

# Intrapleural central venous catheter malposition

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## Summary

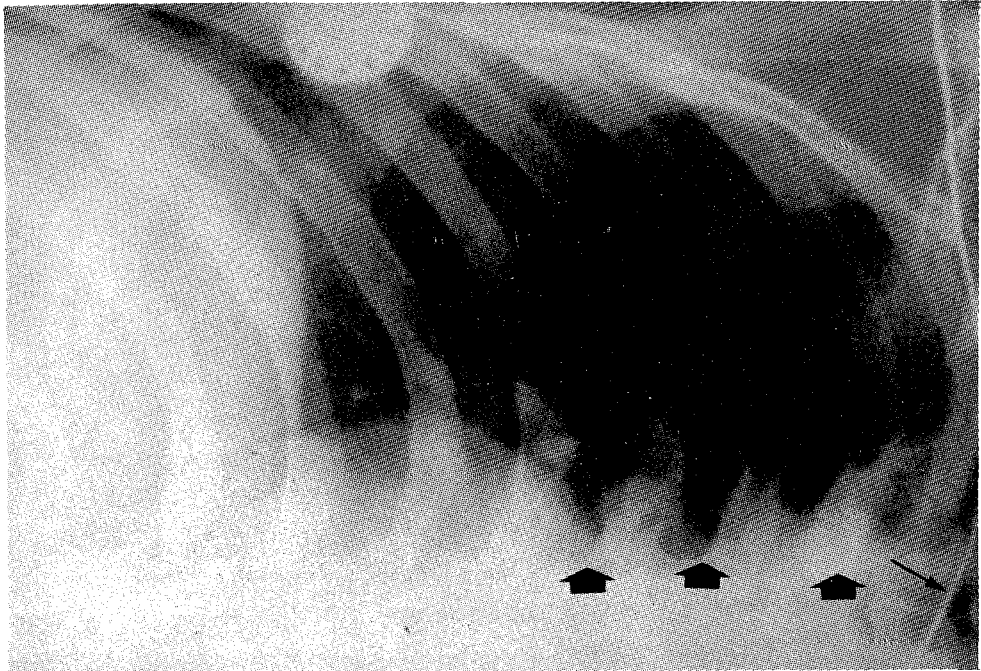
Percutaneous insertion of central venous catheter (CVC) is a valuable procedure in managing critically ill patients. However, placement of CVC is not without its complications. The author reports a case in which a CVC was inserted into the right pleural cavity which was not detected by the usual clinical methods of confirming catheter placement and an antero-posterior (A-P) chest x-ray.

