**Appropriate Initial Interventions:**
- Intravenous access – 2 large bore IVs and Central Venous Cath
- Labs: T&S, CBC, Plts, INR, PT, PTT, Fibrinogen, Electrolytes, BUN/Creatinine, ionized calcium
- Continual monitoring: VS, U/O, Acid-base status
- Aggressive re-warming
- Prevent / Reverse acidosis
- Correct hypocalcemia: CaGluc or CaCl
- Target goal ionized calcium 1.2 – 1.3
- If use CaCl 1 gm, give slowly IV
- Repeat lab testing to evaluate coagulopathy
- Stop crystalloid - avoid dilutional coagulopathy

**Other considerations:**
- Anticipate hypocalcemia and infuse 1g calcium gluconate per 1-2 units PRBC’s transfused
- Cell salvage: Anes Tech via front desk 93-64270 (Main & CVCOR)
- Heparin reversal: Protamine 1mg IV/100 U heparin
- Warfarin reversal: Vitamin K 10 mg IV; Consider Prothromin Comp
- 4 Factor PCC Kcentra INR 2-4 25units/kg, INR>4-6, 35 units/kg, INR>6, 50 units/kg; repeat doing not recommended
- Chronic Renal Failure + VW Factor; DDAVP 0.3 µg/kg IV x 1 dose
- Consider antifibrinolytics:
  - Tranexamic acid 1 gm bolus plus infusion 1 gm over 8 hrs
  - Amicar 5 gm IV bolus then 1 gm/hr IV infusion

**Additional help**
- Anesthesia: Page 8003; Trauma Chief (via web or operator)
- Rapid Response Team pager 90911 or call stat page 141

**General Guidelines for Lab-based Blood Component Replacement in Adults:**

<table>
<thead>
<tr>
<th>Product</th>
<th>Consider for</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBCs</td>
<td>N/A</td>
<td>MD discretion</td>
</tr>
<tr>
<td>FFP</td>
<td>INR &gt; 1.5</td>
<td>4 units FFP</td>
</tr>
<tr>
<td>Platelets</td>
<td>&lt; 100,000</td>
<td>One 5-pack Plts</td>
</tr>
<tr>
<td>Cryoprecipitate</td>
<td>Fibrinogen &lt; 100</td>
<td>Two 5-packs Cryo</td>
</tr>
</tbody>
</table>

**Massive Transfusion Protocol (MTP) – ADULT**

**Identify and Manage Bleeding**

(Surgery, Angiographic Embolization, Endoscopy)

**Clinical Team Activates MTP & Designates Clinical Contact**

Clinical Contact phones Blood Bank (BB) at 936-6888 and:
- Provides name of clinical contact person to Blood Bank (BB)
- Provides MR#, sex, name, location of patient
- Records name of BB contact, calls if location/contact information changes
- Sends person with patient name and MR to pick up the cooler
- Ensures that MTP protocol electronic order is entered in CareLink

**BB Prepares MTP Pack**

MTP Pack: 6U RBCs; 4U FFP; One 5-pack Platelets

This will result in an approximate 1:1:1 ratio

**Hemostasis & resolution of coagulopathy?**

**YES**
- Stop MTP
  - Notify BB & return any unused blood ASAP
  - Resume standard orders
  - D/C MTP Electronic order

**NO**
- Repeat Labs
  - CBC, Platelets
  - INR/PT, PTT
  - Fibrinogen
  - ABG (Ionized Calcium, Potassium, Lactate, Hematocrit)

**If persistent coagulopathy consider:**
- rFVIIa: 90 µg/kg dose

4 Factor PCC: Kcentra INR 2-4 25units/kg, INR>4-6, 35 units/kg, INR>6, 50 units/kg; repeat doing not recommended
**Massive Transfusion Protocol (MTP) – Pediatric**

**Identify and Manage Bleeding**

(Surgery, Angiographic Embolization, Endoscopy)

≥ 30 ml/kg and ongoing uncontrolled bleeding

Clinical Team Activates MTP & Designates Clinical Contact

Clinical Contact phones Blood Bank (BB) at 936-6888 and:

- Provides name of clinical contact person to BB
- Provides MR#, sex, name, location and weight of patient
- Records name of BB contact, calls if location/contact information changes
- Sends person with patient name and MRN to pick up the cooler
- Ensures that MTP protocol electronic order is entered in CareLink

BB Prepares Peds MTP Pack per weight

Transfuse as 1:1:1 Ratio (e.g. 1 rbc, 1 plasma 1 single platelet)

- Intravenous access – by weight (kg):
  - 1-5 kg: 22-24 gauge
  - 6-10 kg: 20-24 gauge
  - 11-25 kg: 18-22 gauge
  - 25-50 kg: 16-20 gauge

- Admission labs:
  - T&S, CBC, INR/PT, PTT, Fibrinogen, Electrolytes, BUN/Cr, ionized calcium, ABG, lactate
  - Continual monitoring of vital signs
  - Aggressive re-warming
  - Prevent / Reverse acidosis
  - Minimize crystalloid – avoid dilutional coagulopathy

**Other considerations:**

- Anticipate hypocalcemia with CaGluconate or CaCl
- 25 units/kg, INR>4-6, 35 units/kg, INR>6, 50 units/kg; repeat doing not recommended
- Antifibrinolytic therapy:
  - Amicar 100 mg/kg bolus then 33.3 mg/kg/hour
- Cell salvage: Anes Tech via Mott OR Front Desk 76-32430

**Additional help:**

- Anesthesia: pager 1534
- Pediatric Surgical Fellow – pager via web or operator
- Rapid Response Team pager 90147 or call stat paging 141

