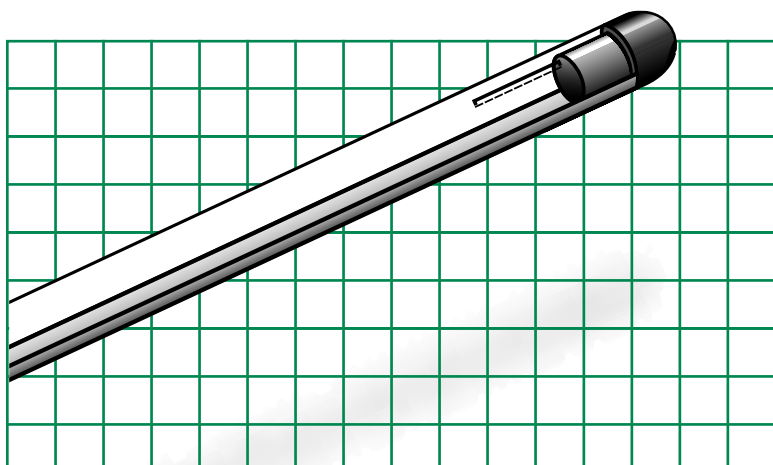


**Bard Access Systems**

---

# **Groshong<sup>®</sup> C.V. Catheters**



**NURSING PROCEDURE MANUAL**

---

**IBARD**

---

# Table Of Contents

	Page
<b>Introduction</b> .....	<b>1</b>
Description	
Placement	
Valve Function	
Indications for Use	
VitaCuff® Antimicrobial Cuff	
Warnings	
<b>Catheter Irrigation Procedure</b> .....	<b>10</b>
Routine Maintenance	
After Blood Aspiration	
Blood Sampling After TPN	
Pediatric Flushing Guidelines	
<b>Blood Withdrawal/Aspiration Procedure</b> .....	<b>12</b>
Hub-To-Hub Technique	
Needle Through Injection Cap Technique (vacuum blood collection system)	
<b>Injection Cap Change Procedure</b> .....	<b>15</b>
<b>Dressing Change Procedure</b> .....	<b>17</b>
Gauze and Tape Dressing	
Transparent Dressing	
<b>Clearing Occluded Catheters Procedure</b> .....	<b>22</b>
For Suspected Blood or Fibrin Occlusion	
<b>Pressure Monitoring Procedure</b> .....	<b>25</b>
Water Manometer	
Pressure Transducer	
<b>Repair Kit / Specifications Table</b> .....	<b>26</b>
<b>Connector Repair Procedure</b> .....	<b>27</b>
<b>Single-Lumen Catheter Body Repair Procedure</b> .....	<b>29</b>
<b>Multi-Lumen Catheter Extension Repair Procedure</b> ..	<b>33</b>
<b>Multi-Lumen Catheter Body Repair Procedure</b> .....	<b>37</b>
<b>Troubleshooting Guide</b> .....	<b>41</b>
I. Aspiration Difficulties	
II. Bleedback in Catheter	
III. Catheter Occlusion	
IV. Catheter Damage	
V. Air in Line	
VI. Fluid Leakage From Catheter Exit Site	

---

# *Introduction*

## **Description**

Groshong® catheters consist of soft, medical grade silicone tubing with a closed rounded tip. Unlike open-ended catheters, the closed end has a patented three-position valve (or valves) which allows fluids to flow in or out, but remains closed when not in use.

This manual refers to the use of the following **Groshong** Valve products:

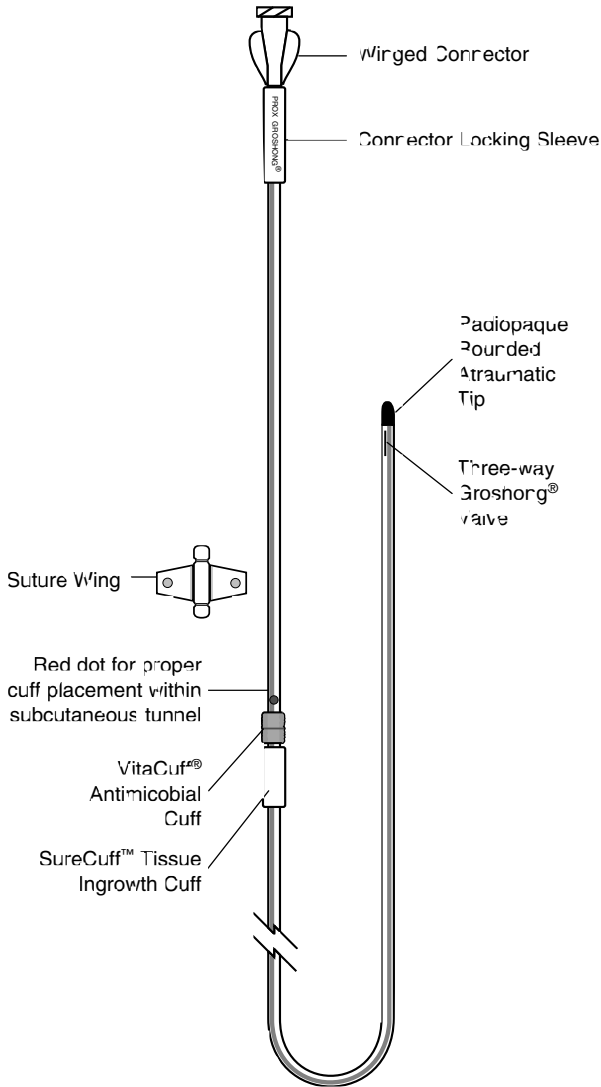
- 1 **Groshong** Central Venous Catheters (long-term, cuffed)
- 2 **Groshong** O.T.G. Central Venous Catheters (non-cuffed)
- 3 **Groshong** Acute Care Central Venous Catheters (non-cuffed)

In addition to the **Groshong** Valve, **Groshong** Catheters have the following features:

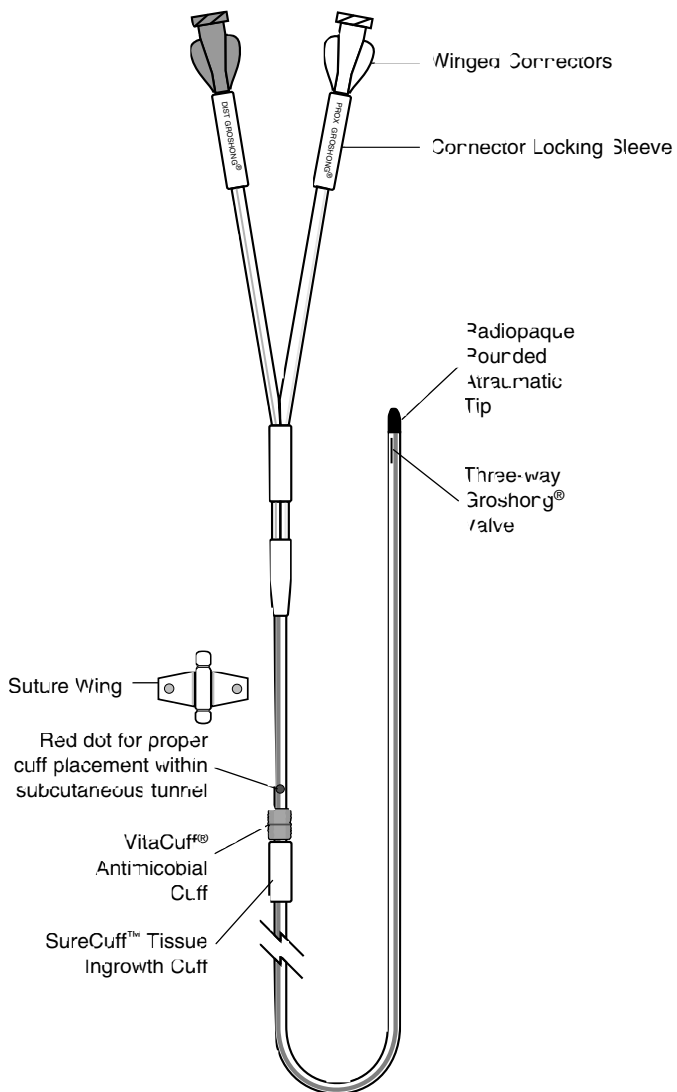
- Soft, medical grade silicone tubing
- Radiopaque tip
- Radiopaque stripe
- SureCuff™ Tissue Ingrowth Cuff (long-term catheters) (acute care catheters are not cuffed)
- Winged connector(s)
- Depth markings
- VitaCuff® Antimicrobial Cuff
- Attachable suture wings
- Large lumen(s)
- Single or multiple lumens

