



## NCCU CLINICAL GUIDELINES SECTION: 5

# VENOUS AND ARTERIAL ACCESS, SAMPLING AND LINE MANAGEMENT

Section: 5 Venous and Arterial Access, Sampling and Line Management  
Central venous access devices (Longline/PICC line)  
Date created: June 2006  
Date revised: Feb 2014  
Review date: Feb 2017

Neonatology Clinical Guidelines  
King Edward Memorial/Princess Margaret Hospitals  
Perth Western Australia  
Authorisation & review by  
Neonatal Coordinating Group

---

## CENTRAL VENOUS ACCESS DEVICES (LONGLINES, PICC LINES)

---

### CVAD'S ARE INDICATIONS FOR:

- Infant's with difficult peripheral IV access
- To provide long-term venous access for parenteral nutrition (PN).
- To provide a safer route of administration for hyperosmolar fluids / drugs, less risk of extravasation.
- For the concurrent infusions of medications, inotropes / locally toxic solutions and concentrated glucose solutions.
- Non tunnelled, peripherally (percutaneously) inserted central venous catheters (PICCs) are easier to maintain than short peripheral catheters, with less frequent site rotations, infiltration or phlebitis noted. They have fewer mechanical complications such as thrombosis or extravasations.
- Multilumen CVADs permit the concurrent administration of various fluids, medications and haemodynamic monitoring among critically ill infants. Multilumen catheters are associated with an increased risk of infection because of increased trauma at the insertion site and multiple ports increase the frequency of CVAD manipulation.
- Tunnelled catheters provide vascular access to patients requiring prolonged intravenous therapy and haemodialysis.

### THEY CONSIST OF:

1. Percutaneous inserted fine bore long lines (LL/PICC) can be inserted into the basilic vein, brachial vein, cephalic vein or long saphenous vein. They can be single or dual lumen.
2. Non-tunnelled central venous catheters - Femoral and jugular lines
3. Tunnelled central venous catheters - these surgically implanted long central catheters are inserted in theatre usually by the surgeon.

### KEY POINTS

1. Insertion is a surgical aseptic technique – [See Infection Control Manual - framework for aseptic technique](#)
2. Catheter tips terminating in either the superior (SVC) or inferior (IVC) vena cava are considered centrally placed even if peripherally inserted. Long line tips are NOT TO BE POSITIONED IN THE RIGHT ATRIUM, and should be pulled back accordingly. Preferred long line catheter tip placement is in the superior vena cava (above T4) when inserted via

the upper extremities. When inserted through the lower limb veins, the catheter tip should reside in the inferior vena cava (below T9). An x- ray is required to determine correct positioning before any fluids other than heparinised saline is infused through the line.

3. Long lines are not advocated for the administration of blood or blood products. Intermittent medications e.g. antibiotics may be infused in the absence of a peripheral line, or in the case of long line sepsis after discussion with the consultant.
4. Blood samples are not to be taken from the very narrow lumen (27G) silastic long lines, as this will cause thrombosis. Blood may be withdrawn from a central line at the discretion of the consultant. The nurse sampling from the line must be NNT and deemed competent in the procedure.
5. During insertion of central catheters with a guide wire, if there is any resistance to the catheter being advanced, this indicates that it is not in the correct place and the catheter should be withdrawn.
6. Subxiphoid pericardiocentesis should be considered part of the resuscitation procedure in any infant with a long line catheter as pericardial effusions and tamponade are complications, although rare. The infant with tamponade develops rapid onset of unexplained bradycardia or tachycardia, hypotension, and/or cardiac or respiratory distress. They may also exhibit an unexplained rise in lactate, or metabolic acidosis.
7. Immediately cease the infusion of fluids via the catheter if pericardial effusion or tamponade is suspected. An x- ray showing a widened mediastinum or enlarged cardiac shadow as compared to an x- ray taken prior to catheter insertion can confirm this diagnosis. An echocardiogram will show the presence of pericardial fluid.
8. Long line fine bore catheters have a working pressure limit of approximately 760 mmHg for continuous infusions and 900 mm Hg for bolus injections. The smaller the size of the syringe, the greater the pressure generated for any given force. A 1ml syringe will generate a pressure of 9 780 mm Hg, a 5ml syringe will generate a pressure of 1 499 mm Hg, and a 10 ml syringe will generate a pressure of 1 033 mm Hg. Therefore, a minimal 10 ml syringe via a pump must be used for flushing a long line. (Manufacturer's recommendation).
9. The "Insertion and Removal of Central Venous Lines" stamp or sticker is placed in the progress notes and completed by the medical staff performing the insertion of the long line. If the catheter was pulled back this is also documented here. Also document on observation chart the procedure and how the procedure was tolerated.

