Central Line-Associated Bloodstream Infection (CLABSI) Prevention

Basics of Infection Prevention
2-Day Mini-Course
2015

Objectives

- Describe the etiology and epidemiology of central line associated bloodstream infections (CLABSI)
- Identify risks associated with CLABSI
- Identify evidence-based practices for CLABSI prevention
- Describe the development of "bundles" and their impact on CLABSI prevention
- Review CLABSI surveillance

CLABSI Prevention Objectives

- U.S. Health and Human Services (HHS) HAI Action Plan 5-Year Targets
  - Reduce CLABSI by 50% (since 2009 baseline)
  - Achieve 100% compliance with CLIP
- Centers for Medicare and Medicaid Services (CMS) Value-Based Purchasing
  - All US hospitals reporting CLABSI via NHSN by Jan 2011
  - Annual payment update (2%) awarded for hospital participation
  - "Pay-for-performance" began 2013

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HHS Action Plan for Prevention of Healthcare-Associated Infections Website: http://www.health.gov/hai/prevent_hai.asp

Central Line or Central Vascular Catheter

- Intravascular catheter that terminates at or close to the heart or one of the great vessels and is used for infusion, withdrawal of blood or hemodynamic monitoring*
  - Nontunneled CVCs (subclavian, jugular)
  - Tunneled CVCs (Broviac, Hickman, Groshong)
  - Dialysis catheter (Quinton)
  - Peripherally inserted central catheters (PICCs)
  - Implanted ports (Permacath)
- Used increasingly to provide long-term venous access in all care settings, including outpatient

* Note: midline catheters are not in this category

Pathogenesis of CLABSI

More Common Mechanisms

- Extraluminal: Pathogens migrate along external surface of catheter
  - More common in early period following insertion, < 7 days
- Intraluminal: Hub contamination, migration along internal surface
  - More common >7 days, intraluminal colonization

Less Common Mechanisms

- Hematogenous seeding from another source
- Contaminated infusates

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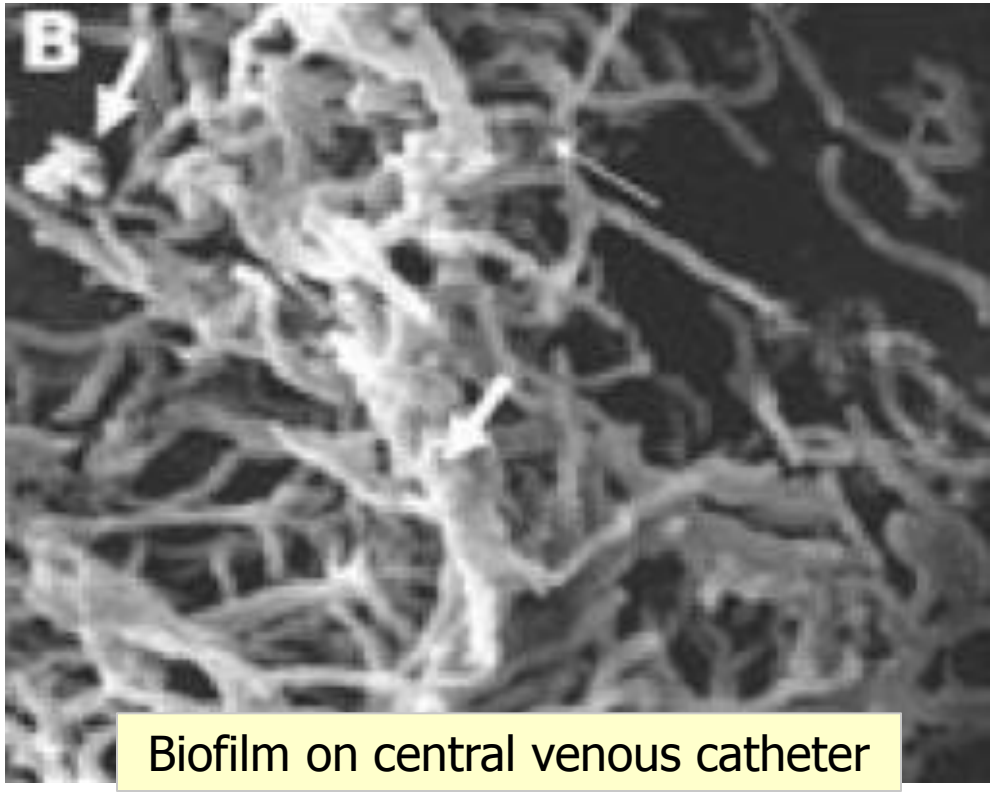
Biofilms

