



Central Venous Access Device (CVAD) Learning Package

Developed for Markham Stouffville Hospital use by:

Professional Practice
Revised June 2021

Table of Contents

| Content | Page |
|---|-------|
| Introduction | 3 |
| Learning Objectives | 3 |
| Types of Central Venous Access Devices (CVADs) | 4-9 |
| • Power Technology | 6 |
| • Indications/Contraindications | 6 |
| Self Assessment One | 10 |
| Care and Maintenance of CVADs | |
| • Short Term Percutaneous Central Catheters | 11-13 |
| • Peripherally Inserted Central Catheter (PICC) | 14-17 |
| • Tunneled Catheters (Hickman®) | 18-19 |
| • Implanted Vascular Device (PORT-A-CATH®) | 20-22 |
| IV Tubing and Cap Changes | 23 |
| Blood Withdrawal | 23-24 |
| Complications | 25-26 |
| Troubleshooting Guide | 27 |
| Patient and Family Education | 28 |
| References | 29 |
| Self Assessment Two | 30-31 |
| Answer Key | 32 |

Introduction

This learning package provides information on caring for a patient with a Central Venous Access Device (CVAD), and includes modules on types, care and maintenance of various devices.

Learning Objectives

After reading and studying this learning package, the nurse will be able to:

1. Define Central Venous Access Device
2. Describe the indications for CVAD use.
3. Distinguish between the various types of CVAD's
4. List the advantages and disadvantages of different types of CVAD's.
5. Identify 3 types of potential complications use of a CVAD.
6. Identify signs and symptoms of pulmonary embolus.
7. Define turbulent flushing and positive pressure.
8. Identify when lines and caps are due to be changed.

Learning Activities

In order to meet your learning objectives, you should engage in the following activities:

- Read the learning materials provided.
- Complete Self-Assessment Tests 1 and 2 included in the Learning Package.
- Attend in-services or 1:1 learning with Practice Leader or an RN with the knowledge, skill, and judgment in CVAD care.
- Develop skills for CVAD care and maintenance, with coaching from your Professional Practice Leader or a competent RN.
- Refer to CVAD Competency Checklists
- Access CVAD policies and procedures via ACORN.

Evaluation

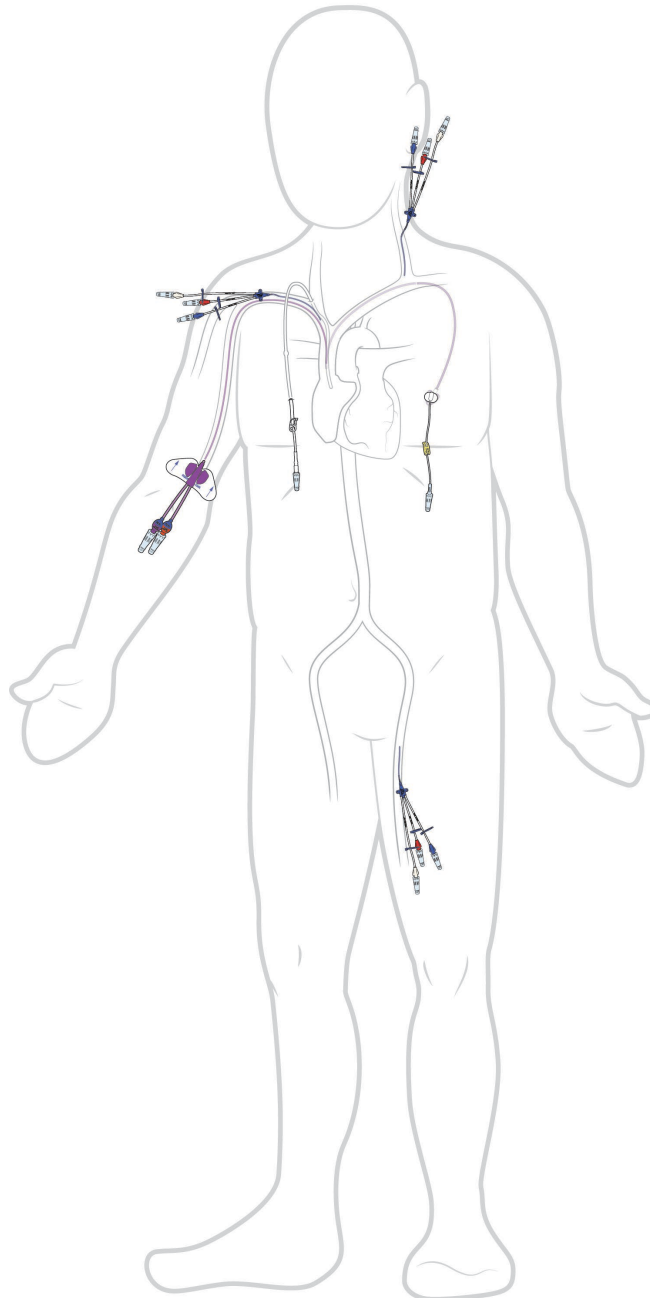
- Demonstration of appropriate assessment and documentation protocols for patients with CVADs

In order to engage in any nursing task, the nurse is required to determine whether or not they have the appropriate knowledge, skill and judgment. The nurse is to seek out appropriate resources as necessary prior to performing the skill.

Central Venous Access Devices (CVADs)

CVAD refers to intravenous therapy involving the placement of a flexible catheter into one of the patient's large veins. The tip of the catheter is situated in the lower third of the superior vena cava or in the inferior vena cava at the level of the diaphragm if placed femorally.

There are various types of CVADs. It is very important to correctly identify the device that your patient has. For each patient that has a CVAD, there should be a pre-printed order set (Central Venous Access Device (CVAD) Flushing and Locking Order Set *pictured below*) completed by the most responsible physician (MRP). If there is no pre-printed order set in the patient's chart, please ensure one is filled out completely so CVAD flushing orders are present and will be transcribed to eMar. It can be found on ACORN.



Central Venous Access Device (CVAD) Flushing and Locking Order Set

Allergies

NKA Allergies confirmed within Meditech
 New Allergies to be entered into Meditech: _____

Type of Vascular Access Device

Percutaneous Line (jugular, subclavian, femoral)
 PICC Line (peripherally inserted central catheter) (CVAD valved or non-valved. Choose appropriate option below)
 Tunneled Line (e.g. Hickman) (CVAD valved or non-valved. Choose appropriate option below)
 Implanted Port (e.g. Port-a-cath)

Number of Lumens

Single Double Triple Quadruple

Submitter Name: _____ Date & Time: _____ Order Verified by Signature: _____ Date & Time: _____
 Co-Signer Signature: _____ Date & Time: _____ Scanner Signature: _____ Date & Time: _____
 _____ Date & Time: _____ Transcriber Signature: _____ Date & Time: _____

 PatientOrderSets (9/18) (12/17) (DTC 10/15) / M-CENVADFLO Page 1 of 2

Central Venous Access Device (CVAD) Flushing and Locking Order Set

CVAD Flushing and Locking Volumes

| Type of Device | Flushing Solution | Locking Solution | Frequency of Flushing/Locking when Dormant |
|---|----------------------------|--|--|
| <input type="checkbox"/> Percutaneous Line | 10 mL 0.9% Sodium Chloride | 10 mL 0.9% Sodium Chloride | Every 12 hours |
| <input type="checkbox"/> CVAD-valved/ closed-ended/no clamp | 10 mL 0.9% Sodium Chloride | 10 mL 0.9% Sodium Chloride | Every 24 hours |
| <input type="checkbox"/> CVAD-non-valved/ open-ended/clamp | 20 mL 0.9% Sodium Chloride | 300 units (3 mL) Heparin Lock (100 units/mL) | Every 6 days |
| <input type="checkbox"/> Implanted Port | 20 mL 0.9% Sodium Chloride | 500 units (5 mL) Heparin Lock (100 units/mL) | Every 4 weeks |

Frequency of FLUSHING

0.9% Sodium Chloride FLUSH: Use turbulent flush technique
 Before and after medication administration (for both intermittent and continuous infusion)
 When converting continuous to intermittent therapy
 Before and after blood sampling. DO NOT FLUSH BEFORE taking a blood culture
 Before and after the administration of blood products
 Any lumen not in use

Frequency of FLUSHING and LOCKING when lumen is in use

When converting continuous to intermittent therapy
 If intermittent therapy would be more frequent than twice per day, and locking solution is Heparin, continue maintenance IV solution. Notify MRP.
 When capping off or leaving dormant


Post Blood Sampling or Transfusion

Immediately flush CVAD lumen twice with 10 mL 0.9% Sodium Chloride to thoroughly flush blood from lumen

Patients with Heparin Induced Thrombocytopenia (HIT) or suspected HIT

Flush and lock CVAD lumen(s) with 0.9% Sodium Chloride ONLY. Do NOT use Heparin
 10 mL 0.9% Sodium Chloride q8h if dormant. Follow Frequency of Flushing if accessing line more frequently than every 8 hours

Submitter Name: _____ Date & Time: _____ Order Verified by Signature: _____ Date & Time: _____
 Co-Signer Signature: _____ Date & Time: _____ Scanner Signature: _____ Date & Time: _____
 _____ Date & Time: _____ Transcriber Signature: _____ Date & Time: _____

 PatientOrderSets (9/18) (12/17) (DTC 10/15) / M-CENVADFLO Page 2 of 2

If the type of CVAD is unknown, the MRP may order an x-ray to verify type of device in situ and confirm placement of catheter tip. Other resources include the Oncology Clinic, Medical Day Unit (MDU) or Professional Practice Leaders (PPLs).

