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Superior vena cava syndrome: do not miss the Ariadne's thread

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ABSTRACT
A central venous catheter tip located too high into the superior vena cava (SVC) is known to be a strong risk factor for central venous thrombosis and subsequent SVC syndrome. We report herein the usefulness of catheterizing the implanted port catheter lumen as a salvage procedure to circumvent a complete SVC occlusion in a breast cancer patient. Because the standard central vein catheterization attempt is often unsuccessful, the port catheter should always be considered as the Ariadne's thread and used as an attempt for catheterization.

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Central venous catheter tip location assessment is mandatory during the implantation procedure. It is well accepted that the optimal position of the catheter tip is located at the atrial caval junction (1). Importantly, a catheter tip located too high into the superior vena cava (SVC), where it faces the azygos vein arch or upstream into the SVC or one of its tributaries (e.g., brachiocephalic veins [BCVs]), is known to be a strong risk factor for thrombosis and subsequent SVC occlusion (28.8% left, 5% right), especially in cancer patients (2–4).

Case report

A 55-year-old female patient with breast cancer presenting with a right internal jugular vein implanted chamber catheter was referred to the emergency department due to severe SVC syndrome. Upon computed tomography (CT) scan examination, the SVC syndrome was found to be due to catheter-related SVC occlusion.

The patient was given full anticoagulant therapy, diuretics, and corticoids for one week, and then scheduled to receive an endovascular stent (Fig. 1). The procedure was performed under intravenous sedation (hydroxyzine, 40 mg), analgesia (paracetamol, 1 g), antibiotic prophylaxis (amoxicillin and clavulanic acid, 1 g), and heparin 3000 IU bolus.

Using right common femoral vein access, a 5F multi-purpose SVC catheter was used to abut the SVC occlusion, but the retrograde catheterization procedure failed despite the use of an 80 cm long 6F introducer sheath tutor and various hydrophilic guidewires. We then explanted the subclavicular port chamber under sterile conditions while maintaining the 7F internal jugular vein catheter for use as the "Ariadne's thread". The catheter lumen was catheterized using a 260 cm long, 0.025 inch hydrophilic guidewire. The catheter tip was clearly distinguishable despite the complete SVC occlusion, and we were able to easily circumvent the obstruction and target the inferior vena cava. The long femoral sheath was removed and replaced by a short 6F introducer. The 0.025 inch guidewire was pushed downward to the right femoral vein and snared through the right groin introducer sheath using a snare loop. Thus, an internal jugular vein-to-femoral through and through wire access procedure was performed. The 80 cm sheath was reintroduced into the right groin. Right BCV contrast medium opacification showed hypertrophic venous collaterals and no antegrade flow into the SVC. An over-through and through femoro-jugular 260 mm long 0.035 inch exchange Rosen guidewire procedure allowed for a successful SVC tight stenosis high pressure balloon dilation. A 6×20 mm long balloon angioplasty of the SVC occlusion was performed to facilitate the WALLSTENT® (Boston Scientific, Natick, Massachusetts, USA) 14×60 mm prosthesis expansion. A progressive diameter high pressure balloon, which was 8 and 12 mm in diameter and 40 mm in length, was used to dilate the vessel up to 20 atmospheres. Subsequent

