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CASE REPORT

Percutaneous reconstruction of chronic total occlusion of brachiocephalic vein using transseptal needle in dialysis-dependent patient

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Abstract Placement of a dialysis catheter substantially increases the risk of central vein stenosis. 52-year-old female with end-stage renal disease and a right brachial–cephalic hemodialysis access presented with right arm swelling. The chronic total occlusion of right brachiocephalic vein was refractory to wire traversal. Sharp recanalization of the central venous occlusion was done with transseptal needle retrogradely. The track was balloon dilated and stented. When the conventional catheters and guide wires options fail, sharp recanalization technique may be used to salvage a precious dialysis access.

Keywords Dialysis · Brachiocephalic vein · Transseptal needle

Introduction

Central venous obstruction is a serious and prevalent challenge in the management of hemodialysis patients that lead to significant morbidity and dysfunction of the vascular access. In patients on dialysis, central vein stenosis is primarily related to the placement of an ipsilateral central venous catheter and can occur up to 40 % of patients [1]. The ideal management target is both resolving the obstruction and maintaining the patency of the ipsilateral hemodialysis access. Percutaneous transluminal venoplasty, either on its own or with stent placement, is the preferred approach to central venous obstruction.

Case report

We report a case of a 52-year-old female with a medical history of diabetes and end-stage renal disease, on regular hemodialysis from right brachial–cephalic A–V fistula, transferred to our facility with progressive worsening right upper extremity swelling (Fig. 5a) and difficulty in hemodialysis over 2 months. She has nonfunctioning A–V fistula in left upper limb (surgically ligated in past). Access was obtained puncturing the venous component of the brachial–cephalic A–V fistula in right arm. Venography done by 5 Fr pigtail catheter inserted into right subclavian vein through the fistula revealed complete occlusion of the right brachiocephalic vein at the termination of the right internal jugular vein and the subclavian vein (Fig. 1a).

A 5 Fr multipurpose catheter and 0.035-inch hydrophilic guidewire (Terumo, Japan) combination was initially used to probe occluded vein, even with the stiffer back end of the wire. But we were not able to cross the lesion. A stiffer 0.014 inch CROSS IT 200 XT wire (Abbott Laboratories, IL, USA) along with Finecross MG microcatheter (Terumo, Japan) was used to cross the lesion. Multiple attempts were made to cross the occlusion both antegradely and retrogradely using standard catheter and guidewire techniques but we were not able to cross the lesion. Hence, sharp recanalization with transseptal needle set (Cook

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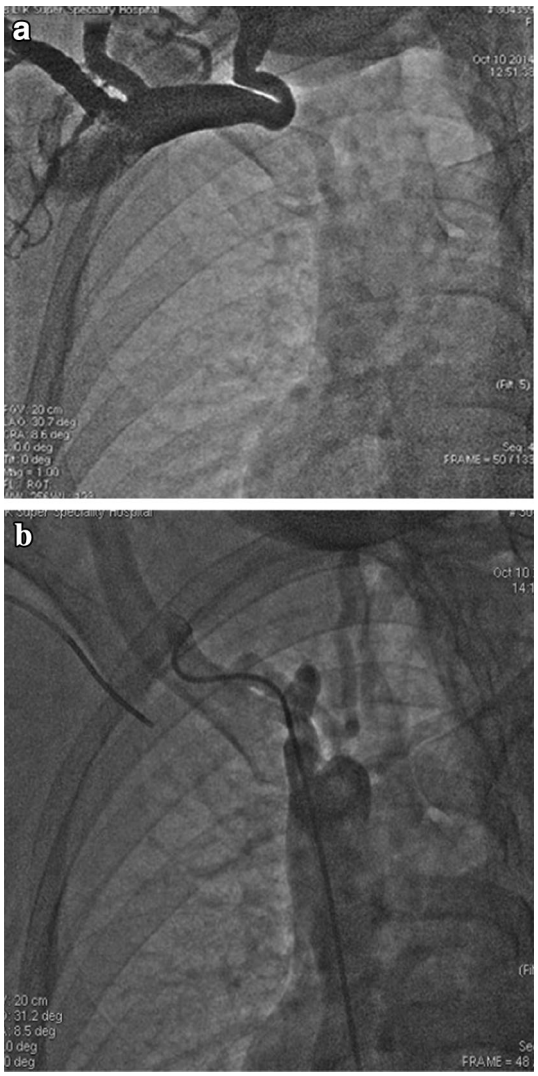

