Graduate Medical Education Policy	Central Venous Catheter (CVC) Placement
Facility/Sponsor	CMC/GMEC
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PURPOSE

Carilion Clinic is committed to excellent patient care, with the highest priority for 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.

SCOPE

This policy applies to all Accreditation Council for Graduate Medical Education (ACGME), Council on Podiatric Medical Education (CPME), and Commission on Dental Accreditation (CODA) accredited graduate medical education programs sponsored by Carilion Medical Center (CMC).

This policy outlines the education, training and supervision of all trainees involved in CVC insertion. All postgraduate medical trainees performing CVC placement in their clinical duties will be trained in anatomic landmarks and ultrasound guided CVC insertion techniques as appropriate to location. 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.

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

DEFINITIONS

Trainee: any postgraduate trainee in the institution, including residents, fellows, and students.

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

Clinical Supervisor: supervising Attending or all trainees who have reached teaching competency for CVC insertion.

Direct Supervision: supervision of the procedure with the Clinical Supervisor in the room with the trainee
Oversight: the attending 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.

Learner, Competency, Teaching (Previously 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. Procedure section of this policy defines the required training and supervision at each level.

CVC sites: Subclavian, Internal jugular, femoral

Difficult patient: Any patient in whom a CVL placement is being considered and who is at increased risk of complications. Trainees in Learner phase are not to attempt to place CVC in this group of patients and even Trainees deemed competent are encouraged to have a Clinical Supervisor immediately available. 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

Patient in Extremis: a patient who is in a critical or near-death state.

Large Bore Catheter: CVCs greater than 7.5 fr such as those used for 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.

Site Specific competency: Femoral and Internal Jugular (IJ) sites are routinely placed using ultrasound guidance while subclavian lines are placed using anatomic guidance and competency with one approach does not indicate competency with other. For the purposes of Carilion Clinic, Femoral and IJ approach will be considered together and subclavian separately. Further, a trainee can be certified at just the Femoral/IJ sites or at All Sites based on demonstrated successfully supervised CVCs placed at each site.

PROCEDURE

1. **Learner Phase (Previously Level One Training)**
    a. Definition: Trainee has completed requisite educational material referenced below for CVC insertion and is placing CVC under direct supervision. The goal is to

progress to the competency phase and be able to place lines independently (Indirect or Oversight supervision) after a minimum of ten (10) lines.

b. Requirements: Must be done prior to any attempt to place CVC in a patient:
    i. Complete Duke Infection control CVC online module and pass the post-test with a minimum score of 80 percent.
    ii. Carilion Clinic Central Line training course.
c. Appropriate Patient Selection: The following are not appropriate patient for a Learner to place a CVC
    i. Difficult patient
    ii. Large Bore Catheter
    iii. Patient in extremis, or whose placement must be accomplished in a limited time frame
d. Supervision: Direct Supervision is required for all lines and may be provided by faculty with appropriate credentialing, fellow or senior resident who has attained Teaching Phase in the specific site utilized (Clinical Supervisor).
e. All CVC should be placed following the Carilion Clinic standardized CVC insertion guidelines. (See Appendix A)

2. Competence Phase (Previously level 2 competency)

a. Definition: Trainee has completed all the training steps in the Learning Phase, has had a CVC MedHub competency attestation completed (Appendix B), and has been approved by their Residency Program Director (PD) or faculty designee to place CVC with indirect supervision. The goal of this phase is to develop further skill in placing central lines independently with the potential to progress to the Teaching phase. However, this may be the terminal achievement for a trainee, they are competent to place central venous catheters independently and be credentialed upon graduation as competent in this procedure by specific sites but are not considered competent to teach the procedure.
b. Requirements:
    i. Successful placement of 10 Central lines (completed during the learner phase)
    ii. CVC Competency attestation (See Appendix B)
    iii. Program Director certification of meeting Competency Phase (MedHub)
c. Appropriate patient selection
    i. Difficult patients: Trainee may place CVC on these patients with direct or indirect supervision but should have direct supervision immediately available
    ii. Large Bore Catheters: May be placed but require Direct Supervision by an appropriate Supervisor until a total of five (5) at any site have been successfully placed. See section on Residents Entering GME Programs at PGY2 level (section 5).
d. Supervision: Oversight or Indirect supervision by qualified attending physician. While not required, Residents should seek direct supervision when available for continued learning and progression of skill during this phase.

