UNM HOSPITALS	Applies To: **UNM Hospitals** Responsible Department: Transfusion Medicine Effective date: 05/24/2018

Title: **Pediatric Massive Transfusion Protocol Procedure and Information**	**Procedure**
Patient Age Group: ( ) N/A ( ) All Ages (x) Newborns (x) Pediatric ( ) Adult	

DESCRIPTION/OVERVIEW

The purpose of the Pediatric Massive Transfusion Protocol (MTP) Procedure and Information document is to standardize operational steps and provide complete information necessary for a successful pediatric MTP.

This procedure:

- Provides clarity on the type and quantity of administered blood products during a massive hemorrhage
- Expedites blood product allocation by the patient care team regardless of patient location
- Facilitates early appropriate lab orders
- Assures timely resulting of coagulation and hematology tests
- Describes the required steps of Activation, Notification, Monitoring, Point of Contact Handoff, Prevention of Complications and Endpoints
- Shares Important Information
- Describes required roles and responsibilities

REFERENCES

External References

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Internal References

- Type and Screen
- Issuing Products
- Issuing Blood without Crossmatch
- Transfusion of Blood and Blood Components
- Providing Blood Components for Emergency Transfusion
- Blood Bank Samples Used for Testing
- Transfusion Reaction Workup
- Frozen Plasma
- Platelet Transfusion
- Cryoprecipitate
- Massive Transfusion Protocol Contact Sheet

AREAS OF RESPONSIBILITY

This document applies to UNM University Hospital (UNMH) pediatric patients who are experiencing massive blood loss/ hemorrhage and the clinical staff providing patient care.

RESPONSIBILITIES	
Position/Title/Group	**Requirements/Expectations/Duties**
Nursing	1. Provide appropriate patient identifying information to the Blood Bank. 2. Ensure appropriate patient identification prior to blood product administration. 3. Administer MTP blood products as directed by the treating team/physician and patient status. 4. Monitor the patient for transfusion reactions. 4.1. The treating team should be notified if there is a suspected transfusion reaction. 4.2. A transfusion reaction work-up should be submitted, in a process identical to patients receiving routine transfusions with a suspected transfusion reaction. 5. Arrange for transport of the MTP packs from the Blood Bank to the patient location and provide the transporter with the necessary patient identification to allow blood to be released from the Blood Bank. 6. Draw STAT baseline labs and serial labs. 7. Document time, volume, and type of blood component transfused. 8. Document vital signs and patient status.
Clinical Attending Physicians	1. Activate the MTP when indicated. 2. Closely monitor the hemodynamic status of the patient

	throughout the duration of the MTP. 3. Once the decision to deactivate the MTP has been made, it is the requesting physician's responsibility to notify the Blood Bank of the decision to discontinue the MTP. At this point the Blood Bank will no longer maintain a ready MTP round for immediate transfusion. The attending physician is then responsible for ordering all subsequent blood products for transfusion. 4. The physician responsible for activating the MTP must sign (within 24 hours of transfusion) an emergency release statement for every unit of red blood cells that was transfused prior to finishing initial patient blood bank testing is completed. 5. All blood products need an electronically signed order before they can be issued. 5.1. The blood bank will start preparing an order as soon as notified, however there must be an MTP power plan order before the products can be issued. 5.2. The initial MTP power plan order will serve as a valid product order for future red blood cells, plasma, and platelets for the duration of the MTP. 5.3. Cryoprecipitate must be ordered separately.
Blood Bank Staff	1. Document communications on the MTP contact sheet. 2. Immediately begin to prepare products, and begin to thaw plasma units as soon as notified. The Blood Bank will notify the MTP Point of Contact once a MTP round is ready for pickup. 3. The Blood Bank must notify: 3.1. Pathology resident on day call for Transfusion Medicine. 3.2. Pathology resident on call (968-1055) after hours. 3.3. Pathology resident if the patient has known antibodies or a positive antibody screen with identification is in progress. 3.1. If there are staffing issues, in the blood bank, the lab Lead Tech (934-5186) will be notified that the Pediatric MTP has been activated. The Lead Tech evaluates the staffing needs to facilitate the preparation and distribution of blood products. 4. Alert United Blood Services (UBS) if there appears to be a need for an urgent type specific blood delivery, or other critically low blood product shortages. 5. Crossmatch procedures and procedures for emergency release of products at the University Hospital will remain the same for MTP patients as for patients undergoing scheduled transfusions. 6. Issuing multiple units during an emergency will follow the streamlined procedure. 7. Data on MTP activations will be tracked by the Blood Bank and Pathology house staff. The pathology resident receiving the call will fill out an information log for Quality Assurance purposes and the daytime Blood Bank resident will follow-up. 8. Appropriateness of activation in each case will be evaluated, as well as blood products issued and patient outcomes. 9. Summaries of these MTP activations will be presented to the

