Received: 27 September 2024 | Accepted: 6 January 2025

DOI: 10.1002/ams2.70038

ACUTE MEDICINE & SURGERY WILEY

CASE REPORT

Inadvertent insertion of dialysis catheter into subclavian artery treated with a covered stent: A case report

Yohei Takenobu[1] | **Akihiro Furuta**[2] | **Sumire Haga**[2] | **Hiroshi Yukawa**[3] | **Noriko Nomura**[1] | **Mizuha Toyama**[1] | **Akihiro Okada**[4] | **Takeshi Kawauchi**[4] | **Yukinori Terada**[4] | **Manabu Inoue**[1] | **Kenji Hashimoto**[4]

[1]Department of Neurology, Osaka Red Cross Hospital, Osaka, Japan

[2]Department of Radiology, Osaka Red Cross Hospital, Osaka, Japan

[3]Department of Cardiology, Osaka Red Cross Hospital, Osaka, Japan

[4]Department of Neurosurgery, Osaka Red Cross Hospital, Osaka, Japan

Correspondence
Yohei Takenobu, Department of Neurology, Osaka Red Cross Hospital, 5-30 Fudegasakicho, Tennoji-ku, Osaka 543-8555, Japan.
Email: takenobu@kuhp.kyoto-u.ac.jp

Abstract

Background: When inserting central venous catheters, inadvertent injury of major vessels is a rare yet critical complication. Direct surgery is sometimes overly invasive. This report describes a subclavian artery injury caused by inadvertent cannulation of a dialysis catheter, successfully treated with a covered stent.

Case Presentation: An 82-year-old woman with acute renal failure due to sepsis required emergency dialysis. During the insertion of a 12-Fr dialysis catheter into the right jugular vein, pulsatile reflux was noted. Computed tomography revealed catheter misplacement in the subclavian artery. Considering the patient's fragility, endovascular repair was performed. After embolization of side branches, a GORE VIABAHN stentgraft was delivered using a pull-through technique and deployed to seal the injury site. The patient was discharged without neurological or vascular complications.

Conclusion: Covered stents offer an effective solution for major vessel injuries requiring immediate hemostasis, particularly when direct surgery is complicated by underlying medical or anatomical conditions.

KEYWORDS
central venous catheters, covered stent, endovascular repair, inadvertent catheter insertion, subclavian artery injury

INTRODUCTION

Insertion of a central venous catheter is a common procedure but not without risks, such as inadvertent injury to major vessels, including subclavian artery (SA). Prompt intervention is crucial to prevent adverse outcomes. However, direct surgery for SA injury may be overly invasive, depending on the patient's condition. This report presents a case of SA injury due to dialysis catheter cannulation, successfully treated with endovascular repair using a covered stent.

CASE PRESENTATION

An 82-year-old woman with chronic kidney disease was brought to the emergency department with general malaise. The patient had stable vital signs, although laboratory data showed pyuria with gram-negative rods (later identified as *Escherichia coli*), serum creatinine of 6.42 mg/dL, blood urea nitrogen of 130.9 mg/dL, white blood cell count of 6.37×10^3/μL, and C-reactive protein of 13.5 mg/dL. A diagnosis of acute kidney injury on chronic kidney disease associated with urosepsis was made, necessitating

emergency dialysis. Attempted 12-Fr dialysis catheter insertion via the right jugular vein under ultrasound guidance resulted in pulsatile backflow through the catheter. The patient's vital signs, including respiratory and circulatory parameters, remained stable. Contrast-enhanced computed tomography revealed inadvertent catheter insertion into the SA, just distal to the vertebral artery (VA) bifurcation (Figure 1A). Bilateral VAs were well developed and connected to the basilar artery. Given the patient's compromised condition, direct surgical repair was deemed too invasive. Instead, due to the patient's favorable collateral circulation, an emergent repair with a covered stent was performed.

