



Case Report

Intercostal artery damage and massive hemothorax after thoracocentesis by central venous catheter: A case report

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ABSTRACT

Central venous catheters (CVCs) are widely used in various puncture and drainage operations in intensive care units (ICUs) in recent years. Compared to conventional operating devices, CVC was welcomed by clinicians because of the advantages of easy use, less damage to the body and convenient fixation process. We came across a patient with severe acute pancreatitis (SAP) who developed cardiac arrest due to thoracic cavity massive bleeding 24 h after thoracocentesis with CVC. Thoracotomy surgery was carried out immediately, which confirmed an intercostal artery injury. The patient was discharged from hospital without any neurological complications two months later. Here we report this case to remind all the emergency department and ICU physicians to pay more attention to the complication of thoracic cavity bleeding following thoracocentesis conducted by CVC.

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Introduction

Central venous catheters (CVCs) are widely used in various puncture and drainage operations in emergency department and ICUs in recent years, especially in dealing with fluid accumulation in the thoracic cavity, abdominal cavity and subcutaneous area.^{1,2} Compared to conventional operating devices, CVC is popular because it is easy to operate, has less damage to the body and is convenient to be fixed.^{3,4} Intercostal artery injury is not very rare in clinical practice. The anatomical variation is usually thought to be the main reason. Intercostal arteries curve at the edge of the ribs, especially near the spine. Some intercostal arteries have branches that wriggle toward the adjacent rib. Here we shared a case of massive hemothorax in a severe acute pancreatitis (SAP) patient, which aroused our consideration about the security of thoracocentesis puncture operated by CVC.

Case report

A 44-year-old female patient was diagnosed as having SAP. She soon developed acute respiratory distress syndrome (severe) and level III acute kidney injury. Right pleural effusion was found and

thoracocentesis was carried out by CVC (Fig. 1). Twenty-four hours after the thoracocentesis, massive hemothorax was observed and then CVC was adjusted and blood was drained from it. Chest X-ray showed massive right pleural effusion (Fig. 2). The patient developed shock and cardiac arrest. Cardiopulmonary resuscitation was started immediately and the patient obtained restoration of spontaneous circulation (ROSC). Thoracotomy was carried out very soon after ROSC. Intercostal artery damage was confirmed and ligated. Surgeons blocked the bleeding effectively and removed approximately 5000 ml hemothorax inside the thoracic cavity. After the operation the patient was transferred to the ICU, where vital signs and other laboratory findings were stable without any pharmacologic supports. The patient regained consciousness.

Recovery was uneventful. The patient received minimally invasive percutaneous drainage surgery and endoscopic debridement for infected pancreatic necrosis. Two months later, abdominal and chest CT scan showed a clean pancreas thorax. She was discharged from the hospital with full recovery. Till now, the follow-up showed that the patient survived and started working again. She had no neurological complications. The chest CT showed nothing abnormality in the lung.

Discussion

For our patient, the thoracocentesis was performed by experienced ICU doctors strictly following the operation sequence. But this patient still developed a fatal chest bleeding, which warned us

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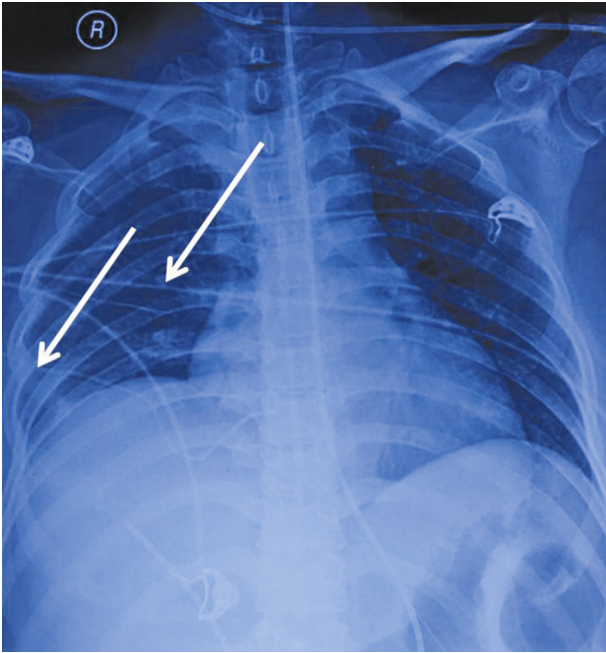


Fig. 1. Chest X-ray shows a central venous catheter was placed inside of the right pleural (arrows).