- Complex aggregation of microorganisms growing on a solid substrate
- Form on catheter surfaces
- Contribute to risk for CLABSI

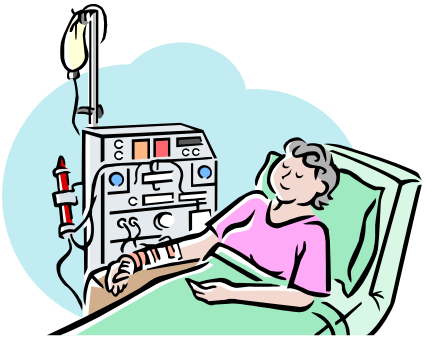


Biofilm on central venous catheter

source www.cdc.gov

CLABSI Risk Factors

- Multiple catheters and/or multiple lumens
- Emergency insertion
- Prolonged duration of CVC
- Prolonged hospital stay prior to CVC insertion
- Excessive manipulation of the catheter
- Neutropenia
- Prematurity
- Total parenteral nutrition



Dialysis patients have many of these risk factors

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Modifiable Factors Vary CLABSI Risk

	Higher CLABSI Risk	**Lower CLABSI Risk**
Insertion circumstances	Emergency insertion	Elective insertion
Skill of inserter	General clinician	Specialized (eg. PICC team)
Insertion site	Femoral	Subclavian
Skin antisepsis	Alcohol (& povidone iodine)	Chlorhexidine*(lowest risk)*
Catheter lumens	Multilumen	Single lumen
Duration of use	Temporary (non-tunneled) catheters (including PICCs) left in place long-term	Dialysis fistula *(lowest risk)* or permanent (tunneled) catheter when long-term use expected
Barriers for insertion	Anything less than maximal	Maximal

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What is a Bundle?

- Introduced by the Institute for Healthcare Improvement (IHI)
- Groups of practices with high-level clinical evidence of effectiveness
- When applied together, improvements synergistically greater
- Benefits of a Bundle
  - Treatment variation is minimized
  - Reliability is enhanced

The whole is greater than the sum of its parts!

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IHI Bundle – Central Line Insertion Practices (CLIP)

Five practices supported by high-level evidence

- Hand Hygiene
- Maximal barrier precautions
- Chlorhexidine skin antisepsis
- Optimal catheter site selection
- Daily review of line necessity

IHI CLABSI Bundle
http://www.ihi.org/resources/Pages/Changes/ImplementtheCentralLineBundle.aspx

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Review of IHI Bundle Components

1. Hand Hygiene
   - Before and after palpating* catheter insertion sites
   - Before and after inserting, replacing, accessing, repairing, or dressing a catheter
   - When hands obviously soiled or contamination suspected
   - Before and after invasive procedures
   - Between patients
   - Before donning and after removing gloves

* Note: palpation of insertion site should **not** be performed after application of antiseptic unless aseptic technique maintained

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Bundle Components – continued

2. Maximal barrier precautions
   - Wear cap, mask, sterile gown and sterile gloves
     - Both the line inserter AND immediate assistant
   - Cover patient from head to toe with sterile drape with small opening for site of insertion
3. Chlorhexidine skin antisepsis
   - Allow time to dry completely before puncturing site
4. Optimal catheter site selection
   - Subclavian vein the preferred site for non-tunneled catheters in adults

Empower nurses and others to
"STOP THE LINE"
if any of bundle components are missing

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Bundle Components – continued

5. Daily review of central line necessity with prompt removal of unnecessary lines
   - Risk of infection increases with duration of line
   - Examples of appropriate uses: receipt of TPN, chemotherapy, extended use of antibiotics, or hemodialysis

