Yorkshire and Humber Neonatal ODN (South) Clinical Guideline

Title: Long line - indications, insertion, accessing, care of

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Review date: March 2019

This clinical guideline has been developed to ensure appropriate evidence based standards of care throughout the Yorkshire and Humber Neonatal ODN (south). The appropriate use and interpretation of this guideline in providing clinical care remains the responsibility of the individual clinician. If there is any doubt discuss with a senior colleague.

Best practice recommendations represent widely used evidence-based practice and high quality standards that all Neonatal Units across the Network should implement. Subsequent suggested recommendations may be put into practice in local units. However, alternative appropriate local guidelines may also exist.

A. Summary page

1. Aim of guideline
This guideline is to ensure safe insertion and maintenance of percutaneous long lines while minimising complications.

2. Summary

Insertion
- This should be using an aseptic technique
- Consideration should be given to the use of an insertion checklist
- The tip of the long line should not lie within the heart

Dressing
- Lines should be dressed appropriately
- Weekly routine dressing changes, and also if the dressing is not intact

Accessing
- Lines should be accessed as little as possible to minimise infection
- When accessed, a full aseptic technique should be used

Removal
- Consider early removal to minimise infection risk (at 120ml/kg/day feed)
B. Full guideline

1. Background
Percutaneous long lines are used extensively in neonatal medicine as a means of central access for infusions and drugs.

2. Aim
To ensure safe insertion and maintenance of percutaneous long lines and minimise risk of complications including infection.

3. Areas outside remit
This guideline does not include surgical lines (e.g. Broviac lines) or umbilical lines (arterial or venous) - see relevant guideline.

4. Guideline:

4.1 Insertion of long line

Indications for insertion of percutaneous long line:

- Need for central access to administer infusions that need to be given centrally eg inotropes
- Need for TPN ie infants who will not achieve full feeds in 5 days (see guideline feeding-initiation of feeds for preterm infants). In general these are infants <1250g (as per guideline)
- Need for long standing IV access when repeated cannulation is thought to be difficult

4.2 Method of insertion

This should be done in a strict aseptic technique.

The sterile procedure should include wearing a gown and double gloves. The area around the procedure trolley should be kept as clear from traffic as possible eg by using screens. This zone should not be entered by personnel not assisting with the procedure.

An assistant is required to prepare the equipment and in draping the infant. They also may be required to provide comfort to the infant during the procedure. An assistant is required for dressing the line (see Dressing). The site for insertion should be cleaned using an appropriate skin cleanser. If insertion is not possible on the limb chosen, the procedure should be repeated, with new sterile gloves and new sterile drapes. Handling of the line should be kept to a minimum. The largest bore line possible should be inserted into the infant.

Recent “care bundles” have encouraged the use of “insertion checklists” to ensure standard use of aseptic techniques and allow the procedure to be stopped if this is not followed. These care bundles have been associated with a significant reduction in long line infections and the associated morbidity (see appendix 1)
4.3 Location

Percutaneous long lines ideally should lie in the superior vena cava if inserted in the upper limb or scalp, and the inferior vena cava if inserted in the lower limb. The tip must not lie within the heart as per the department of health guidance to reduce the risk of pericardial extravasation and tamponade. For lines inserted in the upper limb, it should be kept at 90 degrees to the chest. All long lines should be re-xrayed after withdrawal if the line tip has been seen to lie within the cardiac silhouette.

Occasionally it will be necessary to leave a line in the subclavian or femoral vein, especially if access has been difficult. The main complication that may occur here is venous obstruction which can be treated with removal of the line. See appendix 3 for xray examples.

Lines that take an unusual course should be reviewed by a senior doctor and consideration of further xray views taken. At times, the very fine lines can be accidentally inserted into small vessels which are more prone to extravasation eg the lumbar vein resulting in intrathecal extravasation. Lateral xrays or horizontal beam may be of use to help in localising lines further.

