Maintenance and Removal of Central Venous Catheters
Presenter

Karen Jones, RN, MPH, CIC
Clinical Research Project Coordinator
University of Michigan

Contributions by
Vineet Chopra, MD, MSc
University of Michigan

Kristi Felix, RN, BSN, CRRN, CIC, FAPIC
Madonna Rehabilitation Hospital

Len Mermel, DO, ScM, AM (Hon)
Medical School of Brown University

Russ Olmsted, MPH, CIC, FAPIC
Trinity Health, Livonia MI

Payal Patel, MD, MPH
University of Michigan
Learning Objectives

• Discuss components of the central venous catheter (CVC) maintenance bundle

• Outline issues to address during the transition of care of a patient with a CVC

• Describe strategies to promote the removal of unnecessary CVCs
Impact of Infection

- CLABSIs result in increased mortality and health care costs
- Of all healthcare-associated infections, CLABSIs cause the highest number of preventable deaths
- 65%–70% of CLABSIs can be prevented by implementing evidence-based practices

Standardize CVC maintenance care where possible
Maintain awareness of CVCs that are in place
Remove CVC when no longer necessary

Mrs. Smith is admitted to the ICU following a motorcycle accident
   - Traumatic brain injury
   - Compound open fracture of femur, rib fractures
   - Requires mechanical ventilation

Has an internal jugular CVC for hemodynamic support and antibiotic administration.

**Question: What are the CVC maintenance priorities for this patient?**

*Disclaimer: All case studies are hypothetical and not based on any actual patient information. Any similarity between a case study and actual patient experience is purely coincidental.*
Conduct daily assessments of the necessity of CVCs, with prompt removal if no longer needed

Access ports of entry with aseptic technique

Perform proper care of infusion tubing

Assess and care for central venous catheter dressings

*(Checklist for Prevention of Central Line Associate Blood Stream Infections, CDC, 2011)*
Basics to Consider

Hand hygiene before and after all CVC care and manipulation

Personal protective equipment use for insertion and maintenance of CVCs

Competency-based training for those that insert and maintain CVCs

Proper staffing of nurses that care for patients with CVCs in critical care

Engage patient and families in CVC care and education

(Marschall J, Infect Control Hosp Epidemiol, 2014)
Daily Assessment of Necessity

Assess necessity of CVC daily with a multidisciplinary team

Indications for ongoing use can include:

– Clinical instability of the patient
– Prescribed continuous or intermittent infusion therapy
– Hemodynamic monitoring
– Documented history of difficult peripheral venous access

Use tools like electronic medical record reminders, daily rounding forms or checklists to prompt discussion among staff and leaders

(Gorski L, J Infus Nurs, 2016)
Example of CVC Necessity Tracking Tool

<table>
<thead>
<tr>
<th>Date</th>
<th>Time (check once per day)</th>
<th>Necessity of Central Line Reviewed</th>
<th>Indication for Central Line Use/Continued Use (see list below)</th>
<th>If no longer indicated, is there a plan to remove Central Line?</th>
<th>RN Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No</td>
<td>Yes No N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INDICATIONS FOR CENTRAL LINE USE/CONTINUED USE: (List all that apply)**

1. Prolonged IV therapy
   a. Antibiotics
   b. Total parenteral nutrition
   c. Chemotherapy
2. Irritating medications
3. Critical illness requiring central venous access
   a. Hemodynamic monitoring
   b. Vasoactive drips
   c. Hemodialysis or plasmapheresis

Comment: Blood sampling is not indication for a central line unless there is poor peripheral venous access.

Modified from IPRO's "Review Daily With Physician for Foley Catheter Necessity" Tracking Tool.

Proper Access of CVC

Access CVC only with sterile devices

“Scrub the hub” vigorously for at least 5 seconds with an appropriate antiseptic and allow to dry prior to every access

Assess patency of lines by flushing and aspirating for blood return

Minimize the interruptions of the CVC
  – Maintain a closed system as much as possible
  – Minimize frequency of tubing disconnects and flushing

CVC Infusion Tubing

Replace administration sets not used for blood, blood products or lipids at intervals of no more frequently than every 96 hours but at least seven days

- Includes secondary piggyback sets attached to primary continuous set if it remains connected

Replace tubing used to administer Propofol infusions every 6 or 12 hours, per the manufacturers’ recommendations or when the container is changed

Change needleless components at least as frequently as the administration set

- There is no benefit to changing these more frequently than every 72 hours

(Gorski L, J Infus Nurs 2016; O’Grady NP, Am J Infect Control, 2011)
CVC Dressing Change

