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## Case Report

# Iatrogenic femoral artery pseudoaneurysm surgically repaired with combined bovine pericardial roll and autologous great saphenous vein grafts

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## ABSTRACT

Iatrogenic femoral artery pseudoaneurysm caused by invasive procedures is one of the common complications for endovascular interventions. We present a case of a young male with a complex iatrogenic femoral artery pseudoaneurysm as a result of iatrogenic femoral artery puncture. The defective femoral artery was repaired with combined bovine pericardial tube and autologous great saphenous vein grafts. Computed tomography angiography showed the grafts were still patent one year after the surgery.

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## Introduction

Iatrogenic femoral artery pseudoaneurysm (IFAP) is quite common during endovascular procedures.<sup>1</sup> Small IFAPs can spontaneously clot or be easily treated with non-surgical procedures, such as manual compression or duplex ultrasound-guided percutaneous thrombin injection.<sup>2</sup> Here we report a case of a young male patient with a complicated IFAP, and we surgically repaired the defective femoral artery with combined bovine pericardial roll (BPR) and autologous great saphenous vein (GSV) grafts. The consent of publication has been obtained from the patient.

## Case report

A 26-year-old male patient who suffered from the pseudoaneurysm of left femoral artery was referred to our hospital with no history of hypertension, diabetes, obesity or other specific diseases (such as autoimmune diseases). However, he had a history of deep venous thrombosis of the right lower extremity due to traditional Chinese acupuncture, and a temporary filter of inferior vena cava was then successfully implanted. The filter was retrieved through the puncture site of left femoral vein 3 weeks later. However, the left common femoral artery (CFA) was accidentally injured during

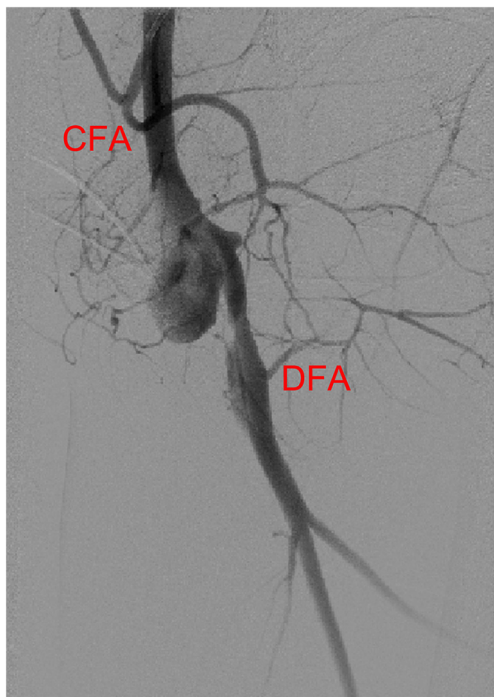
the retrieving, and a pseudoaneurysm was found at the puncture site. The patient was treated unsuccessfully with compression bandaging and ultrasound-guided thrombin injection (UGTI), and then he was referred to our hospital (10 months after the formation of the pseudoaneurysm). A pulsating mass was palpable and the distal pulses of the left lower limb presented unperceivable. Duplex ultrasound demonstrated a 6 cm × 4 cm × 4cm pseudoaneurysm over the bifurcation, and the pseudoaneurysm neck was measured nearly 1cm. Thrombosis in the proximal end of the left superficial femoral artery (SFA) was also confirmed. Digital subtraction angiography (DSA) was performed to reveal a femoral pseudoaneurysm and the SFA was confirmed to be occluded (Fig. 1).

Accordingly, an open surgical approach was proposed. The surgery was performed on schedule and a contained pseudoaneurysm was revealed. The pseudoaneurysm was difficult to dissect due to severe inflammatory infiltration and fibroplasia, which was confirmed by hematoxylin and eosin (H&E) staining (Fig. 2). The distal and proximal ends of the defective femoral artery were clamped to hemostasis with vascular forceps. The mass, together with the involved CFA, SFA and deep femoral artery (DFA) about 6 cm long, was excised meticulously. The thrombi in the proximal end of SFA were removed with a 5-French embolectomy catheter (LeMaitre Vascular, Burlington, USA). Then a 5 cm × 3 cm bovine pericardial patch (BalMedic, Beijing, China) was sutured with 6–0 Prolene into a hollow roll graft, which was anastomosed end-to-end with the stumps of the left CFA and DFA. A segment of ipsilateral GSV about 5cm long was harvested. The proximal end of the GSV graft was anastomosed end-to-end with the SFA, while the distal end was

