Case report

JVA The Journal of Vascular Access

Internal jugular to internal jugular vein bypass of symptomatic central vein obstruction

The Journal of Vascular Access
1–5

DOI: 10.1177/11297298211070703
journals.sagepub.com/home/jva
SAGE

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Abstract

Introduction: Central venous obstruction (CVO) often arises among hemodialysis patients with upper extremity access due to a varying number of risk factors. While the true incidence of CVO in hemodialysis patients is unknown, it been reported in the range of 20%–40% in dialysis patients undergoing venograms. In the non-hemodialysis population, chronic central vein obstruction has a compensatory mechanism comprised of numerous collaterals along the chest wall, neck, and mediastinum. However, the presence of an AVF or AVG ipsilateral to a central venous stenosis or occlusion can overwhelm the collateral network due to the significantly elevated blood flow. This may result in severe and debilitating upper extremity and fascial swelling. While ligation results in almost instantaneous symptomatic relief, it does not address the patient's underlying pathologic process and necessitates an additional access. As these patients continue to live longer, our strategies to manage these failing accesses are becoming increasingly complex. The goal of preserving existing access while correcting any symptoms is paramount. Previous case reports have documented various surgical options for preserving an existing access.

Case presentation: Our patient is a 49-year-old female with hypertension and end-stage renal disease, on hemodialysis through a right arm arteriovenous (AV) fistula. She had a history of multiple AV fistulae creations in the past, all of which previously thrombosed. Several years after the creation of her most recent fistula, she developed severe throbbing headaches, right arm and facial swelling, right eye lacrimation, and blurry vision. AV fistula angiogram demonstrated right brachiocephalic vein chronic occlusion and endovascular revascularization through both trans-AVF and transfemoral approaches were attempted, but unsuccessful.

Discussion: This case illustrates the success of the creation of an internal jugular-jugular vein bypass to maintain a right arm arteriovenous fistula, while at the same time, correcting the symptoms of a right brachiocephalic vein occlusion.

Keywords

Fistula, bypass, jugular vein, central venous obstruction, case report

Date received: 8 June 2020; accepted: 15 December 2021

Introduction

Central venous obstruction (CVO) often arises among hemodialysis patients with upper extremity access. Multiple risk factors contribute to this occurrence, including intimal trauma caused by central vein catheterization, endoluminal obstruction from thrombus or from devices such as pacemakers, intimal hyperplasia due to increased flow, and turbulence after arteriovenous (AV) fistula or graft creation. While the true incidence of CVO in hemodialysis patients is unknown, it has been reported in the range of 20%–40% in dialysis patients undergoing venogram for various reasons.[1–3] In the non-hemodialysis population, chronic central vein obstruction has a compensatory

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mechanism comprised of numerous collaterals along the chest wall, neck, and mediastinum. However, the presence of an AVF or AVG ipsilateral to a central venous stenosis or occlusion can overwhelm the collateral network due to the significantly elevated blood flow. This may result in severe and debilitating upper extremity and fascial swelling. While ligation results in almost instantaneous symptomatic relief, it does not address the patient's underlying pathologic process and necessitates an additional access. As these patients continue to live longer, our strategies to manage these failing accesses are becoming increasingly complex. Especially for patients with limited access options, the goal of preserving existing access while correcting any symptoms is paramount. Previous case reports have documented various surgical options for preserving an existing access.[4–7] We report here a case of an internal jugular-jugular vein bypass to maintain a right arm arteriovenous fistula and simultaneously correcting the symptoms of a right brachiocephalic vein occlusion.

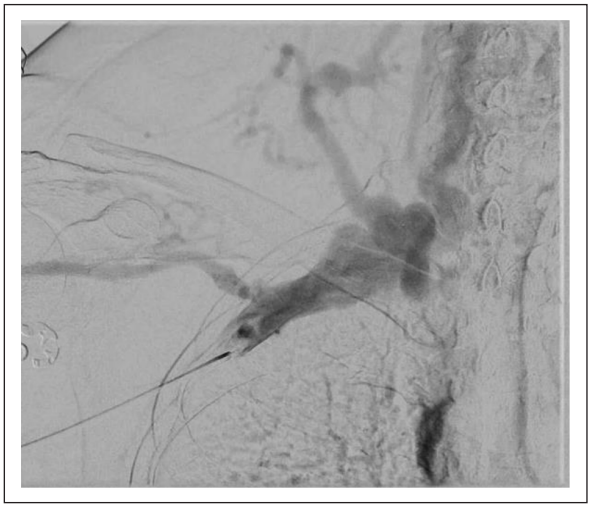


Figure 1. AV fistula angiogram demonstrating retrograde drainage into R internal jugular vein and external jugular vein.

