Iliocrural long bypass using the deep femoral artery as a midway outflow for limb salvage: Report of a case

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A patient who presented with total occlusion of the right common femoral artery, superficial femoral artery and popliteal artery is reported. Ilio-deep femoral and deep femoroposterior tibial bypass with an expanded polytetrafluoroethylene graft and an in situ

saphenous vein graft, respectively, was successfully performed. A simple and reproducible technique for crural bypass in patients whose common and superficial femoral arteries are unavailable as inflow and outflow sites is presented.

Key Words: Deep femoral artery; Iliocrural bypass; In situ saphenous vein graft; Limb salvage

The common femoral artery (CFA) is the most favourable source for inflow of any type of infrainguinal bypass procedure. However, on occasion, the CFA and superficial femoral artery (SFA) cannot be used in patients with critical limb ischemia because of obstruction, severe calcification or previous dissection. We report a patient who underwent a transpubic ilio-deep femoral bypass and a deep femoroposterior tibial bypass with an expanded polytetrafluoroethylene (ePTFE) graft and an in situ saphenous vein graft, respectively.

CASE PRESENTATION

A 72-year-old woman with a severely ischemic right leg was referred to the Osaka University Graduate School of Medicine, Osaka, Japan. She had an ulcer between the third

and fourth toes, and both toes were almost necrotic. Her left leg had already been amputated above the knee due to severe arterial occlusive disease three years previously. Three-dimensional computed tomography revealed complete occlusion of the SFA, right iliofemoral and popliteal arteries. The right deep femoral artery (DFA), right anterior and posterior tibial arteries were visualized (Figure 1). Doppler ultrasonography also revealed blood flow only in these three arteries. Although her left leg had already been amputated, she had been able to perform her activities of daily living using a wheelchair, even using a toilet seat by herself, employing her right leg as a cane, before the rest pain in the right foot manifested. To maintain her present quality of life, bypass surgery was performed for limb salvage.

Figure 1) Preoperative three-dimensional computed tomography angiogram. **A** The left common iliac artery, right internal iliac artery, and right common and superficial femoral arteries were completely occluded. The right deep femoral artery was enhanced through collateral arteries. **B** The popliteal artery was also occluded and there was no target vessel above or below the knee. **C** The posterior tibial artery (arrow 1) and anterior tibial artery (arrow 2) were visualized, although they were very small. A Anterior view; LP Left posterior; PR Posterior right

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Figure 2) Postoperative three-dimensional computed tomography angiogram showing the patent expanded polytetrafluoroethylene graft and saphenous vein graft. Blood flow in the right leg was markedly increased **A** Patent ilio-deep femoral artery bypass with a ringed expanded polytetrafluoroethylene graft and proximal anastomosis of deep femoroposterior tibial bypass with in situ saphenous vein graft; **B** and **C** Patent in situ saphenous vein graft. Blood flow in the right leg was markedly increased

Surgical procedure

The right external iliac artery, the right DFA and the posterior tibial artery at the level of the medial malleolus were exposed. Subsequently, the right greater saphenous vein was exposed with intermittent incisions from the saphenofemoral junction to the ankle. All the side branches were ligated. The posterior tibial artery was also exposed at the level of the medial malleolus.

Doppler flowmetry revealed the blood flow of the DFA was 30 mL/min, and no blood flow was detected in the posterior tibial artery.

After systemic heparinization (5000 U), an 8 mm thin wall, ringed ePTFE graft was anastomosed to the right external iliac artery in an end-to-side fashion with a continuous CV-5 ePTFE suture. The distal end of the ePTFE graft was anastomosed to the middle zone of the right DFA in the same fashion as the proximal end. The right great saphenous vein was transected at the saphenofemoral junction and at the ankle, and the venous valves were incised using a LeMaitre valve cutter (LeMaitre Vascular, Inc, USA). The in situ saphenous vein was anastomosed to the DFA just below the anastomotic site of the ePTFE graft with a continuous 6-0 polypropylene suture in an end-to-side fashion. The other end of the in situ saphenous vein was anastomosed to the posterior tibial artery with a continuous 7-0 polypropylene suture in an end-to-side fashion.

Once the distal anastomosis was completed, good pulsation was observed in the posterior tibial artery. Doppler flowmetry revealed that the blood flow was 240 mL/min in the DFA, 35 mL/min in the in situ saphenous vein graft and 10 mL/min in the posterior tibial artery.

Postoperative three-dimensional computed tomography revealed that both bypass grafts were patent and that peripheral blood flow was remarkably increased (Figure 2).

