

## Right Hydrothorax after Left External Jugular Vein Catheterization

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Hydrothorax is a known complication of central venous catheterization. In the past year, we observed four patients who developed *right* hydrothorax secondary to central venous catheters inserted through the *left* external jugular vein (ejv). The history of one of these patients serves to illustrate this complication and the associated clinical features.

## REPORT OF A CASE

A 66-year-old woman was scheduled for abdomino-perineal resection of the colon for carcinoma of the rectum. She had hypertension and hypothyroidism for which she received furosemide and thyroid supplement. She had no history of pulmonary or cardiac disease. Prior to induction of anesthesia, a 14-gauge, six-inch Teflon† catheter was inserted into the left external jugular vein over a J wire which had been advanced into an intrathoracic vein using the Seldinger technique<sup>1</sup> as described by Blitt *et al.*<sup>2</sup> The catheter was connected to a pressure transducer, and the appropriate central venous pressure waveform was obtained. The patency of the catheter was maintained by intermittent injections of heparinized saline, 2 units/ml. During the surgical procedure, all fluids were given through a peripheral intravenous catheter. When the patient was discharged from the recovery room, 5% dextrose in water was infused through the CVP catheter at 30 ml/h. A portable chest roentgenogram taken on the evening of surgery revealed that the CVP catheter extended across the midline from the left innominate vein into the superior vena cava. Later that night the peripheral intravenous line infiltrated and maintenance fluids were infused through the CVP catheter. During the next 22 hours, the patient received 2,750 ml of 0.45% sodium chloride with 5% dextrose and 500 ml of fresh frozen plasma via the central catheter. Fluid flowed readily through the catheter only when the patient's head was rotated to the right. The central venous pressure measurements were taken by water manometer and respiratory oscillations were present. Although the central venous pressure was 8 cmH<sub>2</sub>O, urine output decreased. Late in the afternoon of the first postoperative day, the patient developed an expiratory grunt but was not dyspneic. That evening she became tachypneic and dyspneic. Supplemental oxygen was given via a mask and analysis of arterial blood gases showed a PaO<sub>2</sub> of 85 mmHg, pH<sub>a</sub> 7.26, and PaCO<sub>2</sub> 51 mmHg. A chest roentgenogram revealed a large right pleural effusion. A right tube thoracostomy was performed and 2,200 ml of semi-clear fluid was evacuated.

The CVP catheter was then removed. Over the next 24 hours, an additional 1,500 ml of fluid were drained from the right chest. The chest tube was discontinued after two days and the patient was discharged on the twelfth postoperative day.

## DISCUSSION

Two types of complications of central venous catheterization have been reported.<sup>3</sup> One results from the method of the catheter insertion and the other from the presence of an indwelling venous catheter. The complication that we are reporting is an example of the latter type.

All four patients who developed right hydrothorax secondary to CVP catheters inserted in the left ejv had the following features in common: six-inch catheters were used; all catheters functioned properly in the intraoperative period and the hydrothorax did not develop until 24–48 hours after insertion; the chest roentgenogram showed that the tip of the catheter was positioned at the junction of the left innominate vein and the superior vena cava and the terminal portion of the catheter was in a transverse position (fig. 1). We believe that this position contributed to the erosion of the vein since the tip of the catheter was perpendicular to the right lateral wall of the superior vena cava. This caused the catheter tip to be pushed repeatedly against the wall of the vein by respiratory and cardiac motions and movement of the head and neck. Fisher and Scherz<sup>4</sup> showed that flexion of the head of infant cadavers advanced catheters 2 to 6 cm. Lingefelter *et al.*<sup>5</sup> reported a caudal displacement of the tip of CVP catheters from the right atrium to the right ventricle by flexion of the neck.

The tip of the central venous catheter should be within a major intrathoracic vein to permit valid pressure measurements but positioned in a way to minimize venous or cardiac perforation. Blitt *et al.*<sup>2</sup> reported that 90% of the 5.5-inch catheters inserted through the left ejv reach the superior vena cava, while Belani *et al.*<sup>6</sup> demonstrated that 100% of the same length catheters were located in the left innominate vein. These differences can be explained by a variation in the site of the vein puncture or in the length of the necks of the patients.<sup>6</sup> Our experience agrees with Belani, and we now use an 8-inch catheter for the left ejv CVP. This longer catheter allows the tip to turn caudally and remain in

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† duPont trademark.

the superior vena cava without abutting the venous wall (fig. 2).