There are 4 types of CVADs, designed to provide short-term (weeks) or long-term (months to years) of venous access.

| TYPE OF CVAD | DURATION |
|---|------------------------------------|
| Short-Term Percutaneous Central Venous Catheter | Short-term device Up to 1 month |
| Peripherally Inserted Central Catheter (PICC) | Long-term device Up to 1 year |
| Implanted Vascular Device (Port-A-Cath®) | Long-term device Several years |
| Tunneled Catheter (Hickman®) | Long-term device Over 1 year |

Power Technology

“Power” technology refers to the ability of a CVAD to withstand increased pressures required for injection for some diagnostic tests such as Computed Tomography (CT) scans. Not all CVADs are made to withstand these increases in pressure. A CVAD that has ‘Power’ technology will withstand injection pressures up to 300psi at 5ml/second for diagnostic procedures requiring contrast dye. All CVADs inserted at MSH use Power technology.

If used for CT, the Power Port must be accessed with a special, non-coring, Power rated needle that can withstand the high pressure injection of contrast dye.

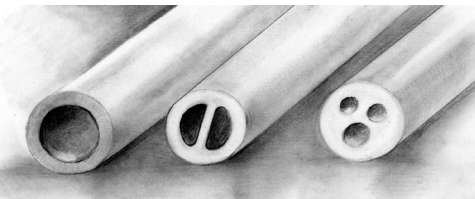
Indications for CVAD use

- Limited or poor peripheral venous access
- Infusion of hyperosmolar solutions (e.g. total parenteral nutrition (TPN))
- Infusion of chemotherapy drugs that may be vesicants/irritants
- Intermediate to long-term IV therapy
- Administration of multiple therapies or incompatible medications (for use with multi-lumen CVAD)
- Therapy involving frequent blood sampling
- Central venous pressure (CVP) monitoring

Contraindications for CVAD insertion

- Dermatitis or cellulitis at or around insertion site
- Burns around insertion site
- Previous radiation treatment to upper torso
- Hemodialysis
- Lymphedema
- Compromised anatomy
- Abnormal coagulopathy

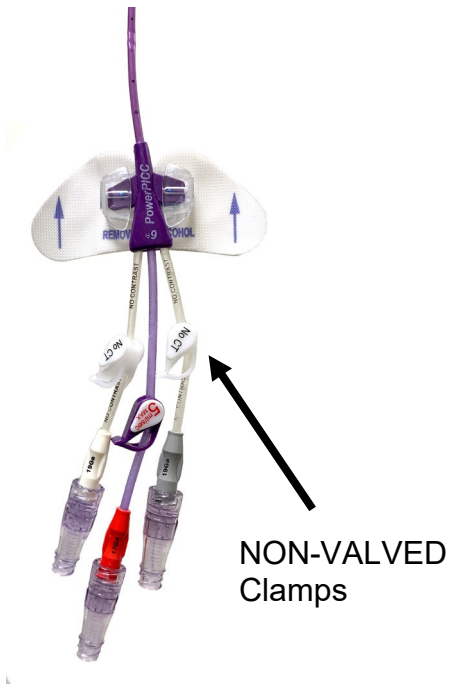
Catheter Designs



(Drawings by N. Bauer, Published with permission)

CVADs are available with single, double or triple lumens/septums and vary in sizes. With multi-lumen catheters, each separate lumen is enclosed within a single sheath making the catheter appear to have only one line. Each lumen will allow for separate infusions through an individual line, therefore allowing incompatible medications/solutions to be administered at the same time via separate lumens.

Catheters are also available with an open-ended valve, closed-ended valve, or a pressure-activated safety valve (PASV). It is important that you know what type of catheter your patient has, as the care and maintenance vary for each catheter design.

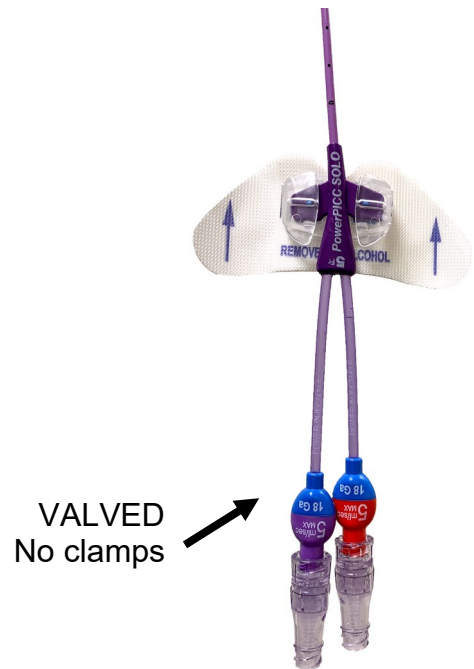


OPEN-ENDED/NON-VALVED/CLAMPS

- These catheters have a blunt end.
- They require positive pressure locking when not in use, to maintain patency and prevent backflow, and stasis of blood in the tubing.
- Require clamp to achieve positive pressure
- Can be cut at this distal open end at time of insertion to correct length for patient.
- Require routine flushing with normal saline and “locking” with heparin when not in use.
- Open-ended catheters are not inserted at MSH, however you may see them on patients who have transferred from other sites

CLOSED-ENDED/VALVED/NO CLAMPS

- These catheters have a rounded closed tip.
- This device has a valve that opens inward for aspiration, outward for infusion, and remains closed when not in use.
- Advantages include
 - Decreased risk of bleeding or air emboli
 - Catheter clamping is not required
 - Heparin not required
- Requires routine flushing with Normal Saline when not in use to maintain patency.



Pressure-Activated Safety Valves (PASVs)



- PASVs are located in the catheter hub and are similar to the positive pressure adapter valves.
- These valves open with minimal positive pressure for infusion and require four times the negative pressure for aspiration.
- This device also prevents reflux of blood into the end of the catheter and only requires saline flushes weekly when not in use.

- Currently at Markham Stouffville Hospital (MSH) we do not insert this type of device however you may see patients from other institutions that have had these devices in-situ.

Device Selection

Optimum central venous device selection is guided by a collaborative approach between health team members and the patient. The table below outlines advantages and disadvantages of each catheter type.

Types of CVADs

| Type of Catheter | Duration | Advantages | Disadvantages |
|---|--------------------------------------|---|---|
| <p>Short-Term Percutaneous Central Catheter</p> <p>‘Triple-lumen’</p> <ul style="list-style-type: none"> • Internal Jugular (IJ) • Subclavian • Femoral | <p>Days to weeks</p> | <ul style="list-style-type: none"> • Quick bedside insertion and removal • Can have multiple lumens • Lowest initial cost | <ul style="list-style-type: none"> • Highest rate of catheter related blood stream infection (CRBSI) • Requires routine sterile dressing change • Pt self-care is difficult • Pt activity may be hampered • External catheter breakage possible |
| <p>Peripherally Inserted Central Catheter (PICC)</p> <ul style="list-style-type: none"> • Non-valved/ open-ended catheter • Valved/closed-ended | <p>Weeks to approximately 1 year</p> | <ul style="list-style-type: none"> • Closed-ended catheters do not require heparin flushing • Insertion by certified RN, or Interventional Radiology (IR) • Less traumatic to place • No surgical requirements • Reliable long-term access • Easily to remove • Decreased peripheral bacterial colonies vs. jugular, thoracic or femoral insertion sites • Repair kits available • Preservation of peripheral vascular | <ul style="list-style-type: none"> • Open-ended catheters require heparinization • Requires routine saline flushing every 7 days • Patient self-care is difficult • Requires routine sterile dressing and injection cap change • External catheter, catheter breakage possible • Body image (i.e. catheter outside body) • Activity restrictions • Requires adequate peripheral access • Post-insertion phlebitis common |

