Central Line Associated Bloodstream Infection Prevention

Last updated 2017
Objectives

- Describe the etiology and epidemiology of central line associated bloodstream infections (CLABSI)
- Identify patients at risk for CLABSI
- Review evidence-based CLABSI prevention care practices
- Discuss adherence monitoring and feedback
CLABSI Prevention Objectives

• National 2020 Target Goal: Reduce CLABSI by 50% from 2015 baseline
  • Recommended for adoption in California hospitals by the CDPH HAI Advisory Committee
• Centers for Medicare and Medicaid Services (CMS) Value-Based Purchasing
  • Reduce payments for hospitals ranking among the lowest-performing 25 percent

National Action Plan for Prevention of HAI, 2013:
https://health.gov/hcq/prevent-hai.asp
CMS Hospital Value-Based Purchasing:
https://www.qualitynet.org/dcs/ContentServer?c=Page&pagemenu=QnetPublic%2FPage%2FQnetTier2&cid=1228772039937
CLABSI Prevention – What works?

Best sources for evidence-based CLABSI prevention practice recommendations

- **CDC Guidelines** for the Prevention of Intravascular Catheter-Related Infections, 2011
- **CDC Checklist** for CLABSI Prevention of CLABSI
- **SHEA/IDSA** Strategies to Prevent Central Line-Associated BSI Acute Care Hospitals, 2014
Central Line

- Intravascular catheter that terminates at or close to the heart or one of the great vessels
- Used for infusion, withdrawal of blood or hemodynamic monitoring
- Multiple types
  - Nontunneled (subclavian, jugular)
  - Peripherally inserted central catheters (PICCs)
  - Tunneled (Broviac, Hickman, Groshong)
  - Dialysis catheter (Quinton)
  - Implanted ports (Permacath)

(Midline catheters are not central lines)

NHSN Patient Safety Module: Chapter 4
CLABSI Pathogenesis

Common mechanisms

• Extraluminal contamination
  • Pathogens migrate on external surface of catheter
  • CLABSI in early period following insertion, < 7 days

• Intraluminal contamination
  • Pathogens migrate along internal surface
  • CLABSI more common >7 days
  • Access port contamination

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 CLABSI risk
Common CLABSI Pathogens

- Coagulase-negative Staphylococci 16%
- *Staphylococcus aureus* 13%
- *Klebsiella (pneumoniae/oxytoca)* 8%
- *Enterococcus faecalis* 8%
- *Enterococcus faecium* 7%
- *Candida albicans* 6%

Distribution of Pathogens Reported to NHSN by HAI Type, 2015:
CLABSI Risk Factors

- Multiple catheters
- Catheters with multiple lumens
- Emergency insertion
- Prolonged duration
- Prolonged hospital stay prior to line insertion
- Excessive line manipulation
- Neutropenia
- Prematurity
- Total parenteral nutrition
- Hemodialysis
Hemodialysis

- Catheters (specifically, central lines) are the most common cause of BSI in dialysis patients
  - 7X higher CLABSI risk than arteriovenous fistulas or grafts

<table>
<thead>
<tr>
<th>Vascular Access Type</th>
<th>Rate (per 100 patient-months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV fistula</td>
<td>0.26</td>
</tr>
<tr>
<td>AV graft</td>
<td>0.39</td>
</tr>
<tr>
<td>Other vascular access type</td>
<td>0.67</td>
</tr>
<tr>
<td>Central venous catheter</td>
<td>2.16</td>
</tr>
</tbody>
</table>

- Include hemodialysis providers and contractors in CLABSI prevention education and competency programs
Can You Modify CLABSI Risk?

<table>
<thead>
<tr>
<th>Modifiable Risk Factors</th>
<th>Higher CLABSI Risk</th>
<th>Lower CLABSI Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion circumstances</td>
<td>Emergency insertion</td>
<td>Elective insertion</td>
</tr>
<tr>
<td>Skill of inserter</td>
<td>General clinician</td>
<td>Specialized (e.g., PICC team)</td>
</tr>
<tr>
<td>Insertion site</td>
<td>Femoral</td>
<td>Subclavian</td>
</tr>
<tr>
<td>Skin antisepsis</td>
<td>Alcohol (and povidone iodine)</td>
<td>Chlorhexidine (lowest risk)</td>
</tr>
<tr>
<td>Catheter lumens</td>
<td>Multilumen</td>
<td>Single lumen</td>
</tr>
<tr>
<td>Duration of use</td>
<td>Temporary (non-tunneled) catheters (including PICC) left in place long-term</td>
<td>Dialysis fistula (lowest risk) or permanent (tunneled) catheter when long-term use expected</td>
</tr>
<tr>
<td>Barriers for insertion</td>
<td>Anything less than maximal</td>
<td>Maximal</td>
</tr>
</tbody>
</table>

HAI Prevention Practice Terms

Core / Basic Care Practices

- Standard of practice
- Based on higher levels of scientific evidence
- Demonstrated feasibility
- Effectiveness depends on consistency

Special Approaches

- Used in addition to Core/Basic care practices when HAI rates remain high or during outbreaks
- Based on some scientific evidence
- May not be feasible in all settings
CLABSI Prevention – What Works?

