هموویژولانس ترانسفوزیون

دکتر امیرهوشنگ پورخانی
فوق تخصص سرطان و خون
وپیوند مغزاستخوان

Donation Guidelines

- Donor must:
  - Be healthy
  - Be at least 17 y/o (16 y/o if allowed by state law)
  - Weigh at least 50 Kg
  - Not have donated blood in the last 8 weeks

Donation Guidelines

- Individuals with the following are not permitted to donate blood:
  - Fever
  - High blood pressure
  - Very high or very low pulse rate (with the exception of highly conditioned athletes)
  - Irregular heartbeat

Donation Procedures

- Donation procedures use standard precautions for both donor and phlebotomist
- Donor is asked to remain in a recumbent position until s/he feels ready to sit up.
- Blood banks typically offer donors both food and fluids.

Donation Procedures

- Donors are asked to:
  - Leave the dressing in place
  - Avoid heavy lifting for several hours
  - Increase fluid intake for 2 days
  - Avoid alcoholic beverages for 3 hours
  - Avoid smoking for 1 hour
  - Eat healthy meals for 2 weeks.

Complications of Donating

- Excessive bleed at donor site
- Anginal chest pain
  - Can occur with those with CAD
- Seizure
  - (rare but can occur with those with epilepsy)
- Fainting : most common
- Hypotension
- Syncope.

Blood Supply Safety

- The Iranian Blood Transfusion Organization (IBTO) is responsible for ensuring the safety of the blood supply in the Islamic Republic Of Iran
- Once blood has been received from the donor it is immediately tested for blood type and infectious diseases.

Blood Screening

- Prior to be being released for patient use :
- NAT blood screening detects minute amounts of the RNA and DNA of specific viruses
- NAT testing has been IBTO-approved for:
  - Hepatitis C
  - Human immunodeficiency virus (HIV)

Administering Blood Products

- Whole Blood
- Packed Cells(routin PRBC, Washed red cells, Leukocyte depleted red cells)
- Platelets
- Fresh Frozen Plasma (FFP)
- Cryoprecipitate
- Albumin
- Spesific Coagulation Factor
- Intravenous immunoglobulin.

Characteristics of Selected Blood Components

Component	Volume, mL	Content	Clinical Response
PRBC	180-200	RBCs with variable leukocyte content and small amount of plasma	Increase hemoglobin 10 g/L and hematocrit 3%
Platelate	50-70	5.5 x 10^{10}/RD unit	Increase platelet count 5000–10,000/μL
	200-400	>3.0 x 10^{11}/SDAP product	CCI >10 x 10^{9}/L within 1 h and >7.5 x 10^{9}/L within 24 h posttransfusion
FFP	200-250	Plasma proteins—coagulation factors, proteins C and S, antithrombin	Increases coagulation factors about 2%
Cryoprecipitate	10-15	Cold-insoluble plasma proteins, fibrinogen, factor VIII, vWF	Topical fibrin glue, also 80 IU factor VIII

