GUIDELINE

Umbilical Arterial Catheter (UAC)

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

Child Safe Organisation Statement of Commitment

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.

This document should be read in conjunction with this disclaimer

Contents

Aim

Outlines the indications, insertion and management of umbilical arterial lines **in neonates**. **Use t**his guideline in conjunction with the Central Venous Access Device Bundle**.**

Risk

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

- Catheter malposition - vessel or peritoneal perforation, movement of catheter
- Vascular complications like thrombosis, embolism/infarction, vasospasm, vascular compromise to the lower extremities.
- Hypertension
- Air embolism
- Infection
- Bleeding

Indications for Insertion

The umbilical artery begins to constrict after birth but may be cannulated up to the first week of life**. The decision to insert a UAC should be made on a case-by-case basis and discussed with the consultant or senior registrar. Indications for insertion may include:**

- Frequent blood sampling or blood gas monitoring in:
  - preterm infants (<800 grams or <26 weeks)
  - other unstable infants (give consideration to infants with inadequate antenatal steroid cover)
  - infants with increasing oxygen requirements +/- ventilation
- Requiring blood pressure monitoring
  - Critically unwell infant
  - Infant requiring ionotropic support
- Exchange transfusion

Prior to Procedure

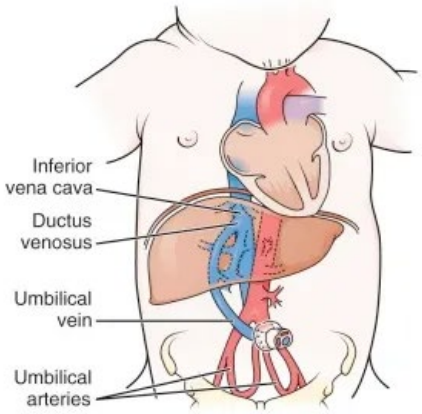
- The clinician performing the procedure must have appropriate training or supervision during the procedure
- Document clinical indication in the patient's progress notes
- Adequate cardiac and SaO2 monitoring of the infant throughout the procedure.

- Refer to Neonatal Intravascular Device Insertion Record (MR422) for procedural checklist.
- UAC is often inserted in conjunction with an Umbilical Venous Catheter (UVC)
- Refer to the Reusable Medical Devices: Reprocessing, Tracking and Traceability guideline for tracking and tracing process and documentation at point of care for reusable medical devices (RMD's)

Anatomy and Position

The umbilical arteries are the direct continuation of the internal iliac arteries. A catheter passed into an umbilical artery will usually (but not always) enter the aorta via the internal iliac artery. Its path is, therefore, initially inferior and lateral as it passes around the bladder, before turning cephalad and medial to enter the aorta.

Occasionally it may pass into the femoral artery via the external iliac artery or into the gluteal arteries. The femoral artery or gluteal artery are unsuitable sites for sampling, infusion, or blood pressure monitoring.



Adapted from: *From Robert and Hedge's Clinical Procedures in Emergency Medicine*

There are two potential positions for the UAC. These are described as "high" or "low".

- The **high position** is at the level of thoracic vertebral bodies T6-T9. This position is above the coeliac axis (T12), the superior mesenteric artery (T12-L1), and the renal arteries (L1). This position is essentially "above the diaphragm".
    - A high UAC position is associated with significantly less risks of clinical vascular compromise and aortic thrombus formation. This position should be used exclusively unless a low position is the only position that can be obtained, and a UAC is deemed necessary for optimum patient care.
- The **low position** is at the level of lumbar vertebral bodies L3-L4. This position is below the structures as above and is above the aortic bifurcation (L4-L5). The inferior mesenteric artery arises from L3-L4. This position is essentially "above the bifurcation".

