Medical Education Policy: Central Venous Catheter (CVC) Placement

Facility: CMC  
Origin Date: June 2015  
Revision Date:  
Sponsor: GMEC

1. PURPOSE:

Carilion Clinic is committed to excellent patient care, with the highest priority towards patient safety and excellent clinical outcomes. As a graduate medical education training site, Carilion Clinic will standardize the basic education, competency assessment, supervision and procedural methods for medical students, resident physicians and fellows inserting central venous catheters (CVCs) under this policy. This policy will guide the education of trainees in the use of proper sterile technique, anatomical landmarks and ultrasound guidance when inserting CVCs.

The CVCs covered by this policy are all percutaneously inserted central catheters including large bore central catheters such as dialysis and resuscitation catheters.

This policy supports the routine use of ultrasound guidance for internal jugular and femoral venous sites of CVC placement unless the clinical urgency and/or immediate unavailability of ultrasound precludes sonographic guidance.

At times, extraordinary clinical circumstances or clinical judgment of the attending physician may dictate that different approaches to central line placement may be utilized. It is expected that these will be an unusual occurrences.

2. SCOPE:

This policy outlines the education, training and supervision of all postgraduate medical trainees (residents, transferring residents, visiting residents, and fellows) and medical students involved in CVC insertion. All postgraduate medical trainees and medical students performing CVC placement in their clinical duties will be trained in anatomic landmarks and ultrasound guided CVC insertion techniques. This policy designates the minimum standard by which a resident or fellow will be educated to place CVCs, when they may place central lines without DIRECT supervision, and who may supervise and teach central line placement.
This policy is applicable for ALL trainees, including transferring residents/fellows, and visiting residents/fellows.

3. IMPLEMENTATION:

The implementation of this policy is the responsibility of the GMEC and residency Program Directors.

4. DEFINITIONS:

Trainee: Any postgraduate medical resident, sub-specialty fellow in training or medical student

Direct Supervision: Supervision of the procedure with the supervisor in the room with the trainee

Indirect Supervision with Direct Supervision immediately available: The supervisor for the procedure is on site and is immediately available to the trainee as needed.

Oversight: The supervising physician is available to provide review of procedures/encounters with feedback provided after care is delivered but is neither physically present nor available for the procedure.

Clinical Supervisor: Physician credentialed to place CVCs per Carilion Clinic Staff office and all trainees who have reached level 3 competency for CVC insertion.

CVC sites: Subclavian, Internal jugular, femoral

Level 1, 2 or 3 Training: Designation of varying levels of training designed to lead to the achievement of varying levels of proficiency in the insertion of CVCs. Section V of this policy defines the required training and supervision at each level.

Level 1, 2 or 3 Competency: Designation of varying levels of proficiency in CVC insertion along an educational continuum which leads to proficiency in the insertion of CVCs. Section V of this policy defines the scope of practice for a trainee as it relates to CVC insertion

Difficult patient: Any patient in whom a CVL placement is being considered and who is at increased risk of complications. The following are examples of conditions which may make the CVC placement difficult:
Extremes of body habitus  BMI <20 or >40

Coagulopathy (platelets < 50,000, INR > 1.5, APTT > 50 seconds)

Unresuscitated shock with inadequate vein filling noted by completely collapsed vessel on ultrasound

Altered anatomy (prior radiation therapy or prior insertion at this site)

Previous surgery at or near the intended vein location

Agitated patient/lack of cooperation in being immobile or positioned correctly

Previous thrombosis of intended vein

Large Bore Catheter: CVCs which are used for the purpose of hemodialysis (commonly referred to as Vas Caths) or rapid resuscitation from hypovolemic or septic shock (commonly referred to as trauma catheters).

Seldinger Technique: A method of percutaneous insertion of a catheter into a blood vessel or space. A needle is used to puncture the structure and a guide wire is threaded through the needle; when the needle is withdrawn, a catheter is threaded over the wire; the wire is then withdrawn, leaving the catheter in place.

