HEALTH HOLDING

HAFER ALBATIN HEALTH CLUSTER
MATERNITY AND CHILDREN HOSPITAL

Department:	Neonatal Intensive Care Unit (NICU)		
Document:	Multidisciplinary Policy and Procedure		
Title:	Insertion and Removal of Umbilical Venous Catheter		
Applies To:	All NICU Staff and X-ray Technicians		
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1. PURPOSE:

1.1 To establish indwelling venous access in a critically ill neonate.
1.2 For Exchange transfusion.
1.3 Central venous pressure monitoring (if catheter is in inferior vena cava).

2. DEFINITIONS:

2.1 Gaining a central venous access by inserting a catheter in inferior vena cava via the umbilical vein.
2.2 Low setting of umbilical vein catheter: Catheter is introduced 3-5 cm beyond the muco-cutaneous junction till achieving blood return. It is an acceptable venous access for a short term during an emergency, as a route for resuscitation drugs and fluids (in this situation the catheter tip will not have reached as far as the portal circulation).
2.3 The umbilical vein passes from the umbilicus cephalad and a little to the right, where it joins the left branch of the portal vein after giving off several large intrahepatic branches that are distributed directly to the liver tissue. The ductus venosus becomes a continuation of the umbilical vein by arising from the left branch of the portal vein, directly opposite where the umbilical vein joins it. It terminates in the inferior vena cava along with hepatic veins,

3. POLICY:

3.1 Indications:
- 3.1.1 Emergency vascular access for administration of drugs and fluids e.g. in delivery room
- 3.1.2 Exchange transfusion
- 3.1.3 Measurement of central venous pressure (if catheter is across ductus venosus)
- 3.1.4 Infusion of hypertonic solutions, only if the tip is in Inferior Vena Cava e.g. total parenteral nutrition
- 3.1.5 In the extremely low birth-weight infants (< l000gm or < 29 weeks) in whom parenteral nutrition is essential until enteral feeds are established, umbilical venous catheter can be placed up to a maximum of 14 days (preferably 7 days), then replaced by peripherally Inserted Central Catheter if central line is still needed
- 3.1.6 For neonates ≥ 29 weeks gestation, insert UVC only if the patient is intubated and ventilated, or FiO_2> 40% on CPAP, or hemodynamically unstable, needing fluid bolus or inotropes.
- 3.1.7 For cardiology diagnostic evaluation

3.2 Contraindications:
- 3.2.1 Abdominal wall defects
- 3.2.2 Peritonitis
- 3.2.3 Necrotizing enterocolitis
- 3.2.4 Omphalitis

3.3 Umbilical catheter is a central line. Bundle to prevent Central Line Associated Blood Stream Infections are strictly followed. Follow neonatology policy "Prevention of Catheter Associated Blood stream Infection " and hospital infection control policies

3.4 Remove and do not replace umbilical venous catheters if any signs of catheter related blood stream infection or thrombosis are present.

3.5 Remove umbilical catheters as soon as possible when no longer needed. UVC can be used up to 14 days if managed aseptically, preferably not more than 7 days.

3.6 An umbilical catheter may be replaced if it is malfunctioning, still needed and the total duration of catheterization has not exceeded 14 days.

3.7 Blood sampling can be collected and vasoactive drugs, prostaglandin E, blood and blood products can be administered via the umbilical venous catheters.

3.8 Setting:

3.8.1 High setting: Tip should be in Inferior Vena Cava above the diaphragm, outside and below the right atrium (around T8 to T10, just above the right diaphragm).

3.8.2 Low setting: Introduce 3-5 cm to achieve blood return. Used for exchange transfusion or to give medications during resuscitation.

3.9 Size of catheter: 3.5F for infants weighing < 1200 g, and a 5F catheter for larger infants. Catheter has rounded tip radiopaque line and end hole.

4. PROCEDURE:

4.1 For high setting, use any of the following formula:

4.1.1 Shukla's formula; {(3 X birth Weight (kg) + 9)} /2 + 1cm + umbilical stump (most commonly used)

4.1.2 { 1.5 x Birth Weight (kg)} + 5.6 + umbilical stump, or,

4.1.3 66% of the shoulder to umbilical distance.