	Tissue and Transfusion Committee and to the Trauma Service at least yearly. This information will be offered to other services that have participated in MTP activations upon request.
Pathologists	1. Obtain the following information from the Blood Bank: 2. Patient name, MRN, location 2.1. Status of Type and Screen, and any underlying alloantibody or crossmatch incompatibility issues that may delay or compromise the ability to quickly provide blood products. 2.2. Ensure that there is a current MTP point of contact and contact number 2.3. Contact their attending Transfusion Medicine physician and relay pertinent clinical information. 3. Triage any questions from the Blood Bank or clinical team. 3.1. The clinical service is responsible for all aspects of communicating orders and picking up blood products. 4. The pathologist does not need to "approve" the request for MTP activation – this decision is made by the clinical attending physician. 5. For all pediatric massive transfusion protocols that have been activated, the pathology resident should go to the patient location to assess the clinical situation and actively assist the clinical team to help facilitate the MTP. 5.1. If the resident is not in-house, they should call to assess the clinical situation first and then come into the hospital for Pediatric massive transfusion protocols.

PROCEDURE

1. MTP Activation Process

1.1. Activation of the pediatric MTP is at the discretion of the requesting physician. Once a threshold of ≥ 40 mL/kg of red blood cells (RBCs) has been ordered in rapid succession, activation of the MTP should be considered.

1.1.1. Indications for activation may also include the following:

1.1.1.1. Massive blood loss with profound hemorrhagic/hypovolemic shock

1.1.1.2. Refractory hypotension (hypovolemic shock) not responsive to ≥ 40 mL/kg RBCs

1.1.1.3. Continued significant bleeding in the presence of an elevated INR >1.9, depressed fibrinogen (<160 mg/dL), or thrombocytopenia (<50,000/mL without intracranial/intraocular hemorrhage or <100,000/mL with intracranial/intraocular hemorrhage)

2. Activate and Run a Pediatric MTP

2.1. Once the decision has been made by the requesting Attending Physician to activate the MTP, a clinical point of contact should be designated. The Pediatric Massive Transfusion power plan must be **ordered, initiated, and signed.**

3. Notification of the Blood Bank

3.1. A member of the clinical team must immediately notify the UNMH Blood Bank that they are activating the Pediatric Massive Transfusion Protocol.

3.1.1. "333" Emergency Notification Procedure (in-hospital phone)

3.1.2. 272-3333
3.1.3. 925-3333
3.1.4. 272-2591

3.2. The caller must provide the following information, which will be recorded on the MTP contact sheet by the blood bank technologist:
3.2.1. Patient Name and Medical Record Number (MRN)
3.2.2. Patient Location
3.2.3. **Estimated weight of the patient**
3.2.4. Name of the Attending Physician responsible for MTP activation
3.2.5. Point of Contact Name, phone number, and pager number.
3.2.5.1. The clinical team will designate one individual to be the point of contact for the lab.
3.2.5.2. The Blood Bank and on-call pathologist frequently need to contact this person for clinical updates, and to ensure the MTP is running as designed.
3.2.6. In order to facilitate effective communication, the Blood Bank requests that unofficial notification not be made (please do not call with rumors of a MTP activation).
3.3. The blood bank technologist performs a read back of the patient's identifying information to the caller, ensuring the information is accurate.

