



CLINICAL GUIDELINE	
Central Venous Access Devices Insertion, Management and Removal	
Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

This document should be read in conjunction with this [DISCLAIMER](#)

Contents

Indications for Use	2
Insertion	2
Long Line Insertion (PICC).....	3
Femoral Central Venous Catheter Insertion	5
Internal Jugular Catheter Insertion	7
Tunnelled Central Venous Catheters Insertion.....	7
Management.....	7
Commencement of Infusions.....	7
Giving Set Changes.....	7
Medication Administration.....	8
Blood Sampling.....	8
Dressing Changes.....	8
Assessment.....	10
Removal.....	10
Complications.....	11
References.....	11

Indications for Use

- 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.
- Multi-lumen CVADs permit the concurrent administration of various fluids, medications and haemodynamic monitoring among critically ill infants. Multi-lumen 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 catheters (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 long central catheters are inserted in theatre usually by the surgeon.

Insertion

Key Points

- Check correct patient for procedure.
- Insertion is a **surgical** aseptic technique.
- 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.
- A repeat x-ray should be performed following catheter adjustment to confirm tip position.
- 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.
- Blood samples are not to be taken from the very narrow lumen (27G) silastic long lines, as this will cause thrombosis – ie; Longlines.

Central Venous Access Devices: Insertion and Management

Blood may be withdrawn from a central catheter at the discretion of the consultant. The nurse sampling from the line must be NNT and deemed competent in the procedure.

- 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.
- 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.
- 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.
- Long line fine bore catheters have a working pressure limit of approximately 760 mmHg for continuous infusions and 900 mmHg 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 9780 mmHg, a 5mL syringe will generate a pressure of 1499 mmHg, and a 10mL syringe will generate a pressure of 1033 mmHg. Therefore, a minimal 10mL syringe via a pump must be used for flushing a long line (Manufacturer's recommendation).
- Complete the Neonatal Intravascular Insertion Device Record MR422. Also document on observation chart the procedure and how the procedure was tolerated.

Equipment Required

- Sterile instrument tray
- Sterile drapes x 2
- Transparent sterile drape x 1
- Sterile gown and gloves
- CVAD (single or double lumen)
- 1% Chlorhexidine solution > 27 weeks gestation or 10% Povidone-iodine solution < 27 weeks gestation
- 0.9% Sodium Chloride
- Gauze swabs x 3 packets
- 10mL luer lock syringe and drawing up needle
- 20 or 22G Intravenous cannula
- Transparent dressing, skin closure strips, Fixomull tape
- Measuring Tape
- Multi- lumen extension sets 2 or 3 ports
- Long extension line for each lumen
- 50 mL syringe of heparinised saline from CIVAS x 1 or 2 if double lumen
- Infusion pumps

Optional

- Lignocaine 0.5 to 1%
- 1 mL syringe, drawing up needle and 25g needle
- 3.0 silk suture with curved needle
- Three way taps

Long Line Insertion (PICC)

- 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 protocols.
- Prepare the sterile tray and catheter. Flush catheter with 0.9% sodium chloride using 10mL 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. **NOTE:** skin prep **must** be dry prior to insertion of catheter as contact with solution may interfere with integrity of catheter.
- 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.

Central Venous Access Devices: Insertion and Management

- Aspirate for adequate blood return and flush each lumen of the catheter with 0.9% saline using a 10mL 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 giving sets.
- 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 1mL 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 0.5 units/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](#) in this guideline. If the catheter is adjusted a repeat X-ray should be taken to confirm the catheter is in the correct position. 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.

Femoral Central Venous Catheter Insertion

- Consider sedation and pain relief prior to commencing procedure. For infants spontaneously breathing 5 micrograms/kg Morphine and 10 micrograms/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 100-200micrograms/Kg and Midazolam 50-100micrograms/Kg to provide pain relief and to minimise spontaneous movement.

- **Placement of catheters 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 0.9% saline in 10mL 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 0.5cms 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 0.9% sodium chloride.
- 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 1mL 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).

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.

Tunnelled Central Venous Catheters Insertion

These 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 with difficult access.

