Blood Specimen Collection: Blood Cultures - CE

ALERT
Don appropriate personal protective equipment (PPE) based on the patient’s signs and symptoms and indications for isolation precautions.

Strictly adhere to guidelines for hand hygiene, standard precautions, and site preparation to minimize the risk of a health care–associated infection.19

Signs of nerve injury include severe, unusual or shooting pain, tingling or numbness or a tremor in the arm. If the patient complains of any of these symptoms during venipuncture, withdraw the needle immediately.5

Draw specimens for a blood culture before administering antibiotics.

OVERVIEW
Although recommendations are that trained phlebotomy personnel collect peripheral blood culture specimens by venipuncture to minimize collection errors,14 nurses may be responsible for specimen collection. Nurses should be familiar with the organization’s practice and the state’s nurse practice act regarding venipuncture, blood specimen collection, and delegation.

A blood culture specimen is a 20 to 30-ml blood sample drawn at one time from one location.2 Blood culture specimens should be drawn when the patient is experiencing signs and symptoms of bloodstream infection, including fever or chills, and before the administration of antibiotics to increase the likelihood of obtaining a true-positive result. If the patient is receiving antibiotic therapy when the specimen is collected, the laboratory should be notified because an additive can be applied to the culture medium to negate the antibiotic effect.24 Typically, two sets of blood cultures are ordered, each with one aerobic bottle and one anaerobic bottle. Orders regarding the spacing of the specimens may vary among practitioners and organizations.

In some instances, blood culture specimens from a central venous access device (CVAD) may be ordered. A CVAD specimen should be used only when a central line–associated bloodstream infection (CLABSI) is suspected.14 When a CLABSI is suspected, one set of specimens should be obtained via venipuncture and the other set should be obtained through the distal lumen of the CVAD suspected of being infected.16 When venipuncture is not possible, two blood specimens may be collected through different lumens of the same CVAD, if they are available. A higher rate of contamination has been found on blood samples obtained from central lines when compared with samples drawn from peripheral sites.25 The specimen bottles should be appropriately marked to reflect the sites from which the specimens were obtained.

Drawing at least two culture specimens from two different sites helps to distinguish between skin contamination and a true CLABSI.24,25 A CLABSI is confirmed when both cultures grow the same infectious organism. When only one of the cultures grows bacteria, the likely cause is contamination, not a true CLABSI.24

Caution should be taken to avoid contaminating the skin or equipment to minimize the risk of false-positive test results, which can lead to inappropriate antibiotic use.
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False-positive results may expose patients to additional laboratory tests and increased length of stay.

Blood culture specimens are usually drawn using either a needle and syringe or a vacuum extraction blood-sampling system that draws blood into vacuum-sealed test bottles. In both cases, a hollow-bore needle is inserted into the lumen of a vein to obtain the specimen. Straight needles from extraction-collection systems are not used with blood culture bottles. Instead, winged-butterfly needles with a short length of tubing may be approved by the organization for use.

The correct amount of blood required by the laboratory must be extracted into each bottle to ensure accurate results and decrease the patient’s risk of anemia. If more than one specimen is to be drawn during a single venipuncture, specimens for blood cultures should be drawn first to maintain asepsis and prevent contamination with additives from laboratory tubes.

Because limited venous access may be a life-threatening complication of venipuncture, maintaining the vein’s integrity is essential. A patient with veins that may collapse or become injured from the vacuum pressure may require an alternate method of specimen collection. In addition, a patient’s veins may be difficult to locate because of unusual anatomy, trauma from repeated phlebotomy, or edema. Transillumination and ultrasonography may be available to help detect veins that are impalpable or difficult to see.

Tourniquets should be used with caution. If a tourniquet is deemed necessary, the nurse should apply one for no longer than 1 minute to obtain valid results. Prolonged tourniquet application can cause stasis and hemoconcentration. Infection control standards require that tourniquets be single use. Staphylococcus aureus contamination from reused tourniquets is a common finding.

Venipuncture can be painful, and a patient may experience anxiety or fear before the procedure. In some cases, just the appearance of a needle is frightening, especially to a child. A calm approach and skilled technique may help limit a patient’s aversion to venipuncture. The application of a vapocoolant spray has been shown to be effective in reducing pain during venipuncture in children. Anxiety may be eased by communicating with the patient about how to help relieve his or her concerns.