Catheter Size and Insertion Distance

<1500g 3.5F – single lumen catheter

>1500g 5F – single lumen catheter

The preferred method for estimating the insertion distance for the UAC is by measuring the umbilicus to shoulder distance. Measure from the skin at the base of the stump where it connects to the anterior abdominal wall then add the length of the umbilical stump to the distance inserted. See table below:

Shoulder-Umbilical distance (cm)	Low UAC (cm)	High UAC (preferred) (cm)
9	5	9
10	5.5	10.5
11	6.5	11.5
12	7	13
13	7.5	14
14	8.5	15
15	9.5	16.5
16	10	17.5
17	11	19
18	12	20

Equipment

Common equipment Appendix 1.

- Surgical gown x 1
- Sterile pair of gloves x 2
- Mask x1
- Face Shield (as required) x1
- Sterile non-woven (soft) gauze*
- Antiseptic solution:
  - >27 weeks gestation: 1% chlorhexidine soln
  - ≤27 weeks gestation: Povidone-iodine 10% soln/swab
- **PICC placement kit (PCH only)**
- Sterile 0.9% Sodium chloride ampoules x2
- Blunt drawing up needle x 1
- Sterile absorbent towel x 1
- 3-way taps x 3
- Smartsite™ valves x2 (for each 3-way tap)

UAC specific

- Appropriate size UAC for gestation
- Transducer Set
- Suture- 3.0 Prolene / 3.0 Silk
- Sterile Instrument pack
- Cord tie
- Sterile plastic drape

**to reduce the risk of abrasive skin injury*

Fluids

- ≤27 weeks - Sodium Chloride 0.45% + 0.5 u/mL Heparin
- >27 weeks - Sodium Chloride 0.9% + 0.5 u/mL Heparin

Procedure Steps

1. Arrange all the equipment on the procedure trolley in a systematic manner. Appendix 1.

Assistant to complete tracking and traceability requirements of Reusable Medical Devices: Reprocessing, Tracking and Traceability.

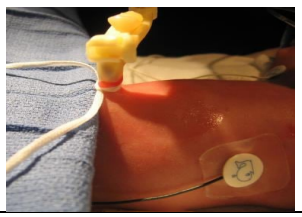
2. Draw up 10 mL of 0.9% sodium chloride into a syringe and attach a three-way tap to the catheter. Flush through both the three-way tap and the catheter with the saline (both lumens of the catheter) ensuring that there is no air in the catheters.

Note: Sodium Chloride for priming of catheters is to be drawn up directly from ampule with a drawing up needle.

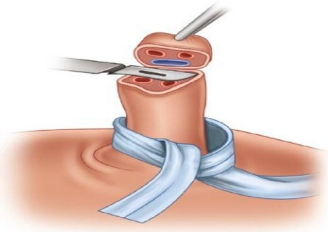
3. Ensure three-way tap are connected at end of all lumens of catheter. Turn the three-way tap off or clamp the line to prevent any entry of air into the catheter To reduce the risk of air embolism whilst the catheter is being inserted.

4. Position the infant comfortably and drape the bed with a sterile “blue cloth” on the side where the operator is standing.
5. Hold the cord clamp with the sterile forceps and hand that over to the assistant.
6. Clean cord and peri-umbilical area with disinfectant appropriate for the age and gestation. Avoid excess application and any spillage around down to the back of the baby as this may cause burns to very preterm skin.
7. **Allow to dry for 30/60 seconds depending on solution** and wash off with sterile water and pat dry to prevent potential chemical burns and skin irritation.

8. Tie umbilical tape around the base of the cord tightly enough to minimise blood loss but loosely enough to allow the catheter to be passed through.

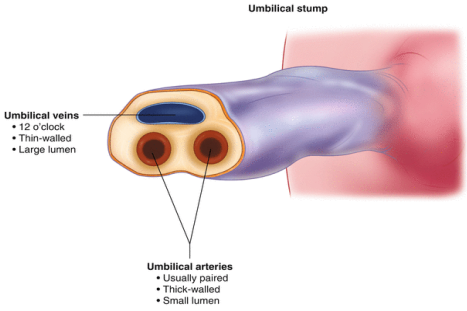


9. Make a clean horizontal cut in the cord under the clamp with a scalpel blade (or scissors) preferably leaving 1cm of cord above the skin junction



10. Cover the baby with the large clear sterile plastic drape, with the pre-cut hole in the centre of over the site of insertion.