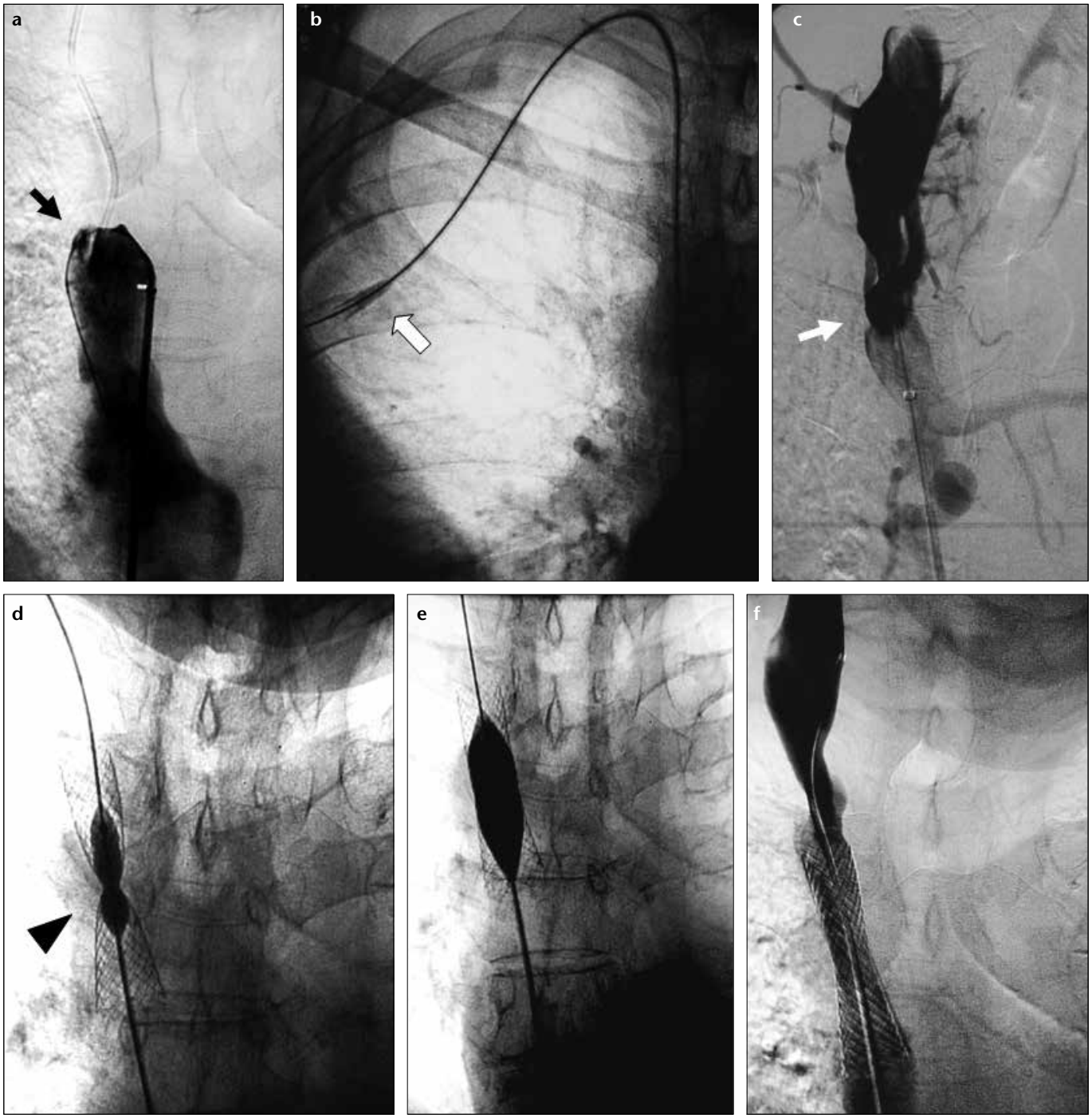

Figure 1. a–f. Retrograde superior vena cava (SVC) catheterization attempt **(a)** shows complete SVC horizontal occlusion (lower section) within the lower third of the vessel (*arrow*). Through and through right guidewire subclavian/common femoral catheterization using the Ariadne wire is seen **(b)**. The *arrow* indicates that the port catheter was left in place. Antegrade SVC opacification **(c)** demonstrates the upper part of the occlusion (*arrow*). High pressure balloon dilation **(d, e)** allows for assessment of the diameter, length, and stiffness of the stenosis (*arrowhead*). Attention must be paid not to overdilate the stenosis in case of postradiation stenosis. Final antegrade SVC opacification is seen **(f)**.

opacification showed full reopening of the SVC lumen and the disappearance of collateral pathways.

No complication was reported and the patient's clinical symptoms disappeared completely within two days. The patient was administered a vitamin K antagonist for two months. A CT scan performed one month after the procedure showed a patent and well-positioned prosthesis within the SVC (Fig. 2).