Fig. 1 **a** Venography through brachial–cephalic fistula revealing complete occlusion of the right brachiocephalic vein at the termination of the right internal jugular vein and the subclavian vein. **b** Retrograde venogram through SVC showing multiple collaterals near SVC

Medical, USA), containing 18 gauge 71 cm transseptal needle and 8 Fr 63 cm introducer sheath, was performed. Transseptal needle with small curved needle (shaft to needle tip angle approximately 19°) was used. We chose the left femoral approach, as we are familiar to maneuver transseptal needle through femoral route for transseptal catheterization and also presence of multiple collaterals near SVC end made it difficult to visualize the target for penetration antegradely, while a blunt stump of brachiocephalic vein made it easy to target for penetration retrogradely (Fig. 1b).

Transseptal needle with introducer was advanced to superior vena cava through right femoral vein. Transseptal needle directed toward multipurpose catheter positioned at

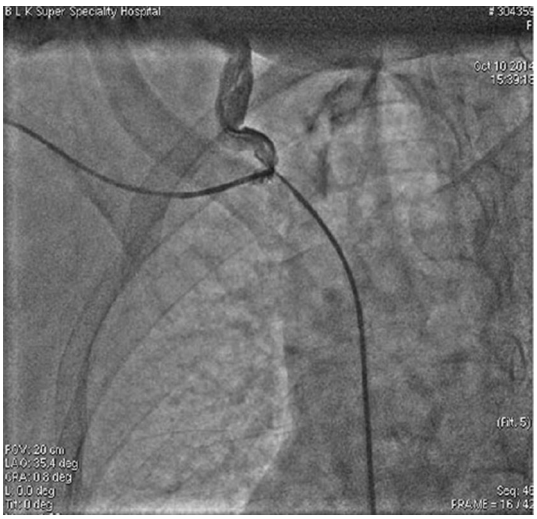

Fig. 2 Transseptal needle crossed the fibrotic occlusion and entered in right brachiocephalic vein from superior vena cava (confirmed by injecting contrast through needle). A multipurpose catheter positioned at the precise site of occlusion peripheral to occlusion in right subclavian vein

the precise site of occlusion peripheral to occlusion in right subclavian vein. Length of total occluded segment was 4 mm. We use various angulations (RAO 30, LAO30, AP and Lateral) to decide appropriate needle direction toward multipurpose catheter placed on other side of subclavian vein. Needle with introducer sheath was advanced while staining with contrast across the fibrous tissue from superior vena cava to right brachiocephalic vein. As the needle crossed the fibrotic occlusion and entered in right brachiocephalic vein (confirmed by injecting contrast through needle), introducer sheath was also advanced (Fig. 2). Transseptal needle was withdrawn and a 0.035-inch hydrophilic guidewire (Terumo, Japan) was advanced through introducer sheath. This wire advanced into jugular vein. Introducer sheath was removed and a 0.018-inch hydrophilic guidewire (Terumo, Japan) was advanced through multipurpose catheter from right subclavian vein and crossed the occlusion, the end of wire now in right iliac vein was snared through right femoral vein and exteriorized to form a rail between both access sites. A 5 Fr multipurpose catheter was advanced over this wire from femoral vein up to right subclavian vein and wire exchanged with 0.035 inch Amplatz super stiff guidewire (Boston scientific, USA). Initially a Conquest 8 × 40 mm peripheral angioplasty balloon (BARD Peripheral Vascular Inc, USA) was passed over the wire from femoral vein. Multiple dilatations were given at the site of block up to 16–18 atm. Further dilation is done with ATLAS 12 × 40 mm peripheral angioplasty balloon (BARD Peripheral Vascular Inc, USA) up to 16 atm (Fig. 3). After balloon dilatation there was recoil at the obstruction site with pressure gradient of 10 mm Hg. A self expanding

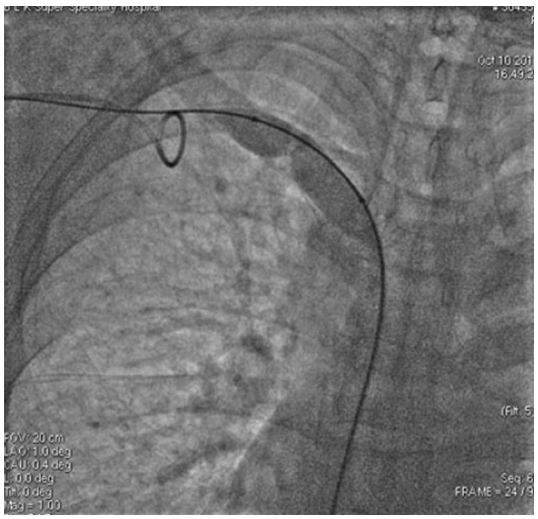

Fig. 3 Balloon dilatation of the obstructed segment with 12 × 40 mm ATLAS peripheral angioplasty balloon

