

# The rules of transfusion:

## Best practices for blood product administration

*Your patient's life may depend on your ability to prevent, detect, and manage a transfusion reaction.*

By Sabrina Bielefeldt, BSN, RN, OCN, and Justine DeWitt, BSN, RN, OCN

**BLOOD TRANSFUSIONS** are a life-sustaining and life-saving treatment—but they aren't without risk. Conditions that warrant blood transfusions range from acute trauma to intraoperative blood loss to compromised blood-cell production secondary to disease or treatment. If you're a nurse on the front line of patient care, you must be adept at administering blood products safely and managing adverse reactions with speed and confidence.

### Why reactions occur

Blood transfusion reactions typically occur when the recipient's immune system launches a response against blood cells or other components of the transfused product. These reactions may occur within the first few minutes of transfusion (classified as an acute reaction) or may develop hours to days later (delayed reaction). If red blood cells are destroyed, the reaction may be classified further as hemolytic; all other types of reactions are broadly classified as nonhemolytic.

Some reactions result from infectious, chemical, or physical forces or from human error during blood-product preparation or administration. (For details on types of reactions, signs and symptoms,

appropriate interventions, and prevention methods, see *A closer look at transfusion reactions.*)

### Before starting the transfusion

Safe practice starts with accurate collection of pretransfusion blood samples for typing and crossmatching. Some facilities may require a second authorized staff member to witness and sign the form as the phlebotomist obtains the specimen. Also take these other key actions before you begin the transfusion:

- Verify that an order for the transfusion exists.
- Conduct a thorough physical assessment of the patient (including vital signs) to help identify later changes. Document your findings.
- Confirm that the patient has given informed consent.
- Teach the patient about the procedure's associated risks and benefits, what to expect during the transfusion, signs and symptoms of a reaction, and when and how to call for assistance.
- Check for an appropriate and patent vascular access.
- Make sure necessary equipment is at hand for administering the blood product and managing a reaction, such as an additional free I.V. line for normal saline so-

lution, oxygen, suction, and a hypersensitivity kit.

- Be sure you're familiar with the specific product to be transfused, the appropriate administration rate, and required patient monitoring. Be aware that the type of blood product and patient's condition usually dictate the infusion rate. For example, blood must be infused faster in a trauma victim who's rapidly losing blood than in a 75-year-old patient with heart failure, who may not be able to tolerate rapid infusion.
- Know what personnel will be available in the event of a reaction, and how to contact them. Resources should include the on-call physician and a blood bank representative.
- Before hanging the blood product, thoroughly double-check the patient's identification and verify the actual product. Check the unit to be transfused against patient identifiers, per facility policy.
- Infuse the blood product with normal saline solution only, using filtered tubing.

### Premedication

To help prevent immunologic transfusion reactions, the physician may order such medications as acetaminophen and diphenhydramine before

## A closer look at transfusion reactions

Understanding the different types of transfusion reactions helps you relieve symptoms while addressing the cause of the reaction. For any type of reaction, early recognition and prompt intervention are crucial.

