

Newborn Critical Care Center (NCCC) Guidelines

Umbilical Line Placement

GENERAL INFORMATION

Umbilical vein and/or artery catheterization is an imperative and potentially life-saving measure performed for critically ill infants that require timely and reliable vascular access. This vascular access may be used for the administration of fluids (e.g., parenteral nutrition, crystalloid, colloid, and medications), the obtainment of laboratory values, as well as accurate and continuous blood pressure monitoring.

I. Indications for Placement

- A. Umbilical arterial catheterization
 - 1. Frequent monitoring of arterial blood gases and/or blood sampling
 - 2. Continuous monitoring of arterial blood pressure
 - 3. If no venous access, infusion of maintenance glucose/electrolyte solutions
 - 4. Exchange transfusion
- B. Umbilical venous catheterization
 - 1. Emergency vascular access for fluid resuscitation and medication administration
 - 2. Central venous access for parenteral nutrition
 - 3. Hypertonic fluid administration
 - 4. Vasoactive drug administration (e.g., inotropes, vasopressors)
 - 5. Exchange transfusion

II. Selection of Catheter and Fluids

- A. Catheter size
 - 1. Umbilical artery catheter (UAC)
 - a) Use 5 Fr catheter for term infants and infants > 1500 grams
 - b) Use 3.5 Fr catheter for infants ≤ 1500 grams
 - c) Use 2.5 Fr for ELBW that will not accommodate a 3.5 Fr catheter
 - 2. Umbilical venous catheter (UVC)
 - a) Select catheter size based on the size of the infant
- B. UVC type
 - 1. Use of multiple lumen UVCs is associated with decreased usage of PIVs in the first week of life but an increase in catheter malfunction¹
 - 2. Considerations for the use of multiple lumen UVCs are as follows:
 - a) Place a dual-lumen UVC for all newborns with congenital cyanotic heart disease requiring prostin administration due to incompatibility of prostin with other fluids
 - b) Consider dual-lumen UVC access for infants with the following conditions:

- (1) Persistent pulmonary hypertension
 - (2) Meconium aspiration syndrome
 - (3) Hypoxic ischemic encephalopathy requiring therapeutic hypothermia
 - (4) Significant hemorrhage or placental abruption
 - (5) Prolonged resuscitation
 - (6) Infants < 750g or < 25 weeks GA, if unable to place a UAC
- c) Consider triple lumen 5.0 Fr UVC if multiple infusions are anticipated and fluid compatibility is a concern (these are rarely utilized)

C. Type of Fluid

1. Add heparin (0.5 units/mL) to all UAC and UVC fluids²
2. Any type of fluid, medication or blood product may be infused through a UVC
3. **Do NOT infuse the following fluids/medications through a UAC**
 - a) Inotropes (e.g., dopamine, dobutamine, epinephrine)
 - b) Calcium boluses
 - c) Indomethacin / Ibuprofen Lysine
4. Blood and prostaglandin E1 may be infused through a UAC if there is no alternate venous access

III. Preparation for Procedure

A. Order the procedure:

1. Under Order Sets, select Neonatal Procedure Focused and open the order set
2. Click on Procedural Pain/Sedation and select desired medications if indicated
3. Click on intra-venous fluids and choose desired solutions if not previously ordered
4. Click on Procedure/Nursing
5. Select UAC Procedure
6. Select UVC Procedure

B. Collect and set-up the necessary equipment (preferably prior to delivery):

1. Umbilical Catheter Insertion Tray
2. Venous and Arterial Catheters (see section II for selection of catheters)
3. Scalpel
4. Chlorhexidine or Betadine as deemed appropriate for weight/gestational age (Note: **Only use betadine for infants < 1000 grams**; see clinical guideline on procedural skin preparation for further details)
5. Two silk sutures (3-0 or 4-0)
6. Sterile gown, sterile gloves, hat, and mask
7. Sterile saline vials and adapter (or 5% Dextrose syringes for ELBW's)
8. Three way stop cocks (one three way stop cock per catheter lumen)
9. Minimum of four 3 mL syringes
10. Two 5 mL syringes

C. Calculate the depth of insertion for line placement

1. UAC

- a) High lines are placed in the descending aorta above the diaphragm and below the take-off point of the subclavian artery, with the tip optimally positioned between T6 and T9.
- b) Low lines are not preferred as they are associated with a higher incidence of ischemic phenomena.¹ If placed, they should be positioned between L3 and L4.
- c) To calculate the **DEPTH OF INSERTION** in centimeters, use the following equation: **(Birth weight x 3) + 9 cm.**
 - (1) Alternatively, measure from the umbilical stump to the shoulder, making sure to account for the length of the umbilical stump.

