### Women and Babies: Procedure for insertion of Peripherally Inserted Central Catheters

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Women and Babies: Procedure for insertion of Peripherally Inserted Central Catheters

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Compliance with this Procedure is Recommended 2
1. **Introduction**

Central venous catheters are often necessary in sick newborn infants to provide critical nutrition and medications. However, they come with potential complications, of which infection is the most common. Meta-analysis shows that evidence-based best practice care bundles focusing on central venous catheters reduce the number of infections. This procedure guideline aims to summarise current procedure recommendations for insertion of peripherally inserted central catheters at RPA Newborn Care.

2. **The Aims / Expected Outcome of this Guideline**

   - To facilitate the appropriate evidence-based aseptic insertion of peripherally inserted central catheters in newborn infants and to reduce incidence of central line-associated complications

3. **Risk Statement**

   SLHD Enterprise Risk Management System (ERMS) Risk #

   - Clinical risk of hospital acquired infection associated with peripherally inserted central catheters (PICC).
   - Risk of non-infective complications of incorrectly placed PICCs including extravasation, pericardial and pleural effusions.

4. **Scope**

   - RPA Women and Babies: Newborn Care

5. **Resources**

   - RPA Education Program
   - RPA Infection Control Committee

6. **Implementation**

   - Implementation and coordination through Newborn Care Education Program
   - RPA Newborn Care Infection Control Committee provides governance and audits Central Venous Catheter use and infection.

7. **Key Performance Indicators and Service Measures**

   - All positive blood stream infections are coded monthly by the neonatal consultant group with representation from the hospital microbiologist.
   - Those blood stream infections attributable to central venous catheters are coded and reviewed at a state wide level. There is monthly feedback via the NSW Neonatal Intensive Care Unit Study (NICUS) Sepsis Prevention in Neonatal intensive care units Group (SPRING).
   - Central venous catheter associated blood stream infections are audited on a 2 yearly basis by the RPA Newborn Care Infection Control Committee.
8. Guidelines

8.1 Background

Prolonged central venous access is necessary in the very low birth weight infant to supply adequate nutrition prior to the establishment of full enteral feeds. The majority of units in Australia use peripherally inserted central catheters to facilitate this. The technique involves percutaneous placement into a peripheral vein of a small diameter silicone or polyurethane central venous catheter. The main advantages over peripheral cannulae are improved nutrient input, decreased phlebitis and reduced attempts at venous access per baby.

PICC use is safe, in a unit where strict management guidelines are followed, which includes the clear demonstration of catheter tip position. Though rare, pericardial tamponade resulting from an incorrectly positioned catheter tip can be fatal. There was one case of tamponade reported in an Australian study of 2186 catheters. Other reported non-infective complications in the same cohort, with reasons for catheter removal were:

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

Central line-associated blood stream infection (CLABSI) is the most common complication associated with central lines in newborn infants. An audit of central venous catheter use in 2012 at RPA showed CLABSI to be more common in those infants <30 weeks and <1000g, but that there was also an incremental risk of CLABSI for catheters in-situ >10 days.

Consistent reduction in infection rates related to central venous catheters may be achieved by implementing a program that is multidisciplinary, includes leadership commitment and uses evidence-based recommendations for preventing intravascular catheter-related infections.

8.2 Peripherally Inserted Central Catheter Bundle of Care

There is strong support in the evidence, including from a systematic review, that the implementation of evidence-based best practice care bundles focusing on central venous catheters reduce the number of CLABSI. These bundles are included in many infection control policies. The NSW NICUS network has developed a video giving a step-by-step guide to PICC insertion, available by clicking on the ‘PICC video’ link on the NICUS database, following this link or by searching the NSW Pregnancy and Newborn Services Network website, under ‘Clinical Resources’.

A dedicated PICC trolley should be used for each PICC insertion. All resources should be assembled prior to commencing the procedure. Ideally two people should be scrubbed for each procedure.
8.2.1 Necessity – who gets a PICC?

