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Case Report

Popliteal-to-Dorsalis Pedis In-Situ Small Saphenous Vein Bypass under Planning with Mapping Using Computed Tomography Volume Rendering Technique

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The small saphenous vein (SSV) is an important graft in limb salvage surgery. It is frequently translocated for bypass surgery. Sometimes, the use of the SSV as an in-situ graft for posterior tibial artery or peroneal artery reconstruction offers the advantages of reduced vein graft injury and improved patency. Recently, saphenous vein mapping through computed tomography (CT) volume rendering technique offers a great quality view to the surgeon. We experienced a patient in whom a CT image with volume rendering technique revealed an aberrant SSV connected with the great saphenous vein at the medial malleolus level. This case indicates that an aberrant SSV may be successfully used as an in-situ conduit for bypass to the dorsalis pedis artery. Here, we present the case of a popliteal-to-dorsalis pedis in-situ vein bypass using a LeMaitre valvulotome (LeMaitre Vascular Inc., USA) under mapping of the aberrant SSV by CT volume rendering technique.

Key Words: In-situ bypass, Aberrant small saphenous vein, Volume rendering technique, LeMaitre valvulotome

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INTRODUCTION

Bypass operations with the great saphenous vein have become more common when primary endovascular procedures in diabetic patients with critical limb ischemia have failed. If the ipsilateral great saphenous vein is not of good quality for use as a bypass conduit, other conduits are searched as alternatives to the great saphenous vein. The small saphenous vein (SSV) has been successfully used as one such alternative. Shandall et al. [1] presented one of the first reports of lower limb bypass using an in-situ SSV. They recommended preoperative duplex scanning to assess and map the location of the SSV. Recently, dynamic multi-slice three-dimensional (3D) computed tomography (CT) angiography has been used in many surgical fields [2]. Especially, a 3D CT volume rendering technique is a possible noninvasive method for the diagnosis of unusual lower extremity varicose veins [3].

Here, we present the case of a popliteal-to-dorsalis pedis in-situ vein bypass using a LeMaitre valvulotome (LeMaitre Vascular Inc., Burlington, MA, USA) under mapping of the aberrant SSV by CT volume rendering technique.

CASE

A 72-year-old man was transferred to our department due to skin graft failure on his heel (Fig. 1). He had been diagnosed with diabetes 20 years ago and gout 5 years ago. An angiogram revealed a critical stenosis of the right popliteal artery, multifocal steno-occlusive lesions of the anterior tibial artery and complete occlusion of the posterior tibial and peroneal arteries (Fig. 2A). Initially,

Fig. 1. A photograph of a failing skin graft on the heel.

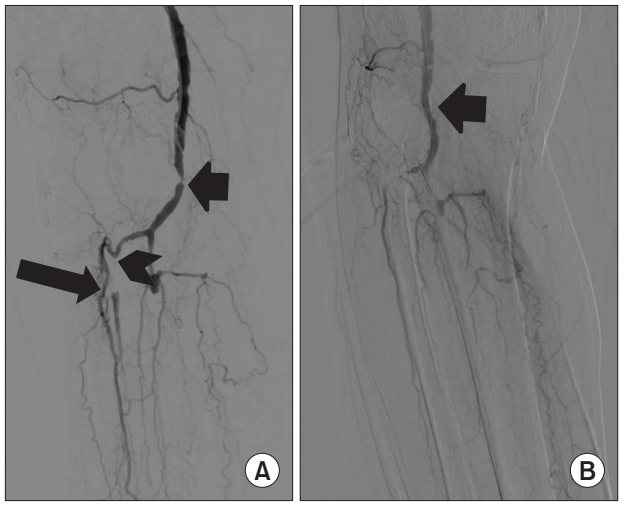

Fig. 2. (A) An angiogram showing severe stenosis of the popliteal artery (short arrow) and non-visible ostium of the anterior tibial artery (arrowhead). Also, collateral muscular branches were seen (long arrow). (B) After balloon angioplasty, a patent popliteal artery was seen (arrow), but the distal run-off vessels were not clearly visualized.

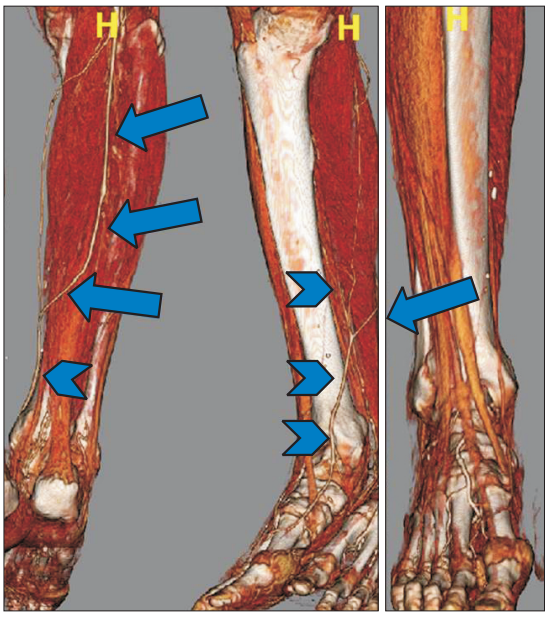

Fig. 3. Three-dimensional computed tomography angiogram with volume rendering technique showing an unusual right small saphenous vein (arrows) connected with the great saphenous vein (arrowheads) at above the medial malleolus.

