CASE REPORT

Novel Use of GuideLiner with a Low-Profile Balloon for the Retrieval of Disrupted Balloon Catheter

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Summary

We report a case of successful percutaneous retrieval of an unexpectedly disrupted balloon catheter using GuideLiner and a low-profile balloon. The procedure and the mechanism of this novel technique were described in detail with ex-vivo testing. This case demonstrated the utility of the combination of GuideLiner and low-profile balloon as a bail-out for intravascular foreign body.

Key words: Balloon disruption, Complication

Intravascular foreign bodies during percutaneous coronary intervention are something like a nightmare for interventional cardiologists because they are thrombogenic, which might result in acute myocardial infarction or some other adverse cardiovascular event. Various methods have been reported to retrieve them, such as the use of snare, twisted guidewire technique, biopsy forceps, and surgical intervention.1-3) However, balloon catheter disruption is particularly a rare complication, and percutaneous retrieval from a tortuous and calcified artery seems difficult. In this case report, we present a novel method using GuideLiner (GL; Vascular Solutions Inc., Minneapolis, MN, USA) and a low-profile balloon to retrieve a disrupted balloon catheter safely.

Case Report

A 56-year-old man with a history of inferior acute myocardial infarction was admitted to our institution due to exertional chest pain with positive stress electrocardiography without Q wave. Coronary angiography showed significant focal in-stent restenosis in the mid right coronary artery (RCA) and diffusely under-expanded full-metal-jacket with severe calcification (Figure 1A). Successful rotational atherectomy (Rotablator Ø2.0 mm, Boston Scientific, Natick, MA, USA) was performed via femoral artery with strong backup support of a 7 Fr SL3.5 (Lanucher, Medtronic, Minneapolis, MI, USA) and temporal pace-maker (Figure 1B). RotaWire Floppy (Boston Scientific) was exchanged to Runthrough Extra Floppy (Terumo, Tokyo, Japan) using FineCross GT (Terumo). A drug-coated balloon (DCB; Sequent Please 3.5 × 30 mm, B. Braun, Melsungen, Germany) was applied at the distal target lesion following adequate dilatation with a 3.75 mm high pressure balloon (Figure 1C). A 7 Fr GL was effectively used to deliver these bulky devices. After a second DCB (3.5 × 30 mm) application at the mid target lesion, the deflated DCB was stuck in the RCA. Gentle pull-back was performed but resulted in disruption of the balloon catheter despite deep intubation of both the guiding catheter and GL (Figure 2A). Only the proximal part of the balloon catheter, without the balloon itself, was extracted from the patient’s body. The DCB catheter was found to be disrupted at the junctional point of guidewire port (Figure 2B), which suggested that an approximately 30 cm long foreign body remained inside the patient. As coronary blood flow in the RCA was preserved, percutaneous retrieval was attempted immediately. First, Fielder FC (ASAHI Intec, Nagoya, Japan) was inserted to the distal RCA and the twisted guidewire technique was tried, but it failed, with the disrupted DCB moving ahead (Figure 2C). Next, an Amplatz GooseNeck Snare (Medtronic) was tried, but it failed to go into the guide-extension lumen of GL due to the bulky device profile (Figure 2D), only making DCB migrated more distally. Finally, a low-profile IKAZUCHI Zero semi-compliant balloon (1.5 × 10 mm, Kaneka Medical Products, Osaka, Japan) was carefully inserted through the GL without any resistance and inflated at 14 atm (Figure 3A). Successful entrapment of the disrupted DCB using GL and the balloon was performed, and all of the devices were retrieved together, keeping the guiding catheter engaged deeply (Figure 3B). To complete the revascularization, a third DCB (4.0 × 20 mm) was applied at the proximal target lesion following additional dilatation with a 4.0 mm high pressure balloon. Final excellent angiography was achieved without any other
Figure 1. Coronary intervention for severely calcified in-stent restenosis. A: Initial angiography showed focal restenosis (arrow) and diffusely under-expanded stents (dotted line) in the right coronary artery. B: Rotablator burr ø2.0mm was successfully passed through the entire length of the lesion. C: A drug-coated balloon was applied with strong backup support of GuideLiner.

