DAVOL Specialty Access Products

NURSING PROCEDURE MANUAL

GROSHONG™ C.V. CATHETER

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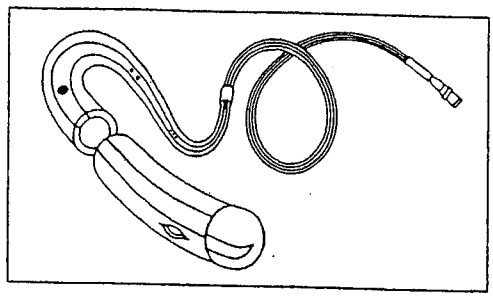
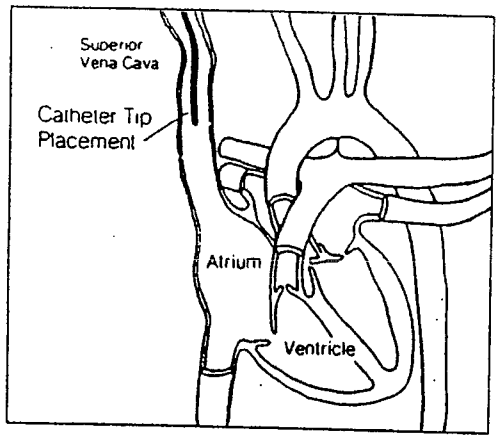
INTRODUCTION

Description



The Groshong™ Central Venous Catheter is a thin-walled, translucent silicone rubber catheter with a radiopaque stripe, depth markings, and a rounded, blunt tip that incorporates the patented three-position Groshong™ valve. The Groshong™ valve is available in long-term, cuffed catheters and shorter term, non-cuffed acute care catheters, as well as in an implantable port.

Placement

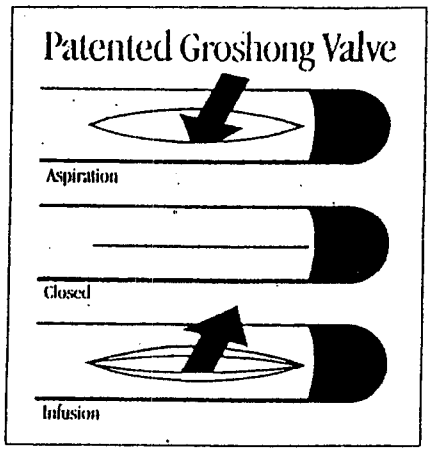


The catheter is placed via one of the large central veins so that its tip lies in the superior vena cava above the right atrium. The long-term catheter is tunnelled subcutaneously for several inches to the desired exit site. The dacron cuff, attached to the long-term catheter, is positioned in the tunnel 3-5 cms above the skin exit site. The cuff assists in securing the catheter in place through ingrowth of fibrous tissue and helps reduce the potential for infection caused by the migration of bacteria through the subcutaneous tunnel. The acute care catheter is not tunnelled.

Valve Function

The Groshong™ central venous catheters incorporate the patented, 3-position, pressure-sensitive Groshong™ valve. It is placed near the rounded, closed, radiopaque catheter tip and allows fluid infusion and blood aspiration. When not in use the valve design restricts blood backflow and air embolism by

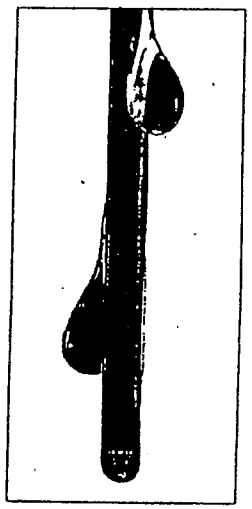
remaining closed. The Groshong™ valve is designed to remain closed between -7 and 80 mm Hg. The normal central venous pressure range in the superior vena cava is 0 to 5 mm Hg. Pressure in the superior vena cava must exceed 80 mm Hg to force the valve inward and cause bleedback. Air cannot enter the venous system if the catheter is open unless the superior vena caval pressure drops below -7 mm Hg. Applying significant negative (vacuum) pressure will cause the valve to open inwards, allowing blood aspiration. Positive pressure into the catheter (gravity, pump, syringe) will open the valve outward, allowing fluid infusion. When pressures return to normal values, the valve will close. The need for the anticoagulant effect of heparin is eliminated because the closed valve prevents blood from backing into the catheter tip and clotting. If the catheter is aspirated, pulling the valve inward, it must be flushed to allow the valve to return to its normal closed position.



The benefits provided by the Groshong™ valve are:

1. Patient safety due to reduced risk of air embolism or bleedback.
2. Elimination of the need for heparin as an irrigant to maintain catheter patency.
3. Reduced need for catheter clamping.
4. Reduced need for flushing when the catheter is not in use (flushed every seven days with normal saline when not in use).

The multi-lumened Groshong™ catheter valves are rotated and staggered, allowing the concurrent infusion of incompatible drugs. Each lumen of a multilumen catheter is treated separately for maintenance and irrigation purposes.



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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

10 cc syringe with attached 20-21 gauge 1" needle filled with 5cc normal sali

Procedure:
1. Clean injection cap with alcohol and/or povidone-iodine wipe.
2. Insert needle of syringe filled with 5 cc normal saline into injection cap.
3. Inject saline, maintaining positive pressure on syringe plunger as last 1/2 is infused and 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:

Supplies:
Isopropyl alcohol and/or povidone-iodine wipes

10cc syringe with attached 20-21 gauge 1" needle filled with 10cc normal sali

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

NOTE: If blood is aspirated prior to infusion of medications (to check venou placement), catheter should be irrigated with 10 cc of normal saline prior to attaching medication syringe, or IV, or pump tubing. Failure to do so may re: in an occluded catheter, which can lead to difficulty in aspirating in the futur

Prior to blood sampling when TPN infusing:

Procedure:
1. Follow routine maintenance irrigation procedure, **except use 20cc norm saline** and flush vigorously to clear TPN from catheter.

References:

"Patient's Information Manual, Groshong/Cath-tech® CV Catheter -Long Term", Catheter Technology Corporation, Salt Lake City, Ut., 1988.

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BLOOD WITHDRAWAL/ASPIRATION PROCEDURE

Purpose:

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

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

Hub-To-Hub Technique (syringe)

Supplies:

3 - 10 cc syringes

2 - 19-20 gauge 1" needles.

0.9% Sodium Chloride (normal saline).

Isopropyl alcohol wipes/povidone-iodine wipes

Blood specimen tubes.

Procedure:

1. Wash hands thoroughly.
2. Draw up 10 cc of normal saline in syringe and set aside.
3. Remove injection cap/I.V. tubing from catheter hub.
4. Clean catheter hub with alcohol and/or povidone-iodine wipe.
5. Attach an empty 10 cc syringe to catheter hub.
6. Pull back syringe plunger 1-2 cc, pausing for 2 seconds to allow catheter valve to open and blood to come into catheter. Slowly continue to aspirate 5 cc of blood.
7. Disconnect syringe and discard (saline in catheter dilutes specimen and may alter lab values).
8. Attach an empty 10cc syringe and aspirate per step no. 6 to withdraw amount of blood needed for testing.
9. Disconnect syringe and attach saline-filled syringe.
10. Vigorously flush the catheter with 10 cc normal saline.
11. Disconnect syringe and clean catheter hub with alcohol and/or povidone-iodine wipe.
12. Attach new injection cap per Injection Cap Change Procedure or attach sterile I.V. tubing to hub of catheter.

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

:edle Through Injection Cap (Vacutainer™)

lay use 10cc syringe with attached needle in place of Vacutainer™)

ıpplies:

ıcutainer™ sleeve and attached needle.

10cc syringes with attached 20-21 gauge 1" needle

)% Sodium Chloride (normal saline)

)propyl alcohol wipes/povidone-iodine wipes

ood specimen tubes

ocedure:

Wash hands thoroughly.

Draw up 10 cc of normal saline in syringe and set aside.

Clean injection cap with alcohol and/or povidone-iodine wipe.

Insert needle of 10 cc syringe into injection cap.

Pull back syringe plunger 1/2 cc, pausing for 2 seconds to allow catheter valve to open and blood to come into catheter. Slowly continue to aspirate 5 cc of blood.

)TE: A Vacutainer™ specimen tube may be used to withdraw the discard nple, but be sure to use one with at least a 5 cc capacity.

Remove syringe from injection cap and discard.

Insert Vacutainer™ needle into the injection cap. Push blood specimen tube into Vacutainer™ sleeve so that needle pierces rubber stopper.