Case presentation

The patient is a 49-year-old female with hypertension and end-stage renal disease, on hemodialysis through a right arm arteriovenous (AV) fistula. Several years after the creation of the fistula, she developed severe throbbing headache, right arm and facial swelling, right eye lacrimation, blurry vision. The patient had history of multiple AV fistulae creation in bilateral upper extremities, all thrombosed except the current AV fistula. She underwent a right arm AV fistula angiogram, which demonstrated right brachiocephalic vein chronic occlusion. The arteriovenous fistula drained retrogradely to the right internal jugular (IJ) vein and external Jugular vein (Figure 1). Endovascular revascularization through both trans-AVF and transfemoral approaches was attempted, but unsuccessful.

Left arm venogram was also performed which demonstrated a focal occlusion of the left subclavian vein, but patent left internal jugular vein and left brachiocephalic vein (Figure 2(a) and (b)).

We then proceeded with IJ to IJ bypass. Bilateral oblique incisions were made along the anterior border of sternocleidomastoid muscle. The right IJ appeared severely dilated with palpable pulsatility and thrill (Figure 3(a)). The venous pressure was measured as 43 mmHg. After both IJs were isolated, we then tunneled anteriorly and placed a 10 mm reinforced PTFE Propaten graft at pretracheal space, anastomosed both ends in an end-to-side fashion to each jugular vein (Figure 3(b)). After completing the anastomosis, we again measured the right internal jugular pressure again, which had decreased to 23 mmHg. On the first post-operative day, patient already reported improvement in her headache, arm and fascial swelling, and blurry vision. Patient was anticoagulated with Apixiban 5 mg per day and discharged.

At 2 weeks after the procedure, most of her symptoms were significantly improved. At 3 months post-procedure, her headache, right facial and arm swelling, and right eye congestion completely resolved, with no issues using the right arteriovenous fistula during dialysis. Ultrasound duplex demonstrated a patent jugular-to-jugular bypass

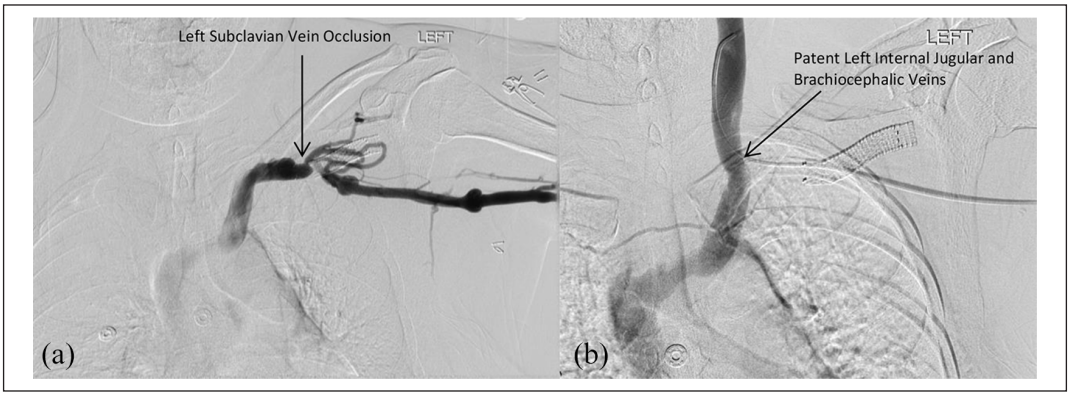


Figure 2. (a) Left arm venogram showing focal occlusion of left subclavian vein. (b) Patency of left internal jugular vein and left brachiocephalic vein.

