

Best Practices for the Care and Maintenance of ARGYLE® Neonatal Peripherally Inserted Central Catheters

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INTRODUCTION

Tyco Healthcare/Kendall recently launched the first-of-its-kind ARGYLE® Dual Lumen 1.9 Fr Neonatal Peripherally Inserted Central Catheter. Many customers have requested information regarding the best way to maintain this product. The information provided in this document is also applicable to the ARGYLE® Single Lumen PICC.

Always refer to the manufacturer's Directions For Use.

Heed all specific warnings indicated throughout this document. Pay special attention to the following warnings:

WARNING: Do not use alcohol or acetone based skin protectants, adhesives or solutions on the ARGYLE PICCs. When an alcohol containing product is used on the infant, it must dry completely before the PICC is placed or replaced in that area.

WARNING: Only syringes 5cc or larger are to be used with this catheter. Smaller syringes can generate very high-pressures that may rupture a PICC even if it is not occluded.

WARNING: Infusion pump occlusion sensitivity should NEVER be set greater than 25 psi.

The following topics are addressed in this document:

- Catheter Insertion Tips
- Care & Maintenance
 - Dressing Changes
 - Flushing
- Add-On Devices
- Flow Rates
- Blood Sampling & Administration
- Catheter Embolus
- Catheter Replacement
- Radiographic Visualization
- Declotting Procedure

Catheter Removal

CATHETER INSERTION TIPS

PICC catheters should only be inserted by properly trained personnel.

Tip 1- Feed in ¼ cm increments

Products with a stylet are usually fed at about ½ cm increments. This is possible since the product is stiffer. Non-stylet products should be fed at ¼ cm increments. Feeding too much at a time can cause the catheter to buckle and lead to vessel irritation or mechanical phlebitis. The ARGYLE® PICC does not have a stylet and should be fed in ¼ cm increments.

TIP 2- Flush to dilate the vessel and open valves

Products with a stylet are stiffer, so they generally can pass through valves within the venous system easily. However, valves can cause resistance to a non-stylet product, such as the ARGYLE® PICC. To facilitate insertion, flush the PICC to dilate the vessel and open the valve. Then advance the PICC.

TIP 3- Milk the vein

Massage the vein toward the heart to empty it of blood then allow it to refill. This can also aid in threading.

TIP 4- Apply heat

Applying heat will dilate the vessel allowing for increased blood flow, which can aid in insertion.

Remember, always feed slowly and carefully. The inner layer of the vein can become damaged from trauma. When this happens a thrombotic cascade can occur. Platelets and red blood cells clump together to form a protective layer over the area of irritation. If the irritation continues, the layer becomes larger and may develop into a full clot or thrombus.

CARE AND MAINTENANCE

PICC catheters should only be maintained by properly trained personnel. Properly cared for, polyurethane PICC catheters with tip termination in the superior or inferior vena cava may remain in place for the length of intravenous therapy.

The manufacturer's directions for use are always the best source of information regarding specific utilization of individual catheter brands. These recommendations have been developed with information based on historical data. While it is always important to adhere to institutional policies, these policies should reflect the recommendations of the manufacturer regarding care and maintenance issues.

DRESSING CHANGES

PICC catheter dressings provide a protective environment for the catheter entrance site, and help to prevent catheter migration. A properly applied dressing should decrease the incidence of sepsis, leakage and breakage.

Standard practice indicates that PICC dressings be changed 24 hours after initial catheter insertion if visible drainage is present under the dressing, then weekly, or any time the dressing becomes damp, loosened, or soiled, or when inspection of the site is necessary. **NOTE:** In the NICU environment dressing changes are accomplished on an as needed basis, or per institutional policy.

Dressing changes must be performed utilizing strict aseptic technique. The following supplies will be required:

- One pair of clean gloves
- One pair of sterile gloves
- Sterile prep solutions per institutional policy
- One sterile transparent dressing
- Three sterile tape strips
- Face Mask

Prior to changing the dressing, inspect the insertion site for edema, exudates, or erythema. Measure and document both upper arms or legs circumferences; depending on insertion location.

Procedure:

1. Don facemask and clean gloves. Loosen the tape strips from the old transparent dressing.

WARNING: DO NOT use alcohol or acetone based products to remove the dressing or tape strips.

