CENTRAL VENOUS ACCESS DEVICE (CVAD) MANAGEMENT IN NEONATES IN THE ICU ENVIRONMENT

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- **This document applies to any inpatient with a Central Venous Access Device (CVAD) during the neonatal period *ie Birth to 28 days term corrected* and being cared for in NICU, CICU or PICU only.**
- SCHN Neonatal CVAD CPG is based on current research findings and best evidence thereby allowing clinicians to expand knowledge in CVAD management, validate and improve practice and enhance evidence-based decision making
- Insertion and maintenance care bundles have been found to be important for reducing Central Line Associated Blood Stream Infections (CLABSI).[1]
- CVAD placement and position must be confirmed and documented before a CVAD is used.
- CVAD insertion record/ removal documentation is to be completed by the individual inserting or removing the device
- Clinical need for a CVAD is to be assessed on a daily basis and promptly removed when no longer indicated.
- Aseptic Non-Touch Technique (ANTT) must be used for the clinical management of all CVADs. [2]
- Currently there is no consensus regarding the ideal agent for cutaneous antisepsis in neonatal population. Consequently the recommended practice for SCHN is based on body of evidence that can be trusted to guide practice in most situations (*Grade B*) [3,4,5,6,7,8]
- Chlorhexidine gluconate 0.1% irrigation (aqueous preparation) is endorsed as the appropriate antiseptic for use with skin preparation for insertion and dressings in neonatal inpatients [3-8]

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy Procedure and Guideline Committee	
Date Effective:	1st May 2023	**Review Period**: 3 years
Team Leader:	Clinical Nurse Consultants	**Area/Dept**: CICU and GCNC

- **Use Chlorhexidine gluconate 0.1% irrigation (aqueous preparation) for skin antisepsis in neonates and infants under 2 months of age** due to risks of skin irritation and chemical burns
- Only the minimum amount of Chlorhexidine gluconate 0.1% irrigation (aqueous preparation) required should be used and the solution should not be allowed to pool in skin folds or under the patient. Any excess solution and any soaked materials, drapes or other material in direct contact with the patient should be removed as soon as possible.[9]
- Close monitoring of the neonate's skin should be undertaken to detect and manage cutaneous adverse effects at an early stage.[10] Staff are required to undertake and document the Neonatal Skin Risk Assessment Scale (NSRAS) on admission and twice daily and implement strategies based on scoring.
- When administering medications and sampling blood, connections are to be swabbed with **Chlorhexidine gluconate 2% and isopropyl alcohol 70%** and allowed to dry before connecting the tubing or syringe.
- Each infusion should be given via an infusion pump with pressures reading capability set
- Site inspection must occur hourly and be documented
- All administration lines, medications and /or intravenous fluids should be labelled in accordance with NSW Health Ministry of Health Policy Directive PD2022_032: Medication Handling [11]
- CVAD Dressings must be undertaken by two staff members one of whom is accredited
- Removal of a CVAD is a competency based skill and must only be undertaken by trained clinician[12]
- Transfer of a patient between locations should not occur within 30 minutes of removal of a CVAD[12]

CHANGE SUMMARY

- Additional Umbilical Venous Catheter section added.
- Alteplase administration and considerations added.
- CVAD types updated to include tunnelled uncuffed lines and maximum flow rates.
- Revised staff information sheets on procedures
- CSA documents included for CVAD line dressings and removals.
- CVAD decision pathway tool added.
- References updated.

READ ACKNOWLEDGEMENT

- Clinician competency is validated by documenting the knowledge, skills, behaviours and ability to care for a neonate with a CVAD in-situ.
- The person assessing the performance of clinicians is competent with the skill being assessed.
- Neonatal CVAD Accreditation Process for Registered Nurses comprises:
  - Online Neonatal CVAD learning program.
  - Practical/or observation session with CNE or CVAD accredited assessor
  - Completion of Neonatal CVAD Nursing Clinical Skills Assessments
  - Reaccreditation – consists of completion of Neonatal CVAD Nursing Clinical Skills Assessment
  - Timeline for completion of these components will be determined locally
- Read Acknowledge Only – Medical staff caring for neonates are required to read and acknowledge the document.

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Introduction

CVADs are multipurpose venous catheters whose catheter tip is often situated in the superior vena cava, inferior vena cava or right atrium. The most commonly used veins in neonates are the umbilical, internal jugular, subclavian or femoral. CVADs vary in lumen size, numbers of lumens, placement and usage.

- CVADs are indicated in patients who require:
  - Administration of irritant, vesicant or hyperosmolar drugs / fluids
  - Long term access for frequent or prolonged use
- All inpatients with a CVAD in situ should be reviewed daily and CVADs that are no longer required should be removed as soon as possible[6].

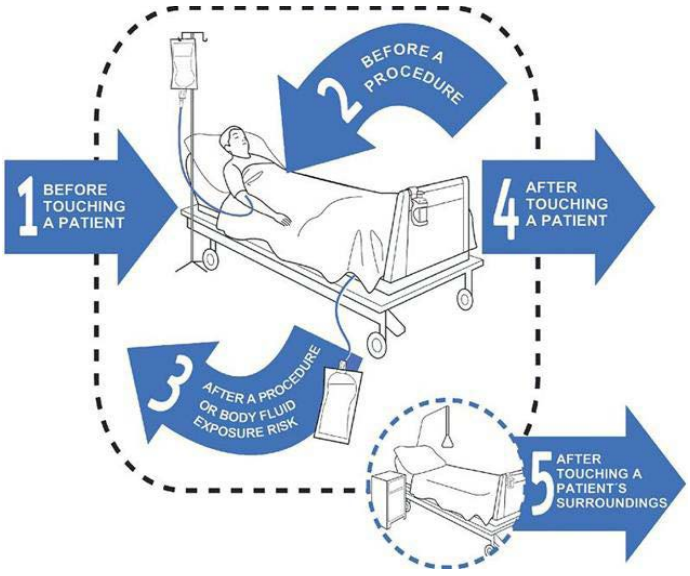
Principles of Practice

Document applies to any inpatient with a CVAD during the neonatal period ie Birth to 28 days term corrected and being cared for in NICU, CICU or PICU only

Hand Hygiene [13, 14]

Hand hygiene is recognised as the cornerstone of infection prevention. Hand hygiene is the act of cleaning hands with alcohol based hand rub (ABHR) in either liquid, foam or gel form; antiseptic liquid hand wash and running water; or (plain) liquid soap and running water.

