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Case Report

Successful percutaneous retrieval of a detached microcatheter tip using the guide-extension catheter trapping technique: A case report

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ABSTRACT

A 55-year-old male with stable angina pectoris was referred to our hospital. Coronary angiography showed severe stenosis from the proximal to the middle part of the left circumflex artery (LCX). Based on the severity of lesion calcification, we performed percutaneous coronary intervention with rotational atherectomy. After crossing a 0.014-inch guidewire, we replaced it with a rotawire using a microcatheter. Following the retrieval of the microcatheter, we noted that a radiopaque tip of the microcatheter had been detached at the site of severe stenosis in the proximal part of the LCX. We advanced a guide-extension catheter to this site and wedged the detached tip using a balloon catheter (2.0-mm diameter; 12-mm length) in the guide-extension catheter. The detached tip was successfully retrieved along with the guide-extension catheter. After passing two guidewires into the main vessel and the side branch, we dilated the lesion using a 2.5-mm non-compliant balloon. Finally, we implanted two sirolimus-eluting stents, followed by post-dilatation with a 3.75-mm non-compliant balloon. This approach resulted in excellent dilatation and blood flow. Use of the guide-extension catheter trapping technique (i.e. use of a guide-extension catheter and a small balloon catheter) resulted in the successful percutaneous retrieval of a detached microcatheter tip.

<**Learning objective:** We occasionally encounter adverse events related to the detachment or breakage of devices when performing percutaneous coronary intervention. The guide-extension catheter trapping technique using a guide-extension catheter and a small balloon is a useful approach for the retrieval of dislodged or entrapped devices.>

Introduction

Percutaneous coronary intervention (PCI) has been widely used for the treatment of coronary artery disease. However, we occasionally encounter adverse events related to the detachment or breakage of devices [1–6]. In this article, we present a case of microcatheter tip detachment during PCI for the treatment of the left circumflex artery (LCX) stenosis.

Case report

A 55-year-old male with chest pain on exertion was referred to our hospital. We suspected angina pectoris, and coronary computed tomography angiography demonstrated triple-vessel disease. Subsequently, coronary angiography revealed chronic total occlusion of the middle part of the left anterior descending artery, severe stenoses from the proximal to the middle part of the LCX (Fig. 1A and B), and severe stenoses of the distal part of the right coronary artery (RCA). After obtaining informed consent from the patient, we decided to perform PCI for the treatment of these lesions. Initially, we performed PCI for the RCA. One month later, we performed PCI for the LCX. A 7-French AL2.0 guiding catheter with a side hole (Hyperion™, ASAHI Intecc, Nagoya, Japan) was inserted into the left coronary artery via the right femoral artery. It was not possible to

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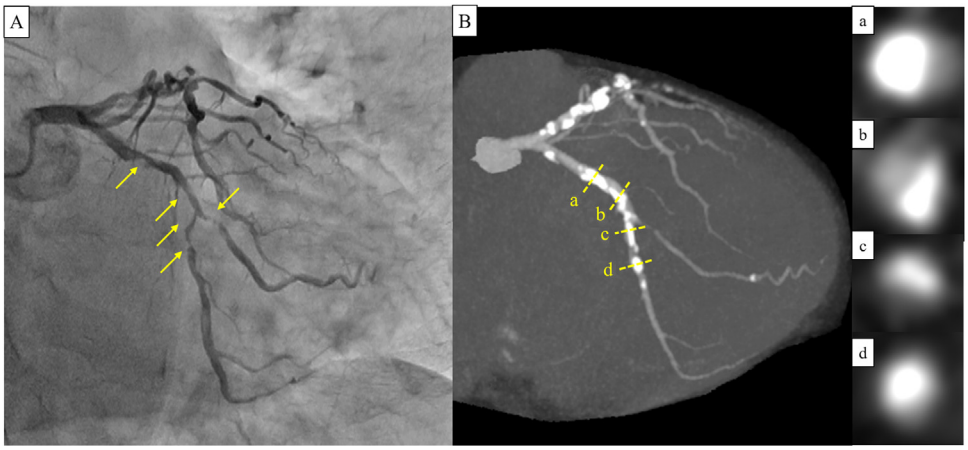