The patient was intubated to prevent potential airway obstruction due to hematoma growth and placed under general anesthesia. An 8-Fr sheath (40-cm long) was inserted into the femoral artery. Selective angiography of the left VA visualized the entire vertebrobasilar system (Figure 1B), indicating tolerance to right VA occlusion. Side branches from the SA were coil embolized to prevent type-II endoleak (Figure 1D). The right VA was embolized under flow control using a balloon catheter (LOGOS; PIOLAX, Inc., Yokohama, Japan) to prevent distal embolization. A 6-Fr sheath was inserted into the right brachial artery. A 0.035 inch ×300 cm wire was passed to the brachial artery to complete the pull-through (Figure 1E). Despite the 8-Fr sheath reaching only the descending aorta, the pull-through technique facilitated stent system (GORE VIABAHN 10×50 mm, W. L. Gore & Associates, Inc., Flagstaff, Arizona, USA) advancement along the guidewire. As a preparatory step, after systemic heparinization, the distal one-third of the VIABAHN was deployed, with a touch-up balloon (Mustang 10×40 mm; Boston Scientific, Marlborough, Massachusetts, USA) positioned just distal to the covered stent (Figure 2A). For the main step of vessel sealing, the following procedure was performed sequentially: Immediately after the dialysis catheter extraction, the remaining two-thirds of the covered stent was fully deployed and the stent system was withdrawn to the brachiocephalic artery (Figure 2B), followed by swift balloon advancement to the injury site and inflation (Figure 2C). No extravasation was observed. After confirming the patency of cerebral vessels, the patient returned to the intensive care unit.

The patient was extubated the following day and administered 100 mg of aspirin. Another dialysis catheter was placed in the left internal jugular vein. Continuous hemodiafiltration was initiated on postoperative day 1 and continued until day 3, followed by intermittent hemodialysis. An arteriovenous fistula for maintenance dialysis was created in the left forearm, and the patient was discharged to a rehabilitation

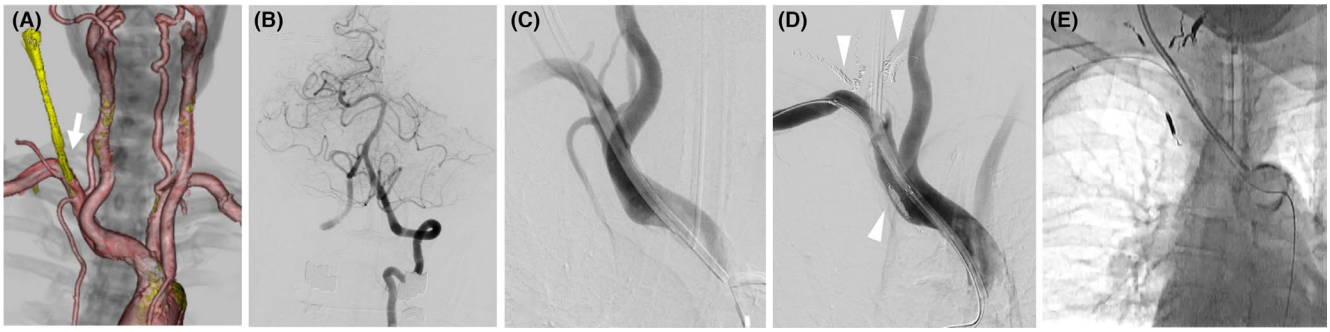

FIGURE 1 Computed tomography angiography demonstrating inadvertent dialysis catheter insertion into the right subclavian artery (arrow), just distal to the vertebral artery (A). Digital subtraction angiography (DSA) of the left vertebral artery demonstrating adequate perfusion to the entire basilar system (B). DSA image before treatment (C). Occlusion of side branches with coils (arrowheads) to prevent type-II endoleak (D). The pull-through system constructed to advance the stent system without the support of a guiding catheter (E).

