Case Report

Endovascular Stenting for Left Subclavian Venous Stenosis for a Hemodialysis Patient with a Persistent Left Superior Vena Cava

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A persistent left superior vena cava (PLSVC) is the most common thoracic venous anomaly, and we should be aware of its existence. We encountered a case of significant left arm swelling due to recurrent left subclavian venous stenosis in a hemodialysis patient with a PLSVC. Endovascular stent placement was performed safely and effectively for the stenosis employing the pull-through technique, in which a guidewire was passed from the left internal jugular vein to the access vein. On the following day, left arm swelling had improved. 3 months after stent placement the left arm swelling has not recurred.

Keywords: stent, pull-through technique, persistent left superior vena cava

INTRODUCTION

The prevalence of a persistent left superior vena cava (PLSVC) is estimated to be approximately 0.3%–0.5% in individuals with a normal heart and 4% in those with congenital heart disease.1) A PLSVC can be detected incidentally during procedures such as hemodialysis (HD) catheter placement,2,3) and can cause difficulties during central venous and pulmonary artery catheterization.4) Serious complications such as shock, angina and cardiac arrest have been described during catheterization in adults with a PLSVC.5,6)

Recently, we encountered a recurrent left subclavian venous stenosis in an HD patient with a PLSVC. We performed endovascular stent placement safely and effectively for the stenosis employing the pull-through technique from the left internal jugular vein to the access vein.

CASE REPORT

The patient was a 56 year-old man who had undergone HD due to renal failure following chronic glomerulonephritis for 28 years. The patient presented with left arm swelling 1 year after new creation of a native brachial arteriovenous (A-V) fistula for HD. Percutaneous transluminal angioplasty (PTA) for the stenosis of the left subclavian vein was performed twice within 2 months at another hospital. However, arm swelling recurred a few weeks after the last PTA, and then the symptoms gradually worsened. The patient did not want closure of the A-V fistula. Therefore, he was referred to our hospital for endovascular stent placement. At the time of hospital admission, the patient had left upper arm and forearm diameters of 31 and 25 cm.

Initially, the access vein was punctured with an 18 gauge needle. Then, venography, obtained by the manual injection of 12 mL of contrast medium (150 mg of iodine...
per milliliter) with an 18 gauge needle, revealed a PLSVC and focal severe stenosis of the left subclavian vein (Fig. 1A). The diameter of the adjacent vein was approximately 12 mm.

The patient received an intravenous heparin injection of 3000 U (50 U/kg) before the procedure. After the insertion of a 7-French sheath introducer from the puncture site under local anesthesia, the stenosis was traversed with a hydrophilic 0.035-inch guidewire (Terumo, Tokyo, Japan) and a 5-French catheter (Clinical Supply, Gifu, Japan) through the sheath introducer. A balloon catheter of 8 mm in diameter and 20 mm in length (Powerflex; Cordis, Miami, FL, USA) was inserted through the sheath introducer and inflated over the stenotic lesion at 10 atm for 1 minute as pre-dilatation. Then, we performed stent placement. The diameter of the adjacent vein was so large that there was a possibility that the stent would migrate to the PLSVC. To prevent such migration and provide sufficient traction to deliver a large-sized catheter device, we decided to place the stent employing the pull-through technique as follows. First, a 7-French sheath introducer was inserted from the left jugular vein under local anesthesia. Next, a 0.035-inch guidewire of 260 cm in length (Terumo) was inserted through a 5-French catheter which was advanced through the 7-French sheath introducer placed in the left jugular vein. The 0.035-inch guidewire was navigated into the sheath from the access vein. The guidewire was grasped by surgical forceps with the sheath inserted from the access vein and was pulled out of the sheath (Fig. 1B). Then, the 5-French catheter was

