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Providing Blood Components for Massive Transfusion - Royal Oak

Document Type: Procedure

I. PURPOSE AND OBJECTIVE:

The purpose of this document is to provide the Blood Bank staff with instructions for providing blood components for massive transfusion.

II. SCOPE:

This document applies to massive transfusions of all patients, regardless of age.

III. PRINCIPLE:

A. A patient who is exsanguinating due to physical trauma, unexpected massive bleeding during a surgical procedure, delivery of an infant, or another cause of large-volume blood loss requires:
    1. Fluid resuscitation,
    2. Red cell mass replacement to maintain tissue oxygenation, and
    3. Platelet and coagulation factor replacement to counteract depletion resulting from consumption and dilution.

B. The massive transfusion protocol provides red blood cells (RBCs), plasma (either liquid plasma or FFP / thawed plasma), and platelet components (PLTs) in pre-determined ratios with the intent to prevent or minimize the risk of dilutional coagulopathy in the massively bleeding patient.

C. The Blood Bank must be prepared to support the patient's transfusion requirements, keeping in mind the blood supplier's ability to provide components, as well as the transport times between the blood supplier, the Blood Bank, and the patient. Blood components can be infused to the patient in less time than is required to dispense them from the Blood Bank as heated infusions systems are

capable of infusing about one unit of RBCs per minute. The massive transfusion protocol is designed to allow the Blood Bank staff to rapidly prepare and dispense blood components.

IV. DEFINITIONS AND ACRONYMS:

A. **Adult patient**: For the massive transfusion protocol, a patient who is 12 years or older.

B. **Pediatric patient**: For the massive transfusion protocol, a patient who is less than 12 years old.

C. **Current sample**: A sample that was collected no more than 3 days before the current date. For example, if a sample is drawn on Monday (day 0), then the sample remains "current" all day Mon., Tues., Wed., and Thur.

D. **Complete blood type**: ABO/Rh typing that includes both a forward and a reverse typing. A neonatal typing is not a complete typing because a reverse typing is not performed. See Transfusion Medicine policy, Forward Typing Determination Of Neonatal ABO and Rh for Patients Less Than Four Months of Age By Tube Method.

E. **Dispense**: Process of issuing blood products for transfusion.

F. **Plasma**: The term used throughout this document referring generally to both FFP, thawed plasma, and liquid plasma.

   1. **FFP (Fresh Frozen Plasma)**: A plasma that was frozen within 8 hours of collection, and used within 24 hours of collection.
   2. **Thawed Plasma**: A plasma that has been thawed and stored refrigerated for greater than 24 hours and up to 5 days.
   3. **Liquid Plasma**: A plasma product that is never frozen. Compared to frozen and thawed plasma components, liquid plasma has extended expiration times but may contain diminished coagulation factors.

G. **PLT**: Platelet.

H. **ABO-identical**: A component that is of the identical ABO blood group as the recipient.

I. **ABO-plasma-compatible**: Refers to platelets, plasma, and cryoprecipitate components that do not contain ABO antibodies corresponding to the recipient's ABO antigens.

J. **ABO compatible**: Refers to donor RBCs that lack the ABO antigens corresponding to the recipient's ABO antibodies.

K. **Rh(D) identical component**: A component that is of the identical Rh(D) as the recipient.

L. **Rh(D) compatible component**: A blood component of the following specificity:

   1. For a Rh(D) negative recipient, the component is Rh(D) negative.
   2. For a Rh(D) positive recipient, the component is either Rh(D) positive or Rh(D) negative.
   3. For a recipient with a Rh(D) type that is undetermined for any reason, the component is Rh(D) negative.

M. **Massive transfusion**: The administration of 8 - 10 RBC units within a 24 hour period, or the acute administration of 4 - 5 RBC units within a one-hour period to an adult patient

N. **Trauma massive transfusion**: The acute administration of 4 - 5 red cell units within one hour.

O. **Emergency issue (EI)**: A bleeding event in which the attending physician determines that blood components must be dispensed / transfused prior to completion of applicable compatibility

testing.

