East of England Neonatal ODN
(Hosted by Cambridge University Hospitals)

Clinical Guideline:

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For use in: EoE Neonatal Units
Guidance specific to the care of neonatal patients.

Used by: Doctors and ANNPs

Key Words: UVC, umbilical venous catheter insertion, indications, complications, position

Date of Ratification: **2nd June 2025**

Review due: **01 June 2028**

Registration No: **NEO-ODN-2025-5**

Approved by:

Neonatal Clinical Oversight Group	
Clinical Lead	**Sajeev Job**

Ratified by ODN Board:

Date of meeting	

Audit Standards:

Audit points

To be locally agreed.

1) Background

The use of umbilical venous catheters (UVCs) is an essential part of neonatal care allowing delivery of intravenous fluids, nutrition, and medication. However, the use of UVCs is associated with a number of potential complications. Whilst catheter-associated infection is well recognised, extravasation into a body cavity is less common but potentially fatal if tamponade ensues. The British Association for Perinatal Medicine has recently published a framework for practice to reduce harm and improve safety in babies needing central venous catheters.[1] The present guideline for UVC insertion incorporates key practice points highlighted by the BAPM expert working group to reduce the risk and complications arising from this procedure.

2) Objective

To ensure the safe insertion of an umbilical venous catheter.

3) Indications[2]

- Central venous access for low birth weight infants to avoid multiple peripheral cannulae
- Delivery of drugs and parenteral nutrition
- Emergency vascular access for resuscitation of infants at birth
- Exchange transfusion

4) Contraindications[2]

- Abnormalities of the abdominal wall
- Necrotising enterocolitis
- Peritonitis

5) Complications[1]

- Sepsis[4,5]
- Embolism[3]
- Venous thrombosis[6]
- Pericardial effusion[7,8]
- Pleural effusion[9]
- Portal hypertension
- Displacement leading to blood loss
- Breakage of catheter on removal[10]
- Intra-abdominal extravasation[1]

6) Mispositioned catheters

- Catheters placed in the heart can cause pericardial effusion, cardiac tamponade, endocarditis, arrhythmias, and death[1,8,11,12,13,14,15]

- Catheters placed in the portal system are associated with necrotising enterocolitis, perforation of colon and hepatic necrosis[15,16].
- Catheters in a low position (pre-hepatic) may be at increased risk of hepatic necrosis and intra-abdominal extravasation[1]

7) Key notes (based upon the recommendations of the 2018 BAPM Framework[1] and shared learning from PMRT)

- A umbilical venous catheter (UVC) tip should lie outside the cardiac silhouette ideally at T8-T9.
- A UVC with tip sited at or below T10 should only be used in the short term (if considered essential) as this site carries a significantly higher risk of extravasation
- Staff inserting UVCs have a responsibility to ensure they maintain their competence and should be familiar with the equipment and procedures used for catheter insertion.
- In each situation where a UVC is required an assessment should be made as to who is the most appropriate person to undertake the procedure.
- A Central Cather Care bundle should be used to covers all aspects of insertion, use and on-going management of the UVC.
- Staff inserting the UVC should have undertaken a formal training package for the insertion of central venous catheters. This should include an assessment of technical competence and awareness of potential complications
- When inserting a UVC each UVC should be withdrawn to a point at which it freely aspirates blood (to prevent malposition) and, after being secured in position, should be x-rayed to confirm that the position is acceptable.
- Following any new manual adjustment of UVC position, irrespective of how small the adjustment, a further radiograph must be obtained to verify the new position.
- The UVC position should also be noted on any subsequent x-ray done in the baby
- Umbilical catheters should be clearly labelled to distinguish arterial and venous catheters.
- Ensure the first hour of care bundle is followed, with antibiotics and nutritional support delivered promptly and in line with established clinical guidelines. Where there are delays in confirmation of central lines, consider inserting a peripheral venous line or using the UVC to administer 10% dextrose and antibiotics, if required.
- Use of ultrasound to confirm ongoing position can be used where facilities and skill mix allows.[27]
- There is no evidence to support the practice of ‘railroading’ a second UVC alongside the one which is thought to be malpositioned. This practice is to be avoided since it may increase the risk of vessel trauma and consequent extravasation.
- There should be thorough contemporaneous documentation of each UVC insertion including indication, description of the catheter itself, number of attempts, length inserted, confirmation of blood aspiration, position on X-ray, and any adjustments subsequently made. The accepted position should be verified in

writing within 24 hours of insertion by a consultant neonatologist/consultant paediatrician or from a consultant radiologist's report.
- The need for continued retention/use of a UVC should be reviewed daily.
- On-going care of UVC should include regular review of catheter fixation and position, strict asepsis and minimising catheter access.
- Any clinical deterioration of a baby in whom a central venous catheter is present should raise the question of catheter-related complications, particularly infection, extravasation and tamponade
- Parents should always be informed about the use of central catheters at the earliest opportunity, although formal prior consent is impractical.