---

## Groshong® Single-Lumen Catheter Features



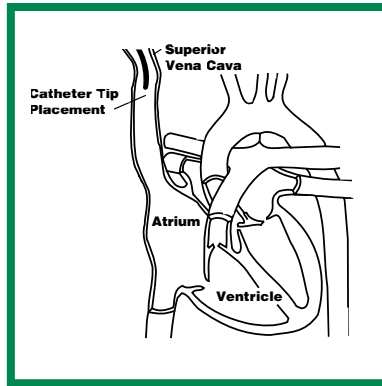
## Groshong® Dual-Lumen Catheter Features



---

## Placement

The catheter is placed into one of the large central veins so the tip lies in the superior vena cava above the right atrium. The long-term catheter is tunneled subcutaneously for several inches to the desired exit site. The **SureCuff** Tissue Ingrowth Cuff, attached to the long-term catheter, is positioned in the tunnel. The cuff promotes tissue ingrowth to secure the catheter in place.



## Groshong® Valve Function

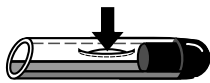
The **Groshong** central venous catheter incorporates the patented, three-position, pressure-sensitive **Groshong** valve. The valve is located near the rounded, closed, radiopaque catheter tip and allows fluid infusion and blood aspiration. When not in use, the valve restricts blood backflow and air embolism by remaining closed.

The **Groshong** valve is designed to remain closed between -7 and 80mm Hg. Since the normal central venous pressure range in the superior vena cava is 0 to 5mm Hg, the valve remains closed at normal central venous pressure. Pressure in the superior vena cava

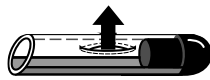
---

must exceed 80mm Hg to open the valve inward. Also, negative pressure (vacuum) will cause the valve to open inward, allowing blood aspiration.

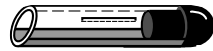
When the valve is closed, air cannot enter the venous system if the catheter is open to the air unless the superior vena caval pressure drops below -7mm Hg. Positive pressure into the catheter (gravity, pump, syringe) will open the valve outward, allowing fluid infusion. When pressures return to between -7 and 80mm Hg, the valve will close. The need for the anticoagulant effect of heparin is eliminated because the closed valve prevents blood from entering the catheter and clotting. **If the catheter is aspirated, pulling the valve inward, it must be flushed with normal saline to allow the valve to return to its normal closed position.**



**ASPIRATION**  
Negative Pressure



**INFUSION**  
Positive Pressure



**CLOSED**  
Neutral Pressure

**Groshong** multi-lumen catheters have **Groshong** valves which are staggered and rotated, allowing the concurrent infusion of incompatible drugs. Each lumen of a multi-lumen catheter is treated separately for maintenance and irrigation purposes.

---

## Groshong catheters have the following benefits

1. **Increased patient safety** due to reduced risk of air embolism or bleedback.
2. **Virtual elimination of heparin flushing** to maintain catheter patency.
3. **Reduced need for catheter clamping.**
4. **Reduced need for flushing** when the catheter is not in use (only flushed every seven days with normal saline when not in use).

---

## Indications for Use

1. **Groshong Long-Term Catheters** are designed for long-term central venous access. They are available in both a single lumen catheter (3.5, 5.5, 7 and 8 Fr) and a dual lumen (5.0 Fr and 9.5 Fr) catheter.
2. **Groshong O.T.G. Catheters** are designed for short-term vascular access in the acute care setting. They are available as both triple and dual lumen catheters (15, 20 and 30 cm. lengths).
3. **Groshong Acute Care Catheters** are designed for short-term vascular access in the acute care setting. They are available as both triple and dual lumen catheters (15, 20, and 30 cm. lengths).

All **Groshong** Central Venous Catheters are designed for the administration of IV fluids, blood products, drugs, and parenteral nutrition solutions, as well as blood withdrawal.

Catheters with **VitaCuff** Antimicrobial Cuffs are intended to help provide protection against catheter-related exit site infection and sepsis.

---

## VitaCuff® Antimicrobial Cuff

### *Description*

The VitaCuff® device is designed to help provide protection against infections related to vascular access catheters. The outer, tissue-interfacing surface of the **VitaCuff** device may help reduce the incidence of infection by incorporating an antimicrobial agent into the porous collagen matrix.

The **VitaCuff** device is comprised of two concentric layers of material.



The internal layer is constructed of specially formulated and processed medical grade silicone. The external, tissue-interfacing layer is VitaGuard® antimicrobial collagen matrix. The antimicrobial activity of the **VitaGuard** material is attributable to the silver ions bound to the collagen matrix. The activity lasts until the **VitaGuard** matrix is completely absorbed by the tissue in four to six weeks.

The **VitaGuard** collagen sponge is initially in a compressed state for ease of insertion. After placement, the matrix absorbs physiological fluids, quickly expands to approximately twice its original size, and helps provide an antimicrobial barrier and a physical barrier at the exit site. Tissue ingrowth into the **VitaGuard** collagen matrix occurs in a few days, further securing the catheter in place, and reducing catheter movement.

**CAUTION:** The antimicrobial cuff **is not intended to be used as a treatment for catheter related infections.** The antimicrobial cuff does not provide protection against “blood seeding” infection or infusate-related infection. It is not intended to provide protection from bacteria for longer than one month. The antimicrobial cuff should not be used on patients with known sensitivities to silver ions or collagen.

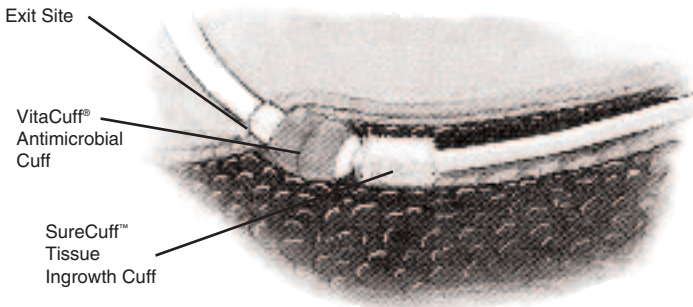
---

## **Warnings:**

Infusion pressures should never exceed 25 psi. Smaller syringes generate more pressure than larger syringes. A two pound weight equivalent force on the barrel of a 3cc syringe generates pressure in excess of 25 psi. The same two pound weight equivalent force on the barrel of a 10cc syringe generated less than 8 psi of pressure. It is recommended that no smaller than a 10cc syringe be used for infusion into a **Groshong** catheter.

When catheter damage or connector separation occurs, the catheter should be immediately clamped or kinked closed to prevent any possibility of air embolism or loss of blood.

Universal precautions should be observed by all health care professionals when performing the procedures included in this manual.



---

## *Catheter Irrigation Procedure*

### **Purpose**

To maintain catheter patency.

***Routine Maintenance (every 7 days; or after IV administration of TPN, IV fluids, or medications)***

### **Supplies**

- Isopropyl alcohol and/or povidone-iodine wipes
- 10cc syringe with attached 1 in. needle filled with 5cc sterile 0.9% Sodium Chloride (normal saline)

### **Procedure**

1. Clean injection cap with alcohol and/or povidone-iodine wipe.
2. Insert needle of syringe filled with 5cc normal saline into injection cap.
3. Inject saline, infusing last  $\frac{1}{2}$  cc as the needle is withdrawn from injection cap. (Helps prevent a vacuum which can pull a small amount of blood into tip of catheter).