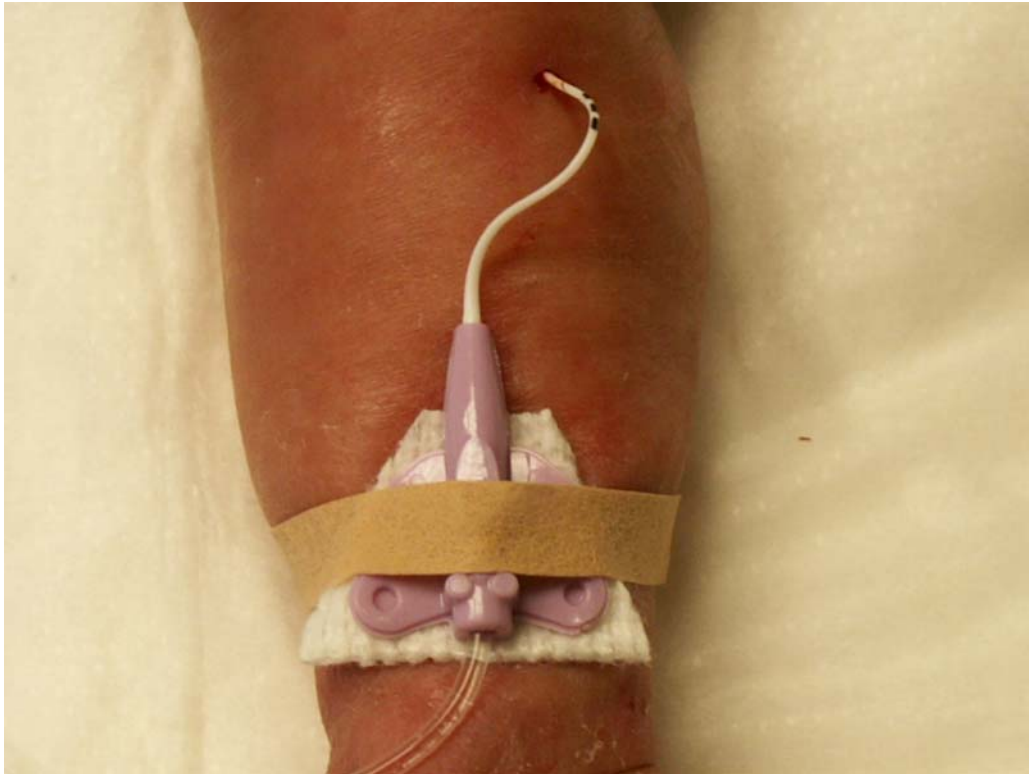
2. Carefully remove the old dressing while stabilizing the stabilizing wing. Peel the dressing toward the insertion site only.
3. Remove and discard gloves. Drop dressing change supplies on a sterile field, don sterile gloves.
4. Check for catheter migration using hospital protocol. If the catheter has migrated, the tip may no longer be in the intended position and an x-ray should be obtained to verify tip position.
5. Note orientation of catheter skin reference marking. Do not reinsert any excess catheter length.

6. Cleanse the insertion site with prep solution (s) per institutional policy. Allow to dry completely. **NOTE:** In the neonatal setting, sterile saline or water is sometimes used to remove the prep solution to prevent direct uptake into the venous system. In the pediatric population, the prep solution is never removed.

WARNING: Do not use alcohol or acetone based skin protectants, adhesives or solutions on the ARGYLE PICCs. When an alcohol containing product such as Chloraprep® is used on the infant, it must **dry completely** before the PICC is replaced in that area. Prep solutions are maximally effective when dry.

7. Position the catheter tubing at a slight offset. Anchor the catheter with a **sterile** tape strip placed across the polyurethane “butterfly”. Note: In very premature infants, with fragile skin, this tape strip may be omitted. **NOTE:** Do not place tape over the catheter since this could cause slight occlusion or damage to the catheter during removal

NOTE: Place catheter tubing **in line** with the skin fold prior to dressing. Placing the catheter tubing in a straight line, across a skin fold, may cause intermittent catheter occlusion.



- Place the transparent dressing over the insertion site, covering the polyurethane “butterfly” stabilizing wing.



