CASE REPORT. BILATERAL CONSOLIDATION OF THE LUNGS IN A PRETERM INFANT: AN UNUSUAL CENTRAL VENOUS CATHETER

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Case report

Bilateral consolidation of the lungs in a preterm infant: an unusual central venous catheter complication

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Summary

We describe a case of bilateral parenchymal consolidation with sudden respiratory distress in a preterm baby as a complication of peripherally inserted central catheter (PICC) dislocation. The X-rays showed bilateral pulmonary consolidation with the catheter tip initially located in the right, and later in the left pulmonary artery. The catheter was withdrawn. As soon as the catheter was repositioned all clinical signs and symptoms disappeared. Neonatologists should consider the possibility of dramatic respiratory distress deriving from PICC dislocation. Careful tip catheter placement and conscientious monitoring may reduce morbidity.

Keywords: central venous catheterization; newborn; premature; respiratory distress

Peripheral insertion of central catheters has become a routine procedure in neonates for providing long-term vascular access. These catheters optimize nutrition and provide infusions of critical medications into the central vascular system. Medications that are irritating or damaging to peripheral vessels, or those with a high osmolality or a nonphysiological pH, can be safely administered. Despite its benefits, peripherally inserted central catheter (PICC) use has been associated with a number of device-specific complications that may manifest during insertion while the line is indwelling, and/or after the removal of the line (1–8). Our report describes the development of bilateral pulmonary parenchymal consolidation causing dramatic-onset respiratory distress as a complication of PICC dislocation in a preterm infant.

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Case report

An 850 g female infant, second twin, was delivered by cesarean section at 30.5 weeks because of intrauterine growth retardation. Apgar score was 7 and 8. On day 3, in order to administer parenteral nutrition, a 23G radioopac silastic PICC (Epicutaneo-Cava-Katheter; Vygon Medical products, Aachen, Germany) was inserted via the right arm and its position checked radiologically. On observing the

catheter tip coiling into the right atrium, the catheter was partially retracted and its position verified via ultrasonography just outside the right atrium. Subsequently, the catheter was secured with Steri-strips and transparent dressing. The infant was treated with partial parenteral nutrition and antibiotics (ampicillin and netilmicin). On day 6 skin-to-skin care was commenced. However 2 days later the infant's condition deteriorated and several apneic spells were recorded. A sepsis work up was performed but all values were within normal limits. A chest X-ray showed massive air-space consolidation of the right upper lobe (Fig. 1). The arterial blood gas analysis was pH 7.33, PO_2 8.5 kPa (65.4 mmHg), PCO_2 5.4 kPa (41.3 mmHg), BE −3.6 mmol·l^{-1}. The bacterial cultures from blood and urine were negative. Caffeine was administered. The infant deteriorated rapidly during the night, with tachypnea, chest retractions, and severe respiratory acidosis (pH 7.01, PaO_2 6.5 kPa (50 mmHg), $PaCO_2$ 12 kPa (92 mmHg), BE −5). Mechanical ventilation was required. Hemodynamic values were within normal limits, blood pressure was 55/35 mmHg, heart rate 130–150 b·min^{-1} and urine output 3 ml·kg^{-1} h^{-1}. There was no clinical evidence of sepsis. A second chest X-ray showed massive bilateral upper-lobe consolidation with the PICC tip dislocated in the left main pulmonary artery (Fig. 2). A reexamination of the previous X-ray showed the catheter tip in the right pulmonary artery (Fig. 1). The catheter was promptly transferred to the correct position. Within a few hours there was a dramatic improvement in the infant's clinical conditions. Mechanical support was progressively reduced and after a few hours it was possible to extubate her. The following day she was breathing room air with an oxygen saturation of 95%, and her arterial blood gas was pH 7.30, PaO_2 7 kPa (54 mmHg), $PaCO_2$ 6.5 kPa (50 mm Hg), BE −1.1. The baby made a good recovery and the 18th month follow-up showed normal development.

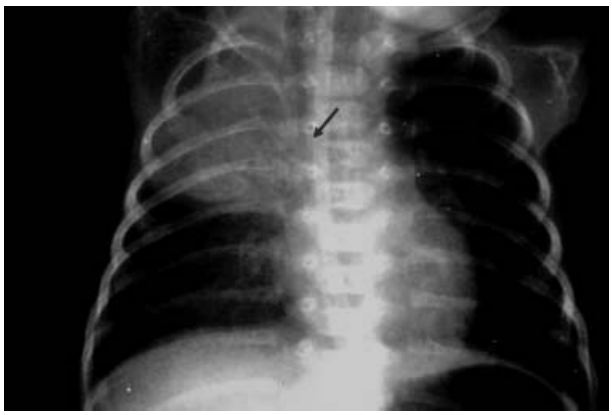

Figure 1
After intrapulmonary infusion of parenteral nutrition when the CVC migrated from the right atrium into the right ventricle and out into the right pulmonary artery.

