Inadvertent Dialysis Catheter—An Interventional Bailout!

Soumil Singhal[1] Nischal Kundaragi[1] Sriram Jaganathan[1] M. C. Uthappa[1] Bibin Sebastian[1]

[1]Department of Intervention Radiology and Intervention Oncology, BGS Gleneagles Global Hospital Bangalore, Bangalore, Karnataka, India

Address for correspondence Soumil Singhal, MD, Department of Intervention Radiology and Intervention Oncology, BGS Gleneagles Global Hospital Bangalore, Bangalore 560060, Karnataka, India (e-mail: Drsoumilsinghal75@gmail.com).

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Here is a 38-year-old male patient who presented in the emergency with complaints of severe abdominal pain, vomiting since 4 days, and breathlessness since 2 days. On clinical examination, the patient was drowsy, with dyspnea and moderate dehydration. Blood evaluation showed elevated lipase (63,365 U/L), amylase (2,457 U/L), and total count (17,000 cells/µL of blood). Imaging was suggestive of acute necrotizing pancreatitis. The patient developed secondary renal and respiratory failure for which the patient was shifted to the intensive care unit (ICU) for ventilatory support. Because of rising serum creatinine levels, central venous access was planned for hemodialysis.

Right internal jugular access was planned by the ICU intensivist. The procedure was performed by Seldinger technique using 16G needle without any ultrasound guidance. After the initial backflow, the needle was blindly advanced further, and a wire was introduced, following which a 6F central vein catheter was placed. No free backflow was observed, and the radiologist was called to perform a Doppler scan.

Check radiography was acquired, which showed the catheter to be positioned slightly off center (►**Fig. 1**). Because of the patient's condition, contrast-enhanced computed tomographic (CT) angiography was performed, which revealed the central venous catheter to be malpositioned with the catheter traversing the right subclavian artery (first part of subclavian artery distal to the origin of the thyrocervical trunk) and surrounded by a localized hematoma. The catheter tip was in the posterior pleural cavity with associated lung contusion and hemothorax (►**Figs. 2, 3**).

The patient was referred to the interventional radiology team to evaluate the condition and take the appropriate interventional step required to bail out the patient from this situation. Both options of covered stent and balloon occlusion were explained to the patient, and covered stent placement was considered over balloon occlusion as balloon occlusion is a temporary technique that can be associated with a risk of re-bleed or increase in the rent size.

Fig. 1 Scanogram showing laterally placed central vein catheter.

The patient was taken up for angiography. Right femoral access using a 5F sheath (Cordis) under ultrasound guidance was achieved. Right innominate artery angiogram was performed using a 100-cm Cobra catheter, which revealed that the central venous catheter had traversed the subclavian artery. However, there was no contrast leak across the puncture site that was likely due to the tamponade effect between the arterial wall and the catheter. Next, a wire was placed across the innominate artery, and the focus was shifted to the central vein catheter. A small volume of contrast was injected as the catheter was withdrawn, and a subclavian angiogram was seen once the side holes of the catheter were within the intraluminal portion of the

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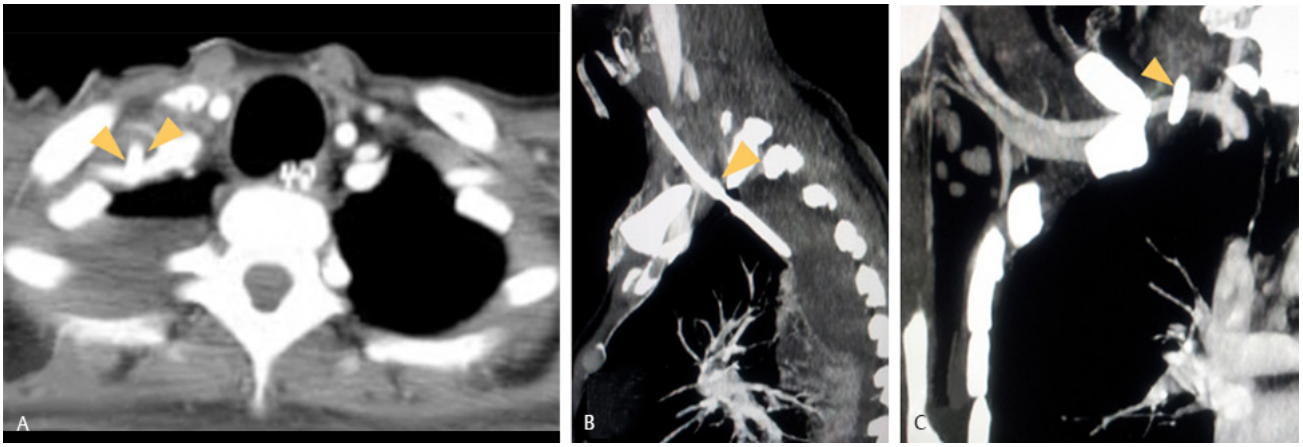

Fig. 2 Contrast-enhanced CT. **(A)** Axial section and **(B, C)** reformatted coronal and sagittal sections show the central vein catheter (yellow arrow head) traversing the right subclavian artery with surroundings hematoma and right hemothorax.