Figure 2. Disruption of DCB catheter and unsuccessful bail-out technique. A: DCB catheter was disrupted when the distal tip of DCB was covered with deeply intubated GL and guiding catheter despite gentle pull-back. B: Disrupted DCB catheter. Only the proximal part of the balloon catheter, without the balloon itself, was extracted by gentle-pullback (looped one). The rest of it (with balloon) was also shown in B but with a picture after the successful retrieval. Arrows indicated the junctional point of the guidewire port. C: Disrupted DCB happens to move distally due to manipulation of another guidewire for the twisted guidewire technique. D: The GooseNeck Snare could not go into the guide-extension lumen of GL. DCB indicates drug-coated balloon; and GL, GuideLiner.
complications and the retrieved balloon was also recorded (Figure 2B). Extracorporeal testing was performed just after the procedure to confirm the feasibility of this bail-out technique (Figure 3C). Disrupted DCB catheter was smoothly withdrawn into the guiding catheter, together with GL and inflated IKAZUCHI Zero balloon (Figure 3D).

Discussion

Balloon catheter disruption is an extremely rare complication. It might occur due to both lesion and device characteristics in the present case. Generally, a used DCB is relatively bulky even after appropriate deflation and a longest DCB of 30 mm was used in our patient, which got stuck in the full-metal-jacket stents deployed in the tortuous and calcified vessel. A guiding catheter tends to be bent-shaped spontaneously to obtain sufficient backup support for intervention during the procedure, which could give the DCB catheter strong stress in its passage. All of these factors would result in the kink and fracture of a balloon catheter at the junctional point of the guidewire port.

The previously reported technique did not work for this case and might provoke a worse situation or another complication because of the lesion and device complexity. In this novel technique, adequate force to grasp long DCB was achieved by the combination of GL and an inflated balloon, which theoretically seemed similar to the way the GL advanced smoothly with an inflated anchoring balloon in the child-in-mother technique. In advancing a IKAZUCHI Zero through the GL, there was no resistance at all even though the residual DCB catheter was in it. According to the official device profile, GL could not accommodate both the DCB catheter and the IKAZUCHI Zero catheter simultaneously. The flexibility of material and elliptical transformation of GL could be an explanation for this phenomenon.

The use of a low-profile balloon was another key point of this technique to prevent the disrupted DCB from migrating distally in passing through the GL. A low-profile balloon with excellent crossability, often used in treating chronic total occlusion and calcified lesion, is preferable for safety reasons. The size of the balloon should be chosen based on the size of inner lumen of the extension catheter to ensure secure and safe capturing of the disrupted balloon. A balloon compliance chart would be also helpful to grasp it firmly. In this case, the 1.5 mm size was selected and the balloon was inflated at rated...
burst pressure (14 atm) because the inner lumen of a 7 Fr GL was 1.57 mm.

In the present case, this technique seemed promising because the GL had already been utilized and located near the disrupted DCB. If a balloon disruption occurred in the case without using GL, the conventional approaches should be tried first including the use of snare catheter. If they were unsuccessful, this technique could be considered before proceeding to the retrieval via another vascular approach or cardiac surgery. In this situation, however, a GL should be advanced to the proximal part of the disrupted balloon shaft very carefully and using an anchoring balloon technique would be recommended to avoid interference.

**Conclusion**

To the best of our knowledge, this is the first case report of successful retrieval of disrupted longest DCB using GL and low-profile balloon. This technique allowed the initial guiding catheter to continue engaging to the coronary artery without another vascular approach for retrieval, which would make an additional procedure for completing revascularization easier.

**Disclosures**

**Conflicts of interest:** The authors have no conflict of interest to declare.

**Ethical standard:** The human subjects have given informed consent and the authors have conformed to institutional guidelines.

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