To review

CDC Prevention Strategies

Core Strategies

- High levels of scientific evidence
- Demonstrated feasibility

Supplemental Strategies

- Some scientific evidence
- Variable levels of feasibility

- Should become standard practice

- Consider implementing <u>in addition to Core</u> when infections persist or rates are high

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CLABSI Prevention Strategies

Core (ALWAYS, every time)

- Remove unnecessary central lines
- Proper insertion practices (CLIP)
- Hand hygiene
- Skin antisepsis
- Lower risk insertion sites
- Hub and access port disinfection
- Educate on central line insertion and maintenance

Supplemental

- Chlorhexidine bathing
- Antimicrobial-impregnated catheters
- Chlorhexidine-impregnated dressings

Considerations for **Supplemental** Prevention Strategies

- **Chlorhexidine bathing**
  - Daily bathing with 2% chlorhexidine decreased BSI rate in ICU compared to soap and water

- **Chlorhexidine dressings**
  - Chlorhexidine dressings have been shown to decrease CLABSI rates in some studies, not in others
  - May be an option when Core interventions have not decreased CLABSI rates to established goals

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Considerations for **Supplemental** Prevention Strategies

Antimicrobial catheters

- May be appropriate for
  - Patient's catheter expected to be used for >5 days **AND**
  - when Core strategies have not decreased CLABSI rates to established goals
- Studies show some supporting evidence for catheters with Minocycline-Rifampin and Chlorhexidine–Silver Sulfadiazine for adult patients
- Platinum-Silver catheters available but less evidence to support use

Measuring Prevention

Requires monitoring for

1. Compliance with practices known to reduce infections (**Process** measures)
2. Changes in infection rates (**Outcome** measures)

Gould C., Catheter-Associated Urinary Tract infection (CAUTI) Toolkit, CDC

CLABSI Prevention Process Measures

Monitor for sustainability

- Central line insertion practices (CLIP)
- Hand hygiene
- Proportion of patients with central lines
- Duration of use
- Central line associated maintenance practices (CLAMP)

Ensuring prevention practices are being performed is itself a "core" prevention strategy

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Monitoring Central Line Insertion Practices (CLIP)

If a patient develops a CLABSI, assess CLIP adherence for his/her central line!

Central Line Insertion Practices Adherence Monitoring

Page 1 of 2
*required for sealing

Facility ID: _____ Event #: _____

*Patient ID: _____ Social Security #: ___-__-____

Secondary ID: _____ Medicare #: _____

Patient Name, Last: _____ First: _____ Middle: _____

*Gender: ☐ F ☐ M ☐ Other *Date of Birth: ___/___/_____ (mm/dd/yyyy)

Ethnicity (specify): _____ Race (specify): _____

*Event Type: CLIP *Location: _____ *Date of Insertion: ___/___/_____ (mm/dd/yyyy)

*Person recording insertion practice data: ☐ Inserter ☐ Observer

Central line inserter ID: _____ Name, Last: _____ First: _____

*Occupation of inserter:

☐ Fellow ☐ Medical student ☐ Other student ☐ Other medical staff

☐ Physician assistant ☐ Attending physician ☐ Intern/resident ☐ Registered nurse

☐ Advanced practice nurse ☐ Other (specify): _____

*Was inserter a member of PICC/IV Team? ☐ Y ☐ N

*Reason for insertion:

☐ New indication for central line (e.g., hemodynamic monitoring, fluid/medication administration, etc.)

☐ Replace malfunctioning central line

☐ Suspected central line-associated infection

☐ Other (specify): _____

If Suspected central line-associated infection, was the central line exchanged over a guidewire? ☐ Y ☐ N

*Inserter performed hand hygiene prior to central line insertion: ☐ Y ☐ N (If not observed directly, ask inserter)

*Maximal sterile barriers used: Mask ☐ Y ☐ N Sterile gown ☐ Y ☐ N

Large sterile drape ☐ Y ☐ N Sterile gloves ☐ Y ☐ N Cap ☐ Y ☐ N

*Skin preparation (check all that apply) ☐ Chlorhexidine gluconate ☐ Povidone iodine ☐ Alcohol

