

Selected Best Practices and Suggestions for Improvement

PSI 07: Central Venous Catheter (CVC)-Related Bloodstream Infections (BSIs)

Why Focus on Central Line-Related Bloodstream Infections (CLABSI)?

- With a reported mortality rate of up to 35% and 14,000 to 28,000 associated deaths per year, hospitals are focusing improvement efforts in reducing and preventing CLABSI.¹
- The prevalence of CLABSI have been estimated to be around 80,000 in intensive care units each year, with 250,000 cases of bloodstream infections (BSIs) estimated to occur annually, if entire hospitals are assessed.²
- Recent data reveal that central venous catheters are increasingly used outside the intensive care unit, putting more patients at risk.¹
- Adverse outcomes include a prolonged length of stay of an additional 7 days; by several analyses, the cost of these infections is substantial, in terms of both morbidity and financial resources expended.^{3,4}
- CLABSI not only cause patient harm, but also increase the cost of patient care significantly.
- At least part of this cost is likely to be shouldered by hospitals. In 2008 the Centers for Medicaid and Medicare Services (CMS) identified CLABSI as one of a number of conditions for which hospitals do not receive the higher payment for cases when the condition was acquired during hospitalization³.
- Starting in 2015, the central venous catheter-related bloodstream infection PSI will be one of the measures used for Medicare's Hospital Value-Based Purchasing (as part of a composite indicator) that links quality to payment.⁵

Recommended Practice	Details of Recommended Practice
Central Line Insertion Checklist	A central line insertion checklist should be used to document that the insertion protocol was followed during insertion of a central line. The following elements, at a minimum, should be found on the checklist: Date, start time, end time, hands washed prior to insertion, sterile gloves, sterile gown, cap, mask for providers inserting and assisting with insertion, full-body sterile drape for patient, chlorhexidine skin prep, insertion site, type of catheter used, circumstances for insertion, dressing type, follow-up chest x-ray complete, and provider inserting procedure note. ^{4,6-7}
Site Selection	The subclavian site is the preferred site for central line insertion while the femoral site should be avoided except in an emergency. ^{2,4,6-7}
Maximal Barrier Precautions and Skin Preparation	To prevent catheter-related BSI, providers must ^{2,4, 6-7} : <ul style="list-style-type: none"> • Wash hands before and after central line insertion. • Apply maximal barrier precautions. • Use chlorhexidine skin prep unless contraindicated.

Daily Monitoring, Assessment, and Line Access	All central lines should be accessed daily for need and removed promptly if the line is no longer needed for care of the patient. Central lines should also be assessed daily for the presence of infection and to ensure that the dressing is intact. ^{2,4,7} Disinfect hubs, needless connectors, and injection ports prior to use. ⁸
---	---

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses, physicians and other providers, hospitalists, and pharmacists from infection control, intensive care, and inpatient units including operating room; and representatives from quality improvement, radiology, and information services to develop time-sequenced guidelines, care paths, or protocols for the full continuum of care for placement and maintenance of central line catheters.

Recommended Practice: Central Line Insertion Checklist

- Develop insertion checklist:
 - The above team must develop the central line insertion checklist. The checklist should have all of the following^{4,6-7}:
 - Date, start time, end time, hands washed prior to insertion, sterile gloves, sterile gown, cap, mask, full-body sterile drape, chlorhexidine skin prep, insertion site, type of catheter, circumstances for insertion, dressing type, follow-up chest x-ray complete, person inserting, cart used, and procedure note.
 - A central line insertion cart should include all the components and equipment needed to insert a central line. The cart should be available on all units/areas where central lines are inserted and should be brought into the room. The central line cart, at a minimum, should include all of the following⁶⁻⁷:
 - Supplies for maximal barrier precautions: sterile gloves, masks, sterile gowns, and caps for any provider inserting or assisting in the insertion of a central line. For the patient, a full-length sterile drape. (if Pyxis is used, replenish cart and charge patient).
 - Chlorhexidine for skin prep.
 - Central venous catheter insertion kit.
 - Central venous catheters (triple lumens, swans, PICCs, etc.).
 - Supplies to dress the catheter site (sterile, transparent, semipermeable dressings are preferred but if the site is bleeding or oozing or the patient is diaphoretic, a gauze dressing is preferred).
 - Central line insertion checklist.
- Follow Protocol for insertion

- The time-sequenced protocol includes the following for all insertions of central venous catheters:
 - Identify indications for catheter insertion and use. Patients must meet criteria for insertion, set by institution.⁶
 - Define competency criteria to identify staff eligible to insert central lines and remove central lines within the institution. These procedures should be done by a nurse, physician, or other health care professional who has received appropriate education to ensure that the proper procedures are followed.⁶
 - Start by first bringing the central line cart into the patient's room or within proximity of patient's room.
 - The clinician assisting the procedure starts with the checklist. The health care professional assisting with the insertion completes the checklist and is empowered to stop the procedure if the central line protocol is not followed.
 - Obtain informed consent from patient to insert the central line and put the consent in the medical record.
 - Educate the patient and if needed, the family, about central line associated bloodstream infections.⁷
 - Ensure that the person inserting and anyone assisting wash their hands with antiseptic soap and water or use an alcohol-based hand rub prior to starting to prep the patient (the use of gloves does not obviate hand hygiene).⁷

