



Central Venous Catheters

In Adult Patients

Self-Learning Module



Image courtesy of Teleflex®



Images courtesy of Bard®

Patty Hignell, RN, BSN, MN, ENC(C)
Vascular Access Clinical Practice Committee
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Please send any requests for use of this material to:

Fraser Health Authority
Clinical Quality & Patient Safety
Central City Tower, 5th Floor
13450 – 102nd Avenue,
Surrey, British Columbia
Canada V3T 0H1
Or Patty.Hignell@fraserhealth.ca

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INTRODUCTION

The use of Central Venous Catheters (CVCs) has increased dramatically over recent years. Once seen only in critical care areas, these catheters are now commonplace in the medical/surgical and community environment. Depending on the patient's needs, there are a variety of central venous catheters available. A CVC can be inserted for short-term or long-term I.V. therapy.

Central venous catheter management requires evidence-based, best practice standards to minimize complications and maximize patient outcomes. CVC management is a specialized skill performed by IV practitioners who have demonstrated the required competencies.

Purpose

This self-learning module will provide you:

- Information about CVCs
- Information about nursing care and management of CVCs in the adult patient
- Information on complications associated with CVCs
- This self-learning module along with return skill demonstration will assist you in meeting the competencies of CVC management.
- Please see Appendix A (Responsibility for CVC management)

Learning Instructions

The learning activities in this self-learning module are based on the objectives and will help you to understand and apply what you have learned. It is recommended that you complete the learning activity after each section.

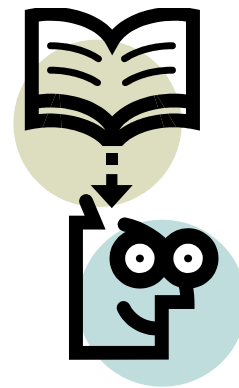
If you are using this self-learning module for the purpose of review, you may wish to attempt the learning activities first to find out what material you need to review.

Objectives

Upon completion of this module the learner will be able to:

- ◆ Define “central venous catheters”
- ◆ Identify types of CVCs and indications for use
- ◆ List advantages and disadvantages for a short-term or long-term CVC.
- ◆ Identify common insertion sites
- ◆ Describe the difference between open-ended and closed-ended (valved) catheters
- ◆ Describe the difference between proximally valved and distally valved catheters
- ◆ Identify the nursing responsibilities for pre-insertion, insertion and post-insertion for short-term and long-term CVCs.
- ◆ List possible complications of CVCs and the nursing actions for each complication.
- ◆ List safety considerations when caring for a patient with a CVC, and provide the rationale

Let's get started.....



What is a Central Venous Catheter?

Central Venous Catheter (CVC) – *[also known as a central line or a Central Venous Access Device (CVAD)]* A CVC is an indwelling device that is inserted into a vein of the central vasculature. CVCs are being used increasingly in inpatient, outpatient, and community settings to provide long-term venous access. CVCs disrupt the integrity of the skin, making infection with bacteria and/or fungi possible. Infection may spread to the bloodstream and hemodynamic changes and organ dysfunction (severe sepsis) may ensue, possibly leading to death. (Center for Disease Control and Prevention, 2011) (Hunter & Hunter, 2012) (Safer Healthcare Now, 2012) (Provonost, et al., 2006)

CVC insertion puts the patient at risk from a number of complications and unintended outcomes, at the time of insertion, after insertion, and upon removal. These include pneumothorax, hemothorax, cardiac tamponade, cardiac perforation, cardiac arrhythmias, erosion of the vessel wall, occlusion, infection, and catheter dysfunction.

There are 2 CVC type classifications: Short-term CVCs and Long-Term CVCs, which includes Implanted Venous Access Devices (IVAD), Peripherally Inserted Central Catheters (PICC), and Tunneled CVCs (Alexander, Corrigan, Gorski, Hankins, & Perucca, 2010) (Bishop, et al., 2007) (Infusion Nurses Society, 2011) (Infusion Nurses Society, 2016).

Indications for Use

- ◆ Administer intravenous fluids and blood products
- ◆ Administer medications
- ◆ Administer hypertonic solutions (Total Parental Nutrition [TPN]), vesicants (e.g. chemotherapy), irritants (e.g. cloxacillin), and solutions with extreme pH values (e.g. vancomycin).
- ◆ Obtain venous blood samples
- ◆ Provide long term intravenous therapy
- ◆ Administer large volumes of intravenous fluid quickly
- ◆ Administer vasopressor or vasodilator therapy (e.g. dopamine)
- ◆ Monitor central venous pressure (CVP)
- ◆ Provide access for transvenous pacemaker or pulmonary artery catheters
- ◆ Access venous circulation when a patient has difficult or impossible peripheral access
- ◆ Provide hemodialysis access

Where Are Central Venous Catheters Inserted?

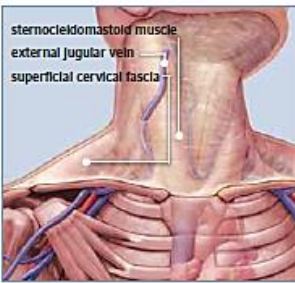
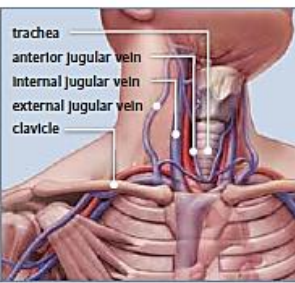
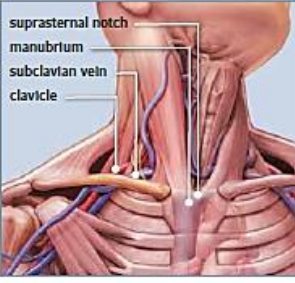
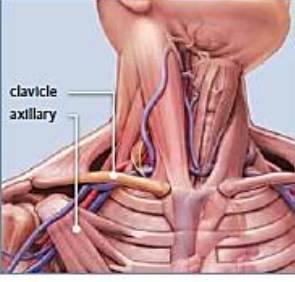
<p>EXTERNAL JUGULAR (EJ)</p> 	<p>LANDMARKS</p> <ul style="list-style-type: none"> • Vessel is part of surface anatomy <p>INSERTION ORIENTATION</p> <ul style="list-style-type: none"> • Needle can be inserted into vessel as visualized on neck surface <p>ADVANTAGES</p> <ul style="list-style-type: none"> • Easy to locate, visible <p>DISADVANTAGES</p> <ul style="list-style-type: none"> • Difficult to cannulate (vessel rolling, valves, tortuous path) • Higher complication rate compared with other sites (thrombosis, infection) • Problematic in patients with tracheostomies • Difficult dressing maintenance 	<p>ADJACENT ANATOMY</p> <ul style="list-style-type: none"> • Carotid artery • Phrenic and vagus nerves • Pulmonary apex • Thoracic duct (left side only) <p>POTENTIAL COMPLICATIONS</p> <ul style="list-style-type: none"> • Arterial puncture • Variable extent of nerve damage • Pneumothorax • Pleural effusion • Chylothorax (Thoracic duct)
<p>INTERNAL JUGULAR (IJ)</p> 	<p>LANDMARKS</p> <ul style="list-style-type: none"> • Angle of mandible • Two heads of sternocleidomastoid muscle • Clavicle • External jugular vein • Trachea <p>INSERTION ORIENTATION</p> <ul style="list-style-type: none"> • Central: Insert needle at apex of triangle formed by the two bodies of the sternocleidomastoid muscle and the clavicle. Insertion depth 3 cm–5 cm. • Anterior: Insert needle at midpoint of sternal head of the sternocleidomastoid muscle approximately 5 cm from the angle of the mandible aiming toward the feet and ipsilateral nipple. Insertion depth 2 cm–4 cm. • Posterior: Insert needle approximately 1 cm dorsal to the place where the EJ and the sternocleidomastoid muscle meet. Insertion depth 5 cm–7 cm. 	<p>ADVANTAGES</p> <ul style="list-style-type: none"> • Large vessel size • Easy to locate • Easy access • Short, straight path to superior vena cava (right side) • Low complication rate <p>DISADVANTAGES</p> <ul style="list-style-type: none"> • Close proximity to carotid artery • Higher infection rate compared with other sites • Problematic in patients with tracheostomies • Uncomfortable to patient • Difficult dressing maintenance <p>ADJACENT ANATOMY</p> <ul style="list-style-type: none"> • Carotid artery • Phrenic and vagus nerves • Pulmonary apex • Thoracic duct <p>POTENTIAL COMPLICATIONS</p> <ul style="list-style-type: none"> • Arterial puncture • Variable extent of nerve damage • Pneumothorax • Pleural effusion • Chylothorax
<p>SUBCLAVIAN</p> 	<p>LANDMARKS</p> <ul style="list-style-type: none"> • Clavicle • Two bodies of sternocleidomastoid muscle • Suprasternal notch • Manubriosternal junction <p>INSERTION ORIENTATION</p> <ul style="list-style-type: none"> • Infraclavicular: Insert needle 2 cm–3 cm caudal to midpoint of the clavicle at the point where the clavicle slants toward the manubrium. Insertion depth may extend to 10 cm. • Supraclavicular: Insert needle at 45-degree angle into the angle formed by the clavicle and the sternocleidomastoid muscle. Insertion depth 1 cm–4 cm. <p>ADVANTAGES</p> <ul style="list-style-type: none"> • Large vessel with high flow rate • Lower infection rate compared with other sites • Easy to maintain dressing • Less restricting for patient 	<p>DISADVANTAGES</p> <ul style="list-style-type: none"> • Lies close to the lung apex (pneumothorax risk) • Close proximity to subclavian artery • Difficult to control bleeding (noncompressible vessel) • Potential for pinch-off phenomenon • Difficult to visualize utilizing ultrasound <p>ADJACENT ANATOMY</p> <ul style="list-style-type: none"> • Subclavian artery • Pulmonary apex • Right lymphatic duct • Costoclavicular ligament, first rib <p>POTENTIAL COMPLICATIONS</p> <ul style="list-style-type: none"> • Arterial puncture • Pneumothorax, pleural effusion • Chylothorax • Pinch-off phenomenon
<p>AXILLARY</p> 	<p>LANDMARKS</p> <ul style="list-style-type: none"> • Lateral to clavicle • Inferior to the axillary artery • Deltopectoral groove • Deep to pectoralis minor muscle <p>INSERTION ORIENTATION</p> <ul style="list-style-type: none"> • Ultrasound guided, transverse (out of plane) Using a steep angle (45-90 degrees), in the inferior-lateral portion of the deltopectoral groove, a needle is guided into the axillary vein. Insertion depth, 1.5-5cm. • Ultrasound guided, longitudinal (in plane) This approach utilizes a less steep angle, in the lateral portion of the deltopectoral groove. The shaft of the needle is visualized throughout the course of the insertion. Insertion depth, 1.5-5cm. 	<p>ADVANTAGES</p> <ul style="list-style-type: none"> • Large vessel with high flow rate • Lower infection rate compared with other sites • Easy to maintain dressing • Easy to control bleeding (compressible vessel) • Patient comfort <p>DISADVANTAGES</p> <ul style="list-style-type: none"> • Potentially a longer learning curve than the IJ vein • Deeper than the IJ vein • Proximity to the axillary artery <p>ADJACENT ANATOMY</p> <ul style="list-style-type: none"> • Axillary artery • Pleural space • Brachial plexus <p>POTENTIAL COMPLICATIONS</p> <ul style="list-style-type: none"> • Arterial puncture, hematoma • Pneumothorax • Nerve injury

Figure 1 – Image courtesy of Teleflex®

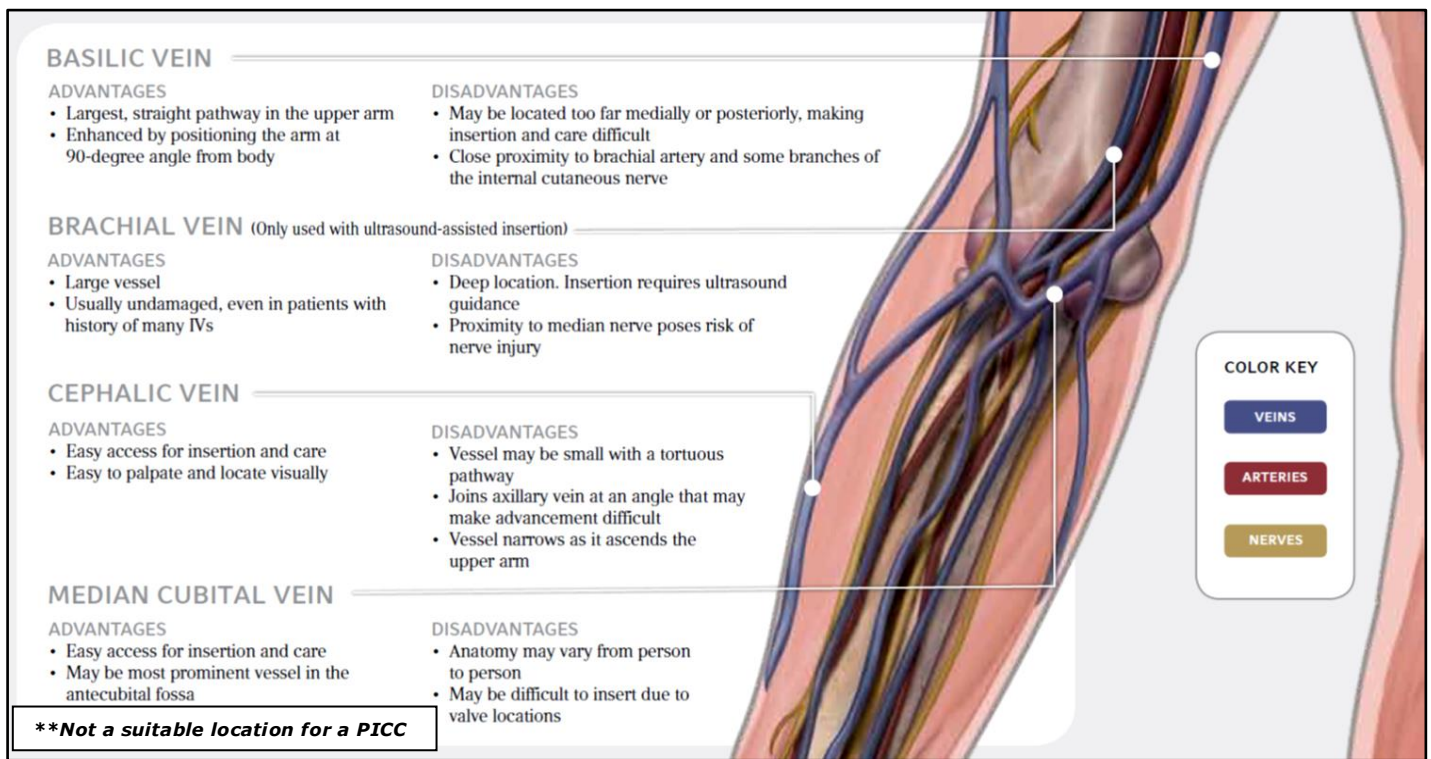


Figure 2 – Image courtesy of Teleflex®

Ideal CVC tip placement should be patient-specific for the intended use of the CVC. The majority of patients who require CVCs for routine vascular access indications (such as medication delivery, fluid delivery, and TPN) will work well with a CVC positioned within the lower segment of the SVC at the cavo-atrial junction (CAJ) or the inferior vena cava above the level of the diaphragm for femorally placed CVCs. High flow catheter function, such as permanent tunneled hemodialysis and pheresis catheters, can be improved by placing the catheter tip in the upper right atrium. Multiorifice CVCs used for venous gas aspiration in the case of a gas embolism are the only other indication for which a CVC tip may be placed within the right atrium. (BC Renal Agency, 2013) (Campisi, Biffi, & Pittiruti, 2007)(Dariushnia, et al., 2010) (Forauer, 2007) (Gebhard, et al., 2007) (Hamilton & Foxcroft, 2008) (Pittiruti, Hamilton, Biffi, MacFie, & Pertkiewicz, 2009) (Shamir & Bruce, 2011) (Vessely, 2003) (Yoder, 2001)

Actual tip placement should be confirmed as soon as possible after insertion, before use, and whenever necessary (CVC measurement has moved from original measurement either in 2cm or greater or out 4cm or greater, disappearance of the venous pressure waveform (may indicate vessel perforation), or upon receiving a patient where initial CVC measurement and confirmation of placement are not available or provided. (Forauer, 2007) (Gebhard, et al., 2007) (Hamilton & Foxcroft, 2008) (Infusion Nurses Society, 2016) (Shamir & Bruce, 2011) (Vessely, 2003) (Yoder, 2001)

Tip confirmation may be done by chest x-ray, fluoroscopy (BC Renal Agency, 2013), monitoring of venous pressure waveform, real-time ultrasound with ECG (PICCs), or, in the case of femorally placed CVCs, by drawing an arterial blood gas from the CVC and confirming it is a venous sample or by CVP waveform analysis. (American Association of Critical-Care Nurses, 2007)



Types of Central Venous Catheters



Images courtesy of Teleflex®

Types of Central Venous Catheters

◆ Short-term (Percutaneous, Non-Tunneled, Non-Cuffed)	Short Term
◆ PICC (Peripherally Inserted Central Catheters)	Long Term
◆ Tunneled Catheters	Long Term
◆ Implanted Venous Access Devices (IVAD)	Long Term

Short-Term CVC – [*also known as a percutaneous CVC, non-tunneled CVC, or percutaneous sheath/introducer*] A CVC inserted by puncture directly through the skin and to the intended location without passing through subcutaneous tissue. (Infusion Nurses Society, 2016) Site placement is typically in either the subclavian vein or the internal jugular vein, though it may also be inserted into the femoral vein. If the CVC will be needed for greater than 2 weeks, consider a referral for a Long-term CVC. The femoral site should be avoided whenever possible due to the high risk of infection, thrombosis, and arterial cannulation and is relatively contraindicated as a route for parenteral nutrition. Femoral CVCs inserted under emergency circumstances should be re-sited to another CVC site within 48 hours of insertion. (O'Grady, et al., 2011) (Pittiruti, Hamilton, Biffi, MacFie, & Pertkiewicz, 2009) (Safer Healthcare Now, 2012) (Sydney South West Area Health Service, 2007) (Wheeler, Wong, & Shanley, 2007)

Note: Percutaneous Sheath Introducers are only for use in Critical Care Areas. Whether or not patients with short-term CVCs are appropriate for admission at sites without 24/7 Internal Medicine coverage is a site-based decision taking into consideration patient safety, staff competency, and patient flow.

Long-Term CVC – A CVC that stays insitu for months to years. Includes Implantable Venous Access Devices (IVADs), Peripherally Inserted Central Catheters (PICCs), and Tunneled CVCs.

- 1) **Implanted Venous Access Device (IVAD)** – [*also known as a "port"*] A catheter that is surgically placed into a vessel, body cavity, or organ and is attached to a reservoir or "port" located under the skin. (Infusion Nurses Society, 2016)
- 2) **Peripherally Inserted Central Catheter (PICC)** – A central venous catheter inserted by a physician or an RN with advanced training and established competency, into an extremity, typically in the cephalic, basilic or brachial veins of the upper arm. (Infusion Nurses Society, 2016)
- 3) **Tunneled CVC** – A long-term CVC whose proximal end is tunneled subcutaneously from the insertion site and brought out through the skin at an exit site. (Infusion Nurses Society, 2016)

Note: Hemodialysis catheters may be Short-term and temporary or Tunneled and permanent and may only be accessed by a Renal Nurse. [Exception: In situations that require emergent or code blue interventions Registered Nurses who work in Critical Care settings (i.e. ER, CCU and ICU) and have undergone the required education and competency assessment may access the hemodialysis catheters.]

