

## CVC Maintenance Bundles

Central venous catheters (CVCs) can be in place from hours to weeks or longer and are manipulated by a multitude of staff members. CVCs are accessed many times while in place, to deliver fluids and medications and to collect blood specimens. Because each entry into access points in the delivery system is an opportunity to introduce microorganisms, the post-CVC insertion period presents multiple opportunities for risk of infection.

Almost 72% of all central line-associated bloodstream infections (CLABSIs) reported to the National Healthcare Safety Network (NHSN) by Pennsylvania acute care hospitals in 2010 occurred more than five days after insertion, suggesting that infection prevention lapses likely occurred in the postinsertion care and maintenance of the CVCs.<sup>1</sup> Shapey et al. sought to assess staff members' practice and knowledge of CVC postinsertion care in a tertiary care hospital, finding that lapses in proper infection prevention techniques occurred in 45% of postinsertion care episodes; **the most common lapses were related to keeping caps and site dressings in place.**<sup>2</sup>

Many of the evidence-based practices used for the insertion of CVCs are also important in the care and maintenance of these catheters (for example, hand hygiene, proper skin antisepsis at the insertion site, dressing changes, thorough disinfection of CVC hubs and injection ports, replacement of administration sets and fluids, daily assessment of the continued need for the CVC).<sup>3,4</sup> The use of insertion bundles has resulted in more consistent application of evidence-based practices during the insertion of CVCs, but much less is known about the potential impact postinsertion bundles might have on the prevention of CLABSIs.

### Potential Maintenance Bundle Components/Elements

- Daily review of line necessity with prompt removal of unnecessary CVCs and documentation
  - Daily review of continued need for CVCs can be done in the following ways:
    - During multidisciplinary patient care rounds
    - By using reminders (such as stickers on patient records or order sets)
    - Via automated computer alerts
- Details of removal documented in the records (including date, location, and signature and name of operator undertaking removal)
- Hand hygiene before manipulation of the IV system
- Catheter injection ports
  - Open lumens (such as catheter hubs or stopcocks) are covered by injection ports, sterile end-caps or needleless connectors.
  - Access ports are sanitized with alcohol, chlorhexidine/alcohol, povidone-iodine, and iodophors before and after each use, a method known as the “Scrub the Hub” protocol.
  - Caps are changed no more often than 72 hours (or according to the manufacturer’s recommendations and whenever the administration set is changed).<sup>5</sup>
- Proper procedures for catheter site dressing monitoring/changes
  - Change gauze dressing every 2 days, clear dressings every 7 days (and more frequently if soiled, damp, or loose).<sup>5</sup>

■Catheter access/manipulation

- Aseptic techniques are used for all access to the line.
- Catheter site care is performed with chlorhexidine at dressing changes.<sup>5</sup> In the absence of chlorhexidine, use povidone iodine.
- Ports or hubs are cleaned using “Scrub the Hub” protocol prior to catheter access.

■Administration set (primary and secondary) replacement

- Set is replaced no more frequently than every 96 hours, and at least every 7 days, after initiation of use unless contamination occurs. This replacement interval is safe and permits considerable cost savings to health care organizations,<sup>6,3,7</sup> with the following exceptions:
  - Set is replaced immediately after administration of blood/blood products.
  - Set is replaced after 24 hours following administration of infusates that enhance microbial growth (for example, fat emulsions combined with amino acids and glucose in three-in-one admixture or infused separately).<sup>6,3,7</sup>
  - Needleless components should be changed at least as often as the administration set and no more often than every 72 hours.<sup>3</sup>
- The evidence is less clear for intravenous sets that are used intermittently, due to a lack of published research in this area.

■Infusate preparation using aseptic technique

■Health care personnel training

- All staff members manipulating CVCs could be required to attend a hands-on training class in the proper techniques for caring for and accessing catheters followed by a competency evaluation of CVC insertion site and hub care.

