Valvar Bypass Operation to Cure Stubborn Lower Limb Edema Caused by Post-thrombotic Syndrome: Case Report and A Literature Review

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Short Report

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Abstract

Obstruction and/or reflux compromise venous emptying, making for the different pathophysiology of chronic venous insufficiency (CVI). We present a patient, presented with stubborn lower limb edema of CVI caused by post-thrombotic syndrome (PTS), succeeded in responding to the therapy of femoral vein valve by axillary vein bypass after ineffectual valvuloplasty and led a normal life. During 3 months observation, the bridging vessel may completely restore the original anatomical structure. Through the literature study, there is no similar operation reported. It shows that this operation may be feasible for some selected patients.

1. Introduction

Chronic venous insufficiency (CVI) is a frequent cause of the population's loss of working hours and days. In the deep veins, obstruction and/or reflux compromise venous emptying due to the different pathophysiology. CVI is often secondary to DVT and categorized as “Esi” (secondary etiology, intravenous) in the updated CEAP classification[1]. If the thrombus lyses or recanalizes, the valves may be damaged or destroyed, and deep venous reflux occurs. If the thrombus does not lyse or recanalize sufficiently, the vessel lumen remains narrow, occluded, and outflow obstructed. Peripheral veins (PVs) may be similarly affected, lose valvular competence, remodel, and enlarge with the outward flow. In the end, the profound venous changes may lead to venous hypertension in the superficial veins. This pathway and related signs have been called post-thrombotic syndrome (PTS)[2, 3]. When both obstruction and reflux are present, the clinical course may be more complicated[4].

We present a patient who presented with stubborn lower limb edema of CVI caused by PTS succeeded in responding to the therapy of axillary vein bypass and led a normal life.

2. Case Report

A 48-year-old male was admitted for severe CVI of the lower extremity. Fifteen years ago, he had no inducement to develop edema with a heavy feeling in both lower limbs, and the right side was worse. He sought medical attention without success (oral drug treatment, specific treatment unknown). The skin itching and pigmentation of both lower limbs gradually appeared. Three years ago, he was diagnosed with deep vein thrombosis involving the deep veins of the right lower limb, including the right iliac vein, due to the aggravation of edema of the right lower extremity with a fracture of the right foot after trauma in the local hospital. He was implanted with an inferior vena cava filter and removed in time. After that, he was anticoagulated with warfarin regularly for one year. However, the edema of the lower limbs had not been alleviated, and the right lower limb's swelling and heaviness became more serious; moderate pain in the right calf may occur after standing for more than 15 minutes, which has seriously affected life and work. A systems review revealed a history of hypertension and hyperlipidemia. There was no tobacco, alcohol, drug abuse, or recent trauma history. Family history regarding arterial and venous
thromboembolism was unremarkable. There was no recent history of fever, headache, visual disturbance, shortness of breath, abdominal pain, nausea, or vomiting.

Photocopied medical records of the physical examination showed no varicose veins in the cross pubic, anterior, and lateral abdominal wall, only that superficial varicose veins scattered in both calves. The skin color of the right lower limb shows mild redness and moderate hemosiderin pigment deposition over the footwear area. In addition, there was no evidence of ulceration and healed ulceration. Both lower limbs showed edema, with concave fingers, which was relatively serious on the right side. The circumference of the lower leg 15 cm below the knee was 32.5 cm on the left and 35 cm on the right. The dorsalis pedis and posterior tibial arteries of the lower limb were palpable. The patient weighed 72 kilograms. He had normal strength and range of motion in all four limbs. Villalta scale[5] was 15 points, and VCSS[6] was 11 points. Color flow duplex ultrasonography revealed marked right lower extremity venous reflux with a venous refill time of 5 seconds and no evidence of venous outflow obstruction. Duplex examination revealed marked incompetence of the common femoral, superficial femoral, popliteal, and greater saphenous veins. Descending phlebography confirmed incompetence of the superficial femoral vein, and blood can flow back to the lower part of the right calf. Ascending phlebography showed superficial varicosities over the bilateral calves, with no incompetent perforating veins. Based on the results of venous hemodynamic evaluation [7], ascending phlebography[8], and descending phlebography [9], the patient classified as C4b, EsiAdPr,o, and Grade (Kinster classification) regurgitation of right femoral vein valve [9], as previously described.

