

Review began 10/05/2026

Review ended 10/25/2026

Published 10/26/2026

© Copyright 2026

Sebaaoui et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.118616

Severe Venous Hypertension Due to Central Venous Occlusion Leading to Arteriovenous Fistula Ligation: A Case Report

Khaoula Sebaaoui¹, Houssam Boukhatem¹, Youssef Banana², Omar El Mahi², Adnane Benzirar²

¹. Vascular Surgery, Mohammed VI University Hospital, Oujda, MAR ². Vascular Surgery, Mohammed VI University Hospital, Faculty of Medicine and Pharmacy of Oujda, Mohammed First University, Oujda, MAR

Corresponding author: Khaoula Sebaaoui, khaoulasebaaoui@gmail.com

Abstract

Central venous stenosis and occlusion are complications of hemodialysis vascular access. In patients with a functioning ipsilateral arteriovenous fistula (AVF), impaired venous outflow can cause severe venous hypertension. Endovascular treatment is first-line, but recurrence is common and management after repeated failure is not well defined. We report a 62-year-old right-handed woman on hemodialysis for five years whose left radiocephalic AVF failed and was replaced by a left humerocephalic AVF; a tunneled left internal jugular catheter was kept for approximately one year. She developed left upper limb edema due to a left brachiocephalic vein stenosis, which resolved after balloon angioplasty and recurred six months later; the same stenosis was dilated again. Four months later, she presented with diffuse limb edema, severe pain, and marked cyanosis of the hand, with preserved distal pulses. Fistulography showed complete occlusion of the left brachiocephalic vein. Because symptoms had recurred after two angioplasties and the patient did not wish a further attempt, the AVF was ligated. Within two days, pain disappeared, the edema regressed until the two limbs were comparable, and cyanosis regressed. A right humerobasilic AVF was created one month later, and the tunneled catheter was removed approximately three months after the ligation. At six months, the left limb remained free of edema and pain, and the new AVF was functional. Ligation with creation of a contralateral access may be considered as a salvage option in similar situations, at the cost of losing the access; a single case cannot establish its safety or superiority.

Categories: Emergency Medicine, Nephrology, Cardiac/Thoracic/Vascular Surgery

Keywords: arteriovenous fistula, balloon angioplasty, central venous occlusion, fistula ligation, hemodialysis vascular access, venous hypertension

Introduction

Arteriovenous fistulas (AVFs) are the preferred vascular access for patients on maintenance hemodialysis because of their better long-term patency and lower complication rates than grafts or central venous catheters. Central venous stenosis and occlusion (CVS/CVO) are common in this population and are strongly associated with prior central venous catheterization [1,2]; their reported prevalence ranges from about 10% among patients with advanced kidney disease undergoing venographic vein mapping to 41% among hemodialysis patients undergoing venography for access-related complaints [2]. CVS/CVO often remain silent until an AVF is created in the ipsilateral limb: the fistula diverts arterial blood into the venous system and markedly increases the flow returning to the heart, which a narrowed or occluded central vein cannot accommodate. Venous pressure then rises (venous hypertension), causing edema and opening collateral veins and, in severe cases, pain, cyanosis or skin discoloration, and rarely ulceration.

Endovascular angioplasty, with or without stenting, is first-line therapy given its lower morbidity [3,4]. However, recurrence is frequent, with reported unassisted patency after angioplasty alone ranging from 23% to 63% at six months and from 12% to 50% at 12 months, and repeated procedures are often necessary to maintain patency [5]. When endovascular options are exhausted or not feasible, surgical alternatives include venous bypass or fistula ligation with creation of a new access at another site, at the cost of the existing access [2,6]; ligation with a new contralateral access has also been described in other forms of fistula-related venous hypertension [7]. Guidance remains limited for patients whose symptoms recur after repeated angioplasty [2,6]. We report a patient with severe upper-limb venous hypertension due to recurrent obstruction of the left brachiocephalic vein, which progressed to complete occlusion despite two balloon angioplasties and was managed by AVF ligation with creation of a new access in the contralateral limb, with regression of the symptoms within two days.

