Peripherally Inserted Central Catheters

Introduction

Prolonged central venous access is necessary in the very low birth weight infant to facilitate adequate nutrition prior to the establishment of full enteral feeds.\textsuperscript{1} The technique involves percutaneous placement into a peripheral vein of a small diameter silicone or polyurethane central venous catheter. The main benefits over peripheral cannulae are improved nutrient input,\textsuperscript{1} decreased phlebitis\textsuperscript{2} and reduced attempts at venous access per baby.\textsuperscript{1} To date there are no trials comparing PICC lines with umbilical venous lines in newborn infants.

RPA NICU practice is to place an umbilical venous line for the first 7 days followed by a PICC line for infants with continued need for total parenteral nutrition. The PICC line should be inserted before removal of the UVC – it is reasonable to leave the UVC in for a longer period if there is difficulty in placing the PICC line.\textsuperscript{3}

Possible complications:

In a large observational study of PICC lines,\textsuperscript{4} only 1 case of pericardial effusion, non-lethal, was seen in 2186 catheters (catheter shown to be incorrectly positioned). Septicaemia occurred in association with 5.3% of catheters. Infection risks are greatest with the smallest babies. The use of percutaneous inserted central venous catheters is safe, in a unit where strict management guidelines are followed, including the demonstration of catheter tip position radiographically, or by ultrasound or contrast radiography if there is any doubt. Other reported reasons for line removal included:

- Local oedema / infiltration (7.0%)
- Blocked / leaking / bleeding (4.4%)
- “Line accident” (1.7%)
- Inflamed insertion site (0.6%)
- Malpositioned tip (0.5%)

PICC lines also have a potential risk of air embolism and thrombosis.

Types of PICC

The preferred choice of line will depend on infant and PICC line factors. The following PICC lines may be used in RPA NICU:

1. Vygon silicone 24G (2F) single lumen 30cm:
   - This is the preferred line for all infants not requiring a second lumen
   - Introducing needle: 19G winged needle – this must be removed after insertion of line by removing catheter from hub, withdrawing the introducing needle, and reinserting catheter line into hub – ensure catheter inserted into hub up to blue line and hub ‘finger tight’.
   - DO NOT unscrew catheter hub (results in lost washer producing leaking line)
   - Minimum flow rate = 0.5ml/min
   - Maximum pressure = 14.5 psi (760mmHg)
   - Only use 10ml syringe to flush / confirm patency

2. Vygon Nutrioline Twinflo polyurethane 23G (2F) double lumen 30cm:
   - This is the preferred line for infants requiring a second lumen
   - Introducing needle: 20G 25mm split cannula
   - Minimum flow rate = 0.5ml/min
Procedure for insertion of PICC

For details of equipment and nursing care - see Nursing Protocols

Observe all preliminary procedure standards appropriate to this procedure as detailed in the preface of this manual.

Insertion and management principles of a central line (without a stylet) include:

- Inserted or supervised by experienced staff (consultant or senior registrar)
- Aim to insert too far and pull back away from vessel walls
- Never leave a catheter where it does not easily and repeatedly withdraw blood during the insertion procedure – this may not apply to the Premicath 28G line.
- The catheter tip position should be determined with a siting X-ray.
- For lines inserted into the upper limbs, the IG tube should always be removed prior to the siting X-ray being taken.
- The siting X-ray should always be reviewed by a senior member of medical staff, Consultant or Fellow.
- If catheter tip is not clearly seen, the tip position should be confirmed to be outside the heart using ultrasound or with an X-ray using radio-opaque contrast.
- If using contrast, be actively injecting during X-ray examination to see contrast coming from the end of the catheter
- Sterile technique for insertion, and for line changes (three times / week)
- Antifungal prophylaxis of oral and nystatin
- Cover insertion site with bio-occlusive dressing and leave undisturbed.

Procedure for inserting PICC line:

- Catheter is inserted under sterile technique using mask, gown and gloves. Increasing the size of the sterile field at insertion site reduces risk of sepsis.
- Skin cleansing at insertion site is one of the most important measures to prevent catheter related sepsis. Aqueous chlorhexidine 0.015% is applied to the insertion site and allowed to dry for 3 minutes. Do not allow solution to pool beneath infant. Replace any damp or wet linen immediately following procedure.
- Insertion of PICC may be assisted by the use of transilluminator, which helps to locate the vein and to improve accuracy in depth perception during venepuncture attempts. Placing a sterile glove over the transilluminator enables incorporation into sterile procedure.
- Insert the PICC line 2-3cm beyond the anticipated length and ‘pull back’ into the correct position. Aspirate blood and then flush with heparin saline (50 IU/5ml) 0.3ml. This ensures the line is in a larger vessel and prevents line migration centrally.
- Avoid excessive pressure with syringe (see above).
- Always use a ‘sharps-safe’ technique – place any sharp in a plastic receptacle prior to disposing in a sharps bin.

Note – it is important to:

When inserting the Vygon 24G (2Fr) catheter:
• ensure the catheter is fully inserted into the hub (the blue section on the catheter should NOT be visible)

• tighten hub
• do not remove blue locking hub (compression lock with washer) as catheter will leak

Once inserted the remaining catheter is looped & secured to sterile skin using steristrips. Catheter hub is placed on small roll of sterile gauze. The insertion site and hub are then covered with occlusive dressing (Tegaderm) – DO NOT apply circumferentially.

Correct positioning of catheter tip:

• The ideal position for a PICC tip is in a large vein:
  ○ Preferable tip locations include superior or inferior vena cava just outside right atrium. Other acceptable tip locations include axillary, femoral, cephalic, subclavian or temporal veins.¹
  ○ Because of the risk of tamponade, the catheter tip should never be left in the chambers of the heart, either right atrium or right ventricle.
• Measure the estimated length of the catheter from the site of insertion to the high mediastinum (for upper body insertion) or to the xiphisternum (for lower body insertions).
• If possible insert the catheter slightly too far and then withdraw to the desired estimated length. This ensures there is no slack in the line resulting from the forward pressure during insertion.

