Title:
The mysterious pleural effusion...

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Pleural effusion: a saphenous CVC complication.

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**The mysterious pleural effusion ...**
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**Abstract**

Central venous catheter placement for long term total parenteral nutrition is a well established practice. Considering the number of placed lines, serious complications are rare, but may be life threatening. We report the case of a 6 months-old infant on total parenteral nutrition since neonatal period, as a consequence of severe intestinal insufficiency secondary to extensive intestinal resection for necrotizing enterocolitis. The child was admitted to the intensive care unit with respiratory failure due to bilateral milky pleural effusion seventeen days after placement of a left internal saphenous line. Pleural effusion analysis was suggestive of chylothorax, with high triglyceride (722mg/dL) and low cholesterol (<20mg/dL). Persistence of pleural effusion, despite adequate treatment, drew attention to other diagnostic hypothesis. Considering that parenteral nutrition solution used is cholesterol-free and the child complained of pain when administered bolus through the catheter, the hypothesis of misplacement of the central venous catheter became more likely. Computed tomography scan after contrast administration through the catheter, revealed its presence in the epidural space and the ascending route reaching the pleural space. When parenteral nutrition was stopped the pleural effusion resolved. At the present time, with two years of follow up, the child does not have any complication of this event.

This is, to our knowledge, the first reported case of an infant developing bilateral pleural effusion secondary to misplacement of a left internal saphenous catheter.
**Introduction**

Central venous access for long-term total parenteral nutrition (TPN) is the standard practice in cases of intestinal failure (1). Central venous catheter (CVC) placement is associated to several complications - namely due to aberrant catheter’s course (1). Misplacement of CVC has been associated with problems of local toxicity, perforation and venous thrombosis (2). Femoral catheterization has a higher incidence of mechanical complications than other CVC locations and some of them are unusual and potentially fatal (2). We report a previously undocumented complication following the malpositioning of the CVC in the left ascending lumbar vein.

**Case Report**

A six month old infant, ex-preterm of 31 weeks with intestinal insufficiency secondary to necrotising enterocolitis, under total parenteral nutrition at home, was admitted for placement of a new CVC. A 4.2 Fr. Broviac® catheter was easily placed into the left saphenous vein by cut-down technique. The position of the catheter was verified, by abdominal anteroposterior radiograph, as being in the inferior vena cava, at the level of the fourth-lumbar vertebrae and it was well functioning. Seventeen days after CVC placement the infant developed irritability, progressive respiratory distress with bilateral decreased breath sounds, with no other accompanying signs and symptoms namely fever. Anteroposterior thoracic radiography and thoracic ultrasound disclosed a bilateral pleural effusion (Fig.1). The infant was transferred to the Pediatric Intensive Care Unit (PICU) where bilateral pleural drainage was placed. Pleural effusion analysis suggested chylothorax [lipemic, pH 8.0, density 1005, glucose concentration 122mg/dL and protein 3.2mg/dL, LDH 168 U/L, triglyceride 722 mg/dL, cholesterol <20mg/dL, cells 2000/mm³ (Neutrophils 20%; Linfocytes 9%; Eosinophils 71%)]. Persistence of pleural effusion, despite adequate treatment (including octreotide), drew attention to other diagnostic hypothesis. It was noticed that the infant progressively complained of discomfort coincident with boluses of medication through the catheter,
which did not allow blood withdrawal. Furthermore, the lipidic solution used does not have cholesterol in its composition, so it could be part of pleural effusion. These facts raised the hypothesis of CVC misplacement and the interruption of its use led to the rapid disappearance of pleural drainage. Echodoppler documented the intravascular location of the proximal catheter’s portion. Computed tomography (CT) scan (Fig.2) after administration of contrast through the catheter revealed the catheter tip at L5 level in the left ascending lumbar vein; the presence of contrast in the epidural space, epidural venous plexus and venous plexus surrounding nerve roots; and the ascending route of contrast until it passes through the intervertebral foramen accompanying nerve roots and reaches the pleural space at upper thoracic level. The CVC was removed and the infant was discharged from PICU eight days later.

At the present time, with two years and a half of follow-up the child as a neurodevelopment adequate for age and does not have any complication related with this event, namely neurological.

Discussion

This case report describes bilateral pleural effusion as a previously unreported complication of femoral CVC misplacement.

In the reviewed literature, there are at least 13 cases described of patients with lower extremity CVC malpositioning into the epidural venous plexus, whose complications include venous stasis, thrombosis, vasculitis, increased pressure in the spinal canal and spinal cord injury (7). None describe pleural effusion as a complication. Usually pleural effusion is a complication of subclavian catheterization (3).

