PURPOSE

To provide a policy and standardized process for managing Massive Transfusion Protocol (MTP) and Hemorrhage Pack (HP). MTP/HP creates a systematic approach to transfusing actively bleeding patients with whole blood ratio during episodes of hemorrhage to avoid dilutional coagulopathy and thrombocytopenia associated with transfusion of incorrect blood component ratio. HP/MTP should not be initiated to correct symptomatic anemia in stable patients. At this time, the use of Hemorrhage Pack is limited to L&D for patients who do not yet need MTP. Utilization of HP in early hemorrhage can effectively reduce downstream blood transfusion, waste, and morbidity for L&D patients. Depending on the condition of the patient, an L&D provider can start with a HP then transitions to MTP or go directly to an MTP. One MTP set constitutes one HP 'A' plus one HP 'B'.

1. The three most common definitions of Massive Transfusion are:
   a. transfusion of more than 100% of the patient's total blood volume (TBV) within 24 hours, this approximates 10 units of whole blood for an average adult patient (70kg)
   b. transfusion of more than 4 units of whole blood in 1 hour for an average adult patient with anticipation of continued need for blood product support
   c. replacement of more than 50% of the TBV by blood products within 3 hours.
2. Once this occurs, the pre-transfusion specimen will not represent the patient's current serological status, and immediate spin and IAT crossmatches can be omitted.
3. A patient is a candidate for the massive transfusion protocol when they have lost 50 % of blood volume within 3 hours, rate of loss of 150 ml per minute or in adult, loss of 3-4 units blood in 1-2 hours.
4. It is the responsibility of the attending physician or designee to initiate and discontinue MTP.
5. Ongoing communication with the Blood Bank regarding the patient's status and clinical condition is essential to meet the patient's transfusion needs and to avoid blood wastage.

REAGENTS

A. Type and screen reagents
B. Phenotyping sera

EQUIPMENT

A. Automated analyzer
B. 12 X 75 mm test tubes
C. Centrifuges
D. Cell Washer
E. 37° C heat block
F. Optical Viewer
G. Validated blood coolers
H. Temperature indicators
I. Ice Packs

SPECIMEN

See Blood Bank Specimen and Requisition SOP.

CONTROL

A. Daily Analyzer QC
B. Daily Reagent QC
C. Daily Equipment QC
D. Supervisory review of LIS records and MTP Worksheet

PROCEDURE

A. Massive blood loss is defined as loss of 50 % of blood volume in 3 hours (150 ml per minute) or in adult, loss of 3-4 units in 1-2 hours. It is considered massive transfusion when the patient has received an amount of blood that exceeded their blood volume. The blood volume estimate is based on the age of the patient as follows:

Age of Patient	Red Blood Cells Issued
Less than 1 year	2 units
1-5 years	4 units
6-11 years	6 units
12-15 years	8 units
16 plus years	10 units

NOTE: Estimated blood volume: 70 ml/Kg or about 5000 ml (10 units of whole blood) in a 70 Kg adult. Adult blood volume is 7 % of body weight whereas 8-9% in a child.

B. When a patient's **blood type is unknown** or **NO DBCK** or **NO current TYSC**, follow the ***SFO-WI.0113 Urgent requirements for Blood and Components*** to dispense MTP or HP.

Patient ABORh	pRBC	FFP	Platelet
Unknown	O Neg, Uncrossmatched **(Female over 50 years old or Male - Switch to O Pos pRBC after 4 units of O Neg pRBC)**	AB **(Switch to group A FFP after 2-4 units of AB FFP – can only give maximum of 4 A FFP)**	Any blood type **Give Rh Neg platelets if available to Rh Neg female 50 years old and younger**
Unknown Female over 50 years old or Male	O Pos, Uncrossmatched during O Neg Shortage	AB **(Switch to group A FFP after 2-4 units of AB FFP – can only give maximum of 4 A FFP)**	Any blood type

NOTE: Refer to SFO-WI.0105 Neonatal Transfusion for Neonates (≤ 4 months old).

1. **Inform caller to send pre-transfusion sample with completed requisition immediately.**
   a. **DBCK** can be drawn at the **same time** but must be drawn **by a different blood drawer** and sent with a separate requisition.
   b. Continued dispense of O Neg pRBC will deplete the limited inventory and deprive usage for subsequent emergencies.

C. A la carte blood product orders are not allowed during Massive Transfusion Protocol (MTP) or Hemorrhage Pack (HP) except for Cryoprecipitate and Platelet Pheresis.