***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 check venous placement), catheter should be irrigated with 10cc of normal saline prior to attaching medication syringe, IV, or infusion pump tubing. Failure to do so may result in an occluded catheter, leading to difficulty in aspirating in the future.

---

## Supplies

- Isopropyl alcohol and/or povidone-iodine wipes
- 10cc with attached 1 in. needle filled with 10cc sterile 0.9% Sodium Chloride (normal saline)

## Procedure

1. Follow routine maintenance procedure, except use 10cc normal saline and flush to clear blood from catheter.
2. If unable to flush all blood residue out of the injection cap, replace it after blood sampling per Injection Cap Change Procedure (per hospital policy).

***Prior to blood sampling when TPN infusing:***

## Procedure

1. Follow routine maintenance procedure, **except use 20cc normal saline** and flush to clear TPN from catheter.

***Pediatric Flushing Guidelines*** (For use with 3.5 Fr to 5.5 Fr catheters only. Larger catheters require more volume):

Use the same procedure as is used for adults with the following amounts:

- 2cc normal saline-routine maintenance (every 7 days; or after IV administration of TPN, IV fluids, or medications)
- 3cc normal saline-after blood aspiration for any reason, or when blood is observed in the catheter.

## References

“Patient Information Manual, **Groshong**/Cath-tech® CV Catheter-Long Term,” Catheter Technology Corporation, Salt Lake City, UT, 1988.

---

# *Blood Withdrawal / Aspiration Procedure Irrigation*

## **Purpose**

To obtain blood samples for laboratory evaluation, eliminating the need for peripheral vein punctures.

To verify venous placement prior to administration of hypertonic or vesicant solutions.

**NOTE:** If you encounter difficulties with blood withdrawal, see Troubleshooting Guide-Aspiration Difficulties.

## ***Hub-To-Hub Technique (syringe):***

## **Supplies**

- 3 - 10cc syringes
- 1 - 1 in. needle
- Sterile 0.9% Sodium Chloride (normal saline)
- Isopropyl alcohol wipes/povidone-iodine wipes
- Blood specimen tubes

## **Procedure**

1. Wash hands thoroughly.
2. Draw up 10cc of normal saline in syringe and set aside.
3. Stop any IV fluids infusing through the catheter, including another lumen of the catheter.
4. Remove injection cap/IV tubing from catheter hub.
5. Clean catheter hub with alcohol and/or povidone iodine wipe.
6. Attach an empty 10cc syringe to catheter hub.
7. Pull back syringe plunger 1-2cc, pausing for 2 seconds to allow catheter valve to open and blood to

---

come into catheter. Slowly continue to aspirate 5cc of blood.

8. Disconnect syringe and discard (saline in catheter dilutes specimen and may alter lab values).
9. Attach an empty 10cc syringe and aspirate per Step 6 to withdraw amount of blood needed for testing.
10. Disconnect syringe and attach saline-filled syringe.
11. Flush the catheter with 10cc normal saline.
12. Disconnect syringe and clean catheter hub with alcohol and/or povidone-iodine wipe.
13. Attach new injection cap per Injection Cap Change Procedure or attach sterile IV tubing to hub of catheter.
14. Attach 1 in. needle to blood sample syringe to transfer to blood collection tubes.

***Needle Through Injection Cap (vacuum blood collection system):***

(May use 10cc syringe with attached needle in place of vacuum blood collection system.)

## **Supplies**

- Vacuum blood collection device
- 2-10cc syringes with attached 1 in. needle
- Sterile 0.9% Sodium Chloride (normal saline)
- Isopropyl alcohol wipes/povidone-iodine wipes
- Blood specimen tubes

## **Procedure**

1. Wash hands thoroughly.
2. Draw up 10cc of normal saline in syringe and set aside.
3. Stop any IV fluids infusing through the catheter, including another lumen of the catheter.

- 
4. Clean injection cap with alcohol and/or povidone-iodine wipe.
  5. Insert needle of empty 10cc syringe into injection cap.
  6. Pull back syringe plunger 1-2cc, pausing for 2 seconds to allow catheter valve to open and blood to come into catheter. Slowly continue to aspirate 5cc of blood.

**NOTE:** A vacuum collection specimen tube may be used to withdraw the discard sample, but be sure to use one with at least a 5cc capacity.

7. Remove syringe from injection cap and discard.
8. Clean injection cap with alcohol and/or povidone-iodine wipe,
9. Insert vacuum blood collection system needle into the injection cap. Push blood specimen tube into vacuum collection device sleeve so that needle pierces rubber stopper.
10. Blood needed for specimen will flow into specimen tube. Change tubes as needed for required tests.
11. Remove vacuum blood collection system and sleeve from injection cap.
12. Clean injection cap with alcohol and/or povidone-iodine wipe.
13. Insert needle of saline-filled syringe and flush the catheter with 10cc of normal saline.
14. If unable to flush all of the blood residue out of the injection cap, attach a new sterile injection cap per Injection Cap Change Procedure (per hospital policy).

## References

Keegan, Marylou & Snyder, Gale, “**Groshong**® CV Catheters - Protocol For Nursing Care & Maintenance,” Catheter Technology Corporation, Salt Lake City, UT, February 1986.

---

## *Injection Cap Change*

### **Purpose**

To minimize potential for infection from overuse of injection cap.

### **Frequency**

- Every seven days (about 18 needle insertions) or per hospital policy.
- When the cap has been removed for any reason.
- Anytime the cap appears damaged, is leaking, blood is seen in the catheter without explanation, or blood residue is observed in the cap.
- After blood withdrawal through the injection cap (per hospital policy).

### **Supplies**

- New sterile injection cap
- Alcohol wipes
- Tape
- 10cc syringe with attached 1 in. needle filled with 5cc sterile 0.9% Sodium Chloride (normal saline)

### **Procedure**

1. Wash hands.
2. Using aseptic technique, open injection cap package and prefill 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 an alcohol wipe and/or povidone-iodine wipe.
  5. Remove the tip protector from the new injection cap and twist the cap clockwise onto the catheter hub.
  6. Irrigate the catheter with 5cc normal saline following the Catheter Irrigation Procedure (per hospital policy).
  7. Tape the connection (per hospital policy).

## References

Keegan, Marylou & Snyder, Gale, "**Groshong CV Catheters - Protocol For Nursing Care & Maintenance,**" Catheter Technology Corporation, Salt Lake City, UT, February 1986.

---

## *Dressing Change Procedure*

### **Purpose**

To prevent infection of the central venous catheter.

### **Frequency**

Gauze and tape dressings - M, W, F, and prn if soiled, damp, or loosened.

Transparent dressings - every 7 days and prn if loosened.

**NOTE:** If granulocyte count less than 200/mm, you may wish to consider changing the dressing daily.

### ***Gauze and Tape Dressing:***

(Long-term catheters: recommended for first 1-2 weeks after placement until the cuff is healed in due to exit site exudate during healing process.)

