CASE REPORT

Hybrid in situ replacement for Samson group V *Staphylococcus aureus* aortic graft infection

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SUMMARY

Aortic prosthesis replacements including extra-anatomical bypass procedures, in situ revascularisations with the neoaortoiliac system, antibiotic bounded prostheses or allogeneic grafts have high graft reinfection rates. We described a case of a 68-year-old man with Samson group V *Staphylococcus aureus* infection of his aortobifemoral graft. He underwent an explantation of the infected graft, wound debridement and a hybrid in situ allogeneic aortoiliofemoral replacement. During surgery one of the limbs of the cryopreserved human aortic allogeneic graft was anastomosed with the endarterectomised left common iliac artery, which later was angioplastied and stented. The closed system Jackson-Pratt drains were used to prevent perigraft fluid collection. The groin wound was treated with the vacuum-assisted closure dressing. On review in 6 months he remained symptom free. We conclude that a hybrid management of infected aortic prosthesis may reduce graft reinfection.

BACKGROUND

Aortic graft infection is a life-threatening condition which requires an explantation of infected prosthesis and an extra-anatomical bypass or an in situ reconstruction including the neoaortoiliac system procedure, replacement with an antibiotic-bounded prosthetic graft or cryopreserved human allogeneic graft. These operations have a relatively high graft-reinfection rate. To prevent infective groin wound complications we proposed a new hybrid technique. We performed a limited endarterectomy of the proximal left common iliac artery (CIA) and anastomosed it with the left limb of the in situ aortic allogeneic graft, with a subsequent balloon angioplasty of the left distal CIA/external iliac artery, endoluminal stenting of the left CIA, and closure of the previous anastomotic defect of the left common femoral artery with an autogenous venous patch.

CASE PRESENTATION

A 68-year-old retired man, in an acute condition, was transferred by a medical air ambulance to our tertiary referral hospital with an oozing-blood right-groin sinus, abdominal pain, fevers and chills.

In 2007, the patient underwent an open aortobifemoral (ABF) Dacron graft repair of his occlusive aortoiliac disease, in 2008 angioplasty and stenting of the right distal ABF graft anastomosis, in 2009 thrombectomy from the right limb of ABF graft, removal of the vascular stent, revision of the right distal ABF graft anastomosis with a Dacron patch

angioplasty. Postoperatively, he developed a right groin *S aureus* sinus, but declined an operation and elected to be treated conservatively with life-long antibiotics.

On admission to a local hospital the patient had temperature of 37.8°C, HR of 132 bpm, arterial blood pressure (BP) of 90/60 mm Hg. The patient's right groin sinus bleeding was controlled by a finger compression proximally to the sinus. An aorta and iliacs duplex ultrasound scan revealed a patent ABF graft with a fluid collection around the stem of the ABF graft. The patient was fluid resuscitated, received an intravenous administration of cefuroxime, metronidazole and gentamicin and was airlifted to our institution.

On arrival to our hospital the patient was febrile, T=37.6°C, tachycardic, HR rate 114 bpm, with BP 110/70 mm Hg. In the right groin there was a 4 mm sinus surrounded by an extensive groin and upper thigh skin erythema. In the right groin above the sinus there was a tender pulsatile mass of 3 cm in diameter with an associated bruit. The abdomen was mildly distended, guarded and tender over a central pulsatile abdominal mass of 6 cm in diameter.

The patient's blood tests showed anaemia, haemoglobin concentration 95 g/L (normal range 130–175 g/L), leukocytosis, white cell count 19.5 (4.0–11.0×10⁹/L), C reactive protein 159 (<5 mg/L), creatinine level 114 (60–105 µmol/L). Blood bacterial cultures were taken and the patient was started on intravenous *S aureus*-sensitive antibiotic, vancomycin. An urgent digital aortography showed a contrast extravasation at the right distal ABF graft anastomosis consistent with a false aneurysm. There was a retrograde blood flow to the left external iliac artery (EIA) and the left CIA (figure 1).

The patient was brought to an operation room for an urgent surgery. A left groin longitudinal incision was performed and the left common femoral artery (CFA) above the left distal graft anastomosis, the left superficial femoral artery (SFA) and left profunda femoris artery (PFA) were dissected out from dense scar tissues. The left distal 'end-to-side' graft anastomosis with the left CFA was exposed. After a midline laparotomy, the duodenum was mobilised and reflected. In the area of the prosthesis bifurcation there was a 400 mL collection of haemorrhagic fluid and soft tissue debris, which was evacuated. After intravenous heparin administration, the aorta below the renal arteries was cross-clamped with the DeBakey aortic clamp, the left CFA above the left distal graft anastomosis, left SFA and left PFA were occluded with vessel loops and

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Figure 1 An urgent digital aortography showed a contrast extravasation at the right distal aortobifemoral graft anastomosis consistent with a false aneurysm (an arrow). There was a retrograde blood flow to the left external and common iliac arteries.

small Satinsky clamps. Retroperitoneal tissues with a fibrous capsule over the aorta and the ABF graft were incised. In the right upper thigh the sinus was excised. During the dissection of the right groin, the right distal 'end-to-end' prosthetic graft anastomosis was found to be partially disrupted (figure 2). The prosthetic ABF graft was completely excised and sent for a bacterial culture.