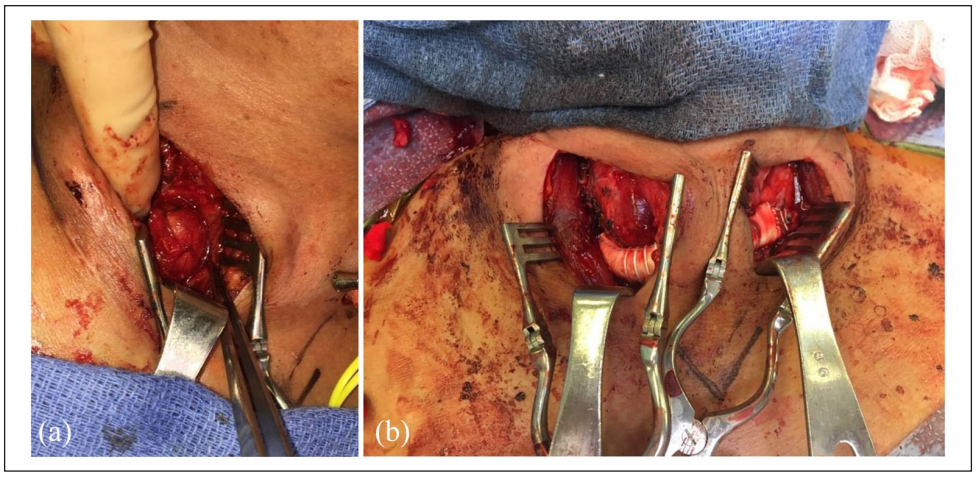
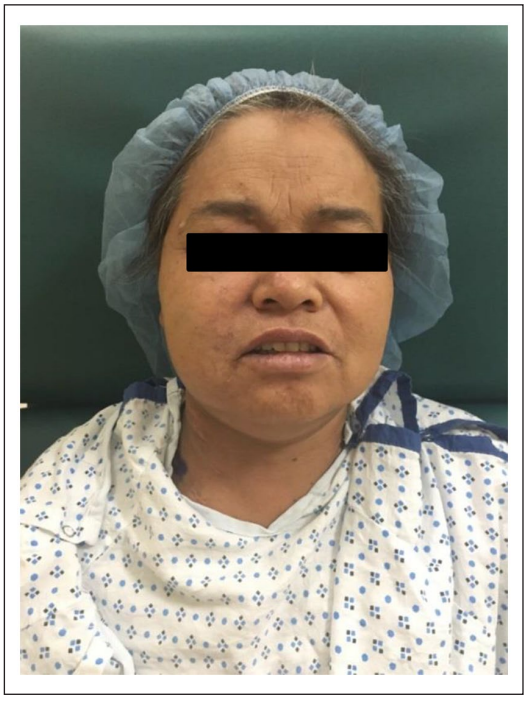
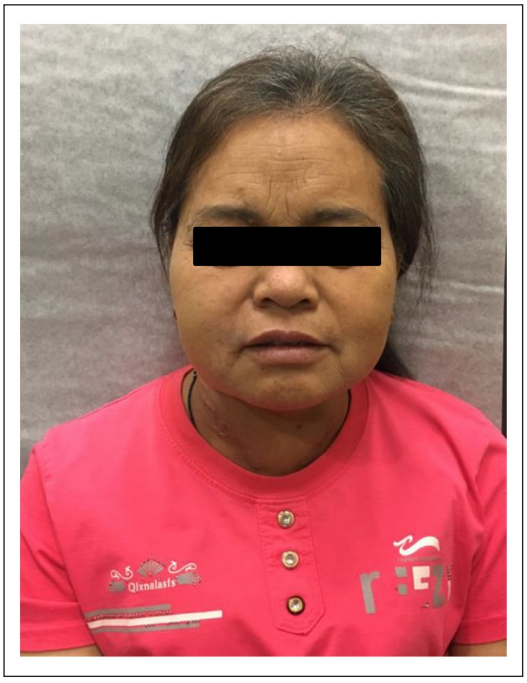


Figure 3. (a) Dilation of the right internal jugular vein. (b) Picture of the reinforced PTFE Propaten graft at pretracheal space, anastomosed both ends in an end-to-side fashion to each jugular vein.



Patient pre-operative



Patient post-operative

graft. At 9 months, she underwent a transplant procedure and was able to stop hemodialysis, but decided to keep the arteriovenous fistula. The Apixiban was switched to Aspirin 81 mg per day. Her bypass and fistula remain patent at 1 year postoperatively.

Discussion

The etiology of CVS remains complex and is likely related to a number of factors, including (1) endothelial injury from either repeated catheter insertion or persistent mechanical damage from contact with the catheter, (2) catheter or AVF related changes in the flow dynamics leading to increased shear stress, platelet aggregation, and intimal hyperplasia. Other contributing factors include presence of cardiac electronic implantable device leads or other foreign bodies, catheter related infections, and presence of external compression.[8]

Central venous obstruction may impede blood return from head, neck, and arm. The presence of an ipsilateral arteriovenous fistula or graft compounds the problem by dramatically increasing venous hypertension and congestion, which often leads to debilitating arm and/or facial

swelling. In our case, the patient had right brachiocephalic vein obstruction which hindered the venous drainage from both right arm and right side of the neck and head. Since the junction of right subclavian vein and right internal jugular vein was still open, high pressure flow from the right arm AV fistula fed the right internal jugular vein in a retrograde fashion, causing right fascial swelling, conjunctival congestion, and headache.