Visualisation of tip position of percutaneously inserted central venous catheters (PCVCs) using a plain X-ray horizontal beam technique:
(A) proper positioning of patient and film plate; (B) correctly positioned PCVC in the inferior vena cava (in front of the vertebral bodies); (C) malpositioned PCVC in the ascending lumbar vein (projecting over the spinal canal); (D) malpositioned PCVC in the inferior epigastric vein (projecting over the anterior abdominal wall).
4.4 Dressing the line

The line should be dressed in an aseptic manner, using 2 operators. The dressing must:
- Protect the limb (eg use of gauze under hub)
- Fully cover the line
- Not encircle the limb
- Be clean and intact (ie no visible blood on dressing)

The dressing should be inspected daily as part of routine nursing line checks. If the dressing is not intact, eg visible blood, peeling dressing, or line not covered, it should be replaced. Consideration should be taken to redressing the line every 7 days. 1, 5

Redressing the line is a 2 person procedure, under aseptic precautions.

4.5 Accessing the long line

Long line infections are a very significant cause of morbidity and mortality. Repeated accessing of lines increases the chances of infection therefore must be minimised. Lines can be used for the following infusions/drugs only. Any deviation from this MUST be made by a senior clinician. 6

<table>
<thead>
<tr>
<th>MUST be given centrally (Long line or UVC)</th>
<th>CAN be given via long line routinely</th>
<th>CANNOT be given by long line as they will block lumen. (but CAN go via UVC/broviac line)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;12.5% dextrose infusion</td>
<td>Adrenaline infusion (standard)</td>
<td>Cryoprecipitate</td>
</tr>
<tr>
<td>Adrenaline infusion (Concentrated)</td>
<td>Alprostadil</td>
<td>Fresh frozen plasma</td>
</tr>
<tr>
<td>Dopamine (concentrated)</td>
<td>Atracurium infusion</td>
<td>Packed red blood cells</td>
</tr>
<tr>
<td>Concentrated &quot;central&quot; PN*</td>
<td>Calcium chloride#</td>
<td>Platelets</td>
</tr>
<tr>
<td></td>
<td>Dextrose infusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dobutamine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dopamine (standard)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fentanyl infusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insulin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Isoprenaline infusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lidocaine infusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Morphine infusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potassium chloride</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sodium bicarbonate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TPN</td>
<td></td>
</tr>
</tbody>
</table>

*peripheral PN may be used peripherally. This has a glucose concentration of no more than 12.5% and no calcium or phosphate added.

#calcium infusions can be given peripherally under the following conditions (as per BNFc): 0.5mL/kg of calcium gluconate can be given over 5 to 10 mins as a single dose for urgent correction, but for infusion recommends a concentration of at least 45 micromols in 1mL, for neonates infused at 22 micromols/kg/hr.
Accessing the line must be by using an aseptic technique such as the following procedure:

This is a two person procedure
- Clean trolley and allow to dry and consider creating a sterile zone with screens
- Assemble all equipment on trolley using a non-touch technique
- Wash and dry hands with sterile towel
- Apply sterile gloves
- Open incubator doors using elbow technique
- Clean long line port using friction for 15 seconds and allow to dry for 30 seconds
- Draw up flush using a filter needle
- Access long line
- If contamination of gloves/equipment occurs change appropriately

4.6 Removal of long line

To minimise infection risks, the line should be removed once the infant is receiving 120ml/kg/day of feeds.

Post operative surgical babies may not tolerate /absorb feeds; therefore the line may be needed for longer in this group.

4.7 Complications

4.7.1 Infection

This is the most common complication. The risk can be minimised by the use of full aseptic technique. Treatment is as per infection guidelines, guided by the organism causing the infection. Line removal may be required.

4.7.2 Thrombosis

This can be commonly seen with percutaneous long lines, however is rarely symptomatic. This should be discussed with a haematologist on a case by case basis.

