

Guidelines for Umbilical Arterial Catheterization, Management and Removal of Catheter

Umbilical Arterial Catheterization

Indications

- Frequent arterial sampling
- Direct BP measurement

Infants that fit above criteria may include...

- Gestation < 28 weeks
- Weight < 1000g
- Hypotensive, requiring inotropic support
- Requiring ventilation within first three days of life
- Exchange transfusion

Contraindication

- Evidence of local vascular compromise in lower extremities or buttocks
- Peritonitis
- Necrotizing enterocolitis
- Omphalitis
- Omphalocele

Equipment

- 1 scalpel blade No. 11 and handle
- 2 probes: fine and medium
- 4 mosquito artery forceps:
 - 2 curved, 2 straight
- 2 pair dissecting forceps:
 - Toothed, non-toothed
- 2 iris forceps
- 1 pair vein scissors
- 1 pair suture scissors
- 1 needle holder
- 2 bowls
- Cotton wool swabs
- Gauze swabs
- Tape measure
- Sterile gown and gloves
- Umbilical dilators
- 1 sterile plastic drape
- 1 umbilical artery catheter
 - < 1250g baby - Fg 3.5 / 3.7
 - > 1250g baby - Fg 5.0
- 1 blood pressure monitoring kit
- 1 disposable luer lock 3-way tap
- 1 x 5ml syringe and 18G needle
- 1ml ampoule heparin 1 000units/ml
- 1 x 10ml ampoule 0.9% saline
- 1 packet 3/0 black silk suture
- Skin preparation solution
 - NOT ALCOHOL BASED
- Infusion pump
- Drug additive label
- Elastoplasts for taping of catheter

Method

- Under sterile condition wearing sterile gown and gloves
- Estimate the position of catheter length
 - Direct measurement of the shoulder-umbilical length
Measure the perpendicular distance from an imaginary line drawn between the shoulders to the level of the umbilicus and calculate the catheter length using the graph
 - Formula: $[(\text{Weight (Kg)} \times 3) + 9]$ cm
Remember to add on the length of the stump
- Flush the selected catheter via the 3-way tap with normal saline, leave the syringe of saline attached to 3 way tap throughout the procedure.
- Cut a hole in the centre of the sterile towel
- With a pair of straight forceps grasp the end of the cord clamp and clean the umbilical cord, cord clamp and surrounding 3-4cm of abdomen with aqueous chlorhexidine - DO NOT USE ALCOHOL. **For babies <1000g do not use iodine**
 - Preparation of the skin at the insertion site is regarded as one of the most important measures for preventing catheter related infection.
 - **Do not allow the solution to pool under the infant as it may burn the skin particularly in the very low birthweight infant.** Change any damp or wet linen under the infant immediately following the procedure.
- Pass the umbilicus through the hole in the sterile towel and drape the towel around the umbilicus over the baby.
- Hand the forceps to the assistant or place on towel.
- Tie a short piece of rolled gauze around the base of the cord. It should be secure enough to maintain haemostasis but not too tight to prevent passage of the catheter. Within 6-12 hours of delivery there is a risk of haemorrhage from the arteries when the cord is cut.
- Maintain gentle upward traction on the cord with the forceps, and slice the cord with the scalpel, 2 – 2.5cm from the skin margin.
- Dispose of the forceps and cord clamp. **Do not** use these forceps again during the procedure.
- Blot the cut surface dry and identify the umbilical vessels:
 - The single thin walled umbilical vein
 - Two smaller thick walled round arteries, generally constricted so that the lumen appear pinpointed.
- Use the other forceps to secure and stabilise the umbilical cord.
- Pick **one** artery and gently open it using either the fine forceps or fine probe. Gradually dilate the artery, advancing either to the curve of the forceps or to half of the probe length
- Cannulate the artery and gently advance the catheter. Obstruction may be encountered at the anterior abdominal wall or bladder. This can usually be overcome by 30-60seconds of gentle steady pressure and pulling the umbilical stump up towards the baby's head to straighten out the artery as it turns caudally in the anterior abdominal wall just below the umbilicus. Avoid excessive pressure or repeated probing. If unsuccessful, **ask for help**.