8) Description and Documentation of the Procedure

Equipment

- Sterile pack for insertion of umbilical lines
- Chlorhexidine antiseptic solution for skin preparation (see further details below)
- Sterile water
- Umbilical catheter (single or double lumen, in size range 3.0 to 5.0 Fr)
- 10 mL syringe
- Yellow needle (21G)
- 0.9% sodium chloride – 10 mL ampoule
- Scalpel
- Sterile gloves and gown
- Suture
- Tape to secure the line in place with suture or umbilical catheter holder
- Umbilical tape

Antiseptic Skin Cleanser

BAPM together with the Neonatal & Paediatric Pharmacists Group (NPPG, 2021) released a position statement in response to antiseptic skin cleansing use in neonates due to reported burn injuries seen in this population. The advice is as follows:

- In babies born before 34 weeks' gestation and who are under 7 days old, use aqueous solution of 0.5% chlorhexidine gluconate for skin preparation.
- In babies born from 34 weeks' gestation onwards and for those babies born before 34 weeks' gestation who are now 7 days or older, use a solution of 2% chlorhexidine in isopropyl alcohol for skin preparation.

- Irrespective of the skin preparation solution used, it is critical to avoid pooling on the skin and surfaces (such as incubator or cot sheets) which may come into contact with the baby's skin. For this reason the use of an applicator device is recommended wherever possible

Preparation

* Clean trolley surface.
* Wash hands.
* Assess the depth that the catheter needs to be inserted using the Neomate® app or from one of the following two methods:

a) ({3 x baby's weight in kg} + 9)/2 and add on cord stump length, (cm)[17]

b) Directly measure length from cord base to xiphisternum and add on cord stump length

* Position the infant and surrounding equipment so that the cord is accessible.
* Where possible, depending on the urgency of the procedure, ensure that infant's temperature is at least 37˚C before starting the procedure. Check that there is adequate output from the radiant heat source or incubator to keep the infant warm during the procedure.
* If the infant is particularly active and doesn't calm when the drapes are in place, ensure that an assistant is on hand to contain and support the infant for the procedure. Consider use of sucrose if applicable.

Physiological instability during insertion

- Closely observe the infant during and following the procedure for any deterioration
- Monitoring (ECG and oxygen saturation) should remain in place throughout the procedure
- If the infant is intubated, check the endotracheal tube is secure before commencing the procedure.
- If the infant is very preterm and is nursed in a polyethylene bag this should remain in place with a small incision made to the polyethylene bag over the umbilicus to provide access.

Procedure

* Wash hands.
* Open the packaging of equipment with a non-touch technique.

* Wash hands thoroughly and dry.
* Put on gown and two pairs of sterile gloves. In addition, hat & mask should be worn where this is local unit policy.
* Follow aseptic procedure principles.
* Draw up 10 mL of 0.9% sodium chloride into syringe and attach a three-way tap to the catheter according to unit policy. Flush through both the three-way tap (if used) and the catheter with the saline ensuring that there is no air in the system.
* Turn the three-way tap off or clamp the line to prevent any entry of air into the catheter to reduce the risk of air embolism whilst the catheter is being inserted.
* Clean cord and peri-umbilical area with chlorhexidine solution following the BAPM & NPPG (2021) guidance above.
* Remove 1 set of sterile gloves.
* Holding cord clamp with sterile gauze, apply sterile drapes.
* Tie umbilical tape around the base of the cord tightly enough to minimise blood loss but loosely enough to allow the catheter to be passed through.
* Grasp the cord with the artery forceps and gently pull the cord upwards whilst you cut the underside of the forceps with a scalpel blade leaving 1-2cm of cord above the skin junction.
* Identify the vessels in the cord. The vein is a thin walled vessel, larger than the two arteries.
* Hold the stump with the toothed forceps and remove any visible clots.
* Place the tip of the catheter, held with forceps or between finger and thumb (see **Figure 1**) into the lumen of the vessel and gently advance to 5 cm into the vein. Remember that the vein goes up towards the heart unlike the arteries which descend first before looping upward; therefore, the catheter should be passed upwards.
* Turn the three-way tap so that the catheter is open to the syringe and apply gentle suction on the syringe.
* If there is smooth blood flow, continue to insert to the predetermined length and aspirate with syringe to verify blood return.