RPA NICU practice is to initially place an umbilical venous catheter (UVC) in babies requiring ongoing ventilatory or inotropic support. For infants who are stable on CPAP, our preference is to place a peripheral cannula and consider a PICC in the first days of life. A UVC with a tip that lies within the ductus venosus can remain in-situ for the first 7 days, after which time a PICC should be placed for ongoing nutritional support if required. For a UVC where the tip is below the ductus venosus, replacement within 48 hours should be considered. The PICC should be inserted before removal of the UVC – it is reasonable to leave a well-placed UVC in for a longer period if there is difficulty in placing the PICC.\textsuperscript{16} The link to the UVC policy may be found here.

Babies >30 weeks, particularly those who are growth restricted or with abnormal flows on Doppler on antenatal ultrasounds, may also require a PICC to aid nutritional intake if time to full enteral feeds is likely to be greater than 7 days.

8.2.2 Maximum barrier precautions

Assemble all the equipment required (see below) prior to PICC insertion. The cot space should be isolated by using screens. A dedicated PICC trolley should be utilised. Both proceduralists should wear a surgical hat, mask and sterile gown. WHO surgical hand scrub is to be performed prior to donning the gown and double gloves. 2 people should ideally be scrubbed for each procedure.

Large sterile drapes are used to completely cover the patient and cot area. Clear plastic drapes are recommended in infants less than 1000g to facilitate temperature control. The cot side should be down under most circumstances. Where thermoregulation is thought to be a challenge, the procedure may be done through the portholes.
Strict asepsis should be maintained at all times during insertion. The below form should be completed in real time by the bedside nurse or other available colleague. The aim of the form is to empower the health care worker to identify and speak up about any potential breaches of infection control.

<table>
<thead>
<tr>
<th>Clean equipment</th>
<th>Sterile equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean dressing trolley with mild detergent wipes, leave one minute &amp; wipe dry</td>
<td>PICC of choice</td>
</tr>
<tr>
<td>Mask and hat</td>
<td>Introducers as preferred</td>
</tr>
<tr>
<td>Blue sterile plastic sheet (to be placed under sterile drape)</td>
<td>Sterile green drapes or clear plastic drapes</td>
</tr>
<tr>
<td>2 ampoules heparinised saline (50IU/5ml)</td>
<td>Dressing pack plus additional gauze</td>
</tr>
<tr>
<td>Unopened solutions for skin preparation (aqueous chlorhexidine 0.015%)</td>
<td>Surgical instrument set</td>
</tr>
<tr>
<td>Tape measure</td>
<td>2 sets of sterile gowns and double gloves</td>
</tr>
<tr>
<td>Protective goggles if patient on open care system</td>
<td>10ml syringe, drawing up needle</td>
</tr>
</tbody>
</table>
## Central line insertion checklist

- Please allocate the bedside nurse or an available colleague to complete this checklist in real time. If a breach in sterility is noted, corrective steps must be taken.

### Designation of operator:
- Fellow
- Nurse practitioner
- Registrar
- Staff Specialist

### Designation of assistant:
- Fellow
- No assistant
- Nurse practitioner
- Nursing staff
- Registrar
- Staff Specialist

### Designation of supervisor:
- Fellow
- No supervisor
- Nurse practitioner
- Registrar
- Staff Specialist

### Type of central venous line:
- UVC
- PICC

### How many lumens:
- 1
- 2
- 3

### Reason for insertion:

### Before the procedure

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands hygiene before gathering equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insertion trolley cleaned prior to use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical hand scrub prior to maximal sterile precautions (minimum 3-5 mins)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximal sterile precautions used: operator (hat, mask, sterile gown, sterile gloves)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximal sterile precautions used: assistant (hat, mask, sterile gown, sterile gloves)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximal sterile precautions used: supervisor (hat, mask, sterile gown, sterile gloves)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### During the procedure

- Antiseptic solution used to disinfect the skin for 2 mins and allow to dry for 3 mins
- Antiseptic solution used to disinfect the skin for 2 mins and allow to dry for 3 mins
- Infant and cot completely covered with sterile drapes
- A sterile field maintained throughout

### Number of attempts required:

- Check with assistant, “Are you happy that sterility was maintained?”

