TWENTY-FOUR

PREVENTING INFECTIONS RELATED TO USE OF INTRAVASCULAR DEVICES

KEY CONCEPTS you will learn in this chapter include:

- Why intravascular devices are an important cause of systemic bloodstream infections
- How to minimize the risk of nosocomial infections related to intravascular devices
- How to insert, care for and remove intravenous lines
- How to set up and administer blood or blood products

BACKGROUND

The use of intravascular devices, both venous and arterial, to deliver sterile fluids, medications and nutritional products, as well as for central monitoring of blood pressure and other hemodynamic functions, has dramatically increased during the past decade. It is estimated that about 50% of all patients admitted to hospitals will receive intravenous therapy, creating a large population at risk for local and systemic blood stream infections.

Because catheters inserted into the venous or arterial bloodstream bypass the normal skin defense mechanism, these devices provide a way for microorganisms to enter the bloodstream from:

- the device at the time of insertion,
- subsequent contamination of the device or attachments (e.g., tubing connected to the blood monitoring apparatus or the fluids being administered), or
- pathogens on the skin surrounding the insertion site.

The risk of infection associated with the use of intravascular devices can be reduced by following recommended infection prevention practices related to their insertion (e.g., the use of aseptic technique) and by better management of the device once it is in place. In many countries, poor infection prevention practices, such as infrequent handwashing or use of antiseptic handrub, and the improper use of gloves often result in increased rates of local and systemic infections. Moreover, when intravascular devices (e.g., central venous catheters) are introduced in hospitals where laboratory services to provide identification and antimicrobial susceptibility testing are lacking or inadequate, the treatment

of life-threatening bloodstream infections stemming from these devices is often unsuccessful or results in the emergence of resistant organisms.

This chapter provides guidelines for the preparation, insertion and maintenance of common intravascular devices (i.e., peripheral venous lines for the administration of fluids, electrolytes and blood or blood products).[1]

DEFINITIONS

- **Exit site infection (microbiologic diagnosis)**. Clinical infection in which culture of the discharge (pus or fluid) at the exit site yields a microorganism, with or without microbiologic evidence of bloodstream infection.
- **Phlebitis**. Area of swelling, redness, warmth and tenderness of the skin around the site where the intravascular catheter comes out of the skin (the exit site). If phlebitis is associated with other signs of infection, such as fever and pus coming from the exit site, it is classified as a **clinical exit site infection**.
- **Pocket infection**. Infected fluid isolated from the area around a totally implanted intravascular device, with or without microbiologic evidence of bloodstream infection.
- **Tunnel infection**. Tenderness, redness and swelling for more than 2 cm (about 1 inch) along the tract of an intravascular catheter, with or without microbiologic evidence of local or bloodstream infection.

EPIDEMIOLOGY AND MICROBIOLOGY

Peripheral venous catheters, if inserted using recommended infection prevention practices, are rarely (less than 1%) associated with systemic (bloodstream) infections (**Table 24-1**). If they are not properly maintained, however, these devices can cause local reactions (e.g., phlebitis) that potentially increase the risk of subsequent infection. By contrast, nontunneled central venous pressure catheters (CVCs) account for nearly 90% of all catheter-related bloodstream infections, with the remaining due to use of the other devices (Maki 1992). Because nosocomial bloodstream infections have a relatively high morbidity compared to other types of nosocomial infections, in the range of 10–20% (CDC and HICPAC 1996), it is extremely important that where possible, midline catheters, which have lower rates of phlebitis and infection, be used rather than nontunneled CVCs (Garner and HICPAC 1996).

[1] Insertion and maintenance of other devices (e.g., peripheral artery catheters and nontunneled or tunneled central venous lines) require personnel with special training to minimize the risk of catheter-related complications (e.g., pneumothorax) or infections (CDC and HICPAC 1996). If IV teams are not available, insertion and removal should be the responsibility of a few well-trained staff members using aseptic techniques. Even for insertion of peripheral venous catheters, students or unskilled or inexperienced staff should be directly supervised, and the number of attempts should be limited for patient safety and comfort.

