

Detachable coil embolisation for iatrogenic femoral arteriovenous fistula in patients with CHDs

Brief Report

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Abstract

We present two cases of patients with iatrogenic femoral arteriovenous fistula who underwent successful embolisation using three-dimensional shape detachable coils. A 49-year-old male with Tetralogy of Fallot had arteriovenous fistula which developed from the common femoral artery to the femoral vein with an aneurysm and a 17-year-old female with single ventricle after total-cavo-pulmonary-connection had two arteriovenous fistulas which developed from the internal iliac artery to the femoral vein. A total of six and seven pieces of detachable coils were necessary for complete occlusion, respectively. No complications were recorded. The advantage of the detachable coil is a wide variation and repositioning until the coil achieves good stabilisation and an ideal configuration.

Iatrogenic femoral arteriovenous fistula occasionally occurs due to an inferior puncture,¹ large sheath insertion.^{1,2} The incidence of iatrogenic femoral arteriovenous fistula was reported to range from 0.11% to 0.86% of femoral punctures.^{3,4} Femoral iatrogenic femoral arteriovenous fistula is a clinically important issue, especially in patients of the complex CHDs with right heart failure. Although small femoral iatrogenic femoral arteriovenous fistula might resolve spontaneously or be closed by external compression with an ultrasound probe,⁵ a significant femoral iatrogenic femoral arteriovenous fistula is surgically repaired. Meanwhile, catheter intervention could be applied as an alternative. A stent graft or covered stent is implanted for the purpose of sealing the entry of the femoral iatrogenic femoral arteriovenous fistula.^{6,7} Pushable coil embolisation is also used for embolisation.² We experienced novel embolisation with three-dimensional (3D)-shape detachable coils for femoral iatrogenic femoral arteriovenous fistula in two patients.

Cases

Case 1: A 49-year-old male was diagnosed as right femoral iatrogenic femoral arteriovenous fistula with Tetralogy of Fallot, pulmonary atresia after a Rastelli procedure with impaired right ventricular. The right femoral iatrogenic femoral arteriovenous fistula was noticed because of his symptom of leg dullness. Angiography showed femoral iatrogenic femoral arteriovenous fistula from the common femoral artery with an aneurysm to the femoral vein. The aneurysm size was 9.7 × 13.4 mm (Fig 1a). Catheter embolisation was indicated because of the significant left to right shunt with an enlargement of the femoral vein and the symptom of leg dullness with right heart failure. Bounding pulse was subcutaneously palpable in the right inguinal area. A multi-purpose catheter advanced into the right femoral artery from the contralateral left femoral artery approach. We planned to make a frame inside of the aneurysm with similar size of a 3D coil and then to fill a small coil inside of the frame. Although initially the detachable coil (Target XL coil, Striker, USA) easily went through the aneurysm and migrated to the femoral vein because of high blood flow (Fig 1b), the coil could be repositioned until achieving the ideal configuration and stabilisation. After several repositioning, two pieces of Target XL coil (360 configuration/12 mm/standard type) were successfully deployed into the aneurysm to make a frame. Subsequently, four pieces of Target XL coils (360 configuration/soft type) were filled in frame coils. A total of six pieces of coils were necessary for complete occlusion (Fig 1c). His leg dullness was eased after the procedure.

Case 2: A 17-year-old female was diagnosed as right femoral iatrogenic femoral arteriovenous fistula with single ventricle and pulmonary stenosis after a total cavo-pulmonary connection. A femoral iatrogenic femoral arteriovenous fistula was noticed soon after total cavo-pulmonary connection. Initially, the right femoral iatrogenic femoral arteriovenous fistula was surgically ligated but developed again with continuous murmur. In our institution, femoral iatrogenic femoral arteriovenous fistula in patients with total cavo-pulmonary connection is an indication for surgical or catheter intervention because of its potential risk of the right heart failure. Angiography showed two collateral arteries, the proximal collateral artery and the distal

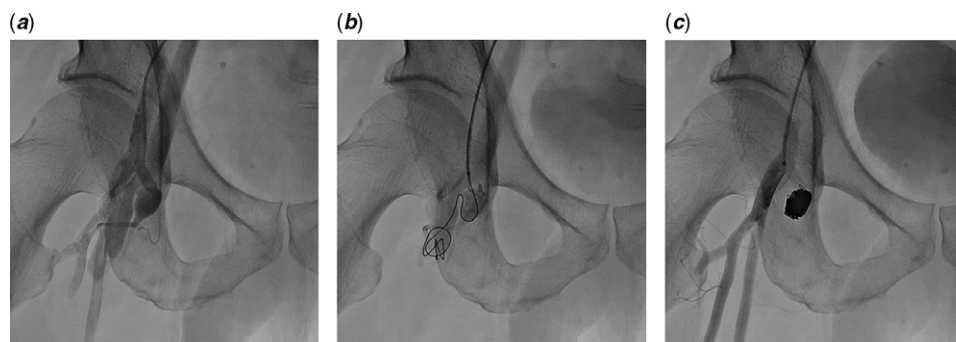


Figure 1. (a) Femoral arteriovenous fistula with aneurysm. (b) Coil went through the aneurysm and migrated to femoral vein. (c) Six pieces of detachable coils were implanted for complete occlusion with compact configuration and stabilisation.