- Using a “chevron” technique, place a tape strip (adhesive side up) under both the catheter extensions, next to the polyurethane “butterfly”, crossing over the polyurethane “butterfly” on top of the transparent dressing. Proper placement of this tape strip is essential to ensure a secure fitting between the catheter and the dressing, thus preventing migration.



TIP- For the ARGYLE® Dual Lumen PICC, it is helpful to chevron each pigtail individually for maximum securement (not shown).

10. Place an additional tape strip as shown, to reinforce the chevron.



NOTE: In the very small neonatal patient with very fragile skin, a sterile “pectin-type” material such as Duoderm ®* dressing may be cut with sterile scissors, to the exact size of the transparent dressing. A hole is then cut from the center of the pectin dressing, and placed over the insertion site, following skin preparation. The catheter-stabilizing wing comes through this hole, and lies on the top of the pectin piece. The transparent dressing is then applied directly to the pectin, and not to the patient’s skin. The remainder of the dressing is done exactly as detailed above.

FLUSHING

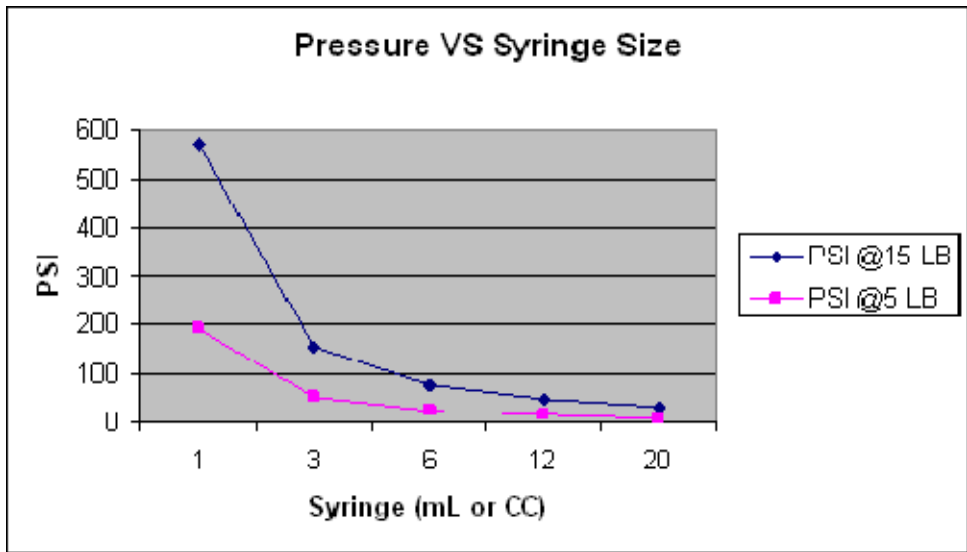
To ensure patency of each lumen of the catheter, flushing techniques and protocols are required. Flushing protocols used with other venous access devices may not be appropriate for use with the PICC catheter.

Even though the ARGYLE® PICC line has two lumens, each lumen should be treated separately for maintenance and flushing. Incompatible medications can now be given separately into each

lumen without fear of damage to the patient and/or catheter. The SASH method of flushing is the recommended procedure for use with this catheter (Saline, Administer, Saline, Heparin).

WARNING: Only syringes 5cc or larger are to be used with this catheter. Smaller syringes can generate very high-pressures that may rupture a PICC even if it is not occluded. Attaching syringes smaller than 5cc to transfer or extension sets does not reduce the risk of high pressures being generated in the catheter.

As the following graph demonstrates, a 1cc syringe can generate extreme pressure, even if minimal force is applied to the plunger.



When using a PICC catheter for intermittent infusion therapy, proper heparinization using a positive pressure technique at appropriate timing intervals will ensure each lumen's patency. The Intravenous Nurses Society recommends flushing volumes of twice the priming volume of the catheter, plus the volume of any add-on devices.

The priming volumes of each lumen of the untrimmed ARGYLE® PICC catheter are:

Dual Lumen PICC

Primary Lumen: 0.15 mL

Secondary Lumen: 0.13 mL

Single Lumen PICC

Primary Lumen: 0.18 mL

NOTE: These prime volumes are for untrimmed catheters. Refer to instructions for use for approximate prime volumes for different trimmed lengths of the ARGYLE® PICC lines.