Recommended Practice: Site Selection

- Select appropriate site for insertion of central line^{2,6,7}:
 - The subclavian vein is the preferred site for nontunneled catheters in adults.²
 - Use of the femoral vein should be avoided except in an emergency.^{2,7}
 - The risks and benefits of a particular site must always be considered on an individual basis and clinician discretion should be used.
 - Providers (including any assistants) should wash their hands before and after palpating catheter insertion sites (palpation of the insertion site should not be performed after the application of antiseptic, unless performed with sterile gloves).

Recommended Practice: Maximal Barrier Precautions and Skin Preparation

- Prep skin:
 - Prepare skin with chlorhexidine skin antiseptic by first breaking the central core. Let the solution saturate the pad.
 - Apply with a back and forth motion for at least 30 seconds. Do not wipe or blot.⁴
 - Allow antiseptic solution to dry completely before puncturing the site.^{2,4}
 - If patient is allergic to chlorhexidine, apply substitute antiseptic (tincture of iodine, an iodophor, or 70% alcohol can be used as a substitute).
 - Apply maximal barrier precautions.^{2,4,6-7}
 - The clinician and anyone assisting with insertion should wear a cap, mask, sterile gown, and sterile gloves.

- The patient should be covered from head to toe with a sterile drape, leaving a small opening for the insertion site.
- Perform time-out to verify the patient ID x2, announce procedure to be performed, and verify that all medication and syringes are labeled.
- Clinician assisting is empowered to stop procedure if central line protocol is not followed.⁴
- Select appropriate catheter for insertion. Use the minimum number of ports or lumens essential for management of patient.
- Insert central line:
 - Consider placing central line via guided ultrasound if available.²
 - Place caps on lumens.
 - Suture in place or use sutureless securement device.
- Dress central line insertion site with a sterile, transparent, semipermeable dressing to cover the catheter site. If the site is bleeding or oozing or the patient is diaphoretic, a gauze dressing is preferred. Consider use of a chlorhexidine-impregnated sponge dressing.^{2,6}
 - Date and time the dressing.
 - Do not routinely apply prophylactic topical antimicrobial or antiseptic ointment or cream to the insertion site of peripheral venous catheters.
- After inserting and dressing the catheter site, remove gown and gloves and then wash hands.
 - Confirm catheter placement via x-ray after placement.
 - Clinician inserting central line should complete progress note on checklist, sign, and put in chart.

Recommended Practice: Daily Monitoring and Assessment

- Review necessity of central line daily^{2,6,7}:
 - During multidisciplinary rounds, review necessity of line and record date and time of line placement. If the patient has a long-term CVC (tunneled or totally implantable), determine a timeframe to review necessity, such as weekly.
 - Remove promptly if line is unnecessary.
 - Inspect central line site daily for signs of infection.
 - Do not replace catheters:
 - At scheduled time intervals.
 - Over a guide wire if the patient is suspected of having catheter-related infection.
 - For nontunneled catheters, change the transparent dressing and perform site care with a chlorhexidine-based antiseptic every 5 to 7 days or more frequently if the dressing

- is soiled, loose, or damp; change gauze dressing every 2 days or more frequently if the dressing is soiled, loose, or damp.
- Clean all injection ports with 70% alcohol or an iodophor before accessing the system. Also cap all stopcocks when not in use.⁸
 - Ensure patency of central line by flushing after every central line use.
 - When removing central lines, follow these steps:
 - Explain procedure to patient.
 - Position patient.
 - Perform hand hygiene and put on clean gloves.
 - Remove the dressing and discard along with gloves.
 - Repeat hand hygiene and don sterile gloves.
 - Remove sutures.
 - Ask the patient to take a deep breath, hold it, and bear down (if applicable).
 - Pull the catheter slowly and gently while covering the site with sterile gauze to prevent air embolism. Stop if there is any resistance.
 - Once catheter is removed, hold pressure until bleeding stops and apply a sterile occlusive dressing.
 - Inspect the integrity of the central line to make sure it did not break off inside the vein.
 - Establish standing order sets for inserting central lines, to include chest x-ray to confirm placement, type of dressing to be used, dressing changes, and daily monitoring. Mandate the use of these standing orders anytime a central line is placed.
 - Assign responsibility for appropriate placement of standing orders on units (decisions based on accessibility via electronic medical record versus paper).

