Arterial Line: Catheterisation and Set Up Umbilical and Peripheral Arterial catheter in Newborn Intensive Care Unit (NICU)

Procedure Responsibilities and Authorisation

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Target Audience	Nurses
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Procedure Review History

Version	Updated by	Date Updated	Summary of Changes
04	Catherine Semmens	Jan 2019	Due for review
03	Joyce Mok	June 2015	Due for review
02	Leanne Baker	Nov 2011	Combine arterial lines placement and set up in one document

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Contents

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1 Overview

1.1 Purpose

To outline the procedure to maintain safety and comfort of infants before and during the insertion of an umbilical arterial catheter or peripheral arterial cannula

1.2 Scope

Waikato staff working in NICU

1.3 Patient / client group

Babies and infants in NICU

1.4 Definitions

Umbilical Arterial Catheter (UAC)	The umbilical arteries are the direct continuation of the internal iliac arteries. Arterial catheter is normally only used during short periods of acute or critical illness. A long 3.5fr or 5fr catheter is inserted under sterile procedure by Nurse Practitioner/Clinical Nurse Specialist/Medical Staff) into one of the new-born infant's umbilical arteries.
Purposes of arterial line	To obtain continuous blood pressure (BP) monitoring, provide access for blood sampling and, sometimes for the administration of fluid or drugs, e.g. antibiotics.
Correct placement of UAC	A catheter introduced into the umbilical artery will usually pass into the aorta from the internal iliac arteries. Placement in aorta is important and one or two positions will be chosen: (a) ***High Position*** – at level of thoracic vertebrae 6-9. Catheter tip is above the diaphragm and the celiac axis. This is usually the initial placement. (b) ***Low Position*** – at level of lumbar vertebrae 4. The catheter tip is below major aortic branches, such as renal and mesenteric arteries. This position coincides with aortic bifurcation.
Peripheral Arterial Catheter (PAL)	A short 24 gauge cannula is inserted using clean aseptic technique into a peripheral artery, usually the long saphenous or radial artery are used. ***No drugs or dead-space returns to be given via PAL***
Purposes of PAL	To obtain continuous blood pressure monitoring and blood sampling only.
NNP	Nurse Practitioner
CNS	Clinical Nurse Specialist
UVC	Umbilical venous catheter

1.5 Special notes

- **Umbilical catheters and PAL must be visible at all times.**
- **UAC: Monitor circulations in lower limbs and buttock**
- **PAL: Monitor circulations at toes and fingers depending on site of the arterial line.**
- **Do not lay babies prone if arterial line is insitu.**
- **All babies must have transducer with limits set appropriately.**
- **Do not nurse baby in cot.**
- **Alarms must be on at ALL times.**
- **It is essential that careful attention is paid to the positioning and taping of the line.**

Drugs not infused/administered via UAC:
- Dopamine
- Indomethacin
- Calcium
- Caffeine
- Phenytoin and Barbiturates with caution

- When no IV access is available, the UAC may be used for fluid administration (Total Parental Nutrition, 10% dextrose). Consultant/NNP/CNS/Registrar's approval is necessary.
- Baby must have transducer with limits set appropriately when the UAC is used for fluid administration to minimise the risk of accidental dislodgement of UAC or loose connections that will result in haemorrhage.

- Handling of UAC after insertion and confirmation of position: Apply aseptic non touch technique principles: hand hygiene, do not contaminate key parts, i.e. the hubs of syringes or ports of ampoules, use of gloves, clean surface to work on, e.g. sterile guard.
- For peripheral arterial cannulation, a clean aseptic technique is used and sterile gown or mask not required.
- Luer plug on arterial line are changed 8 hourly.
- Arterial line fluids are changed at 48 hours following initial insertion and fluid set up.