### **Supplies**

Sterile dressing kit which includes:

- 3 - Isopropyl alcohol swabsticks or hydrogen peroxide and sterile cotton-tipped applicators
- 3 - Povidone-iodine swabsticks
- 1 - Packet povidone-iodine ointment (optional)
- 1 - 2 in. x 2 in. gauze
- 1 - 2 in. x 2 in. split gauze
- 1 - Protective dressing wipe or swabstick (optional)
- 1 - Pair sterile gloves (recommended if dressing is changed in a healthcare facility due to increased risk of cross-contamination)

---

## Procedure

1. Wash hands thoroughly.
2. Carefully remove old dressing and discard. Avoid tugging on the catheter, or the 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 is observed.
4. Wash hands thoroughly.
5. Put on sterile gloves (if used).
6. Clean the catheter exit site with an alcohol swabstick or hydrogen peroxide-soaked cotton-tipped applicator, starting at the exit site and spiraling outward until a circle at least 3 inches in diameter has been covered. Do not return to the catheter exit site with the same swabstick/applicator. Repeat with the remaining 2 swabsticks/applicators.
7. Clean the catheter exit site with a povidone-iodine swabstick, starting at the exit site and spiraling outward until a circle at least 3 inches in diameter has been covered. Do not return to the catheter exit site with the same swabstick. Repeat with the remaining 2 swabsticks.
8. Allow povidone-iodine to dry at least 2 minutes.
9. Gently clean the outside of the catheter with the inside surface of an alcohol wipe, starting from the exit site to the catheter hub. Prevent pulling on the catheter by holding the catheter at the exit site with one alcohol wipe and cleaning with another alcohol wipe.
10. Apply a small amount of povidone-iodine ointment to the catheter exit site (optional).
11. Apply a split 2 in. x 2 in. gauze over the catheter exit site.
12. Top with a 2 in. x 2 in. gauze.
13. If a protective dressing wipe or swabstick is used, apply it to the skin to be taped around the periphery of the 2 in. x 2 in. gauze and allow to dry completely.

- 
14. Cover gauze and 1 in. of surrounding skin with tape.
  15. Loop catheter tubing and tape it securely to dressing or skin (prevents pulling on the catheter exit site).

### *Transparent Dressing*

### Supplies

- 3 - Alcohol swabsticks or hydrogen peroxide and sterile cotton-tipped applicators
- 3 - Povidone-iodine swabsticks
- 1 - Packet povidone-iodine ointment (optional)
- 1 - Transparent dressing
- 2 - Isopropyl alcohol wipes
- 1 - Pair sterile gloves (recommended if dressing is changed in a healthcare facility due to increased risk of cross-contamination)
- 1 - 2 in. x 2 in. or 4 in. x 4 in. sterile gauze

### Procedure

1. Wash hands thoroughly.
2. Carefully remove old dressing and discard. **Avoid tugging on the catheter, or the use of scissors, or other sharp objects near the catheter.**
3. Inspect catheter exit site for swelling, redness, or exudate. Notify physician if problem is observed.
4. Wash hands thoroughly.
5. Put on sterile gloves (if used).
6. Clean the catheter exit site with an alcohol swabstick or hydrogen peroxide-soaked cotton-tipped applicator, starting at the exit site and spiraling outward until a circle at least 3 inches in diameter has been covered. Do not return to the catheter exit site with the same swabstick/applicator. Repeat with the remaining 2 swabsticks/applicators.

- 
7. Clean the catheter exit site with a povidone-iodine swabstick, starting at the exit site and spiraling outward until a circle at least 3 inches in diameter has been covered. Do not return to the catheter exit site with the same swabstick. Repeat with the remaining 2 swabsticks.
  8. Allow povidone-iodine to dry at least 2 minutes.
  9. Gently clean the outside of the catheter with the inside surface of an alcohol wipe, starting from the exit site to the catheter hub. Avoid pulling on the catheter by holding the catheter at the exit site with one alcohol wipe and cleaning with another wipe.
  10. Pat the exit site with sterile gauze to remove any excess povidone-iodine.
  11. Apply a small amount of povidone-iodine ointment to the catheter exit site (optional).
  12. Apply the transparent dressing by centering it over the catheter exit site.
  13. Loop the catheter tubing and tape it securely to the skin (prevents pulling at the catheter exit site).

## References

Jarrard, MM, Olsen, CM, Freeman, JB, "Daily Dressing Change Effects On Skin Flora Beneath Subclavian Catheter Dressings During Total Parenteral Nutrition," *Journal of Parenteral & Enteral Nutrition*, Vol. 4, No. 4, 1980, pp. 391-392.

Murphy, LM, Lipman, TO, "Central Venous Catheter Care in Parenteral Nutrition: A Review," *Journal of Parenteral & Enteral Nutrition*, Vol. 11, No. 2, 1987, pp. 190-201.

Nehme, AE, Trigger, JA, "Catheter Dressings in Central Venous Parenteral Nutrition: A Prospective Randomized Comparative Study," *Nutritional Support Services*, Vol. 4, 1984, pp. 42-50.

---

Palidar, PJ, Siminowitz, DA, Oreskovich, MR, "Use of Opsite as an Occlusive Dressing for Total Parenteral Nutrition Catheters," *Journal of Parenteral & Enteral Nutrition*, Vol. 6, No. 2, 1982, pp. 150-151.

Powell, C, Regan, C, Fabri, PJ, et al, "Evaluation of Opsite Catheter Dressings for Parenteral Nutrition: A Prospective Randomized Study," *Journal of Parenteral & Enteral Nutrition*, Vol. 6, No. 1, 1982, pp. 43-46.

Schwartz, Fulton, J, Colley, R, Valanis, B, et al, "Hyperalimentation Dressings & Skin Flora," *NITA*, Vol. 4, 1981, pp. 354-357.

Vasquez, RM, Jarrard, MM, "Care of the Central Venous Catheterization Site: The Use of a Transparent Polyurethane Film," *Journal of Parenteral & Enteral Nutrition*, Vol. 8, No. 2, 1984, pp. 181-186.

Petrosino, B, Becker, H, & Christian, B, "Infection Rates in Central Venous Catheter Dressings," *Oncology Nursing Forum*, Vol. 15, No. 6, 1988, pp. 709-717.

---

## *Clearing Occluded Catheters*

### **Purpose**

To restore patency to a catheter with an occlusion.

### **Supplies**

- 1 - Sterile injection cap
- 5,000 IU/cc urokinase (catheter priming volume)
- 1 - 10cc syringe with attached 21 gauge 1 in. needle
- 1 - 10cc normal saline-filled syringe with attached 21 gauge 1 in. needle
- Isopropyl alcohol wipes

### **Procedure**

1. Wash hands.
2. Remove injection cap, attach an empty 10cc syringe and attempt to aspirate. If aspiration is successful, withdraw clots and flush catheter with 10ml normal saline. Replace cap. If aspiration is unsuccessful, proceed to Step 3.
3. Obtain physician's order for the use of urokinase 5,000 IU/cc to declot the catheter. **Note: Cautions contained in medication package insert should be observed.**
4. Draw up enough urokinase 5,000 IU/cc into a 10cc syringe to equal the internal volume of the catheter (volume may be reduced if catheter length has been cut). See **Groshong** Catheter Specifications for catheter priming volumes.
5. Aseptically attach the urokinase-filled syringe to the catheter hub. Slowly and gently inject the urokinase solution into the catheter using a 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 10ml syringe attached to catheter. Do not attempt to aspirate for 30-60 minutes.
7. After 30 minutes, attempt to aspirate the drug and residual clot. If unsuccessful, repeat urokinase instillation.
8. When patency is restored, aspirate 5ml of blood to assure removal of all drug and clots.
9. Remove blood-filled syringe and replace it with a 10cc syringe filled with normal saline. Flush catheter to verify patency.
10. Attach sterile, saline-filled injection cap.

**NOTE:**

- **For suspected lipid deposition occlusion** when urokinase does not clear the blockage, an ethanol 70% solution may be instilled and left in place for 1 hour. Follow procedure for urokinase instillation.
- **For suspected calcium and phosphate precipitation** when urokinase does not clear blockage, a sterile 0.1 N Hydrochloric Acid solution may be instilled in the catheter and left in place for one 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.

---

## References

Bjeletich, J, "Dec clotting Central Venous Catheter with Urokinase in the Home by Nurse Clinicians," NITA, Nov/Dec 1987, pp. 428-430.

Faubion, WC, Bollish, SJ, Wesley, JR, "Central Venous Catheter Occlusion Treated by Thrombolytic Agents," Nutritional Support Services, Vol. 3, No. 2, 1983, pp. 24-26.

Gale, GB, O'Connor, DM, Chu, J-Y, Stanley, D, "Restoring Patency of Thrombosed Catheters with Cryopreserved Urokinase," Journal of Parenteral & Enteral Nutrition, Vol. 8, No. 3, 1984, pp. 298-299.

