SF HEALTH NETWORK
SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH

ZUCKERBERG
SAN FRANCISCO GENERAL
Hospital and Trauma Center

ZSFG Clinical Laboratory

Blood Bank and Transfusion Service — Laboratory Manual

Revision 1/2020

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GENERAL INFORMATION

1. Blood Bank Hours: 24 hours/7 days
2. Telephone Number: 628-206-8584
3. Location: Building 25, HG 802 (ground level)
4. Blood Bank Results: Results of pretransfusion testing, blood availability and usage and diagnostic studies are available in Epic under Labs > Blood > Blood Bank.
5. Transfusion medicine consults and special test approvals: A laboratory medicine resident and a blood bank attending pathologist are available at all times for transfusion medicine consults and special test approvals. Contact the blood bank to request a consult.

SPECIMEN COLLECTION AND SPECIMEN REQUIREMENTS

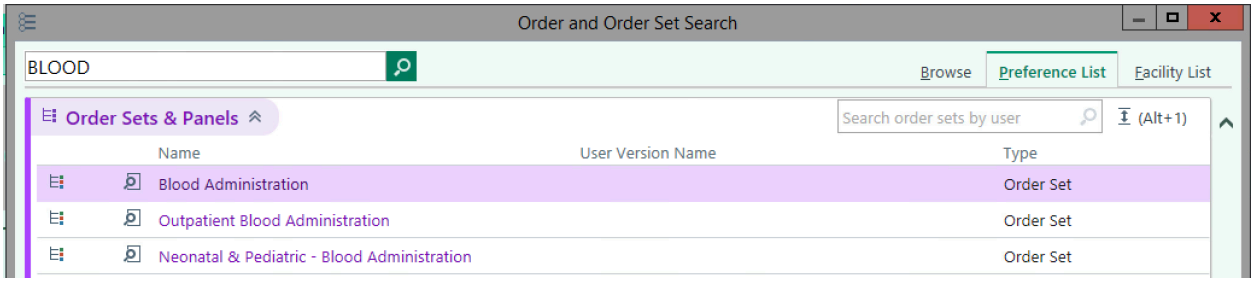
1. Quantity for a specimen: 1 full 10 mL pink top tube.
2. Identification: The patient must be positively identified before collection of the blood specimen. Check the identification band and ask the patient to state his/her name and birth date, i.e., “What is your name and birth date?” (Do not ask “Are you John/Jane Doe?”) If the patient is unable to respond, rely on the arm band identification.
3. Labeling: At the bedside, before phlebotomy, label the pink top tube with an Epic-generated label.
4. In the event of Epic downtime, the phlebotomist is responsible for labeling the specimens correctly and signing his/her name on the top middle section of the manual requisition in the “blood drawer signature” space. The following information should be on the label: First and last name, or Trauma Name/MRN, Medical Record Number, Date of Birth
5. An in-date specimen (3 days old or less) is required to perform a crossmatch.
6. **Inadequately labeled specimens will be discarded -- no exceptions.**

TRANSPORT

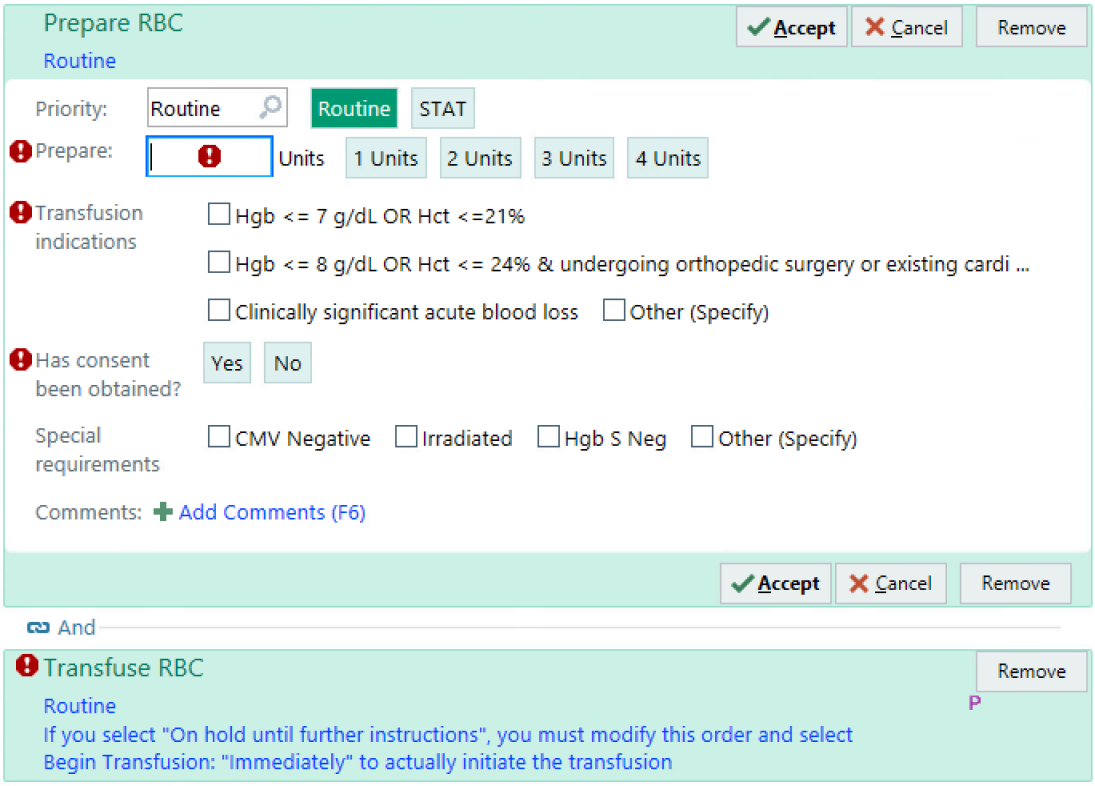
1. Routine: Blood samples may be transported to the Blood Bank via the messenger service, 628-206-8010.
2. Blood specimens may be sent through the pneumatic tube-system (tube station # 100).
3. Emergency - Designate a responsible individual to carry the patient’s sample to the Blood Bank and return with the blood product(s).

