Aortobifemoral graft infection treated with an in situ bovine pericardial self-made bifurcated graft

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Abstract:

Purpose: The purpose of our report is to present a patient with an aortobifemoral graft infection treated with a self-made bifurcated graft created by bovine pericardium patches.

Case Report: We present a 73-year-old male who was admitted because of an aortobifemoral graft infection. The patient was treated by complete removal of the infected graft and in situ reconstruction with a self-made bifurcated graft created by a 12 x 25 cm bovine pericardium patch which was rolled over a 24F chest tube and sutured with two layers of a 5/0 polypropylene running suture. Postoperative course was uneventful. CTA at 3 months revealed the absence of any sign of infection.

Conclusion: Complete excision of the infected prosthetic material, and in situ reconstruction using a self-made bifurcated graft made of bovine pericardium provided good results regarding technical success, patency and freedom from reinfection and reoperation. The bovine pericardium, self-made graft is therefore a valuable part of our surgical armamentarium against aortic graft infections.

According to the European Society for Vascular and Endovascular Surgery (ESVS) 2020 Clinical Practice Guidelines on the Management of Vascular Graft and Endograft Infections, for fit patients with an abdominal aortic vascular graft/endograft infection, complete excision of all graft material and infected tissue is recommended for definitive treatment.[1] The question is how you will restore the perfusion of the lower limbs. In general, there are two options: extra-anatomic and in-line reconstruction, with several choices of grafts being available in the case of in-line reconstruction, including autologous veins, cryopreserved allografts, silver coated grafts, rifampicin bonded polyester grafts and bovine pericardium. According to the ESVS 2020 guidelines, in situ reconstruction with autologous vein should be considered as the preferred method, whereas all the remaining conduits should be considered as alternative solutions.[1] Extra-anatomic reconstruction may be considered for patients with a large abscess or multiresistant microorganisms.[1]

Despite being the best available solution, in situ reconstruction with autologous vein is far from ideal. Harvesting difficulties, a long operation time, and venous morbidity, such as edema, represent some of the most common problems.[1] Moreover, although venous grafts might be effective for highly virulent pathogens, they are not immune to infection, especially in the presence of Gram-negative micro-organisms, MRSA, or Candida spp.[1]

Therefore, the quest for the ideal conduit, combining off-the-shelf availability and resistance to infection, is ongoing. Herein we present a patient with an aortobifemoral graft infection treated with a self-made bifurcated graft created by bovine pericardium patches.

CASE REPORT

A 73-year-old male patient presented at the emergency department of our hospital with abdominal pain. He had an aortobifemoral bypass placed 32 years before for aortoiliac occlusive disease. Two months before the aortobifemoral bypass procedure, he had undergone coronary artery bypass grafting and 25 years later percutaneous transluminal coronary angioplasty. Twenty-nine years after the aortobifemoral bypass he presented with a right femoral pseudoaneurysm at another hospital and was treated with replacement of the distal few centimeters of the right limb of the graft with a new prosthetic graft and a new femoral anastomosis.

The patient was afebrile and his abdomen was soft and non-tender. His lab tests disclosed leukocytosis (22,430/μl) and elevated C-reactive protein (CRP) levels (151 mg/L). A computed tomography angiography (CTA) was performed

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which revealed a fluid collection around the aortobifemoral graft limbs which, in concert with the history of the patient and the lab tests, substantiated the diagnosis of graft infection (Figure 1). An abdominal CTA, performed three years before, when the right femoral pseudoaneurysm was treated, was also available for comparison and revealed the absence of any fluid collection around the graft, further confirming the already made diagnosis.