For standardization, a flushing volume of 0.5 – 1.0 mL is more than sufficient for this catheter.

The appropriate concentration of heparin solution will vary with institutional policy. In the neonatal patient it is recommended to use a heparin solution of 1 U/mL or 10 U/mL **flushing the catheter at least every 4 to 6 hours.**

Catheters may also be kept patent with a continuous infusion of heparinized saline at 0.5 – 1.0 mL/hr, or per institutional policy.

Use a PUSH-PAUSE/START-STOP (turbulent flow) technique when flushing the catheter. Push a bit of solution then pause, push a bit more then pause again until all flush solution is injected. This type of technique is meant to produce turbulence, which may reduce the formation of clots on the catheter inner wall.

WARNING: only syringes 5cc or larger should be used with this catheter.

It is **imperative** to create positive pressure after flushing. A positive pressure device will automatically create positive pressure within the catheter. Positive pressure fills the catheter with the heparinized solution and prevents blood from back-filling into the lumen. The CLC2000, by ICU Medical has been reported to be very effective (www.icumed.com).

ADD-ON DEVICES

The optimal interval for routine replacement of IV tubing, including piggyback tubing and stopcocks, is no more frequently than at 72-hour intervals, unless clinically indicated. IV administration sets include the area from the spike of tubing entering the fluid container to the hub of the PICC. However, a short extension tube may be connected to the device and may be considered a portion of the device to facilitate aseptic technique when changing administration sets. Replace extension tubing if the PICC is replaced.

All add-on devices must be “luer - locking”, to prevent dislodgment and potential contamination.

When changing tubing or add-on devices it is recommended to use strict aseptic technique, including the application of 70% alcohol or povidone-iodine before accessing the device or prior to disconnection.

WARNING: NEVER use clamps, hemostats, or sharp instruments on or near the catheter.

FLOW RATES

It is important to remember that flow rates administered through a PICC catheter will be dependent on many factors such as: patient condition, venous integrity, resistance within the venous system, solution temperature and viscosity, pressure delivered by the pumping device, trimmed catheter tubing length and inner lumen diameter.

NOTE: Neonatal PICC's are almost always used with an infusion pump. Gravity flow is rarely a consideration.

The following facts are based on infusion rates using a pump:

- Each lumen of the ARGYLE® Dual Lumen catheter is capable of achieving an average infusion rate of 118 mL/Hour using saline.
- Each lumen of the ARGYLE® Dual Lumen catheter is capable of achieving an average infusion rate of 59 mL/Hour using the more viscous solution of intralipids with 20% fat content.

NOTE: Flow rates should never be less than 0.4 mL/Hour

Please note that catheter kinking underneath the dressing can cause interference in flow. If intermittent occlusion alarms are occurring with IV pumps, first aspirate and irrigate the catheter to check for patency. Redressing the catheter may be indicated. If the occlusion alarms continue, the flow rate may have exceeded the limits of the catheter size. Increasing the pump pressure or decreasing the pump rate may be beneficial.

WARNING: Infusion pump occlusion sensitivity should NEVER be set greater than 25 psi.

BLOOD SAMPLING AND ADMINISTRATION

Blood sampling (aspirating) or blood administration (infusing) is **CONTRAINDICATED** for use with the ARGYLE® PICC's. It is recommended that a peripheral IV be utilized to administer and routinely sample blood.

CATHETER EMBOLUS

Polyurethane catheters have been the industry standard for long-term dwell for a number of years. Polyurethane is biocompatible, biostable, and hemocompatible. However; due to the delicate nature of this size catheter, potential for fracture exists, therefore; prevention of fracture is mandatory.

If using a splittable ((break away) needle introducer, never advance the needle or retract the catheter after inserting the catheter into the needle. Such action may result in a sheared or severed catheter leading to a catheter embolism. If using a peel-away cannula introducer, the needle is removed prior to introduction of the catheter tubing, therefore preventing catheter shear.

NEVER suture the catheter or stabilizing wing.

NEVER use a clamp or any sharp near the catheter body.

