

Long-segment central venous occlusion in a hemodialysis patient treated by segmented sharp recanalization strategy

A case report

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Abstract

Introduction: Among hemodialysis population, central vein occlusion (CVO) is a common complication. Percutaneous transluminal angioplasty has become the mainstay treatment these days. But the treatment of long-segment central venous occlusion remains difficult.

Patient concerns: We presented a 73-year-old man on maintenance hemodialysis complaining of swelling of the right arm and face for 20 days. The patient underwent maintenance hemodialysis via a right internal jugular vein catheter for first 2 months of dialysis while the initial right radiocephalic wrist arteriovenous fistula (AVF) blood flow had been unsatisfactory (below 180 mL/min) for 1 month.

Diagnosis: Digital subtraction angiography revealed long-segment CVO extending from the right subclavian vein (SV) to the right innominate vein (IV), forming an obvious included angle at the right jugular angle.

Interventions: Since conventional guide wire transversal failed, segmented sharp recanalization was performed by separate transversal of the obstructive right SV and right IV, therefore crossing the whole lesion segment by segment, followed by balloon dilation and stent placement.

Outcomes: No procedure-related complication was recorded during or after the operation. After a follow-up period of 5 months, the patient's AVF maintained satisfactory in blood flow, while the edema in his ipsilateral limb and face also notably ameliorated.

Conclusion: The segmented sharp recanalization is a practical strategy in treating angled long-segment CVO which is refractory to traditional guide wire transversal in hemodialysis patients.

Abbreviations: AVF = arteriovenous fistula, CVO = central venous occlusion, DSA = digital subtraction angiography, IV = innominate vein, PTA = percutaneous transluminal angioplasty, SV = subclavian vein.

Keywords: case report, central venous occlusion, hemodialysis, segmented sharp recanalization

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All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Written informed consent was obtained from the patient for publication.

The authors have no conflicts of interest to disclose.

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1. Introduction

Central vein occlusion (CVO) is a common complication in chronic hemodialysis patients due to mechanical damage to the vessel walls from prior catheterization, as well as high flow rate of a functioning arteriovenous fistula (AVF).^[1] CVO could result in ipsilateral limb swelling and altered vascular access function, leading to suboptimal hemodialysis. In recent years, percutaneous transluminal angioplasty (PTA) has become the mainstay in treating CVO of hemodialysis population.^[2] However, interventional recanalization of long-segment CVO still remains difficult.^[3] We report a challenging case of a 73-year-old man suffering CVO extending from the right subclavian vein (SV) to the right innominate vein (IV) with angulation at the right venous angle. The long-angled obstructive lesion was successfully recanalized using a segmented sharp recanalization strategy.

A 73-year-old gentleman on maintenance hemodialysis was admitted for right forearm AVF dysfunction for 1 month. The patient started regular hemodialysis 1 year before via a right internal jugular vein catheter initially with the concomitant establishment of a right radiocephalic wrist AVF. The right internal catheter remained in situ for 2 months. Ten months before, the patient started to use the AVF but for the recent 1 month the AVF blood flow had been unsatisfactory (below 180 mL/min), along with swelling of the right arm and face for 20 days. Preoperative

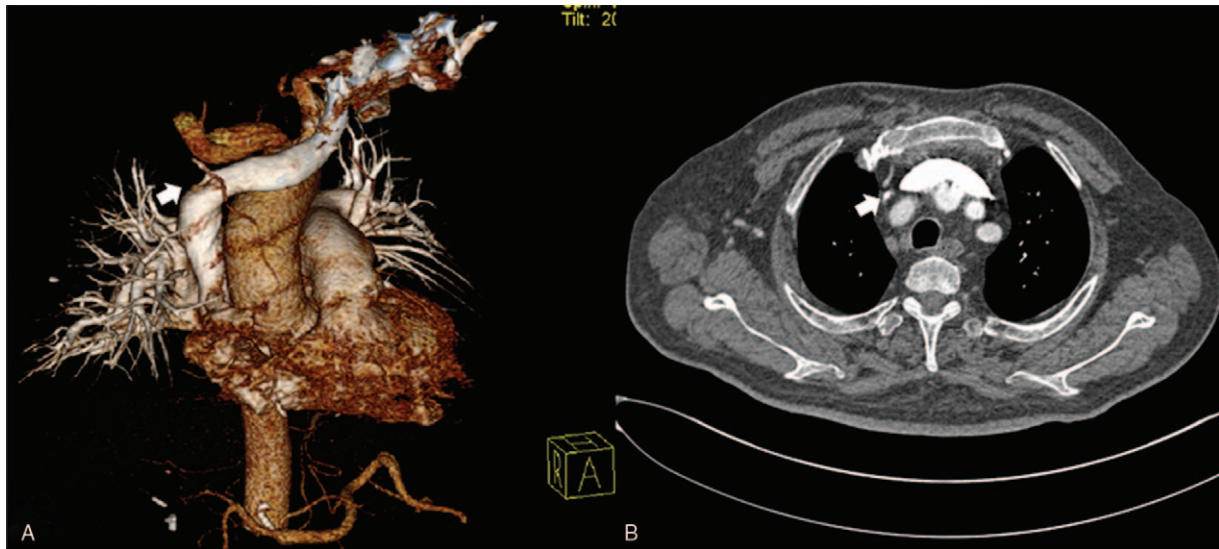


Figure 1. Preoperative CT chest angiography. (A) 3D reconstruction of major chest vessels. White arrow indicates obstructive right IV. (B) CT chest venography. White arrow indicates obstructive right IV. CT=computed tomography, IV=innominate vein.