Murphy, LM, Lipman, TO, "Central Venous Catheter Care in Parenteral Nutrition: A Review," Journal of Parenteral & Enteral Nutrition, Vol. 11, No. 2, 1987, pp. 190-201.

Pennington, DR, Pithic, AD, "Ethanol Lock in the Management of Catheter Occlusion," Journal of Parenteral & Enteral Nutrition, Vol. 11, No. 5, 1987, pp. 507-508.

Shulman, RJ, Reed, T, Pitre, D, Laine, L, "Use of Hydrochloric Acid to Clear Obstructed Central Venous Catheters," Journal of Parenteral & Enteral Nutrition, Vol. 12, No. 6, 1988, pp. 509-510.

---

## *Pressure Monitoring*

### **Purpose**

To determine blood volume, fluid replacement needs, and right heart pressures.

### **Procedure / Water Manometer**

1. Set up IV lines and manometer according to hospital protocol.
2. Flush tubing with IV fluid.
3. Zero the manometer at the level of the prone patient's right atrium.
4. Turn the stopcock on the manometer so that the IV fluid runs into the manometer, not the patient.
5. As the fluid level slowly nears the top of the manometer, rotate the stopcock to allow fluid to flow from the manometer into the patient.
6. Fluid will slowly lower in the manometer until it stabilizes. Record that value.
7. Subtract the "valve closing pressure" from the manometer reading (5.44cm H<sub>2</sub>O or 4mm Hg) to give the true central venous pressure reading.

### **Procedure / Pressure Transducer**

1. Set up pressure transducer per hospital protocol.
2. Continuous IV flow through the catheter maintains the **Groshong** valve in the "open" position, permitting a direct reading of central venous pressure. There is no need to subtract the valve closing pressure.

## Repair Kit / Specifications Table

Catheter Description	Repair Kit Number	Connector Number	Total Length	Tip-Cuff	Volume	Gauge	O.D. / I.D.
<b>Single-Lumen</b>							
Groshong 3.5 Fr.	7741350	7712350	35 cm	8 cm	0.13 cc	19 Ga.	1.1 / 0.7 mm
Groshong 5.5 Fr.	7741550	7712550	40 cm	18 cm	0.4 cc	16 Ga.	1.8 / 1.1 mm
Groshong 7.0 Fr.	7741700	7712700	50 cm	24 cm	0.7 cc	15 Ga.	2.2 / 1.3 mm
Groshong 8.0 Fr.	7741800	7712800	50 cm	24 cm	0.9 cc	14 Ga.	2.5 / 1.5 mm
Groshong 8.0 Fr. Extra Long	7741800	7712800	65 cm	31 cm	1.2 cc	14 Ga.	2.5 / 1.5 mm
<b>Dual-Lumen</b>							
Groshong 5.0 Fr.	7740000 - ext	7712500 - red 7712510 - white	52 cm	18 cm	0.42 cc - red 0.35 cc - white	19 Ga. - red 20 Ga. - white	1.6 / 0.8 mm - red / 0.6 mm - white
Groshong 9.5 Fr.	7742000 - body 7740000 - ext	7712500 - red 7712510 - white	60 cm	24 cm	0.83 cc - red 0.52 cc - white	15 Ga. - red 17 Ga. - white	3.2 / 1.33 mm - red / 1.10 mm - white
Groshong 9.5 Fr. Extra Long	7742000 - body 7740000 - ext	7712500 - red 7712510 - white	67.5 cm	31 cm	0.94 cc - red 0.57 cc - white	15 Ga. - red 17 Ga. - white	3.2 / 1.33 mm - red / 1.10 mm - white

<b>Adhesive</b>	
Description	Repair Kit #
Adhesive Repair Kit	0601720
Silicone Adhesive for Catheter Repair (Does not contain catheter components)	

---

## *Connector Repair Procedure*

### **Purpose**

To repair a damaged or loose connector.

**NOTE: Catheter should have been clamped** with an atraumatic non-toothed clamp between the catheter exit site and the damaged area when damage or connector separation occurred and **must remain clamped** during repair.

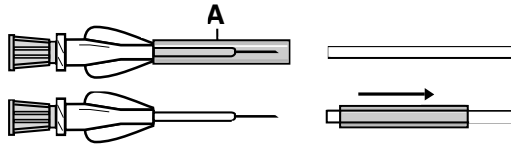
### **Supplies**

- 1 - Replacement connector
- 3 - Isopropyl alcohol wipes
- 1 - Povidone-iodine wipe
- 1 - Sterile scissors
- 1 - Pr. Sterile gloves
- 1 - 10cc syringe with attached 1 in. needle filled with 5cc sterile 0.9% Sodium Chloride (normal saline)

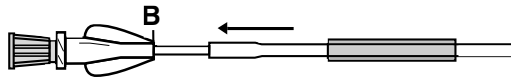
### **Procedure**

1. Obtain a new sterile replacement connector of the correct size (color-coded).
2. Determine where the damaged catheter is to be cut off. Do not cut at this time. Be sure to retain as much of the original external segment as possible. If the external segment needs to be lengthened, see the Single Lumen or Dual Lumen Body Repair Procedure.
3. Thoroughly clean the catheter with alcohol and povidone-iodine wipes at the point where it is to be cut.
4. Wearing sterile gloves and using sterile scissors, cut the catheter off at a 90° angle, 1/2 in. distal to the location of the previous connector or damaged site to remove any damaged catheter material.

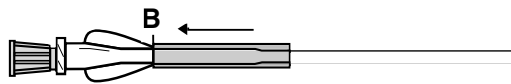
- 
5. Transfer the clear sleeve (A) onto catheter from connector.



6. Firmly push catheter onto adapter to Position B.



7. Slide the clear oversleeve over the catheter and hub to Position B. If catheter starts to bunch up, swab the catheter with an alcohol wipe before sliding sleeve over it.



8. Remove and discard stylet.



9. Attach injection cap and flush catheter with normal saline, or flush catheter with normal saline and attach IV tubing.

---

# *Single-Lumen Catheter Body Repair Procedure*

## Purpose

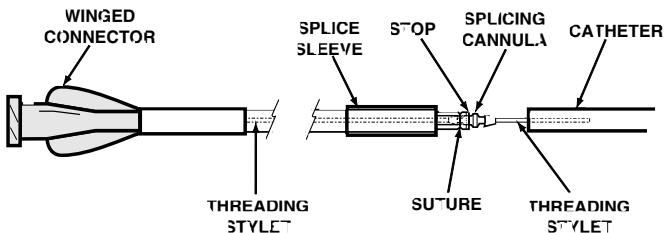
To replace or lengthen a damaged external long term catheter segment.

**NOTE: Catheter should have been clamped** with an atraumatic non-toothed clamp between the catheter exit site and the damaged area when damage occurred and **must remain clamped** during repair.

## Supplies

- 1 - Sterile repair kit:
- Povidone-iodine wipe
- Isopropyl alcohol wipes
- Atraumatic clamp
- 2 - 4 in. x 4 in. gauze pads
- 10cc syringe with attached 1 in. needle filled with 10cc normal saline
- Surgical mask and cap (per hospital policy)
- Tape
- Tongue blade
- Isopropyl alcohol or normal saline solution
- Sterile gloves

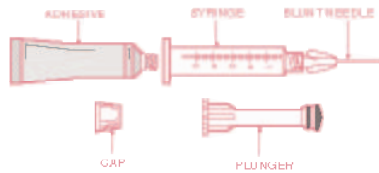
## Component Nomenclature



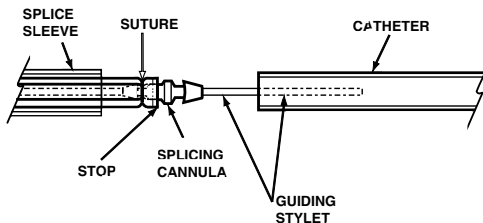
---

## Procedure

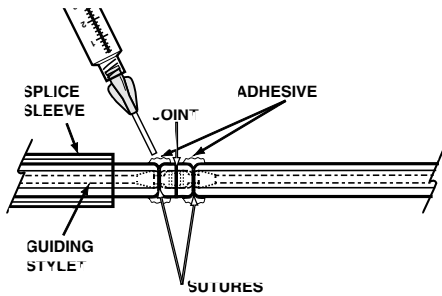
1. Wash hands thoroughly.
2. Clean the catheter segment to be repaired with an alcohol wipe and a povidone-iodine wipe.
3. Place the cleaned catheter on a sterile 4 in. x 4 in. gauze.
4. Put on sterile gloves. Remove the powder from the gloves with the alcohol solution and 4 in. x 4 in. gauze. (Powder adheres to silicone.)
5. Place drape to create a sterile field.
6. Load adhesive into syringe barrel and insert plunger.