Line removal is recommended, however 3-5 days of anticoagulation is recommended prior to line removal to reduce the risk of paradoxical emboli.

**Asymptomatic** Following line removal, radiological monitoring with anticoagulation for 6-12 weeks if extension of thrombosis occurs. If line removal is not possible, consider anticoagulation however radiological monitoring may be appropriate with treatment if clot extension occurs.

**Symptomatic** Following line removal, anticoagulation for 6-12 weeks. If line removal is not possible, anticoagulation is recommended at least until the line is removed.

Anticoagulation/Thrombolysis

There is minimal evidence to support dosage regimes. Neonates, especially preterm infants have different levels of all elements of the haemostatic pathway leading to challenges in monitoring and dosages.
**Low molecular weight heparin**
Due to the reduced monitoring requirement and lack of interference by drugs, LMWH is often used provided it is unlikely that an urgent invasive procedure is required and bleeding risk is low since the half-life of LMWH is several hours. LMWH should be avoided in renal impairment.

The usual recommended starting dose of Enoxaparin for a neonate is 1.5mg/kg/dose twice daily subcutaneously with subsequent dose adjustment based on anti-Xa levels (aim for 0.5-1.0 units/ml 4 hours post dose). Often higher doses are required to achieve this therapeutic range, especially in premature infants. A suggested dose adjustment regime is as below

<table>
<thead>
<tr>
<th>Anti-factor Xa level (U/mL)</th>
<th>Dosage adjustment</th>
<th>Next anti-factor Xa level</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.35</td>
<td>Increase next dose by 25%</td>
<td>Following day, 4 hr following adjusted dose</td>
</tr>
<tr>
<td>0.35-0.49</td>
<td>Increase next dose by 10%</td>
<td>In 1-2 days 4 hr following adjusted dose</td>
</tr>
<tr>
<td>0.50-1</td>
<td>No change</td>
<td>Weekly levels whilst an inpatient, 4 hr following a dose. If change in renal function, addition of antibiotics, signs of bleeding, check level 4 hr after next dose</td>
</tr>
<tr>
<td>1.1-1.5</td>
<td>Reduce next dose by 20%</td>
<td>4 hr following next adjusted dose</td>
</tr>
<tr>
<td>1.6-2</td>
<td>Delay next dose by 3hrs and reduce dose by 30%</td>
<td>Consider trough level before next dose (see below). Check level 4 hr following dosage adjustment</td>
</tr>
<tr>
<td>&gt;2</td>
<td>Withhold dose until anti-factor Xa level &lt;0.5, then reduce next dose by 40%</td>
<td>Every 12 hr until anti-factor Xa level &lt;0.5, then 4 hr following reinstitution of therapy</td>
</tr>
</tbody>
</table>

In the event of overdose or need for reversal discuss with a haematologist, Protamine can be used but does not achieve complete reversal of LMWH.

**Unfractionated heparin (UFH)**
This may be considered if invasive procedures are felt to be likely or there is a significant concern regarding haemorrhage, as it has a short half-life and can be more easily reversed. UFH is also recommended over LMWH if there is renal impairment. Otherwise LMW heparin is the drug of choice for anticoagulation.

Again there is limited evidence of dosages but BNFc suggests:
- **Loading dose of 75units/kg with a lower dose of 50units/kg for infants <35 weeks corrected gestational age.** The loading dose should be omitted if there are significant haemorrhagic concerns
- **Maintenance infusion of 25units/kg/hour**, adjusted to anti-Xa levels

Due to limitations in APTT monitoring and confusion regarding “normal ranges” in neonates, heparin therapy should also be monitored by anti-Xa levels with a target of 0.35-0.7U/ml (note different to LMW range). See table below for suggested adjustments

