

PARKLAND HEALTH & HOSPITAL SYSTEM
Nursing Services

Section: Intravenous Therapy
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**CENTRAL VENOUS CATHETERS: INSERTION, CARE, and USE
& REMOVAL (SINGLE OR MULTILUMEN) — ADULT PATIENTS**

PRACTICE

STATEMENT: The licensed nurse shall assist the provider with central venous catheter insertion. Administration of medications and/or IV fluids through the catheter and dressing changes are the responsibility of the assigned licensed nurse. The Central Venous Catheter may be removed by registered nurses upon written order of a provider in Critical Care, Medical and Surgical areas.

Collection of blood specimens is limited to the provider and/or registered nurse at the provider's direction.

Neonatal Services, refer to Nursery Services #900.02 Central Venous Catheters <http://intranet.pmh.org/home/PP-Index/NICU/900/900.02.doc>

PURPOSE: To establish and maintain a central venous access to be used for central venous pressure monitoring, obtaining blood specimens, administering parenteral nutrition, medications, fluid, and blood/blood products.

EQUIPMENT: For Insertion:
Central venous catheter kit or subclavian tray
Sterile 4x4's - two (2) packets
Transparent occlusive and antimicrobial dressing
IV fluids as ordered
Needleless compatible IV tubing, extension sets, infusion plugs according to the number of lumens intended for use
Stopcocks, if needed
IV pump and tubing as ordered or required
Syringes
30 ml Normal Saline for injection
Sheet roll
Sterile towels
Sterile gloves
Mask
Cap (if hair long or loose)
Sterile gown

For Maintenance of Ports:

One 3-ml needleless syringes
Flush solution as ordered (saline and/or heparin)
Alcohol prep pads

For Administration of Medications/Fluid/Blood Products:

Flush solution as ordered
Alcohol prep pads
Extra infusion plugs
Item to be administered, with syringe or needleless tubing, (labeled with contents)
Gloves

For Dressing Change:

In-line dressing change kit
Antimicrobial dressing

For Tubing Change:

IV infusion tubing
Extension sets
Alcohol prep pads
Infusion plugs
Stopcocks, if needed
Manometer, if in use for central venous pressure (CVP)
Gloves

Transducer Set-up

Pressure monitoring kit with disposable transducer
1000-ml Normal Saline (Heparin added as ordered)
Transducer holder
IV pole
Monitor

For Blood Sampling:

One (1) vial normal saline for injection or prefilled syringe
Two (2) 10-ml syringes
One (1) syringe (appropriate size for the total volume of specimen required)
or
Vacutainer tubes and connector
Flush solution as ordered
Lab tubes, requisition slips and patient identification labels
Alcohol prep pads
Sterile gloves

For Central Venous Pressure Measurement:

IV fluid as ordered
IV infusion tubing
CVP manometer
Extension set
Alcohol prep pads
Sterile gloves for connecting tubing

For Removal of Catheter:

4x4's
Tape
Occlusive Dressing
Suture removal set
If catheter tip is for culture
Sterile container
Patient labels
Requisition

PROCEDURES:

A. INSERTION OF CATHETER:

1. Identify patient by using two identifiers, name and medical record number or name and date of birth if no armband, provide privacy and explain procedure.
2. Assemble equipment.
3. Prepare IV fluid(s) and tubing(s) making sure not to allow open tubing ends to touch non-sterile surfaces. Purge the tubing with IV fluid and remove all air. This may be one or more tubing, depending on the number of catheter lumens and their intended use. Label, date, time and initial all tubing. Place IV bag on IV pole at the patient's bedside, away from the sterile field but within easy access of the assistant.
4. Follow appropriate "TIME OUT" procedure. Obtain base line vital signs.
5. Clip the hair around the catheter insertion site, if necessary. Do not shave the area.
6. Provide analgesic and/or sedation for the patient as ordered by the provider.
7. Don mask. Wash hands.
Note: Person performing the insertion wears sterile gloves, gown, mask and cap (if hair long or loose).

