

Local Guideline and Procedure



Health
Hunter New England
Local Health District

Umbilical lines in NICU

Sites where Local Guideline and Procedure applies	Neonatal Intensive Care Unit JHCH
This Local Guideline and Procedure applies to:	
1. Adults	No
2. Children up to 16 years	No
3. Neonates – less than 29 days	Yes Approval gained from the Children Young People and Families Network on 26/09/2017
Target audience	NICU clinical staff who provide care to neonatal patients
Description	Guideline to assist clinicians in the insertion and management of umbilical arterial and venous lines in NICU

[Go to Procedure](#)

Keywords	Arterial, blood gas sampling, BP monitoring, catheter, umbilical, venous, NICU, JHCH
Document registration number	NICU JHCH_NICU_10.03
Replaces existing document?	Yes
Registration number and dates of superseded documents	NICU JHCH_NICU_10.03 February 2015
Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:	
<ul style="list-style-type: none"> • NSW Health Policy Directive PD 2017_013 Infection Control and Prevention Policy • NSW Health Policy Directive 2014_036 Clinical Procedure Safety 	
Prerequisites (if required)	N/A
Local Guideline and Procedure note	This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s requires mandatory compliance . If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patients' health record.
Position responsible for and document authorised by	Pat Marks. General Manager / Director of Nursing CYPFS
Contact person	Jenny Ormsby
Contact details	Jennifer.Ormsby@hnehealth.nsw.gov.au
Date authorised	26/09/2017
This document contains advice on therapeutics	No
Issue date	26/09/2017
Review date	26/09/2020

Note: Over time links in this document may cease working. Where this occurs please source the document in the PPG Directory at: <http://ppg.hne.health.nsw.gov.au/>

PURPOSE AND RISKS

This local clinical procedure has been developed to provide instruction to the health clinician and to ensure that the risks of harm to the child associated with insertion, management and removal of an umbilical line are prevented, identified and managed.

The risks are:

- *Vascular compromise*
- *Infection*
- *Blood loss*
- *Perforation of the umbilical vessels*

The risks are minimised by:

- *Experienced neonatal clinicians such as Neonatologists, Fellows or Nurse Practitioners performing procedure of insertion or providing guidance to inexperienced clinicians*
- *Clinicians seeking assistance if the therapy is outside their scope of practice*
- *Following the instructions set out in the clinical procedure*
- *Recognition of clinical signs of complications*
- *Identification of the causes of vascular compromise, infection, blood loss and perforation of the umbilical vessels.*

Risk Category: *Clinical Care & Patient Safety*

GLOSSARY

Acronym or Term	Definition
CVAD	Central Venous Access Device
CXR/AXR	Chest XRay/Abdominal XRay
ELBW	Extremely Low Birthweight Infant
MRN	Medical Record Number
VLBW	Very Low Birthweight Infant
UAC	Umbilical arterial catheter
UVC	Umbilical venous catheter

GUIDELINE

This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

Staff Preparation

It is mandatory for staff to follow relevant: “Five moments of hand hygiene”, infection control, moving safely/safe manual handling, documentation practices and to use HAIDET for patient/carer communication: **H**and hygiene **A**cknowledge, **I**ntroduce, **D**uration, **E**xplanation, **T**hank you or closing comment.

Table of Contents

[Clinical Procedure Safety Level](#)

[Background](#)

[Umbilical Arterial Catheter \(UAC\)](#)

[Indications](#)

[Indications for Immediate Removal](#)

[Appropriate positioning of umbilical arterial catheter](#)

[Equipment](#)

[UAC Fluids](#)

[Technique for insertion of UAC](#)

[Confirmation of UAC position](#)

[Nursing considerations](#)

[Removal of UAC](#)

[Umbilical Venous Catheter \(UVC\)](#)

[Indications](#)

[Appropriate positioning of UVC](#)

[Estimation of insertion length of UVC](#)

[Equipment](#)

[Technique for insertion of UVC](#)

[Confirmation of UVC position](#)

[Complications](#)

[Nursing considerations of indwelling UVC](#)

[UVC removal](#)

[Appendix 1: Central Venous Line Insertion Record](#)

[Appendix 2: CVAD Care Plan](#)

[References](#)

CLINICAL PROCEDURE SAFETY LEVEL

[top](#)

Level 2 procedure

Pre Procedure Level 2

Patient identification/ Procedure verification

The patient's identification and procedure verification must be confirmed before the procedure commences by checking the name, MRN if available and date of birth on the ID band (mother's details if procedure prior to medical records available) and sticker on the *Central Venous Access Device Care Plan*

Patient position: Ensure the infant is correctly positioned for the procedure

Essential imaging available: Record on the *progress notes and observation chart* imaging performed

Allergy / adverse reaction check: N/A

Medications/Antibiotics: Administer antibiotics as applicable

Anticipate critical events

Post procedure Level 2

Document procedure in patient's health care record or Radiology Information System:

Provide advice for clinical handover to staff caring for patient

Equipment problems/issues

Arrange post procedure tests where clinically relevant e.g. CXR/Echo post insertion UVC/UAC

Background: Umbilical Catheters in NICU

[top](#)

Insertion of an umbilical catheter is done using a sterile aseptic technique. In general only ill infants should have umbilical catheters inserted. Umbilical vessels are relatively accessible in newborns:

- ❖ The umbilical vein (UVC):
 - Is large and easy to cannulate; and,
 - Can be used as secure venous access for fluids containing glucose >12.5%, amino acid/glucose solutions, calcium, bicarbonate and inotrope infusions.
- ❖ The umbilical arterial catheter (UAC):
 - Used to provide reliable physiological information for the management of sick or preterm infants.
 - The UAC provides access for blood pressure monitoring; and,
 - For collection of arterial blood gases, blood glucose levels, biochemical and haematological blood samples.

Pain relief for insertion of umbilical catheters

Consider the use of appropriate measures to relieve distress including:

- Containment by holding the infant
- Oral sucrose
- Avoid placing clamps or sutures on the skin

Umbilical arterial catheter (UAC)

Indications

[top](#)

- Need for placement of UAC should always be discussed with Neonatal Fellow or Neonatologist
- Unacceptable systemic blood pressure and/or poor central perfusion (capillary refill > 3 seconds) after adequate fluid resuscitation
- Need for continuous arterial blood pressure monitoring – e.g. inotrope infusions
- Frequent blood sampling (>6 per day) such as arterial blood gases to monitor acid-base status, electrolytes, sugar, bilirubin etc.
- Exchange transfusion

Indications for Immediate Removal (Lissauer & Fanaroff, 2011):

[top](#)

- Evidence of local vascular compromise in lower limbs or buttocks
- Incorrect tip location OR change in position noted on subsequent incidental X-rays
- Omphalitis
- Peritonitis

Appropriate positioning of umbilical arterial catheter

[top](#)

- **‘High placement’** – high positioned catheters (T6-10) are usually placed such that the catheter tip is in the descending aorta above the level of the diaphragm and below the left subclavian artery. This is the preferred site in NICU. High positioning of UAC catheters leads to fewer complications, therefore use of high placement of UAC is recommended.
- Various formulae have been developed to provide proper placement of UACs. Though these formulae help to determine anatomical tip location they are used only as an estimation of catheter tip position.