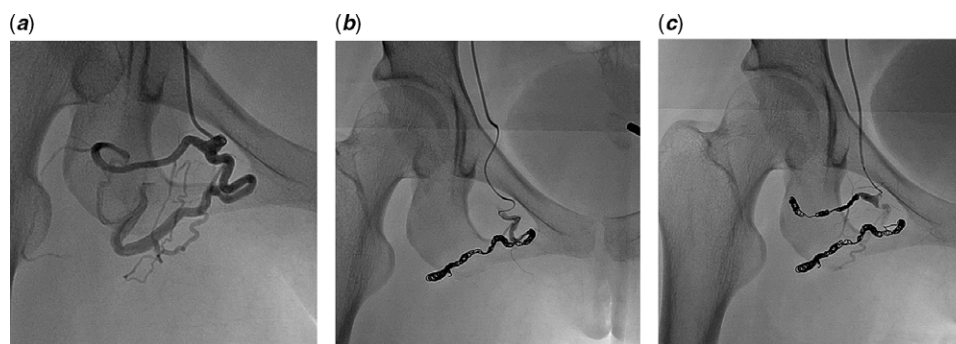


Figure 2. (a) Proximal collateral artery and distal collateral artery branched off from right common internal iliac arteries. (b) Four pieces of detachable coils were implanted for complete occlusion in distal branching artery. (c) Three pieces of detachable coil were implanted for complete occlusion in proximal branching artery.

collateral artery which branched off from the right common internal iliac arteries (Fig 2a). A cobra-type catheter advanced into the branching arteries from the contralateral left femoral artery approach. Three pieces of detachable coil (5 mm, 4 mm, and 3 mm of Delta fill, CERENOVUS, NJ) and 1 piece of fill coil (Galaxy G3 3 mm, CERENOVUS, NJ) were implanted for complete occlusion in the distal branching artery (Fig 2b). Subsequently, two pieces of detachable coil (4 mm and 3 mm of Delta fill, CERENOVUS, NJ) and one piece of fill coil (Galaxy G3 3 mm, CERENOVUS, NJ) were implanted for complete occlusion in the proximal branching artery (Fig 2c).

Written informed consent was obtained from both patients before the procedure. No complications were recorded for 3 years of follow-up.

Discussion

Significant femoral iatrogenic femoral arteriovenous fistula could result in congestive heart failure with volume overload or limb ischaemia. Especially, patients with Fontan circulation or impaired cardiac function after surgical repair could be vulnerable to even a small femoral iatrogenic femoral arteriovenous fistula. Surgical repair for a femoral iatrogenic femoral arteriovenous fistula is widely done for standard treatment. However, surgical repair might cause complications such as infection, nerve injury, haemorrhage, or recurrence of the femoral iatrogenic femoral arteriovenous fistula.

Catheter intervention was tried for femoral iatrogenic femoral arteriovenous fistulas. A covered stent or stent graft could be

applied in several reports.^{6,8} Those devices could be treated for short neck or window-type fistula.⁸ However, stent-graft migration leaks around the stent-graft or side branch obstruction was reported.⁸ Furthermore, acute thrombosis and long-term patency of the stent-graft become critical issues. Acute thrombosis occurred in 17% of patients during a 1-year follow-up.⁶ Intimal hyperplasia was revealed in 40% of patients during a mean of 18.5 months of follow-up.⁷ Patency rates of the stent-graft in the superficial femoral artery have been reported to be 76% and 55% at 1 and 4 years, respectively.⁹ Stent-grafts or covered stents for femoral iatrogenic femoral arteriovenous fistula are feasible but have a high risk of devices occlusion.

When fistulas originate from branching arteries, have aneurysm or form long tunnels, coil embolisation could be applicable. Pushable coil embolisation for femoral iatrogenic femoral arteriovenous fistula was tried.² Although it is not suitable for a high flow fistula because of the risk of migration, the balloon-assist technique could be helpful. A vascular plug is another device for embolisation if it fits morphologically.¹⁰

Advantages of the detachable coil are their wide variations and capability of repositioning until the coil becomes good in stabilisation and ideal in configuration without the balloon-assist technique. A variety of configurations, stiffness, and sizes of detachable coils can be selected. The detachable coil can be useful especially for fistula with high-flow shunt or aneurysms. Femoral iatrogenic femoral arteriovenous fistula from branching arteries is also a good indication. In case of aneurysmal fistula with a high-flow shunt, initially a three-dimensional type coil that is with equal to or 1 mm larger than the aneurysm should be selected to make

an anchor frame. Subsequently, soft coils should be filled inside of the frame. Each coil entangled and never came loose. Consequently, migration risk of the detachable coil can be minimised.

In conclusion, the detachable coil could be a safe and effective for fistulas with aneurysms, fistulas with high blood flow and fistulas from branching arteries, although window or short neck fistulas should be treated by surgery or stent-graft implantation.

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Conflicts of interest. None.

Ethical standard. Written informed consent was obtained from patients before the procedure.

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