Late venous laceration after inappropriate placement of a left internal jugular hemodialysis catheter: a case report

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Abstract
Central venous catheterization is a necessary and common method of building the circulation pathways of patients with end-stage kidney disease. Venous rupture is a severe and fatal complication of central venous catheterization. We herein present a case of slowly occurring venous rupture after reinsertion of a left internal jugular vein (IJV) catheter. A man in his early 70s was hospitalized with end-stage kidney disease. We inserted a hemodialysis catheter through the left IJV. A short section of the patient's catheter slipped out 1 month later. The original catheter was reinserted at its primary position without a guidewire. The patient reported chest pain and developed hypotension during dialysis the next day. He underwent femoral venous catheter insertion and heparin-free dialysis. The patient finally recovered and underwent regular hemodialysis using an arteriovenous fistula in the left forearm. This is the first reported case of venous laceration after repeated left IJV catheterization. Left IJV catheterization is associated with high rates of complications and should be closely monitored with the help of radiography during and after the operation. Central venous catheters should be carefully placed with clear knowledge of their direction and location to prevent serious complications.

Keywords
Complication, hemodialysis, catheterization, end-stage kidney disease, venous rupture, case report

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Introduction

Central venous catheterization is a necessary and common method in building the circulation pathways of patients with end-stage kidney disease who require blood purification. The most common central venous catheter-related complications are pneumothorax, venous thrombosis, arterial puncture, and infection. Great vessel perforation is rare, and its early detection is difficult. Delayed great vessel perforation and mediastinal hematomas are always accompanied by events such as harmful puncture locations or strenuous exercise. In the present report, we describe a case of slowly occurring venous rupture after reinsertion of a left jugular vein catheter. This is the first reported case of venous rupture after repeated central venous catheterization. The reporting of this case conforms to the CARE guidelines.

Case presentation

A man in his early 70s with a 15-year history of high blood pressure (BP) developed symptoms of severe uremia including fatigue, anorexia, and nausea 3 weeks previously. His hemoglobin concentration was 62 g/L, creatinine concentration was 1154 μmol/L, and uric acid concentration was 604 μmol/L. The patient was diagnosed with end-stage kidney disease and admitted to our department in early March 2020. A timeline of the patient’s clinical course is shown in Figure 1.

One day later, the patient underwent B-ultrasound-guided internal jugular vein (IJV) catheterization. The right IJV was narrowed to a diameter of 8 mm, so we inserted an ABLE® hemodialysis (HD) catheter (11.5-Fr, 13-cm, without cuff, non-tunneled) through the left IJV (diameter of 12 mm). Chest computed tomography (CT) showed no abnormalities during catheterization (Figure 2(a)). Initially, HD was performed without complications, and dialysis was thereafter performed three times a week. An arteriovenous fistula in the left forearm was built 31 days later. Thirty-six days later, we found that the fixation suture of the IJV catheter was broken and that a short section of the patient’s catheter had slipped out. The catheter was only partly pulled out. We used iodophor to disinfect the small section of the catheter that had slipped out. We did not insert a new catheter through a new puncture site or perform catheter exchange through a guidewire; instead, the original catheter was reinserted to its original position without a guidewire. However, the next day, the patient reported chest pain and developed hypotension (BP of 80/50 mmHg) during HD, and he was therefore removed from the dialysis machine immediately. He returned to the ward with normal BP. Chest CT in the emergency department revealed an upper left mediastinal hematoma accompanied by a small amount of gas accumulation (Figure 2(b)). Emergent CT angiography of the chest revealed a posterior view of the catheter in the left IJV, and part of the proximal segment of the catheter was outside the blood vessel and accompanied by the left upper mediastinal hematoma (Figure 2(d)). Compared with the chest radiograph after the first catheterization (Figure 2(e)), the updated image showed that the position of the catheter had moved (Figure 2(f)). The patient then underwent femoral venous catheter insertion and heparin-free dialysis. The catheter in the left IJV was removed at the end of April. Chest CT in early May showed that the hematoma had been absorbed (Figure 2(c)). The patient was thereafter in good condition and continued to undergo regular HD using an arteriovenous fistula in the left forearm. Written informed consent for treatment and publication of this case report were obtained from the patient. The requirement for ethics approval was
waived because of the nature of this study (case report).

**Discussion**

Physicians often prefer to cannulate the right IJV to establish central venous access because it provides a more direct path to the superior vena cava and is the most effective choice. The left IJV is considered optimal only in patients with a history of multiple access failures. Current guidelines do not recommend insertion of dialysis catheters through the left IJV. We have herein described the first reported case of a delayed, slowly occurring vascular wall injury after repeated central venous catheterization in the left IJV.

A mediastinal hematoma due to HD catheter-related great vessel perforation is rare and mostly occurs immediately after catheter insertion. One report described delayed great vessel perforation in the third course of HD, but the venous rupture in our case occurred after repeated central venous catheterization. During insertion of a left IJV catheter, two 90° twists must be navigated: at the junction with the subclavian vein and at the junction with the superior vena cava. Cannulation of the left IJV is more
difficult because of its structure, and there is a larger risk of problems than with cannulation of the right IJV. The resultant complications are painful and possibly fatal.3

Several lessons were learned from this case. First, the non-tunneled 13-cm catheter without a cuff was not suitable for the left IJV because its length was too short to reach the cavoatrial junction or the mid-atrium. Second, the position of an HD catheter can be easily moved when the fixation suture is lost, but in the present case, the original catheter was reinserted to its original position without a guidewire. Current guidelines recommend the use of a guidewire when reinserting a catheter.4 Otherwise, the tip of the catheter would have been at an angle that may have injured a vein (brachiocephalic or subclavian vein), which would have increased the risk of venous wall injury. Vessel perforation might have occurred during the reinsertion procedure. However, hemorrhage did not immediately develop, which made us careless. Third, central venous catheter-related complications should be monitored carefully within the first 72 hours after the procedure. The venous rupture in this case might have been induced by the harmful location of catheter reinsertion without guidance by digital subtraction angiography and checking by CT. Dialysis catheters must be placed with the tip in the superior vena cava or within the upper third of the right atrium. Finally, the catheter might have been placed a bit too firmly. In addition, the catheter should be parallel to the wall. This is important because venous wall injury is more likely to occur if the catheter tip is positioned against the wall.
In conclusion, our case indicates that left IJV catheterization is associated with a high risk of great vessel perforation. Left IJV catheterization should be performed with the help of digital subtraction angiography during insertion. Chest radiographs should be performed after the insertion to judge the placement of the catheter and detect anatomic variants. Moreover, it is important to use a guidewire while reinserting the catheter. The direction and location of the catheter should be clearly known to prevent serious complications in patients undergoing HD.

Author contributions
All authors contributed to the conception and design of the study. The first draft of the manuscript was written by Xiaohua Hu. Cheng Xue critically revised the work. Liming Zhang conceptualized the article. Bibo Wu, Hua Yu, and Congdie Liang provided the case information. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declaration of conflicting interests
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