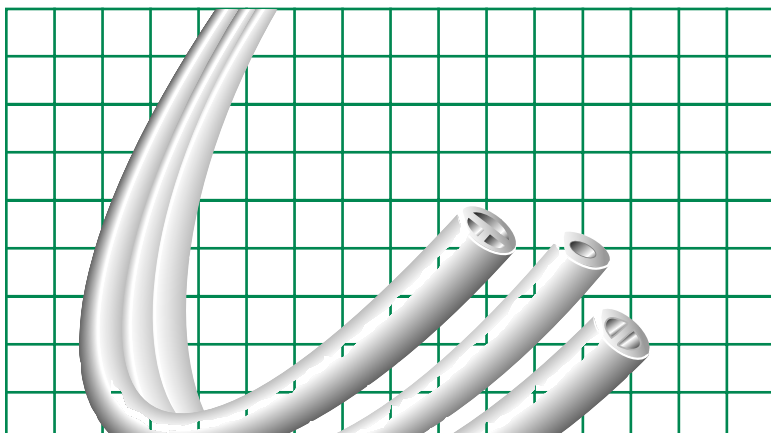


Bard Access Systems

Hickman[®], Leonard[®] and Broviac[®] Catheters



NURSING PROCEDURE MANUAL

BARD

Table Of Contents

	Page
Introduction	1
Description of Catheters and Accessories	
Placement	
Indications for Use	
VitaCuff® Antimicrobial Cuff	
Warnings	
Catheter Irrigation Procedure	6
Routine Maintenance	
Hemodialysis and Plasmapheresis	
Catheter Irrigation Procedure	8
Catheter Irrigation After Blood Aspiration or	
When Blood is Observed in the Catheter	10
Blood Withdrawal/Aspiration Procedure	11
Injection Cap Change Procedure	15
Dressing Change Procedure	17
Clearing Occluded Catheters Procedure	23
Repair Kit / Specifications Table	26
Broviac® Catheter Repair Procedure	28
Hickman® Single-Lumen Catheter and	
Multi-Lumen Adapter Leg Repair Procedure	32
Hickman / Leonard® Multi-Lumen Catheter	
Body Repair Procedure	36
Troubleshooting Guide	41
I. Aspiration Difficulties	
II. Catheter Occlusion	
III. Catheter Damage	
IV. Air in Line	
V. Fluid Leakage From Catheter Exit Site	



Introduction

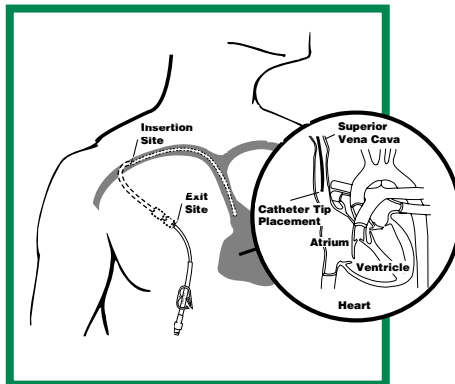
Description of Catheters and Accessories

Bard Access Systems Hickman®, Broviac® and Leonard® tunneled catheters are made of radiopaque medical grade silicone. Each has female luer locking adapter(s) and SureCuff™ Tissue Ingrowth Cuff for fixation of the catheters in the subcutaneous tunnel.

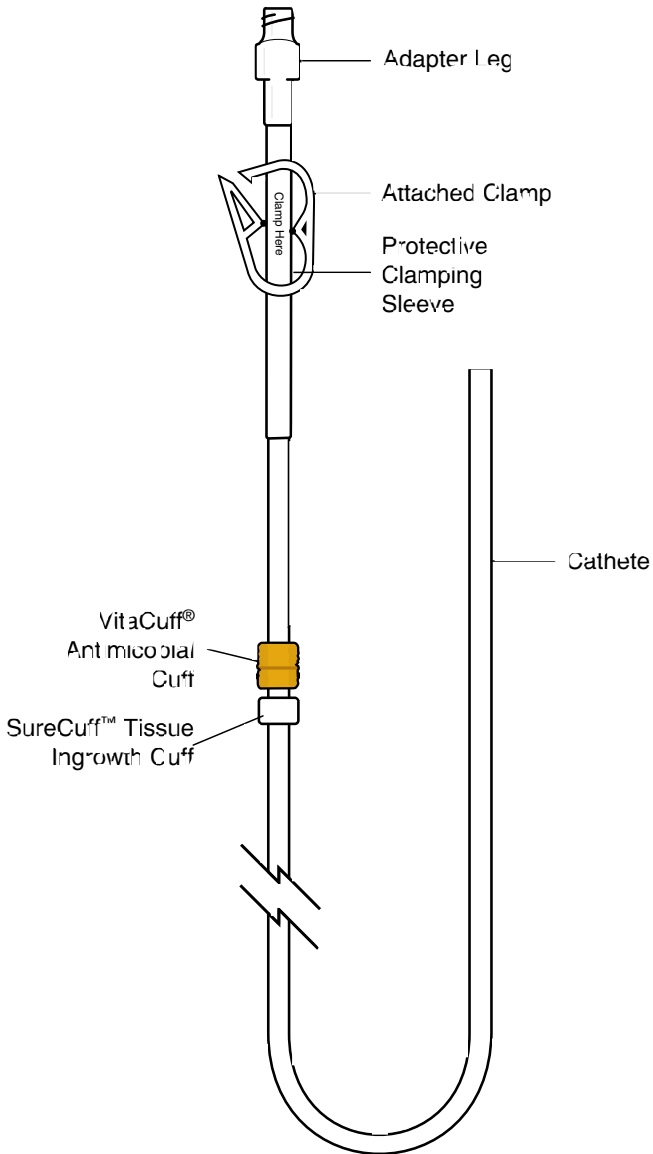
Each catheter is supplied in a double sterile package. Catheter repair kits for **Hickman**, **Broviac** and **Leonard** catheters are also sterile packaged.

