References

Further Reading

Teleflex is the home of Arrow, Deknatel, Hudson RCI, LMA, Pilling, Riach, and Weck – trusted brands united by a common sense of purpose.
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Introduction

Correct management of intravascular devices is crucial to the clinical success of venous access. Most post-insertion complications can be dramatically reduced or even avoided by routine and scrupulous care and maintenance of the intravascular line.

PICCs and midlines are indicated for use in both inpatient and outpatient settings. PICCs are indicated for long-term use and may be prone to common post-insertion complications when compared to short-term devices in the inpatient setting. These complications may cause severe consequences for patients as well as an increase in cost of care for the healthcare system.

This booklet is a compilation of available best practices information for care and maintenance of PICCs and midlines. It is not intended to replace institutional policies and procedures, nor is it a substitute for sound clinical judgment, decision making, or professional experience relative to diagnostic and treatment options of a specific patient’s medical condition. As with any medical device, clinicians should review their own institutional policies and procedures and the intravascular access device Instructions For Use for detailed information regarding the Instructions For Use, Contraindications, Potential Adverse Events, Warnings, and Cautions prior to use.
What is a PICC?
A Peripherally Inserted Central Catheter (PICC) is a soft, flexible catheter constructed of polyurethane or silicone. They are inserted through the peripheral veins of the arms ( basilic vein, cephalic vein, brachial veins, and veins of antecubital area, including branches of the median cubital and cephalic veins at or below the antecubital crease) and advanced to a tip position at or above the junction of the superior vena cava (SVC) and right atrium. Tip placement verification is required prior to use.

Indications
• Short-term or long-term access to the central venous system
• Intravenous therapy, infusions with no limitation in terms of osmolarity and pH or chemical properties of infusates
• Blood sampling
• Central venous pressure monitoring
• High-pressure injection of contrast for diagnostic studies if labeled (always refer to manufacturer instructions for use prior to high-pressure injection)
• Appropriate for use in inpatient and outpatient care settings

Special Considerations
• Inadequate, thrombosed, infected, sclerosed, or stenotic vasculature of the arm or great veins of the chest
• Emergency venous access
• Chronic kidney disease, mastectomy with lymph node dissection, paralyis, and other conditions that may preclude device placement
• Patient preference and lifestyle

What is a Midline?
Midline catheters are defined as a flexible catheter often measuring from 8 cm up to 20 cm in length. They are constructed of either polyurethane or silicone. Midline catheters are inserted through the peripheral veins of the arms ( basilic vein, cephalic vein, brachial veins, and veins of antecubital area, including branches of the median cubital vein and cephalic veins at or below the antecubital crease). The tip position of midline catheters is at or below the axillary line (the axillary fold is used to determine the axillary line). Tip placement verification is not required.

Indications
• Short-term peripheral access – less than 30 days
• Infusion therapy
• Blood sampling
• High-pressure injection of contrast for diagnostic studies, if labeled, always refer to manufacturer instructions for use prior to high-pressure injection
• Appropriate for inpatient and outpatient care settings

Special Considerations and Contraindications
• Not indicated for infusions with osmolarity greater than 900 mOsm/L
• Should not be used for drugs and solutions with extreme variation in pH when compared to pH of plasma (7.35-7.45)
• Not indicated for vesicant medications/solutions or irritating medications/solutions (even if not governed by osmolarity or pH variations)
• Chronic kidney disease, mastectomy with lymph node dissection, paralysis, and other conditions that may preclude device placement
• Patient preference and lifestyle
Arrow PICC from Teleflex

The Arrow PICC is a peripherally inserted central catheter manufactured with medical grade, flexible polyurethane. It is designed with a non-tapered catheter body. It is indicated for short- or long-term peripheral access to the central venous system for adult patients.
Post-Insertion Complications – CRBSI

Catheter-Related Bloodstream Infection (CRBSI) – Catheter is confirmed as source of infection.