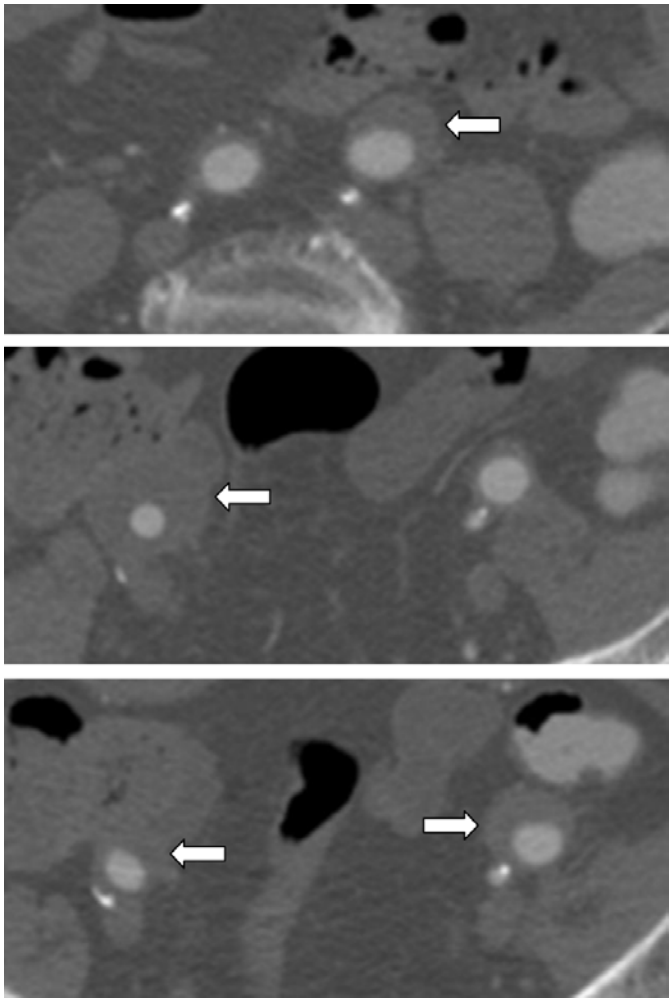

Figure 1: Abdominal CTA revealing the presence of fluid collections (arrows) around the aortobifemoral graft limbs, indicating graft infection.

The patient was admitted to the hospital and a broad-spectrum intravenous (IV) antibiotics regimen was established, consisting of ciprofloxacin 400 mg bid and metronidazole 500 mg tid. Two blood cultures taken before the initiation of the antibiotics were negative. Despite this fact, white blood cell count returned to normal limits within 3 days (9,700/μl) whereas CRP remained elevated (98.5 mg/L). This was considered to be the ideal time for the excision of the aortobifemoral graft. The length of the conduit required for an in-line reconstruction was measured on the CTA and was found to be 30 cm (Figure 2). Due to the long length of the required vascular conduit, reconstruction with a self-made bifurcated bovine pericardium graft was decided.

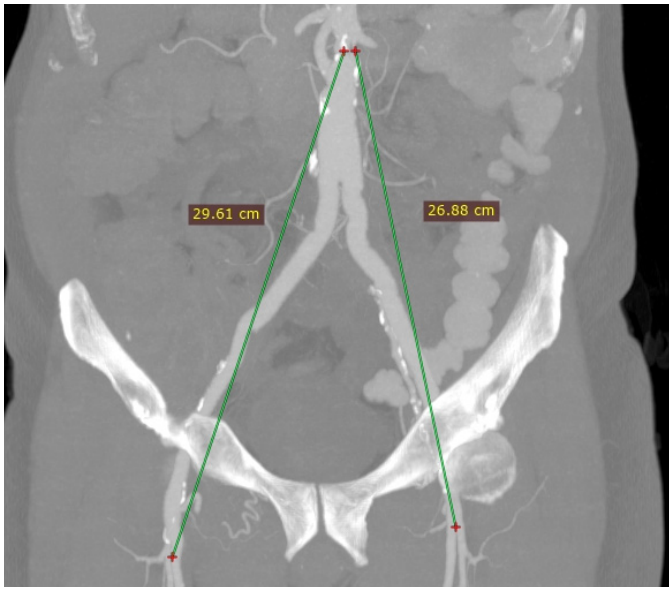

Figure 2: Abdominal and lower limb CTA revealing that the distance from the lower renal artery to the common femoral artery bifurcation was 30 cm on the right side and 27 cm on the left.

