SUBJECT	Central Lines Advanced Competency for Nurses: Pediatric (RNs and RPNs)	**NUMBER**	C-1804
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Introduction:

A central venous catheter is a catheter inserted centrally through the subclavian, internal jugular or femoral vein, or peripherally through the brachial, saphenous or cephalic vein (peripherally inserted central catheter - PICC). The distal end of the catheter is positioned in the superior or inferior vena cava regardless of the insertion site. (See Appendix A, Figures 1 and 2)

Central venous catheters that are tunneled or implanted i.e. Hickman or Port are considered to be long-term catheters. These catheters are usually tunneled in the subcutaneous tissue in the upper chest below the clavicle then eventually the distal end of the catheter is positioned in the internal jugular vein or axillary/subclavian vein.

Definitions:

Valved PICC: A valved PICC is a central venous catheter with a valve that is present at the distal or proximal tip. Valved PICCs require application of positive pressure (flushing or infusion) or negative pressure (aspiration) for fluid to move within the catheter. Clamping is not necessary; therefore, there are **no** clamps on a valved PICC. (See Appendix A, Figure 3)

Non-valved PICC: a non-valved PICC is a central venous catheter that does not have any valve and must be used in combination with a neutral or positive pressure cap, which will act as the valve. Non-valved PICCs will have clamps. (See Appendix A, Figure 4)

Tunnelled Catheter: a tunnelled catheter has a portion of the catheter tunnelled through the subcutaneous tissue prior to exciting from the skin (usually on the chest wall). There is a cuff on the catheter below the skin which encourages in-growth of fibrous tissue to provide a physical barrier to infection. These catheters are also known as Hickman catheters, Broviac catheters or Cook catheters. (See Appendix A, Figure 5)

Implanted Central Venous Device: an implanted central venous device (ICVAD) is placed under the skin; port is placed in chest or arm. The distal end of the catheter terminates at or near the superior vena cava. This device has a separate policy. (see Nursing Policy C-1830)

Positive Pressure Technique for a non-valved catheter: Exerting pressure on the syringe plunger while clamping and removing the syringe from the cap prevents reflux of blood into the catheter. When there is approximately 1.5 mL of saline solution left in the syringe, clamp catheter while simultaneously injecting a final 0.5 mL. The syringe should never be “bottomed out” or fully depressed. There should always be approximately 1 mL of fluid left in the syringe after this process.

Positive Pressure Technique for a valved catheter: Exerting pressure on the syringe plunger while removing the syringe from the cap prevents reflux of blood into the catheter. When there is approximately 1.5 mL of saline solution left in the syringe, simultaneously inject a final 0.5 mL of saline solution and remove syringe. The syringe should never be “bottomed out” or fully depressed. There should always be approximately 1 mL of fluid left in the syringe after this process.

Stop/start technique: Flush 2 - 3 mL at a time, pausing between each flush, to create a turbulent effect. This removes blood and or medications from the inside of the catheter and prevents catheter occlusion.

Policy:

1. Only authorized nurses (RNs and RPNs) may perform the following procedures related to central venous catheters (see Nursing Policies A-1250 and A-1257 for authorization requirements and competency to perform):
   1.1. initiation of an infusion
   1.2. discontinuation of an infusion
   1.3. obtaining a blood specimen
   1.4. changing the injection cap
   1.5. changing the dressing on a central line

   NOTE: See Nursing Policy C-1820 regarding removal of central line.
   NOTE: Nurses do not discontinue tunneled or implanted catheters.

2. All pediatric patients will have their lines heparinized. For heparin volumes see Appendix B.

3. An infusion via central venous catheter should be regulated by pump or buretrol.
   NOTE: In emergent situations requiring rapid volume resuscitation, a buretrol or pump may not be required.