Causes/Factors:
- Age: greater than 1 year or less than 60 years
- Immunocompromised state
- Thrombotic state or accumulation of fibrin on the device
- Inadequate skin cleansing
- Inadequate hand hygiene
- Lack of sterile technique and appropriate draping procedure
- Contamination of catheter hub
- Hematogenous seeding (from an infection elsewhere in the body)
- Localized changes such as erythema, pain or tenderness at catheter entry site (associated with site infection/phlebitis and may be a precursor to CRBSI)
- Cording along catheter tract (associated with site infection/phlebitis and may be a precursor to CRBSI)
- Inadequate education for personnel inserting and maintaining the catheter
- Location of catheter insertion site
- Contaminated infusate

Signs/Symptoms:
- Systemic changes, such as fever, chills, general malaise, tachycardia, hypotension, elevated white blood cell count
- Localized changes such as erythema, pain or tenderness at catheter entry site (associated with site infection/phlebitis and may be a precursor to CRBSI)
- Cording along catheter tract (associated with site infection/phlebitis and may be a precursor to CRBSI)

Prevention:
- Good handwashing technique
- Appropriate use of gloves
- Aseptic insertion technique with maximal barrier precautions*
- Meticulous hub care
- Effective catheter stabilization
- Scrupulous line care and tubing maintenance/replacement (including add-on-devices)
- Surveillance for CRBSI
- Insertion site away from infectious sites
- Dry, occlusive dressing
- Scrupulous care (cleaning) of insertion site and skin
- Use of antimicrobial (CHX) dressings

*Varies in policy and procedures and guidelines
Post-Insertion Complications – Phlebitis

Vessel wall inflammation or irritation with damage to endothelial and subendothelial layers of cells (tunica intima), and may involve tunica media. Phlebitis can have mechanical, chemical or bacterial/fungal origin.

Causes/Factors
• Source of irritation may be the catheter itself or the catheter movement back and forth into the vein (mechanical)
• Rapid or poor insertion technique secondary to catheter, guidewire or sheath/dilator advancement
• Contamination with particulate such as glove powder or lint from gauze – poor sterile technique
• Infusion of solutions with inappropriate osmolarity, pH or chemical properties through a non-central line like a midline (chemical)
• Contamination of component of the infusion system – less common (bacterial/fungal)

Signs/Symptoms
• Warmth and/or erythema along the course of the vein
• Pain upon palpation
• Palpable venous “cord” (may indicate advancement of phlebitis to thrombophlebitis and may warrant possible need for removal)

Prevention
• Use smallest catheter size that fits with prescribed therapy and is appropriate for the size of the vessel
• Gently thread the catheter during insertion
• Proper catheter fixation/stabilization with dressing
• Avoid areas of flexion (cubital fossa) for insertion site
• Use central lines for solutions with extreme variations in pH and osmolarity versus other non-central access
• Observe solutions for expiration date
• Sterile technique for site care and dressing change

Post-Insertion Complications – Venous Thrombosis

The formation of a blood clot (thrombus) on the vein wall. Venous thrombosis may be symptomatic or asymptomatic.

Causes/Factors
• Alterations in blood flow caused by venous catheters of inappropriate size
• Traumatic or difficult venous access
• Irritation of intima during guidewire and/or catheter advancement
• Hypercoagulable state
• Infusion of solutions with extreme variations in osmolarity or pH through a non-central line

Signs/Symptoms
• Leakage of fluid from PICC entry site
• Edema: moderate to severe edema, often with evidence of collateral circulation formation – extremity, shoulder, chest/neck
• Discoloration and/or pain in the affected extremity
• Unexplained fever

Prevention
• Detailed pre-insertion assessment of patient and risk factors
• Avoid extremity with impaired veins (basilic, brachials, cephalic)
• Avoid areas of flexion (antecubital crease) for insertion
• Avoid extremity with limited movement
• Correct fixation of the catheter
• Use the smallest catheter appropriate for patient (catheter-to-vessel ratio) and therapy
### Post-Insertion Complications – Partial Catheter Occlusion

Partial obstruction of the catheter lumen(s) – may be withdrawal occlusion or sluggishness.

**Causes/Factors**
- Inadequate flushing of the lumen(s)
- Decreased vascular volume
- Increased venous pressure
- Catheter migration
- Catheter tip against the wall
- Fibrin tail or fibrin sheath

**Signs/Symptoms**
- Ability to flush the line with inability to aspirate blood
- Fibrin matrix may accumulate around catheter body and/or tip. When flushing/infusing, fibrin “tail” blows away from tip, but when aspirating, the tail occludes the tip
- Leakage at insertion site
- Pain or discomfort with infusion

**Prevention**
- Routine flushing with pulsatile technique
- Aspirate blood samples with 3-5 mL syringe
- Increase volume of flush to 10-20 mL sterile normal saline for injection after blood sampling or infusion of blood/blood products
- Avoid blood reflux with using a proper locking procedure
- Correct catheter tip position and catheter length
- Check patency at least every shift (ability to aspirate blood and flush)

### Post-Insertion Complications – Complete Catheter Occlusion

Complete obstruction of the lumen.