Staff must perform the 5 Moments for Hand Hygiene during patient care activities.



Hand Hygiene should be conducted before & after palpating catheter insertion sites.

Aseptic Non-Touch Technique - ANTT® [2]

ANTT® is a technique used to prevent contamination of key parts and key sites by microorganisms that could cause infection. In ANTT®, asepsis is ensured by identifying and then protecting key parts and key sites by hand hygiene, non-touch technique, using new sterilised equipment and/or cleaning existing key parts to a standard that renders them aseptic prior to use[2].Principles of ANTT ® must be adhered to whenever the CVAD is accessed.

1. Essential components of ANTT® include: [15, 16]

   i. Identifying and protecting key parts and sites:

   ii. **Key part:** is the part of the equipment that must remain sterile, such as a syringe hub, and must only contact other key parts or key sites.

   iii. **Key site:** is the area on the patient such as a wound, or IV insertion site that must be protected from microorganisms.

   iv. Use hand hygiene, non-touch technique, a defined aseptic field, sterile equipment and clean existing key parts prior to use.

   v. Attempt not to touch key parts/sites directly, **WEAR STERILE GLOVES** during procedures where touch of key parts/sites may occur to reduce contamination risk.

   vi. Utilise a defined aseptic field to provide a controlled working space that ensures and promotes asepsis.

   vii. Sequence your practice to ensure efficient, logical and safe order of tasks.

STANDARD ANTT ®	SURGICAL ANTT ®
• Technically simple procedures • Short duration *(< 20 mins)* • Involves one or two key sites *e.g. wounds or IV cannula site* • Few key parts *eg dressing pack items* • Uses general and/or micro critical aseptic fields to maintain aseptic technique • Non-sterile *(clean)* gloves required • ***Examples*** *- simple dressings, administration of CVAD medication, administration set change and blood sampling*	• Technically difficult procedures • Long duration *(> 20 mins)* • Involve large, open key sites *eg large open wound/s* • Large number of key parts • Critical aseptic field and often full barrier precautions to maintain aseptic technique • Sterile gloves required • ***Examples*** *- specific neonatal CVAD procedures, complex CVAD dressings, CVAD insertion and surgical procedures*

USE STERILE GLOVES IF KEY PARTS MAY BE TOUCHED

Documentation

- CVAD INSERTION documentation must be completed by the clinician inserting the CVAD in the patient's medical record or eMR including the CVAD Insertion Record. This must include the catheter type, size, and tip location - Product batch number and/or item number should ideally be documented if available.

The correct location of the CVAD tip must be confirmed and documented by a medical officer prior to use.

- See Assessment and Site Care section for ongoing assessment documentation.
- CVAD REMOVAL documentation is to be completed by the clinician removing the CVAD in the patient's medical record or eMR including in Removal and Removed by sections of the CVAD Insertion Record. This must include the date and reason for removal, that catheter tip was intact – if not actions taken, site condition and if local sepsis is considered that the CVAD tip was cultured.

Clinical Handover

Standard Key Principles for Clinical Handover17 are to be incorporated into all types of handover to ensure effective, concise and complete communication

- In CVAD management this includes:
  - the use of the patient record to cross-check information e.g. *intravenous fluid or medication orders*
  - tracing of infusion lines from between the patient and the solution container
  - cross-checking infusion pump settings
  - examination of CVAD entry site and dressing integrity
  - comprehensive discussion of all aspects at all points of patient transfer

Scrub The Hub[18,19]

Substandard maintenance practices of needleless access devices (NADs) are associated with contamination of the hub leading to intra luminal biofilm development and increasing the risk of CLABSI[20]. To help minimise infection, staff are required to scrub the NAD or 'scrub the hub' for 15 -30 seconds and allow to dry prior to use. The key components of accessing CVADs and using the scrub the hub approach include:

- Perform hand hygiene as per the five moments (Moment two)
- Put on clean gloves prior to accessing the device. Perform a "hub scrub" using a 2% **Chlorhexidine Gluconate and 70% Isopropyl Alcohol antiseptic wipe** and friction in a twisting motion on the hub.
- Solution **must be allowed to dry** naturally prior to accessing the device, at least 30 secs should be allowed.
- Infuse medication or withdraw blood and label as per policy[12.]
- Discard gloves and perform hand hygiene.

Understanding Syringe Pressure[21]

- It is possible to generate up to 5 times the maximum safety pressure with any size of handheld syringe. Subjecting the catheter to excessive pressure can result in catheter rupture and embolism. **Smaller syringes generate higher pressures than larger ones**. The difference in exit pressure between syringe sizes is discussed in detail on Understanding Syringe Pressure Staff Information Sheet
- In order to avoid the risk of damaging any CVAD catheter the following is recommended:
  - Always use the equivalent of a 10 mL syringe (*e.g., 10mL syringe or 5mL prefilled sodium chloride 0.9% syringe*) when priming and flushing the catheter
  - Always use 10 mL syringes to infuse boluses of medication which can be diluted.
  - If medication cannot be diluted, smaller syringes should be placed on a syringe infusion pump.
  - If medication cannot be diluted or infused utilising a syringe infusion pump, administer bolus medications as a slow IV push: *within 3-5 minutes or as per the individual medication recommendations.*

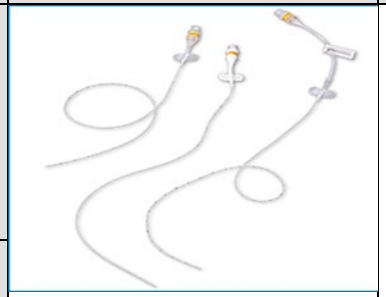
Flushing CVADs[22]