Case Presentation

A 62-year-old right-handed woman with end-stage kidney disease secondary to diabetic nephropathy, who had been on maintenance hemodialysis for five years, was referred to our vascular surgery department for progressive swelling and severe pain of the left upper limb. Her comorbidities were limited to insulin-treated diabetes mellitus; she did not smoke and took no medication other than insulin, in particular no antiplatelet

How to cite this article

Sebaaoui K, Boukhatem H, Banana Y, et al. (October 26, 2026) Severe Venous Hypertension Due to Central Venous Occlusion Leading to Arteriovenous Fistula Ligation: A Case Report. Cureus 18(10): e118616. DOI 10.7759/cureus.118616

or anticoagulant therapy. A timeline of the main events is shown in Table 1.

Time	Event
Hemodialysis start (≈5 years before presentation)	Tunneled left internal jugular catheter (at the patient's request, as she is right-handed); left radiocephalic AVF created
+2 months	Failure of maturation; proximal re-anastomosis
+4 months	Thrombosis of the left radiocephalic AVF
+7 months	Left humerocephalic AVF created (3 months after the thrombosis, an interval chosen according to the patient's preference)
≈1 year after hemodialysis start	Left humerocephalic AVF usable; end of catheter dependence
≈1 year before presentation	Onset of chronic left upper-limb edema
+1 month	Fistulography: stenosis of the left brachiocephalic vein; first angioplasty through the fistula (8F introducer, Conquest PTA 12 × 40 mm, 26 atm), no residual stenosis, no stent; edema regressed over 6 days
+6 months after the first angioplasty	Recurrence of edema; second angioplasty of the same stenosis (same technique, no stent)
+4 months after the second angioplasty (presentation)	Diffuse edema, severe pain (VAS 8/10), cyanosis in a warm limb, prominent chest, shoulder, and arm venous collaterals, no neurological signs; fistulography: complete occlusion of the left brachiocephalic vein; patient did not wish a further angioplasty
Day 0	Simple ligation of the left AVF under local anesthesia; right tunneled internal jugular catheter placed the same day
Day 2	Marked regression of edema, pain, and cyanosis
1 month after ligation	Right humerobasilic AVF created (timing chosen according to the patient's preference)
6 weeks after creation	Superficialization
3 weeks after superficialization	First cannulation; removal of the right tunneled catheter
6 months after ligation	Left limb free of edema and pain; right AVF functional and in regular use

TABLE 1: Timeline of the main events

AVF, arteriovenous fistula; PTA, percutaneous transluminal angioplasty; VAS, visual analog scale

Her hemodialysis had been started through a tunneled left internal jugular catheter, placed at the patient's request because she is right-handed, together with the creation of a left radiocephalic AVF. This fistula failed to mature and was revised by proximal re-anastomosis two months after its creation. It thrombosed two months later, and a left humerocephalic AVF was created three months after the thrombosis, an interval chosen according to the patient's preference, approximately four years before the current presentation. As a result of the failure of the radiocephalic access and of this interval, she remained dependent on the tunneled catheter for approximately one year, until the humerocephalic AVF became usable.

About one year before presentation, she developed chronic edema of the left upper limb. Fistulography revealed a stenosis of the left brachiocephalic vein, treated by balloon angioplasty one month after symptom onset. The procedure was performed through puncture of the fistula with an 8F introducer; the stenosis was crossed with a 0.035-inch hydrophilic guidewire and dilated with a Conquest PTA high-pressure balloon (12 × 40 mm; Bard Peripheral Vascular, Tempe, AZ) inflated at 26 atm. The procedure was technically successful, with no residual stenosis and no complications, and the edema regressed progressively over six days, with complete resolution. No stent was placed because the result was satisfactory, without residual stenosis. The edema recurred six months later, and the same stenosis was treated by a second angioplasty using the same technique, again without residual stenosis, complication, or stent placement. The details of both procedures are summarized in Table 2.

Parameter	First angioplasty	Second angioplasty
Timing	1 month after symptom onset	6 months after the first angioplasty
Indication	Chronic left upper-limb edema; stenosis of the left brachiocephalic vein on fistulography	Recurrence of edema; same stenosis
Access	Puncture of the fistula	Puncture of the fistula
Introducer	8F	8F
Guidewire	0.035-inch hydrophilic	0.035-inch hydrophilic
Balloon	Conquest PTA high-pressure, 12 × 40 mm	Conquest PTA high-pressure, 12 × 40 mm
Inflation pressure	26 atm	26 atm
Technical success	Yes	Yes
Residual stenosis	None	None
Complications	None	None
Stent	Not placed	Not placed
Clinical response	Edema regressed progressively over 6 days	Edema regressed progressively over 6 days
Time to recurrence	6 months (recurrent edema)	4 months (complete occlusion with more severe symptoms)