Whole Blood

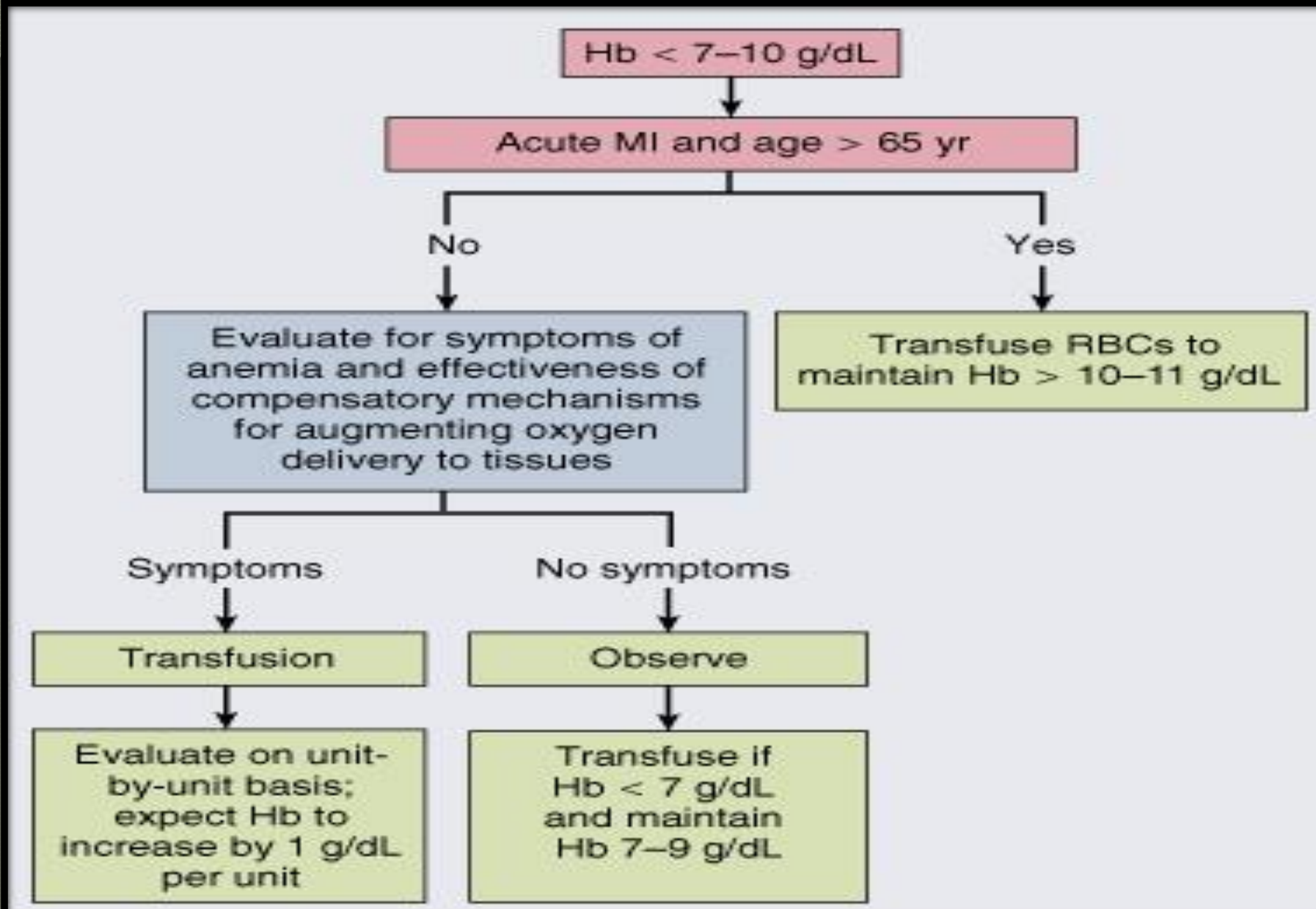
- Whole blood provides both oxygen-carrying capacity and volume expansion.
- It is the ideal component for patients who have sustained acute hemorrhage of 25% total blood volume loss.
- Whole blood is stored at 4°C to maintain erythrocyte viability, but platelet dysfunction and degradation of some coagulation factors occurs.

Whole Blood

- In addition, 2,3-bisphosphoglycerate levels fall over time, leading to an increase in the oxygen affinity of the hemoglobin and a decreased capacity to deliver oxygen to the tissues, a problem with all red cell storage.
- Whole blood is not readily available since it is routinely processed into components.

Packed Red Blood Cells

- This product increases oxygen-carrying capacity in the anemic patient.
- Adequate oxygenation can be maintained with a hemoglobin content of 70 g/L in the normovolemic patient without cardiac disease; however, comorbid factors often necessitate transfusion at a higher threshold.
- The decision to transfuse should be guided by the clinical situation and not by an arbitrary laboratory value.



Packed Red Blood Cells

- In the critical care setting, liberal use of transfusions to maintain near-normal levels of hemoglobin may have unexpected negative effects on survival.
- In most patients requiring transfusion, levels of hemoglobin of 100 g/L are sufficient to keep oxygen supply from being critically low.

Packed Red Blood Cells

- PRBCs may be modified to prevent certain adverse reactions.
- Leukocyte reduction of cellular blood products is increasingly common, and universal prestorage leukocyte reduction has been recommended.
- Prestorage filtration appears superior to bedside filtration as smaller amounts of cytokines are generated in the stored product.

Packed Red Blood Cells

- These PRBC units contain $<5 \times 10^6$ donor white blood cells (WBCs), and their use lowers the incidence of :
  - posttransfusion fever,
  - cytomegalovirus (CMV) infections, and
  - alloimmunization.
- Plasma, which may cause allergic reactions, can be removed from cellular blood components by washing.