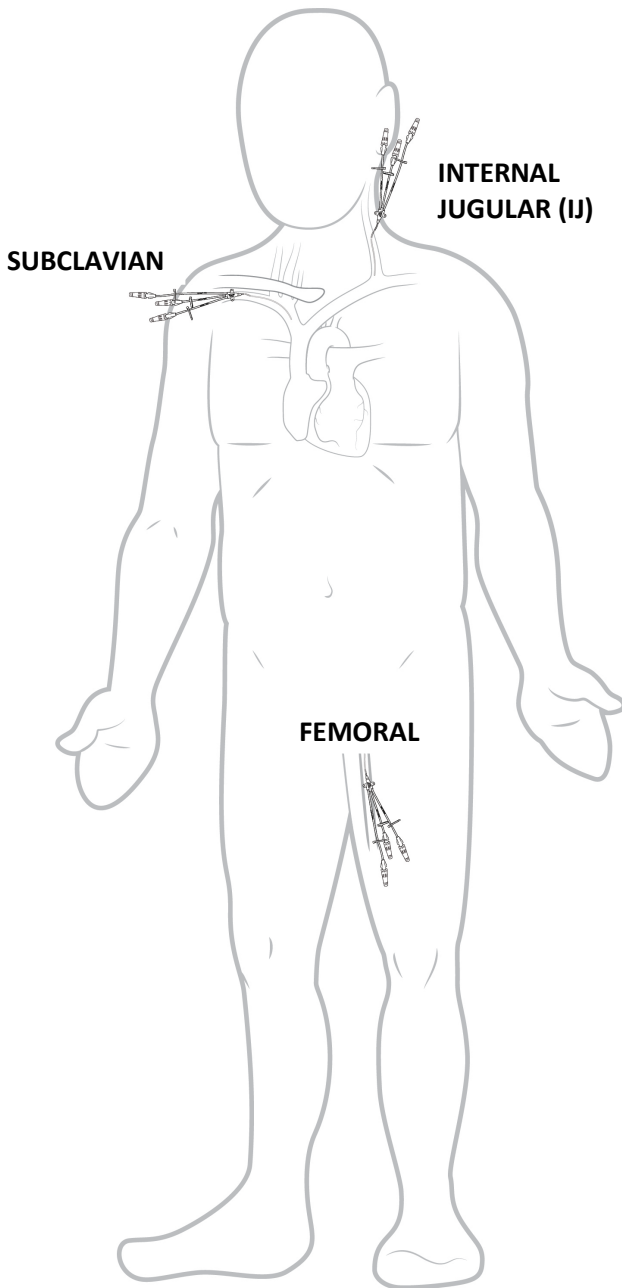
| | | | |
|---|--|---|--|
| | | <p>system</p> <ul style="list-style-type: none"> • May be inserted as an outpatient | |
| <p>Tunneled Catheters</p> <ul style="list-style-type: none"> • Hickman® • Broviac® • Leonard® | <p>> 1 year and as per manufacturer recommendations</p> | <ul style="list-style-type: none"> • Pt can care for catheter at home • Can be inserted on outpatient basis • Can be repaired externally • Dressing optional following placement >3-6 months once insertion site has healed | <ul style="list-style-type: none"> • Requires routine heparin flushing if open-ended • Body image (i.e. catheter outside of body) • Requires surgical/radiological insertion/removal |
| <p>Implanted Vascular Devices</p> <ul style="list-style-type: none"> • PORT-A-CATH® | <p>Several years</p> | <ul style="list-style-type: none"> • No dressing required 1-2 weeks post insertion once incision sites have healed • Can be inserted as an outpatient • Monthly heparinization when not in use • Body image intact • Unrestricted activity • Decreased risk of infection • No external components to break | <ul style="list-style-type: none"> • Special needle must be used to access • Displacement of needle possible • Most expensive CVAD device to place • Surgical procedure to place and to remove • Discomfort may be associated with accessing • May cause artifact on CT or MRI |

Self Assessment One

Try this self assessment to check your knowledge related to CVADs so far. Answer sheet on page 34.

1. **CVADs are used to access small and large veins.**
 - a) True
 - b) False
2. **Heparin flush is not required for which of the following CVADs:**
 - a) Hickman®
 - b) PORT-A-CATH®
 - c) Open-ended PICC
 - d) Closed-ended PICC
3. **The following CVADs may be placed to provide access for over one year**
 - a) Hickman®
 - b) PORT-A-CATH®
 - c) PICC
 - d) a & b
4. **Which catheter has the highest rate of catheter related blood stream infection (CRBSI)?**
 - a) PICC
 - b) Tunneled catheter
 - c) Short-term percutaneous central catheter
 - d) Implanted vascular device
5. **The tip of any central venous catheter can lie in the superior vena cava or inferior vena cava depending on catheter selection.**
 - a) True
 - b) False
6. **A Power Port requires a specific type of non-coring needle for access to perform a CT scan.**
 - a) True
 - b) False
7. **Open-ended catheters require routine heparin flushes to maintain patency and prevent backflow of blood.**
 - a) True
 - b) False
8. **What would the optimum device for patients requiring therapy > 1 year**
 - a) PICC
 - b) Tunneled catheter
 - c) Implanted vascular device
 - d) b & c

Short-Term Percutaneous Central Catheters



A short-term percutaneous central catheter is often simply referred to as a subclavian, jugular or femoral central line. These catheters are considered non-tunneled. The subclavian and jugular catheters are inserted percutaneously usually through the subclavian or jugular vein into the superior vena cava with the tip of the catheter resting in the lower one third of the superior vena cava (SVC) 3-4 cm above the SVC-right atrial junction. With a femoral vein insertion, the tip of the catheter is threaded into the inferior vena cava to lodge at the level of the diaphragm.

These devices are designed to be left indwelling for **days to weeks**, although usually less than one month. If the catheter is multi-lumen the segment of the catheter that remains on the skin is divided into separate injection lumens lines for individual lumen access.

These lumens are labeled distal, median, and proximal reflecting the three internal exit points. The distal lumen is 16 gauge, and the median and proximal lumens are 18 gauge.

The terms “percutaneous central catheter” and “central venous catheters” are used interchangeably at MSH.



Insertion:

Insertion is performed by a physician on any clinical unit, usually in the Emergency Department and Intensive Care Unit. A nurse may be required to assist the physician with the insertion. It has been demonstrated that sterile draping the patient from head to toe for the procedure reduces the incidence of central line infections.

Supplies you may need include:

- Central line insertion kit
- Xylocaine
- Sterile gloves
- Sterile drapes that cover patient from head to toe
- Masks

After insertion by the physician, a chest x-ray is ordered to confirm catheter placement.

Documentation should include:

- Type of catheter inserted and size
- Insertion site
- Physician's name
- Vitals signs before and after procedure
- Patient outcomes

If any lumens are not in use, ensure caps are applied and flushed as per hospital policy (Central Venous Access Devices).

Care and Maintenance:

After insertion, the catheter exit site may be dressed with gauze and a transparent dressing. The gauze may be required if there is oozing of blood following insertion. The initial dressing should be changed after 24 hours to reduce the risk of infection. Remove old gauze during dressing change and do not re-apply gauze.

It is important to maintain patency with regular flushing.
Each lumen should be flushed with 20mL Normal Saline qShift.

Infusion pumps are mandated for CVAD infusions to maintain flow and catheter patency. When a short-term percutaneous central catheter lumen is not in use ensure the catheter is clamped to maintain patency and prevent backflow of blood. All CVAD care must be documented on the electronic health record and Kardex.

If TPN is infusing, a dedicated lumen must be established. The most appropriate is the distal lumen.