ORDERING BLOOD

1. All requests for blood or blood products and all blood bank diagnostic tests (e.g. type and screen) should be submitted via Epic
2. A type and screen must have been ordered with the past 3 days before crossmatch-compatible blood can be provided. Call the blood bank if you are not sure if such a specimen is available. 628-206-8584
3. Order blood transfusion with the appropriate blood administration order set:



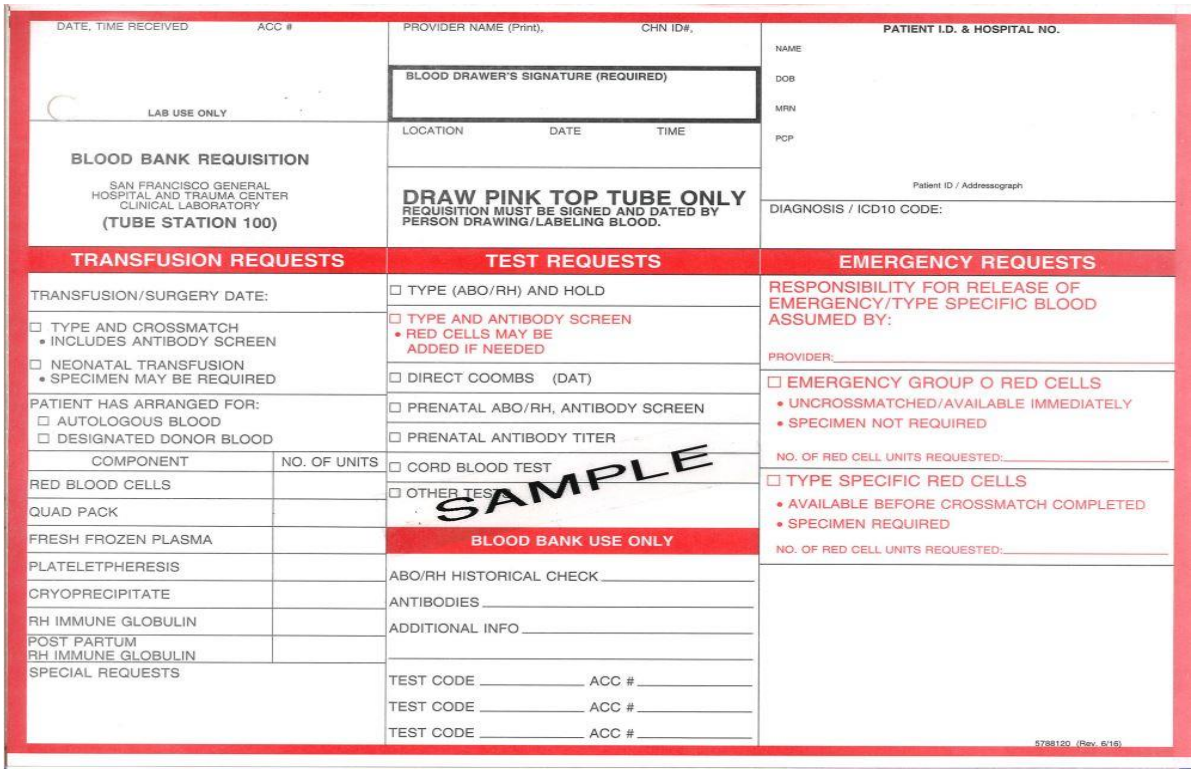
4. Be sure to choose the product type and fully complete the “Prepare” order screen, including selecting an evidence-based indication:



MANUAL REQUISITION FOR EMERGENCY RELEASE AND DOWNTIME

1. Emergency Requests. Sign under “Responsibility Assumed By _____.” Call Blood Bank to release blood before completion of crossmatch. The signature of the ordering physician is mandated by the FDA.
2. Test Requests. Fill in diagnosis and indicate test requested
3. Addressograph. Required Patient identification Information: First and last name or trauma name/MRN, Medical Record number, Date of birth, Account number, Gender, Location, Date
4. ICD10 Code - Diagnostic information, which establishes medical necessity.
5. The patient’s name and medical record number must match the specimen label.
6. Required Physician Identification. Include the physician's name, ID code number, and pager number. It may be necessary for the Blood Bank to contact the physician if there are problems.

Sample Requisition (Form # 5788120, Rev. 06/16)



DATE, TIME RECEIVED ACC #

LAB USE ONLY

BLOOD BANK REQUISITION

SAN FRANCISCO GENERAL HOSPITAL AND TRAUMA CENTER
CLINICAL LABORATORY
(TUBE STATION 100)

PROVIDER NAME (Print), CHN ID#,

BLOOD DRAWER'S SIGNATURE (REQUIRED)

LOCATION DATE TIME

DRAW PINK TOP TUBE ONLY
REQUISITION MUST BE SIGNED AND DATED BY PERSON DRAWING/LABELING BLOOD.

PATIENT I.D. & HOSPITAL NO.