5. PROCEDURE TO OBTAIN COMPETENCY LEVELS:

A. Qualifications for Supervising Attending:

1. Attending physician skilled in CVC insertion and credentialed by the Carilion Medical staff to perform this procedure.

B. Level One Training

1. Definition: Trainee is completing the educational material for CVC insertion and has not started to insert CVCs on patients.

2. All trainees must complete the Duke Infection control CVC online module and pass the post-test with a minimum score of 80 percent.

3. All trainees must complete Carilion Clinic Central Line training course. This will include the lectures on CVC insertion, ultrasound central line training and Simulation Central Line Experience training prior to participating in CVC insertion on a patient.
4. After successful completion of the Central Line course and online modules, the resident will be able to perform CVC insertion on a patient with direct supervision by a qualified supervising physician who has met criteria as a clinical supervisor.

5. All Central lines should be placed following the Carilion Clinic standardized CVC insertion guideline. (See Appendix A)

6. Once a trainee has completed all of level one training, he/she has achieved Level One Competency.

7. The trainee must be approved by his/her Residency Program Director (PD) to move to Level Two training.

C. Level Two Training

1. Definition: Trainee has completed all the training steps in Level One training and has been granted Level One Competency by his/her PD. The trainee is ready to begin directly observed CVC insertions on patients.

2. The trainee must be directly observed by a qualified supervising physician and be successful with the placement of a minimum of:
   a. Ten (10) total successful CVC placements
   b. At least three (3) at any site to be certified at that site

3. Once a trainee has completed Level Two training in CVC insertion he/she has achieved level Two Competency.

4. The trainee must be approved by his/her PD to move to Level Three training.

D. Level Three Training

1. Definition: Trainee may place CVCs with indirect supervision or with oversight, but the trainee may not supervise other trainees. During this period of training the trainee is honing their skills independently.

2. The trainee may insert large bore catheters under direct supervision by a qualified supervisor.

3. The trainee has completed all the required elements to achieve Level Two Competency.

4. Level Three Competency may be achieved in CVC placement alone or in combination with placement of large bore catheters. The criteria for each competency level is noted below:
a. CVC competency: Successful insertion of a minimum of total of 20
CVC placements with at least five (5) line placements at each of the
anatomic sites

b. Large Bore Catheter Placement competency:
   i. The trainee must successfully place a minimum of five (5) large
   bore catheters under **direct supervision** by a qualified
   supervisor.
   ii. Preferred sites for large bore catheter placement are femoral
   and the right internal jugular vein

5. Have competency assessment completed with a CVC insertion on a difficult
   patient.

6. Trainee is proficient in central line insertion in all circumstances in at least one
   anatomic site.

7. Once a trainee has completed all of Level Three training requirements in
   either CVC insertion and/or large bore catheter insertion, he/she has
   achieved level Three Competency. Level Three Competency may be
   achieved in CVC insertion alone and/or large bore catheter insertion and may
   be site specific.

8. The trainee must be approved by his/her Residency Program Director to then
   be able to provide supervision to other trainees.

E. Residents Entering Graduate Medical Education Programs at the PGY – 2 level,
   Transferring Residents, Visiting Residents and Fellows:

   1. The trainee needs to provide written documentation from their prior residency
      program director (residents entering at the PGY – 2 level, transferring
      residents or fellows) or current residency program director (visiting residents)
      of successful completion of comparable training and supervision regarding
      CVC insertion (including the number of CVC insertion) to their program
      director.

   2. All trainees must complete the DICON CVC online module and pass the post-
      test with a minimum score of 80 percent.

   3. All trainees must demonstrate competency in the insertion of at least one (1)
      CVC at the bedside supervised by a qualified physician.

   4. All trainees must be approved by residency/fellowship Program Director.
5. Trainees who have not successfully completed comparable training / supervision regarding CVC insertion, or if not competent on demonstration, must complete the entire program for independent CVC insertion.