**Causes/Factors**
- Inadequate flushing of the lumen(s)
- Blood reflux into the catheter (back flow)
- Lipid accumulation, drug precipitate or mineralization
- Mechanical (lumen clamped, catheter kinked or bent, malposition of the catheter tip)

**Signs/Symptoms**
- Inability to aspirate blood or flush/infuse

**Prevention**
- Pulsatile flushing technique
- Aspirate blood samples with 3-5 mL syringe
- Increase volume of flush to 20 mL sterile normal saline for injection after blood sampling or infusion of blood/blood products
- Avoid blood reflux by using a proper locking procedure
- Use of positive or neutral displacement needleless connectors

### Types of Catheter Occlusion

- **Intraluminal Clot**
  Accumulation of blood clot inside the catheter lumen. This is properly termed a thrombotic occlusion rather than a thrombus.

- **Fibrin Sheath**
  Fibrin sheath is a fibrous protein matrix. It forms a sheath or matrix on the surface of catheters placed in the bloodstream and can provide a potential focus for bacterial growth. A fibrin tail serves to act as a valve preventing blood return on aspiration.
Care and Maintenance

Goals
The goal of implementing appropriate policies and procedures for care and maintenance of vascular access devices is to avoid the occurrence of post-insertion complications, thus preserving the patient’s vessel health and allowing a catheter to dwell for the length of the prescribed therapy or as long as indicated.

General Cautions
• When using alcohol based solutions (antiseptics) with polyurethane catheters, care should be taken to avoid prolonged or excessive contact. Alcohol solutions should be allowed to completely air dry before applying an occlusive dressing.
• Alcohol should not be used to lock catheter lumens, soak the catheter body or to treat occlusion in polyurethane catheters. Alcohol is known to degrade polyurethane material with repeated and prolonged exposure.
• Do not expose the catheter to acetone containing solutions or apply polyethylene glycol containing ointments at the exit site or around the catheter. These can damage the polyurethane material if used over time. Ensure catheter patency prior to use for infusion or high-pressure injection.
• Use only lumen(s) labeled “Pressure Injectable” for pressure injection to reduce risk of catheter failure and/or patient complications. Refer to the Arrow PICC Pressure Injection Information card for pressure injection instructions and information.
• Ensure catheter patency prior to use, including prior to pressure injection. Do not use syringes smaller than 10 mL (a fluid filled 1 mL syringe can exceed 300 psi [2068.4 kPa]) to reduce risk of intraluminal leakage or catheter rupture. Power injector equipment may not prevent over pressurizing an occluded or partially occluded catheter.

General Recommendations
It is required to assess the midline or PICC and document the assessment routinely and prior to use.

Assessment includes:
• Visual inspection of the site and track of the vein including the chest and neck for the presence of edema, erythema, drainage or leaking of fluid and skin color and color.
• Palpation from site to axilla and along chest wall observe for pain signs, heat or venous cord.
• Integrity of the dressing.
• Length of external portion of the catheter.
• Patency check: ability to obtain brisk blood return from and flush each lumen.
• Infusion rate, pump occlusion alarm settings and rate of infusion.
• IV tubing connections, solutions being infused and status, presence of particulate or color change in tubing.
• Catheter necessity.
Hand Hygiene

Goals

- Maintain aseptic technique during the care of the intravascular catheter in order to avoid both intraluminal and extra-luminal contamination

When

- Before and after palpating catheter insertion sites
- Before and after accessing the catheter
- Before and after applying dressings (dressing change)
- Before and after add-on device change

How

- Perform hand hygiene using an alcohol based hand gel or soap and water
- Wear either clean or sterile gloves when accessing the catheter (follow institutional policies and procedures)

To effectively reduce the growth of germs on hands, handrubbing and/or handwashing must be performed by following all of the illustrated steps. This takes only 20–30 seconds!

