A Venous Catheter Complication: Venous Perforation and Lung Injury

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Central venous catheters are frequently used for different causes, like fluid infusions, haemodialysis, and measurement of central venous pressure. Complications that occur at the time or after the placement of these catheters can give harm to the patient or can cause need for a new attempt. Complications, like malfunction of the catheter, arterial puncture, haemothorax, or pneumothorax, can be seen in 5%-26% of the patients, and early detection is very important. We want to present a venous perforation and lung injury case according to the catheter based upon the literature.

Key Words: Central venous catheters, complications, thoracic surgery

Introduction

Central venous catheters are frequently used in anaesthetic and intensive care practices. They are most frequently used for central venous pressure measurement, long-term intravenous access, intravenous therapy, inotropic agent use and parenteral nutrition. Various catheter-related complications may be encountered in 5-26% of the patients and early diagnosis of these is of vital importance (1). In the literature, the incidence of vascular perforation has been reported to be less than 1%. Insertion of catheter by an experienced clinician and the use of ultrasound (US) or intracardiac electrocardiography reduces the incidence of complications (2, 3).

With the present case, we would like to report a right subclavian catheter-related venous perforation, and damage in the right upper lobe of the lung and superior vena cava.

Case Presentation

A 32-year-old female patient (50 kg, 162 cm) was hospitalized for a cystic lesion in the right lower lobe of the lung. The patient, with no history of systemic disease, had undergone surgery nine years ago with a diagnosis of hydatid cyst or abscess in the right lung. Results of complete blood count, blood chemistry, bleeding tests and respiratory function tests were within the normal ranges. PA chest x-ray and electrocardiography (ECG) demonstrated no pathology. Informed consent was obtained from the patient; premedication was performed with 5 mg diazepam at the night and in the morning of surgery, and then the patient was admitted to the operating room. Peripheral venous route was provided in the antecubital region using an 18 gauge cannula and ECG, pulse oximetry and invasive left radial artery blood pressure monitoring was initiated. Induction of anaesthesia was performed using 1 mg kg⁻¹ lidocaine, 2 mg kg⁻¹ propofol, 0.6 mg kg⁻¹ rocuronium and 2 µg kg⁻¹ fentanyl. Maintenance of anaesthesia was provided by desflurane (0.5-1 MAC), propofol infusion (50 mg hour⁻¹), and rocuronium when necessary. Mechanical ventilatory support was initiated, and an attempt was made to insert a central venous catheter (Certofix trio 720, Braun, Germany) into the right internal jugular vein (VJI). As repeated attempts were unsuccessful, the right subclavian artery on the surgery side was used and central catheter was placed on the second attempt. While blood was easily aspirated from the proximal and distal lumens of the catheter, it was aspirated by force from the central lumen. Central venous pressure (CVP) was monitored and blood pressure (BP) was recorded as 114/74 mmHg, CVP: 8 mm Hg, heart rate: 90 min⁻¹, and oxygen saturation: 98%. The patient was placed in the left lateral decubitus position and single lung ventilation was initiated. A right thoracotomy incision was made, and it was observed that the catheter moved out of the subclavian vein, punctured the lung

(Figure 1) and damaged the wall of the superior vena cava, and the catheter-tip was lying in a hematoma of 200 mL volume (Figure 2). CVP of the patient was 7-10 mmHg until that time and no haemodynamic problems were encountered. The catheter was removed and superior lobe of the lung, which was damaged, was closed by primary suture; no intervention was considered for the superior vena cava. The surgery of the patient, who underwent lower lobectomy, lasted for 330 minutes and the patient was extubated in the operating room. The patient required one unit of erythrocyte suspension and after staying in the intensive care unit for one day and in the ward for 9 days, she was discharged from the hospital with full recovery.

Figure 1. Right subclavian vein perforation causing injury in the right upper lobe of the lung. (a) the right 5th rib (b) the site of perforation in the right subclavian vein; (c) access point of the catheter in the right upper lobe of the lung; (d) Superior vena cava; (e) right upper lobe of the lung

Figure 2. Injury in the superior vena cava caused by the catheter (the catheter was cut and removed from the right upper lobe of the lung). (a) The injury on vena cava caused by the catheter; (b) Access point of the catheter into the right upper lobe; (c) Hematoma traces around the superior vena cava (after aspiration of 200 mL of blood)

Discussion

Although central catheter-related complications are quite common, serious complications are rarely encountered. A wide variety of complications including arterial puncture, pneumothorax, arrhythmia, air embolism, cardiac tamponade, cardiac perforation, catheter malposition or extravasation, and catheter infection can be encountered. Whereas the incidence of these complications has been determined to be low as 0.4-1% in some studies, there are also studies reporting rates between 5% and 26%. The incidence of vascular perforation has been reported less than 1% (1-3).