Blood needed for specimen will flow into specimen tube. Change tubes as needed for required tests.

Remove Vacutainer™ needle and sleeve.

Insert needle of saline-filled syringe and vigorously flush the catheter with 10 cc of normal saline.

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).

)TE: If you encounter difficulties with blood withdrawal, see Troubleshooting ide - Aspiration Difficulties

ferences:

egan, Marylou, & Snyder, Gale, "Groshong™ CV Catheters - Protocol For rsing Care & Maintenance", Catheter Technology Corporation, Salt Lake City, , February 1986.

INJECTION CAP CHANGE

Purpose:

To minimize potential for infection and 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

10 cc syringe with attached 20-21 gauge 1" needle filled with 5cc normal saline

Procedure:

1. Wash hands.
2. Open injection cap package and prefill injection cap with normal saline.
3. Hold the hub of the catheter below the level of the heart (prevents "manometer effect") and unscrew 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 it clockwise onto the catheter hub.
6. Irrigate the catheter with 5 cc normal saline following the Catheter Irrigation Procedure.
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

urpose:

o prevent external iatrogenic infection of the central venous catheter.

requency:

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

ansparent dressings - every 7 days and prn if loosened.

OTE: If granulocyte count less than 200mm , you may wish to consider anging the dressing daily.

auze and Tape dressing

ong-term catheters: recommended for first 1-2 weeks after placement until the lff is healed in)

ıpplies:

erile dressing kit which includes:

- Isopropyl alcohol swabsticks or hydrogen peroxide swabsticks
- Povidone-iodine swabsticks
- Packet povidone-iodine ointment
- 2" x 2" split gauze
- 2" x 2" gauze
- Protective dressing wipe or swabstick (optional)
- Isopropyl alcohol wipe
- Pr. - Sterile gloves (recommended if dressing is changed in the hospital)

ocedure:

Wash hands thoroughly..

Carefully remove old dressing and discard. Avoid tugging on the catheter, or the use of scissors, or other sharp objects near the catheter.

Inspect catheter exit site for swelling, redness, or exudate. Notify physician if problem observed.

Wash hands thoroughly.

Put on sterile gloves.

Clean the catheter exit site with an alcohol or hydrogen peroxide swabstick, 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. Repeat with the remaining 2 swabsticks.

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 prepped. 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. Do not pull on the catheter.
10. Apply a small amount of povidone-iodine ointment to the catheter exit site.
11. Apply a split 2" x 2" gauze over the catheter exit site.
12. Top with a 2" x 2" 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" x 2"'s and allow to dry completely.
14. Cover gauze and 1" 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 swabsticks

3 - Povidone-iodine swabsticks

1 - Packet povidone-iodine ointment (optional)

1 - Transparent dressing

1 - Isopropyl alcohol wipe

1 Pr. - Sterile gloves (recommended if dressing is changed in the hospital)

1 - 2" x 2" or 4" x 4" 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 or hydrogen peroxide swabstick,

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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. Repeat with the remaining 2 swabsticks.

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 prepped. Do not return to the catheter exit site with the same swabstick. Repeat with the remaining 2 swabsticks.

Allow povidone-iodine to dry at least 2 minutes.

Gently clean the outside of the catheter with the inside surface of an alcohol wipe, starting from the exit site to the catheter hub. Do not pull on the catheter.

Pat the exit site with sterile gauze to remove any excess povidone-iodine.

Apply a small amount of povidone-iodine ointment to the catheter exit site (optional).

Apply the transparent dressing by centering it over the catheter exit site.

Loop the catheter tubing and tape it securely to the skin. (Prevents pulling on the catheter).

erences:

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

phy, LM, Lipman, TO, "Central Venous Catheter Care in Parenteral Nutrition: eview", Journal of Parenteral & Enteral Nutrition, Vol. II, No. 2, 1987, pp. 201.

me, AE, Trigger, JA, "Catheter Dressings in Central Venous Parenteral ition: A Prospective Randomized Comparative Study", Nutritional Support ices, Vol. 4, 1984, pp. 42-50.

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

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

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

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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.

PICC DRESSING CHANGE PROCEDURE

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

Frequency:
Every seven days and prn if loosened or damp.

Supplies:
Sterile dressing kit which includes:

3 - Isopropyl alcohol swabsticks

3 - Povidone-iodine swabsticks

1 - Packet povidone-iodine or antibiotic ointment

2 - 2" x 2" gauze

1 - 10 x 12 cm transparent dressing

1 Pr. - Sterile gloves

Procedure:

1. Wash hands thoroughly.
2. Carefully remove old dressing and discard. Avoid tugging on the catheter, or use of scissors, or other sharp objects near the catheter.
3. Inspect the catheter exit site for swelling, redness, or exudate. Notify physician if problem observed.
4. Wash hands thoroughly.
5. Put on sterile gloves.
6. Clean the catheter exit site with an alcohol swabstick, starting at the exit site and spiraling outward until a circle at least 2 inches in diameter has been prepped. Do not return to the catheter exit site with the same swabstick. Repeat with the remaining 2 swabsticks.
7. Clean the catheter exit site with a povidone-iodine swabstick, starting at the exit site and spiraling outward until a circle at least 2 inches in diameter has been prepped. 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. Apply a small amount of povidone-iodine or antibiotic ointment to the catheter exit site and all suture sites.
10. Fold a 2" x 2" gauze in half and place it under the catheter hub.
11. Place a 2" x 2" gauze over the catheter exit site and suture site.
12. Apply the transparent dressing, centering it over the gauze.
13. Loop tubing and tape it securely to dressing or skin (prevents pulling on the catheter)

CLEARING OCCLUDED CATHETERS

Purpose:
To restore patency to a catheter with an occlusion

Supplies:

1 - Sterile injection cap

1 ml - 5,000 IU/cc urokinase

1 - 10cc syringe with attached 20-21 gauge 1" needle

1 - 10cc normal saline-filled syringe with attached 20-21 gauge 1" needle

Isopropyl alcohol wipes

Procedure:

1. Wash hands.
2. Remove injection cap, attach an empty 10cc syringe and attempt to aspirat If aspiration is successful, withdraw clots and flush catheter with 10 ml normal saline. Replace cap. If aspiration is unsuccessful, proceed to Step
3. Obtain physician's order for the use of urokinase 5,000 IU/cc to declot the catheter.
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):

Single Lumen Catheters

8 Fr XL = 1.2cc

8 Fr = 0.9cc

7 Fr = 0.7cc

5.5 Fr = 0.4cc

3.5 Fr = 0.13cc

Dual Lumen Catheters

9.5 Fr = red 0.83cc / white 0.52cc

9.5 Fr XL = red 0.9cc / white 0.57cc

PICC Catheters

Single lumen = .33cc

Acute Care Catheters

Dual lumen:

15cm = red 0.48cc / white 0.27cc

20cm = red 0.56cc / white 0.30cc

30 cm =red 0.74 cc / white 0.35cc

Triple lumen:

15cm = red 0.38cc / yellow 0.27cc / white 0.28cc

20cm = red 0.44cc / yellow 0.30cc / white 0.31cc

30cm = red 0.57cc / yellow 0.35cc / white 0.36cc

Aseptically attach the urokinase-filled syringe to the catheter hub. Slowly and gently inject the urokinase solution into the catheter. If strong resistance is felt, to avoid catheter rupture, do not force entire amount into catheter.

Leave 10 ml syringe attached to catheter. Do not attempt to aspirate for 1-2 hours.

After 1-2 hours, attempt to aspirate the drug and residual clot. If unsuccessful, repeat urokinase instillation.

When patency is restored, aspirate 5 ml of blood to assure removal of all drug and clots.

Remove blood-filled syringe and replace it with a 10cc syringe filled with normal saline. Flush catheter to verify patency.

Attach sterile, saline-filled injection cap.

)TE:

Infusing:

TPN and lipid "all in one" 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.

ferences:

letich, J., "Declotting Central Venous Catheters with Urokinase in the Home Nurse Clinicians", NITA, Nov/Dec 1987, pp. 428-430.

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

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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. II, No. 2, 1987, pp. 190-201.

Pennington, CR, Pithic, AD, "Ethanol Lock in the Management of Catheter Occlusion", Journal of Parenteral & Enteral Nutrition, Vol. II, 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.

