Purpose

- To identify standards of care for patients with tunneled CVADs.
- To act as a resource for staff so that errors leading to complications are reduced.
- To identify and comply with current best practices from infection control and infusion nursing standards.

Policy Statement

Health care professionals who care for and maintain tunneled CVADs shall have education and demonstrated competency.

Only power injectable central catheters may be used to administer power injected radiographic IV contrast.

Tunneled dialysis catheters should never be used outside of the dialysis unit except in emergency situations (eg. code blue).

Vesicant solutions or medications will not be administered into catheters if unable to aspirate blood.

Applicability

This policy and procedure applies to all Covenant Health facilities, staff, members of the medical staff, students and any other persons acting on behalf of Covenant Health.

Principles

Knowledgeable and educated health care professionals reduce the risk of central line associated blood stream infections.

Using infection prevention maintenance bundles decreases central line associated blood stream infections.

Indications for use of Tunneled CVADs:

- exhausted or poor peripheral venous access
- patients who require long term IV therapy (chemotherapy agents, blood products, IV fluids, TPN, or antibiotics)
- patients with chronic renal failure who require small-bore tunneled catheters inserted into the right internal jugular vein to avoid thrombosis of arm and subclavian veins
- frequent blood sampling
- infusion of hyperosmolar solutions; eg. parenteral nutrition
- infusion of vesicant / irritant drugs.
Responsibilities

Health care professionals who care for and maintain CVADs must clearly understand their indications for use and the potential for complications and adhere to current evidence-based practices outlined herein.

Health care professionals shall demonstrate compliance with this policy and procedure by:

- adhering to the education requirements
- ensuring that they understand the appropriate care and maintenance needed to prevent infection after the CVAD is inserted
- Providing proper care of the CVAD post-insertion to preventing Central Line Associated Blood Stream Infections (CLABSIs).

Procedure

See attached

Definitions

**Catheter flush** is a technique whereby the solution is pushed through the catheter into the bloodstream (no dwell time).

**Catheter lock** is a technique by which a solution is injected into the catheter lumen dead space until it is filled and then allowed to dwell for a period of time until the catheter is accessed again.

**Health care professional** means an individual who is a member of a regulated health discipline, as defined by the Health Disciplines Act or the Health Professions Act, and who practices within scope and role.

**Most responsible health practitioner** means the health care professional who has responsibility and accountability for the specific treatment/procedure(s) provided to a patient and who is authorized by Alberta Health Services to perform the duties required to fulfill the delivery of such a treatment/procedure(s), within the scope of his/her practice.

**Qualified health care professionals** are individuals who are authorized to provide care relative to this policy/procedure in accordance with their respective practice Regulation under the Health Professions Act (or other legislation) and in accordance with Covenant Health policy.

**Scrub the hub** means: Each time the needleless connector is entered it must be cleaned with an alcohol or chlorhexidine/alcohol wipe. Scrub the needleless connector with the wipe for 15 seconds using friction and allow the solution to dry.

Related Documents

Corporate Policy #VII-B-330, *Maintenance of IV / Hypodermoclysis Equipment*

References


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1.0 GENERAL INFORMATION

1.1 The catheter is placed by locating the subclavian or internal jugular vein, forming a tunnel from the vein to an area between the sternum and the nipple, putting the catheter through the tunnel, inserting it into the vein, and threading it until the tip is in the superior vena cava.

Tunnelled CVADs are inserted by qualified health care professionals in the operating room or diagnostic imaging department under local or general anesthetic. An x-ray/fluoroscopy is required immediately post insertion to confirm proper placement. For catheters inserted into the subclavian and jugular veins, the catheter tip dwells in the distal superior vena cava at the junction of the right atrium, and for catheters inserted into the femoral vein in the inferior vena cava above the level of the diaphragm.

1.2 Tunnelled CVADs are made of polymeric silicone/polyurethane and contain a 1 cm wide Dacron cuff.

1.3 The Dacron cuff is positioned in the subcutaneous tunnel and promotes the growth of a connective tissue seal and enhances catheter stability. This reduces the risk of infection by inhibiting bacterial migration along the catheter track. (See diagrams 1 and 2.)

1.4 Single or multiple lumen catheters and open or closed ended catheters are available.
2.0 INFECTION PREVENTION & CONTROL

2.1 While they are in hospital, daily bathing or scrubs with chlorhexine impregnated cleansing towelllettes will help reduce the resident bacteria on the patient's skin.