Fig. 1. Images of initial coronary angiography (CAG) and computed tomography (CT) in the left coronary artery. (A) CAG revealed the severe stenoses from the proximal to the distal part and posterolateral artery of the left circumflex artery (LCX). (B) CT image confirmed the severe stenoses from the proximal to the distal part and posterolateral artery of the LCX. The severe stenosis included the entire circumferential severe calcified plaque (a and d) and the eccentric calcified plaque (a and d).

cross a 0.014-inch guidewire (SION blue™, Asahi Intecc) with a microcatheter (Caravel™, Asahi Intecc) through the distal part of the LCX due to severely calcified stenosis. Subsequently, we succeeded in crossing the lesion by replacing the SION blue™ guidewire with a tapered guidewire (XT-R™, Asahi Intecc). In spite of the resistance, we advanced the Caravel™ microcatheter to the distal part of the LCX. Subsequently, we unsuccessfully attempted to advance an intravascular ultrasound catheter (AltaView™, Terumo, Tokyo, Japan). Therefore, based on the severity of the calcification, we decided to perform rotational atherectomy. We advanced the Caravel™ microcatheter to the distal part of the LCX again, and replaced the guidewire with a dedicated guidewire (Rotawire Floppy™, Boston Scientific, Marlborough, MA, USA). Subsequently, we retrieved the Caravel™ microcatheter and advanced a 1.5-mm