The aortic suture line and the aneurysmal portion of infrarenal aorta were excised to the level of healthy aortic tissue. The paraprosthetic infected tissues and femoral tunnels were extensively debrided and necrotic tissues removed. The proximal 'end-to-end' anastomosis between the infrarenal aorta and a cryopreserved human ABF 200×16×150 mm allogeneic graft (CHA) was performed. After a limited endarterectomy of the left proximal CIA, the left distal CHA anastomosis with the endarterectomised left CIA was performed in an end-to-end fashion. The severely stenosed left CIA and EIA was balloon angioplastied and left CIA was stented with a Zilver Flex 9×100 mm vascular stent (figure 3). The defect in the left CFA was closed with an autogenous venous

patch and after standard flushing manoeuvres were performed the patch suture was tied re-establishing the blood flow to the left lower extremity. The right limb of the CHA passed into the right groin beneath the inguinal ligament and was anastomosed with the right CFA in an end-to-end fashion and all vascular clamps were then removed. Jackson-Pratt closed drains were inserted into the left groin wound, into the pelvis and along CHA. The laparotomy wound was closed. In the left groin, the subcutaneous tissue and Scarpa's fascia, but not the femoral sheath were repaired with continuous absorbable sutures, then the skin wound was closed. The right groin wound was closed with a vacuum-assisted closure (VAC) wound dressing maintaining continuous negative pressure of 50 mm Hg. The VAC wound dressing was changed in 3 days with an overall duration of treatment for 6 days, the wound was then closed. The preoperative blood bacterial culture and microbiological culture of the explanted ABF graft yielded growth of *S aureus* sensitive to vancomycin, oxacillin, ciprofloxacin, moxifloxacin, cotrimoxazole, rifampicin and gentamicin.

Postoperatively, the patient received an antiplatelet therapy with aspirin and clopidogrel. Deep vein thrombosis prophylaxis was started on day 1 after surgery with subcutaneous administration of 40 mg of enoxaparin daily.

The patient was discharged in a stable condition and received an 8 weeks of outpatient intravenous vancomycin therapy followed by a 6 months course of oral ciprofloxacin.

INVESTIGATIONS

Investigations were routine blood tests, blood and graft bacterial cultures, aorta and iliacs duplex ultrasound, CT of abdomen and CT angiography.

TREATMENT

Broad spectrum-specific/microorganism-specific antibacterial medications, interventional radiological and surgical treatment was given.

OUTCOME AND FOLLOW-UP

The patient was reviewed in our outpatient clinic for 6 months. He remained asymptomatic. A three-dimensional CT aortography showed a patent CHA and the left CIA stent with a satisfactory runoff to the lower extremities (figure 4).

Figure 2 The disrupted right distal 'end-to-end' aortobifemoral graft anastomosis (an arrow).

Figure 3 The stented left common iliac artery.

Figure 4 A three-dimensional CT aortography showed a patent cryopreserved human aortoiliac allogeneic graft and left common iliac artery stent with a satisfactory runoff to the lower extremities.

DISCUSSION

Aortic graft infection occurs in 2–3% of all prosthetic revascularisations of lower limbs.¹ It is associated with 20–80% mortality and 10–45% limb amputation rate.^{2–6} Treatment of patients with infected aortic grafts presents a formidable challenge for vascular surgeons and incurs, on average, healthcare costs of £51 300 per patient in 2013.⁷

Conservative treatment of patients with aortic graft infection is associated with mortality (OR 3.6; 95% CI 1.2 to 11.2).⁵ Only on rare occasions high-risk surgical patients with an infected aortic graft can be treated conservatively with antibiotics.^{8–9} Initially our patient had a localised ABF graft infection with postoperative right groin sinus. He declined an excision of the infected limb of ABF graft and the right axillofemoral bypass surgery and was treated with antibiotics. In the presence of the groin sinus antibiotic therapy was unsuccessful and resulted in the development of a life-threatening Samson group V vascular graft infection.¹⁰