If a catheter embolus has occurred, immediate medical intervention is required. If the catheter was inserted into an antecubital vein, direct pressure to the vein, high in the cannulated extremity, may prevent the catheter embolus from migrating into the central circulation. This direct pressure should remain in place until the fragment can be located radiographically, and removed via venous cutdown.

Transvenous removal is the method of choice when the embolus has already advanced into the central circulation. With any delay in embolus removal, thrombi may encase the fragment and promote adherence to the vessel wall and provide a mode for infection.

CATHETER REPLACEMENT

It is ideally suggested that broken or damaged catheters be removed and replaced. In the event that there are no alternate veins available, a sheath exchange can sometimes be accomplished.

When performing a sheath exchange, it is very important to utilize the best aseptic technique possible. The use of maximum universal precautions is mandatory. Prepare the patient and equipment as you would for an initial insertion. Cut off the catheter stabilizing wing from the existing catheter, while holding it securely with one hand. Remove the needle from the introducer, and slide the sheath over the existing catheter and into the original entrance site. With the sheath held firmly in place, remove the existing catheter, and replace it with the new catheter per manufacturer's instructions for use.

Sheath exchange requires a physician's order. The physician may also wish to include prophylactic antibiotic coverage following exchange.

Guidewire exchange of ARGYLE® PICC catheters is not recommended by the manufacturer.

RADIOGRAPHIC VISUALIZATION

The ARGYLE® PICC catheter is more radiopaque than the typical silicone catheter. The use of the following radiographic techniques has been helpful in enhancing visualization of polyurethane PICC catheters:

- A rib visualization technique (modified shoulder film) is used with a medium to fast screen
- Aa Kodak® * O.G. PMG high contrast, or TMG film is used
- KV of 50 – 60 and an MAS setting of 1.0 to 1.5 with a distance of 36 – 40 inches. (30 inches if an overhead warmer is in use)

Along with the radiopacity of the ARGYLE® PICC catheter, use of the above methods will make contrast medium virtually unnecessary.

The infant's extremity should be allowed to remain in a position during x-ray to enable the clinician to view the most common tip location of the catheter. Increasing the radius of arm during x-ray will make the catheter tip appear to be in a deeper tip location.

CATHETER DECLOTTING PROCEDURE

Catheter occlusion can be caused by drug incompatibilities, retrograde blood flow, gradual accumulation of intraluminal fibrin, or catheter kinking.

In the older pediatric patient, midclavicular tip placement of a PICC may increase the risk of thrombus development due to the curvature of the vessel allowing more contact between the endothelial lining and the catheter tip.

If a catheter is looped or coiled within the vessel, the risk of thrombus increases due to intravascular flow resistance.

Signs and symptoms of catheter occlusion include:

- Swelling of the face, neck, or arm in which the catheter is placed due to pooling of venous blood
- Inability to flush the catheter
- Tenderness or pain
- The inability to aspirate and obtain a blood return, once a possible occlusion is determined.

The manufacturer recommends replacement of the PICC catheter if a clot occurs.

Declotting a PICC catheter should only be attempted following a thorough discussion with the physician. Declotting can be a very expensive procedure, and can expose the patient to the added risks of intracranial hemorrhage, embolism, and anaphylaxis. Consideration should be given to alternative access choices, replacement of the PICC, duration of remaining therapy, venous status of the patient, and reimbursement issues. If after discussion with the physician it is deemed necessary to "declot", then the procedure described below may be used.

TPA/Alteplase is the drug of choice for occlusions caused by blood.

When using TPA, reconstitute the drug using the manufacturer's guidelines. Usually the reconstituted drug is equal to 1mg/mL. TPA must be used immediately after mixing.

Utilize only the procedure listed below, which has been proven to provide a safe and effective administration of the drug. Remember that the use of direct ***positive pressure*** with small-bore syringes (<5cc syringes) and a catheter known to be occluded, may lead to catheter rupture and potential embolus.

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The intraluminal dose of TPA should be equal to 110% of the internal volume of the catheter lumen, not exceeding 2 mL.

Dual Lumen PICC Catheter

- Primary Lumen: 0.17 mg/0.17 mL
- Secondary Lumen: 0.14 mg/0.14 mL

Single Lumen PICC Catheter

- Primary Lumen: 0.20 mg/0.20 mL

NOTE: These prime volumes are for untrimmed catheters. Refer to instructions for use for approximate prime volumes for different trimmed lengths.

