack 3	MTP Pack 4 <sup>1</sup>
<b>PRBC</b>	25ml/kg	25ml/kg	25ml/kg	25ml/kg
<b>FFP</b>	20ml/kg	20ml/kg	20ml/kg	20ml/kg
<b>PLT</b>	10ml/kg	10ml/kg	10ml/kg	10ml/kg
<b>Cryo.</b>	4ml/kg	4ml/kg <sup>2</sup>	4ml/kg <sup>2</sup>	4ml/kg <sup>2</sup>
		<sup>3</sup> Ca++? <sup>4</sup> rFVIIa?	<sup>3</sup> Ca++?	<sup>3</sup> Ca++?

**Children 11 – 25kg:**

Product	MTP Pack 1	MTP Pack 2	MTP Pack 3	MTP Pack 4 <sup>1</sup>
<b>PRBC</b>	2 Units	2 Units	2 Units	2 Units
<b>FFP</b>	2 Unit	2 Unit	2 Unit	2 Unit
<b>PLT</b>	1 Pack	1 Pack	1 Pack	1 Pack
<b>Cryo.</b>	2.5 Units (½ bag) (100mL)	2.5 Units (½ bag) <sup>2,3,4</sup> (100mL)	2.5 Units (½ bag) <sup>2,3</sup> (100mL)	2.5 Units (½ bag) <sup>2,3</sup> (100mL)
		<sup>3</sup> Ca++? <sup>4</sup> rFVIIa?	<sup>3</sup> Ca++?	<sup>3</sup> Ca++?

**Children 26 kg and up:**

Product	MTP Pack 1	MTP Pack 2	MTP Pack 3	MTP Pack 4 <sup>1</sup>
<b>PRBC</b>	4 Units	4 Units	4 Units	4 Units
<b>FFP</b>	4 Unit	4 Unit	4 Unit	4 Unit
<b>PLT</b>	1 Pack	1 Pack	1 Pack	1 Pack
<b>Cryo.</b>	5 Units (1 bag)	5 Units (1 bag) <sup>2,3,4</sup>	5 Units (1 bag) <sup>2,3</sup>	5 Units (1 bag) <sup>2,3</sup>
		<sup>3</sup> Ca++? <sup>4</sup> rFVIIa?	<sup>3</sup> Ca++?	<sup>3</sup> Ca++?

<sup>1</sup>for additional MTP Packs, repeat cycle as needed

<sup>2</sup>additional cryoprecipitate available by request only, if indicated based on fibrinogen levels

<sup>3</sup>consider calcium replacement

<sup>4</sup>consider administering rFVIIa

**APPENDIX B  
SUGGESTED COMPONENT REPLACEMENT GUIDELINE DURING TRAUMA RESUSCITATION -  
Adult Patients**

COMPONENT	GUIDELINE	INDICATIONS	NOTES
<b>Packed Red Blood Cells (PRBC)</b>	<b>Goal:</b> initial 4 units of uncrossed O negative or O positive emergent blood	Base Deficit negative 6 or greater; INR greater than 1.5; Hgb less than 10; Systolic BP less than 90 mmHg	All PRBC use Rapid Infuser warmer  Use Normosol solution for adult blood administration
<b>Fresh Frozen Plasma (FFP)</b>	<b>Goal:</b> 1 unit of FFP for every 1 unit PRBC's <b>[utilize pre-thaw option]</b>  •For timeliness in massive transfusion, 1:1 ratio of PRBC to FFP should be simultaneously infused. •Monitor INR thereafter to guide FFP replacement.	PT, PTT greater than 1.5 times control and/or INR greater than 1.8.  2- Massive transfusion by itself is an indication of FFP at least at the beginning of the MTP	2 units thawed at all times in Blood Bank  Ice chest of blood product taken to ED / OR / ACC
<b>Platelets</b>	<b>Goal:</b> 5 pooled units ( 1 Pack) after <b>each</b> 4 units PRBC's	Oozing  Platelet count less than 50000	Infuse in over 5 minutes at room temperature.  <b>Note: Do not infuse by rapid blood warmer pump (Belmont). Can use Enflow warmer for platelets</b>
<b>Calcium</b>	<u>Calcium Chloride:</u> 1000 mg slow IVP over 10 minutes, <b>must have a central line</b>  Pediatric Dose: <b>SEE APPENDIX A</b>  <u>Calcium Gluconate:</u> 3000 mg slow IVP over 10 minutes  Pediatric Dose: <b>SEE APPENDIX A</b>	After every other MTP Pack and based on lab results	Calcium Chloride preferred.  Use calcium gluconate if no central line
<b>Tranexamic Acid</b>	Preferred Dose: 1,000 mg IVPB over 10 minutes then 1,000 mg IVPB infused over 8 hours  Alternative Dosing for Limited Access: 1,000 mg IVPB over 10 minutes then repeat 1,000 mg IVPB over 10 minutes at 3 hours  May administer intraosseous	Administer with initiation of 1st MTP pack	
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	For Pediatric Dose, see Appendix A		