4. Blood Product Pickup
4.1. **The clinical service is responsible for picking up all blood products required during the MTP, whether from the Blood Bank or from one of the remote BloodTrack issuing refrigerators.**
4.2. The Blood Bank will notify the MTP Point of Contact when each new round of the MTP is ready to be picked up. A new round will be prepared once the previous round has been picked up from the Blood Bank.
4.3. Blood and other blood products are generally available for pickup at the Blood Bank unless otherwise arranged.
4.4. Emergency group O RBCs and group AB or A plasma may be obtained from the BloodTrack in the adult ED Resuscitation Room. The Blood Track in the Pediatric Operating Room only contains 2 units of O negative RBCs.
4.5. RBCs and plasma can be issued in portable coolers, refrigerator on wheels (ROW), or in a plastic container or bag (if time does not permit a cooler to be packed). Product containers should be kept at the patient bedside or with the patient during transport.
4.5.1. Coolers and ROWs are packed by the Blood Bank with RBCs and thawed plasma units placed directly from cold storage.
4.5.2. The Blood Bank has coolers in two sizes, one with the capacity for 2 units and the other for 6 units.
4.5.3. Platelet and cryoprecipitate units stay at room temperature and **do not** go in the coolers or ROWs for any period of time.

5. Labs to be Sent (automatically ordered as part of the Pediatric Massive Transfusion Power Plan)
5.1. Initial Labs to send:
5.1.1. Type and Screen (lavender top tube)

5.1.2. Emergency Hemorrhage Panel (EHP): includes hemoglobin (Hgb), Hematocrit (Hct), Platelet count (Plt), PT/INR, and Fibrinogen. The EHP yields results within 15 minutes of specimen arrival in the laboratory (one light blue top and one lavender top tube).

5.1.3. Baseline Labs included in Power Plan: CBC, Chem7, ABG, ionized calcium, lactate, PT/aPTT, fibrinogen

5.2. Monitoring Labs:

5.2.1. A new EHP should be sent to the laboratory after each MTP round or "pack" is given, or at least every 30 minutes during the MTP activation.

5.2.2. Additional monitoring labs include a CBC, Chem7, ABG, ionized calcium, lactate, PT/aPTT, and fibrinogen, and are ordered at the discretion of the clinical team.

6. Antifibrinolytics (Tranexamic Acid)

6.1. Early administration of antifibrinolytics, such as Tranexamic Acid (TXA), has been associated with reduced mortality and blood product requirements in severely injured adults. There is minimal published data examining TXA use in pediatric trauma, despite its frequent use in pediatric spine and cardiac surgery.

6.2. TXA loading dose should be 15mg/kg (max 1g) mixed with saline over 10 minutes.

7. Product Description

7.1. Efforts should be made to transfuse at a 1:1:1 ratio of RBCs to plasma to platelets

7.1.1. Each component (RBCs, plasma, and platelets) is prepared to maintain the 1:1:1 ratio.

7.1.2. One apheresis platelet unit is equivalent to a "6 pack" of platelets.

7.2. In the event that a patient's measured weight is unknown, dosing the MTP rounds will be based on the patient's Broselow measurements.

7.3. For children < or = 20 kg

1st MTP Pack	**2nd MTP Pack**	**3rd MTP Pack**	**4th MTP Pack**
2 units RBCs	2 units RBCs	2 units RBCs	2 units RBCs
2 units plasma	2 units plasma	2 units plasma	2 units plasma
1 apheresis platelet	No platelet	1 apheresis platelet	No platelet

7.4. For children >20 kg and <50 kg

1st MTP Pack	**2nd MTP Pack**	**3rd MTP Pack**	**4th MTP Pack**
4 units RBCs	4 units RBCs	4 units RBCs	4 units RBCs
4 units plasma	4 units plasma	4 units plasma	4 units plasma
1 apheresis platelet	No platelet	1 apheresis platelet	No platelet

7.5. For children >50 kg and adults

1st MTP Pack	**2nd MTP Pack**	**3rd MTP Pack**	**4th MTP Pack**
6 units RBCs	6 units RBCs	6 units RBCs	6 units RBCs
6 units plasma	6 units plasma	6 units plasma	6 units plasma
1 apheresis platelet	No platelet	1 apheresis platelet	No platelet

