

UMBILICAL CATHETERS: CARE AND MANAGEMENT IN CICU

PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

Parental consent:

- Umbilical catheterisation is often used as part of neonatal resuscitation or stabilisation, subsequently consent is impractical¹
- Parents should be informed as soon as practical of reasons for the procedure
- Elective insertion of an umbilical catheter requires informed written consent

Insertion:

- Currently there is no consensus regarding the ideal agent for cutaneous antisepsis in neonatal population. Consequently the recommended practice for SCHN is based on body of evidence that can be trusted to guide practice in most situations (Grade B)²⁻⁷
- 0.1% Aqueous Chlorhexidine Gluconate is endorsed as the appropriate antiseptic for use with skin preparation for insertion and dressings in neonatal inpatients²⁻⁷
- Only the minimum amount of 0.1% Aqueous Chlorhexidine Gluconate solution required should be used and the solution should not be allowed to pool in skin folds or under the patient. Any excess solution and any soaked materials, drapes or other material in direct contact with the patient should be removed as soon as possible.⁸
- All catheters must be checked radiographically for correct placement and a repeat xray performed following any catheter adjustment to confirm tip position
- Umbilical venous catheterisation (UVC) insertion documentation is to be completed by the individual inserting the device in CVAD insertion/removal record in eMR and/or in patient's progress notes. This must include the catheter type, size and tip location and other relevant fields listed.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st August 2019	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: CICU

- Umbilical arterial catheter insertion documentation is to be completed by the individual inserting the device in eMR and/or in patient's progress notes.

General Information:

- ANTT must be used for all clinical management of umbilical catheters⁹
- This document should be read in conjunction with **Central Venous Access Device in Neonates** and [Invasive Arterial Monitoring in CICU Clinical Practice Guidelines](#) which contain detailed aspects of required management
- Maintenance care bundles have been found to be important for reducing Catheter Related Blood Stream Infections (CRBSI)¹⁰ and include the following:
 - i. Assess and document daily whether or not catheter placement and continued use is necessary
 - ii. Perform appropriate hand hygiene
 - iii. Securement of the catheter must be assessed at commencement of each shift and with any patient reposition
 - iv. Perform securement procedure when required
 - v. Develop and standardise intravenous tubing setup and changes
 - vi. Maintain aseptic technique when changing IV tubing setup and changes
- Neonate must be nursed supine or on their side, **THEY MUST NOT TO BE NURSED PRONE** whilst UAC or UVC in-situ
- Lower abdomen, legs and feet **MUST ALWAYS** be visible and toes, feet and legs continuously observed - wrappings/blankets and booties must not to be used.
- All administration lines and /or intravenous fluids should be labelled in accordance with NSW Health Ministry of Health Policy¹¹
- Umbilical catheters must be clearly labelled to distinguish Arterial from Venous catheters

Blood Sampling:

- Prior to obtaining blood samples, check with medical team if infusion can be discontinued
- **NB: BLOOD SAMPLING MUST NOT BE OBTAINED WHERE AN INOTROPE OR OTHER CRITICAL INFUSION IS IN PROGRESS VIA AN UVC**
- Blood sampling from UAC should be carried out slowly to decrease risk of cerebral hypoperfusion as there is a direct relationship between the rate of the flush of the catheter and changes in cerebral blood flow velocity¹².

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- *Recommended rate of withdrawal and flush is **1mL per 30 seconds** to reduce the effect on the cerebral blood flow* ¹²
- Effect of blood withdrawal from a UVC is similar regarding cerebral blood flow and cerebral oxygenation as blood sampling from a UAC ¹³

Removal:

- Catheters should be removed one at a time
- Removal should only be performed by an accredited RN or trained medical officer.
 - If only one umbilical catheter is to be removed and if it has been stitched in separately, an accredited RN may remove the catheter.
 - If the umbilical catheters have been stitched in together then it is the responsibility of medical staff to remove the catheter.
- If there is any evidence of local vascular compromise in lower limbs or buttocks, the UAC or UVC must be removed
- UVC removal documentation is to be completed by the individual removing the device and documented in CVAD insertion/removal record in eMR and/or in patient's progress notes **noting presence of intact tip**
- UAC removal documentation is to be completed by the individual removing the device and documented in eMR and/or in patient's progress notes **noting presence of intact tip**

