Introduction

In general, collateral perfusion is sufficient to prevent severe ischemia during infrarenal aortic clamping in open repair of aortic and iliac aneurysms. In high-risk patients, when prolonged cross-clamping can be expected, and collateral perfusion is reduced, the use of a temporary shunt may reduce the risk of ischemic complications. In a patient with Marfan’s syndrome and aortic dissection who had developed infrarenal aneurysms, segmental arteries had been occluded by prior aortic surgery and collateral arteries in the anterior torso could have been damaged by previous pectus excavatum, muscle flap, sternotomy, and ventral hernia operations. The axillary artery was dilated. For the prevention of ischemia during open repair with a bifurcated graft, a temporary extracorporeal brachio-femoral vascular prosthesis shunt was constructed. Ischemia was not observed. The use of a temporary extracorporeal brachio-femoral shunt with a vascular prosthesis is a feasible method for ischemia prevention.

Keywords: aortic aneurysm, ruptured, ischemia, blood supply, blood vessel prosthesis

Case report

The patient was a 45-year-old woman with Marfan’s syndrome and severe scoliosis, who was admitted in March 2009 with pain in the back and left iliac fossa and groin, of three months duration. In childhood she had been operated on twice for pectus excavatum with Ravitch-type procedures, later on a pedicled right rectus abdominis muscle flap was used to improve cosmesis, and 20 years before admission she had breast enlargement prostheses implanted (Fig. 1a and 1b). Nineteen to eight-and-a-half years before admission, she had undergone three operations for aortic dissection and dilatation in previous operations. The axillary artery was dilated and might have been prone to dissect. For the prevention of lower-body and spinal cord ischemia during open repair with a bifurcated graft, it was, therefore, elected to use a temporary extracorporeal brachio-femoral shunt with a vascular prosthesis. The use of brachio-femoral shunts has rarely been reported previously.14)
with successive replacement of the entire supraceliac aorta without intercostal artery reattachment. The aortic valve had been replaced because of concomitant aortic insufficiency and pulmonary edema. Two-and-a-half years before admission, a synthetic mesh had been implanted for an epigastric ventral hernia. Postoperatively, she had temporary respiratory insufficiency, due to her scoliosis and a phrenicus paresis on the left side. The synthetic mesh became infected and had to be removed 4 months later. Two months before admission, a new expanded polytetrafluoroethylene mesh had been implanted for recurrent hernia (Fig. 1g and 1h). The restrictive respiratory insufficiency due to her thoracic deformity necessitated nightly biphasic positive airway pressure support the last 14 months before admission.

Computed tomography angiography showed an aortic dissection that extended from the distal end of the aortic prosthesis to the iliac bifurcations (Fig. 1c–1h) with an abdominal aortic aneurysm of the false lumen with a contained rupture towards the left kidney (Fig. 1g). There was also dilatation of both common iliac arteries (Fig. 1h) and an aneurysm on the left internal iliac artery. The maximal diameter of the brachiocephalic artery, containing a dissection membrane, was 2.8 cm; the right subclavian artery was 2.5 cm, the left axillary artery 2 cm, the left common carotid artery 2 cm, and the left renal artery 1.26 cm (Fig. 1e and 1f). The angiography furthermore revealed that the left and the medial branch of the right internal mammary arteries appeared to have been caught by the lowest sternal wire. The intermittent irradiating pain to the left iliac fossa and groin was considered most likely to be caused by pressure on nerves and not by tension in the pseudoaneurysm.

Since segmental arteries had been occluded by prior aortic surgery and branches from the subclavian and inferior epigastric arteries could have been damaged by the pectus excavatum, muscle flap, sternotomy, and hernia operations, open repair with a bifurcated vascular prosthesis and temporary shunt for ischemia prevention was planned. Upper-arm systolic blood pressure was 145 mm Hg on the right side and 135 mmHg on the left side. The right brachial artery displayed a good biphasic Doppler signal; on the left side the signal was almost monophasic. The axillary arteries were dilated, and there might have been a risk of iatrogenic dissection if they had been used for supplying blood to the temporary shunt. It was, therefore, elected to use a shunt from the right brachial artery to the right femoral artery. The patient was informed of the procedure and consented.

