Reminder of important clinical lesson

Cardiac tamponade due to umbilical venous catheter in the new born

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Correspondence to Dr Mohamed Abdellatif, molatif66@yahoo.com**Summary**

With more and more extreme premature and very low-birth weight babies being resuscitated, umbilical central venous catheterisation is now being used more frequently in neonatal intensive care. The authors present a case of cardiac tamponade following umbilical venous catheterisation in a neonate, an uncommon, yet potentially fatal complication. The patient was diagnosed at the appropriate time by echocardiography and urgent pericardiocentesis proved lifesaving.

BACKGROUND

Central venous catheters are frequently used in neonatal intensive care especially in premature babies as well as term babies. They are relatively easy to insert and provide secure venous access for a longer duration and for administration of fluids and parenteral nutrition, including 'locally toxic solutions' such as calcium gluconate and 'concentrated dextrose'.¹ However, they can cause lots of complications, including arrhythmias, intracardiac thrombosis, systemic and pulmonary embolisation, endocarditis, myocardial perforation, pericardial and pleural effusion, pulmonary infarction, haemorrhage and catheter related infections.²⁻⁷

CASE PRESENTATION

A term baby boy was born at 38 weeks gestation to a 32-year-old mother via normal vaginal delivery. The mother has medical history of sickle cell trait, sarcoidosis and protein S deficiency and was on enoxiparin and prednisolone. Birth weight was 2400 grams with normal length of 50 cm and head circumference 33 cm. The infant appeared to be well at delivery, with Apgar scores of 8, 9 and 9. He then experienced respiratory distress with tachypnea, and hypoglycaemia for which the baby was admitted to the neonatal unit. The low blood sugar was attributed to low birth weight. Chest x-ray showed fluid in the transverse fissure most likely due to transient tachypnea of the new born which improved on nasal canula oxygen. The patient required glucose infusion rate of 10 mg/kg/min for which a silastic umbilical venous catheter (UVC) (Vygon) was inserted. X-ray abdomen and chest was done to confirm the position of the UVC which was above the diaphragm, between T 7 and 8. (figure 1). Insulin levels were found to be high (5.5 mIU/l). Hypoglycaemia improved gradually over the next 72 h and oral feeding was initiated and increased gradually. On day 3 of life the patient developed acute asystole and hypoperfusion not responding to external cardiac massage. Blood pressure was not recordable. The baby was intubated immediately and active cardiopulmonary resuscitation was performed with administration of intravenous adrenaline. Heart sounds were normal.

INVESTIGATIONS

Post intubation CXR showed UVC tip migrated upward to the level of T5 level which appeared to be in the right atrium with no cardiomegally (figure 2). Urgent echocardiography was done which showed huge pericardial effusion with signs of cardiac compression (figure 3).

TREATMENT

All fluids through the umbilical catheter were discontinued and a peripheral intravenous line was started. The baby required two boluses of normal saline and dopamine was started at 10 mcg/kg/min for low blood pressure. Urgent pericardiocentesis was performed (both therapeutic and diagnostic) with a pig tail catheter inserted in the pericardial space under fluoroscopic guidance (figure 4) which

Figure 1 Chest x-ray showing umbilical venous catheter between T 7 and T 8

Figure 2 Chest x-ray showing umbilical venous catheter tip migrated to T5

confirmed the presence of the UVC in the right atrium. Approximately 45 mls of clear fluid was aspirated and drained from the pericardial space. The fluid was sent for culture and virology, which were negative. Analysis of the pericardial fluid revealed high glucose level of 11.9 mmol/l (blood glucose 13.5 mmol/l) which suggested accidental infusion of the 12.5% dextrose solution into the pericardial cavity related to the UVC. Proteins and lactate dehydrogenase were normal. Microscopy showed occasional red and white blood cells only. Microbiological and viral studies were negative. The UVC was removed.

OUTCOME AND FOLLOW-UP

An echocardiogram was done after the procedure revealed full resolution of the pericardial effusion. Seventy-two hours later, the pericardial drain was removed with no further reaccumulation of pericardial effusion. The baby continued to do well and was discharged on day 10 of life. Repeat echocardiogram postdischarge at 4 weeks of age showed no accumulation of pericardial effusion. At 6 months of age the baby showed normal growth and development.

DISCUSSION

Though central venous catheterisation is now being widely used in intensive neonatal care, the advantages of umbilical catheters must be carefully balanced against the potential risks. The majority of complications are related to either malposition or dislodgment of the catheter. The best location of UVC is recommended to be at the intersection of the right atria and inferior vena cava or in the thoracic inferior vena cava.^{7 8} One of the life-threatening complications is pericardial effusion and cardiac tamponade. The pathogenesis of this complication is most likely due to erosion of the vascular or cardiac wall secondary to contact with the end of the catheter leading to perforation. The hyperosmolar fluid infused through the line then diffuses into the pericardial space creating the effusion. It is essential to do chest x-ray and echocardiogram for accurate prediction of the

Figure 3 Four chamber echocardiography view showing a significant pericardial effusion with evidence of cardiac tamponade.