## Maintenance Bundles to Reduce CLABSI Rates

Intervention/Organization/Guidelines	Bundle Components	Outcomes (if applicable or available)
<p>Scope: National (U.S.) and multi-institutional, 5 adult ICUs</p> <p>Developed by: U.S. researchers at a large university hospital</p> <p>Time Frame: 2004</p>	<p>Education was directed at all nurses and physicians. CVC insertion practices were not the focus of the study, as evidence-based practices for CVC insertion were already part of the hospital's internal guidelines.<sup>8</sup></p> <p>Components of the postinsertion care education included<sup>8</sup>:</p> <ul style="list-style-type: none"> <li>■ Hand hygiene</li> <li>■ Proper procedures for catheter site dressing changes</li> <li>■ Proper procedures for CVC manipulation</li> <li>■ Proper procedures for infusate preparation</li> </ul>	<p>CLABSI rates decreased from 3.9 infections per 1,000 catheter-days before the intervention to 1.0 infection per 1,000 catheter-days during the intervention.<sup>8</sup></p>
<p>Scope: National (U.S.) Multi-institutional, 29 pediatric ICUs across the United States</p> <p>Developed by: 27 National Association of Children's Hospitals and Related Institutions (NACHRI) member hospitals</p> <p>Time Frame: October 2006–September 2007</p>	<p>The group sought to identify which infection prevention practices would have an impact on CLABSI rates in children. The pediatric population has risk factors for infection that are different from adults (for example, CVCs are often used to obtain blood samples or are kept in place longer in case the line is needed in an emergency, or the presence of underlying genetic syndromes and congenital malformations could affect the functioning of CVCs in children), and little research has been done on whether multifaceted interventions that have been successful in reducing adult CLABSI rates would apply to children.<sup>9</sup></p> <p><b>Insertion bundle<sup>9</sup></b></p> <ul style="list-style-type: none"> <li>○ Wash hands before the procedure.</li> <li>○ For all children aged more than 2 months, use chlorhexidine gluconate to scrub the insertion site for 30 seconds for all areas except the groin, which should be scrubbed for 2 minutes. Scrubbing should be followed by 30 to 60 seconds of air drying.</li> <li>○ No iodine skin prep or ointment is used at the insertion site.</li> <li>○ Prepackage or fill the insertion cart, tray, or box, including full sterile barriers.</li> <li>○ Create an insertion checklist, which empowers staff to stop a nonemergent procedure if it does not follow sterile insertion practices.</li> <li>○ Use only polyurethane or Teflon catheters.</li> <li>○ Conduct insertion training for all care providers, including slides and video.</li> </ul> <p><b>Maintenance bundle<sup>9</sup></b></p> <ul style="list-style-type: none"> <li>● Assess daily whether catheter is needed.</li> <li>● Catheter-site care <ul style="list-style-type: none"> <li>○ No iodine ointment.</li> <li>○ Use a chlorhexidine gluconate scrub to sites for dressing changes (30-second scrub, 30-second air-dry).</li> <li>○ <u>Change gauze dressings every 2 days unless they are soiled, dampened, or loosened.</u></li> <li>○ <u>Change clear dressings every 7 days unless they are soiled, dampened, or loosened.</u></li> </ul> </li> </ul>	<p>CLABSI rates decreased by 43% across the 29 pediatric intensive care units (PICUs) (5.4 versus 3.1 CLABSIs per 1,000 catheter-days) over the study period.<sup>9</sup></p> <p>Adherence to each element of the insertion and maintenance bundles was also monitored during this time period, with insertion bundle adherence at 84% and maintenance bundle adherence at 82%; bundle adherence was assessed as “all or none,” meaning all elements of each patient's insertion and maintenance procedure needed to comply with all elements of the respective bundle to be considered adherent. When the researchers assessed the relative importance of the insertion versus the maintenance bundles, they found that <b>the only significant predictor of</b></p>

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	<ul style="list-style-type: none"> <li>○ Use a prepackaged dressing-change kit or supply area.</li> <li>● Catheter hub, cap, and tubing care <ul style="list-style-type: none"> <li>○ Replace administration sets, including add-on devices, no more frequently than every 72 hours unless they are soiled or suspected to be infected.</li> <li>○ <u>Replace tubing that is used to administer blood, blood products, or lipids within 24 hours of initiating infusion.</u></li> <li>○ <u>Change caps no more often than 72 hours (or according to manufacturer recommendations); however, caps should be replaced when the administration set is changed.</u></li> <li>○ Use the prepackaged cap-change kit, or supply area elements to be designated by the local institution.</li> </ul> </li> </ul> <p>Procedures shown <u>underlined</u> are according to the recommendations of the US Centers for Disease Control and Prevention (CDC).</p>	<p>improvement in the CLABSI rate was maintenance bundle adherence.<sup>9</sup></p>
<p>Scope: One institution; Denver VA Medical Center</p> <p>Developed by: Denver VA Medical Center nursing staff</p> <p>Time Frame: October 1, 2008–September 30, 2009</p>	<p>This study was one of the first to focus on postinsertion care of CVCs in a setting where insertion bundles had already been successfully implemented. It demonstrated that sterile technique at the time of CVC insertion, while essential to prevent infection, is not sufficient alone.<sup>10</sup></p> <p>The postinsertion bundle, developed by nursing staff and facilitated by each nursing unit’s IV champion, included the following<sup>10</sup>:</p> <ul style="list-style-type: none"> <li>● Hand hygiene before manipulation of the IV system</li> <li>● Daily inspection of the insertion site</li> <li>● Site care if the dressing was wet or soiled or had not been changed for 7 days</li> <li>● Application of a chlorhexidine-impregnated sponge at the insertion site</li> <li>● Alcohol scrub of infusion hubs for 15 seconds before each use</li> <li>● Documentation of the ongoing need for the CVC</li> </ul> <p>All nursing staff members were required to attend a 4-hour, hands-on training class in the proper techniques for caring for and accessing catheters, which was followed by a competency evaluation of CVC insertion site and hub care.<sup>10</sup></p>	<p>During the implementation of the postinsertion bundle, adherence to the insertion bundle protocol remained high at 93%. The CLABSI rate, however, declined significantly to 1.1 CLABSIs per 1,000 catheter-days, from the 5.7 rate observed in the preintervention period.<sup>10</sup></p>
<p>Guidelines: US CDC’s 2002 maintenance bundle guideline</p> <p>Developed by: Consensus of pediatric physicians and nurses.<sup>5</sup></p> <p>Time Frame: 2002</p>	<ul style="list-style-type: none"> <li>● Assess the continued need for the catheter every day.</li> <li>● Perform catheter site care with chlorhexidine at dressing changes.</li> <li>● Change gauze dressing every 2 days, clear dressings every 7 days (and more frequently if soiled, damp, or loose).</li> <li>● Replace administration sets and add-on devices no more frequently than every 72 hours, unless contamination occurs.</li> </ul> <p>Replace tubing used to administer blood, blood products, or lipids within 24 hours of start of infusion.</p> <p>Change caps no more often than 72 hours (or according to manufacturer’s recommendations and whenever the administration set is changed).</p>	<p>While this was a successful initiative, the collaborators recognize that additional research will be necessary to determine the optimal maintenance bundle components that will facilitate the elimination of CLABSIs in pediatric patients with short- or long-term CVCs.<sup>9</sup></p>