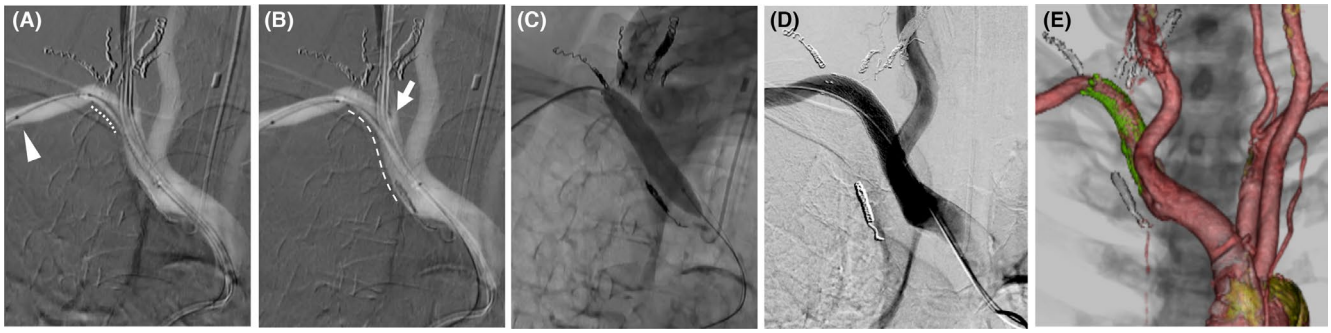

FIGURE 2 One-third stent deployment (dotted line) and positioning of a touch-up balloon distal to the stent (arrowhead pointing to the balloon tip) with the pull-through wire (A). Full deployment of the covered stent (dashed line) following catheter removal (B). Swift advancement and inflation of the balloon to secure the tear (C). The final angiography (D) and the follow-up computed tomography angiography (E) confirm successful repair.

facility. Over 11 months, the patient remained free of neurological and vascular complications.

DISCUSSION

Central venous catheter insertion, while common, carries risks including arterial injury, pneumothorax, hemothorax, and stroke. Internal jugular vein insertion can result in arterial mispuncture (6.3–9.5%),[1] and catheter misplacement (0.17%),[2] posing serious complications, especially with dialysis catheters due to their thickness. Catheter-related inadvertent arterial injuries can involve the carotid, subclavian, vertebral, brachiocephalic arteries, and even aorta. However, the proportions of such injuries by site have not been consistently documented across studies. The standard procedure for ultrasound-guided internal jugular vein cannulation is described elsewhere.[3] However, the needle tip may not always be clearly visible at deeper levels in a cross-sectional view, particularly in conditions such as obesity or a short neck. Consequently, mispuncture of deeper structures can occur even with ultrasound guidance.

Treatment options include removal/compression, direct surgery, and endovascular treatment. Removal/compression is discouraged due to a high complication rate (94%). Direct surgery, while having a low complication rate (0% in 37 cases), sometimes requires open-chest procedures, making it too invasive for medically fragile patients. Endovascular treatment, with a complication rate of 5.4%, is increasingly preferred.[4] Covered stents, along with suture-based vascular closure devices, are commonly employed.[5]

The VIABAHN for vascular repair is a self-expandable nitinol stent with an expanded polytetrafluoroethylene membrane and heparin coating. It is preferred for axillary-subclavian vessel injuries due to its low profile and reduced friction. Navigating VIABAHN with 9–10 mm diameter requires 8-Fr sheaths. In emergencies where long-profile sheaths are unavailable, the pull-through technique with an 8-Fr sheath of short length can be employed.[6] In this case, even though the sheath only reached the descending aorta, the pull-through technique enabled the stent system to advance through the curved vessel.

Adequate perfusion from the contralateral VA to the entire vertebrobasilar system is vital when covering the VA orifice.[7] Selective vertebral angiography helps visualize collaterals of posterior circulations and assess tolerance for sacrificing the VA. In cases with controversial collaterals, balloon occlusion tests may be considered.