Table 24-1. Types of Intravascular Devices and Comments on Their Use

Peripheral venous catheter	Usually inserted into the veins of the forearm or the hand; most commonly used short-term intravascular device; rarely associated with bloodstream infection
Peripheral arterial catheter	For short-term use; commonly used to monitor hemodynamic status and to determine blood gas levels of critically ill patients; risk of bloodstream infection may approach that of CVCs[1]
Midline catheter	Peripheral catheter (size 7.6–20.3 cm or 3–8 inches) is inserted via the antecubital fossa (forearm) into the proximal basilic or cephalic veins, but it does not enter central veins; is associated with lower rates of phlebitis and infection than CVCs
Nontunneled CVC	Most commonly used CVC; accounts for an estimated 90% of all catheter-related bloodstream infections; increased risk of infection with internal jugular vein site of insertion
Pulmonary artery catheter	Inserted through a Teflon introducer and typically remains in place for an average duration of only 3 days; most catheters are heparin-bonded to reduce catheter thrombosis and microbial adherence to the catheter
Pressure-monitoring system	Used in conjunction with arterial catheter; associated with both epidemic and endemic nosocomial bloodstream infections; source is often the fluid column in the tubing between the patient's intravascular catheter and the pressure-monitoring apparatus, contaminated infusate, or contaminated nondisposable transducers
Peripherally inserted central catheter	Provides an alternative to subclavian or jugular vein catheterization; is inserted via a peripheral vein into the superior vena cava, usually by way of cephalic and basilar veins; is easier to maintain and is associated with fewer mechanical complications (e.g., hemothorax) than are nontunneled CVCs
Tunneled CVC	Surgically implanted CVC with tunneled portion exiting the skin and a Dacron cuff just inside the exit site; the cuff inhibits migration of organisms into the catheter tract by stimulating growth of the surrounding tissue, thus sealing the catheter tract; used to provide long-term vascular access to patients
Totally implantable device	A subcutaneous port or reservoir with self-sealing septum is tunneled beneath the skin and is accessed by a needle through intact skin; low rates of infection

[1] CVC: central venous catheter

Adapted from: Mermel et al 2001.

Most infections are caused by contamination of the catheter with organisms from the patient's skin or the health worker's hands during insertion, with the catheter providing a direct path to the bloodstream. Once the catheter is inserted, pathogens can be transferred into the bloodstream in four ways:

1. by traveling along the catheter-tissue interface,
2. through contamination of the hub,
3. through contaminated infusion fluid, and
4. through the bloodstream from another site of infection.

Microbiology

Both gram-negative bacteria and staphylococci are primary causes of catheter-related infection; however, with the advent of the HIV/AIDS epidemic, infections with fungi are increasingly being reported (Jarvis and Hughes 1993). Some microorganisms, especially coagulase-negative *Staphylococcus aureus* and pseudomonas and acinetobacter species, adhere to the fibrin film that forms on the inside wall of catheters within days after insertion. As a consequence**,** infection with these organisms is quite common, especially if the infection occurs within 10 days of insertion (Raad et al 1993). For devices left in place longer than 30 days (e.g., tunneled CVCs), bloodstream infections are more likely due to the contamination of the hub of the catheter, especially if frequent handling of the hub occurs (Schaberg, Culver and Gaynes 1991).

RISK FACTORS

A number of factors increase the risk of infection from intravascular devices. For example, infection rates are higher among patients in large hospitals who may be especially ill, those with burns or surgical wounds or those who are malnourished or immunocompromised (e.g., by HIV/AIDS or chronic corticosteroid treatment). In addition, the rates are higher for certain devices (e.g., nontunneled CVCs), the type of fluid being infused (parenteral nutritional products are most risky) and the length of time the catheter is left in place (Jarvis et al 1991; Maki and Mermel 1998; Mayhall 1992).