Allow the TPA to dwell for 30 minutes, then attempt to aspirate for a blood return, if successful, attempt an infusion of 3 mL of normal saline. If after 30 minutes you are unable to aspirate blood, and then allow the drug to remain in the catheter for an additional 90 minutes, for a total of 120 minutes after TPA administration. Then attempt to aspirate for a blood return. If the catheter remains “dysfunctional” after a single dose of TPA, treat with a second dose, using the same procedure. If unsuccessful after two doses of the drug, consult the physician.

Failure to utilize the proper SASH method of flushing between administrations of incompatible medications can result in the formation of a precipitate that can occlude the catheter. Altering the solubility of the precipitate by altering the pH may dissolve the obstruction and clear the catheter.

Signs and symptoms of occlusions caused by drug incompatibilities include:

- Visual precipitate in the IV tubing
- Occlusion occurring immediately after the administration of solutions known to precipitate
- Two unsuccessful attempts to declot using TPA

Prevention should include the addition of a 0.22 micron filter to the infusion set, careful calculation of the solubility coefficients during compounding of the drugs, delivery of solutions at room temperature, allowing a limited time lapse between compounding and infusion, and the use of proper flushing between incompatible solutions.

The following step-by-step procedure should be utilized minimizing potential complications/side effects to the patient and to avoid damage to the catheter. Equipment required will include:

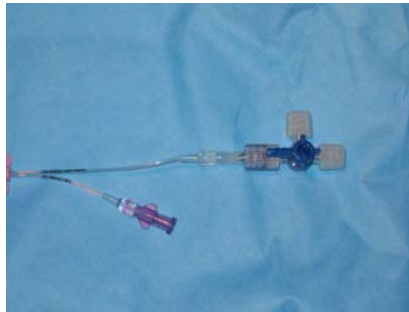
- (1) 5cc syringe, and (1) 1cc syringe (both should be luer - locking)
- Sterile 3-way stopcock
- Sterile gloves
- Face Mask

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- Sterile povidone-iodine swab sticks

Assemble the supplies, reconstitute the declotting agent, and begin the procedure as follows:

1. Don face mask and gloves. Keeping the patient's arm below the level of the heart, swab the catheter hub with povidone-iodine and allow to dry (**wet povidone-iodine is useless for antisepsis and can cause harm if the solution gets inside the connection and into the blood stream**). Remove the IV tubing and any add-on devices. Attach the 3-way stopcock, with the stopcock in the "OFF" position.

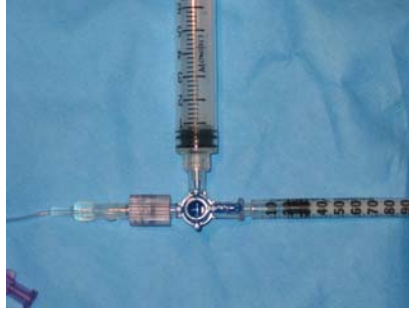


2. Swab one port of the stopcock with povidone-iodine, and attach an empty 5cc syringe. Swab the remaining port with povidone-iodine, and attach the prefilled 1cc syringe (containing TPA).

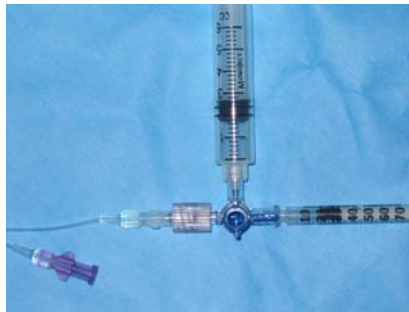


3. Turn the stopcock "OFF" to the prefilled syringe, and "OPEN" to the empty 5cc syringe.

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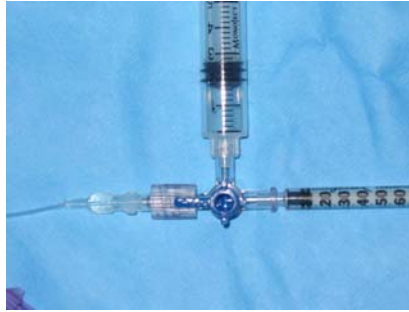
4. Aspirate on the empty syringe, causing the catheter to empty, and leave a **negative pressure** in the line.