Placement

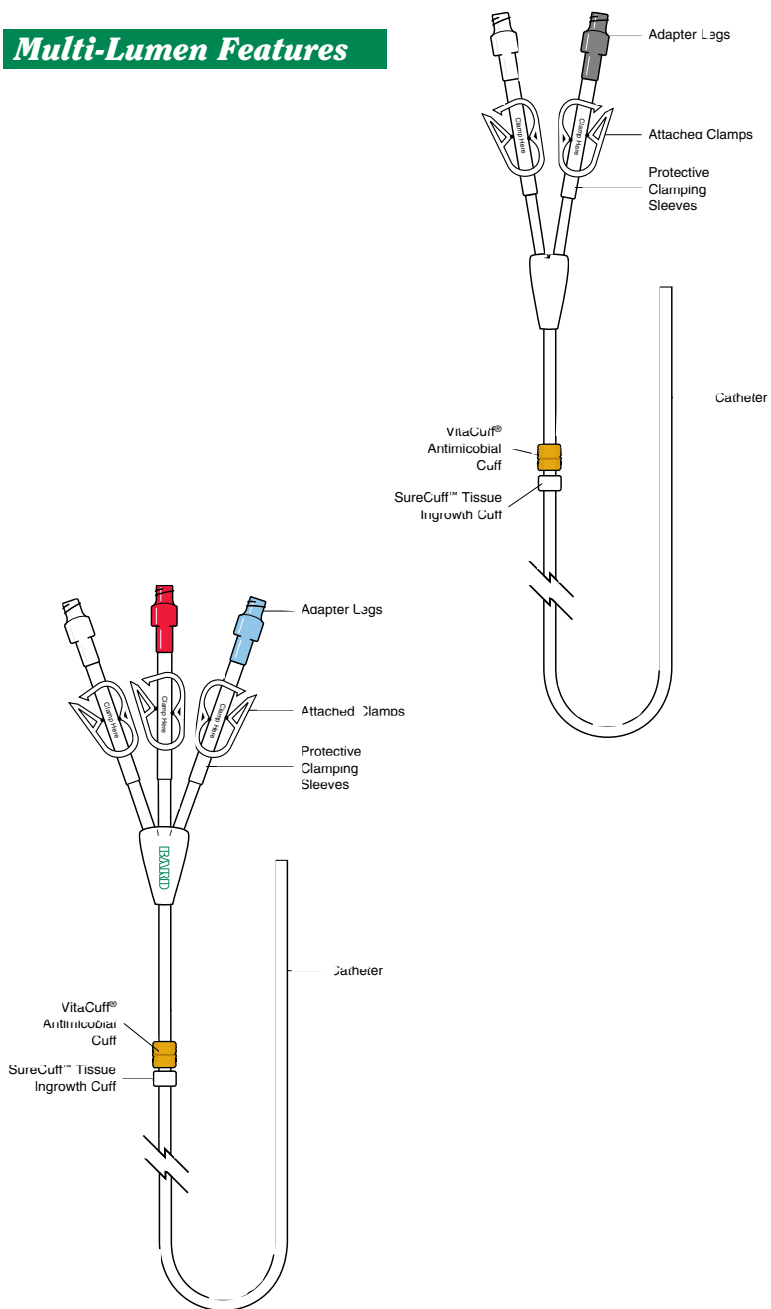
The catheter tip is placed via one of the large central veins into the superior vena cava above the right atrium. The proximal end of the catheter is tunneled subcutaneously for several inches to the desired exit site. The **SureCuff** Tissue Ingrowth Cuff, attached to the catheter, is positioned in the tunnel. The cuff helps secure the catheter through fibrous tissue ingrowth and creates a physical barrier to help reduce the potential for infection caused by the migration of bacteria through the subcutaneous tunnel.



Single-Lumen Features



Multi-Lumen Features



Indications For Use

Hickman, Leonard, and Broviac central venous catheters are designed for the administration of I.V. fluids, blood products, drugs and parenteral nutrition solutions, as well as blood withdrawal. Catheters with a **VitaCuff** Antimicrobial Cuff are intended to help provide protection against catheter related exit site infections and sepsis.

VitaCuff® Antimicrobial Cuff

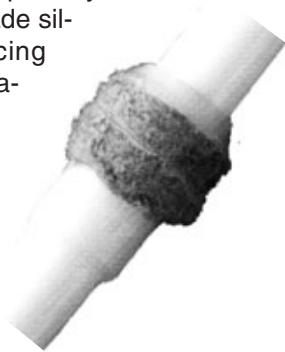
Description

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.

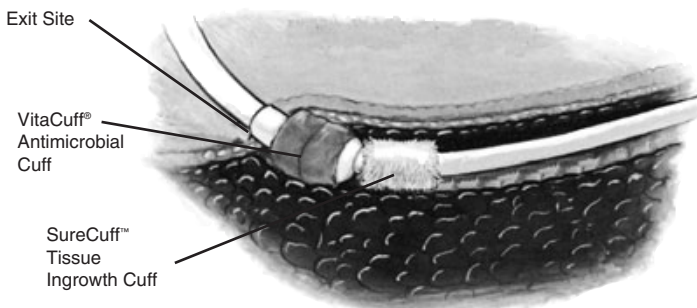
CAUTION: The antimicrobial cuff is not intended to be used as a treatment for catheter related infections. The antimicrobial cuff does not provide protection against “blood seeding” infection or infusate-related infection. It is not intended to provide protection from bacteria for longer than one month. 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 3 cc syringe generates pressure in excess of 25 psi. The same two pound weight equivalent force on the barrel of a 10cc syringe generates less than 8 psi of pressure. It is recommended that no smaller than a 10cc syringe be used for infusion into a **Hickman, Leonard, or Broviac** 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

Flushing frequencies from once daily to once weekly have been found to be effective when the catheter is not in use. Flush with heparin after IV administration of TPN, IV fluids, or after medications. **NOTE:** For frequently accessed catheters (accessed at least every 8 hours), flushing with 5cc of normal saline without heparin between infusions has been found to be effective.

Supplies

- Isopropyl alcohol and/or povidone-iodine wipes
- 10cc syringe with attached 1 in. needle, filled with 2.5cc of heparinized saline, or 5cc normal saline (Using a 10cc syringe reduces pressure during flushing and reduces chances of rupturing the catheter due to over pressurization.)