TABLE 2: Details of the two angioplasties

PTA: percutaneous transluminal

Four months after this second procedure, she returned with markedly worse symptoms: diffuse edema of the left upper limb, predominating in the fingers, the hand, and the distal third of the forearm, severe pain (visual analog scale (VAS) score: 8/10), and marked cyanosis of the hand and distal forearm (Figure 1, blue arrows), causing significant functional impairment. A prominent collateral venous circulation was visible over the chest wall, the shoulder, and the arm (Figure 1, red arrows), and the left humerocephalic AVF was still in place (Figure 1, white arrow). The limb was warm, and the arm was soft. Distal arterial pulses were palpable, and capillary refill was preserved, indicating maintained arterial inflow despite severe venous congestion. There were no neurological signs, and no ulceration or tissue loss. No cannulation difficulties had been encountered during hemodialysis sessions before these events.

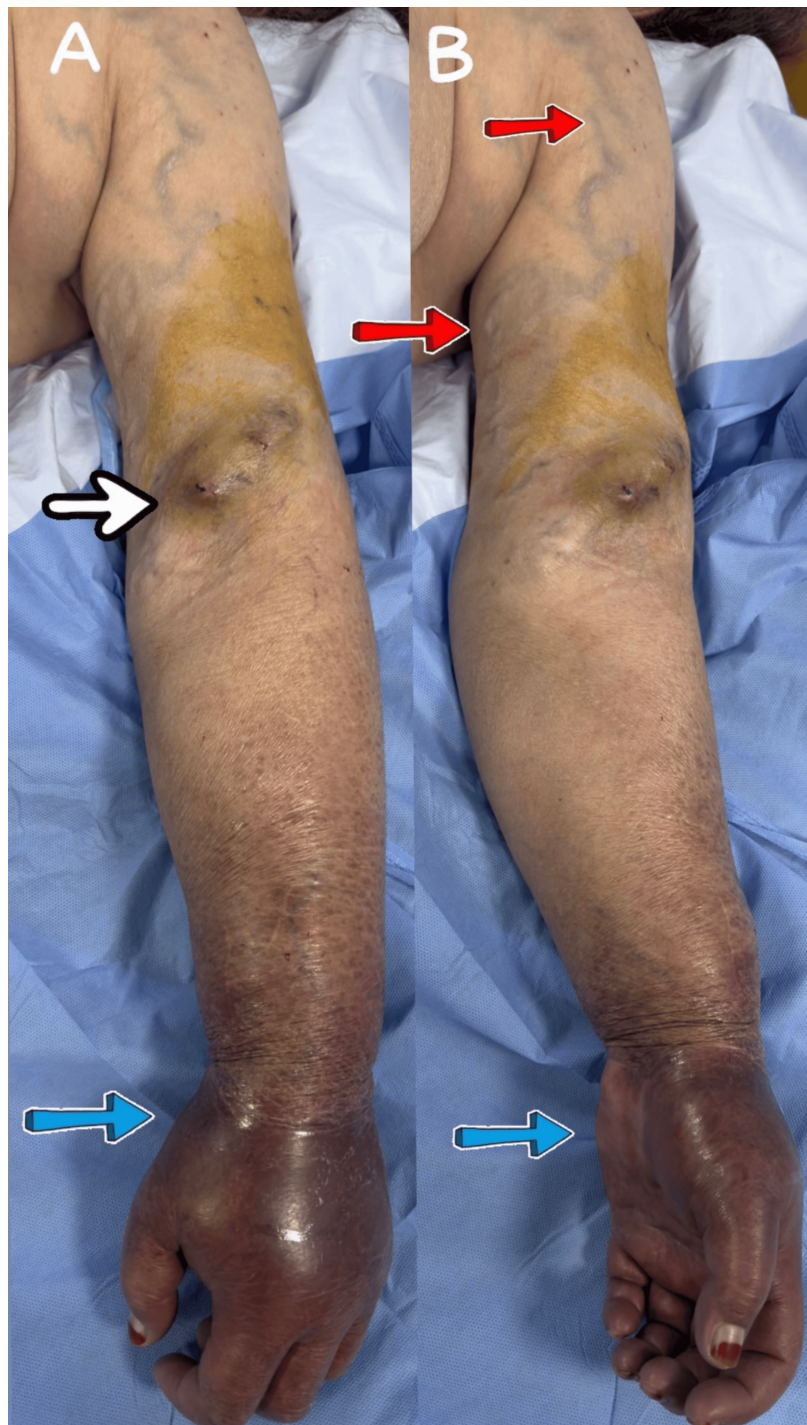


FIGURE 1: Left upper limb before fistula ligation, four months after the second angioplasty, shown from two angles (A and B)