Contaminated equipment and solutions also provide microorganisms with a way to get into the bloodstream. The following device-related factors increase the risk of infection:

- **Before insertion**:
  - Cracks in infusion bottles
  - Punctures in plastic containers
  - Contaminated infusion fluid or additives
  - Leaky IV administration sets with multiple connections
  - Unsterile preparation of intravenous infusion fluid

- **During use**:
  - Multiple changes of IV fluid containers while using the same IV administration set

- Multiple injections and irrigations of the system
- Central venous pressure measurement apparatus

Person-to-person contact also increases the risk of infection associated with intravascular devices. These include:

- Cross-contamination with other infected areas of the patient's body either by the patient or on the hands of the health worker.
- Cross-contamination from another patient via the hands of the health worker.
- Cross-contamination from the patient when the health worker comes in contact with the patient's blood during insertion, care of the insertion site or removal of the catheter.
- Poor insertion or dressing change technique.

REDUCING THE RISK OF NOSOCOMIAL INFECTIONS

All Types of Intravascular Devices

Hand Hygiene and Gloves

- Wash hands before touching any of the IV set components. (If hands are visibly clean, you can disinfect them with an antiseptic handrub made from 60–90% ethyl or isopropyl alcohol and an emollient, such as glycerin.)
- Clean examination gloves or reprocessed high-level disinfected surgical gloves should be put on just before touching the insertion site or the hub of the needle or catheter.
- Wash hands or use a waterless, alcohol-based antiseptic handrub after removing gloves.

Site Care and Dressings

- If the site for inserting the catheter is visibly dirty, wash it with soap and clean water and dry it before applying the skin antiseptic.

Note: PVI releases free iodine (the active antiseptic agent) slowly.

- If using povidone-iodine (PVI) as the antiseptic agent, allow it to dry after applying or wait at least 2 minutes before insertion.
- Applying antimicrobial ointment around the insertion site does not reduce the risk of infection (APIC 2002).
- Transparent, adherent dressings allow inspection of the site, act as tape to hold the catheter or needle, and may be more comfortable, but they are expensive and there is no evidence, based on randomized controlled trials, that they reduce the risk of infection compared to sterile or clean gauze and surgical tape.
- Dressings can be left in place for up to 72 hours if they are kept dry. (They should be changed immediately if they get wet, soiled or loose.)

- Gauze and tape dressings need to be changed if an inspection of the site is necessary.
- The catheter or needle site should be gently palpated daily for tenderness.
- The insertion site should be inspected if the patient develops tenderness or fever without an obvious cause (CDC and HICPAC 1996).

Peripheral Catheters (Venous and Arterial)

Site Selection and Rotation

- For adults, hand veins are preferred over arm veins, and arm veins over leg and foot veins. (Needles and catheters inserted in leg and foot veins are more likely to cause inflammation at the insertion site or phlebitis.)
- Rotating sites at 72–96 hours will reduce phlebitis and local infection. (Teflon or polyurethane catheters are preferred over steel needles because they are less apt to perforate the vein with movement.)
- If only short-term (less than 48 hours) IV infusion is planned, straight or butterfly needles are less irritating than plastic catheters and have lower rates of infection.
- Because straight and butterfly needles frequently infiltrate, they should not be used with solutions that could cause tissue necrosis.
- Inline filters, except for administering blood or blood products, are not recommended; they are more expensive, less effective and more prone to cause infusion problems than if the solutions are filtered in the pharmacy after preparation (CDC and HICPAC 1996).

Central Venous Catheters

Site Care and Dressings

Note: In 1994, Raad et al reported lower rates of blood stream infections when full barrier precautions were used compared to insertions by staff using only sterile gloves and a small drape with a hole in the center.

- If the site for inserting the catheter is visibly dirty, wash it with soap and clean water and dry it before applying the skin antiseptic.
- Use 2% chlorhexidine gluconate, 10% PVI or 60–90% alcohol for skin prep. (In 1991 Maki, Ringer and Alvarado reported that the infection rate with chlorhexidine was 84% lower than with PVI or alcohol.)
- Insertion should be done using full barrier precautions (sterile or high-level disinfected gloves, gown, mask and site drape) in a procedure area, not at the bedside.

Changing Fluids and Infusion (Administration) Sets

- Change infusion bottles or plastic bags with parenteral solutions every 24 hours.
- Change infusion bottles or plastic bags with lipid emulsion given alone within 12 hours (CDC and HICPAC 1996).

