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Case Report

Femorofemoral Bypass using Accessory Saphenous Vein Graft in Superficial Femoral Artery Total Occlusion: A Case Report

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ABSTRACT

Background: PAD can be treated with either endovascular intervention and open surgery. Great saphenous vein (GSV) is the most commonly used vein conduit for infrainguinal vascular bypass. **Case Summary:** 38-years old man presented with intermittent claudication for 2 months and diabetic foot ulcer on his left cruris. Left pedal artery pulse was absent with ABI of <0.4. Angiography showed a chronic total occlusion of left superficial femoral artery (SFA). Upon intraoperative, an aneurysmatic GSV and a good accessory saphenous vein (ASV) were found through the same incision. Thus, ASV was chosen as the vein conduit. Postoperative period of 3 days was steady. Two month follow up revealed his ability to walk normally, good pulse and perfusion, and no deterioration on his ulcer. **Conclusion:** GSV performed better than prosthetic conduits with a 5-year patency rate of 80%, thus it becomes the conduit of choice in 2024 ESVS guideline. However, the GSV was found inadequate, and the prosthetic graft was unavailable, in this case. ASV was decided to be more suitable to be used as an alternative vein conduit. In the absence of adequate GSV, alternative autologous vein can be used and even perform better than prosthetic conduits.

Highlights:

1. While GSV has its advantage as a conduit of choice, in certain cases it might not be suitable option for the patient depending on how complex the case is.
2. This article discusses the usage of ASV as alternative vein conduit and it shows an interesting result.

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Introduction

Peripheral arterial disease (PAD) is defined as blood flow's partial or complete occlusion in the distal arteries that can be caused by the reduction of vessel's elasticity or diameter [1]. Nearly 236 million people worldwide were affected by PAD in 2015, with smoking, diabetes mellitus (DM), hypertension, high cholesterol level, age of >50 years old and BMI >30 being some of the risk factors [2,3]. PAD usually manifests as pain, cramping, or tiredness on affected legs or hip muscles during physical effort which usually disappears with rest. Fontaine (in Europe) and Rutherford (in the USA) classification are the most used classifications for PAD [4]. Imaging techniques, such as Duplex ultrasound (DUS), magnetic resonance angiography (MRA), digital subtraction angiography (DSA) and computed tomography angiography (CTA) is crucial in aiding a timely diagnosis, monitoring treatment efficacy, and preventing recurrence.[1]

PAD management strategy includes lifestyle modification, pharmacological therapy, and surgical intervention. Smoking habit cessation and supervised exercise therapy are effective in relieving patients symptoms and delaying disease progression [1,2]. Antiplatelet drugs, oral anticoagulants (OAC), antihypertensive drugs, cholesterol reduction, and peripheral vasodilators are the commonly used pharmacological therapy [3]. Invasive approaches including endovascular revascularization and surgical intervention. The decision making between either endovascular or surgical intervention depends on the patient's risk and preference, limb threat severity, anatomical distribution of PAD, and the availability of autogenous vein.[5]

Surgical bypass is one of the revascularization strategies in PAD at aorta down to the foot. Prosthetic grafts such as Dacron and PTFE and autogenous grafts using artery or vein can be used in varied conditions. The great saphenous vein (GSV) is the commonly used conduit for small and medium vessel bypass, especially in infrainguinal reconstructions. A prosthetic graft is chosen when a good-quality vein is not obtainable, as previous studies shows that autogenous graft outperforms prosthetic grafts at ≥ 2 years.[6]

Case Presentation

We present a case of a 38-year-old man presenting to our hospital complaining of chronic pain on his left lower leg. At that moment, his left lower limb felt heavy and painful when he walked for a few meters. No rest pain was present. Intermittent claudication (IC) was present 2 months prior to arrival. His prior illness includes an uncontrolled type 2 diabetes mellitus (T2DM) and hypertension. Physical examination on the left lower limb upon presentation showed edema, slight coldness, and paleness on

regio pedis. Distal artery pulsation was absent, and the left lower extremity ankle brachial index was <0.40. The patient has a non-healing ulcer in his left cruris containing necrotic tissue. A diagnosis of peripheral arterial disease of chronic threatening limb ischemia (CLTI) which classified into WIfI wound clinical category grade 1, ischemia category grade 2, and foot infection category grade 1. As revascularization was indicated, vascular imaging was then planned. Digital Subtraction Angiography with iodine contrast medium of the lower extremity was performed, which showed interesting findings; a chronic total occlusion on superficial femoral artery (SFA) (Fig. 1).