insertion length of the catheter and appropriate placement and satisfactory location after insertion,^{9 10} to minimise any possible complications. Several studies have attempted to identify variables that can be used to estimate the correct insertion length. Two of the most common methods used to guide insertion length are the Dunn-method which is based on the measurement of the shoulder-umbilicus length and uses nomograms to determine the insertion length of the catheters and the Shukla-method which uses equations based on birth weight.^{11 12} The desired location for a UVC tip is just above the right diaphragm or at the levels of T 8–9 vertebral bodies which is usually the junction of right atrium and inferior vena cava.⁹ Anteroposterior chest x-ray is the most frequent technique used to verify the position of umbilical catheters. Any catheter tip placement in the right or left atria is associated with a high rate of severe complications.^{7 8} The best positions seem to be at the thoracic inferior vena cava or the intersection of the right atrium and inferior vena cava.^{7 8} However, it is unreliable to depend on chest x-rays alone in determining the precise location of the catheter tip.^{9–13} It has been reported that UVC placed at the junction of the inferior vena cava and the right atrium or in the thoracic inferior vena cava, on an x-ray were found to be over a broad range of vertebral bodies T6–T11 when checked on subsequent echocardiography.¹⁴ This may be due to the inconsistency in the size of the right atrium and location in neonates. In our case, although the catheter tip was at the level of T7 initially, this later migrated to T5 level. Prematurity is an additional risk factor, as the methods used to estimate the insertion length are not satisfactory to guide to the exact position in premature infants.¹⁴ Furthermore, the repositioning of UVC due to weight loss and consequently decreased abdominal girth may result in complications related to catheter migration in very low-birth weight newborns.¹⁵

Mortality has been estimated to be 45% to 67%.¹⁶ Pericardial effusion typically occurs within the first week of placing the catheter. Diagnosis is primarily by suspicion of

Figure 4 Anterior posterior fluoroscopic view of heart showing the UVC tip in right atrium. A contrast seen in the pericardial space injected via a 4F pigtail catheter demonstrating the large pericardial effusion and a clear heart border.

an increased cardiac silhouette; presentation is sudden cardiac decompensation or unexplained cardiorespiratory instability.

Learning points

- ▶ Initial placement of umbilical catheters must be well secured to avoid movement of the tip.
- ▶ Any newborn with a central venous catheter must be vigilantly monitored to recognise any catheter-related complication.
- ▶ A high level of awareness for cardiac complications of pericardial effusion is needed.
- ▶ Education and increasing the level of awareness about the likely complications of UVCs may assist in decreasing the complications.

Acknowledgements The authors would like to thank all the doctors and nursing staff who participated in the management of this baby.

Competing interests None.

Patient consent Obtained.

REFERENCES

1. Menon G. Neonatal long lines. *Arch Dis Child Fetal Neonatal Ed* 2003;**91**:F311.
2. Egan EA2ndEitzman DV. Umbilical vessel catheterization. *Am J Dis Child* 1971;**121**:213–8.
3. Mehta S, Connors AF JrDanish EH, *et al*. Incidence of thrombosis during central venous catheterization of newborns: a prospective study. *J Pediatr Surg* 1992;**27**:18–22.
4. Gilon D, Schechter D, Rein AJ, *et al*. Right atrial thrombi are related to indwelling central venous catheter position: insights into time course and possible mechanism of formation. *Am Heart J* 1998;**135**:457–62.
5. Savani RC, Valentini RP, Mimouni F. Neonatal radiology casebook. Pericardial effusion as a complication of umbilical catheterization. *J Perinatol* 1990;**10**:443–5.
6. Björklund LJ, Malmgren N, Lindroth M. Pulmonary complications of umbilical venous catheters. *Pediatr Radiol* 1995;**25**:149–52.
7. Paster S, Middleton P. Roentgenographic evaluation of umbilical artery and vein catheters. *JAMA* 1975;**231**:742–6.
8. Nadroo AM, Lin J, Green RS, *et al*. Death as a complication of peripherally inserted central catheters in neonates. *J Pediatr* 2001;**138**:599–601.
9. Greenberg M, Movahed H, Peterson B, *et al*. Placement of umbilical venous catheters with use of bedside real-time ultrasonography. *J Pediatr* 1995;**126**:633–5.
10. Nash P. Umbilical catheters, placement, and complication management. *J Infus Nurs* 2006;**29**:346–52.
11. Dunn PM. Localization of the umbilical catheter by post-mortem measurement. *Arch Dis Child* 1966;**41**:69–75.
12. Shukla H, Ferrara A. Rapid estimation of insertional length of umbilical catheters in newborns. *Am J Dis Child* 1986;**140**:786–8.
13. Raval NC, Gonzalez E, Bhat AM, *et al*. Umbilical venous catheters: evaluation of radiographs to determine position and associated complications of malpositioned umbilical venous catheters. *Am J Perinatol* 1995;**12**:201–4.
14. Ades A, Sable C, Cummings S, *et al*. Echocardiographic evaluation of umbilical venous catheter placement. *J Perinatol* 2003;**23**:24–8.
15. Salvadori S, Piva D, Filippone M. Umbilical venous line displacement as a consequence of abdominal girth variation. *J Pediatr* 2002;**141**:737.
16. Hogan MJ. Neonatal vascular catheters and their complications. *Radiol Clin North Am* 1999;**37**:1109–25.

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Please cite this article as follows (you will need to access the article online to obtain the date of publication).

Abdellatif M, Ahmed A, Alsenaidi K. Cardiac tamponade due to umbilical venous catheter in the new born.

BMJ Case Reports 2012;10.1136/bcr-2012-6160, Published XXX

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