- Infusion (administration) sets (including piggybacks) should be changed whenever they are damaged and at 72 hours routinely. (If the tubing becomes disconnected, wipe the hub of the needle or plastic catheter with 60–90% alcohol and connect it to a new infusion set.)
- Tubing used to administer blood, blood products or lipid emulsions should be replaced within 24 hours (CDC and HICPAC 1996).

INSERTION, MAINTENANCE AND REMOVAL OF PERIPHERAL VENOUS LINES

Insertion Procedure for Establishing an Intravenous (IV) Line

STEP 1: Make sure all items are available:

- IV solution bag or bottle
- Straight or butterfly needle or plastic catheter (steel needle inserter covered with soft plastic tubing that is left in place after the needle is withdrawn)
- Infusion (administration) set—infants and children require drip rate (drips per mL) and volume control devices
- Antiseptic solution (e.g., 2% chlorhexidine, 60–90% alcohol or 10% povidone-iodine) and sterile or clean gauze squares (2 x 2 or cotton swabs)
- Surgical tape or transparent dressing
- Clean tourniquet
- Clean or new arm board
- Towel to place under patient's hand or forearm
- IV pole
- Clean pair of examination gloves (If examination gloves are not available, reprocessed high-level disinfected surgical gloves can be used.)
- Basin of clean warm water, soap, face cloth and clean dry towel
- Plastic bag or leakproof, covered waste container for disposal of contaminated items

Note: Use distal veins (farthest from the wrist or elbow) first and avoid placing the IV line over the wrist or in the patient's dominant hand (the one s/he writes with).

STEP 2: Explain the procedure to the patient.

STEP 3: Prior to starting the procedure, identify the best vein(s) for inserting IV needle or plastic catheter.

STEP 4: If the venipuncture site is visibly soiled, first wash it with soap and clean water and dry with a clean cloth.[1]

[1] If tap water is contaminated, use water that has been boiled for 10 minutes and filtered to remove particulate matter (if necessary), or use chlorinated water—water treated with a dilute bleach solution (sodium hypochlorite) to make the final concentration 0.001% (see **Chapter 26**).

STEP 5: Wash hands with soap and clean water and dry with a clean, dry towel or air dry. (Alternatively, if hands are not visibly soiled, apply 5 mL, about 1 teaspoonful, of an antiseptic handrub to both hands and vigorously rub hands and between fingers until dry.)

STEP 6: Check the IV solution (bottle or plastic bag) to be sure it is correct and the right additives, such as potassium, have been added.

STEP 7: Open the infusion set and assemble parts, if necessary using aseptic technique (e.g., don't touch ends of tubing).

STEP 8: Insert infusion set into solution bottle or bag:

- Remove protective cover from solution bottle or bag without touching the opening.
- Remove protective cap covering insertion spike without touching the spike and insert spike into stopper of IV bottle or opening of IV bag.

STEP 9: Fill infusion tubing:

- Compress drip chamber and release.
- Remove protective cover of IV tubing and release roller clamp to allow fluid to fill the tubing, close the roller clamp and replace the protective cover. (Check to be sure tubing is clear of air bubbles.)

STEP 10: With forearm and hand hanging down, place tourniquet 10–12 cm (5–6 inches) above the insertion site. (Ask patient to open and close fist and/or tap lightly over the vein to make it easier to see or feel.)

STEP 11: With tourniquet in place and vein filled, place hand and arm on the clean towel on bed or on arm board.

STEP 12: Put clean examination gloves on both hands.

STEP 13: Cleanse insertion site with antiseptic solution using a circular motion outward from the insertion site. (If using povidone-iodine, allow it to dry, about 2 minutes, because it only releases free iodine, the active antiseptic agent, slowly).

STEP 14: Attach straight or butterfly needle or plastic catheter to a syringe if blood is to be taken for testing. If not, the needle or butterfly should be attached to sterile end of the IV tubing.

Note: Do not insert unattached needle or catheter into a vein and allow blood to drip out on the patient's hand, forearm, the bed or floor!