Assess dressing status at least daily

Replace dressing:
- Every 2 days for gauze dressings
- Every 7 days for transparent dressings
- And whenever dressing becomes damp, loosened or soiled

Use aseptic technique and prepare clean skin with greater than 0.5% chlorhexidine with alcohol

(O’Grady NP, Am J Infect Control, 2011)
Document date and time on dressing

Do not disturb or change a clean, dry, intact dressing until the due date
Case Study: Transfer of Care

Tracheotomy placed for continuous ventilator support

Neurological status remains poor

Diagnosed with osteomyelitis

Peripherally inserted central catheter (PICC line) placed for long-term course of antibiotics

Mrs. Smith to be transferred to LTACH

Question: What aspects of care coordination for the central line need to be addressed upon transfer?

Disclaimer: All case studies are hypothetical and not based on any actual patient information. Any similarity between a case study and actual patient experience is purely coincidental.
Key details to communicate:

- Initial indication for CVC
  - If for antibiotics, the date they were started and reason for treatment
- Date that the line was placed
- Date that the dressing and tubing were last changed
- Issues with patency of lumens

Ongoing assessment of necessity should occur in the new care setting

Disclaimer: All case studies are hypothetical and not based on any actual patient information. Any similarity between a case study and actual patient experience is purely coincidental.
Day 28: Mrs. Smith is improving and breathing on her own and she is hemodynamically stable

Antibiotic course is completed and the infection has resolved

She is scheduled for routine lab tests every two days

**Question:** Does Mrs. Smith need to continue to have a PICC line in place? Can the line be removed?

*Disclaimer: All case studies are hypothetical and not based on any actual patient information. Any similarity between a case study and actual patient experience is purely coincidental.*
Removal: A Bundle Element

Michigan Keystone Project

Decrease in CLABSI in 103 ICUs in Michigan (66% reduction)

- Hand hygiene
- Full barrier precautions during central line insertion
- Skin cleansing with chlorhexidine
- Avoiding femoral site
- Removing unnecessary catheters
- Use of insertion checklist

### Appropriate Indications for PICC use

<table>
<thead>
<tr>
<th>Indication</th>
<th>Duration Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery of peripherally compatible infusates when the proposed duration of such use is ≥6 days</td>
<td></td>
</tr>
<tr>
<td>Delivery of non-peripherally compatible infusates (e.g., irritants or vesicants), regardless of proposed duration of use</td>
<td></td>
</tr>
<tr>
<td>Delivery of cyclical or episodic chemotherapy that can be administered through a peripheral vein in patients with active cancer, provided that the proposed duration of such treatment is ≥3 months</td>
<td></td>
</tr>
<tr>
<td>Invasive hemodynamic monitoring or requirement to obtain central venous access in a critically ill patient, provided the proposed duration of such use is ≥15 days</td>
<td></td>
</tr>
<tr>
<td>Frequent phlebotomy (every 8 hours) in a hospitalized patient, provided that the proposed duration of such use is ≥6 days</td>
<td></td>
</tr>
<tr>
<td>Intermittent infusions or infrequent phlebotomy in patients with poor/difficult peripheral venous access, provided that the proposed duration of such use is ≥6 days</td>
<td></td>
</tr>
<tr>
<td>For infusions or palliative treatment during end-of-life care</td>
<td></td>
</tr>
<tr>
<td>Delivery of peripherally compatible infusates for patients residing in skilled nursing facilities or transitioning from hospital to home, provided that the proposed duration of such use is ≥15 days</td>
<td></td>
</tr>
</tbody>
</table>

*(Chopra V, Ann Intern Med, 2015)*
Barriers to CVC Maintenance and Removal

• Difficulty engaging physicians and nurses
• Lack of insertion and maintenance supplies
• Lack of knowledge and skill regarding CVC care and maintenance processes
• Poor communication across the continuum of care
Solutions for Improvement

• Use data to drive action: monitor and share CVC utilization and infection data

• Standardize where you can
  – Pre-packaged dressing change kits
  – Protocols for care processes

