CASE REPORT

Bronchovascular fistula - complication of percutaneous central venous catheter in a neonate

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Abstract

Objectives: to present a case of central venous line misplacement with vasculo-pulmonary fistula and severe respiratory consequences in a newborn. To review the literature concerning respiratory and non-respiratory complications related to the introduction of percutaneously placed central venous lines in children.

Report: evaluative and diagnostic data were described after patient chart review. A premature newborn was admitted in a NICU after delivery for treatment of low-grade hyaline membrane disease and infection manifested afterwards. In the day after the introduction of the percutaneously placed central venous catheter, in order to provide parenteral nutrition, respiratory distress began with rapid progression. Mechanical ventilation was demanded to establish proper gas exchange. The complication was revealed after checking the catheter course using radiographic contrast.

Comments: complications associated with central venous catheter insertion are not rare and infection is the most frequent one. It is essential that the caretakers be aware of the many less frequent ones like vascular thrombosis and catheter misplacement with organ injury and extravascular fluids collections. Only one description related to this kind of complication verified in our patient was found in newborns. This singular characteristic may have resulted in embarrassment for rapid diagnosis. Care related aspects, after catheter insertion, that could make easier the prompt recognition of these complications are emphasized.


Introduction

There is a constant need for long-term venous access in the treatment of premature neonates. Since peripheral venous catheters can be left in place only for a short period of time, central venous catheters have been increasingly used in NICUs. Their advantages are associated with the chance of providing nutritional support through parenteral route, safer administration of fluids, possibility of performing hemodynamic monitoring, and fewer efforts to maintain them in place, avoiding the stress and discomfort caused by repeated punctures. Peripherally inserted central catheters (PICC) have now been used in the treatment of newborns (NB) for almost three decades, especially in premature infants who require long-term venous access for receiving parenteral nutrition. The initial report on the use of PICC in neonates was written by Shaw in 1973.1 Since then, the use
of such catheters in children has been prospectively evaluated; moreover, the efficiency of PICCs in guaranteeing a long-term central venous access has been demonstrated.\(^2\)

The authors describe a case of bronchovascular fistula, with severe consequences for the NB, due to extravascular migration of the PICC (Per-Q-Cath; Bard Access Systems, Salt Lake City, Utah). This complication is extremely rare and, after reviewing the subject, we found only one previous report of arterial-bronchial fistula in newborns (from a branching of the pulmonary artery),\(^3\) which differs from this case, which presents a bronchial-venous fistula (from the superior vena cava).

**Case description**

Premature NB was admitted to the NICU with four hours of life for the treatment of respiratory distress. After a C-section due to preeclampsia, the patient showed an 8/8 apgar score, with gestational age of 35 weeks (by the Capurro method), and birth weight of 2,410 g. The chest x-ray was compatible with mild hyaline membrane disease (HMD). The infant required oxygen therapy (OxyHood), using a low level of \(\text{Fi}_2\) up to the third day of life. On the following day, the patient presented hypoactivity and abnormal leukogram (NT=5,964, NJ=924, rel=0.15). The abdomen was distended; therefore, a partial parenteral nutrition (PN) was initiated through peripheral venous access. The enteral diet, in low volumes, was initiated on the fifth day of life, and PN was suspended on the seventh day. On the eighth day, the newborn presented with perfusion disorder and fever; the chest x-ray revealed right parahilar infiltrate. Parenteral antimicrobial therapy, vasoactiveamines and oxygen inhalation therapy were initiated (OxyHood 0.3). The diet was suspended. Patient did not present gasometric or respiratory abnormalities, and administration of \(\text{O}_2\) was interrupted after 24h. Antibiotic therapy was modified 72hrs later, due to blood culture results (\textit{enterobacter}). On the twelfth day of life, PN was restarted with PICC, introduced on the same day through a cephalic vein. On the following day, respiratory distress and constant falls in oxygen saturation levels were observed. In less than 24 hours, the newborn evolved with respiratory insufficiency, being intubated for mechanical ventilation. Subsequent radiography presented bilateral infiltrates, initially more evident to the left, followed by a diffuse loss of transparency. The echocardiogram was normal. Due to the worsening of the pulmonary status, bronchoscopy was performed on the fifteenth day of life in order to obtain a bronchoalveolar lavage. A high amount of low viscosity fluid, similar to PN, was found in the airways. Thus, a contrast material (Optiray 320) was injected into the venous catheter (PICC), evidencing bronchovascular fistula. Likely diagnoses of lipid pneumonia and iatrogenic pulmonary edema were established. Following catheter withdrawal, a rapid clinical and radiological improvement were observed, with extubation occurring two days later.