EDUCATION

- Explain the purpose of collecting the blood specimen and the method to be used.
- Explain how a tourniquet, antiseptic swab, and venipuncture may feel.
- Explain that pressure is applied to the venipuncture site after the needle is withdrawn. Explain that the patient may apply pressure if he or she is able. If the patient has a bleeding disorder or is undergoing anticoagulant therapy, explain that applying pressure for a longer period of time may be required to achieve clotting.
- Instruct the patient to report persistent or recurrent bleeding or an expanding hematoma at the venipuncture site after the initial hemostasis is achieved.
- Encourage questions and answer them as they arise.
ASSESSMENT AND PREPARATION

Assessment
1. Perform hand hygiene and don gloves and PPE as indicated for needed isolation precautions.
2. Introduce yourself to the patient.
3. Verify the correct patient using two identifiers.
4. Determine whether antibiotics have been administered before specimen collection and inform the practitioner and laboratory of the time of antibiotic administration. Resin can be added to the culture medium to negate the antibiotic effect. If cultures are needed while the patient is receiving antibiotic therapy, obtain the specimen shortly before the next antibiotic dose.
5. Assess the patient's history for risks associated with venipuncture, such as anemia, anticoagulant therapy, low platelet count, a bleeding disorder, venous collapse, traumatic venipuncture, and phlebitis.
6. Determine the patient's ability to cooperate with the procedure and his or her experience with blood specimen collection.
7. Review the patient's history of venipunctures and ask about signs of adverse responses to previous venipunctures, including a vagal response.
8. Assess the patient for anxiety or fear related to the procedure. Provide reassurance and inquire about how to make him or her more comfortable.
9. Assess the need to apply a local anesthetic to reduce pain from the venipuncture per the organization’s practice.
10. Assess the patient for an allergy or sensitivity to antiseptic or analgesic agents or to latex (if latex is used in equipment [e.g., collection barrels, sheathed needles, tourniquets, bandages, specimen tube tops, gloves]).
11. Assess the patient for sites contraindicated for venipuncture, such as an IV access site; a site with a hematoma or signs of phlebitis or previous infiltration; a site on the arm on the side of a mastectomy or other lymphatic system compromise; a site affected by radiation, tissue injury, or infection; a site on the arm on the affected side of a stroke; or a current or planned hemodialysis access site.
12. Assess the patient’s hydration and perfusion status.
13. Assess the need for equipment to help localize the vein, such as a transilluminator or ultrasound machine.

Preparation
1. Review the anatomy of the venous system and the organization’s practice for the preferred veins for venipuncture.
2. Review the manufacturer’s instructions for using a blood culture vacuum-extraction system or a syringe and needle for the collection. If drawing blood from a central line, review the manufacturer’s instructions for the CVAD, including those regarding connector caps, proper syringe size for flushing and aspiration, and port clamping.
3. Determine whether precautions or preconditions must be met before the collection of blood specimens for other laboratory tests. Specimen timing can be affected by medication administration, nutritional intake, procedures, or diagnostic testing.
4. Consult with the practitioner about obtaining blood for all required tests during one venipuncture and eliminating routine testing.
5. At the patient’s side, access or complete laboratory requisitions or orders. Obtain computer-generated labels. Compare the labels with the patient’s identification band.
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by reading at least two identifiers (per the organization’s practice) and having the patient confirm the spelling of his or her full name and date of birth (when possible). Use computer-scanning verification, if available.

Do not draw blood if there is a discrepancy between the laboratory requisitions or labels and the patient’s identity.

6. Review orders for the number of blood culture specimen sets to be drawn and the time required between the venipuncture for each set. Compare them with the laboratory requisitions and labels.

a. Blood culture sets are usually drawn in immediate succession.

b. Blood specimens should be obtained in pairs from different peripheral sites.

7. Identify the appropriate laboratory tubes and bottles and validate the sequence in which the specimens are to be collected (if multiple specimens are required) and the volume required for each test with the laboratory.

a. Plan to aspirate only the amount needed to avoid blood loss.

b. Plan to obtain all ordered blood specimens at one time, if possible, to minimize entries into the bloodstream and the risk of infection.

8. Identify special requirements for the laboratory specimen, such as whether it must be placed in an ice slurry.

9. Review the requirements of the laboratory for labeling and handling the specimens.

10. Bring supplies and equipment, including specimen bottles and labels and an ultrasound machine or transilluminator, if required, to the patient’s side. Two culture bottles (one aerobic and one anaerobic) are required for each set of cultures.

a. Ensure that all equipment has been cleaned and disinfected using an Environmental Protection Agency-registered disinfectant per the organization’s practice.

b. Ensure that all work surfaces used to hold blood-drawing equipment, including chair arm extensions and tables, have been disinfected to protect the patient and the specimen from contamination.

c. Ensure that tube expiration dates have not passed and that all equipment and tubes are intact and free from defects or compromises.

d. Ensure that tubes have been stored upright and at the correct temperature (e.g., tubes with some fixative agents require refrigeration).

e. Do not preassemble devices before patient identification.

f. Ensure that devices for the blood collection process are from the same manufacturer.

