I. Purpose: To maintain catheter patency and prevent catheter related bloodstream infection.

II. Routine Maintenance (every 12 hours); After IV Administration of TPN, IV Fluid or Medications

A. Equipment and/or Supplies:
   1. Chloraprep wipes (or povidone iodine swabs)
   2. 10 ml syringe filled with 5 ml of sterile 0.9% Saline with 2ml of 100 units per ml heparin (patient more than 5 Kg) or 10 units per ml heparin (patient less than 5 Kg)
   3. Sterile gloves
   4. Curos Cap(s)

B. Procedure:
   1. Wash hands with soap and water thoroughly and dry. Wear gloves.
   2. Swab the top of the injection cap with Chloraprep wipe for at least three seconds and let dry.
   3. Discard the used Chloraprep wipe. Be careful not to touch the opening of the injection cap after swabbing
   4. Insert syringe directly into the injection cap and turn clockwise.
   5. Inject heparinized saline, infusing last 0.5 ml as the syringe is withdrawn from the injection cap. (This helps prevent a vacuum which can pull a small amount of blood into tip of catheter.) Discard used syringe into sharps container.

   Note: Apply Curos Cap to dormant port(s).

III. After Blood Aspiration for Any Reason or When Blood is observed in the Catheter

   Note: If blood is aspirated prior to infusion of medications (to verify venous placement), catheter should be irrigated with 10 ml of normal saline prior to attaching medication syringe, IV tubing or infusion pump tubing Failure to do so may result in an occluded catheter, leading to difficulty in aspirating in the future.

A. Equipment and/or Supplies:
   1. Chloraprep wipe(s)
   2. 10 ml syringe filled with 5 ml of sterile 0.9% Saline with 2ml of 100 units per ml heparin (patient more than 5 Kg) or 10 units per ml heparin (patient less than 5 Kg)
   3. Sterile gloves
   4. Curos Cap(s)
B. Procedure:
1. Wash hands thoroughly with soap and water. Dry hands and wear gloves.
2. Swab the top of the injection cap with Chloraprep at least three seconds and let dry.
3. Discard the Chloraprep in appropriate trash bin. Be careful not to touch the opening of the injection cap after swabbing.
4. Insert syringe with 10 ml saline directly into the injection cap and turn clockwise, flush to clear blood from catheter.
5. If unable to flush all blood residues out of the injection cap, replace it per injection cap change procedure. (This helps prevent a vacuum which can pull a small amount of blood into tip of catheter.)

Note: Apply Curos cap to all dormant ports.

IV. Flushing Guidelines for Small Patients
Use the same procedure as used for adults with the following exceptions:

Use 2 ml normal heparinized saline (for routine maintenance - every 12 days; or after IV administration of TPN, IV fluids, or medications).

A. Use 3 ml normal saline after blood aspiration for any reason, or when blood is observed in the catheter.

Note: This amount is insufficient to clear blood from the injection cap. The injection cap should be changed following blood withdrawal.

V. Injection Cap Change Procedure

A. Purpose: To minimize potential for infection from overuse of injection cap.

B. Frequency:
1. Every seven days (about 18 uses).
2. When the injection cap has been removed for any reason.
3. Anytime the injection cap appears damaged, is leaking, blood is seen in the catheter without explanation or blood residue is observed in the injection cap.
4. After blood withdrawal through the injection cap.

C. Supplies:
1. New sterile injection cap
2. Chloraprep wipes
3. 10 ml syringe filled with 5 ml of sterile 0.9% normal saline
4. Sterile gloves
5. Curos Cap(s)
D. Procedure:
1. Wash hands thoroughly with soap and water. Dry hands and don sterile gloves.
2. Using aseptic technique, open injection cap package and pre-fill injection cap with normal saline.
3. Hold the hub of the catheter below the level of the patient's heart (prevents "manometer effect" or fluid drop in the catheter) and remove the old injection cap.
4. Clean the outside of the catheter hub with Chloraprep.
5. Remove the tip protector from the new injection cap and twist clockwise onto the catheter hub.
6. Irrigate the catheter with 5 ml normal, heparinized saline as per Catheter Irrigation procedure.
7. Apply Curos cap to each dormant port.

VI. PICC Dressing Change Procedure

A. Purpose: To prevent external infection of the central venous catheter.

B. Frequency:
1. Every seven days and PRN if dressing is loose or damp.
2. Chlorhexidine gluconate (Chloraprep) is the suggested antiseptic to use. Acetone and tincture of iodine should not be used. 2% Chlorhexidine gluconate or 70% isopropyl alcohol swabs may be used for dressing changes. Povidone-iodine may also be used as an antiseptic.