4. Intravenous (IV) administration and extension sets must have luer lock connections.

5. A needleless system will be used when gaining access to the closed central line

6. A syringe smaller than 10 mL will not be used to gain access to a central venous catheter.

7. The IV tubing and the central venous catheter will be maintained as a closed system.
   7.1. All central lines must have a needleless end-cap.
   7.2. If it is necessary to place a stopcock in the line for administration of medication, a needleless injection cap will be placed on the stopcock to close the system.

8. If a PICC has been inserted, a tourniquet or blood pressure cuff will not be placed on the affected limb above the insertion site.

9. All central line solutions will be completed or discarded within 96 hours (see Nursing Policy T-7000 Tubing Changes).
   EXCEPTION: Parenteral Nutrition (PN), i.e., amino acid and lipid solutions, will be completed or discarded within 24 hours.

10. Intravenous tubing will be changed (see Nursing Policy T-7000 Tubing Changes):
    10.1 a minimum of once every 96 hours
    10.2 Tubing changes may vary based on administration of certain fluids and medications.

11. The Authorized Health Care Professional (Physician or Advanced Practice Nurse) will confirm placement of central venous catheter before usage.

12. Patency should be established prior to administration of any fluid or medication. Patency can be established by aspirating blood from the catheter. If unable to aspirate blood from the catheter:
    12.1. attempt a start/stop flush (never against resistance)
    12.2. clamp and remove cap, attach 10 mL syringe, unclamp and gently pull back until blood visible.
    12.3. If unable to aspirate or flush catheter, notify MD.

13. To maintain patency flush with 2-10 mL of sterile 0.9% sodium chloride (clamping between
    13.1. syringe changes when needed) using the start/stop technique prior to each medication
    13.2. administration, or blood product transfusion, even if continuous infusion present.
    13.3. In the case of a continuous infusion, flush at the port closest to the patient
    13.4. In the case of a multilumen catheter all lumens must be flushed when any lumen is accessed
    NOTE: Flushes must be done manually with a syringe, not through an infusion pump as the pump does not provide enough pressure

14. When a central venous catheter remains in place for a prolonged period and is used intermittently:
    14.1 the line will be clamped when not in use
    14.2 the catheter will be flushed using start/stop technique following its use, a minimum of weekly with 2-10 mL sterile 0.9% sodium chloride, unless otherwise ordered; when the catheter has more than one lumen, all lumens must be flushed with 2-10 mL sterile 0.9% sodium chloride
    14.3 the valved central venous catheter is not clamped and is flushed weekly with 2-10 mL sterile 0.9% sodium chloride using a stop/start and positive pressure technique

15. Catheter cap(s) must be changed every 72 hours in the hospital setting for any central line, continuous or intermittent, or anytime the injection cap appears damaged, is leaking, is filled with blood or contaminated for any reason.

16. Central venous catheter insertion sites will be assessed a minimum of once per twelve hour shift for evidence of cannula related complications.
    16.1 If the patient has unexplained fever or there is pain or tenderness at the insertion site, the dressing will be removed and the insertion site will be examined.
    16.2 If redness, swelling, tenderness or discharge is noted at the site obtain a patient care order for a swab for culture and sensitivity.

17. The central venous catheter dressing will be changed:
    17.1 24 hours post insertion of central line
    17.2 every 7 days for transparent dressings
    17.3 every 48 hours for gauze dressings (a transparent dressing with gauze under is considered a gauze dressing)
    17.4 when the dressing must be removed to allow inspection of the site
    17.5 when the dressing becomes damp, loosened or soiled

18. If a central venous catheter should break or develop a hole, the nurse will:
    18.1 immediately clamp the catheter as close to the skin insertion site as possible with existing catheter clamp or forceps
    18.2 position the patient in Trendelenburg position on left side
    18.3 notify the physician

19. When a central venous catheter is used to infuse Parenteral Nutrition (PN) solutions the single lumen catheter, or a specific lumen of a multilumen catheter, will be designated exclusively for PN solutions.

20. Only nurses authorized in the management of specialty catheters (i.e. hemodialysis lines) may manage the maintenance and care of such devices.