NAME
DOB
MRN
PCP

Patient ID / Addressograph

DIAGNOSIS / ICD10 CODE:

TRANSFUSION REQUESTS

TRANSFUSION/SURGERY DATE:

☐ TYPE AND CROSSMATCH
• INCLUDES ANTIBODY SCREEN

☐ NEONATAL TRANSFUSION
• SPECIMEN MAY BE REQUIRED

PATIENT HAS ARRANGED FOR:
☐ AUTOLOGOUS BLOOD
☐ DESIGNATED DONOR BLOOD

COMPONENT	NO. OF UNITS
RED BLOOD CELLS	
QUAD PACK	
FRESH FROZEN PLASMA	
PLATELETPHERESIS	
CRYOPRECIPITATE	
RH IMMUNE GLOBULIN	
POST PARTUM RH IMMUNE GLOBULIN	

SPECIAL REQUESTS

TEST REQUESTS

☐ TYPE (ABO/RH) AND HOLD

☐ TYPE AND ANTIBODY SCREEN
• RED CELLS MAY BE ADDED IF NEEDED

☐ DIRECT COOMBS (DAT)

☐ PRENATAL ABO/RH, ANTIBODY SCREEN

☐ PRENATAL ANTIBODY TITER

☐ CORD BLOOD TEST

☐ OTHER TES

SAMPLE

BLOOD BANK USE ONLY

ABO/RH HISTORICAL CHECK _____
ANTIBODIES _____
ADDITIONAL INFO _____

TEST CODE _____ ACC # _____
TEST CODE _____ ACC # _____
TEST CODE _____ ACC # _____

EMERGENCY REQUESTS

RESPONSIBILITY FOR RELEASE OF EMERGENCY/TYPE SPECIFIC BLOOD ASSUMED BY:

PROVIDER: _____

☐ EMERGENCY GROUP O RED CELLS
• UNCROSSMATCHED/AVAILABLE IMMEDIATELY
• SPECIMEN NOT REQUIRED

NO. OF RED CELL UNITS REQUESTED: _____

☐ TYPE SPECIFIC RED CELLS
• AVAILABLE BEFORE CROSSMATCH COMPLETED
• SPECIMEN REQUIRED

NO. OF RED CELL UNITS REQUESTED: _____

5788120 (Rev. 6/16)

REQUEST FOR DELIVERY OF BLOOD

1. Telephone the Blood Bank and provide the following information: Patient's first and last name or trauma name/number, Medical record number, Ward or clinic, Your name
2. Routine Transport: When you order blood products, the Blood Bank will arrange for delivery via the Messenger Service. When you receive the blood, record date/time and sign the Messenger Delivery Form.
3. Emergency Transport: In extreme emergencies, the responsible physician should designate a responsible person to transport the blood products from the blood bank (Building 25, ground level, HG 802).
4. Anyone who comes to pick up ordered blood products from the Blood Bank window must identify in writing or print the name and medical record number of the patient for whom the blood product(s) is (are) intended. This safety check will be enforced at all times and under all circumstances, including emergency requests and massive transfusion.
5. Returning unused blood: If blood is not transfused, it must be returned to the Blood Bank within 30 minutes of the time that it was issued, unless issued in a blood bank cooler.
6. Blood must be stored in a Blood Bank monitored refrigerator with an alarm. The only refrigerator outside the Blood Bank that is suitable for blood storage is located in the Operating Room area. Unit refrigerators are NOT suitable for blood storage.

GUIDELINES FOR TRANSFUSION

Following is a summary of ZSFG Transfusion Guidelines for Pediatric and Adult Patients (ZSFG Infant Care Center has Special Guidelines for Transfusion in Neonates & Young Infants). These guidelines are intended to provide a rational approach for common clinical conditions and situations. Special circumstances in individual patients may require exceptions or modifications. In these situations, and for other patient management questions involving blood product or coagulation factor use, the Clinical Hematology Service should be consulted. For transfusion guidelines in neonates and young infants, contact the Infant Care Center.

Summary Table: Transfusion Guidelines

Blood Product	INDICATION		
	Appropriate	Controversial	Inappropriate
Red Blood Cells (RBC)	1. Hgb < 7.0 g/dL. 2. Hgb < 8.0 g/dL and orthopedic surgery or cardiovascular disease. 3. Clinically significant acute blood loss regardless of Hgb.	Maintaining hgb ≥ 10 g/dL in “at-risk” patients (co-existing heart / lung disease, ischemic vascular disease).	1. Stable, asymptomatic anemia. 2. Medically correctable anemia (e.g., deficiency in iron or Vit. B12 with mild symptoms responsive to temporary decrease in physical activity while the anemia is being corrected).
Fresh Frozen Plasma (FFP)	1. INR ≥2.0 AND planned surgical or other significant invasive procedure; e.g, interventional radiology procedure. (Orders will be approved for INR >1.5.) 2. Clinically significant acute blood loss **or trauma patient at risk of bleeding** regardless of PT/INR. 3. Bleeding or procedure in patients with congenital deficiencies of factors II, V, VII, X, XI or XIII. 4. Correction of warfarin overdose. Note: in life-threatening bleeding Kcentra (4 factor Prothrombin Complex Concentrate) should be used. 5. Treatment of specific plasma factor deficiencies: a) awaiting plasma exchange in treatment of TTP, b) life-threatening hereditary angioedema due to C1-Esterase deficiency, c) Antithrombin (AT) III deficiency in patients who require but are refractory to heparin.	Treatment / correction of: 1. Minor invasive bedside procedures (thoracentesis, paracentesis, line placement) AND INR 1.6-2.0. 2. Treatment of hypovolemia from capillary leak or massive loss of lymph fluid. 3. Treatment of hepatorenal syndrome.	Treatment / correction of: 1. Hypovolemia, unless other intravascular volume expanders are ineffective or are contraindicated. 2. Prolonged INR in the absence of bleeding or planned invasive procedure. 3. Minimally prolonged INR (< 1.5) prior to bedside procedures. 4. Immunoglobulin deficiency. 5. Uremia and bleeding. 6. Correction of PT/PTT in patients undergoing angioplasty or other angiographic procedures where heparin is used. 7. Heparin overdose.

