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Long-term outcome of crossover femoro-femoro-popliteal bypass using side-to-side anastomosis in ilio-femoral occlusive disease

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Purpose: During crossover femoro-femoro-popliteal sequential bypass (CFFPB) surgery in ilio-femoral occlusive disease, proximal anastomosis of the femoro-popliteal bypass is usually performed distal to the distal anastomosis of the crossover femoro-femoral bypass. If not, it is done with a piggyback configuration. Another method is a side-to-side anastomosis. Its benefit is that this is the only anastomosis made. And it is less bulky compared with the piggyback configuration. This study was aimed to investigate the long-term outcome of CFFPB using side-to-side anastomosis.
Methods: From Sep 2006 to Aug 2012, 21 patients who underwent CFFPB using side-to-side anastomosis were enrolled. Externally supported polytetrafluoroethylene graft was used as a conduit in all patients. Patient demographic data and procedure details were investigated. Primary graft patency was calculated using the Kaplan-Meier method.
Results: The mean age of patients was 79 years (range, 62–81 years) and males were 17 (81%). Fifteen patients (71%) had critical limb ischemia. Inflow arteries comprised of 16 common femoral artery (CFA), 4 superficial femoral artery (SFA), and 1 deep femoral artery (DFA). Side-to-side anastomosis was performed on the CFA in 11, SFA in 2, and DFA in 8 patients. During the mean follow-up period of 21 months (1–60 months), 8 patients died. The 1-, 3-, and 5-year primary patency rates were 76%, 63%, and 63%.
Conclusion: Long-term patency of CFFPB using side-to-side anastomosis was acceptable. It can be one of the treatment options for patients with ilio-femoral occlusive disease.
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Key Words: Bypass surgery, Anastomosis

INTRODUCTION

As skills in endovascular techniques and instrumentation are improving, these days many cases of ilio-femoral multilevel occlusive disease are treated using endovascular treatment or hybrid surgery, such as iliac artery stenting with infrainguinal bypass. However, bypass surgery is still recommended for Trans-Atlantic Inter-Society Consensus (TASC) C or D aortoiliac and femoropopliteal lesions [1].

For ilio-femoral occlusive disease, the crossover femoro-femoro-popliteal sequential bypass (CFFPB) is one of the treatment options. During CFFPB, generally two types of techniques are used (Fig. 1A, B). One is separation of the proximal anastomosis of the femoro-popliteal bypass from the distal anastomosis of the femoro-femoral bypass. The other is a piggyback configuration. Besides these methods, side-to-side anastomosis can be used (Fig. 1C, D). The side-to-side anastomosis has several theoretical advantages: it has a small

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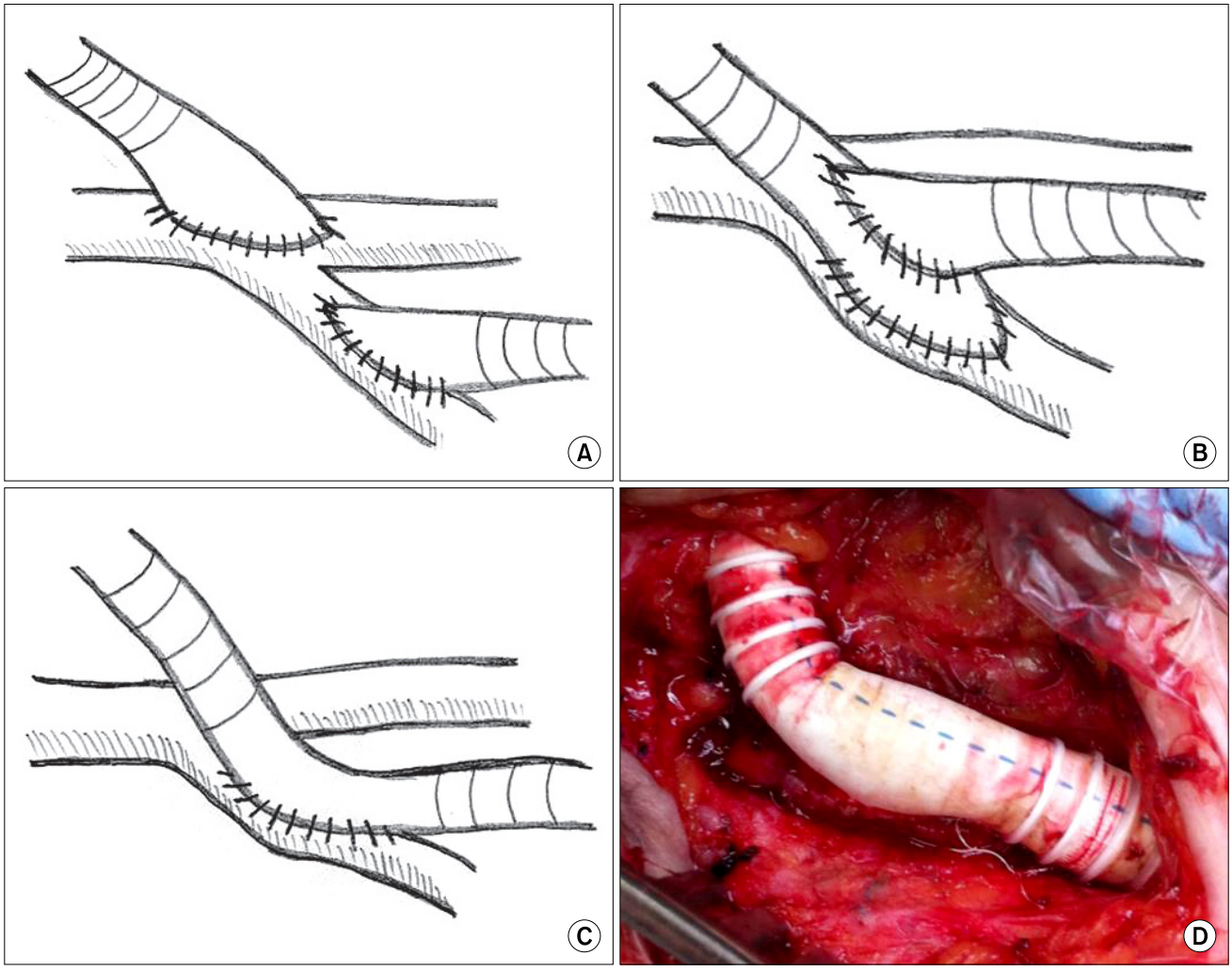