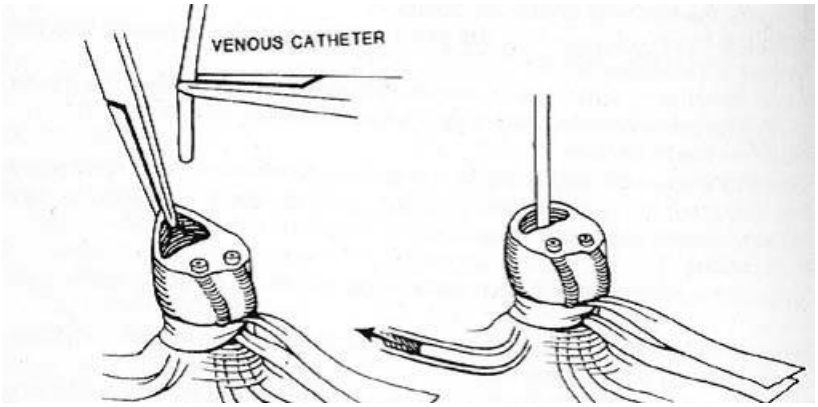

Figure 1 Inserting catheter into umbilical vein (from 'Atlas of Procedures in Neonatology' [2,])

- If no blood is aspirated at this point either advance the catheter 1 cm at a time or withdraw catheter 1 cm at a time until blood can be aspirated.
- If it is not easy to get blood back, rarely the catheter may be in a small blood vessel and have a clot in the tip – withdraw whilst maintaining suction, remove the clot and reinsert the catheter. Note that UVCs placed during newborn resuscitation also require demonstration of adequate back sampling of blood before use.
- If there is any resistance and you cannot advance the catheter to the desired depth or there is a bobbing motion of the catheter, it may have entered the portal vein or be wedged in the intra-hepatic branch of the umbilical vein. The catheter must be retracted or removed and replaced. Some authors have described a technique involving insertion of another smaller bore catheter alongside which may then pass into the ductus venosus before removal of the original catheter[21]. However, there is insufficient evidence to support the technique of double cannulation at the present time. This practice may increase the risk of umbilical vein trauma and should therefore be avoided pending better supportive evidence for its safety[1].
- Take blood samples as required and flush the line with saline.
- Secure the catheter using a technique that avoids tape being applied to the skin, if possible, e.g. suture and flag or Sulle securing device secured with a suture to the umbilicus[22,23]. Or use a colloid based umbilical catheter holder that will protect the skin, e.g. Neobridge[24]. Use Cavilon spray prior to using an adhesive on the skin. Once secured in place the catheter should not be advanced any further into the vein during any subsequent adjustments.
- Running 0.9% saline solution at 1.0 mL/hr through the catheter while awaiting X-ray confirmation of position may reduce the risk of the catheter blocking.
- Ensure that the correct position of the catheter is confirmed on AXR/CXR. The catheter should lie outside the cardiac silhouette ideally at T8-T9[1]. A UVC tip sited at or below T10 should only be use short term (if considered essential) as situation at or below this level carries a significantly higher risk of extravasation.[1] **Figures 2** and **3** illustrate the umbilical vein and its main anatomical relations.