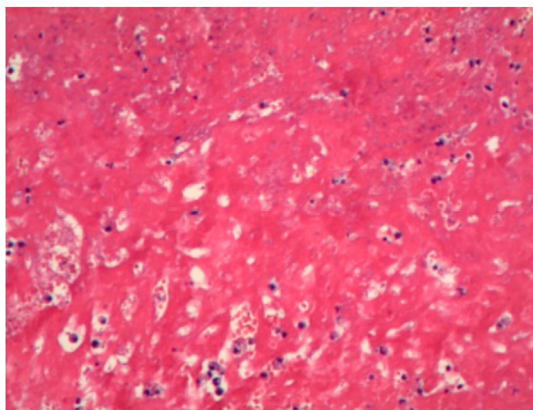
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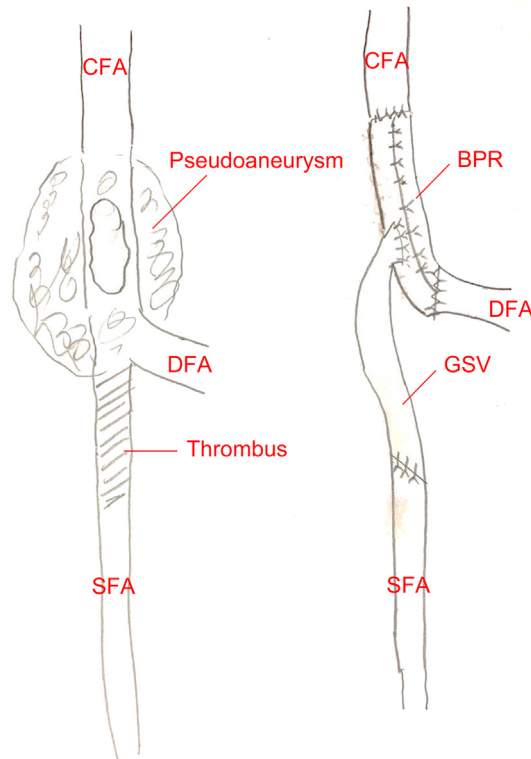


**Fig. 1.** Digital subtraction angiography was performed to reveal a left CFA pseudoaneurysm with a wide neck. Meanwhile, the SFA was occluded. CFA: common femoral artery; DFA: deep femoral artery; SFA: superficial femoral artery.

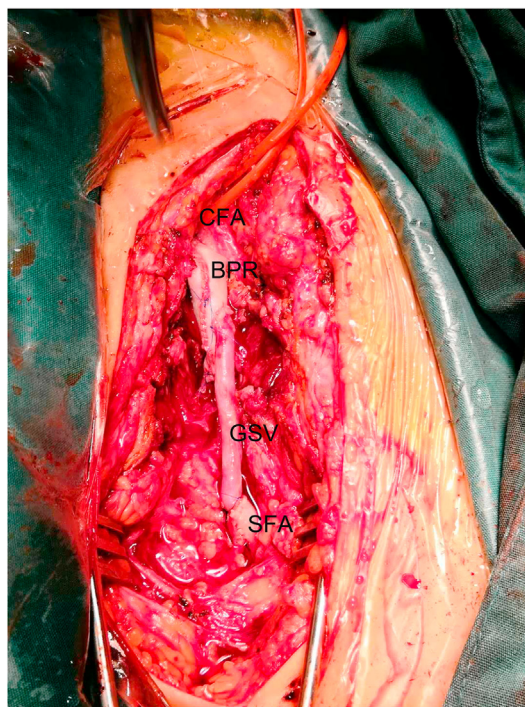


**Fig. 2.** HE staining (10 × ) revealed inflammatory infiltration and fibroplasia in the pseudoaneurysm sac.

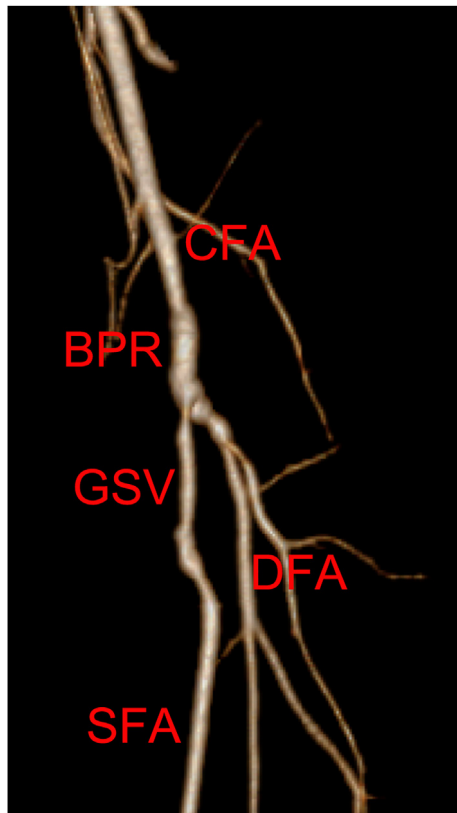
sutured by means of end-to-side anastomosis with the BPR graft (Figs. 3 and 4). The blood flow was restored after 2 hours of blocking, and the pulsation of popliteal artery and dorsalis pedis artery could be perceived. The incision was closed in layers and there were no postoperative complications. The operation lasted 4 hours. The estimated blood loss was about 400ml and thus no blood transfusion or autotransfusion was performed. An elevated ankle brachial index (ABI) of the affected extremity was detected after the reconstruction (0.95 versus 0.21). The patient was discharged 14 days after the surgery with full recovery. After the discharge, the patient was prescribed with dual anti-platelet medications for 3 months. Computed tomography angiography performed 1 year after surgery showed patency of the combined grafts (Fig. 5).



