

## Umbilical Venous Catheter Guideline

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### Anatomy

The umbilical vein supplies oxygenated blood from the placenta to the fetus. From the umbilicus it joins the left branch of the portal vein after giving off several intrahepatic branches and continues on to the inferior vena cava by way of a vessel called the ductus venosus.

## Indications for Umbilical Venous Catheter (UVC)

- Secure central access
- Infusion of medications that need to be delivered centrally
  - Eg, inotropes, high concentration glucose
- (Emergency UVC for resuscitation drugs)
  - This procedure is performed in the delivery room as a 'clean procedure' rather than under asepsis in view of the life-threatening situation the baby is in.

## Which babies should have a UVC inserted?

Insert UVC	Consider a UVC
<ul style="list-style-type: none"><li>• All babies &lt;25 weeks gestation</li><li>• Term infants undergoing therapeutic hypothermia</li><li>• Term infants who have had full resuscitation and an emergency UVC inserted in the delivery room*</li></ul>	<ul style="list-style-type: none"><li>• 25-27 weeks and ventilated on day 1</li><li>• Infants with a high glucose load (although a long line may be more appropriate)</li><li>• Any ill term baby where the cord allows (eg, Meconium aspiration syndrome, severe sepsis)</li><li>• Infant needing an exchange transfusion</li></ul>

*\*These infants should have their emergency UVC replaced with a UVC inserted under aseptic technique*

## Relative Contraindications to umbilical lines

- 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 venous catheter:

Generally, all babies will have a 4F double lumen UVC inserted, and this is our default UVC. These have been inserted into babies as small as 370g and there is no lower weight limit.

The only circumstance where we would site a single lumen (5F) umbilical line would be if a baby had a transposition of the great arteries with an intact ventricular septum which required a septostomy. In this case a single lumen UVC allows access to the right atrium to perform the septostomy. Most infants with this condition are identified antenatally.

Catheter size (F)	Length (cm)	Lumens	Priming volume (ml)	Max flow rate (ml/min)
4F	20	2	0.19 per lumen	11

### Preparation for UVC insertion:

#### • Equipment

- Sterile gown, hat, mask, gloves
- Umbilical line insertion pack AND Line (see above)
  - Open pack and arrange equipment on the trolley in an organised fashion
    - It can be helpful to arrange the equipment in the order with which it will be used (ie, swabs and cleaning, drapes, instruments, line etc)



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 iris forceps
8. Luer lock syringes (for flush)
9. Plastic tray (place the primed line in here)
10. Suture

- Apply blue bungs on the end of each lumen

- Prime each lumen with 0.9% sodium chloride
- Ensure each lumen is clamped off after priming with saline
- Calculate the desired insertion length (PLUS umbilical stump)

$$\text{Length of UVC cm} = (1.5 \times \text{birthweight in kg}) + 5.5$$

- **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
- Pre-empt by increasing incubator temperature in advance of starting, using a plastic bag and having everything set up prior to starting to minimise the time the incubator side is open.

- **Parents**

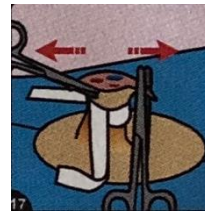
Wherever possible, parents should be told in advance of umbilical line insertion. This is especially relevant if the lines are not inserted immediately after birth, and therefore there is time for a brief explanation. This should be documented in the medical records.

### **Insertion of a UVC**

Insertion of UVC 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. If the baby is preterm, clean with 0.05% chlorhexidine and then wash off with water. If the baby is near term or term, clean with 2% chlorhexidine and 70% alcohol solution and allow to evaporate.

2. Apply a sterile cord ligature [1] around the base of the cord (not skin) and pull tight
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 to pick up the cord clamp to avoid direct contact with gloves
4. Apply the clear drape supplied in the umbilical insertion line kit [2]. You can also have a drape that is placed slightly under one side of the baby, as this helps to absorb any cleaning fluid that may drip down the side of the baby [3].
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 vein has been identified, using tweezers [7], pick up the umbilical line, and thread it through the vein to the desired length (as calculated above)
  - It can be helpful to pull the umbilical stump in the direction of the baby's feet during insertion
  - 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
10. Ensure blood can be aspirated **from both lumens**. 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 **both lumens flush easily**.
  - If unable to aspirate blood, reposition the line until it is possible to aspirate blood.
  - The inability to aspirate blood at insertion of a UVC means the catheter is not placed within a large vessel therefore it should NOT be left in situ, it must be repositioned or removed



- 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 they have been secured and X-rayed, the only repositioning permitted is withdrawal in view of the risk of introducing infection into the central bloodstream.
- Consider that if the UVC is withdrawn to a shorter than intended length, it is likely that the tip will be in a suboptimal position.

11. Fix as per the guidance below

12. 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.

**Ideal UVC tip position: Just above the diaphragm,  
*not within cardiac shadow and not within the liver shadow.***

#### **Trouble-shooting UVC tip position on X-ray:**

The aim is for the catheter to pass through the ductus venosus and sit in the inferior vena cava at the junction between the IVC and right atrium. The UVC should head immediately superiorly as soon as it enters the baby.

If only a UVC has been sited, ensure that the catheter does not pass inferiorly before turning superiorly, as occasionally a UAC is sited accidentally when attempting UVC insertion.