### After the procedure

- Blood cleaned from the site using antiseptic solution and allowed to dry
- Applied a transparent dressing
- Dressing covered the line
- Line position confirmed with x-ray
- Sterile drapes removed for x-ray
- Operators maintained sterility whilst waiting for position confirmation
- Line manipulated following x-ray
- Corrective steps taken prior to manipulation for any sterility contamination
- Document insertion into electronic health record

### Procedural reminders

- Hand hygiene
  - Follow the 5 moments of hand hygiene using a surgical hand scrub. Nail polish, rings, and artificial nails are not permitted.

- Maximal sterile barriers
  - Use a hat, mask, sterile gloves and gown and a large sterile drape. If the infant is not ventilated ensure there is free flowing gas under the drape.

- Skin disinfection
  - Use yellow antiseptic solution to clean skin (0.015% chlorhexidine and cetrimide 0.15%) and allow it to dry. Do not remove skin preparation.

- Dressing
  - Apply a sterile transparent dressing. Only replace dressing if damp, loose or soiled.

- Do not send to medical records. Please return to rowena.mcmullan@health.nsw.gov.au
8.2.3 Appropriate catheter

The preferred choice of catheter will depend both on infant size and requirements and PICC factors. The following PICC are currently available in RPA NICU:

- Vygon Epicutaneo-Cava
- Vygon Premicath
- Vygon Twinflo

<table>
<thead>
<tr>
<th>Catheter</th>
<th>Vygon Epicutaneo-Cava (ECC)</th>
<th>Vygon Nutriline Twinflo</th>
<th>Vygon Premicath</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>2 Fr 30cm single lumen</td>
<td>2Fr 30 cm double lumen</td>
<td>1 Fr 20cm single lumen</td>
</tr>
<tr>
<td>Introducer</td>
<td>19G winged needle, 20G Microflash peelable cannula or 20G (pink) cannula</td>
<td>20G Microflash peelable cannula or 20G (pink) cannula</td>
<td>24G breakaway needle or 24G (yellow) cannula</td>
</tr>
<tr>
<td>Maximum pressure</td>
<td>14.5 psi (760mmHg)</td>
<td>21.8 psi (1140mmHg)</td>
<td>21.8 psi (1140mmHg)</td>
</tr>
<tr>
<td>Usefull insertion notes</td>
<td>The introducer needs to be removed after insertion by carefully sliding the needle over the catheter. See below for details.</td>
<td></td>
<td>Has a stylet which needs to be removed after insertion. It is occasionally not possible to aspirate blood from this line, even when correctly sited.</td>
</tr>
<tr>
<td>Suitable infants</td>
<td>Preferred PICC for all infants &gt; 750g.</td>
<td>For infants requiring multiple infusions.</td>
<td>Infants &lt;750g or when a 2Fr catheter is unable to be inserted.</td>
</tr>
</tbody>
</table>

8.2.4 Insertion technique for PICC

Each PICC should be inserted or supervised by an experienced staff member (consultant/ fellow/ senior registrar/nurse practitioner) who has appropriate training.

For babies <750g, PICC should be inserted by consultants, fellows or nurse practitioners only.

Suitable insertion sites include the saphenous, cephalic and basilic veins. PICC inserted into the lower limbs have lower rates of complications than in the upper limbs.17

Procedure for inserting PICC:

**Preparation**

- Utilise maximum sterile precautions as above.
- Gather equipment and the correct catheter as above.
- Measure the correct distance of insertion. Preferable tip locations include superior or inferior vena cava just outside the right atrium. Other acceptable tip locations include axillary, femoral, cephalic, or subclavian veins. 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).
• Make sure the infant has adequate analgesia, is placed in a comfortable position and the cot is free of other equipment. Place a ‘bluey’ under the infant.
• After performing 3-5 minute surgical scrub and wearing hat, mask, gown and double gloves you may prepare your trolley with the help of one assistant. Flush your PICC with heparinised saline. Please note only 10ml syringes should be used.

