Your guide to safe transfusions

Blood may be the gift of life, but transfusions aren't without risk. Nurses play a key role in safeguarding patients receiving blood components.

"Give the gift of life."

Every year, about 8 million Americans respond to that message, donating some 14 million units of blood at blood drives organized by local businesses, schools, hospitals, and religious groups.\(^1\) The beauty of these donations is that more than one person can benefit from a single donation.

Each unit of blood can be separated into its components—red cells, platelets, and plasma.\(^2\) Red cell transfusions replace severe blood loss in cases of trauma or complex surgery; they're also given to increase oxygen supply in severely anemic patients. Platelet transfusions can prevent or control bleeding in patients with thrombocytopenia or impaired platelet function. And plasma, which is rich in clotting factors, increases factor levels in patients with these deficiencies.

While the benefits of this therapy can be substantial, even life-giving, there are risks whenever blood components from one individual are given to another. This review will help you minimize those risks.

How safe is the blood supply?

While screening for hepatitis B has been done since the 1970s, it wasn't until the early 1980s when blood products were identified as a source of HIV infection that concern about the safety of the blood supply intensified.\(^3\) Since then, careful screening and exclusion of donors with potential risk factors and new methods for testing donated blood have greatly reduced the possibility of all types of transfusion-acquired infections.\(^5\)

Although the risks of acquiring hepatitis and HIV through transfusion have declined dramatically, the emergence of new infectious agents continues to pose a challenge. For example, experimental screening for West Nile virus (WNV) was implemented in the summer of 2003.\(^5\) As a result, 600 units of blood were removed from the supply because they were infected with the virus. The good news is that only two cases of transfusion-acquired WNV have thus far been reported.\(^5\)
The reality, though, is that today the greatest threat to patients who need transfusion therapy involves incompatibility. A mismatch between the donor and recipient can trigger an immune-mediated response that ranges from a simple fever to a life-threatening hemolytic reaction. To thwart a reaction, you must have a clear understanding of some blood basics.

**Blood type and Rh: Mismatch leads to hemolysis**

Blood is typed (or grouped) according to the surface antigens found mainly on red cells. Since there are hundreds of antigens found on all types of blood cells, there are a number of ways to group blood.

The two most important blood groups for which patients are routinely typed include the ABO and Rh systems. The ABO system determines an individual's overall blood type. If, for instance, a patient has type A blood, it means he has the surface antigen A on his red cells. And because nearly everyone develops antibodies to the ABO antigens they lack, he will also have anti-B antibodies in his plasma. (The box on page 24 lists blood types and compatibilities).

If he's then given a blood transfusion of type B blood, his life is in immediate danger of an acute hemolytic reaction within minutes of receiving the first few milliliters of incompatible blood. That's because his immune system will identify the donor blood as foreign, and his anti-B antibodies will attack the donor cells. And, if whole blood is used, donor plasma anti-A antibodies will attack the patient's red cells. The result: the red cells will clump together (agglutinate) and then break down (hemolysis), triggering shock, intravascular coagulation, and renal failure. The reaction is usually fatal.

Acute hemolytic reaction can also occur because of Rh incompatibility. The Rh system includes about 50 different surface antigens, the most important of which is Rh-D. The presence of Rh-D means that the person is Rh-positive. Since 85% of the population has the Rh-D antigen, you don't hear much about incompatibility until someone who is Rh-negative is given a dose of Rh-positive blood.

The hemolysis, in this case, occurs extravascularly, triggering the coagulation cascade and the release of vasoactive agents that together bring on cardiorespiratory arrest. Fortunately, an Rh-hemolytic reaction can be stopped by giving Rh immune globulin (RhoGAM).

**Nonhemolytic reactions can be fatal, too**

The surface antigens found on white blood cells, along with lesser known antigens on red cells and even those found on platelets, are responsible for most nonhemolytic reactions. Sensitivity often develops with multiple transfusions, or in those who are immunocompromised.

A patient who has a history of fever linked to transfusion therapy—typically 1° above baseline—may only need to be premedicated with acetaminophen (Tylenol) and diphenhydramine (Benadryl) to ward off an immune-mediated reaction.