Platelets

- Thrombocytopenia is a risk factor for hemorrhage, and platelet transfusion reduces the incidence of bleeding.
- The threshold for prophylactic platelet transfusion is 10,000/μL.
- In patients without fever or infections, a threshold of 5000/μL may be sufficient to prevent spontaneous hemorrhage.
- For invasive procedures, 50,000/μL platelets is the usual target level.

Platelets

Platelet Count/μL	Clinical Situation or Procedure
50,000	Surgery in absence of other coagulation abnormalities
20,000–50,000	Invasive procedures, e.g., lumbar puncture, organ biopsies, dental extraction, central venous catheter
15,000–20,000	Acute leukemia with signs of hemorrhage, high fever, rapidly falling platelet count, etc.; bladder and necrotic tumors
10,000–20,000	Bone marrow aspiration/biopsy
10,000	Acute leukemia Solid tumors
< 10,000	Chronic, stable thrombocytopenia, e.g., aplastic anemia

Platelets

- Platelets are given either as pools prepared from five to eight RDs or as SDAPs from a single donor.
- In an unsensitized patient without increased platelet consumption [splenomegaly, fever, disseminated intravascular coagulation (DIC)], six to eight units of RD platelets (about 1 unit per 10 kg body weight) are transfused, and each unit is anticipated to increase the platelet count 5000–10,000/μL.

Platelets

- Patients who have received multiple transfusions may be alloimmunized to many HLA- and platelet-specific antigens and have little or no increase in their posttransfusion platelet counts.
- Patients who may require multiple transfusions are best served by receiving SDAP and leukocyte-reduced components to lower the risk of alloimmunization.

Fresh-Frozen Plasma

- FFP contains stable coagulation factors and plasma proteins:
  - Fibrinogen,
  - Antithrombin,
  - Albumin,
  - as well as proteins C and S.

Fresh-Frozen Plasma

- Indications for FFP include correction of coagulopathies, including
  - the rapid reversal of warfarin;
  - supplying deficient plasma proteins;
  - and treatment of thrombotic thrombocytopenic purpura.
- FFP should not be routinely used to expand blood volume.

Fresh-Frozen Plasma

- FFP is an acellular component and does not transmit intracellular infections, e.g., CMV.
- Patients who are IgA-deficient and require plasma support should receive FFP from IgA-deficient donors to prevent anaphylaxis.

Cryoprecipitate

- Cryoprecipitate is a source of
  - Fibrinogen,
  - Factor VIII,
  - and Von Willebrand factor (vWF).
- It is ideal for supplying Fibrinogen to the volume-sensitive patient.
- When factor VIII concentrates are not available, cryoprecipitate may be used since each unit contains approximately 80 units of factor VIII.
- Cryoprecipitate may also supply vWF to patients with dysfunctional (type II) or absent (type III) von Willebrand disease.

Plasma Derivatives

- Plasma from thousands of donors may be pooled to derive specific protein concentrates, including:
  - Albumin,
  - Intravenous immunoglobulin,
  - Antithrombin,
  - and Coagulation factors.

Plasma Derivatives

- In addition, donors who have high-titer antibodies to specific agents or antigens provide hyperimmune globulins, such as
  - Anti-D (RhoGam, WinRho),
  - Hepatitis B virus (HBV),
  - Varicella-zoster virus,
  - CMV,
  - and other infectious agents.