To estimate the insertion length of catheter for high placement (Wright, Owers & Wagner, 2008; Rennie & Kendall, 2013):

- *For infants < 1500 grams;*

$$\text{UAC insertion length (cm)} = (\text{Birthweight in kg} \times 4) + 7\text{cm} + \text{stump length (cm)}$$
 E.g.: for an infant weighing 1.2kg

$$= (4 \times 1.2) + 7 + 1\text{cm} = 12.8\text{cm}$$
- *For infants > 1500 grams*

$$\text{UAC insertion length (cm)} = (\text{birthweight in kg} \times 3) + 9\text{cm} + \text{stump length}$$
 E.g.; for an infant weighing 2.2kg

$$= (3 \times 2.2) + 9 + 1\text{cm} = 16.6\text{cm}$$

Equipment[top](#)

- 2 X Personal protective equipment (PPE)
- 2 X Appropriate sized sterile Gloves
- Umbilical Arterial/Venous box
 - 2 X Surgical mask and hat
 - 2 x sterile surgical gown
 - 1 x umbilical placement Kit pack
 - 1 x each umbilical vessel catheters (single and double lumen in 3.5Fr and 5Fr)
 - 2 x 10 mL 0.9% saline
 - 1 x large sterile plastic drape
 - 3 x 18G drawing up needles
 - 1 x 3 way tap with luer lock
 - 2 x 3ml syringes
 - 2 x 5ml heparinised saline 50IU in 5mls
 - 2 x small circular band aids
 - 1 x pack gauze
 - 2 x absorbable Haemostat 5cm x 7.5cm
 - 1 x 3.0 Mersilk suture with curved needle
 - 2 x Red "for Intra-Arterial Use only stickers

Additional items

- 1 x blood pressure transducer with short arterial tubing extension
- 1 x 50ml syringe
- 1 x 100ml bottle 0.9% saline
- 1 x Syringe pump
- 1 x 180cm extension tubing
- Paediatric Procedure Record sticker 2 x red arterial line stickers

Skin preparation solution

- Chlorhexidine solution (>1000 grams) and allowed to dry before insertion.
- Povidone iodine solution (<1000 grams) & 0.9% saline to wash off

Umbilical Arterial Catheter sizes (Rennie & Kendall, 2013):

- Size: (general guide only)

< 1500 grams	3.5 F
> 1500 grams	5F

- Radio-opaque to visualize position of the catheter on x-ray

UAC Fluids[top](#)

- The preferred UAC fluid concentration in this NICU is heparin 1 unit /ml of 0.9% sodium chloride. To make up this concentration 10mls of 0.9% sodium chloride Intravenous Infusion BP is removed from the 100ml bottle leaving 90mls. 10 mls of heparinised saline 50 units/ 5 mL is placed into the 90mls of 0.9% sodium chloride solution making a total of 100 units of heparin in 100mls of 0.9% sodium chloride.
- A continuous infusion with Heparin 1 unit /ml has been found to be more effective than intermittent infusion in maintaining patency of the UAC (MacDonald & Ramasethu, 2007).

- In small preterm infants, particularly in the first week of life, hypernatremia may result from receiving an excessive sodium load from arterial line infusion and flush solution (MacDonald & Ramasethu, 2007). In VLBW infants the use of 0.45% sodium chloride as the infusion solution can be considered.

Technique for inserting a UAC

[top](#)

NOTE: The following procedure describes one method for umbilical arterial vessel catheterisation. Inexperienced clinicians should only perform procedure under the direction of an experienced neonatal clinician e.g. neonatologist or fellow.

Clinician assisting in insertion of UAC

- Consider the use of appropriate measures to relieve distress including:
 - use of [Sucrose solution 24%](#)
 - containing the infant by holding
 - securing the catheter as soon as possible
- It is preferable that UAC's are inserted with the infant on an open care bed to allow unrestricted access, for example the Giraffe Omnibed® with temperature probe attached and placed on servo control to maintain infant's temperature during the procedure
- Refer to CPG "[Aseptic Technique in NICU](#)" JHCH NICU_03.01 for information about setting up and maintaining a sterile field
- Collect equipment and open onto sterile field
- Prepare infusion, check solution is correct and prepared to the stage where it can be immediately connected onto the catheter (see section on UAC fluids above)

Clinician Inserting UAC

- Estimate the position of catheter tip:
 - the correct position is in the descending aorta above the origin of the mesenteric and renal arteries (to avoid occlusion in these vessels)
 - the catheter length may be calculated from the formula, remember to add the length of the cord stump
- Gown and glove following "[Aseptic Technique in NICU](#)" JHCH NICU_03.01
- Check sterile equipment and set up on trolley
- Attach three-way tap to catheter & draw up heparinised saline (Heparinised saline 50units /5mls) to flush the three-way tap and catheter. NOTE: *Throughout the insertion the catheter must be kept filled with the Heparinised saline and a closed three-way tap attached*
- Place drapes ensuring the infant's face and upper chest are not obscured. Clear plastic drapes provide good visibility – ensure the plastic drape does not cover the infant's face compromising the airway
- Clean the umbilical area and the skin around the umbilical stump:
 - For babies < 1000gms use a Povidone iodine 10% solution, which is allowed to dry for 2 minutes, and then cleaned off with sterile water.
 - For babies > 1000 grams Chlorhexidine 2% solution is used.
- Tie a short piece of sterile umbilical tape around the base of the cord. It should be secure enough to maintain haemostasis but not too tight to prevent passage of the catheter.
- Grasp the end of the cord clamp with a pair of straight forceps and pass the forceps to the assistant. Whilst the assistant applies gentle upward traction, slice the cord with the scalpel, 1-1.5cm from the skin margin.

- When the cut surface is blotted dry, the umbilical vessels can be identified as:
 - the single thin walled umbilical vein
 - 2 smaller thick walled round arteries, generally constricted so that their lumen appear pinpoint. They often protrude from the cut surface of the umbilical cord
- To insert the arterial catheter the orifice of the artery is gently opened with fine forceps to dilate lumen of artery.
- Initially 1 tip and then both tips of the iris forceps should be gently inserted into the artery. The tips should be allowed to spring apart.
- The tips should be gradually advanced to the curve of the forceps. Then the vessel may be cannulated.
- Obstruction may be encountered at the anterior abdominal wall or bladder. This can usually be overcome by 30-60 seconds of gentle, steady pressure. Avoid excessive pressure or repeated probing.
- If unsuccessful, seek advice from a more experienced person. 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.
- Ensure patency of catheter by checking for easy withdrawal of blood and 'pulsation' of blood/saline in the catheter.
- Loosen the umbilical ties slightly upon completion of procedure and obtain X-ray confirmation of position
- Secure the catheter – Suture with 'band aid' method. Suture catheter to the umbilical stump, and tie the suture around catheter to secure (Fig 1). Repeat twice to ensure catheter is secure. Wrap band aid around catheter, and secure tie to band aid (Fig 2).

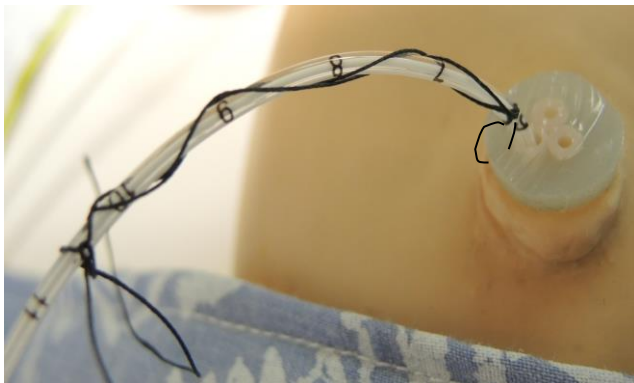


Figure 1. Suture attached to cord



Figure 2. Band aid method to secure catheter

Confirmation of UAC position:

[top](#)

- A chest and abdominal x-ray (AP view) must be taken to confirm the position of the catheter tip. An additional lateral shoot through x-ray may be taken to assist in confirming catheter position.

NOTE: On the x-ray a catheter placed in the umbilical artery will descend before turning upwards with the tip between T6-T10.

- If catheter re-adjustment is required, a repeat x-ray must always be performed
- Clinicians trained in the use of point-of-care Ultrasound may use this to confirm catheter tip position
- Document insertion, including number of attempts and final tip position confirmed by Xray on Central Venous Line Insertion Record (SMR090200)-see Appendix 1
- Discard all sharps safely

NOTE: NEVER ADVANCE AN UMBILICAL CATHETER FURTHER INTO THE VESSEL ONCE THE STERILE TECHNIQUE HAS BEEN BROKEN.

