VANDERBILT UNIVERSITY MEDICAL CENTER

Standard Operating Procedure

Massive Transfusion Protocol (MTP)

Category	Clinical Practice
Approval Date	October 2023
Effective Date	January 2024
Supersedes	New

Applicable to: ☒ Adult Enterprise ☒ Pediatric Enterprise ☐ Behavioral Health Enterprise ☐ VUMC

This SOP correlates directly with VUMC policy:
Blood Product Administration

I. Purpose:

A. To outline a standard process for safe, rapid preparation, delivery, and administration of blood products for patients who experience massive hemorrhage.

B. To provide guidance on the conservation of blood components while ensuring the safe and rapid administration of blood products.

II. Definitions:

Massive Transfusion: The replacement of the patient's total blood volume over a 24-hour period or the actual or anticipated administration of

A. Greater than 40mL/kg PRBC for pediatrics in 2 hours or less; or

B. Greater than 10 units of blood products in 24 hours in adults or 3 units in 1 hour.

III. Specific Information:

A. Massive Transfusion Protocol (MTP) should be considered for cases of massive blood loss with profound hemorrhagic/hypovolemic shock or conditions of disseminated intravascular coagulopathy (DIC).

1. In the setting of massive transfusion, blood cells and other blood components (platelets, plasma, and fibrinogen) will become depleted, and ongoing laboratory monitoring (platelet count, prothrombin time, and fibrinogen level) will be necessary to replace these appropriately.

2. Commonly accepted age-specific blood volumes:

a. Preterm infant: 90 - 100 mL/kg (may adjust for VLBW infants and gestational age).
b. Term infant <3months: 80 - 90 mL/kg.
c. Child >3months: 70 mL/kg.

B. Indications for initiation of the MTP include severe blood loss (Class III/IV hemorrhagic shock with blood loss greater than 30-40% blood volume) with no imminent end to the bleeding. Actual hemorrhage does not have to occur before the determination is made to activate MTP. Anticipated large-volume blood loss is an appropriate MTP activation criterion.

C. Patient selection:

1. Patients with current, ongoing, or impending massive blood loss should be considered for activation of MTP.

2. Activation of the massive transfusion protocol should be strongly considered for patients who receive more than two units of blood products in the ED or who have an Assessment of Blood Consumption (ABC) score of 2 or greater.

IV. Procedures:

A. Activation

1. Upon identification of need, the attending physician or designee places an order for MTP via eSTAR.

   Note: Verbal MTP activation is allowable only when electronic MTP order entry is impossible due to patient condition or eSTAR downtime. ALL verbal MTP activations require subsequent eSTAR MTP orders to be placed by the provider or designee.

2. The Blood Bank is called to confirm the MTP order was received.

3. The following patient information is provided (electronically or verbally) to the Blood Bank:

   a. Name (this may be an assigned STAT name);
   b. Medical record number (MRN);
   c. Sex;
   d. Approximate age (required to identify females of likely childbearing age):
   e. For pediatric patients: Approximate weight (or $\leq$ 40kg or >40 kg);
   f. Location; and
   g. Name of attending physician who initiated MTP. Note that when a surgical fellow activates MTP, the name of the attending is also required.

   Note: For obstetrical emergencies, such as postpartum hemorrhage, the caller must specify the need for OB-MTP when ordering.

4. Type and Screen sample and ABO Verification sample (if indicated) is collected within 15 minutes of the MTP activation (if not already collected).

Each sample must be obtained with a minimum of 2 mL in accordance with VUMC policy, Blood Product Administration. This sample cannot be diluted or drawn from a site with active infusion/transfusion running distally.

B. Cycle Process

1. The Blood Bank reads back the information provided to the caller and announces the MTP verbally in the Blood Bank.

   a. The First cooler is ready within 10 minutes of the activation time and contains uncrossmatched trauma products based on the provided information. Subsequent coolers will be ready within 30 minutes from the previous cooler being picked up.
   b. For OB-MTP:
      i. Cryoprecipitate (2-5pks) in every other cycle, starting with cycle 2 for OB-MTPs only.
      ii. OB-MTP Only Fibrinogen concentrate is administered with the first MTP cooler.
      iii. Fibrinogen Concentrate is available from Pharmacy or designated medication supply cabinets.
   c. Platelets and Cryoprecipitate cannot be infused with a rapid infuser or fluid warmers.