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<p>Guidelines: Health Protection Scotland: Preventing infections when inserting and maintaining a CVC<sup>11,12</sup></p> <p>Developed by: National Services Scotland</p>	<p>When maintaining an inserted CVC and accessing the insertion site and line, ensure the following<sup>11,12</sup>:</p> <ul style="list-style-type: none"> <li>• The need for the CVC is reviewed and recorded today (on a daily basis).</li> <li>• The CVC dressing is intact.</li> <li>• The CVC dressing has been changed in the last seven days.</li> <li>• A solution of 2% chlorhexidine gluconate in 70% isopropyl alcohol is used for cleaning the insertion site during dressing changes.</li> <li>• Hand hygiene is performed immediately before accessing the line or site (WHO Moment 2 of “My 5 Moments for Hand Hygiene”).</li> <li>• An antiseptic containing 70% isopropyl alcohol is used to clean the access hub prior to accessing; rub the access hub for at least 15 seconds (“scrub the hub”).</li> </ul>	
<p>Guidelines: United Kingdom Department of Health – High Impact Intervention: Central venous catheter care bundle<sup>13</sup></p>	<p>Central venous catheter care bundle includes<sup>13</sup>:</p> <p>Hand hygiene</p> <ul style="list-style-type: none"> <li>• Hands are decontaminated immediately before and after each episode of patient contact using the correct hand hygiene technique. (Use of the WHO “My 5 Moments of Hand Hygiene” or the National Patient Safety Association “Clean Your Hands” campaign is recommended.)</li> </ul> <p>Site inspection</p> <ul style="list-style-type: none"> <li>• Site is inspected daily for signs of infection, and finding is recorded in the patient’s record.</li> </ul> <p>Dressing</p> <ul style="list-style-type: none"> <li>• An intact, dry, adherent transparent dressing is present.</li> <li>• Insertion site should be cleaned with 2% chlorhexidine gluconate in 70% isopropyl alcohol prior to if dressing changed.</li> </ul> <p>Catheter injection ports</p> <ul style="list-style-type: none"> <li>• Injection ports are covered by caps or valved connectors.</li> </ul> <p>Catheter access</p> <ul style="list-style-type: none"> <li>• Aseptic techniques are used for all access to the line.</li> <li>• Ports or hubs are cleaned with 2% chlorhexidine gluconate in 70% isopropyl alcohol prior to catheter access.</li> </ul> <p>Administration set replacement</p> <ul style="list-style-type: none"> <li>• Set is replaced immediately after administration of blood/blood products.</li> <li>• Set is replaced after 24 hours following total parenteral nutrition (if it contains lipids).</li> <li>• Set is replaced within 72 hours of all other fluid sets.</li> </ul> <p>Catheter replacement</p> <ul style="list-style-type: none"> <li>• Catheter is removed if no longer required or decision not to remove is recorded.</li> <li>• Details of removal are documented in the records (including date, location, and signature and name of operator undertaking removal.)</li> </ul>	

Intervention/Organization/Guidelines	Bundle Components	Outcomes (if applicable or available)
<p>Guidelines: Canadian Patient Safety Institute (CPSI) Safer Healthcare Now!<sup>14</sup></p>	<p>Central Line Care bundle<sup>14</sup>:</p> <ul style="list-style-type: none"> <li>• Daily review of line necessity, with prompt removal of unnecessary lines</li> <li>• Aseptic lumen access</li> <li>• Catheter site and tubing</li> </ul> <p>Compliance with the central line bundles can be measured by simple assessment of completion of each item. The approach has been most successful when all elements are executed together—an “all or none” strategy used by collaborative pediatric teams.</p> <p>Additional details for each of the bundle elements are included on the Canadian Patient Safety Institute (CPSI) Safer Healthcare Now! website.<sup>14</sup></p>	

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