Successful Case of Thrombo-aspiration Using a 8-Fr Long Sheath into 10-Fr Short Sheath for Subacute Limb Ischemia

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Running Title: Thromectomy with Large-diameter Sheath

Abstract

A 79-year-old man, with a history of atrial fibrillation, presented with a sudden onset of intermittent claudication of the left lower limb. The angiogram revealed a thrombotic total occlusion in the left superficial femoral artery (SFA). A 10-Fr sheath was antegradely inserted into the left common femoral artery (CFA), and the guidewire penetrated the lesion. Thrombo-aspiration using the 8-Fr long sheath into the 10-Fr short sheath was performed repeatedly. Intravenous anticoagulant was administrated immediately after the endovascular treatment. Follow-up angiogram performed 12 days after the procedure confirmed the absence of any residual thrombus in the SFA. Thrombo-aspiration, using a large-diameter catheter, is a feasible strategy for the treatment of acute and subacute limb ischemia, and is cost-effective.

Key Words: acute limb ischemia, thrombectomy, endovascular procedure, thrombosis

Introduction

Acute or subacute limb ischemia (ALI/SLI), characterized by a sudden decrease in blood perfusion to the limb, is a clinical emergency with the risk of eventual limb loss and life-threatening complications. ALI is one of the major causes of lower limb amputation, with an incidence rate of approximately 1.5 persons per 10000 per year,¹ with its prevalence increasing due to the aging of the general population. There are two principal etiologies of ALI, one being arterial embolism (30%) and the another thrombosis of an atherosclerotic artery (60%). Diagnostic and therapeutic delay may lead to irreversible ischemic damage. Therefore, expeditious diagnosis, accurate assessment, and urgent treatment are crucial to prevent a major amputation and save the limb.

The management of ALI depends on the patients' status, including the severity of ischemia, limb viability, diseased lesion, age, and comorbidities. Generally, anticoagulant therapy is the first and crucial step for the initial treatment of ALI/SLI. Catheter intervention or surgical revascularization is frequently needed, especially in cases of severe ischemia. Percutaneous intervention offers two strategies for reperfusion, namely pharmacological thrombolysis and mechanical thrombo-aspiration. In the absence of neurological deficits, catheter-directed thrombolytic therapy (CDT) is the more appropriate treatment. In more severe cases with neurological deficit, extraction or aspiration of the thrombus and surgical therapy are preferable.²

However, the therapeutic strategies of percutaneous thrombo-aspiration have not been well-established, with variation in approaches based on the institution and the skill and preference of the surgeon. Herein, we report a successful case of thrombectomy performed using a large diameter catheter system for SLI. Our strategy has the potential of being one of the most feasible percutaneous methods for ALI/SLI.

Case Report

A 79 year-old man reported a sudden onset of left leg fatigue and intermittent claudication within a walking distance of 100 m, 2 weeks prior to consultation through our outpatient clinic. The patient complained of pain, pallor/paleness, and pulseless of his left lower limb among 5 characteristic symptoms; 5Ps (pain, paresthesia, pallor/paleness, pulseless, paralysis/paresis) of ALI at the presentation. The ankle brachial index (ABI) for his left leg was decreased to 0.57. His medical history included untreated atrial fibrillation, hypertension, dyslipidemia, coronary artery bypass graft surgery, and stage G3b chronic kidney disease (CKD). Enhanced CT was not performed in this case to save the amount of the contrast media because of stage G3b CKD and angiogram was directly performed. Angiogram revealed a thrombotic occlusion at the proximal segment of the left superficial femoral artery (SFA) and floating thrombus at the popliteal artery (**Figure 1A**). SLI was confirmed as the final diagnosis (Rutherford ALI classification I) based on the sudden onset of left leg fatigue and intermittent claudication, and thrombotic occlusion from the SFA to the popliteal artery on angiogram. Fontaine IIb peripheral artery disease (PAD) could be considered as a differential diagnosis, however, the sudden appearance of leg symptom strongly indicates SLI in this case. Endovascular thrombectomy was subsequently attempted as the first treatment. Catheter directed thrombolysis (CDT) seemed to be inappropriate to this case since the immediate revascularization was preferable because of his lower limb pain. Surgical thrombectomy was not available at that time in our institute. Five thousand units of unfractionated heparin were immediately administered at the beginning of the procedure. First, a 10-Fr x 11 cm sheath (Medikit Co. Ltd., Tokyo, Japan) was inserted in antegrade fashion into the left common femoral artery (CFA). Second, a 0.018-inch guide wire (Command; Abbott Cardiovascular, California, USA) was used to easily penetrate the site of occlusion, and an 8-Fr x 45 cm sheath (Medikit Co. Ltd., Tokyo, Japan) was advanced along the guide wire through the 10-Fr sheath. Finally, a 20-ml syringe was connected to the 8-Fr sheath, after removal of the guide wire, and thrombectomy was repeatedly performed using manual aspiration (**Figure 1B**). A large amount of thrombi was

successfully removed from the left SFA (**Figure 2C**). Adjunctive balloon angioplasty (Coyote 2.0/220mm; Boston Scientific, Marlborough, MA, USA) was then performed, from the SFA to the posterior and anterior tibial arteries (PTA and ATA, respectively). The final angiogram showed good blood flow through the SFA, despite the presence of some small thrombi remaining in the distal left SFA. Hemostasis of the femoral 10-Fr sheath was successfully completed after EVT, using a suture-mediated closure device (Perclose Proglide; Abbott Vascular, Redwood City, CA, USA). Administration of fifteen-thousand units/day of unfractionated heparin was immediately started after the procedure. At 12 days post-EVT, there was no evidence of thrombi on the angiogram (**Figure 2D**) and the ABI of the left limb had improved from 0.57 to 0.93. Unfractionated heparin was replaced with warfarin on discharge.

