Catheter Related Bloodstream Infections: Pearls for diagnosis and prevention

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Disclosure

• I have no relevant financial relationships to disclose
Learning Objectives

• Define and understand diagnostic criteria for CRBSI & CLABSI

• Interpret blood culture results as true CLABSI, secondary bacteremia, colonization or contamination

• Review pearls for the diagnosis and prevention of CLABSI
Terminology & Diagnostic Criteria
Catheter Related Bloodstream Infection (CRBSI)

- Bacteremia (from peripheral cx)
- Intravascular catheter in place
- Clinical signs of infection
- No other apparent source

Proof that the catheter is the culprit

The burden of “proof”

Growth of the same organism from catheter tip culture
- (>15 CFU per catheter segment if semiquantitative, >100 CFUs if quantitative culture)

OR

If 2 simultaneous blood samples were drawn (one from a catheter and one from a peripheral vein):
- **CFU count from catheter sx ≥ 3x greater than CFU from peripheral cx** (quantitative cultures)
  OR
- **Growth from catheter cx ≥ 2 hours faster than peripheral cx** (differential time to positivity)

Central Line Associated Bloodstream Infection (CLABSI):

CDC Definition:

A primary bloodstream infection (BSI) in a patient that has/had a central line within the prior 48-hour period that is not due to infection at another site.

- Used for surveillance and reported to the CDC/NHSN, overestimates true incidence of CRBSI

https://www.cdc.gov/infectioncontrol/guidelines/bsi/background/terminology.html
In the face of positive cultures…

Ask yourself:

- Is this true bacteremia?
- Is the catheter the culprit?

Bacteremia (from peripheral cx) + Intravascular catheter in place + Clinical signs of infection + No other apparent source - Proof that the catheter is the culprit
Cases
Case #1

• 65 year old woman with history of altered GI anatomy and recurrent bacteremias
• Recent history of drug resistant E coli bacteremia for which she just completed a course of antibiotics via PICC line (still in place)
• Came to clinic for follow up and complained of vague fatigue and headache.
Case #1

• Blood cultures were drawn from PICC and showed:
  PICC culture #1: 2/3 bottles candida parapsilosis at 13 hours

• Patient was sent to ER. Repeat cultures obtained (prior to antimicrobials):
  PICC culture #2:  Negative
  Peripheral culture:    Negative
Case #1: CRBSI?

PICC culture #1: 2/3 bottles candida parapsilosis @ 13 hrs
PICC culture #2: Negative
Peripheral culture: Negative

Is this true bacteremia? **NO**
Is the catheter the culprit? **YES**

Bacteremia (from peripheral cx) + Intravascular catheter in place + Clinical signs of infection + No other apparent source + Proof that the catheter is the culprit

So what is this?
Case #1: Line colonization

• Suspect when:
  • Culture positive from line, negative from peripheral draw
  • Patient appears well

• Common organisms:
  • Skin commensals: coagulase-negative staphylococci, S. aureus, enterococci, and candidal species

Figure 2. Diagram of an intravenous catheter with biofilm growth.

HCW: healthcare worker.

Image courtesy of Remedica Journals
Case #1: Line colonization

- **Treatment:**
  - Close monitoring (consider no antibiotics)
  - Repeat cultures
  - **Remove catheter if able**
  - Consider antibiotic or alcohol lock therapy if catheter needs to remain in place
Pearl #1

*Don’t routinely draw blood cultures from central lines*

- Contamination and colonization rates are high, frequent false positives
- Always draw from peripheral sites
  - If concern for CLABSI, draw from peripheral and catheter at the same time

Case #2

- 78 year old woman in the cardiac ICU after cardiac arrest. A CVC is placed in the RIJ on admission for use of pressors and hemodynamic monitoring. Urinary catheter placed on admission and kept in place for close monitoring of urine output.