NOTE: The appropriate heparin concentration, volume, and flushing frequency should be based on the patient's medical condition, laboratory tests, and prior clinical experience. Heparin concentrations of 10 u/ml - 1,000 u/ml have been found to be effective.

Procedure

Hickman and Leonard Catheters:

1. Clean injection cap with alcohol and/or povidone-iodine wipe.
2. Insert needle of 10cc syringe containing 5cc normal saline or 2.5cc heparinized saline into injection cap.
3. Release clamp.
4. Inject irrigation solution, withdrawing needle from injection cap as last $\frac{1}{2}$ cc of solution is infused (Helps prevent a vacuum which can pull a small amount of blood into catheter tip).
5. Close catheter clamp if indicated by hospital procedure.

Broviac Catheters:

Follow the above procedure except use 2cc normal saline or 1.5cc heparinized saline.

CAUTION: Always use a 10cc or larger syringe and flush slowly to avoid rupturing the catheter.



Hemodialysis and Plasmapheresis Catheter Irrigation Procedure

Purpose

To maintain catheter patency.

Routine Maintenance

Prior to initiation of therapy or reinstallation of fresh heparinized saline, the indwelling heparin should be aspirated from the catheter and the lumen(s) flushed with 10cc sterile normal saline. Flush with 10cc sterile normal saline and then heparin after completion of therapy.

Supplies

- Isopropyl alcohol and/or povidone-iodine wipes
- 10cc syringe with attached 1 in. needle, filled with 10cc normal saline
- 10cc syringe with attached 1 in. needle, filled with catheter priming volume of heparinized saline

NOTE: The appropriate heparin concentration and flushing frequency should be based on the duration of the interdialytic period, patient's medical condition, laboratory tests, and prior experience. Heparin concentrations of 1000-5000 USP units/ml have been found to be effective for maintaining the patency hemodialysis and plasmapheresis catheters.

Procedure

1. Wash hands thoroughly.
2. Clean injection cap with alcohol and/or povidone-iodine wipe.
3. Insert needle of saline-filled 10cc syringe into injection cap.
4. Release clamp.
5. Inject normal saline into catheter and remove needle from injection cap.
6. Clean injection cap with alcohol and/or povidone-iodine wipe.
7. Insert needle of heparin-filled 10 cc syringe into injection cap.
8. Release clamp.
9. Inject irrigation solution, withdrawing needle from injection cap as last 0.5cc of solution is infused (helps prevent a vacuum which can pull a small amount of blood into catheter tip).
10. Close catheter clamp, if indicated by hospital procedure.



Catheter Irrigation After Blood Aspiration or When Blood is Observed in the Catheter

Supplies

- Isopropyl alcohol and/or povidone-iodine wipes
- 10cc syringe with attached 1 in. needle containing 10cc normal saline.
- 10cc syringe with attached 1 in. needle containing 2.5cc heparinized saline (if catheter is to be heparin-locked).

Procedure

Hickman and Leonard Catheters:

1. Follow Routine Maintenance Procedure, except use 10cc normal saline to clear blood from the catheter, followed by 2.5cc heparinized saline to heparin lock the 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).

Broviac Catheters:

Follow above procedure except use 3cc normal saline, followed by 1.5cc heparinized saline. The injection cap may need to be changed because blood cannot be flushed entirely out of cap with this amount of fluid.



Blood Withdrawal / Aspiration Procedure

Purpose

To obtain blood samples for laboratory evaluation, without peripheral venipunctures.

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

NOTE: While smaller lumen **Broviac** catheters have been used successfully for blood withdrawal, their small lumen sizes increase the chance of clotting. The larger **Hickman** single-lumen catheter is intended for both infusion of I.V. fluids, medications, and nutritional solutions, and for withdrawal of blood samples.

Hub-To-Hub Technique (syringe)

Supplies

- 4 - 10cc syringes
- 1 - 1 in. needle
- 0.9% Sodium Chloride (normal saline)
- Heparinized saline (10u - 1000u/ml. per hospital policy)
- Isopropyl alcohol wipes/povidone-iodine wipes
- Blood specimen tubes

Procedure

1. Wash hands thoroughly.
2. Draw 10cc of normal saline into one 10cc syringe and 2.5cc heparinized saline into another 10cc syringe and set aside.
3. Apply smooth-edged atraumatic clamp to silicone clamping sleeve.

-
4. Stop any IV fluids infusing through the catheter, including another lumen of the catheter. Remove injection cap/I.V. 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. Open clamp.
 8. Aspirate 5cc of blood.
 9. Re-clamp catheter.
 10. Disconnect syringe and discard (saline or heparin in catheter dilutes specimen and may alter lab values).
 11. Attach an empty 10cc syringe, open clamp, and aspirate sample.
 12. Re-clamp catheter.
 13. Disconnect syringe and attach saline-filled syringe.
 14. Open clamp.
 15. Flush the catheter with 10cc normal saline.
 16. Re-clamp catheter.
 17. Attach heparin-filled syringe.
 18. Open clamp.
 19. Flush the catheter with 2.5cc heparinized saline.
 20. Re-clamp catheter.
 21. Disconnect syringe and clean catheter hub with alcohol and/or povidone-iodine wipe.
 22. Attach new injection cap per Injection Cap Change Procedure or attach sterile I.V. tubing to hub of catheter.
 23. Attach 1 in. needle to blood sample syringe to transfer to blood collection tubes.

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

Needle Through Injection Cap:

(May use 10 cc syringe/needle in place of vacuum tube blood collection system)

Supplies

- Vacuum Collection system sleeve and attached needle
- 4 - 10cc syringes with attached 1 in. needle
- 0.9% Sodium Chloride (normal saline)
- Heparinized saline (10u - 1000u/ml. per hospital policy)
- Isopropyl alcohol wipes/povidone-iodine wipes
- Blood specimen tubes

Procedure

1. Wash hands thoroughly.
2. Draw up 10cc of normal saline into one 10cc syringe and 2.5cc heparinized saline into another 10cc syringe.
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. Aspirate 5cc of blood.

