Operation for an Infected Thoracoabdominal Aneurysm in a Patient Previously Treated with an Axillobifemoral Bypass for an Infected Abdominal Aortic Prosthesis: A Case Report

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High operative mortality of infected thoracoabdominal aortic aneurysms (ITAA) is partly attributable to ischemic injury during aortic clamping. A case is presented of an 88-year old man who was admitted with imminent rupture of an ITAA. Axillobifemoral bypass grafting had been performed after removal of an infected abdominal aortic prosthesis six years earlier. In situ graft replacement was performed during 70 minutes of aortic clamping just below the pulmonary hilum without causing any but transient renal ischemic injury. Since the infrarenal aorta was absent after previous removal of an infected aortic prosthesis, the axillobifemoral bypass provided sufficient blood supply to intestines, kidneys and spinal medulla via arterial collaterals. Blood supply was sufficient, although a previous rectosigmoid resection must have destroyed some of the collaterals and one iliac artery was chronically occluded. The most important message from this case is that an axillobifemoral bypass may prevent ischemic injury during operations for ITAA even when collateral circulation is reduced, possibly on the condition that backbleeding from end-organ arteries is prevented, and there is a pressurized aortic segment that can redistribute blood that arrives via arterial collaterals.

Keywords: aortic aneurysm, thoracic, aneurysm, infected, ischemia, blood supply, blood vessel prosthesis

Introduction

Infected thoracoabdominal aneurysms (ITAA) carry a high operative mortality (12%–40%).1–4) Ischemic injury during aortic clamping is a significant mortality cause5) that largely can be prevented by lower body perfusion.6–8) We operated on a patient with an ITAA who had previously undergone an operation for a ruptured abdominal aortic aneurysm with implantation of a vascular prosthesis that had to be replaced by an axillobifemoral bypass due to infection. Since the patient’s infrarenal aorta was absent, one iliac artery was occluded, and he had previously undergone a rectosigmoid resection, there was a reduced capacity of arterial collaterals between his femoral arteries and end-organs at risk for ischemic injury: intestines, kidneys and spinal medulla.

Since other modes of treatment or of prevention against ischemic injury were not considered options in our case, it serendipitously demonstrates the protective effect of the axillobifemoral bypass during 70 minutes of aortic clamping just below the pulmonary hilum when the capacity of relevant arterial collaterals is reduced.
Case Report

The case was an 88-year old man who during the last month had suffered from fever up to 40°C, shivering, nausea, anorexia, and abdominal pain. Six years earlier he had been operated on for a ruptured abdominal aortic aneurysm with an aortoduodenal fistula. A bifurcated polyester graft had been implanted, but had to be removed 1 month later after it had become infected. At the same time, he underwent left-sided axillofemoral bypass grafting. This bypass occluded and was thrombectomized three times. When it occluded the fourth time a right-sided axillofemoral bypass was constructed. Eight years before admission he had suffered from a stroke. Two years before admission he had undergone sigmoid resection with the Hartmann procedure due to anastomotic leakage after anterior resection of the rectum after 8 previous transanal operations for rectal tubulovillous adenomas. He was on treatment for gouty arthritis with allopurinol 100 mg twice daily, for arterial hypertension with atenolol 50 mg and amlodipine 5 mg once daily, and on anticoagulation with warfarin. CT after admission showed a thoracoabdominal aortic aneurysm extending from the upper margin of the 10th thoracic to the upper margin of the 1st lumbar vertebra just above the celiac ostium. The infrarenal aorta, right and left common and left external iliac arteries were occluded; the left internal iliac artery was filled retrogradely. The aneurysm, suspected of being infected, measured 6 cm in diameter. C-reactive protein (CRP) at admission was 156 mg/L. Blood culture was taken and gave growth of enterococcus faecalis and staphylococcus epidermidis. Antibiotic treatment with cefotaxime 2g intravenously (i.v.) twice and metronidazole 0.5 g i.v. 3 times daily was started. Clopidogrel 75 mg daily was substituted for warfarin. He had severe pain. A repeat CT, 11 days after the first CT, showed that the aneurysm had increased in diameter to 7.1 cm (Fig. 1) and he was operated on for imminent rupture. The left thoracic cavity was entered in the 7th intercostal space. The diaphragm was free-dissected from the aneurysm, and the aorta was clamped for 70 minutes just below the pulmonary hilum. The aneurysm was opened, the infected thrombus was removed, and a 22-Fr Foley catheter was used to prevent back-bleeding from the distal aorta, while a gelatine-impregnated polyester tube graft (Uni-Graft, Braun, Melsungen, Germany) was anastomosed to the aortic necks, first distally, then proximally using the inlay technique. Peroperative bleeding was 2900 ml. Most of the blood was retransfused via a cell-saver. Fibrin sealant (Tisseel, Baxter, Deerfield, IL) was used to stop bleeding at the distal anastomosis. Cefalothin 2g i.v. was perioperatively given 3 times. Postoperatively, he continued with metronidazole i.v. for one week, then 400 mg orally 3 times daily, in addition to ampicillin 2g i.v. 3 times and cloxacillin 2g i.v. 4 times daily.

