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ISCHEMIC HEART DISEASE

CASE REPORT: CLINICAL CASE

Handmade Embolization Coil for Managing Guidewire-Induced Coronary Perforation

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ABSTRACT

This paper reports the case of an 83-year-old woman who underwent percutaneous coronary intervention in the left circumflex coronary artery complicated by a guidewire-induced perforation. Hemostasis was successfully achieved using a handmade coil prepared from available devices during percutaneous coronary intervention due to challenges with commercial microcoils. (JACC Case Rep. 2024;29:102528) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

An 83-year-old woman underwent invasive coronary angiography due to severe exertional chest pain despite multiple medications.

PAST MEDICAL HISTORY

The patient had long-lasting history of hypertension and dyslipidemia.

TAKE-HOME MESSAGES

- To demonstrate that hemostasis of guidewire perforations post PCI in emergency settings may be obtained using handmade coils created from available devices.
- Operators should know how to bail out coronary perforation when commercial microcoils are unavailable.

INVESTIGATIONS

Coronary angiography revealed severe stenotic lesions in the mid-left anterior descending artery and left circumflex artery (LCX) (**Figure 1A**).

MANAGEMENT

The patient underwent percutaneous coronary intervention (PCI) after shared decision-making. Prior to treatment, she received a total of 8,000 U of heparin, achieving an activated clotting time of 452 seconds. A guiding catheter was positioned in the left coronary artery. We attempted to thread a guidewire through the LCX lesion, which was difficult due to severe stenosis. A microcatheter (Zizai, Terumo) provided support, enabling successful passage of a tapered guidewire (XT-R, Asahi) through the stenosis. Subsequent angiography confirmed the guidewire placement beyond the stenosis into a side branch (**Figure 1B**). After retracting into the primary trunk, it was then advanced to the distal portion of the LCX.

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ABBREVIATIONS AND ACRONYMS

LCX = left circumflex artery

PCI = percutaneous coronary intervention

The lesion was predilated with a balloon (NSE Aperta 2.25-9 mm, Nipro). Intravascular ultrasound confirmed no major dissection or hematoma. Because of the small vessel, the lesion was dilated with a drug-coated balloon (Agent 2.5-20 mm, Boston) without stent placement. The left anterior descending artery lesion was treated similarly using a drug-coated balloon (Agent 2.5-15 mm, Boston). Final angiography revealed enlarged stenotic lesions; however, we observed extravascular leakage of the contrast material at the base of the left ventricular lateral wall (**Figure 1C**), attributed to guidewire perforation during the entry into the side branch in the LCX lesion crossing (**Figure 1B**). Despite stable vital signs, the patient reported persisting chest pain. Hemostasis was required to stop the bleeding.

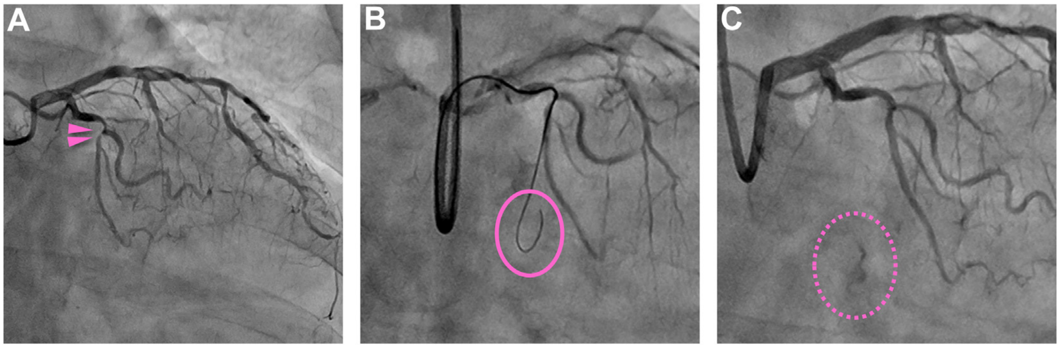
Efforts to reduce bleeding in the side branch via low-pressure balloon dilation in the middle of the LCX were limited by ischemia. Administration of protamine (30 mg) reduced activated clotting time to 172 seconds but did not achieve hemostasis. The Zizai microcatheter was advanced into the bleeding side branch (**Figure 2A**, Video 1), and the tip contrast injection indicated a bleeding point (**Figure 2B**). An embolization microcoil (Hilal Curl 0.018-inch, 10 mm, Cook) was deployed through the microcatheter (**Figure 2C**). The microcoil reached the Zizai microcatheter tip, which bent to fit the shape of the curled microcoil due to its soft tip, and slipped out of the side branch (**Figures 2D to 2F**). This event occurred twice. To deliver the microcoil to the bleeding point, we attempted to increase the microcatheter diameter; however, it (Finecross GT, Terumo) could not advance into the side branch.

We hypothesized that the curled shape of the microcoil would hinder their delivery through the microcatheter; however, all commercial microcoils at our facility were either curled or tornado-shaped, and straight microcoils were unavailable. Given the successful entry of the guidewire into the side branch, we opted to implant a fragment of the guidewire tip at the bleeding point instead of using a commercial microcoil.