The easiest surgical solution for access-associated CVO is ligation of the access, which results in immediate relief of symptoms.[8] However, ligation does not correct the underlying defect, and further renders the affected extremity unsuitable for future access. Additionally, the patient is still left with a need for new permanent access at another site, either in the contralateral arm or in the lower extremities.

In the endovascular era, angioplasty with or without the addition of a stent is the mainstay of treatment in HD patients with chronic venous obstruction.[9,10] The AV fistula can be easily accessed for the endovascular intervention, and the technical success rate is reported up to 70%–100% using a variety of techniques.[11] However, the primary patency rate with plain balloon angioplasty is less than 50% at 1 year, and the secondary patency is quite variable, ranging from 13% to 100%.

However, when the CVO cannot be opened with an endovascular approach, a bypass surgery should be considered, especially when the patient has working AV fistula with limited alternative choices for dialysis access. Surgeries previously described include extra anatomic bypasses to an open venous segment or direct reconstruction of the occluded vein segment. These surgical options include the following: Internal jugular vein turn-down, ipsilateral and contralateral axillary-jugular vein bypass, axillary to femoral bypass, and direct bypass to either the superior vena cava, inferior vena cava, or right atrium. Other surgical options for patients with CVO include an all-arterial graft, such as an axillary-axillary arterial-arterial loop conduit or the HeRO graft (Hemodialysis Reliable Outflow-Merit Medical).[12] Surgical reconstruction has been reported to have primary patency at 1 year ranging from 80% to 100%. However, many of these options are relatively invasive and are associated with significant morbidity and mortality.[8]

In our case, a bypass to the ipsilateral internal jugular vein was not an option given the right brachiocephalic occlusion, and the patient was not interested in a bypass to the right atrium. We present an intermediate option of jugular to jugular bypass. We opted for an anterior tunnel for our bypass. This allowed us to avoid routing the graft around the carotid arteries, lessening the chance for graft compression at this level. We also avoided extensive dissection of the vagus nerve and the inherent risk of nerve injury. Its placement behind the strap muscles would provide adequate coverage to avoid infection. While a retroesophageal tunnel is preferred for carotid-carotid bypass to reduce the length of the bypass, this advantage is lessened somewhat when bypassing the jugular veins lower in the neck. We chose a reinforced PTFE graft over autologous vein or Dacron to provide additional protection against external compression. The presence of the high flow arteriovenous fistula and the addition of anticoagulation would help maintain patency of the graft.

Conclusion

To date, our literature review shows that there have been no reported cases of an anterior approach internal jugular to contralateral internal jugular venous bypass to preserve an ipsilateral brachiocephalic autogenous access. At 1-year follow-up, she continues to be symptom-free with a functional fistula. While endovascular intervention remains the first line treatment for symptomatic CVO related to hemodialysis access, the improvement in patient survival has led to repeated and more complex interventions to preserve access in increasingly limited access sites. When endovascular approaches are unsuccessful or failed, surgical bypass can play an important role for symptom relief and arteriovenous access salvage. Our approach to treating a patient with CVO after multiple previous percutaneous interventions provides an additional therapeutic modality to the treatment of CVO.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethics

This case report has been approved by the committee of Institutional Review Board at Maimonides Medical Center and complies with all ethical principles and properties established.

Participant confidentiality

In order to maintain confidentiality, the patient's name will not be connected to any publication or presentation that uses the information and data collected about the patient or with the research findings from this study. The researcher will use anonymizing measures to identify participants rather than patient name. Patient's name and identifiable information will only be shared if required by law or the patient gives written permission.

Disclaimer

The risk of participating is minimal. If the patient had health concerns that impacted their ability to participate, however, they were able to consult a health care professional before agreeing to participate in this study.

Refusal to sign consent and authorization

The patient was not required to participate in this study and had the right to refuse. Refusal to participate in this study did not affect their rights to services they received from Maimonides Medical Center.

Cancelling this consent

At any time during the study, the patient had the right to withdraw their consent to participate in this study

Participant certification

The patient had been given the opportunity to ask questions regarding the study, and the patient had received answers to any questions they had regarding the study. They understood that if they had any additional questions about the study or their rights as a research participant, they were able to contact us. The patient agreed to be a participant in this study. They acknowledged that they were aware of what the study involved, and that they were at least 18 years old.

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