Procedure: The following is a list of appendices regarding central line procedures:
Procedure A: Central line dressing
Procedure B: Initiation of Infusion
Procedure C: Discontinue Infusion
Procedure D: Obtaining a blood specimen
Procedure E: Changing an injection cap
Procedure F: Changing IV
Procedure G: Considerations with a tunneled catheter

PROCEDURE A: CENTRAL LINE DRESSING

Equipment

Dressing Tray
2% chlorhexidine gluconate with 70% alcohol solution/swab
Sterile occlusive dressing, either gauze and tape or a transparent dressing
Sterile Gloves
Mask

Procedure:

1. Perform hand hygiene.

2. Mask, self and patient, if applicable (i.e. in the case of immunocompromised patient).

3. Assess catheter site and surrounding skin.
   3.1 If redness, swelling, tenderness or discharge present, inform the physician and request a patient care order for a swab for culture and sensitivity.

4. Cleanse catheter site with 2% chlorhexidine gluconate with 70% alcohol solution/swab using back- and- forth motion, clean at least a 5 cm area then allow skin to dry.
   4.1 Cover with sterile transparent dressing or gauze dressing as applicable and then label dressing with date, time, and initials of nurse performing procedure.

Recording and Reporting:

1. Notify the physician when:
   1.1 exit site redness, swelling, tenderness or discharge are noted
   1.2 the patient's oral or axilla temperature exceeds 38 degrees Celsius
   1.3 dislodgement of the line is suspected

2. Document on the Interprofessional Comprehensive Patient Care Record, Interprofessional Progress Note or unit specific documents:
   2.1 completion of dressing change, site assessment and patient response

3. Note the next scheduled dressing change in the Interprofessional Patient Profile (kardex).

PROCEDURE B: INITIATION OF AN INFUSION IN AN ESTABLISHED LINE

Equipment:

Via Injection Cap
Alcohol swabs
Syringe 10 mL
Intravenous tubing
Intravenous solution (as ordered)
Sterile 0.9% sodium chloride (0.9% NaCl) vial or
pre-filled syringe 10 mL
4x4 gauze

NOTE:
- If catheter patency is not clearly established, do not flush/initiate infusion. Notify the physician.
- Never connect a syringe with a volume of less than 10 mL to a central venous catheter. The pressure would be too high when injecting or withdrawing and may damage the catheter.

Procedure:

1. Confirm patient care order.
2. Perform hand hygiene.
3. Apply mask to self and patient if patient is immunocompromised.
4. Assess catheter site and surrounding skin.
5. Perform hand hygiene and glove.

Initiation of Infusion in a Central Venous Catheter via Injection Needleless end-cap

1. Prime intravenous tubing with solution, as ordered.
2. Cleanse the port of the injection needleless end-cap by scrubbing thoroughly with alcohol swab. Place cleansed line and needleless end-cap on sterile gauze 4x4.
3. Attach 10 mL syringe.
4. Unclamp, and assess catheter patency (refer to number 12 of policy).Draw a minimum waste of 1.5 mL.
5. Clamp and remove syringe, and attach flush syringe.
6. Unclamp and flush with appropriate amount of sterile 0.9% sodium chloride using start/stop technique. See appendix B for volumes.
7. Connect intravenous tubing, unclamp catheter and initiate infusion.

NOTE: no clamping is required for valved catheter.

PROCEDURE C: DISCONTINUATION OF AN INFUSION

Equipment:

Gloves
Sterile 0.9% sodium chloride vial or pre-filled syringe 10 mL x 2
Heparin 100 units/mL vial or pre-filled syringe
Alcohol swab
Sterile gauze 4x4

NOTE: For recommended volumes of heparin and sodium chloride, see Appendix B.

