» **Case Report** «

Combined Total Arch Replacement and Bypass from the Ascending Aorta to the Bilateral Profunda Femoris Arteries

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A 72-year-old woman who had aortic arch aneurysm was admitted. The patient was unable to walk without assistance because of aortoiliac occlusive disease. Total arch replacement and the ascending aorta to the bilateral profunda femoris artery bypass were performed during the same operation. On outpatient visits, the patient was able to walk with a cane and the ankle-brachial pressure index was markedly improved. This combined procedure is an option for patients with aortoiliac occlusive disease who are not candidates for alternate inflow procedures, especially when the patient has another indication for median sternotomy.

Keywords: thoracic aneurysm, simultaneous operation, profunda femoris artery

Introduction

Atherosclerosis is a systemic disease that can affect all body arteries. In some instances, simultaneous revascularization procedures may be required because of the presence of concomitant thoracic aorta disease and aortoiliac occlusive disease. An extra-anatomic bypass graft using the ascending aorta as the source of inflow is a valid alternative in patients undergoing operation through median sternotomy. In the same cases, aortofemoral bypass using the profunda femoris artery (PFA) as the outflow vessel would be useful for limb salvage.

Case Report

A 72-year-old woman who had back pain was admitted to our hospital for surgery on an aortic arch

aneurysm which tended to expand. The patient had been treated medically for aortic dissection (Stanford type B) since the age of 66. At age 67, she presented with bilateral claudication, and computed tomography showed total occlusion of the bilateral superficial femoral arteries and aortoiliac occlusive disease. Combined aorto-bilateral femoral bypass and bilateral femoral-popliteal bypass was performed using synthetic prosthesis. Although she had no hypercoagulable states, abundant mural thrombi or any arrhythmia, the bypass conduits became occluded over the years and repeat revascularizations for the lower limbs were performed. All the grafts were occluded by age 71. As a result, apart from the PFA and collateral vessels, the arteries from the infrarenal abdominal aorta to the bilateral superficial femoral arteries were occluded. Although further interventions were considered, the patient refused invasive surgical procedures.

The patient also had complained of resting pain in the toes and foot for over a year. On physical examination, the legs were found to be pale and no pulse was palpable. The ankle-brachial pressure index could not be measured, and no Doppler signal was obtainable at the ankle. Naturally, the patient was unable to walk without assistance. Computed tomography

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Fig. 1 Preoperative computed tomography with contrast demonstrates aortic arch aneurysm of about 6 cm (A), aortoiliac occlusive disease, and total occlusion of the bilateral superficial femoral arteries. Only the profunda femoris arteries remain patent with rich collateral flow (B).

with contrast showed dissecting aortic aneurysm of about 6 cm and a totally occluded artery from the infrarenal abdominal aorta to the superficial femoral artery with rich collateral flow to the lower limbs (Fig. 1). The popliteal and crural arteries were patent bilaterally.

Total arch replacement (TAR) was planned for the aortic aneurysm, but a number of the following considerations were raised regarding the operation: (1) Circulatory arrest is required for TAR, which would impair the blood flow in the lower limbs. As this might exacerbate critical limb ischemia (CLI), a simultaneous revascularization procedure for the lower limbs would be necessary; (2) Due to occlusion of both the common and superficial femoral arteries, only the PFA would be available as the outflow vessel; (3) The abdominal aorta could not be used as the inflow because of prior surgery, and the axillary artery was not acceptable because of the poor patency rate of the axillary-femoral bypass. Following discussion, TAR and ascending aorta-bilateral PFA bypass were planned.

Following median sternotomy, cardiopulmonary bypass was initiated by cannulation of the ascending aorta and the right atrium. TAR using a prosthetic

graft with four branches (J-graft 26 mm; Japan Lifeline, Tokyo, Japan) was performed with moderate hypothermic circulatory arrest and selective antegrade cerebral perfusion. During weaning from the cardiopulmonary bypass, ascending aorta-bilateral PFA bypass was performed. A tunnel was created between the mediastinum and the bilateral inguinal region at the posterior aspect of the rectus muscle sheath through the preperitoneal space, and a reinforced 16 mm × 8 mm × 8 mm prosthesis (J-graft; Japan Lifeline, Tokyo, Japan) was inserted. With side biting, the proximal end of the graft was anastomosed to the arch graft at the ascending portion with a continuous 4-0 polypropylene suture. The distal ends were then anastomosed to the bilateral PFA with a continuous 5-0 polypropylene suture. The operation time was 235 minutes, cardiopulmonary bypass time 100 minutes, coronary ischemic time 64 minutes, and circulatory arrest time 47 minutes. The patient was transferred from intensive care unit to general ward on the next day. The ankle-brachial pressure index was markedly improved (right: 0.62, left: 0.56) and the patient was able to walk with a walking frame on the fifth postoperative day. Computed tomography with contrast showed a patent vascular

