DEPARTMENT NAME

Transfusion Medicine

TRANSFUSION SERVICE LABORATORY−Ronald Reagan UCLA Medical Center

GENERAL INFORMATION

Hours of Operation:	Daily, 24 hours
Location:	Room B403 RRUCLA
Phone:	(310) 267-8150
Fax:	(310) 267-3550
Key Personnel:	Medical Director: Alyssa Ziman, MD (310) 267-8090
	Asst. Medical Director: Andrea McGonigle, MD (310) 267-0135
	Asst. Medical Director: Dawn Ward, MD (310) 794-4969
	Asst. Medical Director: Zhen Mei, MD (310) 794-1476
	Lab Manager: Edward Griffin, MBA (310) 267-8106
	Transfusion Safety Officer: (310) 267-8109
	Consultation Support: (310) 267-8151
	Transfusion Medicine Resident: (310) 267-8152 (After hours: pager 93996)

TRANSFUSION SERVICE LABORATORY−Santa Monica UCLA Medical Center and Orthopedic Hospital

GENERAL INFORMATION

Hours of Operation:	Daily, 24 hours
Location:	Room B504 (Southwest Wing)
Phone:	(424) 259-8103

Fax:	(424) 259-6645
Key Personnel:	Medical Director: Alyssa Ziman, MD (310) 267-8090
	Asst. Medical Director: Andrea McGonigle, MD (310) 267-0135
	Asst. Medical Director: Dawn Ward, MD (310) 794-4969
	Asst. Medical Director: Zhen Mei, MD (310) 794-1476
	Lab Manager: Anthony P. Johnson (424) 259-8121
	Blood Bank Sr. Clinical Lab Specialist: Jenny Tan (424) 259-8116
	Transfusion Medicine Resident: (310) 267-8152 (After hours: pager 93996)

SERVICES PROVIDED

The Transfusion Service Laboratory provides standard and specialized blood components for transfusion; diagnostic testing for patients sensitized to red cell, platelet, or granulocyte antigens and for patients with immune hemolytic anemia, transfusion reactions, and hemolytic disease of the fetus/newborn. Transfusion Medicine faculty and staff provide ongoing transfusion medicine education through lectures, in-laboratory workshops, and interdepartmental in-service programs. Research support is available upon request.

Twenty four-hour consultation is available for transfusion-related problems and questions. Requests may be directed to the Transfusion Service Laboratory, the Blood Bank Resident/Fellow or the Medical Directors (see above). The laboratory automatically refers many problems for medical review including all reported transfusion reactions, suspected cases of immune-mediated hemolysis, situations requiring uncrossmatched or crossmatch-most compatible blood, atypical serological test results, and atypical or extraordinary requests for blood products or services.

TRANSFUSION SERVICE POLICIES

The Transfusion Medicine staff, in conjunction with the UCLA Blood and Blood Derivatives Committee, is responsible for ensuring appropriate blood use and transfusion safety. To help carry out this directive, the following policies and practices have been established.

CIRCULAR OF INFORMATION

The Circular of Information for the Use of Human Blood and Blood Components is supplied to conform with applicable federal statutes and regulations of the Food and Drug Administration (FDA), United States (US) Department of Health and Human Services. The Circular is available on the Mednet Forms Portal (Form 10352).

Please refer to the UCLA Hospital System Transfusion Policy HS 1338 (http://www.mednet.ucla.edu/Policies/pdf/enterprise/HS1338.pdf) for policies regarding the following issues:

- Blood Transfusion Consent: Section 1
- Blood Product and Transfusion Orders: Section III
- Check-Type Policy: Section IV
- Pre-Operative Orders for Elective Surgery: Section V
- ABO and Rh Compatibility Guidelines: Attachment 1
- Blood Order Guidelines for Surgery (BOGS): Attachment 3

SPECIMEN COLLECTION

Hospital specimen collection policies and procedures are detailed in HS1328

The identity of the phlebotomist, date and time of specimen collection must be traceable for all blood bank tests. If a specimen is collected using a CareConnect / Beaker generated identification code, the identity and collection information is viewable in CareConnect. Specimens collected outside of CareConnect / Beaker must have the phlebotomist name, initials, or identification code, and collection date and time recorded on the specimen label or an accompanying order requisition. **If the identity of the phlebotomist or collection information cannot be ascertained within Blood Bank policy, the specimen is considered unsatisfactory for testing and a new specimen will be requested.**

Unlabeled or mislabeled tubes will be discarded. Information on a tube label cannot be altered by anyone once it has been received. If a discrepancy in patient identity on the specimen label or requisition is noted, Blood Bank will notify the blood drawer and request a new specimen. All labeling errors are documented and reviewed by the Blood and Blood Derivatives Committee.

BLOOD AVAILABILITY TIME

Blood Product	Time for Blood to be Available (transport time not included)	Check-Type Needed?	Use Blood Bank Release Form?	Risks and Comments
Type O, uncrossmatched RBC	**10 minutes**	No	No, must order Tier in Care Connect	0.2% to 0.6% of population will have RBC antibody; acute hemolytic transfusion reaction is rare.
Type-compatible, crossmatched RBC (negative antibody screen)	**1 hour** after specimen/check-type arrives in Blood Bank (includes performance of blood type and antibody screen)	Yes, unless trauma patient with BB ID band or historical blood type available	Yes	RBC compatibility testing by electronic crossmatch
	15 minutes for STAT release request (Testing, blood type and antibody screen, complete)			
	30 minutes for STAT release request of aliquot (Testing, blood type and antibody screen, complete)			Once an aliquot is taken from a mother unit, the unit will be reserved for the patient until discharge
RBC, crossmatch problem (positive antibody screen)	**90 minutes** to several hours; sometimes longer	Yes, unless trauma patient with BB ID band or historical blood type available	Yes	Antibody identification and IgG crossmatch may take 90 minutes or longer. If blood is needed before testing is completed, hemolysis may occur but transfusion should not be withheld if absolutely necessary; life-threatening morbidity is rare.

