# Innominate Vein Stenosis in Association with Ipsilateral Hyperdynamic Brachiobasilic Fistula Causing Ipsilateral Limb and Hemifacial Swelling


## Abstract

A 34-year-old hypertensive woman with a hyperdynamic, left brachiobasilic dialysis fistula presented with a long history of throbbing in her head and swelling of the left side of the face. Tight stenosis of left brachiocephalic vein was found to be causing retrograde flow into the left jugular vein which normalized after dilatation and stenting with resolution of all the symptoms and patient is asymptomatic for 1 year.


**Keywords:** *Brachiocephalic vein stenosis, central vein stenosis, dialysis fistula, percutaneous transluminal angioplasty*


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## Introduction

Dialysis vascular access thrombosis is usually due to outflow obstruction. Central venous stenosis (CVS) compromises ipsilateral vascular access.[1] Brachiocephalic (or innominate) vein stenosis or thrombotic occlusion can occur in dialysis patients. In such patients, creation of an autologous ipsilateral arteriovenous fistula (AVF) can produce retrograde flow in the ipsilateral jugular vein resulting in unilateral facial swelling, breast and limb swelling, papilledema, pseudotumor cerebri, and cerebral venous hypertension.[2] We report a female with chronic kidney disease developing ipsilateral limb edema, hemifacial swelling and throbbing headache 1 year following left brachiobasilic fistula and found to have idiopathic left brachiocephalic stenosis.

## Case Report

A 34-year-old hypertensive female with a 2-year history of end-stage renal disease secondary to progressive sclerosing glomerulonephritis presented with a 2-month history of progressive swelling of the left upper limb, hemifacial swelling, and throbbing headache, 6 months after an autologous left brachiobasilic fistula. She had failure of left radiocephalic fistula created 2 years back. Left brachiocephalic fistula was created elsewhere in a single stage and thrill was good. However, as it was not possible to cannulate this fistula, a left brachiobasilic fistula was created. She had undergone hemodialysis (HD) through 11.5 French right internal jugular polyurethane venous catheter for 8 weeks, 9 months back. On examination, she had edema over the left half of the face with dilated veins over the face and neck [Figure 1]. There was slight left proptosis; visual acuity was normal. There was no bruit over the cranial vessels. Doppler study showed minimal aneurysmal changes at brachiobasilic fistula site with good flow. Velocity of flow was not measured. Patient was subjected to magnetic resonance angiography (MRA) initially to ascertain the diagnosis and conventional angiography was not performed. Gadolinium was used at a dose of 0.25 mmol/kg, and she underwent HD after the procedure. Arch aortogram showed failure of the left vertebral artery to fill, as well as venous return in the cephalic, axillary, and subclavian veins refluxing toward the head in the left internal jugular vein (IJV) and crossing through the skull base to exit the skull vault through the right IJV. Late venous phase showed reflux toward the head in the left IJV. Central venogram showed tight stenosis in the most medial aspect of the left brachiocephalic vein [Figure 2]. Percutaneous transluminal angioplasty (PTA) of the left innominate vein was done for 90% ostioproximal stenosis using 14 mm × 20 mm Atlas™ balloon at a pressure of 6 atm. After venoplasty with Atlas 14 mm × 20 mm

**How to cite this article:** Narendra JB, Sreenivas J, Karthikeyan VS, Nagaraja NH. Innominate vein stenosis in association with ipsilateral hyperdynamic brachiobasilic fistula causing ipsilateral limb and hemifacial swelling. Indian J Nephrol 2017;27:452-5.



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**Access this article online**

**Website:** www.indianjnephrol.org

**DOI:** 10.4103/0971-4065.194393

**Quick Response Code:**

balloon, there was residual 50% stenosis and flow was sluggish. Hence, a 14 mm × 40 mm E Luminex™ self-expanding metallic stent was implanted at 8 atm pressure and good flow was established [Figure 3]. The patient quickly reported a marked improvement in the throbbing headache, intracranial noise, and left-sided facial swelling within 2 days [Figure 4]. Poststenting Doppler demonstrated an immediate return to normal direction of flow in both the left vertebral artery and left jugular vein. Repeat MRA performed at 3 weeks with the same dose of gadolinium revealed reduced distension in the left superior ophthalmic and facial veins. She underwent immediate postprocedure HD and did not develop nephrogenic systemic fibrosis after MRA. At the end of 1 year, the patient is asymptomatic without recurrence and with a well-functioning AVF.