COMPOSITION

- ◆ Polyurethane or Silicone

COATINGS

- ◆ May have antimicrobial or antiseptic coating to protect against bacterial seeding
- ◆ May have heparin coating to reduce fibrin formation
- ◆ Radiopaque to confirm tip placement by X-ray

The type of CVC inserted depends on the:

- ◆ Type of therapy to be administered
- ◆ Length of therapy (i.e. Short term or Long term)
- ◆ Complex or unusual vascular anatomy
- ◆ Previous devices and complications
- ◆ Clinical diagnosis and assessment
- ◆ Clinical situation
- ◆ Care setting
- ◆ Patient/family preference
- ◆ What alternatives are there?
- ◆ ***Always advocate for Best Practice!***

Site selection includes an assessment of the patient's condition, age, diagnosis, comorbidities, condition of the vasculature at the insertion site and proximal to the intended insertion site, condition of skin at intended insertion site, history of previous venipunctures and access devices, type and duration of infusion therapy, and patient preference. (Infusion Nurses Society, 2016)

A device with the smallest gauge and least number of lumens needed in order to infuse the prescribed therapy, length of treatment, duration of dwell, vascular integrity, patient preference, and patient ability and resources to care for the device should be inserted in an effort to reduce central line-associated bloodstream infections (CLA-BSIs). (Infusion Nurses Society, 2016) (Safer Healthcare Now, 2012)

Devices inserted for patients in the Residential setting should be single lumen, close-ended, with a distal valve whenever possible.

When selecting a CVC type, consideration should be given as to whether the device will be used for high-pressure injection and a suitable device chosen for this purpose. (Infusion Nurses Society, 2016)

A physician's order is not required to access a CVC, including IVADs.

Reassess the continued need for the CVC daily. Obtain a physician's order is required to remove the CVC or provide alternate route for therapy if no longer needed. (Center for Disease Control and Prevention, 2011) (Safer Healthcare Now, 2012)

Central Venous Catheters: Single Lumen vs. Multi-lumen

- ◆ Single, double and triple lumen catheters are available in most catheter types
- ◆ **Each lumen must be treated as a separate catheter**
- ◆ Incompatible medications can be infused simultaneously via separate lumens
- ◆ Exit ports are approximately 2cms apart on the short-term catheter



When TPN is being infused a lumen *MUST* be dedicated and labeled for this use. It is discouraged to administer anything else via that lumen due to increased incidence of occlusions and infections associated with this practice.

(In a triple lumen catheter, the Medial lumen is typically used)

Central Venous Catheters: Non-Valved or Valved

Non-Valved

- ◆ The catheter is open through the whole catheter to the distal tip
- ◆ The catheter requires clamping before entry into the system
- ◆ Clamps are usually built into the catheter
- ◆ Requires periodic flushing (see Pg. 66)
- ◆ Non-valved CVCs are open-ended

Valved

- ◆ Valves may be placed distally (at the tip) or proximally (at the hub).
- ◆ Clamps are **not** required or built into the catheter as the valve is closed except during infusion or aspiration.
- ◆ May be present on Tunneled Catheters, Implanted Ports and PICCs, but NOT Short-term CVCs.
- ◆ Valved CVCs may be open-ended or closed-ended

How the Valve Works

- Valves may be placed distally (at the tip) or proximally (at the hub).
- When negative pressure (suction) is applied, the valve opens inward and blood flows into the syringe.
- When positive pressure is applied (fluid infusion or flush) the valve opens outward and fluid enters the bloodstream.
- The valve works when pressure is applied to it. With no pressure the valve remains closed.

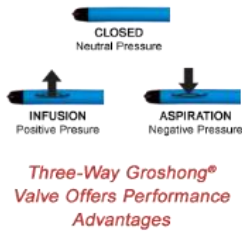


Figure 3 – Distal Valve - Image courtesy of Bard®

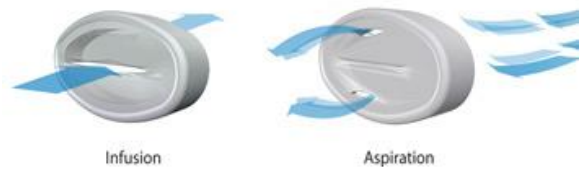


Figure 4 – Proximal Valve - Image courtesy of Bard®

Example of a closed-ended catheter with a proximal valve in the hub of the catheter:

Figure 5 – Image courtesy of Bard®



Test Your Learning



- 1) Which of the following would **not** be considered a CVC? A catheter placed:
 - a) in the radial artery
 - b) in the superior vena cava
 - c) so its tip is at the junction between the superior vena cava and the radial artery
 - d) with its tip in the external jugular vein
 - A. a & b
 - B. b & d
 - C. a, c, d
 - D. All of the above

- 2) Uses for a CVC include which of the following?
 - a) TPN administration
 - b) IV drug and fluid administration
 - c) Blood product
 - d) Blood sampling
 - e) Measurement and monitoring of Central Venous Pressure
 - f) All of the above

- 3) List four types of CVCs
 - a) _____
 - b) _____
 - c) _____
 - d) _____

- 4) Open-ended CVC's requires clamping? T or F?

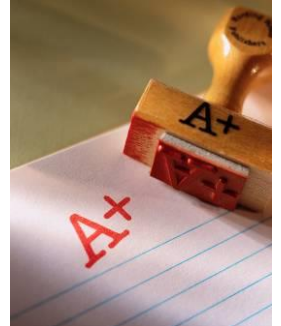
- 5) With a proximally valved CVC, clamping is _____ required as the valve is _____ except during infusion or aspiration.



**For all CVC's, it is important to know catheter type, design
(open-ended or closed-ended), and tip location**

Answers

- 1) C
- 2) F
- 3) Short Term, PICC, Tunneled, and IVAD
- 4) True
- 5) Not, Closed



Congratulations! You have just completed the first section.

Let's keep moving.....

Short-Term CVCs



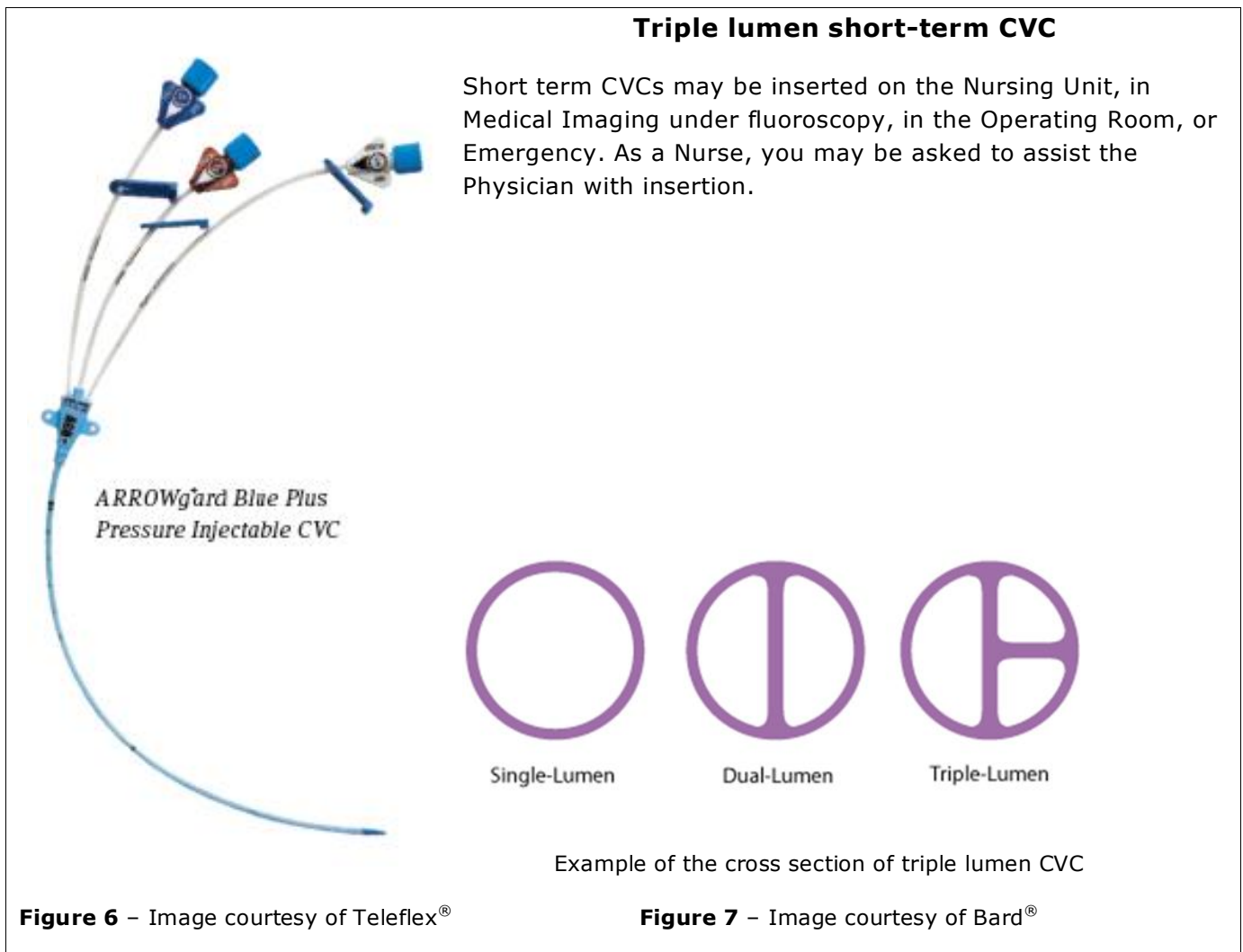
Images courtesy of Teleflex®

Short-Term CVCs

A short-term CVC is inserted directly into a large central vein through the skin. These catheters may be single or multi lumen. Some are sutured in place at the insertion site.

Examples of Short-Term Catheters:

- ◆ Multi-lumen short-term CVC
- ◆ Percutaneous introducer
- ◆ Temporary hemodialysis catheter



Percutaneous Introducer/ Sheath



Figure 8 – Image courtesy of Teleflex®

Single Lumen with side port or Percutaneous Introducer. Comes in 7 and 8.5F sizes. Obturator must be in place to seal the diaphragm when the catheter is not being used as an introducer for a Pulmonary Artery Catheter, a pacemaker wire, or a multi- lumen CVC.

*****Found in Critical Care Areas ONLY*****

	USES	ADVANTAGES	DISADVANTAGES
SHORT-TERM CVCS	<ul style="list-style-type: none"> ◆ Short term use, but may be left in as long as the catheter is needed, if it is still functional and not a source of infection ◆ Emergency access 	<ul style="list-style-type: none"> • All types of therapies can be administered • Preserves peripheral veins • Can be single, double, or triple lumen • Adult or pediatric sizes • Can be used for blood sampling • Economic, quick placement 	<ul style="list-style-type: none"> • HIGHEST risk for infection • Not for home intravenous therapy • Greater risk of insertion and post insertion complications (e.g. pneumothorax, air embolism) • Not to be used long term. Consider referral for insertion of long-term CVC if it will be needed for >14 days • Firm catheter may erode the vessel over time • Can be easily dislodged

**Suggested Lumen Choice for Infusions
Multi-lumen Short-Term Catheters**

				INTRODUCER WITH SINGLE LUMEN ADAPTER	
FUNCTIONS	PROXIMAL 18 gauge	MEDIAL 18 gauge	DISTAL 16 gauge	SIDE-ARM	SINGLE LUMEN (CVP)
IV Fluid Administration	X	X3	X	X	X
Blood or Colloid Administration	X	X3	X	X	X
Rapid IV/Blood Replacement			X	X	X
T.P.N.		X1		X1	or X2
Medication Administration	X	X3	X	X3	X3
Blood Sampling	X	X3	X	X	X
CVP Monitoring			X		X
	X1 - preferred unless blood sampling will be required from this lumen.				
	X2 - used for TPN when CVP Monitoring is not required and blood sampling from Side Arm is required.				
	X3 - Lumen is not used for medication administration while TPN is infusing.				



WHICH HUB DO YOU SCRUB?

- Friction scrub the Neutral Displacement IV Cap prior to accessing through the cap
- Friction scrub the CVC hub when removing/changing cap
- Always scrub using an alcohol swab for 30 seconds and allow to dry completely
- If using an alcohol-impregnating cap on the needleless connector, the cap needs to be on the needleless connector for a minimum of 1 min to take the place of a 30 sec scrub with an alcohol swab



Figure 9 – Courtesy of 3M™



Hemodialysis Catheters

- ◆ A hemodialysis catheter (HD line) is a type of Central Venous Catheter used for patients requiring hemodialysis. The lumens of these catheters are larger allowing for large volumes of blood to be processed and returned to the patient.
- ◆ The Renal Program has specific policies and procedures related to these catheters.
- ◆ **HD lines may be accessed by Critical Care Nurses in a Code/ Trauma situation or with Continuous Renal Replacement Therapy (CRRT).**
- ◆ **HD lines are central venous catheters/ Maintain aseptic technique as they are the patient's life lines.**
- ◆ Catheter lumens must never be left unattended when open to air.
- ◆ If there are problems with withdrawing from a lumen **do not push** locking agent or clot into the patient.
- ◆ Once patient stabilizes, plan for use of an alternative access.

The HD line can be used for:

- blood samples
- infusing a medication
- IV infusion

Procedure:

- ◆ Place patient supine
- ◆ Create a sterile field/ Don sterile gloves/mask
- ◆ Ensure both clamps closed
- ◆ **Scrub the Tego™ connector hub** with alcohol swab and leave to dry
- ◆ Attach a 10 mL luer syringe, unclamp and withdraw 5 mL locking agent, and discard.
- ◆ Using a second 10 mL syringe, withdraw and instill blood 2-3 times (ensures locking agent is cleared)
- ◆ Flush line with the NS 0.9% 10 mL pre-filled syringe for a total of 20 mL per lumen.



Figure 10 – Image courtesy of ICU Medical®

Infusing Medication/ IV infusion

- ◆ Clamp. Discard syringe. Attach solution tubing

Blood samples

- ◆ Withdraw 10ml discard from the lumen, clamp and discard. Attach a Vacutainer™ or syringe, unclamp and take blood samples. Re-clamp. After use flush catheter with 20ml NS 0.9%.
- ◆ Once you are finished, run an IV 0.9% NS solution at 20 ml/hr.



Notify the Renal Unit that the dialysis line has been accessed.

*****A Renal Nurse must flush and re-cap the catheter after the dialysis line has been accessed.**

Exception: ICU Nurses performing Continuous Renal Replacement (CRRT) may access and de-access a dialysis line.

Nursing Care: Pre/Post Insertion of Short-Term CVCs

Key Points to Remember:

- **Pre-Insertion:**

- Prior to insertion ensure the patient/family understands the procedure, its benefits and what might be expected of the patient during and after insertion (Physician responsibility)
- Assess patient's vital signs and document.
- Perform a respiratory assessment including breathing patterns, depth, symmetry, and sounds
- Place patient in Trendelenberg position to dilate the veins and reduce the risk of air embolism if tolerated. Some patients are unable to tolerate this position. When this occurs follow the Physician's direction.

- **Use of maximum barrier precautions:**

- **The patient** is covered from head to toe with a sterile drape with a small opening for the insertion site (to observe/monitor the patient's head area, consider placing a mayo stand under the drape in this area).
- **The inserting practitioner** must remove jewellery, wear eye protection, hand wash to remove visible dirt (soap and water or 2% Chlorhexidine), subsequent hand washing before and after palpating catheter insertion site (alcohol gel is sufficient), and use a surgical cap (bouffant cap), mask, sterile gown, and sterile gloves.
- **The assisting practitioner** must hand wash and use a surgical cap (bouffant cap), mask, sterile gown, and sterile gloves.
- **Other personnel**, such as those without direct contact, must wear a mask.

- **Post-insertion**

- Order a portable chest x-ray for Physician to confirm correct placement of line
- **NOTE: Do not use CVC until confirmation of placement received by Radiologist or Physician unless condition warrants need for immediate infusion of large volume of fluid.**
- **FEMORAL SITE:** If a Short-term CVC is inserted into a femoral site – no chest x-ray required. **To confirm correct placement in vein, draw blood gas from the femoral CVC and send sample to Lab to ensure the results are a venous sample (Venous Blood Gases). In Critical Care areas, transduce the femoral CVC and ensure you have an appropriate CVP waveform.**
- Ensure that all lumens are flushed with 2 x 10 mL of NS pre-filled syringes immediately after insertion.
- Monitor patient vital signs every 30 min x 2

- **Documentation**

- Documentation to be done on the ***Central Venous Catheter Insertion and Removal Form (see Appendix C)*** including:
 - Date & time
 - RN who assisted with the insertion
 - Physician who inserted the line and their initials
 - The nature of the insertion
 - Type of catheter
 - Preparation
 - Insertion procedure
 - Vein used
 - How the catheter was secured
 - If a transparent dressing was applied
 - Initial complications
 - Completion of chest x-ray
 - Placement confirmation
- ***CVC Weekly Maintenance Record (See Appendix D):***
 - Date routine flushes are due
 - Date IV cap and/or tubing changes are due
 - Daily need for CVC reviewed
 - Patency Assessment
 - How much of the catheter is showing above the insertion site (in centimetres)
- ***Fluid Balance Record:***
 - Amount of infused solution
 - Type of IV solution
- ***Multi-disciplinary Progress Notes***
 - Appearance of the entrance site
 - Patient tolerance of procedure
 - Post-insertion patient assessment



Test your Learning

- a. Short-Term catheters are inserted _____ into a _____ through the _____.
- b. Short-term catheters have the _____ rate of infection.
- c. Short-term catheters are _____ ended.
- d. What position is the patient placed in for a short-term catheter insertion?

- e. List two responsibilities of the primary nurse post-insertion of a short-term CVC?
- f. Assessment is done post-insertion of a short-term CVC Q _____ min x _____.
- g. Post-insertion, check for signs of:
 - a) _____
 - b) _____
 - c) _____
 - d) _____

Answers

1. directly, vein, skin

2. highest

3. open

4. Trendelenberg

5.

- Order a portable chest x-ray for physician to confirm correct placement of line.
- Ensure that all lumens of a CVC are flushed with 20 mL of NS post-insertion
- Document
- Post-insertion assessment and vital signs

6. Q30min x 2

7.

- a) Subcutaneous emphysema
- b) Bleeding
- c) Air embolus
- d) Pneumothorax



Congratulations! You have just completed the second section.

Let's keep moving.....



Peripherally Inserted Central Catheters



Image courtesy of Bard®

Peripherally Inserted Central Catheter (PICC)

Peripherally Inserted Central Catheter (PICC) – A central venous catheter inserted by a physician or an RN with advanced training and established competency, into an extremity, typically in the cephalic, basilic or brachial veins of the upper arm. (Infusion Nurses Society, 2016)

Venous access is obtained by puncturing the brachial, cephalic, or basilic vein just above the antecubital fossa.

The catheters are approximately 40-60 cm long, but are usually individually sized upon insertion.

PICCs are usually chosen for patients requiring IV therapy for more than six days and up to one year, although a PICC may stay in longer than a year as long as it is still required, functional, and not a source of sepsis.