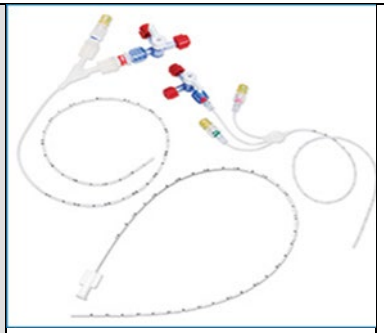
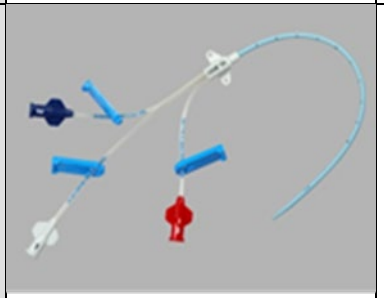
- The dynamic of the injection flow plays a pivotal role in adequate flushing of CVADs.
- Correct flushing technique is imperative with any NAD. The flushing technique must match the NAD system being used:
  - In SCHN **NEUTRAL** displacement NADs are used
  - A **NEUTRAL** displacement NAD allows minimal movement of fluids in either direction on disconnection of tubing or syringe and will automatically perform the clamping action of a positive-pressure flushing technique.
  - **NEUTRAL** displacement needleless access devices are not dependent on flushing technique,[23] so any technique can be used.[24]
- Prevent disconnection reflux by using the appropriate sequence for flushing, clamping, and disconnection determined by the type of NAD being used.

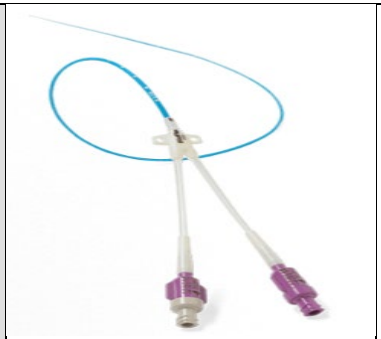
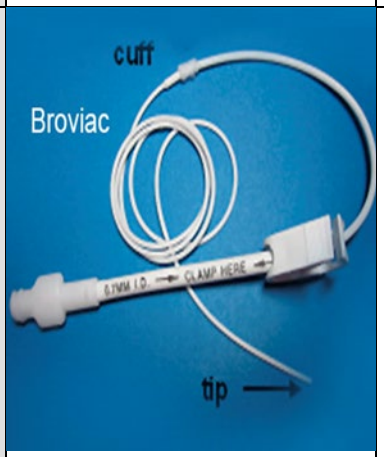
Turbulent / Pulsatile Flush [25,26, 27]

- This method is used to **clear the catheter** of blood or drugs that may adhere to the internal surface of the catheter.
- Turbulent flush should be administered **BEFORE AND AFTER** infusion of intravenous medications.
- This technique utilises a stop-start or push-pause method when injecting the flush solution into the catheter.
- Theoretically, turbulent flow removes any blood attached to the catheter wall and thus reduces the risk of catheter occlusion

CVAD types – Quick reference guide

Line Type	Picture	Description	Min Flow	Safe clinical delivery flow rate	Clamping	Blood Sampling	Blood Adminis-tration	Removal
PICC *(<2Fr Premicath®)* *Single lumen - 20cm or 30cm in length*		• Inserted in basilic, brachial or cephalic vein and advanced through to the central circulation. • Alternate location is long saphenous vein at ankle • Exit site is directly above the entry into the vein • PICCs can remain in place for weeks	1 mL / hr	1Fr: 9 mL / HOUR 2Fr: 18 mL / HOUR	No	No	No	Accredited RN
PICC *(≥2Fr)* *Single Lumen* *Double Lumen* *Both 30cm in length*			1 mL / Hr	Line dependent	No	No	No	Accredited RN

Umbilical Venous Catheters 3.5Fr, 4Fr, 4.5Fr & 5Fr		•Inserted through the umbilical vein entering the inferior vena cava via the ductus venosus and terminating at the junction of the inferior vena cava and the right atrium. •UVCs can remain in place for up to 14 days but ideally are removed by day 7 to minimise risk of CLABSI and thrombus.	1 mL / hr	7-11 mL / MINUTE Check packaging for per lumen advice	No	Yes	Yes	Accredited RN
Non-tunnelled CVAD **Arrow 22Ga.**		• Inserted percutaneously into the internal or external jugular vein or femoral vein • Exit site directly above entry into the vein • Can remain in place for up to 14 days but ideally removed at 7 days post insertion	1 mL / hr	550 mL / HOUR (distal) 425 mL / HOUR (proximal)	Yes	Yes	Yes	Accredited RN

Tunnelled non-cuffed **BioFlo PICC**		•Tunnelled non-cuffed CVCs are surgically inserted under a general anaesthetic by an interventional radiologist •Proximal end of the catheter is tunnelled subcutaneously to the catheter exit site •Can remain in place for several months •Preferred line type for many patients as line can be removed on the ward with no anaesthetic	1 mL / HOUR	1 mL / SECOND	Yes	Yes	Yes	Accredited RN, CVAD CNS2 or NP
Tunnelled Cuffed CVAD **Broviac© 2.7Fr or 4.2Fr**		•Tunnelled CVCs are surgically inserted under a general anaesthetic by a surgeon •Proximal end of the catheter is tunnelled subcutaneously to the catheter exit site •Tunnelled CVCs contain a Dacron cuff that is situated under the skin close to the exit site	1 mL / HOUR	5 mL -10 mL / SECOND	Yes	Yes	Yes	Surgeon

Tunnelled Cuffed CVAD **BD Powerline**		•Cuff provides stability due to fibrous adhesion that occurs around cuff, also minimising infection as it forms barrier to ascending pathogens from the exit site along the external catheter tunnel •Can remain in place for months	1 mL / HOUR	5 mL / SECOND	Yes	Yes	Yes	Surgeon

For CHW guidance on appropriate CVAD selection in a neonate see the CHW CVAD Decision Tree and Pathways tool for further information and guidance CHW CVAD Decision Tree and Pathways.