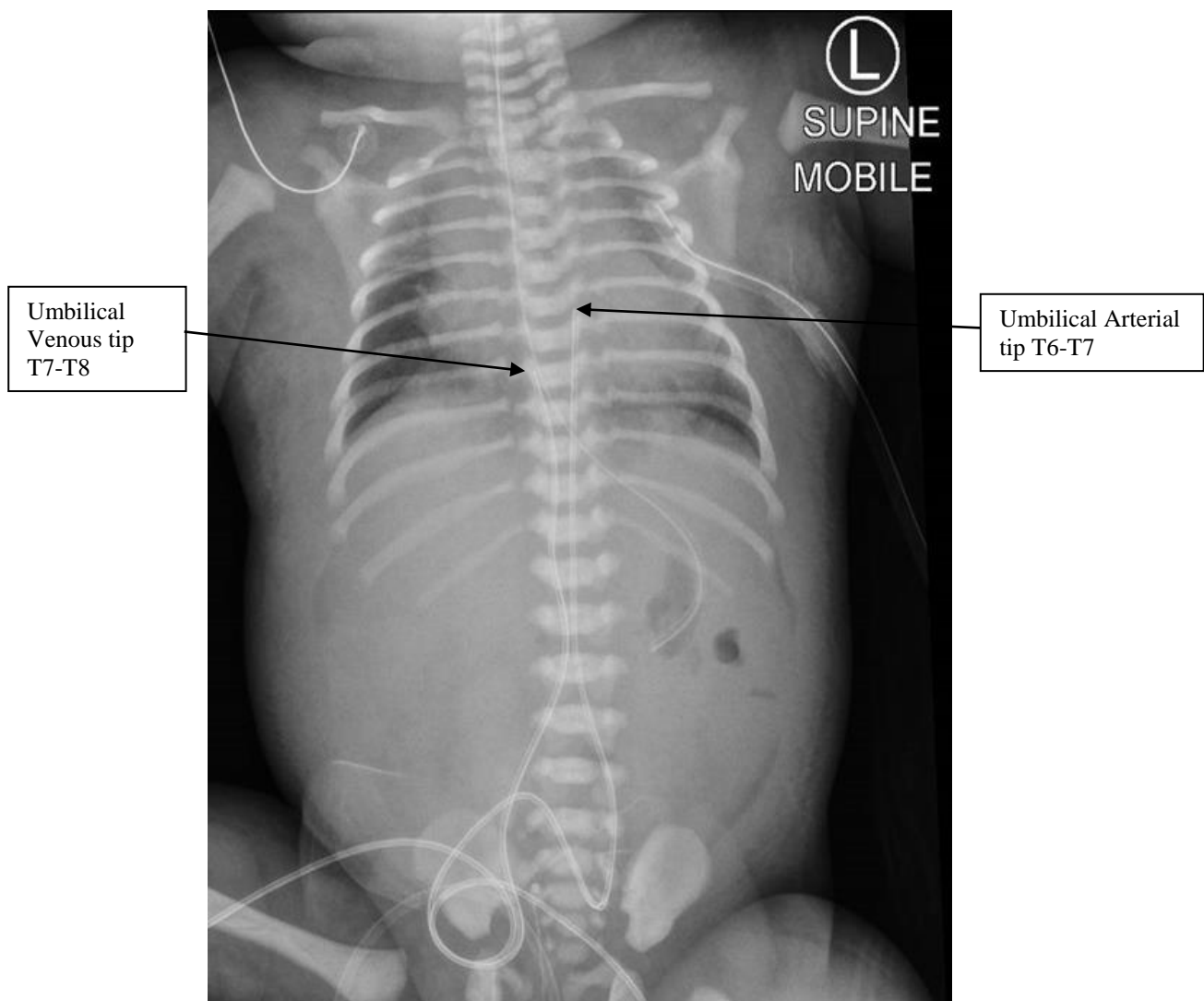


Figure 3. Abdominal X-ray demonstrating correct placement
(Image courtesy of HNE Imaging)

Assistant

- Connect to infusion tubing and commence infusion at prescribed rate
- Check for arterial waveform on arterial transducer after it is connected and calibrated. Refer to "[Peripheral Arterial line in NICU](#)" CPG for details on priming and setting up transducer
- Ensure time of insertion is documented in infant's notes on procedure sticker as well as observation chart-include centimetre marking on catheter at insertion level to assess for catheter migration
- Loosen umbilical ties slightly upon completion of procedure
- Assess umbilicus for leakage or bleeding. Do not cover umbilicus with a dressing. Dressing may delay recognition of bleeding or catheter displacement
- Ensure catheter is secure, and examine frequently if infant is placed in the prone position, because haemorrhage may go unrecognised
- Remove umbilical tape if no oozing or once oozing has stopped for greater than 4 hours

Nursing Considerations of Indwelling UAC[top](#)

- Observe UAC and cm mark at site of insertion into umbilicus each hour
- Observe skin colour. Note any blanching or bruising of limbs, toes or buttocks prior to the procedure, during and following the procedure, and while catheter is in situ. Report immediately to MO/NP.
- Refer to "[Peripheral Arterial line in NICU](#)" CPG for details on blood collection from an arterial line
- Keep catheter free of blood to prevent clot formation:
 - Flush catheter with 0.5ml of flush solution slowly over 5 seconds each time a blood sample is collected
 - Between samples infuse arterial fluids continuously via a syringe pump through catheter to prevent retrograde flow
 - Observe for indications of clot formation, decrease in amplitude of pulse pressure on blood pressure tracing, difficulty withdrawing blood samples
- Report to MO/NP if clot forms. Do not attempt to flush clot forcibly.
- Filters are not used for IA lines. All connections must be Luer lock.
- Document in the Central Venous Access Device (CVAD) Care Plan (see Appendix 2) to monitor correct labelling, insertion site, measurement and securement
- Document intravenous fluid solution infused in fluid section of flow chart.
- Document amount of blood removed for infants <1000g

Positioning of infant:

- Maintain infant supine or in lateral position for at least 4 hours post-procedure to observe for haemorrhage from umbilical stump
- If the infant is placed prone in the abdominal position the catheter should be observed frequently for accidental slipping, kinking and removal of the catheter
- Care should be taken so that the infant is positioned to prevent dislodgement of the catheter
- Positioning the catheter away from the limbs lessens the chance of accidental dislodgement
- Once stable, the infant can have skin-to-skin cuddles with parents; however staff must ensure the safety and security of the UAC and observe closely

Removal of UAC

[top](#)

This procedure is not without risks. It may be removed by an experienced RN , MO or NP by gentle traction on the catheter however if no movement of catheter observed then sharp implements are required to cut the suture, e.g. stitch cutters or surgical scissors (experienced clinicians personal preference). Two clinicians are required for this procedure if stitch removal is necessary.

When requested to remove both UAC and UVC in same procedure it is a safer option to remove the UAC first as UVC still available for emergency fluids if bleeding occurs.

Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place >5 days (CDC, 2011).

Equipment:

- PPE
- Gloves
- Alcohol swab
- Sterile stitch cutter or fine surgical scissors
- Sterile blade
- Dressing pack
- Specimen container (only sent catheter tip for culture and sensitivity if infection is suspected)

Procedure:

- Consider sucrose for pain relief
- Discontinue infusion
- Apply PPE and gloves
- Clean the stump with alcohol swab-normal saline soaking may be necessary if coagulated blood around the site is impeding vision of sutures.
- Caution when 2 catheters in-situ and 1 requires removal. -isolate and identify catheters carefully
- Gentle traction to catheter may be applied to withdraw catheter.
- If no movement of catheter, apply artery forceps to the catheter below the sutures (to prevent bleeding or migration of the catheter internally if catheter accidentally cut) see Fig.4



Figure 4. Clamping catheter with artery forceps below sutures



Figure 5 Using stitch cutter to cut stitch whilst catheter safely clamped

- When removing UAC cut the suture at the umbilicus with either a stitch cutter (pictured) or with surgical scissors, and remain vigilant to avoid catheter transection.
- Place gauze square handy in readiness for when catheter removed.
- Remove suture and withdraw catheter slowly and evenly to promote vasospasm. Slow removal allows the artery to constrict, and may minimise bleeding after the line is discontinued.
- Place gauze square firmly over umbilicus in a downward direction for a minimum of 5 minutes.

