

# Clinical Guideline: Insertion of a Percutaneous Venous Catheter (PICC) In Neonates

**Authors:**

**For use in:** EoE Neonatal Units  
Guidance specific to the care of neonatal patients.

**Date of Ratification:** 23<sup>rd</sup> January 2020

**Review due:** 1<sup>st</sup> January 2020

**Registration No:** NEO-ODN-2020-1

**Approved by:**

|                                   |                                         |
|-----------------------------------|-----------------------------------------|
| Neonatal Clinical Oversight Group |                                         |
| Clinical Lead Matthew James       | <b>Matthew James</b><br><b>23/01/20</b> |

## 1. Goal

- To achieve central venous access
- To achieve successful insertion with minimal discomfort to the infant
- To ensure that the long line tip is placed at the correct level
- To minimise the risk of long line infections.

## 2. Long Lines

Long lines are small gauge silastic or polyurethane catheters, which are inserted into a peripheral vein and advanced to a central position, ideally in the inferior or superior vena cava, lying outside the heart.

## 3. Indications

- Administration of parenteral nutrition
- Long term administration of intravenous medication
- Administration of inotropes
- Administration of hyperosmolar fluids or irritant drugs
- Limited intravenous access

## 4. Notes

- The insertion of a long line is a 2 person procedure.
- In cases of recent sepsis wait at least 24 hours after removal of previously infected lines if possible
- Ensure the infants' comfort during the procedure – analgesia or comfort measures such as sucrose (see sucrose guideline), non-nutritive sucking or containment should be used.
- For difficult to place catheters a 2Fr microsite Kit (micro-seldinger technique kit) is available. This allows a 24g cannula to be inserted then upsized to a 20g long line split needle using a seldinger technique.
- The ideal position is the superior vena cava atrial junction or in the inferior vena cava at the level of the diaphragm
- Looped catheters must be withdrawn as there is a risk of migration
- **In any infant who collapses with a long line in situ, it is critical to urgently exclude cardiac tamponade as a cause of the collapse**

## 5. Instability during insertion

Physiological instability can occur during invasive procedures:

- Observe the infant during and following procedure for signs of deterioration
- Monitoring (ECG and oxygen saturation) should be in place throughout the procedure.

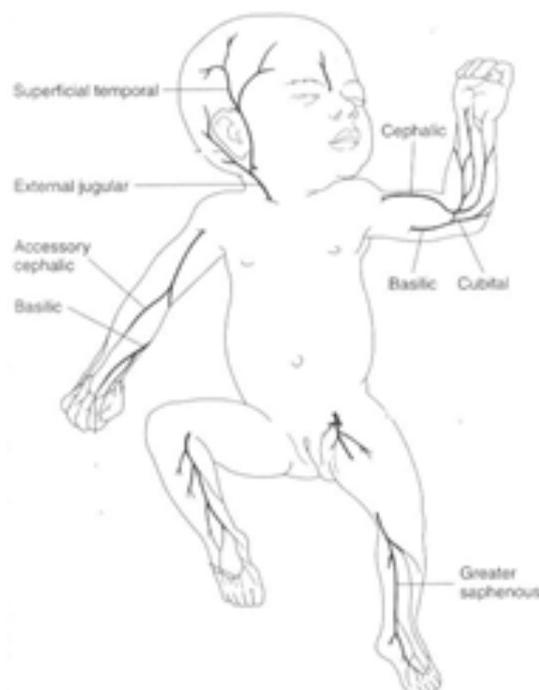
## 6. Method

### Types of Long Line available

- Temena Neocath 27g (1Fr) 20cm
- Temena Singlecath 23g (2Fr) 33cm
- Vygon Nutriline Twinflo 24g 30cm

### Long Line Veins

- Large vein in the antecubital fossa
- Long saphenous vein
- Lesser saphenous
- Popliteal veins
- Scalp veins