2 Clinical Management

2.1 Competency required

Registered nurse with Waikato DHB generic IV certification and NICU Advanced CVL/UAC/PAL certification

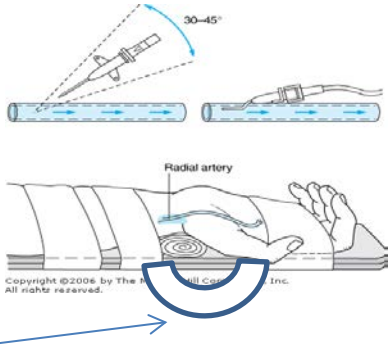
2.2 Equipment

Equipment for UAC catheterisation and set up

- Bedside Trolley, cleaned
- Intra-Arterial (IA) line Tray
- Arterial catheters, e.g. sizes 5 / 3.5 Fr
- 3-way tap
- Luer plug
- 10 ml syringe
- Blunt drawing up needle
- 10 ml vial of Sodium Chloride 0.9%
- Mask and hat
- Doctor / CVL gown pack
- Sterile drapes
- Sterile gloves
- Alcohol free chlorhexidine skin cleansing agents
- Sterile water to remove chlorhexidine for babies with fragile skin, e.g. birth weight ≤1250 gm, or according to baby's condition
- Alcohol/chlorhexidine Prep pads
- Cord tie
- One packet of 4.0 silk
- Blade
- Specimen container for umbilical cord

Equipment for PAL catheterisation and set up

- Sterile paper guard and clean trolley/surface
- IV cannula, e.g. Insite 24g/14mm
- Alcohol free chlorhexidine skin cleansing agents
- Alcohol/chlorhexidine Prep pads
- 3-way tap
- Luer plug
- 1ml and 5ml syringe for flush
- 10ml vial of sodium chloride 0.9%
- Short IV extension set
- Leucoplast white and brown tape for securing
- Tegaderm or OpSite as required
- Non sterile gloves
- Long splint with U-shaped bend (as per diagram)



2.3 Procedure

2.3.1 Catheterisation of UAC and PAL

1 Preparations

- Put “DO NOT ENTER/STOP” sign on nursery door to minimise traffic in the nursery.
- Collect equipment and arrange on cleaned bedside trolley.
- Raise incubator top or transfer infant to radiant warmer, attach servo probe.
- Ensure ECG monitor and oximeter attached.
- Baby should be positioned on his/her back to ensure easy and safe insertion of UAC.

2 Preparing equipment

- Put on mask and hat.
- Perform hand hygiene.
- Open IA line tray.
- Open gown and gloves in a sterile matter.
- Assist medical staff to gown up.
- Open sterile equipment onto a sterile field.
- Set up BP transducer and UAC fluids (Refer to section 2.3.2) or request assistant to do this if busy.

3 Insertion procedure by NNP/CNS/medical staff

- NNP/CNS/medical staff will arrange equipment on sterile field.
- They will begin with connecting the catheter and 3-way tap prior to insertion.
- Assistant clean the neck of vial of sodium chloride 0.9% with Alcohol/Chlorhexidine Prep pads and hold the open vial so NNP/CNS/medical staff can fill 10ml syringe and use this to prime the catheter, 3-way tap and luer plug.
- UAC insertion is done within the first hour of admission; if not, wait until baby is stable.
- UAC – nurse will gently restrain infant’s legs and arms under sterile guard throughout procedure.
- PAL – nurse will gently hold infant’s limb and assist with taping.
- After procedure, dispose of sharps, equipment and rubbish in designated receptacles.

4 Confirming UAC placement

- Once UAC is in place and sutured in, wait for x-ray to confirm placement before connecting fluids.
- UAC line placement must be confirmed by x-ray and verified by NNP/CNS/medical staff to avoid vascular compromise.
- Commence fluid infusion immediately following insertion once NNP/CNS/ medical staff has confirmed placement.

5 Insertion of PAL

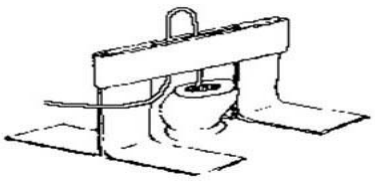
- PAL cannula is taped as for IV cannula.
- Commence fluid infusion immediately following insertion and securing of the PAL. Refer to diagram on page 5) for securing of PAL.

6 Safety of infant

- Observe and monitor infant's condition throughout procedure to detect any changes.
- Whilst waiting for confirmation of UAC placement, ensure line is safely positioned/secured to avoid accidental dislodge of catheter and risk of haemorrhage.
- After insertion ascertain from NNP/CNS/Registrar which catheter is UAC/UVC; and label the catheters correctly.