☐ Other (specify): _____

If skin prep choice was not chlorhexidine, was there a contraindication to chlorhexidine? ☐ Y ☐ N ☐ U

*Was skin prep agent completely dry at time of first skin puncture? ☐ Y ☐ N (If not observed directly, ask inserte

*Insertion site: ☐ Femoral ☐ Jugular ☐ Lower extremity ☐ Scalp ☐ Subclavian ☐ Umbilical ☐ Upper extrem

Antimicrobial coated catheter used: ☐ Y ☐ N

*Central line catheter type:

☐ Non-tunneled (other than dialysis) ☐ PICC

☐ Tunneled (other than dialysis) ☐ Umbilical

☐ Dialysis non-tunneled ☐ Other (specify): _____

☐ Dialysis tunneled

("Other" should not specify brand names or number of lumens; most lines can be categorized accurately by selecting from options provided

*Did this insertion attempt result in a successful central line placement? ☐ Y ☐ N

Assurance of Confidentiality: The voluntarily provided information obtained in this surveillance system that would permit identification of any individual or institution collected with a guarantee that it will be held in strict confidence, will be used only for the purposes stated, and will not otherwise be disclosed or released without the consent of the individual, or the institution in accordance with Sections 304, 308 and 308(d) of the Public Health Service Act (42 USC 242b, 242k, and 242m(d)).

Public reporting burden of this collection of information is estimated to average 5 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to CDC, Reports Clearance Officer, 1600 Clifton Rd., MS D-74, Atlanta, GA 30333, ATTN: PRA (0920-0666).

CDC 57.125 (Front) Rev4, v6.0

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Monitoring Central Line Care and Maintenance

Observation examples

- How long has the line been in?
  - Does the RN know?
- Observe technique in accessing the line
  - Hand hygiene before and after? Cleanse the port?
- Are dressing changes performed using sterile technique?
- Is the dressing transparent, dated, and less than 7 days old?
- How long has the tubing been up?
- Is there documentation of daily review of line necessity?

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CLABSI Prevention Outcome Measure

- Perform surveillance for CLABSI using NHSN standardized definitions and methods
- Use central line days to calculate infection rates

$$\frac{\text{\# of CLABSI}}{\text{Central line days}} \times 1000$$

- Compare your CLABSI rates over time to assess prevention progress
- Make comparisons only with similar patient populations (e.g. same unit with same type of patients over time)

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More coming in Epi/Surv presentation

CLABSI Surveillance Definition

Patient with a central line must meet one of the following criterion

LCBI 1

Patient of any age

- ☐ has a recognized pathogen cultured from one or more blood cultures

and

- ☐ Organism cultured from blood is not related to an infection at another site

LCBI 2 *

Patient of any age

- ☐ has common skin commensals cultured from 2 or more blood cultures drawn on separate occasions

and

has **at least one** of the following signs or symptoms

- ☐ Fever (> 38°C), chills, or hypotension

and

- ☐ Signs and symptoms and (+) lab results are not related to an infection at another site

LCBI 3 *

Patient ≤ 1 year of age

- ☐ has common skin commensals cultured from 2 or more blood cultures drawn on separate occasions

and

has **at least one** of the following signs or symptoms:

- ☐ Fever (>38°C core), hypothermia (<36°C core), apnea, or bradycardia

and

- ☐ Signs and symptoms and (+) lab results are not related to an infection at another

* All criteria occur within 7 day infection window period

2015 NHSN Updated Definition

NHSN Patient Safety Module: Chapter 4 Device-Associated Module: BSI

Mucosal Barrier Injury BSI

- Resulted from need or more specific BSI definition in oncology patients
  - Misclassification of BSI resulting from translocation of intestinal organisms inflates CLABSI rates
- Pertains only to patients who are post allogeneic hematopoietic stem cell transplant or severely neutropenic (definitions provided in protocol)
- Review three criteria as applicable to your facility
  - Table 3: MBI-LCBI Eligible Enterobacteriaceae
  - Table 4: Examples Illustrating MBI-LCBI Criteria for Neutropenia