'RESSURE MONITORING

ırpose:
· determine blood volume, fluid replacement needs, and right heart pressures.

pplies:
'ater manometer)
fluid
ıter manometer
tubing
ıpcock

ɔcedure:
ater manometer)
Set up IV lines and manometer according to hospital protocol.
Flush tubing with IV fluid.
Zero the manometer at the level of the prone patient's right atrium.
Turn the stopcock on the manometer so that the IV fluid runs into the manometer, not the patient.
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.
Fluid will slowly lower in the manometer until it stabilizes. Record that value.
Subtract the "valve closing pressure" from the manometer reading (5.44cm H_2O or 4mm Hg) to give the true central venous pressure reading.

ɔplies:
essure transducer)
ssure transducer
ɔplies as indicated by hospital procedure

ɔcedure:
essure transducer)
Set up pressure transducer per hospital protocol.
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.

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CONNECTOR REPAIR PROCEDURE

Purpose:
To repair a damaged or loose connector.

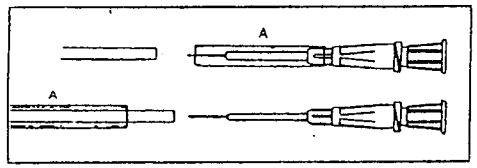
Supplies:
1 - Replacement Connector:

Catheter Size	Connector Color	Connector Product Code No.
8 Fr.	Orange	7712800
7 Fr.	Pink	7712700
5.5 Fr.	Yellow	7712550
3.5 Fr.	Green	7712350
9.5 Fr. DL	Red	7712500
9.5 Fr. DL	White	7712510
4 Fr. (PICC)	Gray	7712400

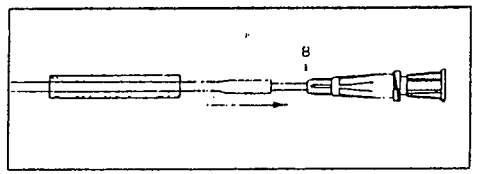
3 - Isopropyl alcohol wipes
1 - Povidone-iodine wipe
1 - Sterile scissors
1 Pr. - Sterile gloves
1 - 10cc syringe with attached 20-21 gauge 1" needle filled with 5cc normal saline

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" distal to the location of the previous connector or damaged site to remove any damaged catheter material.

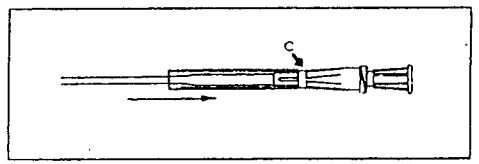
5. Transfer the clear sleeve (A) onto catheter from connector.



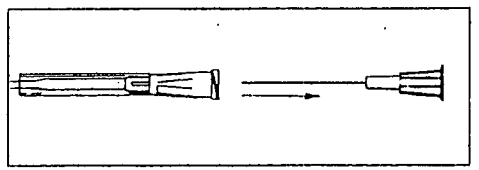
6. Firmly push catheter onto adapter to Position B.



7. Slide the clear oversleeve over the catheter and hub to Position C. 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.



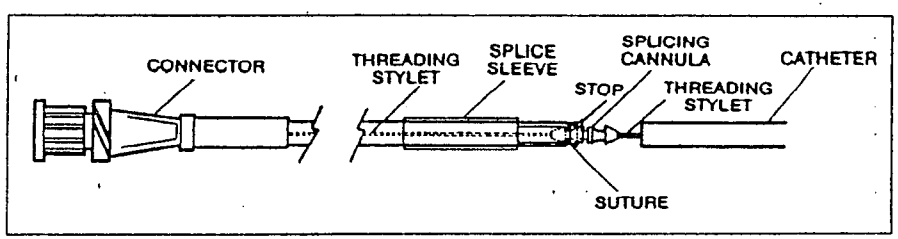
SINGLE LUMEN CATHETER BODY REPAIR PROCEDURE

Purpose:
To replace or lengthen a damaged external catheter segment

Supplies:
1 - Sterile repair kit:
- 8 Fr #7741800
- 7 Fr #7741700
- 5.5 Fr #7741550
- 3.5 Fr #7741350

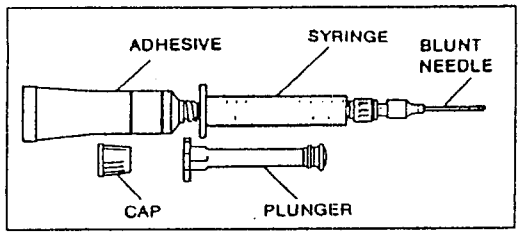
Povidone-Iodine wipe
Isopropyl alcohol wipes
Atraumatic clamp
2 - 4" x 4" gauze pads
10 cc syringe with attached 20-21 gauge 1" needle filled with 10cc normal saline
Surgical mask and cap (per hospital policy)
Tape
Tongue blade
Isopropyl alcohol solution
Sterile gloves

Component Nomenclature:

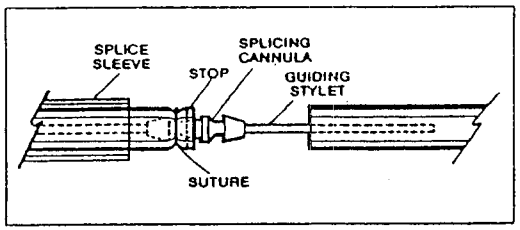


Procedure:
1. Wash hands thoroughly.
2. Clean the catheter segment to be repaired with a povidone-iodine wipe. Remove iodine with alcohol wipe. Allow to dry completely.
3. Place the cleaned catheter on a sterile 4" x 4" gauze.

4. Put on sterile gloves. Remove the powder from the gloves with the alcohol solution and 4" x 4" 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.

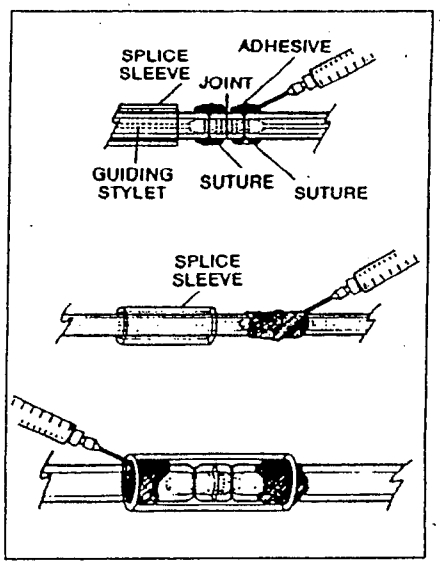


8. Cut the external portion of the damaged catheter on a 90° angle. The length of the remaining external segment must be at least 2 inches to permit catheter repair and prevent catheter retraction under the skin.
9. Using the green threading stylet, align the splicing cannula (pre-attached to replacement 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 1/2 inch on either side of the connection. Slide the splice sleeve 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 green threading stylet from the catheter hub.

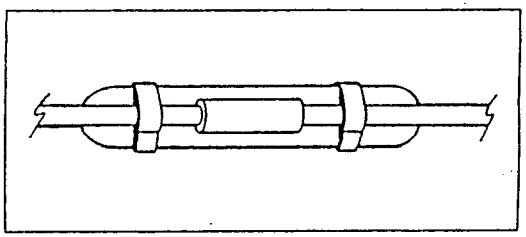


STERILE FIELD NO LONGER REQUIRED

13. Remove atraumatic clamp, if used. Aspirate the air in the replacement segment. Then gently fill the catheter with 10cc sterile normal saline.

CAUTION: Excess 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 four hours. The joint will not achieve full mechanical strength for 48 hours, at which time, the tongue blade may be removed.

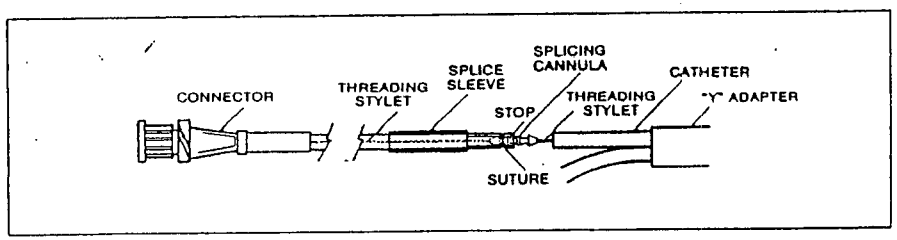
0124

DUAL LUMEN CATHETER EXTENSION REPAIR PROCEDURE

Purpose:
To replace damaged extension tubing of the dual-lumen Groshong™ Catheter.