**Discussion**

PICC is defined as a catheter that is percutaneously introduced through a peripheral vein until its extremity lodges into a central vein. Peripheral intravenous catheters (Jelco) are relatively easy to be inserted; however, due to phlebitis or infiltration, they need to be frequently changed, imposing a progressive difficulty in finding new sites and keeping accesses available. The administration of fluids and intravenous medications through these catheters may occasionally cause tissue injury, necrosis and, sometimes, intense desquamation of the epidermis.\(^4\)

Success in the insertion of PICC in newborns is lower than in older children. Nevertheless, radiologists using imaging techniques - such as ultrasound and fluoroscopy, to...
guide the insertion of the catheter, may obtain high rates of success, ranging between 67% and 94%, as reported in the literature. Mechanical problems, such as laceration, can occur in 16 to 27%. Dislocation, due to a difficulty in fixing the catheter, and occlusion of the catheter may also occur. Some studies that have assessed the insertion of PICC in children have reported relatively low rates of complication and, comparatively, even lower rates in relation to surgically inserted catheters. However, some severe complications associated with the introduction of this type of catheter have been reported: pleural and pericardial effusion, cardiac tamponade, myocardial perforation, cardiac arrhythmia, migration of the catheter to the brain, vascular trombosis, bacteremia, endocarditis, sepsis, pulmonary embolization following fracture and catheter migration, and pneumonitis caused by PN through pulmonary artery branches.

The main indication for the insertion of PICC is the need of venous access for any period longer than three days. The decision of introducing a PICC in this patient was made based on the necessity of a stable and long-term venous access in order to administer antimicrobial drugs and PN.

Central access is defined by the tip of the catheter lying in the superior vena cava, right atrium or inferior vena cava, above or at diaphragm level. Sometimes, it is not possible to insert the catheter up to a central position, and the tip occasionally remains in brachiocephalic, jugular, axillary, or saphenous veins. This can occur in as much as 33% of punctures. Some reasons for this difficulty include vasospasm, vein tortuosity, or the presence of venous valves. This position (midline) is associated with a higher number of complications, probably due to a combination of factors such as the size of the vessel, venous blood flow, flow turbulence and endothelial lesion. The National Association of Vascular Access Networks recommends that the ideal position of a PICC is the inferior third of the superior vena cava, close to the junction with the right atrium, if peripherally inserted from the head or upper extremity. The position of the catheter tip must be verified through radiological examination (spot); however, we do not know whether such procedure was performed in this case, since nothing was reported in the patient’s medical record. Radiological exams, performed after respiratory abnormalities began to be observed, did not clearly reveal the course of the catheter; nevertheless, this could be solved with the injection of 1 to 2 mL of radiographic contrast material.

Migration of the catheter tip seems to be a relatively common problem, and monitoring, through two weekly radiological exams, is recommended by other authors. A short period of time was observed between the insertion of PICC and the beginning of respiratory symptoms; in addition, radiography with contrast material, performed right after bronchoscopy, revealed a long path between perforation of the superior vena cava and the left lower bronchial lobe. Therefore, we believe that extravascular migration occurred during the procedure of PICC insertion, and not as a result of problems related to the fixation of the catheter. If this actually occurred, we can say that a failure in the performance of the technique recommended for the introduction of PICCs into scalp veins took place. The extension of the part of the catheter to be inserted must be measured from the area chosen for puncture up to two fingers below the sternal notch.

Vascular and bronchial perforations have been previously reported, also with silicone catheters. The only case involving a NB showed that perforations probably occurred in a branch of the pulmonary artery after migration of the catheter and in the right main bronchus. The outcome of this severe complication was positive, immediately after the catheter was withdrawn, as verified by us.

The rapid clinical and radiological resolution does not reinforce the hypothesis of lipid pneumonia following an unadvised endobronchial administration of lipid emulsion. The performance of a computed tomography could be useful for demonstrating the typical low density consolidations, with negative Hounsfield units, indicating the presence of lipid deposits.

The use of PICCs is increasingly more frequent in ICUs, in cases when peripheral veins are not visualized or palpated, after unsuccessful peripheral punctures, and in situations requiring long-term venous access. Verification of the position of the catheter tip, immediately after puncture and during the time it remains in the vein, could avoid this type of complication, or allow the early identification of migration or effusion, leading to the adoption of appropriate measures.

References


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