• Audit adherence and provide with “just-in-time” education and feedback

• Address CVC need at every hand-off
Tools for Improvement

**CLABSI Surveillance. Dressing Integrity Observation Audit**

Reviewers: ___________ Month Completed ___________

<table>
<thead>
<tr>
<th>Unit</th>
<th>Y/N</th>
<th>Y/N</th>
<th>Y/N</th>
<th>Y/N</th>
<th>Y/N</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Line Dressing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Line Dressing is intact and 100% occlusive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dressing is intact</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The dressing has been changed within the last 7 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The gauze dressing has been changed within the last 48 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The gauze dressing is used for vascular access only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The gauze dressing is used for vascular access and central line filling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration Sets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All IV tubing is labeled with administration sets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All IV tubing is changed 48 hours or per policy for particular fluid infusing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All IV tubing is changed 48 hours or per policy for particular fluid infusing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Number:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Days Since Last CLABSI. Eliminate Harm Across the Board.**

**CDC TAP**

The Targeted Assessment for Prevention Strategy

A quality improvement framework that targets resources to maximize efficiency for the reduction of healthcare-associated infections (HAIs).

**CAUTI • CDI • CLABSI**

Prevent HAIs by targeting locations with excess infections, assessing for gaps, and implementing interventions.

**PREVENT**

TAP Implementation Guides contain actionable tools and resources that allow facilities to customize their interventions, based on identified gaps.

**ASSESS**

TAP Assessments systematically identify gaps in prevention and opportunities for improvement, while serving as real-time teaching moments among multidisciplinary staff.

The Centers for Disease Control and Prevention (CDC) is available to assist with all aspects of implementing the TAP strategy. Please email HAPrevention@cdc.gov for assistance and visit the TAP website for more information: http://www.cdc.gov/hai/prevention/tap.htm
Summary

Use a bundled approach to improve CVC maintenance and removal practices

Address of CVC care for patients that move from one care setting to another

To overcome barriers, use strategies that involve data, audits, feedback and standardize care and supplies where possible
Reference


CDC Targeted Assessment for Prevention (TAP) CLABSI Implementation Guide. Centers for Disease Control and Prevention, CDC. Available at https://www.cdc.gov/hai/prevent/tap/clabsi.html


Days Since Last CLABSI. Eliminate Harm Across the Board. Available at http://www.hqinstitute.org/sites/main/files/file-attachments/6.clabsi_days_between_events.pdf


This module, titled “Maintenance and Removal of Central Venous Catheters,” will review key steps and strategies to ensure proper maintenance and removal of central venous catheters.
This module was developed by national infection prevention experts devoted to improving patient safety and infection prevention efforts.
After completing this module you will be able to:

• Discuss components of the central venous catheter maintenance bundle;

• Outline issues to address during the transition of care of a patient with a central venous catheter; and

• Describe strategies to promote the removal of unnecessary central venous catheters.
To begin our discussion of maintenance and removal of central venous catheters, let’s review the impact of central line-associated bloodstream infections, or CLABSIs. Data show that CLABSIs result in a higher rate of mortality for patients and increased health care costs. Of all the healthcare-associated infections, CLABSIs cause the highest number of preventable deaths. But the good news is that by implementing evidence-based practices, 65 to 70 percent of CLABSIs can be prevented.
Other modules for this course describe appropriateness of central venous catheters and best practices for insertion. This module will focus on best practices for maintenance and removal that hospital teams should implement as part of their CLABSI prevention program. This includes standardizing CVC maintenance care where possible, maintaining awareness of CVCs that are in place, and promptly removing CVCs when no longer necessary.
Let’s consider a case study to help illustrate common maintenance and removal issues for central venous catheters. Mrs. Smith is a 52-year-old woman who was just in a severe motorcycle accident. Mrs. Smith suffered a traumatic brain injury, multiple rib fractures and a compound open fracture of her right femur. In the emergency department, an internal jugular, or IJ central line was placed for infusion of fluids and vasopressors for her hypotension and antibiotics for her open fracture. The patient is admitted to the ICU. Question: What are the CVC maintenance priorities for Mrs. Smith?
To answer that question, we can look at maintenance practices using a bundled approach. There are four practices to consider as priorities for CVC maintenance.