11. Provide privacy for the patient.

12. Ensure that the lighting is appropriate for observing vein contours and colors.

13. Raise or lower the bed or chair to a comfortable working height to prevent injury.
14. Assist the patient to a comfortable supine or low-recumbent position and have the patient remove gum, mints, or food from his or her mouth. If drawing blood from a CVAD, position the patient so the device is exposed.

   Rationale: A low, supported position and an empty mouth reduce the risk of injury to the patient if he or she experiences lightheadedness, faints from vagal stimulation, or experiences a seizure.

15. Be prepared to manage venipuncture-associated vasovagal or seizure reactions for an at-risk patient.

PROCEDURE
Blood Specimen Collection via Venipuncture
1. Perform hand hygiene and don gloves and appropriate PPE based on the patient’s signs and symptoms and indications for isolation precautions.
2. Verify the correct patient using two identifiers.
3. Explain the procedure to the patient and ensure that he or she agrees to treatment.
4. Indicate the volume of blood needed for each test on the label on each bottle. Typically, the required amount is at least 10 ml for each bottle.
5. Support the patient’s arm and extend it to form a straight line from the shoulder to the wrist. Place a small pillow or towel under the upper arm or place the arm on the arm extension of the chair.

   Rationale: Proper patient positioning helps stabilize the extremity.

6. Place a clean cloth or paper drape under the patient’s arm.
7. Identify the best sites for venipuncture per the organization’s practice, avoiding contraindicated sites, such as IV access sites.

   a. Choose a vein that is easily visible without applying a tourniquet.

      Avoid the use of a tourniquet if possible.

   i. If IV fluid is being administered in one arm, choose a site on the opposite arm. If unable to locate a site on the opposite arm, look for a venipuncture site distal to the IV infusion site.

      Consult with the practitioner about stopping the IV infusion for 2 minutes before obtaining the blood specimen.

   ii. Choose a vein that is straight and does not divert into another branch; that has no swelling, hematoma, phlebitis, infection, or infiltration; and that has not had recent venous access or venipuncture. Typically, the median cubital vein is the easiest to puncture because it lies between muscles.

   b. Consider using ultrasonography or transillumination, per the organization’s practice, for a patient with veins that are difficult to observe or palpate.
c. If a tourniquet is deemed necessary, apply a single-use tourniquet proximal to and four to five finger widths above the site. If the venipuncture site will be on the same arm as an IV infusion site, place the tourniquet between the IV infusion site and the intended venipuncture site.

   Rationale: A tourniquet blocks venous return to the heart from the extremity, causing the veins to dilate for easier assessment.

i. Encircle the extremity and pull one end of the tourniquet tightly over the other, looping one end under the other.

   Apply the tourniquet loosely or do not use a tourniquet for a patient who has a history of bleeding, is easily bruised, has fragile skin, or has diminished circulation.

ii. Apply the tourniquet so it can be removed by pulling one end with a single motion.

   Do not keep the tourniquet on the patient longer than 1 minute. Prolonged tourniquet application causes stasis, hemolysis, and hemoconcentration because of changes in the vascular endothelium from increased venous pressure and hypoxia.

   Rationale: A healthy vein is elastic and rebounds on palpation. A thrombosed vein is rigid, rolls easily, and is difficult to puncture.

   Do not use a vein that feels rigid or cordlike or one that rolls when palpated.

   Rationale: Making a fist facilitates the distention of veins by forcing blood up from the distal veins. Vigorously opening and closing the fist may cause pseudohyperkalemia.

   e. Instruct the patient to make a fist without vigorously opening and closing it.

   Rationale: Warming enhances blood flow, making veins more prominent.

   If unable to locate an acceptable vein and a tourniquet was used, consider transillumination or ultrasonography, per the organization’s practice, to help locate an appropriately perfused vein before attempting venipuncture.
g. Inspect the vein to confirm the selected venipuncture site. If a tourniquet has been reapplied, quickly inspect the vein distal to the tourniquet, then release the tourniquet.

**Do not select a vein on the ventral surface of the wrist.**

8. As prescribed or per the organization’s practice, apply a topical anesthetic if required to reduce pain. Remove the anesthetic completely from the skin after the prescribed dwell time.

9. Prepare the collection equipment using bottles, holders, needles, syringes, and transfer devices from the same system and manufacturer. Rationale: Combining systems may cause injury to the patient or yield incorrect test results because of hemolysis, needle disengagement, or inadequate tube filling. Incompatibility of components may cause failure of the process.

