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Research Article

Limb Salvage Technique for End Stage Vascular Disease: Femoropopliteal Bypass with Tibioperoneal Angioplasty

Byoung Chul Lee[1], Byeong Gwan Noh[1], Young Mok Park[1], Jung Bum Choi[1], Sang Su Lee[2] and Hyuk Jae Jung[1]*

[1]*Department of Surgery, Biomedical Research Institute, Pusan National University Hospital*

[2]*Department of Surgery, Pusan National University Yangsan Hospital*

***Corresponding author:** Hyuk Jae Jung, Division of Vascular and Endovascular Surgery and Transplantation, Department of Surgery, Biomedical Research Institute, Pusan National University Hospital, Korea

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Abstract

Introduction: Total occlusion with limited vascular reconstruction options in critical limb ischemia (CLI) can be a challenge for vascular surgeon. To secure in-flow and out-flow is most important to maintain patency in CLI. We defined the end stage vascular disease (ESVD) as conditions including occlusion of more than three lower extremity vessels (common femoral artery, superficial femoral artery, and tibioperoneal artery) with CLI, failures of previous multilevel intervention or long bypass, and no available autogenous vein for long bypass. Our purpose is to evaluate the efficacy and feasibility of hybrid operation, which is open popliteal approach of tibioperoneal angioplasty and femoro-popliteal bypass.

Materials and methods: Between November 2013 and August 2014, 8 cases of ESVD were treated with open popliteal true lumen approach of tibioperoneal angioplasty and femoro-popliteal bypass. Primary endpoint was major amputation and technical success rate.

Results: The preoperative ABI of 0.13 increased to postoperative ABI of 0.67. The combined diseases were 4 hypertensions, 3 diabetes mellitus, 2 cardiovascular diseases, 1cerebrovascular accident in the study group. No major amputation occurred during postoperative 30 days. The technical success rate was 88.5% (7/8). There was no perioperative mortality and major amputation.

Conclusion: In ESVD, total occlusion of lower leg arteries, poor distal run-off, and poor vein conduit always provoke painful challenge to vascular surgeon. In selected patients with limited available reconstruction options, this hybrid operation may give one of option to treat challenge case of ESVD.

Abbreviations: CLI: Critical Limb Ischemia; CFA: Common Femoral Artery; ESVD: End Stage Vascular Disease; SFA: Superficial Femoral Artery

Introduction

Critical limb ischemia (CLI) is defined as the presence of unhealed ischemic wound or gangrene, resting pain, and reduced ankle-brachial index to a level of < 0.4 [1]. Patients with CLI have poor prognosis combined 1- year mortality and amputation rate of up to 50% [2,3]. Without revascularization of arterial occlusion, more than 25% of patients are requisite for major amputation [4]. Recently, multilevel involvements of peripheral arterial disease with condition of CLI have been increasing, and extensive revascularization will require to avoid major amputation [5]. We defined the end stage vascular disease (ESVD) as conditions including occlusion of more than three lower extremity vessels (common femoral artery, superficial femoral artery, and tibioperoneal artery) with CLI and failures of previous multilevel intervention or long bypass. These patients have no vein conduit for long bypass due to previous surgery. Patients with ESVD usually have high risk of mortality and morbidity rates requiring wide and

multilevel revascularization procedures. In these high risk patients inflow constrictions may limit the success of revascularization.

At the same time, the constriction of outflow may play important role for long term patency. In this report, we describe a defined subset of 8 patients (8 limbs) with CLI secondary to ESVD. These patients had previous histories of intervention or surgery associated with multilevel occlusion and are highly recommended major amputation. For the recanalization of multilevel occluded vessels, combining tibioperoneal angioplasty through antegrade popliteal approach and femoropopliteal bypass can be secured in-flow and out-flow. The aim of this study was to evaluate the immediate and early clinical results of 8 patients with ESVD treated by tibioperoneal angioplasty and femoropopliteal bypass.

Material and Methods

This retrospective study included 8 patients with ESVD who underwent a total of 8 hybrid revascularization, which is tibioperoneal angioplasty and femoropopliteal bypass from November 2013 to August 2014. The inclusion criteria were as follows: [1] occlusion of more than three lower extremity vessels (common femoral artery, superficial femoral artery, and tibioperoneal artery) [2]. Previously failed lower extremity bypass or multilevel intervention [3] strongly recommended major amputation for treating their diseases [4] no available autogenous vein conduit for long bypass. Data retrieved included patients' demographics, clinical characteristics, history of previous revascularization procedure, and details of procedure, perioperative data, and postoperative information.