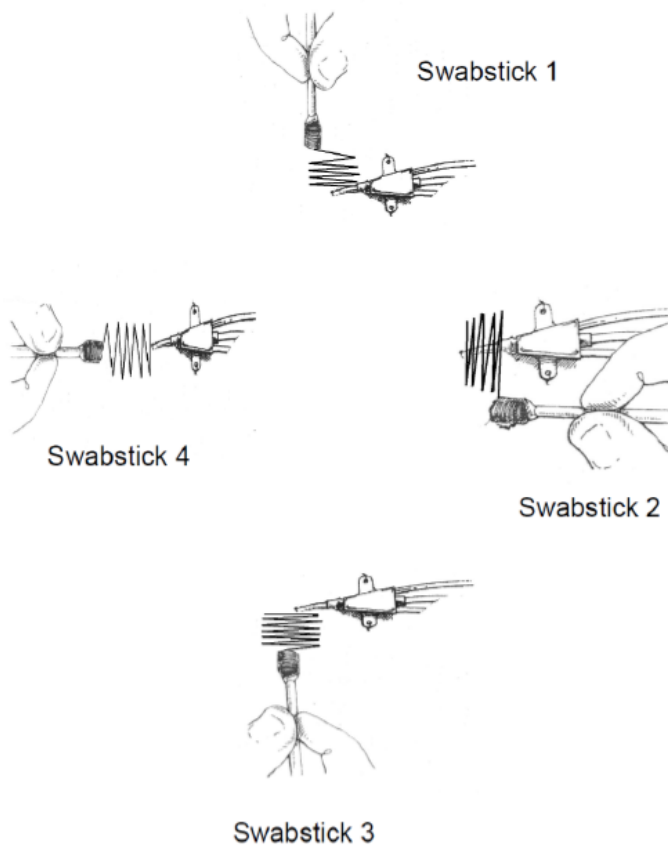
Flushing:

- Always use at least a 10 mL syringe, or larger to ensure pressure never exceeds 25 pounds per square inch (psi)
- When flushing, observe the catheter tract for extravasation and/or swelling, and assess the patient for burning, pain or discomfort. If this occurs, notify physician and do not use.

- Flush with 20 mL of normal saline (2 x 10mL prefilled syringes) for routine flushing and following chemotherapy treatment, intermittent medication administration or blood withdrawal.
- Ensure all de-accessed lumens are flushed per policy.
- Use turbulent flushing and positive pressure when flushing CVAD
 - **Turbulent flushing:** A flush technique used to prevent build-up of medication precipitate and promote removal of blood/fibrin on the internal lumen of the device. To achieve turbulent flushing the nurse uses a push-pause (stop-start) method.
 - **Positive pressure:** A technique used to maintain positive pressure inside the lumen in order to prevent blood reflux from the vein into the lumen of the vascular device. To achieve positive pressure maintain positive pressure on the syringe plunger while closing the clamp and before removing the syringe from the cap of the device.

Dressing:

- Purpose is to protect site, prevent infection and stabilize the device.
- Change dressing every 7 days and PRN.
- Assess site Q8H.
- Utilize aseptic technique (sterile gloves and mask)



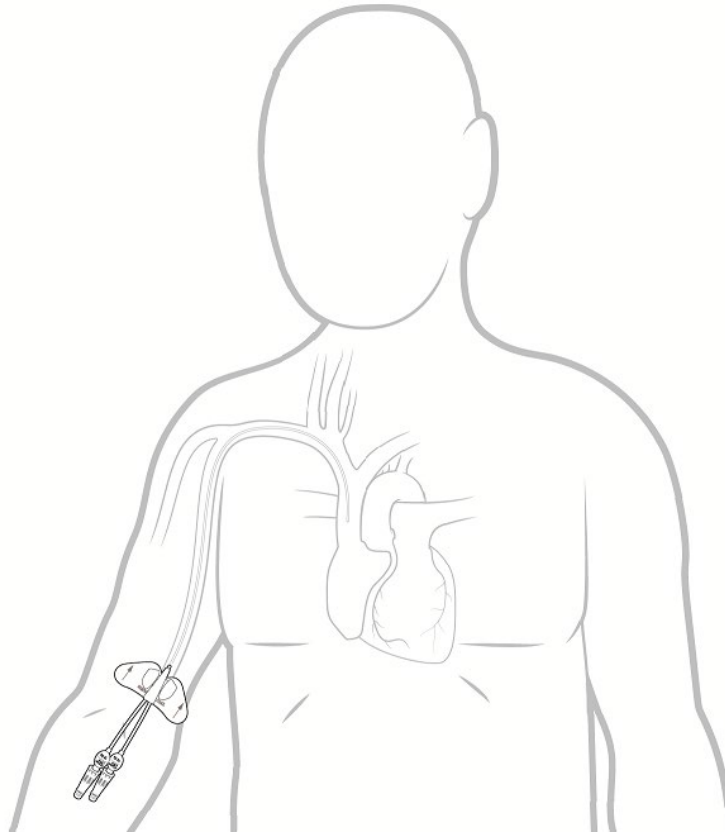
- Cleanse catheter exit site with 2% chlorohexidine and 70% alcohol swabstick, starting at insertion site and working outward in a back and forth friction motion. Repeat the same procedure using a new swabstick for each side of insertion site, working in a clockwise pattern. Allow site to dry for 30 seconds prior to applying dressing. Do not wipe or fan to speed drying as this action re-colonizes the site.
- Cover exit site with transparent dressing
- Date and label transparent dressing using sticker/tape on transparent dressing
- Document: procedure completed, problems encountered and nursing interventions, dose and time of normal saline flush on eMAR
- Never use acetone or tape remover on or near the catheter. This may

cause permanent damage to the catheter and irritation to the skin.

Documentation: Document under *GEN IV Central Line Site* intervention qShift.

Peripherally Inserted Central Catheter (PICC)

A PICC is a small gauge catheter that is inserted by venipuncture of the basilica, medial-cephalic, cephalic or medial-basilic vein, at or above the antecubital space and advanced until the tip is positioned in the lower 1/3 of the superior vena cava.



Types of Catheters

PICCs are available as a single, double, or triple lumen. They are either non-valved (open-ended) or valved (close-ended). PICCs inserted at MSH use Power technology, so they may be used for CT scans. Also, MSH only inserts closed-ended/valved PICCs but patients may still have open-ended PICCs in situ if inserted at a different hospital site.

Insertion:

The PICC may be inserted by a physician/radiologist under fluoroscopy or with venous contrast using strict aseptic technique. PICCs are inserted in Interventional Radiology (IR). Certified nurses at MSH may also insert and repair PICC lines, but not under fluoroscopy. An X-Ray (or other approved technology) must be done to confirm tip placement, prior to using the catheter. Only certified nurses and physicians can remove PICC lines.

Care and Maintenance:

After insertion, the catheter exit site is dressed with gauze and securement device and a transparent dressing. The gauze is required as there is usually some oozing of blood following insertion. The initial dressing must be after 24 hours to reduce the risk of

infection. Remove old gauze during dressing change and do not re-apply. Apply warm compresses or heating pad on low over the site 3-4 times a day for 20 minutes for the first week to help prevent mechanical phlebitis.

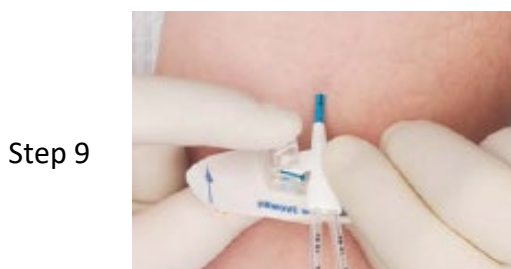
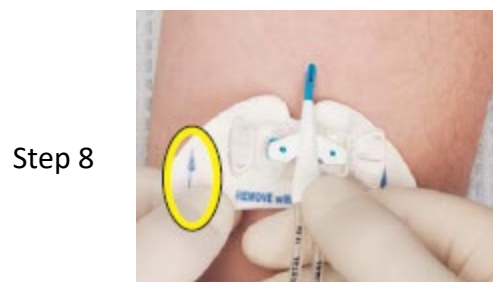
Infusion pumps are mandated for PICC infusions to maintain flow and catheter patency. All PICC care must be documented on the electronic health record and Kardex.

Do not take blood pressure in arm with PICC catheter. For open-ended/non-valved PICCs where any lumen is not in use, ensure line is heparin-locked and clamped.

Exception: Closed-ended/valved/non-clamped catheters do not require heparinization.

Dressing:

- Purpose is to protect site, prevent an infection and stabilize the device
 - Change 24 hours post-insertion, every 7 days and PRN
 - Assess site Q8H
1. Perform hand hygiene and apply non-sterile gloves, surgical mask, and appropriate PPE. Have patient don mask or face opposite direction of arm with PICC.
 2. Prepare sterile supplies: sterile flush, cap, securement device, transparent dressing.
 3. Remove and discard old transparent dressing, then use alcohol to remove securement device (avoid tugging on catheter).
 4. Remove and discard non-sterile gloves, perform hand hygiene.
 5. Cleanse the catheter exit site with chlorohexidine swabstick, starting at insertion site and working outward in a back and forth friction motion. Repeat the same procedure using a clockwise formation pattern using a new swabstick for each side. Use final swab to clean along catheter starting at exit site, swabbing toward cap. Allow site to dry for 30 seconds – DO NOT wipe or fan site!
 6. Perform hand hygiene, apply sterile gloves using appropriate technique.
 7. Apply skin prep to area where securement device will be applied (provided in StatLock® kit) and allow to dry.
 8. Align anchor pad so directional arrow points toward insertion site. Place suture holes in catheter wings over posts.
 9. Support undersurface of anchor pad and catheter while closing retainer doors.
 10. Peel off paper backing one side at a time and place on skin.