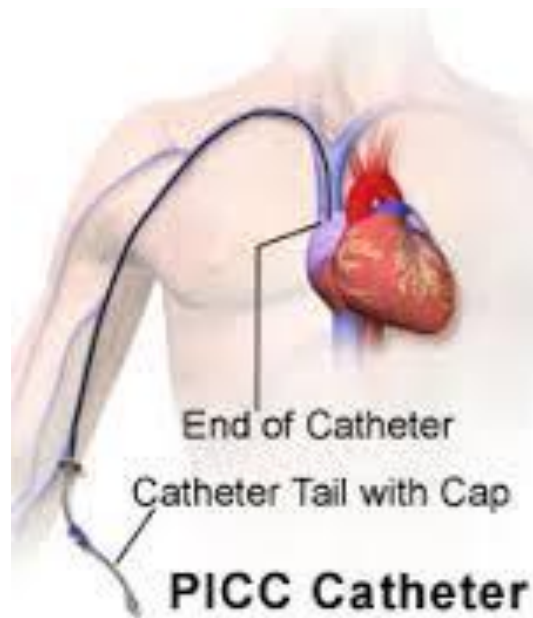


Figure 11 – Image courtesy of Bard®

	USES	ADVANTAGES	DISADVANTAGES
Peripherally Inserted Central Catheter	<ul style="list-style-type: none"> Intended for days to a year of IV access Peripheral insertion may be needed for patients with chest injuries, radical neck dissection or radiation therapy to chest. 	<ul style="list-style-type: none"> PICCs are inserted by Advanced Competency Assessed RNs (i.e. PICC Nurses) Can remain in place for several weeks to a year or more Easily removed by a Competency Assessed RN PICCs eliminate the risks associated with neck, chest & femoral insertion Low infection rate External portion can sometimes be repaired if damaged 	<ul style="list-style-type: none"> Requires a dressing & frequent assessments External device Not ideal for rapid infusions Not recommended route for some medications (e.g. phenytoin). Check Parenteral Drug Therapy Manual prior to use

Nursing Care: Pre/Post Insertion of PICCs

(For Removal – See Removal of Short-Term CVCs and PICCs pg. 73)

Pre-Insertion

- ◆ Ensure patient/family understands reasons for insertion, benefits and risk of procedure.
- ◆ If possible, provide an opportunity for the patient to see pictures, and handle a demo catheter.
- ◆ Administer a sedative prn as ordered prior to the pre-scheduled procedure time
- ◆ Ensure the patient is in the department where the PICC is to be inserted 15 minutes prior to scheduled time (if applicable)

Insertion

- ◆ Insertion of PICC catheters is done by Advanced Competency Assessed RNs who have received special training. These RNs are usually located in the Ambulatory/General Daycare department and/or are a Home/Community IV RN.



PICC Sherlock 3CG Insertion technology
Figures 12 & 13 – Image courtesy of Bard®

Post-Insertion

- ◆ Vital signs **Q1H**: BP, HR and RR
 - Respiratory assessment including: breathing patterns, depth, symmetry and breath sounds
 - Check for signs of:
 - Subcutaneous emphysema
 - Bleeding
 - Air embolus
 - Pneumothorax
 - Ventilated patients:
 - Ensure ventilator system pressures are unchanged
 - Cardiac monitored patients:
 - Observe for the occurrence of cardiac dysrhythmias
- ◆ Prior to using the PICC catheter, ensure placement has been confirmed by PICC RN by ECG or by Chest X-Ray
- ◆ May apply warm compress to arm above PICC venipuncture site QID x 20 minutes for 3 days PRN (to prevent mechanical phlebitis)
- ◆ Do not take blood pressures or venipuncture the arm with a PICC inserted.
- ◆ Monitor for swelling, tenderness
- ◆ Monitor catheter patency and rate of IV infusion

PICC Nurses will be also applying a topical hemostasis agent (StatSeal™) on select patients who experience difficulties with sanguinous drainage post PICC insertion.

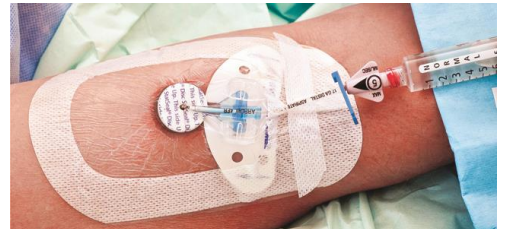


Figure 14 – Image courtesy of CardioMed™ and BioLife™



STATSEAL
Seal The Site. STAT.

StatSeal® quickly forms a seal to stop the flow of blood and exudates

and help protect the site from contamination. The mechanism of action is a simultaneous two-step action:

Figure 25 – Image courtesy of CardioMed™ and BioLife™

The polymer rapidly dehydrates the blood, stacking up the solid blood components.

The potassium ferrate agglomerates the blood solids creating a physical barrier.

Beneath the seal, the blood clots naturally and creates a seal that stops bleeding and oozing:

- Seal forms instantly
- Does not rely on the body's clotting cascade
- Works with any protein-filled fluid
- Minimizes dressing changes
- Seals sites from insertion to 7 days, virtually eliminating 24 or 48 hour dressing changes
- Helps minimize unplanned dressing changes due to bleeding and oozing
- Helps follow CDC guidelines by keeping sites dry and intact
- Helps improve outcomes for patients and staff
- Less exposure of site - Improves delivery of atraumatic care
- Saves nursing time and costs



Figure 36 – Image courtesy of CardioMed™ and BioLife™

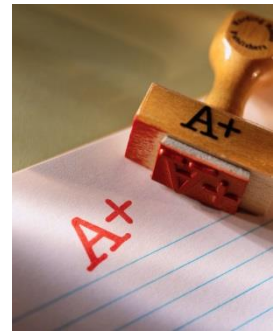
Test Your Learning



1. PICCs should be placed when a therapy will be longer than _____ (time period).
2. The tip of a PICC rests in the:
 - a) radial artery
 - b) jugular vein
 - c) superior vena cava at the junction of the right atrium
 - d) femoral artery at the junction of the right atrium
3. List 2 advantages of PICC lines
 - a) _____
 - b) _____
- 4.) List 2 disadvantages of PICC lines
 - a) _____
 - b) _____
5. PICC catheters are approximately _____ cm in length.
6. Pre-insertion, administer _____ as ordered.
7. Post -insertion prior to using the PICC, ensure placement has been done to confirm by the _____ or _____.
8. Apply warm compresses to arm above PICC site Q _____ X _____ minutes for 3 days PRN.
9. List two things you should not take from the arm where the PICC is inserted :
 - a) _____
 - b) _____

Answers

1. six days
2. c
3. - PICCs are inserted by PICC RN
 - Can remain in place for up to a year
 - easily removed by the Competency Assessed RN
 - PICCs eliminate the risks associated with neck, chest & femoral insertion
 - lower rates of infection
 - the external portion can sometimes be repaired if damaged.
4. Requires a dressing & frequent assessments, external device, some PICCs (small gauge), not recommended for blood sampling, difficult for self-care
5. 40-60 cm long
6. sedative
7. PICC nurse or chest x-ray
8. QID X 20 minutes
- 9 a. blood pressure b. venipuncture



Congratulations! You have just completed the Third section.

Let's keep moving.....

TUNNELED CATHETERS

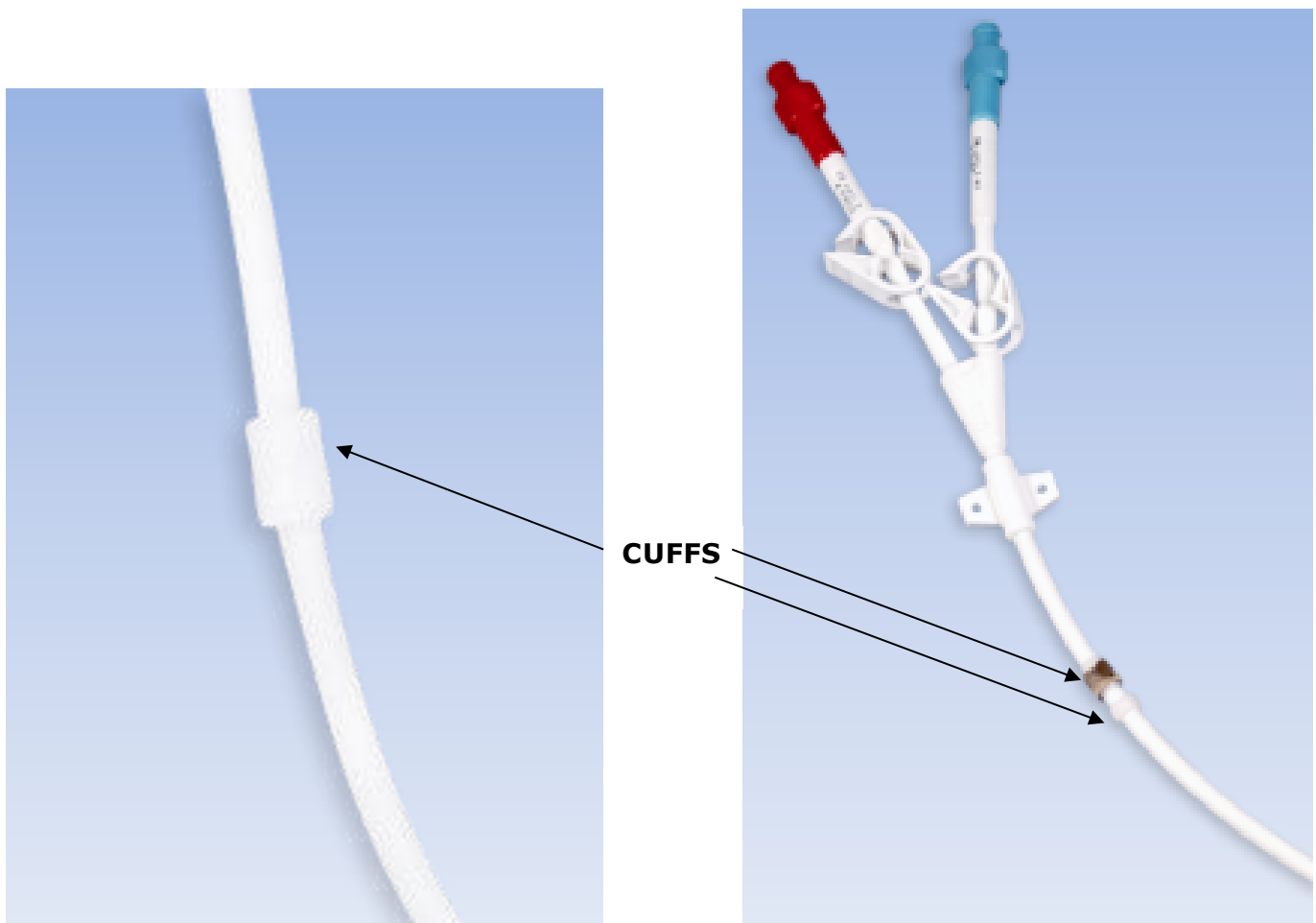


Images courtesy of Bard®

Tunneled Catheters

Tunneled CVC – A long-term CVC whose proximal end is tunneled subcutaneously from the insertion site and brought out through the skin at an exit site. (Infusion Nurses Society, 2016)

- ◆ Most tunneled catheters have one or two cuffs, one of which is a **dacron cuff** on the tunneled portion of the catheter, and sit 3 - 5 inches above the skin exit site. The cuffs facilitate anchoring of the catheter through granulation with the tissue and acts as a barrier to infection.
- ◆ Tunneled catheters may be single, double, or triple lumen.
- ◆ Examples of Tunneled Catheters are Hickmans[®], Broviac[®] and permanent hemodialysis catheters (e.g. Perm-Cath[®], Hemosplit[®], or Equistream[®]).



Figures 17 & 18 – Images courtesy of Bard[®]

	USES	ADVANTAGES	DISADVANTAGES
Tunneled Catheters	Used for long-term intermittent or continuous access for: <ul style="list-style-type: none"> • Medication administration (including vesicants) • Parenteral nutrition • Blood/blood product administration and sampling • Hemodialysis 	<ul style="list-style-type: none"> • Can be left in place indefinitely (if no infection, blockage or thrombosis) • External portion of some types may be repaired • Self-care by patient • Once site healed, no dressing is needed at home 	<ul style="list-style-type: none"> • Inserted in the OR or Medical Imaging under Fluoroscopy • External device • Physician must remove

Nursing Care: Pre/Post Insertion of Tunneled Catheters

Tunneled catheters may be inserted in the Operating Room under a local anaesthetic or in Radiology under fluoroscopy.

The **Nurse's role** in the insertion of a tunneled catheter involves pre-insertion teaching, assessment, and post-operative site care.

PRE-INSERTION

- ◆ Ensure patient/family understands reasons for insertion, benefits and risk of procedure.
- ◆ If possible, provide an opportunity for the patient to see pictures, and handle a demo catheter.
- ◆ Discuss feelings about potential body image changes (external device).
- ◆ Perform baseline vital sign assessment.

INSERTION PROCEDURE

- ◆ This procedure is performed in the Operating Room or Interventional Radiology under sterile technique
- ◆ The patient is placed in Trendelenberg position to dilate the veins and reduce the risk of air embolism
- ◆ The surgeon accesses the subclavian or internal jugular vein using a percutaneous approach and inserts the central venous catheter over a guide wire. Once the catheter is placed in the appropriate vein and the guide wire has been removed, the surgeon selects the exit site. The surgeon then tunnels the catheter subcutaneously away from the insertion site. Catheters are typically tunneled for several inches (4-6") from the location where they enter the vein and usually exit the body midway between the nipple and the sternum.

POST INSERTION OF TUNNELED CATHETERS

- ◆ Post-Insertion and **q30** minutes x 2:
- ◆ Vital signs: BP, HR and RR
 - Respiratory assessment including: breathing patterns, depth, symmetry and breath sounds
 - Check for signs of:
 - Subcutaneous emphysema
 - Bleeding
 - Air embolus
 - Pneumothorax
 - Ventilated patients:
 - Ensure ventilator system pressures are unchanged
 - Cardiac monitored patients:
 - Observe for the occurrence of cardiac dysrhythmias
- ◆ **Q1H:**
 - Monitor site patency and rate of IV infusion
 - Sutures are usually removed from the entrance site after seven to ten days, exit site after 14 days, or as per Physician's Order.

DRESSING: Newly inserted tunneled CVCs have 2 insertion sites. The upper insertion site will have sutures and needs to have a TSM securement dressing applied until it is well-healed. Sutures are removed may be removed when the upper and lower incisions are well-healed (usually 7-10 days). The lower insertion site which the CVC comes out of needs to have a TSM securement dressing to keep the line from migrating until the insertion site is well-healed and the skin growth into the Dacron cuff holds it firmly insitu (i.e. 4 – 6 weeks). If the insertion site shows signs of infection (e.g. redness, warm to touch, purulent discharge, etc.) consult with a physician.

Tunneled CVCs can be left open to the air (with no dressing) after the insertion sites are well healed in Outpatient and Community settings. (Center for Disease Control and Prevention, 2011) (Olsen, Hanson, Gilpin, & Heffner, 2004)



Test Your Learning

1. Tunneled catheters may only be single or double lumen. T or F

2. What are the 3 types of tunneled catheters?

3. List some uses for tunneled catheters

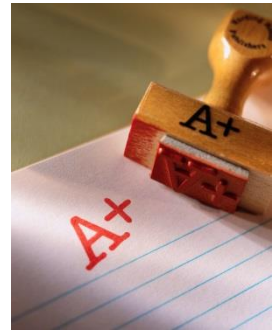
4. What position should the patient be placed in for insertion and why?

5. List possible post insertion complications.

6. Once the insertion site is healed, the dressing and sutures are removed and the site is left uncovered. T or F

Answers

1. F, single, double, or triple
2. Hickmans[®], Broviac[®] and permanent hemodialysis catheters (e.g. Perm-Cath[®], Hemosplit[®], or Equistream[®]).
3. Used for long-term intermittent or continuous access for medication administration, parenteral nutrition, blood/blood product administration and sampling, hemodialysis.
4. The patient is placed in Trendelenberg position to dilate the veins and to reduce the risk of air embolism.
5. Subcutaneous emphysema, bleeding, air embolus, pneumothorax
6. T



Congratulations! You have just completed the Fourth section.

Let's keep moving.....



Implantable Venous Access Device (IVAD)



Images courtesy of Bard®

Implantable Venous Access Device (IVAD)

- ◆ IVADs are long-term (months to years) single or dual chamber “port” surgically implanted in the subcutaneous tissue, usually in the upper chest.
- ◆ Each chamber must be managed as a separate lumen in IVADs with more than 1 septum.
- ◆ A non-coring point needle is required to access the device. (see Figure 15)
- When de-accessing an IVAD, a 5 mL of heparin 10 units/mL (dose to be administered = 30 to 50 units) pre-filled syringe is used.
- ◆ The surgical technique to place an IVAD is similar to that used to place a tunneled catheter. This procedure is done in the Operating Room or Interventional Radiology.



Figure 19 – Image courtesy of Bard®

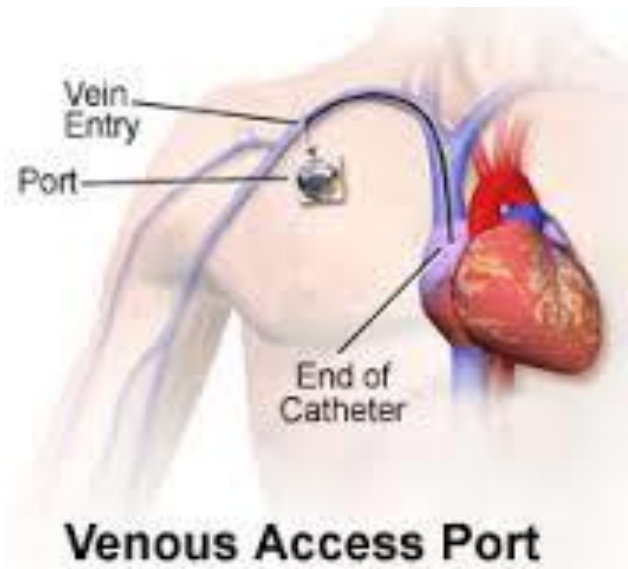
IVAD Components

Portal body - May be stainless steel, titanium, or plastic. May be single or double port.

Septum - Self sealing silicone septum which may stay in as long as the device is required, functional, and is not a source of sepsis.

Reservoir - Inside the port. Volume (of reservoir) is dependant on the size of the port and ranges from 0.2-1.5mL.

Catheter - Tip in superior vena cava. Radiopaque, may be open-ended or close-ended (valved)



Figures 20 & 21 – Images courtesy of Bard®

	USES	ADVANTAGES	DISADVANTAGES
Implantable Venous Access Devices	<p>Used for long-term intermittent or continuous access for:</p> <ul style="list-style-type: none"> • Medication administration (including vesicants) • Parenteral nutrition • Blood/blood product administration and sampling 	<ul style="list-style-type: none"> • Internal device, no dressing or site care • Can be permanent • Unrestricted activity • Decreased risk of infection • No external components to break • Less body image impact • May be used as long as the device is required, functional, and is not a source of sepsis. 	<ul style="list-style-type: none"> • Needle access is required • Surgical procedure required to insert/remove

Nursing Care: Pre/Post Insertion

Pre-Insertion

The nurse's role in pre-insertion care includes patient education:

- ⇒ Provide information about the surgical insertion of an IVAD to the patient and family. This is a shared responsibility between the Physician and the RN.
- ⇒ Pamphlets, videos and/or demo catheters may be available at some sites for patient teaching.
- ⇒ Female patients are sent with their bras to the OR/Medical Imaging to aid the surgeon with site selection.
- ⇒ Advise the patient to carry identification of the port model and composition with them at all times. The implantable ports can cause minor distortion of the MRI and other x-ray procedures.

Insertion

- ◆ IVADs are inserted in the OR/MI under a local anesthetic and sterile technique.
- ◆ A cut down method is used and the catheter is introduced through a venotomy into the subclavian or internal jugular vein.
- ◆ The catheter is then positioned with the distal end positioned at the junction of the superior vena cava and the right atrium.
- ◆ The portal body is placed over a bony prominence (e.g. ribcage), to ensure easy palpation. Appropriate site selection is essential.
- ◆ Once the site is selected, the portal body may be sutured to the fascia on all 4 sides with non-absorbable sutures to prevent it from twisting or moving. Most are now placed in a small subcutaneous pocket that does not require suturing.
- ◆ The port is flushed in the OR/MI. First access usually occurs about one week post-insertion.
- ◆ The entire procedure takes 30-60 minutes.