## Discussion

Complications related to vascular access account for 20–30% of hospitalizations of dialysis patients, primarily from sepsis and thrombosis.[1] Access thrombosis is usually a result of outflow obstruction because of stenosis at various points in the anatomical course of access.[3] CVS has been reported to have female predominance only in some studies and the gender difference however has not been well substantiated. It manifests as extremity and breast edema, pain, inadequate dialysis, and arteriovenous access failure. CVS is usually asymptomatic and hence the exact prevalence is uncertain.[4] CVS manifests as blood flow through the maturing dialysis access increases leading to venous engorgement and poor outflow.[5] Studies have shown subclavian stenosis is 25% of dialysis access failures and CVS in 19% and 16% of dialysis access failures including 27% with previous central venous catheterization (CVC). As AVF increases the venous flow, subclavian cannulation is now usually avoided in chronic renal failure (CRF) patients.[6,7]

Possible mechanisms for the development of CVS include catheter-induced initial vessel wall trauma, foreign body in the vein, sliding movement of the catheter with respiration or postural or head movements, and turbulence following AVF creation. High blood flow during dialysis,

**Figure 1: Clinical picture of the left upper limb and hemifacial swelling at presentation**

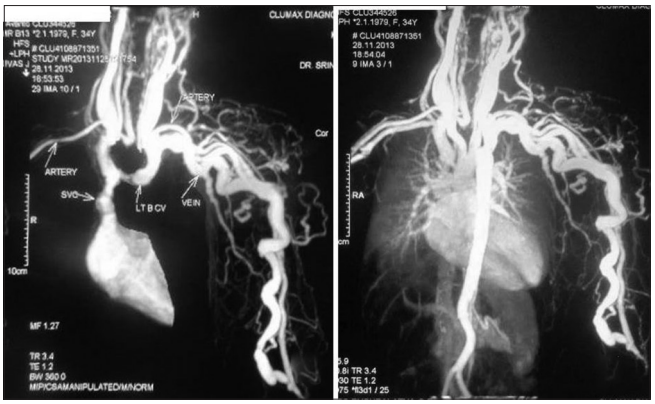


**Figure 2: Magnetic resonance angiogram showing failure of the left vertebral artery to fill, as well as venous return in the cephalic, axillary, and subclavian veins refluxing toward the head in the left internal jugular vein**

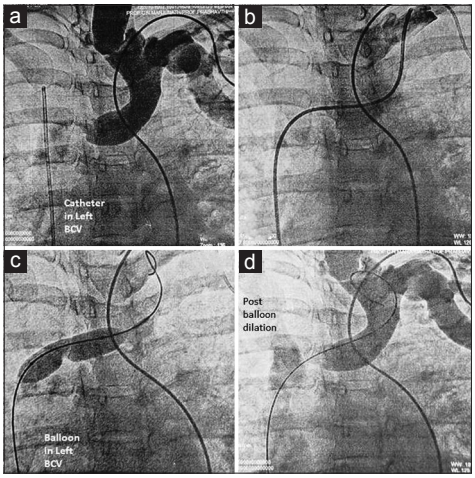


**Figure 3: Percutaneous transluminal angioplasty of left innominate vein stenosis**

**Figure 4: Clinical picture showing resolution of upper limb and hemifacial edema post left innominate vein stenting**

turbulence, and vibration stimulate intimal hyperplasia. The established flow across a maturing AVF travels through right atrium through innominate vein. When CVS occurs, this flow is interrupted, thereby interfering with the successful development of a functional AVF. If AVF develops successfully, collaterals develop due to impedance by anatomical stenosis resulting in venous hypertension. Collaterals partially allow mitigation of symptoms and allow the use of AVF access, but due to symptoms of venous hypertension, leads to angiographic discovery of occult CVS. Hypoproteinemia, CRF, impaired thyroid function, infections, and low left ventricular ejection fraction are other known risk factors for CVS. It is also possible after pacemaker placement.[8]

