

# Cardiac Tamponade Secondary to Umbilical Vein Catheterization in a Premature Newborn: A Case Report

KS LUN, WH LEE

**Abstract** We report a premature newborn who developed circulatory collapse 46 hours after birth due to cardiac tamponade. Echocardiography revealed large circumferential pericardial effusion. Pericardiocentesis yielded 12 ml of clear straw-colored fluid with high glucose level of 102.9 mmol/L. The neonate improved after the procedure. Pericardial tamponade is a rare complication related to umbilical vein catheter. Nevertheless, this life-threatening complication has to be suspected in newborn presenting with shock after umbilical vein catheterization.

**Key words** Cardiac tamponade; Newborn; Pericardial effusion; Umbilical veins

## Introduction

Umbilical vein catheters (UVC) provide convenient and relatively simple intravenous access in the premature newborns. Serious complications are relatively uncommon. We report here a premature neonate who developed severe vascular collapse due to cardiac tamponade. The large pericardial effusion was related to umbilical venous catheterization.

## Case Report

A 830 g para 1 Chinese male was born at 25 weeks gestation by normal vaginal delivery to a 23-year-old healthy woman. Two doses of parenteral dexamethasone were given to his mother before delivery. Apgar scores were 4 and 7 at

one and five minutes respectively. He was intubated and required mechanical assisted ventilation shortly after delivery. Chest roentgenogram revealed grade 2 respiratory distress disease. One dose of surfactant (3.5 ml Survanta™) was given via the endotracheal tube. He showed dramatic improvement of his respiratory status as evident by decrease of the ventilator settings within 8 hours after delivery (decrease of  $\text{FiO}_2$  from 0.5 to 0.21; inspiratory pressure from 18/5 to 13/4  $\text{cmH}_2\text{O}$  and ventilator rate from 50 to 20/min). A dual-lumen UVC was inserted shortly after birth but could not be negotiated into the inferior vena cava. Another 3.5 French single-lumen UVC was inserted successfully into the inferior vena cava. Length of the UVC was estimated from the measured length from the xiphoid to the umbilicus and add the length of umbilical stump. The tip of UVC was one vertebral space above the diaphragm on subsequent chest radiogram. Dextrose 10% solution was infused via the UVC. Clinical condition remained relatively stable until at 46 hours of life when he presented with marked pallor and poor peripheral circulation. Physical examination revealed prolonged capillary refill of 5 seconds and weak peripheral pulses of 180 bpm. There was no radiofemoral delay. Cardiac apex was ill-defined. Heart sounds were normal and a grade 2/6 ejection systolic murmur was audible at left upper sternal border. Blood pressure recorded from umbilical artery catheter was 44/26 mmHg when dopamine 7 mcg/kg/min was infusing intravenously. He had tachypnoea of 60/min with marked subcostal recession. Liver was enlarged

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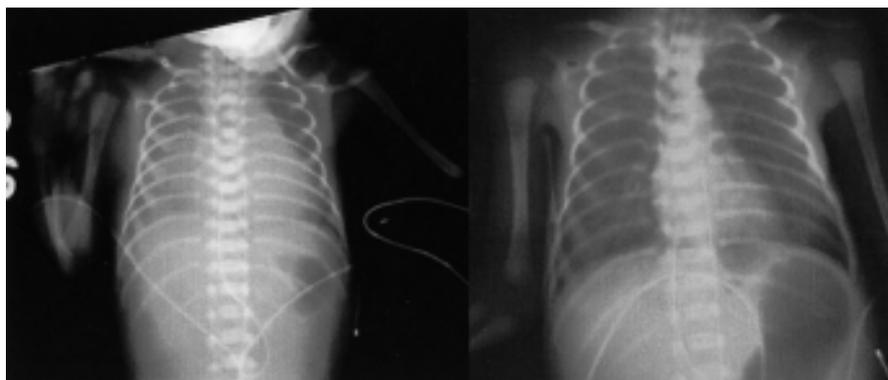
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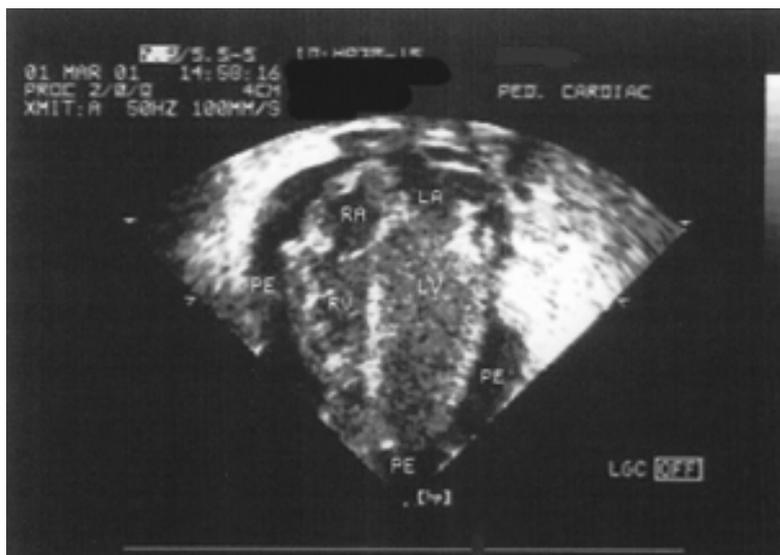
3 cm below right costal margin. Arterial blood gases revealed marked mixed metabolic and respiratory acidosis (pH 6.923, PaCO<sub>2</sub> 5.18 KPa, PaO<sub>2</sub> 7.88 KPa, HCO<sub>3</sub> 8.0 mmol/L, BE -22.8). Chest radiogram showed cardiomegaly and UVC tip at T6-7 level (Figure 1). Condition continued to deteriorate and he required 2 inotropes including dopamine and dobutamine both at 10 mcg/kg/min.