Source: Bard Access Systems

11. Apply transparent dressing over the exit site and securement device, avoiding tension on skin
 12. Date and label transparent dressing using sticker/tape on transparent dressing
 13. Document: procedure completed, problems encountered and nursing interventions, dose and time of normal saline flush/heparin (if required) on eMAR
- Never use acetone or tape remover on or near the catheter. This may cause permanent damage to the catheter and irritation to the skin.

Securement Device

At MSH, all PICC lines require a securement device to secure the line externally. StatLock® is our chosen securement device. Each package includes the three items below:



This is not part of the dressing but may be temporarily used to assist with the sterile dressing change.

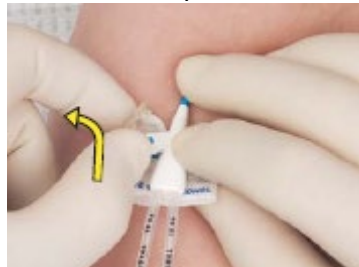
To Remove Device:

1. Remove transparent dressing.
2. First lift edge of anchor pad using alcohol pad. Continue to stroke undersurface of pad with alcohol to dissolve anchor pad away from skin.
3. Stabilize catheter with finger while holding the securement device. Next, use thumb of opposite hand to gently lift retainer door from behind while pressing down with index finger. Repeat with second door.
4. Carefully remove PICC from retainer and a new StatLock® may be reapplied after cleansing skin/catheter exit site.

Step 2.



Step 3.



Step 4.



Source: Bard Access Systems

Flushing:

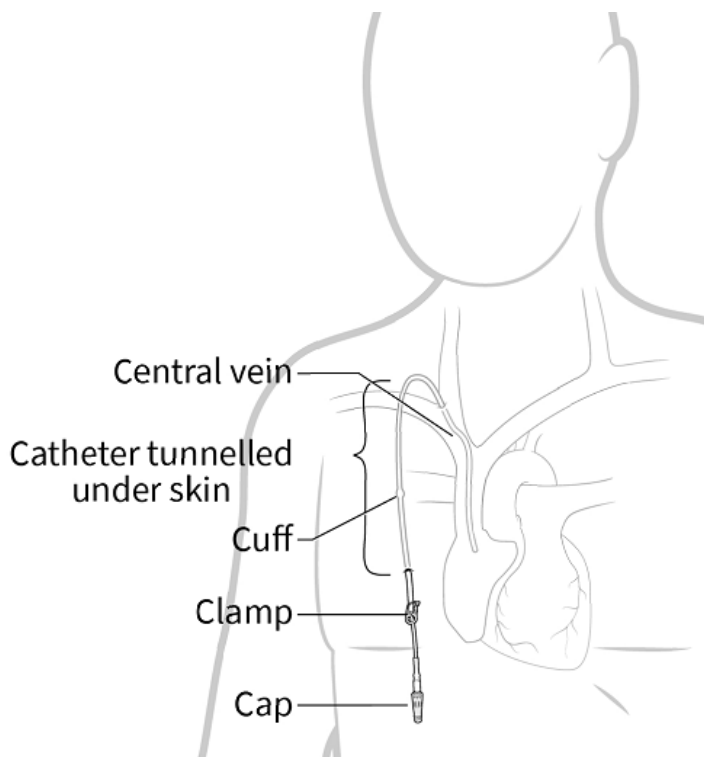
- Always use a 10 mL syringe or larger to ensure pressure never exceeds 25 pounds per square inch (psi)
- When flushing, observe the catheter tract for extravasation and/or swelling, and question or observe the patient to determine whether burning, pain or discomfort is experienced. If this occurs, notify physician and do not use.
- While patient is in hospital,
 - Closed-ended PICCs should be flushed every 12 hours with 20 mL normal saline (for each lumen)
 - Open-ended PICCs should be flushed every 24 hours with 20 mL normal saline followed by 3 mL heparin lock flush (100 units/mL) (for each lumen)
- If patient is in the community,
 - Closed-ended PICCs should be flushed every 7 days with 20 mL normal saline if not in use (for each lumen)
 - Open-ended PICCs should be flushed every 7 days with 20 mL normal saline followed by 3 mL heparin lock flush (100 units/mL) if not in use (for each lumen)
- Flush with 20 mL of normal saline following chemotherapy, when stopping IV infusion, or blood withdrawal.
- To verify placement of a closed-ended PICC: aspirate 2 mL, pause (i.e. to allow the valve to open) then continue to aspirate.
- Ensure all de-accessed lumens are flushed per policy.
- Use turbulent flushing and positive pressure when flushing (refer to page 12 for definitions).

Documentation:

Document under *GEN IV PICC Site* intervention qShift.

Tunneled Catheters (Hickman®)

A tunneled catheter is tunneled subcutaneously from the entry site at the skin surface to the access point into the vascular system. The catheter tip sits in one of the large central veins such as the subclavian, internal or external jugular, or femoral veins. The proximal end is tunneled subcutaneously for several inches to the desired exit site on the anterior chest wall. An antimicrobial Dacron or collagen cuff is located along the catheter sheath about 5 cm from the catheter's exit site at the skin. Tissue heals (enmeshing cuff with fibrous tissue) around this cuff providing stability and a potential barrier to microorganisms. However, this does not guarantee dislodgement won't occur.



Insertion:

Insertion is performed under local anesthetic, by a physician in an operating room or Interventional Radiology suite. X-ray or fluoroscopy confirms tip placement.

Care and Maintenance:

Initial dressings should be maintained using sterile technique until healing has taken place. Healing time may vary. Some indications that the site is healing include a dry scar, and no moisture or redness present around exit site. Once healing has occurred, a dressing may not be required.

Infusion pumps are mandated for tunneled catheter infusions to maintain flow and catheter patency. All care must be documented on the electronic health record and Kardex.

When a tunneled lumen is not in use ensure catheter is clamped to maintain patency and prevent backflow of blood. Unused lumens must be capped and heparin-locked.

Dressing:

- Purpose is to protect site, prevent infection and stabilize the device.
- Change every 7 days and prn.
- Assess site Q8H.
- Utilize aseptic technique (sterile gloves and mask)
- Cleanse catheter exit site with 2% chlorohexidine with 70% alcohol swabstick, starting at insertion site and working outward in a back and forth friction motion. Repeat the same procedure using a new swabstick for each side of insertion site, working in a clockwise pattern. Allow site to dry for 30 seconds prior to applying dressing. Do not wipe or fan to speed drying as this action re-colonizes the site.
- Never use acetone or tape remover on or near the catheter. This may cause permanent damage to the catheter and irritation to the skin.
- If skin around exit site is healed, a dressing is no longer required.