However, if the fever does not resolve with premedication, the blood products may be contaminated with bacteria or other microbes. Platelets are frequently the culprit. That's because platelets are stored at 68° - 75° F (20° - 24° C), a temperature warm enough to foster bacterial growth. For this reason, the American Association of Blood Banks' standards now require blood banks to check platelets for bacteria before releasing them for transfusion.
Blood typing and compatibility

In the ABO system there are four genetically determined blood types: A, B, AB, and O, with opposing antibodies in the plasma. If your patient has type A blood and receives a whole blood transfusion of type B blood, the donor's plasma will have anti-A antibodies that will attack the patient's red cells, causing hemolysis. In turn, the patient's plasma has anti-B antibodies that will attack the donor red cells, also causing hemolysis. That's why blood has to be matched for antigens on the cells as well as antibodies in the plasma.

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<tr>
<th>Blood type</th>
<th>Red blood cell</th>
<th>Plasma</th>
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<tr>
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<td>A antigen</td>
<td>Anti-B antibodies</td>
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<td>B</td>
<td>B antigen</td>
<td>Anti-A antibodies</td>
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<tr>
<td>AB</td>
<td>A and B antigens</td>
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<tr>
<td>O</td>
<td>Neither A nor B antigens</td>
<td>Both anti-A and anti-B antibodies</td>
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<table>
<thead>
<tr>
<th>Patient blood type</th>
<th>Compatible red cell donors</th>
<th>Compatible plasma donors</th>
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<tr>
<td>A</td>
<td>A, O</td>
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Another type of immune-mediated reaction is transfusion-related acute lung injury. TRALI has emerged as a leading cause of transfusion-related deaths. The "two-hit" theory suggests that TRALI is triggered when a patient who already has a systemic inflammation (first hit) is transfused with blood products (often platelets) that stimulate an antibody attack against antigens on the patient's blood cells or vice versa (second hit).

In any case, TRALI results in increased pulmonary capillary membrane permeability that allows fluid to leak into the lungs. The symptoms mimic that of adult respiratory distress syndrome (ARDS): dyspnea, worsening hypoxia, and non-cardiogenic pulmonary edema.

You play a key role in transfusion safety

Two-thirds of all acute hemolytic reactions are a result of misidentification of the patient or the blood, or phlebotomy error. Therefore, if you administer blood components, it's crucial that you follow your institution's transfusion policies and procedures to the letter. Don't take shortcuts!

To start, make sure you have an order and informed consent signed by the patient or a designated legal representative. If you don't have a signed consent form, let the physician know that one needs to be completed before you can give the blood product. Then check for IV access.

Some hospitals prohibit giving blood products through peripheral IVs that have been in place for more than 24 hours, so you may have to start a new IV. And, since medications and other IV solutions cannot be piggybacked into blood transfusions, this is also a good time to check and see if the patient will need a second IV so that scheduled doses of antibiotics, for example, aren't missed while the transfusion is running.

The transfusion order should require you to obtain a sample for type and crossmatch. Keep in mind that JCAHO requires at least two patient identifiers be put on each sample. If you're the one drawing the sample, make sure the patient's identifiers—name, medical record number, and date of birth—on his ID band exactly match the information on the label you attach to the sample. Then draw the blood and send the tube to the...
blood bank, along with the appropriate forms. The blood bank will notify you when the product is ready. In some institutions, blood products are sent from the blood bank to the floor through a pneumatic tube system. Others require a nurse to go to the blood bank to obtain the blood. In the latter case, the nurse picking up the blood should check the blood bag and slip with the technician who’s dispensing the product to assure that the blood type, unit number, and expiration date on the blood bank slip match the information on the product bag before leaving the blood bank.

Because warm blood products provide an excellent media for bacteria to grow, you should start the transfusion within 20 - 30 minutes of receiving the component. If you're delayed for any reason, return the product to the blood bank; never store it in the med room refrigerator.

When you have the blood product in hand, inspect it for signs of infection such as discoloration, bubbles, or clots prior to transfusion. Then, ask a colleague to assist you at the bedside as you get ready to start the infusion.

Read the patient’s name, date of birth, and medical record number from the patient’s ID band out loud while the other nurse compares it with information on the blood bank slip. Follow the same procedure for the information on the product unit label, reading off the blood type, unit number, and expiration date while the second nurse compares it with the data printed on the blood bank slip.

If everything matches perfectly, you’ll both sign the blood bank slip, confirming the information. (If you find a discrepancy, contact the blood bank and take the necessary steps to resolve it.)