2. UVC

- a) During an **emergency/resuscitation**, advance the UVC only until blood return is noted.
- b) During routine placement, the tip of the UVC should be located above the level of the diaphragm at the junction of the inferior vena cava and right atrium.
- c) To calculate the **DEPTH OF INSERTION** in centimeters, use the following equation: **(UAC depth ÷ 2) + 1 cm.**
 - (1) You may want to add in the length of the umbilical stump.

- D. Before placing lines, ensure blood glucose and vital signs have been checked, and if necessary, that a peripheral IV has been placed.

IV. Insertion of Lines

Umbilical line placement is a sterile procedure. Everyone in the pod needs to wear a sterile hat and mask, including family members and visitors. Additionally, be mindful of the time taken to perform the procedure.

- A. Secure infant in a position that is optimal for line placement
 - 1. Swaddle legs and tuck arms to prevent possible contamination of umbilical area
- B. Identify an assistant or nurse who can be available throughout the procedure
- C. Provide sedation if indicated
- D. Perform hand hygiene
- E. Perform a time out prior to beginning the procedure, including RIGHT patient, RIGHT procedure
- F. Perform umbilical line placement and advance catheter(s) to the depth you calculated prior to beginning the procedure
- G. Important considerations to note:
 - 1. Once inserted, lines cannot be advanced unless the field remains sterile
 - 2. To avoid false tracking (i.e., the catheter tracking outside the lumen), the artery should be dilated prior to insertion of the catheter

3. Immediately after placement and suturing of catheter(s), and before obtaining the radiograph for line placement, inspect the infant's buttocks and back, looking for signs of decreased perfusion that would suggest that the catheter has been inadvertently placed in a gluteal or spinal artery. If these areas appear dusky, remove the catheter immediately, and call the fellow or attending.

V. Placement Confirmation

- A. Separate catheters **externally** on the field to allow easier differentiation on radiographs
 1. Place UVC on the right side of the patient, and UAC on the left side of the patient
 2. Make sure the patient is supine with shoulders and hips in alignment
 3. Make sure all other lines and tubes are not crossing the chest, thus obscuring the visibility of the catheter tip(s)
 4. Make sure the infant is not lying on anything that would obscure radiographic confirmation of catheter placement
- B. Obtain Umbilical Line Placement KUB (includes chest and lower pelvis) to verify placement of lines
 1. After ordering, page the XRAY STAT pager through the directory with message stating "Ready now in NCCC"
 2. If the UVC line appears at or just below the edge of the liver, obtain a cross table lateral to confirm the location of the UVC tip
 3. Placement may also be confirmed by trans-thoracic echocardiography

VI. Post-Procedure Documentation

- A. Write a procedure note linked with the procedure previously ordered and route to the supervising physician
- B. Nursing should complete the central line / CABS I documentation per unit protocol

VII. Management Considerations

- A. Remove catheter(s) as soon as clinically indicated
- B. Consider indications for PICC placement
- C. In ELBW's, consider leaving the UVC in place for a minimum of 7 days and preferably no longer than 14 days
- D. Ideally, the UAC should be removed prior to advancing enteral feeds above trophic volumes (20mL/kg/day)

References:

1. Kabra NS, Kumar M, Shah SS. Multiple versus single lumen venous catheters for newborn infants. *Cochrane Database Syst Rev.* 2005 Jul 20; (3): CD004498. PMID 16034934.
2. Barrington KJ. Umbilical artery catheters in the newborn: effects of heparin. *Cochrane Database of Systematic Reviews.* 2000; (2): CD000507. PMID 10796377.
3. Barrington KJ. Umbilical artery catheters in the newborn: effects of position of the catheter tip. *Cochrane Database of Systematic Reviews.* 2000; (2): CD000505. PMID 10796375.
4. Furdon, SA., Hogan, MJ., Bradshaw, WT., & Clark, DA. Nurses' guide to early detection of umbilical arterial catheter complications in infants. *Advances in Neonatal Care.* Issue: Volume 6(5), October 2006, p242-256.
5. Wortham, BM, Gaitatzes, CG, Rais-Bahrami, K. Umbilical Artery Catheterization. In MacDonald, M. & Ramasethu, R, eds. *Atlas of Procedures in Neonatology*, 4th ed. Philadelphia, PA: Wolter Kluwer/Lippincott Williams&Wilkins; 2007. p. 157-176.
6. Wortham, BM, Rais-Bahram, K. Umbilical Vein Catheterization. In MacDonald, M. & Ramasethu, R, eds. *Atlas of Procedures in Neonatology*, 4th ed. Philadelphia, PA: Wolter Kluwer/Lippincott Williams&Wilkins; 2007. p. 177-185.