11. Identify the umbilical vessels:
    - **Vein:** single, large, thin-walled
    - **Artery**: two, smaller, thick wall, generally constricted so that the lumen may appear pin-point.



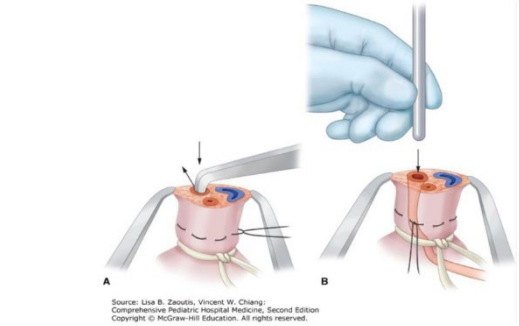
12. To insert the UAC, stabilise the umbilical cord with artery forceps and if needed gently open it using either the iris forceps or fine probe. Gradually dilate the artery.

Note: Repeated probing or excessive probing pressure must be avoided to prevent pushing the catheter outside the vessel lumen as the most common error arises after cannulating the layer between the vascular intima and the muscle thereby forming a "false passage". This usually occurs if dilatation of the artery in the cord has been inadequate.

For alternative method of UAC insertion refer to Appendix 2

13. Cannulate the artery and gently advance the catheter. Obstruction may be encountered at the anterior abdominal wall. Gentle steady pressure with slight rotation may help overcome this.

14. Turn the three-way tap so that the catheter is open to the syringe and assess smooth back flow of blood. If there is good backflow, continue inserting to the predetermined length and aspirate to verify blood return. Umbilical arteries descend first before looping upward; therefore, the catheter should be passed upwards



Umbilical artery catheter insertion. (A) Artery dilation. (B) Catheter insertion.

Note: At no stage use excessive force or pressure. All lines (venous and arterial) should be able to be bleed back on insertion; and should not be used if they do not.

15. 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**.

16. Anchor the knot close to the catheter. For alternative methods of securing the UAC- refer to the Appendix 3.

17. Tie the suture around the UAC tight enough to prevent slippage but still allowing easy drawback and flushing of the line.

18. Open the transducer with infusion giving set onto sterile field. Assistant to attach to syringe for priming. Primed giving set and transducer to be attached to catheter using sterile aseptic technique.

19. Calibrate transducer and commence infusion at 0.5-1.0ml/hr **prior to** x-ray confirmation of placement. The transducer should always be positioned at the level of the right atrium.
20. Apply a 2.5cm piece of brown tape around catheter and suture material as close as possible to umbilical stump/catheter. UAC & UVC should be secured separately.
21. 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. Check the infant is left clean and dry, check linen under the infant and assess temperature
22. Clear away all equipment and ensure that any needles or scalpel are safely disposed of into a sharps bin.
23. Complete the Neonatal Intravascular Device Insertion Record (MR422)
24. Infant to be nursed supine for a minimum of 1 hour post insertion to observe for ooze/blood loss around umbilical stump.

Post Procedure Management

Confirm the catheter tip placement with an X-ray. Refer to Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions

UAC optimal position	T6 - T9 HIGH
Acceptable position with caution	T10 - T11 HIGH L3 - L4 LOW
Not acceptable position	T12 - L2 (as mesenteric arteries and renal arteries arise) or any diversion into the lower limbs.

1. A repeat x-ray is to be performed following catheter adjustment to confirm tip position. Adjustments to be documented in the progress notes MR420 and on the MR422 (UAC/UVC Insertion record).
2. Clinician performed ultrasound may be used in conjunction with X-ray to ensure safe placement and adjustment of UAC.

Nursing Management

- Inspect the umbilical site at least hourly for signs of infection, ooze and catheter position (distance of brown tape from umbilical stump).
- Inspect the lower extremities at least hourly for colour, temperature and perfusion. Any changes should be reported immediately to medical staff.
- Infants with umbilical lines in situ should not be wrapped or have nappies or booties on to allow the pelvic area and feet to be visible to check for adequate circulation.
- Document inspections on MR489.