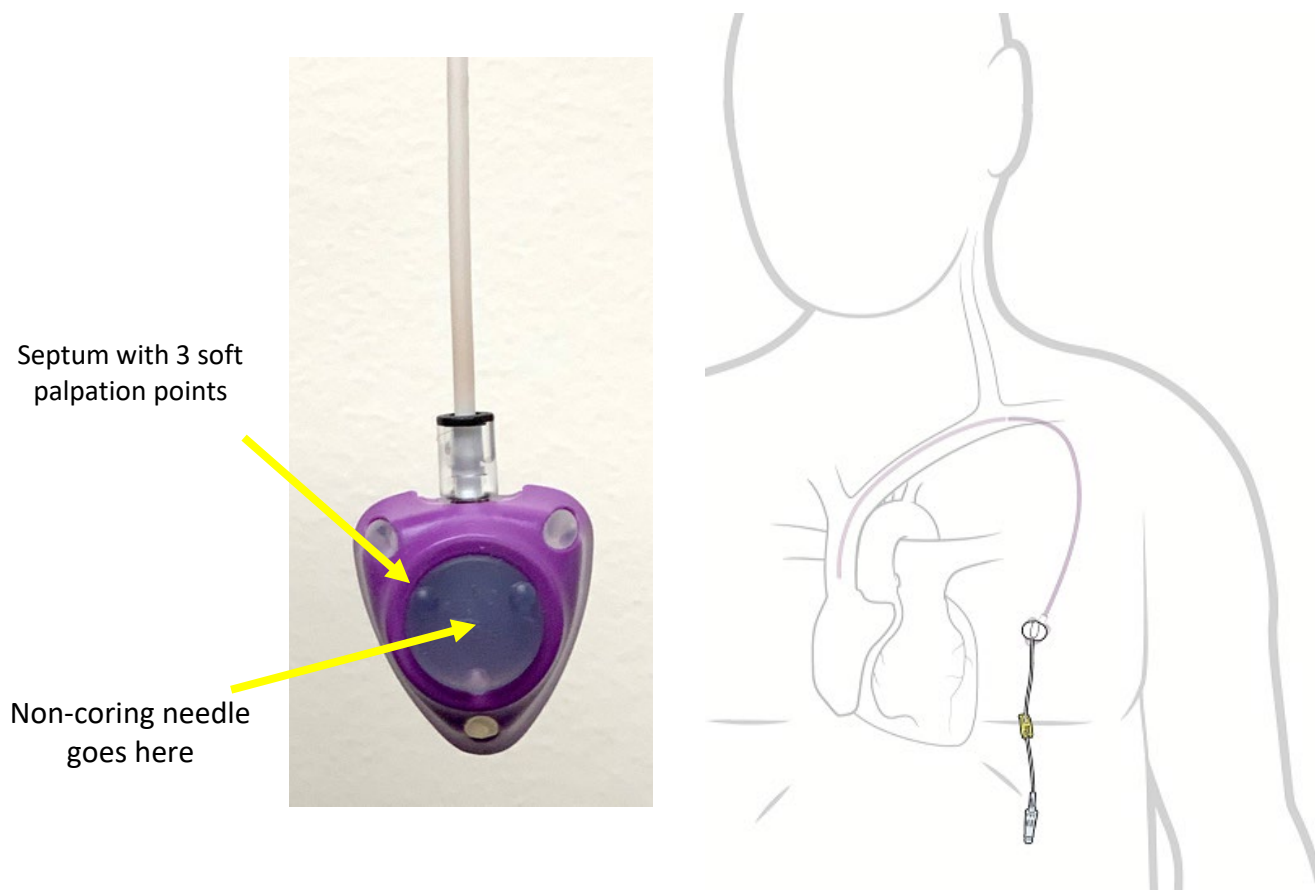
Flushing:

- Always use a 10 mL syringe or larger to ensure pressure never exceed 25 pounds per square inch (psi)
- When flushing, observe the catheter tract for extravasation and/or swelling, and assess the patient for burning, pain or discomfort. If this occurs, notify physician and do not use.
- Flush with 20 mL of normal saline following chemotherapy, when stopping IV infusions, or after blood withdrawal.
- Flush with 20 mL of normal saline for routine flushing and after intermittent medication followed by heparin flush 300 units (3mL) per lumen, if required.
- Ensure all de-accessed lumens are flushed per policy.
- Use turbulent flushing and positive pressure when flushing (refer to page 12 for definitions).

Documentation: Document under *GEN IV Hickman Site* intervention qShift.

Implanted Vascular Device (PORT-A-CATH®)

An implanted vascular device is surgically placed under the skin, and consists of a small vascular access port attached to a thin, flexible catheter. The distal end of the catheter, when in place, is located at the junction of the superior vena cava and the right atrium. Adequate subcutaneous tissue is required over the proposed port site to prevent erosion through the skin. When a port is implanted in an arm it is called a “pas” port and is a smaller size. All ports inserted at MSH are Power Ports. Ports are also available as dual ports where the lumen is separated for different infusions.



Insertion:

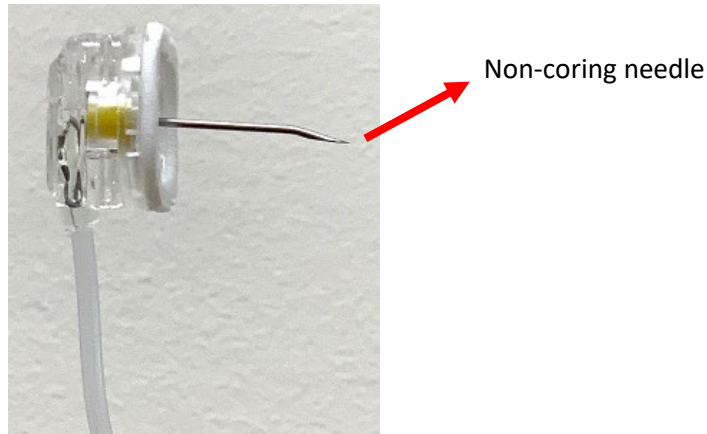
Insertion is performed by a physician, under general anesthetic in the operating room, or under sedation and local anesthetic in the Interventional Radiology Suite. Tip placement is confirmed by x-ray or alternative technologies.

Care and Maintenance:

An implanted vascular device must be accessed aseptically with a non-coring needle. The smallest needle gauge and length appropriate for therapy and patient is preferred. To determine the correct needle size, consider the following:

1. If the port is easily visible under the skin and protruding slightly from the chest, a $\frac{3}{4}$ inch length non-coring needle should be used.

2. If the top of the port is flush with the skin (of average thickness) use a 1-inch non-coring needle.
3. If the port is not visible, but can be felt deeper under the skin with adipose tissue, choose a 1 to 1 ¼ inch needle.



MSH stocks ¾" & 1", 19 & 20 gauge needles. If a longer needle is required it will need to be specially ordered. Part of the preparation of accessing a port is a discussion with the patient and/or family. Sometimes patients will know what size needle worked best during previous accessing of the port.

Infusion pumps are mandated for all port infusions to maintain flow and catheter patency. All care must be documented on the electronic health record and Kardex.

When a port lumen is not in use, ensure port clamp is closed and heparin-locked. The non-coring needle must be changed every 7 days.

Accessing Ports

1. Perform hand hygiene, apply non-sterile gloves and appropriate PPE
2. Position patient comfortably, have patient wear a mask or turn head to face away from port to minimize risk of infection. Palpate port site.
3. Open sterile glove package, spread wrapper to create a sterile field
4. Place sterile 10mL normal saline flush, non-coring needle, cap, and transparent dressing onto sterile field
5. Cleanse site with 2% chlorohexidine with 70% alcohol swabstick using a back and forth motion friction scrub for 30 seconds, extending cleansed area up to 10cm diameter. Do not wipe or fan site. Allow at least 30 seconds to dry.
6. Apply sterile gloves
7. Attach normal saline flush to cap, attach cap to extended tubing connected to non-coring needle. Prime non-coring needle with normal saline, leaving syringe attached
8. Remove cap cover from needle
9. Palpate port again with non-dominant hand, stabilize and feel briefly for diaphragm of port

10. Pick up non-coring needle with dominant hand, hold needle at 90° angle, push needle through skin and port firmly until the needle hits the bottom of the port chamber. Do not rotate the needle once it has punctured the skin.
11. Open the clamp and aspirate to check for blood return
12. Using turbulent flush technique, flush with 20mL of normal saline. Observe for swelling, discomfort, ease of flushing, and quality of blood return
13. Apply transparent dressing over port site to secure needle.
14. Date and label transparent dressing
15. Document on procedure completed, problems encountered and nursing interventions, and dose and time of saline flush/heparin on eMAR

If port needle is not inserted correctly, the needle may be removed but the same needle should never be reinserted as this may increase risk of infection.

If unable to aspirate blood:

- Ask patient to raise arm over head
- Ask patient to move head from left to right
- Turn patient onto the side away from nurse
- Ask patient to take a deep breath and cough.
- Flush line with 0.9% Sodium Chloride and try to aspirate blood again.
- Ask patient what position works best for them
- *If still unable to aspirate blood*, flush line, clamp off tubing and inform MRP

De-accessing Ports

1. Perform hand hygiene, apply non-sterile gloves and appropriate PPE
2. Ensure port has been flushed with normal saline and heparin appropriately as per policy
3. Remove transparent dressing without dislodging the non-coring needle
4. Stabilize port by securely holding the base down against skin, firmly pull the textured handle up until the needle is locked
5. Dispose of needle into sharps container
6. Document on procedure completed, problems encountered and nursing interventions, and dose and time of normal saline and heparin flush on eMAR

Flushing:

- Always use a 10 mL syringe or larger to ensure pressure never exceeds 25 pounds per square inch (psi).
- When flushing, observe the catheter tract for extravasation and/or swelling, and assess the patient to for burning, pain or discomfort. If this occurs, notify physician and do not use.
- Flush with 20 mL of normal saline following chemotherapy or blood withdrawal.
- Flush with 20 mL of normal saline for routine flushing and after intermittent medication followed by heparin flush 500 units (5 mL) if required.
- Use turbulent flushing and positive pressure when flushing (refer to page 12 for definitions).

Documentation: Document under *GEN IV Port-a-Cath Site* intervention qShift.