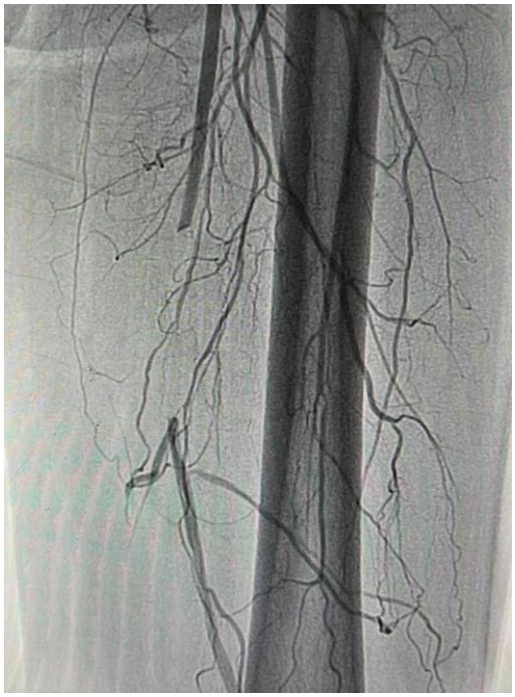

Figure 1. Preoperative digital subtraction angiography (DSA) on left lower limb shows chronic total occlusion on Superficial Femoral Artery (SFA).

Given the patient's occlusion site and condition, an endovascular approach was decided not feasible in this case, thus, a bypass surgery from proximal femoral artery to distal section of the occlusion were planned (femorofemoral bypass/FFB) using autologous graft from patient's great saphenous vein (GSV). Surgery was performed under regional anesthesia subarachnoid block technique. Patient was positioned supine, with Cefuroxime injection given as prophylaxis antibiotics prior to surgery.

First, the femoral arteries were exposed by incising the medial femoral region of the left lower limb. SFA then identified and encircled. Pulsations were present at SFA proximal from the occlusion, but not present at the distal section. Then, GSV and its tributaries were exposed and identified through the same incision. Unfortunately, the GSV was varicose and aneurysmatic. Accessory saphenous vein (ASV), which is one of GSV tributaries, was found to be more suitable.

Following systemic heparinization, ASV then encircled, harvested and flushed with heparinized saline solution to ensure its patency. Both distal and proximal stump of ASV then ligated. Distal SFA then preserved, and arteriotomy was performed followed by endarterectomy as atheromatous plaque was found upon arteriotomy (Fig 2 and Fig 3.). ASV then reversed and then anastomosed with distal SFA with polypropylene suture. Same procedure was done on proximal SFA following the vein graft and distal

anastomosis patency test by flushing a heparinized saline solution to the vein graft (Fig 4). Pulsation of the SFA distal to the vein graft was found after proximal anastomosis was completed. Operative wound then closed and closed wound drainage then placed.

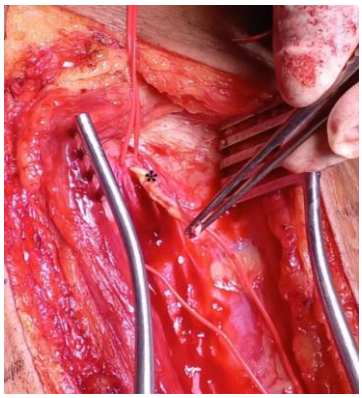

Figure 2. Endarterectomy procedure on distal SFA revealed atheromatous plaque (asterisk).

Figure 3. Atheromatous plaque being extracted from both distal and proximal SFA.

Patient was discharged 3 days after the surgery as his postoperative course was uneventful. Physical examination on the left lower limb performed 7 days and 14 days after being discharged revealed warm feet, redness and partial ulcer granulation on his cruris. Neither CTA nor angiography of the lower limb was done postoperatively, but the patient has been doing well during the 2-month follow up period. He is able to walk and do daily activities without any significant limitations. His left foot showed good perfusion and pulsatile pedal artery. His ulcer showed no deterioration and wound debridement was planned afterwards.

