GUIDELINE

Central Venous Access Device:
Umbilical Venous Catheter (UVC) Insertion and Management

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

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Aim

Outlines the indications, insertion and management of umbilical venous catheters for the neonatal population. This guideline is to be followed in conjunction with the Central Venous Access Device Bundle for consistency of care.

Risk

Invasive devices always carry potential risk which increases when processes and management are not followed. Some of the identified complications associate with umbilical lines include:

- Infection
- Thromboembolism
- Mal-positioned catheter in heart or great vessels: pericardial effusion, cardiac arrhythmias, thrombotic endocarditis, haemorrhagic pulmonary infarction, hydrothorax
- Catheter malpositioned in portal system: hepatic necrosis, hepatic abscess, long term portal hypertension, peritoneal effusion. Also, all drugs will be delivered to the liver and may undergo 1stpass metabolism eg. glucose gets metabolised and so difficulties getting PGL into normal range despite increased glucose concentration and delivery.

Background

A UVC is an easy, pain free and relatively option for intravascular access in the newborn, if positioned correctly. Insertion of an umbilical venous catheter (UVC) is seen as a simple procedure that is often used in emergency situations at birth.

Indications for Insertion

Decision to insert a UVC is on a case-by-case basis after discussion with Consultant/ Senior Registrar. Consider the following indications:

- Preterm neonates < 800 grams or < 26 weeks
- Critically unwell infant e.g. prematurity, surgical infants or HIE
- Administration of multiple medications including inotropes and/or infusions and blood products
- Administration of hypertonic solutions
    - e.g. glucose solutions >12.5%, hypertonic saline, sodium bicarbonate, calcium gluconate.
- Cardiac infants requiring a prostaglandin infusion (if umbilical vein is not likely to be needed for balloon atrial septostomy).
- Exchange transfusion

- **In a resuscitation situation**, it is safe to advance a UVC whilst aspirating frequently until blood return is seen. Inserting the catheter 1-2 cm beyond this point is an appropriate position for emergency use without radiographic confirmation of position.

Use of UVCs for greater than 7 days is associated with an increased risk of central line associated bloodstream infection (CLABSI). If it is anticipated that central venous access is likely to be necessary for longer than 7 days, consideration to replacement with another suitable central venous access device should occur at 5-6 days.

A malpositioned UVC should be pulled out of the liver to a low-lying position, used as a PIVC (no-hyperosmolar infusions/ inotropes) and replaced with alternative suitable access within 24 hours where possible.

Prior to Procedure

- The clinician performing the procedure must have appropriate training or supervision during the procedure.
- Document clinical indication.
- Adequate cardiac and saturation monitoring of the infant (general care).

Refer to Appendix 1 for Relevant Anatomy and Position

- Refer to Neonatal Intravascular Device Insertion Record (MR422) for procedural checklist.
- UVC are often inserted in conjunction with Umbilical Arterial Catheters.
- Refer to CVAD Bundle for further information on insertion preparation.

Catheter Size and Insertion Distance

<1500g	3.5F- double lumen catheter
>1500g	4-5F- double lumen catheter NB For sick infants anticipated to require multiple infusions/ medications/ blood products consider a **4.5F triple lumen** catheter.

- Shoulder-to-umbilicus distance should be measured prior to the procedure.
- Remember to measure from the skin at the base of the stump where it connects to the anterior abdominal wall and add the length of the umbilical stump to the distance inserted.
- The catheter can then be inserted to the appropriate distance according to the table below:
-

UVC Insertion distance	
Shoulder - Umbilicus Distance (cm)	UVC insertion length
9	5.5
10	6.5
11	7.0
12	8.0
13	8.5
14	9.5

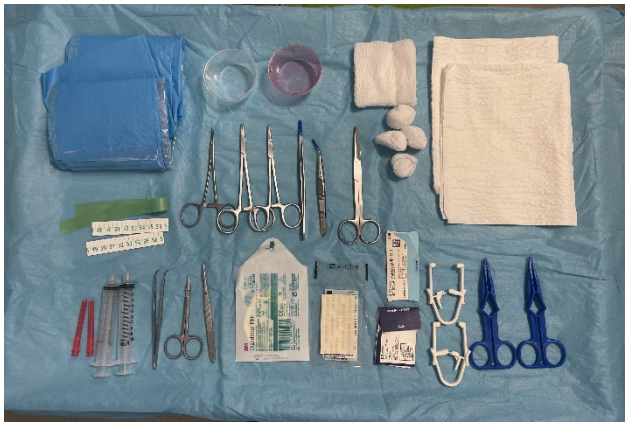
The following calculation may also be used:

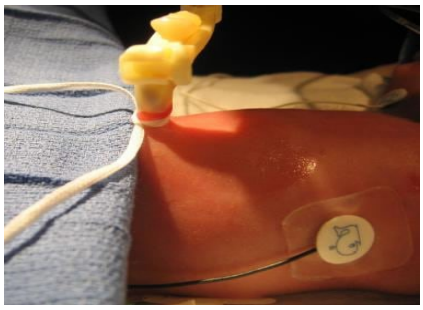
UVC length (cm) = (1.5 x birthweight (kg)) + 5.5

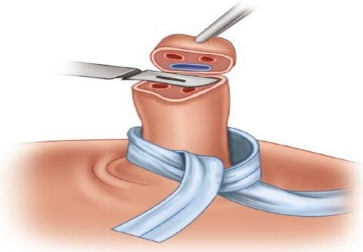
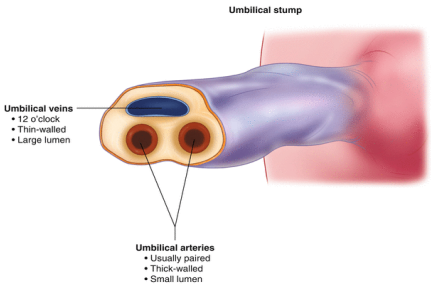
Equipment

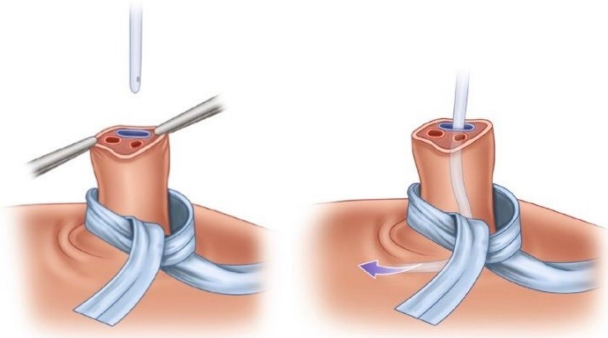
Common equipment	UVC specific
• Surgical gown x 1 • Sterile pair of gloves x 2 Mask x1 Surgical hat x1 Face Shield (as required) x1 • **Antiseptic solution**: ○ >27 weeks gestation: 1% chlorhexidine solution ○ ≤27 weeks gestation: Povidone-iodine 10% solution/swab Umbilical line placement kit (see picture & contents below) • Sterile 0.9% Sodium chloride ampoules x2 • Sterile absorbent towel x 1 3-way taps x no. of lumens Smartsite™ valves x2 (for each 3-way tap) Bin (consider small easily accessible paper bag) • Heparinised saline syringe and extension to run through each lumen until Xray has confirmed correct position.	• Appropriate size UVC for gestation • Suture- 3.0 Prolene / 3.0 Silk • Instrument pack • Cord tie Fluid administration set

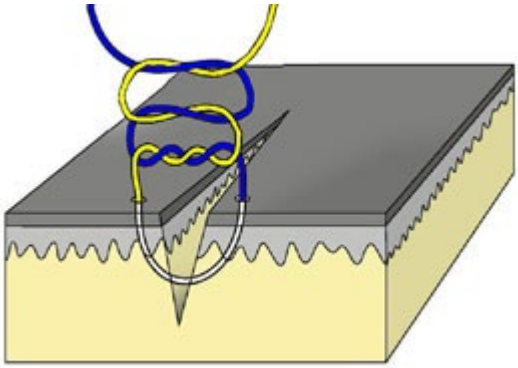
Procedure

Steps	Additional Information
1. Open all equipment onto a sterile drape that fully covers the trolley then arrange the equipment in a systematic manner. Ensure a three-way tap with Smartsite valves is connected to all lumens of the catheter	
2. Draw up 10 mL of 0.9% sodium chloride into syringe and attach a three-way tap to the catheter. Flush through all ports of the three-way tap and the catheter with the saline (both lumens of the catheter) ensuring that there is no air in the catheter. Leave the syringe connected to the end of the 3-way tap on each lumen to ensure a closed system. Sodium Chloride for priming of catheters is to be drawn up directly from ampule (not to be squirted into tray then drawn up).	
3. Position the infant comfortably and drape the bed with a sterile towel on the side where the operator is standing	

Steps	Additional Information
4. Hold the cord clamp with the sterile forceps and hand that over to the assistant.	
5. Clean cord and peri-umbilical area with disinfectant appropriate for the age and gestation **Allow to dry as per CAHS neonatal aseptic technique guideline**	Avoid excess application and any spillage as this may cause burns to very preterm skin.
6. Wash off iodine in infants<27 weeks with sterile water and pat dry. For other infants wash off at end of procedure.	Prevent potential chemical burns and skin irritation
7. Tie umbilical tape around the base of the cord loosely enough to allow the catheter to be passed through.	

