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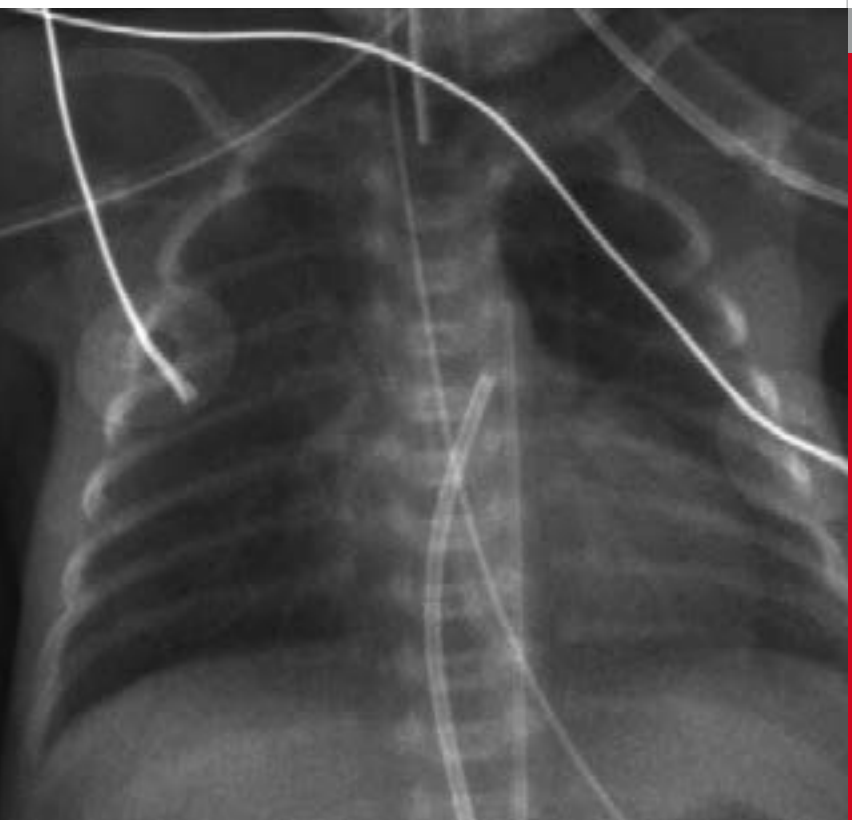
Cardiomegaly in a premature neonate after venous umbilical catheterization



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Schlapbach LJ, Pfammatter J-P, Nelle M, McDougall FJ, Division of Neonatology (SLJ, NM, McDFJ), Division of Pediatric Cardiology (PJ-P), Department of Pediatrics, University of Berne, Switzerland

INTRODUCTION

Umbilical venous catheters (UVC) are frequently used in neonates requiring hyperosmolar parenteral nutrition, catecholamines or when no peripheral venous access can be established. Catheterization of the umbilical vein allows rapid central access, but may be associated with various complications (1). Clinicians are particularly aware of catheter-associated infections and thrombosis. Due to the widespread use of umbilical lines, neonatologists should keep rare complications in mind as well. We present a case of a newborn with pericardial effusion following UVC placement.

CASE REPORT

An extremely premature infant weighing 590 grams was born at 25 weeks gestational age by caesarean section for severe pre-eclampsia and deteriorating fetal Doppler studies. The baby was intubated for respiratory distress syndrome within the first hour of life and umbilical venous and arterial lines were placed (UVC 3.5 Charrière single-lumen, UAC 2.5 Charrière, ArgyleTM polyurethane, Tyco Healthcare, Tullamore, Ireland). The position of the catheters, both of which had been inserted too far (Fig. 1), was corrected according to the CXR by 1.5 cm (UVC) and 2 cm (UAC). After receiving porcine surfactant (Curosurf®), the infant was successfully weaned from mechanical ventilation. CXR before planned extubation on day three unexpectedly showed cardiomegaly with a heart-to-lung ratio of 0.69 (Fig. 2). Echocardiography was performed immediately and revealed a large echo-free pericardial effusion

measuring 6 mm in diameter (Fig. 3). Both atrial and ventricular function were adequate, without diastolic indentation of the atrial wall. The UVC tip was floating within the right atrium. On the X-ray, the UVC was still positioned too high projecting into the cardiac silhouette (Fig. 2), although its initial position had been adequately corrected. Aspiration through the UVC yielded bloody fluid, and blood gas and chemical analysis of the aspirate were consistent with blood and not parenteral nutrition. Ultrasound examination ruled out pleural and abdominal effusions. Stool cultures of the infant and the mother were negative for enterovirus. Maternal serologies were negative for TORCHS, Parvovirus B19, and Coxiella burnetii.

Since the infant remained hemodynamically stable with no signs of cardiovascular compromise, we decided against emergency pericardiocentesis. After removing the UVC, the effusion gradually resolved within a few days, and the infant was successfully extubated. The later clinical course was complicated by bronchopulmonary dysplasia and osteopathy of prematurity. Later cardiac follow-up revealed no functional or anatomical pathology.