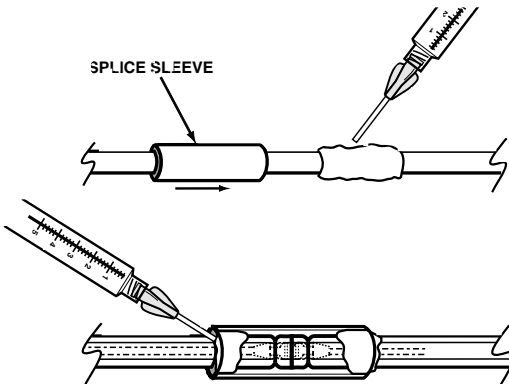
7. Clamp catheter with an atraumatic clamp near the skin exit site.
8. Cut the external portion of the damaged catheter on a 90° angle. The length of the remaining external segment must be at least 2 inches to permit catheter repair and prevent splice-sleeve retraction under the skin.
9. Using the threading stylet, align the splicing cannula (preattached to replacement segment) to the external portion of the damaged catheter. Push the cannula into the catheter segment until the catheter reaches the stop.



- 
10. Tie the suture onto the catheter/cannula just behind the annular ring. Knot at least four times to secure the suture in place.



11. Apply adhesive to the outside of the joint for a distance of  $\frac{1}{2}$  inch on either side of the connection. Slide the splice-sleeve and center it over the area of the joint. Inject additional adhesive under the splice-sleeve to fill the space between the catheter surface and the splice sleeve. Roll the splice-sleeve between fingers to spread adhesive. Wipe off excessive adhesive.



12. Remove the threading stylet from the catheter hub.

---

## STERILE FIELD NO LONGER REQUIRED

13. Remove atraumatic clamp. Aspirate the air in the replacement segment. Gently fill the catheter with 10cc sterile normal saline.

**CAUTION:** Excessive pressure may rupture the joint.

14. Fasten repaired catheter segment to tongue blade with tape.



15. Avoid allowing the adhesive to come in contact with the patient's skin for 48 hours. If necessary, the catheter may be used for infusion after 4 hours. The joint will not achieve full mechanical strength for 48 hours, at which time, the tongue blade may be removed.

---

# *Multi-Lumen Catheter Extension Repair Procedure*

## Purpose

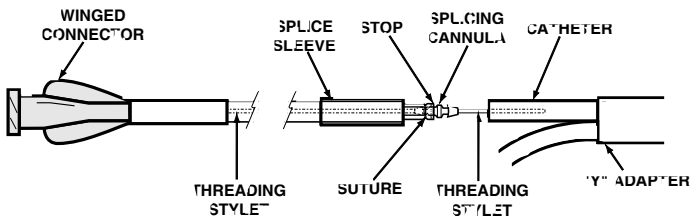
To replace damaged extension tubing of the dual-lumen **Groshong** Catheter.

**NOTE: Catheter should have been clamped** with an atraumatic clamp between the catheter exit site and the damaged area when damage occurred and **must remain clamped** during repair.

## Supplies

- Sterile repair kit for 5 Fr and 9.5 Fr catheters
- Povidone-iodine wipe
- Isopropyl alcohol wipe
- Atraumatic clamp
- 2 - 4 in. x 4 in. gauze pads
- 10cc normal saline filled syringe with attached 21 gauge 1 in. needle
- Surgical mask and cap (per hospital policy)
- Tape
- Tongue blade
- Alcohol or normal saline solution
- Sterile gloves

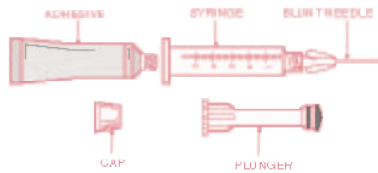
## Component Nomenclature



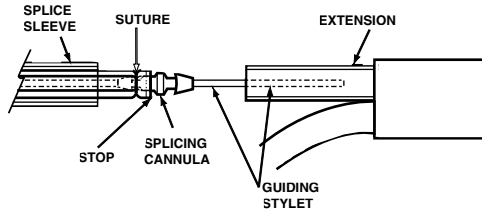
---

## Procedure

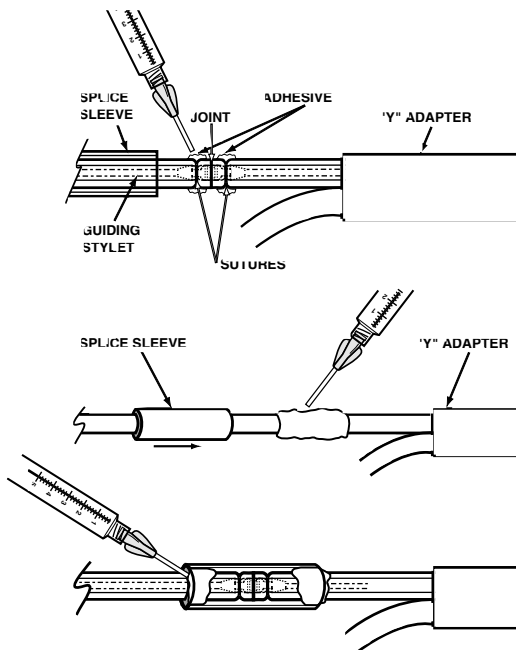
1. Wash hands thoroughly.
2. Clean the extension to be repaired with an alcohol wipe and a povidone-iodine wipe. Allow to dry completely.
3. Place the cleaned extension on a sterile 4 in. x 4 in. gauze.
4. Put on sterile gloves. Remove the powder from the gloves with the alcohol or normal saline solution and 4 in. x 4 in. gauze. (Powder adheres to silicone.)
5. Place drape to create sterile field.
6. Load adhesive into syringe barrel and insert plunger.



7. Clamp catheter with an atraumatic clamp above the “Y” adapter.
8. Cut the damaged extension on a 90° angle. The length of the remaining extension must be sufficient to permit repair without inserting the splicing cannula ( $1/2$  in. long) into the “Y” joint.
9. Using the threading stylet, align the splicing cannula (preattached to replacement extension) with the remaining extension segment. Push the splicing cannula into the extension segment until the extension segment reaches the stop.



10. Tie the suture onto the extension/cannula just behind the annular ring. Knot at least four times to secure the suture in place.
11. Apply adhesive to the outside of the joint for a distance of  $\frac{1}{2}$  in. on either side of the connection. Slide the splice-sleeve and center it over the area of the joint. Inject additional adhesive under the splice-sleeve to fill the space between the extension surface and the splice-sleeve. Roll the splice-sleeve between fingers to spread adhesive. Wipe off excess adhesive.



12. Remove the threading stylet from the catheter hub.

### STERILE FIELD NO LONGER REQUIRED

13. Remove atraumatic clamp. Aspirate the air in the replacement extension. Gently fill the extension and the catheter with 10cc sterile normal saline.

---

**CAUTION: Excessive pressure may rupture the joint.**

**14.** Fasten repaired extension to tongue blade with tape.



**15.** Avoid allowing the adhesive to come in contact with the patient's skin for 48 hours. If necessary, the catheter may be used for infusion after 4 hours. The joint will not achieve full mechanical strength for 48 hours, at which time the splint may be removed.