Priming Volume of Catheter Types, Lumens, Extension Sets and Infusion Lines

- Information to guide clinicians regarding line size (Fr), lumen size (G) and priming volume of catheter (mL), extension set (mL) and infusion lines (mL) is available via Priming Volume Of Catheter Types, Lumens, Extension Sets And Infusion Lines Staff Information Sheets
- If priming a catheter type, lumen, extension set or infusion line where product information is not listed in the table provided, please refer to the product information supplied with the device.

Insertion

- Tip location of a CVAD is determined radiographically or by other imaging technologies *e.g. ultrasound/ fluoroscopy etc* prior to initiation of infusion therapy or when clinical signs and symptoms suggest tip malposition. **NB: All femoral lines need to be x-rayed to confirm placement.**
- CVAD insertion bundles have been found to be important for reducing central line associated blood stream infections (CLABSI) in neonates.[1,28, 29]

Insertion Care Bundle includes the following:

1. Maximum sterile barrier precautions utilised.
2. Skin disinfected with Chlorhexidine gluconate 0.1% irrigation (aqueous preparation) & allowed to dry
3. Placement by skilled clinician
4. All supplies required for the procedure available at the bedside prior to insertion.
5. Hand hygiene standards
6. Documentation in insertion record
7. Staff empowered to stop non-emergent procedure if sterile technique not followed.

Insertion Care

- Appropriate analgesia and sedation must be considered prior to insertion. Ongoing assessment of pain during the procedure needs to occur to ensure the infant remains comfortable and receives additional analgesia if necessary.
- The patient needs to be positioned appropriately prior to insertion, dependant on intended location of CVAD.
- During insertion, the infant must have continuous cardiorespiratory and temperature monitoring.
- Emergency equipment, including working oxygen and suction, needs to be available throughout the procedure.

Parental/Guardian Consent

- Informed written consent is required for the elective INSERTION of any CVAD. The neonate's parent/guardian should have the benefits and risks associated with CVAD insertion explained by person undertaking procedure.
    - *If the CVAD is inserted during a resuscitation or emergency, consent is impractical, but parents should be informed as soon as practical for the reasons for the procedure.*[30]
- During the consent process parents can be provided with a fact sheet. These are the currently available fact sheets:
    - Cuffed Tunnelled Central Venous Catheter fact sheet
    - Uncuffed tunnelled Central Venous Catheter fact sheet
    - Non Tunnelled Central Venous Catheter fact sheet
    - PICC Lines fact sheet
    - Port – Implantable Venous Access Device
- Informed verbal consent is required for the elective REMOVAL of any CVAD. The neonate's parent/guardian should have the benefits and risks associated with CVAD removal explained by person undertaking procedure.

Parent Education

- Parents should be provided with one-on-one education from nursing and medical staff to facilitate collaborative family centred care relating to ongoing management.
- The following components are recommended for discussion:
    - **Risk of sepsis**
        - Importance of hand washing
        - Notification to staff if they observe the CVAD dressing to be lifting or soiled.
        - Requirement to keep the CVAD dressing clean and dry not submersed in water for bathing.
        - Parents are encouraged to identify with staff any changes in their baby's condition.
    - **Risks of dislodgement and damage**
        - Recommendation for two-person transfer in/out of bed/crib to prevent accidental dislodgement or breakage of line.
        - Advised to avoid tension on IV administration sets or dressing.
        - Notification to inform staff if any concerns of accidental dislodgement or damage.

Management of CVADs

PICC lines in neonates are NEVER to be clamped including during line changes due to the high risk of line occlusion and blockage.

Maintenance Care Bundle includes the following: [29]

1. Assess and document daily whether or not CVAD placement and continued use is necessary.
2. Perform appropriate hand hygiene.
3. Assess CVAD dressing integrity and CVAD insertion site daily at a minimum.
4. Perform CVAD dressing change when required.
    - Two-person procedure with appropriate developmental support and analgesia
    - Site cleaned with appropriate solution.
    - Cleansing solution allowed to air dry completely.
5. Develop and standardise intravenous tubing setup and changes.
6. Maintain aseptic technique when changing IV tubing setup and changes.

Infusion Equipment

- Pressure limit defaults for intravascular infusion pumps are programmed by Bio-medical Engineering based on organisation recommendations.
- While there is some benefit to monitoring trends in pressures for some individual patients, there is no evidence available that demonstrate that recording a pressure number prevents occlusion or extravasation.
- Flow rates through any vascular infusion devices will be influenced by anything that increases or decreases resistance or augments any of the variables:
    - **Factors DECREASING flow**: high viscosity of fluid, longer tube length, smaller internal diameter and lessened pressure.
    - **Factors INCREASING flow**: low viscosity of fluid, shorter tube length, bigger internal diameter, increased pressure.

ALERT: Potential adverse events may occur if upper pressure limit is manually increased. If manual increase is undertaken, clinician is expected to document this within the patient's medical record and reduce the pressure limit at the earliest opportunity.

Needleless Access Devices (*NADs*)[32]

- Needleless access devices have different internal mechanisms and fluid pathways.
- NADs protect health care personnel by eliminating needles when attaching administration sets and/or syringes to the CVAD hub or injection site for intermittent infusion.
- NADs are known potential sites for microbial contamination and require careful adherence to infection prevention practices[16].

- When used with either a **continuous or intermittent** infusion system, the NAD is to be changed when the administration set, or extension set is changed or at least every 7 days[20]
- **NADs are to be changed PRIOR to obtaining blood culture** samples as drawing blood cultures through a NAD carries a risk of false-positives that could increase bloodstream infection rates by up to 3-fold [33,34].