Type of reaction	Signs and symptoms	Nursing interventions	Prevention
<b>Acute hemolytic reaction</b> <ul style="list-style-type: none"> <li>Life-threatening complement-mediated immune reaction causing simultaneous intravascular coagulation and hemolysis, DIC, renal failure, and shock</li> <li>Onset: within minutes to 24 hours of transfusion</li> </ul>	<ul style="list-style-type: none"> <li>Classic triad of fever or chills, flank pain, and reddish or brown urine</li> <li>Tachycardia and hypotension leading to shock, cardiopulmonary arrest, and death</li> </ul>	<ul style="list-style-type: none"> <li><b>Stop transfusion immediately.</b></li> <li>Hydrate with normal saline solution, as ordered.</li> <li>Check vital signs frequently.</li> <li>Support airway, blood pressure, heart rate, and urine output.</li> <li>Be aware that patient usually requires ICU management.</li> </ul>	<ul style="list-style-type: none"> <li>Follow facility policies and procedures for obtaining pretransfusion blood bank specimens.</li> <li>Adhere carefully to patient identification procedures.</li> </ul>
<b>Delayed hemolytic reaction</b> <ul style="list-style-type: none"> <li>Noncomplement-mediated immune reaction causing gradual extravascular hemolysis when recipient antibodies bind to and coat donor RBCs</li> <li>Onset: days to weeks after transfusion</li> </ul>	<ul style="list-style-type: none"> <li>Mild fever</li> <li>Jaundice</li> <li>Decreased posttransfusion hematocrit</li> <li>Elevated lactate dehydrogenase and serum bilirubin levels</li> </ul>	<ul style="list-style-type: none"> <li>Patient may not need treatment.</li> <li>If ordered, replace lost blood cells with additional transfusion.</li> </ul>	<ul style="list-style-type: none"> <li>Follow all facility policies and procedures for obtaining pretransfusion blood bank specimens.</li> <li>Adhere carefully to patient identification verification procedures.</li> </ul>
<b>Febrile nonhemolytic reaction</b> <ul style="list-style-type: none"> <li>Most common type of transfusion reaction</li> <li>May be immune or complement mediated</li> <li>Recipient antibodies react with donor WBC antigens or fragments</li> <li>Doesn't cause hemolysis</li> <li>May result from cytokine accumulation during blood storage</li> <li>Onset: within minutes to hours of transfusion</li> </ul>	<ul style="list-style-type: none"> <li>Fever (temperature increase of at least 1° C [1.8° F] above baseline)</li> <li>Chills</li> <li>Flushing</li> <li>Nausea</li> <li>Headache</li> <li>Vague discomfort</li> </ul>	<ul style="list-style-type: none"> <li>Stop transfusion immediately.</li> <li>Help rule out other causes of fever.</li> <li>Manage symptoms as appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>Premedicate with antipyretic and antihistamine, as ordered.</li> <li>Give leukocyte-reduced and/or irradiated products, as ordered.</li> <li>Screen for HLA antibodies in patients with repeated febrile reactions.</li> </ul>
<b>Mild allergic reaction</b> <ul style="list-style-type: none"> <li>Occurs when transfused allergens in plasma activate recipient's IgE antibodies</li> <li>Marked by release of histamine by recipient's mast cells and basophils</li> <li>Onset: immediately or within 24 hours of transfusion</li> </ul>	<ul style="list-style-type: none"> <li>Urticaria with or without itching</li> <li>Localized edema</li> <li>Flushing</li> </ul>	<ul style="list-style-type: none"> <li><b>Stop transfusion immediately.</b></li> <li>Give antihistamines, steroids, or both, as ordered.</li> <li>If ordered, resume transfusion when symptoms subside.</li> </ul>	<ul style="list-style-type: none"> <li>Premedicate with antihistamine, such as diphenhydramine, as ordered.</li> </ul>
<b>Anaphylactic reaction</b> <ul style="list-style-type: none"> <li>May occur in patients with IgA deficiency who have anti-IgA antibodies, causing severe to life-threatening immune response</li> <li>Onset: immediately or within 24 hours after transfusion</li> </ul>	<ul style="list-style-type: none"> <li>Lack of fever</li> <li>Hypotension</li> <li>Stridor</li> <li>Bronchospasm</li> <li>Dyspnea</li> <li>Cramps</li> <li>Flushing</li> <li>Chest tightness</li> <li>Decreased oxygen saturation</li> </ul>	<ul style="list-style-type: none"> <li><b>Stop transfusion immediately.</b></li> <li>Keep vein open with normal saline solution.</li> <li>Obtain vital signs frequently.</li> <li>Support airway, blood pressure, and heart rate.</li> <li>If ordered, give steroids and epinephrine.</li> </ul>	<ul style="list-style-type: none"> <li>If ordered, ensure special preparation of blood products, such as washed cells and products from IgA-deficient donors.</li> </ul>
<b>Transfusion-related acute lung injury</b> <ul style="list-style-type: none"> <li>Occurs when donor WBC antibodies react to recipient's circulating WBCs</li> <li>Life-threatening complement-mediated reaction causing surge of neutrophils into lungs, resulting in pulmonary damage, pulmonary edema, and respiratory distress</li> <li>Onset: immediately or within 24 hours after transfusion</li> </ul>	<ul style="list-style-type: none"> <li>Sudden onset of respiratory distress during or shortly after transfusion</li> <li>Acute noncardiogenic pulmonary edema, pulmonary infiltrates with hypoxia</li> </ul>	<ul style="list-style-type: none"> <li><b>Stop transfusion immediately.</b></li> <li>Keep vein open with normal saline solution.</li> <li>Obtain vital signs frequently.</li> <li>Support airway, blood pressure, heart rate, and urine output.</li> <li>Provide supportive care for respiratory symptoms.</li> <li>Know that patient may require intubation.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure donor screening for HLA and granulocyte antibodies when possible.</li> <li>Administer washed RBCs, as ordered, to eliminate plasma from identified donors.</li> </ul>