- Do not nurse infant prone (on abdomen) for 4 hours following removal of catheter.
- Monitor closely for any minor oozing of blood.
- Inspect the length and integrity of UAC upon removal. In the presence of any abnormalities, do not discard the UAC:
 - Report to Team Leader and / or MO to determine appropriate action / investigation;
 - Document on patient's medical record, and notify on IIMS.
- Document on the Central Venous Access Device (CVAD) Care Plan (see Appendix 2) removal date & time, reason for removal, condition of tip and signature.
- Remove the umbilical tie (trachy tape) if still in-situ, when no oozing of blood evident.

NOTE: Junior and inexperienced staff are to be given the opportunity to first observe UAC removal and then proceed to assist in removal. This is to ensure that junior and inexperienced staff can build their capacity in performing procedure safely.

Complications (Department of Health Victoria, 2014)

- Bleeding due to accidental disconnection or dislodgement, or from open connections.
- Vasospasm of the femoral artery causing blanching of toes and foot is less common with high than low catheters. The opposite limb may be warmed with a warm moist towel. If blanching persists, the catheter must be removed.
- Embolisation from blood clot or air in the infusion system.
- Thrombosis - this may involve:
 - femoral artery resulting in limb ischaemia, gangrene
 - renal artery resulting in hypertension, haematuria, renal failure
 - mesenteric artery resulting in gut ischaemia, necrotising enterocolitis
- Perforation of the umbilical arteries, haematoma formation and retroperitoneal arterial bleeding
- Infections – septicaemia

Umbilical venous catheter (UVC)

Indications for UVC placement

[top](#)

- Need for UVC placement should always be discussed with Neonatal Fellow or Neonatologist
- To establish intermediate-term (<14 days) central venous access in infants
- Exchange transfusion
- During an emergency as short-term (<24 hours) vascular access for resuscitation by fluid and medication infusion with the catheter tip inserted only 3-5 cms below the skin surface - only for clear fluids (Dopamine; TPN should **never** be administered through a low UVC). Aim to remove a low UVC providing an alternate source of access can be found and the baby's clinical state allows this.

Appropriate positioning of UVC

[top](#)

- The best location of the catheter tip is in the inferior vena cava above the diaphragm. When inserted into the umbilical vein it will enter the left portal vein before deviating through the ductus venosus into the hepatic vein and the inferior vena cava.
- Accurate positioning of the UVC is crucial to prevent misplacement leading to complications e.g. cardiac complications if catheter is too high, and liver and portal venous complications if catheter is too low.
- Placement of the catheter tip in the **portal circulation is not acceptable**. Intrahepatic placement into the portal system could be either in the left or right portal vein or even into the superior mesenteric or splenic vein and may cause thrombosis. Perforation of the portal vein may cause haemorrhage or abscess formation in the liver
- Various formulae have been developed to provide practical information to assure proper anatomical placement of UVCs; though these formulae help to determine anatomical tip location they are used only as an estimation of catheter tip position

Estimation of insertion length of umbilical venous catheter

[top](#)

Rapid estimation of insertion length of UVC:

- Birth weight x 1.5 + 4.5cm = length of insertion for UVC (Verheji et al 2013)

The *shoulder-umbilicus distance method* according to following graph:

- Measure the distance from the shoulder tip to the umbilicus
- Remember to measure from the skin at the base of the stump where it connects to the anterior abdominal wall
- Remember to add the length of the umbilical stump to the distance inserted

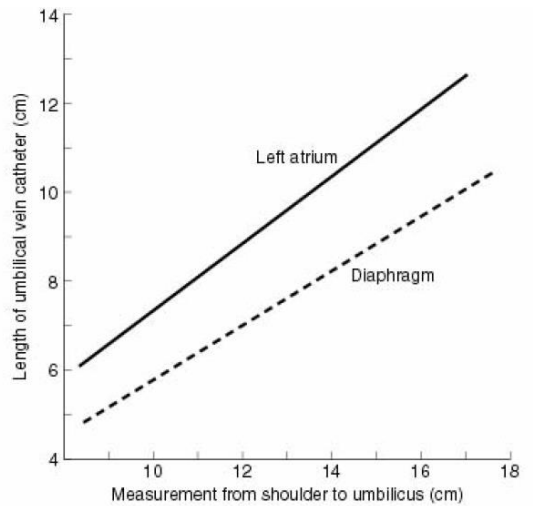


Figure 5: Graph to calculate insertion depth

Equipment

[top](#)

Use the UAC/UVC procedure box

- 2 X Personal protective equipment (PPE)
- 2 X Appropriate sized sterile Gloves
- Umbilical Arterial/Venous box
 - 2 X Surgical mask and hat
 - 2 x sterile surgical gown
 - 1 x umbilical placement Kit pack
 - 1 x each umbilical vessel catheters (single and double lumen in 3.5Fr and 5Fr)
 - 2 x 10mL sodium chloride 0.9%
 - 1 x large sterile plastic drape
 - 3 x 18G drawing up needles
 - 1 x 3 way tap
 - 2 x 3ml syringes
 - 2 x 5ml heparinised saline 50IU in 5mls
 - 2 x safti-ject blue needleless valve bungs
 - 2 x small circular band aids
 - 1 x pack gauze
 - 2 x absorbable Haemostat 5cm x 7.5cm
 - 1 x 3.0 or 4.0 Mersilk suture with curved needle
 - 2 x Red "for Intra-Arterial Use only stickers

Additional Items

- Umbilical catheter size 3.5FG or 5FG (double/triple` lumen)
- I-3 X disposable luer lock 3 way taps
- IV tubing set and solution –up with filters (clear fluids and lipid filter)
- Additional safti-ject blue needleless valve bungs
- Infusion pump

If double lumen UVC:

- Additional luer lock three way tap, 5ml syringe & drawing up needle

Skin preparation solution

- Chlorhexidine solution (>1000 grams) and allowed to dry before insertion
- Povidone iodine solution (<1000 grams)

UVC Catheter size: (general guide only)

< 1500 grams	3.5 F
> 1500 grams	5F

- Double lumen UVC should be considered for infants < 27 weeks gestation if the infant is likely to need inotropes or multiple infusions or for larger sick infants likely to require significant support
- The use of a multi lumen UVC in comparison to a single lumen UVC in neonates is associated with decrease in the usage of peripheral IV's in first week of life, but an increase in catheter related complications (Kabra, Kumar, & Shah, 2005)

Technique for insertion of UVC[top](#)**Clinician assisting in insertion of UVC**

- Refer to CPG "[Aseptic Technique in NICU](#)" JHCH_NICU_03.01 for information about setting up and maintaining a sterile field.
- The patient must be placed on servo control as outlined in [Giraffe™ Incubator in NICU guideline \(JHCH_NICU_04.01\)](#) to ensure the baby does not become hypo/hyperthermic during the procedure
- All UVCs are to be inserted with the infant on an open care bed to allow unrestricted access
- Collect equipment and open onto sterile field
- If commencing an infusion, check solution is correct and prepared to the stage where it can be immediately run into the catheter

Clinician Inserting UVC

- Gown and glove following "[Aseptic Technique in NICU](#)" JHCH_NICU_03.01
- It is recommended that the scrubbed person wear double gloves for the procedure.
- Attach three-way tap to catheter, draw up 0.9% sodium chloride and flush three-way tap and catheter. If a multi lumen catheter is used it is necessary to prime all catheters and three-way taps.

NOTE: *Throughout the insertion the catheter must be kept filled with 0.9% sodium chloride and a closed three-way tap attached. If the infant takes a deep inspiration negative pressure may be generated and air drawn into the catheter which could result in an air embolus.*

- Clean the umbilical area and the skin around the umbilical stump:
 - For babies < 1000gms cleaning should be performed with a Povidone iodine 10% solution, which is then allowed to dry for 2 minutes, and then cleaned off with sterile water.
 - For babies > 1000 grams the Chlorhexidine 2% in alcohol solution is used.
- Establish a sterile field by placing a fenestrated drape over the abdomen. If using a plastic drape a small hole is cut into the centre and then placed over the umbilical stump area. The green drape, which is over the upper body, can be removed to allow visualisation of the baby.
- The scrubbed person removes the first pair of gloves to ensure they continue to use a sterile technique to insert the catheters.