- Proper line insertion practices (CLIP)
- Proper line maintenance
- Competency education of clinical staff
- Adherence monitoring and feedback of prevention care practices
Prevention “Bundle”

• A group of practices with high-level clinical evidence of effectiveness
• When applied together, improvements are synergistically greater
• Benefits of bundle adoption
  • Minimize practice variation among health care providers
  • Adherence to a set of recommendations is enhanced
  • Able to measure adherence

The whole is greater than the sum of its parts!
Central Line Insertion Practices (CLIP) Bundle

Prepare
1. All-inclusive catheter cart/kit
2. Optimal catheter site selection – avoid femoral

Insert
1. Hand hygiene
2. Maximal barrier precautions
3. Chlorhexidine skin antisepsis
4. Daily review of line necessity

Empower all providers to stop the insertion if improper insertion practice observed

Institute of Healthcare Improvement CLABSI Bundle, 2009:
GUID=e876565d-fd43-42ce-8340-8643b7e675c7
CLIP – Hand Hygiene

For central line insertion, perform hand hygiene

• Before and after palpating catheter insertion sites
  • Do not palpate insertion site after applying antiseptic unless aseptic technique maintained

• 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
CLIP - Maximum Barrier Precautions

- Cap, mask, sterile gown and gloves worn by the line inserter and assistant
- Patient covered from head to toe with sterile drape with small opening for insertion site
CLIP – Chlorhexidine Skin Antisepsis

• Perform skin antisepsis just prior to line insertion using a skin antisepsis containing chlorhexidine
• Allow time to dry completely before puncturing site
CLIP – Optimal Catheter Site Selection

• Select lower risk insertion site if possible
• Subclavian vein preferred for non-tunneled catheters in adults
CLIP – Daily Review of Line Necessity

• Perform daily review of central line necessity (and document in patient record)
  • Appropriate use examples include chemotherapy, extended antibiotic course, hemodialysis, total parenteral nutrition
• Promptly remove unnecessary lines
  • Risk of infection increases with duration of line
Central Line Care and Maintenance

• Adopt a central line maintenance bundle
• Perform hand hygiene when replacing, accessing, repairing, or dressing a catheter
• Disinfect hub and access port before each use
  • Only use sterile devices to access catheters
• Monitor adherence to
  • Daily review of line necessity
  • Prompt removal of central lines
  • Accessing the line using “scrub-the-hub” practices
  • Catheter site care and dressing practices
CLABSI Prevention Special Approaches

If CLABSI rates high or have not decreased to established goals despite consistent use of core practices

• Perform daily chlorhexidine bathing (2% solution) in select populations, e.g., ICU
• Consider using antimicrobial-impregnated catheter if line is expected to be in >5 days
• Cover insertion site with chlorhexidine-impregnated dressings
  • Shown to decrease CLABSI rates in some studies, not in others
Measuring Prevention

Requires monitoring for

Adherence with practices known to reduce infections

• **Process** measure

Changes in CLABSI incidence

• **Outcome** measure
Facility Role in CLABSI Prevention

• Ensure policies and practices reflect current evidence based recommendations
  • CDC and SHEA/IDSA guidelines

• Ensure staff competency upon hire and at least annually
  • New hire orientation
  • Annual skills fair
  • Return demonstration to ensure competency

• Perform surveillance and adherence monitoring of care practices
  • Use tools to measure adherence

• Provide feedback to frontline staff and leaders
  • Present adherence results with CLABSI incidence to each unit
Monitoring Central Line Insertion

- If patient develops CLABSI, especially within 7 days after insertion, assess CLIP adherence
- If high CLABSI, monitor CLIP in all locations where lines are inserted, including OR and interventional radiology
### Monitoring Central Line Access Maintenance