Platelets	**Therapeutic** 1. Serious bleeding AND platelet count < 50K (< 100K in case of bleeding involving CNS, eyes, airway or severe trauma) OR congenital or aquired platelet dysfunction (for example myelodysplastic / myeloproliferative syndromes) OR medication interfering with platelet function (for example aspirin, anti-platelet agents). 2. Life-threatening bleeding in DIC, ITP, HIT or TTP. **Prophylactic (not bleeding)** 1. Platelet count < 10 K AND TTP, HIT ruled out. 2. Platelet count < 40- 50 K AND planned invasive procedure. 3. Platelet count < 100 K AND CNS, eye, airway surgery / procedures.	1. Prophylactic platelet transfusion in patients with life-long platelet dysfunction or chronic decreased platelet production. 2. Prophylactic platelet transfusion in patients with platelet counts from 10 to 20K due to temporary decreased marrow production (for example in the setting acute leukemia and/or chemotherapy). 3. Treatment of bleeding or prophylaxis for blind invasive procedures with platelet counts from 50-100K.	Patients with ITP, DIC, TTP and HIT, unless mandated by severe bleeding attributable to thrombocytopenia.
Cryoprecipitate (Cryo)	1. Treatment of bleeding: a) fibrinogen level < 100 - 150 mg/dL (DIC, liver disease, congenital deficiency) b) von Willebrand's disease or Hemophilia A (only when suitable coagulation factor preparations are not available). c) Factor XIII deficiency d) dysfibrinogenemia 2. Prophylaxis: Perioperative or peripartum patients with congenital fibrinogen deficiencies.	Bleeding in uremic patients after therapy with dialysis, DDAVP and estrogens has failed.	1. Treatment of hemophilia A or von Willebrand's Disease (vWD) when suitable clotting factor concentrates are available. 2. Prophylaxis in patients with mild Hemophilia A or vWD.

EVIDENCE BASED TRANSFUSION PRACTICE

1. Evidence-based recommendations for PRBC transfusion thresholds above are adapted from AABB guidelines (JAMA. 2016;316(19):2025-2035. doi:10.1001/jama.2016.9185) which are based on several large randomized controlled trials (RCTs), including the following:

   Hebert et al. N Engl J Med 1999;340:409-17.
   Lacroix et al. N Engl J Med 2007;356:1609-19.
   Carson et al. N Engl J Med 2011;365:2453-62.
   Villanueva et al. N Engl J Med 2013;368:11-21.

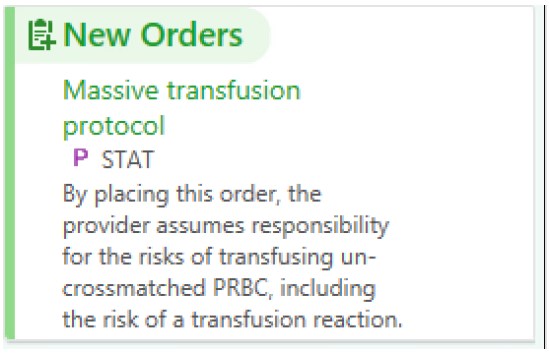
2. In general, platelet transfusion thresholds are not evidence-based. (Kaufman et al Ann Intern Med. 2014 doi:10.7326/M14-1589)
   a) One high quality randomized controlled trial on platelet prophylaxis indicates that platelet transfusion at a threshold of 10K/uL is superior to no prophylaxis in patients with hematolgic malignancy. Stanworth et al NEJM 2013; 268:1771-80.
   b) Bone marrow aspirate & biopsy maybe safely performed with platelet counts < 50 K/μL. Lumbar puncture is probably safe with a minimum platelet count of 10 K/μL in children (Howard SC et al. JAMA 2002;288:2001-7, Howard SC et al. JAMA 2000;284:2222-4) and 20 K/μL in adults (Vavricka SR et al. Ann Hematol 2003;82:570-3).
   c) Platelet counts< 50 K/μL are probably also adequate for other minimally to moderately invasive procedures (central & PICC line placements,paracentesis, thoracentesis), but this has not been well documented in the literature. The American Society for Clinical Oncology (ASCO) recommends a flexible threshold of 40-50K prior to surgery or invasive procedures, rather than a rigid threshold of 50K (Schiffer et al. JClin Oncol 2000;1519-1538).
3. Routine premedication to prevent transfusion reactions is not supported by the available evidence.
   a) Febrile non-hemolytic transfusion reactions (FNHTRs) and mild allergic (urticarial) transfusion reactions are common. Due to the risks of these medications and lack of evidence of benefit, premedication should be reserved for patients with a history of severe allergic or anaphylactic transfusion reactions. H1 blockers (cetirizine, diphenhydramine), H2 blockers (ranitidine), and/or glucocorticoids (hydrocortisone) can be considered. Antihistamines with less anticholinergic activity (cetirizine) should be considered in older patients.
   b) Summary of evidence: A randomized, double-blind, placebo-controlled trial of 315 hematology/oncology patients demonstrated no significant difference in risk of

transfusion reaction between groups receiving and not receiving premedication with acetaminophen and diphenhydramine. (Kennedy et al Transfusion. 2008 Nov;48(11): 2285-91). A small randomized controlled trial of 98 patients showed no difference in the rates of febrile or allergic reactions after platelet transfusion between patients pre-medicated with acetaminophen and diphenhydramine compared to placebo (Wang et al. Am. J. Hematol. 70:191–194, 2002). Another RCT of premedication in 147 patients with thalassemia showed no benefit to premedication (Rujkijyanont P et al Anemia. 2018 Oct 1;2018:9492303. doi: 10.1155/2018/9492303).A recent meta-analysis from the Canadian Blood Services found no evidence to suggest that routine premedication with acetaminophen or antihistamines prevented febrile transfusion reactions (Ning et al Transfusion. 2019 Oct 31; pre-print epub). There is almost no data to guide premedication decisions in patients with a history of mild allergic and/or FNHTRs (Tobian et al Transfusion. 2007 June;47(6):1089-1096).