2. Coolers are set up with the product following amounts based on the type of MTP requested and available patient information:

Adult MTP		
	Male or Female > 50 yrs	Female < 50 yrs
RBC	4	4
Plasma	4	4
Platelet**	1	1
** Platelets will come with every other cycle starting at cycle 5		

OB- MTP	
Note: Requester must specify OB-MTP	Female
RBC	4
Plasma	4
Platelet	1 (every other after starting at cycle 5)
Cryoprecipitate	2 (5pks) even cycles only
Fibrinogen Concentrates	Ordered in tandem with MTP to allow Cryoprecipitate to be thawed for cycle 2

Pediatric MTP		
	Under 40kg	Over 40kg
RBC	2	4
Plasma	2	4
Platelets	1 (odd cycles only)	1

3. Consider the following pharmacological interventions per activating attending physician discretion:

    a. Calcium repletion with each MTP cooler administration and as needed;
    b. Administration of Tranexamic Acid; and
    c. Administration of Prothrombin complex concentrate or other reversal agents of therapeutic anticoagulation.

4. Cooler pickup and return:

    a. Blood products for MTP and any products prepared in a cooler are retrieved from the Blood Bank by a member of the receiving department's personnel.

    b. The transporting staff member (runner) presents a patient identification label which includes at least two identifiers and participates in a readback to verify patient identity prior to the release of the cooler.

    c. A verbal readback is performed at the Blood Bank window to verify the correct cooler is being picked up. Note: MTP may be running concurrently in multiple units/areas for multiple patients.

    d. Returned coolers are given to the Blood Bank technologists and the time of return is noted on the MTP form.
        i. Unused products MUST be returned with the cooler they arrived in.
        ii. Products waiting to be transfused remain in a closed cooler until needed.
        iii. Marking the unit label or bag in any way is prohibited.
        iv. Platelets and cryoprecipitate are never placed inside or on top of coolers.

5. The Blood Bank prepares the next cycle upon pickup of the current cycle.

6. MTP coolers are intended to be given in their entirety until completed. If all products are not desired, strong consideration should be given to MTP discontinuation. A la carte blood products can be ordered upon MTP discontinuation.

7. When MTP cooler #5 is delivered, the designated team member receiving the cooler announces its arrival by stating, "MTP cooler number 5," prompting a multidisciplinary discussion on clinical futility.

    Attending physicians will, at this point, lead a discussion on the patient's overall clinical status, salvageability, and current status of hemorrhage control. Based on these factors, the attending physician(s) will decide whether to continue MTP or consider cessation of efforts based on futility.

C. Laboratory Sample Collection and Patient Monitoring

1. Active monitoring of patient lab values: Consider every 30-60 minutes during the MTP event and at discontinuation if appropriate:

    a. CBC;
    b. Coagulation profile;
    c. Ionized calcium; and
    d. Arterial blood gases (to include full panel if able).

2. Vital signs (heart rate, blood pressure, respiratory rate, and temperature) are to be obtained and documented for each unit of product given.

    a. Vitals should be captured at a minimum of 15-minute intervals.

    b. Continuous temperature monitoring is preferred due to the risk of hypothermia and subsequent coagulopathy.

D. MTP Discontinuation

The most reliable transfusion endpoint is a collaborative decision based on achieving hemorrhage control (operative field examination), laboratory results, and clinical parameters.

1. The attending physician must be aware of and in agreement with the decision to discontinue MTP.

    a. The following indications for deactivation are considered:
        i. Systolic Blood Pressure (SBP):
            1) Greater than 70 plus (age in years x 2) in pediatric patients;
            2) MAP > 60mmHg in adult patients;
        ii. INR less than 1.5;
        iii. Blood pH greater than 7.2;
        iv. Improving base deficit;
        v. Urine Output (UOP) greater than 0.5mL/kg/hr;
        vi. Improved clinical exam;
        vii. Resuscitation is futile; and
        viii. Bleeding has been controlled.

    b. It is the responsibility of the Trauma Surgeon for trauma patients and the attending physician for non-trauma patients to terminate the MTP.

    c. The physician or designee notifies the Blood Bank immediately when the MTP has been discontinued by completing the order in eSTAR (preferred) or calling the Blood Bank (downtime only).

2. Premature discontinuation of MTP should be avoided to minimize catch-up reactive transfusions.

3. The Blood Bank may consider auto-cancellation if the ready cooler has not been picked up after 2 hours.

E. MTP Documentation

1. The following is required to be documented for each unit given:

a. Start time;

b. Stop time;

c. Volume;

d. Dual verification signatures;

e. Acknowledgment of deferral of informed consent and patient education per emergent situation;

f. Expiration verification;

g. Vital signs (may indicate they are captured elsewhere, such as eSTAR or code sheet); and

h. If a transfusion reaction occurred (on the back of the TAR).