In all of our patients, the hydrothorax was caused by the infusion of fluids and not by extravasated blood. Apparently, the slow perforation of the venous wall by the catheter caused hemostasis so that hemothorax did not occur.

Because of the complication encountered in four patients having left ejv CVP catheters, we believe an 8-inch catheter should be used for adults, although the length to be inserted is dependent on the patient's height and site of venipuncture. A chest roentgenogram should be taken as soon as clinically feasible to insure that the catheter tip is in a satisfactory position. Intravenous fluids should not be administered through the CVP catheter without verification that the tip is intravascular by free aspiration of blood. In patients with CVP catheters who develop respiratory distress or signs of pericardial tamponade or hypovolemia in spite of a normal or increased central venous pressure, vascular perforation by the catheter should be considered.

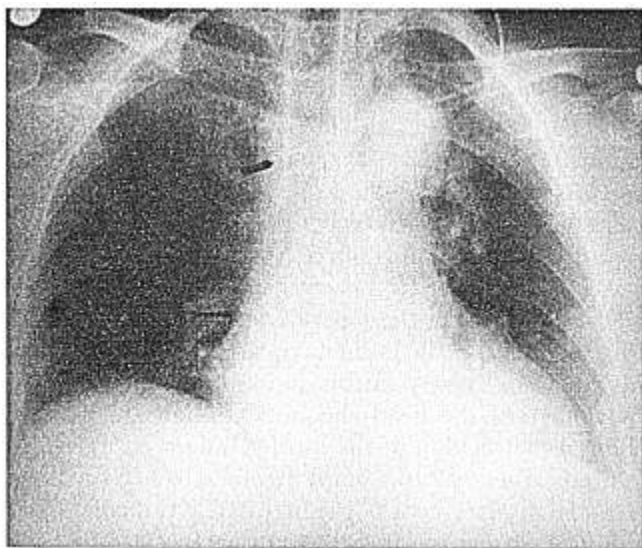


FIG. 1. Chest roentgenogram showing the position of a 6-inch catheter inserted through the left external jugular vein. The arrow indicates the catheter's tip. The line marks the pericardial reflection. Notice that the terminal portion of the catheter lies in a transverse position, so that movements of the catheter cause it to push against the lateral wall of the superior vena cava.

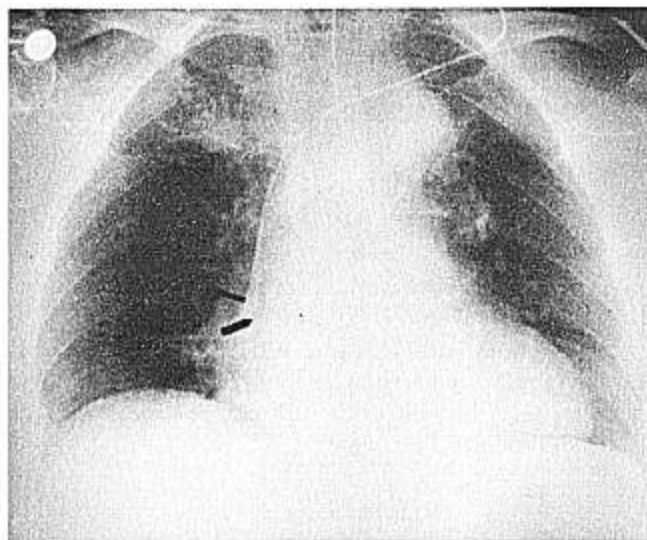


FIG. 2. Chest roentgenogram of the patient in figure 1 with an 8-inch catheter inserted through the left external jugular vein. The arrow indicates the catheter's tip, the line marks the pericardial reflection. This longer catheter allows its terminal portion to turn caudally into the superior vena cava, so that the tip does not abut directly against the venous wall.

In summary, the case described is one of four patients who developed a right hydrothorax after the superior vena cava was eroded by the tip of a catheter inserted in the left ejv. All cases had similar clinical and roentgenographic findings, and based on these, recommendations for the insertion and maintenance of left ejv CVP catheters were made.

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