7 Securing UAC

- Following confirmation of position by x-ray, secure the UAC by the "bridge" taping technique. For babies whose birthweight is above 1000gm or ≥32 weeks gestation.



- Remove cord tie before securing UAC because the cord tie acts like a tourniquet causing swelling of the umbilical stump but it cannot help stop bleeding after insertion of umbilical lines.
- If bleeding from umbilical site occurs, apply pressure for 3-5 minutes until bleeding stops.
- Inform NNP/CNS/medical staff if bleeding is recurrent or persist because other interventions or investigations might be required.
- Perform hand hygiene.

- Apply duoderm to protect skin, especially for very preterm baby to avoid skin damage.
- Use H-shape taping technique (bridge) to secure the UAC to avoid accidental dislodging of catheter and haemorrhage (refer to diagram below).
- Assess skin of Extremely Low Birth Weight (ELBW) infant – may need alternative method of securing until skin matures: wrap leucoplast around catheter and sutures just above insertion site to mark the level (position) of UAC above skin.
- For babies whose birthweight ≤1000gm or ≤32 week gestation, and babies with fragile or compromised skin, no tape on skin during the first 5 days.
- If baby is very active and at risk of removing/pulling the umbilical catheters by itself, notify NNP/CNS/medical staff as individualised taping technique might be applied.
- Secure UAC and UVC separately to allow easy repositioning and independent removal of the catheters.
- Perform hand hygiene.
- Document procedure.

2.3.2 Preparation and connection of arterial line fluids

Equipment

- Sterile paper guard
- 50ml BD syringe
- 500ml bag of sodium chloride 0.45%; occasionally sodium chloride 0.9% may be used as indicated and prescribed by NNP/CNS/medical staff
- Heparin vial 1000 units/ml, e.g. 500 units of heparin = 0.5ml
- 1ml syringe
- Filter needle
- Blunt fill needle
- Pressure monitoring transducer set
- Asena™ syringe driver pump
- Asena™ syringe driver extension set
- Bag access device
- Medication added labels x 2

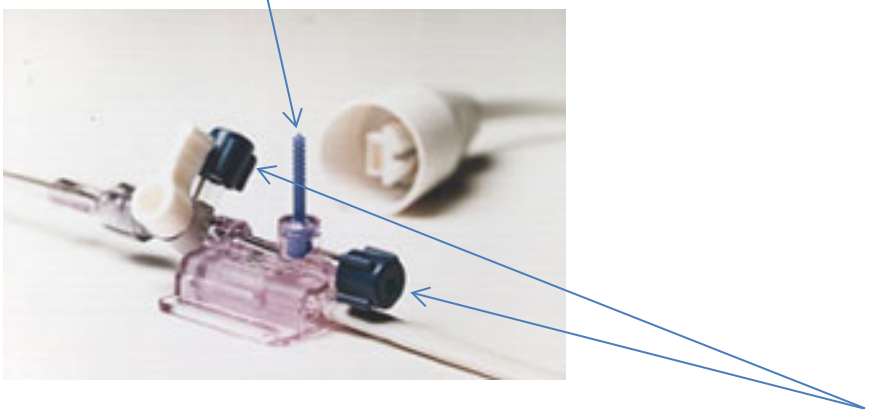
1 Prepare arterial line fluids

- Collect equipment.
- Perform hand hygiene
- Open sterile guard and arrange equipment.

- Prepare heparinised saline solution, which is used to reduce risk of thrombus formation in and around arterial catheter.
- Draw up 500 units of heparin and add to a 500ml bag of sodium chloride 0.45% (i.e. 1 unit/ml of heparinised sodium chloride 0.45% solution). Invert gently several times to mix thoroughly.
- Label bag with a medication added label.
- Add bag access device.
- Draw up 50ml of heparinised sodium chloride solution into the 50ml syringe, and label the syringe with a medication added label.

2 Set up infusion and transducer system

- Open transducer set and Asena™ extension set.
- Maintain the principles of aseptic non touch technique to minimise risk of infection.
- Prime extension set with heparinised sodium chloride 0.45% solution.
- Attach extension set to transducer.
- Pull the coloured rubber valve on transducer while priming the lines slowly to ensure there are no air bubbles through the system to minimise the risk of air embolus.