2. Where to document:

a. Uncrossmatched "Trauma" units issued under the "Trauma, Two" name, that is, they do not have the patient's name on them, are documented on the TAR. When complete, the TARs are uploaded into the EMR.

b. Units issued with the patient's name on the TAR can be documented in the EMR using the standard process when and where resources are available to do so at the time of transfusion as part of the dual verification process. Reference Blood Product Administration; Procedures for (SOP).

3. The total volume of each type of blood product is documented in the EMR. If using the TAR and vital signs are captured elsewhere, indicate "see EMR" or "see code sheet" in the vitals section of each TAR.

V. Quality Review and Improvement

Unused products are returned promptly to the Blood Bank with the cooler they were issued.

Regular review and performance monitoring is ongoing based on current recommended practices and guidelines, not limited to and subject to change:

A. Utilization metrics;

B. Waste of products;

C. Time to prepare the first and second cycles;

D. Time interval to crossmatch availability;

E. Compliance with the call to discontinue; and

F. Stewardship of products.

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VII. Endorsement:

Patient Blood Management Committee	July 2023
Transfusion Committee	July 2023
Monroe Carell Policy and Practice Committee	August 2023
VUH Clinical Practice Committee	August 2023
VUMC Clinical Practice Committee	October 2023
Medical Executive Committee	October 2023

VIII. References:

Adkins, B. D., Libby, T. A., Mayberry, M. M., Brady, T. W., Halls, J. B., Corbett, S. M., Schoeny, J., Shields, E. P., Chowdhury, J., Kinsinger-Stickel, A. N., Wehrli, G., Jaeger, N. R., Robertson, M. P., Butler, K. M., Lowson, S. M., Calland, J. F., & Gorham, J. D. (2021). How did we reform our out-of-control massive transfusion protocol program? *Transfusion*, *61*(11), 3066-3074. https://doi.org/10.1111/trf.16706

Broxton, S., Medeiros, R., & Schumacher, A. (2017). Evaluation Tool for Assessing a Newly Implemented Massive Transfusion Protocol. *Journal of Trauma Nursing*, *24*(3), 164-169. https://doi.org/10.1097/jtn.0000000000000285

Callcut, R. A., Cotton, B. A., Muskat, P., Fox, E. E., Wade, C. E., Holcomb, J. B., Schreiber, M. A., Rahbar, M. H., Cohen, M. J., Knudson, M. M., Brasel, K. J., Bulger, E. M., Del Junco, D. J., Myers, J. G., Alarcon, L. H., & Robinson, B. R. (2013). Defining when to initiate massive transfusion: a validation study of individual massive transfusion triggers in PROMMTT patients. *J Trauma Acute Care Surg*, *74*(1), 59-65, 67-58; discussion 66-57. https://doi.org/10.1097/TA.0b013e3182788b34

Hess, J. R., Ramos, P. J., Sen, N. E., Cruz-Cody, V. G., Tuott, E. E., Louzon, M. J., Bulger, E. M., Arbabi, S., Pagano, M. B., & Metcalf, R. A. (2018). Quality management of a massive transfusion protocol. *Transfusion*, *58*(2), 480-484. https://doi.org/10.1111/trf.14443

Jacobs, J. W., & Booth, G. S. (2022). Blood shortages and changes to massive transfusion protocols: Survey of hospital practices during the COVID-19 pandemic. *Transfusion and Apheresis Science*, *61*(1), 103297. https://doi.org/10.1016/j.transci.2021.103297

Nunez, T. C., Voskresensky, I. V., Dossett, L. A., Shinall, R., Dutton, W. D., & Cotton, B. A. (2009). Early prediction of massive transfusion in trauma: simple as ABC (assessment of blood consumption)? *J Trauma*, *66*(2), 346-352. https://doi.org/10.1097/TA.0b013e3181961c35

Paganini, M., Abowali, H., Bosco, G., Balouch, M., Enten, G., Deng, J., Shander, A., Ciesla, D., Wilson, J., & Camporesi, E. (2021). Quality Improvement Project of a Massive Transfusion Protocol (MTP) to Reduce Wastage of Blood Components. *International Journal of Environmental Research and Public Health*, *18*(1). https://doi.org/10.3390/ijerph18010274

VUMC Policy Manual. (2023). Retrieved from https://vanderbilt.policytech.com.

Clinical Practice Category:
Blood Product Administration
Blood Product Administration; Procedures for (SOP)
Solid Organ Transplant ABO Donor-Recipient Verification Process (SOP)
Solid Organ Transplant: ABO Donor-Recipient Verification