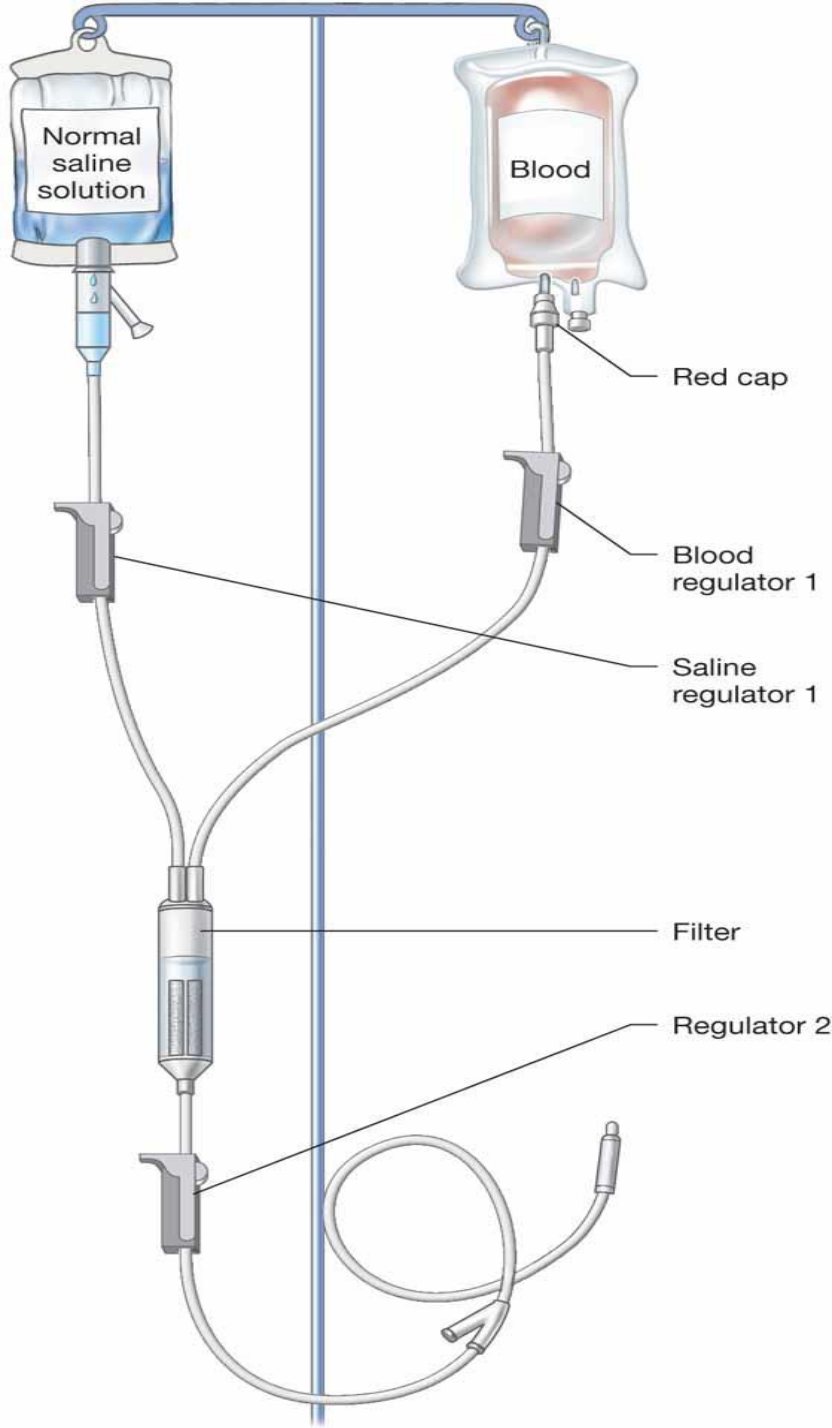
Interventions

- Once the blood has been taken from the blood bank, it must be administered within 30 minutes
- The nurse must ensure:
  - Positive patient identification
  - Appropriateness of blood component
  - Blood product inspection
  - Verification of donor – recipient compatibility
  - Verification of product expiration date

Adminstration on blood

- Pt needs 18 or 20 gauge IV needle so cells are not lysed (destroyed)
- Prior to administration, blood needs to be checked by 2 licensed nurses.
- Check the expiration date, name, medical record number, type of blood, blood band id, pt. birthday
  - Check vitals prior to administration
- **blood must be initiated with in 30 minutes of arrival from lab to floor
- Use blood tubing for administration
- Monitor for blood reactions
- Monitor vitals continuously during administration

Y-type blood tubing



Sample blood administration record from My Nursing Lab

UNIVERSITY OF CALIFORNIA DAVIS
MEDICAL CENTER,
SACRAMENTO, CALIFORNIA

Blood Administration Record

PATIENT PROGRESS RECORD

Date	Product	Unit#	Blood	Time		Pre-meds ?		Pre-Infusion				15 minutes				30 minutes				End of Infusion				Bld Wmr ?		S/S Reaction?		Signature
	Type		Type	Beg.	End	Y	N	T	HR	RR	BP	T	HR	RR	BP	T	HR	RR	BP	T	HR	RR	BP	Y	N	Y	N	