**Do not use pediatric culture bottles for adult blood samples because smaller volumes diminish the yield of pathogens.**

a. Choose an appropriate-size needle that is small enough to fit in the vein but does not cause hemolysis.

i. Adults: 21 G to 23 G

ii. Children, older adults, or patients with small veins: 22 G to 23 G

iii. Neonates: 23 G

Rationale: Hemolysis may disrupt specimens drawn after blood culture specimens are drawn during the same venipuncture. Needles that are 23 G or smaller increase the risk of hemolysis. If the needle is too large for the vein, it tears the vein and causes bleeding.

b. If using a winged-butterfly needle system, ensure that the venipuncture needle with tubing and a safety device is securely attached to the vacuum-extraction system collection barrel. Alternatively, and if required, remove the sterile cap from the rubber sheathed end of the winged-butterfly needle tubing and make the Luer lock connection of the sheathed needle and the collection barrel. If a single-ended, winged-butterfly needle with tubing is used, make the Luer lock connection between the needle and the collection barrel housing of a sheathed needle.

**Keep the needle hub and the connection sites sterile.**

Vacuum-extraction system sheathed needles are considered sharps that are associated with needlestick injuries, and they must be disposed of in a sharps container that is within arm’s reach and is large enough to allow disposal of the entire device without detaching the needle. The flexible cover of the sheathed needle prevents blood from flowing when the needle...
is not engaged in a vacuum tube; however, the sheath does not prevent a needlestick injury if a finger inadvertently enters the collection barrel.

Use a new collection barrel for each patient. Do not detach the needle from the collection barrel for disposal after use.\(^2^9\)

c. If using a vacuum-extraction system, position the culture bottles securely, upright, and close enough to the venipuncture site so the tubing connected to the needle reaches from the selected vein to the upright bottle. Rest the collection barrel over the aerobic bottle. Wait to puncture the rubber stopper with the sheathed needle.

Rationale: Puncturing the stopper before the needle is in the vein causes the tube to lose its vacuum.

**Do not contaminate the top of the bottle after it is prepared with alcohol.**

d. If using a winged-butterfly or straight needle attached to a syringe, position the culture bottles securely upright and place a sterile transfer device housing a rubber-sheathed needle within reach.

Rationale: The rubber-sheathed needle housed in the collection barrel is used to puncture the rubber top of the vacuum bottle. When the rubber top is punctured, the vacuum in the bottle extracts blood from the syringe.

**Do not contaminate the transfer device or the top of the bottle after it is prepared with alcohol.**

10. Locate the selected venipuncture site.
11. Perform hand hygiene and don gloves and appropriate PPE based on the patient’s signs and symptoms and indications for isolation precautions.
12. Prepare the venipuncture site.

a. Cleanse the skin with alcohol, then allow to dry completely.\(^2^5\)
b. Prepare the insertion site with greater than 0.5% chlorhexidine in alcohol solution,\(^1^1,^2^2\) using a back-and-forth motion for a minimum of 30 seconds,\(^1^8\) and allow to dry completely.

**Use chlorhexidine cautiously because it may cause skin irritation and chemical burns in infants less than 2 months old or infants with compromised skin integrity (premature infants).\(^1^1\)**

c. Disinfect the culture bottle tops with 70% isopropyl alcohol (i.e., alcohol pad).\(^2^5\)

13. Obtain the blood culture specimens.
a. Locate the selected venipuncture site. If a tourniquet is deemed necessary, reapply the tourniquet and locate the vein.

b. Remove the cap from the venipuncture needle, maintaining the needle’s sterility. Inform the patient that he or she will feel a stick.

If contamination occurs, discard the needle and the collection barrel or syringe in a sharps container and prepare a new venipuncture set.

c. Place the thumb or forefinger of the nondominant hand distal to the venipuncture site and gently stretch the patient’s skin distal to the patient until it is taut and the vein is stabilized.

Rationale: Gently stretching the patient’s skin helps stabilize the vein and prevent rolling during needle insertion.

d. If using a butterfly needle, hold it by the wings; if using a straight needle attached to a syringe, hold it at the hub. Insert the needle at a 30-degree angle with the bevel up, just distal to the selected site.4

Rationale: The smallest and sharpest point of the needle should puncture the skin first to reduce the chance of penetrating the sides of the vein. Keeping the bevel up causes less trauma to the vein. Entering the skin distal to the vein prevents unanticipated vein puncture, which may result in inadequate blood specimen retrieval and hematoma.

e. Slowly insert the needle into the vein.

Rationale: Inserting the needle slowly prevents puncture through the opposite side of the vein.

14. Transfer the specimen to the culture bottles.

a. Butterfly-winged needle device method

i. Place a safety device on the syringe and distribute the blood volume evenly between the two culture bottles. Ensure a minimum of 10 ml for each bottle. Fill the aerobic bottle first.28

Rationale: The air in the butterfly tubing will be drawn into the collection chamber of the aerobic bottle.28

A. Without dislodging the needle from the vein, push the attached collection barrel onto the prepared aerobic culture bottle by inserting the sheathed needle through the rubber stopper so the vacuum pulls the blood into the bottle. Collect a minimum of 10 ml of blood into the aerobic bottle.2
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**Note the rapid flow of blood into the bottle. Failure of blood to appear indicates that the vacuum is lost or the needle is not in the vein. Avoid overfilling, which may cause a false-positive result.**

B. Detach the collection barrel and insert the sheathed needle through the rubber stopper of the prepared anaerobic bottle. Ensure that the culture bottle receives a minimum of 10 ml of blood.