NOTE: A vacuum blood 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 blood collection sleeve so that the 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 needle 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. Clean injection cap with alcohol and/or povidone-iodine wipe.
 15. 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 (or hospital policy).
 16. Insert needle of heparin-filled syringe and flush the catheter with 2.5cc heparinized saline.

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



Injection Cap Change

Purpose

To minimize potential for infection from overuse and leakage of injection cap.

Frequency

- Every seven days, 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 2.5cc heparinized saline (10u - 1000u/ml. per hospital policy) or 5cc normal saline.

Procedure

1. Wash hands.

-
2. Using aseptic technique, open sterile injection cap package and pre-fill injection cap with heparinized saline, or normal saline.
 3. Apply smooth-edged atraumatic clamp to silicone clamping sleeve 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 2.5cc heparinized saline, or 5cc normal saline following the Catheter Irrigation Procedure (per hospital policy).
 7. Tape the connection (per hospital policy).



Dressing Change Procedure

Purpose

To prevent infection of the central venous catheter.

Frequency

- Gauze and tape dressing - M, W, F, and prn if soiled, damp, or loosened.
- Transparent dressing - 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 - 70% 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. split gauze
- 1 - 2 in. x 2 in. gauze
- 1 - Protective dressing wipe or swabstick (optional)
- 2 - Isopropyl alcohol wipes
- 1 Pr. - Sterile gloves (recommended if dressing is changed in a health care facility due to universal precautions and 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 catheter exit site for swelling, redness, or exudate. Notify physician if problem is observed.
4. Wash hands thoroughly.
5. Put on sterile gloves.
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 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).

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 Pr. - Sterile gloves (recommended if dressing is changed in a health care facility due to universal precautions and 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 observed.
4. Wash hands thoroughly.
5. Put on sterile gloves.
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 prepped. 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 alcohol 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 on the catheter).

Broviac Catheters

Try to secure catheter out of sight for infants and children by:

- Tunneling catheter to lateral back exit site.
- Using vests and other clothing to completely cover tubing and exit site.

Do not allow child to chew or pull on tubing at any time to avoid catheter damage or breakage.

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

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

Shevnan, JC, McGuire, D, Freedman, S. et al, "A Comparison of Transparent Adherent and Dry Sterile Gauze Dressings for Long-Term Central Catheters in Patients Undergoing Bone Marrow Transplant", *Oncology Nursing Forum*, Vol. 18, No. 8, 1991, pp. 1349-1356.



learing 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 1 in. needle
- 1 - 10cc sterile normal saline-filled syringe with attached 1 in. needle
- Isopropyl alcohol wipes

Procedure

1. Wash hands.
2. Apply smooth-edged atraumatic clamp to silicone clamping sleeve.
3. Remove injection cap, attach an empty 10cc syringe, release clamp, and attempt to aspirate. If aspiration is successful, withdraw clots, clamp catheter, and attach saline-filled syringe. Release clamp and flush catheter with 10 ml. normal saline. Clamp catheter. Replace cap per Injection Cap Change Procedure. If aspiration is unsuccessful, proceed to step 4.
4. Obtain physician's order for the use of urokinase 5,000 IU/cc to de clot the catheter.
5. 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 **Hickman/Leonard/Broviac** Catheter Repair Kit / Specifications Table for catheter priming volumes.

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6. Aseptically attach the urokinase-filled syringe to the catheter hub. Release clamp and slowly and gently inject the urokinase solution into the catheter. To avoid catheter rupture, do not force entire amount into catheter.
 7. Leave 10cc syringe attached to catheter. Do not attempt to aspirate for 30-60 minutes.
 8. After 30-60 minutes, attempt to aspirate the drug and residual clot. If unsuccessful, repeat urokinase instillation.
 9. When patency is restored, aspirate 5cc of blood to assure removal of all drug and clots.
 10. Clamp catheter, remove blood-filled syringe, and replace it with a 10cc syringe filled with normal saline. Open clamp and flush catheter to verify patency.
 11. Clamp catheter and remove syringe.
 12. Attach sterile heparin-filled injection cap and flush catheter with heparin per Catheter Irrigation Procedure.

NOTE:

If infusing:

- TPN and lipid solutions, and 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. This may help to clear the catheter of lipid material deposition.
- TPN or calcium and phosphate IV solutions or other medications which might leave a precipitate, and 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.

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Repair Kit / Specifications Table (part 1)

Catheter Description	Repair Kit #	Temporary Repair	Total Length
Single-Lumen			
Broviac 2.7 Fr.	0601600	24 Ga.	71 cm
Broviac 4.2 Fr.	0601610	22 Ga.	71 cm
Broviac 6.6 Fr.	0601620	20 Ga.	90 cm
Broviac 6.6 Fr. Short Length	0601620	20 Ga.	90 cm
Hickman 9.6 Fr.	0601630	16 Ga.	90 cm
Hickman 10.8 Fr. Pheresis / Dialysis	0601650	N/A	30 cm
Hickman 14.4 Fr. Pheresis / Dialysis	0601670	N/A	26 cm
Dual-Lumen			
Hickman 7.0 Fr.	0601680 - White ext. 0601690 - Red ext. 0601760 - Body	16 Ga. (Legs)	65 cm
Hickman 9.0 Fr. Pediatric	0601680 - White ext. 0601690 - Red ext. 0601700 - Body	16 Ga. (Legs)	65 cm
Hickman 9.0 Fr.	0601680 - White ext. 0601690 - Red ext. 0601700 - Body	16 Ga. (Legs)	90 cm
Leonard 10.0 Fr.	0601680 - White ext. 0601690 - Red ext. 0601750 - Body	16 Ga. (Legs)	90 cm
Hickman 12.0 Fr.	0601680 - White ext. 0601690 - Red ext. 0601710 - Body	16 Ga. (Legs)	90 cm
Hickman 13.5 Fr.	0601770 - Blue ext. 0601780 - Red ext.	N/A	36 cm
Hickman 13.5 Fr. Pheresis / Dialysis	0601770 - Blue Leg 0601780 - Red Leg	N/A	28 cm
Hickman 13.5 Fr. Pheresis / Dialysis	0601770 - Blue Leg 0601780 - Red Leg	N/A	40 cm
Triple-Lumen			
Hickman 10.0 Fr.	0601680 - White ext. 0601690 - Red ext. 0601730 - Blue ext. 0601790 - Body	16 Ga. (Legs)	90 cm
Hickman 12.5 Fr.	0601680 - White ext. 0601690 - Red ext. 0601730 - Blue ext. 0601740 - Body	16 Ga. (Legs)	90 cm
Adhesive			
	Repair Kit #	Description	
Adhesive Repair Kit	0601720	Silicone Adhesive for Catheter Repair (Does not contain catheter components)	