- Tie a short piece of sterile umbilical tape around the base of the cord. It should be secure enough to maintain haemostasis but not too tight to prevent passage of the catheter.
- Grasp the end of the cord clamp with a pair of straight forceps and pass the forceps to the assistant. Whilst the assistant applies gentle upward traction, slice the cord with the scalpel, 1-1.5cm from the skin margin.
- Identify two thick walled arteries and a single thin walled vein.
- Stabilize the umbilical stump by holding the Wharton's jelly with two artery forceps at 3 and 9 o'clock, grasping the edge of the cord
- Gently dilate vein with iris forceps. Insert the closed forceps into the vein and gently open them.
- When the lumen is open, grasp the catheter approximately 0.5cm above the tip with straight forceps and gently insert the tip into the vessel lumen.
- Move the forceps back up the catheter in 1cm increments and gently advance the catheter forward.
- When blood is in catheter flush with the sodium chloride 0.9% syringe attached to the three-way tap.

NOTE: Rail road technique may be performed if necessary after consultation with Neonatal Fellow or Neonatologist. This technique involves leaving the misdirected catheter in place while a subsequent catheter is inserted (Mandel et al, 2001). The misdirected catheter is then removed prior to X-ray confirmation.

- Stabilise position of catheter Wrap band aid around catheter 0.5cm from suture, tie suture to Band-Aid to secure. (see Fig.1 & 2)
- The clinician inserting the UVC must remain in the sterile field area until the x-ray has been taken and are then responsible for setting up and connecting to TPN/fluids as outlined in the "[Aseptic Technique in NICU](#)" JHCH_NICU_03.01
- Discard all sharps safely

Confirmation of UVC position

[top](#)

- A chest and abdominal x-ray (AP view) must be taken to confirm the position of the catheter tip. An additional lateral shoot through x-ray may be taken to assist in confirming catheter position.

NOTE: On the x-ray a catheter placed in the umbilical vein will go immediately cephalad from the umbilicus.

- If catheter re-adjustment is required, a repeat x-ray must always be performed
- Clinicians trained in the use of point-of-care Ultrasound may use this to confirm catheter tip position
- Document insertion, including number of attempts and final tip position confirmed by Xray on Central Venous Line Insertion Record (SMR090200)-see Appendix 1.

NOTE: NEVER ADVANCE UMBILICAL CATHETER FURTHER INTO THE VESSEL ONCE THE STERILE TECHNIQUE HAS BEEN BROKEN.

Assistant

- Connect and commence infusion.
- Document exact time of insertion in infant's notes and on observation chart.
- Record centimetre marking on the catheter at the umbilical stump at the time of insertion and initial x-ray – this will assist in accessing for catheter migration.
- Clean trolley.
- Assess umbilicus for leakage or bleeding.

Double lumen UVC

- Used for smaller babies or larger sick babies when obtaining vascular access may be a potential problem.
- Insertion of the double lumen UVC is as per single lumen UVC's.
- When no longer required to maintain patency of second lumen an infusion can be run at 0.5ml /hour.
- **N.B.** Please note that the secondary lumen (usually blue in colour) is approximately the same size as a percutaneous central line. Therefore, blood and blood products should **NEVER** be infused through the secondary lumen.

Complications (Department of Health Victoria, 2014):

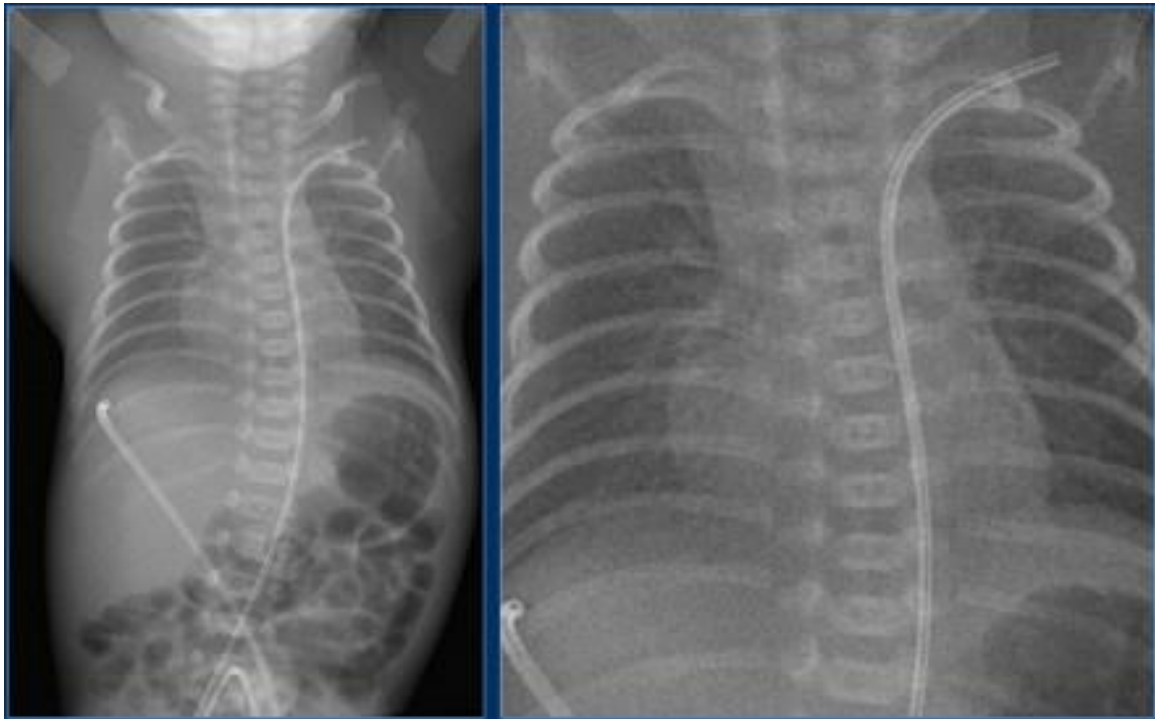
[top](#)

- Infection
- Bleeding due to disconnection of tubing. Always use a Luer locked connection when attaching catheter to infusion tubing
- Perforation – never cut off the rounded end of any indwelling catheter
- Clot formation, embolus and spasm
- Effects of catheter malposition include cardiac arrhythmias, cardiac perforation, hepatic necrosis or portal hypertension
- Extravasation may be a complication of a malpositioned umbilical line

An advanced state may be demonstrated on abdominal X-Ray so it is vital when there is a high index of suspicion that point of care ultrasound is performed to assess extravasation and minimise long term damage and complications. Signs of extravasation include increasing abdominal distension, acidosis and possible hypoglycaemia.

