

## Umbilical Arterial Catheter (UAC) Guideline

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### Anatomy

The umbilical artery is usually paired and carries deoxygenated blood from the fetus to the placenta. The arteries are a direct continuation of the internal iliac arteries and they pass initially inferiorly and latterly as it passes the bladder before turning medially to enter the aorta.

### Indications for UAC

- Monitoring arterial blood pressure
- Regular blood sampling

### Which babies should have a UAC?

In general, any baby with the following should have a UAC inserted:

- Extreme preterm <25 weeks
- Any ill baby

Consider in any baby <500g, irrespective of gestation or any baby who is unexpectedly unwell in the first few days of life, where umbilical access is still a possibility. Peripheral arterial access may be preferred in many instances.

### Relative Contraindications

- Anterior abdominal wall defects
  - Exomphalos, Gastroschisis, Umbilical fistula
- NEC
- Infection
  - Peritonitis, Omphalitis
- Evidence of local vascular compromise in lower limbs
- Abdominal surgery requiring an incision above the umbilicus

### Types of umbilical arterial catheter:

We have 3 sizes of umbilical artery catheters, a 5F (default), 3.5F and a 2.5F\* (see table)

The 5F line is the default UAC

The 3.5F should be used for an infant <1000g

Catheter size (F)	Length (cm)	Priming volume (ml)	Max flow rate (ml/min)
2.5*	20	0.12	3
3.5	40	0.19	10
<b>5</b>	<b>40</b>	<b>0.38</b>	<b>23</b>

\*The 2.5F line should only be used at consultant discretion for infants <500g or where skilled operators cannot insert a 3.5F UAC.

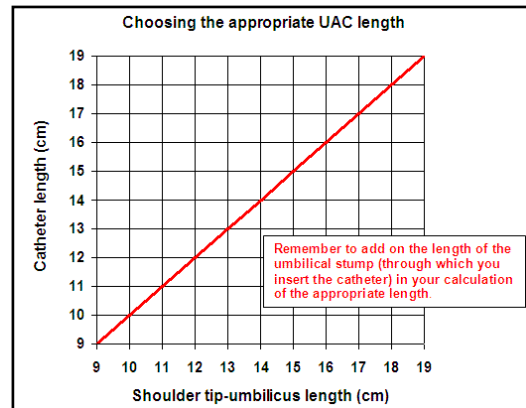
### Preparation for UAC insertion:

- **Equipment**
  - Sterile gown, hat, mask, gloves (2 pairs)
  - Umbilical line insertion pack



1. Umbilical cord ligature
2. Transparent drape with central hole
3. Further sterile drapes
4. Gauze
5. Curved mosquito forceps
6. Dilator (for UAC insertion)
7. Curved tweezers
8. Luer lock syring (for flush)
9. Plastic tray (place the primed line in here)
10. Suture

- Line (see above), 3 way tap, one red bung (which is placed on the middle arm of the 3 way tap)
  - Prime the line with 0.9% sodium chloride or hepsal prior to use
- Measure the desired insertion length
  - Umbilicus -shoulder tip distance PLUS stump



- **Environment**

- Attention to thermoregulation during the procedure is important (see procedural thermal bundle)
- This procedure is performed with the incubator side down to minimise risk of accidental contamination of equipment on the incubator / doors etc, so this poses a risk of the temperature dropping
- Pre-empt this by increasing incubator temperature in advance of starting, using a plastic bag and ensuring everything is set up prior to starting the procedure, to minimise the time the incubator side is open and hence minimising the risk of procedural hypothermia

- **Parents**

Wherever possible, parents should be told in advance of umbilical line insertion. This is especially relevant if the lines are not inserted immediately after birth, and therefore there is time for a brief explanation. This should be documented in the medical records.

### Insertion of UAC

Insertion of UAC is a 2-person procedure (inserter and assistant) and should be performed using the aseptic non touch technique (ANTT). It is advocated that you wear 2 pairs of sterile gloves and remove one pair once the skin and umbilical cord has been cleaned, as this is a common time for gloves to become contaminated.