Add-On Devices

i.e. single, multi-lumen extension sets, NADs, Filters, Stopcocks

- All add-on devices are to be of luer-lock or integrated design to ensure a secure junction, reduce manipulation and minimise the risk of disconnection.
- Consider the use of add-on devices only for clinical indications *e.g. adding length or to support the administration of multiple drug infusions*.
- Utilise a vigorous scrub *(i.e. scrub the hub)* **with Chlorhexidine gluconate 2% and isopropyl alcohol 70% antiseptic wipe** prior to each access allow the surface to dry before use waiting at least 30 seconds.
- Change add-on devices:
  - With new CVAD insertion
  - With new administration set
  - With compromised integrity or suspected of contamination

Filters

- There is insufficient evidence to recommend the use of intravenous in-line filters to prevent mortality or morbidity in neonates [35].
- The decision to utilise in-line filters is determined locally.
- Parenteral nutrition and fat emulsion solutions are filtered using an in-line or add-on filter appropriate to the type of solution.
- All red cell, platelet, FFP and cryoprecipitate units require filtration via a standard 170–200-micron filter. *These filters are incorporated in Blood Product administration sets used within SCHN*
- Please note 1FR and 2 FR PICC lines should not be used for blood product administration.
- Position add-on filters as close to the CVAD hub as possible

Flushing

- CVADs *(excluding PICCs)* are flushed and aspirated for a blood return at insertion and when concerns arise with position to assess catheter function and prevent complications.
  - **PICC LINES IN NEONATES SHOULD BE FLUSHED WITH CAUTION TO AVOID RUPTURE AND NOT ROUTINELY ASPIRATED WHEN IN USE.**
  - If syringe size requirements outlined in this document are followed *ie Always use the equivalent of a 10 mL syringe* this risk is minimised

- Use a minimum volume equal to internal volume of the CVAD and add-on devices when flushing Refer to Catheter Types and Priming Volume Staff Information Sheet
- CVAD functionality should be assessed by using **ONLY** a 10 mL syringe or a syringe equivalent to a 10 mL syringe (Refer to Undertanding Syringe Pressure Staff Information Sheet)
- Use pulsating technique i.e. push-pause-push to minimise blood reflux into the CVAD lumen [25,26,27, 36]

Heparin Locking

- Heparin locking (*Hep-lock*) refers to the installation of heparinised saline into the CVAD lumen(s) when a CVAD is not being used for more than 24hrs. *(Refer to Heparin Locking Staff Information Sheet)*
    - **PICC LINES IN NEONATES ARE NOT HEP-LOCKED**
- Decision whether to hep-lock a small gauge CVAD will be an individualised decision made by the Neonatologist/ ICU Staff Specialist
- Locks containing medication such as heparinised saline must be prescribed by a medical officer or Nurse Practitioner
- **In neonates**, depending on the priming volume, a heparin lock comprises heparinised saline **10 units / mL with 0.5mL to 1 mL instilled per lumen** *(Refer To Catheter Types And Priming Volume Staff Information Sheet)*
- Wherever possible, aspirate CVAD lumen(s) and remove the hep-lock, discarding it prior to installation of a renewed hep-lock or commencement of an infusion.
  NB: Aspiration of small gauge CVADs may not be possible.
- Hep-locking of CVAD lumen(s) is to be attended every 7 days
- Locked catheters with medicine in-situ such as heparinised saline must be labelled as per NSW Health Policy[11]

Use of Alteplase for Thrombotic Occlusions

- For thrombotic line occlusions, alteplase may be considered. This is in consultation with the Neonatologist/ ICU Staff Specialist or Nurse Practitioner and must be administered by accredited staff only.
- Alteplase is only used to manage thrombotic occlusions. ***It is not to be used to resolve occlusions secondary to chemical precipitate or mechanical occlusions***.
- Alteplase may only be used for tunnelled cuffed/uncuffed CVADs only. It is not to be used for PICC line or UVCs.
- Risks and benefits of attempting CVAD salvage with alteplase should be considered over CVAD removal.
- Refer to *4.2.1 Clearing a Thrombotic Occlusion from CVADs* in SCHN CVAD CPG for further guidance.

- **Neonatal Contraindications**
  - Haemolytic disorders
  - Recent active intracranial bleed
  - Premature infants < 30 weeks gestation

Assessment and Site Care

ANTT IS TO BE PERFORMED WHEN PROVIDING SITE CARE ON CVADS

- CVAD site must be assessed hourly and findings documented in the patient medical records such as flow chart or in the electronic medical record
- Documentation should include:
  - Any signs of bleeding
  - Any signs of possible infection such as redness, swelling or exudate
  - Any signs of dislodgement
- Ensure all connections are leuer-locking mechanism and secure
- Securement of the CVAD must be assessed at commencement of each shift and with any patient reposition

Administration Set Change

ANTT IS TO BE PERFORMED WHEN UNDERTAKING ADMINISTRATION SET CHANGES ON CVADS

- All administration lines, medications and /or intravenous fluids should be labelled in accordance with NSW Health Ministry of Health Policy[11]
- All administration sets must be replaced after being disconnected.
- When an administration set is changed, the IV fluid must also be changed.
- During line changes for PICC lines, ensure the new fluid is at a positive pressure by having the pump turned on and the line primed with fluid.
- Replace **continuous** administration sets used to administer solutions other than lipid or blood products up to every 96 hours or as per special considerations for specific medications – **with fluid change.**
  - *Replace IV administration sets for Parenteral Nutrition every 24hrs or as recommended by manufacturer for pre-made solutions i.e. every 48hrs in GCNC*
  - *Replace IV fat emulsion sets (i.e. Intralipid) every 24hrs*
- Replace **intermittent** administration sets, add-on devices and solutions with each medication.

Blood Sampling

Blood MUST NOT be aspirated from a PICC line because its small lumen size and risk of blood cell lysis and potential for occlusion[31].