8. Open the central venous catheter insertion kit.
9. Open sterile gloves.
10. Assist the provider with skin preparation of the catheter insertion site as needed.
11. After the provider has inserted the catheter, each lumen is checked for blood return. Lumens must be capped and flushed until the provider has verified line placement by chest X-ray. (*Refer to Section B for Maintenance of Ports*)
In an emergency: If IV fluids must be administered prior to the line verification by chest X-ray, do so per provider's order.
12. The provider sutures the catheter in place.
13. The licensed nurse should assess the patient throughout the procedure to determine his/her tolerance. If the patient is on a Cardiac monitor, the nurse should monitor vital signs and heart rhythm as the catheter is introduced for any significant fluctuations. Any deviation from baseline should be reported to the provider immediately. Immediately following the procedure, the nurse should assess the patient for immediate complications or adverse reactions, e.g., pneumothorax, characterized by dyspnea and tachycardia.
14. Apply dressing, with antimicrobial dressing positioned with the white surface to the skin, around the catheter insertion site, the slit lying underneath the catheter line. Cover with the occlusive dressing. (*Refer to Section D for Tubing and Infusion Plug Change and E. Dressing Change*)
15. Make the patient comfortable and auscultate for bilateral breath sounds.
16. Obtain a "STAT" chest X-ray.
17. Assure removal and disposal of all sharps and other equipment appropriately.
18. Document the procedure in the Nurses Notes.

The assessment shall include:

- a. Date and time of procedure
 - b. Name of provider
 - c. Site of insertion
 - d. Type of fluid infusing in each lumen
 - e. Blood return from each lumen
 - f. Chest X-ray ordered, completed and verified
 - g. Patient tolerance of procedure
19. Record all fluid and additives on the flow sheet.

B. MAINTENANCE OF HEPARIN LOCK:

Note: All stopcock ports shall be capped with needleless infusion plugs. Stopcocks shall never be used in the lumen through which parenteral nutrition is administered. Lumen(s) not in continuous use shall be capped with infusion plug(s) and flushed according to unit guidelines or as ordered by the provider.

1. Identify the patient by using two patient identifiers (name and medical record number) and explain the procedure.
2. Wash hands and locate the infusion plug(s) to be flushed.
3. Prep the infusion plug with alcohol prep pads and allow to dry.
4. Flush as per provider's order or according to unit guidelines.
5. Unless otherwise indicated, a heparin lock is established using 2 mls of 100 units/ml of Heparin flush in each lumen.
6. Notify the provider if lumen(s) become clotted, and label clotted lumens to prevent inadvertent usage.

C. ADMINISTRATION OF MEDICATIONS/FLUID/BLOOD PRODUCTS:

NOTE: The medication syringe or IV tubing may be connected directly to the lumen or, by a needleless syringe, through the infusion plug. For intermittent infusion, connect with needleless connection through infusion plug. After each intermittent medication infusion, the lumen shall be flushed. Clamp the catheter any time the injection plug is removed.

1. Identify the patient using two patient identifiers (name and medical record number) and explain the procedure.
2. Wash hands, don gloves and expose the site to be used.
3. Clean the connection with alcohol prep pads.
4. Insert saline flush syringe, check blood return and flush lumen with 10 ml saline and remove syringe.
5. Connect medication syringe or IV tubing connection and administer required dose at appropriate rate.

6. Remove syringe or IV connection. Replace a sterile infusion plug using an aseptic technique if one was removed.
7. Flush as ordered.
8. Remove gloves and wash hands.

D. TUBING AND INFUSION PLUG CHANGE:

Tubings, extension sets, stopcocks, infusion plugs, and manometers shall be changed every 72 hours or with insertion of a new line. All non luer-lock connections must be taped to prevent inadvertent disconnection.

1. Prime the tubing and extension set with IV fluid (For parenteral nutrition refer to <http://intranet.pmh.org/home/PP-Index/Nursing/18-07.pdf> NSG 18-07 Administration of Parenteral Nutrition).
2. Clamp the catheter while disconnecting the old infusion plug and tubing and connecting the new infusion plug and tubing. Assure that no open ports come in contact with non-sterile surfaces.

