

Hybrid Vascular Surgery Approaches for Multilevel Arterial Occlusive Disease

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ABSTRACT

Background: The incidence of multilevel vascular occlusive disease is increased with patient age. Multilevel arterial occlusive disease cases are some of the hardest in the vascular surgical realm because of the comorbidities. In these high-risk patients inflow constrictions may limit the success of distal bypasses. At the same time the constrictions in the outflow may necessitate long bypass circuits that have less long-term patency rates.

Methods: Our study included 38 patients with multilevel arterial occlusive disease to whom hybrid vascular approaches were applied between January 2005 and December 2011 in Şişli Florence Nightingale Hospital. The patient group had a mean age of 68.1 (48-98) and included 29 male (89%) and 9 female (11%) patients. Complaints were claudication under 100 meters of walking in 19 patients (50%), resting pain in 14 patients (36%), and disturbed tissue integrity in 5 patients (14%). Mean in-hospital stay was calculated to be 6.4 days (4-15). In one patient (2.6%), a second procedure was necessary due to graft thrombosis and this case resulted in amputation under the level of the knee. Minor toe amputations in a second session were applied to 5 patients (14%) with symptoms of foot sores. Wound infections occurred in two patients (5%) and were treated with antibiotherapy and wound care.

Results: At the end of the follow-up time, extremity survival was found to be 94.1%.

Conclusions: In the treatment of multilevel peripheral arterial occlusive disease, a hybrid approach is a treatment option which is less invasive and sufficient.

INTRODUCTION

Multilevel arterial occlusive disease cases are some of the hardest in the realm of vascular surgery. The patients are older with more comorbidities, compared to patients with single segment disease. These patients also manifests with more symptoms and more extremity loss [Samson 1985]. In this high-risk patient group, constrictions in the inflow may limit the bypass success rate and at the same time the constrictions in the distal run-off may necessitate long bypass circuits that have less long-term patency rates [Nelson 2002; Schneider 2001].

In the last 20 years, surgical algorithms have radically changed with the introduction of endovascular surgery alternatives [Chang 2008]. Less invasive approaches, less in-hospital stay, and less surgery-related mortality/morbidity make endovascular approaches rather attractive. However, endovascular treatment is far from being a feasible treatment choice in most multilevel vascular disease cases. At this point, hybrid approaches with endovascular and open surgery combinations come forth [Lau 1998; Madera 1997].

Hybrid approaches may be done in one or more sessions with two procedures to be applied. Though preoperative endovascular applications are preferred, there is less information in the literature about the two procedures applied at the same session [Lau 1998]. One session hybrid practices which are performed by well-trained vascular surgeons have taken the place of applications that are performed by invasive radiologists [Madera 1997].

Technological developments and successive results have made endovascular approach an indispensable part of vascular surgery [Aburahma 2001]. With the usage of a portable C-arm fluoroscopy device in the operation room, trained vascular surgeons are also able to successfully perform endovascular applications in addition to surgical techniques [Liu 2001; Silva 1996].

PATIENTS AND METHODS

Our study included 38 patients with multilevel arterial occlusive disease to whom hybrid vascular approaches were applied between January 2005 and December 2011 in Şişli Florence Nightingale Hospital. The patient group had a mean age of 68.1 (48-98) and included 29 male (89%) and 9 female (11%) patients. Complaints were claudication under 100 meters of walking in 19 patients (50%), resting pain in 14 patients (36%), and disturbed tissue integrity in 5 patients (14%). Demographic features of patients are shown in Table 1. Five of the patients (14%) had a history of previous vascular surgery in different centers.

Spinal anesthesia was applied to 24 patients (64%), general anesthesia was applied to 8 patients (22%), and local anesthesia was applied to 5 patients (14%). All of the procedures were done by vascular surgeons. Applied procedures are summarized in Table 2. Mean in-hospital stay was calculated to be 6.4 days (4-15). In one patient (2.6%), a second procedure was necessary due to graft thrombosis and this case resulted in amputation under the level of the knee. Minor toe amputations in a second session were applied to 5 patients (14%) with symptoms of foot sores. Wound infections occurred in two patients (5%) and were treated with antibiotherapy and wound care.

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Table 1. Demographic Features

	n	%
Active smoking	27	72
Hypertension	24	64
Hyperlipidemia	22	58
Diabetes mellitus	20	54
Coronary bypass	11	29
Coronary PCI*/stent	8	22
Chronic renal disease	4	11
Stroke	3	7
Claudication	19	50
Resting pain	13	36
Foot sore	5	14

*Percutaneous coronary intervention

RESULTS

Mean follow-up time of the patients was 12 months (6-30 months). There was no early postoperative mortality. At the end of the follow-up time, extremity survival was found to be 94.1%. Four patients died in the follow-up period. Two of these patients died as a result of coronary arterial disease, one due to stroke, and one due to a non-vascular cause.

DISCUSSION

With increased patient age, the incidence of multilevel vascular occlusive disease increases [Samson 1985]. Inflow



Figure 1. Short stenotic segment at the right and a long stenotic segment at the left iliac artery.

Table 2. Applied Procedures

	n
Iliac angioplasty/stenting + femorofemoral bypass	19
Iliac angioplasty/stenting + femoropopliteal bypass	15
Femoropopliteal bypass + tibial angioplasty	2
Superficial femoral arterial angioplasty + popliteotibial bypass	2
Iliac angioplasty + femorotibial bypass	2

constrictions may limit the success of distal bypasses. At the same time, the constrictions in the outflow may necessitate long bypass circuits that have less long-term patency rates [Harward 1995].