## Insertion Distance

- For long lines inserted via the leg – measure from insertion site to xiphisternum
- For long lines inserted via the arm – measure from the insertion site to the sternal notch
- For scalp long lines - measure from the site of insertion to the clavicular head and then to the sternum, level with the second intercostal space

| Site of insertion | Position of baby                                                                                                      | Measurement                                                                                                                                        |
|-------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Antecubital veins | Supine, abduct arm at 90 <sup>0</sup> Turn head toward insertion site to prevent catheter travelling towards the head | Insertion site, along venous pathway to suprasternal notch, to 3 <sup>rd</sup> right intercostal space                                             |
| Saphenous veins   | Supine for greater saphenous - extend leg                                                                             | Insertion site, venous pathway to xiphoid process                                                                                                  |
| Scalp veins       | Supine, turn head to side (though may have to turn the head to midline to assist advancement of catheter)             | Follow approximate pathway from insertion site near ear to jugular vein to right sternoclavicular joint to 3 <sup>rd</sup> right intercostal space |

## Equipment Required

- **Assistant**
- Percutaneous central venous catheter trolley
- Clinell wipes for surface cleaning
- IV Cut down set
- Good source of light
- Minor ops towel pack
- Gown
- 10 mL syringe
- 2 mL syringe
- Needleless connections (Bionectors)
- Tape measure
- Blunt needle (for drawing up the saline flush)
- 0.9% sodium chloride ampoule 10mls
- Clinell antiseptic wipe (2% chlorhexidine in 70% isopropyl alcohol) for skin preparation
- Sterile gauze – small and large
- Steristrips (Size 6 mm x 38 mm)
- Transparent sterile dressing
- Desired Long line
- Sterile gloves x2 pairs

## Prior to the Procedure

- In advance of the insertion, inspect the infant for suitable insertion sites
- Assess skin integrity prior to insertion
- Determine the desired catheter length by measuring the distance between the insertion site and the desired tip location

**Skin Preparation - NB: This is a 2 person procedure to ensure aseptic technique.**

| Please complete each point below to ensure risk of infection is minimised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Initial when done |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Use the dedicated percutaneous central venous catheter trolley and ensure equipment listed above is complete.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |
| Wash hands, apply gloves and apron                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |
| Measure length of expected catheter insertion from selected insertion site(s) to intended location of catheter tip                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |
| <b>Assistant</b> to damp dust the incubator ensuring the portholes are wiped with a Clinell wipe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |
| Re-wash hands, clean trolley with Clinell wipe, then following strict aseptic principles, open out the IV cut down set onto the cleaned trolley surface and add further equipment as required                                                                                                                                                                                                                                                                                                                                                                                          |                   |
| Put on a sterile gown and double gloves, using strict aseptic non-touch technique                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                   |
| Prepare your equipment. (Handle the catheter with care, do not stretch or apply tension)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |
| Flush catheter with 0.9% saline and leave the syringe attached. <b>DO NOT</b> cut the catheter to alter the length                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |
| <b>Assistant</b> to open 1 or 2 (depending on the size of the area subject to cleaning) individually wrapped antiseptic Clinell wipes (2% chlorhexidine in 70% isopropyl alcohol) onto sterile field                                                                                                                                                                                                                                                                                                                                                                                   |                   |
| <b>Assistant</b> to position the infant to facilitate insertion, ensuring that comfort measures and any pain medication is provided                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |
| With <b>assistant's</b> help, position the blue drape (minor ops pack) over the baby with the required insertion site available via the central aperture with the limb being held, as necessary, by your assistant to keep your field sterile                                                                                                                                                                                                                                                                                                                                          |                   |
| Using an <b>individually wrapped clinell wipe</b> , clean the area selected for catheter insertion thoroughly, for a minimum of 10 seconds and maximum of 20 seconds. NB: It is advised that a <b>single</b> application of antiseptic is to be applied only. If catheterisation is done via a limb, the assistant should hold the limb through the aperture while the skin is disinfected by the operator. The operator can then fully take over the holding of the baby's limb using sterile gauze, holding the area already disinfected, before cleaning the remainder of the limb. |                   |
| Allow the disinfected area to air dry completely (for at least 30 seconds) before proceeding with catheter insertion                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |
| Do <b>not</b> use sterile water to wipe off the disinfected skin area after application of antiseptic solution ( <b>unless</b> catheter insertion has been <b>unsuccessful</b> ), because this practice potentially negates the efficacy of the chlorhexidine antiseptic                                                                                                                                                                                                                                                                                                               |                   |
| Remove top pair of gloves and follow the Aseptic Catheter Insertion Technique as follows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |

**Aseptic Catheter Insertion Technique**

|                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Apply tourniquet to limb (if necessary) using gauze, or have an assistant (who would then also need to be surgically gowned) apply pressure above the sterile site if necessary. Anchor the vein by stretching the overlying skin with the thumb and fingers of the free hand. |
| Insert the split needle or appropriate cannula through the skin about 0.5-1cm distal to the intended vein at a low angle (15-30°). When flash back occurs advance chosen cannula/needle appropriately.                                                                         |
| Release the tourniquet (if used). Introduce the primed catheter through the needle/cannula using non-toothed forceps and advance percutaneous central venous catheter to the desired length.                                                                                   |
| Remove split needle carefully, ensuring the catheter does not move position.                                                                                                                                                                                                   |
| Secure the percutaneous central venous catheter in place using Steristrips. If any dried blood needs to be removed from the skin following line insertion, sterile water may be used sparingly for this purpose prior to applying the transparent dressing.                    |
| When the area is completely dry, apply a dressing to secure the PCVC in place.                                                                                                                                                                                                 |
| Attach infusion of saline as standard practice at 0.5 mL/hr until line position is confirmed.                                                                                                                                                                                  |
| Verify and document satisfactory catheter tip location via an x-ray. If catheter position needs to be adjusted following x-ray, use strict aseptic technique when making any adjustments, and ensure a                                                                         |

further check radiograph is obtained to document satisfactory position.

Complete Long Line insertion sticker in clinical notes (procedure sheet)

## Microsite MST (Micro-Seldinger Technique)

Additional steps for using MST to aid insertion in difficult cases. The MST allows the upsizing of a 24g needle to a 20g standard split needle. The technique must be used appropriately, trying technique in too small a vein is likely to tear vein. This is a guidewire based technique and it is vital that it is possible to grasp and remove wire at all times during procedure – a retained wire is a never event. In the case of retained wire follow same procedure to broken/retained catheter as detailed below.

|                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Apply tourniquet to limb (if necessary) using gauze, or have an assistant (who would then also need to be surgically gowned) apply pressure above the sterile site if necessary. Anchor the vein by stretching the overlying skin with the thumb and fingers of the free hand.                                     |
| Insert provided needle in MST kit or 24g cannula into desired blood vessel and remove stylet and tourniquet                                                                                                                                                                                                        |
| Thread wire provided through cannula/needle. Wire should pass easily, without resistance and move freely. If resistance is met, suggestive that cannula/wire not placed in vessel.                                                                                                                                 |
| Wire should be 2-4cm in to vessel (beyond cannula/needle)                                                                                                                                                                                                                                                          |
| Remove cannula/needle, ensuring wire does not move                                                                                                                                                                                                                                                                 |
| Thread dilator/split needle assembly over wire. Before inserting dilator assembly through skin the guidewire MUST be visible distal to the dilator assembly. In smaller vessels it may be necessary to do this in two stage to as to upsize vessel more gradually (inner dilator first followed by whole assembly) |
| During insertion of dilator assembly a gentle twisting motion may assist passage through the skin                                                                                                                                                                                                                  |
| Once dilator assembly is inserted (to similar distance as standard technique) guidewire should still move freely. Guidewire can be removed followed by inner dilator, leaving split needle in vessel. This will usually bleed back, but not always.                                                                |
| Primed longline catheter can now be passed in the standard manner.                                                                                                                                                                                                                                                 |

## Confirm Catheter Position

- Obtain an x-ray to confirm catheter tip location, using water soluble contrast (omnipaque).
- The catheter tip should ideally be located in the inferior or superior vena cava
- The position will need to be confirmed within 24 hours by a consultant (BAPM, 2015)
- Occasionally a sub-optimal position may be acceptable due to difficult access. This should be clarified by the consultant and used for a short period of time with close monitoring. This should be discussed with parent and nursing staff should be aware
- Document the procedure in the infant's notes (using a sticker if it is local practice) including any adjustments made. Clearly document if there are any deviations from optimal position (BAPM 2015)