The surgical procedure was carried out under general anesthesia. After full heparinization, the ‘strip test’ showed that the right femoral vein had severe regurgitation. The veins around the proximal end of the superficial femoral vein were blocked respectively. Longitudinal incision of the superficial femoral vein at the first pair of valves with more attention to protecting the internal valve showed that the anterior valve almost disappeared and the posterior valve exists, but the posterior valve is rigid and thickened. Considering that this flap could not be repaired typically, we decisively chose axillary vein valve transplantation. The anterograde incision was made at the projection of the body surface of the mid and distal axillary vein with valves marked by ultrasound before the operation. It detected a transplantable valved axillary vein with a diameter of about 5mm. A strip test showed that the function of the valve was expected here.

Remove the axillary vein smoothly. Anastomosed the axillary vein with the femoral vein end to side at the appropriate position of the proximal and distal part of the first pair of diseased valves of the superficial femoral vein. After proximal anastomosis, we opened proximal block to confirm that the tube wall at the valve graft filled without reflux. Ligated the superficial femoral vein segment corresponding to the bridging vessel. Used an 8×75 mm Maquet carotid patch to sleeve wrapped the transplanted axillary vein valve segment[8]. A strip test was repeated after valvuloplasty to confirm the absence of reflux. Indwelling drainage in inguinal and axillary incisions and then sutured, the operation was smoothful (Fig. 1).
Heparinization was given for 3 consecutive days after the operation, maintaining APTT 1.5–2.5 times. Then the patient was changed to receive adequate anticoagulation therapy of rivaroxaban for three months. The edema and sense of heaviness and pain in the right lower limb of the patient were significantly relieved after the operation. The patient continued to maintain the pressure treatment of medical elastic stockings on the spot activity. Recheck 1 and 3 months after the operation showed no obvious regurgitation of the right femoral graft vein valve, the valve function was normal, the d-dimer was normal too, and there was no new thrombosis. The patient has returned to normal life and work. 3 months postoperation, the pigmentation of the right lower leg became lighter than before, tension reduction of varicose veins in the lower leg, and the right ankle was slightly edematous (Fig. 2). The heavy feeling, pain, and other lower limb symptoms disappeared, and the edema could be well controlled when wearing elastic stockings. Villalta scale reduces to 5 points, and r-VCSS also reduces to 5. The reexamined ultrasound (Fig. 2) showed that there was no thrombosis near the ligation of the original superficial femoral vein, the valve in the transplanted bypass vessel opened and closed well, and there was no reflux when the valsalva maneuver acted. The patient was very satisfied with the treatment effect. We advise the patient to discontinue the anticoagulation and continue the treatment of long-term elastic compression stockings (ECS). The outpatient department will recheck after 3 months. We have obtained the patient's publication consent.

3. Discussion

The pathophysiology of CVI is best considered as having two distinct components: the events that occur within the larger superficial and deep veins and those that occur subsequently in the microcirculation and surrounding skin tissues [11]. PTS is a set of symptoms and signs of CVI caused by impaired venous outflow due to deep venous obstruction and/or reflux following a DVT[12]. Typical signs are pain with calf compression, varicose veins, edema, and skin changes, like VLUs[13]. This syndrome occurs in 20%–50% of DVT patients, maybe more, of whom 5%–10% develop severe PTS, such as VLUs. This patient had CVI symptoms before DVT. Therefore, considered that CVI disease before DVT is one of the causes of DVT on the patient's right side. Three years after right lower extremity DVT, this patient had obvious lower limb edema, heaviness, pain, varicose veins, pigmentation, etc., before the operation, which was completely consistent with the diagnosis of PTS. Villalta scale was 15 points before the operation, which was a severe PTS manifestation.

In patients with PTS, conservative treatment is the first option. It consists of supervised exercise training, compression treatment, usually with elastic compression stockings (ECS), and pharmacotherapy, including venoactive drugs, such as horse chestnut extract [14]. This patient had tried to appeal to all conservative treatment methods in the past two years, which had not achieved good results, and this disease had seriously affected his life and work. So this patient was very urgent for effective treatment.

