

Clinical Guideline: Percutaneous Central Venous Catheter (PCVC) Insertion In Neonates

1. Goal

- To achieve percutaneous central venous catheter (PCVC) access via peripheral route
- To achieve successful PCVC ('long line') insertion safely with minimal discomfort to the infant
- To ensure that the long line tip is placed at the correct level
- To minimise the risk of catheter-related 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, with the tip 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. The assistant may be a nurse or another medical practitioner/advanced neonatal nurse practitioner. The assistant should be present throughout the procedure and has a key role in observing/assuring aseptic technique, and in performing the check-list record for the insertion (Appendix 2).
- In cases of recent blood culture confirmed sepsis, it is recommended to wait at least 24 hours after removal of the suspected infected catheter if possible.
- Ensure the infant's 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- Looped catheters should usually be withdrawn due to the risk of migration.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.

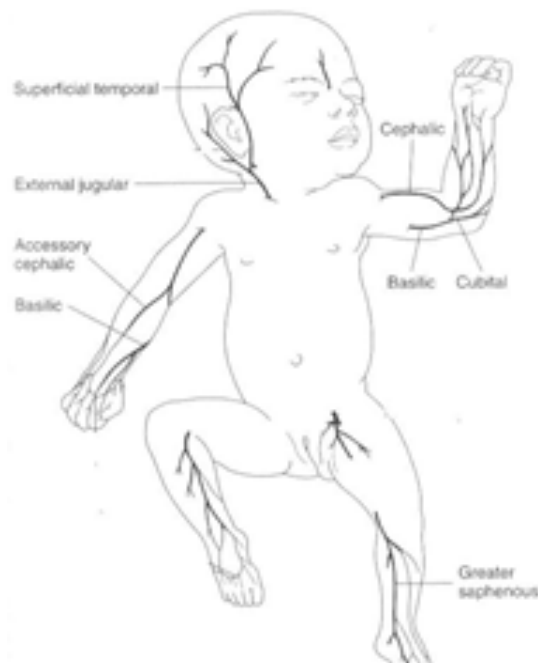
6. Method

Types of Long Line available

- Premicath 28G (1Fr)
- Vygon 24G (2Fr)
- Vygon Nutriline Twinflo 24g 30cm
- Other units may use different lines

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

Table 1. Patient position and measurement for Percutaneous catheter insertion¹

Site of insertion	Position of baby	Measurement
Antecubital veins	Supine, abduct arm at 90 ^o Turn head toward insertion site to prevent catheter travelling towards the head	Insertion site, along venous pathway to suprasternal notch, to 3 rd 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 rd right intercostal space

Equipment Required

- **Assistant**
- Percutaneous central venous catheter trolley
- Clinell wipes for surface cleaning
- IV Cut down set/longline pack
- Good source of light
- Minor ops towel pack/clear ops drape if using longline 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 disinfection (standard)*
- Sterile gauze – small and large
- Cavilon spray
- Steristrips (Size 6 mm x 38 mm)
- Transparent sterile dressing
- Desired Long line
- Sterile gloves x2 pairs

Rational Choice of Antiseptic

2% chlorhexidine gluconate and 70% isopropyl alcohol provides superior skin disinfection in adults compared with weaker chlorhexidine solutions. This combination antiseptic may also be used safely in preterm neonates providing it is used sparingly and care is taken to ensure that there is no prolonged contact of solution with the skin. Use of the small impregnated Clinell wipes (as used for peripheral venous cannulation) should minimise the risk of excess antiseptic application/contact.

*NB For extremely preterm infants (<26 weeks' gestation) who are aged under 48-72 hours postnatal at the time of planned PCVC insertion, the risk of chemical skin injury is probably greater and it would be reasonable in such circumstances to use a weaker concentration chlorhexidine solution instead, e.g. Unisept (0.05% w/v chlorhexidine gluconate solution) or Tisept (equivalent to chlorhexidine gluconate 0.015% w/v; Cetrimide 0.15% w/v).

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 adherence to aseptic technique.

