UMBILICAL ARTERY CATHETER: INSERTION AND REMOVAL

Do not attempt to carry out this procedure unsupervised unless you have been trained to do so and have demonstrated your competence under appropriate supervision

INDICATIONS

- Frequent blood gas analysis:
  - ventilated babies (most babies treated with CPAP can be managed with capillary gases)
- Continuous monitoring of arterial blood pressure (if poor circulation or need for accurate BP)
- Exchange transfusion

CONTRAINDICATIONS

- Umbilical sepsis
- Necrotising enterocolitis (NEC)
- Evidence of vascular compromise in legs or buttocks
- Congenital abnormality of the umbilicus (e.g. exomphalos or gastroschisis)

EQUIPMENT

- Non-disposable umbilical artery catheterisation pack (send instruments to sterile services after use)
- Umbilical catheter: <2 kg use size 3.5 FG, ≥2 kg use size up to 5 FG
- 3-way tap and red bung
- 1 x 2mL syringe for sampling, 1 x 5mL syringe for aspiration, 1 x 10mL with 0.9% saline
- Sterile gown and 2 pairs of sterile gloves
- Sterile towels and sterile drape
- Umbilical tape
- Sutures
- Gauze swabs
- Gallipots
- Tape measure
- Scalpel
- Chlorhexidine 0.5% cleaning solution
- Elastoplast®
- Infusion pump
- Prescribe Sodium Chloride 0.45% infusion containing heparin 1 unit/mL

PROCEDURE

Consent

- Wherever possible inform parents of need and associated risks before procedure; if an emergency, delay explanation until after insertion
- Risks include sepsis and thrombosis
- See **Consent** guideline

Pre-sterile preparation

- Monitor baby's vital signs during procedure
- Estimate length of catheter to be inserted using formula: (weight in kg × 3) + 9 cm
  - alternative method for umbilical artery catheter (UAC) length is twice distance from umbilicus to mid-inguinal point, plus distance from umbilicus to xiphisternum
  - add length of cord stump to give final length
  - prefer high catheter position i.e. tip above diaphragm (T6–T10 vertebral bodies)
- Inspect lower limbs and buttocks for discolouration
- Tie an umbilical tape loosely around base of cord

Sterile preparation

- Scrub up, put on gown and gloves using aseptic technique
- Ask assistant (if available) to gently hold baby's legs and arms away from umbilical site
- Clean cord stump and surrounding skin with Chlorhexidine 0.5%
- Attach 3-way tap to catheter and flush all parts with sodium chloride 0.9% leaving syringe attached
- Place all equipment to be used on a sterile towel covering a sterile trolley
- Place sterile drape with a hole in the centre over the umbilical stump. Pull the stump through the hole ready for catheter insertion
- Avoid using Chlorhexidine on skin surrounding umbilical stump in order to prevent chemical burns in extreme preterm babies (<26 weeks) – cleaning solution to be used on umbilical stump only

Insertion of arterial catheter

- Clamp across cord with artery forceps
- Apply gentle upward traction
- Cut along underside of forceps with a scalpel blade to reveal either the cut surface of the whole cord, or use a side-on approach and cut part way through the cord (on the artery) at a 45° angle
- Leave a 2–3 cm stump; remember to measure length of cord stump and add to calculated placement to give final advancement distance
- Identify vessels, single thin-walled vein and 2 small thick-walled arteries that can protrude from the cut surface (see **Figure 1**)
- Support cord with artery forceps placed near to chosen artery
- Dilate lumen using either dilator or fine forceps
- Insert catheter with 3-way tap closed to catheter. If resistance felt, apply gentle steady pressure for 30–60 sec
- Advance catheter to the calculated distance
- Open 3-way tap to check for easy withdrawal of blood and for pulsation of blood in the catheter

If catheter will not advance beyond 4–5 cm and blood cannot be withdrawn, it is likely that a false passage has been created.
Remove catheter and seek advice from a more experienced person

