Peripheral Arterial Lines: Insertion and Care

This Guideline is applicable to all Medical and nursing staff working in neonatal units in the West of Scotland. Only a suitable trained and competent medical practitioner/ANNP should undertake arterial cannulation. Separate guidance is available for aseptic technique for procedures and for taking blood samples from an indwelling arterial catheter. Staff should also be familiar with the use of equipment to which the arterial catheters will be connected, including: syringe driver; invasive blood pressure monitoring system; and blood sampling circuits. The use of these is covered in separate guidance.

Introduction
An indwelling peripheral arterial line may be used when:

- There is a requirement for frequent arterial blood gas monitoring
- Continuous monitoring of arterial blood pressure is required.

Umbilical arterial lines should be sited in preference to peripheral arterial lines during the immediate newborn period unless contraindicated.

The decision to site a peripheral arterial line should be discussed with the attending neonatal consultant. The need for arterial lines should be reviewed on a daily basis on the consultant ward round.

Where time permits explain the procedure to the parents, including what the procedure involves, the reason for the cannula, the potential risks of a cannula.

Usual sites for cannulation
Peripheral arterial catheters should be sited where there is good collateral circulation

- Posterior tibial artery
- Radial artery

**NB -** the ulnar artery may be used instead of the radial artery if access to the radial artery is problematic, but must be avoided if the radial artery has recently been cannulated (or where an attempt at cannulation has occurred.

Other sites should be avoided, except by agreement with the attending consultant.
Contraindications to peripheral arterial line insertion include:

**Absolute contraindications**
- Inadequate collateral blood flow or recent cannulation of a collateral artery in that limb
- Evidence of reduced limb perfusion
- Evidence of localised skin infection

**Relative Contraindication**
- Uncorrected coagulopathy

**Arterial Pressure Monitoring System**

All arterial lines must be connected to a pressure monitoring system. This allows invasive blood pressure monitoring and also provides a warning of disconnection or occlusion of the catheter.

The pressure monitor will be connected to a closed circuit blood sampling set.

The arterial pressure monitoring system and blood sampling line should be primed before use and calibrated.

**Intra-Arterial Fluids**

Patency of the peripheral arterial line is maintained with an infusion of 0.45% sodium chloride for infusion with 1 unit of heparin per ml (known as hepsal) running at a rate of 0.5-1ml/hour. The Heparinised saline should be changed every 24 hours.

**NB – No other fluids / medications are to be given via an arterial line**

**Selecting the site**

Choose the most appropriate artery to cannulate. If a radial artery is selected check that an ulnar artery is present and patent using Allen’s test - see appendix 2.
Peripheral Arterial Cannulation: Procedure

When inserting a peripheral arterial line, a sterile procedure should be adopted in line with the applicable antisepsis guideline.

Preparation of Equipment

Prepare the following equipment on clean procedure trolley

- Dressing pack,
- 0.9% sodium chloride for injection (5mls),
- 2 ml syringe,
- 5ml syringe,
- 21G needles,
- Neoflon size 22G,
- 3 Way Tap, T – piece,
- Appropriate skin cleansing solution (GG&C Antisepsis Guidelines),
- Transparent dressing,
- Splint
- Oral sucrose for pain relief if applicable – see oral sucrose guidelines
- Light for transillumination, if required.

NB only cold light sources may be used – we recommend the Philips “Wee Sight” Transilluminator.
Insertion Procedure

- Wash hands and apply sterile gloves
- Flush the T-piece and 3 way tap with Sodium Chloride 0.9% IV solution
- Identify the vessel to be cannulated by palpation or transilluminate
- Perform Allen’s test to check for adequacy of collateral circulation
- Establish a sterile field around the cannulation site
- Cleanse the skin with appropriate cleansing solution *(see separate guidance on asepsis for procedures).* Leave for at least 30 seconds in order to allow the solution to dry
- Do not re-palpate the artery once the skin has been cleansed.
- Un-sheathe the cannula & hold it firmly so that the two component parts cannot become separated.
- Gently stretch the skin over the artery.
- Insert the cannula through the skin parallel to the vessel at a shallow angle. Advance the cannula slowly if the aim is to cannulate directly. An alternative approach is to advance quickly with the aim of transfixing the artery.
- If no flashback is seen, pull back slowly, as an artery may be transfixed. If so, a flashback may be seen as the cannula is withdrawn. When the flashback is seen try to advance the cannula over the needle to enter the artery. If no flashback is seen, pull the needle back to the level of the skin and redirect. If blood is seen in the cannula then remove fully and try again with a fresh cannula as it will be difficult or impossible to get a flashback with the original cannula.
- When the artery is punctured blood will be seen to fill the cannula rapidly. Sluggish back flow during an attempted arterial line cannulation may indicate either inadvertent venous cannulation or para-arterial placement, i.e. a haematoma.
- Decrease the angle of the cannula so that it is resting on the skin & try to advance the cannula over the needle and fully into the artery.
- Press firmly on the artery to occlude the blood flow, keep the cannula in position & withdraw the stylet.
- Continuing to protect the cannula, connect the T-piece, and 5ml syringe & flush with Sodium Chloride 0.9% IV solution (just sufficient to clear the cannula of blood).
- Check the site for skin blanching and swelling. If there is any evidence of compromised circulation at any point during the procedure or after consideration should be given to immediate removal.
- Connect to the arterial line set primed with heparinised saline.
- Secure the cannula with a sterile clear dressing. e.g. Tegaderm. Additional secure strapping of the tubing may be required to ensure adequate fixation.
- Apply an appropriate size splint but leave cannula visible for regular inspection. Radial lines should be splinted with the wrist extended. Ensure that all digits are clearly visible after securing the limb to the splint.
- Attach arterial line set to the transducer and monitor.
- Calibrate the transducer following the manufacturer’s instructions
- Observe arterial trace on the monitor for appropriate waveform.