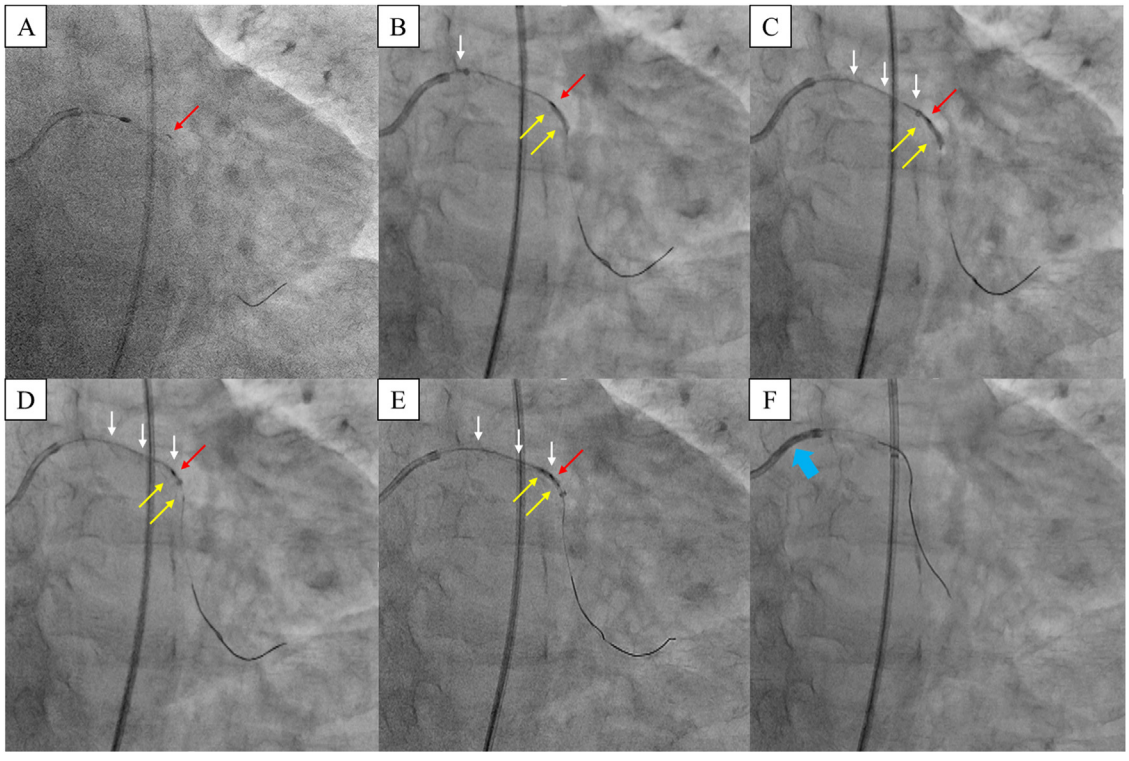

Fig. 2. Retrieval of the detached tip of the Caravel™ microcatheter. (A) Fluoroscopy revealed an abnormal presence in the severe stenosis in the proximal part of the left circumflex artery (LCX) (red arrow). (B) After crossing the lesion with another guidewire (SION blue™), a guide-extension catheter (GuideLiner™) was inserted over two SION blue™ guidewires to the proximal site of the LCX. Subsequently, a small semi-compliant balloon (TREKTM 2.0 × 12 mm) was advanced over the second SION blue™ guidewire to the more distal site of the detached tip of the Caravel™ microcatheter (white arrow: GuideLiner™; yellow arrow: TREK™). (C) The GuideLiner™ was advanced using the anchor balloon technique. (D) The detached tip was completely covered by the GuideLiner™. (E) TREK™ was inflated to wedge the detached tip in the GuideLiner™. (F) All the devices were retrieved together (blue arrow).

rotablator burr (RotaLink Plus™, Boston Scientific). Unfortunately, fluoroscopy revealed an abnormal presence in the severely stenosed proximal part of the LCX (Fig. 2A). We considered that the radiopaque tip of the Caravel™ microcatheter was entrapped and detached during retrieval.

In order to remove the detached tip, we firstly crossed the site with another guidewire (SION blue™) using a dual lumen catheter (SASUKE™, ASAHI Intecc). Secondly, we inserted a guide-extension catheter (GuideLiner™ 7Fr, Vascular Solutions Inc., Minneapolis, MN, USA) over Rotawire Floppy™ and SION blue™ to the proximal part of the LCX. Thirdly, we advanced a small semi-compliant balloon (TREK™ 2.0 × 12 mm, Abbott, Abbott Park, IL, USA) over the second SION blue™ guidewire to the distal site of the detached tip. Subsequently, we advanced the GuideLiner™ guide-extension catheter to the site of the detached tip via the anchor balloon technique, while inflating the balloon (Fig. 2B and C). Immediately after balloon deflation, we advanced the GuideLiner™ guide-extension catheter to completely cover the detached tip (Fig. 2D). Fourthly, we pulled back the balloon into the GuideLiner™ guide-extension catheter and inflated it again to entrap the detached tip (Fig. 2E). Finally, we successfully retrieved all the devices together (Fig. 2F). We changed the strategy to a more simple one without rotational atherectomy. We passed two guidewires again into the distal part of the LCX and posterior lateral branch. We dilated the lesion from the proximal to the distal part of the LCX using the 2.5-mm non-compliant balloon (NC TREK™ 2.5 × 12 mm, Abbott). Subsequently, we implanted two sirolimus-eluting stents (Orsiro 3.0 × 26 mm, 3.5 × 26 mm, Biotronik AG, Bülach, Switzerland) in the stenotic lesion of the LCX and dilated the posterior lateral branch using a drug-coated balloon (SeQuent Please 2.0 × 15 mm, B. Braun, Melsungen, Germany). Finally, a non-compliant balloon (NC TREK™ 3.75 × 12 mm, Abbott) was fully dilated to the stent site under expansion. A final excellent angiography was performed without evidence of other complications.

Fig. 3 shows the detached tip of the Caravel™ microcatheter. The length of the detached tip was approximately 3 mm. Deep injury — apparently caused by severe calcification — was found on the surface and collapse was detected on the tip. Furthermore, ductile fracture of the resin due to stretching was observed at the proximal end.

Discussion

In this article, we report a case of microcatheter tip detachment during PCI for the treatment of severe stenosis in the LCX. We successfully removed the detached microcatheter tip via the guide-extension catheter trapping technique (GeT technique) using a guide-extension catheter and a small balloon. A previous report described the successful percutaneous retrieval of a disrupted balloon catheter using this method [7,8]. However, to the best of our knowledge, this is the first report of successful percutaneous retrieval of a detached microcatheter tip through this method.