Surgical Procedure

All procedures were performed in the operating room with a portable C-arm device (OEC 9800; GE Medical Systems, Milwaukee, WI) under general anesthesia. At the beginning of procedure, most patients received 3000 - 5,000 units heparin. In patients who need inflow improvement, iliac artery endovascular therapy or femorofemoral bypass were performed. Also in patient who received previous interventional procedure in which common femoral artery (CFA) stents covering profunda femoral artery (PFA) were placed, stent explantation was done for anastomosis and enhancing PFA flow. After completing proximal anastomosis of femoropopliteal bypass, popliteal artery is exposed thru medial thigh incision. After popliteal artery endarterectomy (Figure 1A), 7Fr. sheath (AVANTI, Cordis, a Johnson and Johnson company) placed through the arteriotomy site in an antegrade fashion (Figure 1B). The below the knee (BTK) lesions were passed with a 0.014"(Abbott Vascular) guide wire and angioplasty was performed with adequate sized balloons (2.25 to 4.0 mm) (Figure 1C). After successful BTK angioplasty, distal anastomosis of femoropopliteal bypass was done (Figure 1D). And debridement or toe amputation was done at the time of surgery. Postoperative angiography confirmed technical success.

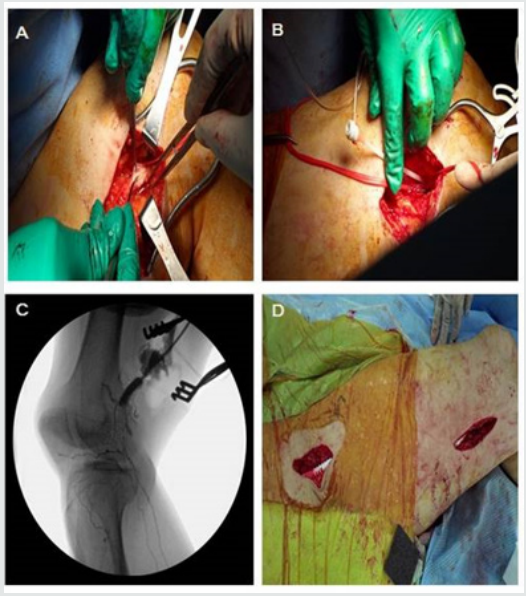

Figure 1: Schematic Surgical Procedures for improving inflow.

Endpoints and Statistical Analysis

Primary endpoints included perioperative mortality and major amputation. The outcome data were analyzed using SPSS 19.0 (SPSS, Inc., Chicago, IL, USA). Kaplan-Meier analysis was used for patency and amputation free survival rate. $P < 0.05$ was accepted as a significant value.

Results

A total 8 patients (8 limbs) were included in this study. Patient demographic and clinical data are shown in Table 1. Four (50.0%) patients had a history of previous vascular surgerys which were CFA stent implant (4/4), anterior tibial artery (ATA) stent implant (2/4), and femoropopliteal bypass (1/4). The most commonly affected arteries were SFA, popliteal artery and BTK arteries (100%) followed by CFA (50%), and iliac artery (37.5 %) (Table 2). Concomitant treatments were performed in 5 patients (62.5%), including CFA stent explantation (37.5%), common iliac artery (CIA) stent implant (25.0%), femoro-femoral bypass (12.5%), iliac thrombectomy (12.5%), and toe amputation (37.5%). The technical success rate of this procedure was 88.9%. There was one technical failure at the time of the operation. In this case, popliteal artery perforation occurred during BTK intervention because of guidewire injury, and this patient was treated with sequential prosthetic femoropopliteal bypass and autogenous popliteo-tibioperoneal trunk bypass.

Table 1: Patient demographics (N=8).

Characteristic	Value
Age, years (range)	68.9±10.3 (51-81)
Gender	
Male	7 (87.5%)
Female	1 (12.5%)
Comorbidities	
Diabetes mellitus	3 (37.5%)
Hypertension	4(50.0%)
Coronary artery disease	2(25.0%)
Cerebrovascular disease	1(12.5%)
Smoking	2(25.0%)
Indications for treatment	
Resting pain	2(25.0%)
Nonhealing ulcer	2(25.0%)
Gangrene	4(50.0%)

Table 2: Location of the lower limb artery lesion.

