Umbilical Vein and Arterial Catheterisation - Pros and Cons

A short report

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As with several other topics in Neonatal Medicine, the choice of vessel in umbilical catheterisation in the ill neonate is subject to controversy. Both procedures carry potentially lethal risks in the newborn and they should not be utilised as routine procedures in Special Care Baby Units. It is here proposed in this short article to include a brief review of the relevant literature in order to justify the present policy in our SCBU at Karen Grech Hospital, at least until such time as future developments may render amendment necessary.

It has been our policy to insert umbilical vein catheters whose tip would lie just short of the liver bed (5 to 6 cm in a full-term), in preference to longer ones terminating in the inferior vena cava, and to umbilical artery catheters. Guidelines for the choice of vessel and length of insertion, however, are not rigid but are tailored to the individual case. When strict aseptic and antiseptic techniques are used, the umbilical vein catheter has served as a very useful lifeline for the administration of dextrose, antibiotics and other drugs; great care is required to dilute the latter adequately if catastrophies in the liver bed are to be avoided. Blood samples can also be taken from it. The catheter is routinely submitted for culture and sensitivity after removal. The incidence of contamination is very low indeed; when bacteria are cultivated, these have not so far proved to lie beyond the reach of antibiotic modification. In the very small preterms these catheters have been left *in situ* for a week without a noticeable increase in sepsis - a more extensive infection screen is adopted in these cases, and always include blood culture, lumbar puncture and urine culture. Adequate washing of hands before handling each infant is in our experience the most effective measure in keeping the risk of infection to a bare minimum. When an exchange transfusion is carried out, the catheter is substituted just before the procedure. Our personal choice is an end-holed catheter which shows

a lesser tendency to suck in the vessel wall when blood is being withdrawn.

During 1979 and early 1980 we were inserting our umbilical vein catheters through the ductus venosus right up to the inferior vena cava; this was a very good central site for measuring CVP and for administering hypertonic solutions, but it also tended to cause uncomfortable variations in heart rate particularly on drug administration such as Calcium and Bicarbonate, and especially during exchange transfusion. There is, besides, the added risk of accidental exsanguination if the catheter becomes disconnected; the negative intrathoracic pressure at this site would also favour air embolism with a leaking catheter.[1]

Umbilical artery catheterisation has only been carried out in those neonates in whom it was essential to monitor blood gases at frequent intervals, such as in infants on ventilators. Small diameter catheters made of less thrombogenic material are utilised, as recommended by several authors.[2,3] We do not insist too much with pushing the catheter in if we meet obstruction; we are rather a trifle disappointed if it enters very readily because of the probable existence of severe hypoxia causing vasodilation which facilitates insertion. The catheter is kept filled with heparinised saline to maintain patency, and the tip is radiologically confirmed to lie between L3 and L5 in order to reduce the possibility of jeopardising the blood supply to the kidneys and intestine. The circulation to the lower limbs is continuously monitored, and the catheter is withdrawn with any untoward colour changes in the buttock or lower limbs. Out of a total of 98 umbilical artery insertions over the past four years, only one death could probably have been hastened because of catheterisation. Before insertion of umbilical catheters the stomach is routinely aspirated in order to prevent vomiting and aspiration during the procedure. Whereas venous catheters are occasionally kept longer than three days, arterial lines are always removed by the third day and submitted for culture as well.

The main complications of umbilical vein catheterisation are Necrotising Enterocolitis, venous thrombosis and sepsis. These are kept to a minimum if the tip of the catheter lies proximal to the liver bed by about 1 cm, and if administered drugs are adequately diluted before infusion. Care must be taken not to administer Calcium and Sodium bicarbonate concurrently because of precipitation. Strict asepsis and antisepsis are the constant pre-requisites.

The literature dealing with the dangers of umbilical artery catheterisation is mainly orientated against the procedure unless its desired benefits seriously outweigh its possible complications.[4,5] The latter include life-threatening infection and thromboembolism[4]. With the tip of the artery catheter lying in the thoracic aorta (T6-T11), Neal[6] recorded in 1972 a 95% incidence of thrombosis, and three years later Goetzman[7] reported a marked reduction to 24%. In 1979, Wesström's[8] figures ranged at 26% incidence of thrombosis or embolism, and a year later[9] this went down to 12%, whereas a further 4% had a demonstrable blood pressure difference in the lower limbs. The sites most commonly affected by occlusion were the ileofemoral and popliteal arteries, and the real possibility exists that in the long term this would be associated with precocious arteriosclerosis[9]. Umbilical artery catheters are also suspected of obstructing the inferior mesenteric artery and causing ischaemic necrosis of the descending colon[10]. Heparinised saline helps to maintain patency of the catheter but does not reduce the incidence of thromboembolism [11]; the latter has caused significant morbidity and has also been occasionally lethal[12]. In a series of 2500 infants who had been catheterised in the umbilical artery, 829 died; in 13% of the latter, catheter complications were discovered at autopsy. In another series of 250 postmortems, 1.2% of the deaths were found to be directly attributed to the catheter[13]. Several other series have confirmed these findings [14,15 16, 17, 18, 19, 20, 21].

Drugs administered into the umbilical artery are even more potentially dangerous than through the umbilical venous route. This particularly applies to Calcium, Ampicillin, 8.4% sodium bicarbonate and dextrose solution exceeding 10% concentration; significant vascular damage to intestine, kidneys and muscle may result[22 23 24].

Stockman[25] considers the umbilical artery catheter as "a potentially lethal weapon", and as such to be handled with great care, for the time being at least.

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1. **Cockburn F, Drillien, C.M.,** *Neonatal Medicine, 1974. p. 158.*
2. **Paed. Research.** *10:656, 1976.*
3. **Paediatric.** *56: 981, 1975.*
4. **Manual of Paediatric Therapeutics.**
5. **Manual of Neonatal Care,** *p. 374.*
6. **Neal** *et al: Paediatrics. 50: 6, 1972.*
7. **Goetzman** *et al: Ibid. 56: 374, 1975.*
8. **Wesström** *et al: Acta Paed. Scand. 68: 575-581 July 1979.*
9. **Ibid:** *69: 371-376, May 1980.*
10. **Neonatal Medicine,** *p. 512.*
11. **Paediatrics.** *63: 552, 1979.*
12. **Manual of Neonatal Care,** *p. 376.*
13. **Ibid,** *p. 380.*
14. **Cochran** *et al: Paed. 42:769, 1968.*
15. **Egan** *et al: Am. J. Dis. Child. 121: 213, 1971.*
16. **Gupta** *et al: Paed. Res. 2: 317, 1968.*
17. **Mokrohisky** *et al: N. Engl. J. Med. 299: 561, 1978.*
18. **Symansky** *et al: J.Paed. 80:820, 1972.*
19. **Wigger** *et al: Ibid. 76:1, 1970.*
20. **Teasdale F.** *et al: Paed. Res. 6: 414, 1972.*
21. **James, L.S.** *Complications arising from Catheterization of the Umbilical Vessels in Problems of Neonatal ICU's. Report on the 59th. Ross Conference on Paed. Research - Ohio 1969 p. 36.*
22. **J. Paed.** *92:793, 1978.*
23. **Paediatrics:** *62: 71, 1979.*
24. **Ibid:** *65: 1145, 1980.*
25. **Osiki, F.A., Stockman, J.A. (Ed), Year Book of Paediatrics,** *Chicago, 1982 p. 40.*