7.6. Weight-based aliquots of the components provided in the MTP rounds are drawn per floor/location protocol. The blood components may be repeatedly accessed using sterile technique to take off additional aliquots and limit wastage.
7.7. RBC, plasma, and platelet dosing for pediatric patients on the MTP is 15mL/kg.
7.8. The MTP products follow the patient during transport between the Emergency Department, Operating Room (OR), procedure areas (i.e. Interventional Radiology), and intensive care units.
7.9. Platelets and cryoprecipitate should NEVER be placed into the MTP containers.
7.10. Cryoprecipitate is not provided nor is it a built in part of the pediatric MTP round.
7.10.1. Cryoprecipitate administration will be based on the patient's most current fibrinogen levels, which should be followed throughout the MTP by the use of the EHP.
7.10.2. Cryoprecipitate dosing will be based on the patient's measured weight. If the patient's weight is unknown, their Broselow measurement will be used for dosing.
7.11. For severe bleeding that does not respond to standard resuscitation measures, or for catastrophic trauma, call Transfusion Medicine and consider coagulation factor concentrates (fibrinogen concentrate, prothrombin complex concentrates (PCC), or recombinant factor VIIa).

8. Endpoints of Pediatric Massive Transfusion

8.1. The physician declares hemostasis based on the absence of bleeding requiring additional intervention on the surgical field or after angioembolization.
8.2. The treating physicians agree that the patient is adequately resuscitated based on their normalizing vital signs.
8.3. If it is recognized that further resuscitation is futile, the Pediatric MTP should be discontinued.

9. Prevention of Complications of Pediatric Massive Transfusion

9.1. Potential complications of massive transfusion include hypothermia, electrolyte disturbances, dilutional thrombocytopenia and coagulopathy.
9.1.1. All blood products should be transfused according to institutional policy.
9.1.2. Hypothermia Prevention: Red blood cells and plasma should be transfused through a blood warmer during administration per unit protocol.
9.2. Electrolyte Disturbance Prevention:
9.2.1. A Chem7 is used to monitor electrolytes during the MTP and is ordered at the discretion of the clinical team.
9.2.2. Hypocalcemia Prevention: Consider limiting the rate of product infusion, especially in patients with liver injury or infants with immature liver capacity to metabolize citrate. Replace calcium with calcium chloride or calcium gluconate as indicated.
9.2.3. Hyperkalemia Prevention: Closely monitor electrolytes in patients with renal injury or pre-existing renal disease to prevent hyperkalemia.
9.3. Dilutional Thrombocytopenia and Coagulopathy Prevention: Transfuse blood products as outlined in a 1:1:1 ratio to treat and prevent coagulopathy.

10. Point of Contact and Hand-off

10.1. A MTP Point of Contact must be available for calls throughout the duration of the massive transfusion.
10.2. Transitions:

10.2.1. If the Point of Contact goes off service, they must find a replacement and notify the Blood Bank (272-2591) who the new Point of Contact will be and the new contact's phone number.
10.2.2. For any patient location change, for example, if the patient transitions to the OR, the Blood Bank must be informed by the MTP Point of Contact, because it is assumed that the anesthesiologist assigned to the case will be the Point of Contact while in the OR.
10.2.3. If the patient transitions from the OR while on an ongoing MTP, a new Point of Contact must be established and their contact information be conveyed to the Blood Bank.
10.3. Once the MTP is deemed no longer necessary, the designated Point of Contact should verbally communicate with the Blood Bank (272-2591) to discontinue the protocol.

