East of England Neonatal ODN
(Hosted by Cambridge University Hospitals)

Clinical Guideline: Long Line Insertion

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

Used by: Doctors, ANNPs, Nurses

Key Words: Long Line, PCC, PCVC, Catheters

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Approved by:

Neonatal Clinical Oversight Group	
Clinical Lead Matthew James	**Sajeev Job**

Ratified by ODN Board:

Date of meeting	

Audit Standards:

Audit points

The completed checklist (Appendix 1) 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

1. Background

PCVC's 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. PCVC's are an essential part of neonatal care allowing delivery of intravenous fluids and medications. However, their use is associated with a number of complications, some of which can be fatal. It is therefore vital that PCVC's are only used: i) in infants who really require them; ii) where the person inserting and looking after the infant with a PCVC is competent and aware of the associated complications; and iii) when correct safety measures are taken to reduce the risk of complications during and following the insertion of the PCVC. The British Association for Perinatal Medicine (BAPM) published a framework for practice to reduce harm and improve safety in babies needing PCVC following several case reports of fatal CVC-associated extravasation. Practice points highlighted by the BAPM framework therefore been incorporated within this guideline.

2. Objectives

- 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.

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. Key Notes

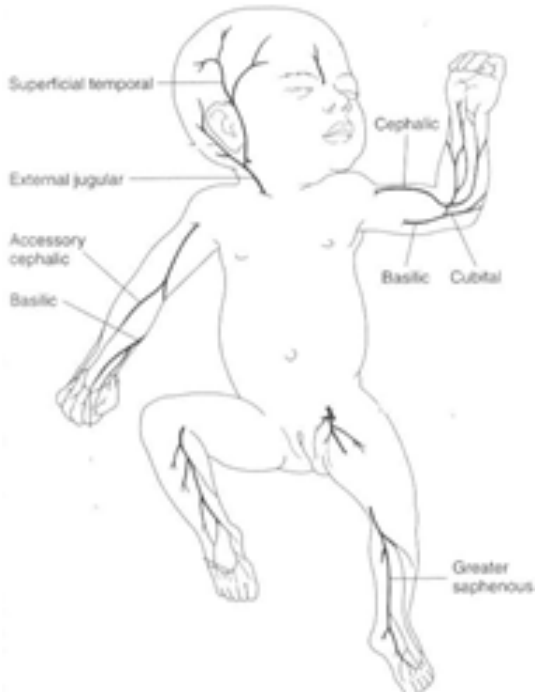
- In any infant who collapses with a long line in situ, it is critical to urgently exclude cardiac tamponade as a cause of the collapse.
- All health professionals who insert PCVC's should have undertaken a formal training package for insertion of catheters which should include an assessment of technical competence and awareness of potential complications.
- Staff who insert central catheters also have a responsibility to ensure they maintain their competence and should be familiar with the equipment and procedures used for catheter insertion in that setting.

- 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 before inserting another.
- 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.
- All catheter tips should be positioned outside the cardiac silhouette. 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.
- Resistance encountered during the insertion long line often indicates malposition, the catheter should be withdrawn to a point at which it freely aspirates blood, it should then be secured and an X-ray performed to determine tip position.
- 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
- Where there are delays in confirmation of central lines, consider inserting a peripheral venous line or using the long line to administer 10% dextrose and antibiotics, if required.

5. 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 insertion[1]		
Site of insertion	**Position of baby**	**Measurement**
Antecubital veins	Supine, abduct arm at 90^0 Turn head toward insertion site to prevent catheter travelling towards the head	Insertion site, along venous pathway to suprasternal notch, to 3rd 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 3rd right intercostal space

Equipment Required

- **Assistant**
- Percutaneous central venous catheter trolley
- Disinfectant 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
- Antiseptic Solution*
- Sterile gauze – small and large
- Cavilon spray
- Steristrips (Size 6 mm x 38 mm)
- Transparent sterile dressing
- Desired Long line
- Sterile gloves x2 pairs

***Choice of Antiseptic Skin Cleanser**

BAPM together with the Neonatal & Paediatric Pharmacists Group (NPPG, 2021) released a position statement in response to antiseptic skin cleansing use in neonates due to reported burn injuries seen in this population. The advice is as follows:

- In babies born before 34 weeks' gestation and who are under 7 days old, use aqueous solution of 0.5% chlorhexidine gluconate for skin preparation.
- In babies born from 34 weeks' gestation onwards and for those babies born before 34 weeks' gestation who are now 7 days or older, use a solution of 2% chlorhexidine in isopropyl alcohol for skin preparation.
- Irrespective of the skin preparation solution used, it is critical to avoid pooling on the skin and surfaces (such as incubator or cot sheets) which may come into contact with the baby's skin. For this reason, the use of an applicator device is recommended wherever possible

Prior to the Procedure

- In each situation where a central catheter is required, an assessment should be made as to who is the most appropriate person to undertake the procedure.
- Unless urgent access is required when the parents are unavailable, the parents should be informed about the procedure prior to placing a long line. They should be informed about the reasons for insertion and given information about the potential hazards (see below), noting that the long line is necessary for optimal clinical care. Ideally a parent information leaflet should be given in addition to verbal information. Formal consent is not required.
- If poor perfusion is noted before the procedure, it may be necessary to correct this prior to line insertion.
- It is appropriate to correct any significant coagulopathy before commencing the procedure however there is no requirement to routinely check FBC and coagulation profile if there is no evidence of a bleeding tendency.
- Consider platelet transfusion before the line is placed, particularly if the platelet count is <50 or there is evidence of excess bleeding from venepuncture sites
- If the infant is known, or strongly suspected to be septic, it may be wise to delay the placement of a long line until the sepsis is under control. Long lines may easily become colonised with micro-organisms which may then prove difficult to eradicate whilst the line remains in situ.
- Examine the infant to identify a suitable vein (See Fig.1)
- 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
- 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.

