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CASE REPORT

# Direct contrast injection method: a novel approach to facilitate device crossing in peripheral artery lesions

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## ABSTRACT

It may be difficult to pass the device through the lesion due to moderate or severe calcification, tortuosity in or proximal to the lesion, excessive plaque load, the age of the lesion, and the characteristics of the device to be used. In such cases, the first thing that comes to mind is maneuvers to increase the support of the system. It may be preferable to choose low-profile and more flexible devices, or to angioplasty with small balloons and try again with a larger one. Intravascular ultrasound (IVUS) guidance and plaque debulking devices such as special balloons or atherectomy/laser/lithotripsy can be used to prepare the lesion. In addition, special lesion crossing devices can be used. However, the tools and equipment required for the special methods listed above are not available in every catheterization laboratory or they are not widely used because their use is not widely recommended and because of payment issues. We encountered a lesion that could not be passed through such a device, and we modified the plaque by injecting contrast directly into the lesion, as in the Carlino method.

**Keywords:** angioplasty, contrast agent, device, lesion, peripheral

## INTRODUCTION

Percutaneous revascularization methods are most preferred in treating severe symptomatic lesions in peripheral arteries (1). The most common reasons for the failure of percutaneous procedures are the passage of the lesion with a guidewire, inability to pass the devices required for lesion preparation or guidewire exchange through the lesion, severe complications during lesion preparation, and inadequate preparation of the lesion (2). It may be difficult to pass a device through the lesion due to moderate or severe calcification, tortuosity in or proximal to the lesion, lesions with severe plaque load, age of the lesion, and features of the device to be used (3). There is no clear consensus on how to pass the device through the lesion. However, there are studies on some of the methods used in this regard (4). We presented a

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method for such a condition, named Direct Contrast Injection into the Lesion for the Device Uncrossable Lesion, the Direct CIL method.

## CASE PRESENTATION

A 67-year-old male patient was admitted with intermittent claudication in the left calf region. During the lower extremity arterial Doppler ultrasound (DUS), monophasic flow in the left popliteal artery (PA), arteria tibialis anterior (ATA), and arteria tibialis posterior (ATP) and total occlusion of the superficial femoral artery (SFA) were seen. Lower extremity peripheral angiography (PAG) was planned. Chronic total occlusion was observed at the left SFA, proximally just after the left common femoral artery (CFA) bifurcation (Figure 1, Video 1). A 7F 90 cm sheath (Flexor Shuttle-SL introducer guiding sheath, Cook, United States) was parked in the left CFA with a 6F right Judkins diagnostic catheter. A 0.035'' NAVICROSS® Support Catheter (Terumo, Tokyo, Japan) with a 0.035'' hydrophilic wire was attempted to cross the SFA occlusion. Then, several guidewires, including Gladius, Halberd, and Astato XS40, tried to cross but were unsuccessful despite the support catheter. So, as a last resort, we used the back of the 0.035'' hydrophilic wire, crossed the SFA occlusion, and finally successfully entered the true distal lumen (Figure 2, Video 2). However, we failed to cross the support catheter into the distal true lumen through the lesion. We exchanged the support catheter for a 4.0x120 mm peripheral balloon (Sterling, Boston Scientific, USA) to cross the lesion, with the aim of exchanging the wire back and performing balloon dilatation of the lesion in preparation for a larger balloon size. Unfortunately, the balloon could not cross the lesion (Video 3). We used simple solutions that can be done in such a situation. We positioned the access sheath at the closest location to the lesion. However, we could not use a special crossing device, atherectomy, laser, or lithoplasty because there was none in our laboratory. Again, we thought we could modify the lesion anterogradely with contrast injection before trying to do a second puncture in a retrograde way to pass the lesion and modify the plaque. We did not have a 0.035-inch compatible dual-lumen catheter. We also did not have an infusion catheter at the time. On the other hand, we could puncture a balloon and use it like an infusion catheter, but we didn't want to waste a new balloon as it was not yet a used balloon.

