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Case report

Catheter-directed intra-arterial thrombolysis in the treatment of acute thrombosis of below-the-knee arteries ☆,☆☆

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ABSTRACT

Selecting treatment options in acute arterial thrombosis of the lower extremity, which threatens limb viability, is still a challenge for vascular surgeons. Early restoration of blood flow is crucial and is conducted by surgical thrombectomies or endovascular procedures, depending on patient condition. Catheter-directed thrombolysis with or without percutaneous mechanical thrombectomy for acute limb ischemia has been widely implemented from the early 1990s. Here, we present 2 cases of acute thrombosis of below-the-knee arteries, where we successfully saved the involved limbs using catheter-directed thrombolysis and thrombus aspiration.

Introduction

Acute arterial occlusion of lower limb arteries leading to limb necrosis affects approximately 1.5 per 10,000 cases annually, and the amputation rate is around 10%-15% during hospitalization despite urgent revascularization [1,2]. This condition also contributes to 12%-15% of the mortality rates in Europe per year [3]. Acute lower limb ischemia (ALI) symptoms depend on its causes and on whether there is a history of chronic arterial occlusive disease. Patients who are admitted to the hospital due to ischemic symptoms within 2 weeks

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Fig. 1 – (Case 1) (A) The condition of the left foot before treatment; (B) Computed tomography angiography showing the obstruction in the middle third segment of the anterior tibial artery, posterior tibial artery, and peroneal artery.

since acute onset are classified as having acute limb ischemia [4,5].

Treatment of ALI is still challenging for vascular surgeons. In fact, open surgical thrombectomies or bypass surgeries may not achieve revascularization, especially in below-the-knee arteries. Due to the successful use of thrombolytic agents in treating cerebrovascular disease, pulmonary embolisms, and deep vein thrombosis, we applied the catheter-directed thrombolysis combined with percutaneous mechanical thrombectomy in 2 cases with infrapopliteal arterial obstruction.

Case report

Case 1: A 54-year-old male patient was admitted to the hospital due to severe left foot pain and pallor in the toes and distal foot for 5 days. The symptoms gradually increased day by day. This patient had a history of type 2 diabetes and primary hypertension for 10 years. The symptoms of intermittent claudication were not well recognized. On physical examination, the patient presented with pallor and poikilothermia in the left distal foot, reducing the sensation of the toes (Fig. 1a). The Duplex ultrasound in the left lower limb showed obstruction in the middle third segment of the anterior tibial artery (ATA) and the posterior tibial artery (PTA). Computed tomography angiography (CTA) showed obstruction in the middle third segment of the ATA, PTA, and peroneal artery. There was no arterial flow below this level (Fig. 1b)

The patient was diagnosed with acute thrombosis of below-the-knee arteries (Rutherford class IIa) and underwent percutaneous catheter-directed intra-arterial thrombolysis and mechanical thrombectomy. We accessed the artery under guided ultrasound, inserted sheath 6F, approached the artery under the ultrasonic guidance, and pumped the contrast agent via the sheath. The digital subtraction angiography (DSA) confirmed the diagnosis (Fig. 2). Subsequently, a microcatheter and guidewire 0.014 were taken through the blood clot; bolus 1 mg alteplase was administered via microcatheter while gradually withdrawing the microcatheter right above the lesion site; and alteplase was continuously infused via automatic syringe with a dose of 0.01 mg/kg/h via microcatheter. After 4 hours, we performed thrombus aspiration. The post-procedure figures of DSA showed the revascularisation of below-the-knee arteries compared to pre-procedure figures (Fig. 3). After the procedure, left foot pain decreased, and the pulse of the dorsal artery was detected clearly. The patient was administered heparin for 2 days, then was switched to low dose rivaroxaban combined with antiplatelets (xarelto 2.5 mg twice a day + aspirin 81 mg). The patient was discharged 3 days later, with a critically improved condition (Fig. 4).

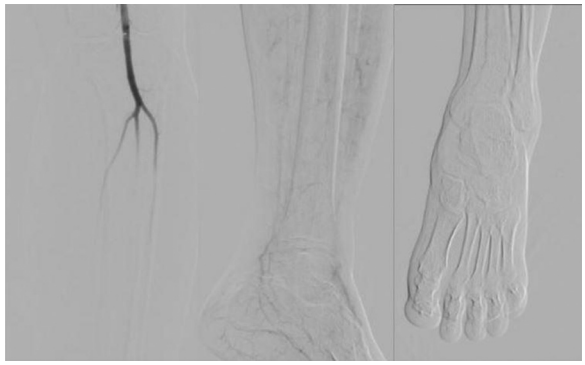

Fig. 2 – (Case 1) DSA shows the total occlusion of below-the-knee arteries.