STEP 15: Fix the vein by placing the thumb over the vein and gently pulling against the direction of insertion.

STEP 16: Insert needle or catheter with the bevel up using the dominant hand. Look for blood return in the tubing and carefully advance the needle or butterfly until the hub rests at the venipuncture site. (With catheters, after getting blood return, advance the needle about 1 cm (½ inch), withdraw the inner insertion needle and then advance the plastic catheter to the hub.)

STEP 17: While stabilizing the needle or catheter, release the tourniquet and roller clamp to permit a rate of flow sufficient to keep the IV line open.

Note: The tourniquet should be washed with soap and water, rinsed and dried whenever visibly soiled and wiped with 0.5% chlorine solution or 60–90% alcohol between patients.

STEP 18: Secure the needle or catheter by placing a narrow piece of tape (1 cm or ½ inch) under the hub with the adhesive side up and cross tape it over the hub. Then place a second piece of narrow tape directly across the hub of the needle or catheter.

STEP 19: Place a sterile gauze square (2 x 2) over the venipuncture site and secure with two pieces of tape. (Alternatively, place a transparent dressing over the venipuncture site.)

STEP 20: Prior to removing gloves, place any blood-contaminated waste items (cotton or gauze squares) in a plastic bag or leakproof, covered waste container.

STEP 21: Remove gloves by inverting and place them either in a plastic bag or waste container.

STEP 22: Wash hands or use antiseptic handrub as above.

Note: Carefully write the date and time of placement of the IV line and needle size on the dressing.

STEP 23: Secure the wrist or forearm to the arm board by applying two strips of tape directly across wrist or forearm. (To minimize discomfort when removing the arm board, attach a shorter piece of tape to the longer piece—adhesive side to adhesive side—that will cover the wrist or arm.)

STEP 24: Adjust the flow rate to the correct number of drips per minute.

Maintenance of IV Line

STEP 1: Observe patient hourly to determine her/his response to the fluid therapy and check that:

- IV line is open and running (if a straight or butterfly needle is being used, check for infiltration);
- correct amount of fluid is being infused; and
- proper flow rate (drops per minute) is maintained.

Note: If only short-term (less than 48 hours) IV infusion is planned, straight or butterfly needles are less irritating than plastic catheters and have lower rates of infection.

STEP 2: Check every 8 hours for phlebitis or evidence of infection.

STEP 3: Rotate the infusion site at 72–96 hours, when practical, to reduce the risk of phlebitis and local infection.

STEP 4: The infusion (administration) sets (including the piggybacks) should be changed whenever they are damaged and at 72 hours routinely.

STEP 5: If the tubing becomes disconnected, wipe the hub of the needle or the plastic catheter with 60–90% alcohol and connect to a **new** infusion set.

Changing IV Solutions

STEP 1: Prepare to change the solution when about 50 mL remains in the bottle or bag.

STEP 2: Check to be sure the drip chamber is half full.

STEP 3: Wash hands or use antiseptic handrub as above.

STEP 4: Prepare the new solution. If using a plastic bag, remove the protective cover from the entry site. If using a glass bottle, remove the metal cap, metal disk and rubber disk. Do not touch the entry site on the bag or bottle.

STEP 5: Move the roller clamp to stop the flow.

STEP 6: Remove the old solution from the IV pole.

STEP 7: Remove the spike from the old IV solution bag or bottle, and without touching the tip, insert the spike into the new IV solution bag or bottle.

STEP 8: Hang the new bag or bottle and discard the empty bag or bottle according to hospital policy.

STEP 9: Check for air in the tubing.

STEP 10: Make sure the drip chamber is half full.

STEP 11: Regulate the flow to the prescribed rate.

STEP 12: Observe the patient hourly to determine her/his response to the fluid therapy and check that:

- the IV line is open and running (if a straight or butterfly needle is used, check for infiltration);
- the correct amount of fluid is being infused; and
- the proper flow rate (drops per minute) is maintained.

STEP 13: Check every 8 hours for phlebitis or evidence of infection.