Lesions (n, %)	Location	Value (n, %)
Total (n=8)	Iliac artery	3 (37.5%)
	Common femoral artery	4 (50.0%)
	Superficial femoral artery	8 (100.0%)
	Popliteal artery	8 (100.0%)
	Below-the-knee arteries	8 (100.0%)

The same patient required re-operation during admission for graft thrombosis, and it was successfully treated with graft thrombectomy and BTK angioplasty through popliteal approach via femoropopliteal bypass graft. There were no perioperative mortalities and morbidities. The mean ABI increased from 0.13 ± 0.1 preoperatively to 0.67 ± 0.18 postoperatively. Pre-discharge CTA showed patent bypass graft and BTK runoff vessel in all patients (Figure 2). The mean follow- up was 13.3 months (range, 7-25 month). Major amputations were performed on 3 patients (37.5%) because of gangrene of lower limb. The major amputation-free survival rate was 87% and 72% at 6- and 12-months follow-up, respectively (Figure 3). Actually, we were supposed to perform revascularization procedures, all of these patients refused further treatment because of financial problem. Also, the patency rates at 6- and 12- months were 83% and 56%, respectively (Figure 4).

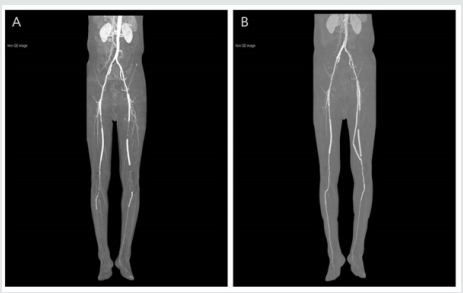

Figure 1: Pre-discharge Computed Tomography findings of competent bypass graft and BTK runoff vessels.

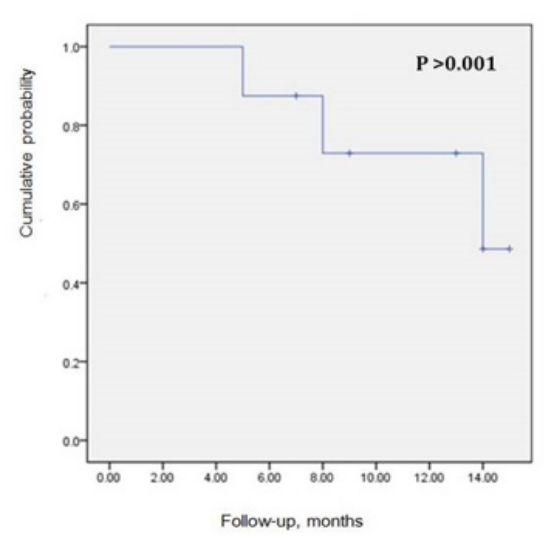

Figure 3: The Major amputation-free survival.

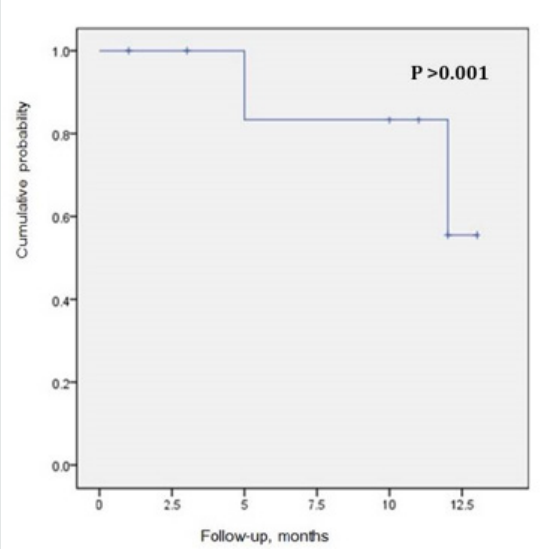

Figure 4: The Patency rates after revascularization Procedures.

Discussion

The end stage vascular disease (ESVD) presented long segment multilevel peripheral arterial occlusive disease with CLI is a vascular disaster requiring major amputation. It usually presented as total occlusion from proximal superficial femoral artery to tibioperoneal trunk. Previously, these patients already had intervention or bypass surgery and are suffering from severe resting pain. With these condition, vascular surgeons have few options to treat ESVD. Femorotibial bypass has been acceptable treatment modality for revascularization avoiding major amputation if inflow and outflow are acceptable, a suitable vein is available, and the condition of patient is enough to endure for over 4 hour operation [6-7].