Transfer of a patient between locations should not occur within 30 minutes of removal of a CVAD¹⁴

CHANGE SUMMARY

- Important additional information included regarding 0.1% Aqueous Chlorhexidine Gluconate being endorsed as the appropriate antiseptic for use with skin preparation for insertion in neonatal inpatients
- Additional information regarding Neonatal Skin Risk Assessment Scale and skin assessment included
- Additional information included to align document with existing SCHN & SCH documents
- References updated

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READ ACKNOWLEDGEMENT

Training/Assessment Required:

- Clinician competency is validated by documenting the knowledge, skills, behaviours and ability to care for a neonate with an umbilical catheter in-situ
- Person assessing performance of clinicians is competent with the skill being assessed
- Neonatal CVAD Accreditation Process for RNs - which includes UVCs - comprises:
 - Online Neonatal CVAD learning program
 - Practical/or observation session with CNE or CVAD accredited assessor
 - Completion of Neonatal CVAD Nursing Clinical Skills Assessments
 - Reaccreditation – consists of completion of Neonatal CVAD Nursing Clinical Skills Assessment
 - Time line for completion of these components will be determined locally
- Neonatal UAC Accreditation Process for RNs requires successful completion of the MANAGEMENT OF INTRA-ARTERIAL LINES Nursing Clinical Skills Assessment
- Clinical staff caring for neonates with any umbilical catheter should read and acknowledge this document.

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Purpose

Umbilical catheters are inserted within the first few hours to days of life and provide short term central access for the sick neonate. Umbilical catheters provide vital access enabling administration of intravenous fluids, blood products and medications such as inotropes and parental nutrition. In addition they provide reliable physiological information via invasive haemodynamic monitoring and an avenue for blood sampling.

Definition of Terms

- **Umbilical venous catheter (UVC):** A catheter inserted through the umbilical vein entering the inferior vena cava via the ductus venosus and terminating at the junction of the inferior vena cava and the right atrium.
- **Umbilical arterial catheter (UAC):** A catheter inserted through the umbilical artery to the aorta via the internal iliac and common arteries.

Contraindications

- Umbilical catheters are contraindicated in neonates with the following conditions:
 - Abdominal wall defects eg Gastrochisis, Omphalocele, umbilical fistula, cord anomalies
 - Infection eg Omphalitis, Necrotising enterocolitis, Peritonitis
 - Coarctation of the aorta
 - Cardiac anomalies requiring balloon septostomy
 - Abdominal surgery requiring an incision above the umbilicus – UVC contraindication

Analgesia/Sedation

- Umbilical cord is devoid of nerve fibres therefore no specific analgesia is needed for sole purpose of insertion of an umbilical catheter
- Patient preparation will require facilitated tucking to avoid movement during the procedure and this is potentially stressful to the neonate. Subsequently, if the neonate is not already receiving parenteral analgesia as part of their clinical management and no contraindications exist then use of oral sucrose should be facilitated.
 - This should also be considered for removal procedures

General Information

- Umbilical catheters are a central access device and therefore any procedures undertaken must utilise ANTT. This includes when changing infusions for invasive pressure monitoring systems.
- UVCs should be sited to minimise the risk of tamponade in the event of extravasation therefore catheter tip should lie outside the cardiac silhouette on X-ray. Where a catheter tip lies within the cardiac silhouette, it should be withdrawn and a repeat X-ray performed.
- Under no circumstances should catheters be **ADVANCED** following check x-ray as this may introduce infection into now contaminated line. The line must be removed and a new line inserted
- All umbilical catheters should allow free aspiration of blood in their final position and this aspiration must be documented by the medical officer undertaking procedure
- Suture each line separately to facilitate adjustment of lines post check X-ray and removal
- Umbilical catheters should be fixed in a way that minimises the chance of catheter migration, allows ongoing assessment of position and permits catheter adjustment and removal.
- Need for continued retention/use of a UVC or UAC should be reviewed daily.
- Double and triple lumen UVCs should be considered if the neonate is likely to require multiple infusions which may be incompatible e.g. congenital diaphragmatic hernia
- Continuous heparinised saline should be infused to maintain catheter patency and prevent thrombosis ¹⁵
 - Heparinisation of the fluid infused through a UAC decreases likelihood of occlusion. The lowest concentration shown to be effective is 0.25 units/mL¹⁵
 - If no infusion is in progress via a UVC, continuous heparinised saline should be infused to maintain catheter patency
- Solutions containing isopropyl alcohol must not be used on catheter to avoid breakdown of integrity of catheter
- UAC can remain in place for 5-7 days, after this time if required peripheral arterial insertion should be undertaken ¹⁶
- Routine removal of UVCs and replacement with a PICC or CVAD within 7 days is no longer best practice. UVCs may stay in situ up to 14 days¹⁶, there is no further risk of infection between day 7-14 providing ANTT is utilised; if left in situ longer than 14 days risk of thrombosis vastly increases ^{17, 18}
- There is insufficient evidence from published randomised clinical trials to support or refute the use of prophylactic antibiotics when inserting UVCs or UACs in neonates^{19,20}