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

Commencement of Infusions

- Connect all infusion lines using surgical aseptic technique.
- All infusions are to be infused via a pressure sensitive pump.
- Pressure limits are to be set at 50-100H₂O on commencement of all infusions.
- Pressure limits are to be checked at the commencement of each shift.
- Pump pressures are to be documented hourly on the MR489 or 491.
- Infusion rate is to be check by 2 staff members at the commencement of the infusion and if a rate adjustment is required.

Giving Set Changes Refer to [Central Vascular Access: Giving Set Changes](#)

- Giving sets are to be changed at least every 96 hours or more frequently if indicated. Lipid infusion giving sets are changed every 24 hours.
- Giving sets are to be changed more frequently if contaminated or accidental disconnection occurs.
- Giving sets are to be changed utilising a surgical aseptic technique.
- All giving set changes are to be documented on the MR489 with date and time change.
- Label all giving sets attached to central catheter with a central intravenous line label.



- Observe aseptic technique practices when accessing lines
 - 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 for at least 30 seconds.

Central Venous Access Devices: Insertion and Management

- Do not use syringes smaller than 10mL when accessing the fine bore long lines as they can rupture. Refer to [key points](#) above. 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.
- **For long lines ALL** fluids and flushes are given via **pressure pumps only**.
- 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.
- If infusions are disconnected use surgical aseptic technique to change fluids and lines.

	Port	Suggested Use
Double Lumen	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.

Medication Administration Refer to [Central Venous Access: Medication Administration](#)

Blood Sampling – Refer to CAHS [Central Venous Access \(CVAD\) and Midline Management](#).

Dressing Changes

Changing of catheter dressing site is a **2 person surgical aseptic technique** and can be performed by an staff deemed competent in the care of central venous catheters.

Dressing changes are at the discretion of consultant/senior registrar or shift coordinator.

Key Points

- Use of transparent semi permeable dressings, to allow visualisation.
- Care must be taken when removing semi permeable dressings from the exposed areas of catheter. The catheter can be dislodged.
- Scissors are not to be used for removal of dressings.
- If the catheter breaks it should be removed and a medical officer should be informed immediately. If the catheter is not visible outside the infant, pressure should be applied over the catheter track and a medical officer informed immediately.
- If the CVC is in the neck area, a rolled wrap placed under the infant's shoulders will expose the neck.

Equipment

- Trolley
- Dressing pack
- Sterile gloves x2
- Appropriate size transparent semi permeable dressing
- Skin closure strips

- Sterile normal saline
- Fixomull tape
- Sterile clear plastic drape
- Sterile swab sticks
- Sterile scissors
- Adhesive remover swabs
- Statlock to secure catheter
- Skin prep wipes

Procedure

1. **NOTE:** Chlorhexidine or Povidone-Iodine should **not** be used during dressing changes as contact with these solutions may reduce the integrity of the catheter.
2. Swaddle infant and consider pain relief such as use of sucrose.
3. A second assistant may be required if the infant is very mobile. It may be necessary for one of the assistants to assist.
4. Assistant can soak the fixomull with adhesive remover and then peel off.
5. Open sterile dressing pack. Open sterile gloves onto separate cleaned surface.
6. Prepare dressing pack. Cut appropriate sized circle in the clear plastic drape.
7. Place sterile drape from dressing pack under the limb, ensuring that the sterile field is maintained.
8. Clean the limb and semi permeable dressing with appropriate skin cleanser. The assistant may hold the limb by using the sterile drape.
9. Apply the transparent drape taking the limb through the centre cut out circle.
10. Use adhesive remover to lift 2 edges of the dressing. Stretch the dressing in an upward motion this allows for ease of removal. Take care not to pull or tear the catheter sheath.
11. Wipe away any dried blood from skin and catheter with sterile gauze and normal saline, taking care to ensure the catheter is not pulled back. Allow to dry. If the skin closure strips need to be replaced gently peel them off with the forceps and clean skin and catheter, allow to dry. Replace using sterile forceps. It is easier to remove and replace the one closest to the exit site first before removing and replacing the others. It may be necessary for the assistant to place a sterile dry swab stick to hold the coiled catheter in place while placing the skin sutures. Replace the sterile pad under the hub if soiled.
12. Ensure the site and catheter are dry, that the catheter is coiled but not kinked. Place new occlusive dressing over catheter site and catheter including hub. Secure edges with Fixomull (optional).
13. If there is any doubt about catheter placement, report to doctor as an x-ray to confirm position may be required.