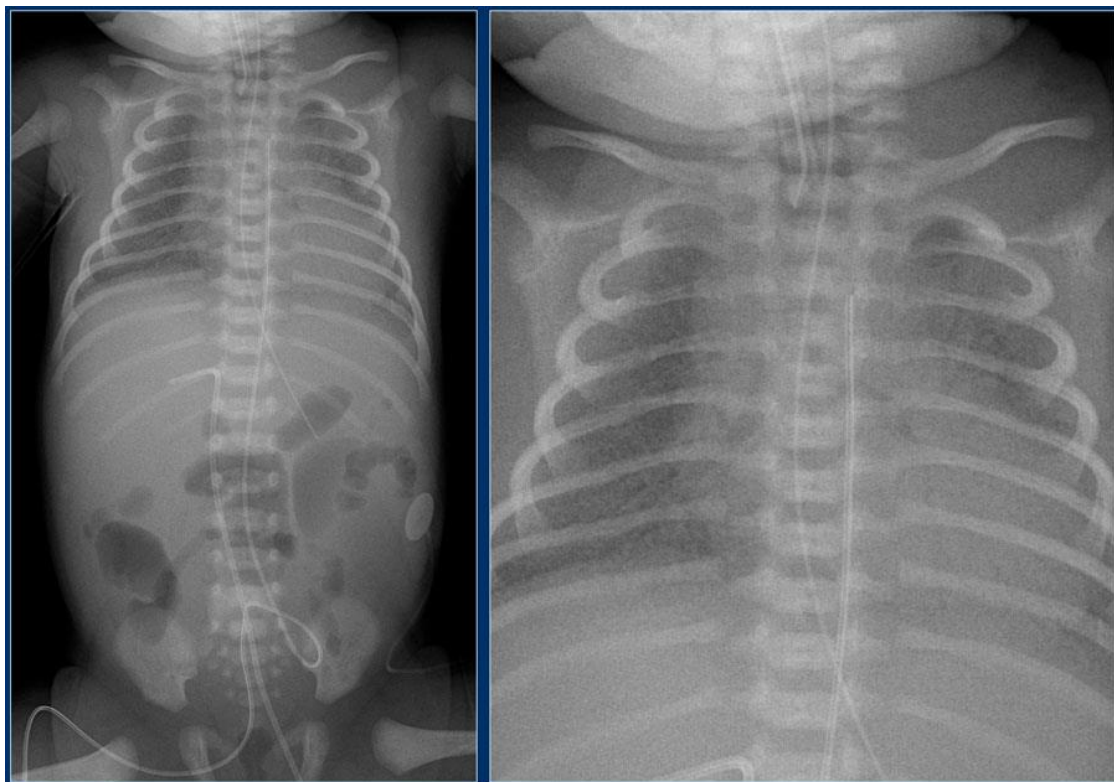


Abdominal XRay showing malpositioned UVC in the liver (Image courtesy of HNE Imaging)



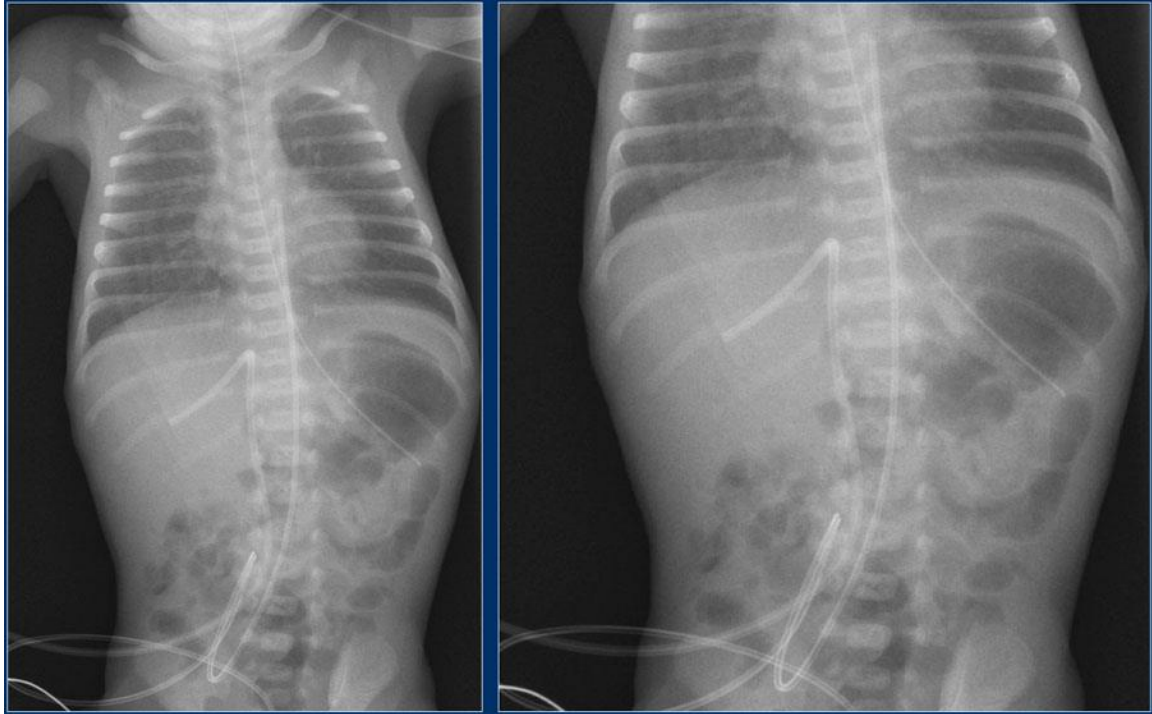
(Radiology Assistant, 2013)

X-ray showing umbilical vein positioned in the periphery of the liver through the right portal vein as well as the arterial umbilical line in the left subclavian artery



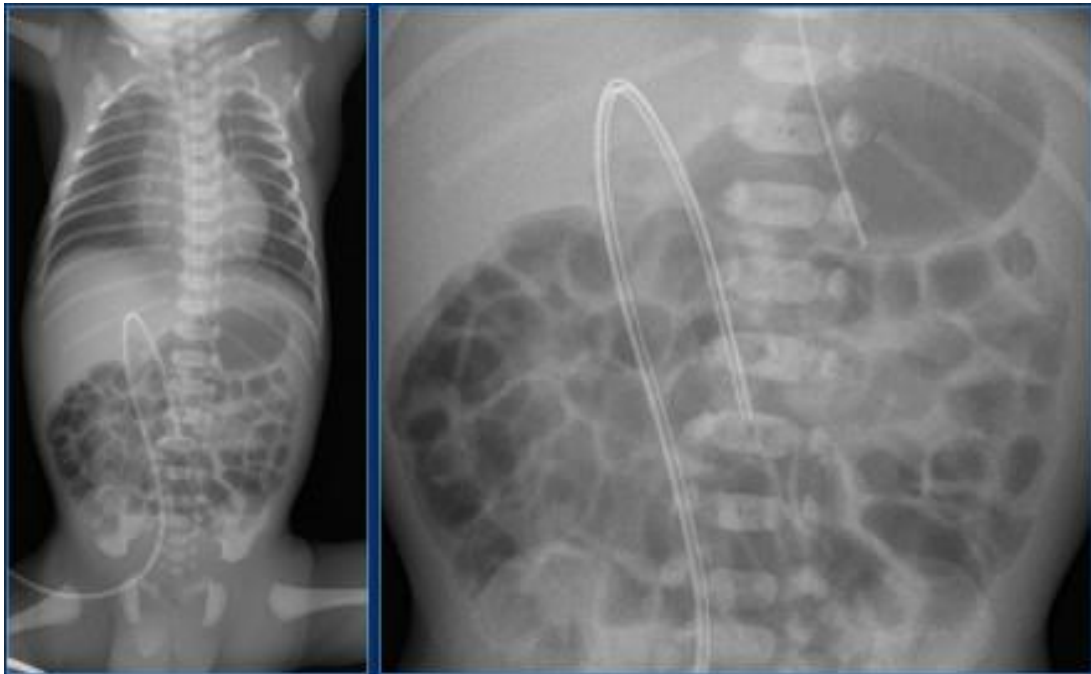
(Radiology Assistant, 2013)

This X-ray shows the umbilical vein line with the tip in the right portal vein and the deep position of the umbilical arterial line in the aortic arch



(Radiology Assistant, 2013)

X-ray shows malposition of the UVC into the right portal vein. UAC is too high position at T4-5. Ideally should be lower between T6-T10



(Radiology Assistant, 2013)

The tip of the umbilical vein catheter line is pointed downwards in this image and situated in the mesenteric vein.

Nursing Considerations of Indwelling UVC

[top](#)

- Observe UVC and cm mark at site of insertion into umbilicus each hour
- All UVC are treated as sterile, i.e. use an aseptic non-touch procedure as outlined in "[Aseptic Technique in NICU](#)" JHCH_NICU_03.01 to change any fluids and administer medications
- Avoid breaking into the line if possible
- Consider synchronizing line changes to minimize line breakages
- Document in the Central Venous Access Device (CVAD) Care Plan (see Appendix 2) to monitor correct labelling, insertion site, measurement and securement
- Document intravenous fluid solution infused in fluid section of flow chart

Positioning of infant:

- Maintain infant supine for at least 4 hours post-procedure to observe for haemorrhage from umbilical stump
- If the infant is placed prone in the abdominal position the catheter should be observed frequently for accidental slipping, kinking and removal of the catheter
- Care should be taken so that the infant is positioned to prevent dislodgement of the catheter
- Positioning the catheter away from the limbs lessens the chance of accidental dislodgement

Once stable, the infant can have skin-to-skin cuddles with parents; however staff must ensure the safety and security of the UAC and observe closely

Timing of UVC removal

[top](#)

- Remove UVC immediately if complications or signs of misplacement or if no longer required and alternative route of fluid administration is in place-i.e. IV or PICC.
- A well-positioned UVC can be used for up to 14 days if managed with aseptic technique (CDC guidelines, 2011).