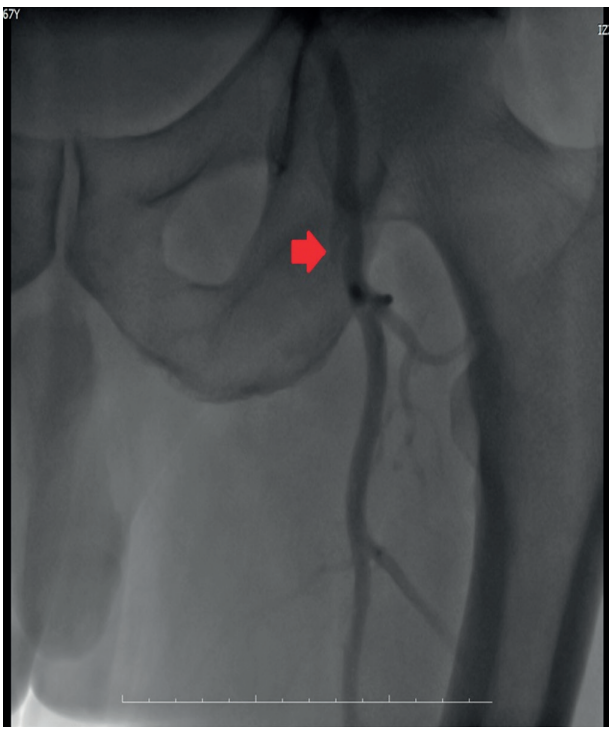

**Figure 1.** The occluded lesion proximal cap was showed with red arrow.

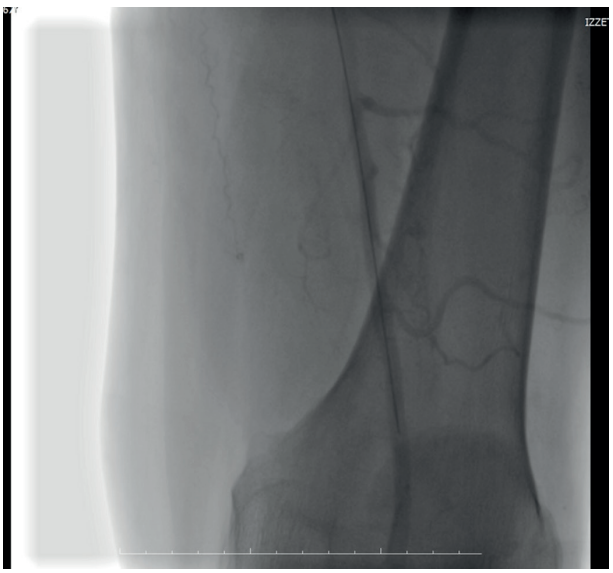

**Figure 2.** The back of the guidewire was in the distal true lumen.

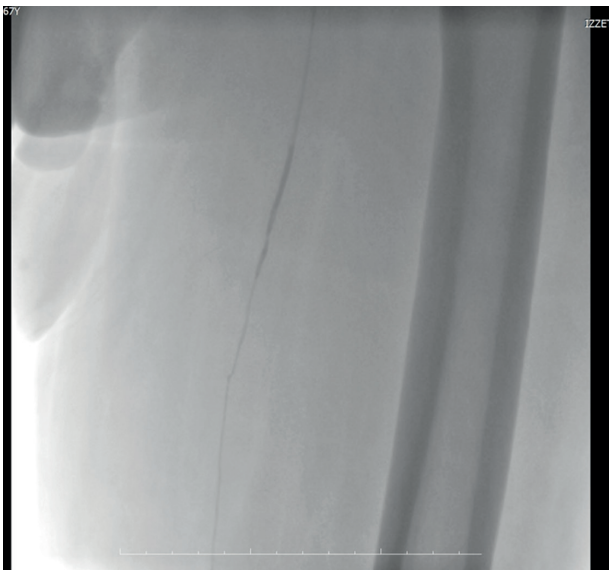

**Figure 3.** Direct CIL method.

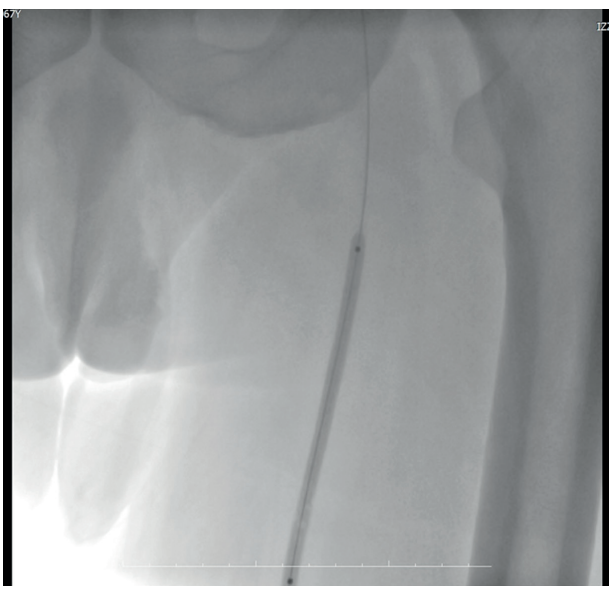

**Figure 4.** Balloon angioplasty with a 6.0 x 150 mm peripheral balloon.

We decided to soften the lesion with contrast agent-Direct CIL method. The support catheter was advanced as far as possible into the lesion with push and rotation. The guidewire inside was pulled, and 10 cc of contrast material (Iohexol 350 mg/ml) was injected into the lesion (Figure 3, Video 4). Then, the existing 0.035'' guidewire was passed through the support catheter crossed the SFA lesion again and into the true distal lumen. The lesion was dilated with a 4.0 x 150 mm peripheral balloon with balloon dilatation, followed by a balloon dilatation with a 6.0 x 150 mm peripheral balloon (Mustang, Boston Scientific, USA) (Figure 4). Afterward, we took an angiographic view (Video 5) to evaluate the lesion. We observed a heavy plaque burden at the distal lesion segment in addition to a long proximal dissection, which did not compromise the antegrade flow. So, we decided to watch the proximal dissection with medical treatment and employ a drug-eluted balloon only at the distal lesion segment for the bulky plaque burden. A 6.0 x 200 mm drug-eluted balloon (Extender, INVAMED, Ankara, Türkiye) was applied (Figure 5). It was concluded that the optimal result was obtained in the angiographic evaluation (Figure 6, Video 6), and the procedure was terminated without any complications. The patient was discharged one day after the procedure. The patient had no complaints at the 15$^{th}$ day control. It was observed that SFA was open on the DUS. The patient had no complaints at the 3$^{rd}$ and 6$^{th}$ month controls, and there was no serious obstruction in the SFA on Doppler USG.