Fig. 3 Volume-rendered image showing the malpositioned catheter placement.

artery (►**Fig. 4**). It was decided to place a stent graft across the through and through puncture site. However, as the site was in proximity to the right vertebral artery (origin is 2.8 cm away), a decision of sacrifice of the right vertebral artery was made after evaluating the patency and caliber of the left vertebral artery. The 5F sheath was replaced by a 6F sheath, and a 40- × 8-mm stent graft (iCAST; Atrium Medical) was placed and deployed across the puncture site after pulling out the central vein catheter. Check angiogram images were acquired, which was suggestive of an excellent hemodynamic outcome (►**Fig. 5**). Dual-antiplatelet (aspirin 75 mg and clopidogrel 150 mg) medication was initiated on day 2. The patient showed improvement in his condition during the postprocedure period.

Discussion

Central vein catheterization is a very commonly performed procedure in an intensive care setting. However, it can be associated with complications that need to be addressed immediately and managed effectively. Complications can be either immediate or delayed in nature. Immediate complications include pulmonary, cardiac, vascular, and placement related, and delayed complications include infection and dysfunction of a device. The use of ultrasound assistance has reduced immediate procedure-related complication significantly down to 4 to 7%.[1–3] However, the use of ultrasound does not eliminate the possibility of an inadvertently placed catheter into the arterial system.[4–6]

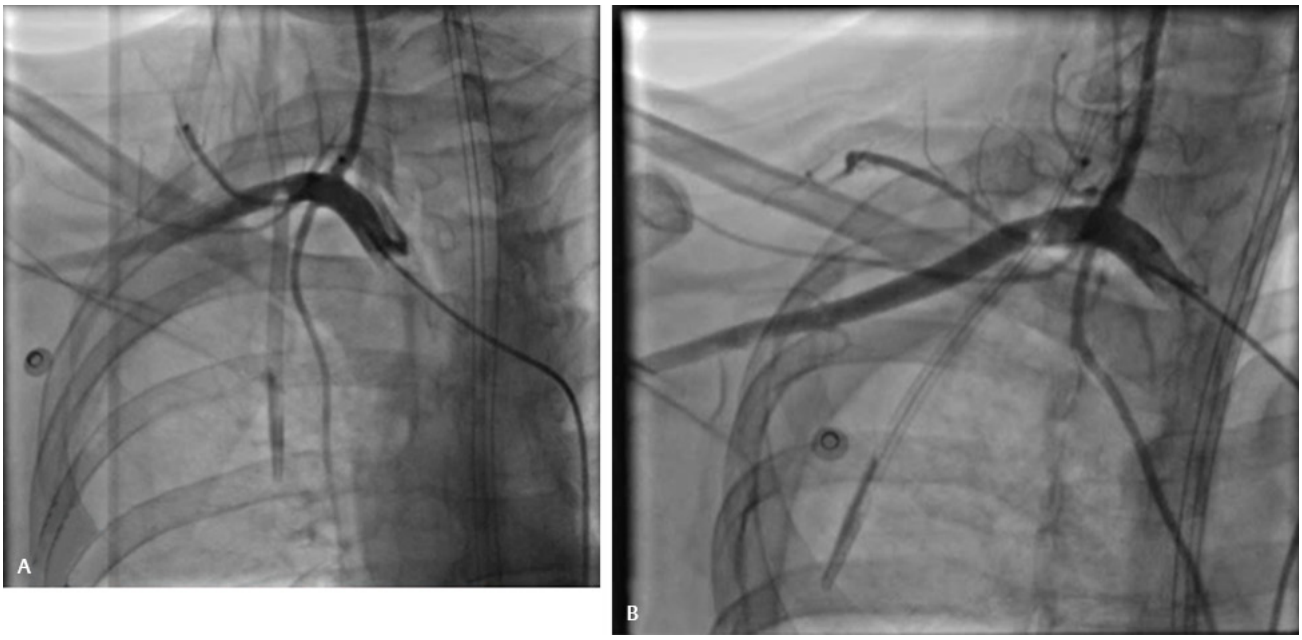

Fig. 4 Angiography images. **(A)** Anteroposterior projection. **(B)** Oblique projection showing a filling defect within the right subclavian artery.