Fig. 1. Anastomosis configurations on recipient femoral artery during femoro-femoro-popliteal sequential bypass. (A) Two separate anastomoses, (B) piggyback configuration, (C, D) side-to-side anastomosis.

number of anastomoses, is less time consuming, and has a less bulky configuration. However, there are no reported outcomes of side-to-side anastomosis because it is rarely used. Therefore, in this study, we attempted to investigate the long-term results of CFFPBs using side-to-side anastomosis.

METHODS

Patients

We retrospectively reviewed the patient registry of vascular surgery. Between September 2006 and August 2012, 21 CFFPBs using side-to-side anastomosis were done. Regarding the conduit, 7 mm externally supported PTFE graft was used in all patients. Mean patient age was 79 years (range, 62–81 years) and 81% of the patients were male. Fifteen of the 21 limbs (71%) were critical limb ischemia. Other patient demographic data are demonstrated in Table 1.

As a concomitant procedure, inflow iliac artery balloon angioplasty with or without stenting was done in 9 patients (43%). Anastomotic site details are shown in Table 2. The most common proximal anastomotic site was the common femoral artery (CFA; 16 patients, 76%), and the deep femoral artery (DFA) was used in 1 patient who had severe adhesions around the CFA caused by previous surgery. Most of the side-to-side anastomoses were done on the CFA or DFA, and all distal anastomoses were performed on the above-knee (AK) popliteal artery.

Procedure details

After exposure of both femoral arteries, a long graft was tunneled through the suprapubic subcutaneous layer from one groin incision to the other. First, a proximal anastomosis was made on the donor femoral artery. Second, a side-to-side anastomosis was made between the graft and recipient femoral artery. The side-to-side anastomosis was usually done using the parachute technique. And then, a distal graft was

Table 1. Patient clinical characteristics (n = 21)

Characteristic	Value
Age (yr)	79 (62–81)
Male sex	17 (81)
Smoking	13 (62)
Critical limb ischemia	15 (71)
Rest pain	8
Minor tissue loss	6
Major tissue loss	1
Hypertension	15 (71)
Diabetes mellitus	2 (10)
Coronary artery disease	6 (29)
Chronic renal insufficiency	1 (5)
Cerebrovascular disease	4 (19)

Values are presented as mean (range) or number (%).

Table 2. Anastomotic sites during the procedures

Arteries	Anastomosis, n (%)		
	Proximal	Mid	Distal
Common femoral artery	16 (76)	11 (52)	-
Superficial femoral artery	4 (19)	2 (10)	-
Deep femoral artery	1 (5)	8 (38)	-
Above-knee popliteal artery	-	-	21 (100)

tunneled again through the subsartorial layer from the groin to the ipsilateral AK popliteal artery. This process is the most important one during the surgery. Great care was taken not to cause graft kinking around the side-to-side anastomosis. Finally, a distal anastomosis was performed on the AK popliteal artery.

Follow-up and statistics

After surgery, the ankle-brachial index (ABI) was checked every 6 months, and a duplex scan or computed tomography angiography was done every 12 months or if the patient's symptoms recurred.

