
بسم الله الرحمن الرحیم

Lab. Diagnosis of Catheter Associated BSI

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Introduction

Central catheter infection may manifest as:

- infection at the skin insertion site
- Cellulitis along the soft tissues overlying the tunneled portion
- Bacteremia without evidence of external infection
- Bacteremia occurs secondarily to infection of the central catheter
- More serious complications, including septic thrombophlebitis or endocarditis.

Common Agents of Intravenous Catheter–Associated Bacteremia
Staphylococcus epidermidis
Other coagulase-negative staphylococci
Staphylococcus aureus
Enterobacteriaceae
Pseudomonas aeruginosa
Candida spp.
Corynebacterium spp.
Other gram-negative rods

Diagnostic Methods

- Qualitative cultures: Catheter Tip & Blood Cultures
- Semi quantitative: (roll plate) cultures
- Quantitative cultures:

1. Lysis-Centrifugation System of ISOLATOR
2. Sonication
3. Catheter flush cultures
4. Differential Time-to-Positivity (DTP) Cultures

Catheter tip cultures

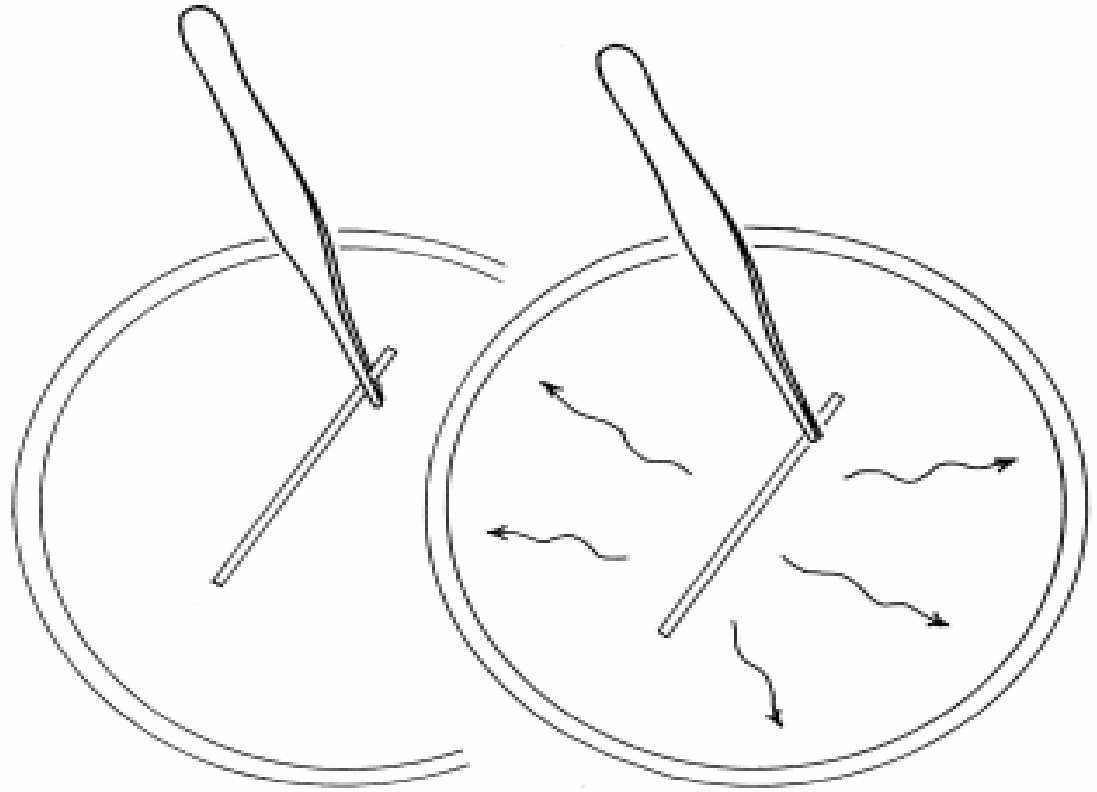
- A negative result is more value
- Perform skin antisepsis with 70% alcohol or chlorhexidine (>0.5%)
- Observing aseptic technique.
- Holding the distal end over a sterile container, cut the tip with a sterile scissors, dropping the last 2 to 3 in. into the container.
- Avoid drying by sealing the tube and submit to the laboratory as soon as possible

- Catheter tips should not be placed in saline or transport medium.
- Culture in broth: a single contaminating microbe can give a positive result
- Submit catheter tips for culture only if there are signs of infection
- Aspirates of pus or fluid expressed from an infected subcutaneous catheter tunnel track may be sent.
- Catheter tips add little to the diagnosis of catheter-related sepsis.

Semi quantitative plate method

- Most laboratories perform the semi quantitative method
- Using a sterile forceps, remove catheter tip from transport tube.
- Lay catheter tip on BAP.
- Roll the tip back and forth across the entire surface of a BAP (and, optionally, either MAC or EMB, in addition to the BAP) using sterile forceps and exerting slight downward pressure.
- If the tip is too long, using sterile scissors.
- The proximal end may be rolled on a second plate.
- Incubate plates at 35C in CO2.

Inoculation of catheter tip to agar plate.