Arterial Transducer

The arterial transducer provides continuous blood pressure monitoring and should always be positioned at the level of the right atrium for accurate monitoring and should be free from blood

NOTE: non-invasive cuff BPs may provide a +/- 10mmHg discrepancy compared to the arterial transducer. If the arterial transducer has a good trace and in the optimal position, this should be considered the more accurate reading.

UAC Removal Guidance

As per the Guidelines for the Prevention of Intravascular Catheter-Related Infection (BSI) Prevention Guidelines (2011), Centre for Disease Control (CDC) and Prevention, a **UAC should be kept in no longer than 5 days due to the high risk for vascular and infection related complications.**

- Review the need for the UAC on clinical rounds every day. Once the decision to remove the catheter has been documented, it should be performed within an hour of the medical order. If delays occur, document and inform medical staff.
- Removal of an umbilical catheter is a 2-person aseptic technique by staff who have received training and are deemed competent. Refer to Appendix 5 for Removal of UAC procedure
- A nurse may remove the UAC if it has been stitched in separately to the UVC. If the catheters have been stitched in together then it is the responsibility of medical staff to remove the catheter.
- Medical staff must be informed of impending UAC removal and be available during removal procedure to attend to the patient in the event of a complication occurring e.g. abnormal coagulation profile, resistance, tight sutures.
- Bedside nurse and assistant to complete pre procedure safety checklist including “time out” prior to removal/adjustment of UAC as per MR422.00.
- Where Reusable Medical Devices are used i.e. universal tray, IA kits, suture tray, refer to the Reusable Medical Devices: Reprocessing, Tracking and Traceability guideline for tracking and tracing process and documentation at point of care.

Related CAHS internal policies, procedures and guidelines
Neonatology Clinical Guidelines • Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions • Central Venous Access Device Bundle • Reusable Medical Devices: Reprocessing, Tracking and Traceability • Sepsis Neonatal

- Aseptic Technique in the Neonatal Unit

CAHS Infection Control Policies

- Hand hygiene

PCH Clinical Practice Manual

- PCH Central Venous Access Devices (CVAD) and Midline Insertion and Management

References and related external legislation, policies, and guidelines

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

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Appendix 1: PICC Placement Kit

- 1 x outer wrap
- 2 x drape towels (absorbent/impermeable)
- 2 x blue prep forceps
- 2 x measuring tapes (60cm)
- 2 x Tegaderm dressings (4cm x 4cm)
- 1 x 10ml luer lock syringe
- 1 x silicone neonatal tourniquet
- 4 x ball swabs
- 2 x hand towels
- 1 x peelable transparent drape with ‘easy peel’ 50cm x 50cm (opening 4cm)
- 1 x straight Reynolds scissors 9cm
- 1 x straight Iris forceps 10cm
- 1 x curved Iris forceps10cm
- 5 x swabs, 4 ply (7.5cm x 7.5cm)
- 2 x gallipots 60ml
- 1 x tray 20cm x 15cm x 4xm
- 1 x pack of small steri-strips (6 x 38mm, x 6)

Note: PICC placement kit is preferred, in-line with the PCH CVAD guideline. However, suitable sterile reusable instrument kits may be used when PICC kits are not available.

Appendix 2: Alternative method for UAC insertion

For difficult arterial insertion especially in cases of absent insufficient or Wharton's jelly to support the umbilical cord, the suture method can be used.

A 4-0 or 5-0 silk suture needle is inserted directly into the arterial lumen and out of 1 arterial sidewall approximately 3-4 mm below the opening of the lumen.