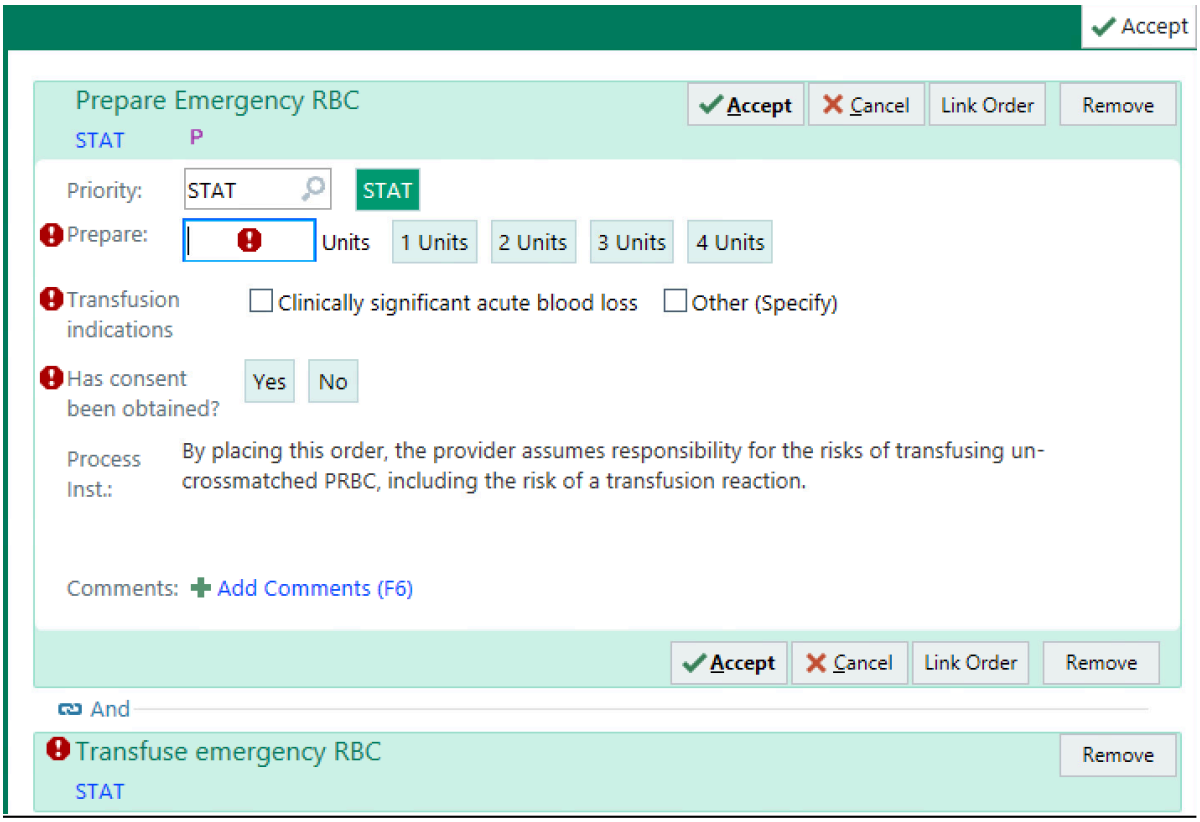
4. There is no evidence to support the use of prophylactic FFP administration for patients with a mildly elevated INR before procedures (Huber et al Cochrane Database Syst Rev. 2019 Nov 28;11:CD012745.) In general, FFP should not be used to treat INR <2.0.

MASSIVE TRANSFUSIONS

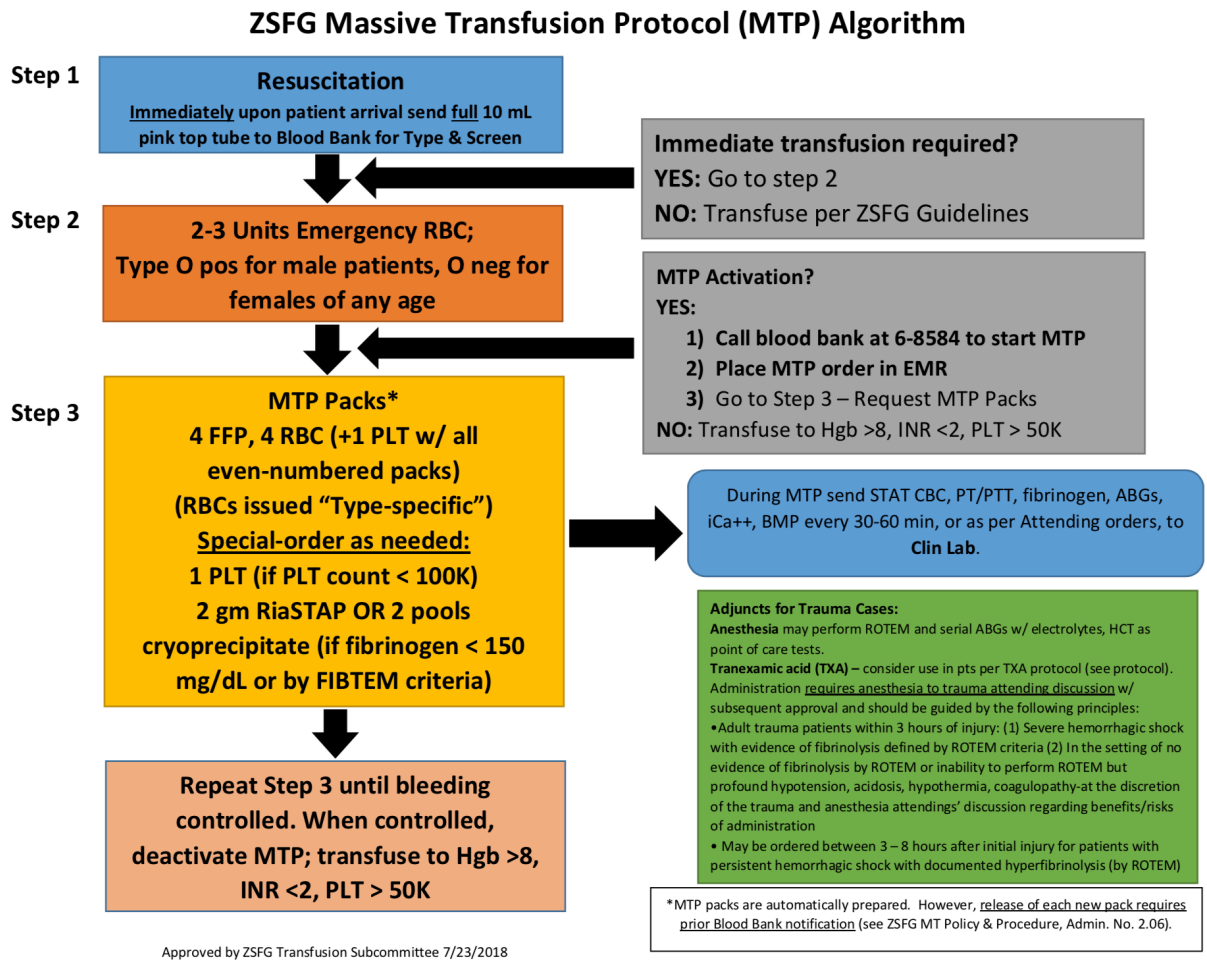
1. Massive transfusion is any situation in which large quantities of uncrossmatched blood products are emergently provided to a patient. Technically, a massive transfusion is the transfusion of >10 units of PRBC within 24 hours.
2. The ZSFG massive transfusion protocol calls for coolers of 4 units PRBC and 4 units FFP. One apheresis platelet unit is provided with every other cooler. Clinicians can order cryoprecipitate or extra platelet units as necessary.
3. For patients with unknown blood type or no in-date specimen, a blood specimen (and an ABO/Rh comfirmation specimen, if necessary) should be sent to the blood bank as soon as possible. It is impossible to determine the patient's blood type once the patient has received several units of PRBC.
4. Massive transfusion should be ordered by calling the blood bank at 628-206-8584 AND then ordering the "Massive transfusion protocol" in Epic.