11. Important Information

11.1. The estimated blood volume for a preterm neonate = 100mL/kg, term neonate = 85mL/kg, >1 month old child = 75 mL/kg.
11.2. All Massive Transfusion Protocols are considered emergency transfusions; however, not all emergency transfusions are considered Massive Transfusions. The patient's transfusion needs should be evaluated on a case-by-case basis and should be periodically reevaluated during the course of a Massive Transfusion Protocol event.
11.3. Uncrossmatched blood is available until type-specific blood can be provided for the patient.
11.3.1. For trauma patients arriving to the ED resuscitation room, uncrossmatched RBCs O Positive (12 units) and O Negative (2-3 units) and thawed plasma (4-6 units) are available in the BloodTrack in the trauma resuscitation room.
11.3.2. For inpatients requiring emergent transfusion, uncrossmatched RBCs and thawed plasma are available from the Blood Bank when crossmatched blood is not immediately available. There are 2 additional units of uncrossmatched O negative RBCs available in the Pediatric Operating Room BloodTrack.
11.3.3. A small supply of thawed plasma is available at all times in the Blood Bank for emergency release to temporize the patient during the 20-25 minutes it takes to thaw frozen plasma.
11.4. Uncrossmatched type O blood will be given until the patient's Type and Screen has been resulted.
11.4.1. If the patient has a current Type and Screen, type-specific blood will be released.
11.4.2. Type-specific blood will **never** be issued based on historical type only. The patient **must** have a current type and screen for type-specific blood to be released.
11.5. The transfusion service recommends the use of Rh-negative units for all pediatric age girls who require emergency release RBCs or a MTP.
11.6. The decision to give Rh-negative or Rh-positive blood to young male recipients is left up to the discretion of the requesting physician.
11.7. To prevent shortages of O negative RBCs, it may be necessary to use O positive RBCs for select patients. O negative RBCs will preferentially be given to all female pediatric patients.
11.8. Blood product modification, apart from leukoreduction, will not be provided, in order to prevent delays in resuscitation.
11.8.1. Washed or volume reduced products will not be provided for any rounds of the MTP, as washing products will significantly prolong blood product preparation

for the patient. If fresh blood is needed for infants, please contact the blood bank directly to discuss the clinical needs of that particular patient.

11.8.2. If previously irradiated products are already available, they can be provided for infants <6 months, however non-irradiated products will be given to these patients if no irradiated blood products are available to avoid delaying resuscitation.

11.9. Because of the short expiration of platelets and to prevent wastages/shortages, a minimal number of platelets are kept in stock at the University Hospital. Additional platelets will be ordered from United Blood Services as needed for transfusion and to replenish stock.

DEFINITIONS

Pediatric massive transfusion is defined as the acute administration of more than half the patient's estimated blood volume in 3 hours, replacement of 10% of the patient's total blood volume per minute, or anticipated replacement of a patient's total blood volume in less than 24 hours. Massive hemorrhage in a pediatric patient may occur in a variety of settings, including trauma, major surgery (cardiothoracic, neurosurgical, spine), or during procedures such as extracorporeal membrane oxygenation (ECMO).

RECORDS

Records will be maintained according to AABB Standards.

KEY WORDS

MTP, Massive Transfusion Protocol, Pediatric, Hemorrhage, Order Set

SUMMARY OF CHANGES

Original Document

RESOURCES/TRAINING

Resource/Dept	Contact Information
Joseph Griggs MD, Transfusion Medicine	505-272-4560
Cindy Jones, Technical Specialist Blood Bank	505-272-2592

DOCUMENT APPROVAL & TRACKING

Item	Contact	Date	Approval
Owner	**Department of Pathology, Transfusion Medicine Office: 505-272-4560**		
Consultant(s)	Dr. Joseph Griggs, Transfusion Medicine	2/23/2018	Yes
	Dr. Evelyn Lockhart, Transfusion Medicine	3/14/2018	Yes
	Dr. Rachel Tuuri, Pediatric Emergency Medicine	3/8/2018	Yes
	Dr. Sonlee West, Surgery	2/23/2018	Yes
	Dr. Amy Babb, Pediatric Anesthesiology	2/28/2018	Yes
	Dr. Niels Chapman, Pediatric Anesthesiology	3/14/2018	Yes
	Dr. Hemant S. Agarwal, Pediatric Critical Care	3/14/2018	Yes
	Dr. Janell Fuller, Neonatology	3/12/2018	Yes