Blood Product	Time for Blood to be Available (transport time not included)	Check-Type Needed?	Use Blood Bank Release Form?	Risks and Comments
Autologous RBC	**1 hour** after specimen arrives in Blood Bank	No	Yes	Autologous donors are tested for infectious diseases similar to volunteer donors. If a test result is positive, the patient and physician will be notified; a red biohazard sticker is placed on the green tag and “Biohazard” is printed on the unit label.
Platelets	**15 minutes** for 1 unit of platelets	Yes	Yes	–
	30 minutes for platelet aliquot			
Plasma	**45 minutes** for 1 unit of plasma	Yes, unless trauma patient with BB ID band or historical blood type available	Yes	Expires in 5 days once thawed.
	60 minutes for plasma aliquot			
Cryoprecipitate	**20 minutes** for pre-pooled adult dose	Yes	Yes	Expires in 4 hours once thawed
	30 minutes for 2-4 units pooled before issue			
	20 minutes for single unit			Expires in 6 hours once thawed

SUMMARY OF AVAILABLE BLOOD COMPONENTS

Red Blood Cells (RBC), Leukocytes-reduced (allogenic)	
Description	"Packed" red cells with reduced plasma, WBC, platelets. CPD/CPDA-1 RBC unit has a volume of 275 mL, hematocrit 70% to 80%. AS-1/AS-3/AS-5 units have a volume of 340 mL, hematocrit 55% to 65%. With pre-storage leukocyte-reduced product, WBC count in the component is less than 5×10^6. This minimizes febrile transfusion reactions caused by leukocytes and reduces the risk of HLA alloimmunization and the transmission of WBC- borne viruses (i.e., CMV).
Indications	See UCLA Transfusion Audit Guidelines (below).
Contraindications	Pharmacologically treatable anemia.
Dose	Determined by clinical situation. One unit should raise an adult's hemoglobin approximately 1 g/dL. For infants and children <20 kg, a dose of 10 mL/kg generally raises the hemoglobin by 1-2 g/dL. For children >20 kg, one unit generally raises the hemoglobin by 1-2 g/dL.
Preparation	Refer to Blood Availability Table.
Saline Washed Red Blood Cells (SW-RBC)	
Description	RBC washed with 1-2 L sterile normal saline to remove up to 99% plasma proteins, electrolytes, and antibody. SW-RBC contains most of the original red cell mass resuspended in residual saline. Final volume (about 300 mL) is listed on the label.
Indications	Severe allergic/anaphylactic transfusion reactions
Contraindications	Same as RBC. Washing procedures result in some RBC loss, shortened expiration date of product to 24 hours, are costly, and require extra time to prepare washed product(s).
Dose	See RBC dose.
Preparation	Allow about 1 hour for compatibility testing and an extra 45 minutes for washing (allow for additional time if more than one washed unit is requested at a time; please consult Transfusion Medicine for a time estimate). Once washed, the product expires in 24 hours.
Platelets, Pheresis, Leukocytes-reduced and Pathogen reduced	
Description	$>3 \times 10^{11}$ platelets collected from a single donor during a 1- to 2-hour apheresis procedure; suspended in 200-400 mL fresh donor plasma. With pre-storage leukocyte-reduced product, WBC count in the component is less than 5×10^6. This minimizes febrile

	transfusion reactions caused by leukocytes and reduces the risk of HLA alloimmunization and the transmission of WBC-borne viruses (i.e., CMV). Pathogen-reduction technology (PRT) reduces the risk of transfusion-transmitted infections (including bacteria and viruses such as CMV and HIV) and TA-GVHD. PRT is equivalent to irradiation. PRT platelets are preferentially distributed to patients most susceptible to severe infection.
Indications	See UCLA Transfusion Audit Guidelines (below).
Contraindications	Plasma coagulation defect or deficiency not associated with platelets; may not help patients refractory to platelet transfusion or patients with Idiopathic Thrombocytopenic Purpura (ITP), immune-mediated drug purpura, untreated DIC, hypersplenism, and heparin-induced thrombocytopenia (HIT).
Dose	Determined by clinical situation and body size; 1 unit is a hemostatic dose for non-immunized adults and should increase the platelet count 30-50,000; children (<10 years or 40 kg) require smaller half doses; dose for infants is 5-10 mL/kg.
Preparations	Patient's ABO/Rh type should be known; ABO compatibility is not required. Allow 15 minutes for preparation.
Granulocytes	
Description	>1 x 10^{10} granulocytes in 100-400 mL fresh donor plasma. Collected by apheresis.
Indications	Severe neutropenia or granulocyte dysfunction (e.g., chronic granulomatous disease) with infection unresponsive to antibiotic therapy.
Contraindications	Therapeutic benefit is controversial.
Dose	Adults: 1 unit (approx. 5 x 10^{10} WBCs) daily until infection resolves or absolute granulocyte count returns to 500/mm^3; children: 10 mL/kg daily; neonates: 10^9 WBCs daily.
Preparation	Patient's ABO/Rh type must be known. Units containing >2 mL red cells must be crossmatched. Do **not** transfuse with a depth-type microaggregate or leukocyte-removing filter.
Frozen Plasma	
Description	200-250 mL plasma from a unit of WB, separated and frozen within 24 hours of collection. Contains about 400 mg fibrinogen and 200 units of other plasma clotting factors (V, VII, IX, XI, ATIII, protein C or S).
Indications	See UCLA Transfusion Audit Guidelines (below).
Contraindications	Coagulation deficiencies that can be corrected with pharmacologic agents (i.e., vitamin K) or factor concentrates; blood volume expansion without symptomatic factor deficiencies; source of nutrition.
Dose	Determined by clinical situation and body size: 10 mL/kg body weight maintains hemostasis.