However, most patients of ESVD have no suitable or available saphenous vein and presented previous revascularization procedures. Another option is simultaneous hybrid revascularization, which is combining surgery and intervention. It is an attractive alternative from the patients' and surgeons' point of view in treating multilevel peripheral arterial occlusive disease [8-10]. It allows for minimally invasive treatment on complex anatomy in medically high-risk patients. Most hybrid techniques involves iliac or superficial femoral artery (SFA) transluminal angioplasty for securing in-flow and distal infrapopliteal bypass for out-flow [11-12]. In our study, femoropopliteal bypass with tibioperoneal angioplasty through open antegrade popliteal approach was used as modality of hybrid technique, because most patients had

inadequate saphenous vein and previous stent insertion or bypass in SFA. Following popliteal artery endarterectomy, sheath insertion and guide wire advancement through popliteal true lumen is an important step in our procedure. This approach can easily revascularize occluded lesion. After tibioperoneal angioplasty, popliteal anastomosis of femoropopliteal bypass was performed.

This technique has not been introduced in the literature. Compared with conventional hybrid revascularization, which was endovascular approach for in-flow and distal bypass surgery for out-flow, our method is opposite to conventional approach. The endarterectomy of popliteal artery can help antegrade tibioperoneal angioplasty to access easily and maintain the patency. Finally, the femoropopliteal bypass can secures enough blood in-flow. Tibioperoneal segment is the least commonly performed site of angioplasty. Although initial technical success of tibioperoneal angioplasty can be high, the long-term results are not so good because of high stenosis recurrence rate [13]. In our study, it was the reason that we did popliteal endarterectomy to overcome low patency rate and re-stenosis. In the circumstance of ESVD, a successful tibioperoneal angioplasty following popliteal endarterectomy with femoropopliteal bypass seems to be one of surgical option when alternative is amputation.

References

1. (1992) Second European Consensus Document on chronic critical leg ischemia. Eur J Vasc Surg 6(A): I-32.
2. Dormandy JA, Rutherford RB (2000) Management of peripheral arterial disease (PAD). TASC Working Group. TransAtlantic Inter-Society Consensus (TASC). J Vasc Surg 31(1-2): S1-S296.
3. Bailey CM, Saha S, Magee TR, Galland RB (2003) A 1 year prospective study of management and outcome of patients presenting with critical lower limb ischaemia. Eur J Vasc Endovasc Surg 25: 131-134.
4. Ouriel K (2001) Peripheral arterial disease. Lancet 358: 1257-1264.
5. Diehm C, Schuster A, Allenberg JR, Darius H, Haberl R, et al. (2004) High prevalence of peripheral arterial disease and co-morbidity in 6880 primary care patients: cross-sectional study. Atherosclerosis 172: 95-105.
6. Sayers RD, Raptis S, Berce M, Miller JH (1998) Long-term results of femorotibial bypass with vein or polytetrafluoroethylene. Br J Surg 85: 934-938.
7. Shah DM, Darling III RC, Chang BB, Kaufman JL, Fitzgerald KM, et al. (1992) Is long vein bypass from groin to ankle a durable procedure? An analysis of a ten-year experience. J Vasc Surg 15: 402-408.
8. Joh JH, Joo SH, Park HC (2014) Simultaneous hybrid revascularization for symptomatic lower extremity arterial occlusive disease. Experimental and therapeutic medicine 7: 804-810.
9. Cotroneo AR, Iezzi R, Marano G (2007) Hybrid therapy in patients with complex peripheral multifocal steno-obstructive vascular disease: Two-year results. Cardiovasc Intervent Radiol 30: 355-356.
10. Dosluoglu HH, Lall P, Cherr GS, Harris LM, Dryjski ML, et al. (2010) Role of simple and complex hybrid revascularization procedures for symptomatic lower extremity occlusive disease. J Vasc Surg 51: 1425-1435.
11. Lantis J, Jensen M, Benvensity A, Mendes D, Gendis C, et al. (2008) Outcomes of combined superficial femoral endovascular revascularization and popliteal to distal bypass for patients with tissue loss. Ann Vasc Surg 22: 366-371.
12. Demirel S, Winter C, Bruijen H, Bockler D, Attigah N (2010) Long-term results of distal-origin bypass after prior femoro-popliteal angioplasty. Ann Vasc Surg 24: 1024-1033.
13. Varty K, Bolia A, Naylor AR, Bell PR, London NJ, et al. (1995) Infrapopliteal percutaneous transluminal angioplasty: a safe and successful procedure. Eur J Vasc Endovasc Surg 9: 341-345.

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