How to Handrub

1. Apply a palmful of the product to cupped hand, covering all surfaces
2. Rub hands palm to palm
3. Right palm over left dorsum with interlaced fingers and vice versa
4. Palm to palm with fingers interlaced
5. Backs of fingers to opposing palms with fingers interlocked
6. Rotational rubbing of left thumb clasped in right palm and vice versa
7. Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa
8. Your hands are now safe

How to Handwash

1. Wet hands with water
2. Apply enough soap to cover all handsurfaces
3. Rub hands palm to palm
4. Right palm over left dorsum with interlaced fingers and vice versa
5. Palm to palm with fingers interlaced
6. Backs of fingers to opposing palms with fingers interlocked
7. Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa
8. Rinse hands with water
9. Dry hands thoroughly with a single use towel.
10. Use towel to turn off faucet
11. Backs of fingers to opposing palms with fingers interlocked
12. Your hands are now safe
Flushing

Goals
- Assess catheter function
- Avoid mixing of incompatible infusates
- Avoid occlusion

When
- Before and after each infusion to clear solution from the catheter lumen
- Always before and after blood sampling or blood/blood product infusion
- With each tubing change and/or lipid infusion
- At least once per week when not in use (outpatient setting)
- Routine flush must include all catheter lumens

How to Flush the Line
- Perform hand hygiene
- Use a 10 mL Luer lock syringe filled with sterile normal saline for injection
- Use 20 mL of sterile normal saline for injection when catheter has been used for blood/blood products infusion, lipid infusion, contrast media infusion or blood backflow is visible internally the line^8
- Wear clean gloves and use Aseptic Non Touch Technique (ANTT).
- Disconnect the infusion line for intermittent infusions (if connected to the lumen) from the needleless connector
- Disinfect needleless connector or injection port to access for at least 5-15 seconds with antiseptic according to institutional policies and procedures, allow to air dry
- Example: if not using a pre-saturated pad, swabstick or sponge, saturate a gauze pad or swab with a solution of 70% isopropyl alcohol or a solution of 2% chlorhexidine gluconate and 70% isopropyl alcohol
- Attach a 10 mL Luer lock syringe filled with 10 mL of sterile normal saline for injection
- Ensure the lumen is unclamped
- Flush the lumen with positive pressure and pulsatile technique
- Clamp the lumen while still applying pressure to the syringe
- Disconnect the syringe
- If a new needleless connector is attached, disinfect and flush the line again

Pulsatile Flushing Technique
Rapidly advance the syringe piston by 1-2 mL each pulse ensuring that thumb pressure remains on the piston. Do this continuously until the syringe is nearly empty. Allowing a small amount of fluid to remain in the syringe further prevents reflux of blood into the catheter. The pulsatile flushing technique produces turbulent flow inside the lumen that enhances the removal of debris from the lumen.
Locking

“Locking” catheter lumen means filling of the lumen with a solution that may or may not have antithrombotic, anti-infective or anticoagulant properties. It is common for sterile normal saline for injection to be used as a locking solution if using a neutral or positive displacement needleless connector.

Goals

- Avoid backflow into the catheter thus decreasing the risk of clotting and consequently occlusion
- Stabilize the catheter securely, thus avoiding friction (pistoning) or movement in-and-out of the insertion site that may cause insertion site inflammation and endothelial irritation that may cause phlebitis
- Decrease risk of catheter dislodgement
- Protect the exit site from bacteria and other environmental pathogens

When

- At the time of use of the lumen is discontinued (to maintain patency) and always after completion of the final flush after medication administration if the lumen is being used intermittently
- At least every seven days (when using a transparent semipermeable dressing), at least every 48 hours if using a gauze dressing
- Any time the dressing is damaged, loose, wet or soiled
- All items under the dressing must be replaced at the time of dressing change including tape and manufactured securement devices

How to Lock the Line

- Make sure the lumen is not clamped
- Flush the lumen (please to refer to previous section – How to Flush the Line)
- Use a new 10 mL Luer lock syringe with a volume of lock solution that is twice the catheter volume (priming volume) + the volume of any add-on device or a volume prescribed by institutional policies and procedures
- Connect the syringe to the needleless connector hub
-Instill the solution leaving a small amount (0.1-0.2 mL) in the syringe to prevent reflux
- Clamp the line while positive pressure is applied using a positive pressure technique-unless using a positive or neutral needleless connector (follow needleless connector manufacturer’s instructions for use)
- Disconnect the syringe from the catheter

Securement and Dressing Change

Goals

- Stabilize the catheter securely, thus avoiding friction (pistoning) or movement in-and-out of the insertion site that may cause insertion site inflammation and endothelial irritation that may cause phlebitis
- Decrease risk of catheter dislodgement
- Protect the exit site from bacteria and other environmental pathogens