Postoperative management lacks consensus on antithrombotic regimens and duration. While dual antiplatelet therapy with aspirin and thienopyridine is standard for peripheral artery disease, due to bleeding vulnerability in this case, only aspirin was administered here to prevent in-stent thrombosis, with no observed complications. Long-term patency is also uncertain, with reported 12-month patency rates ranging from 56.1% to 97%, depending on the vessel size and location.[8,9]

Covered stents can effectively treat large vessel injuries requiring immediate hemostasis. A recent study on traumatic axillo-subclavian artery injuries reported the proportions for open surgery, endovascular repair, and planned hybrid approaches as 23%, 18%, and 25%, respectively.[10] Open surgery remains indispensable in the trauma setting, as arterial injuries often involve vessel transection or severe external bleeding, which can lead to hemodynamic instability. Furthermore, these injuries are frequently associated with complex conditions, such as concomitant vein damage, bone fractures/dislocations, and brachial plexus injury, necessitating the comprehensive approach provided by open surgery. For both iatrogenic and traumatic major vessel injuries in hemodynamically stable patients, endovascular repair offers significant advantage of its minimally invasive approach particularly when direct surgery is complicated by underlying or anatomical factors, though uncertainties exist regarding remote complications.

CONCLUSION

This case demonstrates the successful endovascular treatment of an iatrogenic SA injury from a dialysis catheter using VIABAHN stentgraft. It underscores the effectiveness of endovascular repair as a viable alternative when direct surgery is not feasible. In emergency settings, where long sheath is not available, the pull-through technique can facilitate the advancement of the stent system.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Approval of the research protocol: The Ethics Committee of Osaka Red Cross Hospital approved this case study (No. J-0608).
Informed consent: Written informed consent was obtained from the patient for publication of this case report and accompanying images.
Registry and registration no. of the study/trial: N/A.
Animal studies: N/A.

ORCID

Yohei Takenobu https://orcid.org/0000-0001-9793-0711

REFERENCES

1. McGee DC. Preventing complications of central venous catheterization. N Engl J Med. 2003;348:1123–33.
2. Shah PM, Babu SC, Goyal A, Mateo RB, Madden RE. Arterial misplacement of large-caliber cannulas during jugular vein catheterization: case for surgical management1. J Am Coll Surg. 2004;198:939–44.
3. Ortega R, Barash P. Ultrasound-guided internal jugular vein cannulation. N Engl J Med. 2010;362:e57.

4. Dixon OGB, Smith GE, Carradice D, Chetter IC. A systematic review of management of inadvertent arterial injury during central venous catheterisation. J Vasc Access. 2017;18:97–102.
5. Yoon DY, Annambhotla S, Resnick SA, Eskandari MK, Rodriguez HE. Inadvertent arterial placement of central venous catheters: diagnostic and therapeutic strategies. Ann Vasc Surg. 2015;29:1567–74.
6. Loose HW, Ryall CJ. Common iliac artery occlusion: treatment with pull-through angioplasty. Radiology. 1988;168:273–4.
7. Zoarski GH, Seth R. Safety of unilateral endovascular occlusion of the cervical segment of the vertebral artery without antecedent balloon test occlusion. Am J Neuroradiol. 2014;35:856–61.
8. Ueda T, Murata S, Tajima H, Saito H, Yasui D, Sugihara F, et al. Endovascular treatment with Viabahn stent-grafts for arterial injury and bleeding at the visceral arteries: initial and midterm results. Jpn J Radiol. 2022;40:202–9.
9. Brendel JM, Mangold T, Lescan M, Schmehl J, Ghibes P, Grimm A, et al. Viabahn stent graft for arterial injury management: safety, technical success, and long-term outcome. CVIR Endovasc. 2024;7:23.
10. Boudreau S, Schucht J, Sigdel A, Dwivedi AJ, Wayne EJ. Contemporary review of traumatic axillary and subclavian artery injuries at an urban level one trauma center. Vasc Endovascular Surg. 2024;58:581–7.

How to cite this article: Takenobu Y, Furuta A, Haga S, Yukawa H, Nomura N, Toyama M, et al. Inadvertent insertion of dialysis catheter into subclavian artery treated with a covered stent: A case report. Acute Med Surg. 2025;12:e70038. https://doi.org/10.1002/ams2.70038