## A closer look at transfusion reactions *continued*

Type of reaction	Signs and symptoms	Nursing interventions	Prevention
<b>Transfusion-associated circulatory overload</b> <ul style="list-style-type: none"> <li>• May occur with I.V. infusion of large fluid volume over relatively short time</li> <li>• Marked by increase in central venous pressure and pulmonary blood volume and decreasing lung compliance, leading to heart failure and pulmonary edema</li> <li>• Most likely to occur in elderly adults, small children, and patients with compromised cardiovascular system</li> <li>• Onset: during transfusion or up to 24 hours later</li> </ul>	<ul style="list-style-type: none"> <li>• Headache</li> <li>• High blood pressure</li> <li>• Increased pulse rate</li> <li>• Dyspnea</li> <li>• Orthopnea</li> <li>• Neck vein distention</li> <li>• Nonproductive cough</li> <li>• Pedal edema</li> <li>• Decreased oxygen saturation</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Stop transfusion immediately.</b></li> <li>• Position patient upright.</li> <li>• Provide supplemental oxygen, as ordered.</li> <li>• Check vital signs frequently.</li> <li>• Support airway, blood pressure, and heart rate.</li> <li>• Give diuretics (such as furosemide), if ordered, to reduce intravascular plasma volume.</li> </ul>	<ul style="list-style-type: none"> <li>• Infuse at suggested rate of 2 to 2.5 mL/kg/hour, if ordered. For high-risk patients, recommended rate is 1 mL/kg/hour.</li> </ul>
<b>Transfusion-transmitted bacterial infection</b> <ul style="list-style-type: none"> <li>• Results from bacterial contamination of blood components due to donor bacteremia or contamination during blood collection to collection pack or blood processing</li> <li>• May lead to septic shock or DIC</li> <li>• Onset: within minutes to 5 hours of infusion</li> </ul>	<ul style="list-style-type: none"> <li>• Fever or hypothermia</li> <li>• Chills or rigors</li> <li>• Abdominal pain</li> <li>• Back pain</li> <li>• Nausea, vomiting</li> <li>• Hypotension</li> <li>• Oliguria</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Stop transfusion immediately.</b></li> <li>• Keep vein open with normal saline solution.</li> <li>• If ordered, give empiric broad-spectrum antibiotics (usually a combination of vancomycin and aminoglycoside).</li> <li>• Notify blood bank and microbiology lab of reaction.</li> <li>• Draw cultures as appropriate and send them for microbiologic testing.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure extensive donor screening, leukocyte reduction, and proper storage and handling of transfusion product.</li> <li>• Carefully inspect product for abnormalities before starting transfusion.</li> <li>• Infuse blood product for maximum of 4 hours (6 for fresh frozen plasma).</li> </ul>
<b>Posttransfusion purpura</b> <ul style="list-style-type: none"> <li>• Dramatic, sudden, self-limiting thrombocytopenia caused by development of potent platelet-specific antibody</li> <li>• Onset: 5 to 10 days (on average) after transfusion in patients with history of sensitization resulting from pregnancy or transfusion</li> </ul>	<ul style="list-style-type: none"> <li>• Chills or fever</li> <li>• Wet purpura (mucous membrane hemorrhage)</li> <li>• Epistaxis</li> <li>• GI or urinary tract bleeding</li> <li>• Intracranial hemorrhage</li> <li>• Bronchospasm</li> </ul>	<ul style="list-style-type: none"> <li>• Provide supportive care for acute bleeding, if necessary.</li> <li>• Teach patient about bleeding precautions.</li> <li>• As ordered, administer corticosteroids and IVIG.</li> </ul>	<ul style="list-style-type: none"> <li>• No known prevention methods exist.</li> </ul>
<b>Transfusion-related graft vs. host disease</b> <ul style="list-style-type: none"> <li>• May follow infusion of viable T-cell lymphocytes within cellular blood components</li> <li>• Results from HLA differences between donor and recipient</li> <li>• Onset: 8 to 10 days after transfusion; death usually occurs 3 to 4 weeks after transfusion.</li> </ul>	<ul style="list-style-type: none"> <li>• Fever</li> <li>• Cutaneous eruption that spreads distally</li> <li>• Erythroderma and bullae</li> <li>• Nausea, vomiting</li> <li>• Profuse watery diarrhea</li> <li>• Abnormal liver function tests</li> <li>• Anorexia</li> </ul>	<ul style="list-style-type: none"> <li>• Know that condition resists most immunosuppressive therapies, including glucocorticoids, antithymocyte globulin, cyclosporine, cyclophosphamide, and T-cell monoclonal antibodies.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide symptomatic care as indicated.</li> <li>• Prevention is crucial due to lack of effective therapy. Ensure irradiation and leukocyte reduction of blood product.</li> </ul>