4.1.4 Plot birth weight on the standardized graph

4.2 Make necessary measurements to determine length of catheter to be inserted, adding length of umbilical stump.

4.3 The assigned nurse stabilizes the patient by wrapping a diaper around both legs and taping it. Leave feet, head and upper chest exposed.

4.4 Connect infant to vital signs monitor and ensure proper temperature maintenance of the body.

4.5 Maximum sterile barrier precaution should be taken. Physician assisting (if required) perform antiseptic scrub for hands, wrists and forearms before the procedure. Put on sterile gown, sterile gloves, hat and mask. The nurse holding the patient performs hand hygiene, wears cap, mask and non-sterile gown.

4.6 Thoroughly disinfect the umbilical cord stump and surrounding skin using povidone iodine. Let the antiseptic to dry for at least 30 seconds. Use sterile water or normal saline to wash the povidone after completion of the procedure.

4.7 Never break the sterility of the field.

4.8 Place sterile drapes that cover the baby from upper chest to ankle with an opening around the umbilicus

4.9 Attach stopcock to hub of catheter and fill catheter with heparinized saline solution (0.5 units/ml).

4.10 Place umbilical tie around umbilicus with single knot and tighten only enough to prevent bleeding.

4.11 Cut the cord horizontally about 0.5-1 cm away from abdominal skin. Avoid sawing back and forth when cutting cord. Aim to make a single cut as this provides a straighter site or catheter insertion. Note that much rubbing damages tissue and obscures anatomy.

4.12 Identify the exposed vessels: thin-walled oval vein and two smaller thick-walled round arteries with tightly constricted lumens; the vein is usually located in the 12-o'clock position and the arteries at 5-o'clock and 7-o'clock.

4.13 Insert a purse-string suture near base of Wharton's jelly for haemostasis. Tie a single knot.

4.14 Stabilize stump with toothed forceps. Gently insert tips of iris forceps into lumen of vein and remove any clots. Introduce fluid-filled catheter, attached to the stopcock and syringe, 2 to 3 cm into vein (measuring from anterior abdominal wall).

4.15 After passing the catheter about 5cm, apply gentle suction to syringe to verify, intraluminal position

4.15.1 If there is smooth blood flow, continue to insert catheter to the pre-calculated length.

4.15.2 If there is not easy blood return, catheter may have a clot in tip. Withdraw catheter while maintaining gentle suction. Remove clot and reinsert catheter

4.15.3 Obstruction at the level of the abdominal wall may be relieved by applying gentle traction on the umbilical cord stump accompanied by steady but gentle pressure for about 30 seconds.

4.15.4 The next site of obstruction after the abdominal wall is the portal system. Withdraw the catheter 2-3cm, gently rotate it and reinsert it in an attempt to get the tip through ductus venosus. If the catheter is still in the portal circulation, you may (after informing assigned consultant) leave the misdirected catheter in its place. Pass a new 5-Fr catheter into the same vessel. Once the catheter is in good position, remove the misdirected catheter. This procedure has a success rate of 50%.

4.15.5 Occasionally it is not possible to get the catheter into the inferior vena cava for anatomic reasons, and vigorous attempts to advance the catheter are to be avoided.

4.16 Place marker tape on catheter with base of tape flush with surface of cord, so that displacement of the catheter may be readily recognized. Tie the catheter in place with a silk suture around the vessel and catheter and suture it to the umbilical stump.

4.17 Obtain radiographic verification of catheter position (anterior posterior and lateral views)

4.17.1 If the radiograph indicates that the catheter has been inserted too far, it may be gently withdrawn an estimated amount for appropriate placement

4.17.2 Lf the catheter is not in far enough, it should be completely withdrawn and a new sterile one inserted after the area is appropriately prepared again.

4.17.3 Do not leave the UVC in the right atrium; if in the heart, adjust catheter position and a repeat x-ray should be done to document that the tip is outside the heart

4.17.4 Do not leave a UVC in the portal vein. It should be replaced with a properly positioned UVC or pulled to a low position below the portal vein, in the umbilical vein. If no other access can be obtained, low UVCs can be used for non-vesicant, non-hyperosmolar solutions for a maximum of l-2 days until more suitable access is obtained

4.18 During an emergency, low set umbilical venous access is acceptable in the short term as a route for resuscitation drugs and fluids e.g. in the delivery room, with the catheter tip inserted only 3 - 5cm beyond the mucocutaneous junction (in this situation the catheter will not have reached as far as the portal circulation).