5. Emergency PRBC can be ordered independently of a massive transfusion order using the following Epic order screen:



6. Evidence for balancing plasma, platelet, and PRBC transfusions in trauma is based on observational data and the following randomized controlled trial: Holcomb et al. JAMA. 2015;313(5):471-482. doi:10.1001/jama.2015.12. However, data to support balanced transfusion ratios is limited in both quality and quantity (da Luz et al Transfusion. 2019 Nov;59(11):3337-3349).



VISCOELASTIC TESTING (TEG AND ROTEM)

1. Traumatic injury provokes a coagulopathic state termed **trauma-induced coagulopathy (TIC)** which is characterized by various biologic derangements including the activation and depletion of protein C, endothelial and platelet dysfunction, depletion of clotting factors, and dysregulated fibrinolysis (Kornblith et al. J Thromb Haemost. 2019 Jun; 17(6):852-862). Although the PT and aPTT are often prolonged in patients with TIC, the usefulness of these conventional coagulation tests to guide blood component therapy during trauma resuscitation is limited (Cohen and Christie, Crit Care Clin. 2017 Jan; 33(1):101-118). At ZSFG, based on standard-of-care outlined in ACS TQIP Massive Transfusion in Trauma guidelines, blood products are empirically provided to massively hemorrhaging trauma patients in balanced transfusion ratios (RBCs:plasma:platelets) regardless of the results of conventional coagulation tests.
2. Goal-directed transfusion based on the results of real-time assessments of the mechanical formation and breakdown of clot in whole blood samples by

thromboelastography (TEG) or rotational thromboelastometry (ROTEM) allows for tailored blood component therapy following initial empiric transfusion ratios. The tests generate real-time viscoelastic measurements of several parameters that correlate with specific plasma- and platelet-based hemostatic alterations. The following recommendations for the use of these test results are taken from the ACS TQIP Massive Transfusion in Trauma guidelines:

Rapid TEG parameter	**ROTEM parameter**	**Biological correlate**	**Transfusion trigger**	**Recommended component**
ACT, activated clotting time	CT exTEM and CT inTEM, clotting time	coagulation factor activity and thrombin generation	**TEG:** ACT > 128 seconds **ROTEM:** exTEM > 100 seconds or CT inTEM > 230 seconds	FFP
α-angle, rate of crosslinking of fibrinogen	fibTEM MCF, fibrinogen component of maximal clot strength	fibrinogen concentration and function	**TEG**: α-angle < 60° **ROTEM:** fibTEM MCF < 8 mm	Cryoprecipitate or fibrinogen concentrate (RiaSTAP)
MA, maximal clot strength achieved	MCF exTEM, maximal clot strength achieved	Platelet-fibrinogen interactions	**TEG:** MA < 55 mm **ROTEM:** MCF exTEM < 45mm (with MCF fibTEM > 10 mm)	Platelets
LY30, % clot lysis 30 minutes after MA is achieved	ML exTEM, maximum clot lysis	Fibrinolysis	**TEG:** LY30 > 3% **ROTEM:** ML exTEM > 15%	Tranexamic acid (TXA)

Note: exTEM, inTEM, and fibTEM refer to different test methods on the ROTEM instrument

3. Summary of evidence: A randomized clinical trial of TEG-guided massive transfusion compared with conventional coagulation assay-guided MTP in a Level 1 trauma center showed a significant decrease in plasma and platelet component utilization, no difference in RBC utilization, and increased survival in the group using TEG-guidance (Gonzalez et al. Ann Surg 2016;263:1051–1059). A subsequent retrospective review showed a significant decrease in usage of RBCs, platelets, and plasma, with no difference in ICU days, hospital length of stay, or mortality (Un ruh et al. Am J Surg 2019; pii: S0002-9610(19)30425-8). The optimal thresholds for TEG-based resuscitation are an area of active research (Einersen et al J Trauma Acute Care Surg. 2017 Jan; 82(1): 114–119). Some interferences with both the TEG and ROTEM assays have been identified, such alcohol intoxication at the time of blood draw (Howard et al J. Trauma Acute Care Surg. 2014;77(6):865 and Howard et al. J Trauma Acute Care Surg. 2018 Jan;84(1): 97-103).