A body mass index (BMI) $\geq 30 \text{ kg m}^{-2}$ or $\leq 20 \text{ kg m}^{-2}$, exposure of the catheter insertion site to local surgery or radiotherapy in the past, insertion of the catheter by an inexperienced clinician, and repeated interventions, increase the incidence of complications. Moreover, large-sized, poor quality, and rigid catheters as well as catheters with free tip are the risk factors for venous perforation (2, 3).

While 50% of catheter-related vascular perforations occur 2 days after the insertion of the catheter, various complications that occurred within 1-60 days were also reported in the literature (3-8). Duntley et al. (4) reviewed 34 reports beginning from the year 1979 and determined catheter-related vascular erosion and hydrothorax in 61 patients. Sixty four percent of these patients were female, whereas 36% were male. Of the catheters, 46% were inserted through the left subclavian vein, 20% were inserted through the left internal jugular vein, 18% were inserted through the right subclavian vein, 5% were inserted through the right internal jugular vein, 6% were inserted through the external jugular vein, and 5% were inserted through the brachial vein. Pleural effusions occurred in 79% of the patients, whereas bilateral effusion was encountered in 31%. The most common symptom was dyspnoea (82%) followed by chest pain (46%), while 10% of the patients were asymptomatic. CVP was measured at irregular time intervals or adequate aspiration could not be provided from the catheter in only 2-3% of the patients. Of the patients that developed catheter perforation, 12% (6 patients) died due to direct catheter-related complications. We failed to determine whether these catheter-related complications resulted from misplacement or migration of the catheter (4).

In their case series of 8 patients, Duntley et al. (4) reported catheter erosion that presented itself with hydrothorax. They found the incidence of catheter erosion to be 0.5%. Left subclavian vein cannulation was performed in six patients and right subclavian vein and left internal jugular vein was cannulated in the other two patients. Symptoms appeared within 1-7 days (mean: 2.9 days) and the most common symptoms were dyspnoea in four patients and chest pain in two patients. Dyspnoea was accompanied by hypotension in one patient. Pleural effusion was bilateral in three patients and unilateral in five patients (right-sided pleural effusion in four patients).

Chest tube was inserted in four of the patients and one died due to massive effusion.

Kim et al. (5) reported a case with bilateral hydrothorax and cardiac tamponade that developed after right subclavian catheterization. Florescu et al. (6) determined extravasation of the catheter tip in a case that they placed right subclavian haemodialysis catheter under fluoroscopy guidance. The patient had to undergo open thoracic surgery for the repair of damaged subclavian vein. Wang et al. (7) had to perform thoracotomy due to haemothorax in a patient, who was performed right subclavian catheter insertion under ultrasound guidance. Çelik et al. (8) reported superior vena cava perforation by right subclavian venous catheter in a thoracotomy case. The BMI of the case with no history of previous surgery or radiotherapy was 21.61 kg m⁻², but the catheter could be inserted at the third attempt. There were adhesions in the apical region at thoracotomy, but haemothorax or pneumothorax was not detected and the perforation was closed by primary suture.

In the present case, catheter insertion attempts into the right jugular vein were unsuccessful and the right subclavian vein was tried. The catheter could be placed at the second attempt and the position of the catheter was verified by blood aspiration. However, radiological imaging was considered unnecessary since the operating table was not compatible with the scope and the patient would undergo surgery on the same side of catheter insertion. The BMI of the present patient was 19.05 kg m⁻² and she had a history of right thoracotomy. The patient was considered to be at high-risk for venous perforation owing to a BMI ≤20 kg m⁻², history of past surgery, and repeated interventions. No haemodynamic changes were observed in the patient until thoracotomy; neither desaturation nor increase in airway pressures developed. The fact that the catheter was inserted from the same side of surgery allowed direct recognition and early diagnosis of this case. Thereby, complications such as postoperative pleural effusion, haemo-pneumothorax, hypovolemic shock and cardiac arrest were not encountered. Aspiration of blood from the lumens of the catheter did not provide adequate evidence of correct positioning.

Conclusion

Subclavian catheter placement can lead to serious complications that might result in death. Therefore, the procedure should be performed by experienced subjects, or under their supervision with radiological guidance. Since aspiration of blood from the catheter is not adequate to exclude vascular

perforation, we think that the location of the catheter must be verified by radiological methods.

Informed Consent: Written informed consent was obtained from the patient who participated in this case.

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