

Local Guideline



John Hunter
Children's Hospital
CHILDREN, YOUNG PEOPLE AND FAMILIES



Health
Hunter New England
Local Health District

Tunnelled Central Venous Catheter Management

Sites where Local Guideline applies	
This Local Guideline applies to:	
1. Adults	No
2. Children up to 16 years	Yes
3. Neonates – less than 29 days	Yes
Target audience	NICU clinical staff who provide care to neonatal patients
Description	Guideline for the management of a central venous catheter (excluding PICC, UAC & UVC) for an infant in NICU
National Standard	Comprehensive Care

[Go to Guideline](#)

Keywords	Broviac [®] , Central Venous Catheter (CVC), flushing, Hickman [®] , locking, percutaneous
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Replaces existing document?	Yes
Registration number and dates of superseded documents	JHCH_NICU_10.04 26/05/2014
Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:	
<ul style="list-style-type: none"> • Aseptic Technique for medium or Higher Risk Procedures Conducted in Clinical Settings • NSW health Policy Directive PD 2017_013 Infection Control and prevention Policy • NSW Health Policy Directive PD2017_032 Clinical Procedure Safety • Medication Safety in HNE Health PD2013_043:PCP31 	
Prerequisites (if required)	CVAD competent
Local Guideline note	This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s require mandatory compliance . If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patient's health record.
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This document contains advice on therapeutics	Yes Approval gained from Local Quality Use of Medicines Committee on 01/07/2019
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PURPOSE AND RISKS

This local clinical procedure has been developed to provide instruction to health professionals and to ensure that the risks of harm to the infant associated with insertion and management of a central venous catheter (excluding PICC, UAC or UVC lines) are identified and managed.

The risks are:

- Vascular and cardiac damage
- Infection (local and systemic)
- Extravasation
- Limb injury
- Thrombosis and embolisation
- Premature removal

The risks are minimised by:

- Credentialed clinicians to insert CVCs
- Clinicians having knowledge of CVC insertion and management. Clinicians seeking assistance if care of a CVC is outside their scope of practice. Clinicians following the instructions set out in the clinical procedure for insertion, and management of a CVC
- Recognition of the common clinical signs of extravasation
- Correct aseptic technique when attending to CVC management

Risk Category: *Clinical Care & Patient Safety*

Glossary

Acronym or Term	Definition
CVAD	A central venous access device (CVAD) is an overall term for all intravascular devices (tunnelled or non-tunnelled) with the tip of the catheter located in the superior vena cava, inferior vena cava or right atrium.
CVC	A central venous catheter (CVC) is a percutaneously inserted catheter which has a skin entry point in the neck or trunk and whose catheter tip is situated in the superior or inferior vena cava, or right atrium. These CVCs can either be classified as tunnelled or non-tunnelled and for clarity and purpose of this guideline/procedure the use of the abbreviation CVC will be only relate to a Broviac® or Hickman® catheter.
PICC	A peripherally inserted central catheter or PICC is inserted into a limb (arm or leg) or cephalic vein with the catheter tip generally residing at the level of the axilla or lower SVC in the case of the arm, lower SVC in the case of a cephalic vein and in the lower abdominal area of the inferior vena cava or upper area of the iliac vein if the leg is used. See Guideline 5. 4. 2 PICC line Insertion and Management in NICU
UVC	Umbilical Venous Catheter is inserted into one of the umbilical veins of a newborn and the tip should reside above the diaphragm and below the junction of the inferior and superior vena cava vessels – See Guideline Umbilical lines in NICU JHCH NICU 10.03

OUTCOMES

1	That staff in the NICU have a comprehensive understanding of how to manage neonates with a CVC <i>in situ</i>
2	Safe management of CVCs to minimise complications (including risk of injury/morbidity) to the infant

GUIDELINE

This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

Central Venous Catheter (CVC)

Broviac® and Hickman® catheters are cuffed lines which are percutaneously inserted into either the superior or inferior vena cava. Catheters come in a variety of sizes; however, for use in neonates, sizes 2.7 Fr and, rarely, for a bigger infant, 4.2 Fr single or double lumen are used. Document in the infant's notes the dead space of the catheter for flushing purposes and if alteplase (rt-PA) required for a blocked catheter.

Indications for use in neonates

- Long-term parenteral nutrition (PN) or medication
- UVC or PICC line no longer an option
- Vein status poor

CVCs can be used to give blood products; preferably a CVC SHOULD NOT be used for blood collection unless requested by neonatologist. This needs to be clearly documented on the care plan.

Insertion can only be undertaken by medical staff:

Most CVCs are inserted under a general anaesthetic; therefore, principles of asepsis are followed (see [NSW Health Policy Directive PD2011_060 Central Venous Access Device Insertion and Post-Insertion Care](#)).