- Remove white cap from 3-way tap on transducer and replace with blue cap because white cap has a hole in it and must be replaced to maintain airtight system.
- Remove 3-way tap from end of wide bore transducer tubing and connect to baby's arterial catheter that has a 3-way tap already attached by NNP/CNS/medical staff.

3 Connect new transducer to arterial line

- Request assistant from another RN.
- Place sterile guard with baby end of transducer line next to baby.
- Ensure 3-way tap on end of arterial catheter is OFF to baby to avoid accidental haemorrhage.

- Assistant to place syringe into Asena™ syringe pump, turn on and prime fluid through system to ensure pump has built up pressure in the line prior to connecting and to prevent high pressure arterial blood flowing back along catheter.
- Double check for air bubbles.
- Disconnect the 10ml syringe or old transducer line from 3-way tap on arterial catheter and connect the new line.

Note: When changing lines and fluid for **an existing arterial line**, the 3-way tap is not changed as it is treated as part of the catheter to prevent breakage/damage to the umbilical catheter.

- Set Asena™ syringe pump to deliver the volume of the prescribed fluid, e.g. 0.5ml/hr for UAC.
- For PAL, the infusion rate is 0.8 to 1ml/hour because peripheral artery is small and requires higher pressure to maintain patency.
- Ensure the arterial line fluid and infusion rate are prescribed daily by NNP/CNS/medical staff on the *General Treatment Sheet*.
- Document fluid and line change on fluid forms.

4 Zero (calibrate) transducer

- Plug the white plug from the transducer into the monitor invasive blood pressure cable (kept in the pendant drawer).
- Ensure 3-way tap on arterial catheter remains off all ways to prevent accidental haemorrhage.
- Turn 3-way tap on transducer off to baby.
- Remove blue plug from transducer and open to air
- Press “Zero Art” key on Phillips™ monitor and wait until monitor says “zero complete” to ensure transducer is calibrated (zeroed) to the air pressure.
- Replace the blue plug and turn on 3-way transducer tap first, and final step is to turn on 3-way tap on to baby’s arterial catheter.
- Check all connections are secure.
- Observe monitor for return of blood pressure wave and reading to ensure transducer functioning and Blood Pressure (BP)/Mean Arterial Pressure (MAP) within normal parameters.
- Check alarm is on and set correctly to alert for change in pressure as this is critical in case of haemorrhage.

5 After care

- Collect and dispose of rubbish and sharps in appropriate receptacle.
- Perform hand hygiene.

2.4 Potential complications

Malposition of catheter	• Vessel perforation • Refractory hypoglycaemia (if catheter tip opposite coeliac axis) • Peritoneal perforation • False aneurysm
Vascular accident	• Thrombosis • Embolism/Infarction • Vasospasm • Loss of extremity • Hypertension • Paraplegia • Heart failure (from aortic thrombosis) • Air embolism
Equipment related	• Broken catheter • Transection of catheter • Plasticizer in tissues • Improper grounding of electronic equipment • Conduction of current through fluid-filled catheter
Other	• Haemorrhage • Infection • Necrotising enterocolitis • Intestinal necrosis or perforation

3 Evidence base

3.1 References

- Auckland DHB (2013). Umbilical arterial and vein catheterisation. Newborn Service Clinical Guideline. Retrieved Jan 22, 2019 from http://www.adhb.govt.nz/newborn/Guidelines/VascularCatheters/UmbilicalCatheters.htm
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- Gardner, S. et al. (ed.) (2016) *Merenstein & Gardner's Handbook of Neonatal Intensive Care, 8th Edition* (on-line resource electronic book). St. Louis, Missouri: Elsevier.
- NHS Networks (2017). Umbilical artery catheterisation and removal. *Neonatal Guidelines 2017-2019*, 343-345. Retrieved from www.networks.nhsuk/nhs-networks/staffordshire-shopshire-and-black-country-newborn/neonatalguideline

3.2 Associated Waikato DHB Documents

- Waikato DHB NICU Nursing Procedure: Admission to Level III Intensive care nursery in NICU (4571)

- Waikato DHB NICU Nursing Procedure: Arterial lines – sampling, nursing management and removal (1638)