Videothoracoscopic-guided management of a central vein perforation during hemodialysis catheter placement

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We present a case of the successful repair of an iatrogenic central vein lesion using a videothoracoscopic approach. The confluence of the right innominate vein and the superior vena cava was perforated during the placement of a right internal jugular vein long-term dialysis catheter. The misplacement of the tips of the catheter in the right pleural space was promptly observed. The catheter was removed under pleural videothoracoscopic vision while a tamponade was directly applied to the mediastinal perforation. Massive bleeding was prevented and the central vein perforation was treated successfully using a minimally invasive technique. (J Vasc Surg 2010;52:1354-6.)

Tunneled hemodialysis catheters are generally inserted through an internal jugular vein puncture. Among the risks, there is the possibility of iatrogenic perforation of the central vein with bleeding into the pleural cavity.[1-3] Under this circumstance, the treatment involves thoracotomy and correction of the injury[4] or the use of an endoprosthesis[5] to occlude the perforation site.

We present the first report of a case of videothoracoscopic-guided treatment and the successful outcome of a mediastinal venous perforation in a patient undergoing placement of a long-term hemodialysis catheter.

CASE REPORT

The patient was a 53-year-old man with renal failure since the age of 33 due to polycystic kidney disease. He underwent a kidney transplant that failed after 14 years, 4 years of peritoneal dialysis, and 2 years of hemodialysis via an arteriovenous fistula in the left upper limb. He was admitted to the hospital for the implantation of a long-term tunneled catheter because extensive acute cephalic vein thrombosis had caused vascular access failure. He had a one-time-only hemodialysis catheter insertion in his right subclavian vein for a 3-week period 20 years ago, no preexisting trauma history, no pacemakers, and had not had other surgeries in the upper thorax or limbs. Coagulation tests, a chest radiograph, and an ultrasound scan of the jugular and subclavian veins were normal.

With the patient under general anesthesia, the right internal jugular vein was punctured. Progression of the J-tipped metallic guidewire (included in the catheter kit, Ash Split Cath III, Medcomp, Harleysville, Pa) toward the right atrium was assessed by fluoroscopy. Resistance was encountered while advancing the guidewire in the transition from the neck to the mediastinum, which was attributed to probable intraluminal scarring from the previous catheter. Using conventional maneuvers, the guidewire was advanced caudally. By fluoroscopy, we observed the location of the guidewire tip was directed toward the inferior vena cava. After subcutaneous catheter tunnelization and dilatation of the puncture path through to the venous lumen, a 14F-diameter catheter was inserted through the disposable trocar. We observed that the split tips were located laterally to the cardiac shadow. Iodized contrast was injected through the catheter and caused an immediate diffuse haze in the entire right pleural cavity, indicating the catheter tips' positioning in the pleural space. Blood aspiration was interpreted as hemothorax. The patient maintained steady hemodynamic parameters and presented no difficulty with mechanical ventilation. We chose not to remove the catheter to keep a tamponade of the passage between the injured vein and the pleural space. The simple tracheal cannula was exchanged for a selective endotracheal tube that allowed deflation of the right lung. We placed the patient in the left lateral decubitus position and then made a small incision in the fifth right intercostal space (RICS) in the anterior axillary line and positioned a 10-mm diameter, 30° vision angle camera. We observed a hematoma dislocating the pleura of the superior mediastinum, a perforation where the catheter protruded into the right pleural cavity with no active bleeding, and free blood in the pleural cavity (Fig 1). A second minor incision was made in the eighth RICS in the posterior axillary line into which we placed the camera, and a third 1-cm incision was made in the fifth RICS in the auscultatory triangle for aspiration. An endoscopic surgical grasper was introduced through the incision in the fifth RICS anterior axillary line with a double-folded gauze compress attached to its tip so as to achieve pressure on the mediastinal pleural orifice from which the catheter protruded. While we compressed the perforation, the catheter was removed by external traction (Fig 2). We maintained consistent compression of the perforation site for 20 minutes, with no bleeding during or after grasper withdrawal. Concurrently, cervical compression at the puncture site was performed. The right pleural cavity was washed with saline solution and then suctioned with no further bleeding. A tubular thoracic

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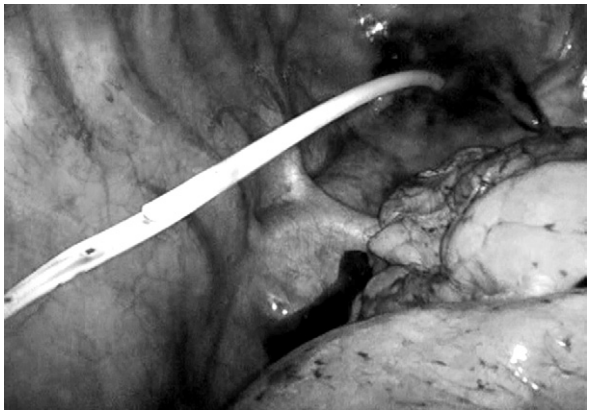

Fig 1. Videothoracoscopic image of the perforation of the mediastinal pleura with a catheter in the right pleural cavity.