## EQUIPMENT REQUIRED

<ul style="list-style-type: none"> <li>• Instrument tray. Sterile drapes x 2. Transparent sterile drape x 1</li> <li>• Gown and sterile gloves</li> <li>• CVAD (single or double lumen)</li> <li>• Chlorhexidine swab stick 1.0%/Povidone-iodine 10% solution</li> <li>• 0.9% Normal Saline</li> <li>• Gauze swabs x 3 packets</li> <li>• 10ml luer lock syringe and drawing up needle</li> <li>• 20 or 22G Intravenous cannula</li> <li>• Transparent dressing, skin closure strips, fixomull tape</li> <li>• Measuring Tape</li> <li>• Multi- lumen extension sets 2 or 3 ports</li> <li>• Long extension line for each lumen</li> <li>• 50 ml syringe of heparinised saline from CIVAS x 1 or 2 if double lumen.</li> <li>• Infusion pumps</li> </ul>	<p><b>OPTIONAL</b></p> <ul style="list-style-type: none"> <li>• Lignocaine 0.5 to 1%</li> <li>• 1ml syringe, drawing up needle and 25g needle</li> <li>• 3.0 silk suture with curved needle</li> <li>• Three way taps</li> </ul>
--	--

## 1. LONGLINE INSERTION

---

- Measure the distance from the proposed insertion site to the 3rd – 4th intercostal space (upper extremity placement) or to the xiphoid process (lower extremity placement). Allow for additional loop of catheter for external fixation.
- Consider the use of appropriate measures to reduce distress and provide pain relief. Swaddling / containing the infant. Use of oral sucrose, opioids and or sedatives as per NICU medication guidelines.
- Prepare the sterile tray and catheter. Flush catheter with saline using 10 mL syringe. Ensure all multi- lumen extension ports are primed with saline.
- Cut appropriate sized circle in the clear plastic drape.
- Apply the disposable drapes.
- Clean the area around the insertion site in a wide circular motion and allow to dry. Skin cleansing at the proposed insertion site is one of the most important measures in preventing catheter related sepsis. An assistant may be able to hold the limb up using a sterile drape.
- Apply the transparent drape taking the limb through the centre cut out circle.
- Provide a tourniquet (if needed), with a piece of sterile gauze to improve visualisation and filling of the vein. NB. If left on for too long it can cause compression of the artery and ischemia of the limb.
- Venepuncture: can be done by using the split cannula provided with the central line (Neocath Split size 20 VYGON).
- Using introducer and slight tension on the skin perform venepuncture and observe for flashback. Release tourniquet if provided. Holding the cannula stationary remove the needle.
- The primed long line is introduced through the cannula using smooth atraumatic forceps. Advance the long line into the vessel to the measured distance with short steady strokes. Stabilise the long line with middle finger and thumb of one hand and gently pull the split cannula.
- **If using Epicutaneo-cava-catheter (size 24G, VYGON):** Pull the metal end of the line through the screw on blue cap connector ensuring the thick black marking on the catheter is not visible. Ensure the metal end lies mainly in the clear half of the connection when in place. The metal can puncture through the line if it migrates beyond the blue cap end resulting in removal of the line
- **If using Premicath (Size 28, VYGON; with/without guide wire):** After advancing the catheter, pull the guide wire out slowly. Pull the needle out of the skin, leaving the long line in situ. Split the needle and remove from around the long line.
- While inserting percutaneous long lines, especially in catheters with a guide wire, if there is any resistance to the catheter being advanced, this indicates that it is not in the correct place and the catheter should be withdrawn.
- Aspirate for adequate blood return and flush each lumen of the catheter with normal saline using a 10 ml syringe to ensure patency.
- Attach primed extension sets these can be double or triple lumen. These are considered part of the line and are not to be removed when changing the lines.
- Loop the catheter and secure with skin closure strips do not cover the exit site with the strips. Place a sterile dry skin protector pad under the catheter hub. Cover the insertion site, the