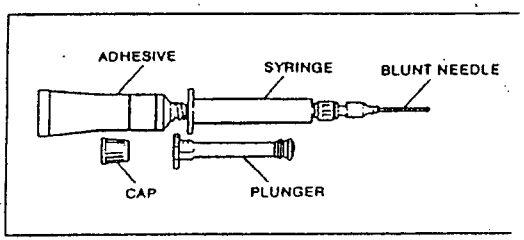
Supplies:
Sterile repair kit #7740000
Povidone-iodine wipe
Isopropyl alcohol wipe
Atraumatic clamp
2 - 4" x 4" gauze pads
10 cc normal saline-filled syringe with attached 20-21 gauge 1" needle
Surgical mask and cap
Tape
Tongue blade
Alcohol solution
Sterile gloves

Component Nomenclature:

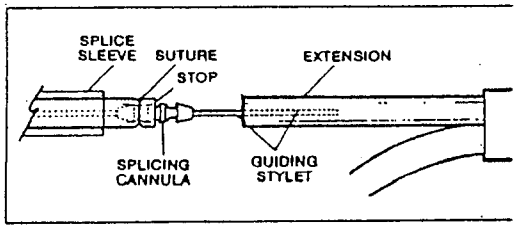


Procedure:
1. Wash hands thoroughly.
2. Clean the extension to be repaired with povidone-iodine wipe. Remove povidone-iodine with alcohol wipe. Allow to dry completely.
3. Place the cleaned extension on a sterile 4" x 4" gauze.
4. Put on sterile gloves. Remove the powder from the gloves with the alcohol solution and 4" x 4" 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.

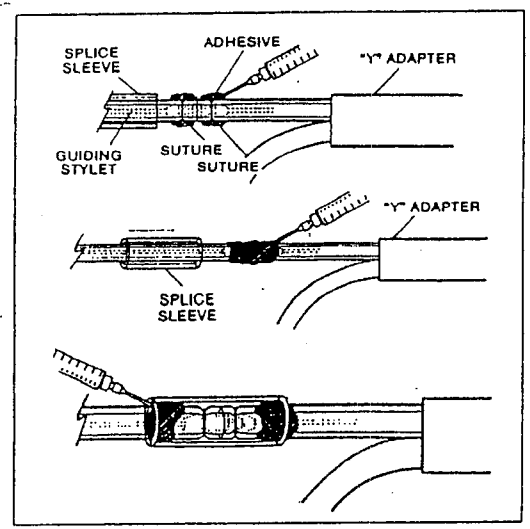


8. Cut the damaged extension on a 90° angle. The length of the remaining extension must be sufficient to permit repair without inserting the splicing cannula (1/2" inch long) into the "Y" joint.
9. Using the green threading stylet, align the splicing cannula (pre-attached to replacement extension) with 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 1/2" on either side of the connection. Slide the splice sleeve 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 green threading stylet from the catheter hub.

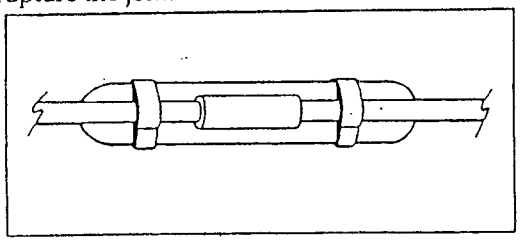


STERILE FIELD NO LONGER REQUIRED

13. Remove atraumatic clamp, if used. Aspirate the air in the replacement extension. Then gently fill the extension and the catheter with 10cc sterile normal saline.

CAUTION: Excess 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 four hours. The joint will not achieve full mechanical strength for 48 hours, at which time, the splint may be removed.



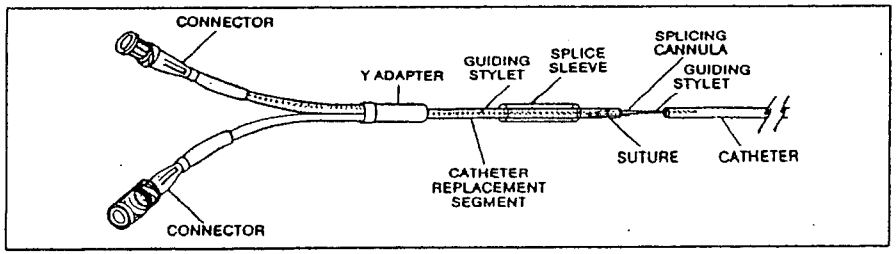
0126

DUAL LUMEN CATHETER BODY REPAIR PROCEDURE

Purpose:
To replace a dual-lumen external catheter segment damaged between the body site and the bifurcation of the extensions

Supplies:
Sterile repair kit #7742000
Povidone-iodine wipe
Isopropyl alcohol wipe
Atraumatic clamp (if needed)
2 - 4" x 4" gauze pads
10 cc normal saline-filled syringe with attached 20-21 gauge 1" needle
Surgical mask and cap
Tape
Tongue blade
Isopropyl alcohol solution
Sterile gloves

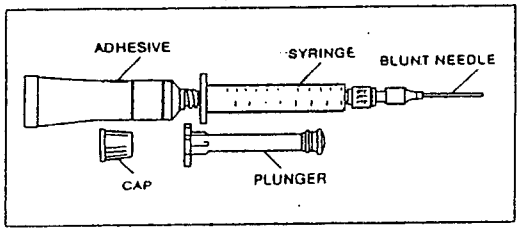
Component Nomenclature:



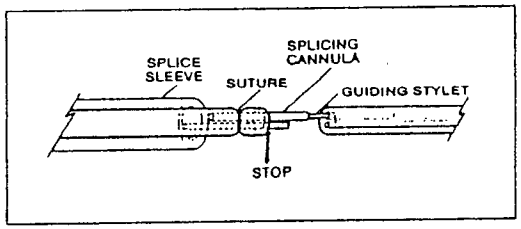
Procedure:

1. Wash hands thoroughly.
2. Clean the catheter segment to be repaired with a povidone-iodine wipe. Remove the povidone-iodine with an alcohol wipe. Allow to dry completely.
3. Place the cleaned catheter on a sterile 4" x 4" gauze.
4. Put on sterile gloves. Remove the powder from the gloves with the alcohol solution and 4" x 4" gauze. (Powder adheres to silicone).
5. Place the drape to create a sterile field.

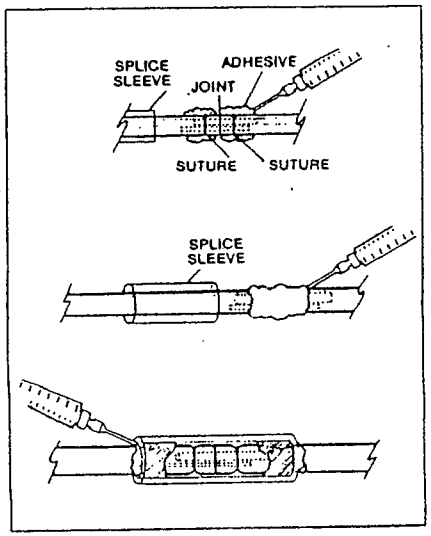
6. Load adhesive into syringe barrel and insert plunger.
7. If needed, clamp catheter with an atraumatic clamp near the skin exit site.



8. Cut the external portion of the damaged catheter on a 90° angle. The length of the remaining external segment must be sufficient (at least 2 inches) to permit catheter repair and prevent catheter retraction under the skin.
9. Using the green threading stylet, align the splicing cannula (pre-attached 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 1/2 inch on either side of the connection. Slide the splice sleeve 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.



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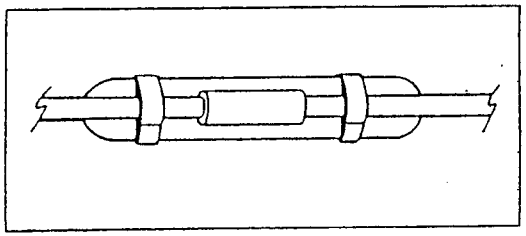
12. Remove the green threading stylet from the catheter hub.

STERILE FIELD NO LONGER REQUIRED

13. Remove atraumatic clamp, if used. Aspirate the air in the replacement segment. Then gently fill each lumen with 10cc sterile normal saline.

CAUTION: Excess 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 four 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. 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 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 obstruct the catheter valve when aspiration is attempted, but offer no resistance to infusion.

3. Compression or transection of the catheter between the clavicle and the first rib ("pinch-off area").
4. 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.

5. Malposition of catheter (i.e. in 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. Exterior sutures may be replaced using the removable suture wing if the cuff is not healed in.
2. If no resistance to infusion is felt, attempt to flush vigorously with 10cc normal saline. Then pull back 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 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. 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 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 open the catheter valve.
- Impingement of the catheter tip on the tricuspid valve, heart wall, or apex of the heart can force the catheter valve open.