*Key words:* Central venous catheter, malposition

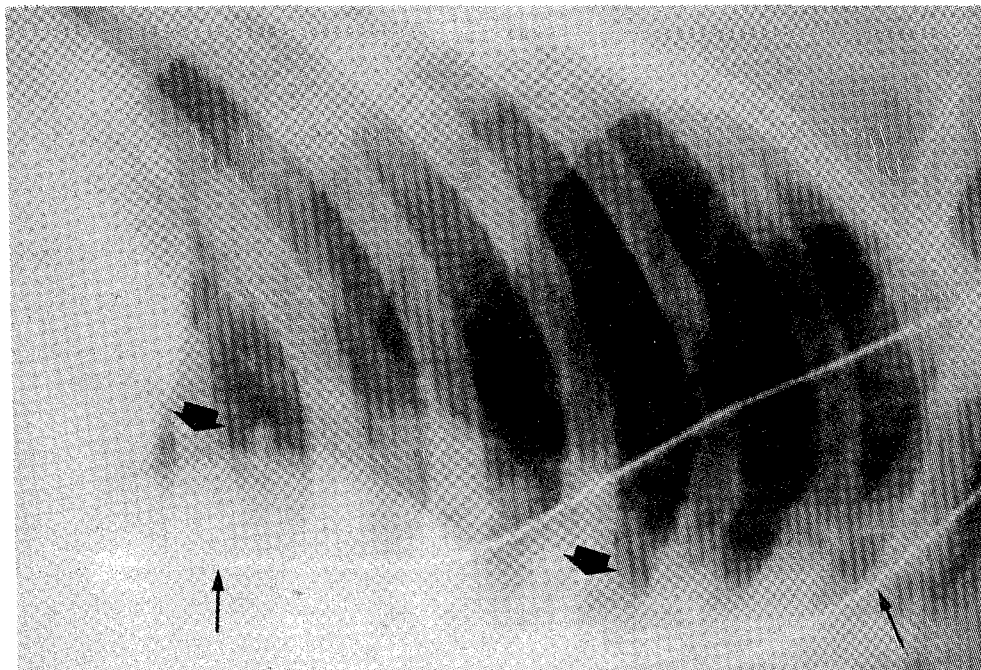
## Case report

A 40 year old construction worker was admitted to the accident and emergency (A and E) department following a fall. He sustained multiple skin lacerations and fractures of his right tibia, left tibia and fibula, pelvis and second lumbar vertebra. He was also paraplegic with sensory loss to pin prick up to L1 level. He was admitted in shock with a blood pressure (BP) of 90/60 mmHg and a pulse rate (PR) of 110 beats per minute. Chest x-ray revealed a right haemothorax for which chest tube was inserted and about 200 ml of blood was evacuated. Because of poor peripheral venous access, the medical officer (M.O) on duty decided to insert a CVC for infusion of fluid and to assess intravascular volume status. A Bardi-Cath catheter (Pennywell Industrial Estate, Sunderland, England SR4 9EW, P. No. 2013, length 30.4 cm) was introduced via the right subclavian vein using an infraclavicular approach. The patient was lying supine with 20 degrees head down tilt and his head was rotated slightly to the left during the CVC insertion. After entry to the vein, a free return of blood back into the infusion tubing was noted by the M.O when the infusion unit was positioned below the patient. Oscillation responding to respiration was also observed, but fast fluctuation synchronous with the pulse was not specifically looked for.

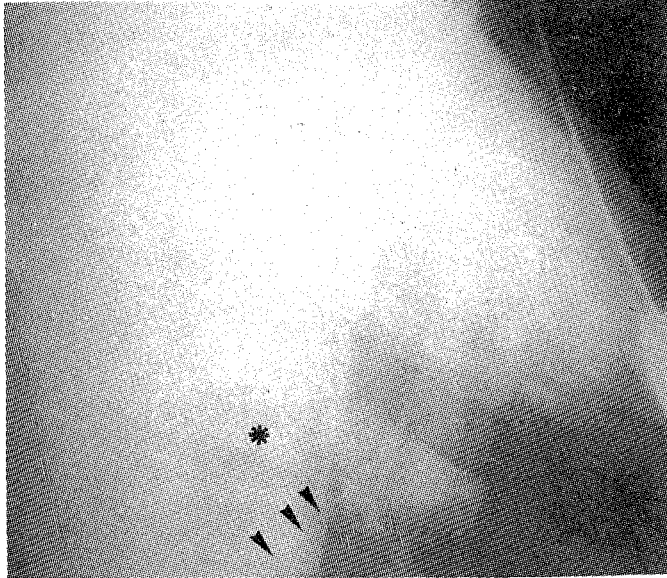
An A-P chest x-ray showed that the CVC was positioned within the vascular shadow (Fig. 1). The initial central venous pressure (CVP) reading was noted to be 2-3 cm of normal saline and 5% albumin infusion was started. While in the surgical intensive care unit (SICU), his BP remained at 90 systolic despite infusion of 5% albumin and normal saline to a total of 1,000 ml through the CVC. At the same time, the chest tube drainage was also noted to be increasing rapidly. However, the quality of blood draining from the pleural cavity was noted to be very diluted. The right atrial wave form was not seen when the CVC was connected to a transducer. In view of these findings, repeat chest films were done and these showed that the tip of the CVC was outside the vascular shadow (Fig. 2, 3). The chest tube drainage subsided following the removal of the CVC.