- **BLOOD SAMPLING MUST NOT BE OBTAINED FROM CVADS WHERE AN INOTROPE OR OTHER CRITICAL INFUSION IS IN PROGRESS**

- To minimise the risk of infection and clot formation, CVADs should not routinely be accessed for blood sampling[20]. If possible, a venepuncture or capillary sample should be obtained. *(Refer to Blood Sampling Staff Information Sheet)* Check with MO that blood can be obtained from CVAD.
- If at all possible, if blood sampling from CVAD is to occur it should only be undertaken when the administrations set is changed.
- Obtaining blood for culture through an old NAD has been found to be associated with contamination events.
    - When blood is obtained for blood culture, the existing NAD should be removed and changed **PRIOR** to obtaining the sample to reduce risk of a false positive result[28,34,36].
- If significant volumes are required, contact laboratory to determine minimum volume required for samples and discuss with medical officer prior to undertaking procedure.
- If blood is to be sampled from a tunnelled cuffed CVAD, an order must be obtained from the Neonatologist/ ICU Staff Specialist.
- The recommend discard volume when aspirating blood for culture or when collecting other blood samples is **1 mL**.
- Blood sampling from UVC should be carried out slowly to decrease risk of cerebral hypoperfusion as there is a direct relationship between the rate of the flush of the catheter and changes in cerebral blood flow velocity.
    - *Recommended rate of withdrawal and flush is **1 mL per 30 seconds** to reduce the effect on the cerebral blood flow [37].*

Dressing procedure for all CVADs

It is essential that staff identify and analyse the potential risks of CVAD dislodgement prior to any dressing change.

- If assessment indicates risk of CVAD dislodgement, this should be discussed with Neonatologist/ ICU Staff Specialist and decision documented in patient's medical record.
- Initial dressings are ideally applied once correct line placement is determined, however in the instance of an active patient, a dressing should be applied to prevent loss of line. Once line placement confirmed this is documented in the patient's eMR.
- Due to concerns for fragile skin integrity in neonatal patients, CVAD dressings are only changed when they become loose, soiled, or compromised. At this time, dressing changes are to be performed immediately. (*Refer to CVAD type-specific Dressing Staff Information Sheet in ePolicy For Staff tab: Dressings for all CVAD types*).
- Two staff members are required for the procedure when a dressing is undertaken on a neonate with a CVAD one of them who has been accredited for the procedure.

ANTT is performed when undertaking dressing changes on CVADs.

- **Scissors or sharp objects should not be used near the catheter when changing CVAD dressings.**
- Use Chlorhexidine gluconate 0.1% irrigation (aqueous preparation) for skin antisepsis in neonates and infants under 2 months of age due to risks of skin irritation and chemical burns.
- Only the minimum amount of Chlorhexidine gluconate 0.1% irrigation required should be used and the solution should not be allowed to pool in skin folds or under the patient. Any excess solution and any soaked materials, drapes or other material in direct contact with the patient should be removed as soon as possible. There is a particular risk of skin irritation and chemical burns in preterm infants <30 weeks or <1000 grams).
- Allow any skin antiseptic agent to fully dry prior to dressing placement.
- A transparent occlusive dressing must be used to cover the CVAD insertion site. An alternative dressing must be used if concerns arise with skin integrity or possibility of medical device related injury.
- If the CVAD catheter has been inserted in an arm or leg, **DO NOT** encircle the limb with the dressing.
- With PICC catheter dressing – maintain visibility of insertion site, coiling an unused portion of the catheter away from the insertion site.
- The initial dressing on a tunnelled CVAD occurs in the operating theatre. Transparent occlusive dressings should not be changed in the first week, if possible, to avoid the risk of inadvertent displacement of the CVAD, unless authorised by the Surgeon.
- Regardless of the dressing type used for the CVAD, the dressing should:
    - **i.** be positioned so the catheter insertion site is in the centre of the dressing.

ii. cover the catheter from the insertion site and the first securement.

iii. create a complete seal from the securement through to the insertion site.

Management specific to Umbilical Venous Catheters

For detailed guidance in CICU at SCH Randwick please refer

SCH Umbilical Catheter Care and Management in CICU

CONTRAINDICATIONS

Umbilical catheters are contraindicated in neonates with the following conditions:

- Abdominal wall defects *e.g. gastrochisis, omphalocele, umbilical fistula, cord anomalies*
- Infection *e.g., omphalitis, necrotising enterocolitis, peritonitis*
- Abdominal surgery requiring an incision above the umbilicus.

Note: Umbilical access in infants with congenital cardiac disease in whom a balloon septostomy may be required should be discussed with both the neonatologist/ICU specialist and the cardiologist.

INSERTION INFORMATION

- UVCs are available in sizes 3.5, 4. 4.5 and 5Fr and may be single, double or triple lumen.
- Depth may be calculated by the formula: (birth weight [kg] x 3) + 9 ÷ 2[41.]
- RN is to remain with the neonate throughout insertion procedure of a UVC.
- Umbilical cord is devoid of nerve fibres therefore no specific analgesia is needed for the sole purpose of insertion of an umbilical catheter.
- Patient preparation will require facilitated tucking to avoid movement during the procedure and this is potentially stressful to the neonate. Subsequently, if the neonate is not already receiving parenteral analgesia as part of their clinical management and no contraindications exist, then the use of oral sucrose should be facilitated. See Sucrose - Management of Short Duration Procedural Pain in Infants NIM.
- These deliberations should be considered for removal procedures also.
- Catheter tip position must be confirmed by xray. **Correct location of UVC tip must be confirmed and documented by medical officer prior to use.**
- UVC may be withdrawn but **NEVER** advanced to correct the position. *See CVAD Placement staff information sheet for more information on ideal tip positioning.*
- UVC must be sutured separately from UAC to facilitate adjustment of lines post chest X-ray and for removal of individual lines.

SECUREMENT

- Secure lines away from neonate's hands and feet to prevent accidental dislodgement, ensuring no traction is applied to either catheter or infusion line
- For securement technique please refer to *Securement of Umbilical Line Staff Information Sheet:*
- Umbilical catheters must be clearly labelled to distinguish venous from arterial catheters.