RECORD REACTION # IN THE "S/S REACTIONS?" COLUMN

Acute Reactions:
1 = fever
2 = temperature of > 1°C during or immediately following transfusion
3 = chills, mild itching or urticaria, sometimes confluent
4 = pain, sudden onset of dyspnea or complaints of inability to breathe
5 = hypotension
6 = sudden drop of systolic blood pressure 40 mmHg
7 = hemoglobinuria
8 = patient complaining of sense of impending doom (particularly for possible acute hemolytic reaction)
9 = abrupt change in urine color to a deep red/brown color or unexpected, sudden decrease in urine output
10 = unexplained bleeding or unexpected oozing from puncture/incision sites, chest pain, shock, pulminary edema

Delayed Reactions:
11 = unexplained onset of jaundice
12 = unexpected decrease in (or failure to increase) hemoglobin level occurring 5–13 days after transfusion
13 = unexpected elevations in liver function tests
14 = sudden and unexplained appearance of rash or diarrhea occuring 6–10 days

Transfusion Reaction Workup:

1. Send ASAP: 7mL clotted blood, and 10mL urine collected after reaction.
2. Six (6) hours post blood sample is required only for acute hemolytic transfusion reaction (HTR) or requested by Medical Director.
3. Send the remainder of the implicated unit(s) or empty blood bags, attached to administration set, all "Y" tubing with Transfusion Reaction investigation form to the Blood Bank.

Blood compatibilities

Patient's Blood Type \ Donor's Blood Type	O-	O+	B-	B+	A-	A+	AB-	AB+
AB+	✓	✓	✓	✓	✓	✓	✓	✓
AB-	✓		✓		✓		✓	
A+	✓	✓			✓	✓		
A-	✓				✓			
B+	✓	✓	✓	✓				
B-	✓		✓					
O+	✓	✓						
O-	✓							

Blood compatibilities

- Universal donor = O-
  - Does not contain A, B, or Rh antigens
- Universal recipients = AB+
  - Blood contains A, B, and Rh antigens
- Usually blood banks exactly match the pt. blood

Blood compatibilities

- More than 100 blood group systems are recognized, composed of more than 500 antigens.
- The presence or absence of certain antigens has been associated with various diseases and anomalies;
- Antigens also act as receptors for infectious agents.

RBC Blood Group Systems and Alloantigens

Blood Group System	Antigen	Alloantibody	Clinical Significance
Rh (D, C/c, E/e)	RBC protein	IgG	HTR, HDN
Lewis (Le^a, Le^b)	Oligosaccharide	IgM/IgG	Rare HTR
Kell (K/k)	RBC protein	IgG	HTR, HDN
Duffy (Fy^a/Fy^b)	RBC protein	IgG	HTR, HDN
Kidd (Jk^a/Jk^b)	RBC protein	IgG	HTR (often delayed), HDN (mild)
I/i	Carbohydrate	IgM	None
MNSsU	RBC protein	IgM/IgG	Anti-M rare HDN, anti-S, -s, and -U HDN, HTR

Adverse Reactions to Blood Transfusion

IMMUNE-MEDIATED REACTIONS

1. Acute Hemolytic Transfusion Reactions
2. Delayed Hemolytic and Serologic Transfusion Reactions
3. Febrile Nonhemolytic Transfusion Reaction
4. Allergic Reactions
5. Anaphylactic Reaction
6. Graft-versus-Host Disease
7. Transfusion-Related Acute Lung Injury
8. Posttransfusion Purpura
9. Alloimmunization

NONIMMUNOLOGIC REACTIONS

1. Fluid Overload
2. Hypothermia
3. Electrolyte Toxicity
4. Iron Overload
5. Hypotensive Reactions
6. Immunomodulation
7. Infectious Complications
   - Viral Infections
   - Bacterial Contamination
   - Other Infectious Agents

Adverse Reactions to Blood Transfusion

CHART 23–6 **Transfusion Reactions**

Class	Cause	Clinical Manifestations	Nursing Care
Allergic reaction	Recipient's sensitivity to foreign plasma proteins. Common in patients with allergies.	Itching, hives, flushing, and chills.	Slow the transfusion. Take vital signs. Notify the health care provider. May be necessary to medicate with antipyretic and/or antihistamine. Then resume the transfusion.
Febrile nonhemolytic reaction	Due to leukocyte or thrombocyte incompatibility (donor's WBCs or platelets react with recipient's antibodies). Usually occurs after multiple transfusions. Accounts for 90% of transfusion reactions. Fever begins about 2 hours after the transfusion. WBC reduced blood helps prevent these reactions.	Increased pulse rate, temperature > 1°C, chills, headache, nausea and vomiting, anxiety, flushing, back pain, muscle aches.	Stop transfusion, but maintain IV site. Give antipyretics as prescribed. Take vital signs. Notify health care provider. Obtain urine and blood sample. Send blood bag, normal saline, and IV tubing to the laboratory. Consider using leukocyte-poor blood.
Delayed hemolytic reaction	May occur up to 14 days after a transfusion when the level of the antibodies has increased to the extent that a reaction occurs.	Fever, anemia, increased bilirubin level, decreased or absent haptoglobin, and jaundice.	Generally not dangerous, but it is important to recognize the reaction because subsequent transfusions may cause a more severe hemolytic reaction. Typically not recognized or treated due to the mild nature of the reaction.