1. Clean skin and umbilical cord with appropriate cleansing agent, taking care that this does not pool **under** the baby as this can cause skin burns.
2. Apply a sterile cord ligature [1] around the base of the cord (not skin) and pull tight

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3. Ideally, an assistant will hold the cord by the cord clamp to allow the inserter to clean without contaminating their gloves. Where this is not possible, use sterile swabs [4] to pick up the cord clamp to avoid direct contact with gloves
4. Apply the clear drape [2] supplied in the umbilical insertion line kit. You can also have a drape that is placed slightly under one side of the baby [3], as this helps to absorb any cleaning fluid that may drip down the side of the baby.
5. Slice the umbilical cord approximately 1cm from the skin with a scalpel in one smooth movement. Avoid sawing the cord, as this results in a jagged surface, making line insertion much more challenging
6. Identify the vessels, usually 2 smaller arteries with muscular walls and one larger vessel with a thin wall
7. Using the curved forceps [5] it can be helpful to grip either side of the umbilicus as this allows some gentle traction to be applied when attempting to insert the catheters. This is particularly useful when inserting UACs, which are notoriously more challenging due to the muscular spasming of the vessel wall.
8. If inserting both UVC and a UAC, it is advisable to insert the UAC first as they can be more challenging for the reasons stated in step 7.
9. When the artery has been identified, use the narrow end of the dilator [6] and insert into the artery using gentle pressure. Take care not to create a false passage at this stage
10. Once dilated, using tweezers [7], take the umbilical catheter and remove the dilator, replacing it immediately with the catheter. Insert to the desired length (as measured above)
  - a. It is also common to feel slight resistance a few cm in, at the umbilical ring. This can usually be overcome by gentle but firm pressure
11. Ensure blood can be aspirated **from the line easily**. It is not necessary to pull blood all the way back into the syringe unless a sample is specifically needed. It is sufficient to see blood flowing back into part of the lumen. Then ensure **the line flushes easily**.
  - a. If unable to aspirate blood, reposition the line until it is possible to aspirate blood.
  - b. The inability to aspirate blood at insertion of a UAC usually means the catheter is not placed within a large vessel and is within a false tract. The line must be repositioned or removed
  - c. When repositioning, it is acceptable to insert the line slightly further **at this time only**, as you are still operating under aseptic non touch technique. This is the only time it is permitted to advance lines. Once the line has been secured and X-rayed, the only repositioning permitted is withdrawal in view of the risk of introducing infection into the central bloodstream.
  - d. Consider that if the UAC is withdrawn to a shorter than intended length, it is likely that the tip will be in a suboptimal position, possibly jeopardising the blood flow to the coeliac trunk or mesenteric arteries as they branch off the aorta

12. If an attempt at UAC is not successful using one artery, the second artery should be preserved for an attempt by a more experienced person.
13. Fix as per the guidance below using the 6 step fixation method
14. Loosen or remove the cord ligature, especially if there is any skin caught within it. If there is oozing noted from the umbilicus, apply a new (clean) cord ligature which can be removed once the oozing has ceased.

Optimal position on X-ray UAC: T8 – T10

### **Trouble-shooting UAC position on X-ray**

The ideal position is that the catheter sits in the descending aorta above the level of important branches of the abdominal aorta (which branch off between T11 and L3). Anatomically, the umbilical arteries pass inferiorly and join the iliac arteries before then heading superiorly towards the aorta. This pattern must be observed to confirm that the catheter is in fact in the artery rather than the vein. We do not ever routinely insert low UACs.

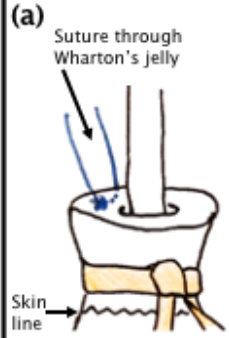

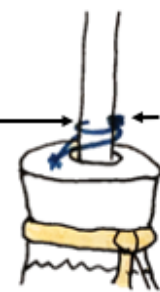
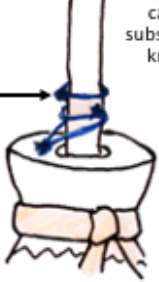

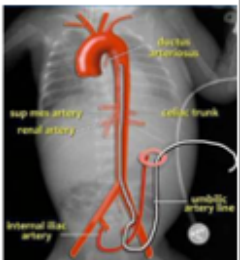


**If the UAC is too high** (above T8 vertebrae) it needs to be withdrawn. The distance to withdraw the catheter should be measured on PACS using the 'graphics' tab and the measurement tool.