The main surgical options include either an extra-anatomic bypass through non-infected field or in situ reconstructions with the removal of an infected aortic graft and debridement of surrounding tissues. An extra-anatomic bypass, axillobifemoral (AXBF) or bilateral axillofemoral, with a graft explantation has mortality of 19.2% (95% CI 14.6% to 23.8%) and an amputation rate of 13.6% (95% CI 8.1% to 19.1%). An extra-anatomical bypass confers 80% survival at 1 year, 55% at 3 years and 40% at 5 years.^{4–11} An extra-anatomical prosthetic bypass has a primary patency of 62% at 1 year, 51% at 3 years, 40% at 5 years.¹¹ A pooled incidence of fatal aortic stump blowout events following an extra-anatomical bypass operation is 8.5% (95% CI 5.4% to 11.6%) and a graft reinfection rate of 15.6% (95% CI 10% to 21.1%).⁴ Furthermore, AXBF or bilateral axillofemoral bypass is contraindicated in the presence of groin infection. Our patient had an extensive upper thigh and groin cellulitis which is a contraindication to an extra-anatomical AXBF or bilateral axillofemoral bypass. The presence of peripheral arterial disease precluded the patient from having an axillopopliteal graft bypass as well.

In situ reconstructions include the neoaortoiliac system (NAIS) procedure, in situ replacement with antibiotic-treated

prosthetic grafts or CHA. In the NAIS bypass the superficial femoral-popliteal veins (FPVs) are harvested, then a bifurcated pantaloon graft is constructed that is anastomosed with the aorta in an end-to-end fashion. There are numerous variations of the use of FPVs as conduits.⁴ An aortic reconstruction with FPVs has a 15% perioperative mortality, 70% 1-year survival and 50% 5-year survival.^{12–13} The NAIS reconstruction has 35% lower extremities fasciotomy, 15% reinfection, 5% graft disruption and 7–10% limb amputation rates.^{12–13} At 1 year a primary FPVs graft patency was reported to be 100%, at 72 months a cumulative primary and secondary/assisted primary graft patency was 81% and 91%, respectively.^{12–13} One of the disadvantages of the NAIS procedure is its duration averaging over 10 h, which is demanding to the patient and the surgical team.¹² We considered the NAIS procedure as being too risky to our haemodynamically fragile and septic patient.

Rifampicin-bonded prosthetic grafts can be used in patients with segmental graft infections caused by low virulence microorganisms such as *Staphylococcus epidermidis*, in aortic graft infections without sepsis and intact anastomoses.¹⁴ Our patient had Samson grade V graft infection involving the entire prosthesis with an overwhelming sepsis and anastomotic disruption. Therefore, an implantation of an antibiotic-bonded prosthetic graft most likely would result in a recurrent prosthetic graft infection and we thought it was unsuitable to this patient. Instead, we elected to perform an in situ reconstruction with CHA. An aortic reconstruction with CHA is associated with 9% 30-day mortality, 81% 3-year survival and 64% 5-year survival.¹⁵ Perioperative reoperation rate for an in situ CHA replacement is 9%, 89% of patients were free from reoperations at 3 and 5 years after operation.¹⁵ CHAs have a proven clinical record of resistance against *S aureus* infections.^{15–16} Our decision to perform an angioplasty and stenting of the left CIA with a subsequent distal graft anastomosis with the left CIA, not ABF bypass was based on the superior results of aortobiiliac bypass versus ABF bypass in groin wound complications, 0% against 11%, respectively, ($p=0.033$).¹⁷ To prevent a perigraft fluid collection we positioned closed system drains near the graft, did not close the femoral sheaths and applied a VAC dressing to the right groin wound.

Learning points

- ▶ A persistent groin sinus despite an organism-specific antibiotic treatment in a patient with aortobifemoral (ABF) graft signifies a failure of conservative management.
- ▶ Samson group V prosthetic graft infection mandates an emergency operation.
- ▶ A complete removal of an infected aortic graft and an in situ cryopreserved human aortic allogeneic graft replacement permits an effective lower extremities revascularisation.
- ▶ A limited proximal endarterectomy, angioplasty and stenting of unilateral common iliac artery allow replacing ABF with an in situ aortoiliac bypass and reduce groin wound complications.
- ▶ An extensive debridement of devitalised and infected tissues, the use of closed system drains, leaving the femoral sheaths open, administration of negative pressure wound therapy and a prolonged course of microorganism-specific antibiotics may prevent a periprosthetic fluid collection and graft reinfection.

Contributors AK and PI provided care to the patient, wrote the Russian version of the paper, provided photos and images, and obtained consent from the patient for the paper publication. AMB performed literature review and had written the final version of the manuscript. The text of the manuscript was approved by all authors.

Competing interests None.

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