<p><b>Kcentra®</b> <b>Prothrombin complex concentrate (PCC)</b></p> <p><b>OR</b></p>	<p>Dose: 50units/kg IV based on actual body weight.</p> <p>PCC IS NOT APPROVED FOR USE IN PEDIATRIC TRAUMA</p> <ul style="list-style-type: none"> <li>• Infuse no faster than 10ml/min.</li> <li>• Avoid if patient is in DIC.</li> <li>• After administration evaluate the need to continue the MTP</li> <li>• BeneFix® (Factor IX) is not equivalent to Profilnine® SD (Factor IX Complex) and SHOULD NOT be used for massive transfusion.</li> </ul>	<p>Consider after 2nd round of MTP packs administered if bleeding persists.</p>	<p>KCentra® (Prothrombin Complex Concentrate (PCC))</p>
<p><b>Factor VIIa</b></p>	<p>Dose: Weight <math>\leq 100</math> kg or less: 5 mg rFVIIa Weight <math>&gt;100</math> kg: consider 6 mg rFVIIa</p> <p>For Pediatric Dose, see Appendix A</p> <ul style="list-style-type: none"> <li>• Effective only with a pH of 7.20 or greater with hemorrhage.</li> <li>• After administration evaluate the need to continue MTP.</li> </ul>	<p>Consider after PCC failure or after 2nd round of MTP packs administered if bleeding persists.</p>	<p>NovoSeven® RT (Recombinant Factor VII)</p> <p>Round to nearest vial size when possible (1mg, 2mg or 5 mg vials)</p>

APPENDIX C  
 COMPLICATIONS OF MASSIVE TRANSFUSION (Greater than 20 units components)

COMPLICATION	RATIONALE	TREATMENT
Hypothermia	Banked blood is kept at 4 degrees C	Blood should be administered using a warmer
Hypocalcaemia	High citrate load in blood additives can lead to decreased levels of ionized calcium	Monitor ionized calcium with transfusions greater than 4 units
Coagulopathy	Multifactor: coagulation abnormalities, excessive fibrinolysis, hypothermia, acidosis, dilutional coagulopathy.	Aggressive resuscitation with warming measures, timely FFP and Platelet (which also have Fibrinogen) administration.
Immunomodulation: Enhanced acute inflammatory response	New emerging detrimental effect of older blood. Stimulation of cytokine release noted with blood older than 14 days associated with worse outcome in trauma patients.	Awareness of age of blood products, potentially note and document age of blood.