- There is no evidence from clinical trials to support or refute continuing antibiotics once initial cultures rule out infection in neonates with UVCs or UACs ^{19,20}

Insertion Information

- Umbilical venous catheterisation (UVC) insertion documentation is to be completed by the individual inserting the device in CVAD insertion/removal record in eMR and/or in patient's progress notes. This must include the catheter type, size and tip location and other relevant fields listed.
- Umbilical arterial catheter insertion documentation is to be completed by the individual inserting the device in eMR and/or in patient's progress notes.

Correct location of the umbilical catheter tip must be confirmed and documented by a medical officer prior to use

- RN is to remain with neonate throughout insertion procedure of a UVC or UAC
- Prior to and throughout insertion procedures, the neonate is to be positioned supine on an open care system with appropriate thermal management utilised. Audible cardio-respiratory monitoring is to be in place for insertion procedure with leads positioned away from abdomen.
- Skin antisepsis around umbilicus and stump (*including clamp / ties*) must be undertaken using sterile 0.1% Aqueous Chlorhexidine antiseptic solution.
- Only the minimum amount of 0.1% Aqueous Chlorhexidine Gluconate solution required should be used and the solution should not be allowed to pool in skin folds or under the patient. Any excess solution and any soaked materials, drapes or other material in direct contact with the patient should be removed as soon as possible.⁸

Determining catheter depth

- Before beginning the procedure, determine the insertion depth. There are different methods used to predict the position of umbilical catheters: ^{21,22,23}

UAC:

- There is no universal formula, which gives the accurate length of placement of a UAC; they can be sited either in the high or low position:
- **HIGH = T6 –T9: catheter tip lies in the descending aorta above the level of the diaphragm and below the left subclavian artery** ²⁴
- Depth is calculated by the formula: **(birth weight [kg] x 3) + 9** ²²
- High positioning of UAC leads to fewer complications without an increase in any adverse sequelae ²⁴ therefore **THIS IS PREFERRED IN CICU**

- **LOW = L3 and L4:** *catheter tip lies above the aortic bifurcation and below the renal arteries near the origin of the inferior mesenteric artery.* A Cochrane review showed no evidence to support the use of low lying UAC's²⁴

UVC:

- Catheter tip lies at the junction of the ductus venosus and inferior vena cava just above or at level of diaphragm and outside the heart - approx. T9 - T10
- In the absence of high-level evidence to promote the superiority of any UVC placement method, CICU adopts a method of calculation based on Verheij et al²⁵
- Depth is calculated by the formula: **(birth weight [kg] x 3) + 9 ÷ 2**

Umbilical Arterial Catheters

- Only available as single lumen with single end holes. Side hole UACs should be avoided as they are associated with increase in thrombosis²⁶
- Available sizes 2.5 or 3.5 Fr (*birth weight <1250g*), 3.5–5 Fr (*birth weight >1250g*)