First, conduct a daily assessment of the necessity of CVCs, with prompt removal if no longer needed. In some cases—like our case study, for example—in some cases, lines placed emergently can require closer monitoring since adherence to aseptic technique in emergencies can be variable. Second, always access ports of entry using aseptic technique. You also want to ensure proper care of infusion tubing, assessment, and care for CVC dressings. By ensuring that these basic practices occur in a consistent way, we can reduce harm to patients.
There are some basic practices that we need to consider when preventing central line infections. Anyone accessing or manipulating a CVC must perform hand hygiene prior to performing line care. Clinicians that are involved in the line insertion, removal or dressing change, should don proper personal protective equipment (PPE) including sterile gloves, masks and gowns. To ensure that staff are properly trained in these and other CVC practices, they should receive competency-based training for aspects of both line insertion and maintenance.
This includes aseptic technique for insertion and proper assessment of insertion site and dressing integrity. For critically ill patients that are at higher risk of developing central line infections, staffing should ensure appropriate nurse-to-patient ratio. And finally but just as important, hospitals need to engage patients and families by providing them education about central lines and encouraging them to speak up when they have concerns about CVCs.
Now that we have discussed the basics, let’s look at some of the key components of the maintenance bundle. An important step to preventing CLABSIs is to conduct a daily assessment of CVC necessity. On each day of CVC use, a multidisciplinary team of physicians and nurses should review and discuss to meet the indications for ongoing need of the device. Indications of ongoing need can include clinical instability of the patient, receiving continuous or intermittent infusion therapy, hemodynamic monitoring or the patient may have a documented history of difficult peripheral venous access. For more information about CVC appropriateness, please review module CLABSI102.
There are many different tools to help promote the daily assessment of CVC necessity. These can include daily prompts built into the electronic medical record (EMR) and rounding forms or checklists that help generate discussion among the team caring for the patient. Electronic medical record prompts can help highlight assessment criteria, ensure accurate documentation of necessity and support monitoring of adherence to best practices. Use of a rounding tracking tool or checklist ensures that all important items are covered in the daily discussion.
Here is an example of a rounding tool that can be used during multidisciplinary rounds to help address the ongoing need for the CVC and prompt removal if it is no longer needed. Ask for the input of your relevant clinical team members (including unit manager and critical care staff) that the tool you decide to use is appropriate and useful for your hospital.
Another important aspect of CVC maintenance is accessing the line using aseptic technique. Disinfecting the connection site prior to accessing the CVC reduces the risk of pathogen contamination to the internal lumen of the catheter, which can lead to infection. Before accessing catheter hubs, needleless connectors or injection ports, vigorously apply mechanical friction or “scrub the hub” for no less than five seconds with an antiseptic such as alcoholic chlorhexidine preparation, 70 percent alcohol, or povidone-iodine and allow it to dry.
Some hospitals now use connector access devices like alcohol-impregnated port protector caps. If using these devices, make sure staff are properly trained to follow the manufacturer’s recommendations for use. To help maintain patency of the CVC, it should be flushed per hospital protocol and all ports assessed on a regular basis. Finally, try to access the CVC and access only when absolutely necessary. Consider consolidating lab draws and switching IV meds to oral when appropriate.
CVC infusion tubing or administration sets should be changed per established guidelines. The timeframes are dependent on the type of fluid being infused and potential rate of bacterial growth associated with that fluid. For administration sets not used for blood, blood products or lipids, tubing should be changed at intervals no more frequently than every 96 hours but at least seven days. For infusions of propofol, the tubing should be changed every six to 12 hours, per the manufacturers’ recommendations or when the propofol container is replaced. Hub, connector or ports should be changed at least as frequently as the administration set, but no more frequently than every 72 hours, unless specified by the manufacturer.
Another important aspect of the maintenance bundle is CVC dressing care. Nurses should assess the status of the dressing at least daily, and some hospitals promote assessment every shift. Dressings should be changed every two days for gauze dressings and every seven days for transparent dressings. If a dressing is damp, loosened or soiled it should be changed immediately.
Clinicians should use aseptic technique when performing dressing changes. This includes wearing sterile gloves and a mask. An alcohol chlorhexidine solution should be used for skin antisepsis during dressing changes. Standardizing these products within a pre-made kit can help promote adherence with these practices.

Auditing adherence with dressing change practices can provide opportunities for quality improvement and staff education. On the right side of the slide is an example of a dressing integrity audit tool that can be used.
Here are a couple of other important aspects of CVC dressing care to keep in mind. First, be sure to have clear documentation of the date the dressing was changed or change due date (as facility policy dictates). And remember, unless loose, damp or soiled, do not disturb or change a dressing until the necessary due date. Changing CVC dressings too frequently can increase the risk of introducing bacteria to the entry site.

You can see in the images on the slide how a dressing should be dated and timed.
Now we’ll return to our case study. After five days in the ICU, Mrs. Smith is unable to be weaned from the ventilator and receives a tracheotomy for continued ventilator support. She is hemodynamically stable, but her neurological status remains poor and after developing a fever, blood cultures and CT scan show that she has developed MRSA osteomyelitis in her injured right femur.
The team inserts a peripherally inserted central catheter, or PICC line, and removes the internal jugular central line. On day eight, the patient’s neuro and respiratory status remain unchanged and the decision is made to move the patient to the long-term acute care hospital or LTACH, for continued support.