1. **A la carte blood product pick-up is also not allowed**. Doctor cannot pick and choose what to pick up.
2. CLS need to inform doctor to cancel the MTP/HP if doctor wants to deviate from the fixed ratio.
3. Doctor may order additional units of platelet for thrombocytopenic patients.
4. Document the Cryoprecipitate and Platelet on the ***TF0030 MTP HP Worksheet*** with **'!'** to indicate **units were ordered a la carte.**

D. Hemorrhage Pack (HP) for L&D Patients

1. Hemorrhage Pack is treated as the same urgency as MTP.

2. Hemorrhage Pack will be dispensed in the following situation:
   a. Anytime L&D calls for emergency **pRBC** regardless of whether the caller specifies HP or ala carte # of units.

3. If L&D calls to request more emergency **pRBC** after dispensed of Hemorrhage Pack 'A', prepare and dispense Hemorrhage Pack 'B'. **NOTE:** Hemorrhage Pack dispense is alternated between 'A' and 'B' each time.

Hemorrhage Pack 'A'	Hemorrhage Pack 'B'
2 pRBC	2 pRBC
2 thawed plasma	2 thawed plasma
	1 platelet pheresis

NOTE: Use the 2 pre-thawed AB FFP whenever available and start thawing 2 more AB FFP units as replacement.

4. Initiate a ***TF0030 MTP HP Worksheet*** to document the following information:
   a. Patient's name, MRN, age and location.
   b. Physician' name who requested the HP.
   c. L&D contact's name and phone number.
   d. Track number of units for each blood component prepared and dispensed to ensure ratio is maintained.

5. MTP may be activated following HP if patient continues to bleed profusely.

6. If MTP is initiated after dispense of HP Pack 'A', pack 'B' should be issued to complete a full MTP ratio set. This will constitute MTP Set 1.

7. Attach a temperature indicator to the back of each pRBC unit.

8. Place blood product for HP 'A' in a cooler for dispense. **NOTE: Do not place 'just thawed warm' plasma in the same cooler as pRBC.** Refer to section '**Dispensing Blood Products'** for more details on cooler dispense.

E. Massive Transfusion Protocol

When informed by the patient's physician or MTP coordinator (usually a physician or nurse) **to activate the MTP**, perform the following:

1. Obtain patient's name, MRN, location and the Physician initiating the MTP. Check LIS while caller is still on the line.

2. Immediately, begin thawing 2 FFP (there should be 2 AB thawed FFP available at all times). Thaw 4 FFP if none available.

3. Initiate a ***TF0030 MTP HP Worksheet*** to document the following information:
   a. Patient's name, MRN, age and location.
   b. Physician' name who activated the MTP.
   c. MTP contact's name and phone number.

4. Designate a CLS to be the BB MTP coordinator, who will perform the following:
   a. Primary contact with the MTP patient care team.
   b. Document activity on the ***TF0030 MTP HP Worksheet***.

5. When MTP is initiated,
   a. Check platelet inventory and order adequate platelets STAT to stay ahead.
   b. Begin assembling MTP Set 1. Refer to the table below.

MTP Set 1	MTP Set 2	MTP Set 3
4 pRBC	4 pRBC	4 pRBC
4 thawed plasma	4 thawed plasma	4 thawed plasma
1 platelet pheresis	1 platelet pheresis* **(substitute with 10 cryo in even# sets if requested by MD)**	1 platelet pheresis

***** Alternate use of 10 units Cryoprecipitate instead of platelet pheresis in even # sets must be verbally communicated to the Blood Bank by the patient's MTP Coordinator. Otherwise, dispense 1 platelet pheresis.

   c. Attach a temperature indicator to the back of each pRBC unit if dispensing to Surgery or in a cooler. **NOTE: Do not place 'just thawed warm' plasma in the same cooler as pRBC.**
   d. Computer Crossmatch Dispense of pRBC can be performed if patient qualifies and if time does not permit crossmatch prior to dispense.
   e. Notify nursing department as blood products become available. Dispense all available blood products.
   f. Continue assembling subsequent sets until the MTP is ended by the physician.
   g. Keep track of the number of units for each blood component prepared and dispensed on the *TF0030 MTP HP Worksheet* to ensure the ratio is maintained.
   h. Serological crossmatch can be omitted after 10 units of pRBCs have been dispensed. However, it will expedite the computer dispense if pRBCs are crossmatched.
   i. Write the Set# on the **top right corner** of the **Product Chart Copy (PCC).**

F. General Blood Product Selection

1. If time permits, select blood products based on **patient's antibody history and ABORh performed on the current sample**.
   a. Attempt to obtain a DBCK specimen if needed. A second ABORh is needed before type specific blood can be dispensed.
   b. Otherwise, set up group O Rh compatible RBCs. See subsequent section for more information on Rh Neg patients and special requirements.