Post-Insertion

- ◆ Post-Insertion and **q30** minutes x **2**:
 - Vital signs BP, HR and RR
 - Respiratory assessment including: breathing patterns, depth, symmetry and breath sounds
 - Check for signs of:
 - Subcutaneous emphysema
 - Bleeding
 - Air embolus
 - Pneumothorax
- ◆ Ventilated patients:
 - Ensure ventilator system pressures are unchanged
- ◆ Cardiac monitored patients:
 - Observe for the occurrence of cardiac dysrhythmias
- ◆ **Q1H**:
 - Monitor site patency and rate of IV infusion
 - The incision dressing may be removed when there is no evidence of drainage (unless otherwise directed by physician)
 - Once healed if accessed, a transparent dressing is applied to the site and then the IVAD is treated as any other CVC. When not accessed, no dressing is required.
- ◆ Observe and document site condition including:
 - Wound hematoma, swelling, infection, device rotation and skin necrosis
 - Slight edema and tenderness around the port implantation site is normal for the first few days post operatively and does not prevent use unless it is excessive
 - Most Physicians prefer to wait a few days before accessing, although this is not always possible if no other access routes are available



“Twiddler’s Syndrome” occurs when a port is dislodged within the subcutaneous pocket because of trauma to the site or manipulation (twiddling) of the port by the patient. When this occurs, the port is noted to move easily under the skin. Resistance may also be noted when attempting to infuse and swelling may occur at the site. If this occurs, stop using the IVAD and notify the Physician to re-stabilize or re-insert the IVAD.



Test your Learning

1. IVADs are surgically placed in the _____, usually in the _____.

2. What type of needle is used to access the device? _____

3. Each chamber must be managed separately. T or F

4. Name the four components of the IVAD.

1) _____

2) _____

3) _____

4) _____

5. List two advantages of using IVADs.

1) _____

2) _____

6. List two disadvantages of using IVADs.

1) _____

2) _____

7. What is the role of the nurse for pre-insertion of an IVAD?

8. Post insertion assessment of IVAD is completed q ___ minutes x ____.

9. Monitor catheter patency and rate of IV infusion q ____.

10. Heparin is only used when _____ an IVAD.

Answers:

1. subcutaneous tissue, upper chest.
2. Non-coring needle
3. T
4. Portal body, Septum, Reservoir, Catheter
5. Internal device, no dressing or site care, can be permanent, unrestricted activity, decreased risk of infection, no external components to break, no body image impact, may be used as long as the device is required, functional, and is not a source of sepsis.
6. Needle access is required, surgical procedure required to insert/remove
7. Patient education
8. q 30 minutes, x 2
9. q 1 hour
10. De-accessing



Congratulations! You have just completed the fifth section.



Let's keep moving.....

Remember to replace all caps that come with a non-coring needle set with neutral displacement caps to prevent occlusions!



Figure 22 – Image courtesy P. Hignell[©]



Power-Injection Capable CVCs



Image courtesy of Teleflex®



Images courtesy of Bard®

Power-injection Capable CVCs

Pressure-injection capable CVCs are designed to withstand the high pressures created by pressure-injectors used to administer contrast dye in Medical Imaging. CVCs designed for high-pressure injection must withstand up to 300psi and be clearly labelled as such. (Infusion Nurses Society, 2016)

All CVCs also come in a “power” version – PURPLE often denotes Power injection-capable, but all vendors will denote power usage on the lumen.

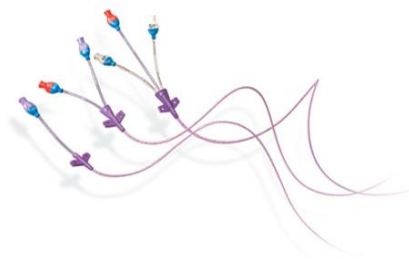


Figure 23 – Image courtesy of Bard®

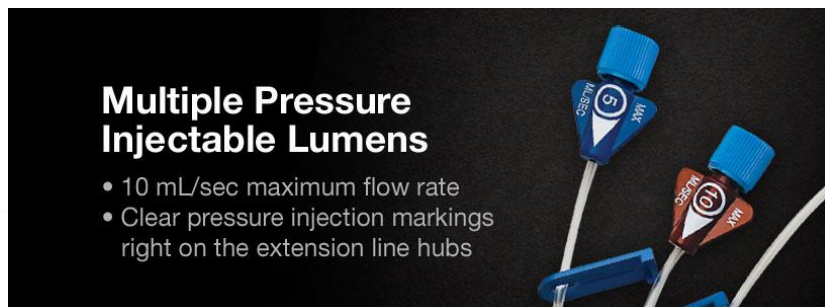


Figure 24 – Image courtesy of Teleflex®

One or more lumens may be power injectable. Imaging may request the RN check the power-injection capable CVC for patency prior to procedure. This involves easy aspiration of blood and easy flushing.

The RN must verify if an IVAD is power-injection capable before use. This must be confirmed by either a radiopaque identifier or symbols on the port are visible under X-ray, fluoroscopy or other appropriate imaging technology or a minimum of two of the following:

- i. Patient implant record.
- ii. Patient identification card, bracelet or key chain received when the port was implanted.
- iii. Palpation of the port to identify a triangular arrangement of three palpation bumps (not available on all brands).

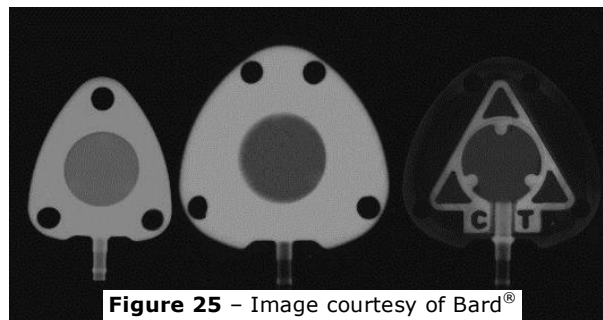


Figure 25 – Image courtesy of Bard®

Power-injection capable IVADs must only be accessed with a power-injection capable non-coring needle when required for power-injection.

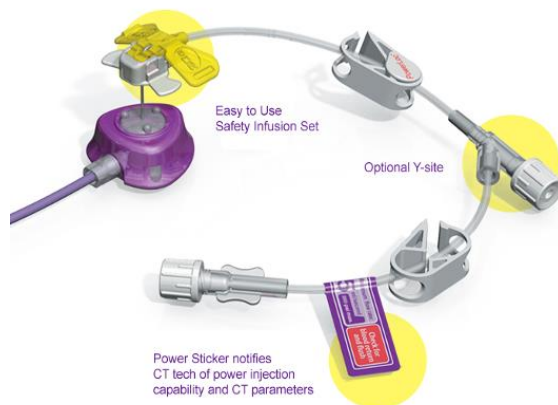


Figure 26 – Image courtesy of Bard®

****** Remember to flush all lumens (including ones with a continuous IV) with 2 x 10 mL pre-filled NS syringe after IV contrast to prevent occlusions.***

Complications Associated With Central Venous Catheters

Infection

Occlusion

Air Embolism

Catheter Related
Thrombus

Infiltration/
Extravasation

Catheter
Embolism

Phlebitis/
Thrombophelbitis

Malposition

Broken/ Damaged

COMPLICATIONS ASSOCIATED WITH CENTRAL VENOUS CATHETERS

Infection

Central Line Associated Bloodstream Infections (CLA-BSI) are a preventable nosocomial infection and adverse event. (Stevens & Schulman, 2012) These infections increase hospital length of stay and facility costs.

Central Line Associated Bloodstream Infection (CLA-BSI) – This term is specific to CVC associated bloodstream infections. A CLA-BSI is a bacteremia or fungemia in a patient with a CVC and no apparent source for the bloodstream infection other than the CVC. There must be at least one positive blood culture (obtained from a peripheral vein) in addition to the clinical manifestations of infection (i.e. fever, chills, and/or hypotension) **AND** had a CVC in use anytime during the 48-hour period before development of the BSI.

A definitive diagnosis of CLA-BSI requires that the same organism grow from at least 1 percutaneous blood culture and from a culture of the CVC tip, **OR** that 2 types of blood samples be drawn (one from each CVC lumen and the other from a peripheral vein) that, when cultured, meet CLA-BSI criteria for quantitative blood cultures. Central Line Associated Bloodstream Infections (CLA-BSI) are common, costly, and potentially lethal. Clinical Practice Guidelines and interventions aimed at decreasing the infection rate are needed to reduce the mortality, morbidity, and increased patient length of stay, and increased costs of this hospital-acquired infection. (Center for Disease Control and Prevention, 2011) (Chittick, et al., 2013) (Chopra, O'Horo, Rogers, Maki, & Safdar, 2013) (Fraser Health Authority, 2009) (Infusion Nurses Society, 2016) (Mermal, et al., 2009) (O'Grady, et al., 2011) (Safer Healthcare Now, 2012) (Provonost, et al., 2006)

Infective organisms may access the vascular access device surface by either:

- Invasion of the percutaneous tract
- Contamination of the catheter hub
- Seeding from a remote source of localized infection

(Association for Professionals in Infection Control and Epidemiology, 2009)

Increased CLA-BSI rates in adults are associated with CVCs placed in the jugular and femoral vein (Center for Disease Control and Prevention, 2011) (Doellman, 2011) (Safer Healthcare Now, 2012) and PICCS in an inpatient setting (Chopra, O'Horo, Rogers, Maki, & Safdar, 2013).

The nurse and/or IV Therapy Practitioner should assess patients for suspected infusion related and CLA-BSIs and document signs and symptoms, interventions implemented and patient response to treatment in the patient's permanent health record and the [*Patient Safety Learning System \(PSLS\)*](#). (Infusion Nurses Society, 2016)

Signs and symptoms of CLA-BSI include:

- Erythema, edema, induration, or drainage at the vascular device insertion site
- Elevated body temperature

Purulent drainage from the catheter-skin junction of a CVC should be collected using the Levine Technique (cleanse site with normal saline prior to collecting swab for culture and swirl the end of the cotton-tipped applicator on a 1-cm² area of the wound bed with enough pressure to cause minimal bleeding). *Rationale: Obtaining the culture from properly cleaned and prepared tissue avoids obtaining only a culture of surface contamination.* (Spear, 2014)

Routine culturing of all CVC tips upon removal is not recommended. Catheter colonization may be detected, but does not indicate the presence of a bloodstream infection. (Infusion Nurses Society, 2016)

Immediate removal of a functioning CVC is not recommended solely based on temperature elevation. Clinical findings, such as temperature elevation with or without chills or inflammation and purulence at the insertion site, are unreliable indicators of bloodstream infection. (Infusion Nurses Society, 2016)

Prior to insertion of a new CVC in a patient with documented CLA-BSI (i.e. positive cultures), it is recommended the patient receive treatment for the CLA-BSI for 48-72 hours. A negative blood culture is recommended before a new CVAD is inserted. *Rationale: If a new CVC is placed with a bacteremia present, the device could become seeded and result in continuing infection. Consideration should be given to the risk versus benefit to the patient when deciding to replace the CVC prior to obtaining negative cultures.* (Daneman, Downing, & Zagorski, 2012)

CVC salvage (avoiding removal of CVC in presence of infection) should be a collaborative decision with the physician, nurse, and patient based on:

- a) The type of CVC (inserted vs surgically implanted)
- b) Difficulty with insertion
- c) Presence of bleeding disorders
- d) CLA-BSI infecting organisms confirmed by at least 2 blood cultures
- e) The presence of other complicating conditions including, but not limited to, severe sepsis, suppurative thrombophlebitis, endocarditis, or the presence of vascular hardware, such as a pacemaker or implanted defibrillator.

Infection of a subcutaneous tunnel or IVAD pocket requires removal of the CVC; however, uncomplicated exit-site infection without systemic infection, positive blood cultures, or purulence may be treated with topical antimicrobial ointment as indicated by culture and sensitivity results. If an IVAD is removed for suspected infection, the port body should be sent for culture of the reservoir contents as well as the catheter tip. (Infusion Nurses Society, 2016)

Implementations of "Bundles" are associated with decreased infection rates. Bundles are a group of evidence-based interventions that, when implemented together, result in better outcomes than when implemented individually. Components of these bundles may include (but are not limited to):

- a) Hand hygiene
- b) Maximal barrier precautions during CVC insertion
- c) Chlorhexidine skin asepsis
- d) Optimal catheter type and site selection
- e) Daily review of CVC necessity
- f) Aseptic lumen access
- g) Routine catheter and tubing site care

(Center for Disease Control and Prevention, 2011) (Pennsylvania Patient Safety Authority, 2007) (Royer, 2010) (Safer Healthcare Now, 2012)

Air Embolism

Air embolism is the presence of air in the vascular system. (Infusion Nurses Society, 2016) A venous air embolism occurs when air is introduced into the venous system and travels to the right ventricle and/or pulmonary circulation. An arterial air embolism results from air entry into the arterial system and can produce ischemia of an organ with poor collateral circulation. (Broadhurst, 2013, p. 17) Air embolism is reported to occur more frequently during catheter removal than during insertion. (Truscott, 2013)

The minimum amount of air that is lethal to humans is not known, however, the risks from smaller amounts increase with a device closer to the central vasculature (CVC) or with pediatric and neonatal patients, particularly in presence of a patent foramen ovale. (Cook, 2013)

The introduction of microbubbles into the vascular system is also related to the development of an air embolism and may go unnoticed. Cardiopulmonary bypass, hemodialysis, mechanical heart valves, major surgeries, warming of cold infusates, and high IV infusion flow rates during trauma resuscitation can produce large amounts of microbubbles. (Broadhurst, 2013) (Cook, 2013)

Interventions to prevent air embolism include:

1. Minimize CVC manipulations.
2. Remove all air from syringes, IV administration sets, needleless connectors, stopcocks, and all other devices added to the CVC.
3. Trace all IV lines from the catheter hub to the IV fluid container to prevent misconnections.
4. Remove air bubbles detected during an IV infusion. Infrequent tiny pinhead bubbles, even though not desirable, can be left but should be monitored.
5. Never use scissors near a CVC to prevent accidental severing of the catheter.
6. Carefully fill and prime IV administration sets and filters and ensure vented tubing is clamped off before the container is completely empty.
7. Use IV infusion pumps with air sensing technology for IV fluid and medication infusions.
8. Place patient in trendelenberg position during CVC insertion at axillo-subclavian or jugular sites.
9. During CVC insertion stop ventilation during insertion of the needle and increase right atrial pressure during tunneling of the catheter
10. Have patient perform Valsalva maneuver during insertion of dilator unless they have a condition which may contradict it (e.g. aortic stenosis, recent MI, glaucoma, and retinopathy).
11. Ensure a catheter clamp is present and clamped before changing administration sets or needleless connectors on open-ended CVCs.
12. During CVC removal, ensure the catheter exit site is lower than the height of the patient's heart.
13. Apply a sterile occlusive petroleum based dressing when removing a CVC and cover that with a TSM dressing. Leave dressing in place for at least 24 hours.
14. Instruct the patient to lie flat for 30 minutes post CVC removal.
15. Instruct patients and caregivers to not disconnect and reconnect any IV administration sets or connectors from the catheter hub to properly prime tubing, to check connections frequently, how to prevent displacement/disconnection, and actions to take in case of CVC displacement or damage. (Broadhurst, 2013) (Cook, 2013) (Infusion Nurses Society, 2016)

Risks for air embolism include:

1. Failure to occlude the needle hub and/or catheter during insertion or removal
2. An improperly primed IV administration set
3. An incorrect technique when administering drugs via the IV route
4. Inadvertent infusions of air
5. An accidental disconnection at the catheter hub, connector, or IV administration set
6. A stopcock placed in the wrong position
7. A ruptured catheter
8. Poor technique during cap changes
9. Poor technique via the track from the removal of a CVC
10. The use of vented IV administration sets
11. IV fluid infusions that are completed or rapid infusion through an air-filled drip chamber with an IV administration set that is unclamped
12. Passive air entry via a CVC during the inspiratory phase of spontaneous respiratory

Sign and symptoms of air embolism:

1. Sudden onset of dyspnea
2. Continued coughing
3. Breathlessness
4. Agitation or irritability, often expressed as a feeling of impending doom
5. Shoulder and chest pain
6. Lightheadedness
7. Hypotension
8. Jugular venous distention
9. Tachyarrhythmias
10. Wheezing
11. Tachypnea
12. Altered mental status
13. Symptoms that emulate stroke including altered speech, changes in facial appearance, numbness and paralysis (Cook, 2013) (Infusion Nurses Society, 2016)

Diagnosis may not be straightforward but prompt diagnosis and treatment will decrease potential mortality and morbidity. Radiological techniques including transthoracic echocardiography and precordial ultrasonography have been used to detect air embolisms. (Cook, 2013)

Treatment should begin immediately even if an air embolism is only suspected to prevent further air from entering the vasculature:

1. Close, fold, or clamp the existing catheter to occlude entry of passive air.
2. Occlude the puncture site of a catheter that had been removed.
3. Place the patient in Trendelenberg left lateral decubitus position (left side, head flat, feet up, right side uppermost) if not contraindicated by other conditions such as increased intracranial pressure or respiratory illness. The goal of this positioning is to trap the air in the lower portion of the right ventricle and prevent it from travelling to the pulmonary arteries.
4. Administer oxygen at 100%
5. If possible, attempt to aspirate air from catheter.
6. Monitor vital signs.
7. Notify physician.

(Broadhurst, 2013) (Cook, 2013) (Infusion Nurses Society, 2016) (Wilkins & Unverdorben, 2012)

Catheter Embolism

Catheter embolism is the result of catheter damage or rupture, resulting in the breaking off of a portion of the CVC into the bloodstream. (Canadian Vascular Access Association, 2013) See also [*CVC Occlusion Management Algorithm*](#).

The most frequent causes for catheter embolism are pinch-off syndrome, damage during catheter exchange, separation of the catheter from an implanted port body, and fracture of a distal portion of an IVAD. (Infusion Nurses Society, 2016)

Interventions to prevent catheter embolism include (Infusion Nurses Society, 2016):

1. Do not withdraw a catheter through a needle during insertion.
2. Never use vascular access devices for power-injection that are not rated for this purpose.
3. The size of the flush syringe should be in accordance with the type of vascular access device and its intended use.
4. Be aware of the early signs of pinch-off syndrome in subclavian CVC insertion sites (when the subclavian vein is compressed between the clavicle and the first rib). Up to 40% of these cases may develop catheter fragmentation and embolization of catheter fragments into the pulmonary artery or heart. Pinch-off syndrome may be asymptomatic or may present as the intermittent or constant inability to aspirate blood from a CVC. Occasionally it may present as chest pain or arrhythmias during infusion procedures or if the patient has to maintain an unnatural position (e.g. arm raised) in order to infuse a solution or medication. To identify pinch-off syndrome, a specific CXR is required (with patient arms kept down at sides). (Canadian Vascular Access Association, 2013) (Infusion Nurses Society, 2016)

Catheter dysfunction, such as the inability to aspirate blood or fluid with localized pain and/or subcutaneous swelling, may be a precursor to catheter embolism. Leaking at the catheter insertion may indicate catheter rupture. CVCs which exhibit these signs should be evaluated further for integrity before use (e.g. CXR for fragmentation or pinch-off syndrome). (Infusion Nurses Society, 2016)

Catheter embolism should be suspected when the patient exhibits symptoms such as palpitations, arrhythmias, dyspnea, cough, or thoracic pain not associated with patient's diagnosis or comorbidities. (Infusion Nurses Society, 2016)

Upon removal, inspect all catheters for damage and possible fragmentation. When vascular access device removal is difficult or if damage to the catheter is seen:

1. Carefully assess the patient for signs and symptoms of catheter fragmentation and;
2. Save catheter and report via [**PSLS**](#) and [**BCCSS Product Concern Form**](#).

Pulmonary Embolism

Pulmonary Embolism occurs when a substance (usually a blood clot) becomes free and circulates to the pulmonary artery causing occlusion. Even small recurrent emboli may cause pulmonary hypertension and right heart failure.