*If an insufficient amount of blood is drawn, inoculate the aerobic culture bottle with the required amount and then inoculate the anaerobic culture bottle with the remaining volume of blood.*

ii. Detach the collection barrel after the anaerobic bottle is filled with 10 ml.

iii. If additional blood specimens are required for other laboratory tests, insert additional specimen tubes into the collection barrel and engage the sheathed needle, as needed. After tubes containing additives are filled with blood, gently turn them up and down immediately.

*Keep the bottles upright to prevent a backflow of broth into the patient’s vein.*

**Blood does not flow out of the collection barrel needle when it is detached from the bottles because the rubber sheath stops the blood flow.**

iv. If the blood flows sufficiently into the bottles or tubes and a tourniquet was used, release the tourniquet just before filling the last specimen tube or syringe. If blood flow is slow, and a tourniquet was used, wait to release the tourniquet until the last bottle or tube is almost full.

*Rationale: Releasing the tourniquet before filling the last specimen tube reduces bleeding at the site when the needle is withdrawn.*

v. Apply a sterile 2 × 2-in gauze pad over the venipuncture site, but do not apply pressure. Quickly but carefully withdraw the needle from the vein, activating the safety mechanism to prevent an accidental needlestick injury.

*Rationale: Applying pressure over the needle can cause discomfort and injury. Carefully removing the needle minimizes discomfort and vein trauma.*

vi. Immediately apply pressure over the venipuncture site with gauze until bleeding stops.

*Rationale: Direct pressure minimizes bleeding and prevents hematoma formation. A hematoma may cause compression and nerve injury.*
If the patient has a bleeding disorder or is undergoing anticoagulant therapy, maintain pressure for several minutes, as needed, until the bleeding stops.

Do not use a cotton ball or a rayon ball when applying pressure because of the potential for dislodging the platelet plug at the venipuncture site.

vii. Observe the venipuncture site for bleeding for 5 to 10 seconds before applying a bandage. Use tape or a bandage to secure the gauze and allow it to remain in place for at least 15 minutes.

Rationale: Applying gauze with tape or a bandage keeps the venipuncture site clean and controls oozing.

Instruct the patient not to bend his or her arm.

b. Needle and syringe method

i. Gently aspirate 20 ml of blood into an appropriate-size syringe.

Carefully assess the patient for the potential for venous collapse when using a syringe barrel that is 10 ml or larger. Consider that young children, older adults, and those who have received treatments damaging to the veins may not be able to withstand high pressure or may require a smaller syringe barrel. Pressure from a large barrel may cause vein wall damage, leading to infiltration. During aspiration, a smaller gauge syringe barrel exerts less pressure.

ii. If the blood is flowing sufficiently and a tourniquet was used, release the tourniquet just before filling the syringe.

Rationale: Releasing the tourniquet before drawing the last of the blood reduces bleeding at the site when the needle is withdrawn.

iii. Apply a sterile 2 × 2-in gauze pad over the venipuncture site, but do not apply pressure. Quickly but carefully withdraw the needle from the vein, activating the safety mechanism to prevent an accidental needlestick injury.

Rationale: Applying pressure over the needle can cause discomfort and injury. Carefully removing the needle minimizes discomfort and vein trauma.

iv. Immediately apply pressure over the venipuncture site with gauze until the bleeding stops.

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If the patient has a bleeding disorder or is undergoing anticoagulant therapy, maintain pressure for several minutes, as needed, until the bleeding stops.

Do not use a cotton ball or a rayon ball when applying pressure because of the potential for dislodging the platelet plug at the venipuncture site.4

v. Observe the venipuncture site for bleeding for 5 to 10 seconds before applying a bandage.4 Apply gauze with tape or a bandage for at least 15 minutes.4

Rationale: Applying gauze with tape or a bandage keeps the venipuncture site clean and controls oozing.

Instruct the patient not to bend his or her arm.

vi. Distribute the blood volume evenly between the culture bottles without replacing the needle. If both anaerobic and aerobic samples are needed, fill the anaerobic culture bottle first.23

A. Keep the bottle and syringe upright and inoculate the anaerobic bottle, ensuring that no air is transferred from the syringe into the anaerobic bottle.

Rationale: Transferring from the syringe alters the bottle’s anaerobic environment. If the bottle and syringe are held upright, air near the syringe plunger should not enter the anaerobic culture bottle.