Preparation	Patient's ABO group should be known and ABO compatible units should be selected. Allow 45 minutes to thaw.
Cryoprecipitated AHF	
Description	Prepared from FFP. Each individual unit contains at least >150 mg fibrinogen, 40% to 70% of von Willebrand factor and 30% of factor XIII present in the original plasma; suspended in plasma.
Indications	See UCLA Transfusion Audit Guidelines (below).
Contraindications	When safer or more concentrated therapy is available (e.g., DDVAP, factor VIII or factor IX concentrate); the clotting deficiency or defect is not known or is not associated with a factor contained in cryoprecipitate.
Dose	Adult: 5 unit prepool cryoprecipitate unit provides a hemostatic dose of fibrinogen which should raise the patient's fibrinogen level approximately 100mg/dL. Pediatrics (<10 years or 40 kg): Single units are pooled to create a hemostatic dose. For fibrinogen, see formula below table to calculate number of bags required.
Preparation	Patient's ABO group should be known. ABO compatibility is not required. Allow about 30 minutes for thawing.

Note: Pediatric calculations for number of cryo bags required

BLOOD STORAGE AND EXPIRATION

Component separation allows the Blood Bank to maintain an inventory stock of different components for specific transfusion needs. Each component has a different storage requirement and shelf life as summarized in the following table.

Temperature (°C)	Component	Expiration*
20-24	Platelets**	5 days
	Granulocytes	24 hours
	Cryoprecipitated AHF, thawed**	4 hours
1-6	Red blood cells**	21 days CPD 35 days with CPDA-1 anticoagulant; 42 days with AS anticoagulant
	Frozen plasma, thawed**	5 days
≤18	Plasma, frozen	1 year
	Cryoprecipitated AHF, frozen	1 year

*If sterility is broken during component processing or preparation, the expiration time for components stored between 1°C to 6°C will change to 24 hours (i.e., saline-washed RBC)

**Syringe aliquots expire 4 hours from time of preparation.

BLOOD LABELING AND INFORMATION

Every blood bag is labeled with the ABO/Rh, the proper name of the component, the unique donor number, and expiration date (and time if appropriate). When expiration time is not indicated on a blood bag, the product expires at midnight on the date of expiration. Donor classification is clearly specified: Autologous or volunteer (directed and community donations).

In addition, autologous units carry a GREEN patient identification tag and units from directed donors carry a BLUE patient identification tag. If available, autologous units should **always** be transfused first, then directed donor units should be used. Units from general stock are used when autologous and directed donor units are not available.

All blood labels refer the physician to a *Circular of Information* which is available on the Mednet Forms Portal. The *Circular of Information* contains a full description of blood components, their indications, contraindications, side effects, dosage, administration, and product testing.

UCLA TRANSFUSION AUDIT GUIDELINES

The Joint Commission and AABB require Hospital Transfusion Committees both to review the appropriateness of all transfusions and to strive to correct transfusion practices that deviate from Hospital guidelines. The development of guidelines promotes the multidisciplinary interactions needed to agree on fairly consistent practices, and the audit requires justification of our transfusion practices. This process is not intended to dictate or to limit transfusion practices.

To comply with Joint Commission standards, medical records will be reviewed on a continuing basis using guidelines for transfusion practice developed by the UCLA Blood and Blood Derivatives Committee and listed below. These guidelines were designed to facilitate a uniform and accurate review. A transfusion whose indication falls outside the following criteria may be audited by The Division of Transfusion Medicine and/or UCLA Blood and Blood Derivatives Committee. It is impossible to anticipate every clinical situation and, understandably, medical reasons may exist to justify transfusions that do not fit within these guidelines. In such instances, an additional explanation or justification for the transfusion will be sought from the attending physician who is responsible for the care of the patient.

UCLA TRANSFUSION GUIDELINES ADULT PATIENTS

RBC Transfusions	
Transfusions are usually needed if Hgb <6 g/dL, rarely needed when >10 g/dL	
Hgb (g/dL)	**Clinical Status**
<7.0	• Hospitalized, stable patients
<8.0	• Hospitalized patients with pre-existing cardiovascular or respiratory disease • Marrow failure/hypoplasia (e.g., secondary to chemotherapy, radiation therapy, HSCT etc.) • Procedure utilizing extracorporeal circuit
<10.0	• Patient with acute MI, unstable angina
Other indications: • Symptomatic Anemia (chest pain, orthostatic hypotension or tachycardia unresponsive to fluid resuscitation, or CHF) • Ongoing rapid blood loss (>15% of TBV or >10 mL/kg body weight within 4 hours) regardless of Hgb/Hct value • Chronic transfusion to suppress production of endogenous Hgb (i.e., sickle cell and thalassemic syndromes)	

Platelet Transfusion		
	Platelet Count (/µL)	**Platelet Transfusion Guidelines**
Prophylactic	<10,000	• Stable, non-bleeding hospitalized patients, including HSCT patients and patient with low-grade bleeding (i.e., petechaie)
	<20,000	• Patients with increased risk of bleeding (i.e., fever, sepsis, hyperleukocytosis, rapid fall in platelet counts, coagulation abnormalities, bladder neoplasm, necrotic tumors)
	<30,000	• Acute promyelocytic leukemia and outpatients
Therapeutic	<50,000	• Active bleeding • Prior to invasive procedures and surgery • Stable, premature (gestational age <37 weeks) infant
	<100,000	• Active bleeding PLUS coagulopathy or DIC • Active bleeding in sick premature (gestational age <37 weeks) infant • Intracranial bleeding, neurosurgery, eye surgery