computed tomography angiography identified steno-occlusive disease of right IV (Fig. 1). Antiplatelet therapy achieved little improvement, and this patient was then subjected to PTA.

Intraoperative digital subtraction angiography (DSA) revealed a long-segment CVO at the right venous angle, involving the right SV distally (Fig. 2A) and the right IV proximally (Fig. 2B) with extensive formation of collateral circulation. The occlusive right IV and right SV formed an obvious included angle. Since conventional guide wire transversal failed from either brachial or femoral access, we then employed a segmented sharp recanalization strategy. Firstly, we penetrated the right IV with the stiff end of a transfemoral hydrophilic wire (Terumo, Tokyo, Japan). The right venous angle was approached and visualized with contrast under DSA (Fig. 2C). Secondly, under DSA guidance, we penetrated the occlusive right SV toward the right venous angle with the stiff end of a guide wire which was then snared (Fig. 2D). Thirdly, the snared guide wire enabled a femoral-brachial pull-through to secure the access from the right IV to the right SV (Fig. 2E).

Balloons of different sizes (4 mm × 60 mm, 6 mm × 60 mm, 10 mm × 60 mm, 12 mm × 60 mm) (Cordis Corporation, Milpitas, CA) were sequentially passed over the guide wire to give graded dilations (Fig. 3A), following which the lesion was further stented (10 mm × 60 mm) (Cordis Corporation) (Fig. 3B). Postoperative DSA verified the patency of the occlusive segment. No complication was recorded during or after the operation. After a follow-up period of 5 months, the patient's AVF maintained satisfactory in blood flow, while the edema in his ipsilateral limb and face also notably ameliorated.

2. Discussion

CVO is a common complication of central vein catheterization which can be unmasked by an ipsilateral fistula, leading to AVF dysfunction and swollen hand.^[4] Without a timely treatment, CVO could result in a decrease in quality of life as well as longevity in hemodialysis patients.^[5] Ligation of the functioning fistula is the simplest symptomatic therapy to relieve limb edema

which, however, sacrifices the hemodialysis access. Due to the high comorbidity and mortality, traditional surgery bypass is reserved as the last option for CVO patients who are refractory to PTA.^[6]

PTA has now been recognized as the first line treatment for CVO with minimally invasive approach and lower morbidity/mortality, consisting of 2 major steps: “crossing” and “recanalization.” By crossing, we mean passing the guide wire through the CVO lesion, while recanalization is to balloon dilate and stent the CVO site.^[5] “Crossing” has been recognized as the key step for the technique success, not until which has revascularization become possible. Blunt crossing is the most widely used maneuver to pierce a lesion^[7] while sharp transversal, which has been described by Ferral et al^[8] who directed a 21-gauge needle toward a transfemorally inserted snare across jugular and subclavian occlusions, becomes the alternative when blunt crossing fails.^[9]

The technical success rates of PTA of CVO could be as high as 70% to 100%^[10,11]; however, there are still patients whose occlusion cannot be traversed using a conventional technique. For long segment CVO, the lesion usually involves more than 1 segment of central veins. The obstruction, not surprisingly, could be curved at the junctions between different vessels. If the angulation of the CVO segment was large enough, direct sharp transversal could no longer be applicable since the sharp needle or agent would not make a turn halfway within the lesion. In this patient, the obstructive SV and IV formed a notable turning at the right venous angle, which is resistant to blunt crossing and as well not suitable for traditional sharp crossing, warranting a new PTA strategy.

As in this case, there were 2 major aspects accounting for the technical success. First, we subdivided the angled lesion into 2 straight segments, so that sharp crossing is possible segment by segment. Second, we visualized the turning point of the tortuous obstruction, so that sharp crossing targeting the right venous angle under DSA guidance is comparatively safe. Once the guide wire advanced to the “turning point” was snared, the channel for recanalization is established, and the balloon dilation and stent placement will follow. To the best of our knowledge, our case is

