Successful retrieval of an entrapped and uncoiled guide wire using a wire-cutting technique

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Abstract
Entrapment and uncoiling of a guide wire are life-threatening and technically challenging complications during percutaneous coronary intervention. We present a case using a wire-cutting technique with the guidance of intravascular ultrasound (IVUS) to retrieve an entrapped and uncoiled guide wire under the stent struts in a calcified circumflex artery.

Keywords: percutaneous coronary intervention, complication, intravascular ultrasound

During percutaneous coronary intervention (PCI), fracture and uncoiling occasionally occur while attempting to withdraw an entrapped guide wire. The fractured guide wire may continue to uncoil and float into the peripheral arteries, cerebral arteries or aorta, resulting in high risk of thrombus formation and the potential for severe clinical sequelae. Hence, fracture and uncoiling of the guide wire is regarded as a severe and life-threatening complication, requiring proper management without delay.

Percutaneous retrieval approaches include guide wire intertwining, snare capture and balloon inflation withdrawal. In some situations, surgical removal will be indicated if percutaneous retrieval is unsuccessful. Herein, we present an intravascular ultrasound (IVUS)-guided wire-cutting technique to withdraw an entrapped and uncoiled guide wire.

Case report
A 61-year-old man with a history of hypertension and hyperlipidaemia was admitted for three years of intermittent and one week of crescendo chest pain. Electrocardiogram demonstrated ST-segment depression in the anterior and inferior leads. Coronary angiography revealed subtotal occlusion in the left anterior descending (LAD) artery, 85% stenosis in a tortuous, calcified left circumflex artery (LCX) and 80% stenosis in proximal right coronary artery (Fig. 1A–C). The patient declined evaluation for coronary artery bypass grafting and preferred percutaneous coronary intervention (PCI) treatment.

Via right radial access, a stent (2.75 × 38 mm, Xience Prime, Abbott, USA) was deployed in the mid-LAD (Fig. 1D). Subsequently, a Sion guide wire (Asahi, Nagoya, Japan) and a BMW guide wire (Abbott, USA) were respectively placed into the LCX and the obtuse marginal (OM) artery. After pre-dilation with a 2.5 × 15-mm balloon (Sprinter, Medtronic, USA), two stents (2.75 × 23 mm, 3.0 × 28 mm, Xience Prime, Abbott, USA) were deployed from the distal to the proximal LCX, followed by post-dilation with a 3.0 × 15-mm non-compliant balloon at 18–22 atm.

The BMW guide wire was not retrieved from the OM prior to post dilation, resulting in the entrapment of the guide wire under the stent struts. The operator attempted to pull the guide wire out from the OM, but the BMW guide wire was uncoiled and fractured. The fractured portion of the guide wire was removed leaving part of the metal inner core and the entire outer coil in the body. (Fig. 1E). The radial sheath was removed and the patient was sent back to the ward.

Subsequently, the patient was transferred to the catheterisation laboratory for retrieval of the guide wire. A 7.0-Fr EBU3.75 guiding catheter was engaged via right femoral artery access. IVUS revealed that the residual guide wire was floating in the left main and proximal LCX (Fig. 2A). Given the challenge of removing the entrapped portion of the guide wire, we decided to cut off the guide wire at the ostium of the LCX.

Via the puncture site, the guide wire was protruding from the punctured site of the radial artery the next day due to the continuous uncoiling of the guide wire (Fig. 1F). The operator failed to pull out the guide wire because the protruded portion was connected to the entrapped portion and the two portions remained as a whole segment in vivo.

Subsequently, the patient was transferred to the catheterisation laboratory for retrieval of the guide wire. A 7.0-Fr EBU3.75 guiding catheter was engaged via right femoral artery access. IVUS revealed that the residual guide wire was floating in the left main and proximal LCX (Fig. 2A). Given the challenge of removing the entrapped portion of the guide wire, we decided to cut off the guide wire at the ostium of the LCX.

Via the puncture site, the guide wire was pulled until the uncoiling process terminated. A 0.009-inch RotaWire was placed into the LAD and rotational atherectomy was performed using a Rotablator (burr size, 1.5 mm; Boston Scientific, USA) at
140 000 rpm while firmly grasping the guide wire (Fig. 2B). After a 10-second rotablation, the guide wire was successfully cut off and retrieved (Fig. 2C). IVUS revealed that the guide wire was cut off at the ostium of the LCX and no guide wire was in the left main coronary artery (Fig. 2D, E).

Post-dilation was performed with non-compliant balloons (3.5 × 12 mm, 4.0 × 8 mm) at 18–20 atm. The patient was discharged three days later and received dual antiplatelet therapy with aspirin 100 mg and ticagrelor 180 mg daily.

After one year, the patient underwent follow-up angiography, which showed no restenosis or thrombus formation at the site of the residual entrapped guide wire (Fig. 2F). Based on the results from the follow-up angiography, ticagrelor was stopped and aspirin was recommended for long-term use. Up to the present time, the patient has been seen at two-year follow ups and remains in good condition without any chest pain.

**Discussion**

Although the uncoiling and entrapment of a guide wire is a rare occurrence, the outcomes of this complication may be catastrophic due to the risk of thrombus formation in the coronary artery. Optimal management of this complication remains under debate and removal of the guide wire is technically challenging.

In a series of case reports, snare capture or balloon inflation withdrawal is the most common technique used for the removal of the guide wire. However, these techniques were unsuitable in this case because any forced withdrawal would have unavoidably resulted in recurrence of fracture and floating of the uncoiled guide wire. Hence, our strategy was to pull the guide wire until the uncoiling process terminated and use rotational atherectomy to cut off the guide wire at the ostium of the LCX so that no guide wire remained in the left main artery. This wire-cutting technique presents an important alternative in cases where conventional retrieval techniques are not feasible and provides an applicable approach to avoid surgical retrieval.

A key consideration of this wire-cutting technique is to keep the guide wire straight while performing rotational atherectomy. A curved guide wire may entwine the burr and cause it to be entrapped. Additional lessons derived from this case were: (1) due to the risk of uncoiling, a BMW guide wire is not recommended to be used as a protective guide wire in the branch vessel of the coronary artery; (2) great care should be taken to avoid guide wire fracture after uncoiling as the residual guide wire would continue to uncoil and float into the other arteries; (3) as an important tool, IVUS provided vital information to optimise the procedure; (4) with standard antiplatelet therapy, the remaining guide wire in the coronary artery may be safely retained with thrombus-free status.
Conclusion

The retrieval of an entrapped and uncoiled guide wire is extremely challenging. In cases where conventional retrieval techniques are not feasible, a cutting-wire technique using rotational atherectomy is a potential alternative to avoid surgical retrieval.

References


Fig. 2. The uncoiled segment of the guide wire was retrieved via a wire-cutting technique. (A) IVUS demonstrated three guide wires in the left main artery; the uncoiled one and the other two guide wires from the LAD and LCX. The arrows indicate the three guide wire locations. (B) Rotational atherectomy was performed from left main to LAD to cut off the coiled guide wire. (C) The coiled segment of the guide wire was retrieved. (D) IVUS revealed the coiled guide wire was cut off at the ostium of the LCX. The arrow indicates the guide wire at the ostium of the LCX. (E) IVUS revealed no guide wire remnant in the left main artery. (F) One-year angiographic follow up showed no restenosis or thrombus formation in the LCX despite the guide wire remnant within the OM and under the stents struts.