2.2 Care and Maintenance Infection Prevention and Control Measures

2.2.1 To minimize the risk of central line associated blood stream infection (CLABSI) associated with direct contact of the hands of health care personnel, hand hygiene is to be performed at the following times;

- before and after palpating the site of catheter insertion
- before and after accessing, replacing, repairing, or dressing the catheter

2.2.2 Aseptic technique is required for all instances of CVAD care. Aseptic technique is also referred to as sterile technique and is used to keep objects and areas free of microorganisms and thereby minimize infection risk for the patient.

2.2.3 Strict aseptic technique is required for:

1. administration set changes,
2. dressing changes,
3. needleless connector changes.

2.2.4 Hands are to be cleansed with alcohol based hand sanitizer and wear protective gloves prior to flushing, locking, handling administration sets, etc. Sterile gloves and mask must be worn for dressing changes.
2.3 To maintain a “closed” system:

2.3.1 Attach a needleless connector (eg. microclave™) to lumen ends.

2.3.2 Attach administration sets to the needleless connector.

3.0 PRE-INSERTION INSTRUCTIONS

3.1 Provide teaching about the tunnelled catheter as required – the most responsible health practitioner shall have discussed insertion with the patient and obtained informed consent.

4.0 IMMEDIATELY POST-INSERTION

4.1 The patient will have two incisions on the upper chest / neck on the side the catheter is inserted. One incision will be over where the catheter enters the vein, called the ‘insertion site’, and one where the catheter exits the skin low on the chest. The steristrips or sutures at these sites will be removed as ordered by the most responsible health practitioner (usually within one to three weeks).

4.2 Observe incision sites for bleeding and dress with dry sterile gauze if bleeding is observed. Once bleeding stops, the gauze may be removed and the exit site covered with one 10 cm x 12 cm transparent dressing.

4.3 Monitor vital signs as per post-op routine.

4.4 Observe patient for signs and symptoms of pneumothorax, arterial puncture, and pericardial tamponade (see section 13 for complications).

NURSING ALERT: Do not infuse medication or TPN into the catheter until placement is confirmed by x-ray or fluoroscopy (this should be completed prior to the patient returning to the unit from the procedure room) and the inserter has written an order to proceed with using the catheter.

4.5 Anchor the catheter to the patient’s skin with tape to avoid tension on the catheter. Use sterile tape from securement dressing to reduce infection.

5.0 SITE ASSESSMENT

5.1 Visually inspect exit site and palpated through an intact dressing and up the tunnel. Palpate for Dacron cuff position. If there is fever without an obvious source, tenderness at the exit site or along the tunnel, or other symptoms suggesting either local or bloodstream infection, the dressing should be removed and the site thoroughly inspected.
5.2 Observe the catheter and exit site for:

- swelling
- redness
- tenderness / pain at exit site, along catheter course /insertion site
- drainage
- malposition of catheter / Dacron cuff in a different location than previously palpated or documented
- loose sutures
- unusual pain or sensations (neck pain, hearing the infusion)

5.3 Site should be assessed every shift, pre-infusion, during infusion and immediately post-infusion.

5.4 Assessment requires observation and palpation of exit site moving proximal from the exit site and up the catheter route.

5.5 Report any of the above to the most responsible health practitioner.

6.0 MAINTAINING THE CATHETER

6.1 Proper maintenance of CVADs is essential for continued patient safety.

6.1.1 The external surface of a catheter hub, connector, or injection port is the immediate portal of entry of microorganisms to the intraluminal surface of the catheter. Microorganisms entering the system attach at any point of contact along the intraluminal surface. The colonizing organisms form within the needleless connector, catheter hub, or the lumen and can be dispersed into the bloodstream, resulting in CLABSI. **It is critical, therefore, that all surfaces be thoroughly disinfected with chlorhexidine/alcohol wipe before they are accessed.** Scrub the hub for a minimum of 15 seconds and allow solution to dry completely every time they are accessed.

**NURSING ALERT:** NEVER use a toothed clamp on the CVAD.

All administration sets, extension tubing, or intermittent needleless connectors attached to central lines must have luer lock connections.