Early outcome (within 30 days) including postoperative complications and mortality were investigated. Regarding the long-term outcome, primary graft patency was calculated using the Kaplan-Meier method. SPSS ver. 15.0 (SPSS Inc., Chicago, IL, USA) was used.

RESULTS

During the perioperative period (<30 days), acute myocardial infarction (AMI) occurred in 1 patient. There was no bleeding or wound infection, and there were no other local or systemic complications. There was no mortality. Early graft occlusion within 1 month did not occur in any patient. To evaluate hemodynamic outcome, ABI was measured before and after surgery. Mean preoperative and preoperative ABI were 0.21 ± 0.21 and 0.75 ± 0.13 respectively.

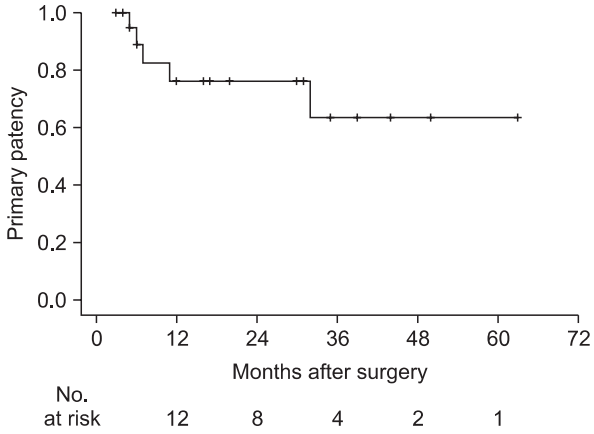

Fig. 2. Kaplan-Meier curve of cumulative primary patency.

During the follow-up (mean, 21 months; range, 1–63 months), graft occlusion occurred in 5 patients. For one patient, redo femoro-femoral bypass with femoro-peroneal bypass was performed. For others, only redo femoro-femoral bypass was performed for limb salvage. Calculated primary graft patency was 76%, 63%, and 63% at 1 year, 3 year, and 5 year after surgery (Fig. 2). Limb salvage had been accomplished in all patients except 1 patient who had major tissue loss with infection. He underwent below-knee amputation at 3 weeks after surgery.

DISCUSSION

The benefit of side-to-side anastomosis configuration is that it needs only one anastomosis. It also takes less time. It is most useful when a recipient femoral artery has a limited segment which is adequate for anastomosis. Piggyback configuration can also be used in such a situation but it is bulky. A superficially located graft is prone to infection or compression. So, a bulky graft may influence outcomes, especially in thin patients. A side-to-side anastomosis provides two separate flows to the recipient femoral artery and popliteal artery, with a slim design.

The flaw of the side-to-side anastomosis is its technical difficulty compared with end-to-side anastomosis because it has two heels. Most of all, there is a risk of graft kinking according to the graft routing done. Therefore, surgeons should pay special attention to avoid making a kink in the graft when performing graft positioning. Some people worry that occlusion in one segment makes the other segment occluded. Femoro-femoral segment occlusion may influence the femoro-popliteal segment because it is an inflow. On the other hand, femoro-popliteal segment occlusion may influence the femoro-femoral segment because it is an outflow. However, there was no study on whether the anastomosis configuration affects graft patency

or not.

In our study, there was no technical failure or early (<30 days) occlusion. Regarding the long-term results, primary graft patency rates were 76%, 63%, and 63% at 1 year, 3 years, and 5 years after surgery, respectively. Reported 5-year patency rates of crossover femoro-femoral bypass range from 60% to 74% [2-6]. And those of femoro-AK popliteal bypass with PTFE graft were from 39% to 68% [7-9]. Although it is difficult to draw a comparison between our study and previous studies, the long-term patency of CFFPS using side-to-side anastomosis seems not to be inferior to that of crossover femoro-femoral bypass or femoro-popliteal bypass with PTFE graft.

Another flaw of side-to-side anastomosis might be that surgeons have to use the same diameter graft on two segments. Fortunately, the 7-mm diameter graft fitted all the patients in our series. Even though it can be a little bit smaller or larger than what we wanted to use, it did not affect graft patency. Some studies have already shown that there is no difference in graft patency according to the graft diameter [5,10].

It is well known that vein graft has better long-term patency than prosthetic graft in AK femoro-popliteal bypass [1]. If vein graft is used, this side-to-side configuration cannot be applied. Our results do not recommend selecting a prosthetic graft as a conduit of AK femoro-popliteal bypass in order to make a side-to-side anastomosis. But, side-to-side anastomosis may be adopted when prosthetic graft is used for femoral occlusive lesion.

In conclusion, CFFPB using side-to-side anastomosis was technically feasible and the long-term patency rate of that technique was acceptable. Therefore, it can be one of the treatment options for patients who need bypass surgery for ilio-femoral occlusive disease. However, a further large study is necessary for obtaining more reliable evidence because our study has the limitations of having a small case number and a retrospective design.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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