E. DRESSING CHANGE:

1. If possible, place the patient in a supine or semi-Fowler's position, with his/her head turned away from the catheter site.
2. Don mask and cap, if hair long and loose. Wash hands.
3. Don non-sterile gloves and remove the dressing by lifting the transparent dressing and stretching it away from the catheter. Holding the catheter in place gently peel the dressing and antimicrobial dressing towards the patient's head. Evaluate the insertion site. Observe for evidence of infection, pain at the site of insertion of catheter, as well as mechanical problems with the catheter (*kinking, leaks, improperly placed or missing sutures, etc.*). Report problems to the patient's provider and document response, orders obtained/not obtained in Nurses Notes.
4. Remove non-sterile gloves.
5. Open the dressing change kit and don sterile gloves:
 - a. Scrub the catheter site and an area as large as the dressing size around it, with an alcohol swab, from the catheter entry to the periphery. Repeat two times. Allow to dry.

- b. Scrub the catheter site with antimicrobial or per unit protocol, from catheter entry to the periphery. Repeat X2. Allow to dry.
- c. Place the antimicrobial dressing around the catheter insertion site with the blue side up, white side to the patient's skin, and the slit lined up under the catheter line.
 - The occlusive and antimicrobial dressing shall be changed **every seven (7) days or prn** as the integrity is disrupted.

NOTE: If an antimicrobial dressing is not used, the dressing must be changed in **72** hours.

- d. Apply a transparent dressing.
 - e. Secure the catheter tubing and dressing with tape to prevent the catheter tubing from being pulled or disconnected.
 - f. Note the date, time of the dressing change and your initials on the outside of the dressing.
6. If the catheter dressing becomes soiled, wet, or loosened, it must be changed according to the outlined procedure.
 7. Remove gloves and wash hands.
 8. Document dressing and tubing changes, and observations of the catheter entry site in the Nurses Notes, and/or Flowsheets.

F. **BLOOD SAMPLING:**

NOTE: Performed by the provider and/or registered nurse.

1. Identify the patient by name and medical record number and explain the procedure.
2. Compare the armband to the label and requisition at bedside.
3. Don gloves.
4. Clean the infusion plug with alcohol prep pads.
5. Use 10 ml syringe to withdraw 5-7 ml of blood from the catheter. Remove the syringe and discard.

6. Using the appropriate size syringe, withdraw the total amount of specimen required. Remove the syringe. Transfer the specimen to the appropriate tube(s).
7. Flush the catheter lumen with ordered flush.
8. Place the labeled tubes and requisition in Biohazard bag at bedside.
9. Remove gloves and wash hands.

NOTE: When a continuous infusion is in progress, prepare as in E.1 through 3. Then disconnect the IV tubing while the patient is holding his/her breath, connect the 10 ml syringe and remove 5-7 ml blood, remove the syringe, connect the specimen collection syringe, or use the clamps on the catheter lumens. Flush the lumen with 10 ml normal saline for injection and reconnect the IV.

G. CENTRAL VENOUS PRESSURE (CVP) MEASUREMENT USING WATER MANOMETER

1. Connect the IV tubing to the ordered fluid (e.g., 500-ml normal saline) and prime it.
2. Clamp the manometer to the IV pole, and insert the IV connection into manometer stopcock.
3. Prime the manometer tubing by closing the manometer port of the stopcock.
4. Don sterile gloves and connect the manometer tubing directly to the patient's extension set. Clean connection with antimicrobial preps and allow to dry.
5. Maintain the IV flow at keep open rate.
6. To measure the central venous pressure, place the patient in a flat supine position. If this cannot be achieved, make certain the zero point is always at the same height for each measurement.
7. Mark the zero point on the patient at the mid-axillary line measuring about 10-12 cm from the back in the fourth intercostal space (a point approximately level with the right atrium).
8. Turn stopcock off to IV fluid and open between manometer and patient.
9. Observe the falling fluid column in the manometer; check for respiratory fluctuations.