Repair Kit / Specifications Table (part II)

Catheter Description	Volume	O.D. / I.D.
Single-Lumen		
Broviac 2.7 Fr.	0.15 cc	0.9 / 0.5 mm
Broviac 4.2 Fr.	0.3 cc	1.4 / 0.7 mm
Broviac 6.6 Fr.	0.7 cc	2.2 / 1.0 mm
Broviac 6.6 Fr. Short Length	0.7 cc	2.2 / 1.0 mm
Hickman 9.6 Fr.	1.8 cc	3.2 / 1.6 mm
Hickman 10.8 Fr. Pheresis / Dialysis	0.9 cc	3.6 / 2.0 mm
Hickman 14.4 Fr. Pheresis / Dialysis	1.4 cc	4.8 / 2.6 mm
Dual-Lumen		
Hickman 7.0 Fr.	0.6 cc.- White 0.8 cc - Red	2.3 / 0.8 mm - White 1.0 mm - Red
Hickman 9.0 Fr. Pediatric	0.6 cc.- White 1.3 cc - Red	3.0 / 0.7 mm - White 1.3 mm - Red
Hickman 9.0 Fr.	0.6 cc.- White 1.3 cc - Red	3.0 / 0.7 mm - White 1.3 mm - Red
Leonard 10.0 Fr.	1.3 cc.- White 1.3 cc - Red	3.3 / 1.3 mm - White 1.3 mm - Red
Hickman 12.0 Fr.	1.8 cc.- White 1.8 cc - Red	4.0 / 1.6 mm - White 1.6 mm - Red
Hickman 13.5 Fr.	1.4 cc.- Blue 1.3 cc - Red	4.5 / 2.0 mm - Blue 2.0 mm - Red
Hickman 13.5 Fr. Pheresis / Dialysis	1.0 cc.- Blue 1.0 cc - Red	4.5 / 2.0 mm - Blue 2.0 mm - Red
Hickman 13.5 Fr. Pheresis / Dialysis	1.4 cc.- Blue 1.4 cc - Red	4.5 / 2.0 mm - Blue 2.0 mm - Red
Triple-Lumen		
Hickman 10.0 Fr.	0.8 cc.- White 0.8 cc.- Blue 1.4 cc - Red	3.3 / 0.8 mm - White 0.8 mm - Blue 1.5 mm - Red
Hickman 12.5 Fr.	0.7 cc.- White 0.7 cc.- Blue 1.6 cc - Red	4.2 / 1.0 mm - White 1.0 mm - Blue 1.5 mm - Red



Broviac® Catheter

Repair Procedure

Purpose

To repair the damaged external segment of a **Broviac** catheter if there is at least 3 cm. of undamaged catheter remaining.

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

Repair Kit Contents

- Silicone External Replacement Catheter Segment
- Silicone Splicing Sleeve (Shipped Loose-Mounted on Replacement Segment).
- Splice Connector Stent (Mounted on Replacement Segment).
- Injection Cap
- Clamp
- Tube of Medical Adhesive
- Disposable Plastic Syringe
- Blunt 18 Ga. Needle
- Instructions

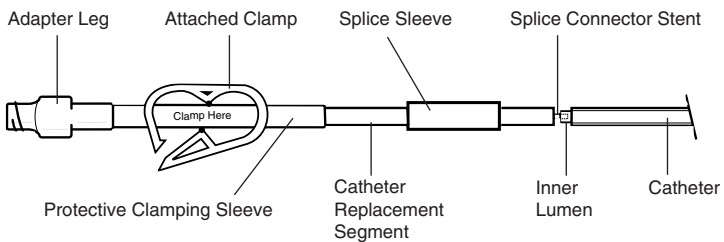
Additional Supplies Needed:

Alcohol
Antiseptic (Povidone-Iodine is Recommended)
Atraumatic Clamp and Forceps
Sterile Drapes
4 in. x 4 in. Gauze Sponges
Heparin (Volume & Concentration per Hospital Policy)
Sterile Scalpel or Scissors

Sterile Gloves
10cc Syringe
Tape
Tongue Blade or Application Sticks

NOTE: The replacement segment, splicing sleeve, and splice connector stents will repair only the catheter size for which the repair kit is indicated.

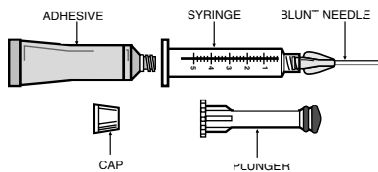
Component Nomenclature



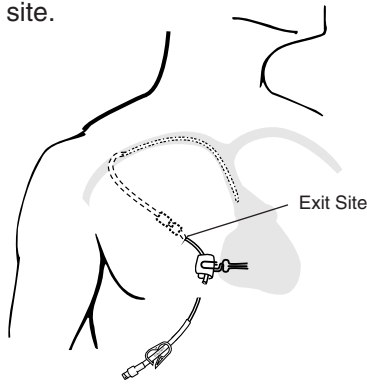
1. Assemble supplies.
2. Clean the external segment of the catheter with antiseptic and gauze and place cleaned segment on a sterile drape. Do not pull on catheter while cleaning.

Using Sterile Technique:

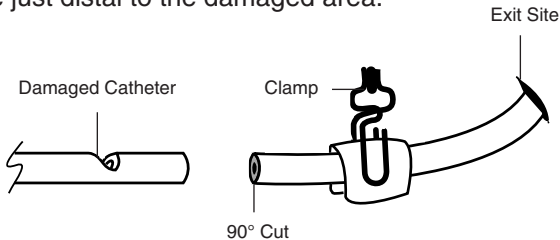
3. Put on sterile gloves, wipe powder from gloves with alcohol and 4 in. x 4 in. gauze, and create a sterile field with drapes.
4. Remove plunger from syringe barrel, inject medical adhesive into syringe barrel, insert plunger, and attach blunt needle.