- If the specimen is from a patient on total parenteral nutrition or is the catheter tip from a hyper alimentation line, culture also for *M.furfur*.
- Using a sterile pipette, add a small drop of olive oil to the initial area of roll after inoculation of the blood plate.
- Do not allow the oil to spread beyond a small area of the plate.
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- **NOTE:** The diagnosis of catheter infection with *M. furfur* is difficult with most blood culture systems. However, the organism load in the catheter is high and a Gram stain of a drop of blood from the catheter hub will generally demonstrate the infecting organisms, without removal of the catheter.

- Cultures from central line and vascular catheter tips should be held for up to 4 days, mainly to look for yeasts, including *M. furfur*, which grow as pinpoint colonies in 3 days.
- Cultures from central nervous system shunt tips should be incubated for up to 14 days in order to recover important slow-growing pathogens such as *Propionibacterium acnes*.

- Read the semiquantitative plates at 24, 48, 72, and 96 h.
- Count each type of colony isolated, comparing growth on each medium.
- Only enumerate the growth on the BAP; MAC or EMB is used only to provide separation of colony types.

Identify to at least the genus level any of the following:

Each organism present from vascular catheter tips with colony counts of >15 CFU, including Gram-positive rods

For counts of <15 CFU, identify only significant pathogens (e.g., *Candida albicans,* group A streptococci, and Gram-negative rods).

Save plates with growth for 1 week for comparison in case blood cultures become positive

Reporting results

- For any morphotype with a count of >15 CFU
- If >15 CFU of different morphologies of coagulase-negative staphylococci are present, report "[number] CFU of coagulase-negative staphylococci (mixed morphologies)."

If any morphotype has <15 CFU

- Report significant pathogens by name.
- Report minimal identification of pure cultures of skin microbiota, e.g., staphylococci or Gram-positive rods.

- If organisms are too numerous to count, report as “>100 CFU.”
- Report preliminary negative cultures as “No growth at x days,” where “x” is the number of days of incubation.
- Report final negative cultures as, e.g., “No growth at 4 days.”
- If Gram-negative rods or *S. aureus* is isolated and no blood culture was submitted, add the following note to the report: “Submit blood cultures to diagnose catheter-related sepsis.”

Interpretation

- Antimicrobial susceptibility testing should be performed on all significant isolates .
- Different morphotypes of the same organism (e.g., two or more species of coagulase-negative Staphylococcus) may be recovered from the blood and the device.
- These morphotypes may have different antimicrobial susceptibility profiles, and antimicrobial therapy should be directed against the most resistant isolate.

- Semiquantitative catheter tip cultures are estimated to have a sensitivity of 85% in diagnosis of catheter-related bacteremia, but the specificity to diagnose catheter-related sepsis is **low**

Sonication Method for Culture of Catheter Tips

- Place catheter tip in 10 ml of TSB.
- Sonicate for 1 min at 55,000 Hz and 125 W.
- Vortex for 15 s.
- Add 0.1 ml of broth to 9.9 ml of saline. Vortex.
- Drop 0.1 ml of broth and 0.1 ml of saline suspension onto separate BAP and MAC (or EMB).
- Incubate for 48 h in 5% CO2 and count colonies.

INTERPRETATION

- A count of more than **100 CFU** is considered significant for catheter-related infection.
- If too numerous to count, multiply the number of colonies on the saline culture plate by **10* 4 CFU.**

REPORTING RESULTS

- Report the genus and species of organisms present, preceded by their count in CFU.
- If organisms are too numerous to count on the higher-dilution plate, report as "Greater than 10*6 CFU."
- If no organisms are present, report "No growth at 1:100 dilution." detection of catheter-related sepsis.

- Quantitative sonication method is reported to be 20% more sensitive than the semi quantitative culture method in the diagnosis of catheter-related bloodstream infection
- Although this method is more reliable than the roll plate method it is not clear whether the difference is clinically significant.
- **Blood cultures remain a very important part of detection of catheter-related sepsis**.

Differential Time-to-Positivity (DTP) Cultures

- **Collect two sets** of paired blood samples, one through the catheter and one from a peripheral site.
- samples must be obtained within 15 min of each other.
- Bottles must be clearly labeled with the exact draw site.
- Perform skin antisepsis.
- Perform catheter port antisepsis.

Lysis-Centrifugation System of ISOLATOR

- The ISOLATOR system consists of:
- Vacutainer tubes for blood collection that contain lysing, antifoaming, and anticoagulating agents.
- The lysis of cells by centrifuge at 3,000 × g for 30 min
- inoculate of the sediment onto anaerobic & aerobic plates
- plates are incubated for 4 days unless unusual fastidious organisms are suspected.

Interpretation

- If the blood collected through the catheter has a count that **is 5- to 10-fold greater** than the count of the same microorganism from the peripheral vein, there is evidence of catheter-related sepsis

DTP cultures

- Report the time from loading of the blood culture bottle onto the incubator until the bottle is flagged as positive .
- **For DTP cultures**, the growth of the same microorganism from the catheter draw sample at least 2 h before growth is detected from the peripheral sample is indicative of catheter-related bloodstream infection.