Discontinuing an Infusion

1. Clamp catheter.
2. Disconnect IV tubing, cleanse catheter cap with alcohol swab and attach sterile 10 mL syringe.
3. Unclamp catheter, verify patency and inject sterile 0.9% sodium chloride (clamping between syringe changes) into the catheter using stop/start and positive pressure technique.
4. Clamp catheter. Remove saline syringe.
5. Insert heparin syringe. Unclamp the catheter and inject recommended volume of heparin using positive pressure technique.
6. Clamp catheter.

NOTE: No clamping required for valved catheter.

Recording and Reporting:

1. Document discontinuation of intravenous solution and fluid volume infused on the Interprofessional Comprehensive Patient Care Record or unit specific document.
2. Document 0.9% sodium chloride and heparin flushes on the Medication Administration Record.
3. Document complications in the Interprofessional Progress Notes.

PROCEDURE D: OBTAINING A BLOOD SAMPLE

Equipment:

Vacutainer
Vacutainer adapter
Waste tube/syringe for waste
Sterile gauze 4x4
Sterile 0.9 % sodium chloride vial or pre-filled syringe 10 mL x 2
Masks
Alcohol swab
Clean gloves
Waterproof pad
Blood transfer device
Specimen bag
Blood tubes (as required for specimen)
Heparin 100 units/mL vial or pre-filled syringe

NOTE: With a multilumen central venous catheter all lumens must be flushed when ANY lumen is accessed.

NOTE: Coagulation studies (e.g., PT, PTT, INR) may be drawn from a central venous catheter ONLY when other access is not possible.

Blood Withdrawal from a Central Line
****For information pertaining to blood cultures please see blood culture collection tool on intranet under clinical tool tab****

1. Confirm the patient care order.

2. Prepare flush syringes with 0.9% sodium chloride and syringe with recommend volume of heparin.

3. Prepare a sterile 10 mL syringe and/or waste tube with vacutainer and adapter.

4. Perform hand hygiene.

5. Mask, self and patient, if applicable i.e. in the case of immunocompromised patient.

6. Cleanse the port of the injection needleless end-cap by scrubbing thoroughly with alcohol swab (let dry for 1 minute). Place cleansed line and needleless end-cap on sterile gauze 4x4.

7. If drawing blood from a line where an infusion is running in the other lumen, stop the infusion for at least 30 seconds prior to blood sampling, and flush with recommended volume of sterile 0.9 sodium chloride prior to sampling.

8. Clamp line. Insert syringe.

9. Unclamp, establish patency, and then flush with recommended volume of sterile 0.9% sodium chloride (clamping between syringe changes) using stop/start technique. Clamp and remove syringe. If the line is heparinzed, remove a waste prior to flushing the line.

10. Insert syringe or vacutainer set up into catheter cap port. Unclamp.

11. If using syringe system, pull back on the syringe plunger to obtain recommended volume of blood as waste. Clamp and discard waste.
    11.1 Insert new syringe and unclamp, draw off blood required and transfer into the appropriate tubes using a blood transfer device to maintain the order of draw.

12. If using a Vacutainer system, insert device, withdraw into a waste tube, clamp and discard waste.
    12.1 Continue drawing off according to the order of draw.
    12.2 Clamp between blood tube changes and after all samples obtained.

13. Attach 10 mL syringe of sterile 0.9 % sodium chloride, unclamp and flush with recommended volume of sterile 0.9% sodium chloride solution (clamping between syringe changes) using stop/start and positive pressure technique.

14. Insert heparin syringe and inject recommended volume of heparin using the positive pressure technique and clamp catheter.
    NOTE: No clamping required for valved catheter

Reporting and Recording:

1. Document sterile 0.9% sodium chloride flushes and heparin on the Medication Administration Record.

2. Document nursing observations and actions in the Interprofessional Comprehensive Patient Care Record, Interprofessional Progress Note or unit specific documents.