### Abbreviation key:

DIC: disseminated intravascular coagulation; HLA: human leukocyte antigen; IgA: immunoglobulin A; IgE: immunoglobulin E; IVIG: I.V. immune globulin; RBCs: red blood cells; WBCs: white blood cells

the transfusion begins to prevent fever and histamine release. Febrile nonhemolytic transfusion reactions seem to be linked to blood components, such as platelets or fresh frozen plasma, as opposed to packed red blood cells; thus, premedication may be indicated for patients who will receive these products. Such reactions may be mediated by donor

leukocytes in the plasma, causing allosensitization to human leukocyte antigens. Cytokine generation and accumulation during blood component storage may play a contributing role.

### Leukocyte-reduced and irradiated blood products

Use of blood products that have been leukocyte-reduced, irradiated,

or both has been shown to reduce complications stemming from an immunologic response. In organ transplant candidates, these products reduce the risk of graft rejection.

### Administering the transfusion

Make sure you know the window of time during which the product must be transfused—starting from

## Quick guide to blood products

This table describes types of blood products, their uses, time constraints for administration, and nursing considerations. With any blood product, always prime the tubing and filter with normal saline solution.

Blood product and description	Actions	Administration and timing	Nursing considerations
<b>Whole blood</b> Contains red blood cells (RBCs), white blood cells (WBCs), platelets, plasma (plasma proteins, antibodies, water, waste), and electrolytes	Improves tissue oxygenation, expands volume, and promotes coagulation	Maximum hang time for 1 unit: 4 hours from refrigerator removal (due to risk of bacterial growth). Recommended total infusion time: 1½ to 2 hours in otherwise healthy adults.	<ul style="list-style-type: none"> <li>Rarely used today except for patients needing rapid, massive replacement of lost blood (more than 25% of blood volume)</li> <li>Requires ABO and Rh crossmatching</li> </ul>
<b>Packed RBCs (PRBCs)</b> Contain RBCs collected from 1 unit of whole blood plus 25% of original plasma	Increase blood's oxygen-carrying capacity in anemic patients; replace blood lost during surgery	Maximum hang time for 1 unit: 4 hours from refrigerator removal (due to risk of bacterial growth). To accommodate smaller catheter sizes and slower infusion times, unit may be split into two smaller bags or infused by I.V. pump.	<ul style="list-style-type: none"> <li>Composed of 70% to 80% hematocrit; one of the most viscous blood products to transfuse</li> <li>Require ABO and Rh crossmatching</li> </ul>
<b>Platelets</b> Contain concentrate made from whole blood (random donor) or plasmapheresis (single donor); also may contain plasma and some RBCs and WBCs	Aid coagulation by controlling or preventing bleeding linked to deficient platelet number or function	Maximum hang time for 1 unit: 4 hours from refrigerator removal or by expiration time marked on unit label (whichever comes first), to help avoid risk of bacterial growth	<ul style="list-style-type: none"> <li>Avoid filters used to transfuse whole blood or PRBCs, as red cell debris accumulated in filter may trap platelets; use new filter instead.</li> <li>Doesn't require ABO crossmatching. Rh antibody status is relevant for infants and small children.</li> </ul>