P. **Standard Blood Bank cooler**: A temperature-monitored cooler used for inpatients that:
    1. Is intended for use during the pediatric massive transfusion protocol for the transport of 3 RBCs and 3 plasma, or
    2. Is intended for use during the massive transfusion protocol for the transport of one half of the massive transfusion pack of 3 RBCs and 3 plasma, or
    3. Is intended for the transport of 1 - 6 blood components which require refrigeration, and
    4. Has been validated for the transport of blood components.

Q. **Massive transfusion cooler**: A large, temperature-monitored cooler that:
    1. Is intended for use during the massive transfusion protocol for the transport of 6 RBCs and 6 plasma, or
    2. Is intended for transport of up to 14 plasma during a therapeutic plasma exchange, and
    3. Has been validated for the transport of blood components.

R. **EPIC**: Hospital computer information system

S. **Designee**: A Blood Bank technical director or transfusion medicine fellow.

V. INTRODUCTION:

A. The Blood Bank's main goals during a massive transfusion protocol are to dispense blood components as rapidly as is required and to prevent or minimize the risk of dilutional coagulopathy. To achieve these goals, the Blood Bank will make every attempt to have one cooler of refrigerated components prepared and pre-dispensed, and one container (plastic bag) of room temperature platelets prepared and ready to be dispensed at all times after initiation of the massive transfusion protocol.

B. One component set will contain RBCs, plasmas, and a platelet. A component set will be prepared and dispensed in the pre-determined ratios (depending on whether the patient is an adult or pediatric patient), as indicated in the table below. Replicate component sets will automatically be prepared until the protocol is terminated by the patient's caregivers, after which time the caregivers may deviate from these pre-determined component ratios.

C. It is the responsibility of the technologist who dispenses the components from the Blood Bank computer to adhere to applicable Transfusion Medicine policies.
    1. Transfusion Medicine policy, Dispensing Blood Products and
    2. Transfusion Medicine policy, *Transporting Blood Components in a Cooler*.

Component Ratios during Massive Transfusion

ADULT MASSIVE TRANSFUSION PROTOCOL (for patients 12 years or older)		
Components will be dispensed in the following ratio: **6 RBCs / 6 Plasma / 1 Platelet**		
The first massive pack should be prepared and issued one-half at a time. This provides the quickest turnaround time upon activation of the massive transfusion protocol.		
Set #1	Upon activation of the massive transfusion protocol, the first set will likely be dispensed as described below (to allow the Blood Bank time to thaw additional FFP, when necessary).	
	1st Massive cooler or standard cooler and room temperature bag	3 RBCs / 3 plasma / 1 PLT
	2nd Massive cooler or standard cooler (available after additional FFP is thawed, if needed)	3 RBCs / 3 plasma
Set #2	For the second and subsequent sets, the Blood Bank will pre-thaw additional FFP, if necessary.	
	Massive cooler and room temperature bag	6 RBCs / 6 plasma / 1 PLT
PEDIATRIC MASSIVE TRANSFUSION PROTOCOL (for patients less than 12 years old)		
Components will be dispensed in the following ratio: **3 RBCs / 3 thawed plasma / 1 Platelet** (the platelet will be dispensed with alternating sets of RBCs / plasma, as follows)		
Set #1	Massive cooler or standard cooler and room temperature bag	3 RBCs / 3 thawed plasma / 1 PLT
Set #2	Massive cooler or standard cooler	3 RBCs / 3 thawed plasma
Set #3	Massive cooler or standard cooler and room temperature bag	3 RBCs / 3 thawed plasma / 1 PLT
Set #4	Massive cooler or standard cooler	3 RBCs / 3 thawed plasma

VI. POLICIES:

A. Persons Authorized to Activate the Massive Transfusion Protocol

1. Activation of this procedure must be requested verbally or by written order of any of the patient's clinicians (e.g., a surgeon, anesthesiologist, physician's assistant, certified registered nurse anesthetist, resident, fellow, etc.).