looped catheter and hub with a transparent occlusive dressing making sure the dressing does not wrap completely around the limb. Once position of the tip is confirmed, cover the edges of the transparent dressing with Fixomull tape (optional). Term and near term babies are more mobile and friction on dressing can cause it to lift. Securing the dressing in this way stops the edges of the transparent dressing from lifting so the dressing remains in place much longer.

- Connect the primed long extension with the heparinised saline prepared by CIVAS and run infusions at 1 ml per hour one for each lumen if double lumen catheter used. Heparinised line may prevent clotting in line if delay with x-ray and consequently starting infusion. Ensure fluid infusing through the long line has Heparin 0.5units/ml. A minimum infusion of 1 ml per hour is required to maintain patency of the long line. Obtain an X-ray of the catheter to check position. Placement or migration of the catheter tip into the right atrium may cause cardiac arrhythmia, myocardial erosion or cardiac tamponade. Preferred long line catheter tip placement is in the superior vena cava (above T4) when inserted via the upper extremities. When inserted through the lower limb veins, the catheter tip should reside in the inferior vena cava (below T9).
- If the catheter tip is beyond the desired position it must be withdrawn using sterile aseptic technique by a doctor, CN or NNT deemed competent in the procedure. Refer to dressing changes for Long Lines this section. Once the position of the tip is verified, the maintenance fluids (prepared by CIVAS) can be commenced as per policy for long line changes.
- The long line catheter should be accessed as infrequently as possible to minimise the risk of catheter-related sepsis. In suspected catheter – related sepsis, the catheter may need to be removed if a blood culture is positive for staph aureus, candida, or gram-negative rods, or 3 positive blood cultures for enterococcus or coagulase – negative staphylococcus. Discuss with consultant and microbiologist.
- The catheter may be a persistent source of organisms that cannot be treated adequately while in situ.
- Catheter retention allows candidaemia to persist discuss with consultant and microbiologist.

## **2. FEMORAL CENTRAL VENOUS CATHETER INSERTION**

---

- Consider sedation and pain relief prior to commencing procedure. For infants spontaneously breathing 5mcgs/kg Morphine and 10mcgs/Kg Midazolam may be given prior to starting the procedure. However, the combination of morphine and midazolam even at low dose in a self-ventilating patient can be problematic. Chloral hydrate works well and is much safer. Otherwise, midazolam alone in a carefully titrated dose.
- For ventilated infants Morphine 100 - 200 mcgs/Kg and Midazolam 50 - 100 mcgs/Kg to provide pain relief and to minimise spontaneous movement.
- **Placement of lines in infants with cardiac disease should be discussed prior to insertion with cardiologists, as the femoral vein should be left for future catheterisations and the jugular vein is often utilised for pressure monitoring).**
- Position the infant in a supine position and place a small roll under the hips and bring the feet together to the midline with the hips and knees externally rotated. Raise the head of the bed 30°.
- Flush the lumens with saline in 10 ml luer lock syringe and clamp but leave the distal lumen unclamped. Flush the 3 way taps.
- Cut a circular opening on plastic drape.

