Central Line-Associated Bloodstream Infection (CLABSI) Prevention

Basics of Infection Prevention
2-Day Mini-Course
2013
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, Jan 2011
  - Annual payment update (2%) awarded for hospital participation
  - “Pay-for-performance” begins 2013

Central Line or Central Vascular Catheter

- Intravascular catheter that terminates at or close to the heart or one of the great vessels
  - 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
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 lumins
- 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*
# Modifiable Factors Vary CLABSI Risk

<table>
<thead>
<tr>
<th>Modifiable Factors</th>
<th>Higher CLABSI Risk</th>
<th>Lower CLABSI Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion circumstances</td>
<td><strong>Emergency insertion</strong></td>
<td><strong>Elective insertion</strong></td>
</tr>
<tr>
<td>Skill of inserter</td>
<td><strong>General clinician</strong></td>
<td><strong>Specialized (eg. PICC team)</strong></td>
</tr>
<tr>
<td>Insertion site</td>
<td><strong>Femoral</strong></td>
<td><strong>Subclavian</strong></td>
</tr>
<tr>
<td>Skin antisepsis</td>
<td><strong>Alcohol (&amp; povidone iodine)</strong></td>
<td><strong>Chlorhexidine</strong>(lowest risk)</td>
</tr>
<tr>
<td>Catheter lumens</td>
<td><strong>Multilumen</strong></td>
<td><strong>Single lumen</strong></td>
</tr>
<tr>
<td>Duration of use</td>
<td><strong>Temporary (non-tunneled) catheters (including PICCs) left in place long-term</strong></td>
<td><strong>Dialysis fistula (lowest risk) or permanent (tunneled) catheter when long-term use expected</strong></td>
</tr>
<tr>
<td>Barriers for insertion</td>
<td><strong>Anything less than maximal</strong></td>
<td><strong>Maximal</strong></td>
</tr>
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*CLABSI: Central Line-Associated Bloodstream Infection*
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!
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
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
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. Chlorhexidene 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
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

• Should become standard practice

Supplemental Strategies
- Some scientific evidence
- Variable levels of feasibility

• Consider implementing in addition to Core when infections persist or rates are high
CLABSI Prevention Strategies

**Core (ALWAYS, every time)**
- Remove unnecessary central lines
- Proper insertion practices
- 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 (single study)
- No data outside the ICU

**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
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

- 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)
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
If a patient develops a CLASSI, assess CLIP adherence for his/her central line!
Monitoring 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?
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).
### CLABSI Surveillance Definition

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

<table>
<thead>
<tr>
<th>LCBI 1</th>
<th>LCBI 2</th>
<th>LCBI 3</th>
</tr>
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<tbody>
<tr>
<td>Patient of any age</td>
<td>Patient of any age</td>
<td>Patient &lt; 1 year of age</td>
</tr>
<tr>
<td>□ has a recognized pathogen cultured from one or more blood cultures <strong>and</strong></td>
<td>□ has common skin commensals cultured from 2 or more blood cultures drawn on separate occasions <strong>and</strong></td>
<td>□ has common skin commensals cultured from 2 or more blood cultures drawn on separate occasions <strong>and</strong></td>
</tr>
<tr>
<td>□ Organism cultured from blood is not related to an infection at another site</td>
<td>has at least one of the following signs or symptoms: □ Fever (&gt; 38°C), chills, or hypotension <strong>and</strong> □ Signs and symptoms and (+) lab results are not related to an infection at another site</td>
<td>has at least one of the following signs or symptoms: □ Fever (&gt;38°C core), hypothermia (&lt;36°C core), apnea, or bradycardia <strong>and</strong> □ Signs and symptoms and (+) lab results are not related to an infection at another site</td>
</tr>
</tbody>
</table>
For LCBI to be considered a CLABSI, central line must be
• In place for >2 days before all elements of lab-confirmed BSI
criterion were first present together
  AND
• Still in place on day of event -or- in place on the day prior to the event
• Date of Event is now date that the last element used to
  meet the LCBI criteria occurred
  (Previously was date of first symptom or blood culture collection)
• Criterion elements must occur within a timeframe that
does not exceed a gap of one calendar day
• See changes in LCBI 3, the additional criteria that can be
  applied to patients <1 year of age*

*Refer to NHSN Patient Safety Manual, Chapter 4, CLABSI, updated Jan 2013
CLABSI Surveillance Location Attribution

- Location of CLABSI attribution is the location of the patient on the day of event
  - Defined as the date that the last element used to meet the BSI criterion occurred (previously the date of the first element)
- Transfer rule: if all elements of CLABSI are present within 2 calendar days of transfer from one location to another, the CLABSI is attributed to the transferring location
  - Since Jan 2013, all NHSN references to 48 hours have been changed to 2 calendar days
CLABSI Surveillance Clarifications

• Timeframe for determining CLABSI due to Common Commensals
  • Limited to positive blood cultures collected within a 2 day period
    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

NHSN Patient Safety Manual, Chapter 4: CLABSI, January 2013
CLABSI Surveillance Clarifications - continued

- If admitted or transferred into a facility with a central line in place (e.g., tunneled or implanted central line), the day of first access is considered Day 1
- CLABSI cannot be attributed to non-bedded locations e.g., Operating Room, Emergency Department
  - Must instead be attributed to the next inpatient location
  - For patients on observation units, NHSN defines ‘inpatient’ as a patient whose date of admission and date of discharge are different calendar days.
Mucosal Barrier Injury BSI  (new type of CLABSI)

- 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*)
- Please review three new criteria as applicable to your facility
  - Table 3: MBI-LCBI Eligible Enterobacteriaceae
  - Table 4: Examples Illustrating MBI-LCBI Criteria for Neutropenia
Measure CLABSI Prevention SUCCESS!

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

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

IHI 100,000 Lives Campaign, How-to Guide
Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals

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PURPOSE
Previously published guidelines are available that provide comprehensive recommendations for detecting and preventing healthcare-associated infections. 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. Refer to the Society for Healthcare Epidemiology of America (SHEA) "Compendium of Strategies to Prevent Healthcare-Associated Infections" Executive Summary and Introduction and accompanying editorial for additional discussion.

SHEA Compendium 2008

www.cdc.gov/hicpac/
Questions?

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

Thank you