B. Communication

1. The Blood Bank employee who takes a phone call indicating that the massive transfusion protocol is being activated shall:
    a. Document the appropriate information on the *Blood Bank Communication for Massive Transfusion or Emergency Issue*, and
    b. Inform other employees of the activation, and enlist supporting help to prepare components and coolers, and
    c. Assess and communicate the degree of compatibility testing that may have been performed on a current sample.
2. If a Medical Technologist becomes aware that six (6) or more RBCs have been dispensed from the Blood Bank on a given patient within one (1) hour, then the technologist should communicate with the patient's caregiver(s) the potential for activation of the massive transfusion protocol. This policy is meant to enhance awareness but is not intended to replace physician responsibility for activation of this protocol based upon the unique circumstances and condition of the patient.
3. The Medical Director should be notified immediately if availability of blood products is compromised or if it is necessary to modify the application of the massive transfusion protocol.
4. The nursing staff / patient's caregivers should be notified when each set of components becomes available for dispensing.

C. Required Information

1. The Blood Bank requires the following information in order to dispense blood components under the massive transfusion protocol:
    a. Patient's name
    b. Medical record number (MRN)
    c. Wrist band number

D. Requirement for Written Documentation of the Required Information

1. In order to dispense components, the runner must present **written** documentation of the patient's name, MRN, and wristband number. The *Blood Product Dispense Form* (F-1564) or the *Urgent Request for Blood Product* form (F-1565) may be used for this purpose. However, if applicable refer to *Extenuating Circumstances / Unable to Obtain the Required Information*, below.

E. Extenuating Circumstances / Unable to Obtain the Required Information

1. Extenuating circumstances may prevent the patient's caregivers from providing the required information to the Blood Bank. In this case, the technologist will weigh the amount of time needed to obtain the required information, versus the patient's need for an immediate transfusion. After weighing these factors, the technologist will proceed as described below:

a. Obtain the required information; i.e. the runner can complete F-1565 or F-1564 if they have the patient's name, medical record number, and wristband number. The runner may also call to the patient's location to acquire the required information. Or,

b. Immediately dispense group O-negative RBCs as described in Transfusion Medicine policy, *Downtime Emergency Issue*. **The Blood Bank shall never refuse to dispense components or unduly delay an emergency transfusion when the required information cannot be obtained**.

c. Any time that the patient's caregivers do not provide the required information a variance shall be submitted.

F. Components Will Not be Divided for Pediatric Massive Transfusions

1. During a pediatric massive transfusion, components will not be divided in bags or syringes. The patient's caregivers will determine the volume to infuse from the entire component. The Blood Bank will issue two 60 mL syringes in each cooler, unless the Blood Bank becomes aware that the pediatric patient is receiving full units and does not require aliquots.

G. Inventory

1. The Blood Bank will assess current inventory levels of RBCs, plasma, and platelets as indicated in Transfusion Medicine policy, Inventory and Ordering of Blood Products - Royal Oak Blood Bank. Inventory levels shall be assessed upon activation of the massive transfusion protocol and periodically throughout the event.
2. If the inventory of any component is less than the minimum, then the Blood Bank shall seek replacement inventory from blood suppliers or other area hospitals.
3. If the Blood Bank is unable to obtain replacement inventory or if there is a regional shortage of components, then the Medical Director or designee shall be notified immediately.
4. Pre-Thawed Plasma Inventory
    a. In anticipation of an activation of the massive transfusion protocol or an emergency issue event, the Blood Bank will attempt to maintain the following minimum inventory of thawed plasma at all times: 3 group AB, 3 group A, and 3 group O. The required number of plasma units (6 for an adult) may not be immediately available for use in the massive cooler with the first set; additional plasma units should be thawed immediately as described in *Component Ratios during Massive Transfusion*.
5. Group A Liquid Plasma Inventory
    a. The Blood Bank will maintain an inventory of group A liquid plasma that may be used during a massive transfusion protocol. Refer to *Use of Group A Liquid Plasma* for additional information.