<table>
<thead>
<tr>
<th>aPTT ratio</th>
<th>Anti-Xa</th>
<th>Bolus (units/kg)</th>
<th>Hold (mins)</th>
<th>Rate change</th>
<th>Repeat aPTT</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1.2</td>
<td>≤0.1</td>
<td>50</td>
<td>0</td>
<td>Increase 10-20%</td>
<td>4 hours</td>
</tr>
<tr>
<td>1.2-1.4</td>
<td>0.2</td>
<td>0</td>
<td>0</td>
<td>Increase 10%</td>
<td>4 hours</td>
</tr>
<tr>
<td>1.5-2.5</td>
<td>0.3-0.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4 hours until 2 in range, then daily</td>
</tr>
<tr>
<td>2.6-3.2</td>
<td>0.8-0.9</td>
<td>0</td>
<td>0</td>
<td>Decrease 10%</td>
<td>6 hours</td>
</tr>
<tr>
<td>3.3-4.0</td>
<td>1.0-1.1</td>
<td>0</td>
<td>30-60 mins</td>
<td>Decrease 10-20%</td>
<td>6 hours</td>
</tr>
<tr>
<td>≥4.1</td>
<td>≥1.2</td>
<td>0</td>
<td>60-120 mins until aPTT ratio &lt;3.5</td>
<td>Decrease 15-30%</td>
<td>6 hours after restart of infusion</td>
</tr>
</tbody>
</table>

In the event of overdose or need for reversal stop the heparin infusion and discuss with a hematologist.
4.7.3 Cardiac tamponade

This is a rare but clearly described complication of percutaneous central lines. It most commonly occurs in lines sited within the cardiac silhouette. It should be considered in any infant with a central line who undergoes unexplained cardiorespiratory collapse. Diagnosis is by echocardiography if the expertise is available. Treatment is emergency cardiac paracentesis with aspiration of the effusion.

5. Minimum standards

A guideline should be available for the insertion, accessing and care of percutaneous long lines.

6. Audit criteria

- Long line infection rate (expressed as infections/1000 line days)
- Long line insertion checklist completion
- Use of long lines (indications, length of time of use)
- Complications of long lines (eg extravasation)
7. References

1. Patient safety first - matching Michigan

2. Department of health guidance for percutaneous long lines

3. Roberton’s textbook of neonatology. Publisher; Elsevier 2005


5. Reducing acquired infections in the NICU: Observing and Implementing Meaningful Difference in Process between high and low acquired infection rate centres. Bloom et Al J Perinatol 2003;23;489-492


12. British national formulary for Children
Appendix 1

Central line insertion checklist

Please complete this checklist during every line insertion.
If a second operator is used, a new cut down set and checklist should be used.
If one of the criteria is not achieved please either
Correct the error
OR Stop the procedure

NB THIS LIST NEEDS TO BE COMPLETED DURING THE PROCEDURE
Time procedure started (ie incubator entered)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Achieved?</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean trolley and allow to dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawers NOT used during procedure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wash hands and forearms for 2 minutes. Dry with sterile towel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gown put on without contamination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 pairs of sterile gloves put on without contamination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment and incubator port holes opened by assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Sterile zone” created with screens around trolley</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area DABBED with chloraprep sponge and allowed to dry.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drapes applied without contamination of sterile field/gloves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For infants both &lt;28 weeks AND &lt;7 days, cleaning fluid washed off after 1 minute</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used equipment discarded, NOT placed on sterile field</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top layer of gloves removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wee light, if used, placed in sterile glove</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriately completes procedure without contamination of the sterile field, equipment and gloves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>De-scrubs and rescrubs if leaves sterile “zone”, eg while waiting/reviewing xray</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line dressed appropriately ie for long lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2 person technique</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dressing not encircling limb,</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dressing covering line and steristrips</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dressing clean</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assistant wears <strong>sterile gown</strong> and gloves during dressing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If site changed, NEW drapes and gloves used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line flushed with 10ml syringe only (not smaller)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes equipment, gloves or gown if contamination occurs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safe disposal of sharps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completion of instrument checklist (by nurse assistant)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Time procedure completed (awaiting xray)
Time all complete (adjustments following xray)

PTO
Line type (tick box)  UAC □  UVC □  Longline □

Line inserted by…………………………

Checklist completed by ……………

Date/Time ..............................

