Case Report

The Use of Autologous Subcutaneous Fat Tissue to Embolize an Infected Iliac Artery Pseudoaneurysm

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Abstract

We describe a patient with a fistula between small bowel and a polyester patch of the common iliac artery. After emergency treatment with an endograft, the patch was replaced by a venous patch. Within 3-week a symptomatic pseudoaneurysm developed. It was decided to embolize the pseudoaneurysm using autologous subcutaneous fat, followed by a femoro-femoral crossover bypass using an allograft. Using this technique, the pseudoaneurysm was successfully excluded. This case shows that subcutaneous fat tissue can be used as an autologous embolic material, also in larger vessel pathology and in cases of ongoing infection, where regular embolization material cannot be used.

Keywords

embolisation, infection, subcutaneous fat, pseudoaneurysm

Introduction

Graft infections are a feared long-term complication after vascular surgery with aorto-enteric fistula being a specific subset. Traditionally, the only curative treatment was considered to be complete removal of graft material and reconstruction with autologous material or an extra-anatomic bypass. More recently, staged procedures became more popular, while strictly conservative treatments, including percutaneous drainage irrigation, are considered only in patients unfit for surgery. Surgery for graft infections is related to a high morbidity rate, with in situ reconstructions having less complications, compared to extra-anatomical bypass.[1,2] The guidelines of the European Society of Vascular Surgeons recommend complete removal of graft material and infected tissue for fit patients with an abdominal vascular graft endograft infection.[3]

In the current paper we describe the use of autologous subcutaneous fat to embolize an iliac artery pseudoaneurysm in an infected environment, after failed reconstruction using venous material.

Case

A 69-year old male patient, with a history of myocardial infarction, renal insufficiency (Glomerular filtration rate 44 mL/min/1.72 m^2), hypertension and diabetes mellitus was admitted to the emergency department with rectal bleeding, with an haemoglobin level of 4.8 mmol/L. Patient had been treated 16-year earlier for aorto-iliac occlusive disease in another hospital. An endarterectomy of the aortic bifurcation was then performed, followed by patching of the right common iliac artery (CIA) using polyester material, and a left-sided polyester iliofemoral bypass with a bilateral endarterectomy of the common femoral artery. Contrast-enhanced computed tomography (CTA) confirmed the diagnosis of an aorto-enteral fistula originating from the patch at the right aneurysmatic CIA (Figure 1A and B). The iliofemoral bypass on the left side was occluded, without signs of infection. In an emergency procedure, a PTFE endograft was deployed (Gore Excluder Iliac Limb, W.L. Gore and associates, Phoenix, AZ) as a bridge to definitive surgery, while intravenous antibiotics were continued. Blood cultures showed a *Pseudomonas Aeruginosa*. A Positron emission tomography (PET)/CT scan was performed to exclude other locations of (graft) infection. It demonstrated increased focal uptake in the region of the

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Figure 1. Transversal (A) and coronal (B) slide of a contrast-enhanced computed tomography showing a proximity of the small bowel (arrow) to the aneurysmatic right common iliac artery with signs of inflammation.

right CIA, without other locations of increased uptake. Two months after treatment, patient was electively re-operated. A hostile abdomen was encountered, related to a cicatricial hernia, which lead to inadvertent enterotomy. Eventually the area of the right CIA could be exposed to clamp safely. There were no signs of an infection in area of the occluded lift-sided bypass and this area was not further explored to prevent secondary infection. The endograft was visible outside of the artery and removed. After closure of the small bowel, the polyester patch was removed and replaced by a great saphenous vein patch. Tissue cultures showed, in addition to the *Pseudomonas Aeruginosa*, *Proteus Mirabilis* and *Enterococcus Faecium*. The *Pseudomonas Aeruginosa* was characterized as intermediate for piperacillin/tazobactam, ceftazidime and ciprofloxacin, and the *Enterococcus Faecium* was resistant to gentamycin and amoxicillin. Postprocedural, the patient went to the intensive care unit where intravenous antibiotics were continued. He was discharged from the hospital at the ninth postoperative day. Two weeks later he was re-admitted with abdominal complaints in his right lower quadrant. Patient had a temperature of 38.6 °C, a serum leucocyte count of 10.6×10^6/L and a C-reactive protein level of 102 mg/L. A CT scan showed disintegration of the venous patch leading to a pseudoaneurysm (Figure 2A and B). In addition, patient was diagnosed with COVID-19, a renal function decline to a glomerular filtration rate of 22 mL/min/1.72 m^2 and congestive heart failure.