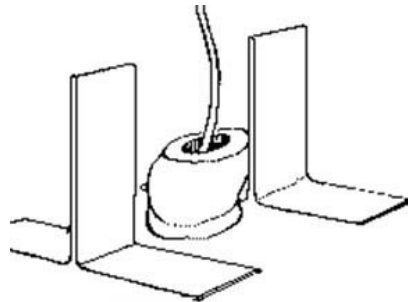
Umbilical Venous Catheters

- May be single, double or triple - multiple lumen catheters allow for infusion of incompatible fluids on separate lines
- 5Fr normally used but low birth weight neonates may need 3.5Fr
- Whilst ultrasound guided insertion of UVC is considered most efficient and accurate in placement of UVC²⁷, due to practical limitations CICU utilises radiography to assess catheter tip position.
- UVC position should be confirmed with an antero-posterior and lateral x-ray prior to infusion of fluid and/or medications unless the UVC is used for acute resuscitation
- If there is a delay obtaining the x-ray intermittently flush the line with 0.9% saline to keep the UVC patent. **NB: UVC may be withdrawn but never advanced to correct the position**
- There is no evidence to support the practice of 'railroading' a second UVC beside one which is thought to be malpositioned. This practice is to be avoided since it may increase the risk of vessel trauma and consequent extravasation¹
- All intravenous tubing and add-on devices must have luer-lock connections
- Hypertonic solutions (eg >10% glucose), vasoactive drugs, parental nutrition and blood products may be infused via UVC (*platelet transfusion is not recommended due to risk of thrombosis*)
- In order to avoid the risk of damaging any umbilical catheter the following is recommended:

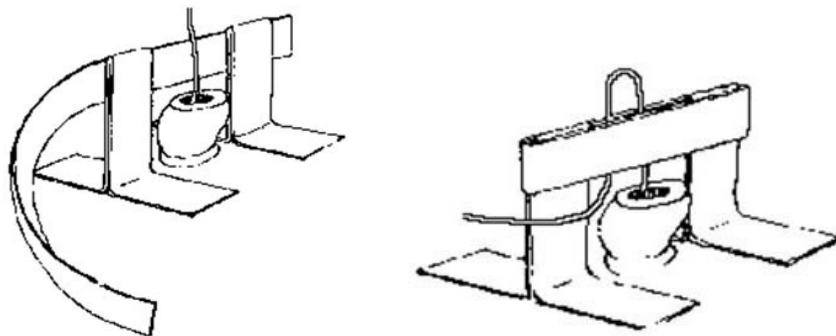
- Always use the equivalent of a 10 mL syringe (e.g. 10mL syringe or 5mL prefilled 0.9% Sodium Chloride syringe) when priming and flushing the catheter
- **Smaller syringes generate higher pressures than larger ones**

Securing the Line

- Catheter is secured using 'goal post' technique to prevent catheter moving in or out
- A strip of hydrogel dressing e.g. *DuoDerm*® is placed parallel on the abdominal skin to protect it on either side of the umbilical stump leaving a small gap of skin



- Adhesive tape is used to create the 'goal post' as per the diagram
- Loop the catheter into the bridge between the two posts leaving a 1cm gap between the tape and the umbilical stump to prevent chafing. **If both UVC and UAC are present loop them in opposite directions**



- A loose clean catheter tie (*trache tape*) can be left in place for any further oozing; tie must be around umbilical stump only, to prevent skin damage
- Record length of insertion, the cm mark at umbilical stump in patient notes
- Due to concerns for fragile skin integrity in neonatal patients, securement tapes on umbilical catheters are only changed when they become loose, soiled or compromised. At this time, changes are to be performed immediately.
- Two staff members are required for the procedure when securement of an umbilical catheter is undertaken

Ongoing Management

- Maintenance care bundles have been found to be important for reducing Catheter Related Blood Stream Infections (CRBSI)¹⁰ and include the following:
 - i. Assess and document daily whether or not catheter placement and continued use is necessary
 - ii. Perform appropriate hand hygiene
 - iii. Securement of the catheter must be assessed at commencement of each shift and with any patient reposition
 - iv. Perform securement procedure when required
 - v. Develop and standardise intravenous tubing setup and changes
 - vi. Maintain aseptic technique when changing IV tubing setup and changes
- ANTT must be used for all clinical management of umbilical catheters⁹
- Ensure all connections are luer-locking mechanism and secure
- Catheter connections should be visible at all times to ensure integrity of each connection. **DO NOT PLACE LINEN OVER ANY CONNECTIONS.**
- All administration lines and /or intravenous fluids should be labelled in accordance with NSW Health Ministry of Health Policy¹¹
- Umbilical catheters must be clearly labelled to distinguish Arterial from Venous catheters
- Neonate must be nursed supine or on their side, **THEY MUST NOT TO BE NURSED**
- **PRONE** whilst UAC or UVC in-situ
- Umbilicus must be exposed at all times to observe for bleeding, fluid leakage, swelling, redness, discolouration of skin or blistering. Any of these findings must be reported to medical team immediately
- Lower abdomen, legs and feet **MUST ALWAYS** be visible and toes, feet and legs continuously observed - wrappings/blankets and booties must not to be used.
- If a nappy is worn it must be positioned in a manner so as not to obscure the umbilical stump and to allow easy access to viewing buttocks.
- Umbilicus must be assessed hourly and findings documented in the patient medical records such as flow chart and/or in the eMR. Check security of tapes and the catheter
NB: the cord remnant separates by a process of dry gangrene and with this suture securing the catheter will weaken
- Documentation should include:
 - Any signs of bleeding
 - Any signs of possible infection such as redness, swelling or exudate
 - Any signs of dislodgement