- Find the femoral arterial pulse 0.5 cms below crease, measure 0.5-1cm medial and inferior. Aim 30-45° and transfix with the cannula (or 20/22g angiocath) into the vein (insert fully to the hub).
- Hold the hub of the needle with left hand. Remove the stylet from the angiocath. Place a syringe on the end of the catheter/needle and slowly withdraw from the skin, withdrawing the syringe at the same time.

### **SELDINGER TECHNIQUE**

- As soon as there is a flashback of blood, remove the syringe. Wait for a few drops of blood to flow and gently advance the guide wire.
- If there is any resistance to the wire then it is not in the correct place and must be withdrawn.
- Remove the needle/angiocath leaving the wire insitu. Ensure the wire does not come out while the needle is withdrawn. With left hand and a gauze swab hold the wire at the insertion site.
- With a push and twist action feed the dilator over the wire with right hand.
- Take the dilator out, keeping the guide wire insitu and pressing on the insertion site to prevent blood loss.
- The wire will come through the white (proximal) lumen of the Cook catheter or the brown (distal) lumen of the Arrow catheter.
- Take the wire out keeping a finger over the end of the lumen to prevent blood loss and ensure air does not enter the circulation. Flush with normal saline.
- Attach a three way tap to each lumen
- Secure the line with sutures and cover the site with a transparent occlusive dressing.
- Attach the primed extension set if required. Extension sets attached under these sterile conditions are considered part of the catheter and do not need to be routinely changed.
- Commence heparinised saline (prepared by CIVAS) at 1 ml per hour through each lumen until correct catheter placement is confirmed. (This is not necessary when a short CVC is inserted).
  - Consider attaching transducer for central venous pressure measurement (optional).

### **3. INTERNAL JUGULAR CATHETER INSERTION**

Usually placed in theatre by the anaesthetist unless in an emergency.

- Sedation and pain relief as per the anaesthetist will be required.
- Position the infant in the supine position. Slightly tilt the head of the bed downward. Turn the head to the opposite side to where the catheter will be inserted. (Usually the right internal jugular vein). A roll may be required to place under infant's neck and shoulders.

### **4. TUNNELED CENTRAL VENOUS CATHETERS**

These surgically implanted long central catheters are inserted in theatre usually by the surgeon. They include Hickman, Broviac, Groshong, and Quinton lines and are commonly used to provide vascular access to patients requiring prolonged intravenous therapy and haemodialysis. In contrast to nontunnelled CVCs, these catheters have a tunnelled portion exiting the skin and a Dacron cuff just inside the exit site. Therefore, it involves two incisions one at the jugular vein or

other nearby vein (entrance) site and one on the chest wall (exit) site. From the entrance site, a tunnel is created and then the catheter is pushed through to the exit site. The entrance site is sutured. The catheter at the exit site is secured by means of a cuff just under the skin. The cuff inhibits migration of organisms into the catheter tract by stimulating growth of the surrounding tissue, thus sealing the catheter tract and providing a natural anchor for the catheter.

## MANAGEMENT OF CVAD

- Hourly observations and documentation of the site and pump pressure is required. Report and document any signs of infection, infiltration or occlusion.
- See ICM protocols when accessing the line.
  - On each access: Assess line patency. Document and report to assist in early detection and management of occlusion (increased pump pressure, swelling or leakage around insertion site).
  - On accessing the line, swab the port with chlorhexidine 2% and 70% alcohol wipe for 30 seconds using friction and allow to dry.
- Do not use syringes smaller than 10mL when accessing the fine bore long lines as they can rupture. Syringe size has a significant impact on the risk of damage to fine bore long lines. Smaller syringes generate higher internal pressures than larger syringes when flushing the catheters.
- All fluids and flushes are given via pumps only.
- Keep line access to a minimum as line manipulation is the most common source of infection from microbes that colonise the hub.
- Positive pressure should be applied and maintained until the needle free access port is clamped therefore do not unclamp until the giving set is connected to the port and drug infusion commenced. At the end of infusion, clamp the needle free access port before disconnecting infusion.
- For continuous infusions, do not disconnect and reconnect at a later time administration sets for the purpose of MRIs or transfers. This may increase the risk of complications such as infection and catheter occlusion. Therefore, when Parenteral Nutrition or glucose infusions are disconnected use aseptic technique to change fluids and lines on return to ward from MRI. It will be necessary to use heparinised saline prepared by CIVAS when disconnecting and reconnecting for MRI.