C. Supplies:
1. 1 each – ChloraPrep One-Step Applicator
2. 2 each – 2 in. x 2 in. gauze – optional
3. 1 each – 10 x 12 cm transparent occlusive dressing
4. 1 pair – Sterile gloves
5. Biopatch
6. Statlock Securement Device

D. Procedure:
1. Wash hands with soap and water and dry thoroughly.
2. Carefully remove all dressing and discard. Avoid tugging on the catheter, use of scissors or other sharp objects near the catheter.
3. Inspect the catheter exit site for swelling, redness or exudate. Notify physician if problem observed.
4. Wash hands thoroughly with soap and water.
5. Dry hands and put on sterile gloves.
6. Clean the catheter exit site with the ChloraPrep One-Step applicator. Pinch the wings on the ChloraPrep One-Step Applicator to break the ampule and release the antiseptic. Do not touch the sponge.
7. Wet the sponge by repeatedly pressing and releasing the sponge against the treatment area until fluid is visible on the skin.
8. Use repeated back-and-forth strokes of the sponge approximately 30 seconds. Completely wet the treatment area with antiseptic. Allow the area to dry for approximately 30 seconds. Do
not blot or wipe away. Maximum treatment area for one applicator is approximately 130 cm² (approximately 4 x 5 in.).

9. Discard the applicator after a single use. Remove and discard gloves. Fold 2 in. x 2 in. gauze in a half and place it under the catheter hub (if desired.)

10. Apply the Biopatch dressing and cover with transparent occlusive dressing over the exit site and catheter tubing.

11. Attach additional Statlock securement device avoiding placement of tape directly on the polyurethane catheter material.

VII. Clearing Occluded Catheters

A. **Purpose:** To restore patency to a catheter with an occlusion.

B. **Supplies:**
   1. 1 – sterile injection cap
   2. Thrombolytic solution
   3. 1 – 10 ml syringe
   4. 1 – 10 ml syringe filled with 10 ml normal saline
   5. 1 – 10 ml syringe filled with 5 ml of sterile heparinized normal saline
   6. Chloraprep wipes
   7. Clean gloves
   8. Curos Cap(s)

C. **Procedures:**
   1. Wash hands with soap and water. Dry hands thoroughly.
   2. Remove injection cap, attach an empty 10 ml syringe and attempt to aspirate. If aspiration is unsuccessful, withdraw clots and flush catheter with 10 ml normal saline. Replace cap. Inject heparinized saline, infusing last 0.5 ml as the syringe is withdrawn from the injection cap. (This helps prevent a vacuum which can pull a small amount of blood into tip of catheter.) If aspiration is unsuccessful, proceed to step 3.
   3. Obtain physician’s order for the use of thrombolytic solution to declot the catheter. Note: Cautions obtained in medication package insert should be observed.
   4. Draw enough thrombolytic solution into 10 ml syringe to equal the internal volume of the catheter (volume may be reduced if catheter length has been cut.)
   5. Aseptically attach the thrombolytic solution filled syringe to the catheter hub. Slowly and gently inject the thrombolytic solution into the catheter using push–pull motion to achieve maximum mixing. To avoid catheter rupture, do not force entire amount into catheter if strong resistance is felt.
   6. Leave 10 ml syringe attached to catheter. Do not attempt to aspirate for 30 to 60 minutes.
   7. After 30 minutes, attempt to aspirate the drug and residual clot. If unsuccessful, repeat thrombolytic instillation.
   8. When patency is restored, aspirate 5 ml of blood to assure removal of all drug and clots.
   9. Remove blood-filled syringe and replace it with a 1 ml syringe filled with normal saline. Flush catheter to verify patency.
10. Inject heparinized saline, infusing last 0.5 ml as the syringe is withdrawn from the injection cap. (This helps prevent a vacuum which can pull a small amount of blood into tip of catheter.)
11. Attach a sterile, saline-filled injection cap. Apply Curos cap to dormant port.
12. Attach securement device avoiding placement of tape directly on the polyurethane catheter material.

Note:
   a. For unsuspected lipid deposition occlusion when thrombolytic solution does not clear the blockage, a sterile ethanol 70% solution may be instilled and left in place for one hour. Follow procedure for thrombolytic instillation.
   b. For unsuspected calcium and phosphate precipitation when thrombolytic solution does not clear blockage, a sterile 0.1% N hydrochloric acid solution may be instilled in the catheter and left in place for one of hour. The solution is then aspirated and the catheter flushed with normal saline.

   This may help to clear the catheter of calcium-phosphate or other drug precipitates. Sodium bicarbonate may also be used for precipitates that are soluble in a basic solution.

VIII. Troubleshooting Guide

A. Aspiration Difficulties
   1. Possible Causes
      a. Failure to flush according to Catheter Irrigation Procedure, resulting in lumen obstruction.
      b. Catheter opening may suck up against vein wall with aspiration.
      c. Blood clot, fibrin sheath, or particulate matter obstructing catheter.
         - A clot or other obstruction in the catheter lumen can produce a one-way valve effect. During infusion, the catheter with wall expands slightly and allows fluid to flow around the obstruction. During aspiration, the catheter wall contracts slightly, tightening down around the obstruction and preventing aspiration.
         - Fibrin sheaths usually begin to form within a few days after the insertion of a central venous catheter.
         - When it has grown enough to extend to the tip of the catheter, it may be pulled into and obstruct the catheter valve when aspiration is attempted, but offer no resistance to infusion.
      d. Kinked catheter outside or inside the body.
      e. Suture constriction at the catheter skin exit site.
      f. Catheter may be curled or kinked within the vessel or under the dressing.
      g. Malposition of catheter tip (i.e. jugular vein, outside of vein).

