



Clinical Practice Policy:	Umbilical Venous and Arterial Catheter (UVC/UAC) Placement and Removal
Effective Date:	November 2, 2018, Revision February 1, 2021

I. Purpose

To provide policies and procedures specific to Licensed Independent Practitioners (LIP), Neonatal-Perinatal Medicine fellows, and neonatal physicians for placement and removal of an umbilical venous catheter or umbilical arterial catheter.

II. All CPGs will rely on the [NICU Nursing Standards of Care](#). All relevant nursing PPGs and other policies are listed below.

- [WNH Standard Policy Statements](#).
- [WNH I.1 Infant Identification](#)
- [WNH S.4 Infant Safety Pause](#)
- [HAPM 1.8.16 Surgical Attire](#)
- [NICU C. 4 Use and Care of Central Venous Catheters and Peripherally Inserted Central Catheters](#)
- [NICU 1.2 Intravenous Angiocatheter Placement](#)
- [NICU C.5 Assisting with Umbilical Vessel \(Arterial and/or Venous\) Catheterization and/ or Peripheral Arterial Line Placement and Removal](#)
- [NICU Venous Access Decision Tree](#)

III. Indications for UAC placement

- a. Need for frequent or continuous measurement of PaO₂ or oxygen content
- b. Continuous monitoring of arterial blood pressure
- c. Need for continuous vasopressors
- d. Exchange transfusion

IV. Indications for UVC placement (also see [NICU Venous Access Decision Tree](#))

- a. Need for emergent administration of medications or intravenous (IV) fluids during resuscitation
- b. Inadequate vascular access
- c. Neonates weighing <1500 grams (for parenteral nutrition immediately after birth)
- d. Therapeutic hypothermia
- e. Need for total parenteral nutrition, dextrose concentrations greater than 12.5%, continuous vasopressors or continuous analgesia for sedation (unless EPIV or PICC is more appropriate)



- f. Need for prolonged IV antibiotic therapy (unless EPIV or PICC is more appropriate)
- g. Need for exchange transfusion
- h. Neonates with GI, congenital, or cardiac disorders, as indicated by clinical condition (with exception of GI contraindications listed below)

V. Contraindications for UAC/UVC placement

- a. Omphalitis
- b. Omphalocele
- c. Necrotizing enterocolitis
- d. Peritonitis
- e. Acute abdominal pathology

VI. Potential complications of UAC placement

- a. Catheter malposition i.e. vessel or peritoneal perforation, movement of catheter
- b. Vascular accident, i.e. thrombosis, embolism/infarction, vasospasm
- c. Hypertension
- d. Air embolism
- e. Infection (per CDC recommendations, UAC should be kept in no longer than 5 days) [7]
- f. Bleeding
- g. Vascular compromise or loss of lower extremity

VII. Potential complications of UVC placement

- a. Catheter malposition in the heart or liver
- b. Infection (per CDC, UVC should be kept in no longer than 14 days, but ideally removed by 7-10 days) [7]
- c. Vessel or peritoneal perforation
- d. Bleeding
- e. Thromboembolism
- f. Cardiac arrhythmias
- g. Pericardial effusion/tamponade

VIII. Equipment

- Umbilical catheterization tray (includes umbilical tape, antiseptic solution, forceps, scalpel and 3.0 silk sutures on a small, curved needle)



- Chlorhexidine (if using for skin cleansing)
- Umbilical Catheter(s): 3.5 Fr. or 5 Fr. single or double lumen, 2.5 Fr. Single lumen
- Sterile Barriers: drapes, gowns, gloves (powder and latex free), hat and mask
- Needleless IV port adapters: claves
- T-Connector (for arterial catheters and one port of venous catheters, to connect Hummi)
- Heparinized saline (1/2 NS with heparin 0.5 units/mL)
- Syringes (1-, 3-, 5-ml, and/or 1-ml heparinized blood gas syringe) – enough to flush each lumen of catheter and draw blood for labs

IX. Measurement and Positioning of Umbilical Catheters [2, 5]

- a. For umbilical venous catheters, double lumen 3.5 Fr. catheters are generally used in infants weighing <1.5 kg and 5 Fr. catheters in infants weighing ≥ 1.5 kg. For umbilical arterial catheters, 2.5 Fr catheters are generally used in infants weighing <1 kg and 3.5 Fr in infants weighing ≥ 1 kg.
- b. An umbilical arterial catheter is in correct position between thoracic vertebrae 6 and 9. A shorthand formula can be used to estimate the total catheter length. The umbilical arterial catheter length in centimeters can be calculated from Shukla's formula: $3 \times (\text{birth weight in kg}) + 9$ [9]. Alternatively, measure the distance from the umbilicus to the acromioclavicular joint of the shoulder. [9]
- c. An umbilical venous catheter is in correct position at the level of the diaphragm. The umbilical venous catheter length in centimeters is calculated from Shukla's formula as $\frac{1}{2} (3 \times (\text{birth weight in kg}) + 9) + 1\text{cm}$ [5]. Alternatively, measure the distance from the umbilicus to the xiphoid and add 1cm (to account for the length of the umbilical stump remaining). [5]
 1. Central UVC: Confirmed by X-ray, in the IVC, at the level of the diaphragm and below the heart
 2. Low-lying UVC: UVCs that cannot be advanced beyond the liver and are not considered central and used peripherally. Only peripheral concentrations of drugs and solutions are used. A low-lying UVC may be placed for volume resuscitation or medication administration during emergent situations in the delivery room. This UVC is non-sterile and must be replaced centrally.

