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

Revised Date: September, 2011

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Important Information:
- **Caution:** Contrast media should be warmed to body temperature prior to power injection.
- **Warning:** Failure to warm contrast media to body temperature prior to power injection may result in catheter failure.
- Vigorously flush the PowerHohn® catheter using a 10 mL or larger syringe and sterile normal saline prior to and immediately following the completion of power injection studies. If using a multi-lumen catheter, flush all lumens. This will ensure the patency of the PowerHohn® catheter and prevent damage to the catheter. Resistance to flushing may indicate partial or complete catheter occlusion. Do not proceed with power injection study until occlusion has been cleared.
- **Warning:** Failure to ensure patency of the catheter prior to power injection studies may result in catheter failure.
- Only use lumens marked as "Power Injectable" for power injection of contrast media.
- **Warning:** Use of lumens not marked “Power Injectable" for power injection of contrast media may cause failure of the catheter.
- Do not exceed the maximum flow rate of 5 mL/sec.
- **Warning:** Power injector machine pressure limiting feature may not prevent over pressurization of an occluded catheter.
- **Warning:** Exceeding the maximum flow rate of 5 mL/sec, and the maximum pressure of power injectors of 300 psi, may result in catheter failure and/or catheter tip displacement.
- **Warning:** The PowerHohn® catheter’s indication for power injection of contrast media implies it’s ability to withstand the procedure, but does not imply appropriateness of the procedure for a particular patient. A suitably trained clinician is responsible for evaluating the health status of a patient as it pertains to a power injection procedure.
- During tunneling, attach the largest lumen of the triple lumen catheter onto the barbed end of the tunneling tool as shown in section C. **Warning:** Attaching either of the small lumens of the triple lumen catheter to the barbed end of the tunneling tool may cause catheter damage.

**Power Injection Procedure**
1. Discontinue use of other lumens when performing power injection procedure.
2. Remove the injection/needleless connector from the PowerHohn® catheter.
3. Attach a 10 mL or larger syringe filled with sterile normal saline.
4. Aspirate for adequate blood return and vigorously flush the catheter with the full 10 mL of sterile normal saline.
   **Warning:** Failure to ensure patency of the catheter prior to power injection studies may result in catheter failure.
5. Detach syringe.
6. Attach the power injection device to the PowerHohn® catheter per manufacturer’s recommendations.
7. Contrast media should be warmed to body temperature prior to power injection.
8. Only use lumens marked as "Power Injectable" for power injection of contrast media.
9. Complete power injection study taking care not to exceed the flow rate limits. Do not exceed the maximum flow rate of 5 mL/sec.
   **Warning:** Power injector machine pressure limiting feature may not prevent over pressurization of an occluded catheter.
10. **Warning:** Exceeding the maximum flow rate of 5 mL/sec, and the maximum pressure of power Injectors of 300 psi, may result in catheter failure and/or catheter tip displacement.
11. Disconnect the power injection device.
12. Replace the injection/needleless cap on the PowerHohn® catheter.
   **Note:** The PowerHohn® catheter testing included 10 power injection cycles.

**Description**
PowerHohn® Central Venous Catheters are constructed of specially formulated and processed medical grade polyurethane and are designed for insertion into the central venous system. PowerHohn® catheters have a kink-resistant, reverse-tapered design. The catheters are radiopaque with female luer locking adapters and StatLock® device compatible suture wing fixation. Each catheter is provided in a sterile package.

**Placement**
The catheter is placed into one of the central veins so the tip lies in the superior vena cava above the right atrium.

**Indications For Use:**
PowerHohn® catheters are indicated for short or long term access to the central venous system. They are designed for administering I.V. fluids, blood products, drugs and parenteral nutrition solutions, as well as blood withdrawal, power injection of contrast media and allow for central venous pressure monitoring. The maximum recommended infusion rate is 5mL/sec. For central venous pressure monitoring, it is recommended that a catheter lumen of 20 gauge or larger be used.

**Contraindications:**
The device is contraindicated whenever:
- The presence of device related infection, bacteremia, or septicemia is known or suspected.
- The patient’s body size is insufficient to accommodate the size of the implanted device.
- The patient is known or is suspected to be allergic to materials contained in the device.
- Severe chronic obstructive lung disease exists (percutaneous subclavian placement only).
- There has been past irradiation of prospective insertion site.
- There have been previous episodes of venous thrombosis or vascular surgical procedures at the prospective placement site.
- There are local tissue factors which prevent proper device stabilization and/or access.