Treated deep vein incompetence (DVI) surgically is indicated if patients without outflow obstruction or with previously corrected outflow obstruction, conservative management of deep venous incompetence of the lower limbs has failed, and severe symptoms and signs of CVD persist. Only patients with axial
Reflux from the level of the thigh, across the popliteal vein, and into the calf veins are considered for intervention[15], that included endovenous or surgical techniques in carefully selected cases[16]. The examination of this patient showed that the thrombus had disappeared completely. The angiography also showed that the right femoral vein flowed back to the distal part of the calf veins, consistent with the indications of surgical intervention.

In this case, angiography evaluation before operation, as well as disappeared anterior valve and rigid posterior valve during operation indicated that valvuloplasty or transposition of the femoral vein can not be advisable choice. Other options for reconstruction are the transplantation of a vein segment with a competent valve (usually the axillary vein) or the creation of a neovalve from the thickened vein wall, or an artificial prosthetic valve[17]. Overall, after open valve reconstructions for DVI, ulcer-free rates vary between 54% and 100% for up to five years. But this could also be attributed to the treatment of superficial reflux or compression therapy in some patients. As no comparative studies have been performed, it is impossible to make any recommendations on selecting the different types of surgery for DVI [18]. Unfortunately, neovalve or artificial prosthetic valve have not come to bedside, although some neovalve cases are presented, the only choice remained valve transplantation. In axillary vein valve transplantation, in this case, the tube diameter of proximal and distal valved axillary vein did not coincide with the femoral vein, so we performed end to side instead of the anterior end-to-end anastomosis. More importantly, we did these anastomosis intended to avoid axial reflux, which may resulted a short term dysfunction of the vulnerable axillary vein valves. Many studies have shown that end-to-side anastomosis can achieve long-term patency of the bypass vein in lower limb vein surgery[19.20.21].

Meanwhile, aimed to avoid femoral vein blood flow distortion and target vessel occlusion, we ligated the trunk of femoral vein. At the same time, based on our experience, we followed a sleeve wrapping operation on the graft valve area of the axillary vein, aimed to achieve a good long-term graft valve function[10].

Surgery to correct deep vein reflux is challenging. Through the literature study, there is no similar operation reported. During 3 months observation, the bridging vessel have completely restored the original anatomical blood flow. The successful experience of this case shows that this operation may be feasible for some selected patients. We will continue to study the reliability of this type of operations.

**Declarations**

**Disclaimers**

None.

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**Conflicts of interest**

None.
None.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Yanyang Wang made substantial contributions to the conception and design of the study; acquisition, analysis, and interpretation of the data; drafting of the manuscript; and critical revision of the manuscript for important intellectual content, and gave final approval of the version to be published. Yali Du provided clinical care for the patient and critically revised the manuscript for important intellectual content. Jianfeng Chen made contributions to the drafting of the manuscript. Jie Zhang, Liang Zhao, and Yingfeng Wu served as primary consultant in the management of the patient and made substantial contributions to the conception and design of the study; analysis and interpretation of the data; drafting of the manuscript; and critical revision of the manuscript for important intellectual content. Yingfeng Wu also gave final approval of the version to be published. All authors state that they have no conflict of interest. We have obtained the patient’s publication consent.

**References**


Figures
Figure 1

A: the anterior valve of SFV almost disappears, the posterior valve exists, but is rigid and thickened. B: anastomosed the AV with the FV end to side, ligated the SFV. C: cover the transplanted AV valve segment with the patch. D: The arrow shows the lengthy posterior valve of the first pair of valves of the SFV during operation. The anterior valve almost disappears and cannot be shown in the picture. E: The long arrow refers to the ligated SFV. The short arrow refers to the healthy valve area of the shunt AV, which can completely block the proximal blood flow (strip test). F: The arrow shows the sleeve wrapping for the AV valve.

*CFV, Common femoral vein; SFV, Superficial femoral vein; GSV, Great saphenous vein; AV, Axillary vein; SW, sleeve wrapping.

Figure 2

Ultrasound images of patient reviewed 3 months after operation. A: The long solid arrow shows the SFV, and the long arrow shows the AV. The short solid arrow shows the ring, and the cross mark shows the
ligation point of SFV. B: The diverted axillary vein is unobstructed, and the arrow shows the healthy axillary vein valve. C: During the valsalva maneuver, there is no blood reflux in the valve of the diverted vein. D and E are photos of patients' lower limbs before and 3 months after operation. Three months postoperation, there was still slight edema in the right calf, but the leg circumference at 15cm below the knee was 1cm less than that before the operation.