If the tip position is **within the cardiac shadow**, this should be discussed with the consultant, measured on PACS to ensure it is withdrawn the correct length and repositioned under aseptic conditions. A repeat X-ray is required.



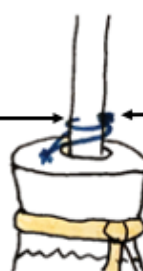
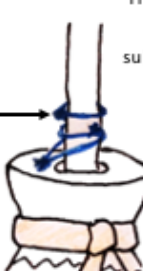

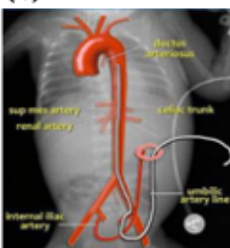
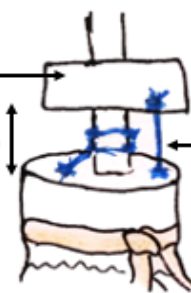

If the tip position is **within the liver shadow**,

- It could lie within the **ductus venosus**. This position is suboptimal and there are risks to infusing parenteral nutrition and medications into the ductus venosus. This should be discussed with the consultant.
- **and** is making a right turn, it has likely migrated into the right hepatic vein and will need to be removed.

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**

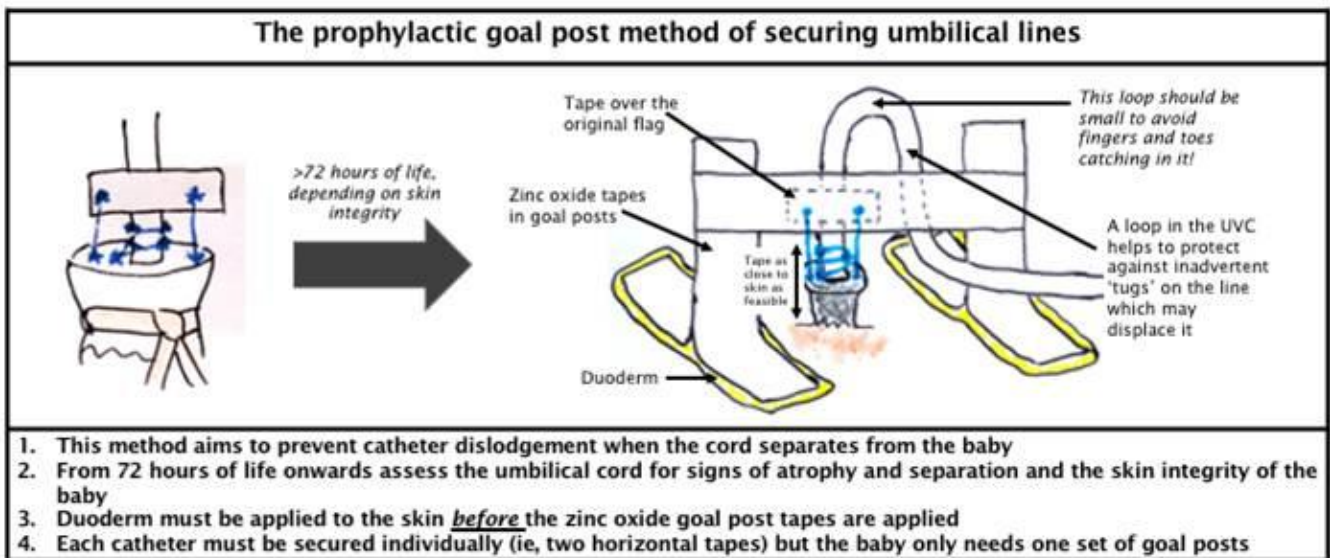
Fixation of umbilical lines is a 6 step approach (see below), with an X-ray to confirm tip position prior to step 5 and 6 of fixation. This allows for potential adjustments to the line if required.

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>Labels in (b): aortic arch, sup. mes. artery, renal artery, celiac trunk, internal iliac artery, umbilic. artery line</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
- If securing both a UAC and UVC, one set of goal post tapes is required, but with 2 separate horizontal tapes, one for each catheter





### Post insertion management

- Clear fluids may be infused via the UVC as soon as the catheter is inserted.
- Drugs and parenteral nutrition should not be infused until the X-ray has confirmed the tip position is acceptable.

### Documentation of UVC insertion

- Full and complete documentation is required on Badgernet.
- This can be found under 'Procedures' and then 'Line insertion'.
- 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.
- **The position of the UVC 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 on a daily basis by the nursing staff looking after the baby until the line is removed.

## **Complications of UVC**

- Infection
- Extravasation
  - Cardiac tamponade poses a risk and this is the reason that lines should not be placed within the right atrium, and the reason that we do not advocate lines being within the cardiac shadow
  - Extravasation within the liver is an under-recognised complication of UVC malposition and can also be fatal.
- 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 displacement once the umbilicus necroses and separates.
- Blockage – usually of one lumen. This is uncommon if there are continuous infusions running via both lumens.

## **Removal of UVC**

- The continued need for a UVC should be justified at least daily on the ward round.
- In extremely preterm infants who are likely to need secure central access whilst establishing enteral feeds, a plan for long line insertion should be made and ideally the long line sited prior to removal of the UVC.
- We do not routinely send line tips to microbiology
- The removal of a UVC should be documented in the same input form on Badgernet as the line insertion is documented.