Catheter Related Bloodstream Infections: Pearls for diagnosis and prevention

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Disclosure

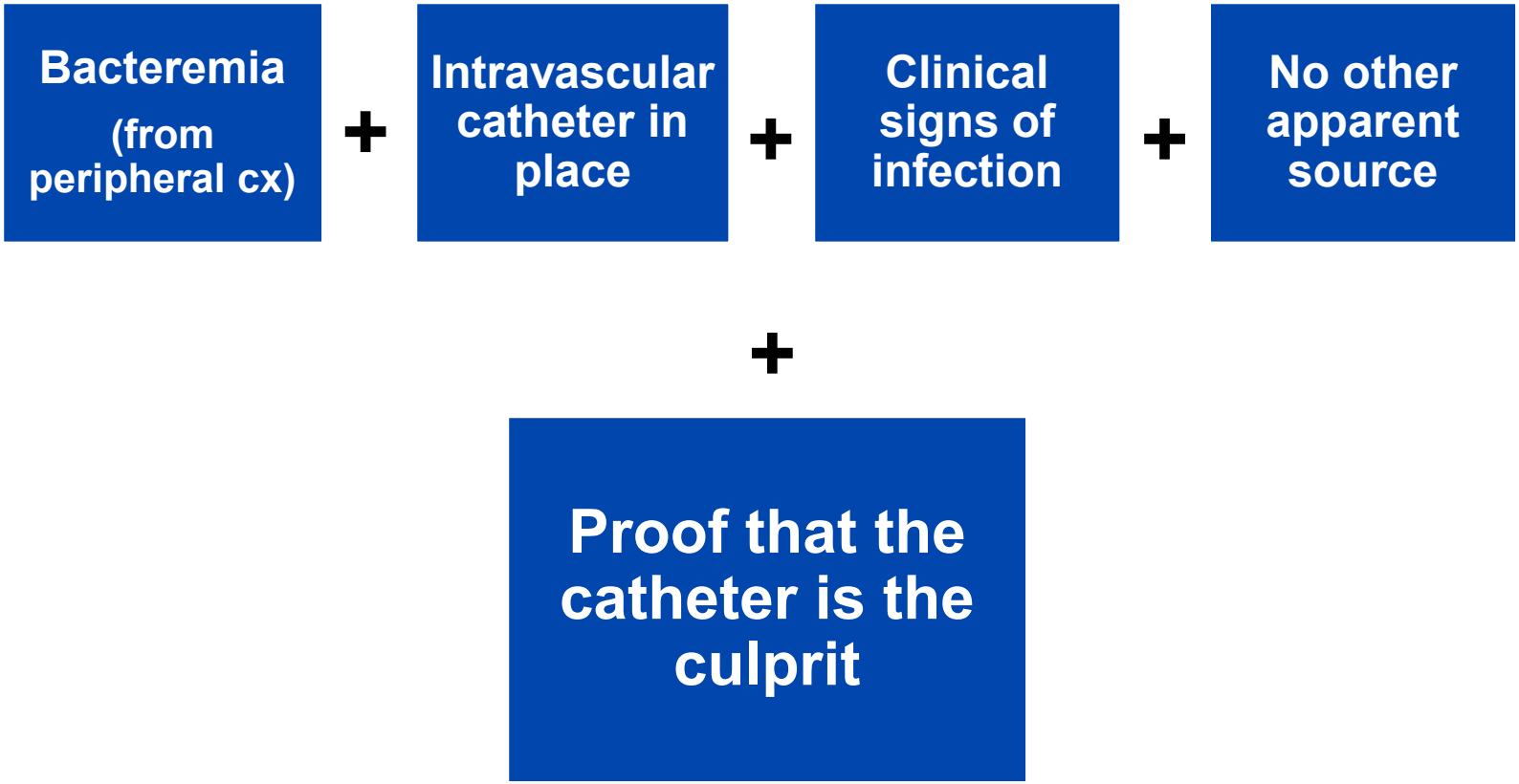
- I have no relevant financial relationships to disclose

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)



adapted from Pearson ML, et al. *Infect Control Hosp Epidemiol,* 1996

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)

adapted from Pearson ML, et al. *Infect Control Hosp Epidemiol,* 1996

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, <u>overestimates true incidence of CRBSI</u>**

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?

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**

So what is this?