4.19 Use the bridge technique to secure catheter to the abdominal wall after suturing.

4.20 Complications:

4.20.1 Infection.

4.20.2 Thromboembolic:

4.20.2.1 If catheter tip lies in the portal system and ductus venosus has closed, emboli will lodge in liver.

4.20.2.2 If catheter has passed through ductus venosus, emboli will go to lungs; or because of right-to-left shunting of blood through foramen ovale or ductus arteriosus in sick newborn infants, emboli may be distributed throughout entire systemic circulation.

4.20.2.3 Splenic vein thrombus or embolus

4.20.2.4 Portal vein thrombosis and aseptic abscess formation with or without infection. Portal hypertension.

4.20.2.5 Haemorrhagic infarction of lung (pulmonary vein thrombus).

4.20.3 Catheter malposition in heart and great vessels may lead to:

4.20.3.1 Pericardial effusion/cardiac tamponade (cardiac perforation),

4.20.3.2 Cardiac arrhythmias

4.20.3.3 Thrombotic endocarditis

4.20.4 Catheter malposition in portal system:

4.20.4.1 Necrotizing enterocolitis

4.20.4.2 Perforation of colon.

4.20.4.3 Hepatic necrosis: thrombosis of hepatic veins or if catheter tip locates in a branch of the portal vein can lead to areas of liver necrosis following infusions of hypertonic solutions, such as sodium bicarbonate, hypertonic glucose, or vasoactive drugs into liver tissues.

4.20.5 Perforation of peritoneum.

4.20.6 Retained broken-off catheter fragment

4.20.7 Calcification of portal vein or umbilical vein.

4.20.8 AIR EMBOLUS RISK:

4.20.8.1 Before insertion ensure an air-free catheter to prevent introduction of air into the patient. Fill the lumen with infusion solution and close the stopcock until the catheter is in the vein.

4.20.8.2 All through catheter indwelling time do not leave catheter open to atmosphere, the catheter must be kept filled with fluid and attached to the closed 3-way stopcock. If the infant takes a deep inspiration, negative pressure may be generated and air drawn into the catheter could result in air embolism

4.20.9 Avoid infusion of hypertonic solutions when catheter tip is not in inferior vena cava

4.21 Document on the progress notes; time of the procedure, size of catheter used, tip position on X-Ray, tolerance of the infant to the procedure and any complication.

4.22 Removal of catheter:

4.22.1 Use suture removal forceps and scissors to remove sutures. Cut suture at skin, not on catheter to avoid catheter transaction. Be careful not to cut through the line.

4.22.2 Removal of catheter should be done by the physician on duty slowly and evenly at about 1-2 cm/minute.

4.22.3 Ensure the catheter and tip is complete.

4.22.4 Immediately apply gentle pressure with a sterile 2 x 2, on the infant's abdomen for 3-5 minutes.

4.22.5 If resistance is met when removing catheter, soak umbilical stump with normal saline for 5minutes. Do not pull on catheter with excessive force.

4.22.6 Leave infant supine for approximately 6 hours to observe site closely for any bleeding.

5. MATERIAL AND EQUIPMENT:

5.1 Sterile gown and gloves, masks and surgical caps

5.2 Sterile drapes with central aperture

5.3 Umbilical artery catheter (3.5 F for infant weighing < 1.5kg and 5 Fr weighing > 1.5 kg),

5.4 Haemostat

5.5 Fine forceps,

5.6 3-way stopcock with luer-lock,

5.7 3.0 silk suture on small curved needle

5.8 Antiseptic solution

5.9 Heparinized saline

5.10 Umbilical catheter tray:

5.10.1 Measuring tape

5.10.2 Scissors

5.10.3 Syringes (1ml, 3ml,10ml)

5.10.4 Scalpel (blade and holder)

5.10.5 Umbilical tie

5.10.6 Needle holder

5.10.7 Gauze pads

6. RESPONSIBILITIES:

6.1 Physician

6.2 Nurse

6.3 X-ray Technician

7. APPENDICES:

N/A

8. REFERENCES:

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9. APPROVALS:

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