Confirmation of catheter tip position

• **Position of catheter tip is normally confirmed by X-ray.** *For upper limb lines, the IG tube must be removed prior to taking the X-ray.*
• The siting x-ray should always be reviewed by a senior member of medical staff, Consultant or Fellow.
• For catheter tips that are clearly visible and well away from the heart, this siting x-ray should be sufficient.
• If there is any doubt on this initial x-ray, there should be a low threshold for confirming that the tip is not in the heart by performing an ultrasound of the RA/SVC junction or the RA/SVC junction (depending on the insertion site). If the skills to perform the ultrasound are not available or there is
still uncertainty after the ultrasound, the x-ray should be repeated with contrast.

- If the catheter is coiled within the heart on the x-ray, then it should be withdrawn by an amount in excess of any measurement estimate taken from the x-ray and the confirmation that the catheter is completely clear of the heart, as described above, should be repeated.
- A siting x-ray should be obtained following every re-positioning of a CVL
- Any subsequent x-ray of an infant (for any reason) with a central line should be reviewed for the line position.
- Ultrasound can help for catheter tip location but because these lines are quite flexible, it's not always easy to see the line right to the tip in one plane. Consequently even if ultrasound is used, position should be confirmed radiologically. There are no appropriate studies of the accuracy of US for this purpose.

**Lines with a stylet**

Ensure that the guide wire has been removed, is intact, and sighted by the proceduralist and independent observer. Record in medical records.

**If a contrast X-ray is required:**

Setting up contrast after long line insertion:

1. **After securing the long line, while still sterile:**
   - Flush the long line with heparinised saline, and clamp it
   - Connect up TPN system
   - Draw up 0.35 ml Ultravist 300 in a 1mL syringe with aseptic technique.
   - Attach the syringe to the 3 way tap, but don’t flush until the x-ray staff arrive.
   - Turn 3 way tap off to the syringe. TPN can run while you are waiting for x-ray or just leave the line clamped with hep saline in it.
   - You can now remove your gloves and gown.

2. **When x-ray staff arrive,**
   - Put on a lead apron and inject 0.35 ml of contrast as the x-ray is taken. (To ensure that the timing is correct get the radiographer to count to three and inject on “3”)
   - You can remove the syringe any time after this.
   - Once the x-ray has been taken, resume TPN flow

Ultravist 300 (iopromide injection 62.3%) contains 300mg/mL of organically bound iodine. Neonates exposed to iodine in large amounts have been found to develop transient hypothyroidism and hyperthyrotropinemia. The longer term consequences of transient hypothyroidism are unknown, but in view of developmental delay that can result from congenital hypothyroidism, it is highly desirable to minimise exposure to iodine.

**Note - It is also important to:**

- ensure the catheter hub is immobilised
permit adequate visualization of insertion site
- avoid kinking of the catheter
- secure dressing at the edges
- ensure peripheral circulation is unimpaired

Clinical experience suggests that risk of PICC infection increases with each subsequent week of catheter stay. In general elective catheter removal at the end of week 4 balances catheter longevity & infant infection risk.

**Catheter-site dressing**

There are no trials to guide frequency of dressing changes.

1. Replace the catheter-site dressing when it becomes damp, loosened, or soiled or when inspection of the site is necessary.
2. Otherwise DO NOT replace dressings as the risk of dislodging the catheter outweighs the benefit of changing the dressing.
3. If dressing change performed – recheck line tip position with x-ray and/or echo.

**Line removal**

Ensure PICC line has been removed, is intact, and sighted by the proceduralist and independent observer. Lines may be removed by a medical officer or RN.

- Intact central line on removal should be confirmed by a CNS or Registrar and documented.

**Documentation**

All central lines should have the following documented in the infant’s medical record by the proceduralist and the line position cross checked by an independent observer (Neonatal fellow or Consultant):

- Line type, gauge and number of lumens
- Side and vessel/site of insertion
- Distance inserted at skin
- Position of line tip / method(s) of visualizing catheter tip
- Intact guide wire if used (measure length)\(^Z\)
- Intact central line on removal

Any and all complications of central lines should be notified to the on call Neonatologist and an IIMS report completed including the following:

- Line type, gauge and number of lumens
- Side and vessel/site of insertion
- Distance inserted at skin
- Position of line tip / method(s) of visualizing catheter tip
- Complication

**KEY POINTS**

- If not fully skilled, person doing insertion should be supervised by experienced staff
- Insert the catheter 2-3cm too far then pull back to desired level
- Aspirate blood and then flush to ensure in larger vein
- Do not leave in a position where you can not easily withdraw blood
- For PICCs inserted from the upper limbs, the nasogastric tube should always be removed prior to the siting x-ray being taken.
- The siting x-ray should always be reviewed by a senior member of medical staff, Consultant or Fellow.
For catheter tips that are clearly visible and well away from the heart, this siting x-ray should be sufficient.

- If there is any doubt on this initial x-ray, ensure tip is outside the heart using ultrasound, or obtain X-ray with radio-opaque contrast.
- Use image modification techniques to assist in PICC line localisation on x-ray
- Obtain a new sitting X-ray following any re-positioning of a line
- Sterile technique for insertion and line changes
- Use antifungal prophylaxis (Nilstat)
- Cover insertion site with Tegaderm and leave undisturbed
- Document line insertion in medical records
- Double check guide wire and line intact when removed and document
- Report all central line complications

References


A/Prof David Osborn
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