The infant is prepared for theatre as per guideline: [Surgery-Preparation and care of infant in NICU JHCH NICU 16.05](#)

Tip placement

Documented radiological confirmation of the correct anatomical placement of the catheter tip is required prior to using the CVC.

The catheter tip is, ideally, placed at the junction of the superior vena cava and the right atrium however a lower position may be preferred if very long-term use is anticipated.

Nurses who provide care for the neonate should regularly review and document the insertion site and state of the CVC.

Ensure lines are labelled with a central venous sticker which is replaced with line changes.



The main complications are: Incorrect tip position, central venous perforation, thrombosis, infection and CVC dysfunction.

Note: It is good practice to use an opportunity for radiological confirmation (e.g. with routine chest x-ray) of the tip placement with documentation in the clinical record.

Key care points:

Do not use the catheter if there is any evidence of mechanical damage or leaking.

The principles of aseptic, non-touch technique (ANTT) and universal precautions apply when accessing any CVAD; this includes appropriate hand washing technique and wearing gloves.

Accessories and components used in conjunction with a CVC **MUST** have Luer lock connections

If any sign of extravasation exists, discontinue use immediately and seek medical advice – see

Guideline [Extravasation in NICU JHCH NICU 10.02](#)

DO NOT USE A SYRINGE SMALLER THAN 10 ML if giving a medication or flushing without a syringe pump. The reason for this is an increase in pressure per square inch (PSI) with syringes smaller than 10 mL that may cause damage to the vein.

Clamping

Where possible, only use the clamp provided with the CVC as shown in Fig 1.

Clamp only on the protective clamping sleeve area as shown in Fig 1.

If another form of clamp is necessary, it must be smooth edged to reduce the risk of trauma to the neonate.

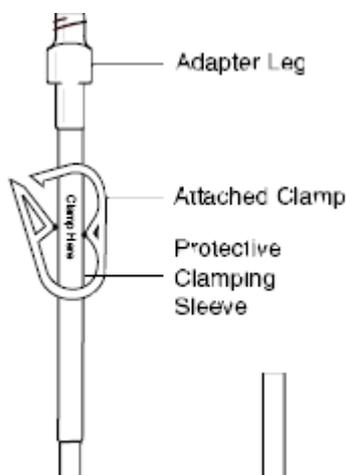


Fig 1
Adapted from Bard Access Systems.
2017

Catheters should be clamped:

- When not in use, to maximise safety.
- If there is damage to the catheter (you need to clamp between the damaged area and the patient).
- If connector separation occurs.
- Whenever distal tubing is disconnected e.g. during line changes to prevent air embolus.

Dressing CVCs

- Use aseptic, non-touch technique (ANTT) to change the CVC dressing.

- Clean skin and catheter with solution as per aseptic CPG.
- Use a sterile, transparent, semi-permeable dressing e.g. OPSITE IV3000 Transparent Adhesive Film Dressing, which should be changed every 7 days or if the dressing is lifting or damaged.
- A dry gauze dressing can be used (requires a daily change), this is recommended if there is a breakdown in skin integrity when using a transparent dressing.
- Suture to be removed following advice from surgeon.
- Newly inserted CVC: Dressings should be left intact for 5–7 days after insertion unless otherwise directed by medical staff or the dressing is damaged.
- Do not use any antibiotic topical ointment around the insertion site.
- Report and document any leaking, redness or swelling around insertion site.
- Insertion site to be swabbed and specimen collected and sent to microbiology.

Securing CVCs

- The surgical team will indicate the preferred method of securement such as:
 - Looping the catheter under the dressing to relieve tension
 - Using a transparent dressing as a securing device
 - Taping the catheter and or sterile surgical strips (not covering insertion site)
- Suturing
- Commercial securement devices are available, but must be changed every seven days
- Secure away from contaminated areas such as nappies
- NEVER use pins of any kind to secure a CVC to anything

NB: No matter what form of securement is used, it is the responsibility of staff to ensure **no tension ever** occurs on the catheter. Parental education is an important aspect of CVC care.

Patency/flushing/locking; accessing and de-accessing CVCs

Flushing and locking are the two key principles in ensuring patency is maintained if the CVC does not have any continuous fluid.

Flushing

It is normal practice in the NICU to use a syringe driver or an IV infusion pump to infuse any fluids into any venous access device and this includes any flushing fluids.

If flushing by hand, it is recommended that CVCs are flushed using a *push-pause method* to minimise the mixing of incompatible medications or fluids and to reduce fibrin build-up or accumulation of medication precipitate in the catheter lumen. The *push-pause method* (stop-start) keeps the solution moving along the walls of the catheter. Do not flush rapidly as this can cause rapid changes in circulatory volume and pressure.