Assesment and Documentation

- Insertion and removal of CVAD to be documented on Neonatal Intravascular Devices Insertion Record MR422.
- Inspect the insertion site and the limb above and below the site:
 - At least hourly.
 - With each intermittent medication.

Central Venous Access Devices: Insertion and Management

- Document site inspection on the MR489. Report and document any signs of infection, infiltration or occlusion.
- Document pump pressure and volume infused hourly with site inspection.
- Any adverse findings and action plan are to be documented in the patient's medical record.
- Observe the limb and upper or lower trunk for signs of extravasation. Any signs of extravasation should have immediate medical review.

Removal

Central venous catheters are removed when they are no longer required or sepsis is suspected. Removal of a CVC is a **two-person** standard aseptic technique, one staff member is required to aid in positioning the infant. CVC can be removed by nursing staff deemed competent in their removal. Tunnelled catheters must be removed by medical staff.

Key Points

- If sepsis is suspected, the tip must be sent to the laboratory for culture.
- Prior to removing the catheter, check the documented length of catheter inserted.
- If there is any resistance, do not pull the line with force; ask a more experienced member of staff for assistance with the removal.
- Document the line removal on the observation chart and complete the removal section on the Neonatal Intravascular Device Insertion Record MR422. Documentation should include any difficulties with catheter removal and state whether the catheter was visualised to be intact.

Equipment

- Dressing pack, sterile scissors/forceps
- Sterile specimen container (if tip required for culture)
- Adhesive remover
- Gauze

Procedure

1. Consider administration of sucrose prior to procedure.
2. Use adhesive remover to lift 2 edges of the dressing. Stretch the dressing in an upward motion this allows for ease of removal. Take care not to pull or tear the catheter sheath.
3. If sutures in place use forceps to hold catheter below suture knot before removing the sutures.
4. Remove the catheter using gentle sustained traction, holding the catheter close to the insertion site. Do not over stretch the catheter. Over stretching the catheter may cause it to rupture and rebound into the vein, causing a catheter embolus. If catheter rupture does occur and the catheter is not visible, place a finger over the vein without applying pressure. If the catheter is visible outside of the infant, grasp the catheter. Seek medical assistance and request an x-ray.
5. If the catheter remains firmly attached surgical removal is required.
6. If sepsis is suspected cut the tip with sterile scissors and send for culture.
7. Apply gentle pressure to the site with gauze, until bleeding stops to prevent a haematoma forming. Do not apply a dressing over the site until bleeding has stopped.
8. Document removal on Neonatal Intravascular Device Insertion Record MR422.

Complications

Complication	Definition	Signs and Symptoms
Phlebitis	Local inflammation of the vein at or near the cannula site. Mechanical - irritation to the vein at or near the cannula site. Bacterial - inflammation from microorganism.	Erythema/redness around site or long the vein. Tenderness on palpation. May feel warm to touch. Palpable venous cord - usually present at an advanced stage.
Infiltration (Tissued)	Non vesicant fluid infused into the tissues surrounding the site.	Leakage around site. Swelling/tightness of skin. Cool to touch. Blanching. Discomfort.
Extravasation	Infiltration of vesicant fluids or chemotherapeutic drugs into the surrounding tissues.	Leakage around site. Painful on palpation. Erythema/redness. Swelling/tightness of skin. Blanching. Blistering.
Blocked catheter	Clot formation in cannula. Kink in cannula. Restrictive taping.	Leakage around site. Can be red or painful if thrombus formation Increase in pump pressures. Unable to flush catheter.

Related CAHS internal policies, procedures and guidelines

CAHS: Infection Prevention and Control

- [Aseptic Technique](#)

Neonatology

- [Central Vascular Access: Giving Set Changes](#)
- [Central Venous Access: Medication Administration](#)

PCH

- [Central Venous Access \(CVAD\) and Midline Management.](#)

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Central Venous Access Devices: Insertion and Management

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