**Warnings:**
- Failure to warm contrast media to body temperature prior to power injection may result in catheter failure.
- Failure to ensure patency of the catheter prior to power injection studies may result in catheter failure.
- Use of lumens not marked “Power Injectable" for power injection of contrast media may cause failure of the catheter.
- Power injector machine pressure limiting feature may not prevent over pressurization of an occluded catheter.
- Exceeding the maximum flow rate of 5 mL/sec, and the maximum pressure of power injectors of 300 psi, may result in catheter failure and/or catheter tip displacement.
The PowerHohn® catheter’s indication for power injection of contrast media implies it’s ability to withstand the procedure, but does not imply appropriateness of the procedure for a particular patient. A suitably trained clinician is responsible for evaluating the health status of a patient as it pertains to a power injection procedure.

- Attaching either of the small lumens of the triple lumen catheter to the barbed end of the tunneling tool may cause catheter damage.
- Do not use the catheter if there is any evidence of mechanical damage or leaking. Damage to the catheter may lead to rupture, fragmentation, possible embolism and surgical removal.
- If signs of extravasation exist, discontinue injections. Begin appropriate medical intervention immediately.
- Ensure that the stylet tip does not extend beyond the trimmed end of the catheter. Extension of the stylet tip beyond the catheter end may result in vessel damage, stylet damage, difficult removal, stylet tip separation, potential embolism and risk of patient injury.
- If the artery is entered, withdraw the needle and apply manual pressure for several minutes. If the pleural space is entered, withdraw the needle and evaluate patient for possible pneumothorax.
- Avoid vessel perforation.
- Place a finger over the orifice of the sheath to minimize blood loss and risk of air aspiration. The risk of air embolism is reduced by performing this part of the procedure with the patient performing a Valsalva maneuver until the catheter is inserted into the sheath.
- This is not a right atrium catheter. Avoid positioning the catheter tip in the right atrium. Placement or migration of the catheter tip into the right atrium may cause cardiac arrhythmia, myocardial erosion or cardiac tamponade. Preferred location of the catheter tip is at the junction of the superior vena cava and the right atrium.
- The fluid level in the catheter will drop if the catheter connector is held above the level of the patient’s heart and opened to air. To help prevent a drop in the fluid level (allowing air entry) while changing injection caps, hold the connector below the level of the patient’s heart before removing the injection cap.
- When using alcohol or alcohol containing antiseptics with polyurethane catheters, care should be taken to avoid prolonged or excessive contact. Solutions should be allowed to completely dry before applying an occlusive dressing. Chlorhexidine gluconate and/or povidone iodine are the suggested antiseptics to use.
- Alcohol should not be used to lock, soak or decort polyurethane catheters because alcohol is known to degrade polyurethane catheters over time with repeated and prolonged exposure.
- Acetone and polyethylene glycol containing ointments should not be used with polyurethane catheters, as these may cause failure of the device.
- Central venous pressure monitoring should always be used in conjunction with other patient assessment metrics when evaluating cardiac function.
- You should not feel any resistance when withdrawing the catheter from the vein. If you do encounter resistance, this may indicate that the catheter is being pinched between the clavicle and first rib (the “pinch-off” sign). Do not continue pulling against resistance as this may cause catheter breakage and embolism. Free up the resistance (e.g. by repositioning the patient) before proceeding further.
- Intended for Single Patient Use. DO NOT REUSE. Bard Access Systems products are single use devices and should never be reimplanted. Reuse carries with it the attendant concern of cross-infection regardless of the cleaning or sterilization method. Resterilization of incompletely cleaned devices may not be effective. Any device that has been contaminated by blood should not be reused or re-sterilized.
- This device is not intended for pediatric or neonatal use.
- After use, this product may be a potential biohazard. Handle and dispose of in accordance with accepted medical practice and applicable local, state and federal laws and regulations.
- Pinch-off Prevention: Catheters placed percutaneously into the subclavian vein, should be inserted at the junction of the outer and middle thirds of the clavicle, lateral to the thoracic outlet. The catheter should not be inserted into the subclavian vein medially, because such placement can lead to compression of the catheter between the first rib and the clavicle, which can cause damage and even severance of the catheter. A radiographic confirmation of catheter placement should be made to ensure that the catheter is not being pinched by the first rib and clavicle.