**Fig. 3.** The schematic diagram of the operation. The BPR graft was anastomosed end-to-end with the stumps of the left CFA and DFA, and the ipsilateral GSV graft was implanted reversely between the roll graft and recanalized SFA. CFA: common femoral artery; BPR: bovine pericardial roll; GSV: great saphenous vein; DFA: deep femoral artery; SFA: superficial femoral artery.



**Fig. 4.** The photograph of the operation. CFA: common femoral artery; BPR: bovine pericardial roll; GSV: great saphenous vein; SFA: superficial femoral artery.



**Fig. 5.** Computed tomography angiography performed 12 months after surgery showed patency of the implanted grafts. CFA: common femoral artery; BPR: bovine pericardial roll; GSV: great saphenous vein; DFA: deep femoral artery; SFA: superficial femoral artery.

## Discussion

IFAP has been reported to complicate up to 2%–7.7% of endovascular procedures.<sup>1</sup> Management of small IFAPs may need observation alone. Some non-surgical approaches such as compression bandaging and UGTI are also deemed acceptable.<sup>3</sup> Our patient was treated with manual compression and UGTI at first. Instead, thrombosis was confirmed in the left SFA by means of duplex ultrasound, which was probably the complication of thrombin injection. Balloon-assisted thrombin injection might reduce the risk of thrombosis in distal artery. Samal and colleagues<sup>4</sup> reported 4 cases of patients with femoral pseudoaneurysms who were treated with a combination of percutaneous thrombin injection and temporary balloon isolation under fluoroscopy without any complications.

Endovascular therapy has also been proved to be effective in the treatment of IFAP, such as coil embolization, stent grafts<sup>5</sup> and suture-based closure devices (ProGlide).<sup>6</sup> As for the young patient, because of the occluded SFA caused by thrombosis and the large perforating lesion close to the bifurcation, endovascular repair was considered unfeasible. Coil embolization would worsen the existing thrombosis, stent grafts might cover the DFA, and the pseudoaneurysm neck was too wide for a ProGlide device.

Open surgical repair is deemed to be the gold-standard treatment modality for pseudoaneurysms, especially for the complicated ones.<sup>2</sup> For our patient, open surgery might be the last and only hope. During the surgical operation, we found that the pseudoaneurysm severely adhered to the surrounding tissues which might be caused by the chronic inflammatory stimulation of injected thrombin. And a part of the involved femoral artery,

together with the pseudoaneurysm sac, had to be excised and reconstructed. Scavee and colleagues<sup>7</sup> reported a surgical procedure to successfully reconstruct a femoral bifurcation with a reversed saphenous vein graft. Despite the good anti-infective property for GSV grafts, the caliber mismatch of GSV with the CFA in our patient was a big problem, and then the combination of autologous GSV and self-made bovine pericardial roll graft might be a better option. Bovine pericardium patch has been widely used to treat congenital cardiac diseases. Several researchers have attempted to repair aortic defects with xenopericardial roll grafts.<sup>8</sup> Salles et al.<sup>9</sup> concluded the good properties of bovine pericardial conduits: softness, easy surgical handling, hemostatic anastomosis for suture lines, and low thrombogenicity. Another study has proved a lower incidence of infection for BPR grafts compared to Dacron grafts.<sup>10</sup> Almási-Sperling and colleagues<sup>11</sup> surgically treated the patients suffering from prosthetic graft infections with bovine pericardium and they found that bovine pericardium reconstruction showed a good short-term outcome after aortic or peripheral prosthetic graft infections. Because of the low incidence of infection for bovine pericardium, we chose BPR graft for vascular reconstruction. We anastomosed the BPR graft end-to-end with the stumps of CFA and DFA, and then implanted the harvested GSV graft reversely between the roll graft and recanalized SFA. The short-term effect of the procedure is promising, but the long-term result is absent and only one case is available. In light of this, a larger randomized controlled trial might be needed for future application.

In conclusion, we report a case of a young patient with a complex IFAP as a result of iatrogenic femoral artery puncture. The defective femoral artery can be surgically repaired with combined bovine pericardial roll and autologous great saphenous vein grafts.

## Funding

Nil.

## Ethical statement

All the procedures performed in the case report were approved by the patient and ethics committee.

## Declaration of competing interest

The authors declare no conflicts of interest.

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