H. ABO and Rh of Components Dispensed Under the Massive Transfusion Protocol

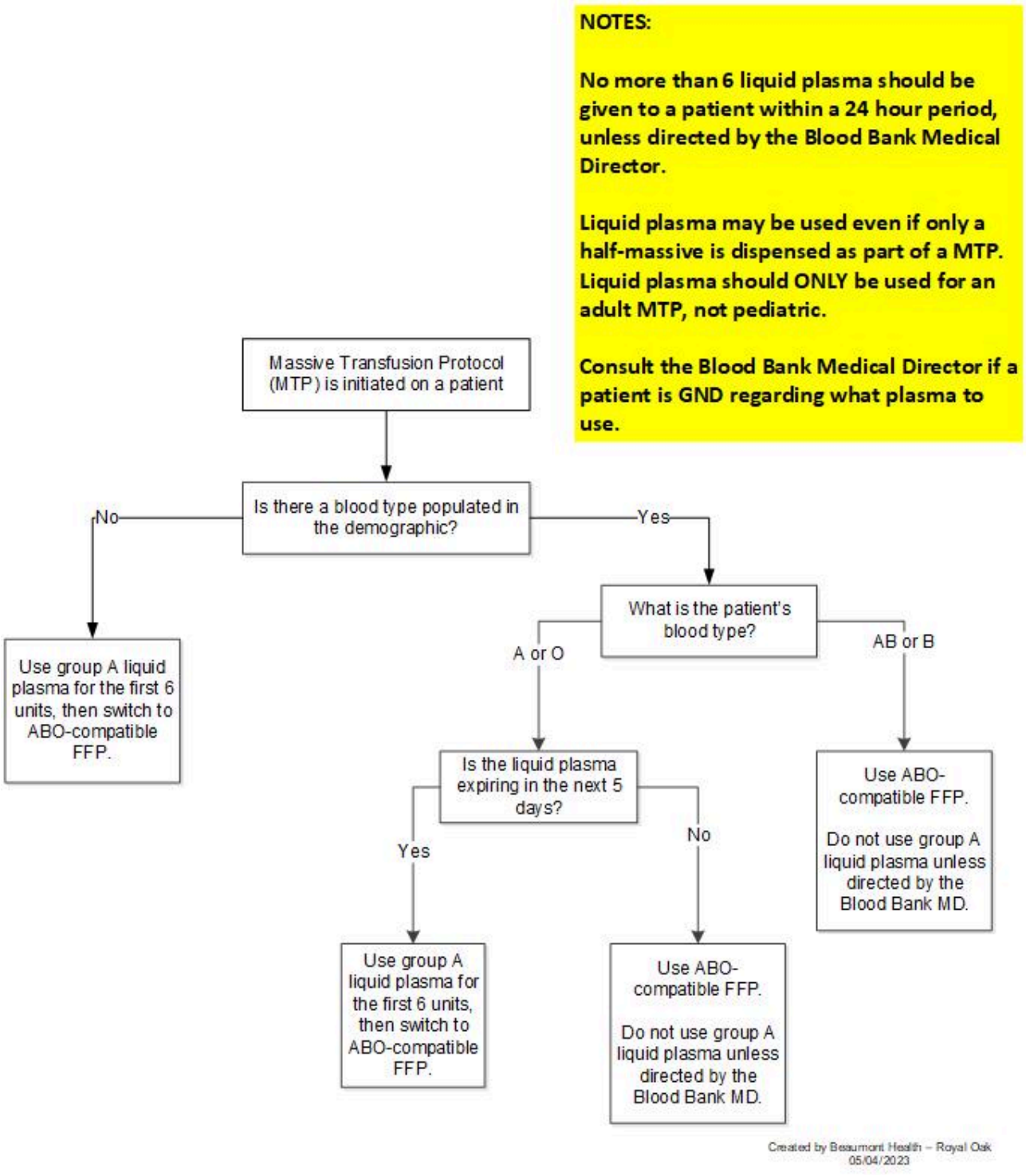
1. If compatibility testing is complete, the appropriate ABO and Rh of the blood products dispensed under this massive transfusion protocol is described throughout the Transfusion Medicine

policies.