If you haven’t already set up the tubing, do so now. You’ll need special IV tubing with a 170 - 260 micron filter. Use a Y-set tubing that splits into two short lines above the filter when giving packed cells or fresh frozen plasma. To one line of the Y, attach a small IV bag (100 - 150 ml) of 0.9% normal saline—never use 5% dextrose in water because it damages blood cells. Then, prime the filter, and flush the entire tubing. Attach the bag of blood or plasma to the other short line of the Y and the long line to the patient.

For platelet transfusions you need special tubing. This, too, has a filter, but because the volume you’ll be infusing is smaller, the appropriate tubing is shorter than the Y-set and also straight. In many institutions, the blood bank will give you this tubing when you pick up the platelets. Other plasma products, such as albumin and cryoprecipitate, for example, also require special tubing that is provided by the blood bank.

Obtain and record baseline vital signs—temperature, pulse rate, and blood pressure—right before you start the transfusion. Open the clamp on the blood tubing, and start slowly. That way, if there are any problems, the patient will have only received a very small amount of the blood product.

Since acute hemolytic reactions occur within the first few minutes, you should stay at the bedside for at least 15 minutes after starting the transfusion. That way you can spot trouble early on. Be sure to document the monitoring you do.

What you should do when the worst happens

Suspect an acute hemolytic reaction if the patient suddenly becomes anxious or apprehensive and complains of low back pain—a classic sign. When the blood is being given through a peripheral IV, the patient may also complain of pain at the infusion site, caused by red cell clumping and inflammation. Other symptoms include those you’d expect to see with a severe allergic reaction: nausea, abdominal cramping, tachycardia, changes in blood pressure, chest pain, dyspnea, wheezing, and diaphoresis.

If you suspect an acute hemolytic reaction, stop the transfusion immediately and call for help. Ask someone to notify the physician and the blood bank. Disconnect the blood tubing from the IV and place it in a plastic bag so it can be returned to the blood bank. Hang a new IV of normal saline at 20 ml/hr. Be prepared to give IV steroids and antihistamines to slow the reaction. You’ll also want emergency equipment and the code cart close at hand in case the patient’s condition deteriorates further.

Check and record the patient’s vital signs at least every five minutes. Have another nurse monitor the patient while you complete any other procedures your facility requires. Depending upon your blood bank’s policy, these may include rechecking the patient’s ID information and the label on the product with the blood slip, drawing a new blood specimen, and completing a transfusion reaction form.

When the physician arrives, be prepared to transfer the patient to the ICU for closer monitor-
ing. Intensive care is needed because renal failure is a major concern with acute hemolytic reaction, even if the patient initially appears stable.

Be on the lookout for other reactions, as well

Because signs and symptoms of an allergic reaction, an infection, and TRALI may not always appear until several hours after a transfusion, don’t let your guard down.

If the patient experiences allergic symptoms—rash, hives, itching, or changes in heart rate or BP, for example—despite premedication and careful crossmatching—stop the transfusion. Call the physician to evaluate the patient before you continue. Depending on the severity, he may want to resume the transfusion with leukocyte-poor blood, which will help reduce the risk of further reactions.

Suspect bacterial contamination of donor blood products in a patient whose temperature suddenly spikes more than two degrees above baseline. Hypotension and chills are also classic signs of this kind of reaction. If this occurs, you’ll need to stop the transfusion and notify the physician and blood bank. Obtain stat blood cultures and give antibiotics as ordered. Return the unit to the blood bank with the appropriate documentation.

Suspect TRALI in a patient who complains of dyspnea after the transfusion is started. Like ARDS, transfusion-related lung injury can be hard to diagnose. When you suspect it, notify the physician. He may order an arterial blood gas sample to assess oxygenation, and a CBC with differential to assess for an acute drop in neutrophils, which is linked to TRALI. Monitor the patient’s vital signs and oxygen saturation by oximeter. A patient with suspected TRALI is often transferred to the ICU for closer monitoring and supportive care, including mechanical ventilation. The mortality rate for patients who develop TRALI is as high as 50%.

Keep in mind, though, that the signs of pulmonary edema don’t always mean TRALI. Patients receiving blood products can develop pulmonary edema because of the increase in circulating volume.

Patients with compromised cardiac function and those receiving more than one blood product are particularly at risk. Tachycardia, hypertension, distended neck veins, and rales are all signs of volume overload. To prevent this complication, transfuse blood products slowly, especially in children, the elderly, and patients with a history of cardiac or kidney disease. Monitor vital signs, lung sounds, and urine output closely in these patients. The physician may order prophylactic diuretics to be given before or after the transfusion.

