Bilateral pleural effusions following central venous cannulation

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ABSTRACT
We describe a patient who developed bilateral pleural effusions as a delayed complication following central venous catheter insertion. Respiratory distress should not only raise the clinical suspicion of a pneumothorax but also of erosion and perforation of the central vein. The mechanism, diagnosis, management and prevention of this complication are discussed.

This case highlights a rare but significant complication of central venous catheters (CVC). It is therefore important to recognize that despite correct initial placement of the CVC, late complications may still occur. Specifically, this case demonstrates a deterioration of the patient’s condition due to erosion and penetration of the CVC tip through the superior vena cava several days later. Therefore, in the presence of a new onset pleural effusion, clinicians need to have a high index of suspicion of this complication.

Case History
A 20-year-old female with relapsing acute myeloid leukemia, was admitted for total body irradiation and bone marrow transplantation. Prior to commencement of treatment, a CVC (Kimal and Arrow International™, Middlesex, UK) was inserted via a left subclavian vein approach, using the Seldinger technique. Following insertion, blood was freely aspirated and good forward flow was tested to ensure no resistance to flow. In addition, a postprocedural chest radiograph confirmed satisfactory vertical catheter tip positioning in the superior vena cava (SVC).

Cyclophosphamide chemotherapy was subsequently started and it proceeded uneventfully until four days later when the patient complained of chest pain and breathlessness. A total volume of 7000 ml (a combination of cyclophosphamide infusion and continuous normal saline infusion) had been administered. A chest radiograph demonstrated a large right pleural effusion, a widened mediastinum but no pneumothorax. The CVC tip was noted to be displaced and located within the mediastinum. A computed tomography (CT) of the chest demonstrated a mediastinal fluid collection, bilateral pleural effusions and the CVC tip lying within the right pleural space [Figure 1]. The CVC was removed via a standard well-described right common femoral venous approach. A chest drain inserted into the right pleural space and a needle thoracocentesis of the left pleural space, yielded two liters of straw-colored fluid with biochemical content consistent with 0.9% normal saline. The patient’s symptoms resolved following thoracocentesis.

Discussion
This case illustrates that despite initial correct CVC placement, a complication of pleural effusion became evident four days later, secondary to CVC tip erosion through the SVC, even in the absence of any specific risk factors. The CVC displacement may have potentially lethal complications but clinicians’
The tip of CVC should be within the SVC, above the pericardial reflection, to reduce the risk of vessel perforation and cardiac tamponade. Despite advances in technique and design, CVC erosion remains a rare but significant clinical problem. Clinical manifestations vary with the size and speed of onset of the pleural effusion, usually related to cardio-respiratory compromise.

The content of the left pleural effusion was identical to that of the right suggesting either a congenital interpleural communication or fluid dissipation through the mediastinum from one pleural space to the other. The pleural fluid contained no red blood cells. Thus is surprising but plausible that a thrombus formed around the erosion site may have prevented any clinically evident hemorrhage.

Numerous factors influencing the risk of perforation have been described. Stiffer catheters and those with excessively mobile tips are reported to increase the risk of vessel perforation. The angle formed by the catheter tip and the vein wall is important, the more perpendicular the angle, the greater the risk of perforation. Left-sided catheters themselves pose a particular problem as the left brachiocephalic vein forms a near right angle with the SVC, increasing the risk of impingement. High-pressure fluid infusion is also a risk factor. It is likely that some perforations are secondary to guide wire or dilator trauma, particularly when complications occur soon after insertion.

Vessel perforation should be suspected if there is a curved appearance of the distal catheter, an atypical catheter course, pneumothorax, mediastinal widening, pleural effusion, hemothorax or pneumomediastinum. CT would be diagnostic.

Several lessons can be learnt from this case. Firstly, the left side approach should be avoided but if required, the CVC should be advanced far enough into the SVC so that it lies parallel with the vessel wall. Secondly, any unexplained respiratory deterioration must arouse suspicion of catheter erosion and clinicians should recognize the development of a pleural effusion as a potential delayed complication, days after apparently successful CVC placement. Early evaluation by pleural aspiration or drainage is both diagnostic and therapeutic. The use of ultrasound guidance for CVC placement is supported by meta-analysis which suggests a significantly reduced failure rate of cannulation, decreased need for multiple attempts, more rapid access and reduced complications during insertion. However, the use of ultrasound would not have prevented the particular complication described.

References


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