When

- At least every seven days (when using a transparent semipermeable dressing), at least every 48 hours if using a gauze dressing
- Any time the dressing is damaged, loose, wet or soiled
- All items under the dressing must be replaced at the time of dressing change including tape and manufactured securement devices

Carefully lift the old dressing. Ideally, this should be done towards the insertion site, not away from it. This reduces risk of pulling line out.
How to Change Securement and Dressing

- Wash and dry hands thoroughly
- Wear clean gloves and use ANTT
- Create a sterile field on the trolley
- Check catheter patency (aspirate blood to ensure a brisk blood return and ease of flush) using a 10 mL Luer lock syringe filled with sterile normal saline for injection
- Flush the line
- Put all the equipment onto the sterile field
- Remove the current dressing from patient’s arm
- Remove the clean gloves
- Put on sterile gloves
- Secure the catheter firmly with a sterile tape strip
- Release the catheter from the securement device (image 1)
- Peel the securement device from the skin (image 2)
- Clean the exit site carefully - Using a chlorhexidine alcohol applicator (image 3) or a gauze pad or swab saturated with solution chlorhexidine gluconate 2% and isopropyl alcohol 70% for at least 30 seconds (or, alternatively an approved antimicrobial preparation solution according to the institutional policies and procedures may be used) and let it air dry
- Check the catheter markings and verify that it has not been accidentally dislodged
- Apply a new securement device (images 4 and 5)
- Apply the new transparent semipermeable membrane dressing (images 6, 7, and 8)

Remove the dressing and release the catheter from the securement device taking care not to dislodge the catheter

Clean the site in a cross-hatch pattern for at least 30 seconds and allow to air dry for at least 30 seconds

Insertion site should be in the middle of the clear window. Note that the securement device is covered too.
Flexible Catheter Securement – Box Clamp

The box clamp is used for added securement when there is excess catheter exiting the insertion site. The box clamp consists of a flexible clamp and a rigid plastic fastener. To apply using box clamp method:

- Spread wings of clamp (white piece or yellow soft plastic piece) and position on catheter
- Ensure proper placement over catheter securement holes
- Snap rectangular, rigid fastener (blue piece) onto flexible catheter clamp

This is a secondary securement device (not to be used as the only method of securement). The catheter should still be secured at the primary securement site or catheter junction.

Administration Tubing Set Replacement

Procedure to change or replace intravenous administration sets (tubing).

Goals

- Ensure that infusion therapy is administered safely
- Avoid intraluminal contamination and possible bloodstream infection

When

- No more frequently than every 96 hours, but at least every seven days, for continuously used lines
- Within 24 hours of initiating infusion of blood or blood product or fat emulsion (lipid solution) or parenteral nutrition

How to Replace the Administration Tubing Set

- Wash and dry hands thoroughly
- Wear clean gloves and use ANTT
- Stop infusion
- Clamp the lumen (if changing the needleless connector at this time)
- Disconnect the administration tubing from the needleless connector
- Change gloves
- Disinfect needleless connector hub with an approved antimicrobial preparation solution according to institutional policies and procedures
- Check patency of each lumen by aspirating for blood return and flushing with sterile normal saline for injection using a 10 mL Luer lock syringe
- Attach the new administration tubing, label with date and time of tubing change
Needleless Connector
All add-on devices shall be of Luer lock design to ensure a secure connections.1,3,5
• Change needleless connectors no more frequently than every seven days with dressing changes, tubing changes or in accordance with manufacturer’s instructions for use.
• Ensure that all components are compatible to minimize leaks and breaks in system (do not overtighten).
• Reduce contamination risk by scrubbing needleless connector hub with an approved antiseptic preparation solution according to institutional policies and procedures using friction prior to each access for 5-15 seconds, always allow to air dry.
• Scrub the catheter hub (with the same antiseptic solution) and let it air dry prior to replacement of a new sterile needleless connector. Use strict ANTT. Use only sterile equipment to access the catheter hub or needleless connector.