<table>
<thead>
<tr>
<th>Observation</th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Adherence by Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply kit is used for central line dressing changes.</td>
<td>Yes</td>
<td>Yes</td>
<td>2 # Yes 2 # Obs</td>
</tr>
<tr>
<td>Hand hygiene performed before <strong>and</strong> after manipulating the catheter (regardless of glove use).</td>
<td>Yes</td>
<td>Yes</td>
<td>0 # Yes 2 # Obs</td>
</tr>
<tr>
<td>Wet, soiled, or dislodged dressings are changed promptly.</td>
<td>Yes</td>
<td>Yes</td>
<td>2 # Yes 2 # Obs</td>
</tr>
<tr>
<td>Need for line assessed daily by a practitioner, with prompt removal of unnecessary lines.</td>
<td>Yes</td>
<td>Yes</td>
<td>1 # Yes 2 # Obs</td>
</tr>
<tr>
<td>Scrubbing method is used during dressing change when applying CHG to the insertion site.</td>
<td>Yes</td>
<td>Yes</td>
<td>1 # Yes 1 # Obs</td>
</tr>
<tr>
<td>Dressing is changed with aseptic technique, using clean gloves to remove the old dressing and sterile gloves when applying the new dressing.</td>
<td>Yes</td>
<td>Yes</td>
<td>1 # Yes 1 # Obs</td>
</tr>
<tr>
<td>The access port or hub is scrubbed immediately prior to each use with the appropriate antiseptic.</td>
<td>Yes</td>
<td>Yes</td>
<td>1 # Yes 1 # Obs</td>
</tr>
<tr>
<td>Antiseptic-containing protector caps are utilized for all line connectors if it is facility policy.</td>
<td>Yes</td>
<td>Yes</td>
<td>Not Policy</td>
</tr>
<tr>
<td>The catheter is accessed with only sterile devices.</td>
<td>Yes</td>
<td>Yes</td>
<td>1 # Yes 1 # Obs</td>
</tr>
<tr>
<td>Daily bathing with a 2% CHG solution is done if facility policy.</td>
<td>Yes</td>
<td>Yes</td>
<td>2 # Yes 2 # Obs</td>
</tr>
</tbody>
</table>

Total # Yes 11  
Total # Observations 14  
#Yes/#observations x 100 = 79% Adherence
## Monitoring Central Line Dressing Maintenance

<table>
<thead>
<tr>
<th>Central Line Maintenance Practices</th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Adherence by Task</th>
<th># Yes</th>
<th># Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central line insertion date is documented.</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Dressings wet, soiled, or dislodged are changed promptly.</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Need for the line assessed daily by a practitioner, with prompt removal of unnecessary lines</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Optimal site selected, avoid femoral site in adult patients.</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Sterile gauze, sterile transparent or sterile semi-permeable dressing used to cover the catheter site is in place for ≤ 7 days (Mark “No” if no date on the dressing.)</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Antiseptic-containing protector caps are utilized for all line connectors if facility policy.</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>A CHG-impregnated sponge applied at insertion site</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Tubing and administration set have been in place for ≤ 7 days. (Mark “No” if no date on dressing.)</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>TPN/Lipids: tubing dated to ensure change every 24 hours.</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>None</td>
<td>Today</td>
</tr>
<tr>
<td>Daily bathing with a 2% CHG solution is done if facility policy.</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Total # Yes: **11**  
Total # Observations: **18**  
#Yes/#observations x 100 = **61%** Adherence
CLABSI Practices Adherence
40 Hospitals with High Rates, 2015-2016

- Staff annual training: 80%
- Physicians annual training: 72%
- Indication list to evaluate line necessity: 70%
- Available insertion cart/kit: 90%
- CLIP checklist for all insertions: 87%

Successful • Missed
CLABSI Practices Adherence
40 Hospitals with High Rates, 2015-2016

- Review line need daily with primary provider: 70%
- Maintenance bundle: 75%
- Investigates CLABSI cause factors: 64%
- Protector caps on ports: 77%
- Antimicrobial catheters: 20%
## CLABSI Practice Observations
### 40 Hospitals with High Rates, 2015-2016

<table>
<thead>
<tr>
<th></th>
<th># Observations</th>
<th>Adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Line insertion</strong></td>
<td>8</td>
<td>93%</td>
</tr>
<tr>
<td><strong>Line maintenance</strong></td>
<td>206</td>
<td></td>
</tr>
<tr>
<td>Insertion date documented</td>
<td></td>
<td>81%</td>
</tr>
<tr>
<td>Hand hygiene before/after even if gloves worn</td>
<td></td>
<td>70%</td>
</tr>
<tr>
<td>Clean, dry, intact dressing</td>
<td></td>
<td>93%</td>
</tr>
<tr>
<td>Daily line assessment, prompt removal</td>
<td></td>
<td>99%</td>
</tr>
<tr>
<td>Avoid femoral site</td>
<td></td>
<td>95%</td>
</tr>
<tr>
<td>CHG sponge at insertion site</td>
<td></td>
<td>96%</td>
</tr>
<tr>
<td>Daily CHG bath if hospital policy</td>
<td></td>
<td>55%</td>
</tr>
</tbody>
</table>
Preventing CLABSI: The MOST Important Things

Prevent Early- and Late-Onset CLABSI

- Provide list of indications for central line
- Education of HCP inserting or caring for central line
- Bathe ICU patients with CHG daily
- Adhere to infection prevention practices at insertion (CLIP)
- Use all-inclusive catheter cart/kit
- Use Ultrasound guidance for insertion
- Use alcoholic CHG skin prep

- Disinfect hub before accessing central line
- Remove nonessential catheters
- Change transparent dressings and site care with CHG every 5-7 days or if soiled
- Replace administration sets not used for blood product or lipids no longer than every 4 days (96 hours)
- Use antimicrobial ointment for hemodialysis catheter insertion sites
- Perform CLABSI surveillance
Questions?

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

Or email HAIProgram@cdph.ca.gov