Two tube grafts were prepared using a 12 x 25 cm bovine pericardial patch (PERI-GUARD Patch, Baxter International Inc. Deerfield, IL, USA) which was rolled over a 24F chest tube and sutured with two layers of a 5/0 polypropylene (Corolene, Peters Surgical, Boulogne-Billancourt, France) running suture, the first one in a meandering fashion and the second one in an over and over technique. The two tube grafts were then sewn together at their proximal end to form a bifurcated graft. The required length of 30 cm was achieved by adding a main body in the bifurcated graft. The main body was created by rolling a bovine pericardial patch over both 24F chest tubes and suturing it with two layers of a 5/0 Prolene running suture (Figure 3).

Figure 3: Creation of a bifurcated graft by suturing together two tube grafts and then adding a main body, all made by bovine pericardium patches rolled over chest tubes and sewn with 5/0 polypropylene sutures.

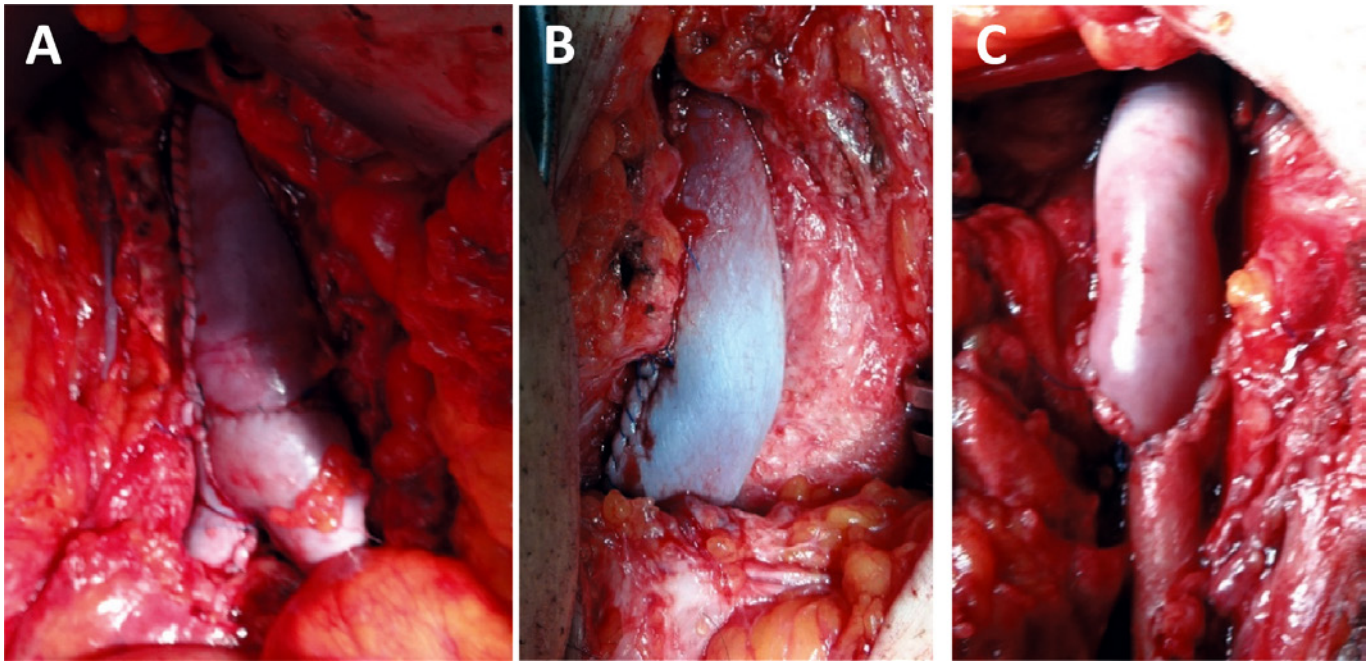

Figure 4: Aortobifemoral bovine pericardium graft after successful insertion. (A) main body, (B) right femoral and (C) left femoral anastomosis.