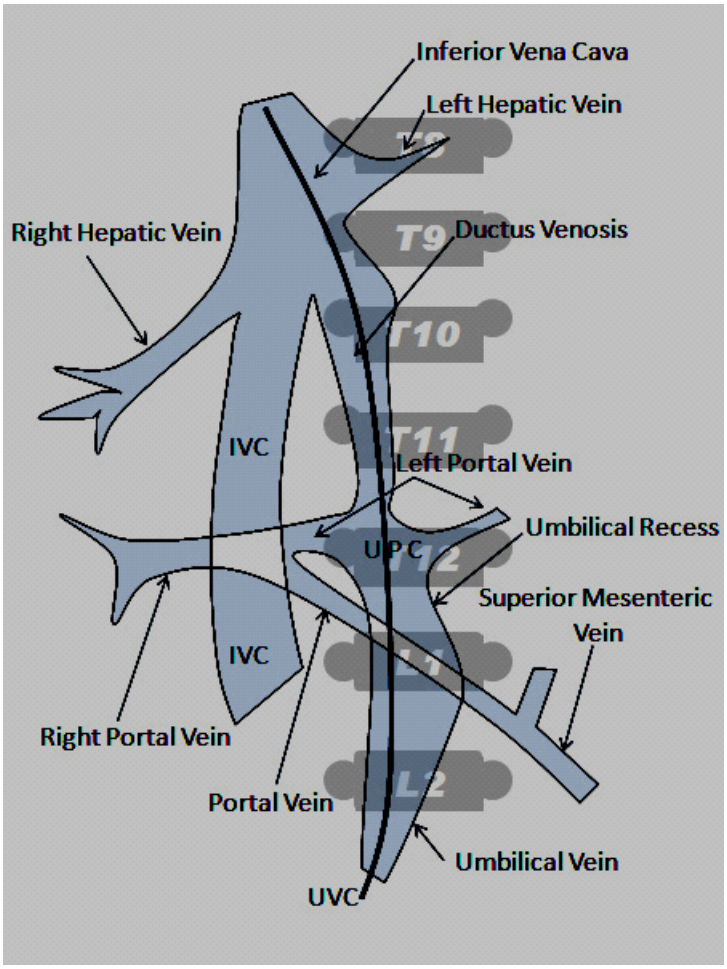

Figure 2 Schematic diagram of umbilical and associated veins

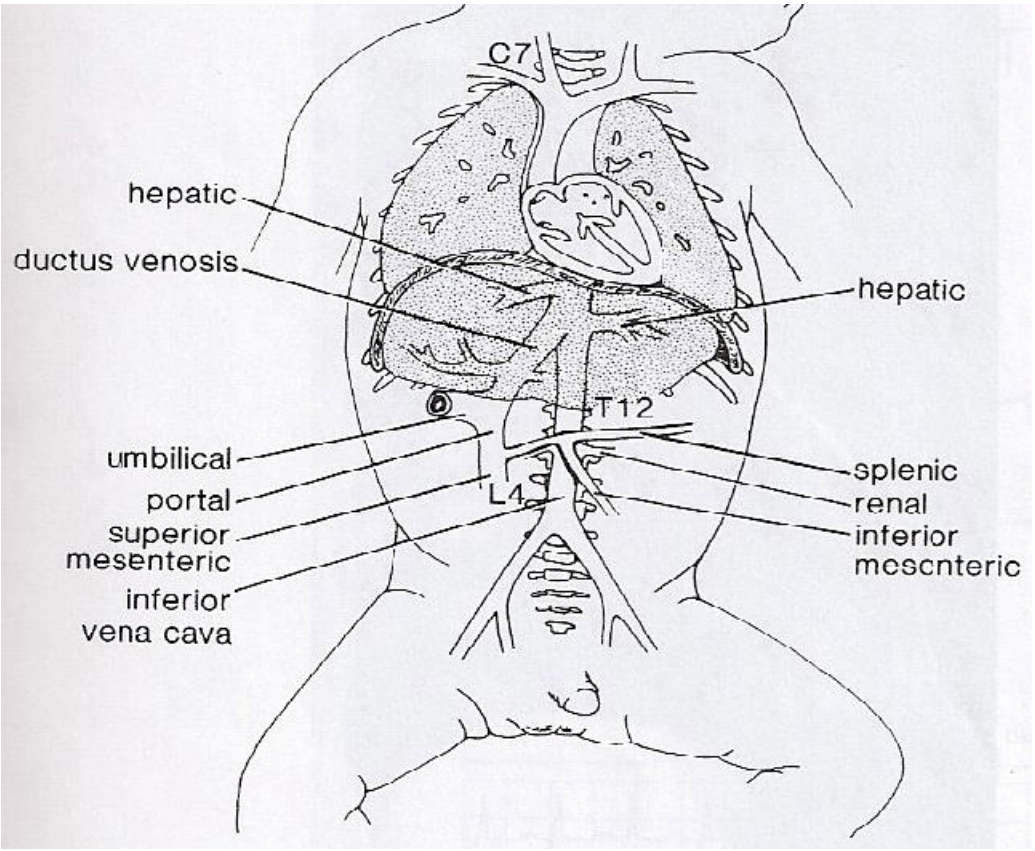

Figure 3 Anatomy of the umbilical and associated veins, with reference to external landmarks (from 'Atlas of Procedures in Neonatology' [2,])

* There may be some bleeding from the umbilical vein because it is not a contractile vessel. Applying pressure may be enough to stop the oozing or the ligature around the bottom of the stump can be tightened slightly for a short while but released once oozing has stopped.