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.
Assistant 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 <u>sterile gown and double gloves</u> , 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. DO NOT cut the catheter to alter the length.
Assistant to open and offer 1 or 2 (depending on the size of the area subject to cleaning) individually wrapped antiseptic Clinell wipes (2% chlorhexidine in 70% isopropyl alcohol) to the operator for them to take and place onto the sterile field. (NB Consider using a weaker antiseptic solution instead, only if baby <26 weeks gestation and aged <72 hours postnatal at the time of catheterisation) .
Assistant to position the infant to facilitate insertion, ensuring that comfort measures and any pain medication is provided.
With assistant's help, position the drape 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 the clinell wipe, clean the area selected for catheter insertion thoroughly, for a minimum of 10 seconds and maximum of 20 seconds. NB: It is important that there is only a single application of antiseptic made to the skin area, to minimise the risk of chemical skin injury from the antiseptic solution. 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 not use sterile water to wipe off the disinfected skin area after application of antiseptic solution (unless catheter insertion has been unsuccessful), because this practice potentially negates the longer term 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.
Apply Cavilon to skin (if <28 weeks gestation) by holding the bottle 10-15cm above the site and apply an even application to prevent skin damage from the adhesive dressings. Allow 30 seconds to dry. Ensure the bottle is cleaned before and after use.
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. Remove stylet if Vygon Nutriline Twinflo used.
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 should move freely. If resistance is met, this is suggestive that the cannula/wire is not properly placed in vessel.
Wire should be 2-4cm in to vessel (beyond cannula/needle)
Remove cannula/needle, carefully ensuring that the wire does not move
Thread dilator/split needle assembly over the 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 stages so 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 is then 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 following which the split needle is removed and catheter secured.

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 considered 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)

- A repeat radiograph must always be done to check line tip position following any adjustment to the catheter – no exceptions

7. Complications

7.1 Localised Skin Irritation

- 2% chlorhexidine in 70% isopropyl alcohol may cause chemical skin injury if used excessively
- Use of Clinell wipes should minimise this risk as there should be no excess cleaning solution to pool.
- Consider use of a weaker chlorhexidine solution only if gestation <26 weeks and infant aged <72hours postnatal at time of catheterisation (see notes above)
- Use Cavilon spray on skin of all neonates <28 weeks prior to securing dressing
- Daily skin integrity assessment at insertion site should be made and documented while the line is in situ

7.2 Infection

- Severity of illness, prematurity, postnatal age, poor skin integrity, multiple invasive procedures, inferior antiseptics, and length of time the line is in-situ 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 PCVC line if infection is suspected, however in some cases, it may be decided 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 before attempting a new line insertion

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
- **Always consider the possibility of pericardial effusion/cardiac tamponade in any neonate with a long line/central venous catheter in-situ who collapses unexpectedly**
- 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 is removed, the reasons for removal and the date/time of removal should be recorded in the case notes. The completed checklist (Appendix 2) must be completed by the assistant in all cases, and must clearly document their name and the name of the operator
- Audit of catheter-associated bloodstream infection is an ongoing audit for all centres as part of the National Neonatal Audit Programme
- Adherence to this guideline will be audited from review of completed catheter insertion checklists, and there should be particular scrutiny of checklists for cases of catheter-related infection

References

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Exceptional Circumstances Form

(Appendix 1)

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 requesting receipt. Send hard signed copy to: Mandy Baker

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

Patient ID label

Clinical Guideline: Insertion of a Percutaneous Central Venous Catheter (PCVC)

Appendix 2 – Assistant to complete, print and file in baby’s case notes.

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	
Assistant to damp dust 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. DO NOT cut the catheter to alter the length	
Assistant to open and offer 1 or 2 (depending on the size of the area subject to cleaning) individually wrapped antiseptic Clinell wipes (2% chlorhexidine in 70% isopropyl alcohol) to the operator for them to take and place onto the sterile field. (NB Consider using a weaker antiseptic solution instead, only if baby <26 weeks’ gestation <i>and</i> aged <72 hours postnatal at the time of catheterisation)	
Assistant to position the infant to facilitate insertion, ensuring that comfort measures and any pain medication is provided	
With assistant’s help, position the drape 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 the Clinell wipe , clean the area selected for catheter insertion thoroughly, for a minimum of 10 seconds and maximum of 20 seconds. NB: It is important that there is only a single application of antiseptic made to the skin area, to minimise the risk of chemical skin injury from the antiseptic solution. If catheterisation is done via a limb, 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 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 not use sterile water to wipe off the disinfected skin area after application of antiseptic solution (unless catheter insertion has been unsuccessful), because this practice potentially negates the efficacy of the chlorhexidine antiseptic	
Remove top pair of gloves and follow the Aseptic Catheter Insertion Technique as described in guideline	
Ensure Cavilon in applied to skin (if <28 weeks gestation) by holding the bottle 10-15cm above the site and apply an even application to prevent skin damage from the adhesive dressings. Allow 30 seconds to dry. Ensure the bottle is cleaned before and after use.	
X-ray with contrast to confirm Line tip position	
Document line insertion on procedure sheet with sticker.	

Date: Time:.....

Operator (Sign and Print name):
Assistant: (Sign and Print name)