5. Reposition atraumatic clamp near the skin exit site.

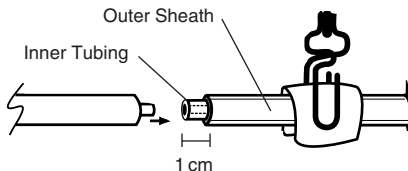


6. Cut the external portion of the damaged catheter at a 90° angle just distal to the damaged area.

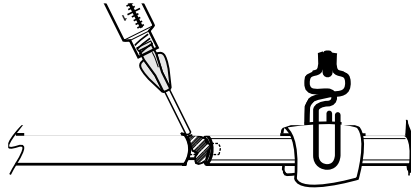


NOTE: The length of the remaining external segment must be sufficient to permit catheter repair and prevent catheter retraction under the skin line. If the inner lumen of the catheter retracts inside the outer sheath, the outer sheath should be cut off flush with the inner lumen.

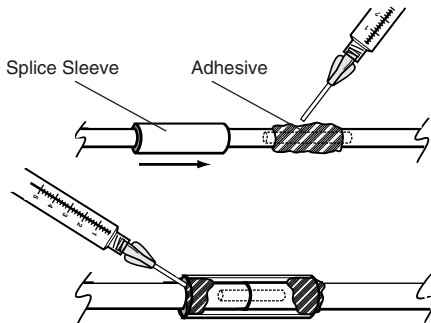
7. Pull inner tubing from outer sheath 1 cm with atraumatic forceps. Insert the splice connector (stent) into the inner lumen until catheter segments are together. Lubricate with Isopropyl 70% alcohol if necessary, but be sure the alcohol is removed or evaporated before proceeding.



-
8. Use syringe to apply adhesive onto the exposed inner lumen and ease outer sheath over it. Roll between fingers to evenly distribute the adhesive and wipe away excessive adhesive.

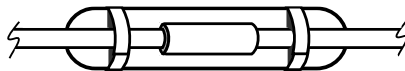


9. Use syringe again to apply adhesive onto the outside of the catheter around the spliced joint. Slide the splicing sleeve down and center it over the joint. Inject adhesive underneath each end of the splicing sleeve. Roll the splicing sleeve between fingers to distribute and extrude excess adhesive. Wipe away excess adhesive.



Sterile Field Is No Longer Required

10. Remove clamp and GENTLY fill catheter with heparin. **CAUTION: Excessive pressure may rupture joint.**
11. Fasten catheter repair joint to splint (application sticks or tongue blade) with tape.



NOTE: If necessary, the catheter may be used for infusion after four hours. The joint will not achieve full mechanical strength for 48 hours. The splint may be removed at that time.



Hickman[®] Single-Lumen Catheter and Multi-Lumen Adapter Leg Repair Procedure

Purpose

To repair the damaged external segment of a single-lumen **Hickman** catheter if there is at least 3 cm. of undamaged catheter remaining beyond the skin exit site, or 3 cm. remaining on the adapter leg of a multi-lumen catheter.

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

Repair Kit Contents

- Silicone External Replacement Catheter Segment
- Silicone Splicing Sleeve (Shipped Loose-Mounted on Replacement Segment)
- Splice Connector Stent (Mounted on Replacement Segment)
- Injection Cap
- Clamp
- Tube of Medical Adhesive
- Disposable Plastic Syringe
- Blunt 18 Ga. Needle
- Instructions

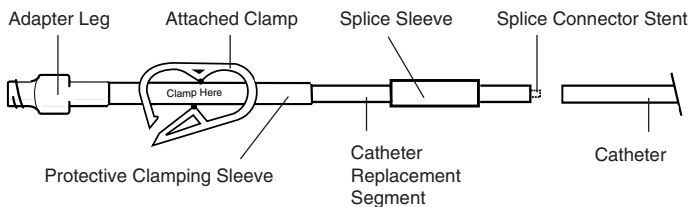
Additional Supplies Needed

Antiseptic (Povidone-Iodine is Recommended)
Atraumatic Clamp
Sterile Drapes

4 in. x 4 in. Gauze Sponges
Heparin (Volume and Concentration per Hospital Policy)
Isopropyl 70% Alcohol
Sterile Scalpel or Scissors
Sterile Gloves
10cc Syringe
Tape
Tongue Blade or Application Sticks

NOTE: The replacement segment, splicing sleeve, and splice connector stents will repair only the catheter size for which the repair kit is indicated.

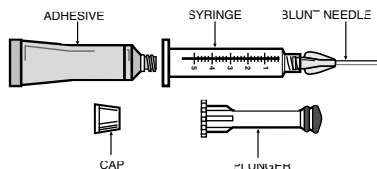
Component Nomenclature



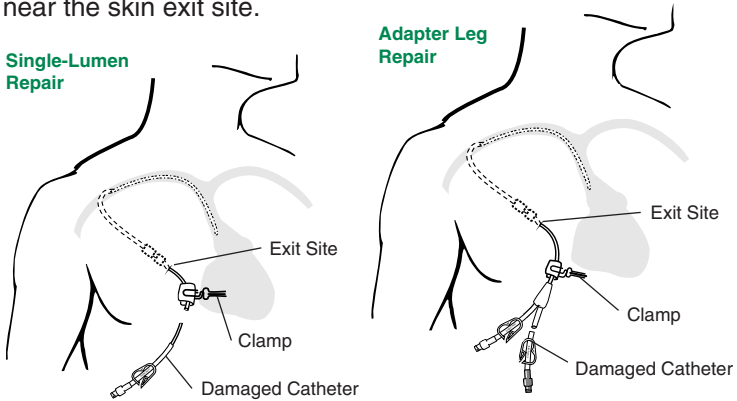
1. Assemble supplies.
2. Clean the external segment of the catheter with antiseptic and gauze and place cleaned segment on a sterile drape.