Femorofemoral and femoropopliteal bypass surgery candidates with iliac level constrictions may be cured with iliac artery angioplasty and/or stent implantation in the same session (Figures 1 and 2). If one of the bilateral iliac artery stenosis is not suitable for angioplasty, simultaneously femorofemoral bypass can be performed (Figures 1 and 2). Thus, smaller wound surface, less blood loss, and avoidance from laparotomy can be obtained. Surgery, and by this, anesthesia time is shortened. Mortality and morbidity can be decreased [Aburahma 2001; Harward 1995].

Another option is endovascular approaches to be applied preoperatively in different sessions. In these cases, dissection to a groin area that was previously wounded may be difficult [Nelson 2002] and postoperative wound problems are more frequent [Lantis 2008]. Also, psychological and economic effects of two different procedures must be taken into account. The concomitant revascularization surgery and endovascular applications do not increase the morbidity and

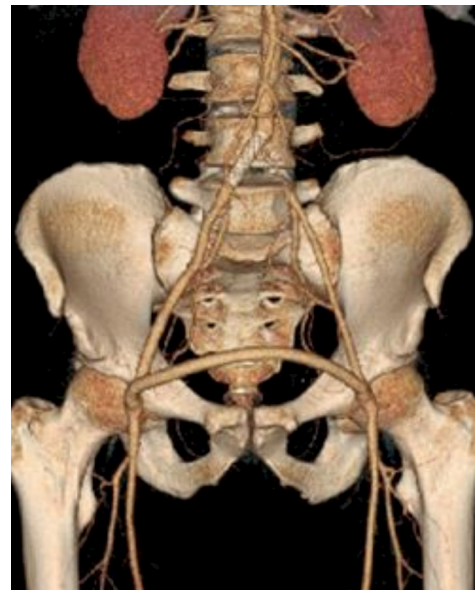


Figure 2. Femorofemoral bypass surgery with iliac artery angioplasty to the right short segment stenotic lesion in the same session.

this approach also decreases in-hospital stay, thus, intervention costs.

Superficial femoral artery bifurcation is one of the typical localizations of atherosclerotic lesions. The high success rate of iliac artery endovascular interventions is not the case when it comes to femoral arterial diseases. One of the most important causes of this is occlusion of the deep femoral artery during balloon procedure and the other is a high probability of damage to the stent because of the continuous mobility of the femoral area. Other than these circumstances, a stent implantation to the femoral artery may make the surgical intervention to the femoral artery very difficult.

The cases with superficial femoral arterial stenosis and need for distal revascularization, or with proximal bypass and distal stenosis, can be cured with shorter conduits by the help of hybrid approaches. It is known that shorter bypasses have higher long-term patency rates [Schneider 2001].

During revascularization surgery, intraoperative endovascular interventions can be performed with success by experienced vascular surgeons using the help of a C-arm fluoroscopy device. Inflow or outflow stenosis can be opened with intraoperative endovascular interventions, helping the surgery, and, at the same time, complications of angioplasty or stents can be corrected instantly [Liu 2001].

In the treatment of multilevel peripheral arterial occlusive disease, a hybrid approach is a treatment option which is less invasive and sufficient enough [Schneider 2001; Nishibe 2009].

REFERENCES

- Aburahma AF, Robinson PA, Cook CC, Hopkins ES. 2001. Selecting patients for combined femorofemoral bypass grafting and iliac balloon angioplasty and stenting for bilateral iliac disease. *J Vasc Surg* 33:93-9.
- Chang RW, Goodney PP, Baek JH, et al. 2008. Long-term results of combined common femoral endarterectomy and iliac stenting/stent grafting for occlusive disease. *J Vasc Surg* 48:362-7.
- Harward TR, Ingegno MD, Carlton L, Flynn TC, Seeger JM. 1995. Limb-threatening ischemia due to multilevel arterial occlusive disease. Simultaneous or staged inflow/outflow revascularization. *Ann Surg* 221:498-503.
- Lantis J, Jensen M, Benvenisty A, Mendes D, Gendies C, Todd G. 2008. Outcomes of combined superficial femoral endovascular revascularization and popliteal to distal bypass for patients with tissue loss. *Ann Vasc Surg* 22:366-71.
- Lau H, Cheng SW. 1998. Intraoperative endovascular angioplasty and stenting of iliac artery: an adjunct to femoro-popliteal bypass. *J Am Coll Surg* 186:408-14.
- Liu C, Guan H, Li Y, Liu W. 2001. Combined intraoperative iliac artery stents and femoro-popliteal bypass for multilevel atherosclerotic occlusive disease. *Chin Med Sci J* 16:165-8.
- Madera FA, Orecchia PM, Razzio RA, et al. 1997. Balloon angioplasty by vascular surgeons. *Am J Surg* 174:152-6.
- Nelson PR, Powell RJ, Schermerhorn ML, et al. 2002. Early results of iliac artery stenting combined with common femoral artery endarterectomy. *J Vasc Surg* 35:1107-13.
- Nishibe T, Kondo Y, Dardik A, Muto A, Koizumi J, Nishibe M. 2009. Hybrid surgical and endovascular therapy in multifocal peripheral TASC D lesions: up to three-year follow-up. *J Cardiovasc Surg* 50:493-9.
- Samson RH, Scher LA, Veith FJ. 1985. Combined segment arterial disease. *Surgery* 97:385-96.
- Schneider PA, Caps MT, Ogawa DY, Hayman ES. 2001. Intraoperative superficial femoral artery balloon angioplasty and popliteal to distal bypass graft: an option for combined open and endovascular treatment of diabetic gangrene. *J Vasc Surg* 33:955-62.
- Silva MB Jr, Hobson RW, Jamil Z, et al. 1996. A program of operative angioplasty: endovascular intervention and the vascular surgeon. *J Vasc Surg* 24:971-3.