Risk Factors:

- Irrigation of a clogged IV
- Debris in IV solution (some may require filter -refer to PDTM)
- Debris caused by incompletely dissolved, reconstituted drugs
- Unfiltered blood or plasma

Prevention:

- NEVER irrigate the catheter if the IV is not flowing
- Use in-line filters where applicable (see PDTM)
- Thoroughly inspect medication and solution containers for particulate matter prior to use

Signs and Symptoms:

- Apprehension
- Pleuritic discomfort
- Dyspnea, tachypnea
- Cyanosis
- Cough, unexplained
- Hemoptysis
- Diaphoresis
- Tachycardia
- Low-grade fever
- Chest pain radiating to neck and shoulders

Treatment:

- Place patient on strict bed rest in semi-Fowler's position
- Notify physician immediately
- Monitor vital signs
- Administer Oxygen
- Assess CVC for patency (for emergency drugs)
- Document in patient's permanent health record

Pulmonary Embolism

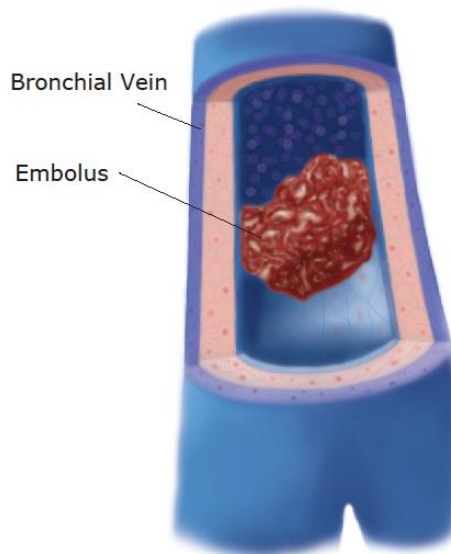


Figure 27 – Image courtesy Natalie Design Co.®

Catheter-Related Thrombosis (CRT) or Catheter-Associated Venous Thrombus

This term refers to a thrombus that has attached to the CVC and has also adhered to the vessel wall. CRT is associated with CLA-BSI. CRT increases the risk and incidence of CLA-BSI. Conversely, CLA-BSI also increases the risk and incidence of CRT. (Canadian Vascular Access Association, 2013) Any catheter inserted into the vasculature has the potential to cause a venous thrombosis (Trerotola, et al., 2010). PICCs are especially prone to Upper Extremity Deep Vein Thrombosis (UEDVT).

CRT is associated with CR-BSI. CRT increases the risk and incidence of CR-BSI. Conversely, CR-BSI also increases the risk and incidence of CRT. (Canadian Vascular Access Association, 2013)

Risk factors for CRT include:

1. Sub-optimal CVC tip placement
2. Difficult, previous, or traumatic insertions
3. PICCs with multiple lumens or larger gauges or inserted in the ACF
4. Children and adults over 60 years of age
5. Chronic illnesses such as lupus, irritable bowel syndrome, or end-stage renal failure
6. History of previous DVT (Yacopetti, 2008)

Signs and symptoms are related to the obstruction of venous blood flow and include:

1. Pain in the extremity, shoulder, neck, or chest
2. Edema in the extremity, shoulder, neck, or chest
3. Engorged peripheral veins in the shoulder, neck, or chest wall (Infusion Nurses Society, 2016) (Yacopetti, 2008)
4. Children and adults over 60 years of age
5. Chronic illnesses such as lupus, irritable bowel syndrome, or end-stage renal failure
6. History of previous DVT (Yacopetti, 2008)

CVC flushing and locking procedures have no effect on CRT as the solutions and technique are directed at the internal lumen of the CVC rather than the vein lumen. (Infusion Nurses Society, 2016)

Usual management of CRT includes thrombolysis and systemic anti-coagulation with or without CVC removal. Consider removal of CVC with caution as this may be their only vascular access and systemic anti-coagulation increases their risk for bleeding. Despite a lack of direct evidence proving safety and efficacy of anticoagulation for upper extremity deep vein thrombosis, anticoagulant therapy with a goal of relieving acute symptoms and preventing embolization remains the cornerstone of therapy.

Anticoagulant therapy is generally effective for preventing pulmonary embolism in patients with lower extremity deep vein thrombosis. In patients with acute UEDVT involving the axillary or more proximal veins, anticoagulation is recommended as for lower extremity DVT, provided there are no contraindications, with or without catheter removal. In patients who have UEDVT that is associated with a CVC that is not removed, the American College of Chest Physicians (ACCP) guidelines recommend that anticoagulation is continued as long as the CVC remains over stopping after 3 months of treatment. This is consistent with guidelines from the ACCP and other International guidelines. (Berube & Zehnder, 2016) (Kearon, et al., 2012)

Routine removal of the catheter is not recommended. In most patients with UEDVT that is associated with a CVC, it is suggested that the catheter not be removed if it is functional and there is an ongoing need for the catheter. In patients who have UEDVT that is associated with a central venous catheter that is removed, the ACCP guidelines recommend 3 months of anticoagulation over a longer duration of therapy.

This approach has been associated with good clinical outcomes in small series of patients, including patients with cancer. (Berube & Zehnder, 2016) (Kearon, et al., 2012)

CVCs should be removed in cases of:

1. Infected thrombus;
2. Malposition of the tip (radiologic reposition of the tip often fails, as a consequence of the inability to reach it inside the thrombus); or
3. Irreversible occlusion of the lumen.

(Campisi, Biffi, & Pittiruti, 2007) (Infusion Nurses Society, 2016) (Yacopetti, 2008)

Prophylactic anti-coagulation is controversial and compliance has been shown to be poor. Focus should therefore be on prevention of CRT:

1. Insertion of longer-term CVCs in applicable patients earlier in their course of treatment
2. Use of advanced technology on insertion (e.g. ultrasound, modified Seldinger technique, tip placement technology)
3. Right-sided placement is preferred as the required CVC length is shorter and more likely to lie parallel in the vessel
4. Insert the smallest gauge CVC with the least number of lumens required for the patient's course of treatment

(Campisi, Biffi, & Pittiruti, 2007)(Yacopetti, 2008)

Phlebitis and Thrombophlebitis

Phlebitis is inflammation of the wall of a vein.

Thrombophlebitis is when a blood clot in the vein causes the inflammation.

These conditions are characterized by pain, erythema, swelling, and palpable thrombosis of the cannulated vein. Risk factors for phlebitis include:

- Patients who are female
- Patients with poor-quality peripheral veins
- Insertion in the lower extremity, antecubital fossa, and points of flexion
- The presence of underlying medical conditions including cancer and immunodeficiency
- Insertion in an emergency

There are 3 major types of phlebitis: mechanical, bacterial, and chemical:

Inserting a vascular access device causes **mechanical** disruption to the skin, the body's first line of defense against infection. Movement of the cannula in the site also causes mechanical injury to the vein, as does using a catheter too large for the site.

When the skin is breached, patients are at risk for **bacterial** infection. Hand hygiene and cleansing the insertion site thoroughly before insertion and applying a dressing after are the major steps to prevent bacterial infection.

Chemical phlebitis can be related to the tonicity of the fluid, the number and dosage of medications, the pH of the medications, or wet skin. In particular, 5% dextrose in water is isotonic in the bag but hypotonic in the body after the dextrose is infused and metabolized. Hypertonic fluids pull fluids from the endothelium, causing the cells to shrink and making them vulnerable to infiltrations and phlebitis. (Washington & Barrett, 2012) Chemical irritation also happens when the skin is not allowed to dry after.

Phlebitis may occur at rates as high as 50% or even as high as 75% in patients with infectious diseases; however, the incidence rate in patients who do not have diabetes, burns, or a need for urgent catheter insertion is approximately 20%. This inflammation may occur while the catheter is in place and up to 96 hours after removal. The residual occurrence of phlebitis may still be a problem to the patient as long as 5 months after the incident.

All vascular access sites should be routinely assessed for the signs and symptoms of phlebitis.

(Dychter, Gold, Carson, & Haller, 2012) (Groll, Davies, MacDonald, Nelson, & Virani, 2010) (Hadaway, Short Peripheral Catheters and Infection, 2012) (Infusion Nurses Society, 2016) (Tripathi, Kaushik, & Singh, 2008) (Washington & Barrett, 2012)

Inflammation and clot due to trauma of vein

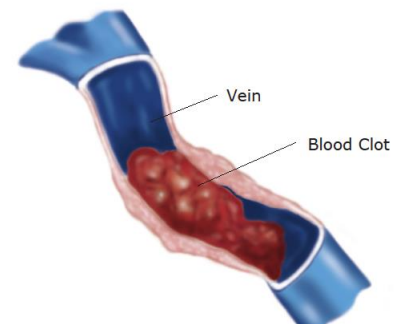


Figure 28 – Image courtesy Natalie Design Co. ©

Types and Causes of Phlebitis

Chemical Phlebitis

- Hypertonic solutions >375 mOsm/L
- Medications and solutions with pH <5 or >9
- Drugs classified as irritants or vesicants
- Solutions with large amounts of particulate

Mechanical Phlebitis

- Trauma from the IV catheter during insertion or while indwelling
- Rigid catheter material (i.e., FEP Polymer)
- Larger gauge and/or longer length catheters
- Lower skill level of inserting clinician
- Inadequate stabilization of the catheter
- Insertion across a joint

Bacterial Phlebitis

- Compromised skin integrity (i.e., shaving)
- Palpating site after applying skin prep
- Other breaks in aseptic technique
- Contamination of the IV system
- Non-sterile dressing

Figure 29 - Image courtesy of BD®

Infiltration and Extravasation

Infiltration is defined as the inadvertent leakage of a non-vesicant solution or medication into surrounding tissue.

Extravasation is the leakage of a drug or fluid from a vein into the surrounding tissue during intravenous administration (NHS Cheshire and Merseyside Strategic Clinical Networks, 2016). These injuries range from less significant erythematous reactions to skin sloughing and necrosis. Whilst extravasation is possible with any intravenous injection it is considered to be especially problematic with compounds known to have irritant or vesicant properties. The onset of symptoms may occur immediately or several days to weeks after administration. If left undiagnosed or inappropriately treated, necrosis and functional loss of tissue and limb concerned may ensue. (WOSCAN Cancer Nursing and Pharmacy Group, 2012)

Extravasation is associated with cytotoxic chemotherapy agents such as doxorubicin, paclitaxel, and vinca alkaloids, as well as a number of non-cytotoxic drugs, including phenytoin, sodium bicarbonate (>5%), calcium chloride and gluconate, amphotericin B, acyclovir, ganciclovir, digoxin, diazepam, potassium (>40 mmol/L), dextrose 50%, cefotaxime, IV contrast media, and mannitol, that can also cause tissue necrosis. The incidence of infiltration and extravasation is hard to determine because of limited reporting; however, extravasation injury from cancer chemotherapy is reported to be 11% in children and 22% in adults. One study found that, of all the complications associated with PIVs, 33.7% occurred as a result of infiltration. Rates of extravasation with cancer chemotherapy infused through implanted ports range from 0.3% to 6%. (Dychter, Gold, Carson, & Haller, 2012) (Hadaway, 2007)

*****See also [Extravasation Drug and Antidote Table on the FH Pulse](#).**

1. **Vesicant** - A drug which has corrosive properties and has the potential to cause tissue destruction if extravasated. Varying degrees of pain, edema, erythema, blistering and necrosis may occur. Vesicants are further divided into two groups. When extravasated, non-DNA binding agents (vinblastine, vinorelbine, vincristine) are inactivated or quickly metabolized and follow the normal healing process whereas DNA binding agents (epirubicin, mitomycin, doxorubicin, daunorubicin, idarubicin) remain in the tissues resulting in long-term injury.
2. **Exfoliant** - A drug capable of causing inflammation and shedding of skin but less likely to cause tissue death.
3. **Irritant** - This has the potential to cause pain, aching, tightness and phlebitis with or without inflammation, rarely progressing to tissue breakdown.
4. **Inflammitant** - Drug with the potential to cause mild to moderate inflammation and flare in local tissues.
5. **Neutral Drugs** – Drugs that cause very little or no tissue damage when extravasation occurs. (BC Cancer Agency, 2016) (NHS Royal Cornwall Hospitals, 2014)(WOSCAN Cancer Nursing and Pharmacy Group, 2012)

All vascular access sites should be routinely assessed for the signs and symptoms of infiltration and extravasation. Children and infants are vulnerable populations requiring special attention and the use of appropriate assessment tools. Pediatric assessment has been incorporated into this tool.

NOTE: For administration of oncologic agents for chemotherapy, please refer to the [BCCA Systemic Therapy Guidelines](#) for drug categories and administration procedures.

Measures to prevent infiltration and extravasation include:

- Selection of an appropriate site for catheter insertion - Avoid areas of joint flexion such as wrist and antecubital fossa
- Selection of an appropriate size catheter - Use the smallest size catheter needed for the prescribed therapy
- Use of appropriate fluids depending on vascular access type – Medications/fluids with an osmolarity of greater than 900 mOsm/L, a pH of less than 5 or greater than 9, and vesicants need to be given via a CVC.
- Stabilization of the catheter – Always use a securement device/dressing. Avoid circumferential taping of the limb.
- Use of proper administration techniques - The patency of the catheter and vein should be assessed frequently so that infiltration or extravasation can be prevented. Before administering each dose of medication, the nurse should visually inspect and palpate the site, checking for vein cording, edema, skin temperature, and tenderness or discomfort. Check for a positive blood return. Each drug should be diluted in a separate syringe. When dilution is done either in a syringe or by slow injection through an infusing, compatible IV fluid, according to the PDTM, the injection can be stopped if the patient complains of any problems. (Hadaway, 2007)

More frequent site assessments:

- Every 5 to 10 minutes for patients receiving peripheral intermittent infusions of vesicants (NOTE: The nurse should advocate for central vascular access administration of vesicant medications whenever possible. The peripheral infusion of vesicant agents should be limited to less than 30 to 60 minutes. In addition to visual assessment of the site, a blood return should be verified every 5 to 10 minutes during the infusion.) (Infusion Nurses Society, 2012)
- Patients receiving chemotherapeutic vesicants: The RN will remain with the patient, and will check blood return and assess the IV site every 2 minutes throughout the procedure. (BC Cancer Agency, 2014)

Common signs and symptoms of IV infiltration include:

- Cool skin temperature at the insertion site
- Skin that looks blanched, taut, or stretched or that the patient says feels "tight"
- Edema at the insertion site
- Discomfort and/or tenderness
- Change in quality and flow of the infusion
- Frequent IV infusion pump downstream occlusion alarms (do not rely on an IV infusion pump to alert you to an infiltration as this alarm is often a late sign; an IV infusion pump will exacerbate the problem until the IV infusion pump is stopped) (Pennsylvania Patient Safety Authority, 2007)
- IV fluid leaking from the insertion site

(Amjad, Murphy, Nylander-Housholder, & Ranft, 2011) (Dychter, Gold, Carson, & Haller, 2012)
(Hadaway, 2007) (Infusion Nurses Society, 2011) (Simona Pop, 2012)



Signs and symptoms of extravasation are the same as those of infiltration but also include burning/stinging pain, redness followed by blistering, tissue necrosis, and ulceration. Both infiltration and extravasation can have serious consequences including full-thickness skin loss, compartment syndrome, and muscle and tendon necrosis. The patient may need surgical intervention resulting in large scars, experience limited function, or even require amputation. Another long-term effect is complex regional pain syndrome, a neurologic syndrome requiring long-term pain management. (Amjad, Murphy, Nylander-Housholder, & Ranft, 2011) (Dychter, Gold, Carson, & Haller, 2012) (Hadaway, 2007) (Infusion Nurses Society, 2011) (Simona Pop, 2012)

For extravasation of contrast media, see [Extravasation of Non-Ionic Intravascular Contrast: Patient Management Guidelines](#)

Table 2 - Distinguishing Extravasation from other conditions:

Characteristic	Flare reaction	Vessel irritation	Venous shock	Extravasation
Immediate Symptoms	Itchy blotches or hives; pain and burning uncommon	Aching and tightness	Muscular wall of the blood vessel in spasm	Severe pain or burning at the insertion site and/ or anywhere along the vein or catheter that lasts minutes or hours and eventually subsides; usually occurs while the drug is being given.
Colouration	Raised red streak, blotches or "hive-like" erythema along the vessel; diffuse or irregular pattern	Erythema or dark discolouration along vessel		Erythema around area of needle or around the venipuncture site
Timing	Transient and usually resolves with or without treatment within 30 min, sometimes within 1 – 2 hours, and rarely takes up to 24 hrs.	Usually appears within minutes after injection. Colouration may only appear later in the process.	Usually appears right after injection	Symptoms start to appear right after injection, symptoms endure
Swelling	Unlikely	Unlikely		Occurs often; does not dissipate for several days
Blood return	Usually, but not always intact	Usually, but not always intact	Often absent	Usually absent or sluggish

(BC Cancer Agency, 2016) (European Oncology Nursing Society, 2007)

FLARE: painless local reaction along the vein or near the intact injection site characterised by:

- Immediate, red blotches or streaks (histamine release phenomenon), or local wheals; edema may sometimes occur
- With or without pruritus or irritation
- Symptoms usually subside with or without treatment 30 min after the infusion is stopped, although they may last for 1-2 hours and rarely more than 24 hours

VESSEL IRRITATION: Aching and tightness occurs along the vein. Seen with drugs such as vinorelbine and dacarbazine. Applying warmth to dilate the vein can relieve this. Blood return is usually intact although erythema or redness may be present.

VENOUS SHOCK: Rapid administration or the administration of very cold drugs can cause the muscle wall of the vein to go into spasm. Blood return may be lost. Heat can help to relax and dilate the vein.

IMMEDIATE TREATMENT

If extravasation is suspected, it is important to act quickly to prevent tissue necrosis. In the event of a CVC extravasation please follow steps 1-5 and discuss immediately with the patient's MRP. A Plastic Surgery consult is recommended for further advice to discuss removal of the device and immediate and future treatment as this may differ with each event.

1. **Stop the infusion or injection immediately – DO NOT remove the CVC at this point.**
2. Seek assistance if needed.
3. Disconnect the infusion (not the CVC catheter or non-coring needle).
4. Leave the CVC catheter or non-coring needle in place and try to aspirate as much of the drug as possible from the cannula using a 10 mL syringe. Avoid applying direct manual pressure to suspected extravasation site.
5. Remove the non-coring needle. Elevate and apply gentle pressure to site till hemostasis is achieved. Consult MRP regarding removal of CVC. **Exception:** *With extravasation of **Mechlorethamine** the antidote Sodium Thiosulfate is to be given through the existing IV line immediately after the extravasation and preferably through the same needle to insure injection into the same tissue plane as the extravasation.*
6. Mark the affected area and take digital images of the site (with patient consent).
7. Obtain extravasation kit or appropriate antidote and notify the MRP, and PCC or Charge Nurse.
8. Decide on how the extravasation should be treated. (**See below**)
9. Apply warm towel or ice pack wrapped in towel/cold compresses to the extravasation site for 1 hour as per Extravasation Drug and Antidote Recommendation Table. Care must be taken to avoid tissue injury from excessive heat or cold.
10. Administer pain relief as needed.
11. For vesicants, consult Plastic Surgery ASAP.
12. Document the injury with a digital image if possible. See [Fraser Health Media Consent Form](#).
13. Provide patient education and complete all documentation, including PSLs. See Also [FH Policy: Disclosure of Unintended Medical Outcomes](#)

(BC Cancer Agency, 2016) (NHS Cheshire and Merseyside Strategic Clinical Networks, 2016) (NHS Royal Cornwall Hospitals, 2014) (NHS Wales, 2008) (Reynolds, MacLaren, Mueller, & Fish, 2014)

Extravasation kits should be stocked on or available to all inpatient and outpatient Oncology Units. For access to the medications on other sites/units, contact the Oncology Unit or Site Pharmacy. They may include the following:

- Pain Ease[®] spray
- 25 gauge needles
- Dimethylsulfoxide (DMSO) 99% topical solution
- 3 mL syringes
- Hyaluronidase 1500 units /mL injection (HYALASE[®]) ampoule**
- Black indelible ink marker

- Hydrocortisone 1% cream
- Phentolamine 10 mg
- Ice pack - in freezer
- Sodium thiosulfate 25% injection, 10 mL vial***
- Sterile gauze dressings and tape
- 10 mL syringe (for preparing sodium thiosulfate)***

** Available through Health Canada Special Access Program

*** Only if intravenous mechlorethamine is available for use

(BC Cancer Agency, 2016) (Reynolds, MacLaren, Mueller, & Fish, 2014)

All vascular access sites should be routinely assessed for the signs and symptoms of infiltration and extravasation.