## 7. Complications

### 7.1 Localised Skin Irritation

- 2% chlorhexidine in 70% isopropyl alcohol has been shown to cause skin damage/burns if used excessively.
- Use of Clinell wipes should minimise this risk as there should be no excess cleaning solution to pool.
- Daily skin integrity assessment at insertion site should be made whilst line is in situ

### 7.2 Infection

- Severity of illness, prematurity, postnatal age, poor skin integrity, multiple invasive procedures and length of time the lines are in-situ for all potentially increase the risk of infection
- Central catheters to be sited under strict aseptic conditions
- Good handwashing and non-touch technique maintained each time fluid is changed or drugs given (as per Catheter Care Bundle)
- Lines should be broken into as few times as possible

- Good practice is to remove the PICC line if infection suspected, however in some cases, it may be an option to treat with appropriate antibiotics without removal of the line
- In cases of recent sepsis wait at least 24 hours after removal of previously infected lines if possible

### 7.3 Catheter migration

- The catheter may have looped on insertion
- May have been inserted or migrate to the cardiac chambers, internal jugular vein, subclavian vein, ascending lumbar vein.
- Can cause pericardial effusion, pleural effusion, cardiac arrhythmias, tamponade, or cardiac perforation and tissue extravasation
- **Consider pericardial effusion/cardiac tamponade in any neonate who collapses with a long line/central venous catheter**
- Decision to remove line or re-position is based on the position of migration
- If the tip is in the heart the line must be pulled back to the optimum position and re-x-rayed prior to use
- The line may be pulled back and serve as a 'short' long line if looped in the jugular or brachiocephalic veins although there is more risk of fluid extravasation

### 7.4 Catheter Dysfunction

- Indicated by a rise in the pressures or inability to infuse fluid
- Due to malposition, fibrin clot, precipitate from infusate with high mineral content, drugs or lipid deposits
- Flexion of an extremity may also lead to temporary occlusion
- Check catheter fixation to ensure there are no kinks in the catheter
- Check the position of the catheter on X-ray -using contrast if necessary
- Consider flushing using aseptic technique to remove any blockage
- Consider line sepsis

### 7.5 Catheter Breakage

- The catheter may be punctured or even in rare cases severed by the introducer needle during insertion, snap because of excess tension on the external section of the catheter or rupture because of excessive pressure
- There is a risk of embolism formation from the internal section of the fractured catheter
- Do not move the limb excessively
- Secure the external portion of the catheter
- Apply pressure above the insertion site to prevent catheter advancing
- Contact Consultant Neonatologist urgently
- Consult with appropriate specialist if necessary e.g. Paediatric/Vascular Surgeon or Radiologist
- Keep parents informed and document actions in the notes

## 8. Documentation

When the catheter has had to be removed the reasons for removal and the duration that it has been in situ should be recorded in the notes.

## References

Clarke P, Craig JV, Wain J, et al: Safety and efficacy of 2% chlorhexidine gluconate aqueous versus 2% chlorhexidine gluconate in 70% isopropyl alcohol for skin disinfection prior to percutaneous central venous catheter insertion in preterm neonates: the ARCTIC randomised-controlled feasibility trial protocol: *BMJ Open* 2019;9:e028022. doi: 10.1136/bmjopen-2018-028022

BAPM (2015) Use of Central Venous Catheters in Neonates: A Framework for Practice, British Association of Perinatal Medicine,  
<http://www.bapm.org/publications/documents/guidelines/Use%20of%20Central%20Venous%20Catheters%20in%20neonates.pdf>

Beardsall K, White DK, Pinto EM, Kelsall AW. (2003) Pericardial effusion and cardiac tamponade as complications of neonatal long lines: are they really a problem? *Archives of Disease in Childhood Fetal and Neonatal Ed.* July;88(4):F292-5. [III]

Darling JC. et al (2001) Central venous catheter tip in the right atrium: a risk factor for neonatal cardiac tamponade. *Journal of Perinatology.* October- November;21(7):461-4

Evans M, Lentsch D. (1999) Percutaneously inserted polyurethane central catheters in the NICU: one unit's experience. *Neonatal Network.* September;18(6):37-46

Gladman G, Sinha S, Sims DG, Chiswick ML. (1990) Staphylococcus epidermis and retention of neonatal percutaneous central venous catheters. *Archives of Disease in Childhood.* February;65(2):234-5.