- Note any skin blanching, bruising of limbs, toes or buttocks prior to, during and after any procedure and at any time the catheter is in situ – report immediately
 - *If one limb involved, warm opposite limb to induce reflex vasodilatation of affected limb*
 - *If above fails, catheter should be withdrawn 0.5 - 1.0cm and observe*
 - *Remove catheter if blanching persist for >30 minutes*
- Replace **continuous** administration sets used to administer solutions other than lipid or blood products up to every 96 hours or as per special considerations for specific medications – with fluid change
 - *Replace IV administration sets for Parenteral Nutrition every 24hrs or as recommended by manufacturer for pre-made solutions*
 - *Replace IV fat emulsion sets (i.e. Intralipid) every 24hrs*
- Replace **intermittent** administration sets, add-on devices and solutions with each medication
- Ensure that no traction is applied to an umbilical catheter at any time
- Secure lines away from neonates hands and feet to prevent accidental dislodgement, ensuring no traction is applied
- Level and zero UAC line at commencement of every shift and if patient is repositioned. If UVC is utilised to monitor CVP then this same requirement should be undertaken.
- Each UVC requires **minimum** infusion rate of 1mL per hour
- Continuous heparinised saline should be infused through the UAC as per [Invasive Arterial Monitoring - CICU - SCH](#) to prevent thrombosis
- After discussion with CICU Staff Specialist, neonate may have cuddles with parents
 - Safety and security of the umbilical catheter must be ensured and neonate closely observed throughout cuddle therefore RN must remain at bedside at all times
- Umbilicus is to be kept clean and dry
- Observe abdominal girth for signs of distension and document if noted

Sampling

- If significant volumes are required, contact laboratory to determine minimum volume required for samples and discuss with medical officer prior to undertaking procedure. *Record volume removed on flow chart to aid in quantifying blood loss and to guide future sampling by colleagues*
- Check with medical staff if infusions(s) can be discontinued prior to obtaining blood samples – **BLOOD SAMPLING MUST NOT BE OBTAINED WHEN AN INOTROPE OR OTHER CRITICAL INFUSION IS IN PROGRESS**
- Blood sampling from UAC should be carried out slowly to decrease risk of cerebral hypoperfusion as there is direct relationship between rate of flush of catheter and changes in cerebral blood flow velocity¹²
- Recommended rate of withdrawal and flush is **1mL per 30 seconds** to reduce the effect on the cerebral blood flow ¹²
- Effect of blood withdrawal from a UVC is similar regarding cerebral blood flow and cerebral oxygenation as blood sampling from a UAC ¹³

Troubleshooting

Blockage

- UVC: If lumen becomes blocked it should be clamped, labelled as '**NOT FOR USE**', MO notified and an IIMS notification completed.

Accidental dislodgement

- UVC: Gently pinch the abdomen **ABOVE** the umbilicus for 2-5 minutes as this will compress the umbilical vein and control bleeding, notify MO and complete IIMS notification
- UAC: Gently pinch the abdomen **BELOW** the umbilicus for 2-5 minutes to compress the umbilical artery and control bleeding, notify MO and complete IIMS notification

Accidental severance of catheter:

Clamp the line between the neonate and the severed end

NOTIFY MO IMMEDIATELY AS THIS IS AN EMERGENCY

- Inspect the length and integrity of umbilical catheter
- **DO NOT DISCARD SEVERED PORTION**
- Document on patient's medical record
- Complete IIMS notification