4. Catheter valved 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 vigorously with 10cc normal saline. If resistance is felt, see #3.

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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.
- 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 completely obstructing lumen.
3. May be kinked, coiled, damaged, or pinched between the clavicle and the 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. 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 #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 for holding long-term catheters in place until the Dacron 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 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 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 the damage has occurred.

B. Possible solutions

1. 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 inches of intact catheter beyond the skin exit site is needed to be able to repair the body of the catheter.
4. Always use a 10cc syringe or larger when irrigating 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 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 8-10 cms 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 certain fluids 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.
- Diffusion of water across the silicone membrane is not likely to occur where the catheter is inside the body, due to the high water content of the body. The amount of air observed in the external segment will, therefore, be only about 0.5cc or less in volume.

References:

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

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 connector and oversleeve (see Connector Repair Procedure).
4. Aspirate the air and then irrigate the catheter with 10cc normal saline to flush out any aspirated blood.
5. Flush the catheter with 5cc normal saline if 1/2cc of air is not considered to be a risk to the patient.
6. Perform procedures requiring the catheter to be opened to the air with the connector end below the level of the heart.

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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 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. 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 Catheter Technology Corporation (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 Catheters. Urokinase may be able to dissolve or soften the sheath enough so that aspiration of it through the catheter will be possible.

References:

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

RIGHT ATRIAL CATHETERS

	HICKMAN		GROSHONG		CENTRAL VENOUS
1.	Inserted into right atrium	1.	Inserted into uppermost tip of right atrium	1.	Inserted into the subclavian vein
2.	White, flexible catheter usually has white hub	2.	Opaque, flexible catheter usually has orange hub	2.	Triple lumen catheter proximal, middle, distal ports
3.	Must use smooth clamps (no teeth) when removing cap or changing tubing	3.	Does not need to be clamped. Has an anti-reflux valve in tip	3.	Clamp CVC ports with smooth edged clamps
4.	Use only one inch needle when drawing blood or hanging fluids. A longer needle can puncture the catheter	4.	Same	4.	Same
5.	Use only luer-lok caps on the end of the catheter. Change at least once a week and PRN	5.	Same	5.	Same
6.	Must flush with 5cc hep-lock solution (1:100u/cc) every day	6.	Must flush with 5cc normal saline once a week if not in use	6.	Flush every port not in use with 2cc Hep-lock solution (1:100 u/cc) every 8 hours
7.	Flush with slow even pressure. May flush through cap	7.	Flush vigorously to clear out valve. It's best to flush with the cap off	7.	Flush with slow even pressure. May flush through cap
8.	After blood draws, flush with 20cc of normal saline then 2cc hep-lock solution after each IV med infusion	8.	Flush with 5cc normal saline after each IV medication (if no maintenance IV) and with 20cc after blood draws	8.	Flush with 5cc normal saline then 2cc hep-lock solution after blood draws or aspiration
9.	Change dry sterile dressing 2x/week and biocclusive dressing Q week	9.	Same	9.	Change dry sterile dressing every 48 hours and biocclusive Q week
10.	Coil excess catheter up and tape on chest with cap pointing upwards towards patient's shoulder	10.	Same	10.	Same

Catheter Management

Karen Burke, RN, BSN, CNSN

SHORT TERM CATHETERS

Infection and occlusion are the most commonly occurring complications of central line catheters. With the insertion of catheters using sterile technique and the evolution of strict protocols for catheter site care, the rate of catheter infection has decreased.

site cath tip culture

Catheter Sepsis

Definition:

1. *Catheter associated infection*
   a. *Purulent discharge at the catheter site*
   b. *> 15 colony forming units on a semi quantitative culture*

2. *Catheter related bacteremia*
   a. *Same organism cultured from the catheter and blood*
   b. *Increased temperature; increased WBC*

Evaluation of Suspected Catheter Infection:

1. *Work up a febrile patient with a central line with no obvious source. Look for local signs of infection.*
   a. *If local infection is suspected culture site*
   b. *If culture is positive, catheter should be removed and a catheter should be placed in a new site*

2. *Work up for a febrile patient with a central line with no obvious source of infection.*
   a. *change catheter over a guidewire and culture*
      1. *Semi Quantitative Culture- > 15 colony forming units are significant for confluent growth*
      2. *Culture Tip- cut tip long enough to roll over agar plate*
      3. *Culture Skin Segment- that segment from entry of skin to entry of vein. (2-3 cm)*
      4. *Blood Cultures- peripherally and centrally*

   b. *If tip > 15 cfu. the catheter is removed; patient is treated with the appropriate antibiotic and a new catheter site is chosen*

Fever goes ↓

c. *If the patient efferverses after catheter was removed, the catheter was most likely the culprit even though the culture may be negative*

d. *After rolling the catheter over an agar plate, the catheter is placed in a broth culture. This will provide information about inside of the catheter*

e. *Microorganisms that cause catheter infection*
   1. *Gram positive cocci- 60%*
      a. *Coagulase Negative Staphylococci*
      b. *Staphylococcus aureus*
      c. *Streptococcus*
   2. *Gram negative Bacilli- 25%*
   3. *Fungi- 10%- TPN supports the growth of fungal infection*
   4. *Miscellaneous organisms*

Types of Short Term Catheters

1. *Single Lumen Catheter- lower rate of infection*
2. *Triple Lumen Catheter- large hole, more ports, multiple portal of entry*
3. *Swan Ganz*

Causes of Catheter Related Infection

1. *Migration of micro organisms from skin through catheter tract*
2. *Contamination of the catheter hub*
3. *Contamination of infusion fluid- rarely*
4. *Hemogenous seeding of the catheter from another source*

Prevention

Insertion-

Site Selection- femoral higher incidence of infection. Jugular is next due to difficulty of maintaining dressing integrity. Subclavian approach is the easiest to dress, least likely to become infected.

Sterile technique during insertion is necessary. Use mask, gloves, gown, drapes. Watch guidewire! Assistant needs mask.

Duration- Indefinitely

Although there are studies that support changing every 3 to 7 days

-When Nutrition Support Team places a catheter it is not changed unless there is a problem with the catheter.

-Some of our catheters have remained in place for months

Use for TPN- greater chance of infection when a catheter is used for TPN, reserve one port for TPN

Dressing Management

1. *Materials should be packaged in a sterile kit*
   -should include gloves, alcohol, betadine ointment, gauze dressing, skin protectant and tape

Site Care

1. *Acetone/Alcohol- acetone can be irritating; alcohol is defatting agent. destroys integrity of cell wall; not effective against yeast and fungi*

2. *Hydrogen Peroxide-*

3. *Povidone Iodine- effective against yeast and fungi*
   - kills in 30-60 seconds
   -bacterialcidial effect last 8-12 hours

4. *Chlorhexidine- More difficult to use because it needs to be washed off. Make study showed chlorhexidine was 3 fold better in preventing infection. We have used for skin prep in patients who are allergic to betadine.*

5. *Ointment*

a. *Betadine- use small amount; large amount can irritate the skin*

b. *Neosporin- increased risk for superinfection*

Frequency of dressing changes

1. *Gauze and tape- every 48-72 hours; M-W-F is an acceptable schedule*

2. *Transparent- dressing can remain in place up to 7 days without changing*

3. *Any time occlusive seal is broken*

Catheter dressing

Type

Gauze, tape

Transparent- new transparent dressing Opsite 3000- allows water vapors to evaporate

Care of hub- wash, clean & Alc, Betadyne

Silver impregnated cuff and catheter

Complications of CVC catheter

1. *Pneumothorax- can be delayed*
   -emaciated thin patient more at risk
   -need experienced physician
   - > 25% require chest tube insertion
   - watch for signs and symptoms after line insertion

2. *Catheter malposition- radiologic confirmation of position is necessary even with guidewire changes*

3. *Thrombosis- tenderness, pain, swelling in neck/collarbone region*
   -pain or swelling in the arm on the side catheter is placed
   -sluggish infusion flow

4. *Arterial puncture- often occurs when patients are dehydrated*
-better to hydrate prior to line insertion

5. *Air Embolism- leur lock*
-needless system
needleless

Occluded Catheters

Catheter flush, frequency, concentration, volume

Swans
Flush q8hrs
new hepar/~~q7h~~ q8hrs
100u/ml

Things that clog:
-blood
-Calcium- phosphate precipitate
-IV lipids

Declotting Occluded Catheter

Many hospitals require physician to aspirate clot

Urokinase- enzymatic protein used for fibrin occluded CVC
half life 11-23 ~~menulle~~ minutes
5000 units/ml
know volume of catheter

Catheter Clearance Protocol
for Occluded Central Venous Catheters

SUSPECTED CAUSE OF OCCLUSION	AGENT OF CHOICE TO CLEAR CATHETER
Blood coagulum	*Urokinase (5000 units/ml)*
Calcium-phosphate precipitate	*0.1 N hydrochloric Acid*
IV lipid	*Ethanol 70%*

If you suspect blood coagulum as the cause of obstruction, use urokinase (x 2). If you note an obvious calcium-phosphate precipitate from parenteral nutrition (PN) solution, or if urokinase fails, use 0.1N HCL solution (x2).