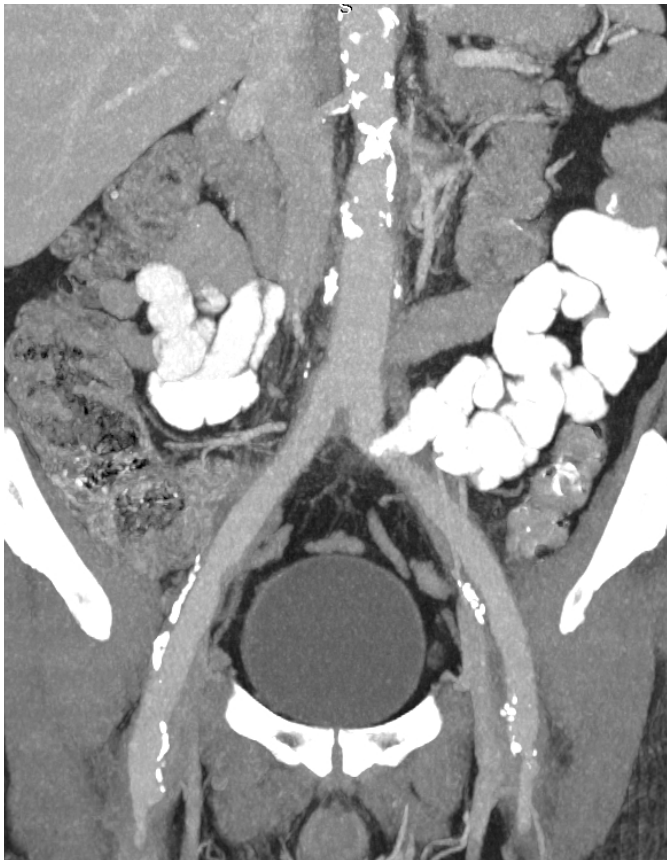

Figure 5: CTA 3 months after the implantation of the bifurcated bovine pericardium graft reveals an ideal reconstruction without any signs of infection.

Under general anesthesia, a laparotomy and two longitudinal femoral incisions were performed by a second team working simultaneously. After careful adhesiolysis, the aortobifemoral graft was exposed, the aorta was clamped between the two renal arteries and the graft was excised and replaced by the self-made bifurcated bovine pericardium graft (Figure 4). The synthetic graft as well specimens of the surrounding tissues were sent for bacterial culture, which revealed the presence of a multisensitive Staphylococcus epidermidis.

Postoperative course was uneventful. Following instructions by the hospital infectious disease team, the patient received IV antibiotics for another two weeks and was discharged with an oral antibiotic regimen of ciprofloxacin 500 mg and minocycline 100 mg twice daily.

A follow-up CTA was performed 3 months after the operation and disclosed unrestricted patency of the bovine pericardium graft and complete regression of all signs of retroperitoneal infection (Figure 5). Subsequently, antibiotic treatment was discontinued. After another three months, the patient remains asymptomatic.

DISCUSSION

The self-made bovine pericardial graft combines several properties of an ideal vascular conduit used for aortic reconstruction in the case of prosthetic graft infection, including off-the-shelf availability, high resistance to infection, good patency and low reintervention rates. Whether these advantages are alleged or real has been evaluated in a recent systematic review of 4 studies describing 71 patients treated for aortic graft and native aortic infections with orthotopic xenopericardial grafts.[2] The excellent patency was confirmed beyond any doubt, since there were no cases of early or late graft thrombosis. The resistance to infection, on the other hand, is relatively high but not absolute, with 5.6% of the patients suffering from a recurrent infection leading to the death of two of them by rupture at 4 and 7 months after implantation

of the self-made tube graft. Within a mean follow-up of 28 months, 3.7% of the patients had a false aneurysm, 1.4% early rupture and 3.7% late rupture. Two retrospective studies, published thereafter, confirmed the high level of resistance to infection that the bovine pericardial graft offers, reporting a reinfection-free rate of 98-100% after a median follow-up of 6-11 months.[3,4]

