Successful Retrieval of Entrapped Gaia Guidewire in Calcified Chronic Total Occlusion Using Rotational Atherectomy Device

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Summary

We report a novel technique for retrieving an entrapped Gaia guidewire in severely calcified coronary chronic total occlusion (CTO) using a rotational atherectomy device. By successfully cutting the entrapped and untangled guidewire within the CTO with the use of a rotational atherectomy device, we could effectively remove the Gaia guidewire from the right coronary artery.

Key words: Guidewire entrapment, Coronary intervention

Entrapment and fracture of coronary guidewires are rare complications of percutaneous coronary interventions (PCI) that can lead to life-threatening complications. Adverse sequelae from retained fractured wire fragments have been described, including accelerated restenosis, thrombosis, and perforation. The management of this complication is still under debate, and various options and devices are available from a percutaneous approach such as the use of a snare, stenting against the vessel wall, deep-guide catheter wedging with balloon inflation, and cardiovascular surgery. We report a case of successful retrieval of an entrapped guidewire during an elective PCI on coronary chronic total occlusion (CTO) of the mid right coronary artery (RCA) using various methods, including a rotational atherectomy device.

Case Report

A 75-year-old man was referred to our hospital for aggravating chest pain for over a month, despite receiving optimal antianginal medication. His risk factors for coronary artery disease were diabetes mellitus, hypertension, dyslipidemia, persistent atrial fibrillation and previous PCI history on the left anterior descending artery (LAD) and RCA, which were performed 10 years before in another hospital. Diagnostic coronary angiography (CAG) demonstrated patent previous stents in the distal-LAD and proximal-RCA; however, mid-RCA CTO with a collateral flow from LAD was found (Figure 1A). Coronary artery computed tomography angiogram was performed the day after CAG to evaluate the CTO lesion, and a severe calcified plaque was observed in the mid-RCA with a full moon calcification at the cross sectional view (Figure 2A, B). 5F Judkins left diagnostic catheter was engaged in the left coronary artery via the right radial artery for contra-lateral injection and 7F Amplatz left 1.0 short tip guiding catheter was engaged in RCA via the right common femoral artery. A Gaia second guidewire (Asahi Intecc, Nagoya, Japan) was introduced into the RCA with the help of a Corsair microcatheter (Asahi Intecc). Due to the difficulty in RCA CTO penetration using the Gaia second guidewire, a Gaia third guidewire was introduced, and a parallel wire technique was performed together with the Gaia second guidewire. However, the tip of the Gaia third guidewire was entrapped in a severely calcified plaque of the mid-RCA and could not be advanced or withdrawn (Figure 1B). An attempt to withdraw the guidewire was performed by inflating a 2.5 mm × 15 mm semicompliant balloon (Ryujin, Terumo, Tokyo, Japan) within the 7F Amplatz left guiding catheter and simultaneous guiding the catheter pullback. However, the retrieval of the Gaia third guidewire failed but caused guidewire elongation. Ligated and untangled guidewire was found within the descending aorta (Figure 1C). A second attempt was performed within the descending aorta by using an Amplatz goose-neck snare (25 mm; Medtronic, Minneapolis, MN, USA), which further elongated and untangled the guidewire by pulling the ligated end of the Gaia third guidewire. Since the guidewire tip was completely entrapped in the calcified plaque, the third attempt of guidewire retrieval consisted of cutting the guidewire at the ostium of the RCA CTO with a rotational atherectomy device. A 6F Judkins right guiding catheter was introduced via the right radial route, and a 0.009-inch RotaWire was placed at the CTO proximal cap. After firmly grabbing the untangled Gaia third guidewire within the descending aorta with the Amplatz goose-neck snare device to avoid embolization, wire cutting was performed using a Rotablator (burr size, 1.5 mm; Boston Scientific, Marlborough, MA, USA) at the previous stent area (Fig-
NOVEL TECHNIQUE FOR RETRIEVING ENTRAPPED GUIDEWIRE

Figure 1. A: Chronic total occlusion (CTO) in the mid right coronary artery. B: Entrapment of a Gaia third guidewire during coronary intervention. C: Untangled and ligated distal portion of the Gaia third guidewire within the descending aorta (white arrow heads). D: Wire-cutting technique of the entrapped Gaia third guidewire by using a rotational atherectomy device. E: Retrieved untangled Gaia third guidewire. F: Severed guidewire fragment was retained within the right coronary CTO lesion.