- On hospital day 6, she develops fever, leukocytosis, and mild hypotension.
Case #2

• Blood cultures were drawn:
  - CVC cx: E coli 2/3 bottles @ 18 hrs
  - Peripheral cx: E coli 3/3 bottles @ 14 hrs

• Urinalysis: 51-100 WBCs, +LE, and gram negative bacilli on gram stain

• Urine culture: E coli >100,000 CFUs
Case #2: CRBSI?

CVC cx:  E coli 2/3 bottles @ 18 hours
Peripheral cx:  E coli 3/3 bottles @ 14 hours
Urine culture:  E coli >100,000 CFUs

Is this true bacteremia? **YES**
Is the catheter the culprit? **NO**

Bacteremia (from peripheral cx) + Intravascular catheter in place + Clinical signs of infection + No other apparent source + Proof that the catheter is the culprit

So what is this?
Case #2: Secondary Bacteremia

- **Diagnosis:** when primary source is an infection at another site is secondarily seeding bloodstream
- More microbial growth from the periphery than from the catheter culture

  - CVC cx: *E coli* 2/3 bottles @ 18 hours
  - Peripheral cx: *E coli* 3/3 bottles @ 14 hours

- **Treatment:**
  - Antibiotics for primary source
  - Do not need to routinely remove line, but may need to consider lock therapy

* Assuming the same volume of blood was drawn in each blood culture bottle
Pearl #2

Always draw the same amount of blood in each blood culture to ensure accurate results

- 8-10 ml blood/bottle is ideal
- Less than this will decrease diagnostic yield considerably (decreases sensitivity) and affects differential time to positivity

Example:

CVC cx: S. aureus 2/3 bottles @ 13 hrs (10ml blood)
Peripheral cx: S. aureus 3/3 bottles @ 15 hrs (4 ml blood)

This impacts interpretation of results!

Case #3

- 74 year old man admitted to the ICU for COPD exacerbation requiring intubation. CVC is inserted for central access

- The patient improves and is extubated. The CVC is removed and his line is “deescalated” to a triple lumen PICC.

- Prolonged hospitalization due to multiple complications, including CHF exacerbation, AKI, and deconditioning
Case #3

- Hospital day 17, patient develops fever, leukocytosis, and erythema noted at PICC site

- Blood cultures are drawn:
  - PICC cx: S. aureus 3/3 bottles @ 18 hrs
  - Peripheral cx: S. aureus 3/3 bottles @ 21 hrs

(10 ml blood drawn for each)
Case #3: CRSBI?

PICC cx (10ml):  S. aureus 3/3 bottles @ 18 hours  
Peripheral cx (10ml):  S. aureus 3/3 bottles @ 21 hours

Is this true bacteremia? **YES**  
Is the catheter the culprit? **YES**
Case #3: CLABSII/CRBSI

• Meets criteria for confirmed CRBSI:
  • Positive peripheral culture, positive line culture
  • No other known source
  • Growth from catheter culture detected > 2 hours prior to peripheral culture

• Common pathogens: coagulase-negative staphylococci, S. aureus, enterococci, and candidal species

• Treatment:
  Antimicrobial therapy + catheter management
  (remove, exchange, or lock)
Pearl #3

Do not use PICC lines as a strategy to reduce CLABSI rates or “deescalate lines”

- In ICU patients, infection risk of PICC approaches that of temporary CVC
Pearl #4

Always use the fewest number of lumens possible to reduce risk of infection and thrombosis

Take home points

• Diagnosis of CRBSI requires:
  
  Bacteremia
  (from peripheral cx)

  Intravascular catheter in place

  Clinical signs of infection

  No other apparent source

  Proof that the catheter is the culprit

• Differential diagnosis for + cultures:

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<th>Colonization/ Contamination</th>
<th>Secondary bacteremia</th>
<th>CRBSI/ CLABSI</th>
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<td>Peripheral cx</td>
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<td>Catheter cx</td>
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Take home points

• Don’t routinely draw blood cultures from central lines (high rate of false positives)

• Always draw same amount of blood for each culture (8-10ml for typical cultures)

• Do not use PICCs as a CLABSI reduction strategy

• Always choose the lowest number of lumens possible to reduce risk of infection and thrombosis
Questions & Discussion

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