Adverse Reactions to Blood Transfusion

Acute hemolytic reaction	ABO incompatibility of the blood and recipient. May be due to a mistake in labeling by laboratory or blood bank or nursing error. Causes agglutination of cells, which causes obstruction of the capillaries and blockage of blood flow.	Bloody urine and decreased urine output. Petechiae, jaundice, decreased BP, chest tightness, low back pain, nausea, anxiety, and dyspnea. Hypotension, bronchospasm, and vascular collapse may occur. Hemoglobinemia, acute renal failure, shock, cardiac arrest, death. Symptoms typically occur within the first 15 minutes of the transfusion.	Emergent life-threatening situation. Stop transfusion, but maintain IV site and infuse IV colloid solutions to maintain BP. Give diuretics as prescribed to maintain urine flow. Insert urinary catheter to assess output and color. Obtain vital signs. Treat shock. Start CPR if necessary. Give epinephrine. Notify health care provider. Obtain urine and blood sample. Send blood bag, normal saline, and IV tubing to the laboratory.
Hemolytic or anaphylactic reaction	Reaction to donor plasma proteins. Specifically, infusion of IgA proteins to an IgA-deficient recipient who has an IgA antibody.	Wheezing, restlessness, anxiety; progressing to cyanosis, shock, and possibly cardiac arrest.	Stop infusion, but maintain IV site. Give epinephrine per doctor's order. Initiate CPR if necessary. Notify health care provider. Obtain urine and blood sample. Send blood bag, normal saline, and IV tubing to the laboratory.

Sources: Josephson, D. (2004). *Intravenous infusion therapy for nurses* (2nd ed.). Clifton Park, NY: Delmar Cengage Learning; Porth, C. M. (2005). *Pathophysiology: Concepts of altered health status* (7th ed.). Philadelphia: Lippincott Williams & Wilkins.

Risks of Transfusion Complications

	Frequency, Episodes:Unit
Reactions	
Febrile (FNHTR)	4:100–1
Allergic	4:100–1
Delayed hemolytic	1:1000
TRALI	1:5000
Acute hemolytic	1:12,000
Fatal hemolytic	1:100,000
Anaphylactic	1:150,000
Infections	
Hepatitis B	1:63,000
Hepatitis C	1:1,600,000
HIV-1	1:1,960,000
HIV-2	None reported
HTLV-I and -II	1:641,000
Malaria	1:4,000,000
Other complications	
RBC allosensitization	1:100
HLA allosensitization	1:10
Graft-versus-host disease	Rare

Generic Management of Acute Transfusion Reaction

- Most ‘reactions’ occur within the first fifteen minutes of blood transfusion being started
- This is the most important time for observations to be done.
- Do not hide the patient away during this time ;
- Let the nurses know transfusions are running and that
- They should do formal observations for the first fifteen minutes and then routinely.

Generic Management of Acute Transfusion Reaction

If a reaction occurs:

- Stop the unit of blood being transfused!
- Ensure patient is clinically well and no other pathology is present (why are they having transfusion etc)
- Treat the underlying cause of ‘reaction’; Once patient is deemed OK,
- Disconnect and take down entire transfusion giving set and blood unit.
- Maintain venous access with normal saline
- Check administrative details from transfusion forms and patient’s wrist band.

Generic Management of Acute Transfusion Reaction

- Contact the haematology / transfusion lab and inform them you are returning the unit of blood for testing.
- Take bloods : Blood film, FBC, Cultures, Clotting, Cross match sample (U&Es).
- If blood transfusion is essential or serious reaction occurs need further advice from haematologist.
- Nursing staff need to observe patient for signs of ‘shock’, DIC, acute renal failure.

Thus ‘Regular’ observations of BP, Pulse, T^{o}C, Urine output.