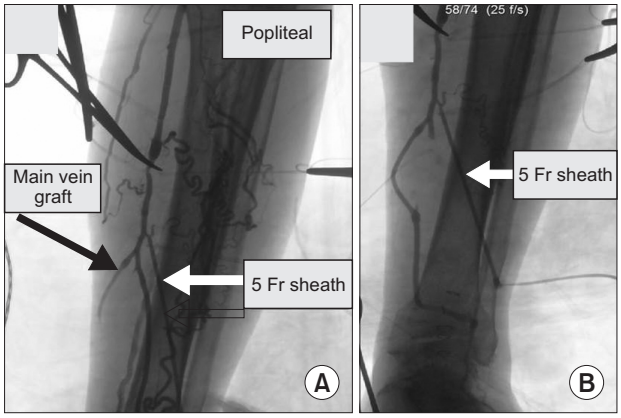

Fig. 4. (A) An angiogram showing enlarged four branch vessels of the small saphenous vein. (B) After ligation of the branch vessels, the in-situ bypass graft was seen clearly without collaterals.

the popliteal artery was treated successfully by balloon angioplasty (Fig. 2B). Next, all tibial arteries were tried to be treated with angioplasty, but was unsuccessful because of failure to pass the guidewire into the tibial arteries due to severe calcification. The patient was treated by popliteal-to-dorsalis pedis in-situ SSV bypass using a LeMaitre valvulotome in the lateral decubitus position by mapping using CT volume rendering technique (Fig. 3).

The popliteal artery and proximal SSV were exposed through a posterior longitudinal incision in the lateral decubitus position and a sapheno-popliteal anastomosis was done. Next, an incision was made between the dorsalis pedis artery and the great saphenous vein on the dorsum of the foot. Using this same incision, the distal 4 cm of the saphenous vein on the dorsum was dissected and mobilized so that it could reach the dorsalis pedis artery. A LeMaitre retrograde valvulotome was inserted from the distal end of the vein graft to just below the proximal anastomosis, and pulled through two times. After feeling an arterial pulsation with adequate flow through the distal SSV, the distal anastomosis was constructed. After that, two main

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Fig. 5. After two months, the skin graft was healed.

branches of the SSV were identified by ultrasonogram and then ligated and divided. One week later, four enlarged branches were detected on angiogram (Fig. 4A). These branches were subsequently ligated (Fig. 4B). Two months later, the skin graft of the patient was healed (Fig. 5)

DISCUSSION

In-situ saphenous vein bypass was performed first by May et al. [4] in 1965. This technique has a several benefits. Firstly, it reduces endothelial injury by preserving the vasa vasorum. Secondly, because of the smaller incisions required, the technique avoids or minimizes skin complications. Thirdly, because of the natural taper of the in-situ vein, the larger diameter of the vein can be anastomosed to the larger proximal artery, and the smallest diameter of the vein can be anastomosed to the smaller distal artery. Better outcomes with in-situ saphenous vein bypass have been reported with the development of instruments and an increase in the experience of vascular surgeons [5-8].

Shandall et al. [1] presented one of the first reports of lower limb bypass using an in-situ SSV. They performed the distal anastomoses using the SSV on the posterior or anterior tibial arteries in four patients. They noted that the SSV was reliably adequate for use as a bypass conduit when visualized with preoperative duplex vein mapping. Thus they recommended preoperative duplex scanning to assess and map the location of the SSV.

Recently, dynamic multi-slice 3D CT angiography has revolutionized many surgical fields [2]. 3D reconstruction with volume rendering technique using images of the delayed phase of peripheral CT angiography provided most clear delineation of the peripheral venous arcade. Especially, 3D CT angiography with 360° dynamic rotation provides enhanced knowledge over the existing technologies which are useful to design planning for in-situ bypass with vein graft or to know superficial vein status.

This patient had a diabetic foot with critical limb ischemia. Attempts for tibial angioplasty failed and the ipsilateral great saphenous vein was not good for bypass graft. At that time, images using 3D reconstruction with volume rendering technique revealed an aberrant SSV connected with the great saphenous vein at the medial malleolus level. Venous mapping with CT volume rendering technique can support surgical planning of in-situ bypass with a SSV having an aberrant course. Using this finding, the patient was treated by popliteal-to-dorsalis pedis in-situ SSV bypass using a LeMaitre retrograde valvulotome.

The LeMaitre valvulotome is a retrograde valvulotome and its cutting head is self-sizing and self-centering [9]. This allows effective and safe valve destruction, and ensures the prevention of mismatch between the diameter of the vein and the cutting head of the valvulotome.

As in our case, positioning the patient in the lateral decubitus position for exposure of the dorsalis pedis and popliteal arteries should be considered when an aberrant SSV is to be used as in-situ bypass conduit.

Saphenous vein mapping through CT volume rendering technique offered a great quality view to the surgeon as in our case. On the basis of these findings, in-situ bypass was safely performed and the skin graft of the patient was rescued successfully.

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