PROCEDURE E: CHANGING AN INJECTION CAP

Equipment:

Masks x 2
Gloves
Needleless end-cap(s)
Sterile 0.9 % sodium chloride vial or pre-filled syringe 10 mL x 2
Multipurpose dressing tray (optional)
Alcohol swab
Sterile gauze 4x4
Heparin 100 units/mL vial or pre-filled syringe

NOTE: Catheter needleless end-cap(s) must be changed every 3 days on intermittent or continuously used catheters and/or replaced sooner when there are signs of needleless end-cap damage or blood in the needleless end-cap, e.g., crack, leak or contamination.

Procedure:

1. Perform hand hygiene.

2. Apply mask to self and patient if patient is immunocompromised.

3. May prepare multipurpose dressing tray (optional).

4. Using aseptic technique prefill injection needleless end-cap with 0.9 % sodium chloride.

Changing the Injection Needleless End-cap

1. Prepare a 10 mL syringe with sterile 0.9 % sodium chloride and second syringe with recommended volume of heparin.

2. Drop prefilled sterile needleless end-cap onto sterile gauze or onto dressing tray.

3. Scrub the connection and the contiguous tubing as applicable with alcohol (let dry 1 minute). Place cleansed line and needleless end-cap on sterile 4x4 gauze.

4. Clamp catheter and remove old injection needleless end-cap.

5. Attach prefilled sterile needleless end-cap.

6. Unclamp and assess patency.

7. Clamp and connect the syringe to the catheter. Inject 2-10 mL sterile 0.9 % sodium chloride (clamping between syringe changes) and flush using the stop/start technique. Clamp.

8. Insert heparin syringe and inject recommended amount of heparin using positive pressure technique.

9. Leave catheter clamped if not in use.

Recording and Reporting:

1. Document needleless end-cap change on the Interprofessional Comprehensive Patient Care Record, Interprofessional progress notes or unit specific flow sheet.

2. Document next needleless end-cap change on the Interprofessional Patient Profile.

3. Document heparin on the Medication administration record.

PROCEDURE F: CHANGING IV TUBING

Equipment:

Masks x 2
Gloves
Dressing tray
Alcohol swabs
Intravenous solution (as ordered)
Sterile gauze 4x4
Syringe 10 mL
Sterile 0.9 % sodium chloride vial or pre-filled syringe 10 mL x 2
Intravenous tubing (as required)

NOTE: If IV tubing being changed, any added devices should also be changed such as needleless end-caps or extension lines.

Procedure:

1. Apply mask to self and patient, if patient is immunocompromised.

2. Assess catheter site and surrounding skin.

3. Scrub catheter and intravenous tubing junction for a minimum of 30 seconds with alcohol (let dry for 1 minute).

4. Prime intravenous tubing with prescribed solution.

5. Perform hand hygiene.

6. Clamp catheter.

7. Remove the old intravenous tubing and insert the new intravenous tubing. Ensure luer lock is secured tightly.

8. Unclamp catheter and initiate intravenous infusion.

Reporting and Recording:

1. Document needleless end-cap change on the Interprofessional Comprehensive Patient Care Record, Interprofessional progress notes or unit specific flow sheet.

2. Document the date of the next needleless end-cap change on the Interprofessional Patient Profile.

PROCEDURE G: CONSIDERATIONS WITH A TUNNELLED CATHETER

1. A tunnelled catheter with neutral or positive pressure end cap is treated the same as any other central line. See procedures above, and for additional management see below.

2. **Dressing:** Refer to Procedure A above. Once the entry site is healed no dressing is required (typically 21 days post insertion). This type of catheter is very heavy and should be securely anchored to the chest wall

NOTE: Pinch off syndrome: Pinch off syndrome occurs when the catheter is "pinched" or compressed between two bony structures. This pinching will lead to an inability to infuse or withdraw from the catheter. Repeated wear and tear on the pinched portion of the catheter can lead to catheter fracture or embolus. Physician should be consulted if there is suspicion of pinch off syndrome.

NOTE: If flushing is possible but aspiration is not the physician should be consulted prior to infusing fluids.