Educational Recommendation

- Plan and provide education on protocols and standing orders to physicians and other providers, nurses, and all other staff involved in inserting, maintaining, and accessing central lines (emergency department, intensive care unit, other medical units, ancillary departments, etc). Education should occur upon hire, annually, when this protocol is added to job responsibilities, and when new equipment is introduced in the organization.⁷

Effectiveness of Action Items

- Track compliance with elements of established protocol steps by using insertion checklist, appropriate documentation, and other required procedures.⁷
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.⁷
- Mandate that all personnel follow the central line protocol and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.⁷
- Conduct surveillance and prevalence of bloodstream infections (using Centers for Disease Control and Prevention's NHSN definitions) to evaluate outcomes of new process.⁷
- Monitor and evaluate performance regularly to sustain improvements achieved.⁷

Additional Resources

Systems/Processes

- How-to Guide: Prevent Central Line-Associated Bloodstream Infection. Institute for Healthcare Improvement
<http://www.ihl.org/resources/pages/tools/howtoguidepreventcentrallineassociatedbloodstreaminfection.aspx>
- How-to Guide: Improving Hand Hygiene. Institute for Healthcare Improvement
<http://www.ihl.org/knowledge/Pages/Tools/HowtoGuideImprovingHandHygiene.aspx>
- Guideline for Hand Hygiene in Health-Care Settings. Centers for Disease Control and Prevention
<http://www.cdc.gov/mmwr/PDF/rr/rr5116.pdf>
- The Joint Commission. Preventing Central Line–Associated Bloodstream Infections: A Global Challenge, a Global Perspective. Oak Brook, IL: Joint Commission Resources
http://www.jointcommission.org/assets/1/18/CLABSI_Monograph.pdf
- Johns Hopkins Medicine Department of Hospital Epidemiology and Infection Control. Central Line-Associated Bloodstream Infections (CLABSI)
http://www.hopkinsmedicine.org/heic/infection_surveillance/clabsi.html
- Armstrong Institute for Patient Safety and Quality: CLABSI: Central Line-Associated Bloodstream Infection Prevention Toolkits & Resources
<https://armstrongresearch.hopkinsmedicine.org/csts/clabsi/resources.aspx>

Policies/Protocols

- Montana State Hospital Policy and Procedure – Handwashing
http://dphhs.mt.gov/Portals/85/amdd/documents/MSH/volumeii/infectioncontrol/handwashing_1.pdf
- JHH Policy for the Care of Patient with Short Term Central Venous Catheter
https://cdn.community360.net/app/jh/csts/clabsi/JHH_VAD_Appendix_F_Care_Shortterm_Cath.pdf
- Saskatoon Health Region Central Venous Catheters Insertion – Assisting Policy
<https://www.saskatoonhealthregion.ca/about/NursingManual/1073.pdf>

Tools

- Central Line Insertion Checklist. Johns Hopkins Health System
https://cdn.community360.net/app/jh/csts/clabsi/JHH_VAD_Appendix_C_Central_Line_Checklist.pdf

Staff Required

- Physicians and other providers trained in inserting central lines
- Specially trained nurse to provide assistance with insertion of central line
- Multidisciplinary team rounding on patient

Equipment

- Antibacterial soap or alcohol-based hand rub
- Chlorhexidine skin antiseptic

- Maximal barrier precautions
- Central line catheters

Communication

- Systemwide education on protocol
- Time-out to verify hand washing before central line insertion

Authority/Accountability

- Senior leadership mandating protocol for all providers⁶
- Providers inserting and assisting insertion of central lines held accountable for following protocol
- RN empowered to stop procedure⁴

References

1. Safe practices for better healthcare—2010 update. Washington, DC: National Quality Forum; 2010.
2. O’Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta: Centers for Disease Control and Prevention; 2011. www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf. Accessed May 20, 2016.
3. Hospital-Acquired Conditions and Present on Admission Indicator Reporting Provision. Baltimore, MD: Centers for Medicare & Medicaid Services; October 2012. <https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/wPOA-Fact-Sheet.pdf>. Accessed May 20, 2016.
4. How-to guide: prevent central line-associated bloodstream infection (CLABSI). Cambridge, MA: Institute for Healthcare Improvement; 2012. <http://www.ihl.org/resources/Pages/Tools/HowtoGuidePreventCentralLineAssociatedBloodstreamInfection.aspx>. Accessed May 20, 2016.
5. Hospital Inpatient Quality Reporting (IQR) Program measures (calendar year 2014 discharges). (Prepared by Telligen under contract to the Centers for Medicare & Medicaid Services.) <http://qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic/Page/QnetTier3&cid=1138900298473>. Accessed May 20, 2016.
6. Marschall J, Mermel L, Classen D, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. *Infect Cont Hospl Epidemiol* October 2008;29 Suppl 1:S22-S30.
7. The Joint Commission. 2016 National Patient Safety Goals. http://www.jointcommission.org/standards_information/npsgs.aspx.
8. Chopra V, Krein SL, Olmsted RN, et al. Prevention of central line-associated bloodstream infections: brief update review. In: *Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices*. Rockville, MD: Agency for Healthcare Research and Quality; 2013 Mar. (Evidence Reports/Technology Assessments, No. 211.) Chapter 10. <http://www.ahrq.gov/sites/default/files/wysiwyg/research/findings/evidence-based-reports/services/quality/patientsftyupdate/ptsafetyIIchap10.pdf>. Accessed May 20, 2016.