XI. Procedure for UAC/UVC placement

A video of this procedure can be found on the New England Journal of Medicine webpage at <https://www.nejm.org/doi/full/10.1056/NEJMvcm0800666>.



MD/LIP Tasks

1. Determination of need is assessed by medical team.
2. Gather all equipment and supplies for the sterile procedure (see Section VIII).
3. Determine the size and type of catheter needed based on infant size, needs and acuity.
4. Clean work surface to be used with aseptic wipes and allow to dry completely prior to set-up.
5. Perform hand hygiene with a waterless alcohol hand rub.
6. Put on hat and mask.
7. Open equipment and drop sterile items on sterile field. Open sterile gown and gloves.
8. Position the infant appropriately for the procedure (supine with extremities appropriately secured).
9. Do 3-min. scrub with chlorhexidine then dry and don sterile gown and gloves.
10. Place a needleless connector on the end of the UVC blue port. Place a T-connector followed by a needleless connector to the end of the clear port of the UVC, and to the UAC catheter to be used with the Hummi closed blood draw system.
11. Draw up 1/2NS with 0.5 units/mL of heparin in a sterile manner (assistant will hold non-sterile bag while MD/LIP inserts sterile needle into bag's port to draw up flush). Attach syringe to each needleless connector and flush each lumen of the catheter with heparinized saline.
12. Do a safety pause prior to the start of the procedure.
13. Have an assistant grasp the cord by the cord clamp or with forceps to hold up the cord clamp.
14. Prepare the umbilical cord and surrounding area (diameter of 5 cm) with antiseptic solution per departmental protocol. Allow drying for two minutes prior to umbilical catheter insertion.
15. Drape the area surrounding the cord with sterile towels.
16. Place the umbilical tie around the base of the umbilicus and tie once.
17. Cut cord horizontally using a scalpel.
18. Transfer supplies needed for line insertion such as flushed catheter, forceps with and without teeth, and 2x2 gauze onto the sterile field.
19. Identify the umbilical vessels. The vein is thin-walled and close to periphery of umbilical stump. The two umbilical arteries are smaller, thick-walled and will need to be dilated.
20. For umbilical venous catheter placement, grasp cord with toothed forceps avoiding vessels. For umbilical arterial catheter placement, the vessel must gently be dilated with the curved forceps. Adequate time spent dilating artery will increase likelihood of successful placement.
21. Insert catheter into vessel using hands or forceps. Advance to measured position (see Section IX) then draw back on syringe to ensure easy blood return.
22. Clear blood by flushing with 0.5 ml of heparinized saline solution.
23. Obtain blood samples for laboratory evaluation if needed, being careful to not introduce air into the line and flush catheter with heparinized saline solution after removal.



24. If unable to obtain blood return, try troubleshooting, such as removal of catheter with reinsertion, doing a cutdown or if an umbilical vein attempt placement of a second catheter next to the first catheter.
25. Using a 3-0 silk suture on a small, curved needle, suture the catheter to the Wharton Jelly.
26. Obtain an x-ray or babygram while maintaining the sterile field to verify the position of the catheter and adjust as necessary. If the umbilical catheter is too deep, it may be withdrawn to a correct position in a sterile fashion. If under sterile conditions, an umbilical catheter may be pushed in if found to be low to the correct position, but once no longer sterile the catheter must be removed.
27. Once placement is confirmed make sure to fully secure the catheter by suturing in place.
28. Antiseptic solution should be removed from the skin using warm water or saline and gauze after the procedure.
29. Make sure to complete a procedure note in the patient's chart. The procedure note should include radiographic verification of the catheter tip. Also confirm final position with the bedside nurse.
 30. The bedside nurse will secure the umbilical catheter to the abdomen by placing a cut piece of Duoderm on the abdomen next to the umbilicus, and securing the umbilical catheter in a loop over the Duoderm using Tegaderm, ensuring that the catheter markings are visible. In infants with both UAC **and** UVC placement, each line should be secured separately, one on each side of umbilicus.
30. If persistent oozing is noted from the umbilical stump after placement, check the umbilical tie to ensure it is tight enough. Avitene is also available if oozing persists. Once Avitene is placed, the RN will visualize the site and q 15 minutes x 1 hour. If oozing persists, the responding clinician will be called to the bedside for further management regarding whether lab monitoring or blood product replacement if necessary.