Apart from epileptic seizures on postoperative day 5, when antiepileptic therapy with carbamazepine, initial dose 100 mg twice daily was started, the postoperative course was uneventful. Spinal and intestinal function remained normal. Serum creatinine was 151 µmol/L preoperatively, increased to a maximum of 257 on the 7th day and was 151 on the 14th day postoperatively. The second postoperative day he was able to feed himself, could walk, and was transferred to the ward. On the 42nd postoperative day, there was growth of Pseudomonas on the central venous catheter, and ciprofloxacin, 750 mg orally twice daily was started. On postoperative day 52, he went home continuing with ciprofloxacin, metronidazole 400 mg orally 3 times daily, cloxacillin 500 mg orally 4 times daily, amoxicillin 500 mg orally 4 times daily.
daily and, for a fungal superinfection; fluconazole 200 mg orally once daily until postoperative day 88 when CRP was <10 mg/L and metronidazole was stopped. All antibiotic therapy was stopped on postoperative day 130 when CRP was still <10 mg/L, and the leucocyte count was 8.7 × 10⁹/L. He died 2.5 years later, of metastasizing pancreatic carcinoma. A CT examination two days before death showed a 4-mm layer of fluid around the aortic graft that was compatible with a low-grade graft infection. At autopsy, findings in relation to the aortic graft were inconspicuous.

**Discussion**

The findings in our case are in accordance with a previous report, which shows the benefit of lower body perfusion by a temporary axillofemoral bypass in operations for thoracoabdominal aortic aneurysms.⁶ Although the aorta of our case was clamped just below the pulmonary hilum for 70 minutes, the postoperative course of the patient showed that he did not suffer any but transient renal ischemic injury. The bypass prevented ischemia despite the absence of an infrarenal aorta, chronic occlusion of one iliac artery, and despite the fact that some collateral vessels must have been sacrificed 2 years earlier when the patient underwent a rectosigmoid resection.

The Foley catheter used for periceliac aortic occlusion during aortic clamping, may have contributed to the prevention of ischemia by preventing back-bleeding⁹ and by creating a pressurized aortic segment. The Foley catheter must have obstructed the ostium of the celiac artery, preventing entrance or exit of blood through this artery (Fig. 2, black part).

Blood, therefore, entered to and exited from the pressurized aortic segment via lumbar or renal arteries or via the superior mesenteric artery (SMA), providing similar blood perfusion pressure to all tissues with arterial connection to this aortic segment.

If a temporary bypass to the aortic prosthesis had been used as previously described,¹⁰ the patient might have been exposed to a lower risk of ischemic injury since antegrade blood flow to renal and visceral arteries could have been resumed after completion of the distal anastomosis (Fig. 2, gray part). This would, however, have encumbered the operation with repositioning of the patient and access to the left axillary artery which had been operated on earlier.

According to a common but unproven notion, direct perfusion of renal and visceral ostia might have exposed the kidneys and intestines to a lower ischemic risk, but this method would have necessitated a thoracolaparotomy and aortotomy distally to the renal arteries. It was considered that our patient was too frail to undergo such extensive surgery, but that he would have a fair chance of recovery with a more limited access, a thoracotomy in the 7th intercostal space. This access made the distal anastomosis somewhat awkward to suture, thus explaining the 70 minutes of aortic clamp time. Cardiopulmonary bypass with hypothermia might have increased the risk of hematogenic dissemination of the infection, more bleeding due to more extensive heparinization, and the capillary leak syndrome and was not considered an option in our frail patient.¹¹

Stent-grafts have been used with some success in the treatment of ITAA.¹² In our patient, since the infrarenal aorta was absent, a stent-graft would have had to be introduced through a branch from the aortic arch or via direct access to the descending thoracic aorta with all the attendant risks. Introduction of the stentgraft through the right subclavian or carotid artery would have stopped or restricted blood flow to the right axillobifemoral bypass.

**Fig. 2** Anatomy (in black) and use of a temporary bypass for reducing ischemic time (in gray). The black part of the figure shows the functional vascular anatomy. Arrows indicate probable directions of collateral blood flow. A 22-Fr Foley catheter was used for distal aortic occlusion. The gray part of the figure shows how a temporary bypass from the axillary artery to the aortic prosthesis (ap) might have been used to reduce ischemic time to the time needed for suturing the distal anastomosis.
The aneurysm went down to the upper margin of the celiac artery. Stent-grafting would have necessitated covering the celiac ostium with the stent-graft. Reducing the run-off further to only the renal arteries and the SMA might have reduced aortic flow, facilitating mural thrombus formation. Furthermore, the aorta below the celiac ostium was too short to accommodate the leading end of available stent-graft delivery systems.

Bypassing all four visceral vessels followed by removal of infected aneurysm tissue was considered, but was not thought to be a safer option.

Conclusion

In the present case, permanent ischemic injury during 70 minutes of clamping of the descending thoracic aorta was prevented by a preexisting axillofemoral bypass. Since the infrarenal aorta was absent after previous removal of an infected aortic prosthesis, the bypass provided sufficient blood supply to intestines, kidneys and spinal medulla via arterial collaterals. Blood supply was sufficient, although a previous rectosigmoid resection must have destroyed some of the collaterals and one iliac artery was chronically occluded.

An axillofemoral bypass may prevent aortic clamp-induced ischemic injury during operations for ITTA, even when collateral circulation is reduced, possibly on the condition that backbleeding from end-organ arteries is prevented, and there is a pressurized aortic segment that can redistribute collateral blood.

Consent

Written informed consent was obtained from the next of kin of the patient for publication of this case report and accompanying image. A copy of the written consent is available for review by the Managing Editor of this journal on request.

Acknowledgement

Audun Braaten, MD, processed the CT image used for Fig. 1.

Conflict of Interest

The author declares that he has no conflicts of interest.

References