Attach cut down set sticker here:

Line type (and sticker):

Length inserted to:

Xray position:

Readjusted? Please document final length if moved.

Repeat xray (if needed)- result:

Line position checked:

Name  Date/time
What is an Umbilical Arterial Catheter (UAC)?
A UAC is a special line which is sited through an artery in your baby's umbilical cord. A UAC is very useful for taking blood samples and monitoring your baby's blood pressure.

What is an Umbilical Venous Catheter (UVC)?
A UVC is a special line which is sited through a vein in your baby's umbilical cord. A UVC is useful for giving your baby fluids or medication.

What is a long line?
A long line is a thin catheter which either goes into a vein in your baby's arm, leg or neck. Longlines are helpful to administer total parenteral nutrition (TPN). TPN is intravenous feeding and is usually used when babies are unable to tolerate feeding into the stomach. Medication can also be given through a longline.

How are these lines inserted?
All the above lines are inserted under sterile conditions on the Neonatal Unit. It is extremely important to ensure they are in the correct place. Your baby will therefore have an x-ray to check their position after they have been inserted. In order to reduce the risk of clots forming a drug called Heparin, which helps keep the blood thin, may also be passed through the lines.

How long do the lines remain in for?
The insertion of lines into your baby can carry risks, therefore in order to reduce these risks and the chances of complications the lines will be taken out as soon as they are no longer needed. Nursing or medical staff will keep you updated.

What are the benefits?
All of the lines are invaluable in the management of sick babies. The UAC/UVC lines reduce the need to handle poorly babies. They also reduce the need for repeated pricking of your baby with needles so that blood samples can be taken or medication given.

If your baby is receiving TPN via a longline this will help your baby receive the calories they need to help them grow.

What are the risks?
There is a risk of complications; however medical/nursing staff will discuss these risks with you explaining the complications against the need for ensuring your baby receives the appropriate care and treatment.
Below are some of the known complications:

- Infection
- Clot formation with the possibility of the clot being carried to other areas in the body.
- Migration – the line extending to beyond where it was thought to be
- Reduced blood supply to the intestines
- Artery spasm with discoloration of the skin of toes.
- Cardiac tamponade (perforation of the heart muscle with fluid in the sac around the heart).

Staff will carry out regular inspections of the site of the lines and if necessary the lines will be removed.

**Are there any alternatives?**

There are currently no alternatives. If you are concerned about lines being inserted please discuss your concerns with medical or nursing staff.

**Additional Information**

If you require any additional information please do not hesitate to speak to a member of medical or nursing staff on the Neonatal Unit.

**Concerns and Queries**

If you have any concerns/queries about any of the services offered by the Trust, in the first instance, please speak to the person providing your care.

Review Period: May 2019
Author: Consultant Paediatric Lead Neonatal Unit
Lower limb

Ideal position - IVC, avoiding renal vein (L2/3)
Acceptable position - external iliac vein

Note lines taking unusual course or with kinks/curves at the end must be reviewed by a senior doctor. Consider lateral or horizontal images for further information.

In emergency situations other positions may be used (document reason in notes).

Lines sitting within the cardiac silhouette MUST be re-xrayed following repositioning.
Upper limb

Image with arm at 90° to chest

Ideal position - SVC
Acceptable position - subclavian/brachiocephalic vein
Within cardiac silhouette is unacceptable - a repeat x-ray MUST be performed following repositioning

Note lines taking unusual course or with kinks/curves at the end must be reviewed by a senior doctor. Consider lateral or horizontal images for further information
In emergency situations other positions may be used (document reason in notes)