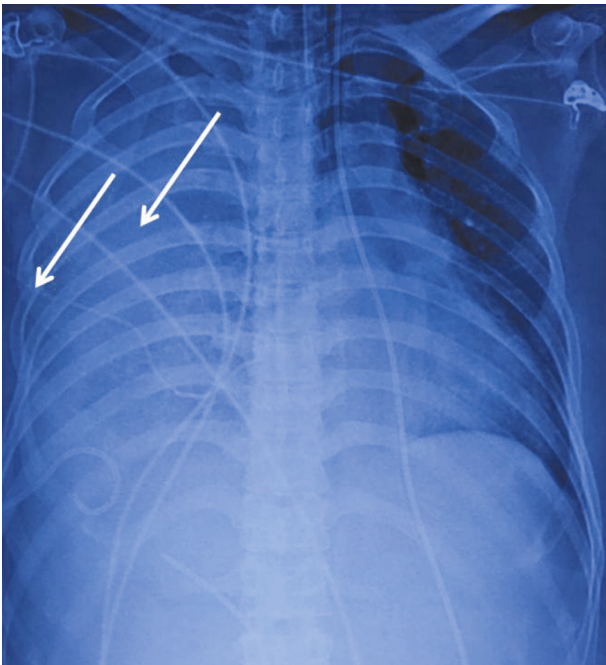


Fig. 2. Chest X-ray shows a large number of high density effusion in the right pleural (arrows) 24 h after right thoracocentesis.

about the security of using CVC to perform thoracocentesis. SAP is a severe illness in clinical practice, which is characterized by intensive inflammatory response and MODS in the early phase and infected pancreatic necrosis in the later phase.⁵ SAP patients usually accompany with large number of pleural effusion in the early stage of SAP.⁶

Massive hemothorax after pleural drainage by CVC is not rare in clinical work. Our patient is a middle-aged woman. She was very thin, so the rib gap was very small. Coupled with skin edema, skin anesthesia and other local factors, the puncture point was close to

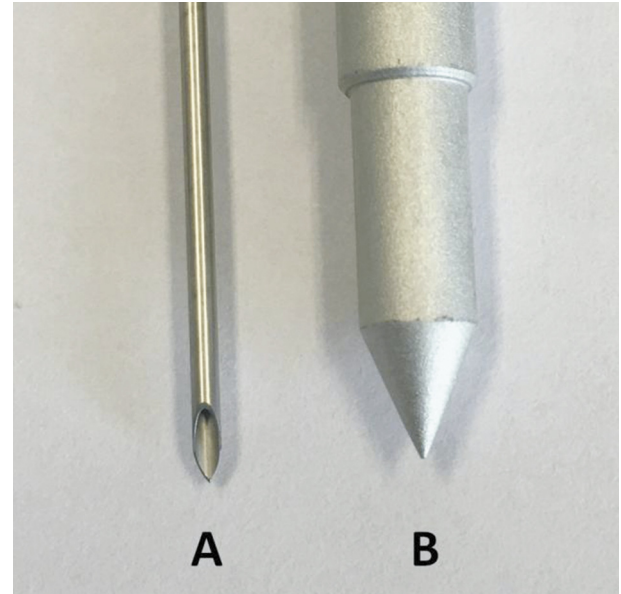


Fig. 3. The head of CVC puncture needle (A) and conventional chest tube puncture needle (B).

the lower edge of the upper rib. However, anatomical variation of the intercostal artery was not found during surgery.

In addition to operating irregularities and intercostal artery variation, there are other objective factors. The sharp surface area of the CVC puncture needle is bigger than that of the conventional chest tube, which is often neglected by doctors. The force plate of conventional chest tube needle is minimal (Fig. 3). The diameter of conventional chest tube puncture needle is larger than CVC puncture needle. During puncture, its head is squeezed by two adjacent ribs to the middle area which is considered as the safety zone to puncture. Even if the needle hits the blood vessels, it will pass over the vessel surface due to the elasticity of the vascular wall in most instances. Needle of CVC is extremely sharp, for which it can pierce the vessel wall into the blood vessels smoothly for its design purposes. Its head is elliptical, greatly increasing the contact surface with the vessels. It is also worth noting that, patients do not appear life-threatening hemothorax immediately since the oppression of the catheter to the injured intercostal artery after puncture, like pneumothorax reported in many patients.^{7–9} Hemothorax usually occurs soon after the adjustment of the catheter position.

This is a tragic incident occurred when we are enjoying the benefits of thoracocentesis puncture carried out by CVC. Not only surgeons, but ICU and emergency physicians are using CVC for thoracocentesis widely. When conducting thoracocentesis with CVC, everyone should follow the rules strictly. Avoidance of puncture close to the lower edge of the upper rib is very important. Taking into account heteromorphosis and puncture injury of arteriae intercostales, close observation of the color of the drained fluid, the patient's respiratory rate, finger oxygen saturation, heart rate, and chest ultrasonography or chest X-ray are very important. This case warns all the ED and ICU physicians about the complication of thoracic cavity bleeding caused by CVC.

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