Not every blood reaction or infection can be prevented. Still, there’s much you can do to reduce the risk by strictly following hospital policies and procedures when you administer blood. And, when a patient does experience a transfusion reaction despite your best effort, your close monitoring and early intervention can make a crucial difference.

REFERENCES

OBJECTIVES After reading the article you should be able to:
1. Compare and contrast hemolytic and nonhemolytic transfusion reactions.
2. Discuss nursing and medical management for a patient experiencing a transfusion reaction.
3. Develop a plan of care for a patient receiving a transfusion.

Circle the one best answer for each question below. Transfer your answers to the card that follows page 40. Save this sheet to compare your answers with the explanations you’ll receive. Or, take the test online at www.rnweb.com.

1. Every year, how many Americans donate blood?
   a. 2 million
   b. 4 million
   c. 6 million
   d. 8 million

2. How many units of blood are donated in the United States each year?
   a. 8 million
   b. 10 million
   c. 12 million
   d. 14 million

3. In 2003, how many units of blood were found to be infected with West Nile virus?
   a. 200 units
   b. 400 units
   c. 600 units
   d. 800 units

4. All of the following occur in a hemolytic reaction involving the ABO system EXCEPT:
   a. Donor cells begin to develop
   b. Agglutination
   c. Hemolysis
   d. Shock

5. Rh-hemolytic reaction can be stopped by giving:
   a. Gamma globulin
   b. Rh immune globulin (RhoGAM)
   c. Aminocaproic acid (Amicar)
   d. Tranexamic acid (Cyklokapron)

6. The most important Rh antigen is:
   a. Rh-A
   b. Rh-B
   c. Rh-C
   d. Rh-D

7. What percentage of the population is Rh-negative?
   a. 15%
   b. 45%
   c. 75%
   d. 85%

8. Which of the following statements is true of a nonhemolytic reaction?
   a. It's treated with Rh immune globulin.
   b. Sensitivity is always immediate.
   c. Patients may be premedicated with diphenhydramine (Benadryl).
   d. It only occurs in healthy individuals.

9. To prevent contamination, what temperature should platelets be stored at?
   a. 53.6° - 60.8° F (12° - 16° C)
   b. 60.8° - 68° F (16° - 20° C)
   c. 68° - 75° F (20° - 24° C)
   d. 75° - 82.4° F (24° - 28° C)

10. Which of the following is a characteristic of transfusion-related acute lung injury (TRALI)?
    a. TRALI results in decreased pulmonary capillary membrane permeability.
    b. Symptoms mimic that of acute respiratory distress syndrome.
    c. It is the second most common cause of transfusion-related deaths.
    d. There is a "one-hit" theory behind the cause of TRALI.

11. What portion of acute hemolytic reactions have occurred because of misidentification of blood or phlebotomy error?
    a. One-third
    b. One-fourth
    c. One-half
    d. Two-thirds

12. Nursing care for a patient receiving a blood transfusion includes:
    a. Starting an IV of 5% dextrose in water.
    b. Start the transfusion one hour after receiving the blood component.
    c. Having a signed informed consent.
    d. Piggybacking the IV solution into the blood tubing.

13. Which antibodies are in the plasma of a person with type A blood?
    a. Anti-A
    b. Anti-B
    c. Both anti-A and anti-B
    d. Neither anti-A nor anti-B

14. The nurse should start a blood transfusion within how many minutes of receiving the unit from the blood bank?
    a. 30
    b. 60
    c. 90
    d. 120

15. How long should the nurse stay with the patient after starting the transfusion? At least:
    a. Five minutes
    b. 10 minutes
    c. 15 minutes
    d. 20 minutes

16. Which of the following symptoms is a classic sign of an acute hemolytic reaction?
    a. Blurred vision
    b. Low back pain
    c. Bradycardia
    d. Acute urinary retention

17. What action should the nurse take initially if the patient shows signs of an acute hemolytic reaction?
    a. Hang a new IV of 5% dextrose in water at 75 ml/hour.
    b. Stop the transfusion and call for help.
    c. Disconnect and discard the blood tubing.
    d. Record vital signs every 10 minutes.

18. All of the following are patient identifiers EXCEPT:
    a. Name
    b. Blood type
    c. Medical record number
    d. Date of birth

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