**Signs of Pinch-off**

**Clinical:**
- Difficulty with blood withdrawal
- Resistance to infusion of fluids
- Patient position changes required for infusion of fluids or blood withdrawal

**Radiologic:**
- Grade 1 or 2 distortion on chest X-ray. Pinch-off should be evaluated for degree of severity prior to explantation. Patients indicating any degree of catheter distortion at the clavicle/first rib area should be followed diligently. There are grades of Pinch-off that should be recognized with appropriate chest x-ray as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Severity</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 0</td>
<td>No Distortion</td>
<td>No Action.</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Distortion present <strong>without</strong> luminal narrowing</td>
<td>Chest x-ray should be taken every one to three months to monitor progression of pinch-off to grade 2 distortion. Shoulder positioning during chest x-rays should be noted as it can contribute to changes in distortion grades.</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Distortion present <strong>with</strong> luminal narrowing</td>
<td>Removal of catheter should be considered.</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Catheter transection or fracture</td>
<td>Prompt removal of the catheter.</td>
</tr>
</tbody>
</table>
Precautions:
- Carefully read and follow all instructions prior to use.
- Federal (U.S.A.) law restricts this device to sale by or on the order of a physician.
- The catheter should be maintained in accordance with standard institutional protocol.
- Follow all contraindications, warnings, cautions, precautions and instructions for all infusates, including contrast media, as specified by its manufacturer.
- Contrast media should be warmed to body temperature prior to power injection.
- Do not clamp extension leg when stylet or stiffening wire is in catheter to minimize the risk of component damage.
- Catheters can be cut to length if a different length is desired due to patient size and desired point of insertion according to hospital protocol. Catheter depth markings are in centimeters.
- Use caution when using scissors or any sharp-edged instruments as they could damage the catheter.
- The stylet or stiffening wire needs to be well behind the point the catheter is to be cut. NEVER cut the stylet or stiffening wire.
- Subcutaneous tunneling of central venous catheter should only be performed by medical practitioners licensed by law, trained and experienced in tunneling procedures.
- Avoid inadvertent puncture of the skin or fascia with the tip of the tunneler.
- When tunneling, the catheter must not be forced.
- Only medical practitioners licensed by law, trained and experienced in placement of catheters in the central veins (internal or external jugular, subclavian) and in proper positioning of catheters in the central venous system should insert, manipulate, and remove this catheter.
- When inserting the catheter via a subclavian approach, maintain a horizontal trajectory when introducing the needle beneath the clavicle. Vertical needle passage may increase the risk of pneumothorax.
- Do not cut guidewire or alter length.
- Do not insert stiff end of guidewire into vessel as this may result in vessel damage.
- Keep sufficient guidewire length exposed at hub to allow for proper handling. A non-controlled guidewire can lead to wire embolism.
- Do not use excessive force when introducing guidewire or microintroducer as this can lead to vessel perforation and bleeding.
- If the guidewire must be withdrawn while the needle is inserted, remove both the needle and guidewire as a unit to help prevent the needle from damaging or shearing the guidewire.
- Do not withdraw dilator from microintroducer sheath until sheath is within vessel to minimize the risk of damage to sheath tip.
- Do not grasp the catheter with any instrument that might sever or damage the catheter.
- Do not pull apart the portion of the sheath that remains in the vessel. To avoid vessel damage, pull back the sheath as far as possible and tear the sheath only a few centimeters at a time.
- Never use force to remove the stylet. Resistance can damage the catheter. If resistance or bunching of the catheter is observed, stop stylet withdrawal and allow the catheter to return to normal shape. Withdraw both the catheter and stylet together approximately 2 cm and reattempt stylet removal. Repeat this procedure until the stylet is easily removed. Once the stylet is out, advance the catheter into the desired position.
- Never leave stylet or stiffening wire in place after catheter insertion; injury may occur. Remove stylet or stiffening wire and T-Lock (as applicable) after insertion.
- Do not suture through or around any part of the catheter’s tubing (shaft or extension legs). If using sutures to secure catheter USE THE SUTURE WINGS and make sure they do not occlude, puncture, or cut the catheter.
- Use aseptic techniques whenever the catheter lumen is opened or connected to other devices. Povidone-iodine or chlorhexidine gluconate are the suggested antiseptics to use with this device and components. Acetone and tincture of iodine should not be used because they could adversely affect the performance of the catheter and connectors. 10% acetone/70% isopropyl alcohol swab sticks used for dressing changes should not adversely affect the catheter.
- To reduce potential for blood backflow into the catheter tip, always remove syringes or needleless caps slowly while injecting the last 0.5 ml of saline.
- To minimize the risk of catheter breakage and embolization, the catheter must be secured in place.
- Do not cut the catheter before removal from vein to avoid catheter embolism.
- Do not use scissors to remove dressing to minimize the risk of cutting catheter.
- As reported in literature, anaphylactic or anaphylactic-like reactions occur in a small percentage of the population during placement, positioning, flushing of central venous catheters or cleaning of catheter exit site. These reactions are reported in association with insertion, rapid flushing, or manipulation of the catheter and/or use of chlorhexidine gluconate (CHG) in some patients. Be aware of potential symptoms or signs of these reactions and take precautionary steps as dictated by institution protocol for their prevention or treatment.
- If CHG allergy is suspected, confirmatory testing is recommended.

