CHAPTER 217

DRAWING BLOOD CULTURES

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Bacteremia and septicemia are potentially life-threatening conditions caused by a variety of microorganisms. The successful isolation of microorganisms from blood requires an understanding of the intermittent nature of most bacteremias, the low order of magnitude of most bacteremias, and the great variety of organisms capable of causing septicemia.

Consideration must first be given to the patient's clinical status. Indications for obtaining blood cultures are outlined later. Note that 25% of patients with documented bacteremia have periods without fever. In the elderly population, the proportion is even higher, with 50% of bacteremic patients older than 65 years of age being afebrile.

Because most bacteremias are intermittent, blood collections for culture ideally should be made intermittently during a 24-hour period. Two separate blood culture sets should be collected within a 24-hour period. However, if urgent administration of antibiotics is clinically indicated, two sets of cultures from two different sites should be obtained, separated by 20 to 30 minutes if possible. Cultures should also be obtained through any vascular access devices that have been in place at least 48 hours. Each set of culture bottles has one aerobic and one anaerobic bottle.

Most bacteremias are of a very low magnitude, so an adequate volume of blood should be collected for each set of cultures. Small children usually have higher numbers (concentrations) of bacteria in the blood than adults, which means that smaller quantities of blood may be obtained from children. Appropriate volumes are noted in Table 217-1.

INDICATIONS

- Fever and unexplained alterations in mental status, functional status, or autonomic status in a previously healthy patient
- Fever and no source of infection, especially in a patient younger than 2 years of age or older than 65 years of age
- Fever of unknown origin
- Immunocompromised status with a fever and no source
- All febrile infants younger than 3 months of age
- Persistent rigors, with or without fever
- Fever, or no fever in a patient with a toxic or "septic" appearance (including unexplained hypotension, altered mental status, or shock)
- Possible infectious endocarditis (hematuria and elevated sedimentation rate)
- Serious focal infections such as meningitis, septic arthritis, and osteomyelitis
- Patients with pneumonia or pyelonephritis and need for hospitalization or with signs of toxicity

CONTRAINDICATIONS

There are essentially no contraindications to drawing blood cultures. As with any patient, blood should not be drawn through infected skin sites.

EQUIPMENT

- Alcohol pads.
- 2% tincture of iodine in 70% alcohol (alternatively, 2% iodine solution or 10% povidone–iodine [Betadine] may be used).
- Chlorhexidine (Hibiclens) may be used in the iodine-allergic patient.
- Tourniquet.
- Gloves and any equipment needed to follow universal blood and body fluid precautions.
- 21-gauge needle.
- 30-mL syringe.
- Set of blood culture bottles, aerobic and anaerobic, with labels.

PREPROCEDURE PATIENT PREPARATION

Drawing blood for culture does not entail any more risk than drawing blood for any other purpose. Patients should be warned about the needlestick and the potential for bleeding, bruising, and infection. Written consent for this procedure is not necessary.

TECHNIQUE

1. Fill in the laboratory request form and explain the procedure to the patient.
2. Apply the tourniquet and determine the location of the vein to be used for venipuncture (Fig. 217-1A).
3. Cleanse the skin with alcohol swabs three times or until pads are free of surface dirt.
4. Allow the skin to dry.
5. Apply iodine three times in centrifugal circles from the anticipated site of venipuncture.
6. After the third swab, allow to dry at least 60 seconds.
7. Remove the protective cap and cleanse the top of the culture bottles with alcohol swabs.
8. Wipe off dry iodine at the venipuncture site with alcohol swabs. Do not palpate the vein or the area where the needle will be inserted after disinfecting the site. Clinicians should follow universal blood and body fluid precautions.
9. Obtain the required volume of blood (see Table 217-1 for recommended blood volumes by patient size).
10. Immediately apply pressure to the puncture site (after removing the needle) with a clean cotton sponge.
11. Place up to 10 mL of blood in each culture bottle. (These two bottles constitute one blood culture "set.")
12. Inoculate both bottles without changing needles.
13. Repeat at different sites or different times for the requisite number of blood culture sets.
14. Transport the blood cultures as soon as possible to start the incubating process.
15. Specimens need to be held for an extended duration when culturing blood for fungi or fastidious bacteria.

TABLE 217-1 Optimal Specimen Volumes to Be Drawn per Blood Culture Set

Age Group	Ideal Volume per Set (mL)
Neonates	1–2
Infants 5–10 kg	2–4
Children 7–20 kg	3–8
Children 20–40 kg	10
Children >40 kg	20–30
Adults	20–30

COMPLICATIONS

- Bleeding
- Bruising
- Infection

INTERPRETATION OF RESULTS

In the case of a positive blood culture, the offending organism(s) are identified. If sensitivities have been ordered, the antibiotic susceptibility or resistance is reported.

