Selected Best Practices and Suggestions for Improvement

PDI 12: Central Venous Catheter (CVC)-Related Bloodstream Infection Rate (BSIs)

Why focus on central line-associated bloodstream infections (CLABSIs) in children?

- With a reported mortality rate of up to 35 percent and 14,000 to 28,000 associated deaths per year, CLABSIs are a target of hospital prevention and reduction efforts.[1]
- National Healthcare Safety Network (NHSN) data show from 2006 to 2008 the pooled mean rate of CLABSIs for pediatric cardiothoracic ICUs was 3.3 per 1,000 central line days; for pediatric medical/surgical intensive care units (ICUs), the pooled mean rate was 3.0 CLABSIs per 1,000 central line days.[2]
- Overall, central venous catheters are increasingly used in hospitals outside of ICUs.[1]
- In addition to the considerable morbidity and mortality risks for patients, pediatric CLABSIs are costly. A recent study comparing pediatric CLABSI cases to matched controls showed an attributable cost of about $55,000 and an attributable length of stay of 19 days.[3]
- Part of this cost is likely to be shouldered by hospitals, as the Centers for Medicare & Medicaid Services will not reimburse for CLABSI for Medicaid patients unless it is present on admission.[4]
- In addition, CLABSI (in neonatal ICUs and pediatric ICUs) is one of the core set of children's health care quality measures for voluntary public reporting by Medicaid and the Children's Health Insurance Program.[5]
- AHRQ-funded researchers found that an intervention to implement evidence-based practices and reduce CLABSI rates (part of the Michigan Health and Hospital Association Keystone Center for Patient Safety and Quality Keystone ICU project) was successful at nearly eliminating CLABSIs in ICUs (the study included one pediatric ICU).[6]
- Efforts to decrease CLABSIs have been shown to be successful in pediatric populations as well. In one study that implemented a best-practice central line maintenance care bundle, CLABSI rates in hospitalized pediatric oncology patients decreased from 2.25 per 1,000 central line days at baseline to 0.81 per 1,000 central line days by the second 12 months of the intervention.[7]

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, if not contraindicated (e.g., <2 months of age), insertion site, type of catheter used, circumstances for insertion, dressing type, followup chest x-ray complete, and provider inserting procedure note.[8-10]
Site Selection	The upper or lower extremities (or the scalp in neonates or young infants) can be used as the catheter insertion site.[11]

Maximal Barrier Precautions and Skin Preparation	To prevent CLABSIs, providers must[8-11]: • 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 assessed 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.[8,10,11] Disinfect hubs, needless connectors, and injection ports prior to use.[12]

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 in children.

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[8-10]:
        - Date, start time, end time, hands washed prior to insertion, sterile gloves, sterile gown, cap, mask, full-body sterile drape, chlorhexidine skin prep unless contraindicated, insertion site, type of catheter, circumstances for insertion, dressing type, followup 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 following[9,10]:
        - 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, if not contraindicated.
        - Central venous catheter insertion kit.
        - Central venous catheters (triple lumens, Swan-Ganz catheters, peripherally inserted central catheters, umbilical catheters, 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.[9]
    - 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.[9]
    - 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.[8]
    - Obtain informed consent from patient and/or patient's caregiver(s) to insert the central line and put the consent in the medical record.
    - Educate the patient, if appropriate, and caregivers about CLABSIs.[10]
    - 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).[10]

Recommended Practice: Site Selection

- Select appropriate site for insertion of central line[9-11]:

  - The upper or lower extremities or the scalp (in neonates or young infants) can be used as an insertion site.[11]
  - 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

- Prepare skin:

  - Prepare skin with chlorhexidine skin antiseptic, if not contraindicated, 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.[8]
  - Allow antiseptic solution to dry completely before puncturing the site.[8,11]

- If patient is allergic to chlorhexidine or it is contraindicated, apply substitute antiseptic (tincture of iodine, an iodophor, or 70% alcohol can be used as a substitute).
    - For an umbilical insertion site, avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (e.g., povidone iodine) can be used.[11]
- Apply maximal barrier precautions.[8-11]
    - 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 timeout 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.[8]
- 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.[11]
    - 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 for patients >2 months old.[9,11]
    - 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, Assessment, and Line Access

- Review necessity of central line daily[9-11]:
    - 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.
- Remove umbilical catheters as soon as possible. Umbilical artery catheters should not stay in place for more than 5 days and umbilical venous catheters should not stay in place for more than 14 days.[11]
- 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.