Changing IV Tubing

STEP 1: Determine that a new infusion set is needed if:

- there is a puncture of the infusion tubing;
- the tubing becomes contaminated;
- the tubing becomes blocked (e.g., after an infusion of packed red blood cells, whole blood or albumin); or
- the date on the dressing indicates the tubing has been in place 24 hours if used to administer blood, blood products or lipid emulsions, or 96 hours for other fluids.

STEP 2: Make sure the following items are available:

- Plastic bag or a leakproof, covered waste container for disposing of contaminated items
- Infusion tubing

STEP 3: If a new IV dressing must be applied, additional items are:

- Sterile or clean gauze squares (2 x 2) and surgical tape or sterile, wide (1 inch) bandaid
- Antiseptic solution (2% chlorhexidene gluconate, 60–90% alcohol or 10% povidone-iodine)
- Alcohol swabs
- Clean pair of examination gloves (If examination gloves are not available, reprocessed high-level disinfected surgical gloves can be used.)

STEP 4: Wash hands or use antiseptic handrub as above.

STEP 5: Open a new infusion set and assemble it if necessary.

STEP 6: Partially open a sterile gauze square package and place it on the bed near the IV puncture site.

STEP 7: Move the roller clamp to the "off" position on the old infusion tubing, remove the insertion spike from the IV fluid bag or bottle and hang the end of the old IV tubing over the IV pole.

STEP 8: Quickly remove the protective cap on the insertion spike of the new infusion tubing and insert it into the entry site of the IV infusion bottle or bag.

STEP 9: Compress and release the drip chamber to fill half full.

STEP 10: Open the roller clamp, remove the protective cap from the needle adapter, allow the tubing to completely fill, move the roller clamp to the "off" position and replace the protective cap without touching the tip.

STEP 11: Put clean examination gloves on both hands.

STEP 12: If the needle or catheter hub is not visible, carefully remove the IV dressing and place it in a plastic bag or leakproof, covered waste container.

STEP 13: Stabilize the hub of the IV needle or plastic catheter, gently twist and pull out the old tubing, quickly remove the protective cap from the needle adapter of the new tubing, and insert the tubing into the hub of the needle or plastic catheter.

STEP 14: Open the roller clamp on the new tubing and adjust the rate of flow as ordered.

STEP 15: Discard the old tubing in a plastic bag or leakproof, covered waste container.

STEP 16: If necessary, apply a new dressing by placing a gauze square (2 x 2) over the venipuncture site and secure it with two pieces of tape. (Alternatively, place a transparent dressing over the venipuncture site.)

STEP 17: Remove gloves by inverting and place them either in a plastic bag or waste container.

STEP 18: Wash hands or use antiseptic handrub as above.

IV Removal Procedure

STEP 1: Make sure all items are available:

- Clean pair of examination gloves (If examination gloves are not available, reprocessed high-level disinfected surgical gloves can be used.)
- Antiseptic solution (2% chlorhexidene gluconate, 60–90% alcohol or 10% povidone-iodine)
- Gauze squares (2 x 2) and surgical tape or a sterile, wide (1 inch) bandaid
- Puncture-resistant sharps container within arm's reach if a straight or butterfly needle was used
- Plastic bag or leakproof, covered waste container for disposing of the contaminated items

STEP 2: Wash hands or use antiseptic handrub as above.

STEP 3: Stop the infusion by closing the roller clamp.

STEP 4: Put clean examination gloves on both hands.

STEP 5: Remove the arm board and dressing and discard it in a plastic bag or leakproof, covered waste container.

STEP 6: Check the patient's hand or wrist for phlebitis or evidence of an infection.

STEP 7: Carefully remove the needle or the plastic catheter with one hand and with the other hand cover the insertion site with a sterile gauze square (2 x 2).

STEP 8: Press firmly for about a minute, or alternatively place two pieces of narrow tape, about 1 cm or ½ inch wide, directly across the gauze square.

STEP 9: Alternatively, after pressing on the gauze square, remove it and cover the insertion site with a sterile bandaid.