Mucosal Barrier Injury BSI

- CLABSI reporting in NHSN now requires facilities to indicate if MBI–LCBI or LCBI conditions are met
  - Both MBI-LCBI & LCBI must be reported as part of the NHSN Monthly reporting plan for BSI reporting

CLABSI Surveillance Clarifications

- Timeframe for determining CLABSI due to common commensals
  - Blood cultures have been collected on the same or consecutive days

    Example: Blood cultures positive for common commensal organism (e.g. S. epi) collected on Mon-Tues meets LCBI 2; cultures collected on Mon-Wed are too far apart
- Extensive clarifications for determining primary vs. secondary BSI
  - Provides specific scenarios to consider when determining if a BSI is primary or secondary to another site of infection and therefore not a CLABSI

CLABSI Surveillance Clarifications

- For BSI to be considered a CLABSI, a **central line** must be
  - In place for >2 days on the date of the event (date device placed = day one)

AND

  - Still in place on day of event -or- in place on the day prior to the event
- The CLABSI **event date** is defined as the day the first element used to meet the surveillance definition occurs within the seven-day window period *

*2015 NHSN Updated Definition

CLABSI Location Attribution

- A CLABSI is attributed to the location of the patient on the day of event
  - Defined as the date that the **first** element used to meet the LCBI criterion occurred *
- If the date of event for a CLABSI is the day of transfer or discharge, or the next day, the infection is attributed to the transferring location

*2015 NHSN Updated Definition

CLABSI Cannot Re-Occur in the Same Patient within a 14-Day Timeframe

- The date of the CLABSI event is considered day 1
- A new CLABSI is not reported until 14 days have elapsed
- If a new pathogen is identified in the blood within the 14 day timeframe, it should be added to the CLABSI already reported
  - Refer to the CLABSI protocol for more details

CLABSI Infection Window Period

- Defined as the 7-days during which all site-specific infection criteria must be met
- Includes the day the **first** positive blood culture was obtained, 3 calendar days before and 3 calendar days after

How do I apply the CLABSI surveillance concepts?

Let's look at some examples…

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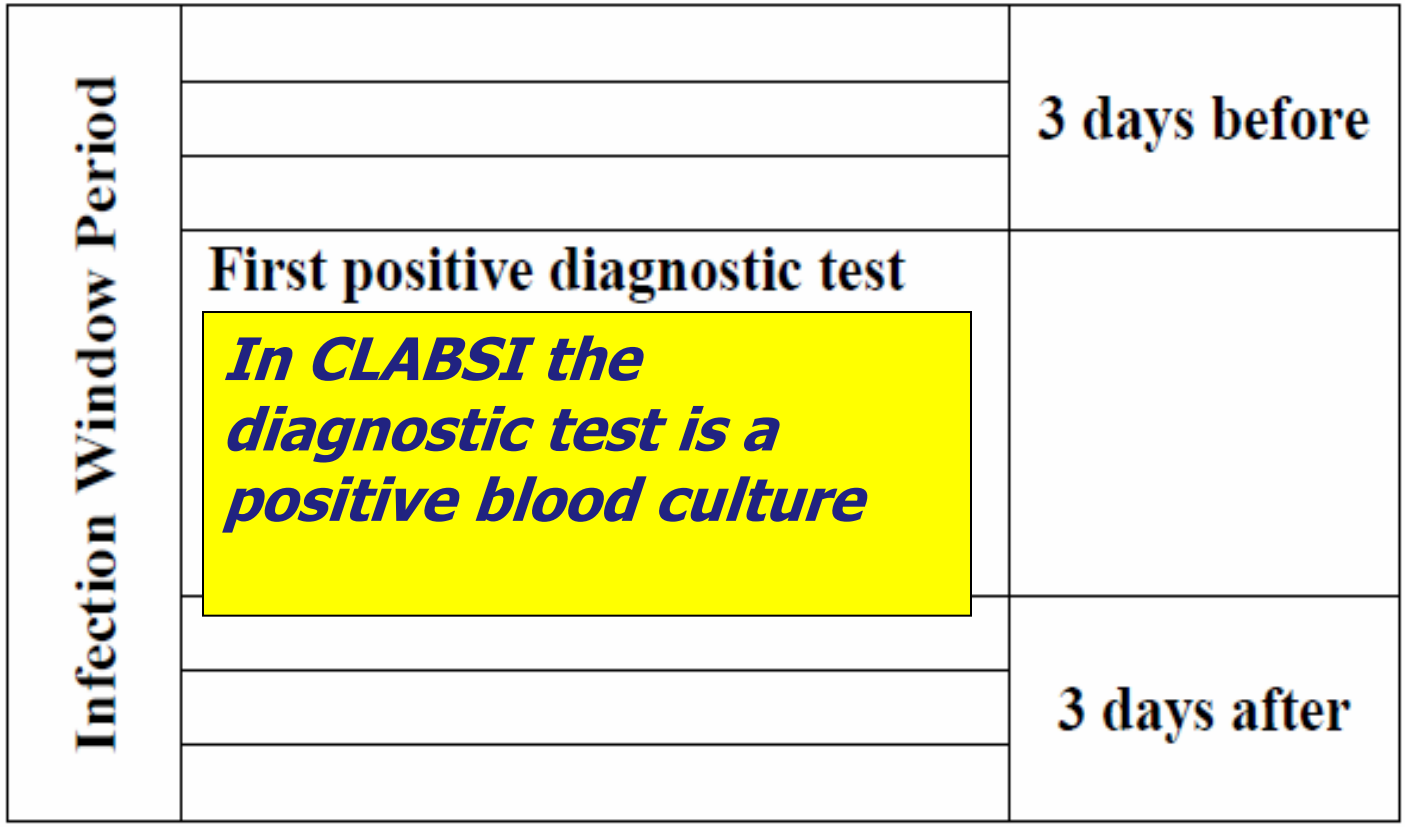
Infection Window Period (New 2015)