- Remove and do not replace umbilicial artery catheters if any signs of CLABSI, vascular insufficiency in the lower extremities, or thrombosis are present.[11]
- Remove and do not replace umbilical venous catheters if any signs of CLABSI or thrombosis are present.
- Follow appropriate dressing assessment and replacement according to best practices specific to the age of the child, type of central line, and other patient-related factors, such as skin condition.

  - In younger pediatric patients, the risk of dislodging the catheter may outweigh the benefit of changing the dressing.[11]

- Clean all injection ports with 70% alcohol or an iodophor before accessing the system. Also cap all stopcocks when not in use.[12]
- Ensure patency of central line by flushing after every central line use.
- When removing central lines, follow these steps:

  - Assess developmental status of the child to determine need for restraint or sedation.
  - Explain procedure to patient/caregiver (as appropriate).
  - 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.[10]
- Provide appropriate education to the caregivers of the pediatric patient on proper infection prevention techniques, such as appropriate hand washing. Caregivers should also be educated on how to care for the line (per hospital policy) if the child is to be discharged with a central line (e.g., Broviac, port-a-cath) in place.

Effectiveness of Action Items

- Track compliance with elements of established protocol steps by using insertion checklist, appropriate documentation, and other required procedures.[10]
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.[10]
- 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.[9]
- Conduct surveillance and prevalence of bloodstream infections (using Centers for Disease Control and Prevention's NHSN definitions) to evaluate outcomes of new process.[9,13]
- Monitor and evaluate performance regularly to sustain improvements achieved.[9]

Additional Resources

Systems/Processes

- How-to Guide: Prevent Central Line-Associated Bloodstream Infections. Institute for Healthcare Improvement
  http://www.ihi.org/resources/pages/tools/howtoguidepreventcentrallineassociatedbloodstreaminfection.aspx
- How-to Guide: Improving Hand Hygiene. Institute for Healthcare Improvement.
  http://www.ihi.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
- Preventing Central Line–Associated Bloodstream Infections: A Global Challenge, a Global Perspective. Joint Commission Resources
  http://www.jointcommission.org/assets/1/18/CLABSI_Monograph.pdf
- Central Line-Associated Bloodstream Infections (CLABSI). Johns Hopkins Medicine Department of Hospital Epidemiology and Infection Control
  http://www.hopkinsmedicine.org/heic/infection_surveillance/clabsi.html
- CLABSI: Central Line-Associated Bloodstream Infection Prevention Toolkits & Resources. Armstrong Institute for Patient Safety and Quality
  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
- Policy for the Care of Patient With Short Term Central Venous Catheter. Johns Hopkins Hospital https://cdn.community360.net/app/jh/csts/clabsi/JHH_VAD_Appendix_F_Care_Shortterm_Cath.pdf
- Policies & Procedures. Central Venous Catheters Insertion – Assisting. Saskatoon Health Region https://www.saskatoonhealthregion.ca/about/NursingManual/1073.pdf

Tools

- Central Line Insertion Care Team Checklist. Johns Hopkins Health System https://cdn.community360.net/app/jh/csts/clabsi/JHH_VAD_Appendix_C_Central_Line_Checklist.pdf
- Reducing Central Venous Catheter-associated Bloodstream Infections, CHANGE PACKAGE. CHCA Clinical Improvement Collaborative http://iphi.nonprofitoffice.com/vertical/Sites/%7B00CFF503-04BE-4895-B1A4-FF765B2CE512%7D/uploads/%7BA8536386-10B4-4983-A868-57FD85E3D911%7D.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
- Timeout to verify hand washing before central line insertion

Authority/Accountability

- Senior leadership mandating protocol for all providers[8]
- Providers inserting and assisting insertion of central lines held accountable for following protocol
- RN empowered to stop procedure[7]

References

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