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 disinfectant wipe.
Re-wash hands, clean trolley with disinfectant 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 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 aseptic skin cleanser* 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 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.
ecure 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 into 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.

Instability during insertion

Physiological instability can occur during invasive procedures:

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

Confirmation of Catheter Position

- Obtain an x-ray to confirm catheter tip location. Consider using water soluble contrast (Omnipaque) for Premi-caths.
- The tip of upper limb PCVC should ideally lie in the superior vena cava, with the relevant arm positioned perpendicular to the chest wall when the check radiograph is taken. For lower limb-inserted PCVC, the tip should ideally be in the inferior vena cava above L4-L5 level, and the possibility of malposition in an ascending lumbar vein requires specific consideration.
- All central catheters should allow aspiration of blood in their final position, and this aspiration should be documented. Where aspiration is not possible, operators should be aware that this may indicate a malpositioned catheter.
- There should be thorough contemporaneous documentation of each central catheter insertion including indication, description of the catheter itself, number of attempts, length inserted, position on X-ray, and any adjustments subsequently made (See appendix 2 sticker example).
- The accepted position should be verified in writing within 24 hours of insertion by a consultant neonatologist/paediatrician or from a radiologist's report.
- A repeat radiograph must always be done to check line tip position following any adjustment to the catheter – no exceptions
- Occasionally a sub-optimal position may be considered acceptable due to difficult access. This should be agreed 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.

6. Complications

Localised Skin Irritation

Chemical skin burns have been reported where aseptic skin cleanser is used excessively whilst inserting a PCVC. An applicator device and dabbing technique is recommended to prevent pooling of the aseptic skin cleanser which increases the risk of chemical burns. BAPM & NNPPG (2021) has written a position statement for the use antiseptic cleansers in different gestation infants. This can be found earlier in this guideline and a link to this statement can be found in the reference list.

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

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. Echo-cardiogram may also be used, if the operator is appropriately trained and skilled.
- 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

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

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

7. On-going Care of Central Catheters

- The need for continued retention/use of a central catheter should be reviewed daily.
- A regular review of catheter fixation and position should be conducted. Documentation of the integrity of the dressing and insertion site should also include the location of the catheter tip, particularly for shorter-than-ideal catheter insertion lengths.
- Any clinical deterioration of a baby in whom a central venous catheter is present should raise the question of catheter-related complications, particularly infection, extravasation, and tamponade.

8. Removal of Longlines

- Removal of longlines must be discussed and agreed with the medical team.
- A line will not usually be removed unless it is no longer required, as it is difficult and uncomfortable to site a new one. Typically, a baby will have achieved full feeds or be very close to this point (100mls/kg/day).
- On some occasions, a line will need to be removed because the baby has an infection, and the line is thought to be the source. Consider sending the catheter tip to microbiology if infection is suspected.
- Longlines should only be removed by a nurse or doctor trained and competent in doing so, as neonatal longlines have a high risk of breaking or snapping during removal.
- The catheter should be removed in small stages, approximately 1cm at a time, with pauses in between, and no pressure should be applied at the insertion site.
- Steady and gentle traction should be used, starting at the insertion site.
- The procedure should be documented in the infant's medical records, including a statement confirming that the catheter length was checked at the time of removal to ensure complete extraction, the reasons for removal, and the date/time of removal

9. References

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Patient ID label

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

Appendix 1 – 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 disinfectant wipe	
Re-wash hands, clean trolley with disinfectant 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 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 **antiseptic skin cleanser***, 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 is 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 +/- 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)
……

Appendix 2: Example of insertion sticker record

Blood aspirated:
Y/N

<table>
<tr><td colspan="5">Parental discussion by (print name and position):

Date:</td></tr>
<tr><td>Type:</td><td>UVC</td><td>UAC</td><td>Long line</td><td rowspan="3">Entry site:

Date and time of insertion:</td><td rowspan="3">Length inserted:</td></tr>
<tr><td>Size:</td><td></td><td></td><td></td></tr>
<tr><td>Inserted by:</td><td></td><td></td><td></td></tr>
<tr><td colspan="4"><u>Operator</u> review of line
Name</td><td>Anatomical position of tip
Date and time of review:</td><td>Line adjusted?:</td></tr>
<tr><td colspan="4"><u>Consultant</u> review of line
Name</td><td>Anatomical position of tip
Date and time of review:</td><td>Line adjusted?:</td></tr>
<tr><td colspan="5">Line tip position as stated on radiology report:
Date radiology report reviewed:</td><td>Line adjusted?:</td></tr>
<tr><td colspan="3">Date line removed:</td><td colspan="3">Reason for removal:</td></tr>
</table>

East of England Neonatal ODN
(Hosted by Cambridge University Hospitals)

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: Date:	Signature of Trust Nursing / Medical Director: Date:
Hard Copy Received by ODN (date and sign):	Date acknowledgement receipt sent out:

Please email form to: kelly.hart5@nhs.net requesting receipt.

Send hard signed copy to:

Kelly Hart
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Box 402
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Robinson Way
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Cambridge CB2 0SW