CASE REPORT

Femoral arteriovenous fistula associated with calf pain 2 months after removal of a haemodialysis catheter

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SUMMARY

Double-lumen catheters are widely used to achieve temporary access to circulation in patients requiring acute haemodialysis (HD); however, several complications are associated with the insertion of these catheters. Arteriovenous fistula (AVF), a rare but significant complication of catheter insertion, has been reported in several cases. In this report, we describe a case of a right femoral AVF that caused calf pain 2 months after HD catheter removal. The right ankle-brachial index was 0.46, and the diagnosis of AVF was confirmed using colour Doppler ultrasound and three-dimensional CT. The fistula was managed by surgical vascular repair. The right ABI improved to 1.06, and the absence of fistula was confirmed using three-dimensional CT. Therefore, physicians and nursing staff should be aware of the potential of this complication and should perform clinical and medical examinations at the insertion and removal of temporary HD catheters.

Figure 1 Three-dimensional CT revealing an arteriovenous fistula between the right superficial femoral artery and the right femoral vein (arrow).

BACKGROUND

Double-lumen catheters are widely used to obtain temporary access to circulation in patients who require acute haemodialysis (HD) because of acute renal failure, in patients who require new vascular access or in patients in whom regular vascular access has suddenly been lost. The clinical practice guidelines for vascular access were updated and published by the National Kidney Foundation Kidney Disease Outcomes Quality Initiative (K/DOQI) in 2000.¹ Commonly used venous access sites include the femoral vein, internal jugular vein (IJV) and subclavian vein. IJV is the most common site, although the femoral vein is often selected as well, depending on the patient's condition.^{2–4}

Several complications are associated with the insertion of these catheters, including bleeding, infection, injuries to arteries and deep venous thrombosis. An arteriovenous fistula (AVF) is a rare but significant complication following catheterisation for temporary HD. Moreover, AVF is often associated with swelling, haematoma and the presence of a continuous bruit and sensation at the previous insertion site. In addition to conventional angiography, accurate localisation of AVF depends on imaging modalities such as colour Doppler ultrasound, three-dimensional computed tomography (3D-CT) or MRI (figure 1).^{5–7} AVF management usually includes surgical repair, although AVF can occasionally close spontaneously.

In this report, we describe a case of AVF associated with calf pain 2 months after the removal of a double-lumen HD catheter. In addition, a review of the literature on traumatic complications associated with HD catheters has been presented.

CASE PRESENTATION

HD was initiated in a 75-year-old Asian man for diabetic end-stage renal failure. Two months later, he was readmitted to the hospital with shunt obstruction. A double-lumen HD catheter (Argyle Blood Access LVC-UK catheter kit (11F) with double axial, Covidien, Japan) was inserted into the right femoral vein under ultrasound guidance; this revealed that the right femoral vein was located just under the right femoral artery. At that time, the international normalised ratio (INR) was 0.89, and the platelet count was 131 000/ μ L. The right ankle-brachial index (ABI) was 0.58, and the left ABI was 1.24 (ABI value <0.9 is the cut-off value, and 1.02–1.42 is the normal range for patients with HD).^{8–9} Blood samples were collected through the catheter to confirm its venous origin, and HD was performed through the catheter. A new Gore-tex arteriovenous graft created in the left forearm was used for HD 10 days later. Bleeding from the catheter insertion site was observed 7 days after admission, when he walked to the restroom. At that time, INR was 2.58. No imaging was

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performed because bleeding was presumably caused by catheter movement. Two days later, the catheter was removed to control the continuous bleeding; as a result, the patient was able to walk without pain and was subsequently discharged.

Medication included the following: 2.5 mg amlodipine besylate, once daily; 40 mg furosemide, once daily; 0.25 µg alfacalcidol, once daily; 15 mg lansoprazole, once daily; 5 mg zolpidem, once daily; 0.25 mg mecobalamin, thrice daily; 0.67 g L-glutamine-azulene, thrice daily; 100 mg tocopherol nicotinate, thrice daily; 3.5 mg warfarin potassium, once daily; 1500 mg precipitated calcium carbonate, thrice daily; and biphasic insulin aspart 30 (BIAsp 30, NovoMix 30, Novo Nordisk, Hillerød, Denmark), 21 units at breakfast and 12 units at dinner.

Two months after catheter removal, the patient was admitted for pain and coldness in the right calf. On physical examination, pulse was regular at 86 bpm, blood pressure was 158/66 mm Hg and temperature was 36.5°C. Body weight was 68.3 kg and body mass index (BMI, weight/height²) was 25.2 kg/m². No pulmonary abnormalities were observed and heart sounds were normal. No oedema was evident in either leg. The dorsalis pedis pulse was palpable, although it was weaker on the right side than on the left. The right ABI was 0.46, and the left ABI was 1.01. Serum levels of creatine, blood urea nitrogen, phosphate (PO₄) and calcium were 603.4 µmol/L, 20.0 mmol/L, 5.6 mg/dL and 7.1 mg/dL, respectively. The haemoglobin level was 12.2 g/dL. ECG revealed normal sinus rhythm and a normal pattern. Chest radiograph revealed no cardiomegaly along with a cardiothoracic ratio of 49.0%. Further, colour Doppler ultrasound and 3D-CT detected AVF between the right superficial femoral artery and the right femoral vein. Moreover, 3D-CT revealed three arterial stenotic lesions immediately distal to the bifurcation of the right common iliac artery (90% occluded), immediately distal to the AVF (90%) and below the knee (75%).