10. Turn the stopcock on the manometer to allow IV fluid to rise in the column to approximately 20-cm. Avoid letting the fluid reach the fiber-filled cap of the manometer when filling it initially.
11. Turn the stopcock to allow the fluid level in the manometer to fall (normal 5-12 cm). Read when equilibrium is reached, at the end of expiration. Identify CVP measurement when the fluid level stops falling. Repeat 8 and 9 to check measurement.
12. Close off the manometer port of the stopcock and restart the other fluid or adjust the rate to keep open, bypassing the manometer.
13. Document CVP readings on the Flow Sheet and notify provider of abnormal parameters.

NOTE: Conversion factor from water to mercury: 1.36 cm H₂O = 1 mm Hg

H. CENTRAL VENOUS PRESSURE MEASUREMENT USING TRANSDUCER SET-UP (Refer to NSG 28-12_Setting up Transducers for Monitoring Arterial/PA and/or CVP Pressures <http://intranet.pmh.org/home/PP-Index/Nursing/28-12.pdf>)

I. CENTRAL VENOUS CATHETER REMOVAL

NOTE: Registered Nurse in Critical Care, Medical and Surgical Areas

1. Verify provider's order.
2. Identify patient by using patient's name and medical record number.
3. Explain procedure to patient.
4. Wash hands.
5. Turn off all infusions and clamp all ports.
6. Place patient in Trendelenburg position if able to tolerate. If unable to tolerate, place in supine position.
7. Don nonsterile gloves and remove dressing.
8. Inspect site for redness, pain, swelling, exudate, or other problems.
9. Don sterile gloves and cleanse site with antimicrobial.
10. Remove sutures. (Be careful to not cut catheter.)

11. Have patient perform Valsalva maneuver or hold breath to decrease risk of air embolism during catheter removal. If patient is receiving mechanical ventilation, remove catheter during expiration.
12. Remove catheter with a steady, gentle motion. If resistance is met, stop removal process and notify provider.
13. Following removal, with sterile 4X4, apply firm pressure to site for a minimum of 5 minutes. Additional time may be required if receiving anticoagulants or patients with coagulopathies.
14. Once bleeding has stopped, immediately apply antiseptic ointment to occlude site and cover with an occlusive dressing.
15. Inspect catheter length and integrity of catheter.
16. If culture is to be obtained, do not allow tip to touch any non-sterile surfaces, cut catheter tip with sterile suture scissors. Place catheter tip in sterile container at bedside and send to the Microbiology laboratory within 30 minutes. Match label to armband and requisition.
17. Document date/time of catheter removal, observations, actions, tolerance to procedure and patient teaching.
18. Change dressing and assess site for signs of infection every 24 hours until healed.
19. Continue to assess patient for complications.

FACTORS CAUSING FLUCTUATIONS, VARIANCES AND INACCURACIES IN CENTRAL VENOUS PRESSURE MONITORING:

- 1) Inaccurate zero point
- 2) Increased intrathoracic pressure
- 3) Hyperventilation
- 4) Catheter tip is not placed correctly in central venous system
- 5) Obstruction at catheter tip

COMPLICATIONS OF CENTRAL VENOUS THERAPY:

- 1) Lost catheter fragments
- 2) Infection
- 3) Thrombo/air embolism
- 4) Pneumothorax, mediastinal infiltration and subcutaneous emphysema
- 5) Hemorrhage, hematoma
- 6) Hydrothorax, hemothorax

- 7) Brachial plexus injury
- 8) Ventricular arrhythmias

IF THE CATHETER SHOULD BECOME DISCONNECTED:

- 1) Reconnect /occlude the open catheter
- 2) Call for assistance
- 3) If appropriate, place the patient on the left side in the Trendelenberg position
- 4) Notify the provider
- 5) Check vital signs as indicated
- 6) Oxygen as ordered

SYMPTOMS TO BE OBSERVED FOR:

- 1) Restlessness
- 2) Chest pain
- 3) Hypotension
- 4) Cyanosis
- 5) Dyspnea
- 6) Tachycardia
- 7) Tachypnea
- 8) Syncope
- 9) Wheezing