Removal of a UVC and/or a UAC

- If an UAC is to remain in situ, the UVC should be removed by a medical officer in case of accidental dislodgement of the UAC
- Document removal in the CVAD insertion/removal record in eMR and/or in the patient's progress notes. Noting the presence of an intact tip.
- Removal documentation is to be completed by the individual removing the device
- Staff must be aware of possible complications of both removal procedure and post-procedure
- Removal should only be performed by an accredited RN or trained medical officer
- Ensure the neonate's FBC and coagulation studies are current (*within 24hours*) and review these prior to removal.
- Prior to commencing the removal procedure, ensure infusions have been discontinued for minimum of 30 minutes and infusion line(s) clamped.
- Explain procedure to parents/carers prior to removal
- Prepare the infant and family; consider comfort techniques and analgesia as required.
- Ensure infant is wrapped and positioned supine in a comfortable posture, arms and legs should be appropriately swaddled and facilitated tucking utilised.
- The infant's observations must be recorded before and after removal. During removal, the infant must have cardio-respiratory monitoring in place.
- Remove tapes securing UAC/UVC
- Clean and prep the area with 0.1% Aqueous Chlorhexidine Gluconate solution
- If umbilical cord has become very dry and appears to stick to the catheter, place sterile gauze soaked in 0.9% saline around the umbilical stump to moisten it and leave in place for approx. 20 mins before proceeding.
- Remove the suture from around the catheter using stitch cutter
- Following the procedure, **leave the neonate supine for a minimum of 4 hours**. During this time the umbilicus must be uncovered, and visible for inspection. Observe for complications including bleeding.
- Transfer of a patient between locations should not occur within 30 minutes of removal of a CVAD¹⁴

UAC:

- using sterile gauze hold the catheter and slowly withdraw it approx. 0.5cm at a time (*Slow removal gives the vessels time to constrict and reduce bleeding*)
- Wait for minimum of 1 minute after withdrawing each 0.5cm. If resistance is encountered **DO NOT CONTINUE** with removal – seek medical assistance
- **WAIT FOR PULSATION IN CATHETER TO STOP.** If the artery continues pulsating, wait and start removing catheter again (*can take approx. 10minutes*)
- Continue until the catheter is removed
- Inspect tip ensuring it is intact
- If bleeding occurs apply pressure to the umbilical stump by pinching the base with a sterile gauze to achieve haemostasis
- Send tip for culture and sensitivity only if infection is suspected. Cut approx. 2-3cm from end of catheter with sterile scissors and using sterile forceps place in sterile specimen jar. Ensure pathology request completed by medical team

UVC:

- Withdraw the catheter slowly with continual traction in a single action. If resistance is encountered **DO NOT CONTINUE** with removal – seek medical assistance
- Continue until the catheter is removed
- Inspect tip ensuring it is intact
- Send tip for culture and sensitivity only if infection is suspected. Cut approx. 2-3cm from end of catheter with sterile scissors and using sterile forceps place in sterile specimen jar. Ensure pathology request completed by medical team

Complications ¹⁸

Indications for Immediate Withdrawal: ²⁸

- Evidence of local vascular compromise in lower limbs or buttocks
- Peritonitis
- Necrotising enterocolitis
- Omphalitis
- Most complications of umbilical catheters are related to incorrect position or the length of time in place:
 - **Thrombosis:** May result from damage incurred during insertion of the catheter, incorrect position, or may develop over the duration of placement. This is the most common complication of UACs and is minimised by a continuous infusion of heparinised saline

- **Air embolism:** Can result from air in tubing, flushing or if the line is left open to air
- **Haemorrhage:** May occur from the disconnection of tubing, dislodgement of the catheter or from umbilical stump
- **Sepsis:** Common complication which is minimised by keeping line accessing to a minimum, strict adherence to hand hygiene and ANTT
- **Vasospasm:** Limbs may blanch when a UAC is flushed due to vasospasm, this usually self resolves
- **Ischaemia and necrosis:** Obstruction of blood flow due to incorrect placement of a catheter or a thrombus can result in ischaemia to lower limbs and the gut
- **Arrhythmia, cardiac tamponade and pericardial effusion:** Can occur due to misplaced or migrated catheter tip
- UVC malposition in heart and great vessels
- Ascites and peritonitis: May result from perforation of the vessel wall by catheter and infiltration of infusing fluids
- Refractory hypoglycaemia: may result if catheter tip near celiac axis

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