If the above two agents fail to re-open the catheter and the patient receives IV lipids through this catheter (especially a 3-in-1 PN solution), a waxy lipid deposit may have caused the occlusion, use ethanol 70% (x 2).

WARNING: Use ONLY a 1 ml TB syringe to instill any solution into an occluded catheter. Use of a larger syringe may generate excess pressure and rupture an occluded catheter.

WARNING: This procedure is NOT to be used for clearing occluded UAC's.

Procedure for all catheter clearance agents:

1. ***USING A 1 ML SYRINGE,*** *carefully instill up to 1 ml of the selected catheter clearing agent into the catheter.*

2. *Allow solution to remain in catheter for 5 minutes.*

3. *Attempt to aspirate blood using a 5 ml syringe. If blood cannot be aspirated, repeat attempt to aspirate every 5 minutes for 30 minutes total.*

4. *If after 30 minutes the catheter is not open, repeat the dose and the every 5 minutes aspiration procedure.*

5. *If catheter opens, flush the catheter with saline.*

If urokinase fails and parenteral nutrition is being infused, try 0.1N HCL next. If urokinase and HCL fail, and if IV lipid is being infused, try ethanol 70%. If the entire procedure fails,

call your surgeon and beg forgiveness!

Quality

%Sepsis

< 5%

Septic Episode/1000 catheter days

$$\frac{\text{Incidence}}{\text{1000 cath. day}} = \frac{\text{Incidence of Sepsis}}{\text{\# cath day}} = \frac{X}{1000}$$

ex. $\frac{\text{(12) incidence of sepsis}}{\text{1435 \# cath. day}} = \frac{X}{100}$

12 = .0084 X 1000

= 8.4 septic episodes/1000 catheter days

CATHETER MANAGEMENT

BIBLIOGRAPHY

Bozzetti, F., Scarpa, D., et al: Subclavian venous thrombosis due to indwelling catheters: a prospective study on 52 patients. Journal of Parenteral Nutrition 1983; 7(6); 560.

Brismar, B., Hardstedt C., Jacobson, S., et al: Reduction of catheter associated thrombosis in parenteral nutrition by intravenous heparin therapy. Arch Surgery, 1982;117: 1196-99.

Callahan, J.L., Wesorick, B.: Bacterial growth under a transparent dressing. American Journal of Infection Control, 1987; (15): 231-237.

Conly, J.M., Grieves, K., Peters, B.: A prospective randomized study comparing transparent and dry gauze dressing for central venous catheters. Journal of Infectious Disease, 1989; 159(2); 310-319.

Cooper, G., George T., Hofsteteer, S.: Air embolism: a lethal but preventible complication of subclavian vein catheterization. Journal of Parenteral Nutrition 1981; 5(2); 166.

Duffy, F., Kerzner, B., Gebus, V., et al: Treatment of central venous catheter occlusion with hydrochloric acid. Journal of Pediatrics 1989; 114(6); 1002-4.

Fabri, P.J., Mirtallo, J.M., Ruberg R.L., et al: Incidence and prevention of thrombosis of the subclavian vein during total parenteral nutrition. Surg Gynecol Obstet 1982; 155: 238.

Katech, M., Band, S.: Local infection of the intravenous catheter wound associated with transparent dressing. Journal of Infectious Disease, 1985; 151: 971-2.

Kennedy, Caldwell, C., Geenter, P.: Nutrition Support Nursing 1988; 487-537.

Maki, D.G., Weise, C.E., Sarafen, H.W.: A semi quantitative culture method for identifying intravenous catheter related infection. New England Journal of Medicine 1977; 296: 1305

McCredie, K.B., Lawson, M., Marts, K., Stern, R.N.: A comparative evaluation of transparent and gauze dressings for central venous catheters. Journal of Parenteral Nutrition 1984; 6: 43-6.

Pennington, C.R., Pithie, A.D.: Ethanol lock in the management of catheter occlusion. Journal of Parenteral Nutrition 1987; 11(5) 507-8.

Powell C., Regan C., Fabri, R. Ruberg R.L.: Evaluation of opsite catheter dressing for parenteral nutrition: a prospective randomized study. Journal of Parenteral Nutrition 1982; 6: 43-6.

Sitges- Serra A., Puig P., Linares J. et al: Hub colonization as the initial step in the outbreak of catheter related sepsis due to coagulase negative staphylococci during parenteral nutrition. Journal of Parenteral Nutrition 1984; 8(6) 668-672.

Vazquez, R., Jarrad, M.: Care of the central venous catheterization site: the use of a transparent polyurethane film. Journal of Parenteral Nutrition 1984; 3(2) 181-6.

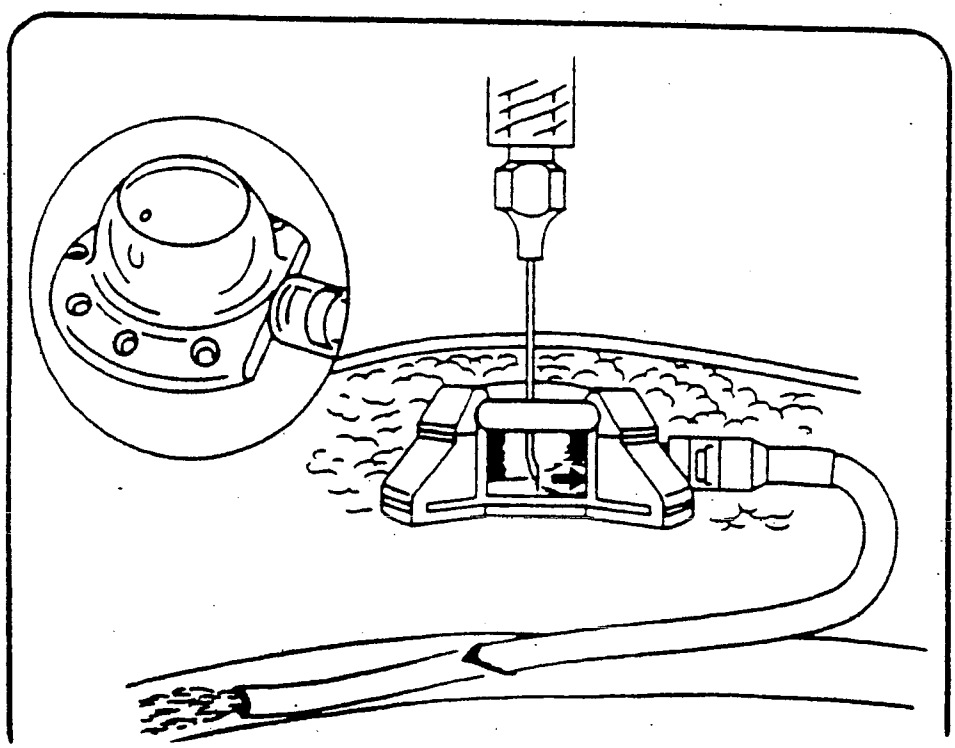
Implanted Ports

Use and Maintenance

Introduction

Implanted Ports *were developed to help provide reliable vascular access for patients requiring long-term drug or fluid therapy. The port is a totally implantable vascular access device which permits the infusion of medications, parenteral solutions, blood products (intravenous ports only) and other fluids; and for blood sampling.*

Port access is performed by percutaneous needle insertion with a non-coring needle. The needle is inserted perpendicularly through the port septum into the reservoir. The drug or fluid can be administered by bolus injection or continuous infusion. The injected fluid flows rom the reservoir through the catheter.



Surgical Implantation

Implantation may be accomplished through a variety of surgical techniques. The surgeon will choose the device and implantation technique most appropriate for the patient's body size and therapy.

