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CASE REPORT

Delayed pneumothorax and hydrothorax with central venous catheter migration

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Summary

We report a case of delayed pneumothorax, central venous catheter migration and iatrogenic hydrothorax in a 22-year-old female. The left subclavian central venous catheter initially transfixed the lung apex; pneumothorax occurred 24 h later following initiation of positive pressure ventilation. Lung collapse as a result of the pneumothorax caused catheter migration and hydrothorax. Catheter removal and chest drainage led to an uneventful recovery.

Keywords *Complications*; delayed pneumothorax, hydrothorax. *Veins*; subclavian, cannulation.

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Pneumothorax is a well-recognised complication of central venous cannulation, occurring in up to 3% of cases, depending on the experience of the operator [1, 2]. Routine chest radiography following insertion may not initially demonstrate any pathology [3]. We report a patient whose initial chest radiograph was normal following insertion of a left subclavian central venous catheter. Subsequent pneumothorax formation associated with lung apex transfixation by the catheter led to catheter migration and iatrogenic hydrothorax. A Medline search of the last 20 years did not reveal any similar cases.

Case history

A 22-year-old female was admitted postoperatively to the intensive care unit with biventricular failure following left thoracotomy and pericardial window for pericardial effusion.

To facilitate haemodynamic monitoring and inotropic support, a 7 French 20 cm triple-lumen central venous catheter was inserted over a 0.83 mm spring guidewire passed through a 6.35 cm 18 G needle, via a left subclavian approach. The left subclavian vein was punctured at the first attempt, and no technical problems were encountered. Blood was freely aspirated from all three ports and a normal central venous pressure tracing was obtained. An initial chest radiograph showed the catheter in an acceptable position in the superior vena cava with no evidence of pneumothorax.

As a result of deterioration in the patient's condition, tracheal intubation and intermittent positive pressure ventilation were undertaken the following day.

A chest radiograph taken 2 days after the initial central line insertion showed a small apical left pneumothorax which was not causing any clinical compromise (Fig. 1). The following day the patient had worsening gas exchange and a chest radiograph taken at this time indicated a large, left pleural effusion with an enlarged area of pneumothorax. The central venous catheter was noted to be looped in the thoracic cavity. Its tip had migrated distally within the superior vena cava (Fig. 2). Pressure transduction of the distal catheter lumen demonstrated a normal central venous pressure tracing.

The central venous catheter was removed and an apical intercostal catheter inserted, which drained milky fluid. Propofol had previously been infused through the proximal catheter port. The effusion subsequently cleared, lung expansion returned to normal and the patient made an otherwise uneventful recovery.

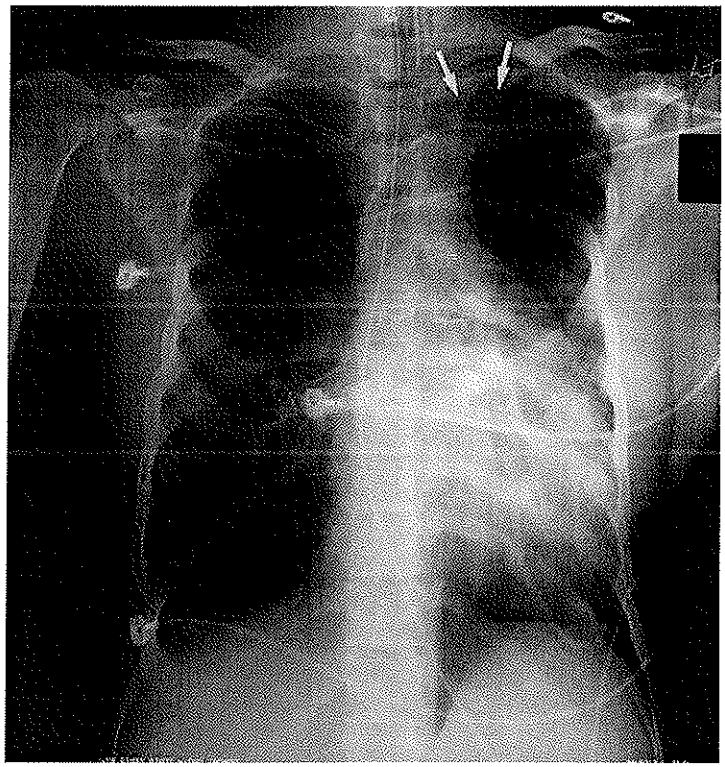

Figure 1 Chest radiograph taken 2 days after left subclavian central venous catheter insertion. A small apical pneumothorax is present (arrows).