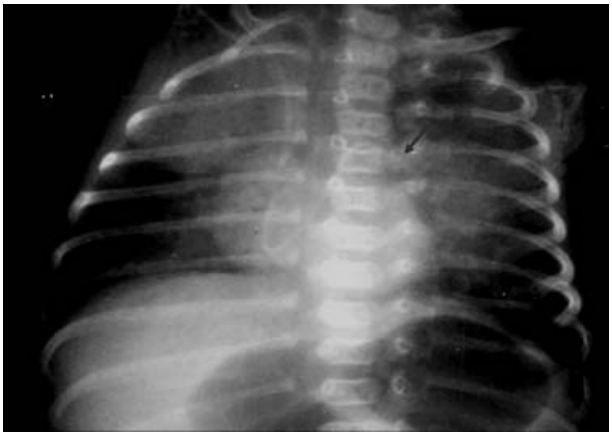

Figure 2
The catheter tip fluctuated from the right pulmonary artery over to the left side.

Discussion

Various complications regarding the use of PICCs have been reported in the literature, such as cardiac perforation leading to cardiac tamponade and hydrothorax (1–3), catheter perforation into the renal pelvis (4, 5), focal neurological manifestations (6), acute abdomen mimicking necrotizing enterocolitis (7), intraabdominal extravasation (8), and pulmonary consolidation with pleural effusion (9, 10). In our patient, the migration of the PICC into the right pulmonary vasculature gave rise to a rapid and severe onset of respiratory distress (RD) and the infant was thought to suffer from pneumonia. Subsequently the catheter fluctuated into the left pulmonary artery and damaged the upper left parenchyma as well. As a result, the clinical conditions of the infant rapidly deteriorated. A careful examination of the two X-rays showed bilateral consolidation and the catheter tip located first in the right, and then in the left pulmonary artery. The simple maneuver of repositioning the catheter in the superior vena cava brought about a sudden improvement in the infant's clinical condition.

There are two particular aspects of our case that have not been reported previously: the fluctuation of the tip from the right to the left pulmonary artery, and the lung consolidation. The first aspect, involving fluctuation of the tip in the pulmonary vascular tree, was a consequence of migration that shifted the catheter from the insertion point into the vein. The catheter tip reached the heart and then the pulmonary vasculature. As previously reported, this situation may have been caused by physiological arm movement combined with the action of the administration of fluid or frequent flushing (10, 11). The second aspect, involving pulmonary consolidation was the sudden clinical deterioration with changes to the gas exchange which cleared up as soon as the catheter tip was withdrawn. As reported previously (9), malpositioning of the catheter in the pulmonary vasculature can lead to perforation of the wall of the vessel and the bronchus with subsequent pulmonary consolidation because of fluid extravasation into the pulmonary tree. We are inclined to assume that either the hypertonic solution damaged the vessel wall of our patient, giving rise to chemical pneumonitis as suggested by the prompt resolution, or that the opacifications observed on the chest X-ray were caused by extravasation from a hole in the pulmonary artery into the pulmonary parenchyma. As the consolidation of the right upper lobe did not resolve when the catheter tip fluctuated into the left pulmonary vasculature, we must assume that a mechanical obstruction to the pulmonary arterial flow was not the causal pathogenic event. It is assumed that an X-ray was performed on insertion to ascertain the initial position of the tip but this was not repeated after the withdrawal.

We believe that after the initial placement there was an accidental migration into the pulmonary vasculature during the 8-day period, which led to dramatic respiratory deterioration. However during that time there was no change in the total parenteral nutrition contents and the line was flushed with the same drugs as those used previously. We assume that there was a causal relationship between the respiratory deterioration and the catheter malpositioning as the clinical signs promptly disappeared and the gas exchange was restored to normal status soon after withdrawal of the catheter. In our patient the complication did not lead to pleural effusion as in other cases reported previously (9, 10) and the dramatic clinical picture is thought to be attributed to parenchymal damage. The regular assessment of the catheter position is recommended (1, 2, 10). We would like to stress the general recommendation that PICCs should only be used when absolutely essential, after informed parental consent, and with the correct positioning of the tip at the superior-inferior vena cava right atrium junction. Strict monitoring of the tip position should be performed with serial X-rays (1), as to our knowledge, ultrasound accuracy is still debatable. However, as dislocation may occur at any time, strict clinical monitoring in a child with a PICC line is mandatory. Signs of sudden clinical deterioration require an immediate X-ray. Neonatologists should be vigilant for the possibility of dramatic RD deriving from catheter dislocation, as careful monitoring and clinical awareness may reduce morbidity related to PICCs lines.

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