Steps	Additional Information
8. Make a clean horizontal cut in cord under the clamp with a scalpel blade (or scissors) preferably leaving 1cm of cord above the skin junction	 Adapted from: Swan T.B. (2018) Neonatal Delivery and the Acutely Ill Neonate. In: Zeretzke-Bien C., Swan T., Allen B. (eds) Quick Hits for Pediatric Emergency Medicine. Springer, Cham. https://doi.org/10.1007/978-3-319-93830-1_6
9. Cover the baby with the large clear plastic drape, with the pre-cut hole in the centre of the drape over the site of insertion. Ensure the sterile field covers the whole bed and extends over the sides while allowing a self-ventilating patient to breath.	
10. Identify the umbilical vessels **Vein:** single, large, thin-walled **Artery:** two, smaller, thick wall, generally constricted so that the lumen may appear pinpoint.	 Adapted from: Lucas J.K. (2016) Umbilical Venous Catheters (Insertion and Removal). In: Ganti L. (eds) Atlas of Emergency Medicine Procedures. Springer, New York, NY. https://doi.org/10.1007/978-1-4939-2507-0_121
11. The cord stump should be stabilised which can be done with 2 artery forceps.	

Steps	Additional Information
12. If both UAC and UVC are being inserted, the UAC should be attempted first. 13. Place the tip of the catheter into the lumen of the vessel and gently advance to 5 cm into the vein. 14. Turn the three-way tap so that the catheter is open to the syringe and assess smooth back flow of blood	 Adapted from: Swan T.B. (2018) Neonatal Delivery and the Acutely Ill Neonate. In: Zeretzke-Bien C., Swan T., Allen B. (eds) Quick Hits for Pediatric Emergency Medicine. Springer, Cham. https://doi.org/10.1007/978-3-319-93830-1_6
15. If there is good backflow, continue inserting to the predetermined length and aspirate to verify blood return.	Remember that the vein goes up towards the heart unlike the arteries which descend first, therefore, the catheter should be passed upwards Directing the catheter to the left shoulder often helps to navigate through the ductus venous
16. 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.	**Note:** UVCs placed during neonatal resuscitation also require demonstration of adequate back sampling of blood before use. These are usually left at 5cm.
17. If there is any resistance and you cannot advance the catheter to the desired depth or the catheter 'bounces' it may have entered the portal vein or be wedged in the intra-hepatic branch of the umbilical vein. The catheter will either be retracted or removed and replaced. 18. Never force the catheter and never leave a catheter in a position where it has come to a stop.	*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.* ***This practice may increase the risk of umbilical vein/ liver trauma and should be avoided.***

Steps	Additional Information
19. Secure the catheter with an anchoring suture that is close to the catheter and goes through Wharton's jelly and **taking a small bite through the skin.**	
20. Anchor the knot close to the catheter. **21. UAC and UVC should ALWAYS be sutured separately.**	Tie suture around the UVC tight enough to prevent slippage but still allowing easy aspiration and flushing of the line. Correct suturing technique is essential so that throws lock against each other to form a secure knot. 
22. Infusion giving set is to be opened onto sterile field and assistant is to spike bag or attach to syringe for priming of line. Primed giving set to be attached to umbilical catheters using sterile aseptic technique.	Commence infusions at 1mL/hr through the catheter prior to x-ray placement confirmation to avoid blocking of the line.
23. Remove excess skin prep with sterile water or saline.	Residual cleaning solutions on the infant's skin can be a potential for chemical skin burns.
24. Apply a 2.5cm piece of brown tape around catheter and suture material as close as possible to umbilical stump/catheter. Alternatively, apply sterile umbilical catheter dressing.	UAC & UVC should be secured separately.

Steps	Additional Information
25. Clear away all equipment and ensure that any needles or scalpel are safely disposed of into a sharps bin.	To safely dispose the sharps, post procedure
26. Check that the infant is clean and dry and assess temperature	
27. Infant to be nursed supine for a minimum of 1 hour post insertion to observe for ooze/blood loss around umbilical stump	
27. Confirm placement of tip with X-ray	Do not use for other infusions/ medications until catheter tip placement confirmed except in an emergency e.g. access at birth for resuscitation (short/low-lying UVC used)

Emergency UVC:

- In a resuscitation situation, it is safe to advance a UVC whilst aspirating frequently until blood return is seen. Inserting the catheter 1-2 cm beyond this point is an appropriate position for emergency use without radiographic confirmation of position.
- In an emergency, a UVC that remains in the portal circulation may be withdrawn until it lies in the umbilical vein. Hypertonic solutions can be infused through this for a short period of time until more suitable access is obtained.