After skin antisepsis, the volume of cultured blood is the next most important variable affecting the sensitivity of detection of bacteria and fungi in the blood.

B. Inoculate the aerobic culture bottle with a minimum of 10 ml for the most accurate results.2

15. Immediately discard the remaining sharp devices, including the collection barrel and transfer device, into an easily accessible sharps container.4 Do not recap needles or attempt to remove the needle from the collection barrel.20

Rationale: Discarding the collection barrel, needle, and tubing prevents cross-contamination from needlesticks and contact with blood.

16. Repeat the specimen collection sequence for a second set. Blood culture sets are usually drawn in immediate succession.

Rationale: Unless ordered by the practitioner or per the laboratory’s practice, blood culture specimens should be obtained from at least two separate blood draws on the same day or consecutive days and with two separate site preparations.25
17. Gently mix the culture broth and blood in the bottles.

   Rationale: Mixing gently blends the medium and the blood.

18. Examine the culture bottles for signs of external contamination with blood. Decontaminate the bottles, if necessary, per the laboratory’s practice.

   Rationale: Decontamination prevents cross-contamination and reduces the risk of exposure to blood-borne pathogens.

19. Help the patient assume a comfortable reclining position. Allow the patient to maintain this position for several minutes.
20. Prepare the specimens for the laboratory.

   a. In the presence of the patient, label the specimens per the organization’s practice.
   b. Prepare the specimens for transport.

      i. Place the labeled specimens in a biohazard bag.
      ii. If the specimens require ice for transport, place the specimens in a biohazard bag, then place the bag with the specimens into a second biohazard bag filled with ice slurry.

      Rationale: Placing the specimens in a separate bag protects the label from being damaged.

21. Immediately transport the specimens to the laboratory.
22. Discard supplies, remove PPE, and perform hand hygiene.

**Blood Specimen Collection via a Central Venous Access Device (CVAD)**

Avoid using a CVAD to obtain blood samples for culturing because these samples are more likely to produce false-positive results. Obtain a blood culture via a CVAD only if diagnosing a CLABSI or if adequate peripheral sites are not available.

1. Perform hand hygiene and don gloves and appropriate PPE based on the patient’s signs and symptoms and indications for isolation precautions.
2. Verify the correct patient using two identifiers.
3. Explain the procedure to the patient and ensure that he or she agrees to treatment.
4. Indicate the volume of blood needed for each test on the label on each bottle. The minimum amount needed for the most accurate analysis is 10 ml of blood for each bottle.
5. Assess the external CVAD site for signs of infection as well as leakage and dressing integrity and report signs of sepsis or infection immediately.
6. Select the appropriate lumen for blood sampling.
Rationale: The appropriate lumen is the largest one that is farthest from the heart and does not have instilled antibiotics.\(^{14}\)

7. If IV solutions or medications are infusing through the CVAD, determine whether stopping the infusion affects the patient’s hemodynamic stability. If appropriate, stop all infusions and flush with 0.9% sodium chloride solution. Research has not established a length of time for stopping the infusion nor the amount of flush solution to be used before obtaining blood from CVADs.\(^ {14}\) Follow the organization’s practice.

8. If the tubing must be detached from the CVAD, place a sterile cap on it.

   Rationale: Placing a sterile cap on the detached tubing maintains asepsis of the IV system.

9. Clamp the port before detaching any tubes, syringes, or devices if the CVAD uses a needleless connector cap with no internal mechanism.

   Rationale: Clamping the port prevents blood reflux out of the CVAD port.

10. Change the needleless connector cap, using aseptic technique. Ensure that no air enters the system.\(^ {14}\)

   **Consider the use of disinfection caps to reduce microbial contamination and rates of CLABSIs.**\(^ {12}\)

11. Disinfect the needleless connector using vigorous mechanical scrubbing for a minimum of 5 to 60 seconds,\(^ {12}\) according to the organization’s practice with an appropriate disinfecting agent (e.g., 70% isopropyl alcohol, an iodophor such as povidone-iodine, or greater than 0.5% chlorhexidine in alcohol solution), and allow the solution to dry.\(^ {12}\)

12. Gently aspirate a minimum of 10 ml of blood per bottle for accurate results.\(^ {2}\)

   **Follow the manufacturer’s instructions and the organization’s practice for the appropriate-size syringe for aspiration.**

   Carefully assess the patient for the potential for venous collapse when using a syringe barrel that is 10 ml or larger.\(^ {29}\)

   Consider that young children, older adults, and those who have received treatments damaging to the veins may not be able to withstand high pressure or may require a smaller syringe barrel. Pressure from a large barrel may cause vein wall damage, leading to infiltration. During aspiration, a smaller gauge syringe barrel exerts less pressure.\(^ {1}\)

   **Do not discard the initial sample from a CVAD because discarding does not reduce contamination rates or increase the**
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Sensitivity of blood cultures, and it can contribute to anemia.\textsuperscript{14,26}

13. Connect the syringe to a sterile safety transfer device to fill the bottles. Ensure that the syringe nozzle is not contaminated.\textsuperscript{21}

Rationale: Vacuum tubes may cause reflux of the broth media into the patient's bloodstream.