Occlusions

(Canadian Vascular Access Association, 2013) See also [CVC Occlusion Management Algorithm](#)

Standards - Immediately after a CVC is inserted into a vessel, the coagulation cascade begins. Thrombus formation may occur within 24 hours of insertion. CVC occlusions can result in interruptions or delays in therapy, infection, embolism, or loss of vascular access. Proper care, maintenance, continued assessment, and early recognition of the pending signs of occlusions can improve patient outcomes and minimize organizational costs. CVCs may remain insitu for as long as the device is functional and required. Restoration of catheter patency supports the longevity of the device's lifespan. CVC replacement costs include cost of the device, supplies, and nursing, clinic, and physician time. The cost of thrombolysis is markedly less than device replacement, both in terms of patient access to treatment and safety and well as financial impacts to the healthcare facility. Catheter salvage and restoring patency (rather than device removal) is the preferred approach to the management of CVC occlusions. Catheter patency is the ability to easily aspirate blood from a CVC lumen and to easily infuse or flush fluid through a CVC lumen. Catheter patency can be compromised by any type of occlusion.

Signs and Symptoms of CVC occlusions:

- i. Upon infusion or flushing:
 1. Resistance when flushing
 2. Sluggish flow
 3. Inability to infuse fluids or medications
 4. Frequent downstream or patient-side occlusion alarms on IV infusion pump
 5. Infiltration, extravasation, swelling, or leaking at the insertion site
- ii. Upon aspiration of blood:
 1. Inability to withdraw blood
 2. Sluggish blood return

Types of CVC Occlusions:

- i. **Thrombotic Occlusions** - Thrombotic occlusions are responsible for approximately 58% of all occlusions. Occlusions develop as fibrin builds on and around the catheter and vessel. In addition to causing catheter dysfunction, thrombotic occlusions can lead to catheter-related thrombosis (CRT). (See also *Catheter-Related Thrombus*)
- ii. **Chemical Occlusions** - Non-thrombotic causes of occlusion account for 42% of all occlusions and are related to medication or drug precipitate. They can specifically be the result of precipitate from the mixing of incompatible medications and solutions or lipid residue.
- iii. **Mechanical Occlusions** - Mechanical occlusions are related to internal or external problems with the CVC. They include CVC or tubing kinks, (see also *CVC Measurement and Device Malposition*), a clogged needleless connector or filter, and incorrect placement of a non-coring needle into an IVAD.

Degree/Type of Occlusion – There are three degrees/types of occlusion:

- i. **Partial** - Decreased ability to infuse fluids/medications into the CVC; resistance with flushing and aspiration; Sluggish flow through the CVC. Causes: Chemical, Mechanical, or Thrombotic occlusion.
- ii. **Withdrawal** - Inability to aspirate blood through the CVC, but ability to infuse without any resistance; Lack of free-flowing blood return. Causes: Mechanical or Thrombotic occlusion.
- iii. **Complete** - Inability to infuse or withdraw blood or fluid into the CVC. Causes: Chemical, Mechanical, or Thrombotic occlusion.

CVC occlusions should be investigated to identify the type of occlusion for appropriate management as soon as they are identified. (See also [CVC Occlusion Management Algorithm](#))

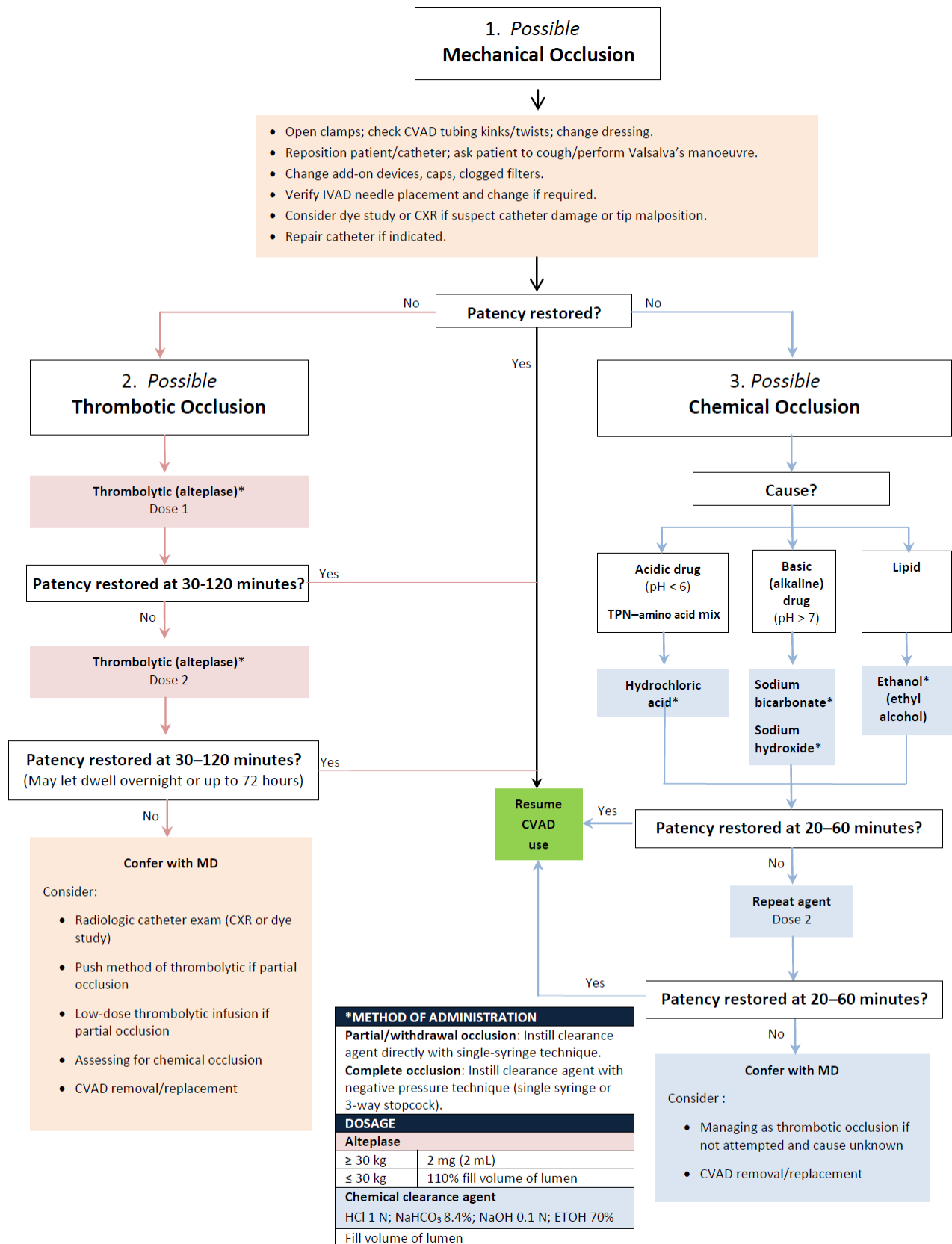
Administration of Unblocking Agents - Thrombolytics (alteplase®) can be administered as per the [Parenteral Drug Therapy Manual](#) by any CVC competent Registered Nurse. Specific RNs designated for this skill will be identified by the Site, Program, or Sector. The procedure **Central Venous Catheter: Unblocking with Alteplase®** can be found on [Clinical Skills by Elsevier](#). Administration of agents to unblock chemical occlusions (from high pH drugs, low pH drugs, and lipids) in CVCs will be limited to PICC RNs and as per the [Parenteral Drug Therapy Manual](#).



Figure 31 - Image courtesy of Roche®

PREVENTION OF OCCLUSIONS

- Prevent occlusions by turbulent flushing before & after use, between incompatible medications, after blood draws, and regular flushes of lumens not in use
- If there is resistance to flushing, lack of free-flowing blood return, or complete inability to infuse or flush call an RN who has been competency assessed to unblock the CVC (this may vary from site to site so check your local guideline)



CVAD = central vascular access device; CXR = chest radiography; IVAD = implanted vascular access device; TPN = total parenteral nutrition.

Figure 32 - Reprinted with permission from the Canadian Vascular Access Association. (Canadian Vascular Access Association, 2013, p. 30)

CVC Measurement and Device Malposition

The external segment of all CVCs (except IVADs and Tunneled CVCs) must be measured a minimum of daily in acute care settings and with each use in community care settings.

If the daily external CVC measurement is altered:

- i. Greater than 4 cm out from the baseline insertion length:
 - STOP infusion
 - Reconfirm placement with CXR and consult with PICC RN or Most Responsible Physician (MRP) before re-starting infusion
- ii. 2 cm in from insertion site:
 - STOP infusion
 - Consult PICC RN or MRP before re-starting infusion
 - A PICC RN or Competency Assessed RN may “withdraw” the CVC back to the original measurement.

If the CVC migrates greater than 4 cm outwards from the insertion baseline, the CVC must not be used until placement is confirmed radiographically (e.g. ultrasound, x-ray, or fluoroscopy) by a PICC nurse or a physician. (Registered Nurses Association of Ontario, 2008)

Secondary CVC malposition, also known as tip migration, may occur at any time during the CVC dwell time and is related to sporadic changes in intrathoracic pressure (e.g. coughing, vomiting), presence of CHF, neck or arm movement, positive pressure ventilation, high pressure injection (e.g. contrast media), or flushing techniques. PICC tip migration is associated with arm adduction and flexion. CVC dislodgement is caused by arm movement, body posture, lifestyle, and patient manipulation (IVADs and Twiddler’s Syndrome). (Infusion Nurses Society, 2016)

Do not advance any portion of the CVC that has been in contact with the skin into the insertion site.

Rationale: *Skin cannot be rendered sterile.* (Infusion Nurses Society, 2016)

Infusions through a malpositioned CVC should be withheld or alternate access established until proper tip position has been confirmed. (Infusion Nurses Society, 2016)

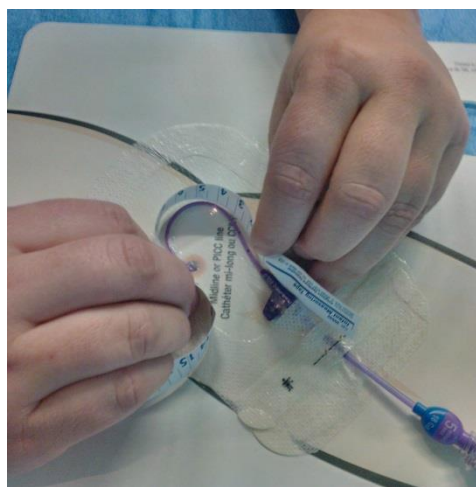
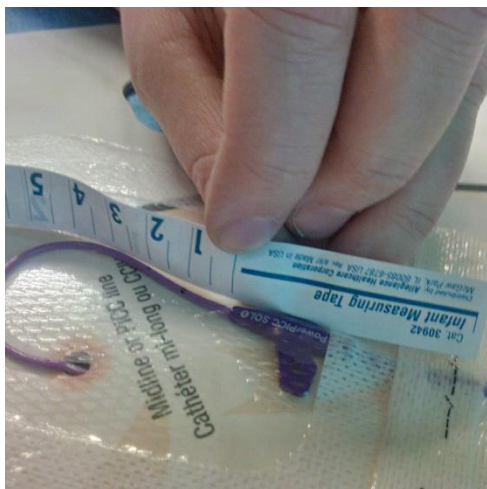


Figure 33 & 34 – CVC Measurement courtesy of P. Hignell ©

Broken/ Damaged CVCs

The use of a blood pressure cuff on the extremity with a CVC (i.e. PICC) in place is not specifically stated as a standard. However, based on anatomy and physiology, the pressure resulting from the application of a tourniquet or blood pressure cuff may result in damage to the catheter and/or vessel that is accessed. Best practice remains that the blood pressure cuff should be placed distal to the catheter's location. A tourniquet can be placed and lab work drawn below a PICC insertion site. (Infusion Nurses Society, 2013)

Immediately upon discovery of catheter damage, the CVC should be clamped or sealed (e.g. closing an existing clamp, adding a non-toothed clamp, covering the damaged area with a TSM dressing, folding the external segment, and securing) between the patient and the damaged area. *Rationale: To prevent air embolism or bleeding from the device.* (Infusion Nurses Society, 2016)

Not all CVCs can be repaired. To determine if the patient's CVC can be repaired, see [site specific algorithms](#). If the CVC cannot be repaired it should be removed and alternate vascular access established (if needed). (Gorski, 2007) (Infusion Nurses Society, 2016)

Repairs of a CVC shall only be completed by a PICC RN competency-assessed in CVC repairs. (Gorski, 2007)

CVC damage increases the risk for catheter fracture and embolization, air emboli, bleeding, CVC lumen occlusion, and CLA-BSI. If CVC repair is possible, it should be performed as soon as possible to reduce the risk of these complications. (Infusion Nurses Society, 2016)

Causes of device damage should be reported through [PSLS](#) and a [BCCSS Product Concern Form](#) (in the case of device failure). Data should be analyzed to identify the root cause(s) including, but not limited to, device failure, flushing technique, syringe size, and using scissors during a dressing change. (Infusion Nurses Society, 2016)

Test your Learning



1. What is potentially the most common complication associated with CVCs?

2. List 3 ways of minimizing the chance of air entering the system?

1) _____

2) _____

3) _____

3. List 3 of the most frequent causes for catheter embolism:

1) _____

2) _____

3) _____

4. Usual management of Catheter Related Thrombus includes _____ and

_____.

5. List 3 types of phlebitis

1) _____

2) _____

3) _____

6. Inability to flush or withdraw blood from a CVC is a sign of _____.

7. What is the best way to prevent occlusions? _____

8. CVCs occluded for >24 hours puts the patient at increased risk for_____.

9. If the CVC migrates greater than 4 cm outwards from the insertion baseline, the CVC may be used until placement is confirmed radiographically T F

10. List 3 things CVC damage increases the risk for:

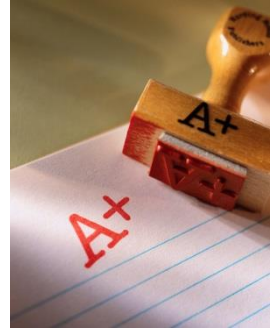
1) _____

2) _____

3) _____

Answers

1. Central Line Associated Bloodstream Infection (CLA-BSI)
2.
 - ensure the lumen is clamped prior to opening the system
 - use luer-lock connections
 - keep blue clamps/padded forceps with patient in case of catheter breakage
 - have patient perform valsalva maneuver when risk of air embolism is high
 - trendelenberg or flat positioning during insertions and removal of catheter
3. pinch-off syndrome, damage during catheter exchange, separation of the catheter from an implanted port body, and fracture of a distal portion of an IVAD
4. includes thrombolysis and systemic anti-coagulation with or without CVC removal. Consider removal of CVC with caution as this may be their only vascular access and systemic anti-coagulation increases their risk for bleeding.
5. mechanical, bacterial, and chemical
6. occlusion
7. turbulent flushing technique
8. infection
9. False, If the CVC migrates greater than 4 cm outwards from the insertion baseline, the CVC **must not be used** until placement is confirmed radiographically
10. catheter fracture and embolization, air emboli, bleeding, CVC lumen occlusion, and CLA-BSI.



Congratulations! You have just completed the fifth section.

Let's keep moving.....

You're almost there!



CARE AND MAINTENANCE OF CENTRAL VENOUS CATHETERS



Image courtesy of 3M®

Care and Maintenance of Central Venous Catheters



The two most frequent reasons for loss of central venous access are occlusion and infection.

Therefore, **pay particular attention to flushing and catheter care techniques**

Patient Positioning

When caring for **open-ended catheters** patients should be positioned:

- Flat, supine with no pillow for:
 - Changing IV tubing or extension tubing
 - Repositioning/removing catheter
 - Initial capping/flushing
 - Insertion

- Any position for:
 - Blood work using vacutainer method
 - Flushing capped lines
 - Dressing changes

Closed-ended catheters or IVADs do not require positioning to prevent air-entering catheter. The relatively long length and small diameter of an open-ended PICC significantly reduces but does not eliminate the risk of air embolus.

Management of Patients with a CVC

Pre-Insertion Assessment:

- Vital Signs including BP, HR and RR
- Respiratory assessment including: breathing patterns, depth and symmetry of breath sounds

Post-Insertion Assessment and q30 minutes x 2:

- Vital signs (as above)
- **You may apply warm compress to arm above PICC insertion site – QID x 20 minutes for 3 days.** This is to prevent mechanical phlebitis.
- **NO** blood pressures or venipunctures to be completed on arm where a PICC has been inserted
- Check for signs of and report to Physician:
 - Subcutaneous emphysema
 - Bleeding
 - Air embolus
 - Pneumothorax

- Ventilated patients:
 - Ventilator system pressures changes
- Cardiac Monitored Patients:
 - Cardiac dysrhythmias

Admission assessment, at the beginning of every shift, and q4h check:

- Dressing/site - secure, dry and intact.
- Condition of site (any inflammation/infection, drainage, edema, bruising, bleeding, subcutaneous emphysema etc.) - palpate around site.
- System check:
 - Catheter is secure.
 - Condition of the catheter (i.e. no kinks, cracks etc.)
 - All connections luer-locked and intact
 - Site condition and patency of infusion

Medications and Tubing

- ◆ Electronic infusion pumps must be used for all infusions administered through a CVC in the acute care setting
- ◆ All connections **must** be luer-locked.
- ◆ IV Tubing changes: **See Appendix F**

Neutral Displacement Caps

- ◆ Only neutral displacement injection caps are used to cap CVCs
- ◆ Caps are not needed on lumens when there is a continuous infusion or CVP monitoring, however, when the CVC is being accessed frequently or dependent on the setting (i.e. Community), neutral displacement caps may still be used.
- ◆ Neutral displacement caps – change q96h and prn in acute and residential care and q6-7days in community and outpatient clinics



Figure 35 – Image courtesy P. Hignell®

Clamps (built into the CVC)

- Clamps must be used when accessing and de-accessing an open-ended CVC to prevent air embolism or blood backflow.
- Open-ended catheters are clamped at all times when not in use
- Clamps are not used on a valved CVC
- A non-toothed or padded forceps must be available at all times in the event of a break in the catheter lumen
- Do not use a sharp edged clamp or hemostat as they can damage the catheter
- Only clamp the reinforced segment of the catheter



Figure 36 – Image courtesy P. Hignell®

Flushing

- **Always use 10 mL syringes** for flushes for CVC as excessive pressure (caused by syringes smaller than 10 mL when flushing and syringes greater than 10 mL when aspirating) can cause catheter damage
- Flushing ensures patency of the catheter
- **All unused lumens** must be flushed at specific intervals
- Turbulent flush method (stop/start) should be used. At any time if unable to flush - DO NOT FORCE. See OCCLUSIONS pg. 54.



Flush Routines - Adult

Type of Device	Short Term CVC	Long Term PICC			Long Term Tunneled		Long Term IVAD	
	Open Ended and Non-Valved	Open-Ended and Non-Valved	Open-Ended and Proximally Valved	Closed-end and Distally Valved	Open ended and non-Valved	Closed-end and Distally Valved	Open-ended and Non-Valved	Closed-ended and Distally Valved
Solution for final flush (Lock solution)	Sterile SODIUM CHLORIDE 0.9% 20 mL <i>Exception: In Outpatient and Community Settings, in patients who have non-valved CVCs, the RN may opt to lock the CVC with 3-5 mL of HEPARIN 10 units/mL.</i>						Sterile SODIUM CHLORIDE 0.9% 20 mL followed by HEPARIN 10 units/mL (3 to 5 mL)	Sterile SODIUM CHLORIDE 0.9% 20 mL
Frequency of flush for unused lumens	Q12H	Q12H	Acute Care and RCAL: min of Q12H Outpt and Community: Min of Q7days if there are no issues with occlusions. If there are issues with occlusions, considering increasing flushing frequency to Q24-72H.	Q7 Days	Acute Care and RCAL: min of Q12H Outpt and Community: Min of Q7days if there are no issues with occlusions. If there are issues with occlusions, considering increasing flushing frequency to Q24-72H.	Q7 Days	Once a month for De-accessed IVAD Q12H for accessed IVAD, (i.e. non-coring needle inserted) but not being used.	Once a month for De-accessed IVAD Q7 Days for accessed IVAD, (i.e. non-coring needle inserted) but not being used.
Flush capped CVC	Sterile SODIUM CHLORIDE 0.9% 10 mL pre-flush & between meds, followed by Sterile SODIUM CHLORIDE 0.9% 20 mL post-flush, capping, or after blood draw or injection of contrast media.							