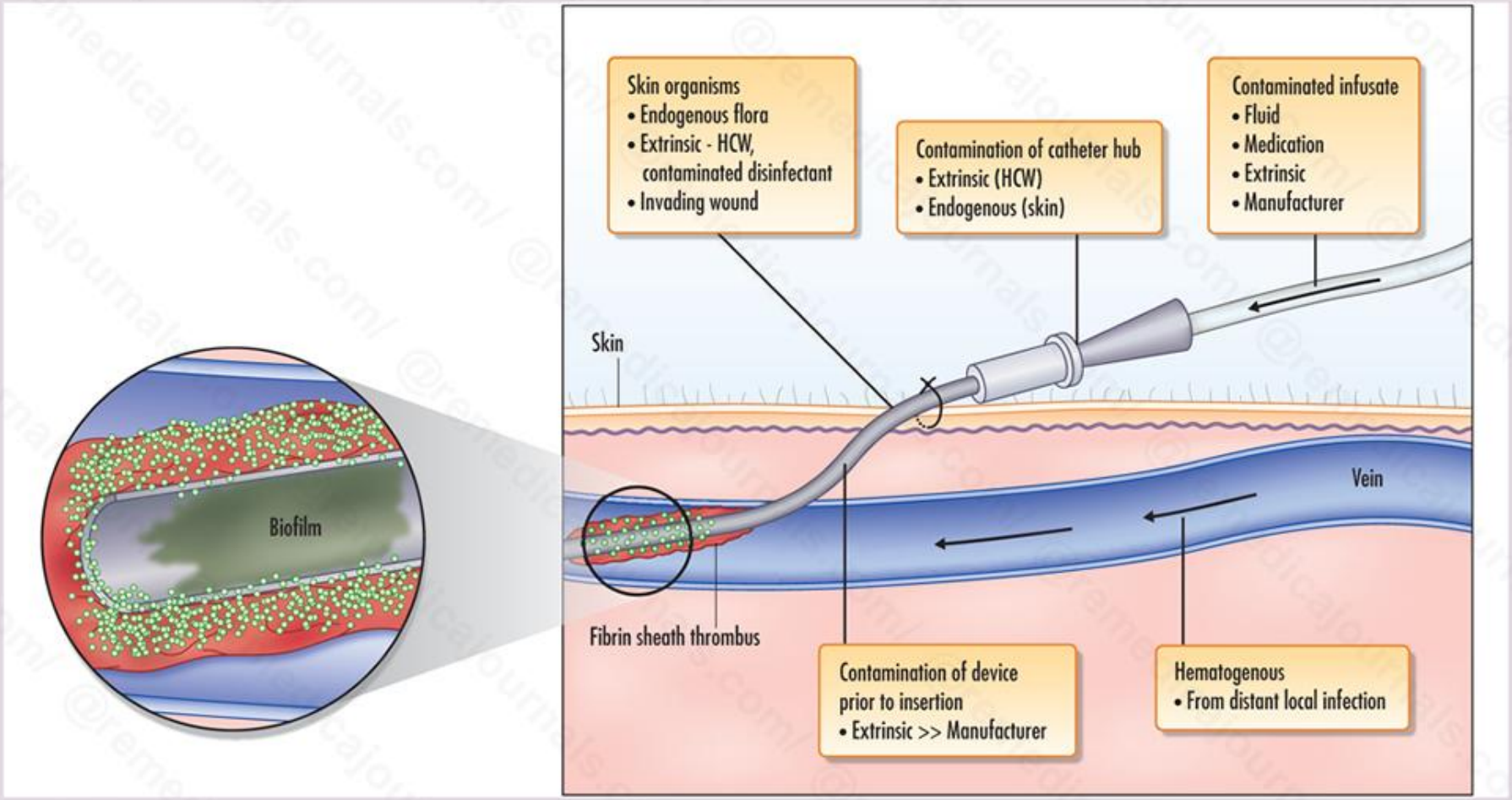
Case #1: Line colonization

- 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

Wisplinghoff H, et al. *Clin Infect Dis.* 2004

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



HCW: healthcare worker.

Image courtesy of Remedica Journals
http://www.remedicajournals.com/The-Journal-of-Invasive-Fungal-Infections/BrowseIssues/Volume-5-Issue-2/Article-The-Story-of-Biofilms

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)

Mermel LA, et al, *Clin Infect Dis*, 2009
Bryant, JK, et al, *Am J Clin Pathol,* 1987

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**

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!

Mermel LA, Maki DG. *Ann Intern Med.* 1993

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:

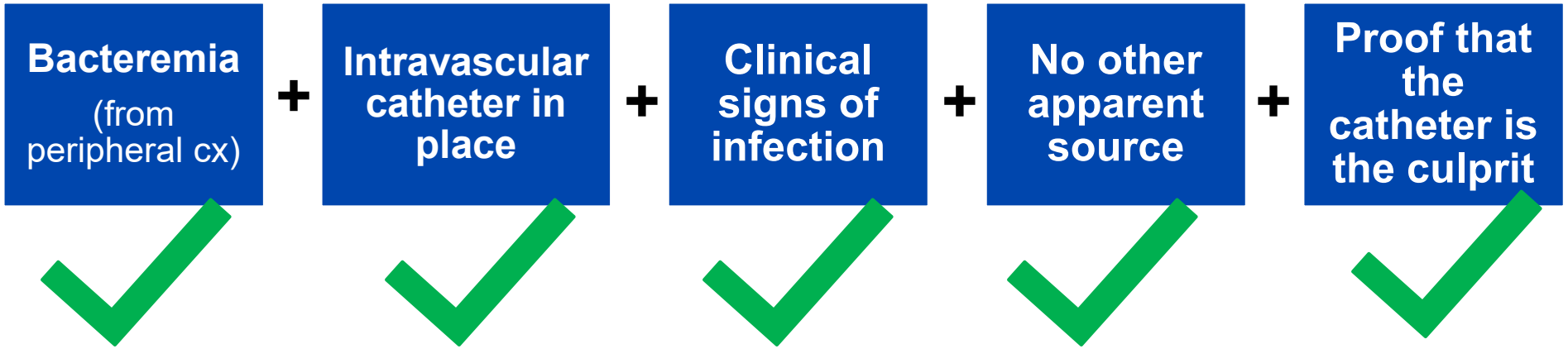
  PICC cx: S. aureus 3/3 bottles @ 18 hrs
  Peripheral cx: S. aureus 3/3 bottles @ 21 hrs