A relaparotomy was considered not a viable option in his condition and, after informed consent, it was decided to exclude the right iliac axis endovascularly and create a femoro-femoral crossover bypass using an allograft. As ongoing local infection was suspected, the use of regular coils was not a valid option. Therefore, it was chosen to embolize the pseudoaneurysm using autologous subcutaneous fat tissue. First both common femoral arteries were exposed, followed by thrombectomy of the left-sided iliofemoral bypass. There were no local signs of infection in the left groin. Subsequently, an angiography was performed showing residual stenosis, treated with a self-expanding stent (8 × 60 mm, EverFlex, Medtronic, Santa Rosa, CA). A 14 × 40 mm self-expanding stent (Epic, Boston Scientific, Marlborough, MA) was positioned from the distal aorta into the left proximal CIA. There was a 3 mm area in the right proximal CIA, that was used to host a 16 × 8mm Amplatzer Vascular Plug (Abbott Cardiovascular, Plymouth, MN) (Figure 3A and B). Thereafter the nitinol stent was deployed to prevent dislodgement of the plug into the aorta. In order to deliver the fat tissue, a 16 mm Dryseal (W.L. Gore and associates) was positioned in the pseudoaneurysm. Subcutaneous fat tissue was harvested from the groin and fractioned in fragments of 2-3 mm that were drenched in thrombin (Tisseel, Baxter, Deerfield, IL). The particles were loaded in a 12Fr Dryseal sheath that was advanced through the 16Fr sheath into the desired location (Figure 3C). The dilator of the 12Fr sheath was modified into a pusher by removing the distal 1 cm. The fat particles were delivered into the pseudoaneurysm, and repeated angiographies were performed to monitor progress (Figure 3A and E). The procedure was completed by a femoro-femoral crossover using a Biointegral allograft (Biointegral Surgical Inc, Mississauga, Canada). Patient went to the ICU unit and antibiotics were continued. A CT scan at the second post-procedural day showed an adequate occlusion of the right iliac tract. Unfortunately, the patient developed a multiple organ failure and cardiogenic shock with dialysis dependency. Patient died the 8 day after the latest intervention due to these complications. Postmortem investigation was not performed.

Retrospective "patient file" research is not in the scope of the Dutch WMO (*Wet Mensgebonden Onderzoek* or Law on Human Subjects Research) and as a consequence written patient informed consent was not obtained.

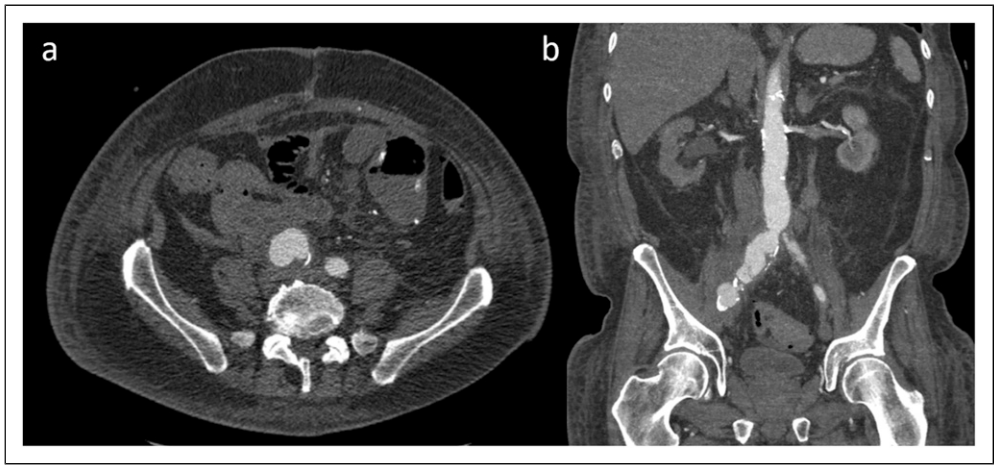

Figure 2. Transversal (A) and coronal (B) slides of a pre-procedural contrast-enhanced computed tomography, showing a pseudoaneurysm of the right common iliac artery, caused by infectious disintegration of a vena saphena magna patch.