Tubing and Cap Changes

- IV tubing must be changed every 72 hours
- TPN tubing must be changed every 24 hours
- All tubing must be labeled with start and discard date.

- For ALL CVADs, caps (clear connectors) must be changed
 - Every 6 days
 - When the cap has been removed for any reason
 - Any time the cap appears damaged, is leaking, blood is seen in the catheter without explanation, or blood residue is observed in the cap
 - After blood draws
 - When converting from a continuous infusion
- Ensure all information is on Kardex is updated.

Blood Withdrawal

CVADs are commonly used for blood withdrawals, both for the inpatient and outpatient population.

Benefits

- Minimizes peripheral venous punctures.
- Allows easy access if peripheral veins are not suitable.
- Lessens patient anxiety related to repeated venipuncture.

Risks








- Handling, accessing and repeated opening of the catheter lines
 - Increases the risk of infection/air embolus
 - Increases thrombus/occlusion risk especially if not flushed adequately afterwards
- Inaccurate results may occur if catheter is inadequately flushed or inadequate amount of fluid is discarded before drawing the sample.

Here are a few tips and reminders but always refer to policy when obtaining blood specimens.

- Stop **all infusions** into the CVAD for at least one minute before drawing blood.
- Withdraw and discard at least 2 times the fill volume of the catheter (usually 7-10mL blood)
- Withdraw blood sample using a 10ml syringe. Blood transfer device must be used to transfer blood in syringe to vacutainer. *Blood collection tubes must be drawn in a specific order to avoid cross-contamination of additives between tubes (see chart below)
- Flush with 20 mL normal saline, using the turbulent flush technique, after blood draw (even if resuming an infusion).
- Flush even if unsuccessful in obtaining specimen.
- Blood may hemolyze if slow/sluggish return.

- If lab results are significantly different from previous values, or are unusually abnormal without cause, peripheral specimen should be taken to compare or if this is not possible repeat with a bigger discard of blood from line before sample is drawn.
- Correctly identify patient and label specimen tube carefully and completely with user's mnemonic and time specimen was drawn

Order of Blood Draw Chart

| Order of Draw | Bottles | Colour |
|--|--|--------------------|
| 1st – Blood Culture Bottles | | Green, then Orange |
| 2nd – Coagulation (INR, PTT and D-Dimer) |  | Blue |
| 3 rd - Non-additive |  | Red Gold |
| 4 th - Chemistry |  | Light Green |
| 5 th – Venous Blood Gas, Carbon |  | Dark Green |
| 6 th – Hematology (CBC, ESR) |  | Lavender |
| 7 th – Blood Bank |  | Pink |
| 8 th – Lactic Acid |  | Grey |



Gently invert tubes 5-10 times when filled with blood.
Do not shake specimen tubes.

Potential Complications of CVADs

| Type | Symptoms | Possible Causes | Intervention |
|--|--|--|---|
| <p style="text-align: center;">Infection</p> <ul style="list-style-type: none"> • Local • Systemic | <ul style="list-style-type: none"> • Fever/Chills • Elevated WBC • Malaise • Drainage at site • Erythema, swelling • Tenderness, pain • Drainage • Tachycardia | <ul style="list-style-type: none"> • Break in asepsis/sterility • Movement of catheter or needle under dressing • Mechanical phlebitis | <ul style="list-style-type: none"> • Blood work • Blood cultures • Site care • Topical/oral/IV antibiotics • Catheter/Needle removal if necessary |
| <p style="text-align: center;">Catheter Occlusion</p> | <ul style="list-style-type: none"> • Malfunctioning catheter • Unable to infuse or aspirate • Pump occlusion alarm sounding • Sluggish infusion/flush or aspiration | <ul style="list-style-type: none"> • Chemical or thrombotic occlusion • Kink in tubing or closed clamp • Pinch-off syndrome (catheter is positioned between clavicle and 1st rib causing a positional occlusion) | <ul style="list-style-type: none"> • Reposition arm • Attempt to gently aspirate and flush with normal saline. Stop if resistance felt • Dye or ultrasound studies • Thrombolytic to dissolve clot (administered by physician only) • Catheter removal if all lumens are blocked |
| <p style="text-align: center;">Air Embolism</p> | <ul style="list-style-type: none"> • Anxiety • Restlessness • Chest pain • Tachypnea • Tachycardia • Hypotension • Collapse • Cardiac arrest • Cyanosis | <p>Look for Cause</p> <ul style="list-style-type: none"> • Open catheter • Disconnected • Fracture of external catheter • Injection cap not prefilled | <ul style="list-style-type: none"> • Seal or clamp leak in catheter or system • Turn pt to left side in trendelenburg, so air collection remains in right atrium • Administer O2, monitor vital signs and notify physician stat |
| <p style="text-align: center;">Phlebitis</p> <ul style="list-style-type: none"> • Mechanical • Chemical • Thrombolphlebitis | <p>Mechanical: erythema, edema, pain anywhere along the pathway</p> | <p>Mechanical: within 7-10 days post insertion, usually within first 24-72 hours</p> <ul style="list-style-type: none"> • Trauma to the intimal wall of the vessel by catheter • Movement of catheter | <p>Mechanical: apply warm, moist heat at first sign, rest, ROM exercise</p> <p>*If signs of improvement within 24hr, continue interventions</p> <p>*If worse, remove device</p> |

| | | | |
|---|---|--|--|
| | <p>Chemical: erythema, edema, pain at the tip and beyond</p> <p>Thrombolphlebitis: erythema, edema, may also be distal to insertion site, pain</p> | <p>Chemical: medications</p> <p>Thrombolphlebitis: can either be mechanical or chemical and related to injury of the vessal wall, coagulopathy and/or restrict blood flow</p> | <p>Chemical: remove device</p> <p>Thrombolphlebitis:</p> <ul style="list-style-type: none"> • Any time post insertion, doppler ultrasound, venogram • considerations for removal |
| Catheter Migration | <ul style="list-style-type: none"> • Increase external length • Sensation of gurgling in ears when flushing • Arm, shoulder, back discomfort • Edema • Chest pain • Arrhythmia | <ul style="list-style-type: none"> • Tissue irritation during insertion • Increased intrathoracic pressure • Poor securement • Twiddler’s syndrome (caused by patient “twiddling” with the catheter) | <ul style="list-style-type: none"> • X-ray to confirm placement • Monitor S&S • May resolve spontaneously • Repositioning of catheter • Removal of catheter |
| Extravasation/Infiltration <ul style="list-style-type: none"> • Fluid infusing into tissue | <ul style="list-style-type: none"> • Swelling • Burning/stinging with infusion • Pain • Redness • Leaking • Warmth • No blood return | <ul style="list-style-type: none"> • Damaged/severed catheter • Dislodgement of port needle • Misplaced catheter • Backflow from fibrin sheath | <ul style="list-style-type: none"> • Avoid infusing vesicants without blood return • Radiologic investigation • Heat or cold • Corticosteroids • Antidotes |
| Venous Thrombosis <ul style="list-style-type: none"> • Formation/presence of blood clot that impedes circulation | <ul style="list-style-type: none"> • Edema of face, neck, arm on cannulated side • Superior vena cava syndrome (blockage in the flow of blood through the superior vena cava causing venous distension in the upper body) | <ul style="list-style-type: none"> • Venous stasis • Dehydration • Disease state | <ul style="list-style-type: none"> • Possible catheter removal • Venous dilation • Thrombolytic therapy • Monitor patient and inform physician |

Troubleshooting Guide

| Problem | Possible Causes | Possible Solution |
|------------------------------|--|---|
| Aspiration difficulties | <ul style="list-style-type: none"> • Improper flushing technique • Catheter opening may adhere to up against vein wall with aspiration • Blood clot, fibrin sheath, or particulate matter obstructing valve when catheter is aspirated • Kinked catheter outside or inside the body • Malposition of catheter tip • Too-rapid aspiration technique • Device lumen too small | <ul style="list-style-type: none"> • Visually assess catheter • Reposition arm • If no resistance to infusion is felt, attempt to flush with 10 mL normal saline and then pull back gently on syringe 2-3 mL, pause and proceed with aspiration • Aspirate with 20 mL syringe (creates greater vacuum) • X-ray or dye study to determine catheter position or occlusion • Thrombolytic solution |
| Blood return in catheter | <ul style="list-style-type: none"> • Clot or particulate matter may be holding the valve open • Migration or placement of catheter tip • Catheter in Right Atrium or Ventricle • Catheter valve tip cut off in error during insertion | <ul style="list-style-type: none"> • Attempt to aspirate clot out of lumen. If no resistance felt, flush with 10 mL normal saline • Need for x-ray or dye study to determine catheter position • Thrombolytic solution |
| Catheter damage | <ul style="list-style-type: none"> • Repeated clamping • Contact with a sharp object • Rupture from attempt to irrigate an occluded catheter with a small syringe | <ul style="list-style-type: none"> • Always use smooth-edged clamp • Certified nurse to repair damage • Use 10 mL syringe or greater |
| Blood at insertion site | <ul style="list-style-type: none"> • Small amount normal for 24 hours post insertion | <ul style="list-style-type: none"> • Apply gentle pressure to site • Avoid vigorous activities for 24 post-insertion |
| Fluid leakage from exit site | <ul style="list-style-type: none"> • Catheter punctured by sharp object • Rupture from attempt to irrigate an occluded catheter with a small syringe • Catheter may have become encapsulated by fibrin sheath • Central vein thrombosis or tumor growth | <ul style="list-style-type: none"> • Slowly infusing normal saline and observe for signs of fluid extravasation under skin • Dye study to determine fluid path • Removal of catheter if leak inside body • If leak outside of body, have physician or certified nurse repair catheter |