Always use a 10mL syringe or large barrel syringe for flushing as it has a lower pressure rating. Smaller syringes have greater pressures and may rupture catheter. Once patency has been confirmed small quantities of medication in syringes of appropriate size for the dose may be administered.
7.0 NEEDLELESS CONNECTOR CHANGE

7.1 Wear protective gloves. Air embolism is avoided by placing the patient supine, clamp the lumen on reinforced area with clamp located on lumen pigtail, cleanse cap/catheter connection with 2% chlorhexidine 70% alcohol swab for 15 seconds then ask patient to perform Valsalva Manoeuvre. Using no touch technique, remove the old needleless connector and replace with a new sterile needleless connector.

**Note:** All needleless connectors require priming prior to attaching to CVAD. Make the connection as the patient holds his/her breath or during exhalation.

![Diagram 4](image)

7.2 Change needleless connectors as per Vascular Access Device Quick Reference Protocol or if removed, soiled, broken or blood in connector.

8.0 FLUSHING AND LOCKING

8.1 Don non-sterile gloves. Scrub the hub and allow the needleless connector to completely dry. Ensure catheter patency by using a 10 mL syringe with NS to instil 1-2 mL of NS. Aspirate for brisk blood return prior to flushing the remainder of the NS using positive pulsing pressure. The catheter should flush without resistance or leaking from insertion site. If resistance is met, notify the most responsible health practitioner.

8.2 Flush with preservative free saline for injection to clear the line of medications prior to locking. When flushing, use “Positive Pulsing Pressure” by giving short jerky pushes on plunger.

8.3 If unable to obtain blood return or there is resistance to flushing the nurse should take further steps to assess patency (is the clamp off?). Report withdrawal occlusion as soon as possible because this is the optimal time to manage occlusions. All complete occlusions must be managed or the catheter removed and replaced if still necessary. Refer to Corporate Policy #VII-B-335, *Occlusion Management of Central Venous Catheters*. Immediately communicate the suspected occlusion to the most responsible health practitioner who can initiate appropriate patient care and document who you’ve notified.
8.4 **Do not** administer *vesicant solutions or medications* if unable to aspirate blood. Catheters that experience withdrawal occlusion may require occlusion management or Venography to ensure patency. Notify the most responsible health practitioner. Assess patient acuity and document the plan for managing the occlusion or if alternate access is required.

8.5 Frequency of flushing:

**20 mL saline flush**
- After blood sampling.
- Before and after blood component administration
- Prior to drawing blood levels.

**10 mL saline flush**
- When converting from continuous to intermittent therapies
- Before and after intermittent medication therapy
- For maintenance of dormant CVADs

8.6 Inject locking solution slowly over 3-5 seconds

8.7 The volume should be at least twice the volume capacity of the catheter lumen plus the priming volume of all add-on devices (eg. extension tubing). Flush with a minimum of 10 mL of normal saline.

8.8 Maintain the patency of each *unused lumen* by locking the each lumen each lumen post infusion, and as per Vascular Access Device Quick Reference Protocol

Locking solutions, in order of preference are:

1. 3 mL sodium citrate 4%
2. 5 mL of heparin lock solution (10 units/mL) or, if not available,
3. 3 mL heparin lock solution (100 units/mL)

8.9 To maintain the patency of *catheters locked between medications* follow SASS or SASH:
- Saline to assess catheter patency
- Administration of medication
- Saline to flush medication out of catheter
- Sodium citrate or Heparin Lock to maintain patency between medications.

8.10 Clamp the catheter when not in use with the clamp provided. Clamp on the reinforced area to prevent damage to the catheter. If catheter has a clamp, **it must be clamped when not in use.** Always ensure there is a clamp present on an open-ended catheter.

8.11 Ensure administration set (tubing) connection is protected with a new sterile end cap after each infusion.
8.12 If heparin locking, platelet count monitoring is recommended for post-op patients every 2-3 days from day 4 -14, or until therapy with heparin is stopped.

8.13 Refer to Corporate Policy #VII-B-330, Maintenance of I.V./Hypodermoclysis Equipment for equipment change times.

**NURSING ALERT:** If IV solution does not readily infuse or lumen cannot be locked without meeting resistance, DO NOT apply force in attempt to free catheter of clot that may have formed. Occluded catheters increase the risk of catheter related blood stream infections. Notify most responsible health practitioner to consider restoring patency to the occluded lumen. Document whom you have notified.