**Figure 5.** Balloon angioplasty with a 6.0 x 200 mm drug eluted balloon at the distal lesion with bulky plaque burden.

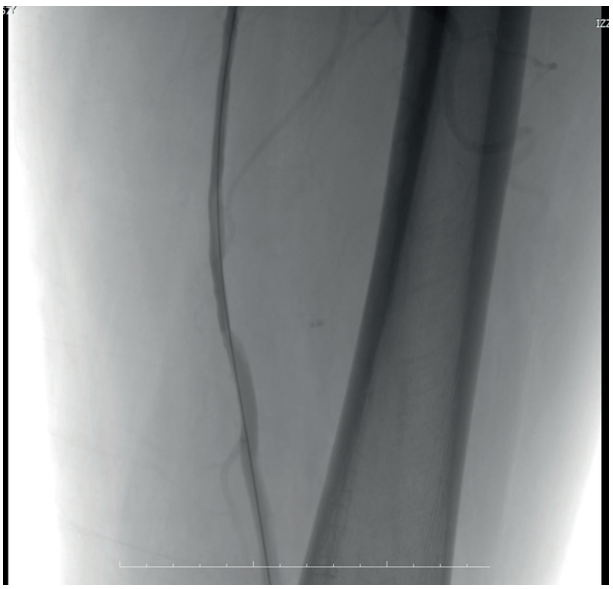

**Figure 6.** The final image after drug eluted balloon angioplasty.

## DISCUSSION

Percutaneous revascularization is the preferred method for the treatment of severe symptomatic peripheral artery lesions (1). Procedural failure often results from guidewire passage issues, device advancement problems, lesion-related complications, or inadequate lesion preparation. Factors such as calcification, tortuosity, plaque load, lesion age, and device characteristics can hinder device passage (2,3). There must be a clear consensus on how to pass the device through the lesion. However, there are studies on some of the methods used in this regard (4). The first thing to do is to increase the support. Especially, the support features of guiding sheaths should be considered, and the most suitable sheath should be selected according to the vessel. Bringing the sheath to the position closest to the lesion is appropriate. The device features planned to be passed through the lesion are also important. A device profile as small as small can make the transition easier. Lesion preparation is also essential, especially for severe fibrocalcific lesions, to avoid futile effort. Crossing devices such as TruePath, Viance, Frontrunner, Crosser, Wildcat, and Ocelot can be used (5). However, the widespread use of these devices has yet to be established in every angiography laboratory and there may be particular financial barriers. In terms of lesion preparation, balloon dilatation with a special balloon catheter (cutting and scoring balloons), atherectomy (rotational and directional), endovascular laser ablation, and lithoplasty are other methods used (6). The last percutaneous method that can be used is the retrograde method (7). The lesion treatment can be started retrogradely; the lesion can be passed retrogradely, and the wire can be externalized and continued anterogradely. Again, a balloon can be inflated next to the wire crossing the lesion, and a retrograde distal anchoring balloon can be made, or this wire can be caught with a snare retrogradely, and the support of the wire can be increased retrogradely. Most of these methods can be considered as applying the methods used in the percutaneous treatment of coronary chronic total occlusion (CTO) to the peripheral arteries (8). In our case, we encountered an uncrossable lesion with a catheter and balloon. Although we successfully wired the lesion anterogradely, we could not pass the lowest profile balloon and support the catheter through the lesion. We used simple solutions that can be done in such a situation. However, we could not use a special crossing device, atherectomy, laser, or lithoplasty because none existed in our laboratory. We named this method "Direct contrast injection into the lesion-Direct CIL". We think the lesion can be used as a poor man's method in uncrossable situations. As a result of using the Direct CIL method in different centers and large patient groups, whether through device-based applications such as dual-lumen catheters or infusion catheters, or without a device as we did, this method will have an important place among the solutions for peripheral uncrossable lesions.

The Direct CIL method is not without some disadvantages. The first, and perhaps the most important one, is to pass the wire beyond the lesion and then administer the contrast agent. Microdissections caused by contrast administration may complicate rewiring. However, considering the lesion subtypes and conditions in which the Direct CIL method is used, this may be an acceptable risk. Secondly, severe dissection may develop during lesion modification caused by contrast injection, and there may even be a risk of perforation. Thirdly, microdissections caused by contrast injection may disrupt the collateral circulation that provides blood stream to the distal

vascular bed. Finally, the answer to the question of how much contrast material should be injected needs to be clarified. The amount used in coronary lesions is generally <5 cc (using the Carlino method) (8). We determined to inject 10 cc in the peripheral artery, which has a larger size than diameter of coronary arteries. However, the question of whether this is still an appropriate amount may be raised in future studies.

The Direct CIL method could be a simple solution for the peripheral arterial uncrossable lesions. However, the presented method is not without some disadvantages. In the future, we believe that the Direct CIL method will have an important place in the solution methods to be applied in peripheral uncrossable lesions by applying the large patient groups.

### Ethical approval

Written informed consent was obtained from the participants.

### Author contribution

Surgical and Medical Practices: EA, ID; Concept: EA; Design: EA, YG; Data Collection or Processing: EA, TD, EO; Analysis or Interpretation: EA, YG, IAI; Literature Search: EA; Writing: EA, SI. All authors reviewed the results and approved the final version of the article.

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The authors declare the study received no funding.

### Conflict of interest

The authors declare that there is no conflict of interest.

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