Cleansing

Solution at the insertion site:

Use 2% chlorhexidine (CHG) with 70% alcohol cleansing solution in single-use packages. If there is a contraindication for the use of alcoholic CHG, povidone-iodine or 70% alcohol may also be used.

Rationale: Alcohol provides instant bactericidal action to the skin surface. CHG provides long-acting anti-microbial action. Single-use packages support infection control practices. (Alexander, Corrigan, Gorski, Hankins, & Perucca, 2010) (Center for Disease Control and Prevention, 2011) (Hunter & Hunter, 2012) (Infusion Nurses Society, 2016) (O'Grady, et al., 2011) (Provonost, et al., 2006) (Registered Nurses Association of Ontario, 2008) (Safer Healthcare Now, 2012)

Allow area to dry completely. **Rationale:** Solution must be dry for maximum anti-microbial effect. If not completely dry, CHG in the cleansing solution can react with the dressing adhesive, causing a chemical burn on the client's skin. CHG-based cleansing solutions and Iodine-based cleansing solution may take longer than 2 min to dry completely. (Alexander, Corrigan, Gorski, Hankins, & Perucca, 2010) (Center for Disease Control and Prevention, 2011) (Infusion Nurses Society, 2016) (O'Grady, et al., 2011) (Provonost, et al., 2006) (Safer Healthcare Now, 2012)

FAILURE TO ALLOW THE SKIN TO DRY COMPLETELY BEFORE APPLYING THE TRANSPARENT DRESSING MAY CAUSE A CHEMICAL BURN ON THE PATIENT'S SKIN DUE TO THE CHLORHEXIDINE IN THE CLEANSING SOLUTION.

Figures 37 & 38 - Images courtesy of 3M®



Solution at connections:

Use 70% alcohol cleansing solution in single-use packages at needleless connector hubs (includes IV caps, CVC catheter hubs, and Y-sites) immediately prior to each use. **Rationale:** While CHG 2% /Alcohol 70% may be used to cleanse the catheter hub, there is insufficient evidence that using CHG for anything other than skin preparation is beneficial. (Center for Disease Control and Prevention, 2011) (Safer Healthcare Now, 2012)

Scrub the needleless connector hubs for a minimum of 30 seconds and allow them to dry completely before use. **Rationale:** Vigorous cleansing of 15-30 seconds is required for maximum effect. Solution must be dry for maximum anti-microbial effect. (Center for Disease Control and Prevention, 2011) (Hadaway, Needleless Connectors: Improving Practice, Reducing Risks, 2011) (Kaler & Chinn, 2007) (Safer Healthcare Now, 2012)

When cleansing the hub with cap changes, remove old cap, then scrub the CVC hub for a minimum of 30 seconds and allow to dry completely. *Rationale: Particulate matter trapped under the old cap is not removed unless you take off the old cap to access this area, leading to an increased risk of infection.* (Alexander, Corrigan, Gorski, Hankins, & Perucca, 2010) (Center for Disease Control and Prevention, 2011) (Infusion Nurses Society, 2016) (Safer Healthcare Now, 2012)

Technique for skin preparation:

Use a friction technique in a back-and-forth pattern for at least 30 seconds. Cleanse an area larger than the intended dressing and allow solution to air-dry completely prior to applying dressing.

Rationale: Friction allows the CHG to penetrate the lower layers of the epidermis, killing a greater number of skin organisms. (Alexander, Corrigan, Gorski, Hankins, & Perucca, 2010) (Center for Disease Control and Prevention, 2011) (Infusion Nurses Society, 2016) (O'Grady, et al., 2011) (Provonost, et al., 2006) (Safer Healthcare Now, 2012)

Securement

Use a securement device on all CVCs. The device may be a stand-alone device or integrated into a dressing specified by the manufacturer to have securement properties. *Rationale: Catheter stabilization shall be used to preserve the integrity of the access device and to prevent catheter migration and loss of access.* (Infusion Nurses Society, 2016)

Sutures/staples/tape should be replaced with a manufactured stabilization dressing and/or device whenever feasible. *Rationale: The use of sutures, staples and tape have been shown to increase the risk of skin breakdown and infection at the CVC site.* (Bishop, et al., 2007) (Infusion Nurses Society, 2016)

Dressings

Types of dressings

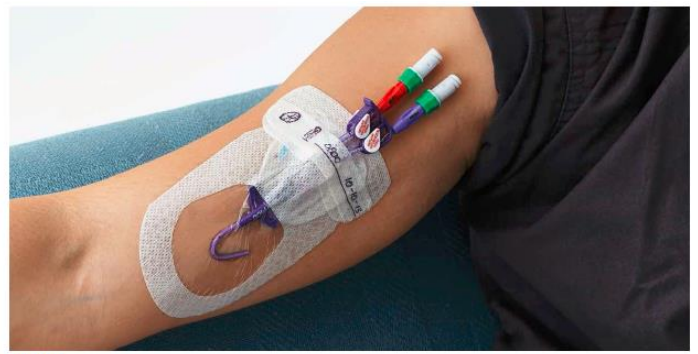
Transparent semi-permeable membrane (TSM) dressings are recommended as the first choice for CVC dressings. The dressing used in FH for CVCs already has incorporated material for sensitive skin as a standard. *Rationale: TSM dressings assist in securement and assessment by allowing for continuous visualization of the CVC site and optimal moisture vapor transfer to prevent skin breakdown from prolonged dressing use.* (Center for Disease Control and Prevention, 2011) (Infusion Nurses Society, 2016) (Safer Healthcare Now, 2012)

Gauze dressings can be used as a second choice if indicated (i.e. bleeding, drainage, diaphoresis, skin sensitivity or allergy), but are not preferred.

The use of Chlorhexidine-impregnated dressing with CVCs should be considered as an additional CLA-BSI prevention measure and for the dressing's absorptive qualities. (Infusion Nurses Society, 2016) (Mermal, et al., 2009) (Ho & Liton, 2009) (Perencevich & Pittet, 2009) (Ruschulte, et al., 2009) (Timsit, et al., 2009) CHG-impregnated dressings shall be applied on all newly inserted CVC sites.



Subclavian



PICC



Jugular



Femoral

Figure 39 - Image courtesy of 3M®

Frequency of dressing changes

When a Chlorhexidine-impregnated dressing is applied on initial insertion of the CVC, it is acceptable to do the initial dressing change in 6-7 days. A non-Chlorhexidine-impregnated dressing may be used for subsequent dressing changes. Dressings on newly inserted CVCs should be assessed 24 hrs post CVC insertion. **Rationale:** *Assess dressings in the first 24 hours for accumulation of blood, fluid or moisture beneath the dressing.* (Bishop, et al., 2007) (Safer Healthcare Now, 2012) **Rationale:** *The risk of dislodgement outweighs the risk of infection.* (Center for Disease Control and Prevention, 2011)

TSM dressings must be changed at least every 6-7 days and gauze-only and gauze+TSM dressings at least every 48 hrs. Change dressings more frequently if indicated (i.e. if the dressing becomes damp, loose, soiled, saturated, when the site needs to be assessed, or to coordinate care). **Rationale:** *Gauze dressings that prevent visualization of the insertion site should be changed routinely every 48 hours and immediately if the integrity of the dressing is compromised.* (Alexander, Corrigan, Gorski, Hankins, & Perucca, 2010) (Infusion Nurses Society, 2016)

If gauze is used to support the wings of a non-coring needle during IVAD access and it does not cover the insertion site under the TSM dressing, it can be considered part of the TSM and changed every 7 days.

Newly inserted tunneled CVCs have 2 insertion sites. The upper insertion site will have sutures and needs to have a TSM securement dressing applied until it is well-healed. Sutures are removed may be removed when the upper and lower incisions are well-healed (usually 7-10 days). The lower insertion site which the CVC comes out of needs to have a TSM securement dressing to keep the line from migrating until the insertion site is well-healed and the skin growth into the Dacron cuff holds it firmly insitu (i.e. 4 – 6 weeks). If the insertion site shows signs of infection (e.g. redness, warm to touch, purulent discharge, etc.) consult with a physician.

Newly inserted IVADs will have a dressing and sutures in the upper chest wall. Sutures are removed may be removed when the upper and lower incisions are well-healed (usually 7-10 days). Suture removal is within the RN Scope of Practice to perform without an order from a physician. (College of Registered Nurses of British Columbia, 2015) If the insertion site shows signs of infection (e.g. redness, warm to touch, purulent discharge, etc.) consult with a physician.

Topical anesthetic cream/patches may be used to decrease pain at an IVAD access site. However, topical anesthetic cream/patches should not be used on the access site of a newly inserted IVAD where incision glue has been used (instead of stitches), as there has been shown to be a reaction between topical anesthetic cream/patches and incision glue that may contribute to the development of an infection.

Dressings should be applied to tunneled CVCs in inpatient and residential settings. *Rationale: CVC sites should be covered due to the increased risk of nosocomial infections in the acute care setting.* (Center for Disease Control and Prevention, 2011)

The dressing on a Hemodialysis Catheter is cared for by the Renal Unit nurses during Hemodialysis. **Exception:** *Registered Nurses working in a non-Renal clinical area may change a dressing if it is compromised (i.e. if the dressing becomes damp, loose, or soiled) between hemodialysis treatments or after renal unit hours in order to protect the site from potential infection. The Renal Unit should be notified as soon as possible of any new complications with the hemodialysis catheter, such as profuse bleeding, dislodgement, or fever.*

Skin Care

All interventions related to IV Therapy, have the potential to affect skin integrity; from the cleansing solution, to the friction scrub, to the securement device, to the application of the dressing. Catheter insertion also creates an unavoidable full-thickness wound at the entry site. Cleansing solutions and a friction scrub disrupt the skin and create shearing forces on the skin. Antimicrobial preparation of the skin is necessary, but disrupts the natural flora of the skin by design.

Securement devices and dressings can contribute to shearing forces on the skin. Unfortunately, despite the prevalence of IV Therapy, little research has been done on the effects on the skin.

When erythema is present after application of cleansing solutions, it is generally presumed to be an allergic reaction. However, two forms of contact dermatitis have been reported in the literature. Allowing the cleansing solution to dry completely before dressing application and the use of new dressing products made for sensitive skin will help to alleviate this in a large sector of the population.

Adhesive trauma is also present, particularly skin stripping and tension blisters. Correct application and removal techniques for adhesive products are vital to avoid injury to the skin. Ensure you follow all of the manufacturer's directions for use.

To prevent damage to the skin, a sterile barrier product shall be applied to the skin after the cleansing solution has dried completely. If using a CHG-impregnated CVC dressing, do not apply the barrier film to the area where the CHG pad will contact the skin.



Figure 40
Image courtesy of 3M®

Use of a sterile clear acrylic absorbent dressing product underneath the TSM dressing has been shown to be effective in managing skin tears without compromising the efficacy of a TSM dressing with securement properties. See also [Clinical Skills by Elsevier](#) for application procedure.



Figure 41
Image courtesy of 3M®

In cases of more severe or complex skin damage, complete a Wound Assessment and consult with your Wound Care Clinician as required.

(Thayer, 2012)

Blood Sampling

- Blood sampling for laboratory testing from a CVC should be considered based on an evaluation of benefits versus risks. (Infusion Nurses Society, 2016)
- Blood must be drawn in a certain order. Refer to the [Fraser Health Lab Accessioning Manual](#) for further information.
- The discard method of drawing blood will be used [Exception: Venous Arterial blood Management Protection (VAMP) system in Critical Care areas]. *Rationale: Other methods have the potential to cause hemolysis and/or re-infuse clots.* (Registered Nurses Association of Ontario, 2008)
- Use the largest lumen (usually distal) of multi-lumen CVCs whenever possible. *Rationale: Decreases the risk of a thrombus occluding the lumen.* (Registered Nurses Association of Ontario, 2008)
- Have a dedicated lumen for blood draws if able. *Rationale: Reduces risk of contaminated sample due to catheter biofilm, including Parenteral Nutrition.* (Alexander, Corrigan, Gorski, Hankins, & Perucca, 2010) (Edwards Lifesciences, 2002) (Infusion Nurses Society, 2016) (Infusion Nurses Society, 2011) (Registered Nurses Association of Ontario, 2008)
- Stop all infusions prior to blood sampling. For drug levels, it is not recommended to draw the level from the same lumen being used for the drug infusion, but caution should still be taken when interpreting results of therapeutic drug levels draw through a CVC. *Rationale: Drug levels may be inaccurate when obtained through the same catheter lumen used for drug infusion.* (Infusion Nurses Society, 2016)
- When drawing blood from a CVC with a continuous infusion running without the use of a connector/ neutral displacement cap, stop the infusion(s), remove the administration set, and attach the luer lock Vacutainer® (see Figure 29) directly to the catheter lumen.

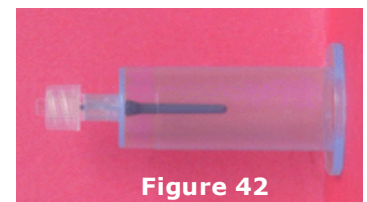


Figure 42
Image courtesy of BCCSS®

Exception: Blood Cultures must be done using syringe method ONLY. See Blood Cultures.

For a capped CVC, luer lock the Vacutainer® directly to the connector/ neutral displacement cap and then change connector/ neutral displacement cap following the blood draw. However, it is not recommended to do blood draws through a cap. (Hadaway, Technology of flushing vascular access devices, 2006) (Infusion Nurses Society, 2016) (Knue, Doellman, Rabin, & Jacobs, 2005) (Registered Nurses Association of Ontario, 2008)

- If the results of coagulation tests are used to monitor anticoagulation treatment or evaluate coagulopathy, heparinized CVCs should not be used for the blood draw (Frey, 2003). If there is any doubt as to the accuracy of coagulation studies the sample should be obtained from a peripheral vein (Bishop, et al., 2007).

Blood Draw discard amount: In all cases, non-additive tubes should be used to collect the discard. The discard amount when drawing blood is 5 mL. The only exceptions are:

- When drawing coagulation studies in adults, the discard amount should be 10 mL. *Rationale: Amount needs to be appropriate to ensure accuracy of lab results, while limited to the minimum needed to avoid significant blood loss due to frequent sampling Prevents contamination of samples from tube additive.* (Bard Access Systems Inc., 2007) (Edwards Lifesciences, 2002) (Fraser Health Authority, 2008) (Registered Nurses Association of Ontario, 2008)
- No discard is done when drawing blood cultures. (Infusion Nurses Society, 2016)

Blood Draw post-flushing: Draw the blood, change the neutral displacement cap (when one was present for the blood draw), and flush the CVC with:

- Adult - 20 mL NS
Rationale: It is impossible to get all the residual blood out of the connector/ neutral displacement cap. Residual blood may leads to an increased risk of infection.

Blood Cultures: Peripheral sampling should be done whenever possible and/or when the clinical situation does not preclude the use of peripheral sampling. *Rationale: Reduces total amount of blood loss from discards. Reduces risk of contaminated sample due to catheter biofilm. Blood samples obtained through catheters that are in use are associated with a higher rate of false-positive results, compared with cultures of percutaneous blood samples* (Martinez, et al., 2002) (Mermal, et al., 2009)

- Blood cultures must be drawn using a syringe and a needless transfer device (see Figure 30). *Rationale: The broth from a blood culture bottle directly attached to a CVC lumen may contaminate the CVC with culture broth.*



Figure 43

Image courtesy of BCCSS®

To Diagnose a suspected CLA-BSI:

Adults and children 12 years of age or older:

- One aerobic Blood Culture set (two green aerobic bottles) be drawn from each lumen of a suspect CVC)
- One Blood Culture set (two green aerobic bottles) be drawn from a peripheral site.

Note: *In some cases, it may not be possible to draw 10 mL of blood. If 5 mL or less is obtained, place all of the blood into the aerobic (green top) bottle.*

(Fraser Health Authority, Test: Blood Culture. MIC 02160, Microbiology, 2009) (Mermal, et al., 2009)

- In addition, if the CVC is removed for a suspected CLA-BSI, send the suspect catheter tip (distal 4-5 cm) to the lab in a sterile C&S container for semi-quantitative culture.

Rationale: Peripheral blood draw – High number of false positives if samples only collected through the CVC as false positive culture can be result of contaminants. Tip culture – Catheter tip is the final common pathway for colonization of the catheter, leading to catheter-related bacteremia. (Infusion Nurses Society, 2016) (Mermal, et al., 2009)

Removal of Short-Term CVCs and PICCs

Central venous catheters (CVCs) including peripherally inserted central catheters (PICCs) are removed when therapy is completed, when the catheter's presence could cause complications (e.g. the catheter is malpositioned), or when the patient has developed a catheter-related infection. Central venous catheters should be removed when no longer necessary to decrease the risk of infection. If a line was placed under non-sterile technique, such as during an emergency, the line should be removed within 48 hours.

POINTS TO REMEMBER BEFORE REMOVAL:

- Ensure presence of a physician's order for removal.
- Assess vital signs and neurovascular status of the extremity distal to the catheter insertion site.
- Assess the current coagulation values. **(consult physician before removing if patient has elevated coagulation values, is on anti-coagulants, or has a pacemaker).**
- Assess the catheter site for signs of infection (i.e., redness, warmth, tenderness, swelling, and presence of drainage.)

POINTS TO REMEMBER FOR THE REMOVAL PROCEDURE:

- Place the patient supine in a slight Trendelenburg position. The level of the catheter site should be below the heart to prevent air embolus during removal. **Place the patient flat if Trendelenburg is contraindicated or not tolerated by the patient, or if a femoral CVC will be removed. If the CVC is in the femoral vein, extend the patient's leg and ensure that the groin area is adequately exposed.**
- If removing an internal jugular or subclavian catheter, ask the patient to take a deep breath in and hold it. This causes a valsalva response. If a valsalva response is contraindicated, such as with glaucoma or retinopathy, the patient should be asked to exhale during the removal. **If the patient is receiving positive-pressure ventilation, withdraw the catheter during the inspiratory phase of the respiratory cycle or while delivering a breath via a bag valve mask device.**
- Gently withdraw the catheter, pulling parallel to the skin and using a constant, steady motion. **If resistance is met, do not continue to remove the catheter. Notify practitioner immediately.**
- As the introducer exits the site, apply pressure with petroleum-based ointment and sterile gauze (or a petroleum impregnated sterile gauze dressing). **The distal end of a multi-lumen catheter should be removed quickly because the exposed proximal and medial openings could permit the entry of air.**
- Upon removal of the catheter, inspect the tip for integrity & length. Place the catheter on a moisture-proof pad and dispose of properly. **If an infusion-related infection is suspected, a segment of the catheter may be sent for culture. If damage to or fragmentation of the catheter is observed, additional assessment, such as a chest radiograph, is warranted.**

- Continue applying firm, direct pressure over the insertion site with petroleum-based ointment and sterile gauze (or a petroleum impregnated sterile gauze dressing), sealing the site until bleeding has stopped. **Because CVCs are placed in large veins, it may take up to 10 minutes for hemostasis to occur. Pressure may be needed for a longer period of time if the patient has been receiving anticoagulant therapy or if coagulation studies are abnormal.**
- Apply a sterile dressing to the site. Use either a transparent, semi-permeable dressing or gauze dressing overtop of the petroleum impregnated sterile gauze dressing. If the patient is diaphoretic or if the site is bleeding or oozing, a gauze dressing is preferred.
- Maintain bed rest for at least 30 minutes after catheter removal. Assess the site for signs of bleeding every 15 minutes times 2, and prn (i.e. every 30 minutes times 2, then 1 hour later as needed).
- Change dressing and assess site every 24 hours after catheter removal until site is epithelialized.