Discussion

The treatment for ALI/SLI is determined according to the Rutherford classification.³ In patients with a viable limb (Rutherford class I), there is time to acquire noninvasive diagnostic imaging or noninvasive vascular studies. By contrast, patients of a Rutherford class II limb ischemia require urgent revascularization, which is often amenable to EVT, whereas those presenting with a class II b ischemia require emergent revascularization, traditionally achieved via open surgery. A Recent case series, however, have demonstrated similar revascularization rates of EVT, with lower morbidity and mortality rates, compared to open surgery.³⁻⁵ Patients with irreversible limb ischemia (class III) may require amputation without attempted revascularization, as reperfusion abruptly releases toxic by-products of ischemic tissue into the systemic circulation.

EVT for limb salvage can be performed using CDT or mechanical thrombo-aspiration. CDT is recommended and widely performed for Rutherford class I or II ischemia.² Endovascular thrombectomy may serve as a complimentary or stand-alone technique for percutaneous revascularization that ideally speeds-up revascularization and limits the need for thrombolysis.⁶

Percutaneous thrombus aspiration, using 6- to 8-Fr aspiration catheter, was described as one of the feasible methods of endovascular arterial thrombus extraction, gaining acceptance as a low-cost method offering quick recanalization, especially in the infrainguinal arteries.⁴ The method is quite simple, with a stable end-hole catheter delivered over a guidewire to the site of thrombus formation, and a negative pressure syringe is then used to aspirate blood and thrombus fragments. To the best of our knowledge, the diameter of 8-Fr aspiration catheter is equivalent to that of 6-Fr sheath. In our case, we applied this method using the larger catheter system of 8-Fr sheath in 10-Fr sheath than previously reported to achieve a more effective and quicker aspiration of the thrombus (**Figure 2**). In fact, a large amount of thrombi was successfully and efficiently removed from the lesion. In the present case, thrombo-aspiration was performed with 8-Fr long sheath. A large diameter guiding catheter would also be feasible. For instance, 10-Fr guiding catheter provides the almost same diameter as 8-Fr sheath and has a potential to work as efficiently as 8-Fr sheath do. Since 10-Fr guiding catheter was not available at that time in our hospital, we used 8-Fr sheath in this case. In a retrospective study, Kwok et al. evaluated thrombolysis using primary aspiration embolectomy,⁶ with technical success achieved in approximately half of the cohort using primary aspiration alone. However, thrombectomy had been performed with relatively small diameter catheters in those previous studies.^{4,6} It should be noted that using the larger diameter catheters or sheaths could be far more efficient than using the small diameter lumen catheters. In addition, in our case, hemostasis of the puncture site was safely achieved using a suture-mediated closure device, despite the large diameter of 10-Fr system used. From our experiences, the suture-mediated closure device is feasible and safe to be used for 10Fr or smaller system. If it becomes more than 10Fr system, “pre-close” technique would be necessary. This is one of the reasons we used 10Fr system in this case. The size of system, however, should be chosen according to the amount and the location of thrombus.

Potential risk of our procedure is a vessel injury due to the large diameter sheath. However, the vessel injury could be prevented by advancing a guide wire and an inner catheter when inserting the aspiration sheath to the lesion.

Several devices for percutaneous thrombectomy have been developed over the past decades. Among these, the Rotarex® device is equipped with a rotating screw at the tip of the catheter to break the thrombus into fragments. The fragments are then aspirated into the catheter from the tip. Beneficial primary revascularization rates have been achieved, especially among elderly patients with multiple medical comorbidities, with previously reported rates of 70% to 96%.⁷ By comparison, the Angiojet® Device uses a hydrodynamic aspiration mechanism. High-speed saline jets are injected through the catheter tip to create a “Venturi effect” with the resulting low-pressure zone producing a vacuum effect that allows for both the simultaneously lysis and aspiration of the thrombus.⁸ Compared to these two methods, our approach was very simple and did not require any special devices, offering high cost effectiveness with sufficient feasibility and safety, which are the most important factors for widespread use, regardless of the expertise of the institution and surgeon.

Conclusion

Our case report illustrates the feasibility, safety, and cost effectiveness of percutaneous thrombectomy, performed using a large-diameter catheter system, for the treatment of ALI/SLI.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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Figure Legends

Figure 1. Angiograms before and after the procedure

- A. Initial angiogram showing a total occlusion of SFA and floating thrombus at the popliteal artery.
- B. Thrombectomy performed using an 8Fr sheath.
- C. A large amount of thrombi is aspirated.
- D. The thrombi were diminished 12 days after the procedure.

Figure 2. Schema of the large diameter system used for Thrombectomy

Thrombectomy is performed using a 8-Fr long sheath in a 10-Fr short sheath.

Fig. 1

Fig. 2