F. Tracking and documentation

All Central Lines will be documented through the CVC procedure navigator in EPIC. The appropriate information of the catheter placement attempt along with the required quality indicators must be filled out on every attempted CVC placement. Failure to do so will result in suspension of the trainee’s CVC insertion privileges until remediation is completed. Training on documentation of CVC is part of the Central Line Course.

G. Competency Assessment

Once the requirements for level 2 training are achieved, trainees may send a Competency Assessment Form to the qualified attending who was present for the entire procedure. Trainees should complete the entire procedure without faltering or assistance to receive a satisfactory score. The supervising attending is responsible for determining independent practice of the individual resident. (Appendix B)

Any qualified attending (per CMC medical staff privileges) may make this assessment for any trainee on any service participating in the central line training program.

H. Escalation

A qualified supervising physician (Attending or Level 3 resident) must take over the procedure if:

1. If after two (2) attempts a trainee has failed to successfully insert the CVC
2. If an arterial puncture has occurred on ANY attempt
3. If there is any suspicion that a pneumothorax may have occurred on ANY attempt or the patient is in any signs of medical distress felt to be due to placement of the CVC.

Escalation may not be assumed by a level 2 qualified trainee. For additional escalation procedures, please see Appendix A.
Appendix A: Standard Central Venous Catheter (CVC) Insertion

This policy is intended to promote patient safety during the placement of routine central venous catheters. This policy is not intended as a substitute for the clinical judgment of an attending physician involved in a CVC placement.

A. Indications: Clinical indication and reasoning of site must be documented after the procedure in the EPIC CVC documentation tool.

B. Difficult Patients or Sites: A resident with level 1 competency must have an attending or resident at level 3 competency assess the patient to determine level of difficulty in CVC insertion prior to initiating the procedure. Level 2 competency residents should communicate this assessment, specifically identifying any complicating conditions directly to the supervising attending prior to initiating the procedure.

C. Trainees at competency levels 1 and 2 must notify the supervising clinician prior to CVC placement or have a qualified physician (attending or competency level 3) provide direct supervision if the following conditions are present:
   - Agitation/lack of cooperation in being immobile or positioned correctly
   - Shock states with inadequate vein filling noted by completely collapsed vessel on ultrasound
   - Previous thrombosis of intended vein
   - Extremes of body habitus (BMI <20 or >40)
   - Coagulopathy (platelets < 50,000, INR > 1.5, APTT> 50 seconds)
   - Previous surgery at or near the intended vein location
   - Previous radiation at the proposed site of CVC insertion
   - Previous CVC insertion at the intended site

D. Site Insertion Selection: Appropriate site selection is dependent on the particular clinical situation and is best determined by the clinicians’ experience with central line placement. At times, clinical circumstances may dictate that approaches to central line placement that diverge from the Carilion Clinic Central Line Guidelines be utilized. It is expected that this will be an unusual occurrence
E. PREPARATION
   1. The patient on whom the procedure is being performed is to be identified with two identifiers per hospital protocol with appropriate consent obtained, the site to be canalized identified, and risk factors for complications assessed.

   2. The equipment required for insertion of the CVC is to be present before starting the procedure.

   3. Prior to the application of sterile precautions the clinician should use ultrasound as indicated above (on IJ and femoral sites) to determine:
      a. Vascular anatomy and location of the target vessel with ultrasound. The provider must be able to reliably distinguish the artery from the vein using anatomy, location, and compressibility and/or Doppler.
      b. Demonstrate the patency of the target vessel

   4. A qualified supervisory physician (based on the trainee’s level of competency) must be identified prior to starting the procedure. This qualified physician must be aware of the procedure prior to any attempt, unless the placement is a true emergency (e.g. code blue, profound shock). Anticipated site selection, patient-related difficulties, and appropriateness for CVC placement must be reviewed with the supervising physician.

   5. An attending physician responsible for the placement must also be identified and documented in the medical record. The attending physician should be notified prior to placement unless urgency of the clinical situation precludes it, at which time the attending will be notified immediately after placement.