Plasma Transfusion
• Bleeding due to multiple factor deficiencies (secondary to liver disease, bleeding, DIC, etc.) and **INR >1.7**

• Prior to invasive procedures and **INR >1.7**. Minor procedures such as paracentesis and thoracentesis may be safely performed with INR **up to 2.0**
• Massive transfusion: Per Massive Transfusion Protocol
• Therapeutic exchange for TTP or severe coagulopathy
• Warfarin overdose with prolonged INR. Correction with vitamin K and prothrombin complex concentrate should be considered. Plasma is only indicated if one of the following is present: Impending invasive procedures (within 12 hours) Ongoing bleeding
• Specific factor deficiencies: FV, FXI, Proteins C, S; ATIII deficiency if patient requires heparin, C1-esterase deficiency if pre-op or angioedema present
Cryoprecipitate Transfusion
• Fibrinogen replacement when there is bleeding or high risk of bleeding. Fibrinogen level of 100 mg/dL is generally hemostatic.
• Massive transfusion: Per Massive Transfusion Protocol
• Dysfibrinogenemia
• Documented congenital or acquired FXIII deficiency (if FXIII concentrate is unavailable)
• Intracranial bleeding in a patient treated with thrombolytic agents
• Active bleeding in uremic patient (BUN >50 mg/dL or creatinine >4.0 mg/dL): May offer some benefit. A trial of DDAVP should be used if possible.

UCLA TRANSFUSION GUIDELINES PEDIATRIC PATIENTS

RBC Transfusions	
Neonates and Infants <4 months of age	
Hct	**Clinical Status**
<20%	• Anemia with low reticulocyte count
<30%	• Requiring O_2 supplementation by nasal cannulae • On < 35% hood O_2 • On continuous positive airway pressure, or intermittent mechanical ventilation with mean airway pressure < 6 cm H_20 • Significant apnea, tachypnea, bradycardia or tachycardia • Poor weight gain (< 10 g/day)
<35%	• Requiring O_2 supplementation by nasal cannula

RBC Transfusions	
Neonates and Infants <4 months of age	
	• On < 35% hood O_2 • On continuous positive airway pressure, or intermittent mechanical ventilation with mean airway pressure > 6-8 cm H_20
<45%	• On ECMO • Congenital cyanotic heart disease
Children >4 months of age	
Surgical patients:	
Hct	**Clinical Status**
<24%	• Preop: If patient has symptomatic anemia or when corrective therapy is not available
<30%	• Sickle cell patients when general anesthesia is planned (Goal Hct = 30%)
NA	• Intraoperative blood loss >15% of TBV
<24%	• Perioperative period and symptomatic
Non-Surgical patients:	
Hct	**Clinical Status**
<21%	• Stable patients
<24%	• On chemotherapy/radiotherapy • Symptomatic anemia (congenital or acquired)
<30%	• Acute blood loss (>15% TBV) • On continuous positive airway pressure, or intermittent mechanical ventilation with mean airway pressure <6 cm H_20 • Significant apnea, tachypnea, bradycardia or tachycardia • Poor weight gain (<10 g/day)
<40%	• On EMCO • Severe pulmonary disease
Platelet Transfusion	
• **Prophylaxis** **<20,000** for most stable patients **<30,000** for stable premature infants **or** high risk term infants (low birth weight, perinatal asphyxia, sepsis, ventilator assistance, fever, clinical instability)	

<50,000-100,000 if premature **and** high risk **< 100,000** if on ECMO
• **Patients with active bleeding** **<50,000** prior to invasive procedures or stable infants with active bleeding **<100,000** for intracranial bleeding, ongoing DIC, or sick premature infant with active bleeding
Plasma Transfusion
• Bleeding due to multiple factor deficiencies (secondary to liver disease, bleeding, DIC, etc.) and **INR >1.7**
• Prior to invasive procedures and **INR >1.7**. Minor procedures such as paracentesis and thoracentesis may be safely performed with INR **up to 2.0**
• Massive transfusion: Per Massive Transfusion Protocol
• Therapeutic exchange for TTP or severe coagulopathy
• Warfarin overdose with prolonged INR. Correction with vitamin K and prothrombin complex concentrate should be considered. Plasma is only indicated if one of the following is present: Impending invasive procedures (within 12 hours) Ongoing bleeding
• Specific factor deficiencies: FV, FXI, Proteins C, S; ATIII deficiency if patient requires heparin, C1-esterase deficiency if pre-op or angioedema present
Cryoprecipitate Transfusion
• Fibrinogen replacement when there is bleeding or high risk of bleeding. Fibrinogen level of 100 mg/dL is generally hemostatic.
• Massive transfusion: Per Massive Transfusion Protocol
• Dysfibrinogenemia
• Documented congenital or acquired FXIII deficiency (if FXIII concentrate is unavailable)
• Intracranial bleeding in a patient treated with thrombolytic agents
• Active bleeding in uremic patient (BUN >50 mg/dL or creatinine >4.0 mg/dL): May offer some benefit. A trial of DDAVP should be used if possible.

ECMO TRANSFUSION GUIDELINES

Red Blood Cell Transfusion
• Goal Hct >30% • Priming: <10 kg = 2 units saline-washed, irradiated; >10 kg = not necessary
Platelet Transfusion
• Plt >50,000 (>100,000 if intracranial hemorrhage present), unless actively bleeding • Consult physician if ACT <200 before transfusing.
Plasma Transfusion
• INR <2.0, unless actively bleeding • Consult physician if ACT <200 before transfusing.
Cryoprecipitate Transfusion
• Fibrinogen >150, unless actively bleeding • Consult physician if ACT <200 before transfusing.