There is a predilection for left-sided CVC due to anatomical reasons. Left IJV merges with subclavian and takes a longer, tortuous course with two opposite curves before reach atrium as compared to the straighter course of the right innominate vein. In one-third patients, left IJV has a smaller cross-sectional area; hence, there is a greater contact of the foreign body and it also can cause right-sided CVS. Mediastinal length increases when patient assumes upright from supine position and is more evident in females due to a large amount of breast tissue.[8] Longer catheters (>14–16 cm) and those with larger caliber are more prone to cause CVS. CVS is relatively rare in patients without prior CVC. Multiple CVC and longer dwell times are more prone. Although short-term catheters used as stopwatch arrangement during maturing AVFs are more benign, they can cause CVS even within an average of 21 days.[9] Subclavian catheters are associated with 42% incidence of CVS compared to that of IJV catheters (10%). Silicone catheters have a lesser incidence than polyurethane CVC.[10] CVC may be completely asymptomatic and detected only on angiography. Edema and venous hypertension involve ipsilateral extremity and breast in subclavian stenosis, face and upper extremity in brachiocephalic stenosis and CVS causes aneurysmal dilatation of AVF.

Angiography (contrast venography) is the gold standard for diagnosis of CVS. Other investigations include color-flow duplex and digital subtraction angiography.[11] MR venogram is advantageous in chronic kidney disease. The Disease Outcomes Quality Initiative (DOQI) guidelines recommend venography in subclavian CVC patients before placement of permanent access.[12] Elevation of limb and anticoagulation can sometimes be useful in acute thrombus-induced CVS, but not in chronic occlusion.

Catheter-induced CVSs is related to the site of insertion, number, type and duration of catheter uses, and occurrence of infection. Cuffed catheters are associated with lower blood flow rates compared with grafts and fistulae, and long-term catheter access is associated with a risk for CVS precluding the establishment of a permanent vascular access for HD. Left IJV catheter placement may be associated with poorer blood flow rates, and subclavian catheters have high risk for stenosis permanently excluding the possibility of upper extremity permanent fistula or graft. Catheters should not be placed on the same side as a slowly maturing permanent access.[13]

K/DOQI recommends PTA with or without stent placement as the preferred approach to CVS, but it is useful only on short term.[13] Primary patency drops to 30–43% at 12 months.[14] Directional atherectomy with PTA is potential but is not practiced due to possibility of central vein rupture. Wallstent can be used for lesions not responding to PTA with primary patency of 56% at 12 months and 28% at 12 months.[14] Long-term primary patency of stent is compromised by neointimal hyperplasia. However, it acts as a lifesaving modality during transition to another modality of renal replacement therapy or aids in creation of AVF on contralateral limb. Surgical exposure of vein and repair is indicated when endovascular options fail. Techniques include axillary vein to IJV bypass, IJV to axillary vein transposition, and axillary to saphenous venous bypass. The last resort to relieve edema and pain is by compression, balloon occlusion, ligation, or embolization of AVF, resulting in abandonment of that limb for future access. Contralateral access or renal transplants are also other options in CVS with AVF complications.

Brachiocephalic vein stenosis (BVS) is less common than subclavian vein stenosis in renal failure patients undergoing HD. BVS is associated with retrograde flow in the jugular vein, facial swelling, and cerebral venous hypertension. BVS can occur even without prior central venous cannulation suggesting that it can be idiopathic. Raised intracranial pressure (cerebrospinal fluid) pressure was not measured in our patient) would be likely in our patient and would explain.

## Conclusion

BVS is unusual, but in patients with a history of subclavian cannulation, the patency of the central veins should be checked before creation of a fistula. A high index of suspicion of central vein stenosis should be maintained when symptoms develop in a limb associated with a fistula as the sequelae are serious and largely reversible.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

### Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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