Discussion

This case illustrates an interesting complication of subclavian central venous catheter insertion by an unusual mechanism. In retrospect, the initial 'uncomplicated' catheter insertion involved transfixation of the apex of the left lung during its passage into the subclavian vein. This allowed slow development of a pneumothorax associated with lung collapse. Since it was transfixing the lung apex, the cutaneously fixed catheter was progressively drawn out of the vessel lumen into the thoracic cavity as the lung deflated. This continued until the proximal catheter port lay outside the lumen, while the distal catheter ports remained functional within the subclavian vein itself. The extravasation of infused fluids, including propofol, manifested clinically as both progressive deterioration in gas exchange and unexpected difficulties with patient sedation.

With the exception of catheter tip malposition, pneumothorax is the most common immediate complication of central venous catheterisation [4, 5]. Various studies have shown its frequency to be associated with the experience of the operator, more than two needle attempts to enter the vein and failed catheter insertion (when such factors as obesity, previous catheterisation and prior major surgery in the area may be involved) [4, 6, 7]. The case we have described involved none of these risk factors.

Delayed development of pneumothorax following central vein catheterisation is a less commonly recognised yet well-documented complication which can develop days after placement and occurs in ≈ 0.5% of all central venous access attempts [1, 5]. While the diagnosis may be delayed because of poor quality chest radiographs or a small pneumothorax missed on initial perusal of films, a pneumothorax may develop in patients whose initial chest radiographs are normal and of good quality. Often in such situations a slow pleural air leak in association with positive pressure ventilation is thought to be the cause [3, 8]. In the case we have described, the central venous catheter was inserted with the patient conscious and breathing spontaneously, and positive pressure ventilation was initiated 24 h subsequently. The first radiological evidence of pneumothorax was present after a further 24 h.

Catheter tip migration is a common phenomenon following central venous catheterisation, occurring to some degree in ≈ 17% of all percutaneously introduced catheters [9]. Furthermore, secondary malposition to aberrant locations as a result of catheter tip migration has been shown to occur in up to 6% of catheters [10]. However, an extensive review of the literature revealed no other cases of

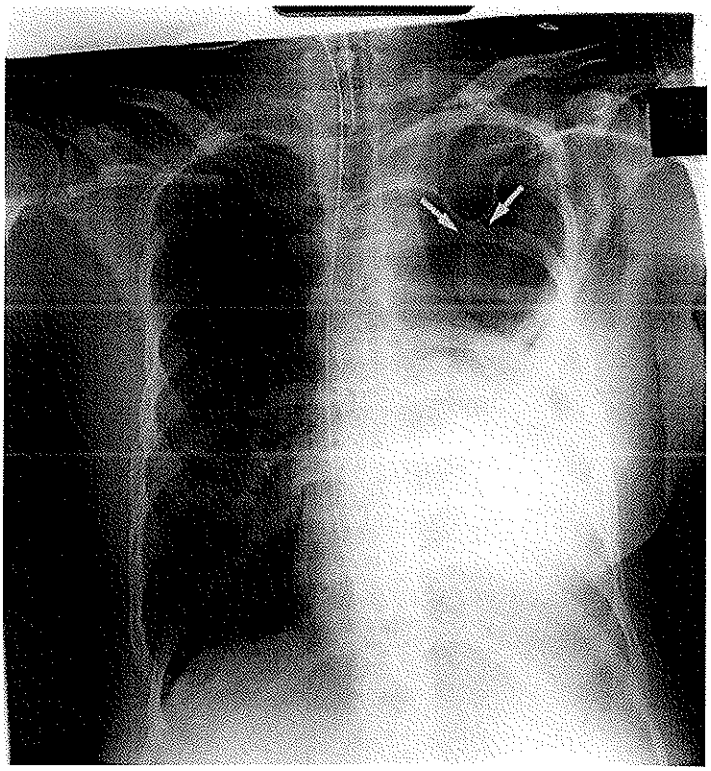

Figure 2 Chest radiograph taken 24 h after the image shown in Fig. 1; the pneumothorax has enlarged, and the lung apex is outlined (arrows). Subcutaneous emphysema and a large pleural effusion are also present. Note the unusual appearance of the central venous catheter.

catheter migration due to catheter retraction by a transfixed, collapsing lung.

Similarly, the onset of delayed hydrothorax has been typically described as a result of initial catheter malplacement [11] or delayed perforation of the vessel wall by the catheter tip [12, 13], rather than extrusion of the proximal catheter port.

In conclusion, while the incidence of delayed pneumothorax following subclavian vein catheterisation is low, it may be associated with significant morbidity. A high index of suspicion should be maintained, especially in patients receiving positive pressure ventilation. Gray *et al.* [14] recommend that chest radiography be routinely performed after insertion of central venous catheters. This case demonstrates that complications from central venous cannulation causing clinical deterioration may be delayed, and that vigilance should be maintained.

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