I. Prior To Placement:
- Examine package carefully before opening to confirm its integrity and that the expiration date has not passed. The catheter is supplied in a double sterile package and is non-pyrogenic. Do not use if package is damaged, opened, or the expiration date has passed. Sterilized by ethylene oxide. Do not resterilize.
- Inspect kit for inclusion of all components.
- Fill (prime) the device with sterile heparinized saline or normal saline solution to help avoid air embolism.
- When using an introducer kit, verify that the catheter fits easily through the introducer sheath.

II. During Placement:
- Avoid accidental device contact with sharp instruments and mechanical damage to the catheter material. Use only smooth-edgedatraumatic clamps or forceps.
- Avoid perforating, tearing or fracturing the catheter when using a guidewire.
- Warning: Do not use the catheter if there is any evidence of mechanical damage or leaking. Damage to the catheter may lead to rupture, fragmentation, possible embolism and surgical removal.
- Avoid sharp or acute angles during implantation which could compromise the patency of the catheter lumen(s).
- Sutures should not be tied around the catheter itself. The suture wings will secure the catheter without compromising catheter patency.
• When using percutaneous introducers:
  - Carefully insert the introducer and catheter to avoid inadvertent penetration to vital structures in the thorax.
  - To avoid blood vessel damage, do not allow the percutaneous introducer sheath to remain indwelling in the blood vessel without the internal support of a catheter or dilator.
  - Simultaneously advance the dilator with rotational motion to help prevent damage.

III. After Placement:

**Warning:** Do not use the catheter if there is any evidence of mechanical damage or leaking. Damage to the catheter may lead to rupture, fragmentation, possible embolism and surgical removal.

- Accessories and components used in conjunction with this device should incorporate luer lock connections.
- Prolonged infusion pressure greater than 25 psi (172 kPa) may damage blood vessels and vissus and is not recommended. Do not use a syringe smaller than 10 mL.
- Exceeding the maximum flow rate of 5 mL/sec may result in catheter failure and/or catheter tip displacement.

**Possible Complications**
The potential exists for serious complications including the following:

- Air Embolism
- Bleeding
- Brachial Plexus Injury
- Cardiac Arrhythmia
- Cardiac Tamponade
- Catheter Erosion Through the Skin
- Catheter Embolism
- Catheter Occlusion
- Catheter Occlusion, Damage or Breakage due to Compression between the Clavicle and First Rib (Pinch-off)
- Catheter-related Sepsis
- Endocarditis
- Exit Site Infection
- Exit Site Necrosis
- Fibrin Sheath Formation
- Hematoma
- Hemorrhax
- Heparin Induced Thrombocytopenia
- Hydrothorax
- Hypersensitivity, Anaphylactic or Anaphylactoid-Like Reaction During Placement, Positioning, Flushing of Catheter or Cleaning of Catheter Exit Site. 10
- Intolerance Reaction to Implanted Device
- Laceration of Vessels or Viscus
- Myocardial Erosion
- Perforation of Vessels or Viscus
- Phlebitis
- Pneumothorax
- Spontaneous Catheter Tip Malposition or Retraction
- Thromboembolism
- Thoracic Duct Injury
- Venous Thrombosis
- Ventricular Thrombosis
- Vessel Erosion
- Risks Normally Associated with Local or General Anesthesia, Surgery, and Post-Operative Recovery

**Placement Procedure**

Before beginning procedure, read the “Contraindications, Warnings and Precautions” and “Possible Complications” sections in these Instructions for Use.