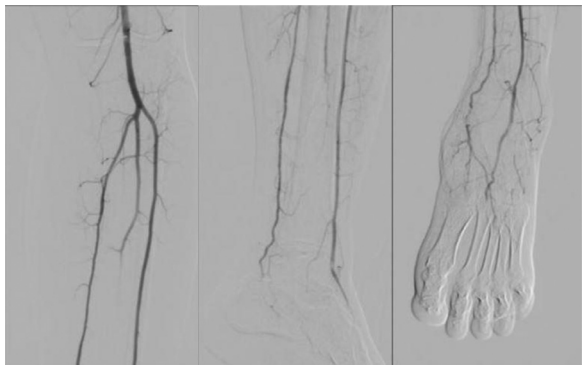

Fig. 3 – (Case 1) Post-procedure DSA shows the revascularisation of below-the-knee arteries.

Case 2: An 83-year-old female patient was admitted to our centre with a chief complaint of right foot pain for 3 days. The medical history included type 2 diabetes mellitus, chronic coronary artery disease, primary hypertension, and atrial fibrillation for 10 years. She had undergone left femoral-popliteal bypass surgery 5 years ago due to chronic superficial femoral arterial occlusion. On physical examination, the patient presented with dark blue color and poikilothermia in her right foot, loss of sensation, and reduced movement of toes (Fig. 5). Duplex ultrasound showed total occlusion of the right popliteal artery, ATA, and PTA.

Fig. 4 – (Case 1) The foot of the patient at 1 day (A) and 1 month (B) after the procedure.

Fig. 5 – (Case 2) The condition of the right foot before treatment

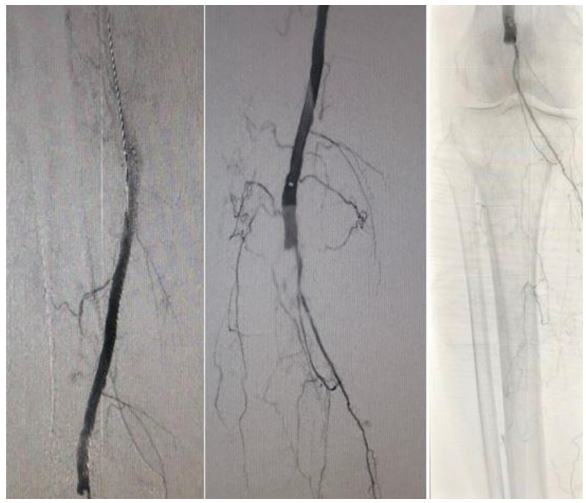

Fig. 6 – (Case 2) The DSA figures confirmed the occlusion of right popliteal and below-the-knee arteries.

Fig. 7 – (Case 2) The post-procedure figures of DSA showed the revascularisation of popliteal and below-the-knee arteries.

The CTA depicted the obstruction of the popliteal artery, ATA, PTA, and PA; there was no collateral circulation below the knee.

The patient was diagnosed with acute popliteal artery thrombosis and below-the-knee artery occlusion with Rutherford class IIb and transferred to a DSA unit. DSA figures confirmed the occlusion of popliteal and below-the-knee arteries (Fig. 6). The patient was transfused with a bolus dose of 1 mg of alteplase and a continuous dose of 0.01 mg/kg/h for 4 hours via a microcatheter combined with thrombus aspiration. The post-procedure figures of DSA showed the revascularisation of popliteal and below-the-knee arteries (Fig. 7)

The patient was administered heparin for 2 days and then switched to low dose rivaroxaban combined with antiplatelets (xarelto 2.5 mg twice a day + asprin 81 mg). She was discharged 5 days later, with a normal condition of her right leg: warm, pain-free, normal sensation, and a well detected dorsal pulse (Fig. 8).

Fig. 8 – (Case 2) The foot at (A) 1 day and (B) 1 month after the procedure, respectively.