Catheter Removal

This procedure is not without risks. It may be removed by an experienced RN, MO or NP by gentle traction on the catheter however if no movement of catheter observed then sharp implements are required to cut the suture, e.g. stitch cutters or surgical scissors (experienced clinicians personal preference). Two clinicians are required for this procedure if cutting the stitch is necessary.

Equipment:

- PPE
- Gloves
- Alcohol swap
- Sterile stitch cutter or fine surgical scissors
- Sterile blade
- Dressing pack
- Specimen container (only sent catheter tip for culture and sensitivity if infection is suspected)

Procedure:

- Consider sucrose for pain relief
- Discontinue infusion
- Apply PPE and gloves
- Clean the stump with alcohol swab-normal saline soaking may be necessary if coagulated blood around the site is impeding vision of sutures.
- Caution when 2 catheters in-situ and 1 requires removal – isolate and identify catheters carefully
- Gentle traction to catheter may be applied to withdraw catheter.
- If no movement of catheter, apply artery forceps to the catheter below the sutures (to prevent bleeding or migration of the catheter internally if catheter accidentally cut) see Fig.4
- Remove suture with stitch cutter or surgical scissors See Fig. 5
- Place gauze square handy in readiness for when catheter removed.
- Remove suture and withdraw catheter slowly.
- Place gauze square firmly over umbilicus in an upward direction for a minimum 5 minutes.
- Nurse infant supine for at least 1 hour following removal of catheter and monitor closely for any minor oozing of blood.
- Inspect the length and integrity of UVC upon removal. In the presence of any abnormalities, do not discard the UVC:
 - Report to Team Leader and / or MO to determine appropriate action / investigation;
 - Document on patient's medical record and notify on IIMS.
- Document on the Central Venous Access Device (CVAD) Care Plan (see Appendix 2) removal date & time, reason for removal, condition of tip and signature.
- Remove the umbilical tie (trachy tape) if still in-situ, when no oozing of blood evident-apply haemostat if bleeding continues

NOTE: Junior and inexperienced staff are to be given the opportunity to first observe UVC removal and then proceed to assist in removal. This is to ensure that junior and inexperienced staff can build their capacity in performing procedure safely.

Appendix 1: Central Venous Line Insertion Record

[top](#)



SMR090200

Holes Punched as per AS2828 1: 2012
BINDING MARGIN - NO WRITING

NH909515 080515

<p>NSW Health</p> <p>CENTRAL VENOUS LINE INSERTION RECORD</p>	FAMILY NAME		MRN
	GIVEN NAME		<input type="checkbox"/> MALE <input type="checkbox"/> FEMALE
	D.O.B. ____/____/____		M.O.
	ADDRESS		
	LOCATION / Ward		
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE			
Date / /		Time	
		Elective <input type="checkbox"/> Emergency <input type="checkbox"/> Rewiring <input type="checkbox"/>	
Patient:			Neonate: Weight: _____
Consent <input type="checkbox"/> Time Out <input type="checkbox"/> Coags <input type="checkbox"/> Pacemaker <input type="checkbox"/>			Gestational age: _____
ICU/HDU <input type="checkbox"/> OT <input type="checkbox"/> ED <input type="checkbox"/> Radiology <input type="checkbox"/> Other: _____			
Local <input type="checkbox"/> Sedation <input type="checkbox"/> GA <input type="checkbox"/> Monitoring: ECG <input type="checkbox"/> SpO ₂ <input type="checkbox"/> BP <input type="checkbox"/> CO ₂ <input type="checkbox"/>			
Asepsis:			INSERTION SHOULD STOP IF ASEPSIS IS BREACHED
Hat, mask, protective eyewear <input type="checkbox"/> Hands washed 2 min <input type="checkbox"/> Sterile gloves and gown <input type="checkbox"/> Prep: alcoholic chlorhex / <input type="checkbox"/> Full sterile draping <input type="checkbox"/> Asepsis maintained throughout <input type="checkbox"/>			
Catheter:			
Right <input type="checkbox"/> Left <input type="checkbox"/> Subclavian <input type="checkbox"/> IJ <input type="checkbox"/> EJ <input type="checkbox"/> Femoral <input type="checkbox"/> Basilic <input type="checkbox"/> Cephalic <input type="checkbox"/> Umbilical <input type="checkbox"/> Long Saph <input type="checkbox"/>			
Lumens: _____ CVC <input type="checkbox"/> PICC <input type="checkbox"/> Vascath <input type="checkbox"/> Other type / site: _____			
Brand: _____ Coating: Antibiotic <input type="checkbox"/> Antiseptic <input type="checkbox"/> Gauge: _____ Catheter Length: _____ cm			
No. of passes: _____ Image Int <input type="checkbox"/> Ultrasound <input type="checkbox"/> Depth inserted from skin: _____ cm			
Venous placement confirmed: Manometry <input type="checkbox"/> Ultrasound <input type="checkbox"/> Transducer <input type="checkbox"/> Other _____ Before Dilation <input type="checkbox"/>			
Guidewire removed intact <input type="checkbox"/> Independently Confirmed <input type="checkbox"/> All open lumens capped <input type="checkbox"/>			
Complications: Nil <input type="checkbox"/> Art Puncture <input type="checkbox"/> Haematoma <input type="checkbox"/> Pneumothorax <input type="checkbox"/> Re-position <input type="checkbox"/>			
Notes: _____			
PICCs only: Stiffener removed intact <input type="checkbox"/> Independently Confirmed: <input type="checkbox"/> Mid-upper limb circumference _____ cm			
Final Tip position: _____			
Confirmed by: CXR <input type="checkbox"/> Image Int <input type="checkbox"/> Name _____ Pager _____			
Proceduralist: (name)		Removal: Date: ____/____/20__	
Sign: _____ Pager: _____		Authorised by: _____	
Specialist / Fell / Reg / RMO / NP / RN Date: _____		Reason: _____	
Assistant: (name)		Local sepsis? Yes <input type="checkbox"/> No <input type="checkbox"/> Tip Cultured: Yes <input type="checkbox"/> No <input type="checkbox"/>	
Sign: _____ Date: _____		Removed By: (name)	
Specialist / Fell / Reg / RMO / NP / RN / EN / Technician		Sign: _____ Pager: _____	
Supervisor: (name)		Specialist / Fell / Reg / RMO / NP / RN Date: _____	
Sign: _____ Pager: _____		CLAB Detected: Yes <input type="checkbox"/> No <input type="checkbox"/>	
Specialist / Fell / Reg / RMO / NP / RN Date: _____		If Yes, date of positive blood culture: ____/____/20__	
		Isolate	

CENTRAL VENOUS LINE INSERTION RECORD

SMR090.200

File in patient's notes

Appendix 2: Central Venous Access Device (CVAD) Care Plan

[top](#)

HUNTER NEW ENGLAND LOCAL HEALTH DISTRICT

Facility: _____

CENTRAL VENOUS ACCESS DEVICE (CVAD) CARE PLAN

FAMILY NAME		MRN	
GIVEN NAME		<input type="checkbox"/> MALE	<input type="checkbox"/> FEMALE
D.O.B. ____ / ____ / ____		M.O.	
ADDRESS			
LOCATION / WARD			
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE			



