Case report

Cardiac tamponade in a newborn because of umbilical venous catheterization: is correct position safe?

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Summary

Cardiac tamponade is a rare but life-threatening complication of umbilical venous catheterization in the newborn. Most complications from central venous catheters are related to incorrect position of the catheter and it is emphasized to confirm the position of the catheter tip after placement in order to avoid possible complications. We present an unusual complication of cardiac tamponade because of umbilical venous catheterization in a term newborn which is extremely rare with correct location of the catheter tip at the junction of inferior vena cava and right atrium. We suggest that correct position never guarantees uneventful catheterization in the newborn. In any infant with a central venous catheter in situ who deteriorates clinically, pericardial effusion/cardiac tamponade must be considered and appropriate action taken.

Keywords: cardiac tamponade; umbilical venous catheter; complication; newborn

Introduction

Central venous catheterization is frequently used in neonatal care. It provides secure venous access for administration of fluids and parenteral nutrition and it also makes possible the administration of locally toxic solutions such as concentrated dextrose (1).

Umbilical venous catheters (UVCs) are relatively easy to insert and have been widely used in sick newborns. However, they have been implicated in the causation of many problem, including arrhythmias, intracardiac thrombosis, systemic and pulmonary embolization, endocarditis, myocardial perforation, pericardial effusion, pleural effusion, pulmonary infarction, hemorrhage and catheter-related infections (2–7). Most complications are related to incorrect position of the catheter. The ideal position of an UVC is suggested to be at the right atrial/inferior vena cava junction or in the thoracic inferior vena cava to minimize complications (7,8).

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We describe a case in which the successful placement of a UVC at a satisfactory position was followed by pericardial effusion and tamponade.

Case report
A term (39 weeks) boy was born by emergency Cesarian section because of fetal distress from a mother with gestational diabetes. He weighed 3450 g and his blood glucose level was low. Dextrose infusion at the rate of $5 \text{mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ was started via a peripheral vein. Because hypoglycemia persisted, dextrose infusion rate was gradually increased to $15 \text{mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$. At 12 h of age, a UVC (5 Fr gauge-polyvinyl chloride catheter) was placed in order to administer a hypertonic dextrose solution. The position of the catheter was checked by X-ray and the catheter tip was judged to be at the junction of inferior vena cava and right atrium (Figure 1).

At 72 h of age, the infant became tachypneic and cyanosed. A chest X-ray showed cardiomegaly and echocardiography revealed a pericardial effusion with the catheter at the junction of inferior vena cava and right atrium. Pericardiocentesis was performed and 80 ml of serohemorrhagic fluid was removed. UVC was not withdrawn immediately because echocardiography illustrated that it was at the correct position. The condition of the baby recovered following pericardiocentesis. However, analysis of the pericardial fluid showed a high glucose level of $52 \text{mmol} \cdot \text{l}^{-1}$ ($950 \text{mg} \cdot \text{dl}^{-1}$). A contrast study was performed through UVC, which showed extravasation of radiocontrast material into the pericardial cavity (Figure 2), confirming that the catheter had perforated through the wall of the inferior vena cava and neighboring pericardium. Infusion through the UVC was stopped and the catheter was removed. There was no subsequent reaccumulation of the pericardial effusion. The infant was discharged at 10 days of life and subsequent follow-up has shown him to be healthy.

Discussion
Umbilical venous catheters are widely used in the care of the sick neonates for initial delivery room

Figure 1
Direct roentgenogram showing the tip of the umbilical venous catheter (UVC) located at the junction of inferior vena cava and right atrium at the level of thoracic 7–8 vertebrae (arrow).

Figure 2
A contrast linogram showing extravasation of radiocontrast material into the pericardial cavity.

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resuscitation and later for administration of fluid, medication and parenteral nutrition in the neonatal intensive care unit. Appropriate placement and satisfactory location are the most important factors to avoid potential complications. Left atrial placement is associated with a high rate of complications. Right atrial placement causes severe complications (7,8). Right atrial/inferior vena cava junction or thoracic inferior vena cava seem to be ideal positions (7).

Anteroposterior chest X-ray is the most common method used to check placement of UVCs. Desired location is for the tip of the catheter to be just above the right diaphragm or defined according to the vertebral bodies. Greenberg et al. (9) reported that UVCs at T8-9 level on chest X-ray were located at the right atrial/ inferior vena cava junction by echocardiography. However, many studies have shown that radiography is unreliable in determining exact catheter placement (9,10). Ades et al. (11) showed that UVC properly placed in the right atrial/inferior vena cava junction or in the inferior vena cava, as documented by echocardiography were located at a wide range of vertebral bodies (T6-T11) on X-ray. The wide variability in atrial size and position and redundancy of the atrial septum in newborns with otherwise normal cardiac anatomy may explain why radiographic landmarks do not correlate with intracardiac anatomy (11). In our case we supposed that the catheter tip was at the right atrial/ inferior vena cava junction although we did not exclude the placement of the catheter in the right atrium by X-ray. Ultrasonography is useful in determining the position of catheters as it allows visualization of the catheter in relation to cardiovascular structures (9–13). Correct location of the catheter at the right atrial/ inferior vena cava junction was also shown by echocardiography in this case.

Prematurity is a risk factor for complications related to central venous catheters, because techniques used to estimate insertion length are not adequate to guide placement to a correct position in premature infants (11). Additionally catheter migration because of loss of weight and subsequently decreased abdominal girth may be also a possible mechanism in catheter-related complications in very low birth weight infants (14). However, our case was a term newborn and we did not observe significant weight loss. Additionally, Figure 2 (on the third day of life) which shows extravasation of radiocontrast material into the pericardial cavity also indicates that the catheter position was the same as the initial position shown in Figure 1 (at 12 h of age). Therefore, there was no catheter migration in our case.

Pericardial effusion usually occurs within 4 days of catheter insertion. Possible mechanisms are direct puncture by the catheter tip, or endothelial damage caused by hyperosmolar infusates, followed by transmural necrosis (15). In this case, pericardial effusion occurred 3 days after catheter insertion and hypertonic dextrose solutions were used. The latter mechanism probably played a role in our case.

Our patient was a term infant and the catheter was placed in the ideal position which could not prevent pericardial effusion. Therefore, we suggest that every patient with a central venous catheter should be carefully monitored to diagnose any catheter-related complication and in any infant with a central venous catheter in situ who clinically deteriorates, pericardial effusion/cardiac tamponade must be considered and appropriate action taken. Correct position never guarantees uneventful catheterization in newborns.

References


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