Canadian Journal of Rural Medicine | Journal canadien de la médecine rurale

Fall 2002 Contents • Automne 2002 Table des matières

The occasional umbilical vein catheterization

John Wootton, MD
Pascal Croteau, MD

CJRM 2002;7(4):275-9

Introduction

In spite of an emphasis on triage, and an attempt to deliver only low risk obstetrical cases in rural areas, this is not always possible, and unexpected neonatal emergencies will continue to occur. Depending on the clinical situation, stabilization of the infant will often require vascular access. Although peripheral venous access is technically less complex, it may be in actual fact more difficult to secure than access through an umbilical vessel. Infants who require transport for specialized care may be more stable en route if secure venous access is assured to treat, for example, hypoglycemia, or to deliver fluids and antibiotics intravenously (IV). Although not without potential complications, the technique itself is straightforward and well within the scope of practice of any rural physician on an obstetrical roster, and it can be of substantial benefit to a newborn in difficulty.

Anatomy

The umbilicus normally contains 2 arteries and 1 vein, although a 2-vessel cord may only contain 1 of each. Catheterization of the vein has been a common procedure since 1947, and catherization of an artery was first carried out in 1962.1

The umbilical vein connects to the L portal vein , the ductus venosus, hepatic vein, inferior vena cava (IVC) and right atrium (RA). The umbilical artery connects to the internal iliac artery, common iliac artery and aorta.

Indications

Traditional indications most likely to be of practical importance in rural settings include resucitation, infusion of medication and IV fluids, and stabilization prior to transfer.

Complications

Many complications have been described, including occlusion, catheter fracture or accidental severing with migration of the fragment beyond reach, thrombosis at the catheter tip or of the portal vein, and complications related to malpositioning in the lungs or the heart leading to damage to these structures. Sepsis may also occur. These complications are, however, rare, and occur much less often (1.3%-3% vs. 25%) with a properly positioned catheter tip.1

Equipment

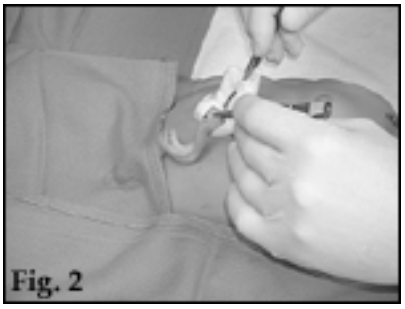
- 3-mL syringes
- 3-way stopcock
- 3.5 or 5.0 F umbilical catheter
- normal saline flush
- providone-iodine
- umbilical tape
- scalpel
- curved hemostat (or iris forceps)
- thumb forceps
- needle driver and suture
- scissors
- waterproof tape
- IV set-up

Procedure

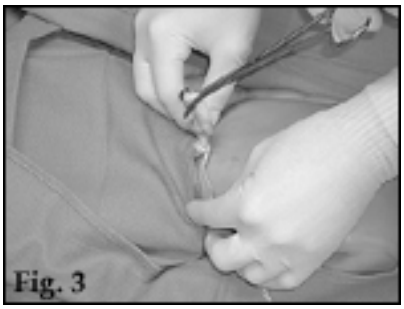
1) Set up instruments
Trays should be set up in advance (Fig. 1).


Fig. 1

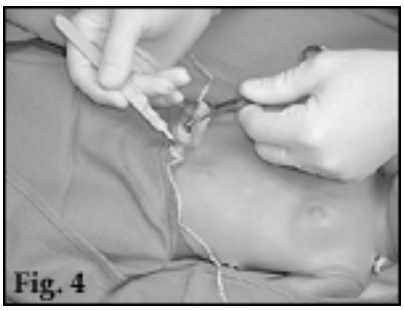
2) Antisepsis
Insertion of an umbilical vein catheter should occur under as sterile conditions as possible (Fig. 2).Frequently, the urgency of the situation and the priorities of resuscitation will result in a procedure that is "clean" if not completely "sterile."


Fig. 2

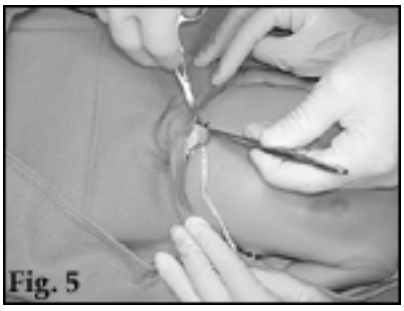
3) Place the umbilical tape
The tape should be knotted loosely around the base of the cord (Fig. 3). It will be tightened later after the catheter has been inserted.


Fig. 3

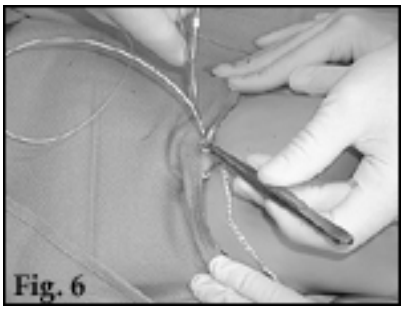
4) Cut the cord
At least 1-2 cm of cord should remain when the cord is cut (Fig. 4). As a precaution it is advisable when clamping the cords of all newborns (even those apparently normal at birth) to leave sufficient cord below the clamp so that an umbilical catheter can be inserted if neccesary.