HNE029200

DEVICE INFORMATION												
CVAD Type: <input type="checkbox"/> Central		<input type="checkbox"/> PICC	<input type="checkbox"/> Vas cath/Pemacath	<input type="checkbox"/> Hickman	<input type="checkbox"/> TIVAD/Implantable Port	<input type="checkbox"/> UVC	<input type="checkbox"/> UAC					
Insertion site: <input type="checkbox"/> Subclavian		<input type="checkbox"/> Internal jugular	<input type="checkbox"/> External jugular	<input type="checkbox"/> Femoral	<input type="checkbox"/> Cubital fossa	<input type="checkbox"/> Upper arm	<input type="checkbox"/> Umbilical Vein/Artery					
Position: <input type="checkbox"/> Left		<input type="checkbox"/> Right	External Catheter Length on Insertion: _____ cm. Upper Arm Circumference on Insertion (PICC only): _____ cm									
SHIFT ASSESSMENT												
Initial items have been assessed each shift												
Date	AM	PM	ND	AM	PM	ND	AM	PM	ND	AM	PM	ND
Time												
IV admin set labelled												
Dressing intact												
Insertion site assessed*												
CVAD secured and intact												
External catheter length (cm)												
Integrity of CVAD catheter												
OTHER CVAD INTERVENTIONS: Dressing/IV admin set/non-coring needle changes as per HNELHD guidelines. Initial when changed												
Dressing changed												
IV admin set/s changed												
Non-coring needle changed												
For PICCs: Arm circumference (cm) if swelling suspected												
REMEMBER TO SCRUB THE HUB FOR 15 SECONDS AND ALLOW TO DRY BEFORE ACCESSING CVAD												
REMOVAL												
<input type="checkbox"/> Removal authorised and documented by a medical officer in the patient's health care record												
Reason for removal: <input type="checkbox"/> No longer required <input type="checkbox"/> Accidental removal <input type="checkbox"/> Blocked <input type="checkbox"/> Leaking <input type="checkbox"/> Suspected Infection <input type="checkbox"/> Other:												
Removal date: _____ Time: _____												
Removed by: _____ Signed: _____ Designation: _____												
Tip intact: <input type="checkbox"/> Yes <input type="checkbox"/> No Tip cultured: <input type="checkbox"/> Yes <input type="checkbox"/> No												
*Includes evidence of inflammation, haematoma, excessive accumulation of blood or moisture under dressing. If any of these are present or catheter length is different to documented insertion length please inform treating team and document in patient progress notes.												

○ BINDING MARGIN - DO NOT WRITE ○

References

[top](#)

1. Barrington KJ. (1999). Umbilical artery catheters in newborn: effects of position of the catheter tip. *Cochrane Database of Systematic Reviews* 91):CD000505.
2. Barrington KJ (2000). Umbilical artery catheters in the newborn: effects of heparin. *Cochrane Database Systematic Review* (2):CD000507.
3. Bradshaw, W T., & Furdon, S. (2006). A nurse's guide to early detection of umbilical venous catheter complications in infants. *Advances in Neonatal Care* 6(3), 127-138.
4. Centers for Disease Control and Prevention. (2011) Guidelines for the prevention of intravascular catheter-related infections.
5. Fletcher, M. A., & MacDonald, M. (1993). *Atlas of procedures in Neonatology* Second edition. JB Lippincott Company: Philadelphia.
6. Furdon, S., Horgan, M., Bradshaw, W., & Clark, D. (2006). Nurses guide to early detection of umbilical arterial catheter complications in infants. *Advances in Neonatal care*, 6(5), pp2242-256.
7. Heiss-Harris, G. (2004). Chapter 15 Common Invasive procedures in Verklan, M & Valden, M (Eds) *Core Curriculum for Neonatal Intensive Care Nursing*. Third Edition. Elsevier Saunders: USA.
8. Kabra NS, Kumar M, Shah SS. Multiple versus single lumen umbilical venous catheters for newborn infants. *Cochrane Database of Systematic Reviews* 2005, Issue 3. Art. No.: CD004498. DOI: 10.1002/14651858.CD004498.pub2.
9. Lissauer, T., & Fanaroff, A. (2011). *Neonatology at a Glance* Second Edition. Wiley-Blackwell:UK
10. MacDonald, M. & Ramasethu, J (2007). *Atlas of procedures in Neonatology* Fourth edition. JB Lippincott Williams & Wilkins: Philadelphia.
11. Mandel, D., Mimouni, F., Littner, Y. & Dollberg, S. (2001) Double catheter technique for misdirected umbilical vein catheter. Department of Neonatology. Lia Maternity Hospital. Israel. doi:10.1067/mpd.2001.117073
12. Department of Health Victoria (2014). Umbilical artery catheterization. *Neonatal ehandbook*. Accessed on 31st March 2014 at: <http://www.health.vic.gov.au/neonatalhandbook/procedures/umbilical-artery-catheterisation.htm>
13. Department of Health Victoria (2014). Umbilical vein catheterization *in Neonatal ehandbook*. Accessed on 31st March 2014 at:
14. NW Newborn Services Clinical Guideline (2001). Umbilical Artery and vein catheterisation. Accessed at: <http://www.adhb.govt.nz/newborn/guidelines/vascularcatheters/umbilicalcatheters.htm> on 14/02/2008
15. Rennie J, & Kendall G. (2013). *A Manual of Neonatal Intensive Care 5th Edition*. Taylor & Francis Group: Boca Raton.
16. Schuppen, J., Onland, W. & van Rijn, R. (2013) Lines and tubes in Neonates. *Radiology Assistant*
17. Accessed 5/10/2016 < <http://www.radiologyassistant.nl/en/p526bd2e468b8c/lines-and-tubes-in-neonates.html> >
18. Shukla, H. & Ferrara, A. (1986). Rapid estimation of insertional length of umbilical catheters in newborns. *American Journal Disease in Childhood* 140, 786-788.
19. Wiki Radiography .World's largest radiography encyclopedia. Accessed 10/2/15 < <http://www.wikiradiography.net/page/Neonatal+Lines,+Tubes+and+Catheters>>
20. Wright, IMR, Owers, M & Wagner, M. (2008). The umbilical arterial catheter: A formula for improved positioning in the very low birthweight infant. *Pediatric Critical Care Medicine*, 9(5), 498-501.

Author (Original): Denise Kinross CNC for Newborn Services

Updated by Jenny Ormsby CNE NICU JHCH August 2017

Reviewers Koert de Waal Neonatologist NICU JHCH
Mark Amey NP NICU JHCH
Nilkant Phad, Neonatologist, NICU JHCH
Paul Craven, Neonatologist NICU JHCH
Ruth Wootton CNS NICU JHCH
Vivienne Whitehead CNE JHCH
Javeed Travadi Neonatologist NICU JHCH
Jo McIntosh Neonatologist NICU JHCH
Anna Mistry Neonatal Fellow NICU JHCH
Larissa Korostenski Neonatologist NICU JHCH
Anil Lakkundi Neonatologist NICU JHCH

Ratified by NICU, Operational, Planning & Management Committee 21/09/17

Clinical Quality & Patient Care Committee 26/09/2017

COMMUNICATION and IMPLEMENTATION PLAN

1. Awareness of this Guideline and Procedure will be promoted via email and the message board on the Neonatal HUB.
2. This revised Clinical Guidelines, Procedures will be posted on the HNE Policy, Procedure and Guideline Directory and Hnehealthkids website.

MONITORING AND EVALUATION

1. Documentation in the Central Venous Line Insertion Record to monitor and record Asepsis, Catheter, Final tip position confirmed by XRay and removal by clinician inserting line.
2. Documentation in the Central Venous Access Device (CVAD) Care Plan to monitor correct labelling, dressing, insertion site, measurement, securement and removal of catheter by bedside nurse.
3. Incident investigations associated with this Guideline and Procedure will include a review of process.
4. The Guideline and Procedure will be amended in line with the recommendations.
5. The person or leadership team who has approved the Guideline and Procedure is responsible for ensuring timely and effective review of the Guideline and Procedure.
6. Evaluation will include a review of the most current evidence as well as a consideration of the experience of Neonatal staff at JHCH in the implementation of the Guideline and Procedure.

FEEDBACK

Any feedback on this document should be sent to the Contact Officer listed on the front page.