2. **RBC Selection**
   Follow the **table** below for patients who have **a current and a second ABORh**. **Rh Neg patients may be switched to Rh Pos pRBC during periods of Rh Neg pRBC inventory shortage (see section, 'Consideration for Rh type and Special Requirement' for details).**

Patient ABORh	1st Choice	2nd Choice	3rd Choice	4th Choice
O Pos	O Pos	O Neg	N/A	N/A
O Neg	O Neg	O Pos	N/A	N/A
A Pos	A Pos	A Neg/O Pos	O Neg	N/A
A Neg	A Neg	O Neg	A Pos	O Pos
B Pos	B Pos	B Neg/O Pos	O Neg	N/A
B Neg	B Neg	O Neg	B Pos	O Pos
AB Pos	AB Pos	AB Neg/A Pos	B Pos	O+,A-,B-,or O-
AB Neg	AB Neg	A Neg	B Neg/O Neg	AB+,A+,B+/O+

(N/A - not applicable)

3. **Patient has negative antibody screen**
   a. Set up ABORh compatible RBC.

4. **Patient has clinically significant antibody** in the **current** specimen or in the **history**.
   a. Set up ABORh compatible and antigen negative RBC if possible/available.
      i. Antigen negative RBC may not be available for those antigens which are of high frequency, i.e. anti-e.
      ii. Inform the attending physician and the pathologist immediately if antigen negative RBCs are unavailable.
   b. If the patient is actively bleeding, consider switching to antigen untested units.
   c. Speak to the physician to confirm that patient's bleeding is still active and cannot be controlled immediately.
   d. Inform the attending physician and the pathologist about switching to antigen untested units.
   e. Inform the attending physician to notify the Transfusion Service immediately if the bleeding is under control and to switch back to antigen negative RBC.
   f. Document the notification in the Communication Log and Blood Bank Comments in LIS.

G. Consideration for Rh type and Special Requirements

1. Select products based on Rh type and special requirements with certain exceptions

specified below.

2. Patient is **Rh Negative**
   a. Patient is a **female 50 years old or younger**, or **a male infant 1 year old or younger**
      i. Set up ABO compatible Rh negative RBC.
      ii. It is preferable to switch to group compatible Rh negative RBC before switching to Rh positive RBC.
      iii. Avoid switching to Rh positive unless absolutely necessary.
      iv. If the continuation of transfusion is expected to deplete the available supply of Rh negative blood, evaluate switching to Rh positive blood product.
      v. When switching from Rh Negative blood to Rh Positive blood becomes necessary, notify the attending physician immediately and the pathologist.
      vi. Document the notification in the Communication Log and in the Blood Bank Comments in LIS that 'Rh Positive blood dispensed to Rh Negative patient'.

   b. Patient is a **female over 50 years old** or a **male over one year old**
      i. Notify the physician and the pathologist of the switch to Rh Positive blood for Rh Negative patient.
      ii. Document the notification in the Communication Log and Blood Bank Comments in LIS.
      iii. Set up ABO compatible Rh positive RBC.
      iv. Switch to Rh positive blood should be made early to conserve blood for other recipients.

3. Patient requires **Irradiated** blood products.
   a. There is no substitution for irradiated blood products.
   b. Notify the physician and the pathologist that the available irradiated RBC inventory is inadequate to sustain the ongoing MTP.
   c. Document the decision of the Medical Director/pathologist in the Communication Log and Blood Bank Comments in LIS.
   d. Set up pre-storage leukocytes reduced RBC or platelet.
   e. Order irradiated products, as directed by the Medical Director/pathologist.

4. Patient requires **CMV Negative** blood products.
   a. Set up pre-storage leukocytes reduced RBC or platelets.
   b. Notify the physician and the pathologist that pre-storage leukocytes removed by filtration RBC can be considered CMV safe.
   c. Document the notification in the Communication Log and Blood Bank Comments in LIS.

5. Patient requires **HgbS Negative** (SIC-) blood products.
   a. Notify the physician and the pathologist that the available SIC- RBC inventory is inadequate to sustain the ongoing MTP.
   b. Majority of the donor units are HgS negative even though the units were not tested.

c. Document the notification in the Communication Log and Blood Bank comments in LIS.

H. Order in LIS (this may be the initial order based on an Emergency Release signed form or placed in HeathConnect directly by the physician).

1. If crossmatch has not been ordered, add Crossmatch Flex to current accession and add Order Comment 'Massive Tx'.

I. Dispensing Blood Products

Massive Transfusion Protocol or Hemorrhage Pack is usually initiated in an emergency. **The TAT is 10 minutes**. However, thawed plasma products may not be immediately available. As such, the blood products are dispensed as they become available.