One of the more challenging aspects of interpreting blood culture results is determining which positive blood cultures are actually false-positive results. Features of false-positive blood cultures are outlined as follows:

- Coagulase-negative staphylococci (*Staphylococcus epidermidis*) and *Streptococcus viridans* in a single bottle in patients not suspected of having infectious endocarditis and without chronic indwelling intravenous catheters are usually contaminants.
- *Corynebacterium*, *Propionibacterium acnes*, and *Bacillus* species are usually contaminants, but they can be pathogens in immunocompromised hosts.
- Multiple organisms growing from the same bottle suggests contamination.
- Species that grow out after a prolonged culture have a greater likelihood of being contaminants.
- The patient's symptoms have resolved or are inconsistent with sepsis. However, special consideration must be given to infectious endocarditis, which can have an indolent course.
- A primary infected source, such as urine, yields a different pathogenic isolate.

CPT/BILLING CODES

If cultures are grown in the office and organisms identified, laboratory codes are as follows:

87040 Culture, bacterial; blood, aerobic, with isolation and presumptive identification of isolates (includes anaerobic culture, if appropriate)

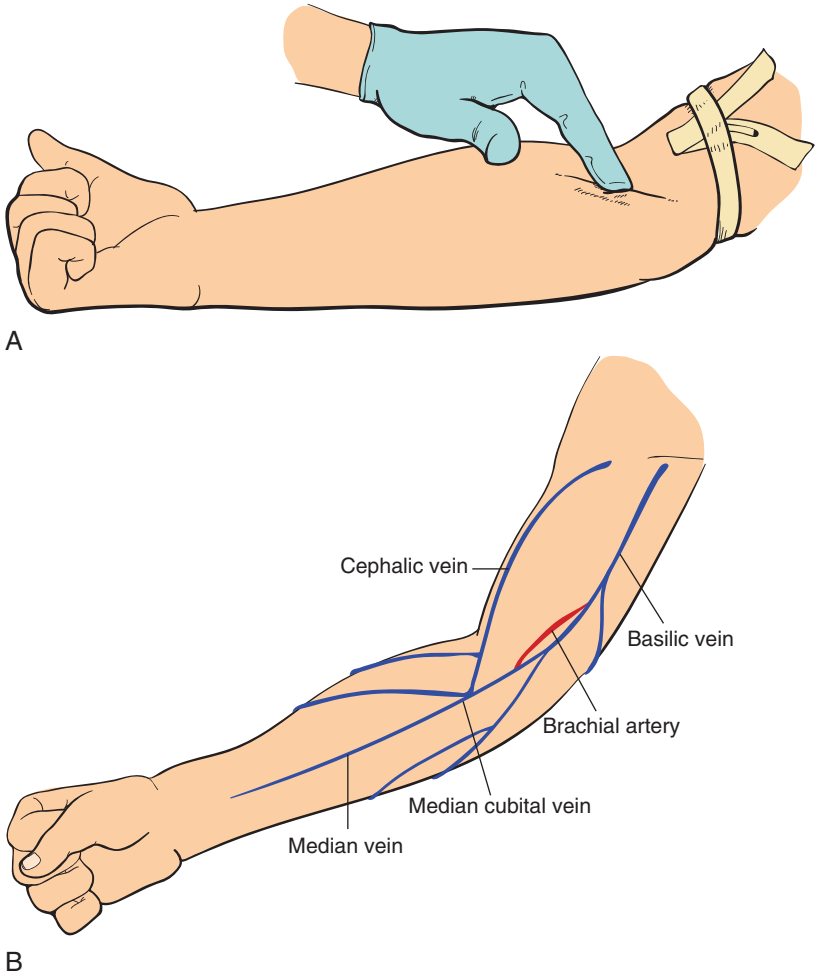

Figure 217-1 Venipuncture. **A,** After the tourniquet is applied, the vein is located. **B,** Veins in arm.

87103 Culture, fungi (mold or yeast) isolation, with presumptive identification of isolates, blood

There is no specific code for drawing blood. Add laboratory handling fee (99000) to office visit.

ICD-9-CM Diagnostic Codes

038.0 Septicemia, streptococcal
038.2 Septicemia, pneumococcal
038.3 Septicemia, anaerobic
038.9 Septicemia, unspecified
771.83 Bacteremia, newborn
790.7 Bacteremia

Supplier

(See contact information online at www.expertconsult.com.)

BacT/Alert blood culture bottles
Organon Teknika Corp.

BIBLIOGRAPHY

Larosa S, Opal SM: Sepsis. In Dale DC (ed): Infectious Diseases: The Clinician's Guide to Diagnosis, Treatment, and Prevention. New York, WebMD Professional Publishing, 2007.

Little JR, Murray PR, Traynor PS, Spitznagel E: A randomized trial of povidone–iodine compared with iodine tincture for venipuncture site disinfection: Effects on rates of blood culture contamination. Am J Med 107:119–125, 1999.

Madell GL, Bennett JE, Dolin R (eds): Principles and Practice of Infectious Diseases, 5th ed. New York, Churchill Livingstone, 2000.

Mimoz O, Karim A, Mercat A: Chlorhexidine compared with povidone-iodine as skin preparation before blood culture: A randomized, controlled trial. Ann Intern Med 131:834–837, 1999.