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Esophageal Perforation after Catheterization of the Subclavian Vein

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ABSTRACT

The insertion of a central venous catheter (CVC) via the subclavian vein is often associated with complications. We report a case in which a patient suffered an esophageal lesion with severe bleeding and a pneumothorax with mediastinal shift induced by the insertion of the dilator of a CVC. The pneumothorax had to be treated immediately by pleural drainage, and the esophageal lesion was successfully corrected by means of an endoclip. The patient survived the complication. However, he died 1 week later from multiple organ failure not associated with the CVC insertion.

INTRODUCTION

The insertion of a central venous catheter (CVC) via the subclavian vein may be associated with numerous complications. We report a case of an iatrogenic esophageal lesion induced by the insertion of the dilator of a CVC.

CASE REPORT

A 65-year-old patient with mitral valve insufficiency IV, suspected to be the result of endocarditis caused by *Staphylococcus aureus*, was admitted to our hospital for emergency mitral valve replacement. The patient suffered from a number of comorbidities, including coronary artery disease of the right coronary artery and a marginal branch of the circumflex artery, arterial hypertension, chronic renal insufficiency treated with diuretics, chronic obstructive pulmonary disease, and alcohol abuse.

The patient had undergone cardiopulmonary resuscitation in the transferring hospital and had to be intubated because of severe pulmonary edema. For hemodynamic stabilization at admission, he received epinephrine 1.5 mg/h and norepinephrine 0.8 mg/h. The patient was immediately transferred to the operation theater. A mitral valve reconstruction and coronary artery bypass grafting (2 venous grafts to the right coronary artery and the marginal branch) were performed. The patient needed high doses of catecholamines on admission to the intensive care unit and was mechanically ventilated with an inspiratory fraction of oxygen (FiO_2) of 0.8 and a positive end expiratory pressure of 18 mbar to keep the arterial oxygen saturation above 90%. The patient needed venovenous hemodiafiltration because of acute renal failure with anuria.

On the sixth postoperative day the patient showed clinical and laboratory signs of infection (elevated levels of procalcitonin and C-reactive protein). We inserted new CVCs and a new arterial line because of suspected catheter-related infection. We planned to insert 2 CVCs into the left subclavian vein, 1 for infusions and 1 for venovenous hemodiafiltration. At this time the positive end expiratory pressure was 15 mbar, and the peak inspiratory pressure was 33 mbar. The first venipuncture was uneventful and the guidewire could be inserted easily. The second venipuncture was performed lateral to the first one and was more difficult. Three attempts were necessary to identify the subclavian vein. The guidewire could not be introduced because elastic resistance was detected after 20 cm. The guidewire and the needle were withdrawn and a new venipuncture was performed. Because the guidewire was buckled, a universal guidewire that was not J-shaped at its tip was used. This guidewire was introduced easily for 30 cm. Thus the dilator was inserted. After insertion of the dilator the oxygen saturation decreased rapidly to 65%, and the patient became hemodynamically unstable. The FiO_2 was set to 1.0, and an x-ray of the thorax was obtained. While we waited for the result of the x-ray, we prepared the left hemithorax for pleural drainage. At this time about 1 L of blood-colored fluid was drained by the nasogastric tube. The gastroenterologist was informed and immediately performed an endoscopic gastroesophageal examination. This examination revealed a transmural lesion of the left lateral esophageal wall, which was treated with an endoclip. Meanwhile the x-ray had confirmed the diagnosis of left tension pneumothorax, and a pleural drainage tube had been inserted. As shown in the x-ray, the CVC seemed to take an abnormal route (Figure 1). Blood gas analysis was used to verify its venous placement. The

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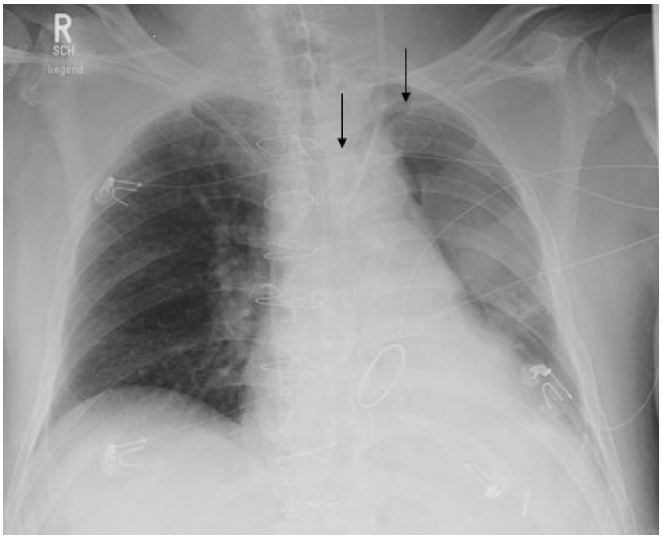

Figure 1. Chest x-ray showing the position of the left subclavian central line (arrow).

patient's hemodynamic status stabilized rapidly, and after 1 hour the patient had no more need for catecholamines. A computed tomographic (CT) scan 2 days later confirmed the suspected perforation of the esophagus with the dilator, and the successful clipping (Figure 2). The CT scan findings ruled out a persistent left superior vena cava as a reason for the abnormal course of the CVC, instead suggesting the diagnosis of an abnormal elongated subclavian vein (anatomic variant).