	Port	Suggested Use
<b>DOUBLE LUMEN</b>	distal	whole blood or blood product delivery and sampling, any situation requiring greater flow rate, CVP monitoring, medication delivery
	proximal	medication delivery particularly vasoactive drugs, parental nutrition

## REFERENCES:

Bard Access Systems. (2007). Instructions for use; Hickman, Leonard and Broviac Central Venous Catheters. Retrieved August 2012, from: [http://www.bardaccess.com/pdfs/ifus/0713603-0600010%20IS\\_Hickman-Broviac\\_IFU\\_web.pdf](http://www.bardaccess.com/pdfs/ifus/0713603-0600010%20IS_Hickman-Broviac_IFU_web.pdf).

Benjamin, D., Miller, W., Garges, H. et al. (2001). Bacteremia, central catheters and neonates: When to pull the line. *Paediatrics* 107, 1272-1276.

Bishop, L. (2009.). Aftercare and management of central venous access devices. In: H. Hamilton & A. Hodenham (Eds.), *Central venous catheters*.(p. 221-237). USA: Wiley-Blackwell.

Cancer Nurses Society of Australia. (2007). Central Venous Access: Principles for Nursing Practice and Education. Retrieved August 2012, from <http://www.cnsa.org.au/documents/CNSA%20CVAD%20Principles%20Summary.pdf>.

Centre for disease control and prevention. (2002). Guidelines for the prevention of intravascular catheter related infections. Retrieved 11th August 2011, from [www.sdc.gov/mmwr/PDF/rr/rr5110.pdf](http://www.sdc.gov/mmwr/PDF/rr/rr5110.pdf)

Conn C, (1993) The importance of syringe size when using an implanted vascular access device. *Journal of Vascular Access Networks* 3, 11-18.

Child and Adolescent Health Service (n.d). Paediatric Nursing practice manual section 2

Joanna Briggs Institute. (1998). *Management of peripheral intravascular devices*. Retrieved 11th August 2012, from [www.joannabriggs.edu.au](http://www.joannabriggs.edu.au)

Kaler, W., & Chin, R. (2007). Successful disinfection of needleless access port: A matter of time and friction. *The Journal of the Association for Vascular Access Devices* 12(3), 140-142.

National Health and Medical Research Council (NHMRC) (n.d). Section B4:2

Pratt, R.J., Pellowe, C.M., Willson, J.A., Loveday, H.P., Harper, P.J., Jones, S.R., McDoughall, C., & Wilcox, M.H. (2007). epic2:National evidence-based guidelines for preventing healthcare associated infections in NHS hospitals in England. *Journal of Hospital Infections* 65(Supp 1) S1-64.

Rosenthal, K. (2004). Guarding against vascular site infection: Arm yourself with the latest knowledge on equipment and technique to protect patients from catheter related bloodstream infections. *Nursing Management (Springhouse)* 35, 4-9.

[www.adhb.govt.nz/newborn/guidelines/vascularcatheters/LineDisinfectants.htm](http://www.adhb.govt.nz/newborn/guidelines/vascularcatheters/LineDisinfectants.htm)

[www.rch.org.au/nets/handbook/index.cfm doc\\_896](http://www.rch.org.au/nets/handbook/index.cfm doc_896)

[www.rch.org.au/cvad/poster\\_1\\_090722\\_PDF](http://www.rch.org.au/cvad/poster_1_090722_PDF)