The right brachial and femoral arteries were exposed just proximally to the elbow and through an old scar, respectively. Access to the aorta was gained via the old midline scar. On the ventral side of the synthetic hernia mesh, there was a 5 × 6 cm area with no tissue ingrowth into the mesh; the surface was slippery, and a small hair was seen. Since this finding was compatible with a low-grade biofilm infection, standard antibiotic prophylaxis with cephalothin was reinforced with vancomycin, gentamycin, and ampicillin.

After exposing the infrarenal aorta, both common iliac bifurcations, and the left internal iliac artery distally to the aneurysm, 5000 IU of Heparin was given, and an 8 mm impregnated polyester vascular prosthesis was anastomosed to the right brachial and femoral arteries. The prosthesis was clamped close to both anastomoses. After clamping of the aorta just distally to the renal
arteries, the vascular prosthesis shunt was opened after de-airing with needle puncture at its highest point, and the shunt was rapidly filled with blood from the brachial artery. A bifurcated vascular prosthesis was anastomosed to the false lumen just distally to the renal arteries. The right branch was anastomosed to the bifurcation of the right common iliac artery, and the aortic clamp was released. Aortic clamp time was 64 minutes. The inconspicuous anterior true aortic lumen (Fig. 1g and 1h) was closed with sutures. The brachio-femoral shunt was clamped close to the anastomoses where after the left branch of the bifurcation prosthesis was anastomosed to the left external and internal iliac arteries.

There were no signs of ischemia. Following closure of the abdomen, the shunt was removed, leaving 1.5 mm of graft on the femoral artery for suture closure. The brachial arteriotomy was closed with a monofilament 7–0 vascular suture after removal of all graft material. A thrombus that formed during closure of the brachial arteriotomy was removed with a Fogarty catheter, and 2500 IU of heparin was given. Intraoperative bleeding was 2.5L, most of it from the true lumen. Red blood cells from shed blood were reinfused using a cell-saver.

Six hours postoperatively, the patient was reoperated for a suture hole bleeding from the true aortic lumen, but only after she had developed hypovolemia, hypotension and a tense abdomen. The sigmoid colon was bluish, most likely as a result of circulatory instability and intra-abdominal hypertension, and a second look operation, therefore, was performed the next day to confirm intestinal viability. During all three operations, the synthetic hernia mesh was split in the midline and resutured. She developed a lymph fistula in the right groin. This wound was opened to prevent infection and healed by secondary intention. At last follow-up, 38 months after the operation, she was in her habitual condition, having had no further untoward events, postoperatively. Yearly computed tomography examinations showed no further dilatation of aortic branches.

Perioperatively, there were no symptoms or clinical signs of lower limb hypoperfusion. Serum myoglobin was 290 μg/L in the evening after the aneurysm operation and 196 μg/L the next morning (reference range: <50 μg/L). Corresponding levels of serum creatine kinase were 75 U/L and 188 U/L, both within the reference range (35–210 U/L). Serum creatinine was normal throughout the perioperative period.

Discussion

The most important finding in this study was that no signs of ischemia were observed. The temporary brachio-femoral shunt allowed the operation to proceed without hurry and may have prevented lower-body and spinal cord ischemia. Without the temporary shunt, collateral arteries between the superior and inferior mesenteric arteries and visceroparietal collaterals might have been the only significant pathways between the upper and lower body. In the absence of chronic stenotic arterial disease, these serially connected collaterals might not have provided sufficient perfusion during aortic clamping, especially if aortic clamp time would have had to be extended for some reason.

During aortic cross clamping, since both external and internal arteries had to be clamped, the right brachio-femoral bypass perfused both internal and contralateral femoral arteries via the collateral network from the femoral artery. These collateral arteries can be relied on to provide an adequate collateral back-pressure in the internal iliac and contralateral femoral arteries during aortic cross-clamping.

Conclusion

The use of a temporary extracorporeal brachio-femoral shunt with a vascular prosthesis allowed open repair of infrarenal aneurysms in a patient with aortic dissection due to Marfan’s syndrome to proceed without hurry, and may have prevented lower-body and spinal cord ischemia. The patient had previously undergone replacement of the entire supraceliac aorta without intercostal artery reattachment, and collateral arteries in the anterior torso might have been destroyed by previous operations. The use of a temporary extracorporeal brachio-femoral shunt with a vascular prosthesis is a feasible method for prevention of ischemic complications during aortic surgery, when the axillary artery is inaccessible.

Disclosure Statement

The author has no conflicts of interests with respect to the manuscript.
References