Post Procedure Management:

1. Confirm the catheter tip placement with an X-ray:
   - Refer to Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions
   - It is essential to confirm the UVC position with both an AP and lateral xray and to seek a second opinion if the catheter does not follow the typical course as misplaced UVCs may be very subtle and can have significant consequences.
2. A repeat x-ray is to be performed following catheter adjustment to confirm tip position. Adjustments to be documented in medical notes.
3. Clinician performed ultrasound may be used in conjunction with X-ray to ensure safe placement and adjustment of UVC.

‘Low’ UVC

Where a UVC is not able to be centrally sited (malpositioned) it should be retracted to a ‘low’ position (usually 5-6cm in term infant and 3-4cm in preterm infant). This means that the catheter is at or below the liver shadow on x-ray. Ultrasound may also be used to confirm the position by those with appropriate training. Low UVCs are at increased risk of complications and may be associated with poor drug or glucose delivery. Where possible a centrally sited line (PICC or CVC) should replace the low UVC, particularly if inotropes, caustic fluids or high concentration glucose are required; or if the patient is not responding to treatment as expected. Low-lying UVCs should only be used as a peripheral cannula and should be replaced with suitable alternative access within 24 hours where possible.

Nursing Management

- Infants with umbilical lines in situ should not be wrapped or have booties on and nappy is to be left loose. Allowing pelvic area and feet to be visible to check for adequate circulation.
- At least hourly inspection of umbilical site for any signs of infection, ooze and catheter position (distance of brown tape from umbilical stump). Document on MR489.
- At least hourly inspection of colour, temperature and perfusion of the lower extremities. Any changes should be reported immediately to medical staff.
- Ensure heparinised fluid is infusing via each lumen at all times.

UVC Removal

- Review the need for UVC on clinical rounds every day. Consider removal as early as clinically possible with maximum of 7 days
- Removal of an umbilical catheter is a 2-person aseptic technique, where staff have received training and deemed competent.
- If intravenous access is still required, ensure that there is another patent intravenous access prior to the removal of umbilical catheters.
- If only one umbilical catheter is to be removed, a nurse may remove the catheter if they have been stitched in separately.
- Once the catheter has been removed, complete the Neonatal Intravascular Device Insertion Record (MR422) and document in medical records.
- Refer to Appendix 3 Removal of UVC procedure

Related CAHS internal policies, procedures and guidelines

Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions
Central Venous Access Device Bundle
Umbilical Arterial Catheter
Hand hygiene
Sepsis Neonatal

References and related external legislation, policies, and guidelines *(if required)*

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Useful resources

PCH Insertion Bundle

PCH Maintenance Bundle

This document can be made available in alternative formats on request.

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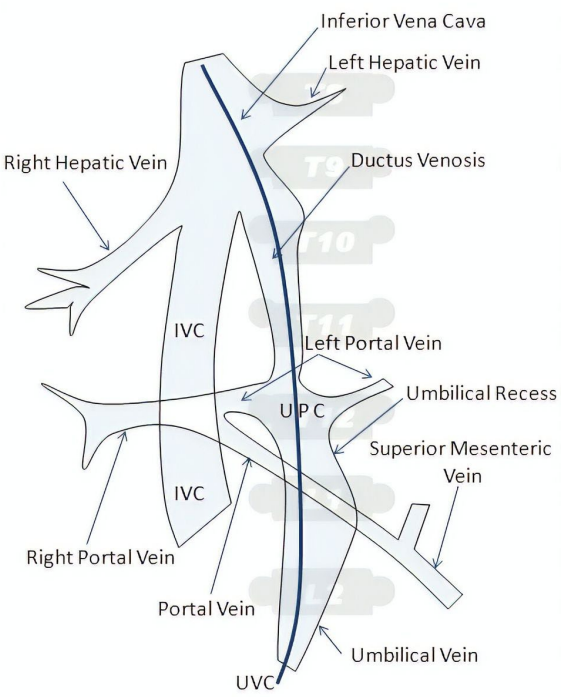
Appendix 1: Relevant Anatomy and Position

The umbilical vein is 2-3cm long and 4-5mm in diameter. From the umbilicus, it passes cephalad and a little to the right. It joins the left branch of the portal vein after giving off several large intrahepatic branches. The ductus venosus arises from the point where the UV joins the left portal vein and bypasses the liver, joining the inferior vena cava just distal to its entry into the atrium.