**Insertion**
• Skin cleansing at the 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. Repeat. Do not allow solution to pool beneath infant. Replace any damp or wet linen immediately following procedure.
• Completely cover the infant and surrounding area with sterile drapes. Remove the outer pair of gloves.
• Insert your chosen introducer, and when you get a good flash back of blood flow, insert the catheter through the introducer into the vein using a ‘no touch’ technique.
• Insert the PICC 2-3cm beyond the anticipated length and ‘pull back’ into the correct position. This ensures the line is taut and not lodged against a vessel wall. Aspirate blood and then flush with heparin saline (50 IU/5ml) 0.3ml. This ensures the catheter is in a larger vessel and prevents tip migration centrally.
• If using the Vygon Epicutaneo-Cava: when the catheter has been inserted to the correct distance, the introducer needs to be removed. Loosen the blue compression hub from the clear plastic extension (but **do not separate them**) and slide out the catheter from the hub. Carefully slide off the introducer over the catheter and replace it into the hub. Make sure the black marker is fully out of sight and tighten the hub.

**Securing the catheter**
• Once inserted the remaining catheter is looped & secured to sterile skin using Steri-Strips. The insertion site should be visible.
• Place the catheter hub or cannula (if utilised for insertion) on a small piece of on a small piece of Comfeel. Make sure that this does not cross a joint. Cover the whole
area with an occlusive dressing (eg Tegaderm film). DO NOT apply circumferentially. Dressing edges are reinforced with the white tapes from a Tegaderm IV (‘teddy bear’).

Catheter-site dressing

Sterile, transparent semi-permeable dressings allow visualisation of the insertion site, and an additional anchor if properly maintained. Replace the catheter-site dressing under full sterile precautions if it becomes damp, loosened or soiled or when inspection of the site is necessary.

Otherwise DO NOT replace dressings as the risk of dislodging the catheter and introducing infection outweighs the benefit of changing the dressing.

If a dressing change is performed, recheck the catheter tip position with x-ray and/or ultrasound.

8.2.5 Confirmation of catheter tip position

Because of the risk of tamponade, the catheter tip should never be left in the chambers of the heart. It is imperative that the exact position of the catheter tip is identified on imaging and known by the treating team.

Primary method: Initially a siting AP X-ray, without contrast, is used to confirm the position of the catheter tip. The X-ray should include the entire length of the line. The position of the limb, particularly upper limbs, is important as tip may migrate with changes in limb position, but also to allow comparison between films. Thus upper limbs should be x-rayed at 90 degrees abduction at the shoulder, with elbow flexed.\textsuperscript{18,19}

Reprinted from Nadroo et al, Pediatrics 2002; 110(1).\textsuperscript{19}
For upper limb PICC, the intragastric tube must be removed prior to taking the X-ray.

If inserting into the left saphenous vein, care must be taken to ensure the catheter has crossed the midline on X-ray. This documents that the tip is in the IVC and not entered the ascending lumbar vein.

The siting X-ray should always be reviewed by a senior member of medical staff; Consultant or Fellow. Picture archiving and storage system (PACS) has been shown to aid in confirming catheter tip position. For catheter tips that are clearly visible and well away from the heart, this siting x-ray should be sufficient.

If the catheter is found to be within the heart, then it should be withdrawn by an amount in excess of any measurement estimate taken from x-ray or ultrasound, 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 PICC.

Any subsequent X-ray of an infant (for any reason) with a PICC should be reviewed for the catheter position.

Secondary methods: If the tip of the catheter cannot be confidently identified on x-ray, an alternative method should be used in an attempt to visualise the tip.