---

# *Multi-Lumen Catheter Body Repair Procedure*

## Purpose

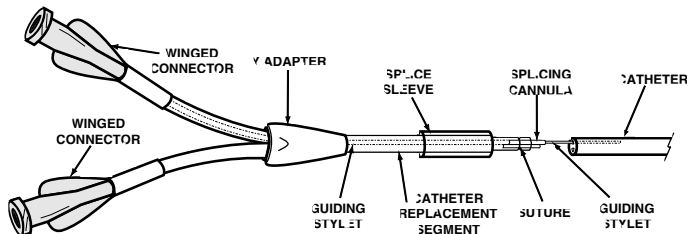
To replace a dual external catheter segment damaged between the body site and the bifurcation of the extension.

**NOTE: Catheter should have been clamped** with an atraumatic clamp between the catheter exit site and the damaged area when damage occurred and **must remain clamped** during repair.

## Supplies

- Sterile repair kit for 9.5 Fr catheter
- Povidone-iodine wipe
- Isopropyl alcohol wipe
- Atraumatic clamp (if needed)
- 2 - 4 in. x 4 in. gauze pads
- 2 - 10cc normal saline filled syringes with attached 1 in. needle
- Surgical mask and cap (per hospital policy)
- Tape
- Tongue blade
- Isopropyl alcohol or normal saline solution
- Sterile gloves

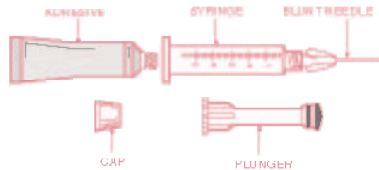
## Component Nomenclature



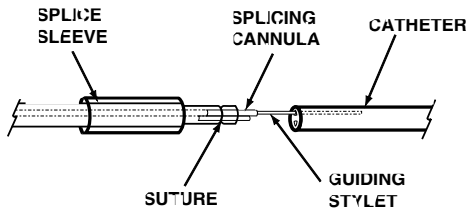
---

## Procedure

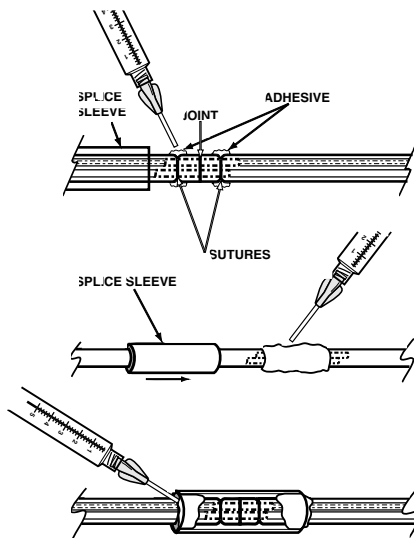
1. Wash hands thoroughly.
2. Clean the catheter segment to be repaired with an alcohol wipe and povidone-iodine wipe. Allow to dry completely.
3. Place the cleaned catheter on a sterile 4 in. x 4 in. gauze.
4. Put on sterile gloves. Remove the powder from the gloves with the alcohol or normal saline solution and 4 in. x 4 in. gauze. (Powder adheres to silicone.)
5. Place the drape to create a sterile field.
6. Load adhesive into syringe barrel and insert plunger.



7. Reposition atraumatic catheter clamp near the skin exit site.
8. Cut the external portion of the damaged catheter on a 90° angle. The length of the remaining external segment must be sufficient (at least 2 in.) to permit catheter repair and prevent splice-sleeve retraction under the skin.
9. Using the threading stylet, align the splicing cannula (preattached to replacement segment) to the external portion of the damaged catheter. Push the cannula into the catheter segment until the catheter reaches the stop.



10. Tie the suture onto the catheter/cannula just behind the ring. Knot at least four times to secure the suture in place.
11. Apply adhesive to the outside of the joint for a distance of  $\frac{1}{2}$  in. on either side of the connection. Slide the splice-sleeve and center it over the area of the joint. Inject additional adhesive under the splice-sleeve to fill the space between the catheter surface and the splice-sleeve. Roll the splice-sleeve between fingers to spread adhesive. Wipe off excessive adhesive.



12. Remove the threading stylet from the catheter hub.

### **STERILE FIELD NO LONGER REQUIRED**

13. Remove atraumatic clamp. Aspirate the air in the replacement segment. Gently fill each lumen with 10cc sterile normal saline.

---

**CAUTION: Excessive pressure may rupture the joint.**

14. Fasten repaired catheter segment to tongue blade with tape.



15. Avoid allowing the adhesive to come in contact with the patient's skin for 48 hours. if necessary, the catheter may be used for infusion after 4 hours. The joint will not achieve full mechanical strength for 48 hours, at which time the splint may be removed.

---

# *Troubleshooting Guide*

## **I. Aspiration Difficulties**

### **A. Possible Causes**

- 1.** Failure to flush according to Catheter Irrigation Procedure, resulting in lumen obstruction.
- 2.** Catheter opening may suck up against vein wall with aspiration.
- 3.** Blood clot, fibrin sheath, or particulate matter obstructing valve when catheter is aspirated.
  - A clot or other obstruction in the catheter lumen can produce a one-way valve effect. During infusion, the catheter 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.
- 4.** Compression or transection of the catheter between the clavicle and the first rib (“pinch-off area”).
- 5.** Kinked catheter outside or inside the body.
  - Suture constriction at the catheter skin exit site, cuff, or vessel insertion site.
  - Catheter may be pulled too tight through skin tunnel, causing kink at vessel insertion site, or where it curves into the subcutaneous tunnel.

- 
- Catheter may be curled or kinked within the vessel, or under the dressing.
6. Malposition of catheter tip (i.e., jugular vein, outside of vein).

### ***B. Possible Solutions***

1. Visually check catheter for any exterior kinks, or constricting sutures. Check operative report, or with placement physician for placement of sutures. If sutures are present, their removal may release the constriction and allow aspiration. A removable suture wing is supplied with the insertion tray to prevent suture constriction at the exit site.
2. If no resistance to infusion is felt, attempt to flush with 10cc normal saline. Then pull back gently on syringe plunger 2-3cc, pause and proceed with aspiration.
3. If resistance to infusion is felt, check for signs of extravasation. If present, notify physician of possibility of catheter leakage or transection and embolization. If not present, see Step 5.
4. Attempt to aspirate with a 20cc syringe (creates a greater vacuum).
5. Move patient's arm, shoulder and head to see if a change in position will allow aspiration. If aspiration can only be accomplished with the patient in a certain position, the patient should be examined to see if the catheter has been placed in the "pinch-off" area. See Step 7.
6. Obtain physician's order and instill urokinase 5,000 IU/ml per Clearing Occluded Catheters Procedure.
7. Obtain physician's order for chest x-ray to verify catheter placement.
  - If the insertion into the subclavian vein is between the clavicle and first rib ("pinch-off" area), the catheter may be occluded mechani-

---

cally enough to allow low-volume infusion, but prevent aspiration due to compression between the clavicle and first rib. The more medial the insertion site, the greater the potential for “pinch-off.” Catheters in this area are at risk for catheter transection and embolization and the physician should evaluate the patient for catheter replacement.

- 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.

## References

Aitken, Delmar R, and Minton, John P, “The Pinch-Off Sign”: A Warning of Impending Problems with Permanent Subclavian Catheters,” *American Journal of Surgery*, Vol. 148, November 1984, pp. 633-636.

Rubenstein, Richard B, et al, “Hickman® Catheter Separation,” *Journal of Parenteral and Enteral Nutrition*, Vol. 9, No. 6, Nov/Dec 1985, pp. 754-757.

## II. Bleedback in Catheter

### A. Possible Causes

1. A blood clot or particulate matter may be holding the valve open.
2. Migration or placement of the catheter tip in the internal jugular vein, or vessel other than the superior vena cava, or coiling of the catheter in a vein may position the catheter tip where the valve is pushed open.