Patient and Family Education

- If PICC, Hickman or Implanted vascular access device (PORT-A-CATH®) was inserted at MSH, ensure they have received Instruction sheet and wallet card.
- Ensure Community Care Assess Center (CCAC) has been arranged for CVAD flushing and maintenance prior to discharge, if required.
- Document health teaching, perceived comprehension and need for follow-up.

Important points to review with patient and family:

- Do not lift heavy objects with the PICC arm.
- Do not shovel or garden using the arm with the PICC
- No blood work or blood pressure should be done on PICC arm
- Do not swim with the PICC or Hickman or otherwise get the dressing wet. May have shower but always cover dressing.
- Do not use scissors near the CVADs.

| Potential Problem | Intervention |
|---|--|
| <ul style="list-style-type: none"> • Dressing is soaked with blood | <ul style="list-style-type: none"> • Do not remove the dressing • Apply pressure with another dressing or clean cloth • Call CCAC nurse right away • Go to closest Emergency Department (ED) if the bleeding is heavy or will not stop |
| <ul style="list-style-type: none"> • Dressing is soaked with clear fluid | <ul style="list-style-type: none"> • Cover the dressing with another clean dressing • Call CCAC nurse right away |
| <ul style="list-style-type: none"> • CVAD site puffy and swollen | <ul style="list-style-type: none"> • Call CCAC nurse right way |
| <ul style="list-style-type: none"> • CVAD falls out | <ul style="list-style-type: none"> • Cover the dressing with another clean dressing • Apply pressure and call CCAC nurse right away • If unable to stop bleeding, go to nearest ED |
| <ul style="list-style-type: none"> • CVAD breaks | <ul style="list-style-type: none"> • Fold it in half, tape or clamp it, and go to the closest ED or call 911 if necessary |
| <ul style="list-style-type: none"> • Notice your heartbeat is strange or irregular | <ul style="list-style-type: none"> • Call 911 • Go to closest ED |
| <ul style="list-style-type: none"> • If you have trouble breathing | <ul style="list-style-type: none"> • Call 911 • Go to closest ED |

References

- Bard Canada. (2003) *Groshong Peripherally Inserted Central Venous Catheter (P.I.C.C.) Nursing Procedure Manual*. Mississauga, Canada.
- Canadian Intravenous Nurses Association. (1999). *Intravenous Therapy Guidelines*. Toronto, Canada: Author.
- Center for Disease Control and Prevention. (August 9, 2002). *Guidelines for the Prevention of Intravascular Catheter-Related Infections* (Volume 51/ No. RR-10). Atlanta, Georgia: Epidemiology Program Office, Centers for Disease Control and Prevention.
- Infusion Nurses Society, (2011). *Infusion Nursing Standards of Practice*. Hagerstown, MD: Lippincott Williams & Wilkins.
- Philpot, P (2003).The peripherally inserted central catheter. *Nursing Standard*. 17, 39-45.
- Regional CVAD Committee, (2006). *Central Venous Access Devices:Nursing CVAD review:care & maintenance of CVAD's*. Ontario, Canada
- Registered Nurses' Association of Ontario, (2005). *Nursing Best Practice Guideline: Care and Maintenance to Reduce Vascular Access Complications*. Toronto, Canada: Author.
- Registered Nurses Association of Ontario (2004). Best Practice Guideline. *Assessment and Device Selection for Vascular Access*. Toronto, Canada: Registered Nurses Association of Ontario.
- Safer Health Care Now (2012). *Prevent Central Line Infections. How to Guide*. Institute for Healthcare Improvement.
- Vascular Access Safety Team RVHS, (2007). *Central Venous Access Device: Self Learning Package for Nurses*. Toronto.

Self Assessment 2

1. **The tip of a PICC catheter should be placed in the:**
 - a) Lower one third of the superior vena cava
 - b) Lower one third of the inferior vena cava
 - c) Lower one third of the basilic vein
 - d) Anywhere in the subclavian vein

2. **PICC can be valved or non-valved**
 - a) True
 - b) False

3. **When accessing a CVAD, always use at least a ____ -sized syringe.**
 - a) 5mL
 - b) 3mL
 - c) 10mL
 - d) 20mL

4. **A client/patient with a CVAD line complains of a swishing noise in his ear when the line is flushed. This could be an indication:**
 - a) That the tip of the catheter has migrated into the jugular vein
 - b) That the CVAD is patent and is being thoroughly flushed
 - c) Of a CVAD-associated infection
 - d) Of a pulmonary embolus

5. **Chest pain, shortness of breath and cyanosis are signs of:**
 - a) A localized PICC-related infection
 - b) Pinch-Off Syndrome
 - c) A venous thrombosis
 - d) An embolism

6. **A transparent dressing on a CVAD insertion site is usually changed every:**
 - a) 24 hours
 - b) 18 hours
 - c) 7 days
 - d) 10 days

7. **Acetone may be used to remove adhesive glue from CVAD.**
 - a) True
 - b) False

8. **After blood sampling from an implanted vascular access device (port), you should always flush with a minimum of:**
 - a) 5mL of Normal Saline
 - b) 10mL of Normal Saline
 - c) 20mL of Normal Saline
 - d) 50mL of Normal Saline

- 9. Phlebitis may be caused by mechanical or chemical means**
- a) True
 - b) False
- 10. If the catheter is occluded or there is resistance upon flushing or infusion the nurse will:**
- a) Check the tubing and under the dressing for clamps or kinks
 - b) Attempt to gently irrigate with 10mLs syringe of N/S
 - c) Consider venous thrombosis and assess the patient for further signs and symptoms
 - d) Contact the physician for a possible order for a lysing agent
 - e) All of the above
- 11. Symptoms of local or systemic infection include the following:**
- a) Increased WBC count
 - b) Febrile
 - c) Petechiae
 - d) Decreased heart rate
 - e) Increased heart rate
 - f) A & B
 - g) A, B & E
- 12. All PICCs must use a securement device:**
- a) True
 - b) False
- 13. To dissolve a clot a thrombolytic may be administered by the nurse.**
- a) True
 - b) False
- 14. A turbulent, pulsating flush method is used when flushing a CVAD because it:**
- a) Reduces the PSI pressure on the catheter
 - b) Reduces the risk of pneumothorax
 - c) Eliminates the need for a heparin flush
 - d) Helps to dislodge fibrin and medication residue from the internal lumen
- 15. If an air embolism is suspected, nursing actions include:**
- a) Position patient in right lateral Trendelenburg
 - b) Position patient in left lateral Trendelenburg
 - c) Vital signs and administer O2
 - d) Notify physician
 - e) a, c & d
 - f) b, c & d

Answers for Self Assessment One

| Question | Answer | Refer to page |
|----------|--------|---------------|
| 1. | b) | 4 |
| 2. | d) | 7 |
| 3. | d) | 7 |
| 4. | c) | 7 |
| 5. | a) | 4 |
| 6. | a) | 4 |
| 7. | a) | 5 |
| 8. | d) | 7 |

Answers for Self Assessment Two

| Question | Answer | Refer to page |
|----------|--------|---------------|
| 1. | a) | 15 |
| 2. | a) | 15 |
| 3. | c) | 19,22,25 |
| 4. | a) | 28 |
| 5. | d) | 27 |
| 6. | c) | 16,21,24 |
| 7. | b) | 16 |
| 8. | c) | 25 |
| 9. | a) | 27 |
| 10. | e) | 27 |
| 11. | g) | 27 |
| 12. | a) | 18 |
| 13. | b) | 27 |
| 14. | d) | 12, 13 |
| 15. | f) | 7 |