SPECIAL BLOOD PRODUCT INDICATIONS

CMV Seronegative

Reduces the risk of CMV infection in susceptible patients. Patients must be CMV seronegative or CMV status unknown. CMV antibody test should be ordered prior to blood transfusions or IVIG or immune serum globulin administration, if possible. ***Note:*** *Leukoreduced products are generally considered equivalent.*

Irradiated

Reduces the risk of transfusion associated graft-versus-host disease in susceptible patients.

Leukocytes-Reduced

*All UCLA red cell and platelet products are leukocytes-reduced.

Reduces the risk of alloimmunization to HLA antigens thereby decreasing the incidence of platelet refractoriness and reduces the risk of febrile non-hemolytic transfusion

reactions (FNHTR). Leukocyte-reduced blood products may be used instead of CMV seronegative products when CMV seronegative blood is not available ("CMV-Safe").

Pathogen-reduced

Pathogen-reduction technology (PRT) reduces the risk of transfusion-transmitted infections (including bacteria and viruses such as CMV and HIV) and TA-GVHD. PRT is equivalent to irradiation. PRT platelets are preferentially distributed to patients most susceptible to a septic transfusion reaction.

Recommendations for special blood products are indicated below. Call Blood Bank for consultations.

Current Recommendations For Special Blood Products			
Clinical Indication		**CMV-Negative**	**Irradiated**
CARDIAC			
Ventricular Assist Device (VAD)		**N**	**N**
Extra-Corporeal Membrane Oxygenation (ECMO)	Neonatal (≤10 kg)	On Request	On Request
	Pediatric (>10 kg) Adult (≥10 Y)	N	**N**
TRANSPLANT			
Bone Marrow / Stem Cell / Cord Blood Candidate / Recipient		**Y***	**Y**
Donor of Bone Marrow or Stem Cell **Prior** to Collection		**Y**	**Y**
Heart	Adult	**Y***	**N**
	Neonate	**Y**	**Y**
Liver	Adult	**N**	**N**
	Pediatric (<18Y)	**Y***	**N**
Lung		**Y**	**Y**
Kidney	Adult	**N**	**N**
	Pediatric (<18Y)	**Y***	**N**
Small Bowel		**Y***	**N**
Pancreas		**N**	**N**
NEONATAL			
Neonates	>1300 g	**N**	**N**
	≤1300 g	**Y**	**Y**
Intrauterine Fetal Transfusion		**Y**	**Y**

Current Recommendations For Special Blood Products		
Clinical Indication	**CMV-Negative**	**Irradiated**
Neonatal Exchange Transfusion	**Y**	**Y**
MEDICAL		
All red cell transfusions in a non-EMC *outpatient* clinic	**N**	**Y**
Pregnancy	**N**	**N**
Chemo / Radiation therapy	**N**	On Request
AIDS / HIV	**N**	On Request
Congenital Immunodeficiency (<18Y)	**N**	**Y**
DiGeorge / Cardio-velofacial and SCIDS	**Y***	**Y**
Sickle Cell / Thalassemia	**N**	**N**
*Unless patient or donor is CMV positive		

All requests for special products are referred for Transfusion Medicine consultation. After approval, a note is placed in the patient's medical record and permanent instructions are added to patient computer demographics to ensure that all subsequent transfusions meet these approved requirements. If a patient's treatment plan or blood requirements change, the physician must notify the Blood Bank accordingly with a telephone call.

BLOOD ADMINISTRATION

UCLA Health System Policy 1338, titled "Transfusion Policy", outlines UCLA procedures for ordering blood products, using transfusion equipment, verifying the identity of the patient and unit, providing patient care during transfusions, responding to transfusion reactions, and charting requirements. This policy and the *Circular of Information for the Use of Human Blood and Blood Components* are available online.

Adverse reactions to transfused blood products can occur and physicians and nursing staff must be prepared to deal with them. Since the signs and symptoms of different types of adverse reactions overlap and their severity can vary considerably, all transfusions must be carefully monitored and stopped as soon as symptoms of a reaction are detected. Early recognition is the key to minimizing serious complications. Instructions to follow when a transfusion reaction is suspected are printed on the Transfusion Record Form accompanying each blood bag.

All adverse reactions to blood and blood components, including suspected cases of transfusion-transmitted disease, must be reported to the Blood Bank. A statement describing any adverse reaction should appear in the medical record.

Outpatients and inpatients who will be discharged shortly after transfusion should be provided with a copy of "Blood Transfusion Discharge Instructions" (Form 10397). This form, available on the Mednet forms portal (patient education), informs the patient or care taker about reaction symptoms and the actions to take should they develop.

TRANSFUSION REACTION CLASSIFICATIONS

Approximate Risk per Unit of Blood or Blood Product	
Type of Reaction	**Risk per Unit Transfused**
Fatal acute hemolytic	1 in 600,000 - 1.3 million
Acute hemolytic	1 in 38,000 - 70,000
Febrile nonhemolytic	1 in 100
Allergic (hives)	1 in 100
Severe allergic reaction	1 in 20,000 - 50,000
TRALI (Transfusion-Related Acute Lung Injury)	1 in 1,200 - 190,000
Transfusion-associated circulatory overload (TACO)	<1 in 100
Hypotensive	<1 in 10,000 (estimated, true incidence still uncertain)

Hemolytic − Immune, Acute (AHTR)

The most severe and life-threatening hemolytic reactions are caused by rapid complement activation and intravascular red cell lysis. They are almost always associated with ABO incompatibility between the donor and recipient because of a clerical error in identifying the patient or blood unit.

Other red cells antibodies can trigger acute intravascular hemolysis. Usually, however, these other antibodies (primarily of the IgG class and unrelated to ABO blood groups) are associated with extravascular hemolysis. Antibodies bind to red cells, and may activate complement. The red cells are sequestered in the reticuloendothelial system and phagocytized by macrophages.

Recipient antibodies that cause destruction of transfused red cells are usually detected with routine compatibility testing. Very rarely, an antibody from transfused donor plasma may be implicated in an AHTR.