**Caution:** Only medical practitioners licensed by law, trained and experienced in placement of catheters in the central veins (internal or external jugular, subclavian) and in proper positioning of catheters in the central venous system should insert, manipulate, and remove this catheter.

**Note:** The use of ultrasound for vessel selection and during needle insertion is strongly recommended. The use of landmark technique may increase the risk of arterial puncture or pneumothorax as compared to placement using ultrasound guidance.

**Section A: Prepping Procedure**

1. Place patient in the supine or Trendelenburg position with head turned away from the intended venipuncture site.
2. Prepare the insertion site and sterile field according to institutional protocol.
3. Perform local anesthetic infiltration in venipuncture, tunnel and tunnel exit site areas (as applicable).
4. Preflush the catheter.
   a. Attach prefilled syringe to the luer attachment on the T-Lock extension set.
   b. Preflush all lumens of catheter with sterile normal saline.
   c. Remove the syringe after prefusing.
   d. Attach end caps to luer adapters to avoid possible air embolus.

**Caution:** Do not clamp extension leg when stylet or stiffening wire is in catheter to minimize the risk of component damage.

**Section B: Modification of Catheter Length**

**I. For procedures when preloaded stylet is present**

**Caution:** Catheters can be cut to length if a different length is desired due to patient size and desired point of insertion according to hospital protocol. Catheter depth markings are in centimeters. Use caution when using scissors or any sharp-edged instruments as they could damage the catheter.

**Caution:** The stylet or stiffening wire needs to be well behind the point the catheter is to be cut. NEVER cut the stylet or stiffening wire.

- Determine desired catheter length including length needed for dressing and tunnel (as applicable).
- Measure the distance from the zero mark to the desired catheter length.
- Disconnect the T-Lock from the catheter luer connector.
- Retract the stylet to well behind the point the catheter is to be cut.
- Using a sterile scalpel or scissors, carefully cut the catheter according to institutional policy.
- Inspect cut surface to assure there is no loose material.
• Re-advance the T-Lock connector/stylet assembly.
• Lock the T-Lock connector to the catheter hub.
• Gently retract the stylet through the locked T-Lock connector until the stylet tip is contained inside the catheter.

**Warning:** Ensure that the stylet tip does not extend beyond the trimmed end of the catheter. Extension of the stylet tip beyond the catheter end may result in vessel damage, stylet damage, difficult removal, stylet tip separation, potential embolism and risk of patient injury. (See Figure 4)

### II. For Procedures without preloaded stylet

**Note:** Catheters can be cut to length if a different length is desired due to patient size and desired point of insertion according to hospital protocol. Catheter depth markings are in centimeters.

**Caution:** Use caution when using scissors or any sharp-edge instruments as they could damage the catheter.

• Determine desired catheter length including length needed for dressing and tunnel (as applicable). Measure the distance from the zero mark to the desired catheter length.
• Disconnect the T-Lock from the catheter luer connector and remove the wire or stiffening stylet (if present).
• Using a sterile scalpel or scissors, carefully cut the catheter according to institutional policy if necessary.
• Inspect cut surface to assure there is no loose material.

#### Section C: Tunneling Procedure (If applicable)

**Caution:** Subcutaneous tunneling of central venous catheter should only be performed by medical practitioners licensed by law, trained and experienced in tunneling procedures.

1. Measure catheter against chest wall of patient to determine desired location and exit site. Mark locations, or make a skin nick at insertion site.
2. Tunneling procedure. Create subcutaneous tunnel from skin exit site to venous entrance using tunneler or long forceps.
   a. Grasp the tunneler at the end.
   b. Insert the rounded tip of the tunneler into a small incision at the desired catheter exit.
   c. Form tunnel by advancing the tip of the tunneler from the skin exit site up to the venous entry site.