**Do not connect blood culture vacuum bottles directly to the CVAD via the sampling device because of the risk of broth medium reflux into the vein.**\textsuperscript{6}

14. Keep the bottle and syringe upright and inoculate the anaerobic bottle first, ensuring that no air is transferred from the syringe into the anaerobic bottle. Inject 10 ml of blood into each bottle.\textsuperscript{6}

Rationale: Blood obtained from a single site should be divided evenly between aerobic and anaerobic bottles. Transferring air trapped in the syringe alters the bottle's anaerobic environment. If the bottle and syringe are held upright, air near the syringe plunger should not enter the first (anaerobic) culture bottle. Air is acceptable in the second (aerobic) bottle.

**After skin antisepsis, the volume of cultured blood is the next most important variable affecting the sensitivity of detection of bacteria and fungi in the blood.**

15. If a second set of cultures from the CVAD is required, repeat the procedure from a second port. Ensure that the culture bottles are correctly labeled to indicate which port was used to collect each set.

**Follow the manufacturer’s instructions and the organization’s practice for the appropriate-size syringe for aspiration.**

16. Immediately discard the remaining sharp devices, including the transfer device, into an easily accessible sharps container.\textsuperscript{4} Do not recap needles or attempt to remove the needle from the collection barrel.\textsuperscript{20}

17. Repeat the specimen collection sequence for a second set. Blood culture sets are usually drawn in immediate succession.

Rationale: Unless ordered by the practitioner or per the laboratory’s practice, blood cultures should be obtained from at least two separate blood draws on the same day or consecutive days and with two separate site preparations.\textsuperscript{25}

18. Change the needleless connector cap if blood or debris is visible, using aseptic technique and vigorous mechanical scrubbing.\textsuperscript{12} Ensure that no air enters the system.\textsuperscript{14}
19. Lock the port with solution per the manufacturer’s recommendation and per the organization’s practice.
20. Clamp the port or reattach the infusion tubing, using aseptic technique, and resume the ordered infusion.
21. Gently mix the culture broth and blood in the bottles.

   Rationale: Mixing gently blends the medium and the blood.

22. Examine the culture bottles for signs of external contamination with blood. Decontaminate the bottles, if necessary, per the laboratory’s practice.

   Rationale: Decontamination prevents cross-contamination and reduces the risk of exposure to blood-borne pathogens.

23. Help the patient assume a comfortable reclining position. Allow the patient to maintain this position for several minutes.
24. Prepare the specimens for the laboratory.

   a. In the presence of the patient, label the specimens per the organization’s practice.19
   b. Prepare the specimens for transport.

      i. Place the labeled specimens in a biohazard bag.
      ii. If the specimens require ice for transport, place the specimens in a biohazard bag, then place the bag with the specimens into a second biohazard bag filled with ice slurry.

   Rationale: Placing the specimens in a separate bag protects the label from being damaged.

25. Immediately transport the specimens to the laboratory.
26. Discard supplies, remove PPE, and perform hand hygiene.
27. Document the procedure in the patient’s record.

**MONITORING AND CARE**
1. Monitor the patient’s tolerance of the venipuncture. Look for signs of anxiety or fear.

   Rationale: A patient may require more venipunctures in the future; therefore, addressing concerns and letting the patient express emotions may reduce any aversion to future venipunctures. Documenting the patient’s response allows for improved care planning for future venipunctures.

2. Reassess the venipuncture site to determine whether bleeding has stopped or a hematoma has formed.
3. Check the laboratory report for test results and compare them with the patient’s baseline and trends. Report abnormal results or results outside of the prescribed range to the practitioner per the organization’s practice.
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4. Monitor hemoglobin and hematocrit values for anemia if frequent blood sampling is needed. Report decreased values to the practitioner.
5. Assess the patient for infection or phlebitis using standardized scales. Report pain, burning, stinging, erythema, warmth, or subcutaneous swelling to the practitioner.
6. Report adverse events in an incident-reporting system.
7. Assess, treat, and reassess pain.

EXPECTED OUTCOMES
- Venipuncture is successful on initial attempt.
- Aseptic technique is maintained.
- Venipuncture site shows no evidence of continued bleeding or hematoma after specimen collection.
- Patient tolerates procedure with minimal anxiety, fear, or discomfort.
- All required laboratory specimens are collected, and accurate results are obtained.