Figure 4. Final result of the surgery. ASV (asterisk) as the graft conduit, was anastomosed with distal and proximal SFA (hashtag) with end-to-side anastomosis technique.

Discussion

Management strategies in managing PAD with IC consist of exercise therapy (ExT), pharmacotherapy to reduce walking impairment, and revascularization interventions, according to 2017 European Society of Cardiology (ESC) and European Society of Vascular Surgery (ESVS) guidelines on PAD. The algorithm suggests endovascular approach for any femoro-popliteal lesions with lesions less than 25 cm in length, and open surgery, in lesions more than 25

cm in length, as long as the vein graft available and risk of surgery is not elevated. Open surgery results in more durable patency but with longer hospital stay and increased risk of complications compared to endovascular approach [7]. A large randomized clinical trial (RCT), the BEST CLI trial, showed open surgery with great saphenous vein (GSV) bypass superiority over endovascular approach in a group of people who had an adequate segment of GSV available as bypass conduit. In another group of people who did not have an adequate GSV/bypass conduit, no significant outcome difference was found between endovascular and open surgery approach [5]. Reintervention rate was reported higher in the endovascular treatment group compared to surgical bypass group [8]. Society of Vascular Surgery (SVS) guidelines suggest considering patient's risk and preference, limb threat severity, anatomical site of lesion, and the availability of vein conduit in making treatment approach decisions [5]. In this case, the endovascular approach of percutaneous transluminal angioplasty (PTA) was planned to be done simultaneously following the diagnostic DSA imaging, which revealed a chronic total occlusion. Thus, an open surgery approach was chosen as the total occlusion is unable to be penetrated by angioplasty stent.

Bypass surgery with GSV is associated with a higher 5-year patency rate, which is 80%, compared to 67% rate in bypass with prosthetic conduits [7]. ESVS in their 2024 guidelines recommended an autologous vein as the conduit of choice over prosthetic grafts for femoro-popliteal bypass due to its advantage in long term patency rates [9]. In a study that compared nine types of graft for above-knee and below-knee bypass surgery, autologous vein graft was found superior in terms of primary patency compared to prosthetic grafts in above-knee bypass surgery [10]. Ipsilateral GSV is the most common vein conduit, but up to 45% patients did not have an adequate GSV to be harvested as vein conduit, as in this patient [11]. An inadequate segment of GSV was found during intraoperative examination which revealed varicose and dilated GSV. Also, ASV which can be seen from the same incision was found to be adequate in size and quality. In the absence of adequate GSV, alternative autologous vein conduits such as contralateral GSV (cGSV), arm vein (AV) and short saphenous vein (SSV) can be used, even perform far better than prosthetic conduits for infrainguinal bypass. However, some surgeons avoid cGSV harvesting as it might be needed for another limb revascularization or coronary artery bypass surgery.[12]

Considering its adequate size and quality; can be harvested through the same incision, and as the prosthetic graft was unavailable, ASV was considered as the best option. ASV is one of GSV branches, located superficial to the saphenous fascia, and may be anterior, posterior, or lateral to

the GSV [13]. ASV wall thickness is half of the GSV, with less elastic fiber and muscle cells than GSV, which makes it prone to varicose changes [13,14]. As far as we know, there is no large study reporting the usage of ASV as vein conduit in any limb vascular bypass yet. However, usage of ASV is common in coronary bypass surgery as most surgeons do not differentiate between ASV and GSV as long as the anatomic factors are favorable, good vein quality, and adequate in caliber and length. ASV is used especially when no adequate GSV segment was available as coronary conduits [14]. In this case, pulsation on the distal SFA was present after the anastomosis, and the postoperative period was steady. Two months follow-up examination showed the patient's ability to walk normally with pedal redness, presence of pulsation, and no deterioration in his ulcer upon physical examination.

Conclusion

ASV should be considered as an alternative vein conduit of limb vascular bypass surgery in the absence of ipsilateral GSV, along with contralateral GSV, arm veins, and SSV. However, future study with larger cases is needed to understand its patency and associated complications.

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