**Caution:** Avoid inadvertent puncture of the skin or fascia with the tip of the tunneler.

3. Attach the lumen tip or one of the lumen tips of the dual lumen catheter onto the tunneler barb with a twisting motion. Barb threads must be completely covered by the catheter tip to adequately secure the catheter as it is pulled through the tunnel. A suture may be tied around the catheter between the tunneler body and large barb to hold it more securely.
4. For the triple lumen catheter, attach the largest lumen onto the barbed-end of the tunneling tool as shown.

For triple lumen catheter, insert barbed tunneler in this lumen.

**Warning:** Attaching either of the small lumens of the triple lumen catheter to the barbed-end of the tunneling tool may cause catheter damage.

5. Pull the catheter up through the tunnel to the venous entry site.

**Caution:** When tunneling, the catheter must not be forced.

6. Remove the catheter tip from the tunneler barb.

7. Cut off the end tied by suture if necessary.

### Section D: Modified Seldinger Technique

1. Select a vein by assessing patient anatomy and condition.

**Note:** If the subclavian vein is used, the vein is entered percutaneously at the point that identifies the junction of the outer and middle thirds of the clavicle using the needle and syringe. Refer to the “Warnings” section concerning Catheter Pinch-off.

2. Remove the needle guard and attach a saline-filled syringe.
3. Introduce the needle into the vessel, aspirate gently as the insertion is made, and observe for flashback. (see figure 6)

**Alternate Technique:** The safety IV catheter may be used as an alternate to the safety introducer needle. Remove the needle from the catheter after the vein is accessed.

**Warning:** If the artery is entered, withdraw the needle and apply manual pressure for several minutes. If the pleural space is entered, withdraw the needle and evaluate patient for possible pneumothorax.

**Caution:** When inserting the catheter via a subclavian approach, maintain a horizontal trajectory when introducing the needle beneath the clavicle. Vertical needle passage may increase the risk of pneumothorax.

4. When the vein has been entered, remove the syringe leaving the needle in place. Place a finger over the hub of the needle to minimize blood loss and the risk of air aspiration. The risk of air aspiration is reduced by performing this part of the procedure with the patient performing the Valsalva maneuver. (see figure 7)

5. Insert the flexible end of the guidewire into the introducer needle. Advance the guidewire as far as appropriate for the procedure. (see figure 8)

**Note:** Reference guidewire information tag for appropriate interpretation of markings.

**Caution:** Do not cut guidewire or alter length.
Caution: Do not insert stiff end of guidewire into vessel as this may result in vessel damage.
Caution: Keep sufficient guidewire length exposed at hub to allow for proper handling. A non-controlled guidewire can lead to wire embolism
Caution: Do not use excessive force when introducing guidewire or microintroducer as this can lead to vessel perforation and bleeding.

6. Gently withdraw and remove the safety introducer needle or safety IV catheter, while holding the guidewire in position. (see figure 9)
Caution: If the guidewire must be withdrawn while the needle is inserted, remove both the needle and guidewire as a unit to help prevent the needle from damaging or shearing the guidewire.

7. Advance the small sheath and dilator together as a unit over the guidewire, using a slight rotational motion. (see figure 10)
Warning: Avoid vessel perforation.
Caution: Do not use excessive force when introducing guidewire or microintroducer as this can lead to vessel perforation and bleeding.

8. If necessary, refer to section A for flushing, section B for modification of catheter length, and section C for tunneling procedure.

9. Withdraw the vessel dilator and guidewire, leaving the sheath in place. (see figures 11 & 12)
Caution: Do not withdraw dilator from the microintroducer sheath until sheath is within vessel to minimize the risk of damage to sheath tip.
Warning: Place a finger over the orifice of the sheath to minimize blood loss and risk of air aspiration. The risk of air embolism is reduced by performing this part of the procedure with the patient performing a Valsalva maneuver until the catheter is inserted into the sheath.