DISCUSSION

Pericardial effusion is a well-known complication of peripherally inserted central catheters (PICC), with an estimated incidence of 1.8/1000 catheters (2). The majority of infants with reported pericardial effusion beca-

me acutely symptomatic due to cardiac tamponade and deteriorated rapidly with signs of respiratory distress, cyanosis, tachycardia or bradycardia, mottled skin, and arterial hypotension finally leading to cardiopulmonary arrest not responsive to standard interventions (3). Notably, approximately a quarter of the cases were first diagnosed post-mortem at autopsy (2). The mortality is very high (45-65%) (2, 3) and those resuscitated successfully improved only after emergency pericardiocentesis was performed. Analysis of the aspirated liquid usually reflected the composition of the parenteral nutrition. Following a series of case reports on infant deaths attributed to PICC-associated cardiac tamponade, guidelines have been published aimed at reducing the risk of cardiac perforation (3-5).

Contrary to PICC, the incidence of pericardial effusion associated with UVC is unknown but case reports have documented sudden cardiovascular compromise in infants with UVC due to pericardial tamponade (6-8).

Perforation and catheter migration are thought to occur as a result of both mechanical pressure by the catheter tip repeatedly pushing against the contracting heart wall and endocardial injury caused by hyperosmotic parenteral nutrition fluids. Transmural diffusion of parenteral nutrition fluids into the pericardial space further contributes to the accumulation of fluid. Contrary to catheter-associated infections and thrombosis which increase over time, pericardial effusion may occur directly

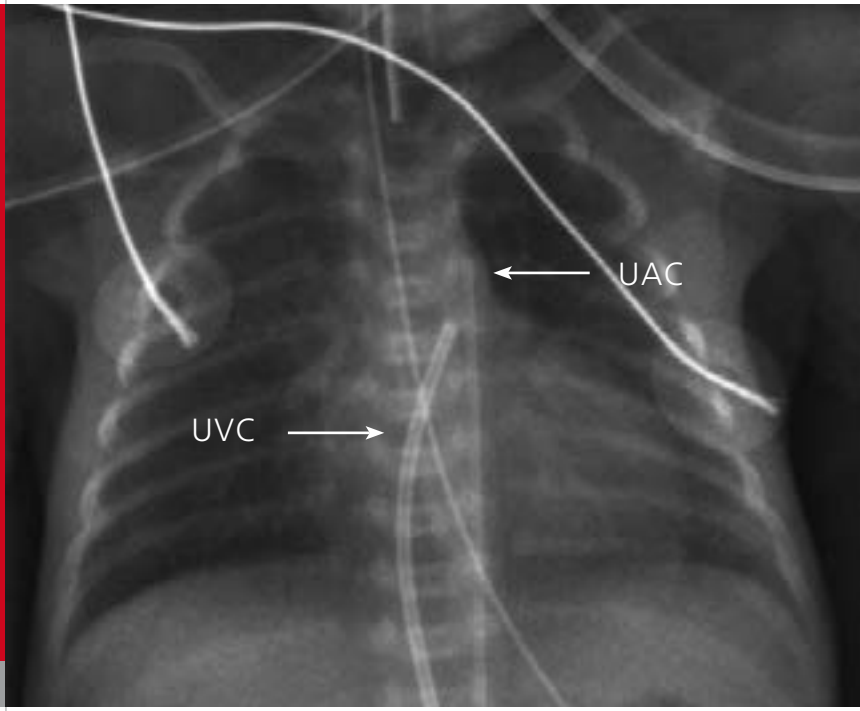

Fig. 1

Chest X-ray on day one after intubation and insertion of venous (UVC) and arterial (UAC) umbilical lines.