F. PROCEDURE (routine, non-emergency CVC insertion)
   1. The patient on whom the procedure is being performed is to be identified per the protocol. A time out will be performed prior to the procedure.

   2. Personal protective equipment that fulfills sterile precautions will be utilized: sterile gown, mask, cap, and sterile gloves. A sterile ultrasound probe cover is required even if a second clinician will provide ultrasound assistance.

   3. An initial prep of Hibclens/chlorhexidine should be applied and then the patient draped appropriately. For non-urgent CVC, this should be head to toe.

   4. The clinician is expected to maintain sterile technique throughout the procedure. If sterile technique is accidentally broken, the clinician should
stop the procedure and restart sterile preparations as clinically indicated. (e.g. replace gloves, obtain second sterile instrument/tray.)

5. The clinician will deliver local anesthesia to completely anesthetize the insertion and secondary securing site.

6. The clinician will identify anatomical landmarks and then sonographically reassess the anatomy, location, and patency of the target vessel. The clinician will correctly identify the position/location of introducer needle.

7. Under direct ultrasound guidance, (IJ and femoral) the clinician should puncture the vein, determine return of dark venous blood with non-pulsatile flow, and advance the wire into the vessel only if no resistance is met. If pulsatile or bright red blood is returned, stop the procedure and refer to escalation guidelines.

8. With the needle and wire in place, the clinician should sonographically confirm that the wire is in the venous lumen by visualizing the artery and vein simultaneously. The following views are recommended:
   i. Demonstrate collapsibility of the vessel where the wire is located
   ii. Use flow and Doppler to document venous flow
   iii. Follow the wire down the vessel, visualizing the target sign
   iv. The probe is then switched to the longitudinal view to again visualize that the wire is not cross-threaded into adjacent artery.

   *The clinician is encouraged to electronically archive or print hard copy images for QA review and reimbursement.*

9. If the wire is correctly located, the clinician should proceed using the standard Seldinger technique
   i. If there is concern for INAPPROPRIATE placement, proceed to section G. **Special techniques for confirmation of venous puncture.**
   ii. If there is an arterial puncture, proceed to section I. **IN CASE OF A SUSPECTED ARTERIAL PUNCTURE DO NOT dilate the vessel.**
   iii. An ABG can be sent off for confirmation about venous placement

10. After placement of the catheter: flush all ports with normal saline, secure/suture the CVC in place.
11. The clinician should clean the insertion site following procedure with hibclens/chlorhexidine,

12. The clinician must apply antibiotic disk, or similar infection control measures unless contraindicated.

13. The clinician (or sterile designee/nurse) must apply sterile central line dressing

14. The clinician is encouraged to subsequently use ultrasound to document the absence of a pneumothorax.

15. The clinician is encouraged to electronically archive or print hard copy images for QA review and reimbursement.

16. The clinician must order post-procedure chest radiograph (Stat, Radiologist to read immediately) for all intrathoracic lines: (subclavian, infraclavicular and supraclavicular approach and internal jugular CVCs.)

G. TECHNIQUES FOR CONFIRMATION OF VENOUS PUNCTURE:

In addition to a chest x-ray which is used for intrathoracic CVCs placement, the position of the line should be verified by one of the following methods to confirm venous placement of the line:

1. Venous manometry (visual or monitor)

2. Blood gas analysis

3. Catheter identified in vein using ultrasound

Trainee must inform the supervising physician about any abnormal results of for the above tests.

H. USING THE CVC

1. If Section F above is performed appropriately and line placement is verified according to Section G, the line may be used. In cases of clinical emergency, the line may be utilized without the above confirmation techniques based on the clinical judgment of the physician.

2. Once correct placement of the CVC is confirmed, the physician must document this in EPIC and inform nursing that the CVC may be used for clinical care.

I. IN CASE OF A SUSPECTED ARTERIAL PUNCTURE:

1. Have somebody immediately call the supervising physician if he/she is not present in the room.
2. Remove the guide wire and/or needle, apply pressure for 5 minutes if the patient is not anticoagulated. If the patient is anticoagulated, apply pressure as per the direction of the supervising physician.