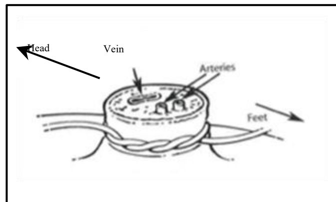

Figure 1: Identifying umbilical cord vessels

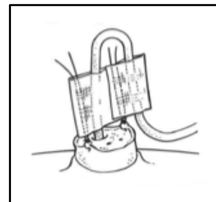

Figure 2: Effective system for more permanent fixation of umbilical catheters

Securing catheter

- If umbilical venous catheter (UVC) is also to be inserted, site both catheters before securing either. Secure each catheter separately to allow independent removal
- For each catheter place 2 sutures into cord, 1 on either side of catheter, allowing suture ends to be ≥5 cm long beyond cut surface of the cord. Sandwich catheter and ends of the 2 sutures between Elastoplast®, tape as close to cord as possible without touching cord (like a flag) (see **Figure 2**). The sutures should be separate from the catheter on either side to allow easy adjustment of catheter length, should this be necessary. Top edge of sutures can be tied together above flag or woven in layers of Elastoplast for extra security after confirming X-ray position
- alternatively, suture can be criss-crossed along shaft of catheter and secured
- If catheter requires adjustment, separate Elastoplast® tape using Appeel between catheter and the 2 suture ends, pull back catheter to desired length and retape; **never** advance once tape applied as this is not sterile

- Connect catheter to infusion of heparin 50 units in 50 mL sodium chloride 0.45% and run at rate of 0.5 mL/hr
- Confirm position of catheter by X-ray: unlike a UVC, a UAC will go down before it goes up
- a high position tip (above diaphragm but below T6) is preferred
- X-ray after line insertion should routinely be combined chest and abdominal
  - subsequent X-rays following line adjustment may be combined or dedicated chest/ abdominal, depending on initial and new estimated line positioning
- if catheter below the diaphragm, withdraw to L3–L4 (low position)
- if catheter position too high (above T6), withdraw to appropriate length
- if catheter length adjusted, repeat X-ray

Acceptable UAC tip positions

Tip position	Acceptable or unacceptable	Precautions/adjustments
T6–T10	Acceptable	Ideal high UAC position
L3–L4	Acceptable	Low UAC position
T11	Can be used with caution	Monitor blood sugar
L5	Can be used with caution	Monitor leg perfusion
T12–L2	Not acceptable	Risk of bowel or renal ischemia, pull back to L3–L4
Above T6	Not acceptable	Pull back to T6–T10
Femoral artery	Not acceptable	Risk of leg ischemia, replace with new UAC

Avoid L1, the origin of the renal arteries
Never attempt to advance a catheter after it has been secured;
either withdraw it to the low position or remove it and insert a new one

DOCUMENTATION

- Record details of procedure on Badgernet and Asepsis Care Bundle, including catheter position on X-ray and whether any adjustments were made
- Always label umbilical arterial and venous catheters using the appropriately coloured and labelled stickers
- Place traceability sticker from catheter/insertion pack onto Asepsis Care Bundle

AFTERCARE

- Nurse baby in a position where UAC can be observed
- Monitor circulation in lower limbs and buttocks while catheter is *in situ*
- Leave cord stump exposed to air
- Infuse heparin 50 units in 50 mL sodium chloride 0.45% at 0.5 mL/hr
- Do not infuse any other solution through UAC. Glucose or blood may be administered through UAC only in exceptional situations, on the authority of a consultant

COMPLICATIONS

- Bleeding following accidental disconnection
- Vasospasm: if blanching of the lower limb occurs and does not resolve, remove catheter (see **Vascular spasm and thrombosis** guideline)
- Embolisation from blood clot or air in the infusion system
- Thrombosis involving:
- femoral artery, resulting in limb ischaemia
- renal artery, resulting in haematuria, renal failure and hypertension
- mesenteric artery, resulting in NEC (see **Vascular spasm and thrombosis** guideline)
- Infection: routine prophylactic antibiotics are not required, unless concerns of infection.

REMOVAL

Do not attempt to carry out this procedure unsupervised unless you have been trained to do so and have demonstrated your competence

INDICATIONS
- Catheter no longer required
- Catheter no longer patent
- Suspected infection
- Complications (e.g. NEC, vascular compromise to the lower limbs)

EQUIPMENT
- Stitch cutter
- Appeel wipes
- Umbilical tape
- Alcohol wipes
  Apron and gloves

PROCEDURE
- Wash hands and put on sterile gloves
- Clean cord stump with cleaning solution
- if umbilical tissue adherent to catheter, loosen by soaking cord stump with gauze swab soaked in sodium chloride 0.9%
- Ensure an umbilical tape is loosely secured around base of umbilicus
- Turn infusion pump off and clamp infusion line
- Take utmost care when cutting sutures not to cut through the arterial catheter
- Withdraw catheter slowly over 2–3 min, taking particular care with last 2–3 cm
- If bleeding noted, tighten umbilical tape
- Do not cover umbilicus with large absorbent pad, a small piece of cotton gauze should suffice
- Inspect catheter after removal: if any part missing, contact consultant immediately

AFTERCARE
- Nurse baby supine for 4 hr following removal, and observe for bleeding

COMPLICATIONS
- Bleeding
- Catheter tip inadvertently left in blood vessel