**Fig. 1** Portable anteroposterior chest x-ray showing the course of the central venous catheter (broad arrows) lying within the shadow of the lateral border of the superior vena cava, the catheter tip cannot be seen clearly in this x-ray. The thin arrow indicates the ECG cables.



**Fig. 2** Portable anteroposterior chest x-ray showing the tip of the central venous catheter (indicated by the lower broad arrow) is lying outside the cardiac shadow, the thin arrows indicate the ECG cables.



**Fig. 3** Portable right lateral chest x-ray showing the tip of the central venous catheter overlying the body of the 8th thoracic vertebra. The asterix indicates the 7th thoracic vertebra.

## Discussion

The most common complication of subclavian venepuncture is pneumothorax. This has been reported to occur with an incidence of 30% of all complications.<sup>1</sup>

The patient had a CVC introduced into his right pleural cavity but had no symptoms and signs of pneumothorax. This could have been due to the following reasons:

- a) Only the parietal pleural was lacerated and air was not introduced into the pleural cavity.
- b) The lung was lacerated but the chest tube inserted earlier to drain the haemothorax evacuated the air present in the pleural cavity. However, laceration of the lung was not likely as subsequent monitoring of the drainage from the pleural cavity showed no evidence of air.

The misplacement of the CVC was not recognised at the time of insertion because of the following reasons:

- a) This patient did not present with a symptomatic pneumothorax or subcutaneous emphysema.
- b) The M.O noted blood refluxed into the infusion tubing when the infusion unit was positioned below the patient. This blood was probably from the residual blood in the pleural cavity.
- c) The M.O also noted oscillation of the normal saline column responding to the patient's respiration, an indication that the CVC tip was positioned in the thoracic cavity. The smaller amplitude higher frequency cardiac oscillation produced by cardiac ventricular action<sup>2</sup> was however, not looked for.

d) A-P chest x-ray showed that the CVC was placed within the vascular shadow (Fig. 1).

A persistently low BP despite fluid infusion and an increasing chest-tube drainage could imply severe intrathoracic hemorrhage requiring exploratory thoracotomy. However, the quality of the chest tube drainage was very diluted. This together with the failure to reproduce the right atrial wave form from the CVC, aroused the suspicion that the CVC may not be placed in the superior vena cava (SVC) or right atrium. A repeat A-P and lateral chest x-ray (Fig. 2, 3) confirmed the suspicion. In retrospect, perhaps the addition of methylene blue into the CVC or simultaneous measurement of haematocrit from the chest tube drainage of the patient might have revealed the diagnosis. Simple bedside manoeuvres such as noting reflux of blood and oscillation responding to respiration, though useful, cannot be relied upon as definitive evidence for proper CVC placement. More sophisticated methods such as observing the right atrial wave form and intravascular electrocardiogram are not usually available in most A and E departments. Chest x-ray has been advocated as the only certain method of identifying the course and tip of the CVC in many studies.<sup>3,4</sup> However, the first A-P film (Fig. 1) of this patient did not indicate that the CVC had extravasated. A lateral chest film is not routinely ordered following insertion of CVC.

It has been recommended that if a subclavian or low internal jugular venepuncture is planned in a patient with a pre-existing pneumothorax and/or underwater chest drain on one side, one should perform the venepuncture on that side.<sup>2</sup> This author agrees with the recommendation. However, this case illustrated some pitfalls with insertion of CVC into the side of chest with a haemothorax. One should not only rely on blood refluxed into the infusion tubing and oscillation responding to respiration as definitive evidence for proper CVC placement; even an A-P chest film could be misleading. One should be more vigilant during the insertion CVC as in this situation and confirmation of proper placement should include chest x-ray and reproducing the right atrial wave form with a transducer.

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