Committee(s)	Transfusion and Tissue Committee	3/14/2018	Yes
Nursing Officer	NA		NA
Medical Director/Officer	**Dr. Kendall Crookston, Dept of Pathology, Transfusion Medicine Office: 505-272-3804**	3/14/2018	Yes
Official Approver	Administrator, Professional Services		Y
Official Signature	**On SharePoint**	05/24/2018	
Effective Date		05/24/2018	

ATTACHMENTS

Pediatric Massive Transfusion Protocol and Pediatric Massive Transfusion: Protocol Indications

Title: Pediatric Massive Transfusion Protocol Flowchart	Effective Date:
Applicability: UNM University Hospital Pediatric Patients	Document Owner: Transfusion Medicine
Related Documents: Pediatric Massive Transfusion Protocol (MTP) Procedure and Information	

Pediatric Massive Transfusion Protocol

BLOOD BANK Notification:
333 (in-house phone)
272-3333
925-3333
272-2591

ACTIVATE PEDIATRIC MTP
1. **Order, Initiate, and Sign** Pediatric MTP PowerPlan
2. **Notify Blood Bank** with the following:
   - Patient Name, MRN, and Location
   - Estimated Weight
   - Attending Physician
   - Point of Contact Name and Contact Number

INITIAL LABS IN MTP PowerPlan:
Type and Screen
ABG
CMP
iCa
EHP (H/H, Plt, PT/INR, Fibrinogen)
-1 lavender and 1 light blue tube
REPEAT LABS:
Every 30 minutes during MTP:
EHP (H&H, Plt, PT/INR, Fibrinogen)
As clinically indicated: ABG, iCa, Chem7

BLOOD BANK PREPARES MTP PRODUCTS BY PATIENT WEIGHT

<20 kg	20-50 kg	>50 kg
2 RBC units 2 plasma units	4 RBC units 4 plasma units	6 RBC units 6 plasma units

-Every other MTP round includes 1 apheresis platelet unit (a "6 pack" of platelets)
-Transfusions < 1 unit: may draw multiple transfusions from 1 unit with sterile syringe/technique

RETURN UNUSED PRODUCTS TO BLOOD BANK
- Return cooler/Refrigerator on Wheels (ROW) to blood bank with all unused products.
Do NOT put platelets or cryo in coolers or

TRANSFUSE PRODUCTS
- Consider **TXA**: 15 mg/kg bolus over 10 min, then 2 mg/kg/hr over 8 hrs (max 1gm each time)
- 15 mL/kg each **RBCs:Plasma:Platelets** (1:1:1 ratio)
- Reassess ongoing need for MTP products

RETRIEVE ROUND FROM BLOOD BANK
Clinical team **must** pick up products from blood bank
Next round prepared when clinical team picks up prepared products

PROTOCOL DISCONTINUED
Discontinued by clinical team
Notify Blood Bank of discontinuation

IMPORTANT TO REMEMBER:
*Cryo is not included in the Pediatric MTP order set - order separately based on lab results.
*Notify the Blood Bank for **ALL** changes to patient location or Contact Person (272-2591).
*Do not put platelets or cryo in the coolers or ROW.
*EHP specimens must be HAND DELIVERED to lab

Title: Pediatric Massive Transfusion Protocol Flowchart	Effective Date:
Applicability: UNM University Hospital Pediatric Patients	Document Owner: Transfusion Medicine
Related Documents: Pediatric Massive Transfusion Protocol (MTP) Procedure and Information	

Pediatric Massive Transfusion: Protocol Indications

BLOOD BANK Notification:
333 (in-house phone)
272-3333
925-3333
272-2591

Actively Bleeding Patient

Suggested Indications to activate MTP:

Continued significant bleeding in the presence of:

- INR > 1.9
- Fibrinogen <160 mg/dL
- Thrombocytopenia with:
  < 50,000 without intracranial/intraocular hemorrhage
  < 100,000 with intracranial/intraocular hemorrhage

Already transfused ≥ 40 mL/kg RBCs

Large blood loss and symptomatic hemorrhagic shock

Ultimately- The decision to activate the MTP is up to the clinical judgement of treating physician