Appendix D

**Adult Massive Transfusion Checklist**

	<b>Recognize Need for rapid infusion of <math>\geq 4</math> units PRBC with ongoing hemorrhage Emergency Department Should Access Trauma Bay Blood prior to Initiating MTP</b>
<b>Initiation</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Call for resources</li> <li><input type="checkbox"/> Initiate "Mass Transfusion" Careset in Cerner (choose adult or ped)</li> <li><input type="checkbox"/> Consider ordering TEG with other labs. <b>Ensure Type &amp; Screen drawn/sent</b></li> <li><input type="checkbox"/> Call Blood Bank at 391-1853 and state "initiating MTP"</li> <li><input type="checkbox"/> Call Pharmacy 391-6495 if need pharmacist at bedside</li> <li><input type="checkbox"/> Obtain green blood slip or Patient sticker with <b>MRN</b> for blood bank</li> <li><input type="checkbox"/> Assign RN to run Rapid Fluid/ Blood infuser. Confirm adequate IV access</li> <li><input type="checkbox"/> Assign runner to take green or Patient sticker with MRN slip to Blood Bank and retrieve MTP packs</li> <li><input type="checkbox"/> Utilize MTP Tracking form to record products</li> <li><input type="checkbox"/> Administer tranexamic acid</li> <li><input type="checkbox"/> Vital Signs with O2 Sat Q 5-15 minutes(goal mean arterial pressure 50-60)</li> <li><input type="checkbox"/> Transfuse Aggressively (1 PRBC: 1 FFP )</li> <li><input type="checkbox"/> Consider placement of Foley with urimeter</li> <li><input type="checkbox"/> Identify/treat site of hemorrhage (IR, OR)</li> <li><input type="checkbox"/> Provider consider Insertion of arterial line and single lumen line (power inject preferred)</li> <li><input type="checkbox"/> Initiate warming methods (warm fluids, forced air warming blanket, adjust room temperature) to avoid hypothermia</li> </ul>
	<b>Continued Bleeding or VS Unstable</b>
<b>Maintenance</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Repeat labs between every 2 MTP packs or hourly (Hgb, PT, fibrinogen, Plt, ABG, iCa, TEG)</li> <li><input type="checkbox"/> Assign individual to tally of product transfused. <b>Maintain 1PRBC:1 FFP ratio</b></li> <li><input type="checkbox"/> Administer <b>Cryoprecipitate every 2 MTP packs</b> (fibrinogen less than 80-100mg/dl)</li> <li><input type="checkbox"/> Assign individual to maintain communication with blood bank</li> <li><input type="checkbox"/> <b>Move to OR / Interventional Radiology/ICU</b></li> <li><input type="checkbox"/> Re-evaluate ongoing need for MTP by physician</li> <li><input type="checkbox"/> Consider PCC or rFVIIa in consultation with Pharmacist</li> <li><input type="checkbox"/> Start infusion of 2<sup>nd</sup> dose of tranexamic acid</li> <li><input type="checkbox"/> Continue monitoring temperature (warm fluids, forced air warming blanket, adjust room temp)</li> </ul>
	<b>Hemorrhage controlled or patient expires</b>
<b>Termination</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Call Blood Bank and terminate MTP</li> <li><input type="checkbox"/> Cancel orders in Cerner</li> <li><input type="checkbox"/> Complete charting/tracking sheet and tally total product transfused include both crystalloid and blood products in total volume)</li> <li><input type="checkbox"/> Complete progress note with fluid tally included</li> <li><input type="checkbox"/> Debrief with team</li> </ul>

**Not a Permanent Part of  
the Medical Record**

Appendix E: Adult Massive Transfusion Policy Tracking Form

					MR #														
<b>Products Prior to Massive Transfusion:</b>																			
<b>Initiated By:</b>																			
Please check appropriate box: <input type="checkbox"/> Flight <input type="checkbox"/> Regional Facility <input type="checkbox"/> ED/Trauma Bay <input type="checkbox"/> L & D <input type="checkbox"/> Other _____																			
Please Record Total # of Units Transfused prior to initiation of MTP:																			
PRBC																			
FFP																			
<b>*If Fibrinogen &lt; 100mg/dl, Call Blood Bank for CRYO</b>																			
<b>Pack # 1</b>					<b>Pack #2</b>					<b>Repeat Labs</b>									
4-PRBC	PRBC	PRBC	PRBC	PRBC	4-PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC					
4-FFP	FFP	FFP	FFP	FFP	4-FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP					
1-PLT	PLT				1-PLT	PLT													
					1-CRYO					CRYO									
Re-evaluate patient and move to next pack										Re-evaluate patient and move to next pack									
<b>Pack # 3</b>					<b>Pack #4</b>					<b>Repeat Labs</b>									
4-PRBC	PRBC	PRBC	PRBC	PRBC	4-PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC					
4-FFP	FFP	FFP	FFP	FFP	4-FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP					
1-PLT	PLT				1-PLT	PLT													
					1-CRYO					CRYO									
Re-evaluate patient and move to next pack										Re-evaluate patient and move to next pack									
<b>Pack # 5</b>					<b>Pack #6</b>					<b>Repeat Labs</b>									
4-PRBC	PRBC	PRBC	PRBC	PRBC	4-PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC					
4-FFP	FFP	FFP	FFP	FFP	4-FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP					
1-PLT	PLT				1-PLT	PLT													
					1-CRYO					CRYO									
Re-evaluate patient and move to next pack										Re-evaluate patient and move to next pack									
<b>Pack # 7</b>					<b>Pack #8</b>					<b>Repeat Labs</b>									
4-PRBC	PRBC	PRBC	PRBC	PRBC	4-PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC	PRBC					
4-FFP	FFP	FFP	FFP	FFP	4-FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP	FFP					
1-PLT	PLT				1-PLT	PLT													
					1-CRYO					CRYO									
Re-evaluate patient and move to next pack										Re-evaluate patient and move to next pack									

NOT A PART OF THE PERMANENT MEDICAL RECORD  
SEND TO BLOOD BANK WHEN COMPLETED