SPECIAL REQUIREMENTS AND PROCESSING

1. All first-time requests for special processing must be approved by the Laboratory Medicine Resident. Exception: Red cell units for neonates are routinely issued gamma irradiated, CMV seronegative
2. Orders for gamma irradiation, CMV seronegative, and washed units have to be filled by the blood supplier, which will delay availability by several hours.
3. **Leukoreduction**: All red cells and all apheresis platelet units issued by ZSFG Blood Bank are pre-storage leukocyte reduced.
4. **Gamma irradiation** of whole blood, red cell and apheresis platelet units with 2.5 Gy renders lymphocytes incapable of proliferation. This treatment prevents transfusion associated graft-versus-host disease (TAGVHD) and is indicated for all cellular units (not plasma or cryo) when the transfusion recipient is at increased risk for TAGVHD as outlined below:
    - Peripheral blood stem cell or marrow transplant
    - Infants < 4 months of age
    - Congenital cellular immunodeficiency
    - Patients treated with purine analogs (e.g., fludarabine)
    - Blood components selected based on HLA compatibility
    - ALL designated donations
    - HIV infection is not an indication for irradiated blood products

4. **CMV negative**: All blood products are leukoreduced, which is considered "CMV safe." CMV seronegative products (lacking antibodies to CMV are indicated for the following patients:
    - Pregnant women who are CMV negative
    - Infants < 4 months of age
    - Severely immunosuppressed patient who are CMV negative
5. **Washed Units.** Washing of red cell or apheresis platelet units with saline removes plasma, which is indicated in rare cases of severe allergic reaction to plasma proteins or sensitivity to potassium loads.

BLOOD PRODUCT INFORMATION

1. Packed red blood cells (PRBC)
    a) Standard Adsol PRBC units contain red cells in a nearly plasma-free anticogulant-preservative solution. Unit volume is approximately 350 mL, with a hematocrit of 50-60%. Shelf life is 6 weeks at 1-6°C.
    b) PRBC units for neonates are gamma irradiated to prevent transfusion associated graft versus host disease and are CMV seronegative.
    c) Expected response to transfusion: in the absence of bleeding, one unit PRBC should raise the Hgb in an average-sized adult by 1 g/dL.
2. Apheresis platelets (AP)
    a) AP units contain approximately 250 mL platelets suspended in plasma.
    b) AP are infused by gravity through an administration set with incorporated filter, issued with the unit(s) from Blood Bank.
    c) If immune-mediated platelet refractoriness is suspected, a platelet count should be performed on a blood sample collected 10 min - 1 hour after each platelet transfusion to assess appropriateness of the platelet count increment. Please consult the blood bank for interpretation of the results.
    d) Compatibility testing is not necessary, and ABO-incompatible platelets can be transfused.
    e) In neonates, children, and adults receiving large volumes of platelets relative to their plasma volume, plasma compatible platelets are recommended to prevent hemolysis due to ABO antibodies in donor plasma.
    f) For maximum effect, platelets intended to increase the platelet count prior to surgery or other invasive procedure should be ordered as close to the procedure as possible.
3. Fresh Frozen Plasma (FFP)
    a) One unit contains 200 – 250 mL of anticoagulated plasma with approximately 400-500 mg (~ 2.0 g/L) of fibrinogen. Each mL of plasma contains 0.7 – 1.0 activity unit of all other clotting factors.
    b) The Blood Bank will thaw FFP; this procedure takes 30 minutes.
    c) FFP should be administered as soon as possible after thawing but can be transfused up to 24 hours provided it has been maintained at 1 - 6°C.
    d) FFP will need approval from the Laboratory Medicine Resident if the PT and PTT are within 1.5 times the normal limits (INR < 1.5), or if no PT and PTT were determined in the last 24 hours.

e) Exceptions to INR threshold:
    1. Patients with PT/PTT 1.0-1.5 times normal and significant bleeding do not need approval.
    2. Trauma or traumatic brain patients can receive FFP regardless of INR.
f) Dose and Timing of FFP administration
    1. The dose of FFP used should be adequate for replacement of coagulation factors. A standard dose in adults is 10-15 mL/kg (3-5 units). The infusion rate depends on the ability of the patient to handle to volume load. Volume overload during transfusion is an common and underrecognized complication (Murphy et al. Am J Med. 2013 Apr;126(4):357.e29-38).
    2. In life-threatening bleeding situations related to warfarin overdose, treatment with a prothrombin complex concentrate (e.g. Kcentra, available from Pharmacy) should be considered.
g) Monitoring of efficacy of FFP: The patient should have a determination of PT/INR and/or PTT: Immediately BEFORE and immediately AFTER the transfusion of FFP.

4. Thawed FFP stored in the Blood Bank at 1-6°C for more than 24 hours will be relabeled Thawed Plasma and issued for up to 5 days after thawing. When available, Thawed Plasma will be issued for the same indications as FFP. The level of stable clotting factors remains the same as in FFP and labile factors 5 and 8 remain at 75-95% (F5) and 45-75% (FV8) levels, respectively.
5. Cryoprecipitate
    a) One unit (12–15 mL) contains approximately 80 units of Factor 8 and 200 - 350 mg of fibrinogen. This product is available in pools of 5 units.
    (a) For Fibrinogen levels < 100 mcg/dL and significant bleeding (or risk thereof) usual adult dose is 10 units of cryoprecipitate, or two pools of 5. This should raise the fibrinogen level by approximately 100 mcg/dL.
    (b) Cryoprecipitate need not be ABO compatible.
    (c) The Blood Bank will thaw cryoprecipitate (pool of 5); this procedure takes 30 minutes.
    (d) Cryoprecipitates should be administered within four (4) hours of thawing, using the recipient set issued from the Blood Bank. Thawed cryoprecipitate must be discarded if it is not used within four (4) hours.
6. Rh(D) Immune Globulin (Human) for intramuscular (i.m.) injection (RhIg). Trade names include: HyperRHO, MICRhoGAM, RhoGAM, Rhophylac.