Intravenous Implantation

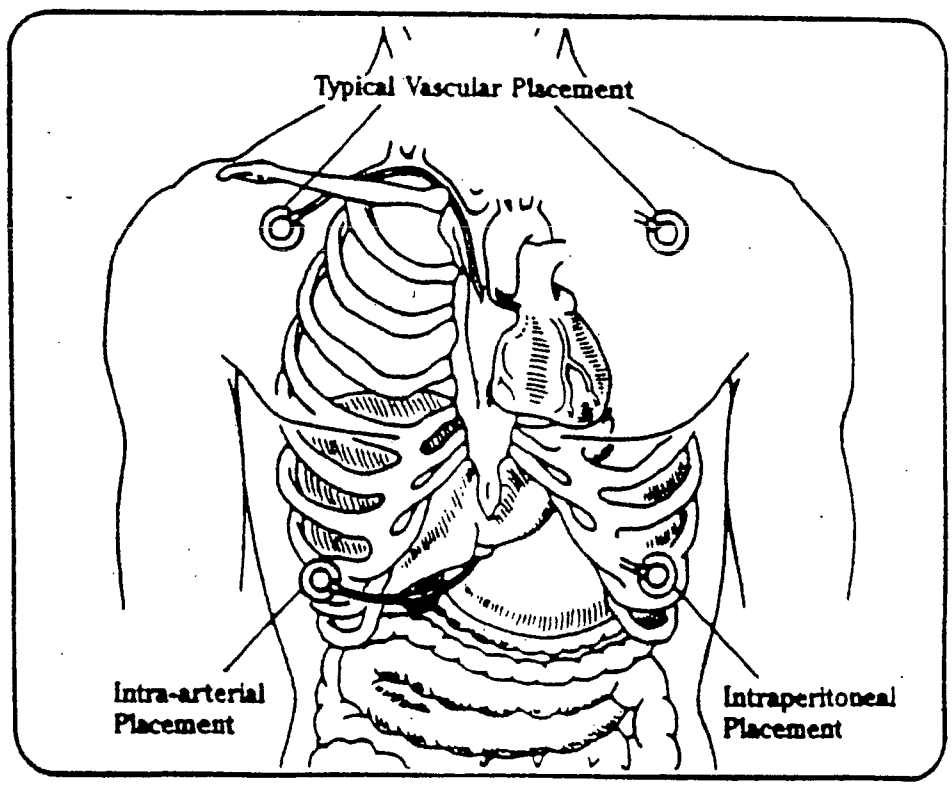
Implantation of an intravenous implanted port can often be performed as an outpatient procedure under local anesthetic. The port is typically placed in the right infraclavicular fossa. The catheter is threaded through the subclavian vein and terminates at the junction of the superior vena cava and the right atrium.

Intra-arterial Implantation

Placement of an intra-arterial port is an inpatient procedure. The port is often placed over the lower ribs with the catheter inserted into the hepatic arterial system.

Intraperitoneal Implantation

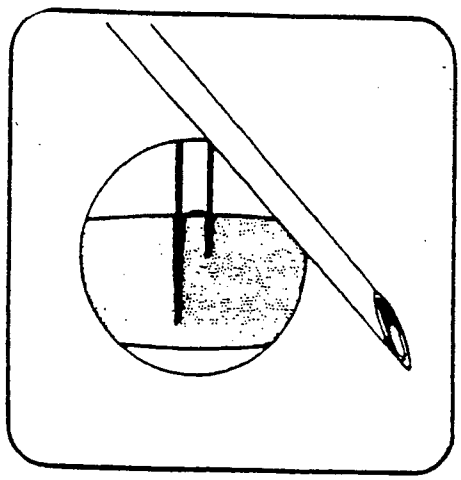
Placement of an intraperitoneal port is also an inpatient procedure. The port pocket is typically located over the lower ribs. The peritoneal catheter is placed with the tip deep in the pelvis.



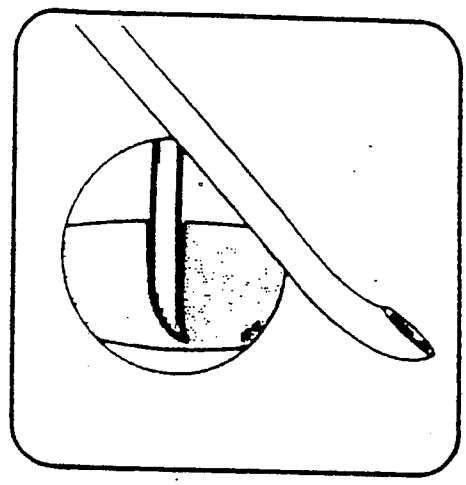
Non-coring Needle

Only non-coring needles should be used with any implanted port including all Davol Implanted Ports. The non-coring needle has a deflected point that helps avoid damage to the septum.

Non-coring needles are availabel in straight or right angle configurations in various lengths and gauges. Either straight or right angle needles can be used for bolus injections. Right angle nnedles are recommended for continous infusions because of their low profile and ease of securement to the patient.

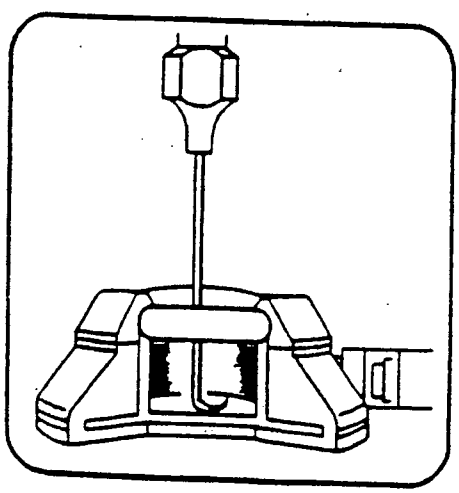


Hypodermic Needle



Non-coring Needle

Care should be taken when inserting a non-coring needle into an implanted port. Excessive insertion pressure or "grinding" of the needle against the portal base may damage the needle point. A "barbed" needle point may damage the resealing septum.



"Barbed" Non-coring Needle Point

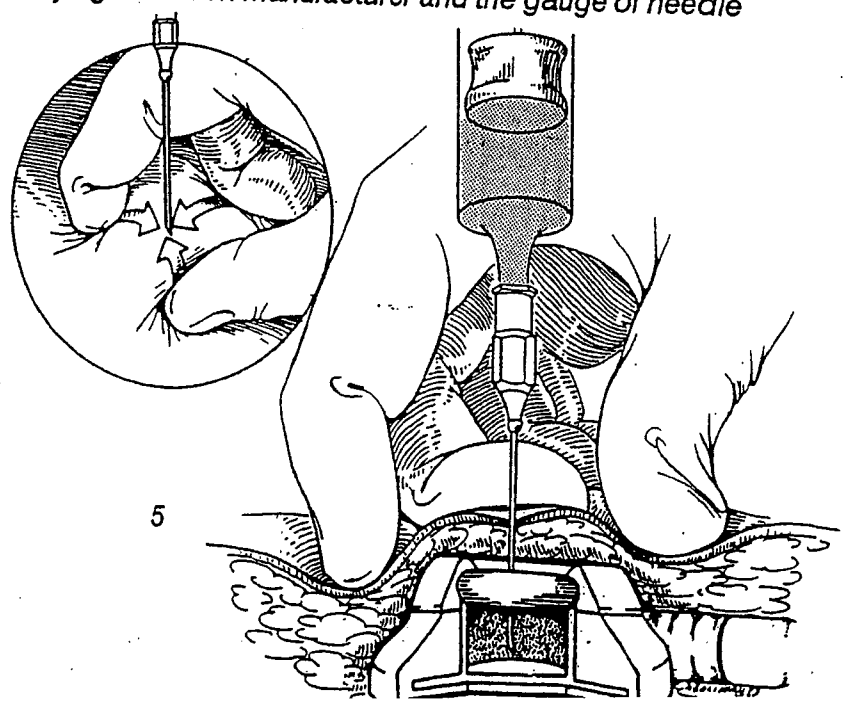
A. ACCESSING THE PORTS

Equipment

IV fluid, tubing and extension
Stopcock (3 Way)
10cc syringes
Normal Saline 30cc vial
Povidone-iodine swabsticks
Sterile drape
Alcohol swabs
Sterile gloves
90 degree angle Huber needle
1 inch, 19 gauge (may use different size Huber needle)
Tincture of Benzoin
Steri Strips
Blood tubes
Heparin-lock solution
4 x 4 gauze dressing
Biocclusive dressing
2 inch tape
Luer-lok cap

The port is located by gentle palpation. A triple skin preparation of alcohol followed by iodine is done regardless of intended procedure. (i.e.: bolus therapy, continuous infusion, or routine heparinization).