3. Perform secondary attempts at another site with direct supervision by a qualified physician or a level 3 supervisor.

J. IN THE CASE OF ARTERIAL DILATION with a central line of 7.5f or greater:
   1. Do not remove the line!
   2. Immediately notify supervising attending and request immediate Vascular Surgery consultation

K. COMPLICATIONS (OR SUSPECTED COMPLICATIONS)
   1. Persistent site bleeding: notify supervising physician or level 3 supervisor, apply pressure to site if not contraindicated. Consider blood product replacement (platelets, factor) in consultation with attending physician or level 3 supervisor.
   2. Pneumothorax: For evidence of tension pneumothorax, clinician should perform immediate appropriate needle decompression. If the attending physician is not qualified to place/supervise tube thoracostomy insertion, obtain stat consultation from the ICU service, general surgery or cardiothoracic surgery, the emergency medicine attending (if in the ED) or inpatient attending if on the floor and the attending is qualified to perform a tube thoracostomy. For any non-tension pneumothorax, consult as appropriate. Consider calling a rapid response.
## Appendix B. Competency assessment form (to be EPIC-based or MEDHUB-based)

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Yes</th>
<th>Yes with reminder</th>
<th>No or Incorrectly Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Obtained informed consent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td>“TIME-OUT”: Identify patient using two valid patient identifiers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2b</td>
<td>“TIME-OUT”: Review patient allergies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2c</td>
<td>“TIME-OUT”: Confirm procedure to be performed, including site and side of patient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Care Provider and all assistants wear caps and masks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sanitize hands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Select appropriate site of venipuncture and visualize the vein using ultrasound (femoral and internal jugular)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Prepare venipuncture site with chlorhexidine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Operator should now don sterile gown and gloves and then place on patient a full-length sterile drape</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Identify Anatomical Landmarks appropriately</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Reconfirm target vessel location by Ultrasound (femoral and IJ)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Anesthetize area using 1% Lidocaine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Cannulate the target vessel using landmarks and ultrasound assistance when appropriate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Venipuncture successful in 2 or less attempts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Confirm vessel entry by aspiration of blood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Insert J wire into needle, advancing wire without resistance, watch for ectopy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Confirm wire in target vessel with ultrasound using multiple views when appropriate and removes needle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Stab-incision with a scalpel at the wire entry site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Dilate the catheter tract using the dilator then remove dilator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Insert catheter over-the-wire to its appropriate length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Remove wire and make sure it is intact. Close the clamp on the port promptly after removing the wire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Attach a 10ml syringe to the distal port and attempt to aspirate blood. If successful, follow this by flushing the port with 5-10 cc of saline. Repeat for other ports.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Suture catheter in place.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Re-clean surgical site to remove all excess blood and apply another chorhexidine wash</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Place Biopatch at cannulation site and cover via an occlusive dressing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Use Ultrasound to check for the presence of Pneumothorax for IJ and SC placed catheters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Verify location of venous location by at least one confirmatory methods other than xray</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Order a STAT, radiologist to read immediately portable CXR for all SC and IJ line placement or attempts. (not required for femoral catheters)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Complete catheter insertion documentation in the medical record including logging in the CVC EPIC navigator (or MEDHUB)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Performs appropriate aftercare</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td><strong>CRITICAL STEP</strong>: sterile field maintained?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td><strong>CRITICAL STEP</strong>: if after 2 unsuccessful attempts (except if emergent), was escalation protocol followed?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>After 2 unsuccessful attempts (except if emergent), resident followed the escalation protocol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td><strong>Trainee demonstrates competency and I certify that this resident can perform CVC catheter placement WITHOUT direct (in the room) supervision (in accordance with GME policy and procedures).</strong></td>
<td><strong>YES</strong></td>
<td><strong>NO</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Dept./Committee</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donald W. Kees, MD</td>
<td>DIO</td>
<td>GMEC</td>
<td>July 21, 2015</td>
</tr>
</tbody>
</table>