Rubin et al, describe a case of an infant who developed severe lung disease presumably as a consequence of perfusion of TPN directly into the lung parenchyma, as consequence of malpositioning of a left brachial vein CVC (11). In our case, the child does not have nor had any respiratory sequelae directly attributed to this intercurrence.
As described in literature, this report demonstrates that even with careful checking of catheter’s position at time of placement, displacement or migration can still occur, usually within the first eleven days (6) (7). Signs and symptoms can vary from non-specific, suggestive of sepsis, difficult blood withdrawal, respiratory distress, neurological deficits due to elevated cerebrospinal protein, glucose and lipid in a patient receiving central venous hyperalimentation (1) (7) (8). Our patient developed symptoms of respiratory distress and difficult blood withdrawal seventeen days after placement. A high index of suspicious is needed to alert a physician to this rare type of complication (6). Post procedure films should be performed to check for complications and misplacement, however, congenital or acquired anatomic variations can difficult the radiologic interpretation of the tip’s location (2). In our case the infant had a post surgical anatomic variation. Anteroposterior and lateral view roentgenograms are a useful means of diagnosing the malpositioning of CVC in the inferior vena cava (6) (7). When plain roentgenogram suggests an aberrant route (subtle lateral deviation of the catheter at the level of L4-L5 and catheter path directly over the vertebral column, rather than to the right of midline) a contrast study is indicated (4) (7). In our case, the anteroposterior roentgenogram and ecodoppler were misleading. Contrast-CT was performed revealing the catheter tip at L5 level in the left ascending lumbar vein and contrast in the epidural space, epidural venous plexus and venous plexus surrounding nerve roots. Contrast took an ascending route, passing through the intervertebral foramen accompanying nerve roots and reaching the pleural space at upper thoracic level.

We can only speculate on the mechanisms of this rare complication. Properly placed CVC into the left saphenous vein ascend via the left iliac vein, impending to the right midline at L4-L5 level, and ascend in the inferior vena cava (7). However, the catheter can deviate posteriorly due to anatomic proximity of the ascending lumbar vein. Passive venous dilatation caused by decreased intra-abdominal and intra-thoracic pressure can force the inadvertent deflection into this location (1; 5). Some authors relate this event to obstruction or thrombosis of femoral vessels as it increases blood flow through the paravertebral plexus, which may displace the tip of the catheter from its
proper place. Neither superior vena cava nor inferior vena cava obstruction was found in our patient, however, post surgical anatomic variations may have caused a decrease in intra-abdominal-pelvic pressure and determine differences in venous drainage route. Significant predominance of left sided paravertebral catheter malposition (10:1) indicates that ascension into the ascending lumbar vein is more likely to occur on the left side (10). The left ascending lumbar vein is longer and more oblique in direction, compared to the right common iliac vein, which is shorter and almost vertical (8). Additionally, the angle formed by the joining ascending lumbar vein is less acute on the left side and consequently the left ascending lumbar vein is more prone to aberrant passage of an ascending catheter (8). Ascending lumbar veins communicates with lumbar vertebral venous plexus through the intervertebral and lumbar veins (1) (8). The vertebral venous system parallels the caval system and during periods of increased intra-abdomino-pelvic pressure, blood flows through the vertebral plexus rather than through the inferior caval system (1), as happened to our patient. The internal vertebral plexus form a continuous network between the dura mater and the walls of the vertebral canal (6). Because these vessels are so thin walled, it is likely that the catheter, having passed into the ascending lumbar veins, entered the intervertebral veins, ruptured its wall, thereby lodging in the epidural space (6). Another explanation would be that after a period of TPN infusion, endothelial damage and ultimately rupture would overcome, releasing TPN into the epidural space (8). In our case, we could not determine for sure the exact mechanism, but we could document the presence of contrast in all length of epidural space. As shown in picture 2 contrast passed from epidural space through the intervertebral foramen to pleural cavity at upper thoracic level. In regards to the mechanism we can only speculate. The child may have a specific anatomic characteristic that at this level facilitates the passage of contrast to pleural cavity accompanying nerve roots.

At the present time, with 2 years and a half of follow up the child does not have nor had any complication related with this event.

Conclusion
Inadvertent placement of CVC into the ascending lumbar vein during cannulation of the inferior vena cava is a rare complication, but much more likely to occur with a line sited via the left lower limb. Unrecognized misplacement of the catheter may be herald by a variety of unspecific symptoms. We describe, to our knowledge, the first case of a patient who developed bilateral pleural effusion secondary to misplacement of a left internal saphenous catheter. Early investigation is imperative if any doubt subsides regarding the CVC placement. Anteroposterior and lateral radiographs of the abdomen are useful means to ascertain catheter position. Every misplaced catheter should be replaced or removed immediately.

Figure 1 – Thoracic Radiograph – Right pleural effusion; bilateral pleural drainage.
Figure 2 – CT scan

a) Lateral left deviation at L4-L5 level of catheter route.
b) Contrast in epidural space.
c) Contrast passing through the intervertebral foramen.
d) Contrast in pleural space.
e) Contrast in epidural space and vertebral plexus surrounding the vertebral body of a low thoracic vertebra.

Bibliography