  (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: CLABSI/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

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SHEA/IDSA PRACTICE RECOMMENDATION

Strategies to Prevent
Infections

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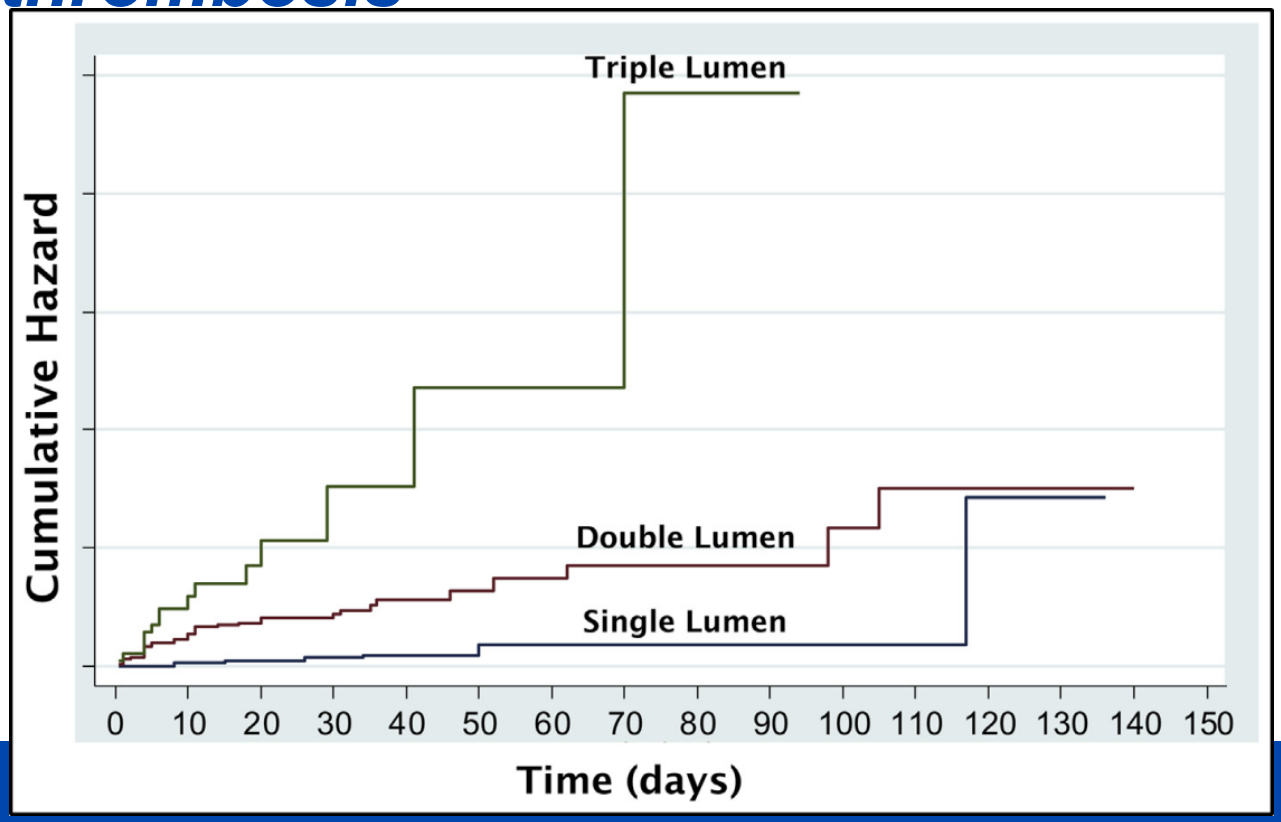
Lynn Hadaway, MEd, RN, BC, CI
Ann Marie Pettis, RN, BSN,
Lisa L. Maragakis

1. Do not use peripherally inserted CVCs (PICCs) as a strategy to reduce the risk of CLABSI.
   i. The risk of infection with PICCs in ICU patients approaches that of CVCs placed in the subclavian or internal jugular veins.[96,97]
   ii. The majority of CLABSIs due to PICCs occur in non-ICU settings.[98] The PICC-associated CLABSI risk may be different outside the ICU.

Pearl #4

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



Chopra, et al. *Am J Med.* 2014

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:

	Colonization/ Contamination	Secondary bacteremia	CRBSI/ CLABSI
Peripheral cx	-	+++	+
Catheter cx	+	+	+++

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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