Although the third and the fourth toes became completely necrotized and were amputated postoperatively, the rest of the right foot became warm and the pain disappeared. At discharge, the patient was again able to perform her activities of daily living.

DISCUSSION

The CFA has been traditionally recognized and accepted as an important inflow site in distal reconstruction. Sometimes, however, the CFA and SFA cannot be used because of obstruction, severe calcification or previous dissection, as in the present patient. In such clinical situations, a transpubic, long, direct bypass may be an option. However, the patency of a transpubic, long, direct bypass is known to be poor (1). One of the reasons for the poor patency may be the lack of the ideal graft material for such a long bypass. Although in bypass surgery for an ischemic limb the best results have been achieved with a saphenous vein graft, autologous saphenous veins with a satisfactory diameter that are long enough for a transpubic, long bypass are not always available. The results with prosthetic grafts are invariably inferior (2), despite adjunctive measures such as distal anastomotic cuffs or arteriovenous fistulas.

The DFA tends to be spared from severe atherosclerosis, and when the disease is present, it tends to be localized at the origin or proximal portion, especially in patients without diabetes (3,4). Access to this artery is possible through various incisions and approaches; therefore, sites of previous dissection or ongoing infection can be avoided (5). Thus, the DFA is today accepted as an important inflow and outflow site in vascular reconstruction (6-8). The DFA has also been successfully used as an intermediate site for sequential bypass (9,10).

In our patient, the vein graft was not long enough for a bypass graft from the iliac artery to the posterior tibial artery in a sequential fashion; thus, we separately performed an ilio-deep femoral bypass and a deep femoroposterior tibial bypass. These were technically easier than the sequential bypass because the twisting of the graft could be easily avoided. Another merit of this procedure is that if the vein graft fails, which is quite possible because of the poor run off, an ilio-deep femoral bypass with adequate blood flow may save the limb. Shindo et al (8) reported the successful use of the DFA as an intermediate conduit between aortoiliac and infrapopliteal arteries. Their technique was similar to that reported in the present article, but different in that they used the infrapopliteal artery as the distal

anastomotic vessel of the vein graft. In our patient, there was no graftable vessel above and below the knee, and the anterior and posterior tibial arteries were the only arteries that could be used as the distal anastomotic site, which means we needed a longer bypass to the poor runoff area.

CONCLUSION

We have described a simple and reproducible technique for crural bypass in patients whose CFA and SFA are unavailable as inflow sites.

REFERENCES

1. Ascer E, Veith FJ, Gupta S. Axillopopliteal bypass grafting: Indications, late results, and determinants of long-term patency. *J Vasc Surg* 1989;10:285-91.
2. Stonebridge PA, Prescott RJ, Ruckley CV. Randomized trial comparing infrainguinal polytetrafluoroethylene bypass grafting with and without vein interposition cuff at the distal anastomosis. The Joint Vascular Research Group. *J Vasc Surg* 1997;26:543-50.
3. Haimovici H. Patterns of arteriosclerotic lesions of the lower extremity. *Arch Surg* 1967;95:918-33.
4. King TA, DePalma RG, Rhodes RS. Diabetes mellitus and atherosclerotic involvement of the profunda femoris artery. *Surg Gynecol Obstet* 1984;159:553-6.
5. Nunez AA, Veith FJ, Collier P, Ascer E, Flores SW, Gupta SK. Direct approaches to the distal portions of the deep femoral artery for limb salvage bypasses. *J Vasc Surg* 1988;8:576-81.
6. Mills JL, Taylor SM, Fujitani RM. The role of the deep femoral artery as an inflow site for infrainguinal revascularization. *J Vasc Surg* 1993;18:416-23.
7. Darling RC III, Shah DM, Change BB, Lloyd WE, Leather RP. Can the deep femoral artery be used reliably as an inflow source for infrainguinal reconstruction? Long-term results in 563 procedures. *J Vasc Surg* 1994;20:889-95.
8. Shindo S, Kubota K, Kojima A, Matsumoto M. Arterial reconstruction using the deep femoral artery as an intermediate conduit between the aortoiliac and the infrapopliteal arteries. *Chirurgia* 2005;18:431-3.
9. Sotturrai VS, Bernstein JD. Transpubic ilio-deep femoral-anterior tibial sequential bypass with nonreversed translocated saphenous vein for limb salvage. *J Vasc Surg* 1988;8:86-8.
10. Sugawara Y, Sato O, Miyata T, Kimura H, Namba T, Makuuchi M. Utilization of the lateral circumflex femoral artery as a midway outflow for aorto-popliteal grafting: Report of a case. *Surg Today* 1998;28:967-70.