### 9.0 DRESSING CHANGE TECHNIQUE / PRINCIPLES

9.1 A clean and dry dressing at the exit site is important to protect the site and to minimize the risk of infection. There are generally two types of dressings that can be used to cover and protect the exit site:

- **a)** Sterile gauze and sterile tape. If the patient is diaphoretic or the insertion site is oozing blood, gauze dressings are recommended

- **b)** Sterile, semipermeable “transparent” polyurethane dressings. Transparent dressings permit continuous visual inspection of the insertion site, help to secure the device, and do not need to be changed as frequently as a gauze and sterile tape dressing.

9.2 Dressing Change Equipment

- Sterile dressing tray
- Clean gloves
- Mask
- Sterile gloves
- Chlorhexidine 2% /alcohol 70% swab sticks – minimum 3 or more as appropriate
- Sterile skin barrier film (eg. Cavilon™ No Sting Barrier Film)
- Dressing – use as many as required to ensure a minimum of one inch (or 2.5 cm) around exit site. Dressing choice may be a transparent film dressing or transparent film which contains chlorhexidine/ antiseptic components as
appropriate for your area. Try to minimize the amount one dressing overlaps another dressing

9.3 Dressing Removal and Dressing Change Procedure:

9.3.1 Chlorhexidine 2%/alcohol 70% cleanser is the cleanser of choice unless allergy is suspected.

9.3.2 Ensure working surface is cleared and disinfected prior to dressing change. Remove gloves and wash hands.

9.3.3 Perform hand hygiene. Set up sterile tray. Open sterile dressing tray and aseptically add dressing supplies (including sterile gloves) to the dressing tray, being careful to keep all supplies sterile. Note that the chlorhexidine swab stick and barrier film swab stick packages may be opened and arranged at the edge of the sterile field or sterile forceps may be used to transfer stick to sterile tray so they may be easily retrieved.

9.3.4 Perform hand hygiene. Don mask and gloves. Remove dressing. Gently and carefully remove transparent film dressing by supporting the skin and the catheter with your fingers and either stretching the dressing laterally to break the adhesive, or gently peeling back the dressing by folding the dressing back over itself. Do not pull the dressing up from the skin because this may cause epidermal or skin stripping. Remove dressing from the hub towards the exit site. (Search Google for product information - eg. “Removing 3M “Tegaderm™” Transparent Film and Removing Tegaderm™ IV Advanced Securement dressing”, etc.)

To aid in lifting a dressing edge, a piece of tape may be used in a corner. Remove and discard gloves.

9.3.5 Don sterile gloves and use a 4x4 sterile gauze to pick up the end caps and prevent contamination of sterile gloves. Cleanse skin from insertion site outwards using a grid pattern until entire surface under the dressing is cleansed.

9.3.6 With a new swab stick (a minimum of three swab sticks will be required for each dressing change), cleanse along the external catheter length that will be under the dressing. Cleanse using a back and forth, and up and down (grid pattern) motion with gentle friction for a minimum of a 30 seconds to kill bacteria on and within the top layers of the skin. Ensure the entire area that will be under the dressing is cleansed.

9.3.7 The area must air dry completely prior to applying any other product according to manufacturer guidelines. A minimum 2-3 minutes drying time is required but may be much longer on humid days or if preparations that do not contain alcohol are used. Applying barrier film or adhesives when the antiseptic solution is still wet results in skin irritation and potentially can cause a chemical burn. Let all skin antiseptics and barrier films air dry - do not wave hands, blow on area or dry area with sterile gauze. This does not allow for the disinfectant to kill all bacteria on the skin if wiped away.
9.3.8 Always ensure you wear sterile gloves prior to touching any part of the newly cleansed catheter or skin. Sterile gauze may be used to protect your sterile gloves.

9.3.9 Apply sterile skin barrier film (e.g. Cavilon™ No Sting Barrier Film) onto the skin, avoiding a 1 cm area around the insertion site. Except for the area immediately around the insertion site, all skin that will be covered by the dressing should be painted with the skin barrier film. Ensure that the barrier film is completely dry before applying the dressing.

- **Exception:** If using a Tegaderm™ CHG IV Securement Dressing or Biopatch™, do not use a barrier film to the area of antimicrobial delivery in order to allow penetration of the chlorhexidine product. The chlorhexidine impregnated area should cover the insertion site and sutures if any.

9.3.10 Position dressing loosely over the exit site and catheter then apply pressure at the exit site and over the catheter to establish adhesion to the skin and catheter. Note: **Do not stretch the transparent film while applying the dressing because this may cause skin stripping and/or blister formation at the dressing edges.**

9.3.11 Label site with your initials, and date that you changed the dressing.

9.3.12 Change dressings as per Vascular Access Device Quick Reference Protocol, or if soiled, damp, or loose. Initial dressing upon insertion with gauze must be changed 24 hours post insertion unless orders suggest otherwise.