Infection Control

- All staff will follow the latest Infection Control Guidelines for Principles of Infection Prevention and control, Routine Practices (including hand hygiene, application of personal protective equipment, and sharps handling and disposal) and Additional Precautions, and blood and body fluid spills clean-up.
- Prior to all procedures, clean dressing cart or bedside table using bactericidal wipes.
- Hand hygiene - cleanse hands using hospital approved alcohol hand gel as per Infection Control protocol.
- Mask and wear sterile gloves for all times that the line is opened (e.g. cap change), the site is uncovered, and with all immunocompromised patients.
- All neutral displacement IV caps and injection ports must be cleansed with a 70% Alcohol swab for 30 seconds and let dry completely prior to accessing.
- Positive displacement IV caps are changed q96 hours, after blood draws, or when contamination is suspected.
- CVC dressings are changed q7days and prn.
- Routine culture of CVC catheter tips is not recommended.

Blood Cultures:

- For the diagnosis of a Central Line Associated Bloodstream Infection (CLA-BSI), it is recommended that one aerobic Blood Culture set (two green aerobic bottles) be drawn from each lumen of the suspect CVC AND one Blood Culture set (two green aerobic bottles) be drawn from a peripheral site
- HOWEVER, if the source of sepsis is unknown, samples need to be collected from at least 2 sites; one set drawn percutaneously from a peripheral vein and one set drawn through the CVC. One set is drawn with two aerobic bottles, the other set with one aerobic and one anaerobic bottle.
- Additionally, with a suspect CLA-BSI, once the CVC is removed send the suspect catheter tip (distal 4-5 cm) to the lab in a sterile C&S container for semi-quantitative culture (see FH Laboratories Microbiology Manual).



WHICH HUB DO YOU SCRUB?

- Friction scrub the Neutral Displacement IV Cap when accessing through the cap
- Friction scrub the CVC hub when removing/changing cap
- Always scrub using an alcohol swab for 30 seconds allow to dry completely

Troubleshooting a Blocked CVC

If no blood returns:

- Reposition patient
- Ask patient to lift arms, cough and perform Valsalva manoeuvre
- Ask patient if usually able to aspirate blood from the line
- Re-aspirate for blood. If you have free-flowing blood return, proceed with flush
- If a cap is present, remove the cap and try to aspirate from a syringe connection directly with the catheter hub
- If line flushes easily, continue with the procedure

If you still have no blood return or difficulty/inability to flush:

- Gently attempt to flush with NS
- **Do not force** - if unable to flush – **Stop, label line as “BLOCKED/ DO NOT USE” and notify Physician requesting orders for fibrinolytic.**
- Competency Assessed RNs on specified care units may administer two doses of fibrinolytic with a Physician’s Order

If still no blood return or inability to flush ~ **label line as “BLOCKED/ DO NOT USE” and notify Physician immediately.**

If air is present (remember to scrub the cap/CVC hub with an alcohol swab for 30 seconds and allowing to dry before accessing):

- Withdraw air from catheter using a syringe
- Remove the syringe from the positive displacement IV cap
- Expel the air from the syringe.
- Insert new syringe with NS and flush.
- Remove syringe
- Clamp line

Monitoring Central Venous Pressure (CVP)

When clinically indicated in a Critical Care area, CVP should be continuously monitored and documented routinely; on admission, the beginning of every shift and a minimum of q4h and:

- Following a bolus IV fluid or a blood product transfusion
- Following the initiation of vasopressor or vasodilator therapy
- After significant vital sign change
- As per Physician’s Order

Test your Learning



True or False (If False, please write correct answer):

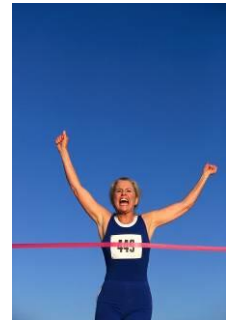
1. Patient must be in Trendelenberg for routine dressing changes. T F _____
2. Primary IV tubing is changed q96hours (except blood, TPN). T F _____
3. Two small smooth-edged clamps are to be at the bedside. T F _____
4. Positive displacement caps are changed q72hours. T F _____
- 5 CVC site dressings are changed q10days and prn. T F _____
6. Capped short-term CVCs should be flushed immediately after capping, blood work, IV medications, and q12hours in acute care. T F _____
7. Blue dead-ended caps are acceptable to cap a CVC in the FHA. T F _____
8. A clampable portion of tubing is not necessary for open-ended catheters. T F _____
9. When should an electronic infusion device be used? _____
10. State 4 situations when a capped CVC should be flushed.
 - a) _____
 - b) _____
 - c) _____
 - d) _____
11. How often should an un-accessed IVAD be flushed? Q_____
12. When performing a blood draw from a CVC, ___ tubes(s) of blood must be discarded.

Answers:

1. False - patient may be in any position for a dressing change
2. True
3. False - one smooth edge clamp is required at bedside
4. False - caps are changed q96h
5. False
6. True
7. False - only neutral displacement caps are used to cap CVCs in FHA - patients transferred from other facilities may not have them
8. False - all open-ended CVCs must have a clampable portion
9. An electronic infusion device must be used for all IV infusions administered through a CVC
10.
 - a) q12h (Acute and Residential)
 - b) following CVC capping
 - c) following IV medications
 - d) following blood work
11. monthly or q28days
12.
 - 0 - when drawing blood cultures
 - 1 - when patient has bloodwork with NO coagulation studies
 - 2 - when the patient has bloodwork with coagulation studies ordered



YEAHOO!



You have just completed a self-learning module that has outlined the basic principles of central venous catheters!

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APPENDICES

APPENDIX A: CVC Skills Scope of Practice

APPENDIX B: Vascular Access Device Selection Algorithm

APPENDIX C: Central Venous Catheter Insertion and Removal Form

APPENDIX D: Regional CVC Maintenance Worksheet

APPENDIX E: IV Tubing Line Setup, Configurations, and Change Frequency

APPENDIX F: CVC Skills Inventory

APPENDIX A: CVC SKILLS SCOPE OF PRACTICE

PROCEDURE	CARE PROVIDER
Access & De-Access CVCs	Competency Assessed RN/RPN
Dressing Change all CVCs	Competency Assessed RN/RPN
IV Tubing Change: all CVCs	Competency Assessed RN/RPN
Cap/Uncapped/Flush: all CVCs	Competency Assessed RN/RPN
Removal of CVC <ul style="list-style-type: none"> - Percutaneous (short term) - Tunneled CVC and IVAD - PICC 	Competency Assessed RN/RPN Physician Competency Assessed RN/RPN
Blood Sampling and Withdrawing of migrated CVC	Competency Assessed RN/RPN
Insertion of PICC	Advanced Competency Assessed PICC RN or Physician
Repair of Tunneled Catheter Repair of PICC Catheter	Advanced Competency Assessed PICC RN Advanced Competency Assessed PICC RN
Instillation of fibrinolytic Instillation of agents for chemical occlusions	Competency Assessed RN/RPN Advanced Competency Assessed PICC RN

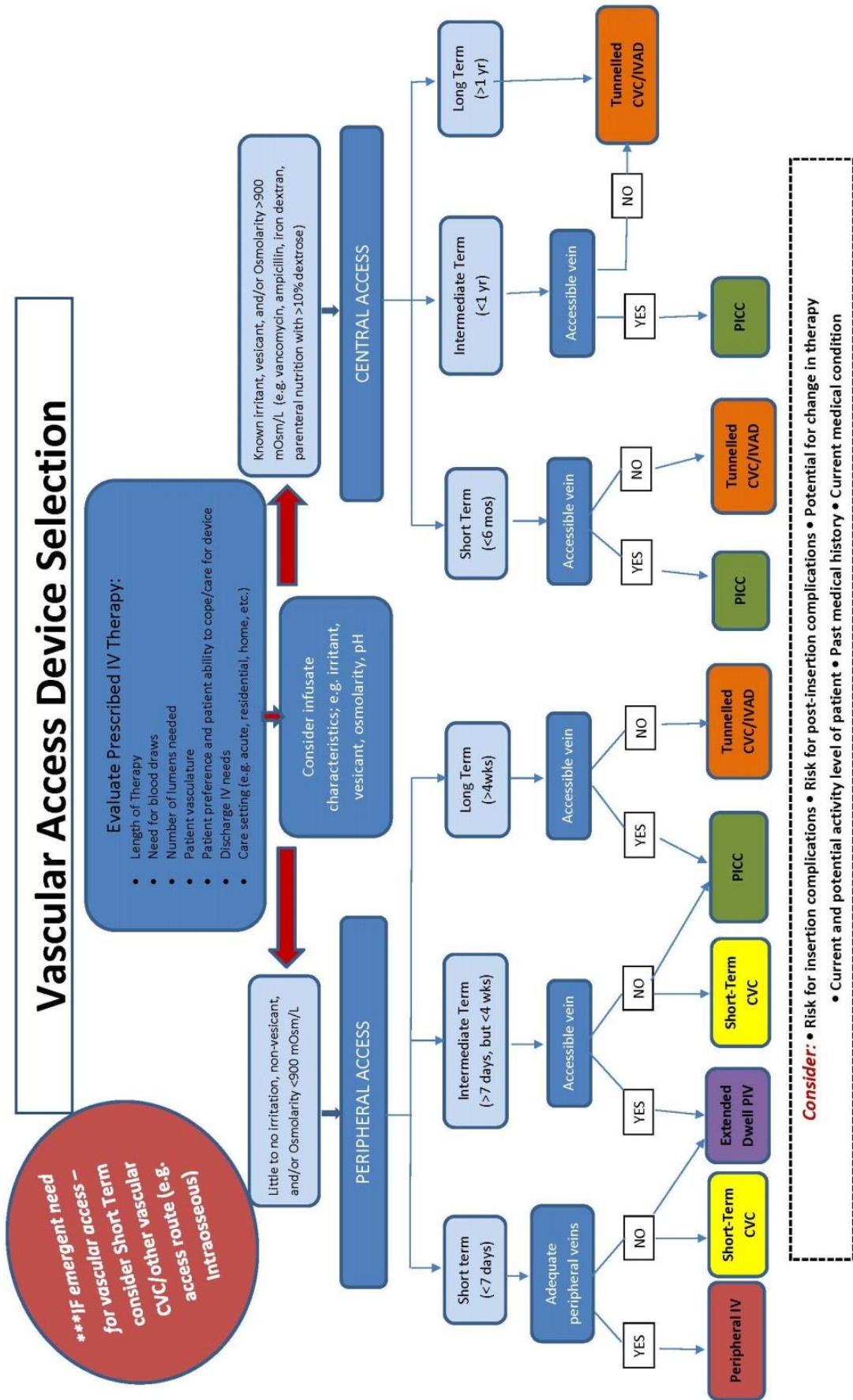
Competency Assessed RNs shall perform the following CVC Competencies:

- Assist Physician during insertion and manipulation of CVC
- Obtain blood specimens from a CVC
- Access a CVC
- Dress a cvc site
- Change IV tubing
- Convert a continuous CVC infusion to a capped system
- Convert a capped CVC to a continuous infusion system
- Change a neutral displacement cap on a CVC
- Flush a capped CVC
- Check patency and remove air from a CVC
- Manage partial and complete CVC occlusion by administering a fibrinolytic
- Withdrawing of a migrated CVC
- Removal of a non-tunnelled, non-implanted percutaneous central venous catheter (Short-term & PICCs)
- Obtain central venous pressure (CVP) measurements (Critical Care Areas only)
- Insert **short** obturator cap into Percutaneous Introducer Sheath with sideport to ensure closure of hemostasis valve (in Critical Care Areas only)

Advanced Competency Assessment is required for the following CVC skills:

- Insertion and repair of PICC lines
- Advanced Competency Assessed Renal RN may cap and flush hemodialysis catheters

APPENDIX B: Vascular Access Device Selection Algorithm



APPENDIX C: Central Venous Catheter Insertion and Removal Form



CENTRAL VENOUS CATHETER INSERTION AND REMOVAL Regional Critical Care Program



OROR103094A

Rev: Oct 06/09

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Insertion:	Date:	Time:	hrs	RN:
Inserted by:	Insertor Initials:			
Reason for Insertion:	<input type="checkbox"/> Volume Resuscitation <input type="checkbox"/> Vasopressor Therapy <input type="checkbox"/> CVP Monitoring <input type="checkbox"/> TPN <input type="checkbox"/> Temporary Pacemaker <input type="checkbox"/> No other access <input type="checkbox"/> Other(state):			
Nature of Insertion:	<input type="checkbox"/> Elective <input type="checkbox"/> Urgent			
Type of Catheter:	<input type="checkbox"/> Standard <input type="checkbox"/> PICC <input type="checkbox"/> Hemodialysis <input type="checkbox"/> Large-Lumen Introducer Catheter Number of Lumens: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 or <input type="checkbox"/> 5 Catheter coated/impregnated with the following: <input type="checkbox"/> N/A <input type="checkbox"/> Antibiotic <input type="checkbox"/> Heparin <input type="checkbox"/> Other(state):			
Preparation: (see insertion bundle on back page)	Insertion site cleansed with: <input type="checkbox"/> Chlorhexidine 2% in 70% isopropyl alcohol <input type="checkbox"/> Other (state): _____ Head to toe sterile drape applied to patient: <input type="checkbox"/> Yes <input type="checkbox"/> No Hand washing by: <input type="checkbox"/> Insertor <input type="checkbox"/> Assistant Maximum barrier precautions used by: <input type="checkbox"/> Insertor <input type="checkbox"/> Assistant Other personnel in room are masked: <input type="checkbox"/> Yes <input type="checkbox"/> No			
Insertion Procedure:	Number of Attempts (state): _____ Ultrasound guided insertion with all attempts: <input type="checkbox"/> Yes <input type="checkbox"/> No			
Vein Used:	<input type="checkbox"/> Internal Jugular (R or L) <input type="checkbox"/> External Jugular (R or L) <input type="checkbox"/> Subclavian (R or L) <input type="checkbox"/> Femoral (R or L) <input type="checkbox"/> Other(state): _____ (R or L)			
Catheter Secured by:				
Transparent Dressing Applied:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Other (state): _____			
Initial Complications:	<input type="checkbox"/> None <input type="checkbox"/> Hematoma at site <input type="checkbox"/> Arterial Puncture <input type="checkbox"/> Pneumothorax <input type="checkbox"/> Other (state): _____			
Placement Confirmation:	X-ray ordered: <input type="checkbox"/> Yes <input type="checkbox"/> No Confirmed by: _____ Date/time: _____			

Additional Comments:

Removal:	Date:	Time:	hrs	RN
Removed by:				
Reason for Removal:	<input type="checkbox"/> No longer required <input type="checkbox"/> Not Patent <input type="checkbox"/> Site reddened <input type="checkbox"/> Potential Central Line associated bloodstream infection <input type="checkbox"/> Other (state): _____			
Dry Dressing Applied to site:	<input type="checkbox"/> Yes <input type="checkbox"/> No			

Additional Comments:

APPENDIX D: Regional CVC Maintenance Record – Adult, Acute Care and Residential

Outpatient and Pediatric versions also available.



CVC Maintenance Record - Adult
Acute Care and Residential Care



Form ID: NUAS104417F

Rev: April 2018

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<input type="checkbox"/> Short Term CVC <input type="checkbox"/> Long Term CVC <input type="checkbox"/> PICC <input type="checkbox"/> Tunneled CVC <input type="checkbox"/> IVAD: Access needle size ____ Gauge ____ Inches	Site: _____ Date Inserted: _____ Tip Placement Confirmation Date: _____ External Length on insertion: _____ cm Trimmed/Cut Length: _____ cm (for proximally valved PICCs)
<input type="checkbox"/> Open Ended <input type="checkbox"/> Closed Ended <input type="checkbox"/> Proximal Valve <input type="checkbox"/> Distal Valve <input type="checkbox"/> Power capable Number of lumens: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	

✓ Check to indicate task completed or N/A if Not Applicable PN - If further documentation in Progress Notes

	Date																	
	D	E	N	D	E	N	D	E	N	D	E	N	D	E	N	D	E	N
Shift																		
Time																		
Daily review of need for CVC																		
Site Assessment Line Measurement (cm)																		
Dressing Change (Q7 Days & PRN) Dressing Last Changed: _____ IVAD non-coring needle Last Changed: _____																		
Neutral Displacement Cap Change (Q96 Hours & PRN) Last Changed: _____																		
Tubing Change (see reverse) Last Changed: _____																		
Patency Assessment (and correct line placement confirmed)																		
FLUSH Sterile SODIUM CHLORIDE 0.9% Flush Amount (mL) **chart additional flushes on Fluid Balance Sheet																		
FLUSH HEPARIN 10 units/mL Amount (mL)																		
Initial																		

Print Shop #256764

APPENDIX E : IV Tubing Line Setup, Configurations, and Change Frequency

PRIMARY IV ADMINISTRATION SETUP ONLY (e.g. 2/3 1/3 @ 125 mL/hr):

Acute Care & Residential: Date and change primary administration tubing every 96 hours, when contaminated, or whenever indicated by the solution/medication that is being administered (e.g. proPOFol, lipids), and/or after each use.

Community Care: Change tubing every 24 hours in clinic setting, Change tubing every 72 hours and prn in home setting

PRIMARY ADMINISTRATION SETUP WITH SECONDARY ADMINISTRATION SET

("piggyback") (e.g. QID antibiotic, etc.)

Acute Care & Residential: Date and change primary administration tubing every 96 hours, when contaminated, or whenever indicated by the solution/medication that is being administered (e.g. proPOFol, lipids), and/or after each use.

Community Care: Change tubing every 24 hours in clinic setting, Change tubing every 72 hours and prn in home setting

Secondary: change Q24H

PRIMARY ADMINISTRATION SETUP WITH CONTINUOUS INFUSION SET (e.g.

continuous infusion of heparin, nitroglycerin, etc.)

Acute Care & Residential: Date and change primary administration tubing every 96 hours, when contaminated, or whenever indicated by the solution/medication that is being administered (e.g. proPOFol, lipids), and/or after each use.

Community Care: Change tubing every 24 hours in clinic setting, Change tubing every 72 hours and prn in home setting

INTERMITTENT INFUSION (with no Primary Administration Setup) (e.g. BID antibiotic, etc.)

Intermittent infusion: change tubing after each dose

ADD-ON DEVICES (Needleless Connectors, Extension tubing, dead end caps)

PIVs

Acute Care & Residential: Change needleless connectors and/or extension tubing every 7 days

Community Care: Change needleless connectors and/or extension tubing every 6-7 days

CVCs

Acute Care: Change needleless connectors and/or extension tubing every 96 hours

Residential & Community Care: Change needleless connectors and/or extension tubing every 6-7 days

SPECIALTY PRODUCTS

Blood Products: Change blood tubing after 4 hours or after 4 units of blood, whichever comes first.

(Refer to Blood Administration Clinical Practice Guidelines for further details)

Parenteral Nutrition: For infusions containing amino acids/dextrose, change the tubing every 96 hours.

Infusions containing lipid emulsion (proPOFol): change the tubing with each dose or a minimum of every 6 to 12 hours.

APPENDIX F: Central Venous Catheter (CVC) Skills Inventory

NAME: _____ UNIT: _____

CNE/MENTOR: _____

1) Specialized Skill: Capping a CVC/ Changing a neutral displacement IV cap

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

2) Specialized Skill: Flushing a capped CVC

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

3) Specialized Skill: CVC Dressing Change

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

4) Specialized Skill: Changing CVC solution tubing

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

5) Specialized Skill: Blood sampling from a CVC (vacutainer and/or syringe method)

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

6) Specialized Skill: Accessing an IVAD

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

7) Specialized Skill: De-accessing an IVAD

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

8) Specialized Skill: Removing a Short-term CVC or PICC

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

9) Specialized Skill: De-clotting with Alteplase®

Date of Theory & Lab	CNE Signature	Clinical Evaluation date	CNE/Mentor Signature

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