Ascending thoracic aortobipopliteal bypass for extensive aortoiliac and femoropopliteal arterial occlusive disease

Pramook Mutirangura, MD, Teravit Phanchaipetch, MD, Chanee Ruangsetakit, MD, Chumpol Wongwanit, MD, and Kamin Chinsakchai, MD, Bangkok, Thailand

This report describes a patient with disabling intermittent claudication resulting from the complex combination of a heavily calcified abdominal aorta, extensive aortoiliac occlusion, bilateral femoropopliteal arterial occlusion, and thrombosis of a previous right axillobifemoral bypass graft, followed by revision of the graft to the left proximal popliteal artery and subsequent graft removal because of chronic infection. The patient underwent successful ascending thoracic aortobipopliteal bypass surgery and had an uneventful postoperative recovery, with ankle pulses palpable bilaterally. After 6 years of follow-up, he could walk unlimited distances, and computed tomography angiography showed patent grafts. (J Vasc Surg Cases 2015;1:180-3.)

Type D aortoiliac occlusive disease with limb-threatening ischemia is usually treated by aortobifemoral or axillobifemoral bypass surgery, depending on the patient’s cardiopulmonary status. Progressively disabling intermittent claudication due to aortoiliac occlusion that is unresponsive to medical treatment is also an indication for revascularization procedures. However, if the abdominal aorta, axillary arteries, and femoral arteries are not suitable for vascular anastomoses, conventional arterial bypass procedures cannot be performed. We report a patient who underwent successful ascending thoracic aortobipopliteal bypass surgery for the treatment of complex aortoiliac occlusive disease. Written consent was obtained from the patient for publication of this case report and accompanying images.

CASE REPORT

A 59-year-old man consulted us regarding disabling intermittent claudication in both lower extremities for several months, which did not improve with conservative therapy. His maximum walking distance was 10 m because of severe pain in his calves and thighs. He had undergone three surgical procedures for aortoiliac occlusive disease during the previous 3 years.

From the Vascular Surgery Unit and Cardiothoracic Surgery Unit, Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University. Author conflict of interest: none.

The ascending thoracic aorta was then approached through a median sternotomy. A 24-mm Dacron (DuPont, Wilmington, Del) tube graft was anastomosed to the ascending thoracic aorta, passed from the pericardial cavity through the diaphragm into the peritoneal cavity, and placed behind the left lobe of the liver, left kidney, spleen, and tail of the pancreas (Fig 2). In the midpoint of the left retroperitoneal space, the Dacron tube graft was anastomosed to a 24-mm Dacron bifurcation graft. Behind the sigmoid
mesocolon, each limb of the Dacron bifurcation graft was anastomosed to an 8-mm ring-reinforced polytetrafluoroethylene (PTFE) graft. The PTFE grafts were tunneled through the pelvic retroperitoneal space, under the inguinal ligament along posteromedial aspect of left femoral vein, behind the subsartorial space into adductor muscles, and towards the popliteal fossa on each side. These areas had never been contaminated by previous infection. The great saphenous veins were used as the final vascular conduits between the distal ends of the PTFE grafts and the popliteal arteries behind the knee joints.

The patient was fully heparinized during the surgical procedure. Hemostasis and wound closure were meticulously performed. The patient’s postoperative recovery was uneventful, and the ankle pulses were easily palpable on both sides.

At the 6-year follow up, the patient was walking unlimited distances and the ankle–brachial index was 0.96 on both sides. Annual follow-up computed tomography angiography showed patent ascending thoracic aortobipopliteal grafts providing good blood flow to the distal parts of both lower extremities (Fig 3).

**DISCUSSION**

Aortoiliac occlusive disease is a high-risk condition, particularly in patients with critical limb ischemia. If revascularization is not possible in a patient with extensive aortoiliac occlusion and a critically ischemic limb, major amputation cannot be successfully performed because the inadequate blood supply prevents healing of the amputation stump.4,5 Our patient had disabling intermittent claudication and required revascularization before the ischemia progressed to a critical level.

Because our patient had healthy bilateral popliteal arteries and distal arteries to the foot, he was a suitable candidate for extensive arterial bypass to these arteries. The profunda femoris arteries could not be used for the distal anastomoses because of his previous vascular surgery. The abdominal aorta could not be used for the proximal anastomosis because of the heavy calcification, extensive aortoiliac occlusion, and extensive adhesions around the suprarenal and supraceliac aortic segments. The left axillary artery was not considered for the proximal anastomosis because the vascular conduit to the popliteal

---

**Fig 1.** Evidence of previous arterial bypass procedures. **A,** Thrombosed left limb of the right axillobifemoral bypass. **B,** Residual thrombosed graft after the revision procedure from the left limb of the previous bypass to the left proximal popliteal artery, which was subsequently removed.