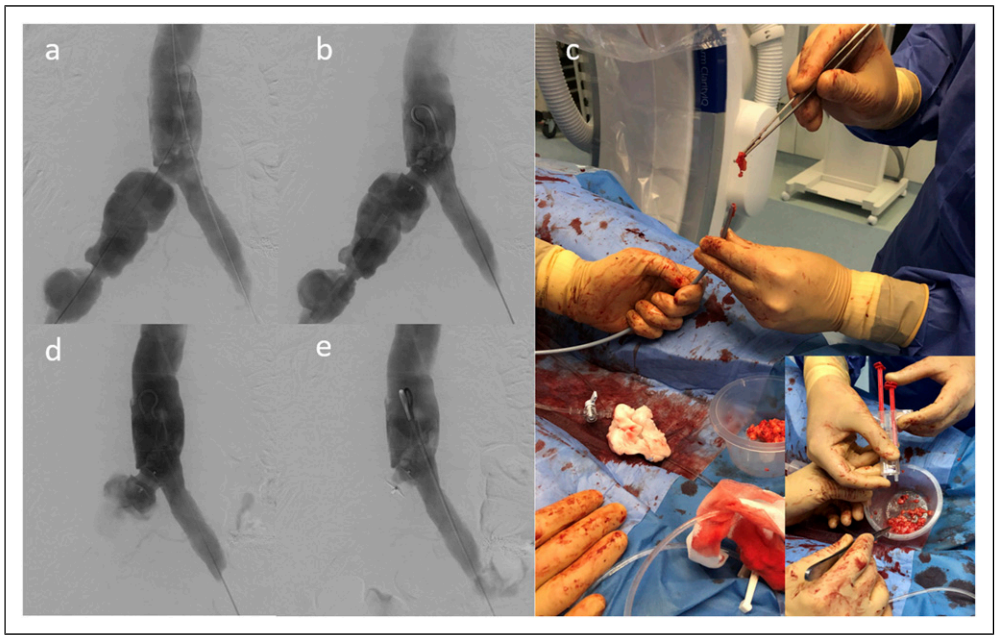

Figure 3. Procedural angiography showing the pseudoaneurysm of the right common iliac artery (A), the result after placement of an Amplatzer Vascular Plug (B). Subcutaneous fat tissue, harvested from the groin, was drenched in thrombin and loaded in a 12Fr sheath, which was advanced into the pseudoaneurysm through a 16Fr sheath, where the fat tissue was delivered as embolic material (C). Angiography after partial occlusion of the right iliac tract (D) and the completion angiography showing a complete exclusion of the right iliac tract (E).

Discussion

We have described the successful use of subcutaneous fat tissue, enriched with thrombin, to occlude a symptomatic infected pseudoaneurysm of a right CIA. Literature on the use of fat tissue for embolization is scarce and limited to small vessel bleedings. He et al. has described a series of 8 patients that were treated for a coronary artery perforation using autologous fat particles.[4] Technical success was achieved in all patients, without major complications. In another publication Hasan et al, described the successful use of autologous fat for the embolization of bleeding complications after percutaneous nephrolithotomy.[5] In both studies small particles of fat tissue were used that were delivered over microcatheters. In our patient, the volume that needed to be treated was much larger and therefore the particles were delivered through a 12 French sheath and, as in the 10 cases described above, technical success was achieved. Unfortunately, our patient died after 2 days due to multiple organ dysfunction syndrome and therefore only an early CT scan was available. Hence, the long-term durability of the treatment remains to be uncertain. Interestingly, in the publication of He et al. 2 patients showed a

recanalization of the treated artery after, respectively, 1 week and 2 years follow-up.

Embolization strategies in an infected environment are complex. Regular embolization coils consist of a nitinol spring loaded with fibres of polyester and might therefore become a nidus for ongoing infection. In addition, there is no evidence on the safety of using novel urethane-based polymer materials, like the Shape Memory Polymer, in an infected environment. We decided to drench the subcutaneous fat particles in thrombin, in an attempt to increase the likelihood of success in this large vessel embolization. Whether this addition is needed is unclear and would require further investigation. In addition, the use of contrast media could also be advocated in order to better localize the particles during delivery.

In the current case we preferred to use a femoro-femoral bypass using a biograft over an axillary-femoral bypass. The latest guideline on the management of vascular and endovascular graft infections have described low patency and high amputation rates for the latter with a reinfection rate up to 27%.[3] The same guideline state that autologous veins have the lowest reported infection rates, between 0% and 6%) and are related to high patency rates. Their use in multiresistant strains is still unclear and there are reports of poor outcomes in the presence of Gram negative micro-organisms, Methicillin-resistant *Staphylococcus aureus*, or *Candida* species, particularly when concomitant sepsis or and aorto-enteric fistula is present. This may explain the occurrence of the pseudoaneurysm of the venous patch in our case.

In conclusion, subcutaneous fat tissue can be used as an autologous embolic material, also in larger vessel pathology and in cases of ongoing infection, where regular embolization material cannot be used.

Declaration of Conflicting Interests

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References

1. Batt M, Feugier P, Camou F, et al. A meta-analysis of outcomes after in situ reconstructions for aortic graft infection. *Angiology*. 2018;69:370-379.
2. O'Connor S, Andrew P, Batt M, Becquemin JP. A systematic review and meta-analysis of treatments for aortic graft infection. *J Vasc Surg*. 2006;44:38-45.
3. Chakfé N, Diener H, Lejay A, et al. Editor's choice - European society for vascular surgery (ESVS) 2020 clinical practice guidelines on the management of vascular graft and endograft infections. *Eur J Vasc Endovasc Surg*. 2020;59:339-384.
4. He LY, Han JL, Guo LJ, Zhang FC, Cui M, Gao W. Effect of transcatheter embolization by autologous fat particles in the treatment of coronary artery perforation during percutaneous coronary intervention. *Chin Med J (Engl)*. 2015;128:745-749.
5. Arı H, Arı S, Can V. A novel embolization technique for renal hemorrhage complication by autologous fat tissue. *Balkan Med J*. 2020;37:108-111.