Fig. 1  A: Venography demonstrated a persistent left superior vena cava (arrows), severe focal stenosis of the left subclavian vein (white arrow), and development of collateral veins (arrowheads).
  B: After the insertion of a sheath introducer from the left jugular vein, a 0.035-inch guidewire was pulled through with the sheath from the access vein.
  C: A stent was precisely deployed over the stenotic lesion without protrusion into the persistent left superior vena cava. Additionally, the venography revealed resolution of the subclavian venous stenosis and disappearance of collateral veins.
withdrawn. The 7-French sheath inserted from the left jugular vein was exchanged with a 12-French stent delivery sheath of 60 cm in length (GZVI; COOK, Bloomington, IN, USA). Finally, a 10 to 25-mm diameter and 30.6 to 39.0-mm-long Palmaz XL stent (Cordis), mounted over a balloon catheter of 15 mm in diameter and 40 mm in length (Maxi-LD; Cordis), was precisely deployed without protrusion into the PLSVC via the 12-French sheath after stenotic lesion coverage became optimal on venography (Fig. 1C). During advancement of the stent mounted over the balloon catheter, tension was maintained at both ends of the 0.035-inch guidewire. On the following day, left arm swelling had improved (diameter of the left upper arm and forearm were 27 and 19 cm, respectively), and the patient was discharged from the hospital. Post-procedural anticoagulation or antiplatelet therapy was not prescribed.

3 months after stent placement the left arm swelling has not recurred.

**Discussion**

The PLSVC descends vertically in front of the aortic arch, close to and slightly lateral to the vagus nerve, and, in most cases, enters the right atrium by way of the coronary sinus. Catheter tip manipulation in the coronary sinus may cause serious complications such as shock, cardiac arrest, and angina in adults with a PLSVC. Central venous stenosis or occlusion is a common complication that leads to access dysfunction in HD patients. Endovascular treatment for central venous stenosis or occlusion is well-known as a safe and effective procedure in HD patients. However, the optimal choice between PTA and stent placement in the management of central venous stenosis and occlusion still remains controversial. Some groups routinely perform stent placement for central venous stenosis; they have reported improved patency rates compared to those with PTA alone. On the contrary, other groups reported that the primary patencies between angioplasty and stent were not significantly different. Further, Ozyer et al. reported that stent placement for central venous stenosis or occlusion led to a significantly lower primary patency rate than PTA but added to the longevity of vein patency in angioplasty-resistant lesions; therefore, stent placement should be considered in such angioplasty-resistant lesions. The most commonly used stents for central venous stenosis or occlusion are self-expandable stents. On the other hand, balloon-expandable stents are used only when the stenosis is short and the diameter is large.

The pull-through technique has been reported in the treatment of totally occluded iliac arteries or the high-grade stenosis of central veins. The technique provides sufficient traction to deliver a large-sized catheter device even when there are sharply angled lesions, as in the present patient.

In the present case, because recurrent left subclavian venous stenosis after repeat PTA developed in an HD patient, stent placement was chosen. Although there has been the disadvantage that a balloon-expandable stent may have developed compression or deformation after deployment, we decided to use a Palmaz stent instead of a self-expandable stent because the subclavian vein was larger than the self-expandable stent available in Japan, with commercial sizes up to 12 mm. Palmaz stent placement was successfully performed for the stenosis employing the pull-through technique, in which a guidewire was passed from the left internal jugular vein to the access vein. There has been one report of a stent being placed for central venous occlusion or stenosis with the use of the pull-through technique between the femoral vein and access vein. To our knowledge, however, there has been no report of stent placement employing the pull-through technique from the left internal jugular vein to the access vein for subclavian venous stenosis in an HD patient with a PLSVC. If we had used the pull-through technique between the femoral vein and access vein in this case, severe complications such as arrhythmia and cardiac arrest would have developed because the guidewire would have passed through the coronary sinus.

In conclusion, we should be aware of the existence of a PLSVC, which is not exceedingly rare, although uncommon, in interventional procedures such as catheterization from the left jugular vein or the left subclavian vein and PTA for left subclavian venous stenosis. Although it is rare to perform endovascular stent placement for a left subclavian venous stenosis or occlusion in patients with a PLSVC, the pull-through technique between the left internal jugular vein and access vein may be safe and effective.

**References**

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