ONGOING MANAGEMENT

- Neonate with UVC in situ must be nursed supine or on their side - **MUST NOT BE NURSED PRONE**
- Umbilicus must be exposed at all times to observe for bleeding, fluid leakage, swelling, redness, discolouration of skin or blistering. Any of these findings must be reported to medical team immediately.
- Lower abdomen, legs and feet **MUST ALWAYS** be visible, and toes, feet and legs continuously observed - wrappings/blankets and booties **MUST NOT** be used.
- Catheter connections **MUST ALWAYS** be visible – **DO NOT PLACE LINEN OVER ANY CONNECTIONS**
- Observe abdominal girth for signs of distension and document if noted.
- Note any skin blanching, bruising of limbs, toes or buttocks prior to, during and after any procedure and at any time the catheter is in situ – report immediately.
- If one limb involved, warm opposite limb to induce reflex vasodilatation of affected limb.
- If above fails, catheter should be withdrawn 0.5 - 1cm and observe.
- Remove all umbilical catheters if blanching persists for >30 minutes.

TROUBLESHOOTING

- *Accidental dislodgement*: gently pinch the abdomen ABOVE the umbilicus for 2-5 minutes as this will compress the umbilical vein and control bleeding, notify MO and complete IMS+ notification
- *Accidental severing:* clamp the line between the neonate and the severed end. **NOTIFY MO IMMEDIATELY AS THIS IS AN EMERGENCY**. Do not discard severed portion. Document in eMR and complete IMS+ notification

Removal of CVAD

- Consideration should be given to removing and replacing CVADs inserted in emergency situations where aseptic conditions cannot be guaranteed *i.e., patients admitted to ICU from other sites.*
- CVADs are removed without delay once the multi-disciplinary team decides they are no longer required for patient care.
- Removal of a non-tunnelled CVC tunnelled uncuffed, PICC or umbilical venous line should only be performed by an accredited RN or trained medical officer. *(Refer to CVAD type-specific Removal of CVAD Staff Information Sheet: Removal of non-tunnelled CVAD, Removal of PICC, Removal of Umbilical venous line, Removal of tunnelled uncuffed line*
- Majority of tunnelled cuffed CVADs are removed under general anaesthesia in the operating theatre. Sometimes, a surgeon may remove a tunnelled cuffed CVAD in the ICU if the neonate infant is stable and has a normal coagulation profile and the line has been insitu for less than 6 weeks.
- The two major complications associated with removal of a CVAD are air embolism and bleeding. Other complications include haemorrhage, infection, dislodged thrombus, and breakage of catheter tip. *Refer to Complications and Troubleshooting*
- Explain procedure to parents/carer, obtain verbal consent and document same
- Prepare the infant and family; consider comfort techniques and analgesia as required.
- Ensure infant is wrapped and positioned supine in a comfortable posture, arms and legs should be appropriately swaddled and facilitated tucking utilised.
- The infant's observations must be recorded before and a minimum of once during the 30 minutes after removal.
- Emergency equipment, including working oxygen and suction and cardio-respiratory monitoring in place throughout the procedure.
- Ensure a second staff member is present or available to assist with removal as per each separate procedure document.
- At the time of removal of the CVAD, the tip of the line should be visually inspected to ensure that removal has been complete. **This should be documented in the electronic medical record and the Central Venous Line Insertion form *Removal section* completed.**
- Unless local sepsis is suspected the line tip is not sent to pathology for culture.
- In the event of suspected line failure or product malfunction, the line should be retained and an IIMS report completed.

Transfer of a patient should not occur within 30 minutes of removal of a CVAD[12]

Complications and Trouble Shooting[19,21, 26]

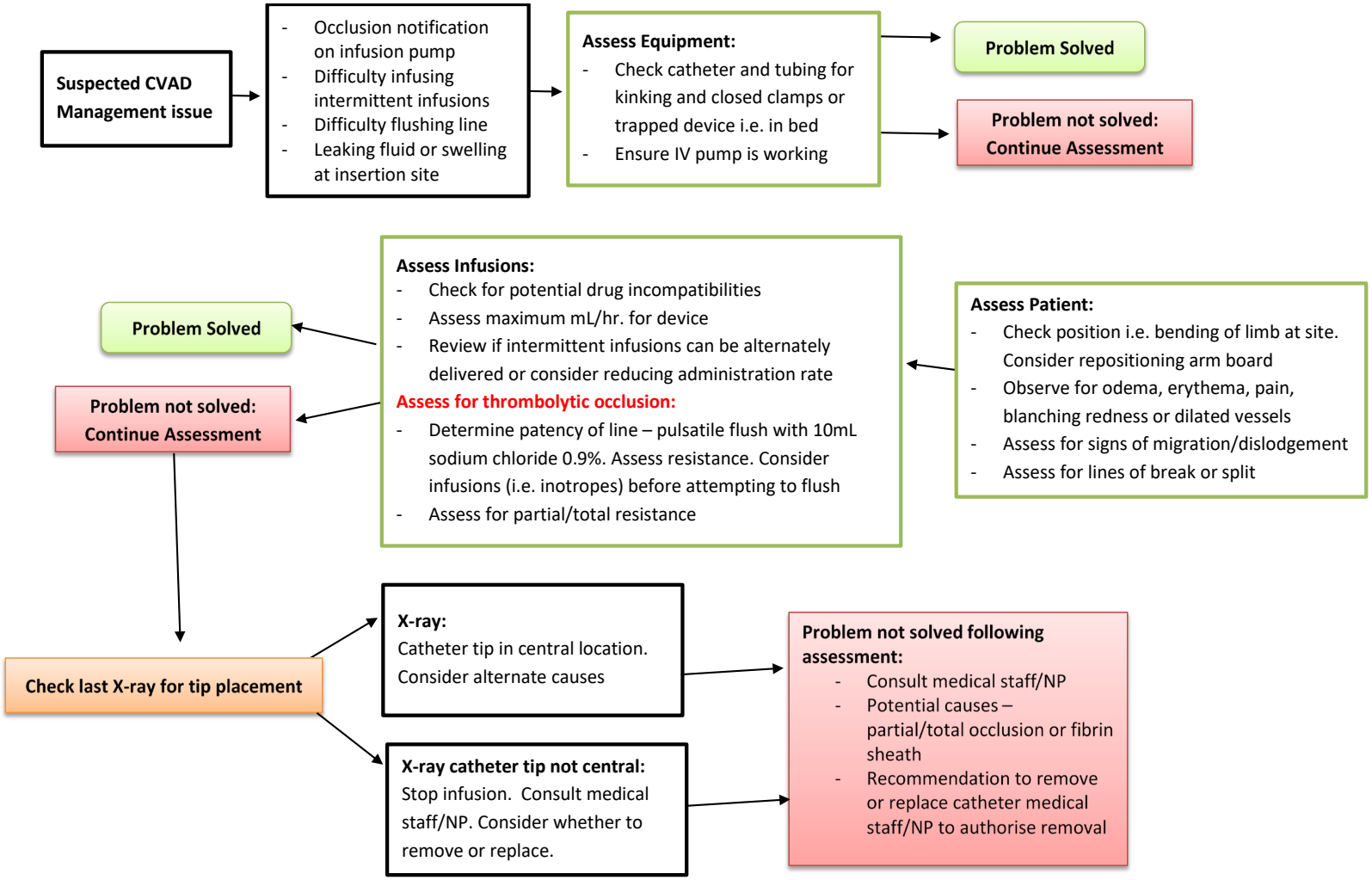
- One in four CVADs fails prior to completion of treatment (38)
- Seek assistance from senior clinician.
- Complete an IMs if a healthcare acquired complication occurs.
- Prevention and management of common complications is outlined in the following table:

Problem	Prevention	Detection	Management
Occlusion	- Use positive pressure flushing techniques - Flush line following administration of drugs - Do not sample blood via PICC - Always run continuous infusion 1mL/hr through PICC line - Promptly correct any obvious signs of mechanical obstruction	- Change in capacity to infuse products - Monitor for kinked CVAD or infusion device	- Check catheter isn't clamped - Attempt to reposition patient - Inspect catheter under dressing for knots, bends, migration - Attempt to clear device (pulsatile flush, push pause push) - Trouble shoot with senior RN (CNS/NUM/NP) Discuss with consultant or NP if alteplase is indicated (Refer to SCHN CVAD Practice Guideline : *4.2.1 Clearing a Thrombotic Occlusion from CVADs*
Sepsis	- Hand hygiene - Minimise line access - Observe for signs of inflammation or discharge from insertion site - Ensure dressing is intact and free of exudate - Remove CVAD when it is no longer required	- Respiratory deterioration, increasing or new apnoea/bradycardia events - Lethargy, poor feeding, hyperglycaemia, temperature instability - Altered white blood cell count	- Remove line - Obtain specimens for culture (urine, blood) - If positive cultures persist evaluate for SVC or RA thrombosis - Evaluate chest x-ray
Phlebitis	- Hand hygiene - Use appropriate skin cleansing agents in appropriate dilutions and allow skin to dry prior to skin breaking procedure.	- Erythema and/or oedema at entry site - Observe insertion site for warmth, oedema and vein induration - Palpate skin around catheter tip to check for tenderness and redness	- Elevate limb - Check chemical properties of infusion. If chemical irritation likely, consider either slower administration or further dilution - If no improvement after 24 hours or phlebitis advances, consider removal and send tip for culture. Retain line for review by manufacturer and complete IIMS.
Air Embolism	- Utilise NAD between end of CVAD and all IV extension sets - Clamp or briefly occlude lines during disconnections - Prevent air entrainment through lines, use pumps for all infusions and ensure connections are secure - Use Luer lock devices - Do not clean CVAD catheter with alcohol-based substances as this can weaken the	- Check for line fracture - Check for tubing disconnection or air in lines or extension sets	- Signs of air embolism can include sudden onset cyanosis, shock and cardiac arrest - Place infant in left lateral head down position; seek medical assistance - Administer 100% oxygen to decrease air embolism

Problem	Prevention	Detection	Management
	material and increase the risk of line fracture		
Catheter Migration	- Maintain security of dressing - Verify tip position whenever a chest X-ray is taken for another clinical reason	- Atrial or ventricular arrhythmias depending on migration location	- Obtain x-ray and verify tip position - Consider repositioning strategies - Consider leaving in current position or pulling back - Check with x-ray following adjustment - Consider removing CVAD
Catheter Dislodgement	- Maintain security of CVAD with intact dressing - Ensure no tension on CVAD or dressing	- Loosening of dressing following a large amount of tension on line - Security of dressing compromised - Tension on catheter or dressing	- Obtain x-ray to check tip position - Consider risks and benefits of leaving catheter in position - Consider removing CVAD
Catheter Breakage	- Maintain security of CVAD with intact dressing - Provide families with information of how to safely move their baby	- Evidence of fluid or blood leaking from the line - Visualisation of a broken or snapped CVAD	- Clamp the line to prevent air entrainment - Check the patient for other signs - Notify medical staff - Determine if the line can be repaired or removed - Implement strategies to prevent reoccurrence
Thrombosis	- Check tip location on x-ray - Detect inflammation and phlebitis early - Secure catheter to prevent migration	- Facial, neck and chest wall oedema or venous distention - Echocardiogram - Respiratory deterioration - Resistance to flushing	- Treat thrombus with heparin or anti-thrombotic agent - Consider removal of line

TROUBLESHOOTING FLOWCHART

The following chart is used to guide the assessment and management of central line occlusions:



Troubleshooting Flowchart Modified from Earhart (2013)[3]

Staff Education and Training

Nursing Competency Assessment and Validation

- Individual clinician is responsible and accountable for attaining and maintaining continued clinical competence within their scope of practice.
- Clinician competency is validated by documenting the knowledge, skills, behaviours, and ability to care for a neonate with a CVAD in-situ.
- The person assessing the performance of clinicians is competent with the skill being assessed.
- Neonatal CVAD Accreditation Process for RNs comprises:
  - Online neonatal CVAD learning program.
  - Practical/or observation session with CNE or CVAD accredited assessor
  - Completion of Neonatal CVAD Nursing Clinical Skills Assessments
  - Reaccreditation – consists of completion of Neonatal CVAD Nursing Clinical Skills Assessment every 3 years.
  - Timeline for completion of these components will be determined locally.
- Refer to CVAD Education Information Tab

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