Blood Withdrawal Procedure
• Wash and dry hands thoroughly.
• Wear clean gloves and use ANTT.
• Discontinue administration of all infusates (if required).
• Disinfect the hub of needleless connector prior to access. Flush with a 10 mL Luer lock syringe filled with sterile normal saline for injection unless performing blood culture.
• Withdraw 3-5 mL of blood using a 3 or 5 mL syringe and discard (standards differ and this is just one method, it should be done according to the institutional policies and procedures), clamp lumen (if required).
• Disinfect needleless connector or catheter Luer hub if doing a direct connect for blood cultures.
• Connect a new 10 mL Luer lock syringe. Alternatively, a 3 or 5 mL syringe may provide an easier blood draw and minimize time required. This may also help reduce occlusion.
• Obtain blood sample of appropriate volume – clamp the lumen (if required).
• Disconnect the syringe.
• Disinfect needleless connector hub or catheter hub if doing a direct draw technique for blood cultures.
• Flush with 20 mL of sterile normal saline for injection using pulsatile technique to adequately clear catheter and any add-on device.
• Attach a new needleless connector if required by hospital policies and procedures and/or needleless connector manufacturer’s instructions for use.
**Glossary**

**ANTT:** Aseptic Non Touch Technique (for more information [http://antt.org/ANTT_Site/what_is_ANTT.html](http://antt.org/ANTT_Site/what_is_ANTT.html))

**Colonization:** Growth of microorganisms on the external or internal surfaces of the catheter, hub and extension tubing. Typically noted after removal with culture.

**CRBSI:** Catheter-Related Bloodstream Infection. A positive blood culture with clinical or microbiologic evidence that strongly implicates the catheter as the source of infection.

**Endothelium:** The thin layer of cells that lines the innermost surface of blood vessels forming an interface between the circulating blood and the vessel wall.

**Exit site:** The point where the catheter comes out of the patient’s skin. It is different from the insertion site in tunneled catheters.

**Flow rate:** Volume of fluid which passes through a given surface per unit time. It may be expressed in either mL/sec (for high-pressure injections) or mL/hour (gravity flow or infusion pump).

**Insertion site:** The point where the catheter enters into the vein.

**Osmolarity:** The measure of solute concentration (tonicity), defined as the number of osmoles (osm) of solute per Litre (L) of solution (mOsm/L).

**Paired brachial veins:** The two veins that join to become the brachial vein in the mid upper arm.

**pH:** A parameter to measure acidity or basicity of a solution. Solutions with pH<7 are said to be acidic and solutions with pH>7 are said to be alkaline or basic. Normal human blood pH is within the range 7.35 – 7.45.

**Phlebitis:** Inflammation of a deep or superficial vein. In superficial veins it may be seen as a linear pattern along a portion of the vein. When phlebitis becomes severe, thrombophlebitis occurs as evidenced by palpable cord along a portion of the vein. Thrombophlebitis is a precursor to venous thrombosis. Phlebitis may be bacterial, chemical or mechanical in origin.

**PN:** Parenteral nutrition

**Precipitation:** Chemical reaction causing two or more incompatible substances dissolved in solution to form a solid.

**Priming volume:** The volume of fluid required to completely fill the inner lumen of the catheter. It is important for lockning technique and administration of some drugs.

**Reverse taper:** The catheter external diameter enlarges in the proximal portion of the catheter body.

**Sterile normal saline for injection:** 0.9% Sodium Chloride Solution for injection.

**TPN:** Total parenteral nutrition

### Signs and Symptoms

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<th>Possible Cause</th>
<th>Directions</th>
<th>Prevention</th>
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<tr>
<td>Drainage, redness, pain, swelling around insertion site, fever and chills</td>
<td>Infection</td>
<td>Call doctor or IV nurse</td>
<td>Use sterile technique; Keep sterile dressing over site; Wash hands prior to procedures</td>
</tr>
<tr>
<td>Arm or shoulder swelling, rash in ear on same side of body where catheter is located while medication given</td>
<td>Catheter position change</td>
<td>Call doctor or IV nurse</td>
<td>Inject flushing/locking solution slowly</td>
</tr>
<tr>
<td>Inability to inject</td>
<td>Catheter clotted or kinked</td>
<td>Call doctor or IV nurse</td>
<td>Completely fill catheter lumen with locking solution between treatments; Flush catheter well before and after medications; Tip verification at time of insertion, if indicated; Use of appropriate catheterumen device</td>
</tr>
<tr>
<td>Leaking from external catheter</td>
<td>Break in catheter material, hub separation</td>
<td>Call doctor or IV nurse</td>
<td>Do not use alcohol or acetone (as in nail polish or tape remover) on catheter; Do not pull on catheter</td>
</tr>
<tr>
<td>Pain on injection</td>
<td>Inflammation of vein</td>
<td>Call doctor or IV nurse</td>
<td>Medications should be given slowly</td>
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