Discussion

In patients presenting with catheter-related SVC occlusion, percutaneous venous stent insertion is the treatment of choice (5) due to its quick effectiveness, safety, and low morbidity. Indeed, short- and long-term follow-up shows good clinical outcome and a high rate of primary and secondary stent patency (6). However, percutaneous SVC stenting may be challenging in cases of complete occlusion due to an exten-

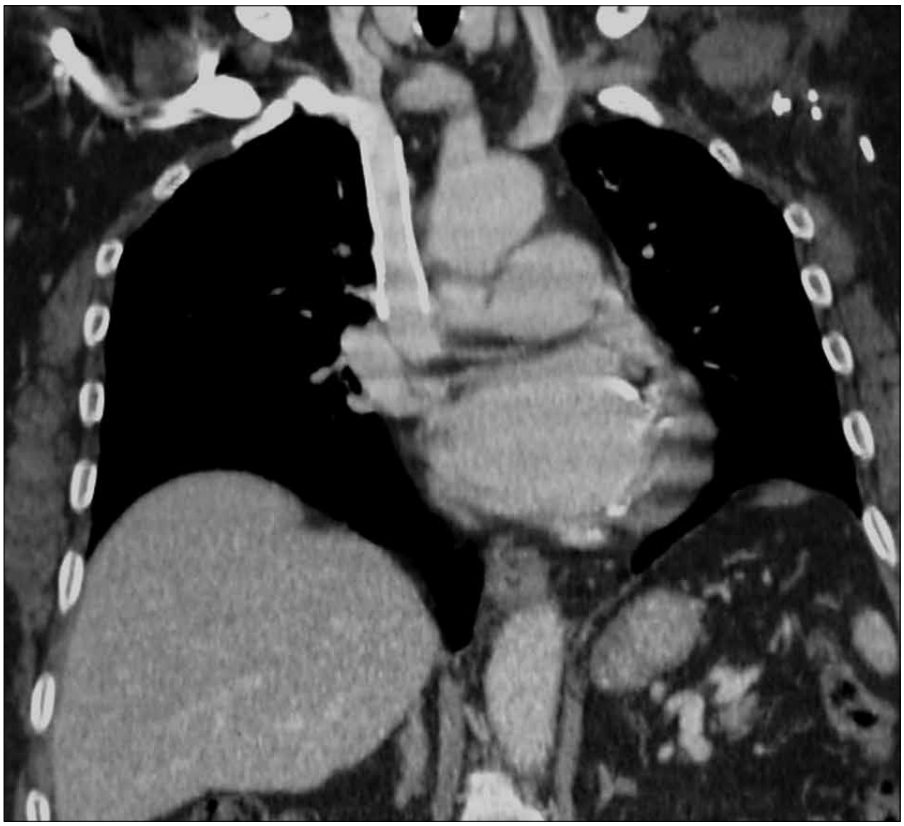

Figure 2. Postprocedure coronal multidetector computed tomography reformation of the chest. Antegrade CT cavogram shows successful reopening of the SVC and disappearance of venous collaterals.

sively organized cruoric thrombus and venous fibrosis. Venous catheterization failure precluded any insertion and deployment of the stent. Furthermore, any risky attempt would have favoured life-threatening guidewire venous perforation, which could lead to hemomediastinum/hemopericardium, particularly in postradiation cancer patients with a fragile SVC wall (7). Therefore, an efficient and attractive approach for this procedure is to catheterize the lumen of the venous implanted catheter as the Ariadne's thread. Although the central venous implanted catheter can be repositioned before and after stent deployment (8), we emphasize that it should not be withdrawn before a guidewire has been placed through the obstruction. Even a catheter that is too short and incorrectly positioned should be used as Ariadne's thread before being replaced. Such a jugular-to-femoral through and through procedure allows for the circumvention of a tight and tortuous SVC occlusion (9). Furthermore, the right-sided femoral-jugular route is straightforward for the careful and progressive dilation of the occlusion. Importantly, low pressure balloon angioplasty should be performed very carefully in radiation therapy patients due to the life-threatening risk of SVC rupture (7).

One limitation of this case study was that we did not attempt any basilic vein access in the arm as a first approach for SVC recanalization. The use of a straight-tip glide wire instead of an angled glide wire could have also led to a successful procedure. Thus, it is critical to closely monitor iterative attempts of SVC recanalization in irradiated lung cancer patients with tortuous vein occlusions, as forceful Glidecath® guidewire (Terumo Medical Corporation, Somerset, New Jersey, USA) catheterization may create an abnormal route outside of the SVC and cause subsequent hemomediastinum and cardiac tamponade.

In conclusion, the presence of a port catheter or a tunneled catheter may provide the only opportunity for the patient to receive successful treatment of SVC occlusion. Therefore, an inserted port or tunneled catheter should not be removed from these patients without informing the interventional radiologist.

Conflict of interest disclosure

The authors declared no conflicts of interest.

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