Example:



3/7/15
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3/10/15

3/11/15
3/12/15
3/13/15

2015 NHSN Updated definition
NHSN Patient Safety Module, Chapter 2

Infection Window Period – Definitions (New 2015)

Diagnostic Test for possible CLABSI	Localized Sign or Symptom for Possible CLABSI (ONLY used with 2 blood commensals)
• Positive blood culture with a pathogen –OR- • 2 positive blood cultures with common commensals	• Fever • Chills • Hypotension

2015 NHSN Updated definition
NHSN Patient Safety Module, Chapter 2

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CLABSI Event Date

Date the first element used to meet the definition for the first time.

HOSPITAL DAY	INFECTION WINDOW PERIOD	HOSPITAL DAY	INFECTION WINDOW PERIOD
1		1	Central Line inserted
2	Blood Culture +*Staph A*	2	
3		3	Fever 38.8C
4		4	*Blood Culture + Staph epi*
5		5	Blood Culture + *Staph epi*
6		6	
7		7	
8		8	
9		9	
10		10	
11		11	
12		12	
13		13	
14		14	
15		15	
16		16	
17		17	
18		18	
	BSI-POA Date of Event =2 Pathogen= *Staph A*		CLABSI-HAI Date of Event =3 Pathogen= *Staph epi*

NHSN Patient Safety Module, Chapter 2

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Secondary BSI Attribution -1 (New 2015)

- The period in which a positive blood culture must be collected to be considered a secondary BSI to a primary site of infection
  - Includes the 7-day infection window combined with the 14-day repeat infection timeframe, or 14-17 days depending on the date of the event
  - A positive blood culture collected outside this 14-17 date ranged cannot be considered a secondary BSI to the primary infection
- A primary BSI (CLABSI) cannot have a secondary BSI

Secondary BSI Attribution – 2 (New 2015)

- A secondary BSI may be attributed to a primary site of infection if one of the following is true:
  1. The blood culture pathogen matches an organism also cultured in the primary infection site

     OR

  2. A positive blood culture is an element used to meet the primary site infection
- See the Secondary BSI Guide (Appendix 1) of the CLABSI protocol for more details

Pathogen Assignment (New 2015)