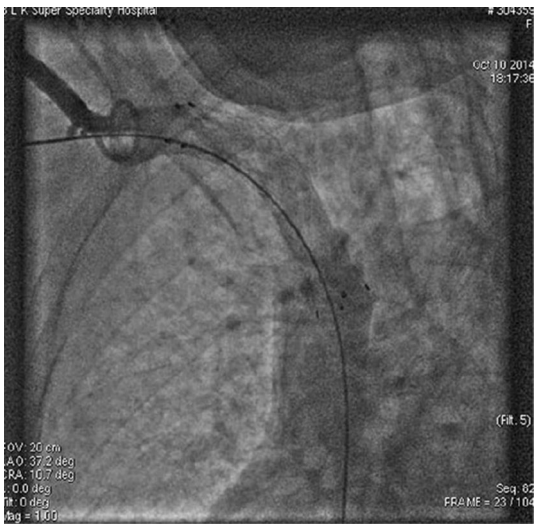

Fig. 4 Venography through brachial–cephalic fistula revealed complete restoration of the flow after balloon angioplasty and stenting of the right brachiocephalic vein

E-LUMINEXX 12 × 40 mm stent (BARD Peripheral Vascular Inc, USA) was deployed across the lesion site and post dilated with 12 × 40 mm ATLAS balloon up to 10–12 atm (Fig. 4). There was no gradient observed across the lesion after post dilation of stent.

We have put the patient on dual antiplatelets (aspirin 150 mg and clopidogrel 75 mg daily) for 1 year, and aspirin 150 mg daily thereafter.

As the patient was referred from other center we are following every month telephonically, by clinical symptoms (no arm swelling). At the time this article was written, the patient continues to have resolution of right arm pain and swelling (Fig. 5b).

Fig. 5 Right arm swelling before procedure. **b** Right arm 24 h after procedure

Discussion

In patients with end-stage renal disease on hemodialysis, central venous obstruction due to hemodynamic stress and intimal injury related to previous catheterization is well known. Central vein obstruction should be suspected when persistent gross upper extremity edema occurs after a graft or arteriovenous fistula has been placed in the ipsilateral arm. In hemodialysis-related central veno-occlusive disease, the preferred treatment is percutaneous transluminal venoplasty.

Several techniques for blindly crossing central vein occlusions have been described, although these should not be attempted without significant endovascular experience [2].

The concept of sharp recanalization has been described before. Ferral et al. [3] directed a 21-gauge needle percutaneously, toward a transfemorally inserted loop snare, for venous catheter insertion in the presence of jugular and subclavian occlusions. A similar method was used by Athreya et al. [4] to insert tunneled dialysis catheters. Murphy et al. [5] recanalized subclavian occlusion with a

Rosch–Uchida needle directed toward an inflated balloon, central to the occlusion, through the axillary vein. Honnef et al. [6] used a TIPS needle (Cook, Bjaeverskov, Denmark) for revascularization of an occluded left brachiocephalic vein. Seckeler et al. [7] describe use of transseptal needle from subclavian vein for brachiocephalic vein obstruction after resection of mediastinal mass.

In our patient, the occlusion was refractory to wire traversal and was successfully recanalized with transseptal needle followed by balloon angioplasty and stent placement. As Rosch–Uchida or TIPS needles are not used for cardiac intervention procedures and many cardiologists may not be familiar to use and maneuver these needles. We demonstrate the use of transseptal needle for total occlusion which is routinely used hardware in cardiac cath lab. The potential risk associated with sharp needle revascularization includes extravasation and puncture of adjoining artery. Care must be taken not to rupture central vein using large size balloon. Appropriately sized covered stent should be available in cath lab. Stent fracture, thrombosis and restenosis are major complications in follow-up. Chances of stent compression and fracture are high if stenting is done for the central venous obstruction near the costoclavicular junction.

To best of our knowledge our case is unique in demonstrating use of transseptal needle by retrograde approach through superior vena cava in hemodialysis-dependent patient with no prior references. The approach described in this report may be used as a revascularization technique, with due precautions for central venous occlusions, refractory to conventional methods.

Acknowledgments Grant information nothing to disclose.

Conflict of interest None.

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