3. Teaching Phase (Previously Level Three training)

a. Definition: Trainee may serve as a Supervisor to a Learner. The goal is to develop competency and expertise in supervision and teaching central line placement including corrective actions and troubleshooting and appropriate patient selection for learner phase trainees. Trainees are proficient in central line insertion in all circumstances in site specific manner, see below for site specific competency.
b. Requirements:
    i. Resident physician who has completed the competency phase

ii. Successful insertion of a minimum of 15 CVC placements at femoral and IJ sites. Subclavian placement is unique, see below.
iii. Subclavian Exception: At least five (5) successful CVC placements at the subclavian site are required to be a Teacher Phase for CVC placed at this site. e.g. trainees may have 15 total lines and if only two (2) are Subclavian, the trainee would need three (3) additional lines to teach/supervise at this site.
iv. The trainee must be approved by their PD to move to Teaching Competency. Note: Teaching Competency can be achieved at only the Femoral/IJ sites or at All Sites

c. Patient Selection: All patients and all sites though residents in Teaching phase should continue to seek out guidance and support in difficult or unusual circumstances during their training.
d. Supervision: Indirect or Oversight supervision is allowed.

4. **Large Bore Catheter Placement Exception**
   a. The goal for this exception is to be able to independently place large bore catheters safely and competently. They are considered separate from routine multi-med type CVC catheters due to their increased risk for complications.
   b. Catheter definition: CVC larger than 7.5 Fr, which Includes Dialysis catheters, Resuscitation catheters (Arrow, trauma catheter) and Cortis introducer/sheath introducer.
   c. Requirements:
      i. Be in the competency phase of CVC placement
      ii. The trainee must successfully place a minimum of five (5) large bore catheters under direct supervision by an Attending Physician or Teacher Phase resident prior to placing these CVCs.
      iii. The trainee must be approved by his/her PD to move to Oversight Supervision for Large Bore Catheters
   d. Patient Selection: Large Bore Catheter demonstrated higher morbidity and are not considered appropriate for placement by someone in the Learner Phase:
      i. Preferred sites for large bore catheter placement are Femoral/ or Right IJ
   e. Supervision: Direct Supervision by Attending or Teacher Phase Resident who has completed five (5) Large Bore CVC is required until five (5) Large Bore CVC are placed.

5. **Residents Entering Graduate Medical Education Programs at the PGY – 2 level, Transferring Residents, Visiting Residents and Fellows:**
   a. 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.
   b. All trainees must complete the DICON CVC online module and pass the post- test with a minimum score of 80 percent.
   c. All trainees must demonstrate competence in the insertion of at least one (1) CVC at the bedside supervised by a qualified physician.
   d. All trainees must be approved by residency/fellowship Program Director.
   e. 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.

6. **Tracking and Documentation**

a. All Central Lines will be documented through the CVC procedure navigator in EPIC. The appropriate information about 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 the suspension of the trainee's CVC insertion privileges until remediation is completed. Training in documentation of CVC is part of the Central Line Course.

7. **Competency Assessment**
    a. Once the requirements for competence 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. (See Appendix B)
    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.
8. **Escalation**
    a. A qualified supervising physician (Attending or Supervisor) must take over the procedure if:
    b. If after two (2) attempts a trainee has failed to successfully insert the CVC
    c. If an arterial puncture has occurred on ANY attempt
    d. 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.
    e. Any complication, suspected complication and need to escalate should be reported on the CVC procedure template.
    f. Escalation may not be assumed by a qualified trainee at Competency level but rather the attending or trainee at Teaching Competency level.
    g. 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.

1. Indications: Clinical indication and reasoning of site must be documented after the procedure in the EPIC CVC documentation tool.
2. Difficult Patients or Sites: A resident at Learner Phase must have an attending or resident at Teacher Phase assess the patient to determine level of difficulty in CVC insertion prior to initiating the procedure. Competency Phase residents should communicate this assessment, specifically identifying any complicating conditions directly to the supervising attending prior to initiating the procedure.
3. Trainees at Learner and Competency Phases 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:
    a. Agitation/lack of cooperation in being immobile or positioned correctly
    b. Shock states with inadequate vein filling noted by completely collapsed vessel on ultrasound
    c. Previous thrombosis of intended vein Extremes of body habitus (BMI <20 or >50)

    d. Coagulopathy (platelets < 50,000, INR > 1.5, APTT> 50 seconds) Previous surgery at or near the intended vein location
    e. Previous radiation at the proposed site of CVC insertion Previous CVC insertion at the intended site
4. 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.
5. Preparation
    a. 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.
    b. The equipment required for the insertion of the CVC is to be present before starting the procedure.
    c. Prior to the application of sterile precautions, the clinician should use ultrasound as indicated above (on IJ and femoral sites) to determine:
        i. 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.
        ii. Demonstrate the patency of the target vessel
    d. 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.
    e. 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 the urgency of the clinical situation precludes it, at which time the attending will be notified immediately after placement.
6. Procedure (routine, non-emergency CVC insertion)
    a. 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.
    b. 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.
    c. 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.
    d. 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 a second sterile instrument/tray).
    e. The clinician will deliver local anesthesia to completely anesthetize the insertion and secondary securing site.
    f. 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.
    g. 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.