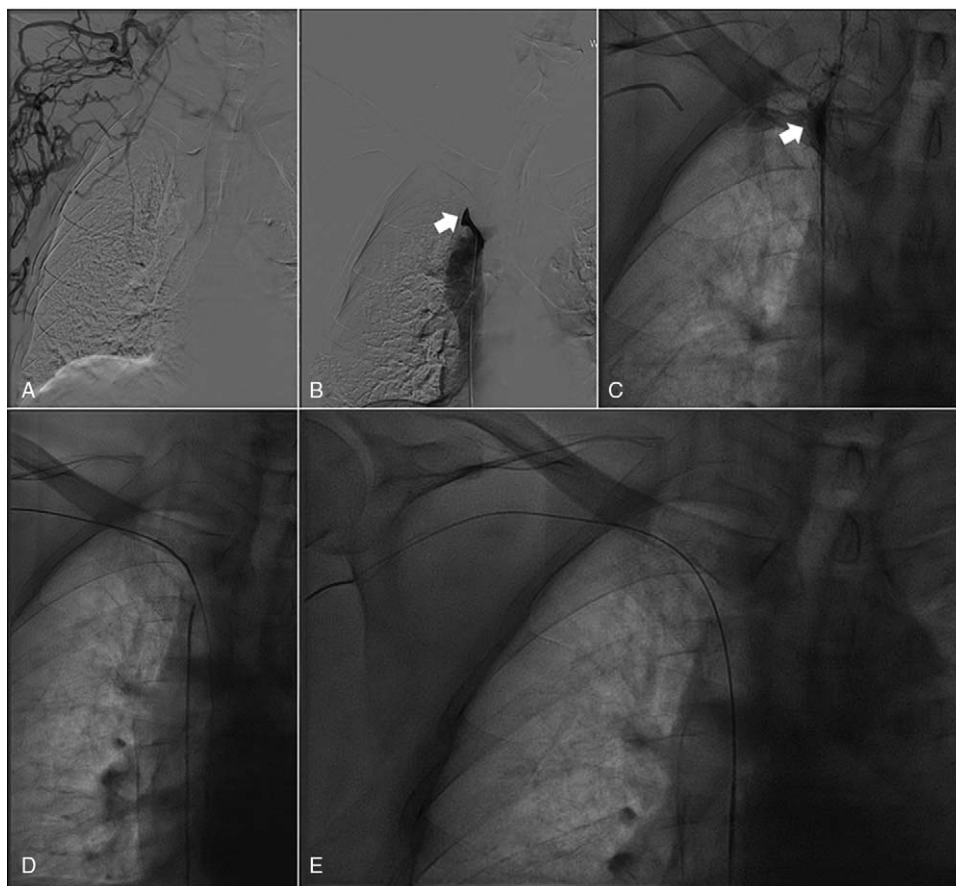


Figure 2. Segmented sharp recanalization. (A) Right SV obstruction with collaterals formation. (B) Right IV obstruction as indicated by white arrow. (C) Sharp transversal of right IV from a femoral approach. White arrow indicates the right jugular angle. (D) Sharp transversal of right SV from a brachial approach. (E) Guide wire snared resulting in a femoral-brachial pull-through. IV=innominate vein, SV=subclavian vein.

unique in developing an segmented sharp recanalization strategy by marking the angle point and crossing the lesion segment by segment, so that PTA of the angled long-segment CVO is made possible.

Some remarkable points deserve attention in this case. Even though PTA should be generally attempted for CVO before major thoracic surgery, it still remains controversial whether PTA

should be regarded as first-line treatment for all patients with complex CVO. The segmented sharp recanalization technique carries all the risks associated with sharp revascularization including extravasation and injury of adjacent artery. Since thrombosis and restenosis are major complications in follow-up,^[9] discussion with patients regarding reinterventions must be carried out before the procedure.

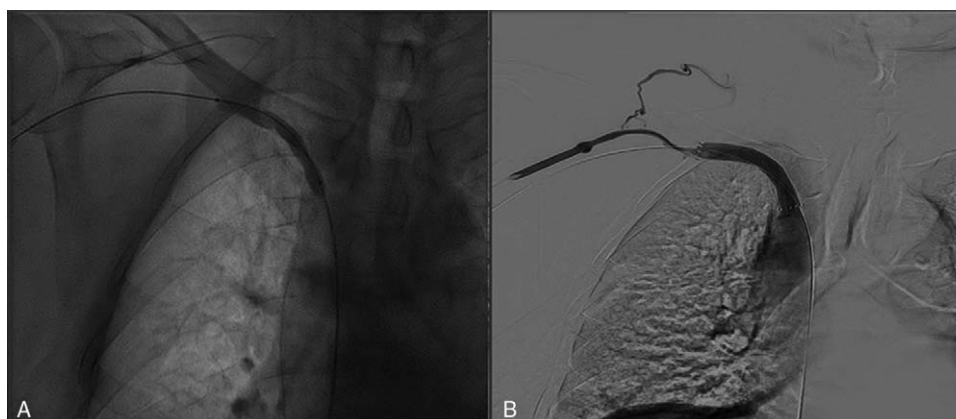


Figure 3. Dilatation and stenting of obstructive lesion. (A) Central venous obstruction dilated by balloons. (B) Central venous obstruction stented.

In summary, the segmented sharp recanalization is a practical strategy in treating angled long-segment CVO which is refractory to traditional guide wire transversal in hemodialysis patients. Future studies are needed to evaluate its efficacy and safety.

Author contributions

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