2. If compatibility testing is not complete, then the appropriate ABO and Rh blood products dispensed under this massive transfusion protocol is indicated in Transfusion Medicine policy, Emergency Issue of Blood Products. Note that group A liquid plasma may be used if the patient does not have a valid blood type for the current admission; refer to *Use of Group A Liquid Plasma* for additional information.

I. Use of Group A Liquid Plasma

1. Group A liquid plasma should be used prior to thawed plasma for the following situations:
    a. If the MTP is emergency issue because there is no current/valid blood type on the patient, the patient should be receiving group A liquid plasma in the massive packs.
    b. If the MTP is non-emergency issue, the patient's blood type is group A or O, and the liquid plasma expires within the next 5 days, the patient should be receiving group A liquid plasma in the massive packs.
    c. No more than 6 liquid plasma should be given to a patient within a 24 hour period, unless directed by the Blood Bank Medical Director.
    d. If directed by the Blood Bank Medical Director, group A liquid plasma may be used in situations outside of the above examples.
2. Group A liquid plasma should not be used for a pediatric MTP.



J. The Use of Coolers

1. Refrigerated components will be dispensed from the Blood Bank in the large, massive transfusion cooler. These coolers have been validated to maintain the required transport temperature.
2. The smaller, standard blood coolers may be used for the pediatric massive transfusion protocol or one half of the massive transfusion protocol because they have been validated for 1 - 6 units of

RBCs and/or plasma.

3. All technologists who dispense components under the massive transfusion protocol must also comply with the policies of Transfusion Medicine policy, *Transporting Blood Components in a Cooler*.

K. Policies Relating to Preparation and Dispensation of Components

1. The massive transfusion protocol is intended to prevent or minimize the risk of dilutional coagulopathy and is designed to allow the Blood Bank staff to rapidly prepare and dispense blood components. If the patient's caregivers wish to deviate from the pre-determined component ratios, the result may be an increase in the time required to prepare and dispense components.
2. The first massive pack should be prepared and issued one-half at a time. This provides the quickest turnaround time upon activation of the massive transfusion protocol. If the second half of the massive is prepared and issued prior to the first half getting picked up, they can be picked up together.
3. During a massive transfusion protocol, the Blood Bank will make every effort to have one cooler of refrigerated components prepared and pre-dispensed, and one transport container (plastic bag) for room temperature platelets prepared and ready to be dispensed at all times.
4. The preparation of replicate sets of blood components must be continued until the patient's caregivers request termination of the massive transfusion protocol.

L. Special Instructions and Transfusion Requirements

1. The Blood Bank will attempt to supply components that meet patients' special instructions / transfusion requirements. However, the first priority will be to dispense components expeditiously. Therefore, the Blood Bank will adhere to these requirements at its discretion. For example:
    a. The Blood Bank may suspend irradiation of blood components during a massive transfusion event at its discretion.
    b. The Blood Bank may decide not to dispense antigen negative RBCs to a massively bleeding patient with a history of unexpected antibodies.
2. If a patient's special instructions / transfusion requirements are not met, then document the occurrence in a variance. Communication is essential to ensure that antigen negative or irradiated components are available when the bleeding event is under control.