Gomella TL, Cunningham MD, Eyal FG. (1994) Ch 25. Venous Access. In *Neonatology 3<sup>rd</sup> Ed.* Prentice-Hall International, London

Gomella TL, Cunningham MD, Eyal FG., Zenk (2003) *Neonatology: Management, Procedures, On-Call Problems, Diseases and Drugs*, 5th Edition, McGraw-Hill Medical. New York

Herring, W. LearningRadiology [Online] Available at:  
<http://www.learningradiology.com/misc/whpage.htm>

Leipala JA, Petaja J, Fellman V. (2001) Perforation complications of percutaneous central venous catheters in very low birth weight infants. *Journal of Pediatrics & Child Health.* April;37(2):168-71

Levene MI, Tudhope D, Thearle J. (1987) Ch 17. Disorders of the Cardiovascular System. In *Essentials of Neonatal Medicine.* Blackwell Scientific. London

Fioravanti J, Buzzard CJ, Harris JP. (1998) Pericardial effusion and tamponade as a result of percutaneous silastic catheter use. *Neonatal Network.* August;17(5):39-42

Marx M. (1995) The management of difficult peripherally inserted central venous catheter line removal. *Journal of Intravenous Nursing.* September-October; 18(5):246-9.

Northern Ireland Adverse Incident Centre. (2001) Advice Notice - The use of central intravenous access in neonatal parenteral feeding

Rennie JM, Robertson NRC. (1999) *Textbook of Neonatology.* 3<sup>rd</sup> Ed. Churchill Livingstone. London

Rorke JM, Ramasethu J. (2002) Percutaneous central venous catheterisation Ch 31. In: MacDonald MG, Ramasathu J. *Procedures in Neonatology 3<sup>rd</sup> Ed.* Lippincott Williams & Wilkins. Philadelphia

Rubin LG, Sanchez PJ, Siegel J, Levine G et al. (2002) Evaluation and treatment of suspected late-onset sepsis: a survey of neonatologists' practice. *Pediatrics.* October;110(4):e42

Smiths Medical International. (2005) 27 GA Single Lumen Central Venous Catheter (Kids Cath Neo) July.

Trotter CW (1996) Percutaneous central venous catheter-related sepsis in the neonate: an analysis of the literature from 1990-1994. *Neonatal Network.* April;15(3):15-28

Trotter CW (1998) A national survey of percutaneous central venous catheter practices in neonates. *Neonatal Network.* 17 (6):31-37

## Exceptional Circumstances Form

Form to be completed in the **exceptional** circumstances that the Trust is not able to follow ODN approved guidelines.

|                                                          |                                                |
|----------------------------------------------------------|------------------------------------------------|
| Details of person completing the form:                   |                                                |
| Title:                                                   | Organisation:                                  |
| First name:                                              | Email contact address:                         |
| Surname:                                                 | Telephone contact number:                      |
| Title of document to be excepted from:                   |                                                |
| Rationale why Trust is unable to adhere to the document: |                                                |
| Signature of speciality Clinical Lead:                   | Signature of Trust Nursing / Medical Director: |
| Date:                                                    | Date:                                          |
| Hard Copy Received by ODN (date and sign):               | Date acknowledgement receipt sent out:         |

Please email form to: [mandybaker6@nhs.net](mailto:mandybaker6@nhs.net) requesting receipt. Send hard signed copy to: Mandy Baker

EOE ODN Executive Administrator Box 93  
Cambridge University Hospital Hills Road  
Cambridge CB2 0QQ