Syringe size

- Only use syringes **10 mL or larger** when flushing or aspirating a CVC, as recommended by the manufacturer. This reduces the risk of clots being dislodged and/or catheter rupture.
- Never use a CVC for blood collection if administering inotropes, analgesia or drugs as when these are paused it can have an adverse outcome on the neonate.
- Aspirate double the volume of the CVC lumen dead space (if the CVC has been trimmed, dead space can be measured by aspirating until first blood flash seen) – use the Bard Accessory Measurement Chart (Appendix 1)
- Clamp the CVC, change syringes and aspirate the smallest possible blood volume required for the pathology requests.

- Change syringe and attach a syringe with the appropriate flushing solution or restart IV fluids as charted. (Note: For babies receiving PN solution a BGL is likely to be inaccurate and may give a false high if using blood collected from the CVC).

Blood taken from a CVC in theatre during insertion is returned to minimise blood loss; however, generally, blood taken is not returned. Excess blood may be used for blood cultures. This must be discussed with the medical officer at the time of the specimen collection.

When to flush a CVC

A CVC should always be flushed before and after:

- Administration of medication
- Administration of blood and blood products
- Intermittent therapy
- Blood collection

Flushing/locking solutions

NB: Locking solution of sodium chloride 0.9% should be twice the volume of dead space of the catheter lumen PLUS the priming volume of add-on devices e.g. filter and 3-way tap

Flushing	Time between flushes/locking		
	<6 hours	<24 hours	>24 hours
Aspiration fluid amount prior to flushing	2–5 mL	2–5 mL	2–5 mL
Flush required BEFORE locking	2–3 mL sodium chloride 0.9%	2–3 mL sodium chloride 0.9%	2–3 mL sodium chloride 0.9%
Locking			
Locking solution required	No locking solution required – just clamp as ending flush	Short-term heparin lock: Heparinised saline (50 units/5 mL)	Long-term heparin lock: Heparinised saline (50 units/5 mL)
		Infant <5 kg – 2 mL daily	Infant <5 kg – 2 mL weekly
		Infant >5 kg 5 mL daily	Infant >5 kg 5 mL weekly

NB: Prior to flushing. If the CVC has been heparin-locked, it is necessary to remove the old fluid that primed the catheter. Withdraw the same amount that was previously given (e.g. 2 mL heparin) prior to undertaking the flush or lock. Proper attention to flushing is paramount.

Positive-pressure locking

If the CVC is not being used for a continuous infusion, then it should be positive-pressure locked.

This is done by clamping off the CVC (e.g. turning the three-way tap off) while still applying positive pressure on the syringe to administer the fluid. In the case of a syringe pump being used it is important to clamp off the CVC **prior** to stopping the pump and disconnecting the giving set. It is critical that the catheter clamp not be applied and unapplied with a locked line. This process pushes small amounts of locking fluid out and allows small amounts of blood to enter the catheter tip – causing fibrin build-up and eventual blockage.

Signs of a blocked CVC

There may be subtle signs of an impending occlusion such as a change in the ability to withdraw from the CVC or a catheter that is sluggish/stiff when flushing.

Blockage may occur when the catheter has moved or is sitting within a thrombus. It may also be intermittent in that it can be relieved by specific position changes, e.g. raising the arm, lying supine, etc.

A CVC that exhibits any sign of an occlusion is considered dysfunctional and requires further assessment and possible treatment.

Pinch-off syndrome is a rare cause of CVC occlusion when the catheter is compressed between the first rib and clavicle. Catheter replacement is recommended for pinch-off syndrome as a measure to prevent catheter fracture.

Unblocking a CVC

Report “blocked” CVC immediately to either the nurse in charge of the shift or the Medical Officer or Nurse Practitioner, as time is a factor in the success of catheter clearance. Any attempt to unblock should only be undertaken by a suitably qualified clinician who is familiar with the procedure.

Loss of patency can be caused by:

- Mechanical causes
 - Clamped accidentally
 - Kinking
 - Malposition
 - Catheter migration
 - Device rupture or breakage
 - “Pinch-off” syndrome where catheter can be compressed or pinched by clavicle or 1st rib
 - External thrombus
- Therapeutic causes
 - Fibrin sheath build up or clots
 - Lipid deposition
 - Drug precipitates
 - External thrombus

Confirmation of blockage:-

- Unable to withdraw fluid from the CVC
- Cannot infuse properly using the CVC

Initial action

- Rule out the presence of a mechanical obstruction (closed clamp/3-way tap, kinks, device damage, filter faulty)
- See if a postural change such as raising the arm or moving the shoulder will relieve obstruction
- Undertake a physical examination, looking for signs of oedema, redness, pain or dilated vessels
- Attempt to aspirate and visualise blood. If resistance is met, no attempt should be made to continue flushing
- Flush with sodium chloride 0.9%
- If able to flush line but no blood return – arrange CXR to confirm line placement and absence of kinking
- If unable to flush, obtain surgical consult

Technique for using alteplase (rt-PA) in CVC occlusion.