- The ideal position for a UVC is in the inferior vena cava, just outside of right atrium, at T9, which correlates to 0.5cm above the diaphragm on the lateral image.
- Position should be verified with anteroposterior and lateral chest-and-abdominal radiographs. Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions
- Any UVC pulled back after an X-ray should be re-X-rayed to confirm the correct position or confirmed by bedside clinician performed ultrasound.
- Clearly document the line length, tip position and any adjustments made to the line after X-Ray.

Appendix 2: Umbilical Catheter placement kit

- 1 x outer wrap
- 2 x drape towels (absorbent/impermeable)
- 2 hand towels
- 1 x peelable transparent drape with ‘easy peel’ 50cm x 50cm (opening 4cm)
- 1 safety hypodermic needle 21G, 38 mm (green)
- 1 safety hypodermic needle 18G, 38 mm (pink)
- 1 silk suture 3.0 with curved needle
- 1 syringe 1 ml Luer Slip
- 2 syringes 3 ml Luer-lock
- 2 syringes 5 ml Luer-lock
- 1x paper measuring tape (60cm)
- 1 umbilical cotton lace 4 mm x 75 cm
- 2 adhesive strips 148 x 12.5 mm
- 1 safety scalpel n°11
- 10 swabs 10 x 10 cm, 4 ply, non-woven
- 1 gallipot 60 ml red
- 1 gallipot 60 ml cristal
- 1 measuring guide
- 1 tray 20 x 15 x 4 cm transparent
- 1 Mayo Hegar needle holder 14 cm
- 1 straight Iris forceps 10 cm with teeth
- 1 full curved Iris forceps 10 cm without teeth
- 1 dilator 14 cm Ø 2 mm
- 2 curved Halstead Mosquito forceps 13 cm without teeth
- 1 straight haemostatic Halstead Mosquito forceps 13 cm without teeth
- 1 curved Reynolds dissecting scissors 11 cm
- 1 curved Iris forceps 10 cm
- 1 straight Iris forceps 10 cm
- **Note:** UVC placement kit is preferred, in-line with the PCH CVAD guideline. However, suitable sterile reusable instrument kits may be used when UVC kits are not available.

Appendix 3: Removal of UVC (2 Person Procedure)

Equipment required:

- Mosquito Forceps Straight and Iris Scissors Straight
- Dressing pack
- Sterile non-woven (soft) gauze
- Gloves (sterile gloves not required)
- > 27weeks gestation 1% Chlorhexidine solution
- ≤ 27weeks gestation or Povidone Iodine 10% swab
- 0.9 % Sodium Chloride

Procedure Steps

Pre-procedure - Perform the **Removal Procedure Safety Checklist including Time Out** as per the Umbilical Arterial and Venous Catheter (UAC/UVC) Insertion and Removal MR 422.00

1. Perform hand hygiene and prepare equipment using aseptic technique.
2. Assistance to gently hold the legs of the infant. Consider sucrose as pain relief
3. Perform hand hygiene and don gloves
4. Remove the tape around the catheter to be removed if suture not visible. If coagulated blood around suture material and umbilical stump, moisten gauze with sodium chloride and wrap around umbilical stump for 1-2minutes. Clean area prior to commencing procedure.
5. Examine umbilicus to confirm UAC and UVC are sutured separately. NOTE: some referral centres may secure both UAC and UVC together using a single suture technique.

TIME OUT: Before applying the forceps to the umbilical catheter to be removed, the assistant must visualise the forceps and agree that it is a forceps and not a scissor.

6. Apply artery forceps **below the sutures** prior to cutting the suture (to prevent migration of the catheter internally in the advent of the catheter being accidentally cut).

   Then cut the suture.

7. Place gauze pad directly over the umbilicus, apply gentle pressure in downward direction for a UAC.
8. Remove catheter in a slow continuous motion to promote vasoconstriction. Check that catheter is intact. Continuous pressure should be applied for a minimum of 5 minutes. Ensure the peripheries stay pink and well perfused.
9. Clean skin prep from skin with sodium chloride and leave infant in the supine position with the stump uncovered for one hour to observe for any blood loss. Perform hand hygiene post procedure.
10. Document the removal procedure on Neonatal Intravascular Insertion Record MR422, and in the patient's progress notes. Include estimated blood loss (if any)