Blue arrows: marked edema and cyanosis of the hand and distal forearm. White arrow: left humerocephalic arteriovenous fistula, still in place before ligation. Red arrows: prominent collateral venous circulation over the shoulder and the arm, indicating chronic venous outflow obstruction with collateral drainage. The limb was warm, with preserved distal pulses and capillary refill.

This combination of diffuse ipsilateral limb edema, severe pain, and cyanosis in a warm limb with preserved arterial inflow and prominent venous collaterals, in a patient with a functioning left humerocephalic AVF, a history of central venous catheterization, and two previous angioplasties of the same stenosis, suggested recurrent central venous obstruction with venous hypertension rather than an arterial cause such as steal syndrome. The key clinical findings and their interpretation are summarized in Table 3. Doppler ultrasonography was not performed. Fistulography confirmed complete occlusion of the left brachiocephalic vein with prominent venous collaterals (Figure 2).

Finding	Observation	Interpretation
Edema	Diffuse, predominating in the fingers, the hand, and the distal third of the forearm	Venous congestion of the limb
Venous collaterals	Prominent over the chest wall, the shoulder, and the arm	Chronic venous outflow obstruction with collateral drainage
Skin color	Marked cyanosis of the hand and distal forearm	Venous stasis
Arterial inflow	Warm limb; palpable distal pulses; preserved capillary refill	Preserved arterial inflow, against an arterial cause such as steal syndrome
Neurological examination	No neurological signs	Against ischemic neuropathy associated with steal syndrome
Pain	VAS 8/10, with functional impairment	Severe symptomatic venous hypertension
Tissue status	No ulceration or tissue loss	No tissue damage at presentation

TABLE 3: Key clinical findings at presentation and their interpretation



FIGURE 2: Fistulography showing complete occlusion of the left brachiocephalic vein with prominent venous collaterals

The purple vertical arrow indicates the site of complete occlusion of the left brachiocephalic vein; the two red horizontal arrows indicate the collateral venous circulation.

Because the symptoms had recurred after two angioplasties, the presentation was now much more severe, and the patient did not wish to undergo a further angioplasty; surgical ligation of the AVF was decided in order to immediately reduce venous flow and relieve the venous hypertension. The AVF was closed by simple ligation under local anesthesia, without complication. A tunneled right internal jugular catheter was placed on the same day to maintain hemodialysis. A right humerobasilic AVF was created one month after the ligation, a timing chosen according to the patient's preference, and superficialized six weeks later. It was first cannulated, and the right tunneled catheter was removed three weeks after the superficialization.

Within two days of the ligation, the pain had disappeared completely, and the edema had regressed until the left limb was comparable to the right limb, with regression of the cyanosis leaving only mild residual skin discoloration (Figure 3). At six months of follow-up after the ligation, the left upper limb remained free of edema and pain; the skin discoloration persisted with a demarcation (Figure 4), and the right AVF was functional and in regular use. A control fistulography is scheduled every six months. In this report, complete resolution of edema and pain was defined as their absence on clinical examination, and severe venous hypertension as the presentation combining diffuse limb edema, cyanosis, severe pain (VAS: 8/10), and functional impairment. Written informed consent was obtained from the patient for publication of this case report and the accompanying anonymized clinical images.