10. Insert catheter into the introducer sheath and advance catheter slowly to desired position in vessel. (see figure 13)
Note: Resistance may be felt approximately 7 cm distal of catheter hub when introducing the catheter into the sheath due to an increase in outer diameter (O.D.). The introducer may be partially split, but not removed to facilitate insertion of the catheter past this point if necessary.
Note: Catheter tip should be placed in the lower 1/3 of the SVC or per institutional protocol.
Warning: This is not a right atrium catheter. Avoid positioning the catheter tip in the right atrium. Placement or migration of the catheter tip into the right atrium may cause cardiac arrhythmia, myocardial erosion or cardiac tamponade. Preferred location of the catheter tip is at the junction of the superior vena cava and the right atrium.
Caution: Do not grasp the catheter with any instrument that might sever or damage the catheter.

11. Withdraw the introducer sheath from the vein and away from the site.

12. Split the introducer and peel it away from the catheter. (see figure 14)
Note: Make sure the catheter is not dislodged from vessel as sheath is removed.
Caution: Do not pull apart the portion of the sheath that remains in the vessel. To avoid vessel damage, pull back the sheath as far as possible and tear the sheath only a few centimeters at a time.

13. Disconnect the T-Lock from the catheter luer connector.

14. Stabilize the catheter position by applying light pressure to the vein distal to the insertion site.

15. Slowly remove the T-Lock and stylet. (see figure 15)
Caution: Never use force to remove the stylet. Resistance can damage the catheter. If resistance or bunching of the catheter is observed, stop stylet withdrawal and allow the catheter to return to normal shape. Withdraw both the catheter and stylet together approximately 2 cm and reattempt stylet removal. Repeat this procedure until the stylet is easily removed. Once the stylet is out, advance the catheter into the desired position.
Caution: Never leave stylet or stiffening wire in place after catheter insertion; injury may occur. Remove stylet or stiffening wire and T-Lock (as applicable) after insertion.

16. Attach primed extension set and/or saline-filled syringe.

17. Unclamp catheter and aspirate for adequate blood return and flush each lumen to ensure patency. In addition, lock each lumen of the catheter. Usually one milliliter per lumen is adequate.
Caution: To reduce potential for blood backflow into the catheter tip, always remove syringes or needleless caps slowly while injecting the last 0.5 mL of saline.

18. Attach end cap(s) or connect to intravenous fluid source.
Warning: The fluid level in the catheter will drop if the catheter connector is held above the level of the patient's heart and opened to air. To help prevent a drop in the fluid level (allowing air entry) while changing injection caps, hold the connector below the level of the patient's heart before removing the injection cap.

19. Secure and dress according to institutional protocol. The StatLock™ catheter stabilization device is included in some PowerHohn® catheter kits. Please refer to StatLock™ catheter stabilization device Instructions For Use on the proper use and removal. The StatLock™ catheter stabilization device should be monitored daily and replaced at least every seven days.
Note: Prior to dressing, inspect catheter for kinks. Kinked catheters may obstruct the passage of fluids.

Note: Remove excess blood and fluids from access site before applying dressing.

Caution: To minimize the risk of catheter breakage and embolization, the catheter must be secured in place.

Caution: Do not suture through or around any part of the catheter’s tubing (shaft or extension legs). If using sutures to secure catheter USE THE SUTURE WINGS and make sure they do not occlude, puncture, or cut the catheter.

Warning: When using alcohol or alcohol-containing antiseptics with polyurethane catheters, care should be taken to avoid prolonged or excessive contact. Solutions should be allowed to completely dry before applying an occlusive dressing. Chlorhexidine gluconate and/or povidone iodine are the suggested antiseptics to use.

Warning: Alcohol should not be used to lock, soak or decot polyurethane catheters because alcohol is known to degrade polyurethane catheters over time with repeated and prolonged exposure.

Warning: Acetone and polyethylene glycol containing ointments should not be used with polyurethane catheters, as these may cause failure of the device.

Caution: Use aseptic techniques whenever the catheter lumen is opened or connected to other devices. Povidone-iodine or chlorhexidine gluconate are the suggested antiseptics to use with this device and components. Acetone and tincture of iodine should not be used because they could adversely affect the performance of the catheter and connectors. 10% acetone/70% isopropyl alcohol swab sticks used for dressing changes should not adversely affect the catheter.

20. Verify correct tip position using radiography or appropriate technology. Obtain a chest x-ray to confirm absence of pneumothorax.