The most common error arises after cannulating the layer between the vascular intima and the muscle. This usually occurs if dilatation of the artery in the cord has been inadequate. **Do not attempt the 2nd artery unless very experienced.**

- Ensure patency of catheter by checking for easy withdrawal of blood and “pulsation” of blood/saline in the catheter.
- Check position of catheter by x-ray.
 - There are two **suitable** positions:

- **HIGH POSITION: Between T6 –T9**

- This is in the descending aorta above the origin of the mesenteric and renal arteries and below the ductus arteriosus. The high position is associated with fewer episodes of blanching and cyanosis of the lower extremities. However hypertension may be more common and this position may also be associated with increased incidence of IVH.

- **LOW POSITION: Between L3 – L4**

- This coincides with the aortic bifurcation at the upper end of L4 and is below the major aortic branches.

- Any other position is unsuitable and the catheter should either be removed or pulled back to one of the two suitable positions if possible. **Under no circumstances should the catheter be advanced, it should be removed and a new catheter inserted under sterile conditions.**

- Secure catheter with 3/0 black silk suture by placing a suture around the base of the cord, avoiding the skin, either side of catheter, knotting securely and keeping the ends long. Cut a long strip of Elastoplast and place at 90 degrees to the catheter, sticky side up. Take the ends of the 2 tied sutures; bring them up keeping them parallel to the catheter and place along with the catheter on the sticky side of the Elastoplasts. Fold the Elastoplasts over so that sticky surface meets sticky surface and it enclose the catheter and suture ends.
- Connect catheter to heparinized saline infusion 0.5 - 1.0ml/hr (1unit/ml) and check for arterial waveform on arterial transducer after it is connected and calibrated.
- **ENSURE THAT LINE IS CLEARLY MARKED AS ARTERIAL (RED CONNECTORS)**

Management of Umbilical Arterial Catheter

Ongoing Management

- Observe skin colour
 - Note any skin blanching or bruising of limbs, toes or buttocks prior to, during and following the procedure and at any time that catheter is in situ. Report immediately.
 - If one limb is involved, warm opposite limb to induce reflex vasodilatation of affected limb.
 - If physical therapy fails, the catheter may be withdrawn 0.5 – 1.0cm and observe. Remove catheter if blanching persists >30minutes
- Maintain infant supine or in lateral position for 24hours post procedure to observe for haemorrhage from umbilical stump.

- Keep catheter and infusion line clear of blood as blood clots may form. Remove all air bubbles in the infusion line and catheter. Interruption to infusion must be for as short a time as possible. Do not flush catheters quickly
- Filters must not be used for arterial catheters or cannulae. All connections must be luer lock.

Complications

Malpositional catheter

- Vascular perforation of the umbilical arteries, haematoma formation and retrograde arterial bleeding
- Refractory hypoglycemia with catheter tip opposite celiac axis
- Peritoneal perforation
- False aneurysm
- Movement of catheter tip position due to changes in abdominal circumference
- Sciatic nerve palsy
- Misdirection of catheter into internal or external iliac artery
- Curving back of itself due to catching in the intima

Vascular accident

- Vasospasm of the femoral artery causing blanching of toes and foot
- Embolisation from blood clot or air in the infusion system
- Thrombosis involving
 - Femoral artery resulting in limb ischaemia, gangrene and loss of extremity or paraplegia
 - Renal artery resulting in hypertension, haematuria, renal failure
 - Mesenteric artery resulting in gut ischaemia, NEC
 - Aorta resulting in congestive heart failure
- Pseudocoarctation of the aorta

Equipment-related

- Bleeding due to accidental disconnection or from open connections
- Breaks in catheter and transection of catheter
- Intravascular knot in the catheter

Removal of Umbilical Arterial Catheter

Indications

- No longer required
- Development of complications (see above)

Equipment Required

- Alcohol swab
- Sterile stitch cutter/Sterile blade
- Sterile scissors

- Specimen container

Method

- Clean the stump with an alcohol swab
- Turn infusion pump off and clamp infusion line.
- Remove sutures and withdraw catheter to within 3-4cm of skin
- Wait for pulsation in catheter to stop - usually takes about 10-20minutes
- Remove rest of catheter with gradual gentle pressure
- If catheter will not move do not apply greater force.
- Ensure that all sutures have been removed
- Soak umbilical cord in saline for 5minutes and retry
- If any bleeding is noted, apply positive pressure below level of stump
- After removal apply positive pressure to below stump for 3-4minutes, longer if continues to bleed or ooze
- Send tip for culture and sensitivity if appropriate
- Do not nurse the infant prone for 4hours following removal
- Observe for bleeding