M. Crossmatching RBCs Dispensed Under the Massive Transfusion Protocol

1. If the patient is eligible for electronic crossmatches, then electronic crossmatches will be performed.
2. If the patient is not eligible for electronic crossmatches and RBCs are not already crossmatched, then the components will be emergency issued; see Transfusion Medicine policy, Emergency Issue of Blood Products. For example, if compatibility testing is incomplete, or if the patient has unexpected antibodies or an unresolved ABO or Rh discrepancy. As described in the section *Authorization / Signature for Emergency Issue Blood Components*, the patient's authorized caregiver

must sign the *Urgent Request for Blood Product* form, F-1565. This form may be signed before or after the incident; the signature is not required at the time of issue.

N. Post-Issue Crossmatches

1. A serologic crossmatch must be performed post-issue for units dispensed by emergency issue, and for the first 12 units issued under the massive transfusion protocol. It is not necessary to perform a post-issue crossmatch for units dispensed after the first 12 under the massive transfusion protocol, unless the patient has a historical or current indication of unexpected antibodies. Post-issue crossmatches may not be indicated for neonates. Note that the computer system does not allow post-issue electronic crossmatching. Refer to Transfusion Medicine policy, Serologic Crossmatching of Red Blood Cells.

O. Ordering and Resulting the MTP test in SoftBank

1. The Massive Transfusion Initiated test is to be ordered in SoftBank and resulted with the date and time of the massive transfusion initiation; see the Blood Bank CDM - Ordering and Resulting the Massive Transfusion Initiated Test for further instruction.

VII. SPECIMEN COLLECTION AND HANDLING:

A. A specimen is not required to initially dispense components under the massive transfusion protocol; products dispensed prior to receipt and testing of a specimen must be dispensed as emergency issue. However, a specimen is required in order to dispense ABO-identical components or ABO plasma-compatible plasma and platelets. If not already done, the specimen should be drawn as soon as possible, preferably prior to transfusion. Specimens must meet the requirements of Transfusion Medicine policy, Triaging And Identifying Acceptable Samples For Testing - Blood Bank.

VIII. EQUIPMENT:

A. Massive transfusion coolers

B. Standard cooler

C. Blood Bank temperature thermometers, one per cooler

IX. SUPPLIES:

A. Ice chips

B. Plastic bags

X. QUALITY CONTROL (QC):

A. Activation of this procedure is evaluated by the Medical Director or designee for appropriateness of the activation, adequacy of response, and outcome.

B. Inappropriate activations are reported to the Chiefs of the Trauma Team and Anesthesiology Department.

C. Document any failure of the runner to provide appropriate patient identification information in a variance.

XI. PROCEDURE:

Follow the steps below to prepare and dispense blood components for an adult massive transfusion. These steps may be repeated as necessary to provide replicate component sets. This procedure is intended only to provide a framework for the massive transfusion protocol, minor modifications may be required.

A. Upon notification that an authorized person has activated the massive transfusion protocol, document the *Blood Bank Communication For Massive Transfusion or Emergency Issue* form and alert your coworkers.

B. Immediately thaw additional FFP, as needed.
    1. Refer to the *Use of Group A Liquid Plasma* section of this document.
    2. Refer to the *Inventory / Pre-Thawed Plasma Inventory* section of this document.
    3. Refer to Transfusion Medicine policy, Thawing Fresh Frozen Plasma and Cryoprecipitate.

C. Place orders in the Blood Bank computer if needed.
    1. Refer to the Blood Bank CDM - Massive Transfusion. The computer codes are:
        a. RC for RBCs.
        b. FFP for plasma.
        c. PPH for PLTs.

D. Crossmatch and tag 3 RBCs (Half pack for an adult, full pack for a pediatric patient).
    1. The first adult massive pack should be prepared and issued one-half at a time. For each subsequent massive pack, prepare/issue full packs).
    2. Refer to the Blood Bank CDM - Electronic Crossmatch and to Transfusion Medicine policy, *Tagging Blood Components*.
    3. If the patient is not eligible for electronic crossmatches, then the RBCs must be emergency issued (unless serologic crossmatches have already been performed).

