Care of the Neonate with an Arterial line

Rationale
In order to ensure accurate blood pressure monitoring of the neonate, and minimise pain and iatrogenic injury from repeated blood sampling an umbilical arterial catheter (UAC) or a peripheral arterial line (PAL) can be sited in the neonate. Due to its invasive nature the nurse should be aware of the complications of having a UAC or PAL in order to maximise patient safety (Nursing and Midwifery Council 2002).

A UAC or PAL is used for:
- Frequent arterial blood sampling
- Continuous arterial blood pressure monitoring
- Exchange transfusion

Position

1. Umbilical arterial catheter

In order to avoid the major branches of the aorta, and subsequent risk of emboli to major organs the UAC tip is ideally placed above the diaphragm:

- High – between thoracic vertebrae 6-10
  Or
- Low – between lumbar vertebrae 3-5

The prolonged use for more than one week may increase the incidence of abdominal symptoms and alter intestinal blood flow (Kempley and Gamsu 1992).

2. Peripheral arterial line

Peripheral arterial line is placed in the radial, brachial or femoral artery. Radial artery is preferred.
Practice

1. Preparation of the system

- Employ non-touch technique for preparations of system (See non-touch technique guideline).
- Prepare transducer ready for attachment to the neonate once UAC sited.
- Infusion fluid to prevent line clotting is **500 units of heparin 1000 units per ml in 500mls of 0.45% saline (a 1 in 1 solution)**
  
  50mls of solution is drawn up in a syringe.
  
  - One 3-way tap on the transducer set is repositioned directly next to the transducer.
  - Attach 50mls syringe and giving set to the transducer and prime, including all 3-way taps. Label the set with the date changing is due. The **transducer set should be changed every 96 hours**.
  - Once the UAC is in place and the infusion solution attached this solution will run at 0.5mls per hour.
  - Draw up a further 9mls from the 500mls bag of heparinised saline in a 10mls luer lock syringe and attach to the 3-way tap nearest to the 50mls syringe.
  - Change the white bung on the 3-way tap nearest to the transducer for the yellow bung included in the transducer set (White bung has a hole in it, which could facilitate cross-infection).
  - Attach prepared transducer to the UAC and to the pressure module lead from the monitor, maintaining non-touch technique.
  - Position the transducer at the approximate level of the neonate’s heart, mid axilla, to maintain an accurate reading (Harling 2000). If the transducer is higher than the heart, readings will be erroneously too low and vice versa.
  - The transducer must now be calibrated or “zeroed”. This should be repeated once per shift, or if the transducer’s position or neonate’s position is altered, to maintain an accurate reading (Harling 2000).

  1. Turn off the tap to the baby, at the attachment point of the 10ml syringe.
  2. Remove the 10ml syringe to open the system to the air.
  3. Press the zero transducer button on the pressure module at the monitor.
4. A (0) should be shown on the screen to indicate the procedure is complete.
5. Reattach the 10ml syringe and turn the tap back on to the baby and off to the syringe.

This type of waveform should be seen:

![Waveform Image]

The highest point is the systolic pressure, the lowest is the diastolic. The notch on the diastolic downslope is called the “dicrotic notch”. This is caused by the aortic valve flipping closed, generating a little back-pressure bump.

Flattening of the curve or loss of the characteristics or the waveform indicates loss of vibration sensed by the transducer. It can be caused by obstruction of the catheter due to clot formation; catheter pushed against arterial wall or bent tubing. If obstruction is suspected catheter should be gently aspirated prior to flushing. If resistance is felt, doctor needs to be informed. If there is no resistance and catheter is sampling, 1 ml flush may be given. If the waveform is still flattened, the position of the limb should be changed and tubing checked (Harling 2000).

2. Catheter care

The syringe, solution, and giving set should be changed every 24 hours, with solution prescribed by the medical team.