Symptoms:	Fever, chills, back/chest pain, a burning sensation at the I.V. site, hypotension, hemoglobinuria, hemoglobinemia
Consequences:	Life-threatening situation that can lead to acute renal failure, shock, DIC, and death.

Lab Data:	Hemoglobinuria, hemoglobinemia, positive DAT, serological incompatibility. Manifestations of DIC and renal failure may be present.
Treatment:	1. Maintain volume and blood pressure: Infuse crystalloids. Monitor patient's EKG, BP, cardiac output, urine output. 2. Although there is no good evidence that the use of diuretic agents can reverse acute renal failure once it has developed, some feel it is reasonable to attempt a trial of furosemide, 80-400 mg I.V. in the early oliguric phase in the hope of inducing a diuresis. 3. Obtain medical consultation as necessary for management of renal failure and/or DIC, if present.
Prevention:	Given that most hemolytic reactions are the result of a clerical or management error, it is important to always carefully identify the patient, the blood product sent for transfusion, and all blood samples drawn for testing.

Hemolytic − Immune, Delayed (DHTR)

Delayed hemolytic reactions occur in patients who have undetectable levels of antibody when pretransfusion testing is performed, so that seemingly compatible antigen-positive units may be transfused. In response to a “secondary” antigen exposure, the patient's immune system increases antibody production within several days to several weeks and the now incompatible transfused RBCs have a shortened lifespan. Delayed hemolysis can be misdiagnosed as post-transfusion bleeding. Often the Blood Bank is the first to recognize the reaction from subsequent antibody detection tests. If antibody is detected but there is no clinical hemolysis, the reaction is classified as a delayed serologic transfusion reaction (DSTR).

Symptoms:	Anemia, hyperbilirubinemia, jaundice, fever, hemoglobinuria (rarely).
Consequences:	Usually not serious, although rare acute hemolysis can occur [especially when Jk (Kidd) antibodies are implicated]. It is critical that the responsible antibody be identified and all additional units are negative for the corresponding antigen.
Lab Data:	Decreasing hematocrit, increasing indirect bilirubin, positive DAT, unexpected RBC antibodies.
Treatment:	Usually no treatment is necessary, although patients should be monitored for significant hemolysis. If hypotension or renal failure occurs, see treatment of AHTR above.
Prevention:	When RBC antibodies are identified, physicians should inform their patients and counsel them to provide this information when they are hospitalized elsewhere. Physicians whose patients tell them about previously identified antibodies should notify the Blood Bank at once.

Hemolytic − Nonimmune

When symptoms of hemolysis are observed and antibody detection tests are negative, the Transfusion Medicine staff will investigate other causes including excessive heating of donor units, accidental freezing of donor units; contact with incompatible I.V. solutions in the donor bag or infusion line; older RBCs infused under pressure or with I.V. pump; mechanical trauma from intraoperative blood collection devices or cardiopulmonary pump-oxygenators; mechanical trauma from rapid infusion through small diameter infusion lines; large volume infusions of hypotonic solutions; bacterial contamination; or rare red cell/hemoglobin defect in the donor.

Symptoms:	Hemoglobinuria, rarely other symptoms of acute hemolysis.
Consequences:	Usually not serious, although significant acute hemolysis can occur. It is essential to correct the cause of hemolysis in order to minimize complications.
Lab Data:	Hemoglobinuria, hemoglobinemia, but no serological incompatibility detected.
Treatment:	Usually no treatment is necessary, but patient must be monitored for significant hemolysis. If hypotension or renal failure occurs, see treatment of acute hemolytic reactions above.

Febrile Nonhemolytic Reaction

These are the most common type of transfusion reactions reported to the Blood Bank. Because their symptoms of fever and chills also occur with acute hemolytic reactions, it is essential to evaluate all such reactions immediately.

Febrile reactions are self-limiting and are usually seen in multitransfused or multiparous patients who have antibodies directed against HLA antigens on donor leukocytes or platelets. Such antibody-antigen reactions can activate complement and stimulate cytokine production which results in the release of endogenous pyrogens. Additional theories suggest that in some cases, cytokines accumulating in stored blood may directly activate endogenous pyrogens.

Symptoms:	Fever, chills, sometimes with subjective malaise, may be seen early in the transfusion or up to several hours post-transfusion.
Consequences:	Not serious, although the patient will have discomfort.
Lab Data:	No evidence of a serological incompatibility
Treatment:	Give antipyretics to relieve symptoms
Prevention:	Only 15% of patients experiencing a febrile nonhemolytic reaction will have another reaction with subsequent transfusion. Leukocyte-reduction of RBC and platelet products reduces the risk of febrile non-hemolytic transfusion reactions (FNHTR); all UCLA red cell and platelet products are leukocytes-reduced. Routine use of prophylactic antipyretics is controversial.

Allergic Reaction

Simple allergic reactions are the second most common type of transfusion complication. These are attributed to soluble substances in donor plasma which react with IgE antibody in the patient attached to mast cells and basophils, as well as recipient factors. The antibody-antigen reaction initiates histamine release which causes hives, itching, and rarely, laryngeal edema.

Symptoms:	Hives (urticaria) or other rash, itching (pruritus), wheezing
Consequences:	Mild to moderate allergic transfusion reactions are not dangerous in and of themselves, but they do cause discomfort and anxiety and may be the first sign of a more serious allergic reaction
Lab Data:	No evidence of a serological incompatibility
Treatment:	1. Monitor the patient carefully − urticaria could be the first sign of a more serious allergic reaction. 2. Give antihistamine to ease discomfort: Diphenhydramine HCl (Benadryl®) − 25-50 mg. 3. If the only symptom was skin rash or hives and the symptom resolves within 30 minutes of treatment, and hospital policy permits, resume the transfusion.
Prevention:	Patients who have had two or more allergic reactions may benefit from oral or parenteral antihistamine prophylaxis (50 mg) 30 minutes prior to transfusion. Transfusing saline-washed RBCs may help patients with frequent severe allergic reactions. Corticosteroids are indicated only in severe, repeated cases.