**If the catheter is between T11 and L3**, this jeopardises blood flow to the gut and kidneys and the line ideally should be replaced. However, a consultant decision might be to pull back the line to sit at L4 (again using the measurement function on PACS) as a 'low' UAC.

There may be extenuating circumstances when umbilical lines with tips in suboptimal positions are accepted for a short period of time. This situation usually arises in the context of a critically unwell baby and is usually related to UVC position being suboptimal, as sub-optimally placed UACs can jeopardise blood flow and tend to be repositioned or removed to avoid a serious ischaemic related complication. The decision to use an umbilical line with a tip in a suboptimal position is at the discretion of the attending consultant and the rationale must be clearly documented in the medical records.

## Fixation of umbilical lines

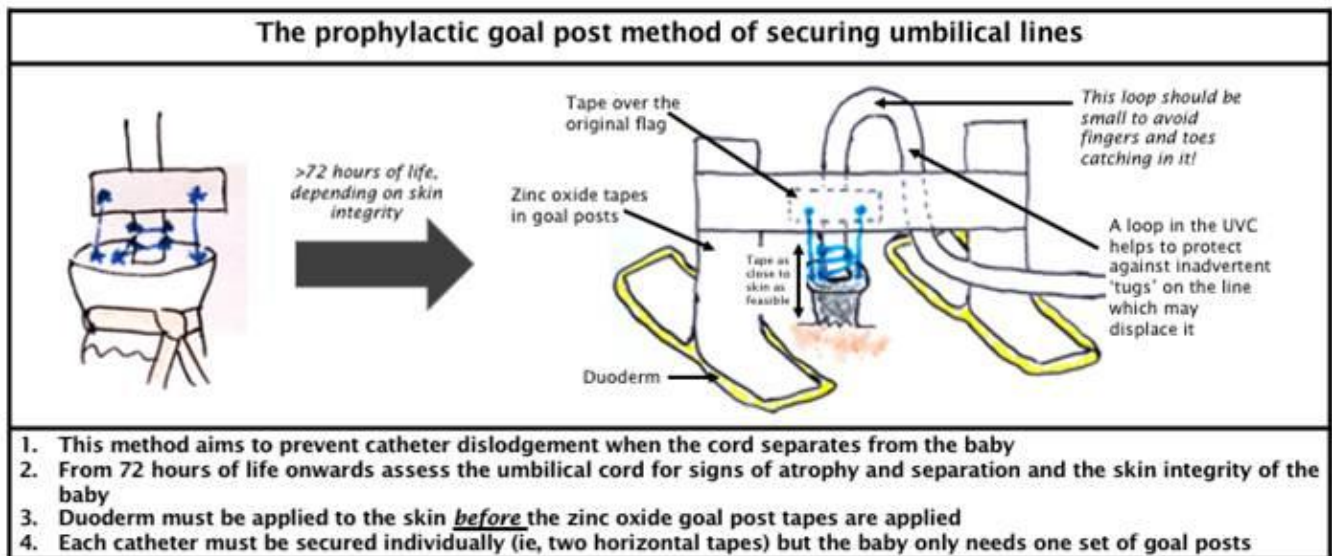
Fixation of umbilical lines is a 6 stage approach, with an X-ray to confirm tip position prior to final stages of fixation. This allows for potential adjustments to the line if required.