* Connect the catheter to the prescribed infusion.

* Clear away all equipment and ensure that any needles or scalpel are safely disposed of into a sharps bin.

* Record the procedure in the infants' medical notes using a dedicated UVC documentation label, such as the example in Figure 4., The UVC label should provide for documented confirmation that there was blood sampling from the UVC at the point of catheter fixation.

Post-Procedural Care of the UVC

Regular nursing observations of the catheter insertion site and the external anatomical site corresponding to the catheter's internal route should be undertaken (for example, using a Visual Infusion Phlebitis "VIP" scoring system). It is recommended that, as a minimum, hourly inspection and documentation of the state of the umbilical catheter insertion site are recorded.

The baby should be nursed in an incubator or under a radiant heater. The umbilical site must be exposed and continually observed, so the neonate must be nursed in an intensive care area and not left unattended.

The baby should have ECG lead monitoring to check for arrhythmias and general deterioration.

The length of insertion of the UVC must be documented on a daily basis.

Standard (universal) precautions and an aseptic non-touch technique (ANTT) must be adhered to when citing, manipulating, accessing, or removing the UVC line.

The need for the UVC should be reviewed daily. The catheter should be removed as soon as it is no longer required, to prevent complications such as thrombosis and infection[,6,25,26]. If it is anticipated that a catheter is likely to be necessary for longer than 7 days, it should be replaced with a PICC[,29.30].

UVC Removal

Removal of the UVC should be considered when 100 ml/kg/day of enteral feeds is reached or after 7 days, whichever comes first [29.30].

On some occasions, a line will need to be removed because the baby has an infection, and the line is thought to be the source of this infection. Consider sending the catheter tip to microbiology if infection is suspected.

UVCs should only be removed by a nurse or doctor trained and competent in doing so, as central venous lines have a high risk of breaking or snapping during removal.

If coagulated blood is present around the suture material and umbilical stump, moisten sterile gauze with 0.9 % Sodium Chloride sodium chloride and wrap it around the umbilical stump for 1-2 minutes.

During the removal, the umbilical cord should be held securely with forceps, and sutures should be cut, taking extreme care not to cut the catheter itself.

A second person should be present to provide a supportive hold of the infant's extremities during suture cutting and to support in the event of acute blood loss.

Artery forceps should be available at the cot side during umbilical catheter removal so that the catheter or umbilical stump can be clamped immediately in the event of acute blood loss.

The catheter should be removed in small stages, approximately 1 cm at a time, with pauses in between.

Steady and gentle traction should be used, starting at the insertion site.

Use sterile gauze to hold pressure on the umbilical stump after the catheter is removed and ensure bleeding has stopped. If oozing persists, Avitene may be applied to achieve haemostasis.

Following removal of the UVC, ensure that the catheter is complete, haemostasis has been achieved, and an adequate period of observation of the umbilicus is undertaken before placing the infant prone[1].

The removal procedure should be documented in the infant's medical records, including a statement confirming that the catheter length was checked at the time of removal to ensure complete extraction.

Fig 4: Example of umbilical venous catheterisation sticker for document procedure in the medical casenotes.

Insertion of UVC

Date:..... Time:.....

Indication .....
Insertion length: use one of following methods
i) ({3 x weight in kg} + 9)/2 + cord stump length. cm or

ii) Directly measure length from cord base to xiphisternum and add on cord stump length

Length by formula: ……cm. Stump length: …… cm

Actual insertion length: ……cm
Confirm that line sampled blood at insertion length: ☐ (tick)
No. of attempts.....

Person undertaking catheter insertion: Name……...
Designation…….. Signature …….
Date and time:..... Successful / Unsuccessful

Position on X-Ray: …… Acceptable Yes or no
If no, state action taken:……
Position on repeat X-Ray:..... Acceptable Yes or no

Sign below to verify line position confirmed as satisfactory by Consultant Neonatologist/paediatrician/radiologist (within 24 hours of insertion)

Name & Signature: Date & Time

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Form to be completed in the **exceptional** circumstances that the Trust is not able to follow ODN approved guidelines.

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Rationale why Trust is unable to adhere to the document:	
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