A Technique for Rapid Catheterization of the Umbilical Artery

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In the resuscitation of asphyxiated newborn and premature infants, an indwelling umbilical-artery (UA) catheter often is valuable in providing a route for reliable and atraumatic blood sampling, parenteral drug and fluid administration, and continuous monitoring of aortic blood pressure.1 We have devised a technique for UA catheterization that is rapid, simple, and easily mastered.

Technique

The obstetrician is requested to leave the umbilical cord long (at least 10 cm). After delivery, the infant is placed on a sterile sheet under a radiant heater, and dried. While one resuscitator manages the airway, the other, wearing cap, mask and sterile gloves, swabs the cord lightly with disinfectant and inserts a 16-gauge plastic over-the-needle cannula† into an artery in the cord, for a distance of about 3 mm (fig. 1). The needle must not be advanced deep to the skin margin, as “blind” advancement of the needle may perforate the artery, producing unrecognized bleeding. Proper placement is easily recognized by direct vision through the translucent material of the cord, and by the “give” as the needle and cannula enter the lumen. The metal needle is then withdrawn, leaving the cannula in the artery. Bleeding is prevented by finger pressure occluding the cord vessels proximal to the point of entry. A 3½-Fr UA catheter is passed through the cannula into the artery. The cannula is withdrawn from the artery over the catheter, leaving the catheter in the artery (fig. 2). The catheter is then advanced an appropriate distance so that the tip is estimated to lie just above the aortic bifurcation.

An infusion of 5 per cent dextrose in water at a rate of 3 ml/kg estimated body weight/hour is maintained through the catheter by an infusion pump. The catheter is fixed by tying a heavy silk suture tightly around the cord just proximal to the point of entry into the artery as a safeguard against bleeding. Using a constant-flush device,‡ either a pressure transducer or a saline manometer is inserted between the catheter and the infusion tubing, for monitoring aortic pressure. After the infant’s condition has been stabilized, catheter position is checked by roentgenogram.

The artery should be cannulated as soon after birth as possible, since arterial spasm will probably prevent success after the age of 10 or 15 min. Also, traction on the cord should be avoided, since this is the most potent stimulus for arterial spasm and closure.2 The catheter must be tested to ensure it will pass through the cannula, since there is considerable variation in the diameters of the “3½-Fr” catheter. If the cannula will not allow the catheter to pass through its lumen, the smallest diameter of the lumen is enlarged by cutting off the tip of the tapering cannula with sterile scissors. The cannula must therefore be both thin-walled and gently tapered, requirements that are met only by the Argyle Medicut®. The cannula is then held in place over the needle, with the thumb of the right hand fixing the cannula’s position so that the tip of the cannula lies just behind the tip of the needle. The needle and overlying cannula are then inserted into the artery as described.

Results

The technique has been employed in 59 infants. In 50 it was successful; in nine it failed. In four of the nine failures, formal catheterization was successful, while in five it was not.

The smallest baby successfully catheterized weighed 540 g and was born at 26 weeks’ gestation, and the largest was a 3,400-g, full-term, depressed infant.

Discussion

Our technique has the advantage of avoiding hemorrhage from the amputated stump of umbilical cord. It is rapid (the catheter is placed within 30 sec to 3 min) and is easily mastered, especially by the anesthesiologist, who is used to cannulating blood vessels. In addition, it can be performed simultaneously and without interfering with such crucial procedures as
endotracheal intubation or external cardiac massage. In the event of a failure of catheterization our technique does not damage the arteries proximally and therefore does not preclude subsequent amputation of the umbilical cord and catheterization by the standard technique. This technique is useful only for inserting 3½-Fr umbilical catheters, not 5-Fr catheters. The 5-Fr umbilical catheter is preferred for all except small premature infants—presumably because of less risk of clotting. We believe that this disadvantage is more than outweighed by the ease and speed of insertion with our method. This is particularly true since the indications for umbilical catheterization are often short-term, i.e., after volume replacement, alkaline administration, and ventilation, the monitoring of cardiovascular and respiratory status with umbilical lines is no longer necessary and the catheter should be removed. Obviously the inherent complications of an indwelling UA catheter are still possible, and the resuscitator must be familiar with these.

One interesting complication arose which was specific for this technique. In cases where simultaneous maneuvers such as endotracheal intubation and/or cardiac massage are being performed, or when a relatively dilated, nontortuous segment of the umbilical artery can be found only at a distance from the abdominal wall, the artery should be entered well away from the abdominal wall, and the catheter threaded proximally. Previously, we simply amputated the umbilical cord distal to the point of entry. In a few days mummified cord had firmly encased the catheter in several centimeters of cement-like stump, necessitating careful surgical dissection to remove the catheter. Since then, when it has been necessary to enter the artery remote from the abdominal wall, the distal cord has been carefully dissected away from the catheter in the delivery room. We feel this is best done while Wharton’s jelly is pliable and translucent and the catheter is easily seen and palpated.

Although trained neonatologists are proficient at umbilical catheterization by the formal method, such individuals may not be present in delivery rooms in hospitals other than sophisticated high-risk centers. Unfortunately, substantial numbers of severely depressed and very small premature infants are born in these hospitals. We believe that, along with possessing skills of endotracheal intubation and ventilation, those responsible for neonatal resuscitation should be knowledgeable and competent in umbilical catheterization; the technique described is ideal for the physician in this situation.

REFERENCES