FIGURE 3: Same limb two days after fistula ligation, showing marked regression of edema and cyanosis with mild residual skin discoloration



FIGURE 4: Same limb six months after fistula ligation, showing complete resolution of edema and cyanosis with mild residual skin discoloration

Discussion

Central venous stenosis and occlusion are frequent in hemodialysis patients, with a prevalence that varies widely according to the population studied [2], and are strongly linked to a history of central venous catheterization, which causes intimal injury and fibrosis of the vessel wall [1,2,8]. Once an ipsilateral AVF becomes functional, the obstructed outflow tract can no longer accommodate the increased venous return, leading to venous hypertension. Clinical manifestations range from mild limb edema and visible collateral veins to severe pain, skin discoloration, and, uncommonly, ulceration [2,6]. In practice, the combination of ipsilateral limb edema, pain, and cyanosis in a warm limb with preserved distal pulses and capillary refill, in a patient with a functioning ipsilateral AVF, should prompt evaluation for central venous obstruction. Our

patient had severe, disabling venous hypertension, but without ulceration, tissue loss, or neurological signs, and with a warm limb, preserved distal pulses, and preserved capillary refill, which argues against an arterial cause such as steal syndrome. Diagnosis is generally suggested by clinical examination and confirmed with fistulography, which remains the reference standard for delineating the site and extent of central venous disease [3].

Percutaneous transluminal angioplasty, with or without stent placement, is considered the first-line treatment for symptomatic CVS/CVO because it is less invasive and allows preservation of the existing vascular access [3,4,9]. However, recurrence following endovascular therapy is frequent, and repeat intervention is not always feasible or durable.

In a meta-analysis of eight studies (281 patients treated with angioplasty and 192 with angioplasty plus stenting), primary patency did not differ between the two strategies at 3, 6, 12, or 24 months, and the authors concluded that angioplasty alone may provide higher assisted primary patency [10]. In a series of 71 hemodialysis patients, stenting did not prolong patency but was associated with higher costs and more interventions, and the authors recommended stents only for angioplasty-resistant or concurrent lesions [11]. Stent or covered stent placement is an alternative for elastic or recurrent lesions [2,3] and is generally recommended when elastic recoil leaves a significant residual stenosis or when a lesion recurs within three months of angioplasty [5]. In our patient, there was no residual stenosis after either angioplasty, and the recurrences occurred after six and four months, so no stent was placed, and the stenosis was treated with balloon angioplasty on two occasions before ligation of the fistula was decided. For lesions refractory to balloon angioplasty, a retrospective comparison of central venous stenting and Hemodialysis Reliable Outflow (HeRO) graft placement in 75 patients after failed balloon angioplasty found similar rates of reintervention and patency [12]. When endovascular options are exhausted or not appropriate, surgical alternatives include venous bypass or ligation of the offending fistula with creation of a new access at another site [2,6]. In a series on the management of AVF-related venous hypertension, the authors suggested that, in selected cases, securing a new access in another limb and closing the native AVF may be preferable to attempts at salvaging the edematous limb [6].

Several alternatives to ligation exist in this setting. Repeat angioplasty with stent or covered stent placement is an option for refractory or recurrent lesions, but the patency of stents is also limited [5,10,11], and in a completely occluded vein, it would first require recanalization [5]. A HeRO graft or a venous bypass can restore outflow in refractory central venous obstruction [5,12], but these are more invasive procedures, mainly considered when no other site is available for access [5]; in our patient, the contralateral limb was available. Flow-reduction procedures, such as balloon-assisted banding, aim to reduce access flow by about half and may allow the access to be preserved when symptoms are due to a mismatch between inflow and outflow [5]. However, a partial reduction is less likely to relieve symptoms when the outflow is completely occluded and the presentation is severe, as in our patient, whereas ligation removed the arteriovenous flow immediately and completely.

The recurrence of symptoms after six months and four months in our patient is consistent with the frequent and rapid recurrence reported after angioplasty alone, with unassisted patency rates of 23%–63% at six months and 12%–50% at 12 months [5]. Stenting does not clearly improve these results: in a comparison of primary angioplasty and primary stenting of central venous stenoses, 12-month primary patency was 29% and 21%, respectively, with no significant difference [5], and a meta-analysis likewise found no difference in primary patency between the two strategies [10]. Secondary patency requires repeated interventions [5]. In comparison, in our patient, ligation led to a complete disappearance of pain within two days, and the left limb remained free of edema and pain at six months, but at the cost of the loss of the left access and approximately three months of catheter dependence. Because this is a single case with six months of follow-up, a direct quantitative comparison with stenting or bypass cohorts is not possible, and the patency of the new right-sided access remains to be evaluated.