- If an additional blood pathogen is identified within the 14-day repeat infection timeframe, it should be added to the already reported CLABSI as a secondary pathogen
- Pathogens excluded from specific infection definitions (e.g. yeast for UTI and PNEU) are also excluded from being considered secondary bloodstream infections
  - Positive blood cultures of yeast or other excluded pathogens must be attributed as either a CLABSI or as a secondary BSI to another primary site of infection (other than UTI or PNEU)

Refer to the NHSN protocol for more details on pathogen assignment and secondary BSI

Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011

Naomi P. O'Grady, M.D.[1], Mary Alexander, R.N.[2], Lillian A. Burns, M.T., M.P.H., C.I.C.[3], E. Patchen Dellinger, M.D.[4], Jeffery Garland, M.D., S.M.[5], Stephen O. Heard, M.D.[6], Pamela A. Lipsett, M.D.[7], Henry Masur, M.D.[1], Leonard A. Mermel, D.O., Sc.M.[8], Michele L. Pearson, M.D.[9], Issam I. Raad, M.D.[10], Adrienne Randolph, M.D., M.Sc.[11], Mark E. Rupp, M.D.[12], Sanjay Saint, M.D., M.P.H.[13] and the Healthcare Infection Control Practices Advisory Committee (HICPAC)[14].

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CDC / HICPAC Guideline 2011

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2014, VOL. 35, NO. 7

SHEA/IDSA PRACTICE RECOMMENDATION

Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals: 2014 Update

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PURPOSE

Previously published guidelines are available that provide comprehensive recommendations for detecting and preventing healthcare-associated infections (HAIs). The intent of this document is to highlight practical recommendations in a concise format designed to assist acute care hospitals in implementing and prioritizing their central line–associated bloodstream infection (CLABSI) prevention efforts. This document updates "Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals,"[1] published in 2008. This expert guidance document is sponsored by the Society for Healthcare Epidemiology of America (SHEA) and is the product of a collaborative effort led by SHEA, the Infectious Diseases Society of America (IDSA), the American Hospital Association (AHA), the Association for Professionals in Infection Control and Epidemiology (APIC), and The Joint Commission, with major contributions from representatives of a number of organizations and societies with content expertise. The list of endorsing and supporting organizations is presented in the introduction to the 2014 updates.[2]

SECTION 1: RATIONALE AND STATEMENTS OF CONCERN

I. Patients at risk for CLABSIs in acute care facilities
   A. Intensive care unit (ICU) population: the risk of CLABSI in ICU patients is high. Reasons for this include the frequent insertion of multiple catheters, the use of specific types of catheters that are almost exclusively inserted in ICU patients and associated with substantial risk (eg, pulmonary artery catheters with catheter introducers), and the fact that catheters are frequently placed in emergency circumstances, repeatedly accessed each day, and often needed for extended periods of time.[3,4]
   B. Non-ICU population: although the primary focus of attention over the last 2 decades has been the ICU setting, the majority of CLABSIs occur in hospital units outside the ICU or in outpatients.[5–10]
   C. Infection prevention and control efforts should include other vulnerable populations, such as patients receiving hemodialysis through catheters,[11] intraoperative patients,[12] and oncology patients.
   D. Besides central venous catheters (CVCs), peripheral arterial catheters also carry a risk of infection.[3]
II. Outcomes associated with hospital-acquired CLABSI
   A. Increased length of hospital stay.[13–17]
   B. Increased cost (the non-inflation-adjusted attributable cost of CLABSIs has been found to vary from $3,700 to $39,000 per episode[14,18–19]).
III. Independent risk factors for CLABSI (in at least 2 published studies)[20–25]
   A. Factors associated with increased risk
      1. Prolonged hospitalization before catheterization
      2. Prolonged duration of catheterization
      3. Heavy microbial colonization at the insertion site
      4. Heavy microbial colonization of the catheter hub
      5. Internal jugular catheterization
      6. Femoral catheterization in adults