Only consider this procedure following consultation with surgeon and neonatologist. Must be carried out by Medical Officers or RNs who have completed the required competency and are under the direction of the senior Medical Officer.

These procedures are used to unblock occluded CVCs or to control infection within a CVC. All procedures are to be attended using aseptic, non-touch technique.

It is strongly recommended that you phone the Haematologist/Oncologist on-call prior to using alteplase. Sites other than JHCH within Hunter New England Local Health District should also phone the JHCH Haematologist/Oncologist on-call for advice.

Alteplase (rt-PA) is used in an attempt to unblock an occluded port when thrombosis is thought to be involved. Consider assessing coagulation/prothrombotic status prior to instillation of alteplase.

- Obtain 1 x 10 mg vial of alteplase from pharmacy (**NOT** 50 mg vial as it is very expensive)
- Reconstitute with water for injection 10 mL to give a concentration of 1 mg/mL
- Draw up 0.5 mg (0.5 mL) alteplase plus an extra 1 mL water for injection, making up a 1.5 mL solution containing 0.5 mg alteplase. Ensure independent double check is performed by a second person. Check the volume of the dead space in the catheter and port as no more than this amount should be administered to the infant
- Explain the procedure to the parent/carer in plain language and obtain verbal consent to proceed – refer to consent policy if required
- Verify correct patient identification by checking against identification band/s.
- Instil solution (no more than the dead space) into the port using sterile technique and leave for 2 hours
- Sign medication chart
- **Withdraw the amount of solution instilled from the port and discard in contaminated waste. Ensure the alteplase is not flushed through the line and into the baby's circulation.**
- Attach a 10 mL syringe of sodium chloride 0.9% and flush the line with a pulsating positive pressure
- If necessary, this procedure may be repeated

Potential complications

Avoid the use of alteplase in patients at high risk of bleeding/thrombotic events.

Side effects are uncommon but may include hypersensitivity, major haemorrhage, thrombosis, embolic events, sepsis, catheter-related complications e.g. rupture.

The CVC is considered to be functioning well if there is brisk blood aspirate.

NB: CVCs can fracture if line is pulled repeatedly, twisted or clamped and unclamped repeatedly in the wrong spot. It is possible, though unusual, to cause fracture if too much pressure is exerted when trying to flush or from pressure caused by clavicle, first rib or costoclavicular ligament

Changing connecting tubing and catheter cap

Connecting tubing

- Change giving sets and filters as per: [Parenteral Nutrition in NICU guideline JHCH NICU 09.02](#)

- Change catheter cap at the same time as filter and or giving sets. Ensure you clamp CVC prior to changing.

Air in line

Possible causes

- Hole in catheter
- Injection cap not pre-filled with fluid
- Loose connections

Possible solutions

- Check catheter, injection cap and connections
- Aspirate air and irrigate with normal saline to flush out any aspirated blood. Heparin-lock the catheter or reconnect infusion. Please note prior comments about heparin

Removal of CVC

It is removed by surgeons if *in situ* for more than 3 weeks.

Consideration should be given to removing a CVC if the line is colonised.

Parental education

It is important that parents are provided with information regarding the following:

- Principles of caring for their baby with a CVC
- Securing CVC – never applying tension
- Not submerging the CVC in a bath
- Kangaroo Care can be undertaken but care with lines is paramount

Pain

Pain at the CVC site is an important sign of infection or leakage and must not be ignored. All neonatal patients with a CVC *in situ* should have a pain assessment attended to as per Guideline 5.9.3

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JHCH Clinical Quality & Patient Care Committee 5/12/2018

Feedback

Any feedback on this document should be sent to the Contact Officer listed on the front page.

This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

Staff Preparation

It is mandatory for staff to follow relevant: “Five moments of hand hygiene”, infection control, moving safely/safe manual handling, documentation practices and to use HAIDET for patient/carer communication: **H**and hygiene **A**cknowledge, **I**ntroduce, **D**uration, **E**xplanation, **T**hank you or closing comment.

Implementation, monitoring compliance

1. Approved clinical guideline will be uploaded to the PPG and communication of updated 'Central Venous Catheter Management in NICU (excluding PICC, UAC or UVC lines)' clinical guideline to NICU staff will be via email and message on the HUB.
2. Incident investigations associated with this Guideline and Procedure will include a review of process.
3. The Guideline and Procedure will be amended in line with the recommendations.
4. The person or leadership team who has approved the Guideline and Procedure is responsible for ensuring timely and effective review of the Guideline and Procedure.
5. Evaluation will include a review of the most current evidence as well as a consideration of the experience of Neonatal staff at JHCH in the implementation of the Guideline and Procedure.