In the present case, several elements favored ligation of the fistula over a further endovascular attempt. First, the stenosis recurred after each angioplasty, and the interval before recurrence shortened from six months after the first procedure to four months after the second. Second, the lesion had progressed to complete occlusion so that further endovascular treatment would have required recanalization of an occluded vein, usually followed by stenting, with uncertain technical success and limited durability [5,10,11]. Third, the presentation was markedly more severe than before (VAS: 8/10, cyanosis, functional impairment), and ligation was the option that immediately removed the arteriovenous flow responsible for the venous hypertension, whereas flow-reduction procedures such as banding only partly reduce it [5]. Fourth, the patient, having experienced two angioplasties followed by recurrence of her symptoms, did not wish to undergo a further attempt. Finally, creating a new access in the contralateral limb allowed hemodialysis to continue through a new access. This approach produced a complete disappearance of pain and a regression of the edema, with the two limbs becoming comparable, within two days. The cost was the loss of a mature access and a period of catheter dependence: dialysis relied on a right tunneled catheter until the new right humerobasilic AVF, created one month after the ligation, was superficialized and became usable approximately three months after the ligation. Bridging with a tunneled catheter is a pragmatic strategy in this setting, despite the infectious and thrombotic risks associated with catheters.

The vascular access history of this patient also deserves comment. Prolonged catheter dwell time is a recognized risk factor for central venous stenosis [1,2,8]. Current Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines recommend the right internal jugular vein as the preferred site for tunneled catheters [9], in line with the European Society for Vascular Surgery guidelines [13], because it offers a shorter and more direct route to the right atrium than the left side. KDOQI also favors placing a catheter in the limb opposite to the anticipated arteriovenous access [9]. In our patient, the tunneled catheter was placed in the left internal jugular vein at the patient's request, because she is right-handed. It was therefore on the same side as the fistulas, and its dwell time of approximately one year may have contributed to the brachiocephalic stenosis. After the ligation, the bridging catheter was placed in the right internal jugular vein, in line with this preference, the left side being no longer usable. Her first accesses were created in the non-dominant (left) arm, in line with usual access planning and with her wish to preserve her dominant arm; the loss of the left side therefore left the dominant right arm as the site for the new access.

This case illustrates that ligation of the fistula with creation of a new access at another site was followed by rapid and sustained symptom relief when symptoms recurred after repeated angioplasty and the presentation was severe. It may be a reasonable option to consider in similar situations, while endovascular recanalization remains the preferred first-line approach. These observations come from a single patient and cannot be generalized.

Its strengths are the detailed timeline, the technical details of each angioplasty, the objective confirmation of the occlusion by fistulography, and the documented patient preferences. This report also has limitations. It describes a single patient with six months of follow-up, without Doppler ultrasonography at presentation and without systematic quantitative measures (limb circumference, serial pain scores, dialysis adequacy parameters), and it therefore cannot establish the safety or superiority of this strategy. The trade-off of this approach was the loss of the left access and approximately three months of tunneled catheter dependence, during which no catheter-related complication occurred. Because the bridging catheter and the new fistula are both on the right side, a control fistulography is scheduled every six months to monitor the right-sided venous outflow, including the central veins; no imaging of these veins was performed before the first use of the new fistula. Longer follow-up is needed to assess the durability of the new access.

Learning points

Central venous stenosis or occlusion should be suspected in a hemodialysis patient with ipsilateral limb edema, pain, and cyanosis in a warm limb with preserved pulses, particularly after central venous catheterization.

Angioplasty is first-line treatment, but recurrence is frequent, and the interval between recurrences may shorten, as in this patient (six, and then four months).

In severe recurrent cases, ligation of the fistula with creation of a new access in the contralateral limb may be considered as a salvage option, at the cost of the loss of the access and a period of catheter dependence.

Conclusions

In this patient, ligation of the AVF with creation of a new access in the contralateral arm led to a complete disappearance of pain and a regression of the edema within two days, and the limb remained free of edema and pain at six months, at the cost of the loss of the access and approximately three months of catheter dependence, without catheter-related complications. This single observation suggests that this approach may be considered as a salvage option in similar situations, but as a single case with six months of follow-up, it cannot establish its safety or superiority.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Khaoula Sebaaoui, Houssam Boukhatem, Youssef Banana, Omar El Mahi, Adnane Benzirar

Acquisition, analysis, or interpretation of data: Khaoula Sebaaoui, Houssam Boukhatem, Youssef Banana, Omar El Mahi, Adnane Benzirar

Drafting of the manuscript: Khaoula Sebaaoui, Houssam Boukhatem, Youssef Banana, Omar El Mahi, Adnane Benzirar