Using Sterile Technique:

3. Put on sterile gloves, wipe powder from gloves with alcohol and 4 in. x 4 in. gauze, and create a sterile field with drapes.
4. Remove plunger from syringe barrel, inject medical adhesive into syringe barrel, insert plunger, and attach blunt needle.



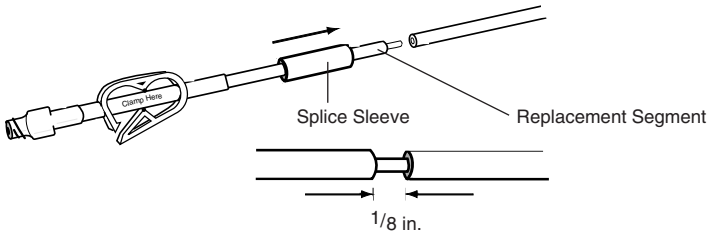
5. Reposition atraumatic clamp near the skin exit site.



6. Cut the external portion of the damaged catheter at a 90° angle just distal to the damaged area.

NOTE: The length of the remaining external segment must be sufficient to permit catheter repair and prevent catheter retraction under the skin line.

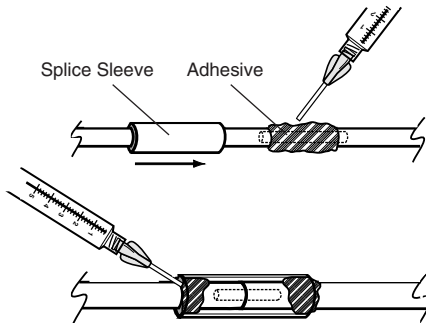
7. Insert the splice connector stent attached to the replacement catheter segment into the catheter lumen until the end of the replacement catheter tubing is $\frac{1}{8}$ in. from the cut end of the catheter.



8. Dry space between catheter ends with a sterile 4 in. x 4 in. gauze pad. Fill the $\frac{1}{8}$ in. space with adhesive and approximate the catheter ends.

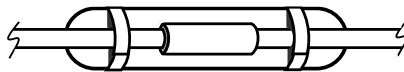
NOTE: If the replacement segment is to be cut to desired length, the splice connector stent can be removed and reinserted. Do not remove the splicing sleeve that is loose-mounted on the replacement catheter segment.

-
9. Use syringe to apply adhesive onto the outside of the catheter around the spliced joint, covering an area about 1 in. overall length. Slide the splicing sleeve down and center it over the joint. Inject adhesive underneath each end of the splicing sleeve. Roll the splicing sleeve between fingers to distribute and extrude excess adhesive. Wipe away excess adhesive.



Sterile Field Is No Longer Required

10. Remove clamp and GENTLY fill catheter with heparin. **CAUTION: Excessive pressure may rupture joint.**
11. Fasten catheter repair joint to splint (application sticks or tongue blade) with tape.



NOTE: If necessary, the catheter may be used for infusion after four hours. The joint will not achieve full mechanical strength for 48 hours. The splint may be removed at that time.



Hickman[®] / Leonard[®]

Multi-Lumen Catheter Body Repair Procedure

Purpose

To repair the damaged external segment of a dual or triple lumen **Hickman** or **Leonard** catheter if there is at least 3 cm. of undamaged catheter remaining.

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

Repair Kit Contents

- Silicone External Replacement Catheter Segment
- Silicone Splicing Sleeve (Shipped Loose-Mounted on Replacement Segment)
- Splice Connector Stents (Mounted on Replacement Segment)
- Injection Cap (one per lumen)
- Clamp (one per lumen)
- Tube of Medical Adhesive
- Disposable Plastic Syringe
- Blunt 18 Ga. Needle
- Instructions

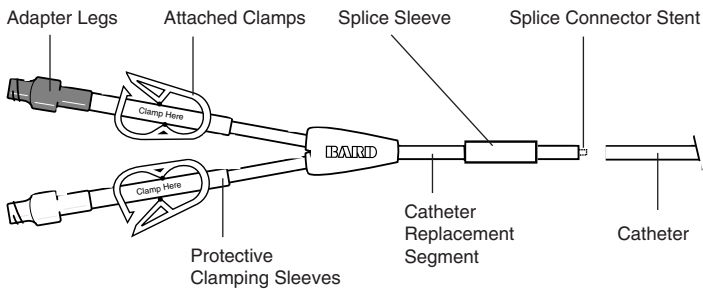
Additional Supplies Needed

Antiseptic (Povidone-Iodine is Recommended)
Atraumatic Clamp
Sterile Drapes
4 in. x 4 in. Gauze Sponges

Heparin (Volume and Concentration per Hospital Policy)
Isopropyl 70% Alcohol
10cc Syringe
Sterile Scalpel or Scissors
Tape
Tongue Blade or Application Sticks
Sterile Gloves

NOTE: The replacement segment, splicing sleeve, and splice connector stents will repair only the catheter size for which the repair kit is indicated.

Component Nomenclature



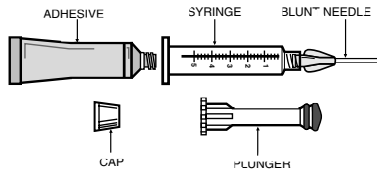
Procedure

1. Assemble supplies.
2. Clean the external segment of the catheter with antiseptic and gauze and place cleaned segment on a sterile drape.

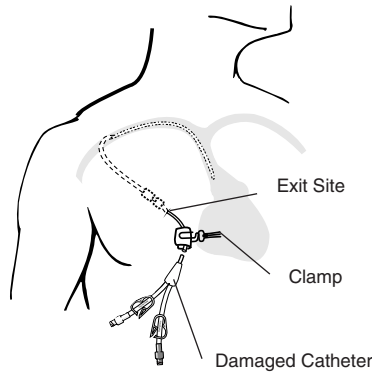
Using Sterile Technique:

3. Put on sterile gloves, wipe powder from gloves with alcohol and 4 in. x 4 in. gauze, and create a sterile field with drapes.