**General Guidelines for Lab-based Blood Component Replacement in Children with Massive Bleeding:**

<table>
<thead>
<tr>
<th>Product</th>
<th>Consider For</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBCs (360 ml/unit)</td>
<td>N/A</td>
<td>30 ml/kg</td>
</tr>
<tr>
<td>FFP (250 ml/unit)</td>
<td>INR &gt; 1.5</td>
<td>20 ml/kg</td>
</tr>
<tr>
<td>Platelets (50 ml/bag)</td>
<td>&lt; 100,000</td>
<td>20 ml/kg</td>
</tr>
<tr>
<td>Cryoprecipitate (15 ml/unit)</td>
<td>Fibrinogen &lt; 100</td>
<td>0.2 units/kg</td>
</tr>
</tbody>
</table>

**Stop MTP**

- Notify BB & return any unused blood ASAP
- Resume standard orders
- D/C MTP Electronic order

**Repeat Labs**

- CBC, Platelets
- INR/PT, PTT
- Fibrinogen
- ABG (Ionized Calcium, Potassium, Lactate, Hematocrit)

**If persistent coagulopathy consider:**

- rFVIIa 90 µ/kg dose

**Clinical Contact calls BB at 6-6888 for another Peds MTP pack**

**** MD can adjust pack based on labs PRN**

**Hemostasis & resolution of coagulopathy?**

**YES**

**NO**
UNIVERSITY OF MICHIGAN
Hospitals and Health Centers

MASSIVE TRANSFUSION PROTOCOL

AUTHORS: TRANSFUSION COMMITTEE
DATE SUBMITTED: DECEMBER 17, 2012
REVISED: 4/1/13, 9/30/13, 3/17/14, 11/20/14
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1. Policy Statement, Scope and Purpose

It is the policy of the University of Michigan Hospitals that a Massive Transfusion Protocol (MTP) be used to standardize procurement of blood and blood components and clarify communications between the blood bank and the patient caregivers.

2. Definitions

<table>
<thead>
<tr>
<th>Massive Transfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adult</strong></td>
</tr>
<tr>
<td><strong>Child</strong></td>
</tr>
</tbody>
</table>

3. Policy Standards/Procedures/Actions

- The MTP may be initiated in any patient care area.
- The MTP may be initiated by the patient’s clinical team.
- The clinical team assigns a clinical contact for the blood bank.
- The clinical team assigns a person to pick up the cooler and blood components.
- The blood bank assigns a contact person.
- The flowcharts “Massive Transfusion Protocol (MTP) – Adult University of Michigan” and “Massive Transfusion Protocol (MTP) – Pediatric University of Michigan” will be used to guide decision making.

### Number of Units to be Issued Per Cooler

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Red Cells</th>
<th>Plasma</th>
<th>Platelets</th>
<th>Cryo (if requested)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>6</td>
<td>4</td>
<td>One 5-pack</td>
<td>One 5-pack</td>
</tr>
<tr>
<td>Pediatric/Infant</td>
<td>6</td>
<td>4</td>
<td>5 single platelets</td>
<td>As ordered</td>
</tr>
</tbody>
</table>
4. Laboratory Test Orders

- The first massive transfusion pack will contain a set of orange cards with the phrases “MASSIVE TRANSFUSION PROTOCOL Phone Coagulation Results to ___________”.
- The clinical team will fill in the phone number/pager.
- This card is to be placed in the bag with blood specimens sent to Specimen Processing to indicate that the specimens should be treated as STAT specimens and Coagulation results should be called to the clinical team.

5. Calcium Replacement

- Anticipate hypocalcemia and infuse calcium gluconate. The adult dose is approximately 1g calcium gluconate per 1-2 units PRBC’s transfused.

6. Exhibits

The Massive Transfusion Protocol (MTP)- Adult University of Michigan
7. References

**Adult**


5. Cotton BA, Reddy N, Hatch QM, LeFebvre E, Wade CE, Kozar RA, Gill BS, Albarado R, McNutt MK, Holcomb JB. Damage control resuscitation is associated with a reduction in


Pediatric


7. Committee Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
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<tbody>
<tr>
<td>Paul Picton, M.D.</td>
<td>Chairman/Anesthesia</td>
</tr>
<tr>
<td>Vinita Bahl, DMD</td>
<td>UMH CIDDS</td>
</tr>
<tr>
<td>Suzanne Butch, MA, MT(ASCP)</td>
<td>Blood Bank</td>
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<tr>
<td>SBB</td>
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<tr>
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<td>Surgery/OCA</td>
</tr>
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<td>Pathology</td>
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<tr>
<td>Enrique Criado-Pallares, MD</td>
<td>Vascular Surgery</td>
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<tr>
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<tr>
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<tr>
<td>Tiffany Hunter, RN</td>
<td>Pediatric Nursing</td>
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<tr>
<td>Raymond Hutchinson</td>
<td>Peds Hem/Onc</td>
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<tr>
<td>Robert Hyzy, MD</td>
<td>Medical ICU</td>
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<tr>
<td>Martin Lawlor</td>
<td>Pathology</td>
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<tr>
<td>Charles Muck, RN</td>
<td>Education Nurse Coordinator</td>
</tr>
<tr>
<td>Lena Napolitano, MD</td>
<td>Intensive Care</td>
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<tr>
<td>Clark Nugent, MD</td>
<td>OB-Gyn</td>
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<tr>
<td>Jeffrey Rohde, MD</td>
<td>Internal Medicine</td>
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<tr>
<td>Samuel Silver, MD</td>
<td>Hem/Onc</td>
</tr>
<tr>
<td>Chisa Yamada, MD</td>
<td>Pathology</td>
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</tbody>
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Please direct any questions and concerns to the Transfusion Committee