Once outside of the arterial wall, the needle is driven through Wharton jelly back to the surface of the transected stump. Gentle, upward traction is applied to the suture, which opens and stabilizes the lumen of the artery

Placement of suture through the arterial wall allows for true upward traction and complete control over the position of the lumen, which is difficult to achieve with iris forceps alone

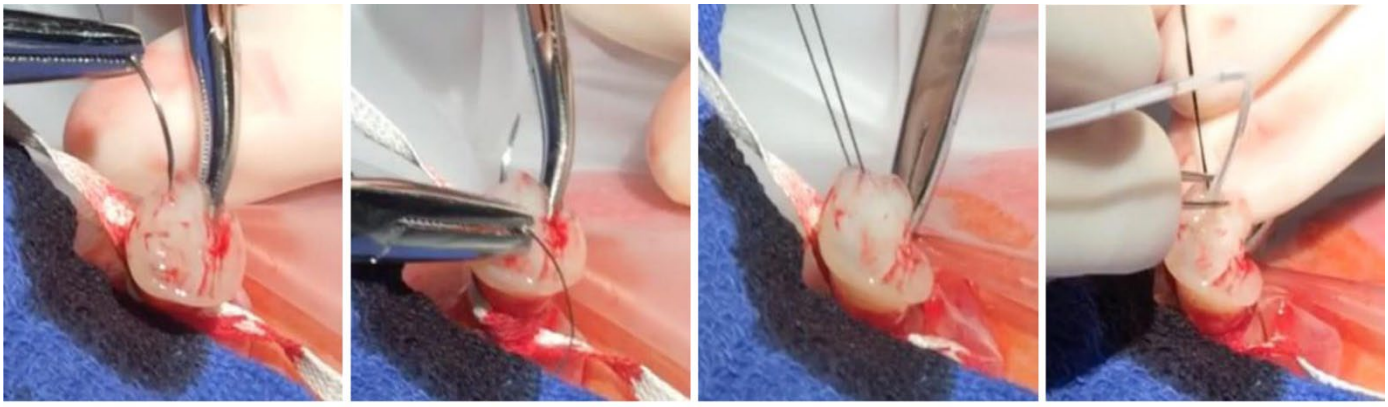
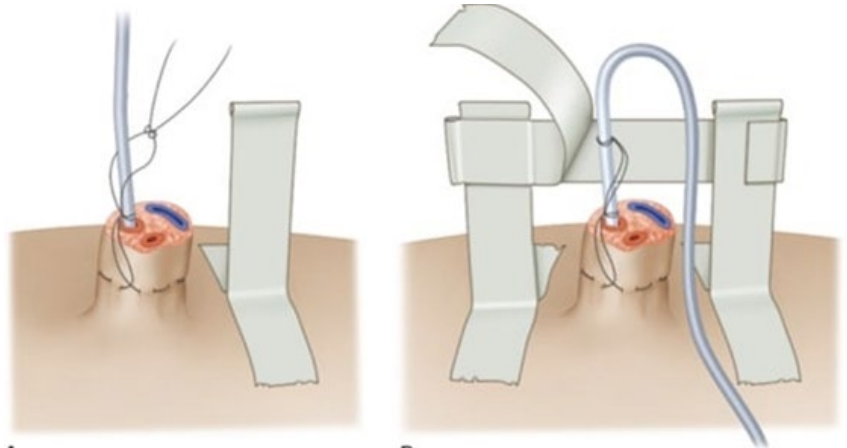


Figure. Technique for UAC placement: **A,** insert suture needle directly into arterial lumen; **B,** drive needle through arterial sidewall and Wharton jelly; **C,** apply gentle upward traction to suture; and **D,** insert umbilical catheter.

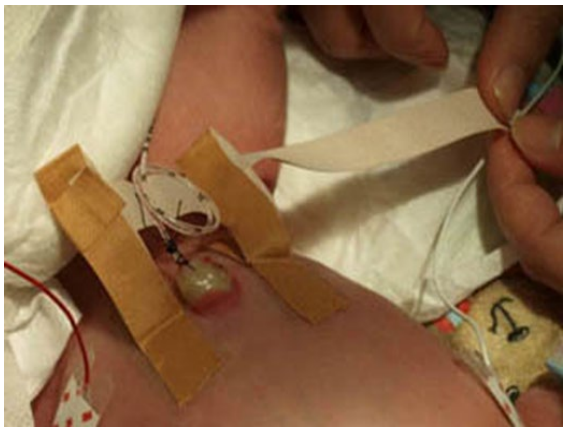
Please refer to the link below for more detailed description of the method and access to the instructional video: [New Technique for Umbilical Artery Catheter Placement in the Neonate - The Journal of Pediatrics (jpeds.com)]