UNEXPECTED OUTCOMES
- Hematoma forms at venipuncture site.
- Infection or phlebitis develops at venipuncture site.
- Nerve or adjacent tissue injury occurs.
- Patient has vasovagal response, including dizziness, fainting, or loss of consciousness.
- Hemostasis is not achieved.
- Specimen has a false-positive result.
- Laboratory specimen is inadequate for testing and cannot be processed.
- Aseptic technique is not maintained.
- Needlestick injury occurs.

DOCUMENTATION
- Date and time of venipuncture, number and location of attempts, and name and credentials of person performing procedure
- Specimens obtained and disposition of specimens
- Location and description of venipuncture site
- Volume of blood drawn for a child, a patient undergoing frequent blood sampling, or a patient with anemia
- Abnormal laboratory test results and related interventions
- Communication of laboratory results to practitioner
- Inability to obtain sample
- Patient and family education
- Patient’s tolerance of venipuncture
- Unexpected outcomes and related nursing interventions

PEDIATRIC CONSIDERATIONS
- Use the appropriate-size vacuum bottles or tubes and vacuum strength. Large tubes with full vacuum may exert too much pressure on a child’s vein.
- Carefully assess a child who is at risk for venous collapse from the vacuum-extraction system. A young child may not be able to withstand vacuum system
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pressure or may require a smaller tube. Pressure from larger tubes may cause vein wall damage, leading to infiltration.

- Explain the procedure to the child in a manner that is consistent with his or her developmental level.

- Prepare the child for the procedure using clear, simple explanations. Use distraction techniques or the assistance of a child-life specialist to assist with pain management.

- If possible, draw a child’s blood specimens in a treatment room to maintain the feeling that his or her room is a safe place.

- Before performing a venipuncture on a child, assess several age-appropriate, organization-approved veins, such as the scalp, antecubital fossa, saphenous, and hand veins.

- There is no consensus on the use of chlorhexidine gluconate in children younger than 2 months old; therefore, follow the organization’s practice.

- Minimum and ideal volumes for blood culture specimens for a neonate and child vary based on weight.

- When collecting a blood culture specimen in a child, fill the aerobic bottle first and then the anaerobic bottle. If there is insufficient blood for both bottles, fill only the aerobic bottle.

OLDER ADULT CONSIDERATIONS

- Older adults have fragile veins that are easily traumatized during venipuncture. Applying a warm compress may help with obtaining a blood sample. Using a small-gauge needle may also help.

- Use the appropriate-size vacuum bottles or tubes and vacuum strength. Large tubes with full vacuum may exert too much pressure on an older adult’s vein.

- An older adult may not be able to withstand vacuum-system pressure or may require a smaller tube. Pressure from larger tubes may cause vein wall damage, leading to infiltration.

REFERENCES


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*In these skills, a “classic” reference is a widely cited, standard work of established excellence that significantly affects current practice and may also represent the foundational research for practice.

Elsevier Skills Levels of Evidence
- Level I - Systematic review of all relevant randomized controlled trials
- Level II - At least one well-designed randomized controlled trial
- Level III - Well-designed controlled trials without randomization
- Level IV - Well-designed case-controlled or cohort studies
- Level V - Descriptive or qualitative studies
- Level VI - Single descriptive or qualitative study
- Level VII - Authority opinion or expert committee reports

Supplies
- Alcohol (70%)
- Antiseptic agent for skin preparation (alcohol, chlorhexidine and alcohol combination, or tincture of iodine per the organization’s practice)
- Appropriate size needles, sterile syringes, and sterile Luer lock transfer device, or winged-butterfly needles with extension tubing and collection barrels
- Blood culture bottles: one anaerobic and one aerobic per set of cultures ordered
- Clean cloth or paper drape
- Gloves and PPE, as indicated
- Sterile gloves, as indicated

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- Identification labels with proper patient identifiers
- Laboratory requisition (appropriate patient identification, date, time, and name of test)
- Occlusive biohazard bag or approved container for delivery of specimen to laboratory
- Single-use tourniquet
- Small pillow or folded towel, or chair with special arm extension
- Sterile 2 × 2-in gauze pads
- Sterile adhesive bandage or tape
- Topical anesthetic agent and occlusive dressing, if needed
- Transilluminator or ultrasound machine, if needed
- Warm compress, if needed
- Sharps container

Supplies required for additional nonculture specimens, as needed:
- Additional occlusive bag
- Appropriate collection tubes
- Ice slurry, if required for specimen storage and transport

Supplies for obtaining a sample from a CVAD:
- 10-ml syringes or appropriate-size barrel for sufficient volume for specimen
- IV tubing end cap (sterile)
- Preservative-free prefilled normal saline for injection syringes
- Sterile Luer lock transfer device
- Sterile needleless connector caps

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