9.3.13 Do not **EVER** use scissors as the CVAD catheter may be accidentally cut.

### 10.0 PATIENT TEACHING

10.1 To prevent air embolism, perform the Valsalva Manoeuvre whenever the catheter is open to air; examples are:

* catheter insertion
* needleless connector changes
* catheter removal (done by the most responsible health practitioner)

10.2 Report any of the following symptoms:

- pain / tenderness or swelling at exit site, neck or shoulder
- unexplained shortness of breath or coughing
- chest pain
- fever
- tingling finger or shooting pain down arm
- ear pain or “gurgling” in ear
11.0 DOCUMENTATION

11.1 Patient Care Record
- integrity of site
- complications of indwelling catheter
- status of infusion
- needleless connector and dressing changes, observation of insertion site, exit site, and sutures (if applicable)
- Any resistance noted when flushing the line (notify the most responsible health practitioner who can initiate appropriate patient care and document who you've notified)

11.2 Fluid Therapy Record
- volume and type of solution
- initiation and discontinuation of therapy

11.3 Medication Administration Record (MAR) record locking solution
- Medication/blood product administration

11.4 Kardex if applicable
- dates of planned equipment changes

12.0 REMOVAL OF CATHETER

12.1 Qualified health care professionals may remove tunnelled catheters.
<table>
<thead>
<tr>
<th>COMPLICATION</th>
<th>SIGNS &amp; SYMPTOMS</th>
<th>ACTION</th>
<th>PREVENTION</th>
</tr>
</thead>
</table>
| AIR EMBOLISM     | • coughing, chest pain, respiratory distress, shortness of breath  
<p>|                  | • cyanosis                                            | • Stop infusions                                                      | • Always clamp catheter before opening.                                      |
|                  | • unconsciousness                                     | • clamp or pinch catheter (above damaged area)                        | Have patient perform Valsalva manoeuvre.                                    |
|                  |                                                      | • patient to lie on left side in Trendelenberg position               | • Remove all air from tubing and syringes.                                  |
|                  |                                                      | • begin resuscitation procedure if required.                          | • Use leur lock connections – ensure they are tight.                       |
|                  |                                                      | • Notify most responsible health practitioner                        | • Have non-toothed clamp available.                                        |
|                  |                                                      | • administer O₂ monitor V/S                                           |                                                                            |
|                  |                                                      | • do not apply force when flushing                                   |                                                                            |
|                  |                                                      | • Notify most responsible health practitioner                        |                                                                            |
|                  |                                                      | • Do not administer vesicant solutions/medications until patency restored. |                                                                            |
| ARTERIAL PUNCTURE| • pulsating blood return                             | • apply pressure over puncture site                                  | Occurs inadvertently during insertion.                                      |
|                  | • blood backing up into tubing during infusion        | • begin resuscitation procedures if required                         |                                                                            |
|                  |                                                      | • Notify most responsible health practitioner                        |                                                                            |
| BRACHIAL PLEXUS INJURY | • tingling of fingers, pain shooting down arm and/or paralysis  | • do not use catheter                                               | Use positive pulsing pressure method when flushing and locking.            |
| CATHETER OCCLUSION| • unable to inject or infuse solution                | • Notify most responsible health practitioner                        | Clamp catheter when not in use.                                            |
|                  | • leaking of fluid or blood from insertion site       | • Do not administer vesicant solutions/medications until patency restored. |                                                                            |
| DAMAGED CATHETER | • leaking of fluid or blood at damaged area           | • Stop infusion                                                      | Never use scissors or sharp objects around catheter.                       |
|                  | • swelling of chest area                             | • do not use catheter                                               | Use 10mL syringes when flushing to prevent catheter rupture.               |
|                  |                                                      | • clamp catheter with non-toothed clamp proximal to the damaged area | Never use force when flushing.                                             |
|                  |                                                      | • Notify most responsible health practitioner                        | Unclamp before flushing.                                                  |
|                  |                                                      | • do not use catheter                                               | Keep catheter securely taped.                                              |