RN/Assistant Tasks

1. Complete a safety pause prior to procedure.
2. Place Sterile Procedure in Progress sign on the closed door prior to the start of the procedure and illuminate the purple light on the nurse call system outside of the patient's room. Everyone present during procedure should wear a hat and mask
3. Make sure that the Observation checklist is completed in EPIC during the procedure.
4. After catheter position has been confirmed and medical provider has sutured the line in place, secure umbilical catheter to abdomen with adhesive, making sure catheter markings are visible.
5. Make sure that Maintenance checklist is obtained and filled out every shift.
6. If oozing is noted from the umbilicus, please refer to nursing policy NICU C.5 Assisting with Umbilical Vessel (Arterial and/or Venous) Catheterization and/or Peripheral Arterial Line Placement and Removal . Once Avitene is placed, RNs must visualize and document the site q 15



mins x 1 hour to ensure no further bleeding. If oozing/bleeding persists, the responding clinician must be contacted for further management interventions.

XII. Catheter Removal

1. Gather all supplies and equipment needed for removal: suture removal kit, gloves.
2. Identify the number on the catheter at the point that it exits the umbilical cord and compare that with documentation in the patient chart.
3. Perform hand hygiene with alcohol-based waterless cleanser. Put on gloves.
4. Hold the umbilical cord securely with the forceps and cut the sutures with the scissors, taking care not to cut the catheter itself.
5. Place one hand gently on the abdomen at the base of the umbilical stump to provide stability, use the other hand to pull out the catheter in a slow (about 2 minutes) and steady manner.
6. Use sterile gauze to hold pressure on the umbilical stump after catheter is removed and ensure bleeding has stopped. If oozing persists, Avitene may be applied to achieve hemostasis.
7. Inspect the umbilical catheter to ensure that it is intact.
8. Document the UVC removal procedure in the infant's electronic medical record and include catheter length.
9. Removal of UVC should be considered when 100 ml/kg/day of enteral feeds is reached or after 710 days, whichever comes first. In addition, UAC removal should be considered between day 3 and 5.

References

- [1] Association of Women's Health, Obstetric, and Neonatal Nurses (2013) Neonatal Skin Care, 3rd edition. 30-35
- [2] Cloherty, J., Eichenwald, E., & Stark, A., (Eds.). 2012. Manual of Neonatal Care, 7th Ed., Ch. 66, Ringer, S.A. & Gray, J.E. Common Neonatal Procedures, pp. 858-865. Philadelphia: Lippincott Williams & Wilkins.



- [3] Gardner, S.L., Carter, B.S., Enzman-Hines, M., & Hernandez, J.A. (Eds). 8th ed., 2016, Merenstein & Gardner's Handbook of Neonatal Intensive Care, Mosby Elsevier: St. Louis. Ch. 7, Bradsaw, W.T. & Tanaka, D.T. Physiologic Monitoring, pp. 129-138.
- [4] Ikuta, L.M. & Beauman, S.S. (Eds.), 2011, Policies, Procedures and Competencies for Neonatal Nursing Care, pp. 191-198. Glenview: National Association of Neonatal Nurses.
- [5] Lean, W.M., Dawson, J.A., Davis, P.G., Theda, C., and Thio, M. Accuracy of five formulae to determine the insertion length of umbilical venous catheters. Arch Dis Child Fetal Neonatal Ed. 2018 Mar 17.
- [6] MacDonald, M. G., Ramasethu, J., & Rais-Bahrami, K. R. (2013). Atlas of Procedures in Neonatology, 5th edition. 156-181.
- [7] O'Grady, N.P., Alexandr, M. Burns, L.A., Dellinger, E.P., Garland, J., Heard, S.O., et al. for the Healthcare Infection Control Practices Advisory Committee (HICPAC). Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011. Centers for Disease Control and Prevention. (<https://www.cdc.gov/hai/pdfs/bsi-guidelines-2011.pdf>)
- [8] Verklan, M.T. & Walden, M. (Eds.). 2015. Core Curriculum for Neonatal Intensive Care Nursing. 5th Ed., Saunders Elsevier: St. Louis. Ch. 15, Bailey, T., Common Invasive Procedures, pp. 299-304.
- [9] Lean WL, Dawson JA, Davis PG, Theda C, and Thio M. Accuracy of 11 formulae to guide umbilical arterial catheter tip placement in newborn infants. Arch Dis Child Fetal Neonatal Ed. 2018 Jul;103(4):F364-F369.
- [10] Infusion Nurses Society, 2016. Infusion Nurses Society Standards of Practice. Wolters Kluwer, Pg S65.