One week later the patient developed acute intestinal ischemia and died from multiorgan failure after an explorative laparotomy.

DISCUSSION

The subclavian vein is the preferred access for the introduction of CVCs in critically ill patients [Collignon 1988; Pearson 1996]. This technique involves less patient discomfort and risk of infection and other long-term complications than occur with other insertion sites [Pearson 1996]. On the other hand, cannulation may be more time-consuming and associated with more complications than insertion via the internal jugular vein. One problem may arise from the curvature of the subclavian vein, which may impede guidewire advancement. In our patient the insertion of the second CVC was first complicated by difficulties in identifying the vein, and then by impeded advancement of the guidewire. The x-ray and the CT scan revealed an anatomical variant of the patient's left subclavian vein, which may be described as elongation. It is known that catheterization of the subclavian vein may be more difficult in patients after median sternotomy, because anatomic structures may be stretched [Polderman 2002]. Another risk factor for CVC-associated complications in this patient was severe respiratory failure requiring mechanical ventilation at high pressures [Polderman 2002].

In our opinion, at least 2 measures could have been taken to avoid the resulting complications. First, the ventilatory pressures could have been reduced to decrease the risk of pneumothorax. There are no official recommendations to do so, and the decision should be made cautiously in patients at high risk for alveolar collapse and hypoxemia.

The second and more important precaution would have been not to use a guidewire without a J-protected tip, especially in this patient, who was at risk for complicated CVC placement. Our patient had numerous risk factors, such as preexisting obstructive lung disease, invasive mechanical

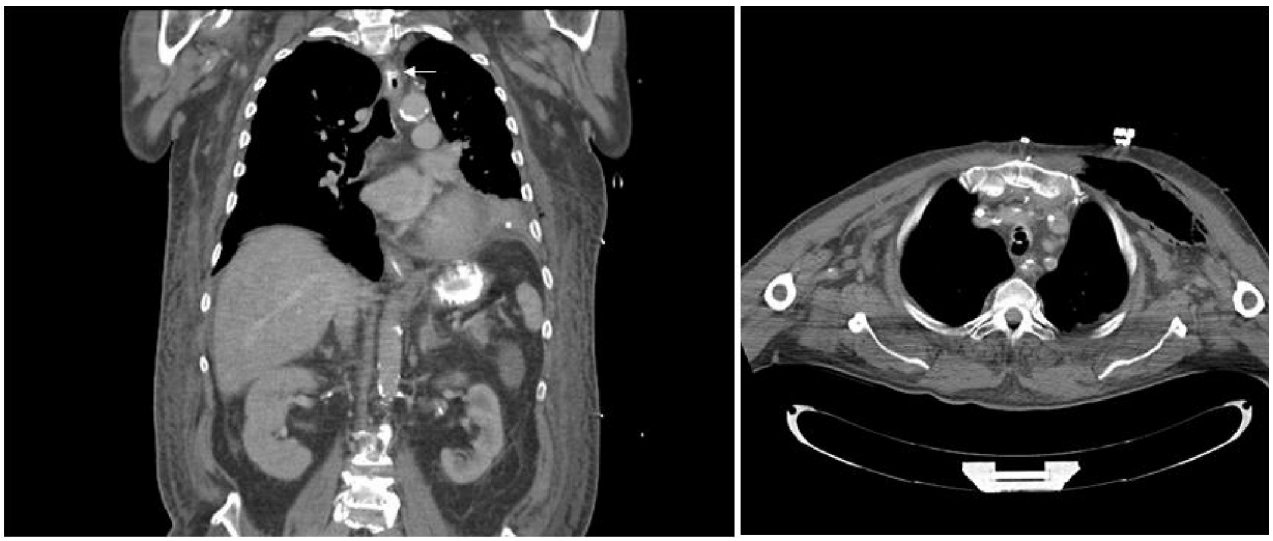

Figure 2. Thoracic computed tomographic scan showing the endoclip closure of the esophageal leak after central venous catheter insertion (left, arrow) and the mediastinal shift (right).

ventilation, and a recent median sternotomy. Because the guidewire was easily introduced up to 30 cm, it must be assumed that the guidewire perforated the vein at the shoulder region, which was abnormally kinked due to the previously mentioned elongation.

In conclusion, in patients presenting with multiple risk factors, insertion of CVCs may be associated with potentially severe complications. The use of guidewires without a J-protected tip should be avoided, especially in patients with high ventilation pressures. A multidisciplinary approach is essential for the rapid treatment of such complications.

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