Anaphylactic Reaction

Unlike the simple histamine-mediated skin reactions above, anaphylactic reactions result in a massive release of vasoactive and smooth muscle-reactive mediators following an antibody-antigen reaction. These increase vascular permeability and smooth muscle contraction to severe, life-threatening proportions. In many cases, the implicated donor antigen is often not identifiable. These reactions have been reported in patients with congenital IgA deficiency and concurrent high-titered IgG antibody to IgA.

Symptoms:	Sudden onset of flushing and hypertension followed by hypotension, wide spread edema, respiratory distress, shock, and sometimes nausea, vomiting, diarrhea can occur within minutes of starting the transfusion.
Consequences:	Potentially fatal due to shock or respiratory failure; early recognition and treatment are critical.
Lab Data:	No evidence of RBC serological incompatibility. Quantitative immunoglobulin levels may be performed.

Treatment:	1. At onset, give subcutaneous epinephrine – 0.3-0.5 mL of 1:1000 and repeat every 20-30 minutes for up to 3 doses. Maintain volume and blood pressure with crystalloid infusions. 2. If intractable hypotension develops, give epinephrine (0.5 mg = 5 mL of a 1:10,000 solution intravenously every 5-10 minutes as needed. Continue to maintain volume with crystalloids. Consider using dopamine 2-50 µg/kg/minute to manage hypotension unresponsive to volume expansion (contraindicated with volume depletion). 3. If hypoxia develops, give oxygen by nasal catheter or mask. Endotracheal intubation may be necessary.
Prevention:	Patients with a history of an anaphylactic reaction to blood may require blood components depleted of plasma; for red cell transfusion, this includes saline-washed RBCs. Transfusion Medicine consult is suggested in advance of ordering these products. *For patients with IgA deficiency, high-titer IgA antibodies and a history of anaphylactic transfusion reaction; if plasma is needed, it should be from a known IgA deficient donor. Extra time is needed to order and prepare these special components.

Transfusion Related Acute Lung Injury (TRALI)

Also known as noncardiogenic pulmonary edema, this life-threatening complication is associated with altered permeability of the pulmonary capillary bed from activation of complement, histamine-mediated events, or prostaglandins, which leads to fluid accumulation, inadequate oxygenation, and reduced cardiac return. The reaction is commonly attributed to leukocyte-agglutinating antibodies in donor plasma which react with recipient leukocytes in the pulmonary microvasculature. Other suggested causes include cytokines in the donor units, recipient antibody to donor cells or protein, and use of extracorporeal perfusion circuits.

Symptoms:	Acute respiratory distress, dyspnea, cyanosis, fever, chills. X-ray shows bilateral pulmonary infiltrates post-transfusion.
Consequences:	Potentially fatal hypoxia.
Lab Data:	No evidence of RBC serological incompatibility. HLA and granulocyte antibody studies may be performed on both donor and recipient samples.
Treatment:	1. Provide supportive therapy for pulmonary edema and hypoxia: Oxygen; positive pressure ventilation via intubation.

	2. Corticosteroids are often used empirically but their effectiveness has not been proven.
Prevention:	Patients who develop TRALI are unlikely to have another reaction because it is most often donor-specific. Donors who have been implicated in a case of TRALI and who possess potent leukoagglutinins can trigger reactions in other patients and are deferred from giving plasma products.

Transfusion-Associated Circulatory Overload (TACO)

Patients who are very young or very old or who have underlying congestive heart failure or chronic anemia and an expanded blood volume are at greatest risk from circulatory overload. When too much blood is transfused too quickly, these patients cannot handle the volume increase and consequently develop heart failure and acute pulmonary edema.

Symptoms:	Dyspnea, cyanosis, coughing, wheezing
Consequences:	Usually not serious if intervening steps are taken. Potentially life-threatening if not recognized.
Lab Data:	No evidence of serological incompatibility.
Treatment:	1. At the first indication, place the patient in a sitting position and stop the transfusion. 2. If symptoms progress, consider treating with diuretics, oxygen support, and other measures for acute pulmonary edema.
Prevention:	Identify patients at risk **before** a transfusion is started and transfuse slowly. The Blood Bank can split blood units and issue only one-half at a time if very slow infusion rates are critical. Monitor patients carefully during transfusion.

Hypotensive Transfusion Reaction

A drop in blood pressure occurring during or within one hour of cessation of transfusion. Other symptoms, such as facial flushing, dyspnea, or abdominal cramps may occur but usually hypotension is the sole manifestation.

Symptoms:	• Adults (18 years and older): Drop in systolic BP of greater than or equal to 30 mmHg AND Systolic BP less than or equal to 80 mmHg. • Infants, children and adolescents (1 year to less than 18 years old): Greater than 25% drop in systolic BP (e.g., drop in baseline systolic BP of 120 mmHg to below 90 mmHg).

	• Neonates and small infants (less than 1 year old OR any age and less than 12 kg body weight): Greater than 25% drop in baseline value using whichever measurement is being recorded (e.g., mean BP). Occurs less than 15 minutes after the start of the transfusion. Responds rapidly (within 10 minutes) to cessation of transfusion and supportive treatment. All other adverse reactions presenting with hypotension must be excluded.
Consequences:	Usually not severe if intervening steps (stopping transfusion, supportive care) are taken.
Treatment:	Supportive
Prevention:	The pathophysiology of hypotensive transfusion reactions is not fully understood. Circumstantial evidence supports the hypothesis that increased bradykinin levels, as seen following the use of negatively charged bedside leukoreduction filters and in patients taking angiotensin-converting enzyme inhibitors (ACEi), are a major contributor.