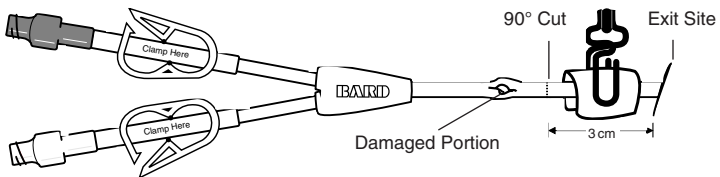
- Remove plunger from syringe barrel, inject medical adhesive into syringe barrel, insert plunger, and attach blunt needle.



- Reposition atraumatic clamp near the skin exit site.

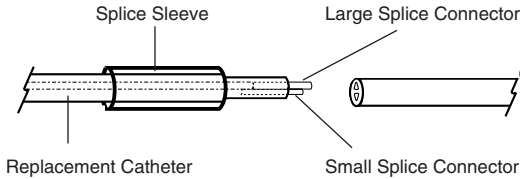


- Cut the external portion of the damaged catheter on a 90° angle just beyond the damaged area.



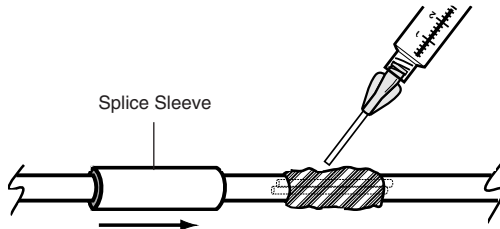
NOTE: The length of the remaining external segment must be sufficient to permit catheter repair and prevent catheter retraction under the skin line (usually about 3 cm).

7. Insert the splice connector stent attached to the replacement catheter segment into the catheter lumen until the end of the replacement catheter tubing is $\frac{1}{8}$ in. from the cut end of the catheter.

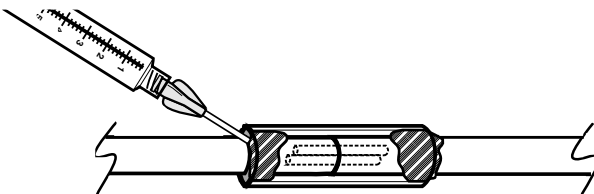


NOTE: Do not remove the splicing sleeve that is loose-mounted on the replacement catheter segment.

8. Dry space between catheter ends with a sterile 4 in. x 4 in. gauze pad. Fill the $\frac{1}{8}$ in. space with adhesive and approximate the catheter ends.
9. Use syringe to apply adhesive onto the outside of the catheter around the spliced joint, covering an area about 1 in. overall length. Slide splicing sleeve down and center it over the joint between the catheter segments.



10. Inject adhesive underneath each end of the splicing sleeve. Roll the splicing sleeve between fingers to distribute and extrude excess adhesive. Wipe away excess adhesive.

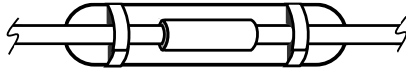


Sterile Field Is No Longer Required

11. Remove clamp and GENTLY fill catheter with heparin.

CAUTION: Excessive pressure may rupture joint.

12. Fasten catheter repair joint to splint (application sticks or tongue blade) with tape.



NOTE: If necessary, the catheter may be used for infusion after four hours. The joint will not achieve full mechanical strength for 48 hours. The splint may be removed at that time.



Troubleshooting Guide

I. Aspiration Difficulties

A. Possible Causes

1. Failure to flush according to Catheter Irrigation Procedure, resulting in lumen obstruction.
2. Catheter tip sucking up to vein wall with aspiration.
3. Blood clot, fibrin sheath, or particulate matter obstructing lumen 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 plug. 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. If it has grown enough to extend to the tip of the catheter, it may be pulled into and obstruct the catheter opening when aspiration is attempted, but offer no resistance to infusion.
4. Compression or transection of the catheter between the clavicle and 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.
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 possible 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 5000 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 mechanically enough to allow low-volume infusion, but prevent aspiration by compression between the clavicle and first rib. The more medial the venipuncture 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. Catheter Occlusion

A. Possible Causes

1. Blood clot completely obstructing lumen.
2. Drug precipitate completely obstructing lumen.
3. May be kinked, coiled, damaged, or compressed between the clavicle and the first rib.
4. Catheter tip may not be within vein.
5. If sutures were used during the placement of the catheter, they can tighten and restrict flow.
6. 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 too tight they should be removed.
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 a 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 “Aspiration Difficulties.”

III. 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 3 cm. of intact catheter beyond the skin exit site is needed to be able to repair the body of the catheter. The appropriate size repair kit must be used.
4. Always use a 10cc syringe or larger when infusing into the catheter.

IV. Air In Line

A. Possible Causes

1. Hole in catheter.
2. Injection cap not pre-filled with normal saline.
3. Loose connections (injection cap, IV tubing).
4. Diffusion and evaporation of water through the external catheter segment due to silicone permeability.
 - 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.

B. Possible Solutions

1. Check catheter for leakage by flushing well with normal saline.
2. Pre-fill injection cap with normal saline before attaching it to the catheter.
3. Check for loose connections (injection cap, IV tubing).
4. Aspirate the air and irrigate the catheter with 10cc normal saline to flush out any aspirated blood. Then heparin lock the catheter.

References

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

V. Fluid Leakage From Catheter Exit Site

A. Possible Causes

1. Catheter punctured by sharp object (i.e. scalpel, suture needle, trocar) just prior to or during placement.
2. Catheter ruptured from attempt to irrigate an occluded catheter with a small syringe (i.e. 1 cc or 3cc syringe).
 - Small syringes can generate very high internal pressure 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.
 - 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.
 - Central vein thrombosis or tumor growths occluding the vein can cause infused fluid to flow back outside the catheter to the skin exit site.
 - 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**, Clinical Support and Field Assurance Department (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.
5. If a fibrin sheath is encapsulating the catheter, obtain order for instillation of urokinase 5,000 IU/ml through the catheter into the fibrin capsule. Follow the procedure for Clearing Blocked Catheter. Urokinase may be able to dissolve or soften the sheath enough so that aspiration of it through the catheter will be possible.

References

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

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: June 1994.
HBLCATHNM

Patents Pending.

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

Clinical Information Hotline: 1-800-443-3385