TREATMENT

Initial treatment involved dilation of the stenotic lesion immediately beneath the bifurcation of the right common iliac artery using a balloon and stent insertion. During surgery, a 3 mm diameter fistula was observed between the right SFA and the right femoral vein; these were then separated carefully and followed by vascular repair. In addition, the stenotic lesion of the popliteal artery below the knee was dilated using a balloon. Following surgical repair, the right ABI increased to 1.06, and the absence of AVF was confirmed using 3D-CT. The patient was discharged 17 days after surgery.

DISCUSSION

AVF is a direct connection between an artery and a vein. AVF formation as a complication of catheter insertion for HD is rare; however, when it occurs, it is often caused by damage to an artery while inserting a catheter into a vein. To prevent this, ultrasound guidance is important. Ultrasound-guided cannulation is recommended by K/DOQI¹ along with other reports.^{10–12} If a vein is observed under an artery on ultrasound, nephrologists should attempt to alter the position of the patient's neck or foot. Moreover, the use of a fine-gauge needle to locate the vein before introduction of the guide wire using the Seldinger needle is suggested as well.¹³

Several cases of AVF as a complication of dual-lumen HD catheter insertion have been described in the literature (table 1). In all these cases, the most common initial symptom was swelling and haematoma; calf pain as the initial symptom was not observed in any of the cases, except the one reported here. Peripheral arterial disease (PAD) is more prevalent in the HD population than in the general population.¹⁸ PAD with intermittent claudication is observed in 15–23% of patients with HD,^{19–21} and if PAD becomes worse after insertion of an HD catheter into the femoral vein in these patients, the possibility of AVF development should be considered.

In this case, PAD was present before the development of AVF, because ABI was less than 0.9. Thus, the presence of the three arterial stenotic lesions proximal to AVF was inferred. AVF reduces blood flow to the lower extremities and could lead to the onset or worsening of ischaemic symptoms in the lower extremities.²² The combination of the balloon technique for the stenotic lesions and surgical repair of AVF improved ABI and relieved the ischaemic symptoms in the lower extremities.

Tong reported a case of femoral AVF observed 3 months after catheter removal.⁷ In the present case, femoral AVF was also observed 2 months after catheter removal. Femoral AVF might be observed later than cervical AVF, probably because of inaccessibility to the groin area. Anatomically, the groin moves more often than the neck. Posterior bony support is provided by the femoral head, and the lack of bony support during compression following catheter removal might cause difficulties in achieving haemostasis.⁷ Therefore, AVF once closed by a haematoma might be reopened by movement or anticoagulation with heparin during HD.

AVF is a rare complication that is occasionally fatal; therefore, these fistulas are usually surgically repaired. Thus, it is important that physicians perform thorough physical examination as well as prescribe ultrasound following catheter removal. In the cases reported in the literature, AVF was diagnosed by clinical examination, colour Doppler ultrasound, 3D-CT or arteriography.

Table 1 Review of the literature of iatrogenic arteriovenous fistulas caused by a temporary haemodialysis catheter

Author	Term of HD	Site of AVF	Cause of AVF	Physical examination	Diagnosis	Treatment
El-Shahawy ²	Initiated on HD	Carotid jugular AVF	Insertion of catheter	Swelling	Clinical examination, carotid arteriogram	Open surgical repair
Kuramochi ¹³	6 years	Femoral AVF	Movement of catheter	Arterial bleeding	Clinical examination, 3D-CT	Open surgical repair
Tong ⁷	Initiated on HD	Femoral AVF	3 months after removal of catheter	Inguinal swelling	Clinical examination, colour Doppler ultrasound, 3D-CT	Open surgical repair
Patel ¹⁴	Initiated on HD	Carotid jugular AVF	Removal of catheter	Pulsating mass	Clinical examination, colour Doppler ultrasound, carotid angiogram	Open surgical repair
Bahcebasi ¹⁵	Unknown	Carotid jugular AVF	Insertion of catheter	Haematoma	Clinical examination, duplex ultrasound, carotid angiogram	Cerebral infarct, septic shock, death
Maruyama ^{16 17}	2 years	Femoral AVF	Removal of catheter	Pulsating mass	Clinical examination, 3D-CT	Open surgical repair

AVF, arteriovenous fistula; HD, haemodialysis; 3D-CT, three-dimensional CT.

In conclusion, physicians and nursing staff should be aware of this potential complication and should perform thorough clinical and medical examinations at the insertion and removal of temporary HD catheters.

Learning points

- ▶ An arteriovenous fistula (AVF) is a rare but significant complication after catheterisation for temporary HD.
- ▶ We report of a case in which arteriovenous fistula was diagnosed by clinical examination, colour Doppler ultrasound, 3D-CT and arteriography.
- ▶ Physicians and nursing staff should be aware of this potential complication and should perform thorough clinical and medical examinations at the insertion and removal of temporary HD catheters.

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Competing interests None.

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