- Clinician Performed ultrasound of the RA/SVC junction or the RA/IVC junction (depending on the insertion site). If clinicians with ultrasound skills are available during PICC insertion, the catheter tip may be positioned under ultrasound guidance. This has been shown to improve identification of tip position, decrease the time taken to insert a PICC by reducing the need to re-position after X-ray, and reduce the number of X-rays performed. The use of ultrasound has identified that 25% PICC thought to be in good position on plain X-ray are actually within the heart on ultrasound. As PICC are quite flexible, it’s not always easy to see the catheter right to the tip in one plane. If ultrasound is used during insertion and uncertainty remains, position should be confirmed subsequently with X-ray. The position of the line tip should be clearly documented in the medical records via either a handwritten entry, or ideally a printout using the ultrasound reporting software.

- Repeat x-ray with contrast injected into the catheter if the skills to perform the ultrasound are not available, or there is still uncertainty after the ultrasound. Method for injecting contrast for X-ray if required:
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.

8.2.6 Documentation

Following insertion of each PICC, an insertion form as shown below, should be completed and placed into the patient’s notes. A note also needs to be documented in the electronic medical record. Insertion details need to be checked and signed by both proceduralists, and catheter position should be cross checked by an independent observer (Neonatal fellow or Consultant).

Infants <1kg and/or <27 weeks gestational age should have Nystatin 1ml q8h commenced for fungal prophylaxis (see small baby guideline).

Discussion regarding ongoing need for the PICC should be part of daily handover using the daily checklist.

- Draw up 0.4 ml Ultravist 300 in a 1mL syringe with aseptic sterile technique, and transfer to 10mL syringe.
- Attach the syringe of contrast to the 3 way tap, and attach a syringe of saline to the other port.
- Turn 3 way tap off to the syringes. TPN can run while you are waiting for x-ray or just leave the catheter clamped with hep saline in it.
- When x-ray staff arrive, put on a lead apron and inject 0.4 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”.
- Flush with 0.5 ml saline. You can remove the 3-way tap after this.
- Once the x-ray has been taken, resume TPN flow.
Any and all complications of catheters should be notified to the on call Neonatologist and an IIMS completed if required.

### 3.2.7 Removal

PICC should be removed at the earliest opportunity, and this decision should be considered on each ward round.

PICC may be removed by a medical officer or RN.

The proceduralist and an independent observer should ensure the PICC is intact when removed.

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**KEY POINTS**

- PICC insertion should be performed, or supervised, by an experienced staff member
- Use sterile technique, and maximum sterile precautions for line insertion
- 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 cannot easily withdraw blood.
- For a PICC 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; Staff Specialist or Fellow.
- 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 tip localisation on x-ray
- Obtain a new siting X-ray/ultrasound following any re-positioning of a PICC
- Use antifungal prophylaxis (Nystatin) in infants <1kg
- Document PICC insertion with tip position in medical records
9. Definitions

<table>
<thead>
<tr>
<th><strong>Central Venous Catheter</strong></th>
<th>A central venous catheter was defined as a venous catheter inserted via either the umbilical or a peripheral vein, such that the catheter tip is placed into a large central venous vessel.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peripherally Inserted Central Catheter (PICC)</strong></td>
<td>Peripherally inserted central catheters are a form of central venous catheter, inserted percutaneously into a peripheral vein and fed through into a larger central vein.</td>
</tr>
<tr>
<td><strong>Central Line Associated Blood Stream Infection (CLABSI)</strong></td>
<td>Proven blood stream infection associated with central venous catheter when a central venous catheter has been in use 48 hours prior to signs and symptoms of an infection, with no apparent source other than the central venous catheter.</td>
</tr>
</tbody>
</table>

10. Consultation

Authors: Rowena McMullan and Adrienne Gordon.
Reviewed and approved by RPA Newborn Care Infection Control Committee and RPA Newborn Care Research/Policies Meeting.

11. References


24. Tauzin L, Sigur N, Joubert C, Parra J, Hassid S, Moulies ME. Echocardiography allows more accurate placement of peripherally inserted


### 11.1 National Standard

- Standard 1: Governance for Safety and Quality in Health Service Organisation
- Standard 3 – Preventing and Controlling Healthcare Associated Infections