E. Select and tag 3 plasma (Half pack for an adult, full pack for a pediatric patient).
    1. Refer to the *Use of Group A Liquid Plasma* section of this document.
    2. Refer to the *Inventory / Pre-Thawed Plasma Inventory* section of this document.
    3. Regardless of the patient's ABO type, the Blood Bank should be able to provide 3 liquid plasma or FFP right away for the first set (from the liquid plasma or pre-thawed plasma inventory).

F. Select and tag 1 PLT.
    1. PLTs for pediatric patients:
        a. A platelet should be dispensed with the first set of 3 RBCs and 3 plasma. An additional platelet is dispensed with alternating sets of RBCs / plasma, so that a platelet is dispensed with the 1st, 3rd, 5th, etc. set of RBCs / plasma.

G. Place the first half massive (3 RBCs, 3 plasma) in a cooler and place the PLT in a bag labeled with a "Room Temperature" sticker. Dispense it whether or not the courier / Operating Room (OR) runner is present.
    1. For pediatric patients, place two 60 mL syringes in the cooler.

2. If a courier or OR runner is present, proceed to step I.
3. If a courier or OR runner is not present, then proceed to step H to pre-dispense components.

H. If the courier / OR runner is not yet present, pre-dispense the blood products. Because the courier or OR runner is not present, a dispense form may not be available. Obtain the necessary information from the *Blood Bank Communication For Massive Transfusion or Emergency Issue* form. Adherence to the following steps is critical to help ensure that the correct blood goes to the correct patient. Investigate and correct any discrepancies before dispensing the blood. **It is the responsibility of the technologist who pre-dispenses the components from the Blood Bank computer to adhere to the Transfusion Medicine policies**.

1. Document "Massive TXN" in the Soft "Receiver ID" field and on the *Record of Transfusion*.
2. Time stamp the *Record of Transfusion* with the time of pre-dispense.
3. Staple the retention copies of the *Record of Transfusion* together and place in the handle of the cooler.
4. When the courier / OR runner arrives, obtain the dispense form from the runner.
5. Verify agreement between the patient's name and MRN, as it appears on the dispense form and the *Record of Transfusion*.
6. Verify agreement between the wristband number as it appears on the dispense form and the wristband number as printed on the *Record of Transfusion*.
7. Time stamp the dispense form.
8. Document the employee ID# of the courier / OR runner to whom the cooler is physically dispensed on the dispense form.
9. Attach the dispense form to the retention copies of the transfusion tags and retain for Blood Bank records.

I. Prepare and tag the second half of the massive (3 RBCs, 3 plasma). Since a PLT was issued with the first half of the massive, do not set up another PLT with the second half.

J. Dispense the second half of the massive pack following the same information provided in steps G-H.

K. Continue to prepare and dispense components for replicate sets by repeating these steps, until the patient's caregivers terminate the massive transfusion protocol.

1. Set up full massive packs (6 RBCs, 6 plasma, and 1 PLT) for adults following the first pack dispensed.
2. Place orders in the Blood Bank computer for the *Massive Transfusion Protocol Initiated* test and result the test with the date and time that the Massive Transfusion was initiated, see the Blood Bank CDM - Ordering and Resulting the Massive Transfusion Initiated Test for further instruction.

XII. REFERENCES:

1. AABB, *Technical Manual*, current edition.
2. AABB, *Standards for Blood Banks and Transfusion Services*, current edition.

Approval Signatures

Step Description	Approver	Date
	Ann Marie Blenc: System Med Dir, Hematopath	5/19/2023
	Kristina Davis: Staff Physician	5/19/2023
Policy and Forms Steering Committe (if needed)	Brooke Klapatch: Medical Technologist Lead	5/4/2023
	Kelly Sartor: Mgr, Division Laboratory	5/4/2023
	Brooke Klapatch: Medical Technologist Lead	5/4/2023