Critical review of the manuscript for important intellectual content: Khaoula Sebaaoui, Houssam Boukhatem, Youssef Banana, Omar El Mahi, Adnane Benzirar

Supervision: Khaoula Sebaaoui, Houssam Boukhatem, Youssef Banana, Omar El Mahi, Adnane Benzirar

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Kundu S: Review of central venous disease in hemodialysis patients . *J Vasc Interv Radiol*. 2010, 21:963-8. [10.1016/j.jvir.2010.01.044](https://doi.org/10.1016/j.jvir.2010.01.044)
2. Echefu G, Stowe I, Lukan A, et al.: Central vein stenosis in hemodialysis vascular access: clinical manifestations and contemporary management strategies. *Front Nephrol*. 2023, 3:1280666. [10.3389/fneph.2023.1280666](https://doi.org/10.3389/fneph.2023.1280666)
3. Tabriz DM, Arslan B: Management of central venous stenosis and occlusion in dialysis patients . *Semin Intervent Radiol*. 2022, 39:51-5. [10.1055/s-0041-1742152](https://doi.org/10.1055/s-0041-1742152)
4. Kitrou P, Katsanos K, Karnabatidis D: Management of central venous stenoses and occlusions. *Cardiovasc Intervent Radiol*. 2023, 46:1182-91. [10.1007/s00270-023-03461-7](https://doi.org/10.1007/s00270-023-03461-7)
5. Agarwal AK: Endovascular interventions for central vein stenosis. *Kidney Res Clin Pract*. 2015, 34:228-32. [10.1016/j.krcp.2015.10.005](https://doi.org/10.1016/j.krcp.2015.10.005)
6. Mittal V, Srivastava A, Kapoor R, et al.: Management of venous hypertension following arteriovenous fistula creation for hemodialysis access. *Indian J Urol*. 2016, 32:141-8. [10.4103/0970-1591.174779](https://doi.org/10.4103/0970-1591.174779)
7. Asari AI, Damasceno DC, de Almeida NA, Moreira HD, Barros RA, Ximenes FA: Ulcers of the fingers and dorsum of the left hand caused by venous hypertension after construction of a brachiocephalic arteriovenous fistula: case report. *J Vasc Bras*. 2019, 18:e20190008. [10.1590/1677-5449.190008](https://doi.org/10.1590/1677-5449.190008)
8. Agarwal AK: Central vein stenosis. *Am J Kidney Dis*. 2013, 61:1001-15. [10.1053/j.ajkd.2012.10.024](https://doi.org/10.1053/j.ajkd.2012.10.024)
9. Lok CE, Huber TS, Lee T, et al.: KDOQI clinical practice guideline for vascular access: 2019 update . *Am J Kidney Dis*. 2020, 75:S1-64. [10.1053/j.ajkd.2019.12.001](https://doi.org/10.1053/j.ajkd.2019.12.001)
10. Wu TY, Wu CK, Chen YY, Lin CH: Comparison of percutaneous transluminal angioplasty with stenting for treatment of central venous stenosis or occlusion in hemodialysis patients: a systematic review and meta-analysis. *Cardiovasc Intervent Radiol*. 2020, 43:525-40. [10.1007/s00270-019-02383-7](https://doi.org/10.1007/s00270-019-02383-7)
11. İgüs B, Fırat A, Bircan HY: Endovascular treatment options in central venous stenosis and occlusion: angioplasty or stent?. *Ankara Med J*. 2020, 20:242-50. [10.5505/amj.2020.42103](https://doi.org/10.5505/amj.2020.42103)
12. Proksch DM, Rodriguez LE, Rathore A, Steerman SN, Panneton JM: A comparison of stenting versus hemodialysis reliable outflow graft for hemodialysis patients with recurrent central venous obstructions. *J Vasc Surg Venous Lymphat Disord*. 2021, 9:1136-44. [10.1016/j.jvsv.2021.01.001](https://doi.org/10.1016/j.jvsv.2021.01.001)
13. Schmidli J, Widmer MK, Basile C, et al.: Editor's choice - vascular access: 2018 clinical practice guidelines of the European Society for Vascular Surgery (ESVs). *Eur J Vasc Endovasc Surg*. 2018, 55:757-818. [10.1016/j.ejvs.2018.02.001](https://doi.org/10.1016/j.ejvs.2018.02.001)