1. **Computer Crossmatch Dispense of pRBC can be performed if patient qualifies**. It may be necessary to override the special requirements (CMV-, IRR, SIC-) warnings.

2. Use **Dispense** to issue units or to emergency release uncrossmatched/unassigned units. It may be necessary to override the antigen negative and/or special requirements warnings. **NOTE: MTP and HP are exempted from Prepare Order.**

3. **Any** of the following with complete patient's identification (emergency identification e.g. Doe, John/Jane is acceptable) can be used as blood products pick-up form:
   a. Last, First name and MR# of the patient on the Blood Bank Product Pickup form.
   b. Last, First name and MR# on a piece of paper.
   c. Last, First name and MR# on the 'Emergency Release of Donor Blood' form.
   d. Last, First name and MR# on the HealthConnect form.

4. Dispense all blood products that are ready. **NOTE:** Blood products will be dispensed per protocol regardless of what is indicated on the pick-up form except for ala carte cryoprecipitate and platelet.

5. CLS performs a **visual inspection** of the blood products.

6. **Omit readback with courier. CLS is responsible** to ensure that **all identifying information and paperwork are accurate and complete** before dispense.

7. **Use one *TF0032 MTP HP Issuance Record* per dispense occurrence.**
   a. Write the patient's name and MRN.
   b. CLS and courier complete the verification section of the MTP HP Issuance Record.
   c. Omit completing the Issuance Record section on all Product Chart Copies (PCC).
   d. Remove yellow copy of the PCC and staple it to the MTP HP Issuance Record along with the pick-up slip.

8. **Dispense units in blood cooler if needed. NOTE: HP 'A' will be dispensed in a cooler.**
   a. Do not place platelet and cryoprecipitate in a cooler. Do not place 'just thawed warm' plasma in the same cooler as pRBC.
   b. Place a completed ***Cooler Dispense Label*** in the cooler's side pocket.
   c. Document on ***AF0033 Cooler Dispense Log***.
   d. Subsequent units need not be dispensed in a cooler if an initial cooler has been dispensed previously.
      i. Instruct runner to place subsequent units in the initial cooler.
      ii. Icepacks should be changed out prior to the 4 hours cooler expiration time.

9. In the 'Cooler' field at Dispense, select 'SFO Surgery' when issuing to OR that has a refrigerator or 'SFO Cooler' when issuing in a cooler.

10. Call nursing department 10 minutes prior to the expiration time of the cooler to inquire if the blood products have been transfused, otherwise the icepacks need to be changed.

J. After the bleeding episode

1. The MTP coordinator or the patient's physician will notify Blood Bank to end the MTP. Record the name of the physician who ended the MTP and the time on the MTP worksheet.

2. **Blood Product Return**
   a. Locate the matching yellow Product Chart Copy (PCC).
   b. If needed, go to PPI Product List and find the Dispensed time for the unit(s) returned. For multiple units, a printscreen of the Product List for all dispensed units may be helpful.
   c. **Write 'R' on the <u>top right corner</u> of the matching yellow Product Chart Copy (PCC). DO NOT remove it from the MTP HP Issuance Record.**
   d. Keep the white PCC with the requisition or place in Cancelled box after release to inventory.
   e. Complete the Return section of the MTP HP Issuance Record.
   f. Return unit(s) in the LIS.

3. Release unused plasma products to inventory.

4. Return to routine compatibility testing after the MTP.

5. Leave paperwork for Supervisor or designee to review.

6. Refer to Platelet Transfusion SOP for RhIg recommendation if Rh Pos Platelets were transfused to Rh Neg female of child bearing age (50 years and younger).

K. Problems during MTP or HP

1. Complete the back page of the MTP HP Worksheet when CLS has time. Add comments if needed.

PROCEDURE NOTES

A. If Hemorrhagic Shock is life threatening, blood for transfusion must be issued immediately regardless of risk
B. When time does not permit crossmatch, units will be issued uncrossmatched (refer to Urgent Requirements for Blood and Components SOP).
C. The pre-event platelet count and fibrinogen will decrease by approximately 63 % with each blood volume replaced without the infusion of platelets or plasma.
D. The results of platelet counts, PT, aPTT, and INR can guide the need for blood components transfusion.
E. In general, 1 platelet pheresis may be administered for every 10 units of RBCs transfused.
F. Refer to Blood Bank Specimen and Requisition SOP for additional specimen and requisition requirements.

REFERENCE

A. AABB, Standards for Blood Banks and Transfusion Services, current edition, Bethesda, MD.
B. Treatment and Prevention of Postpartum Hemorrhage, John Vallee MD. March 16, 2011.