<b>Fresh frozen plasma</b> Contains normal components of blood plasma, including fibrinogen, frozen within 8 hours of removal from whole blood	Aids coagulation in actively bleeding patients with clotting deficiencies and in patients who will undergo invasive procedures likely to cause bleeding	Use as soon as possible after thawing. Maximum hang time for 1 unit: 6 hours (due to risk of bacterial growth)	<ul style="list-style-type: none"> <li>Less viscous than whole blood or PRBCs; therefore, blood-component recipient set may be used. Monitor coagulation studies.</li> <li>Requires ABO crossmatching, but Rh antibody status is irrelevant</li> </ul>

when the product arrives from the blood bank to when the infusion must be completed. (See *Quick guide to blood products*.) Failing to adhere to these time guidelines increases the risk of such complications as bacterial contamination.

### Detecting and managing transfusion reactions

During the transfusion, stay alert for signs and symptoms of a reaction, such as fever or chills, flank pain, vital sign changes, nausea, headache, urticaria, dyspnea, and bronchospasm. Optimal management of reactions begins with a standardized protocol for monitoring and documenting vital signs. As dictated by facility policy, obtain the patient's vital signs before, during, and after the transfusion.

If you suspect a transfusion reaction, take these immediate actions:

- Stop the transfusion.
- Keep the I.V. line open with normal saline solution.
- Notify the physician and blood bank.
- Intervene for signs and symptoms as appropriate.
- Monitor the patient's vital signs.

Also return the blood product to the blood bank and collect laboratory samples according to facility policy. If and when clinically necessary, resume the transfusion after obtaining a physician order. Carefully document transfusion-related events according to facility policy; be sure to include the patient's vital signs, other assessment findings, and nursing interventions.

Most fatal transfusion reactions result from human error. The most important step in preventing such error is to know and follow your facility's policies and procedures for

administering blood products. Be aware, though, that prevention isn't always possible—which means you must be able to anticipate potential reactions and be prepared to manage them effectively. To promote good patient outcomes, you must be knowledgeable about the best practices described in this article. ★

### Selected references

Silvergleid A. Immunologic blood transfusion reactions. *UpToDate*. October 17, 2008. [www.uptodate.com/patients/content/topic.do?topicKey=-EE8E1UGcUSyKQT](http://www.uptodate.com/patients/content/topic.do?topicKey=-EE8E1UGcUSyKQT). Accessed December 22, 2008.

Visit [www.AmericanNurseToday.com/journal](http://www.AmericanNurseToday.com/journal) for a complete list of selected references.

**Sabrina Bielefeldt and Justine DeWitt are Oncology Certified Nurses at Georgetown University Hospital in Washington, D.C. Ms. Bielefeldt is the Clinical Manager and Ms. DeWitt is a Clinical Nurse IV on the Inpatient Hematology Oncology unit. Ms. DeWitt also serves as Co-Chair of the hospital's Nursing Practice Council.**