5. While maintaining this negative pressure, turn the stopcock “OFF” to the empty syringe, and “OPEN” to the prefilled syringe. When this is accomplished, the medication should automatically be drawn into the catheter due to the negative pressure generated.



6. Turn the stopcock “OFF” to the catheter once again, and allow the medication to dwell for 30 minutes



7. Open the stopcock and check for a blood return. If a blood return is established, withdraw a sample for wastage, gently flush with sterile normal saline, and resume use of the catheter with a continuous infusion, or a positive pressure heparin lock.

When utilizing this procedure, catheter rupture is impossible because the declotting agent is given via negative pressure. The potential for complications/side effects is minimized because the drug cannot exceed the volume of the catheter.

CATHETER REMOVAL

As long as there are no indications of complications, the ARGYLE® PICC catheter may remain indwelling until the completion of therapy.

Removal of the catheter is normally achieved easily, without resistance, by slowly withdrawing it from the insertion site. Research has, however, reported rates of 10-17% of PICC removals in neonates as “being difficult”.

Some potential causes of difficult removal include the following:

- Thermoplastic catheters left in place long enough to adhere to the vessel wall
- Phlebitis, thrombophlebitis, venospasm, chemical or mechanical irritation of the vessel
- Infection
- Intense cellulites may lead to resistance due to soft tissue inflammatory changes and swelling
- Cold infusates
- Irritation caused by the motion of the catheter against the vessel wall

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If vessel spasm is the cause of difficult removal, it can last for minutes to hours. Spasm typically occurs when the vein is irritated in some way. The spasm will not maintain indefinitely, and will eventually relax.

Prior to attempting to remove a resistant catheter, an x-ray is indicated to rule out the presence of knots in the catheter.

The following is the widely accepted “standard of practice” for PICC line removal:

Procedure:

1. Prepare equipment. Wash hands. Place patient in a comfortable position. Position arm at a 45 – 90 degree angle from the body.
2. Put on clean gloves; gently remove the dressing by pulling it toward the insertion site. Pulling it away will remove the catheter along with the dressing. Remove any steri-strips securing the PICC line while holding the stabilizing wing with one hand.
3. Cleanse site with an antiseptic and allow to dry.
4. No pressure should be applied at or near the exit site or along the course of the vein during catheter removal. Pressure could increase the potential for an embolus, or may cause the catheter to come into contact with the vein wall, increasing the chances of a venous spasm
5. Using small “bites”, 0.5 – 1 cm at a time, remove the catheter, with a slow steady motion applying gentle traction. Draw the catheter straight out in a line parallel to the vein until the full length of the catheter has been removed. After each increment is removed, begin pulling again near the insertion site. The removal process should take 30sec. - 1 minute.
6. Once the catheter has been successfully removed, apply manual pressure to the site for 2 -3 minutes with gauze. There should be no oozing at the site. Hemostasis should be achieved.
7. Apply sterile gauze dressing, with antimicrobial ointment, to the site and secure well. Change dressing every 24 hours until skin has epithelialized.
8. Measure and inspect the PICC catheter. If any part has broken off during removal, place a tourniquet on affected arm or leg immediately; notify physician and monitor patient for signs of distress. Measure the length and compare to documented insertion length. If there is a discrepancy in length notify physician.

NOTE: If a portion of the catheter breaks during removal, immediately apply a tourniquet to the upper extremity to prevent advancement of the catheter piece into the right atrium. Then check the patient’s radial or dorsalis pedalis pulse. If you don’t detect a pulse, the tourniquet is too tight. Notify the physician and prepare for possible x-ray.

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Do not leave patient with tourniquet in place unattended. Vital signs and pulses should be checked q. 5 minutes while tourniquet is in place.

If efforts to remove the catheter fail then notify a physician. After physician notification apply warm moist heat from a controlled source for twenty to thirty minutes, and attempt removal again. If the catheter is still resistant to removal, redress the catheter, notify the physician, and attempt removal again every four hours until it can be removed without difficulty.

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