Accessing any port requires a percutaneous needle stick. In order to maximize the life of the silicone septum, only non-boring huber point needles are recommended. A non-coring needle, because of its tip geometry, tends to push the septum apart rather than "coring" it, as would occur with a hypodermic needle. A port will accommodate anywhere from 500 to 2,000 needle sticks, varying with each manufacturer and the gauge of needle used.



A 90 degree angled huber point needle is attached to an extension tubing with clamp. The clamp should remain ***closed*** *whenever solution is not infusing through the port. This exerts positive pressure against the distal catheter lumen thus preventing inadvertent migration of blood in to the catheter tip, which could result in catheter occlusion.*

The needle and attached extension tubing are primed with normal saline, retaining approximately five mls in the syringe. The needle is inserted into the septum and advanced until it touches the bottom of the port body. The extension tubing is unclamped and the five mls of saline slowly injected into the system. It is important to limit the injection rate to ten mls per minute to avoid an overpressurized condition in the catheter. Aspiration will confirm needle placement. Failure to obtain a blood return may mean the catheter is abutting a vessel wall. Having the patient change position my help to dislodge the catheter tip. Once placement is confirmed, the tubing is clamped and the saline syringe is removed. You are now ready to proceed with drug therapy or blood sampling.

B. DRUG THERAPY:

To administer a bolus injection, the syringe of medication is attached to the tubing. The clamp is released while positive pressure is maintained on the syringe plunger. The drug is injected slowly. If more that one drug is to be administered, a saline flush between medications will prevent drug interactions.

For continuous infusions, the primed needle with extension tubing is inserted into the port and connected to a primed ambulatory infusion pump. The pump is turned "on" and the extension tubing is unclamped. When you are assured that the infusion is proceeding smoothly, iodine ointment is applied to the puncture site and the needle is stabilized with sterile gauze and tape. Finally, a transparent occlusive dressing is applied. Upon termination of drug therapy the port system is flushed with five mls of normal saline. At all times during drug therapy, it is important to monitor the patient for abnormal sensation or pain at the site. If extravasation is suspected, the infusion should be discontinued and the extravasation protocol adopted by the institution should be followed.

C. DRESSING CHANGES:

Patients receiving continuous infusion via the implanted vascular access port, usually have weekly dressing and needle changes by appropriately trained personnel. Follow the protocols established by your institution. The final product should be an occlusive sterile transparent dressing that is further secured by a window frame of tape. Adherence to sterile technique remains the nurse's responsibility.

D. BLOOD SAMPLING:

Blood sampling may be performed as an isolated procedure, or at the time of a bolus injection or continuous infusion. Follow the procedure for accessing the system, and flush the port with five mls of normal saline. Because the first sample of blood may be diluted with saline or heparin, it is recommended that an initial three to five mls of blood be drawn and discarded. Attach a new syringe and withdraw the desired sample amount. Immediately flush the system with saline, and proceed with he desired infusion or heparinization.

E. HEPARIN LOCK PROCEDURE:

A final step in any vascular access procedure is a heparin lock. A syringe containing three to five mls (per your hospital protocol) of heparinized saline at a concentration of 100 units/ml is attached to the extension tubing. The port body and catheter are flushed, limiting the injection rate to ten mls per minute. While injecting the last quarter milliliter, the needle should be withdrawn from the septum. This will prevent blood reflux back into the catheter. The heparin lock helps retard catheter tip occlusion. Venous ports not in use should be routinely heparinized once a month.

F. MAIN POINTS TO REMEMBER:

* *Always access the port using aseptic technique*
* *Only non-coring huber point needles should be used to access implantable ports*
* *Insert needle perpendicular to the port septum and advance the needle until it hits/touches bottom of port*
* *Use a ten ml or larger syringe to access the port*
* *Never exceed the manufacturer's recommended psi (pressure) limit when delivering fluids through the system.*
* *Always flush the system with normal saline before and after each drug infusion to verify flow and provide a buffer between drugs*
* *Continue injecting fluids slowly in to the system while opening or closing the clamp or extension tubing*
* *Always leave the system filled with three to five mls of heparinized saline (100 units/ml) after each use*
* *Venous ports should be flushed with heparinized saline once every four weeks when not in use*

G. COMPLICATIONS AND TROUBLESHOOTING:

The most common complications of implantable ports are:

1. *Catheter obstruction-* a) *one-way (unable to aspirate)*
   b) *two-way (unable to aspirate or infuse)*
2. *Vessel thrombosis*
3. *Infection- port pocket or systemic*
4. *Catheter migration or embolization*
5. *Extravasation*

A. *Catheter Obstruction*

1. *One-way obstruction- able to infuse but unable to aspirate*

An x-ray should be taken to confirm proper catheter tip placement. A catheter tip abutting the vessel wall is the most common cause of one way obstruction. Aspiration causes the vessel wall to be sucked into the catheter thus blocking blood withdrawal. An infusion, however forces the tip away from the wall and restores patency.

Repositioning of the patient may restore the ability to aspirate from the port. The following maneuvers may be helpful: turn head in opposite direction from the port body; have patient valsalva; have patient cough; have patient extend arms over head. Positional ports may correct themselves during a subsequent access.

One-way obstruction may also be caused by a fibrin sheath encapsulating the catheter tip. A dye study will confirm sheath presence. The catheter should be "kinased" to restore two-way patency (see next section).

2. *Two way obstruction- unable to infuse or withdraw blood*

Though there may be several reasons for two-way obstruction (e.g. thrombosis, catheter migration, etc.), the most common reason is catheter occlusion secondary to blood clot.

Kinase (either Urokinase or Streptokinase) is the drug of choice for catheter declotting. Urokinase is preferred due to the decreased chance of allergic reactions. The drug should be prepared and instilled according to the manufacturer's labelling.

Repeated instillations may be required. In addition, the clinician should be aware of the volume of the port body and catheter.

Subsequent access of the port should be done with care to prevent repeated occlusions.

H. VESSEL THROMBOSIS

Thrombosis is a clot formation in the vessel (vein) around the catheter or at the tip. Symptoms include shoulder,, neck, or arm pain and subclavian and neck swelling. The diagnosis can be made by venogram. Various treatment regimens may be use (e.g. lysis therapy- a peripheral catheter is imbedded into the clot under fluoroscopy and a kinase infusion is instituted; a systemic heparin infusion; or coumadin therapy). In some cases, the port and catheter may need to be removed.

I. INFECTION

Infections may either be local (port pocket or needle exit site) or systemic. Local infections can usually be treated with antibiotics and the device may be salvaged.

Systemic infections can be documented by blood cultures drawn both peripherally and via the implanted port. Systemic infection is suspected when central cultures are negative but peripheral cultures are positive. The patient should be started on appropriate antibiotics; it may be possible to salvage the device. If central cultures are positive and peripheral cultures are negative, catheter-related sepsis is the probable diagnosis requiring antibiotics and the removal of the device.

J. CATHETER MIGRATION/EMBOLIZATION

Catheters positioned in the superior vena cava may spontaneously migrate to the internal jugular vein. This may be significant in infusing sclerosing agents when the larger vessel is preferable. The catheter can be repositioned under fluoroscopy.

Catheter embolization refers to an event whereby the catheter breaks off from the port body and travels to either the right atrium, right ventricle, or pulmonary artery. It can be the result of port body/catheter separation, impurities in the catheter material, inappropriate placement, or inadvertent weakening of the catheter wall by a needle stick. Catheter fragments can be retrieved under fluoroscopy.

K. EXTRAVASATION

Extravasation is the misperfusion of drug into the subcutaneous tissue. The most common cause is needle misplacement or dislodgement. However, there may be other reasons: Backtracking of drug due to thrombosis; separation of catheter from port body; or infusion pressure exceeding recommended limits.

When accessing an implantable port, care should be taken to verify needle placement by blood aspiration. A saline flush should be performed to check for swelling at the needle insertion site. Needles should be well secured in place to prevent accidental dislodgement.

Interventions for extravasation management may include: surgery (excision of all affected tissue followed by skin grafting); pharmacologic measures (local antidote and/or topical or systemic antibiotics); and physiologic measures (local application of heat or cold). Each institution should follow their own accepted extravasation management protocol.

Adapted from "The care and management of implantable vascular access ports" program for continuing education via Washington State Nurses Association and Davol Nursing Procedure Manual