High crossability is an important property required for microcatheters. Therefore, recently developed microcatheters have a lower profile tip and shaft with a hydrophilic-coated thin wall structure. However, this property poses a potential risk of transection of the tip or shaft, especially when used for the treatment of very complex lesions. Although the incidence rate of microcatheter tip detachment remains undetermined, a previous report described a case complicated with transection of a Caravel™ microcatheter in a severely calcified coronary artery during PCI [6]. Similarly, in the current case, the lesion was severely stenotic and severely calcified. The relatively deep injury on the surface and the collapse observed on the retrieved tip of the Caravel™ microcatheter may be attributed to severe calcification (Fig. 3). Although we were able to advance the Caravel™ microcatheter to the distal part of the LCX through the severe calcified lesion, it was unfortunately stuck at the severely calcified site in the proximal part of LCX which was shown in Fig. 1B and eventually transected during removal. We speculated that the microcatheter may be structurally weak for pulling force when it is stuck by calcification, although it is tolerant of pushing force. It is necessary to consider that cases with severe stenosis — especially those with concomitant severe calcification — are associated with a potential risk of microcatheter transection.

Various methods have been reported for the retrieval of entrapped or broken devices, such as the use of a snare catheter, the twisted guidewire technique, biopsy forceps, the low-pressure balloon inflation technique, and the small-balloon inflation technique [1–7]. In this case, the use of a snare catheter was unsuitable due to the small size of the detached tip. Moreover, the low-pressure balloon inflation technique and small-balloon inflation technique were also deemed unfeasible because it is not possible to pass a small balloon through the microcatheter. Although the twist guidewire technique was theoretically possible for the retrieval of the detached tip, guidewires will not always be entangled.

The GeT technique used in the present case is relatively easy and effective, offering instantly achievable results. Judging from the luminal size, GeT technique can be performed using 6 Fr GuideLiner™. However, the bigger size would be better to cover the detached tip without pushing it more distally. Furthermore, this GeT technique can be used for the retrieval of various devices, if it is possible to cover these devices with the guide-extension catheter. Notably, a previous report described the successful percutaneous retrieval of a disrupted balloon catheter using a guide-extension catheter and a small balloon [8]. GeT technique is unsuitable for cases in which even a small balloon cannot pass due to severe stenosis. Furthermore, we must pay attention not to push the detached tip more distally and advance the guide-extension catheter carefully not to injure the calcified lesion. However, its better crossability makes it possible for the guide-extension catheter to advance more easily without injuring the lesion and

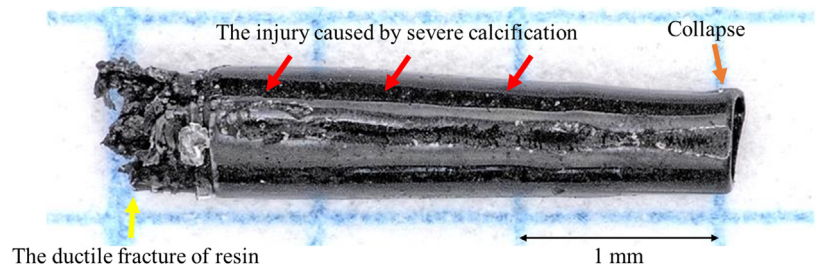

Fig. 3. Image of the detached tip of the Caravel™ microcatheter. The length of the detached tip was approximately 3 mm.

anchor balloon prevents the detached tip from advancing more distally. Therefore, the step of GeT technique is efficient and safe. Nevertheless, in unsuitable cases for GeT technique, other conventional approaches should be attempted.

Conclusions

We successfully retrieved a detached microcatheter tip via the GeT technique using a guide-extension catheter and a small balloon. This technique is useful for the retrieval of dislodged or entrapped devices.

Conflict of interest

The authors declare that there is no conflict of interest.

Acknowledgments

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