Step 1	Step 2	Step 3
<p>(a) Suture through Wharton's jelly</p>  <p>(b) View of the cord from above (without any catheters) to illustrate a purse string suture</p>  <p>Skin line</p>	<p>Wrap suture once around the catheter</p>  <p>Then tie 2 knots</p>	<p>Wrap suture 2<sup>nd</sup> time around the catheter</p>  <p>The second wrap around the catheter and subsequent set of knots is vital</p>
<p>First suture through the Wharton's jelly. This can be (a) a single suture or (b) a purse-string suture.</p>	<p>Take the two ends of the suture and wrap them around the catheter once. Then tie 2 knots in opposite directions to secure.</p>	<p>Wrap the suture around the catheter again a second time and tie 2 knots to secure. Tying twice around the catheter allows them to grip the catheter and hold it more securely in place</p>
Step 4	Step 5	Step 6
<p>(a)</p>  <p>(b)</p> 	<p>Thin zinc oxide tape</p>  <p>&lt;0.5cm</p> <p>Suture going through the flag and the umbilical stump (not skin)</p>	<p>Suture either side of the flag provides more secure fixation</p> 
<p>X-ray to assess position of (a)UVC or (b)UAC before securing any further. If the lines need to be pulled back, do this before moving to step 5.</p>	<p>Apply a flag using thin zinc oxide tape as close to the umbilical stump as possible (&lt;0.5cm). Then insert a suture from cord to the flag on 1 side.</p>	<p>Insert a second suture the other side of the flag. The catheter is now secured from 3 points.</p>

## Prophylactic goalpost fixation of umbilical lines

- After 72 hours, as the umbilical cord starts to undergo its normal necrosis, further fixation may be required to prevent dislodgement
- This is most applicable to the extremely preterm infants and those where central access is deemed life-saving
- We advise a goalpost method of fixation (see diagram)
- Duoderm should be placed on the skin to protect it before the zinc oxide is applied

- If securing both a UAC and UVC, one set of goal post tapes is required, but with 2 separate horizontal tapes, one for each line



### Post- insertion management

- UACs should have an infusion of 0.45% heparinised saline connected as soon as possible after their insertion. There is no need to wait for the Xray to commence this infusion, as long as the line was freely aspirating and flushing when it was inserted.
- The heparinised saline should be infused at a rate of 0.5ml/hr for all babies through a UAC.
- Observe for any immediate discolouration of the legs, which can sometimes occur. This is usually transient but needs to be monitored and if it does not rapidly resolve the catheter should be removed immediately.

### Documentation of UAC insertion

Full and complete documentation is required on Badgernet. This can be found under 'Procedures' and then 'Line insertion'. **The position of the UAC tip must be clearly documented within the free text part of the line insertion form.**

A central line insertion checklist needs to be completed by the person inserting the line. A central line maintenance checklist then needs to be completed by the nursing staff looking after the baby on a daily basis until the line is removed.

Any difficulties during insertion (such as excessive bleeding, clinical instability, any resistance during catheter advancement, or inability to aspirate blood etc) must also be clearly documented, along with any actions as a result of this. Any changes in lower limb

appearance must also be clearly documented, along with a review within 15 minutes if there are concerns, to ensure that the circulation has improved. If there are ongoing concerns, the consultant must be informed and the line should be removed.

### **Complications of UAC insertion**

- Infection
- Displacement
  - Using the 6 step fixation method should reduce the risk of displacement
  - Prophylactic goal-posting of the lines in extremely preterm infants may also reduce the risk of umbilical catheter displacement once the umbilicus necroses and separates
- Bleeding
- Ischaemia
  - Usually lower limbs
  - If the tip is not in the ideal position (ie T10 – L3) there is a risk of impaired blood flow to coeliac trunk, mesenteric ischaemia or renal ischaemia.
  - Any concerns about ischaemia must be taken seriously and if there is any doubt about blood flow, the UAC should be removed.

### **Removal of UAC**

- The continued need for a UAC should be justified at least daily on the ward round
- In extremely preterm infants who are likely to need ongoing arterial access for blood sampling to preserve skin integrity, there may be a plan to insert a peripheral arterial line
- The removal of a UAC should be documented in the same input form on Badgernet as the line insertion is documented
- We do not routinely send line tips to microbiology