

Case report

Iatrogenic hydrothorax complicated by reactive pleural effusion

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Central venous catheterization, an everyday procedure in intensive care units, has a number of well recognized complications.¹ Venous wall perforation resulting in hydrothorax is unlikely when the right internal jugular vein is cannulated by an experienced operator using a J-tipped guide wire and the Seldinger technique.² If perforation of the vein does occur, complications within the chest cavity can result in considerable morbidity, or death.^{3,4} We report the result of propofol and atracurium infusion into the chest cavity and discuss factors related to malplacement of the venous catheter.

CASE REPORT. Following a neurosurgical operation an 80 kg caucasian male aged 17 years was electively hyperventilated. To facilitate anaesthesia and monitoring of cardiac filling pressure, a right internal jugular central venous catheter was inserted using the Seldinger technique and J-tipped guide wire. Although slight resistance was reported when the guide wire was inserted, and radiologically the catheter tip was positioned in an abnormal position (Fig 1), venous blood was readily aspirated from all ports of a 7FR triple lumen polyurethane catheter, and infusion of anaesthetic agents was commenced. In addition it was noted that a major problem, probably related to aspiration at the time of neurosurgical trauma, had occurred in the left chest. Initially high infusion rates of propofol (200 – 400 mg/hr) and atracurium (150 – 250 mg/hr) were required to facilitate ventilation. A total of 1800 ml was infused. Morphine was then infused peripherally at 3 – 7 mg/hr.

Haemodynamically the patient remained stable but oxygenation deteriorated over nine hours, pulmonary arterial oxygen concentration falling from 280 mmHg to 91 mmHg despite the fraction of inspired oxygen being 80% (FI O₂ 0.8) and the use of positive and expiratory pressure (PEEP). Bronchial lavage was undertaken using a fiberoptic bronchoscope to treat left basal collapse. Oxygenation improved and the left lung re-expanded after evacuation of multiple small clots and then the

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catheter tip was partially withdrawn. Repeat X-ray then showed full re-expansion of the left base but persistent abnormal catheter tip position. In addition, the right pleural cavity demonstrated diffuse opacity which was consistent with fluid within the pleural space (Fig 2). Throughout, central venous pressure remained normal.

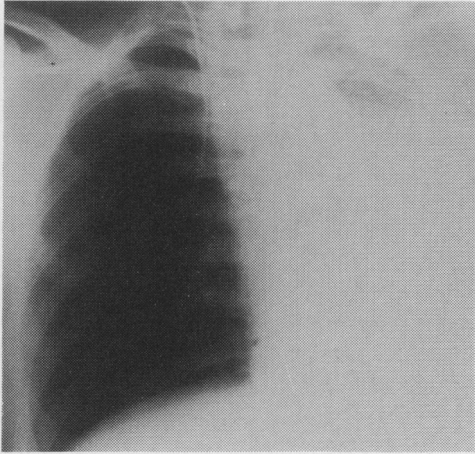


Fig 1. Initial chest X-ray. Note the position of the catheter is outwith the 'cannula tip positioning zone' in the right chest. The left side indicates collapse of the left base and possible effusion most likely related to aspiration in the bronchial tree.

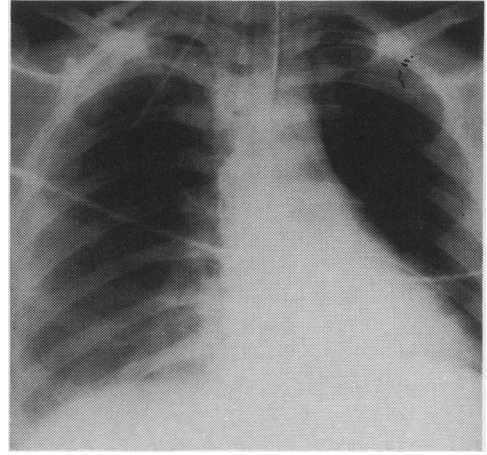


Fig 2. Subsequent to bronchoscopic aspiration of the left tracheobronchial tree and improvement in the left chest. Withdrawal of the cannula tip now shows it clearly in an abnormal position. Note the absence of any clear radiological sign of fluid in the right chest cavity — nine hours after insertion of the cannula and infusion of 1900 ml of fluid.

At 24 hours, further X-ray confirmed a right-sided hydropneumothorax on the same side as the venous cannula. This was associated with further deterioration in peripheral arterial oxygen tension to 143 mmHg despite increasing the inspired oxygen concentration to 90% and continued use of positive and expiratory pressure of 2.5. The central venous catheter was removed and propofol and atracarium were subsequently infused peripherally. Tube thoracostomy immediately drained 1900 ml of bloodstained fluid containing propofol and atracarium of similar volume to that infused. This allowed the right lung to re-expand and arterial oxygenation improved.

Over the subsequent 72 hours a total of 500 ml straw-coloured pleural effusion was evacuated. The effusion was found to be an exudate protein 3.7 g/l and neither it nor cultures from the tips of the central venous line or chest drain produced bacterial growth. Subsequently the chest drain was removed without further complication and, following tracheostomy, the patient was returned for long-term care to the neurosurgical unit.

DISCUSSION

A number of important points can be made from this case in which propofol and atracarium were inadvertently infused into the right chest cavity as a result of malplacement of a right internal jugular venous cannula.

Three consecutive clues could have suggested that the cannula was incorrectly placed. On insertion, a sensation of resistance indicates the need for replacement of the cannula. The withdrawal of blood does not guarantee correct placement because the most proximal portal may be inside the vein, allowing withdrawal of blood while the distal tip is outside the wall. Movement of a patient from the prone to supine position may result in sufficient movement of the tip to take it on through the wall. The X-ray taken to confirm the position of the catheter showed that the tip lay outside the 'catheter tip positioning zone'⁴ and neck flexion and extension can move this between 1.5 and 3 cm. It is generally agreed that the tip should lie 3–4 cm above the superior vena cava, but the position in the present case was deemed acceptable since venous blood was readily aspirated even after initial suspicion had been aroused. At this time, attention was drawn to the significant complication in the left lung which was thought to be the major problem. The third clue came from the abnormally high dose of propofol and atracarium required to facilitate ventilation, and despite dealing with the major complication in the left lung, the arterial oxygen saturation did not improve as expected. Withdrawal of the cannula by several centimetres at this point still allowed venous blood withdrawal, and although the X-ray now showed a clearly abnormal position, there was no obvious sign of collapse or effusion into the right chest cavity. All the X-rays were taken in the supine position, and since up to 500 ml fluid can accumulate without detection on chest films, this delayed the diagnosis even further.

The effects of propofol and atracarium within the pleural cavity have not previously been reported. The thoracic surgeon should be aware of the potential problems, and removal of the offending fluid and re-expansion of the lung may not be enough. Despite being regarded as innocuous to endothelial cells when given intravenously, this combination of agents resulted in an exudative inflammatory process within the chest cavity. Infusion of hyperosmotic fluids, such as used in parental nutrition, can result in pulmonary oedema, chest wall abscess and recurrent pleural effusion⁴ which may mandate continued drainage of the chest after the volume of the infused load has been removed.

There should always be a high index of suspicion for incorrect placement of venous catheters despite distraction by apparently more obvious and pressing complications elsewhere in the chest.

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