Post-Procedure Care

- Dispose of all equipment correctly as per Trust Policy
- Perform a social handwash.
- Document procedure in infants notes including: Date and time of insertion, Site of insertion, Indication for insertion of arterial line e.g. arterial blood gases, cannula type and size, any immediate complications, Indication of the quality e.g. sampling, flushing, good distal perfusion, successful transducing, Signature, print name and grade.
Post-procedural care of the Cannula

Once successfully inserted, inspect the cannula site every hour and document findings on the observation chart. As these observations need to be made frequently staff should ensure that the site is easily visible and not covered with blankets or bedding. If any concerns are identified they should be reported immediately to the medical staff.

- Ensure the tubing and transducer are not pulling on the cannula.
- Inspect the area distal and proximal to the insertion site for signs of
  - compromised circulation: Cyanosis, blanching, delayed capillary refill time, decreased pulse, cool extremities
  - displacement: bleeding, redness, swelling, fluid leakage, blanching, pain or discomfort, loss of arterial waveform on the monitor
  - Infection: Swelling, redness, exudate, pain, temperature change

Accidental displacement of the arterial cannula will require immediate application of pressure to the site for 5-15 mins or until bleeding has stopped

Removal of Peripheral Arterial Cannula

Peripheral Arterial cannula should be removed when no longer required, or if there are complications or contraindications.

Procedure:
1. Withdraw the cannula and apply pressure to the site with a piece of sterile gauze for 5 minutes. Ensure that the circulation to the hand or foot is maintained.
2. Check to see if the bleeding has stopped if it hasn't apply pressure for a further 2-3 minutes before checking again. Continue until bleeding has ceased
3. Cover the site with a small piece of gauze and tape.
4. Document that the arterial line has been removed in the infants’ record and on the observation chart.
5. If an arterial line is removed because of concerns about the circulation distal to the insertion site, document this and highlight to ensure that future attempts at cannulation avoid the site. If perfusion does not return within a few minutes of removal this must be brought to the attention of the consultant medical staff.
**Blood Pressure Monitoring**
Continuous arterial blood pressure monitoring will be carried out on all babies with intra-arterial lines in situ. Arterial waveform analysis provides valuable information as well as the absolute systolic and diastolic pressures. The normal wave should have a sharp peak systole upstroke and a definite end diastole.

![Diagram 2. Comparison of normal, resonant and damped arterial traces.]

**Maintenance: Calibration**
The transducer must be zeroed:
- Following insertion of an arterial cannula
- At the beginning of every shift
- When transducer set is changed

During calibration it is essential that the transducer is level with the **RIGHT ATRIUM** so calibration should also be checked when the child’s position is changed.

**Recording**
- The blood pressure is recorded continuously by the multi-parameter monitor which should have alarm limits set appropriate to the baby’s age and gestation
- The monitor should be set up to display the numerical values and arterial pressure trace
- Blood pressure should be recorded hourly on the baby’s clinical chart
- If the blood pressure is low and the arterial trace is dampened or lost, check all the tubing and connections for kinks, bubbles or disconnections. If all is in order, consider gently flushing the line and recalibrating the pressure transducer. If the problem persists then this should be reported to the medical staff
- Record hourly infusion of the heparinised 0.45% sodium chloride on the observation chart
Appendix 1 - Complications (Burns and Chulay 2006)

- Vasospasm/thrombosis/thrombo-embolism which may lead to compromise of circulation, blanching, necrosis or gangrene of tissues or extremities (Hack et al, 1990).
- Infection both local and systemic (Furfaro et al, 1991)
- Damage to peripheral nerves
- Haematoma/bleeding at the puncture site
- Extravasation
- Air Emboli

Appendix 2 - Allen’s Test

- Occlude both arteries at the wrist until the fingers appear blanched
- Release the pressure on the ulnar artery
- Observe the circulation returning to the hand, i.e. it will flush pink
- If this does not happen within 7 seconds, do not proceed with a radial puncture on that side

References


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Other Professionals Consulted
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