|                  |                                                      | • Notify most responsible health practitioner                        | Clamp only on reinforced area of catheter.                                 |
|                  |                                                      | • Observe simultaneous blood cultures from a peripheral site and each lumen of the CVAD. | Do not use safety pins attached to tape to secure catheter to patient gown. |
| INFECTION        | • redness, pain, warmth, swelling around exit site   | • do not use catheter                                               | Wash hands well with alcohol based hand sanitizer before handling catheter or equipment. |
|                  | • dressing wet with pus, blood or fluid              | • Notify most responsible health practitioner                        | Strict aseptic technique.                                                 |
|                  | • fever and chills                                   | • Obtain simultaneous blood cultures from a peripheral site and each lumen of the CVAD. | Change dressings and equipment according to procedure and when necessary; i.e. soiled, loose, damp. |
|                  | • generalized malaise                               | • do not use catheter                                               | Minimize accessing catheter.                                              |
|                  | • Elevated WBC                                       | • Notify most responsible health practitioner                        |                                                                            |
| MALPOSITION      | • difficulty with aspiration or infusion             | • do not use catheter                                               | Ensure catheter and tubing taped securely.                                |
|                  | • discomfort in chest, neck or arm                  | • inform most responsible health practitioner                        | Ensure sutures remain secure.                                             |
|                  | • edema of neck/shoulder or arms/hands              | • Chest X-ray                                                       | Monitor position of Dacron cuff/sheath.                                    |</p>
<table>
<thead>
<tr>
<th>COMPLICATION</th>
<th>SIGNS &amp; SYMPTOMS</th>
<th>ACTION</th>
<th>PREVENTION</th>
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</thead>
<tbody>
<tr>
<td>HEMOTHORAX</td>
<td>mild to severe dyspnea and/or chest pain</td>
<td>notify most responsible health practitioner immediately</td>
<td>Occurs inadvertently during insertion.</td>
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<tr>
<td>PNEUMOTHORAX</td>
<td>delayed symptoms include tachycardia, hypotension, cyanosis, diaphoresis and hemoptysis</td>
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<td></td>
<td>Tracheal deviation</td>
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<td>PERICARDIAL TAMponade</td>
<td>hypotension</td>
<td>notify most responsible health practitioner immediately</td>
<td>Occurs inadvertently during insertion.</td>
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<td></td>
<td>neck vein distention</td>
<td>begin resuscitation if required</td>
<td></td>
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<tr>
<td>THROMBOSIS</td>
<td>upper chest pain, jaw pain, ear ache, neck pain</td>
<td>do not use catheter</td>
<td>Monitor for signs and symptoms and report.</td>
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<tr>
<td></td>
<td>swelling of hand, arm, neck and shoulder on same side as catheter</td>
<td>notify most responsible health practitioner</td>
<td>Avoid trauma or movement of catheter.</td>
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<td></td>
<td>sluggish flow of IV solution</td>
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<tr>
<td>SUPERIOR VENA CAVA SYNDROME</td>
<td>progressive shortness of breath, dyspnea, cough, chest skin tightness; unilateral edema, cyanosis of face, neck, shoulders and arms; jugular, temporal and arm vein distention</td>
<td>notify most responsible health practitioner immediately</td>
<td>Monitor for signs and symptoms.</td>
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<tr>
<td></td>
<td></td>
<td>do not use catheter</td>
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<td></td>
<td>notify most responsible health practitioner</td>
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<td>place in semi-Fowlers position and start oxygen at 2 L/min.</td>
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<td>provide emotional support</td>
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<td></td>
<td>monitor cardiovascular and neurologic status</td>
<td></td>
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<tr>
<td>CATHETER PINCH-OFF SYNDROME</td>
<td>intermittent catheter occlusion that is relieved by postural change</td>
<td>notify most responsible health practitioner immediately</td>
<td>Can not be prevented.</td>
</tr>
<tr>
<td>(when catheter is inserted via the percutaneous subclavian site and is compressed by the clavicle and first rib)</td>
<td>weak point on the catheter &quot;balloon out&quot;</td>
<td>do not use catheter</td>
<td></td>
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<tr>
<td></td>
<td>difficult to aspirate blood</td>
<td>x-ray confirmation</td>
<td></td>
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<td></td>
<td>resistance to flushing or infusion with catheter fracture</td>
<td>contrast dye study via catheter to rule out partial transection of catheter</td>
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<tr>
<td></td>
<td>intraclavicular pain</td>
<td>can result in complete or partial catheter transection and catheter embolization</td>
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<tr>
<td></td>
<td>palpitation, chest pain</td>
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