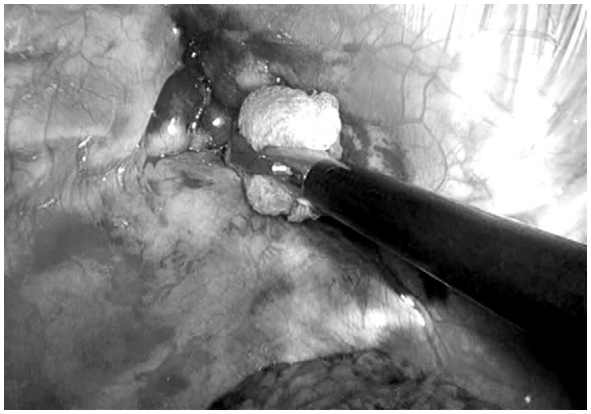

Fig 2. Direct compression of the mediastinal perforation site following catheter withdrawal.

drain was positioned cranially through the eighth RICS incision. The patient was repositioned in the dorsal decubitus position, and another hemodialysis catheter was inserted through the right femoral vein. Throughout the whole procedure, the patient was stable and presented no decrease in hematocrit levels.

There was no blood transfusion at any time. On the first postoperative day, hemodialysis was performed without heparin. There was no significant output through the thoracic drain, which was removed on the second postoperative day. The patient was discharged from the hospital on the third postoperative day.

DISCUSSION

The insertion of central catheters involves several risks,[6] including central vein perforation with hemothorax. Pleural bleeding may lead to hemodynamic instability and hypovolemic shock, requiring exploratory thoracotomy to repair the injury. When inserting hemodialysis catheters with bores larger than regular central catheters, injuries may cause voluminous bleeding and even death.[2-4]

In this case, we avoided massive bleeding and a thoracotomy by early diagnosis of the lesion. Withdrawal of a large-bore catheter at that moment would have led to the depacking of the injury and possibly to uncontrolled bleeding. The consistent tamponade of the perforation and the hemodynamic stability allowed us to resolve the issue in a minimally invasive manner. If necessary, there was always the possibility of an immediate thoracotomy, as the patient had undergone general anesthesia and had been positioned for this purpose. The videothoracoscopic approach would not have been considered if there were coagulopathy or hemodynamic instability.

The withdrawal of long-term catheters is accomplished by the traction of the device and the direct compression of its point of entry in the punctured vein. The resulting orifice will be tamponaded by coagulation mechanisms together with the direct compression of the site long enough to create a stable clot. In the case of mediastinal central vein perforation to the pleural space, there is no possibility of direct compression except by opening the thoracic cavity. In this specific case, we followed the same principle. Under videothoracoscopy, we created a safe condition for direct compression of the site where the catheter perforated the vein and the pleura by performing three small incisions and pleural draining.

There are reports of endovascular repair of central venous injury using endoprosthesis,[5,7] which is a less invasive option than thoracotomy, but this method involves the definitive implant of intravascular synthetic material, with likely obstructive implications in the long term,[8] in addition to the inherent risk of passing again through the venous system in patients with a previously established severe vein injury.

Cheli et al[9] reported a case of combined treatment with thoracotomy and video-assisted surgery of an iatrogenic arterial injury caused by the insertion of a central venous catheter. After urgent thoracotomy, it was technically difficult to access the thoracic dome for hemostasis. Definitive control of the hemorrhage was achieved using videothoracoscopy. The camera and the needle-holder facilitated the repair of the bleeding injury originating from the subclavian artery. In that case, the benefit of the videothoracoscopy was not to reduce operative invasiveness, but to aid repair of the injury.

We present the first report of perforation of a major mediastinal vein entirely treated under the guidance of videothoracoscopy. Through this minimally invasive technique and without any exogenous materials implanted in the patient, we observed a prompt postoperative recovery with little morbidity.

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