The risk of recurrent infection, leading to either graft rupture or false aneurysm formation, makes the need of postoperative antibiotic therapy imperative. Nevertheless, there is no consensus regarding the duration of antimicrobial therapy. In the largest series of 35 patients, published by Weiss et al, the median duration of post-operative antimicrobial therapy was 76 days, ranging from 26 to 1058 days.[5] Lifelong antimicrobial suppression therapy was indicated only in patients with incomplete graft removal. In another series of 13 patients by Lutz et al, all patients received antibiotics during surgery and for at least two weeks following surgery.[6] If persisting clinical signs of infection or fistulae were present, antibiotics were given for 3 months following surgery. Kubota et al recommend that antibiotic treatment should be stopped after 4 to 6 weeks, if inflammatory marker values have become normal and the diagnostic images no longer show evidence of the infection by that time.[7] Otherwise, antibiotic treatment should be continued. Czerny et al, on the other hand, recommend discontinuation of the antibiotics after 6 months, if there is favorable clinical evolution (absence of fever or weight loss), normalization of infectious values (erythrocyte sedimentation rate, C-reactive protein serum levels, white blood cell count) and normalized imaging.[8] Otherwise, antibiotic treatment should be continued. Although no definite conclusion can be made from a single case, in our patient a 3 months antibiotic therapy proved to be adequate. The exact duration of the antimicrobial therapy, as well as the question of whether this decision should take into account the type of microorganism and the presence of an aortoenteric fistula remain to be answered.

Staphylococcus aureus, gram-negative bacteria (mostly Escherichia coli), enterococcus and fungi are the most commonly isolated microorganisms.[2] However, no association between the type of microorganism and mortality or re-infection has been found.[2]

Although autologous vein grafts are also not immune to infection, they remain our first choice, in accordance with the ESVS guidelines. The associated venous morbidity depends on the length of the vein that is harvested. It is our practice to limit the length of the vein we harvest in the subsartorial part, from the adductor canal to the junction between the profunda and the common femoral vein, so that the peri-geniculate collateral vein network between the popliteal and the profunda femoral vein remains intact. In this particular patient, however, the length of the vein graft had to be 30 cm, which means that the popliteal vein should be harvested down to the knee joint. The presence of the perigraft abscess, on the other hand, prevented us from using a synthetic graft, even if it was silver coated or rifampicin soaked.

The timing of the infected graft explantation and the aortic reconstruction is another point where a prudent decision needs to be made. Such operations are associated with a 30-day mortality of about 25%, most part of which is due to septic multiorgan failure.[2] Czerny et al have shown that perioperative mortality is excessively high in emergency procedures and advocate their policy of waiting until clinical as well as laboratory signs of systemic infection are at least decreasing.[8] This is the strategy that we have also adopted in out Department and has been justified by the treatment outcome.

A recent development is the commercial availability of prefabricated bovine pericardial grafts, produced by BioIntegral Surgical Inc, Mississauga, Ontario, Canada. These grafts received CE certification in December 2019. In a series of 21 patients, published by Burghuber et al in 2021, the 30-day mortality was 9.5%, and the 1- and 2-year overall survival was 84% and 75%, respectively.[9] Of the 21 patients treated with the prefabricated bovine pericardial graft, 89% had remained free of recurrent infection after a median follow-up of 22 months. At 2 years, the primary and assisted primary patency rates were 86% and 94%, respectively. No limbs were lost during follow-up.

In conclusion, complete excision of the infected prosthetic material, and in situ vascular reconstruction using a self-made bifurcated graft made of bovine pericardium as a neoaortoiliac system provided good results regarding technical success, patency and freedom from reinfection and reoperation. The bovine pericardium self-made graft is therefore a valuable part of our surgical armamentarium against aortic graft infections.

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