- 
3. Placement of the catheter in the right atrium or ventricle:
    - Contractions of the heart muscle can force the catheter valve open.
    - Impingement of the catheter tip on the tricuspid valve, heart wall, or apex of the heart can force the catheter valve open.
  4. Catheter valve tip cut off in error during catheter placement.

### ***B. Possible Solutions***

1. Attempt to aspirate clot out of the lumen.
2. If no resistance felt, flush with 10cc normal saline. If resistance is felt, see Step 3.
3. Obtain physician's order and instill urokinase or other solution per Clearing Occluded Catheters Procedure to clear lumen and valve of blood clots or precipitates.
4. Obtain physician's order for chest x-ray or dye study to determine catheter position.
  - Check for radiopaque tip to verify if it is still in place. If not, treat catheter as an open-ended catheter, using heparin and clamping with an atraumatic clamp when opening it to the air until it is repositioned.
  - If malpositioned, coiled or kinked, catheter should be repositioned with the tip in the superior vena cava. If unable to reposition for some reason, treat catheter as an open-ended catheter, using heparin and clamping with an atraumatic clamp when opening it to the air.

---

### III. Catheter Occlusion

#### A. Possible Causes

1. Blood clot completely obstructing lumen.
2. Drug precipitate or lipid deposition completely obstructing lumen.
3. Catheter may be kinked, coiled, damaged, or pinched between the clavicle and first rib.
4. Catheter valve may not be within vein.
5. If sutures were used during the placement of the catheter, they can tighten and restrict flow.
6. Catheter may be partially or completely transected. Transection can occur from the repeated pressure of the clavicle and the first rib on the catheter during normal movement if it is placed through the “pinch-off” area.

#### B. Possible Solutions

1. Attempt to aspirate blood clot.
2. Move patient’s arm, shoulder, and head to see if position change affects ability to infuse. If so, see Step 5 (could be pinch-off).
3. Inspect patient and operative report for presence of sutures around the catheter. If sutures are present, they should be removed. Removable suture wings are available in the insertion tray for holding long-term catheters in place until the **SureCuff** Tissue Ingrowth Cuff heals in enough to anchor the catheter.
4. Obtain physician’s order and instill urokinase or other solution per Clearing Occluded Catheters Procedure.
5. Obtain physician’s order for a chest x-ray or dye study to determine the position of the catheter.
  - If the catheter tip is not in the superior vena cava, the catheter should be repositioned.

- 
- If the catheter tip is not in the vein, the catheter should be replaced.
  - If the catheter has been placed through the “pinch-off” area, between the clavicle and the first rib, and is being compressed enough to interfere with infusion or aspiration, it is at risk for catheter transection and embolization. The physician should evaluate the patient for catheter replacement.

## References

See under “Aspiration Difficulties.”

## IV. Catheter Damage

### A. Possible Causes

1. Repeated clamping.
2. Contact with a sharp object.
3. Rupture from attempt to irrigate an occluded catheter with a small syringe (i.e., 1 or 3cc syringe).
  - Small syringes can generate very high internal pressures with 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.

### B. Possible Solutions

1. 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.
2. Determine the site of damage and the size and type of catheter.

- 
3. Refer to the appropriate Catheter Repair Procedure to repair the damage. At least 2 in. of intact catheter beyond the skin exit site is needed to be able to repair the body of the catheter. Use the appropriate size repair kit to assure a good repair.
  4. Always use a 10cc syringe or larger when infusing into the catheter.

## V. Air in Line

### A. Possible Causes

1. Hole in catheter.
2. Injection cap not prefilled with normal saline.
3. Loose connections (injection cap, IV tubing).
  - If the oversleeve has not been put on the catheter connector at all, or if it or the catheter has not been slid all the way onto the hub, air and fluid leakage can occur.
4. "Manometer effect" - holding the catheter connector end above the level of the heart while it is open to the air creates a manometer effect, with fluid dropping to a level of 8-10cms above the **Groshong** valve at the tip of the catheter. Air will not enter the blood stream unless the valve has been propped open by a blood clot or drug precipitate, or the catheter tip has been placed where mechanical pressure forces the valve open.
5. Diffusion and evaporation of water through the external catheter segment due to silicone permeability. This may be noticed in the **Groshong** catheter because it is flushed less frequently than other silicone catheters, and it is clear, allowing the visualization of air, which is not possible with other silicone catheters.

- 
- Silicone has an open matrix which allows water vapor and gases to diffuse through the membrane.
  - The amount of diffusion that takes place is dependent on many factors. Therefore, not all patients with silicone catheters will demonstrate this phenomenon.
  - The air will stay in catheter's external segment. It does not extend below the level of the skin. The air can be aspirated once a week when routine flushing is done. There is no danger of air embolism from silicone permeability.

### ***B. Possible Solutions***

1. Check catheter for leakage by flushing well with normal saline.
2. Prefill injection cap with normal saline before attaching it to the catheter.
3. Check for loose connections (injection cap, IV tubing). Check for the presence of the oversleeve. If present, check for proper attachment of the catheter, the connector and oversleeve (see Connector Repair Procedure).
4. If the catheter is not damaged, aspirate the air and then irrigate the catheter with 10cc normal saline to flush out any aspirated blood. Air present in the catheter due to silicone permeability will only be present in the external catheter segment and will not migrate into the patient's bloodstream unless injected.
5. Perform procedures requiring the catheter to be opened to the air with the connector end below the level of the patient's heart.

---

## References

Dennis, William E, and Larson, Willard D, "Permeation and Silicone Elastomers," Dow Corning Corporation, Medical Products Business, Technical Service & Development, Midland, MI.

## VI. Fluid Leakage from Catheter Exit Site

### A. Possible Causes

1. Catheter punctured by sharp object (i.e., scalpel, suture needle, trocar) just prior to placement.
2. Catheter ruptured from attempt to irrigate an occluded catheter with a small syringe (i.e., 1cc or 3cc syringe).
  - Small syringes can generate very high internal pressures with 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.
3. Catheter may have become encapsulated by a fibrin sheath which is preventing 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.
4. 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.
5. Catheter may have been transected by the clavicle and the first rib due to placement through the "pinch-off" area, allowing fluid infused to flow back along the outside of the catheter to the skin exit site.

---

## **B. Possible Solutions**

1. Infuse 10cc of normal saline and observe for signs of fluid extravasation under the skin.
2. Obtain physician's order for a dye study through the catheter to determine path of fluid flow.
3. Remove the catheter if a leak or transection is discovered inside the body. If a transection has occurred, the embolized fragment may have to be retrieved with a snare. Please report such incidents to Bard Access Systems (800-443-3385).
4. If a leak is discovered in the catheter outside the body, repair it following the Catheter Repair Procedure appropriate for the catheter type and the location of the damage.

## **References**

See under "Aspiration Difficulties" and "Clearing Occluded Catheter Procedure."

---

**WARNING:** An issued or revision date for these instructions is included for user's information. In the event two years have elapsed between this date and product use, the user should contact **Bard Access Systems** to see if additional product information is available.

Revised Date: July 1994.  
GROSNPM

U.S. Patents: 4,547,194; 4,549,879; 4,559,046; 4,671,796; 4,701,166; 4,753,640; 4,995,863; 5,160,325. Other Patents Pending.

© **Bard Access Systems** 1994

**BARD**, **Groshong**, **Hickman** and **Cath-Tech** are registered trademarks of C.R. Bard, Inc., or an affiliate.

**SureCuff** is a trademark of C.R. Bard, Inc., or an affiliate.

**VitaCuff** and **VitaGuard** are registered trademarks of Vitaphore Corp.

## **Bard Access Systems**

5425 West Amelia Earhart Drive  
Salt Lake City, Utah 84116

**Toll Free Order Department: 1-800-545-0890**

**Clinical Information Hotline: 1-800-443-3385**