Question: What aspects of care coordination regarding the central line need to be addressed upon transfer?
In preparation for receiving Mrs. Smith, the LTACH admission nurse calls the ICU to receive her report. When coordinating the care of a patient with a CVC from one care setting to another, there are important details that must be communicated. These include describing what the initial indication for the CVC was. Why did the patient need the central line? And why is it still in place? If the CVC is being used for antibiotic infusions, be sure to share the date the antibiotic was started, the duration of treatment, the antibiotic dose, and the reason for the antibiotic treatment.
Other key information to share across care settings is the date that the CVC was placed and the date the dressing and administration tubing were last changed. Also report any issues with patency of the lumens. If the CVC will remain in place after the transfer of care, the accepting care location should continue to assess the necessity of the line on a daily.
By day 28, Mrs. Smith’s neurological status is beginning to improve and she is now able to breathe on her own without the assistance of the ventilator. She is hemodynamically stable and has completed her course of antibiotics. Her most recent blood cultures were negative and CT scan shows her osteomyelitis is resolved. She is scheduled for routine blood testing every two days.

Does Mrs. Smith need to have a PICC line in place? Or can the line be removed?
As was shown by the Michigan Keystone Project, central line bundles including removal of unnecessary CVC’s reduce CLABSIs.
The beginning of this module explored the importance of assessing CVC necessity and removing lines that are not needed. The Michigan Appropriateness Guide for Intravenous Catheters or MAGIC Guidelines published by Chopra and his colleagues were discussed in more detail in CLABSI102. The guidelines outline appropriate indications for PICC use and help to provide clinicians evidence-based criteria to guide their decision-making. Reviewing the appropriate indications on this slide, we can see that Mrs. Smith does not meet any of these criteria and, therefore, her PICC line should be removed.
This module describes many different practices to help improve maintenance and promote appropriate removal of CVCs. Let’s consider some of the barriers that hospitals may encounter when implementing these practices.

• Sometimes it can be difficult to engage physicians and nurses in change. Changing practices for CVC maintenance and removal may be met with resistance from clinicians, which will need to be addressed to implement sustainable change.
• Lack of adequate supplies can also present a barrier. If a clinician does not have access to the supplies they need, it can make completing a task like a dressing change more difficult.

• Lack of skill and knowledge of staff regarding CVC care and maintenance processes can be another significant barrier. If staff do not demonstrate competency for aseptic technique, CVC site assessment, dressing care and appropriate indications, the patient could be at increased risk of harm.

• Poor communication across care settings, for example, about the patient’s CVC need, is sometimes poor. Hospital teams should assess communications and other barriers at their facility and create plans for improvement to overcome these challenges.
Some possible solutions to consider are:

• Using data to drive action. Engage staff by sharing infection and device utilization data with them in real time. Share data that are unit-specific and when infections do occur, involve staff in the root cause analysis to identify contributing factors and recommendations for improvement.

• Standardize where you can. Make it easy for staff to do the right thing by standardizing supplies. For example, use all-inclusive dressing change kits and keep them stocked in a location that is close to the point of care. Develop standardized protocols for care and maintenance processes. For example, consider a protocol that states that all CVC dressings are routinely changed on the same day of the week unless they are loose, damp or soiled.
• Audit staff adherence with practices and provide “just-in-time” education and feedback. Audit care and maintenance practices, including assessment of condition of dressings, and adherence to scrubbing the hub prior to accessing the line. Use results to educate and coach staff. For more ideas on auditing best practices, please review the foundational course on competency-based training, audits and feedback.

• Finally, make sure to address CVCs at every hand-off opportunity. Clinicians should consider the continued need for CVCs at every transfer of care. As we saw in the case study, when patients are transferred to different care settings, there is critical information that should be shared to ensure continuity of care.
Here are a couple of examples of tools that you might find helpful. On the left is a poster that displays the number of days since a unit’s last CLABSI. This is a great visual way to engage staff in their CLABSI improvement efforts. On the right is a CVC dressing integrity audit tool from the University of Rochester. These tools and more can be found online at CDC’s TAP CLABSI Implementation Guide.
In summary, this module described how to use a bundled approach to improve CVC maintenance practices; shared how to address CVC care for patients that move from one care setting to another; and finally, outlined several strategies that can be used to improve maintenance and ensure prompt removal of CVCs.
No notes.
No notes.