h. 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.
    v. The clinician is encouraged to electronically archive or print hard copy images for QA review and reimbursement.
i. 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 7. 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
j. After placement of the catheter: flush all ports with normal saline, secure/suture the CVC in place.
k. The clinician should clean the insertion site following procedure with hibclens/chlorhexidine.
l. The clinician must apply antibiotic disk, or similar infection control measures unless contraindicated.
m. The clinician (or sterile designee/nurse) must apply sterile central line dressing
n. The clinician is encouraged to subsequently use ultrasound to document the absence of a pneumothorax.
o. The clinician is encouraged to electronically archive or print hard copy images for QA review and reimbursement.
p. 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.)

7. Techniques for confirmation of venous puncture:
    a. 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:
        i. Venous manometry (visual or monitor)
        ii. Blood gas analysis
        iii. Catheter identified in vein using ultrasound
        iv. The trainee must inform the supervising physician about any abnormal results of the above tests.
8. Using The CVC
    a. 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.
    b. Once the 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.
9. In case of a suspected arterial puncture:

a. Have somebody immediately call the supervising physician if he/she is not present in the room.
b. 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.
c. Perform secondary attempts at another site with direct supervision by a qualified physician or a teaching level supervisor.

10. In the case of arterial dilation with a central line of 7.5f or greater:
    a. Do not remove the line!
    b. Immediately notify supervising attending and request immediate Vascular Surgery consultation
11. Complications (Or Suspected Complications)
    a. Persistent site bleeding: notify supervising physician or teaching level supervisor, apply pressure to site if not contraindicated. Consider blood product replacement (platelets, factor) in consultation with attending physician or teaching level supervisor.
    b. Pneumothorax: For evidence of tension pneumothorax, clinicians 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.
    c. Persistent pain: Notify attending physician. Consider reapplication of local anesthesia or CVC removal.

Appendix B. Competency attestation form to be sent to the attending/supervising physician by the resident prior to insertion:

Resident X has placed at least 10 Central Venous catheters successfully and is now eligible for competency phase certification in CVC placement. Achieving this level allows them to place CVC independently and without direct supervision.

I have directly observed resident X performing this CVC and certify they followed the CVC placement check list(click here to review) and attest to their competency and certify them as capable of safely performing CVC placement with only indirect supervision.

□ Yes
□ No (No requires comment): Please comment on areas resident needs to remediate before placing central lines with indirect supervision

(Check list reminder in MedHub)

- □ Obtained informed consent
- □ "TIME-OUT": Identify patient using two valid patient identifiers
- □ "TIME-OUT": Review patient allergies
- □ "TIME-OUT": Confirm procedure to be performed, including site and side of patient
- □ Care Provider and all assistants wear caps and masks
- □ Sanitize hands
- □ Select appropriate site of venipuncture and visualize the vein using ultrasound (femoral and internal jugular

- □ Prepare venipuncture site with chlorhexidine
- □ The operator should now don sterile gown and gloves and then place on patient a full-length sterile drape
- □ Identify Anatomical Landmarks appropriately
- □ Reconfirm target vessel location by Ultrasound (femoral and IJ)
- □ Anesthetize area using 1% Lidocaine
- □ Cannulate the target vessel using landmarks and ultrasound assistance when appropriate
- □ Venipuncture successful in 2 or less attempts
- □ Confirm vessel entry by aspiration of blood
- □ Insert J wire into needle, advancing wire without resistance, watch for ectopy
- □ Confirm wire in target vessel with ultrasound using multiple views when appropriate and removes needle
- □ Stab-incision with a scalpel at the wire entry site
- □ Dilate the catheter tract using the dilator then remove dilator
- □ Insert catheter over-the-wire to its appropriate length
- □ Remove wire and make sure it is intact. Close the clamp on the port promptly after removing the wire
- □ 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.
- □ Suture catheter in place.
- □ Re-clean surgical site to remove all excess blood and apply another chlorhexidine wash
- □ Place Biopatch at cannulation site and cover via an occlusive dressing
- □ Use Ultrasound to check for the presence of Pneumothorax for IJ and SC placed catheters
- □ Verify location of venous location by at least one confirmatory method other than x-ray
- □ Order a STAT, radiologist to read immediately portable CXR for all SC and IJ line placement or attempts.
- □ Complete catheter insertion documentation in the medical record including logging in the CVC EPIC navigator
- □ CRITICAL STEP: sterile field maintained?
- □ CRITICAL STEP: if after 2 unsuccessful attempts (except if emergent), was escalation protocol followed?

Designated Institutional Official	Reviewing Committee	Date Approved
Donald W. Kees, MD	GMEC	July 21, 2015
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	GMEC	
	GMEC	