Echocardiography revealed large circumferential pericardial effusion and a 1.7 mm persistent ductus arteriosus. The right atrium and ventricle was compressed

during diastolic filling suggesting cardiac tamponade (Figure 2). Urgent pericardiocentesis using a 22-gauge Angiocath™ inserted below the xiphoid was performed. Twelve milliliters of clear slight straw-colored fluid was aspirated. Clinical status of the infant improved rapidly after the procedure. Inotropic support could be weaned off on the next day. Analysis of the pericardial fluid revealed high glucose level of 102.9 mmol/L (blood glucose 10.5 mmol/L); protein 2 g/L; LDH 28 IU/L (serum LDH 1088 IU/L). Microscopy showed occasional red and white blood cells only.



**Figure 1** Chest radiogram on the left demonstrates cardiomegaly (cardiothoracic ratio 0.68). The tip of UVC is at T6-7 level. UAC was also shown. Right chest radiogram, which was taken after pericardiocentesis, showed normal cardiothoracic ratio of 0.45. The UVC tip has been withdrawn to just above the diaphragm.



**Figure 2** Echocardiography (apical 4 chambers view) shows a large circumferential pericardial effusion. On real time, the right atrium and ventricle are compressed during diastolic filling. RA-right atrium; RV-right ventricle; LA-left atrium; LV-left ventricle; PE-pericardial effusion.

Microbiological and viral studies were negative. This suggested accidental infusion of the 10% dextrose solution into the pericardial cavity related to the UVC. The UVC was withdrawn just above the diaphragm and there was no reaccumulation of pericardial effusion.

## Discussion

Umbilical vein catheters have been used for administering fluid and medications in newborn for over two decades. Complications associated with UVC include thrombosis, embolism, vessel perforation, haemorrhage, infection, gastrointestinal or renal tissue damage, hepatic necrosis, hydrothorax, cardiac arrhythmias, and erosion of the cardiac chambers.<sup>1</sup> Pericardial tamponade is a very rare but life-threatening complication secondary to umbilical venous catheterization in newborn. There were only a few anecdotal case reports in the literatures.<sup>2-9</sup> Chang et al<sup>6</sup> described a very similar premature neonate who developed profound shock 25 hours after undergoing umbilical venous catheterization. Pericardiocentesis yielded 11 ml of clear straw-colored fluid with high glucose content at 136 mmol/L. The UVC was situated at the left atrium and was pulled back into inferior vena cava. No reaccumulation of pericardial effusion occurred thereafter.

We speculated that the UVC somehow perforated the atrial wall leading to infusion of the dextrose solution into the pericardial cavity and resulted into cardiac tamponade. The exact mechanism of perforation of atrial wall was unknown but probably involved migration of the catheter with entrapment of the catheter tip into the atrial muscle. A small migration of the catheter might result in significant change of position inside the heart in this extreme low birth weight neonate.

To avoid the serious complication of cardiac tamponade, the proper position of the UVC catheter should be at or just above the diaphragm and placement of the catheter tip into right atrium is not advisable. The position of the catheter should be monitored regularly by serial chest radiograms. Fixation of the catheter should be secure to avoid migration

of catheter. Cardiac tamponade should be suspected in neonate presenting with vascular collapse after umbilical vein catheterization. Enlargement of cardiac silhouette on chest radiogram gives the clue of cardiac tamponade and an echocardiography will readily reveal the diagnosis. Urgent treatment of cardiac tamponade is essential to prevent mortality or serious consequences.

## Conclusion

Cardiac tamponade is a rare but life-threatening complication related to umbilical vein catheter. This complication has to be suspected in newborn with circulatory collapse after umbilical venous catheterization. Proper position of the umbilical vein catheter is with the tip at or just above the diaphragm.

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