Discussion

The classification of ALI based on the severity of arterial ischemia significantly affects the decision of selecting suitable therapies. Percutaneous mechanical thrombectomy combined with in-situ thrombolytic agent infusion or surgical thrombectomy is recommended. Currently, the Rutherford classification is mainly used [6]. Our 2 cases have been classified using Rutherford class IIa-b because there has been a slight loss of sensation in the ischemic region.

The treatment goal of acute limb ischemia is revascularization as soon as possible. For patients with Rutherford grade IIa of acute limb ischemia, catheter-directed thrombolysis is recommended as an alternative to surgery. However, for grade IIb, catheter-directed thrombolysis has been debated because there may not be enough time for fibrinolytics to dissolve blood clots and re-supply blood to the critical limb. Therefore, surgical thrombectomy is still the primary treatment for patients with Rutherford IIb [7]. Nevertheless, the updated European Society for Vascular Surgery 2020 Clinical Practice Guidelines on the Management of Acute Limb Ischemia recommend that catheter-directed thrombolysis combined with percutaneous aspiration or thrombectomy may be considered if initiated promptly for patients with Rutherford grade IIb acute limb ischemia [6].

In 3 well-known studies (Rochester, STILE, and TOPAS), 1000 ALI patients were divided randomly into 2 groups. One group received catheter-directed thrombolysis combined with percutaneous aspiration and, the other, open thrombectomy. In the group with thrombolysis, the patients with graft thrombosis after bypass surgery had better outcomes than those who had thrombosis in vessels [8]. The group of patients who received thrombolysis and percutaneous aspiration had a lower recurrence rate and mortality rate than the group who received open thrombectomies. However, the risk of bleeding complications was higher. Even though thrombolysis combined with percutaneous aspiration may decompose the blood clot partially or totally, the clinical outcomes improved significantly in 75%-92% of ALI patients, especially in those who had stent placements or bypass surgeries with prosthetic grafts [7].

Overall, studies recommended that the method of thrombolysis followed by catheter-thrombectomy should only be applied in the cases of Rutherford I and IIa. However, these studies are in reference to infrainguinal arterial occlusive diseases in general, not specifically to infrapopliteal arterial thrombosis. We could not find any research that compared the effectivity between open surgical thrombectomy and catheter-directed thrombolysis combined with percutaneous aspiration for the infrapopliteal arteries. In our cases, the patients are classified into Rutherford IIa-b, and blood clots are located at seriously damaged infrapopliteal vessels by atherosclerosis. Therefore, open surgical revascularisation is considered extremely difficult. Hence, we choose catheter-directed thrombolysis and thrombectomy as an alternative treatment for these cases after considering the contraindications of thrombolytic agents [6,7].

There are 3 generations of thrombolytic agents: the first (streptokinase, urokinase), the second (alteplase and prourokinase), and the third (reteplase, tenecteplase, and staphylokinase). Even though streptokinase, urokinase, and alteplase are frequently used inperipheral arterial diseases, recent guidelines recommend the last 2 thrombolytics [9-11]!. The treatment dose of alteplase is a bolus of 1-2 mg followed by infusion of 0.05 mg/kg/h and 10,000 UI of intravenous heparin per 24 hours. Patients are monitored after administering fibrinogen and aPTT during infusion of alteplase. An angiography is retaken 10-12 hours later.

Our case only used a low dose, and for a shorter duration than that in the instructions, we did not use heparin during infusion of alteplase. After stopping alteplase, heparin was administered for 2 days, TCK was kept 2-2.5, and was then switched to rivaroxaban 2.5 mg BID plus antiplatelets (Aspirin: 81 mg) [12]. Because these were the first cases, we were concerned about bleeding complications; therefore, we only infused for 4 hours. The clinical assessment showed improvement; thus, we decided to readminister DSA, and the blood vessels were revascularised. Consequently, we stopped the infusion of the thrombotic agent. Thereby, we found that if the amount of the thrombus was not much for small blood vessels, just a low dose infusion in a short time may be sufficient. However, further research with more extensive data is needed to confirm this.

In conclusion, in 2 cases of acute thrombosis of below-the-knee arteries, we applied catheter-directed thrombolysis and percutaneous aspiration instead of open surgical revascularisation due to the difficultly of accessing the small branches of the tibial and peroneal arteries. With low infused doses of alteplase administered in a short time, we can improve the critical ischemic situation and eliminate bleeding risks of thrombolytic agents.

Patient consent

Written informed consent was obtained from the patient for the publication of this case report.

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