- NEVER INJECT FLUID BOLUSES OR MEDICATIONS INTO ARTERIAL LINES. Such injections may cause spasm severe enough to obstruct all blood flow through the artery.
- NEVER FORCEFULLY IRRIGATE THE CATHETER. Released clots may obstruct flow to distal arteries. If line appears clotted, aspirate clot or discontinue the line.
- DO NOT ALLOW AIR TO ENTER THE SYSTEM. Air may result in an embolus in the distal arteries. Remove air from flush syringe with syringe change.
3. Blood sampling

1. You will need a 2 ml syringe, a bung, an alcohol swab and a cardboard tray.
2. Wash your hands and put on gloves.
3. Connect the 2 ml syringe to the 3-way tap nearest to the baby.
4. Turn the 3-way tap next to the 10 ml syringe with flush solution off to the transducer. The trace in the monitor will now disappear.
5. Aspirate blood with the 10ml syringe slowly as too rapid aspiration from an umbilical catheter will cause fluctuations in blood pressure and blood flow especially in the very small neonate (Schultz et al. 2003). Observe the site for blanching. Stop when the blood reaches the syringe.
6. Turn the 3-way tap nearest to the baby off towards the transducer. Aspirate slowly the required amount of blood with the 2 ml syringe.
7. Turn the 3-way tap off to the 2ml syringe prior to removing it. Clean the inside of the port with an alcohol swab making sure no blood remains to prevent clots in the system. Close with a new bung.
8. Slowly flush the blood in the line back to the baby.

COMPLICATIONS

- bleeding due to accidental disconnection, or from open connections

- vasospasm of the femoral artery causing blanching of toes and foot is less common with high than low umbilical catheters.

- embolisation from blood clot or air in the infusion system

- thrombosis - may involve
  - femoral artery resulting in limb ischaemia
  - renal artery resulting in hypertension, haematuria, renal failure
  - mesenteric artery resulting in gut ischaemia, necrotising enterocolitis
There should be continuous close observation of the lower limbs and buttocks of a neonate with an umbilical catheter in situ for any signs of blanching and/or discolouration. Keep the site visible, no socks or covers should be used and nappy should be unfastened or blue incopad used instead. If one limb is discoloured, **opposite** limb can be warmed to induce reflex vasodilation of affected limb. Do **not** warm the affected limb. Consider catheter removal if blanching persists >5-10 minutes.

Urine output should be monitored and urinanalysis performed regularly depending on the patient’s condition. Keep catheter and infusion line clear of blood as blood clots may form. All connections must be luer lock.

**4. Arterial line removal**

1. **Umbilical arterial line**

Only remove the arterial line if the stump is clearly visible. Inform the doctor when you are about to remove the line.

**Equipment required:**
- Dressing pack
- Plastics set
- Kaltostat
- Gauze packs
- Specimen pot
- Nylon tape
- Sterile water

1. Collect all equipment on a trolley. Stop the arterial line maintenance fluid.
2. Wash hands. Open the wound care pack and remove gloves, placing them on the side.
3. Drop the contents of the suture removal kit, gauze pack, nylon tape and Kaltostat on the sterile field ensuring everything remains sterile. Wet some of the gauze and Kaltostat with sterile water.
4. Wash hands and put on the gloves.
5. Tie the nylon tape around the base of the umbilicus. Cut the sutures attaching the arterial line to the Elastoplast tape. Using the forceps in the suture removal kit and the scissors cut the stitches attaching the line to the skin. If there is a lot of dried blood, you may need to soak this first with sterile water and gauze. Pull gently on the line. If it does not move easily, look for more sutures.

6. Pull the catheter out slowly and gently looking out for the markers indicating the length of catheter still inside the baby. Have the specimen pot ready.

7. Pull the catheter tip out and place it in the specimen pot. If it bleeds very heavily pull the nylon tape tightly around the base of the umbilicus and place the Kaltostat firmly on the umbilical artery.

8. If there is no umbilical venous line attached with the same tapes, you may remove them, soaking them first with olive oil. Be careful if UVC is still in situ.

9. Wash your hands, take used sterile equipment to the CSSD returns box and send the umbilical line tip to the microbiology.

10. Do not cover the baby for the next two hours in order to observe the umbilicus.

2. Peripheral arterial line

Equipment: Clean gloves
Gauze swabs
Kaltostat©
Large Tegaderm© dressing

1. Stop the arterial line fluid.
2. Wash you hands. Put on clean gloves.
4. Gently pull the Tegaderm© dressing holding the arterial line in situ off the skin.
5. Press the gauze swab over the entry site of the line and pull it out.
6. Keep pressure on the site for 5 minutes. If there is excessive bleeding, use Kaltostat©.
7. Observe for further bleeding. If the site is oozing wrap a thin layer of gauze over it and secure with tape.
8. Remove gloves and wash hands.
9. Observe for bleeding and circulation every 15 minutes x 2 and then hourly for four hours.
References