Related Policies

A-1250 Clinical Nursing Procedures: Designation, Authorization and Education, and Competency to Perform (Policy)
A-1257 Clinical Nursing Procedures: Advanced Competency Procedures Approved for Nurses (RNs and RPNs), Authorization/Challenge/Re-authorization Requirements, and Basic Procedures for Which Additional Education is Required (Policy)
C-1820 Removal of Central Line
C-1830 Implanted Central Venous Access Device
T- 7000 Tubing Changes

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Director, Professional Practice – Nursing Signature

Date

Appendix A
Additional Photographs for identification of Lines

Anatomical Location of Short and Long Term Central Venous Catheters

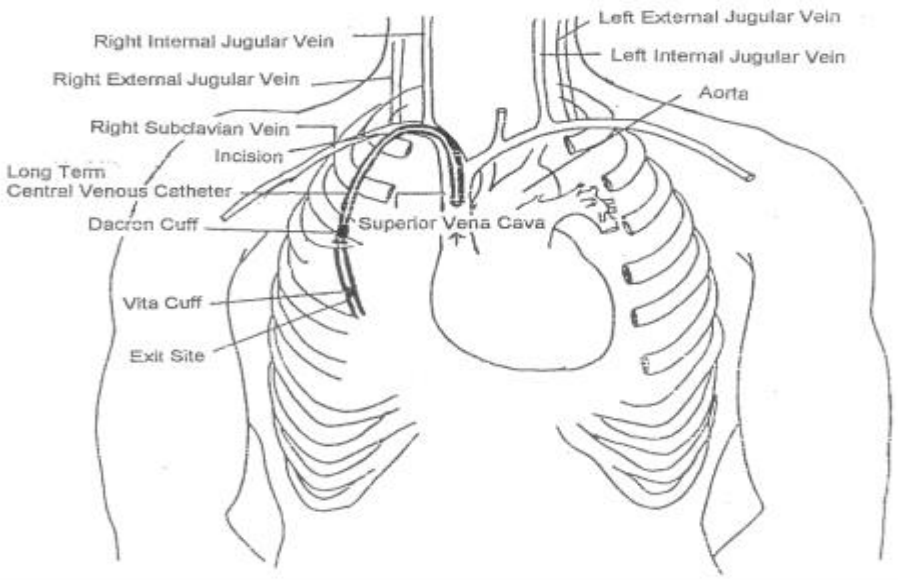


Figure 1

Figure 2

Valved PICC *note no clamp

Figure 3

Non- Valved PICC *note clamp

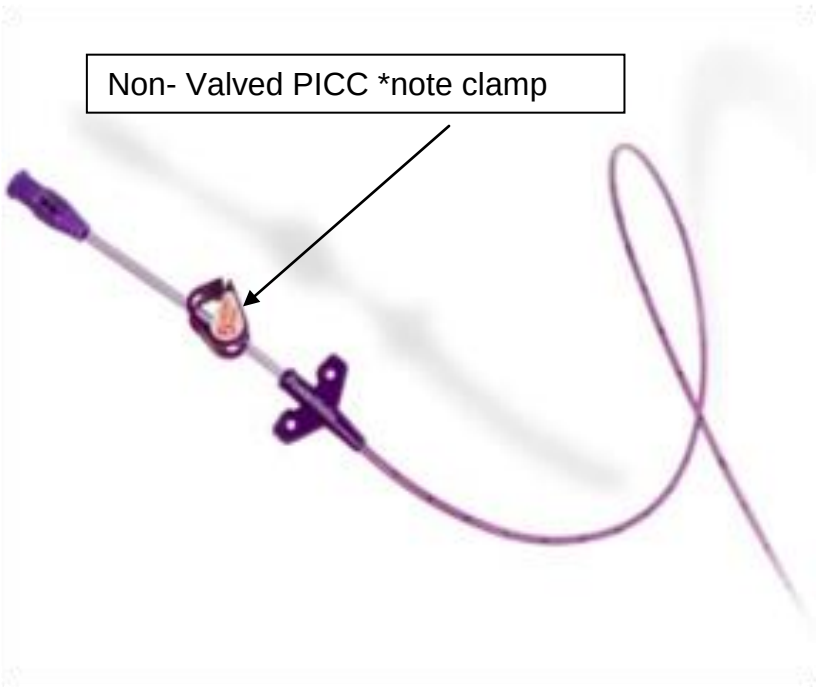
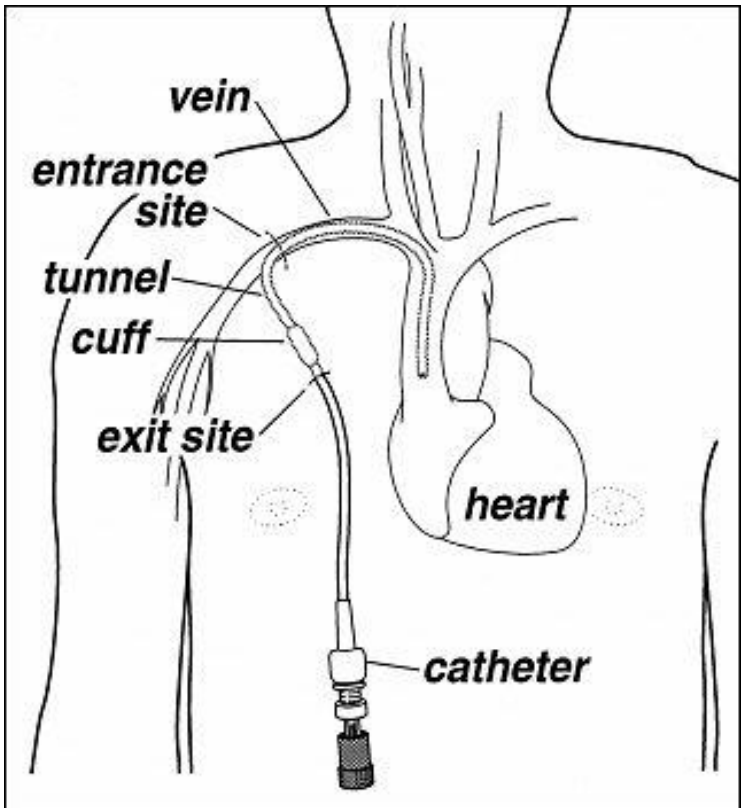


Figure 4


vein
entrance site
tunnel
cuff
exit site
heart
catheter

Appendix B
Usual flush solutions and volumes.
These require a patient care order.
Patients who are allergic to heparin, or who have heparin induced thrombocytopenia syndrome (HITS) require alternative flush solutions.

Type of Catheter/ Line	Patient Weight	Flush Agent to Maintain Patency	Minimum Flushing Volume with 0.9% Sodium Chloride (0.9% NaCl) Before and After Intermittent Medication Administration and Blood Sampling
Central Line per lumen	5 kg or less	50 units of heparin 100 units per mL (0.5 mL) diluted in 1 mL of 0.9% sodium chloride (0.9% NaCl)	3 mL (1.5 mL if patient is fluid restricted). Draw waste of 1.5 mL before blood sampling and flush post sampling with 3 mL.
	Pediatric More than 5 kg and less than 50 kg	150 units of heparin 100 units per mL (1.5 mL)	2-10 mL pre and post medication administration in a 10 mL syringe. Consideration is given to the diameter of the catheter, the size of the patient and fluid restrictions. The smaller the diameter of the catheter the smaller the flush. Draw waste of 1.5 mL before blood sampling and flush post sampling with 2-10mL.
	Adult or pediatric patient 50 kg or more	250 units of heparin 100 units per mL (2.5 mL)	20 mL pre and post medication administration. Draw waste of 6 mL before blood sampling adhering to the order of draw and flush post sampling with 20 mL.