Fig. 4

5) Dilate the vein
Identify the vein, a single large thin-walled structure usually found in the 12 o'clock position in the cord, and dilate it gently (Fig. 5) with a small curved hemostat, or a pair of iris forceps (not illustrated)


Fig. 5

6) Insert the catheter
Insert the catheter 2-4 cm beyond the abdominal wall. The catheter should advance without resistance. This should be sufficient to ensure venous access for drugs and fluids (Fig. 6). For purposes of resuscitation, deeper placement is not necessary and is discouraged by current NRP guidelines.2


Fig. 6

7) Measurements
Catheters that are inserted for more long-term use (as might be appropriate in a neonatal ICU) need careful placement. The optimum location is at the IVC-RA junction. This location corresponds to a catheter tip between T8-T9 on an x-ray (anterior-posterior view). It can be estimated using a variety of anatomical measurements. A useful first approximation is the umbilical stump — xyphoid process distance3 (Fig. 7a), which can be determined without reference to any other information.

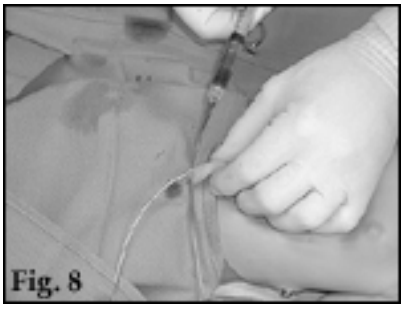

Fig. 7a

The insertion length can be subsequently refined using the umbilical-shoulder distance (Fig. 7b). Reference is then made to an appropriate table2,3 to check the length. Use of ultrasound to guide catheter placement has been advocated.3 Current neonatal resuscitation protocols4 discourage efforts to advance catheters beyond the minimum required to establish blood return.


Fig. 7b

8) Blood return

Withdraw gently with a saline-filled 3-cc syringe. Absence of bloody return may occur even in a correctly placed catheter due to the vein collapsing around the catheter (Fig. 8). If this occurs, flush again with a small amount of saline, and withdraw more gently.


Fig. 8

9) Flush catheter

Flush with normal 2-3 cc normal saline (Fig. 9).

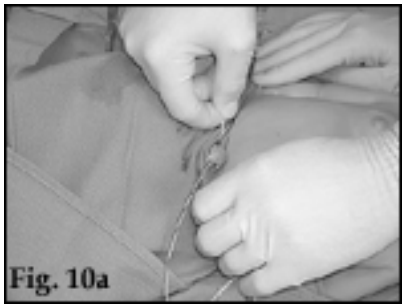

Fig. 9

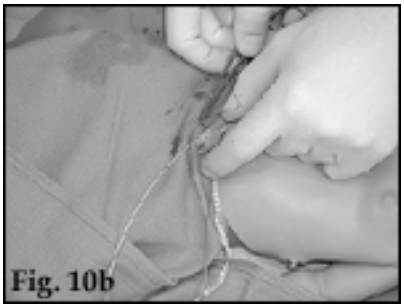
10) Secure the cord

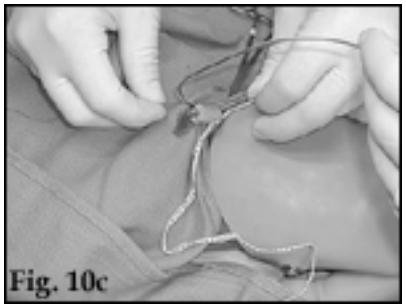
a. Tighten the tape: Tighten the umbilical tape around the base of the cord (Fig. 10a).

b. Place suture: Secure a suture to the base of the cord (not to the infant's skin) (Fig. 10b).

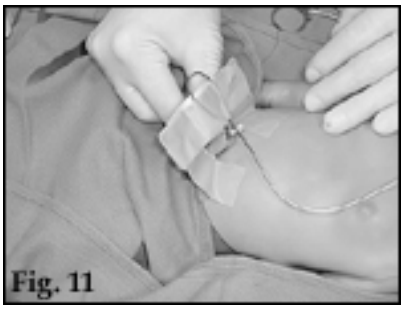
c. Secure suture: Create a loop, and secure to the catheter (Fig. 10c).


Fig. 10a


Fig. 10b


Fig. 10c

11) Bridge
Construct a "bridge" out of waterproof tape to suspend and support the catheter (Fig. 11).


Fig. 11

12) Stopcock
Blood can be withdrawn for analysis through a syringe attached to a 3-way stopcock. Although a variety of 3-way stopcocks exist in the market, many are similar to the one illustrated (Fig. 12), having a single lever arm. In this kind of stopcock the lever arm points to the port that is closed.


Fig. 12

A hemostat can be used to secure the catheter-stopcock junction.

13) IV set-up
Finally, attach an IV set to one port of the 3-way stopcock, and open the stopcock to that port (Fig. 13). A syringe can be left connected to the unused port for future use.


Fig. 13

Conclusion

Although the procedure is straightforward, the need to insert an umbilical vein catheter may occur under stressful conditions. Familiarity with the above procedure will reduce stress and improve quality of care. These techniques can be easily mastered by rural obstetrical teams, even if employed infrequently. This will significantly improve their ability to provide safe and reliable venous access to newborns in difficulty.

Correspondence to: Dr. John Wootton, Box 1086, Shawville QC J0X 2Y0

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