Septic Transfusion Reaction

Blood components are sterile; however, if bacteria are introduced into donor units during collection, processing, or pooling, they may cause sepsis or life-threatening endotoxic shock.

Symptoms:	High fever (often ≥2°C rise), shaking chills, severe hypotension, abdominal pain, vomiting, hemoglobinuria, DIC, renal failure, circulatory collapse, a “warm” shock picture − can occur within minutes of starting the transfusion.
Consequences:	Potentially fatal − must be recognized and treated at once. Do not wait for confirmatory lab data.
Treatment:	1. Aggressive broad spectrum antibiotic therapy. 2. Aggressive supportive care, including the use of vasopressors, may be necessary if septic shock occurs.
Prevention:	Inspect all blood components prior to transfusion for any abnormal color or appearance (including clots or hemolysis) − suspect units should be returned to Blood Bank for investigation. Prime the infusion set and spike the blood bag using aseptic technique. Infuse components as quickly as the patient tolerates − do not allow them to hang more than 4 hours. Promptly return units to the Blood Bank for proper storage if the transfusion cannot be started within 20 minutes.

Metabolic Complications

Patients undergoing rapid, massive transfusion may develop metabolic complications, bleeding, or cardiac arrhythmia from hypothermia, hypocalcemia (citrate toxicity), hyperkalemia, acidosis, or dilutional deficiencies of platelets or clotting factors.

TRANSFUSION-TRANSMITTED DISEASE

Transfusion-transmitted disease and blood safety are major concerns to all. Despite the medical history taken on all blood donors and infectious disease testing for viruses such as hepatitis, HIV, HTLV-I/II, WNV, bacteria, and parasites, there remains minimal residual risk for the known transfusion-transmitted pathogens as well as emerging infectious risks to the blood supply.

The Division of Transfusion Medicine is required by the FDA to investigate and report suspected cases of transfusion-transmitted disease. State regulations and the standards set by the AABB also require that diseases and complications attributed to the use of tissue be reported to Transfusion Medicine or the responsible UCLA Tissue Bank.

Diseases and complications that must be reported include but are not limited to the following:

- Viruses: Hepatitis, HIV, HTLV I/II, West Nile
- Parasites: Malaria, Chagas Disease
- Tick borne: Babesiosis, Rocky Mountain Spotted Fever
- Other: Suspected bacterial contamination, Syphilis, and Spongiform encephalopathies (CJD and vCJD)

These regulations are applicable to all transfused blood products as well as blood derivatives which include:

- Red blood cells
- Plasma
- Platelets
- Cryoprecipitate
- Granulocytes
- Blood Derivatives: RHIG, IVIG, Albumin, Factor Concentrates

Tissues applicable to these regulations include but are not limited to the following:

- Marrow and Progenitor stem cells
- Solid organs
- Other: Bone, skin, corneas, heart valves, vein grafts/vascular tissue, breast milk, donated sperm and ova

When a patient with a blood or tissue transmissible disease is diagnosed or treated, medical staff should evaluate all risk factors involved including blood and tissue use. If the physician suspects that the complication could be attributed to blood or tissue, or such an implication is recognized by infection control or medical record review, the case must be reported to the Transfusion Medicine at (310) 267-8150. If the patient has a history of receiving transfusion and tissue, both areas must be notified.

Notification must include the following information:

- Patient's full name and hospital number (or birthdate)
- Disease or complication
- Date of diagnosis or recognition
- Diagnosing physician's name and address/phone number
- Supportive data, if available
- Date of transfusion, transplant or implicated event

Questions regarding transfusion or tissue transmitted diseases or complications may be directed to the Transfusion Medicine medical staff by calling the Blood Bank at (310) 267-8150. Remind your staff that diagnosed cases of transfusion or tissue transmitted disease must also be reported to Infection Control and the Department of Public Health.

INFECTIOUS RISKS OF BLOOD TRANSFUSION

Blood transfusion is associated with a minimal risk of transmission of infectious agents, particularly viruses. Each unit of blood is tested for evidence of infectious diseases including hepatitis B and C, HIV 1 and 2, HTLV I/II, syphilis, T. cruzi and WNV. Since the risk of transfusion-transmitted infection is currently very low, it is difficult to accurately measure and quantitate the risk. Consequently, risk estimates have been obtained with mathematical modeling techniques applied to data sets obtained from infectious disease testing of blood donors or follow-up investigations of selected transfusion recipients.

The current risks of transfusion-transmitted infection are given in the following table. These risks are expressed per unit of transfused blood rather than per patient; this allows the more precise computation of risk for a given patient (i.e., by multiplying the per unit risk times the number of units transfused). For the most important transfusion transmissible agents, human immunodeficiency virus (HIV) and hepatitis C virus (HCV), the per unit risk is the same for each type of blood component transfused (i.e., red cells, platelets, FFP, cryoprecipitate). In contrast, for human T-cell lymphotropic virus types I and II (HTLV-I/II) there is no risk of transmission from acellular blood products (FFP or cryoprecipitate) since HTLV is highly leukocyte-associated.

Approximate Chance Per Unit of Blood or Blood Product	
Type of Reaction or Infection	**Approx. Risk per Unit Transfused**
Hepatitis B	<1 in 200,000 - 500,000

Approximate Chance Per Unit of Blood or Blood Product	
Type of Reaction or Infection	**Approx. Risk per Unit Transfused**
Hepatitis C	1 in 1,000,000 - 2,000,000
Human immunodeficiency virus (HIV)	~1 in 2,000,000
Human T-Cell lymphotropic virus, types I, II	<1 in 2,000,000
West Nile Virus	1 in 4,570,000