Central Venous Pressure Monitoring

- Prior to conducting central venous pressure monitoring:
  - Ensure proper positioning for the catheter tip
  - Flush catheter vigorously with sterile normal saline
  - Ensure the pressure transducer is at the level of the right atrium
- It is recommended that a continuous infusion of saline (3 mL/hr) is maintained through the catheter while measuring CVP to improve the accuracy of CVP results.
- Use your institution’s protocols for central venous pressure monitoring procedures.

Warning: Central venous pressure monitoring should always be used in conjunction with other patient assessment metrics when evaluating cardiac function.

Catheter Removal

I. Non-tunneled Catheters

- Remove dressing, and StatLock® catheter stabilization device or tape securement strips.
- Grasp catheter near insertion site.
- Remove slowly. Do not use excessive force.
- Remove the exterior segment of the catheter by pulling it from the skin exit site. During removal, have the patient perform the Valsalva maneuver.
- Apply pressure to the catheter/vein insertion site as needed to control bleeding.
- Close the incision with a suture as needed. Apply antibiotic ointment to incision and skin exit sites and an occlusive dressing to prevent air embolism through the tract.
- If resistance is felt, stop removal and follow institutional protocol.

II. Tunneled Catheters

After insertion site heals, catheters can be removed from the subcutaneous tunnel using one of several methods. The catheter can usually be removed by traction on the external segment (see traction removal section below) if it is not sutured internally at the vessel insertion site.

Warning: You should not feel any resistance when withdrawing the catheter from the vein. If you do encounter resistance, this may indicate that the catheter is being pinched between the clavicle and first rib (the “pinch-off” sign). Do not continue pulling against resistance as this may cause catheter breakage and embolism. Free up the resistance (e.g. by repositioning the patient) before proceeding further.

Traction Removal

Pull the catheter external segment downward in a straight line away from the exit site with a series of gentle tugs. Continue to pull gently on the catheter to complete the removal.

a. Remove the exterior segment of the catheter by pulling it from the skin exit site. During removal, have the patient perform the Valsalva maneuver.

b. Apply pressure to the catheter/vein insertion site as needed to control bleeding.

c. Close the incision with a suture as needed. Apply antibiotic ointment to incision and skin exit sites and an occlusive dressing to prevent air embolism through the tract.

Caution: Do not grasp the catheter with any instrument that might sever or damage the catheter.

Caution: Do not cut the catheter before removal from vein to avoid catheter embolism.

Suggested Catheter Maintenance:

Caution: The catheter should be maintained in accordance with standard institutional protocol. Suggested catheter maintenance is as follows:

Dressing Changes

- Assess the dressing for accumulation of blood, fluid, or moisture beneath the dressing per institutional protocol. During all dressing changes, assess the external length of the catheter to determine if migration of the catheter has occurred. Periodically confirm catheter placement, tip location, patency, and security of dressing.

Caution: Do not use scissors to remove dressing to minimize the risk of cutting catheter.

Flushing

- Flushing frequencies from once daily to once weekly have been found to be effective when the catheter is not in use. Flush after IV administration of TPN, IV fluids, or after medications.

Note: For frequently accessed catheters (accessed at least every 8 hours), flushing with 5 mL of normal saline without heparin between infusions has been found to be effective.
• **Occluded or Partially Occluded Catheter**
  Catheters that present resistance to flushing and aspiration may be partially or completely occluded. Do not flush against resistance. If the lumen will neither flush nor aspirate, and it has been determined that the catheter tip is occluded with blood, a declotting procedure per institution protocol may be appropriate. **Warning:** Failure to ensure patency of the catheter prior to power injection studies may result in catheter failure.

• **When Cleaning the Exit Site**
  **Warning:** Acetone and polyethylene glycol containing ointments should not be used with polyurethane catheters, as these may cause failure of the device.
  - Maintain according to institutional protocol.
  - Use chlorhexidine gluconate or povidone iodine to clean the exit site around the catheter.
  - Allow all cleaning agents/antiseptics to dry completely before applying dressing.

• **Power Injection**
  - The PowerHohn* catheter testing included 10 power Injection cycles.
References

5 Halpern M.D., Georges. "Allergic and Toxic Reactions." Adverse events During Infusion Therapy Symposium, University of California, Davis School of Medicine. (1993)
9 Beaudouin, E. et al., "Immediate Hypersensitivity to chlorhexidine: literature review." European Annals of Allergy and Clinical Immunology. 36, no.4 (2004)