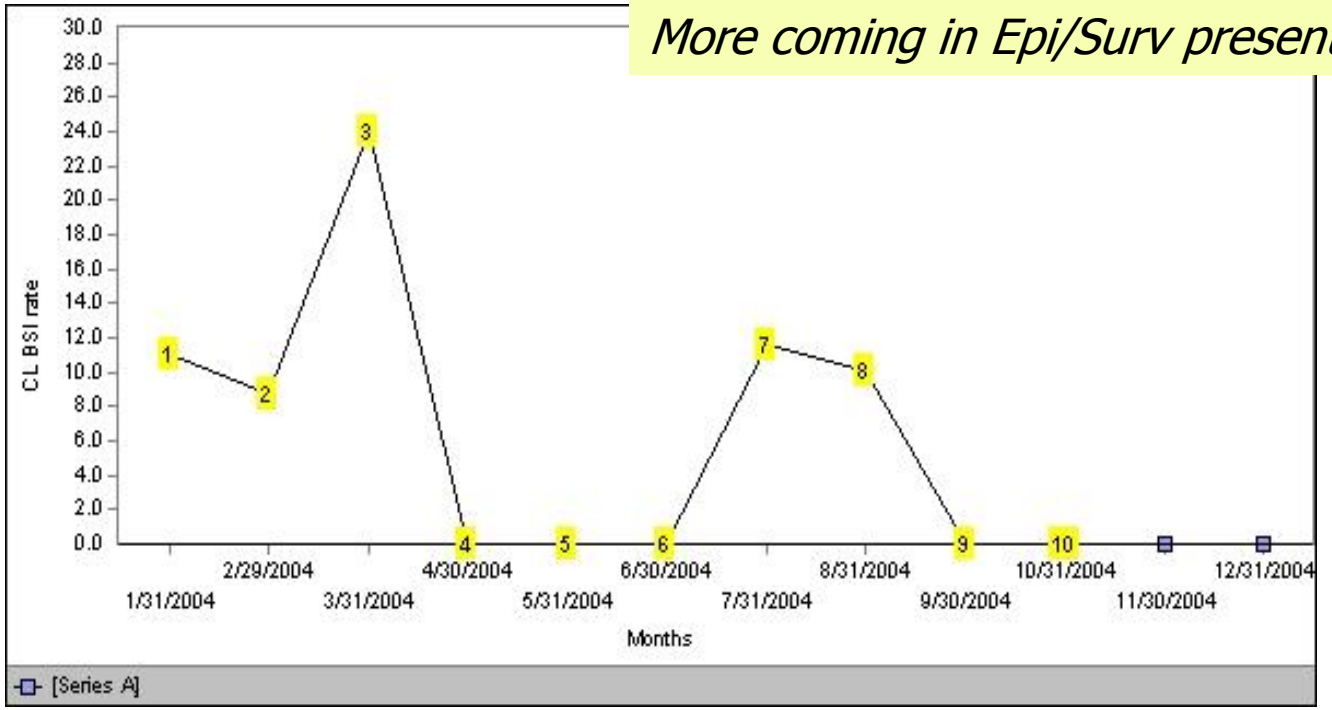
Affiliations: 1. Washington University School of Medicine, St. Louis, Missouri; 2. Bern University Hospital and University of Bern, Bern, Switzerland; 3. Warren Alpert Medical School of Brown University and Rhode Island Hospital, Providence, Rhode Island; 4. St. John Hospital and Medical Center and Wayne State University School of Medicine, Detroit, Michigan; 5. Lynn Hadaway Associates, Inc., Milner, Georgia; 6. Centers for Disease Control and Prevention, Atlanta, Georgia; 7. National Institutes of Health, Bethesda, Maryland; 8. University of Rochester Medical Center, Rochester, New York; 9. University of Nebraska Medical Center, Omaha, Nebraska; 10. Boston Children's Hospital and Harvard Medical School, Boston, Massachusetts; 11. Johns Hopkins University School of Medicine, Baltimore, Maryland; 12. Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts

SHEA Compendium 2014

Measure CLABSI Prevention SUCCESS!

Example: Our Lady of Lourdes Hospital (Binghamton, NY)

More coming in Epi/Surv presentation



IHI 100,000 Lives Campaign, How-to Guide

The reductions here are clearly visible over time. During the course of one year, the rate of CR-BSIs decreased three-fold.

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Questions?

For more information, please contact any HAI Liaison Team member.

Thank you