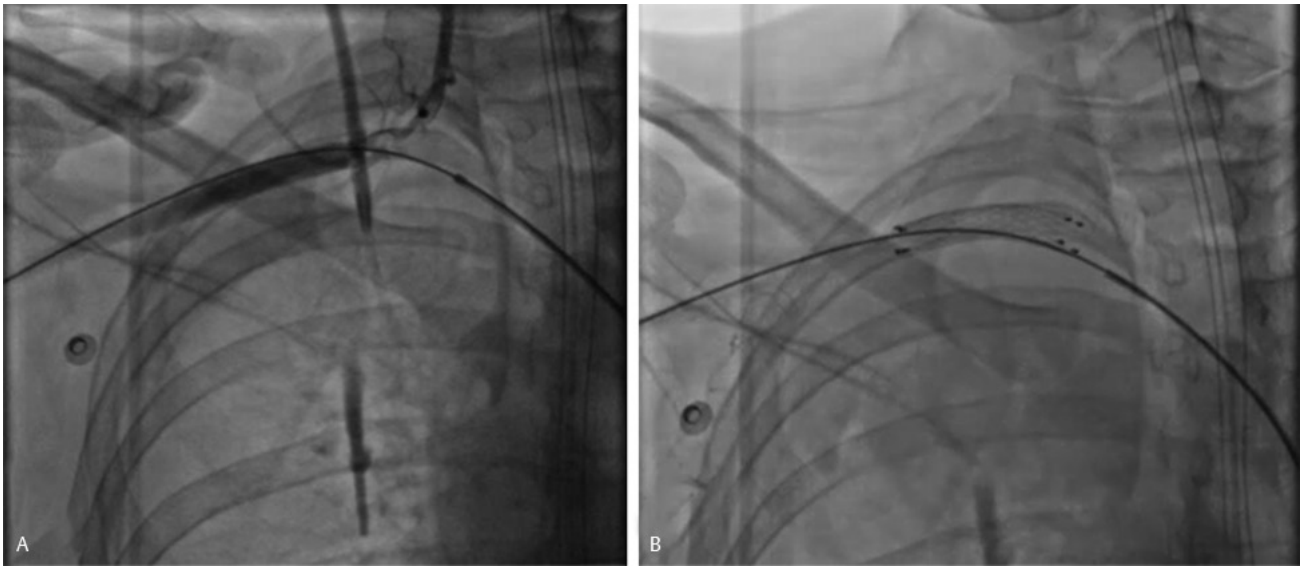

Fig. 5 Angiographic images. Anteroposterior projection. **(A)** Subclavian artery angiogram from pulled back catheter. **(B)** Stent graft placed across the subclavian artery rent.

Arterial injury has been seen in less than 1% of cases.[7] Arterial injury involving femoral artery is more common when compared with subclavian artery.[8] On reviewing the literature, multiple case reports and case series have been found with an inadvertently placed catheter or arteriovenous (AV) fistula formation or pseudoaneurysm development. Our case is unique as the catheter went through and through the subclavian artery prompting for an endovascular approach by the interventional radiology team.

Various devices such as stents, closure devices, and balloons are used to treat complications associated with subclavian artery injury. Based on the location and type of injury, the treatment is tailored specifically to the situation.

A covered stent has been found to be very successful in the management of subclavian artery injury secondary to central vein catheter.[9–14] Two forms of covered stents are available: (1) balloon expandable and (2) self-expanding covered stent. The advantage of balloon-expandable stents is that first, they have a very controlled deployment and second the option of flexible sizing. The long-term outcome of these stents has, however, not been documented.[15] Use of a covered stent is not always possible, especially in cases when the subclavian artery injury is in proximity to important branch vessels, for example the vertebral artery.

Subclavian stents demonstrate a primary patency rate of 77 to 92% and a secondary patency rate of 92 to 96%.[16–18]

The European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) in their guidelines for vascular interventions have recommended that (1) ultrasound screening should be performed on the target vessel to assess the optimal patient position and locate the most appropriate anatomical site for central vascular access and (2) both short- and long-term venous access should be performed under real-time ultrasound guidance rather than ultrasound assistance.[19] The American Society of Anesthesiologists (ASA) strongly recommends the use of ultrasound and also recommends (1) confirmation of the catheter position can be done using ultrasound, manometry, pressure-waveform analysis, or venous blood gas measurement; (2) in case of unsure wire or catheter tip, confirmation can be done using ultrasound, fluoroscopy, continuous electrocardiography, or transesophageal ultrasound; and (3) in case of inadvertent cannulation of an arterial vessel, the catheter should be left in place and an intervention radiologist/surgeon should be consulted.[20]

Conclusion

A standard central vein catheterization can be associated with several avoidable complications when adhered to guidelines laid down by EFSUMB or ASA.

The guidelines also state the appropriate approach in case of an in-advent arterial catheterization. Endovascular approach is preferred in the management of cases that are surgically challenging.

Conflict of Interest
None.

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