Fig. 2 Computed tomography with contrast on postoperative day 7. Total arch replacement and bypass from the ascending aorta to the bilateral profunda femoris artery were performed simultaneously.

prosthesis (Fig. 2). The postoperative course was uneventful, and the patient was discharged without complication on the twelfth postoperative day. Two years after the operation, the patient was doing well and walked by herself with a cane. The ankle-brachial pressure index was 0.6 for both values, and computed tomography angiogram showed patency of the bypass graft and PFAs.

Discussion

In some instances, patients who have aortoiliac occlusive disease require simultaneous cardiac surgery through median sternotomy because of the presence of concomitant coronary artery disease, valvular disease, or thoracic aorta disease. However, concomitant opening of another major body space negatively influences the postoperative course of these patients and may prolong the duration of mechanical ventilation and intensive care unit stay. Less invasive axillofemoral

bypass operations may be considered in such high-risk patients, but the patency rate is unsatisfactory.¹⁾

There have been reports on cardiac surgery with simultaneous revascularization of the femoral arteries using the ascending aorta as a source of inflow.^{2,3)} Baird, et al. reported a patency rate of 70% at 5 years in patients who underwent an ascending aorta-to-bifemoral bypass operation.²⁾ This procedure offers the following advantages: (1) it is simple and easy to perform; (2) it does not require an intraperitoneal procedure and thus does not increase operative mortality; (3) unlike the axillofemoral bypass, the graft is positioned behind the abdominal muscles and therefore is not visible, palpable, or compressive; (4) the ascending aorta is the source of inflow for the graft; and (5) it results in a shorter hospital stay and faster progress of postoperative rehabilitation.⁴⁾ The prosthetic material located behind the muscle of the abdominal wall is not compressible, and this is an important factor that increases the patency rate of this modality.

There are some disadvantages in this procedure. The ventral route of the graft could create difficulties in the event of a future laparotomy. Infection might be of concern since groins are exposed while the chest is opened and since drains are positioned adjacent to the graft.

Morris, et al. were the first to emphasize the use of the PFA in lower limb revascularization.⁵⁾ Atherosclerotic involvement of the PFA, which is less common than of the superficial femoral artery, is most often localized in the initial vascular segment.⁶⁾ Diehm, et al. reported that collateral blood flow to the lower limbs was provided by the PFA in patients with long occlusions of the superficial femoral or popliteal artery. A concomitant critical stenosis or occlusion of the PFA may thus result in CLI under these circumstances.⁷⁾

The literature contains few reports of direct bypass to the PFA. Ouriel, et al. reported 96% cumulative patency and 86% limb salvage at 4 years; on the other hand, axilloprofunda grafts had a poor primary patency rate (26% at 5 years).¹⁾ In aortofemoral bypass using the PFA as outflow, Prendiville, et al. reported that: (1) cumulative patency and limb salvage at 5 years are similar to those for aorta-common femoral bypass; (2) despite the high incidence of severe occlusive disease in the superficial femoral artery, few distal bypass procedures were required to maintain limb salvage.⁸⁾

The PFA is a crucial vessel for maintenance of blood flow to the distal lower limbs in the presence of severe occlusive disease of the superficial femoral arteries.

Conclusions

For patients with peripheral artery disease requiring a concomitant cardiac operation through median sternotomy, ascending aorta-to-femoral bypass is a highly suitable procedure. When aortoiliac and femoropopliteal atherosclerotic disease coexist, bypass using the PFA as the outflow vessel promises long-term graft patency and limb salvage. In patients with systemic atherosclerotic disease who require both cardiac and peripheral arterial surgery, these combined procedures can thus be performed safely on a single occasion.

Disclosure Statement

All authors have no conflict of interest.

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