   2. Possible Solutions:
Procedure
File: “P” Peripherally Inserted Central Catheter

a. Visually check catheter tip for any exterior kinks or constricting sutures. If sutures are present their removal may release the constriction and allow aspiration.
b. Move patient’s arm, shoulder and head to see if a change in position will allow aspiration.
c. If no resistance to infusion is felt, attempt to flush with 10 ml normal saline. Then pull back gently on syringe plunger 2 – 3 ml, pause and proceed with aspiration.
d. If resistance to infusion is felt, check for signs of extravasation. If present, notify physician of possibility of catheter leakage. If not present go to step
e. Attempt to aspirate with a 20 ml syringe (creates greater vacuum).
f. If resistance to aspiration is still present, attempt physician’s order for a CXR or dye study to determine catheter position and status.
g. If studies indicate occlusion is due to a blood clot or drug precipitate, obtain physician’s order regarding the use of thrombolytic or other solution to clear catheter.
   • If the catheter tip is not in the superior vena cava, it should be repositioned.
   • If the catheter tip is out of the vein, it should be replaced.

B. Catheter Occlusion
1. Possible Causes
   b. Drug precipitate or lipid deposition completely obstructing lumen.
   c. Maybe kinked, coiled or damaged.
   d. If sutures were used during the placement of the catheter, they can tighten and restrict flow.

2. Possible Solutions
   a. Attempt to aspirate blood clot.
   b. Inspect patient for presence of sutures around the catheter. If sutures are present they should be removed.
   c. Move patient’s arms, shoulder and head to see if position change affects ability to infuse.
   d. Obtain physician’s order and instill thrombolytic solution or other solution as ordered.
   e. Obtain physician’s order for a CXR or dye study to determine the position of the catheter.

C. Catheter Damage
1. Possible Causes
   a. Repeated clamping.
   b. Contact with a sharp object.
   c. Rupture from attempt to irrigate an occluded with a small syringe (i.e. 1 or 3 ml). Small syringes can generate very high internal pressures with a very little force.
      • The back pressure from an occlusion may not be felt when using a small syringe until damage to the catheter has occurred.
   d. Rupture from attempts to power inject through an occluded catheter.

2. Possible Solutions
Procedure
File: “P” Peripherally Inserted Central Catheter

a. When repairing, always fold the catheter between the patient and the damaged area and tape it together, or clamp the catheter between the patient and the damaged area with a smooth-edged, atraumatic clamp.

D. Air in Line
1. Possible Causes
   a. Hole in catheter.
   b. Injection cap not prefilled with normal saline.
   c. Loose connections (injection cap, IV tubing).
   d. “Manometer effect” – holding the catheter connector and above the level of the heart while it is open to the air creates a manometer effect, with fluid dropping to a level 8-10 ml above the insertion site.

2. Possible Solutions
   a. Check catheter for leakage by flushing well with normal saline.
   b. Pre-fill injection cap with normal saline before attaching it to the catheter.
   c. Check for loose connections (injection cap, IV tubing).
   d. Perform procedures requiring the catheter to be opened to the air with the connector end below the level of the patient’s heart.
   e. If the catheter is not damaged, aspirate the air and then irrigate the catheter with 10 ml normal saline to flush out any aspirated blood.

E. Fluid Leakage from Catheter Exit Site
1. Possible Causes
   a. Catheter punctured by sharp object (i.e. scalpel, suture needle, scissors) just prior to placement.
   b. Catheter ruptured from attempt to irrigate an occluded catheter with a small syringe (i.e., 1 ml or 3 ml syringe).
      - Small syringes can generate very high internal pressures with a very little manual force. The back pressure from an occlusion may not be felt when using a small syringe until the damage to the catheter has occurred.
   c. Catheter may have become encapsulated by a fibrin sheath, which prevents infused fluid from entering the venous system. The fluid will then take the path of least resistance, flowing back along the outside of the catheter to the skin exit site.
   d. Rupture from attempts to power inject through an occluded catheter.
   e. Central vein thrombosis or tumor growth occluding the vein can cause infused fluid to flow back along the outside of the catheter to the skin exit site.

2. Possible Solutions
   a. Slowly infuse 10 ml of normal saline and observe for signs of fluid extravasation under the skin.
   b. Obtain physician’s order for a dye study through the catheter to determine path of fluid flow.
   c. Remove the catheter if a leak is discovered inside the body. (Report such incidents to Bard Access Systems, Inc. (800-443-5505 – Field Assurance Dept.)
d. If a leak is discovered in the catheter outside of the body, repair it following the Catheter Repair Procedure appropriate for the catheter type and the location of the damage.

IX. Reference List:
D. BARD Universal Power PICC Procedures, Revised 2004
E. Bard PICC Care and Maintenance Guide, Revised 2007