Discussion

To the best of our knowledge, this is the first reported case of a retrieval of an entrapped guidewire with a rotational atherectomy device. Rotational atherectomy devices are commonly used in calcified coronary interventions for lumen remodeling and enlargement by ablating the plaque using a diamond-encrusted elliptical burr ro-
tated at high speeds (140,000-180,000 rpm) with a helical driveshaft.\(^{5,6}\) One of the complications in using rotational atherectomy devices is guidewire ligation.\(^5\) Since the atherectomy burr preferentially ablates hard, inelastic material, we hypothesized that the entrapped Gaia guidewire could also be easily ligated with rotablation. As a result, after several maneuvers of rotational atherectomy, the Gaia third guidewire was ligated within the right coronary artery. If the guidewire tip is strongly entrapped in the calcified plaque and retrieving the whole wire is considered to be difficult, the wire-cutting technique with a rotational atherectomy device could be one of the last resort treatment options after employing well-known methods such as stenting against the vessel wall, snare loop, double- or triple-wire technique, biopomt, tornus microcatheter, deep-guide catheter wedging with balloon inflation, or pigtail catheter.\(^{11}\)

It is known that bifurcation lesions, tortuous and calcified lesions, and use of firm-tipped guidewires are important risk factors for guidewire entrapments and fractures. Hydrophilic-coated guidewire tips, in particular, can be easily broken in calcified and tortuous lesions. Therefore, the operator should be more careful when treating complex calcified lesions with hydrophilic guidewires.\(^9\) Gaia wires (Asahi Intecc), which are devoted to CTO interventions, have been recently released in the field of coronary intervention. The main characteristic feature of Gaia wires is the especially constructed composite (dual) core, which has a central core wire wrapped by six acetone wires, with spring coil in periphery.\(^{11}\) This feature eliminates the whip motion effect and enables a more gradual but precise tip rotation, which can increase the success rate of CTO interventions. However, since Gaia wires are also composed of hydrophilic coating at the distal portion, tip breakage and uncoiling or untanglement of the filaments could occur during severely calcified CTO interventions. In hydrophilic-coated guidewires such as those of the Gaia series, tips can be easily broken in calcified and tortuous lesions. Gaia guidewires are composed of six ropecoil wires, and, therefore, wire untanglement and elongation may occur during entrapment in addition to fracture. The most common mechanism of wire entrapment is continuous rotation to same direction while being trapped. Rotating the guidewire both clock-wise and counter clock-wise is thought to be the most important preventive method to avoid wire entrapment, leading to the wire elongation and untangle during CTO wiring.

The entrapment and fracture of guidewires during PCI as well as the retention of the broken part inside the coronary or systemic vascular system are rare complications. In our case, we ligated the entrapped guidewire with a rotational atherectomy device and left behind the guidewire fragment within the coronary CTO lesion since it was already a chronically occluded artery. Adverse sequelae have been reported from retained fractured wire fragments; however, the broken guidewire fragment is rarely the cause of serious complications.\(^{12}\) In a single center study, Hartzler \textit{et al.}\(^{13}\) reported only eight cases of fracture and retention of a guidewire fragment within the coronary circulation in 5,400 PCI procedures. Furthermore, it has been shown that small fractured components can be left in a chronically occluded coronary without significant sequelae.\(^{14}\) Although the ideal management for remnant guidewires is removal, conservative treatment with the wire fragments remaining in the coronary or systemic vascular system may not be hazardous if patients remain asymptomatic and hemodynamically stable.

### Conclusion

Fracture and entrapment of guidewires can occur not uncommonly in calcified and tortuous complex lesions during PCI. In such entrapment cases, percutaneous retrieval or conservative management should be first performed, with several methods having been reported. Our case highlights a novel method for retrieving trapped guidewires in coronary CTO lesions using a wire-cutting technique by rotational atherectomy.
Disclosures

Conflicts of interest: None.

References

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