**Fig 2.** Vascular conduit tunneling and placement. After an anastomosis to the ascending thoracic aorta, a 24-mm Dacron (DuPont, Wilmington, Del) tube graft (a) was passed from the pericardial cavity through the diaphragm into the peritoneal cavity. Subsequent to medial rotation of the left-sided abdominal viscera towards the midline, the Dacron tube graft was placed in the left retroperitoneal space and anastomosed to a 24-mm Dacron bifurcation graft (b). Each limb of the Dacron bifurcation graft was anastomosed to an 8-mm ring-reinforced polytetrafluoroethylene (PTFE) graft (c) behind the sigmoid mesocolon. The PTFE grafts were tunneled behind the inguinal ligament to the popliteal fossa on each side.
arteries would have to be tunneled through the area of the previous graft infection, which carried a risk of further graft infection.

Furthermore, arterial bypass from the axillary artery has limited long-term patency, and further graft failure would have been very difficult to manage in this patient. Using the descending thoracic aorta for the proximal anastomosis would be complicated because the operation would have to be performed through a left lateral thoracotomy with the patient in the right lateral decubitus position, and the arterial bypass to the bilateral popliteal arteries would have to be performed with the patient supine with lateral rotation of both hip joints. Changing the patient’s position during an extensive vascular procedure is difficult.

The ascending thoracic aorta was therefore selected for the proximal anastomosis because this procedure could be performed with the patient supine.

Our review of the literature did not find any previous reports of arterial bypass from the ascending thoracic aorta to the bilateral popliteal arteries for the treatment of lower extremity ischemia. However, this aortic segment has successfully been used for arterial bypass to the bilateral femoral arteries. This case illustrates that it is possible to use the ascending thoracic aorta to provide a substantial blood supply to the ischemic lower extremities in patients with both aortoiliac and femoropopliteal arterial occlusion.

The long prosthetic vascular conduits can safely be tunneled from the pericardial cavity through the diaphragm and into the abdominal cavity, retroperitoneal space, pelvic cavity, subsartorial space, and popliteal fossa. The great saphenous veins can be used as the final vascular conduits for anastomosis to the popliteal arteries because of the high degree of flexibility of the native veins in the popliteal fossae and the similar sizes of the great saphenous veins and the popliteal arteries.

The arterial bypass procedure was successful, and our patient had an unlimited walking distance and continued graft patency after 6 years of follow-up. The ankle-brachial index on both legs dramatically increased from 0.4 to 0.96 after this procedure and remained stable for 6 years of follow-up.

CONCLUSIONS

Ascending thoracic aortobipopliteal bypass can be considered for the surgical treatment of extensive

Fig 3. Postoperative computed tomography angiography at 1 month, 1 year, and 6 years after surgery shows the continued patency of the ascending thoracic aortobipopliteal grafts.
combined aortoiliac and femoropopliteal arterial occlusive disease with limb-threatening ischemia.

REFERENCES

1. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG, et al; TASC II Working Group. Inter-society Consensus for the management of peripheral arterial disease. Int Angiol 2007;26:81-157.

2. Belkin M, Owens CD. Surgical management of aortoiliac occlusive disease. In: Moore WS, editor. Vascular and endovascular surgery: a comprehensive review. 8th edition. Philadelphia: Elsevier Saunders; 2013. p. 401.

3. Brewster DC. Clinical and anatomical considerations for surgery in aortoiliac disease and results of surgical treatment. Circulation 1991;83:42-52.

4. Woodburn KR, Ruckley VC. Lower extremity amputation: technique and perioperative care. In: Rutherford RB, editor. Vascular surgery. 6th edition. Philadelphia: Elsevier Saunders; 2008. p. 2460-73.

5. Back MR, Johnson BL, Shames ML, Bandyk DF. Evolving complexity of open aortofemoral reconstruction done for occlusive disease in the endovascular era. Ann Vasc Surg 2003;17:596-603.

6. Onohara T, Komori K, Kume M, Ishida M, Ohta S, Takeuchi K, et al. Multivariate analysis of long-term results after an axillobifemoral and aortobifemoral bypass in patients with aortoiliac occlusive disease. J Cardiovasc Surg (Torino) 2000;41:905-10.

7. Passman MA, Farber MA, Criado E, Marston WA, Burnham SJ, Keagy BA. Descending thoracic aorta to iliofemoral artery bypass grafting: a role for primary revascularization for aortoiliac occlusive disease? J Vasc Surg 1999;29:249-58.

8. Baird RJ, Ropchan GV, Oates TK, Weisel RD, Provan JL. Ascending aorta to bifemoral bypass—a ventral aorta. J Vasc Surg 1986;3:405-10.

Submitted Jan 13, 2015; accepted Apr 16, 2015.