Appendix 3: Alternative method for securing umbilical catheters

- **Cut 2 pieces of Comfeel®** and adhere to skin at either side of the umbilical stump which protects the skin and provides a barrier against epidermal stripping.
- Fix tapes as illustrated
- Ensure tape is secure and catheter is looped so that accidental tension to line will not displace catheter
- UAC & UVC should be secured separately.
- This method is not routinely used in the preterm population (<32weeks) due to the fragility of their skin.



Source: Lisa B. Zaoutis, Vincent W. Chiang: Comprehensive Pediatric Hospital Medicine, Second Edition



Appendix 4: Blood Sampling from the UAC

- There is potential risk of vasospasm, emboli and ischaemic injury associated with this procedure.
- Sampling must only be performed by staff deemed competent in the procedure. All blood sampling via umbilical catheters is to be ordered by medical staff.
- Blood glucose sampling should coincide with ordered tests to reduce frequency of accessing the line.
- If an arterial line is not insitu the UVC can be used for sampling. Note that blood glucose levels may not be as accurate due to the glucose in infusions.

Equipment

- Blue Tray
- 2% Chlorhexidine/Alcohol swab
- Gauze
- Red combi stop
- 2mL syringes (2-3)
- Blood gas syringe
- Sodium Chloride 0.9%
- Blood specimen tubes

Procedure

1. Perform hand hygiene, clean blue tray and prepare equipment using Asepsis.
2. Open syringe packaging – leave in sleeves to protect key parts, prepare flush, open gauze pack and chlorhexidine swab
3. Put infusion pump on hold
4. Perform hand hygiene and don gloves
5. Use sterile gauze to hold 3 way tap, turn 3way tap off halfway between ports and remove combi stop.
6. Clean the exposed port with a Chlorhexidine Swab for 30 secs and allow to dry.
7. Attach 2mL syringe, turn 3 way tap open to syringe and withdraw 1mL of blood.
8. Turn 3 way tap off halfway between ports. Remove syringe and re-sleeve. (This blood is to be returned to the infant post sampling).
9. Attach gas syringe and withdraw required sample volume. Turn 3 way tap off halfway between ports remove syringe and re-sleeve.
10. Take further samples as required. Ensure 3-way tap is off halfway between ports when attaching and removing syringes.
11. Return blood taken initially back to infant. Take care to remove air bubble from dead space in 3 way tap before returning blood.
12. Flush 3 way tap and catheter with 0.9% Sodium Chloride using a pulsatile motion (push-pause). This takes approximately 0.5mL.
13. Clean 3 way with 2% Chlorohexidine swab and attach new combi stop. Recommence infusions. Perform hand hygiene post procedure.
14. Document blood volume taken, blood tests and flush volume.

Appendix 5: Removal of UAC (2 person procedure)

Equipment required

- Umbilical catheter removal kit
- >27weeks gestation 1% Chlorhexidine solution
- ≤27weeks gestation or Povidone Iodine 10% swab
- Dressing pack
- Gloves (sterile gloves not required)
- Sterile non-woven (soft) Gauze
- 0.9 % Sodium Chloride

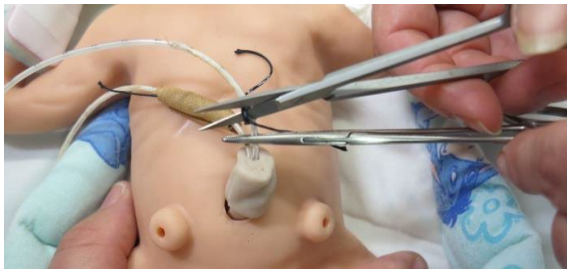
Procedure steps

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. Cleanse umbilical area with appropriate skin prep as per gestation as above.

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)