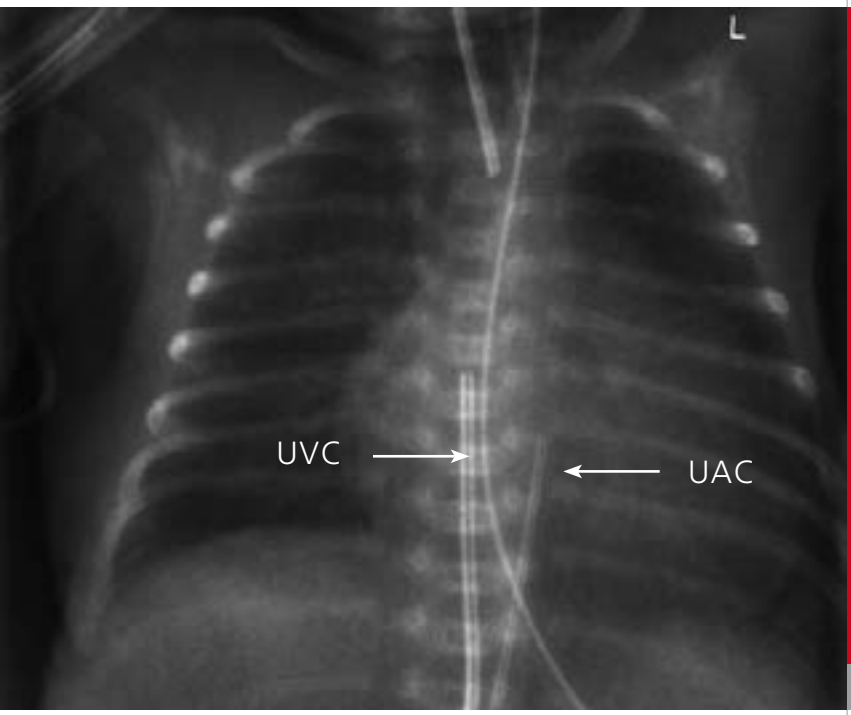

Fig. 2

Incidental finding of cardiomegaly on chest X-ray before extubation on day three. UVC: umbilical venous catheter; UAC: umbilical arterial catheter.

after insertion of catheters, or later, with a peak at three days following catheter insertion (4). Malposition of central catheters is considered the main risk factor for pericardial effusion, particularly if the catheter tip projects into the right atrium or shows angulation (2, 7). The catheter tip should be positioned at the junction of the vena cava inferior and right atrium with the tip lying outside the cardiac silhouette. However, catheter inward migration, as experienced in the present case, has been described and is attributed to retraction of the mummifying cord, changes in abdominal girth and catheter dislocation during manipulations (6, 9). Therefore, even after correct initial placement, the UVC position should be checked regularly using X-ray or ultrasound.

The differential diagnosis of neonatal pericardial effusion includes immune and non-immune hydrops fetalis, congenital infections such as TORCHS and Parvovirus B19, and rarely myopericarditis caused by Enteroviridae, mainly Echovirus and Cocksackievirus, or Coxiella burnetii.

The present case illustrates that pericardial effusion may progress asymptomatically before hemodynamic changes become evident. The incidence of catheter-associated pericardial effusion may therefore be underestimated. Extremely low birth-weight infants might be at particular risk due to the thin myocardial wall with relatively large catheters often - as in this case - being initially inserted too far. Considering the potentially lethal

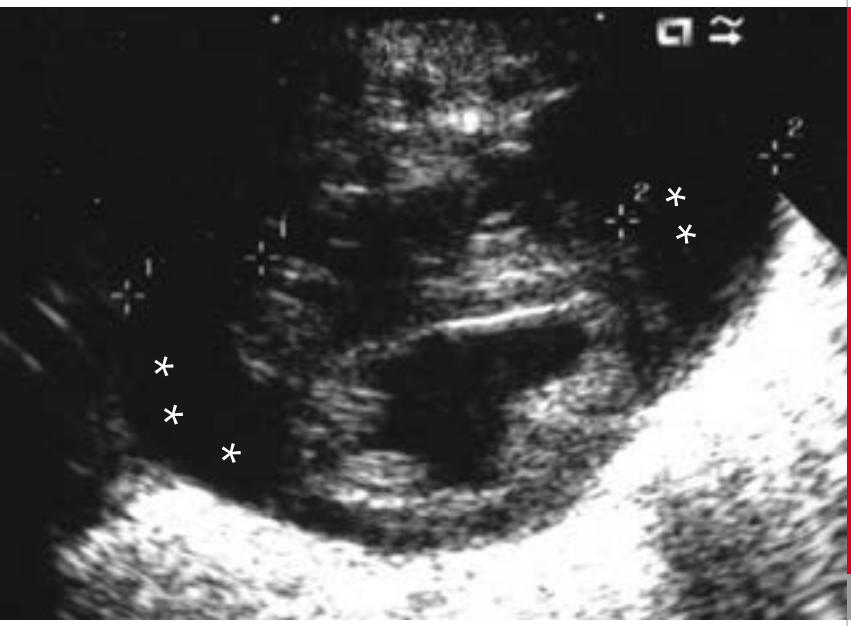

Fig. 3

Echocardiography demonstrating large pericardial effusion (asterisks) on day three.

complications of UVC, neonatologists should carefully consider the indication for placing UVCs and remove UVCs as soon as possible. Whether percutaneous long lines represent a safer alternative remains unclear and further prospective studies comparing UVC and PICC are needed (1). Mal-positioned UVCs should be corrected immediately and the position should be verified afterwards. Finally, neonatologists should maintain a high index of suspicion for pericardial tamponade and readily perform echocardiography in acutely ill infants with UVCs.

In conclusion, pericardial effusion may occur asymptomatically after umbilical venous catheterization and should be suspected in infants with central catheters and progressive cardiomegaly. Prompt removal of catheters and, if signs of pericardial tamponade are present, emergency pericardiocentesis, may prove life-saving.

For related cases, see also COTM 10/2001 and COTM 12/2004.

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Swiss Society of Neonatology
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