STEP 10: Prior to removing gloves, discard the needle or plastic catheter in a sharps container and place the IV tubing and any blood-contaminated waste items (cotton or gauze squares) in a plastic bag or leakproof, covered waste container.

STEP 11: Remove gloves by inverting and place them either in a plastic bag or a leakproof, covered waste container.

STEP 12: Wash hands or use antiseptic handrub as above.

ADMINISTERING BLOOD OR BLOOD PRODUCTS

Transfusion Procedure

STEP 1: Make sure all items for starting an IV (**Step 1** above), are available.

STEP 2: Additional items needed include:

- A #18 or #19 straight or butterfly needle or a plastic catheter
- An infusion (administration) set that has an inline filter, and the tubing also should be Y-type
- A 250 or 500 mL sterile, isotonic (0.9%) saline solution bottle or bag

Note: Sterile saline solution prevents red blood cells from breaking (hemolysis) and is used to keep the IV line open before starting blood or blood products, between units of blood or blood products, and after completing the transfusion to flush the inline filter and infusion tubing.

STEP 3: Explain the procedure to the patient; determine if s/he has ever had a transfusion and note reactions, if any.

STEP 4: Ask the patient to report chills, headaches, itching or rash immediately.

STEP 5: Establish an IV line with a large-gauge (#18 or #19 straight or butterfly needle or plastic catheter) as detailed in **Insertion Procedure for Establishing an IV line** (**Steps 3** through **21** above).

Note: Patients who have had blood transfusion reactions may have greater fear of transfusion, and may be at increased risk of recurrence.

STEP 6: Keep the IV line open with a sterile 0.9% (isotonic) saline solution.

STEP 7: With another health worker, correctly identify the blood product and make sure you have the correct patient:

- Confirm the patient's name and check her/his armband if available.
- Check the compatibility tag attached to the blood bag, including the expiration date of the blood (after which it should not be used).
- For whole blood, check the ABO group and Rh type, which should be on the patient's chart.
- Double-check the blood or type of blood product with the physician's order.
- Check the blood for clots.
- Record the baseline pulse and blood pressure.

STEP 8: Remove the protective cover from the blood or blood products bag or the bottle without touching the opening.

STEP 9: If using a Y-type infusion set, remove the protective cap covering the second insertion spike without touching the spike and insert it into the blood bag or bottle. (If using a single tubing infusion set, carefully remove the insertion spike from the saline bag or bottle, and without touching the spike, insert it into the blood bag or bottle.)

STEP 10: Begin the transfusion:

Note: If a reaction is suspected, **stop** the transfusion, flush the line with isotonic saline and infuse slowly to keep the IV line open and notify the blood bank or transfusion service and physician.

- Fill the inline filter.
- Adjust the rate to 2 mL per minute.

STEP 11: Immerse both gloved hands in a 0.5% chlorine solution, remove gloves by inverting and place them in the plastic bag or a leakproof, covered waste container.

STEP 12: Wash hands or use antiseptic handrub as above.

STEP 13: Monitor the patient's vital signs:

- Take the pulse and blood pressure every 5 minutes for the first 15 minutes of the transfusion and hourly thereafter.
- Observe the patient for flushing (red face or cheeks), itching, difficulty breathing, hives (clear fluid-filled lesions on the skin) or any other rash when checking the vital signs.

STEP 14: Record the administration of the blood or blood product in the patient's chart.

STEP 15: When the transfusion is completed, exchange a new IV solution bottle or bag for the empty blood bag or bottle and return it to the blood bank.

STEP 16: If no further infusions are ordered:

- Remove the needle or plastic catheter and infusion set as detailed in **IV Removal Procedure** (**Steps 1** through **9** above).
- Return the blood bag or bottle and tubing to the blood bank.

STEP 17: Prior to removing gloves, discard the needle or plastic catheter in a sharps container and place the blood administration kit, IV tubing and any blood-contaminated waste items (cotton or gauze squares) in a plastic bag or leakproof, covered waste container.

STEP 18: Remove gloves by inverting and place them either in a plastic bag or waste container.

STEP 19: Wash hands or use antiseptic handrub as above.

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