(a) Indication: Prevention of maternal immunization to the Rh(D) antigen and prevention of Rh(D) immunization in female Rh(D) negative patients who receive Rh(D) positive platelets

(b) The following criteria must be met:

(i) Antenatal: Administer at 28 weeks to Rh(D) negative, weak, or partial, mothers who have not been sensitized to Rh(D) antigen.

(ii) Post partum: Administer within 72 hours of delivery, to mothers who are Rh(D) negative, weak, or partial, and who deliver an Rho (D) positive baby.

(iii) Administer within 72 hours to Rh(D) negative, weak, or partial women who have an ectopic pregnancy, abortion, therapeutic or diagnostic procedure or trauma with the possibility of fetomaternal hemorrhage.

(c) Rh(D) Immune Globulin should be ordered from the Blood Bank – not the Pharmacy – for the patients listed above.

(d) Rh(D) genotyping is recommended on patients with weak D or who have discrepant results using standard serological typing for D. Genotype results can guide the decision about the necessity of RhIg administration (AABB statement).

7. Special Coagulation Products

(a) Factor concentrates, prothrombin complex concentrates (PCC), and recombinant factors **are not** available from Blood Bank. Contact ZSFG Pharmacy for availability and use guidelines

BLOOD CONSENT AND ADMINISTRATION

1. See the DPH Blood Administration Policy and Procedure for details of blood consent and blood product administration.
2. Except in emergency situations, patients should be consented before blood transfusion.
3. Risks, benefits, and alternatives to blood transfusion should be discussed with the patient.
4. By state law, the brochure "A Patient's Guide to Blood Transfusions" should be provided to the patient (Paul Gann Blood Safety Act, H&S § 1645)
5. Before beginning the transfusion, it is extremely important to correctly identify the patient and blood product using a 2-person check. See the DPH Blood Administration Policy and Procedure for details.

TRANSFUSION REACTIONS

1. Transfusion reactions are defined as any adverse reaction to blood products.
2. For guidance in managing transfusion reactions, see DPH Blood Administration Policy and Procedure, Appendix A, Management of Transfusion Reactions.
3. Please report all transfusion reactions promptly with the following steps:
    a. Complete Blood Bank Transfusion Reaction Report Form F 934 and send it to the blood bank .
    b. Order the “Transfusion Reaction Workup” in Epic.
4. Patient care staff should report suspected transfusion-related adverse events immediately to the Blood Bank/Transfusion Service, whether or not the MD responsible for the patient deems it necessary to report the event.
5. Common or Serious Transfusion Reactions
    a. Hemolytic reactions
        i. Symptoms of intravascular hemolytic reactions include: burning along the IV site and arm, anxiety, dyspnea, tightness in the chest, back pain, fever, chills, shock and hemoglobinuria, and abnormal bleeding.
        ii. Symptoms of extravascular hemolytic reactions may include fever and renal failure, but more commonly, these reactions are evidenced by unexplained post transfusion anemia and hyperbilirubinemia.
    b. Febrile non-hemolytic transfusion reactions are among the most commonly seen non-hemolytic transfusion reactions (~50% of total). They are characterized by a sudden temperature rise > 1°C from pre-transfusion value AND temperature of ≥ 38.0°C, or chills, cold sensation and discomfort.
    c. Allergic reactions usually present with urticaria, flushing, pruritis and rarely, symptoms of anaphylaxis including respiratory symptoms and distributive shock.
    d. Septic transfusion reactions can be caused by bacterial contamination of blood components, usually platelets.
    e. Volume overload due to transfusion (Transfusion-Associated Circulatory Overload or TACO) is a common and under-recognized transfusion reaction.
    f. Transfusion related acute lung injury (TRALI) is acute respiratory distress syndrome caused by transfusion.
6. Incompatible I.V. solutions can cause transfusion reactions secondary to cell lysis or agglutination.

BLOOD DONATIONS

1. Blood donations may be made at Vitalant, 270 Masonic Avenue, San Francisco, CA. For appointments, call: (415) 567–6400.
2. Autologous or directed donations. There are very few clinical situations in which autologous or directed blood donations are indicated. Information concerning the process for autologous and designated donations can be obtained by calling the Blood Bank at 628-206-8584.

ELECTIVE SURGERY AND MAXIMUM AUTHORIZED UNITS OF BLOOD

1. Testing protocol for Elective Surgeries: Ideally, specimens from patients who are scheduled for elective surgery the following day must reach the Blood Bank by 5 pm on the day preceding surgery.
2. Antibody screen positive: If an antibody is detected, blood may not be available at the time requested.
3. Maximum Surgical Blood Order Schedule (MSBOS): Requests received by Blood Bank that are not in accordance with the MSBOS list (maximum authorized units of blood for elective surgery) must be approved by the Laboratory Medicine Resident.
4. Type and Screen (T&S), is expected to be sufficient for at least 90% of elective surgical procedures. Emergency blood is always available if there is unexpected bleeding.
5. Procedures requiring only T&S or "zero" blood units in preparation for elective procedures do not routinely require discussion of blood donation options, as stipulated in California's Paul Gann Act, or informed consent for transfusion, as the expected need for blood administration is low (probability is less than 10%).
6. Contact the blood bank for details of MSBOS.