We created the handmade coil as follows (Video 2). Initially, we inserted the tip of a guidewire into the inserter from the tip outside the body (**Figures 3A and 3B**). Using fluoroscopy, we adjusted the length of the guidewire within the insert (**Figure 3C**). Subsequently, we cut the guidewire at the tip of the inserter using scissors (**Figures 3D and 3E**). Commercially, Hilal microcoils are typically available in lengths of 10 and 20 mm, so we tailored the guidewire to match these dimensions, considering its radiopaque portion extended 30 mm, we cut it to be one-third to two-thirds of the opaque portion. Finally, we inserted the guidewire fragment into the microcatheter through the end port (**Figure 3F**).

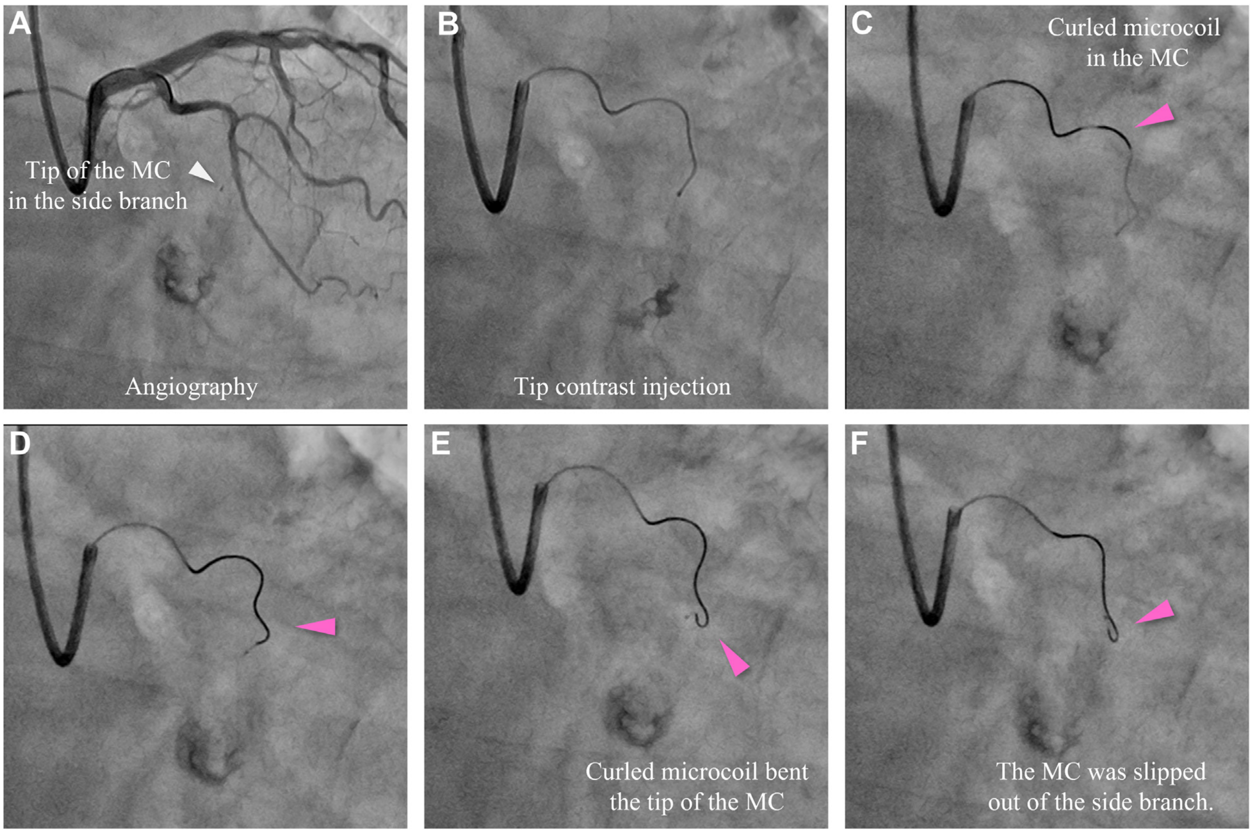
The guidewire fragment (Runthrough UF, Terumo) was then advanced to the tip of the Zizai microcoil. Unlike the curled microcoil, the microcatheter successfully delivered the tip fragment to the bleeding point without slipping out of the side branch (**Figures 4A to 4C**, Video 3). The guidewire fragment effectively sealed the bleeding point, achieving hemostasis similar to standard microcoil placement

FIGURE 1 **Percutaneous Coronary Intervention for a Left Circumflex Artery Lesion**



(A) Target lesion in the mid-left circumflex artery indicated by arrowheads. (B) Tapered guidewire passes through the lesion but advances into the side branch (circle). (C) Post-percutaneous coronary intervention angiography reveals extravascular leakage of contrast medium (dotted circle).

FIGURE 2 **Implantation of a Commercial Curled Microcoil at the Bleeding Point Through the MC**



(A) Zizai MC (arrowhead) inserted into the bleeding side branch. (B) Tip contrast injection indicates the bleeding point. (C) Embolization microcoil (Hilal Curl 10 mm, Cook) (arrowheads) deployed through the MC. (D to F) Microcoil reaches the MC tip, causing it to bend to fit the shape of the curled microcoil, leading to slippage out of the side branch. MC = microcatheter.

techniques (Figure 4D). Echocardiography conducted in the catheterization laboratory revealed no evidence of pericardial effusion.

Subsequently, the chest symptoms of the patient resolved, serial echocardiography indicated no pericardial effusion, and blood tests did not indicate elevated myocardial enzyme levels. The patient was discharged 4 days later.

OUTCOME AND FOLLOW-UP

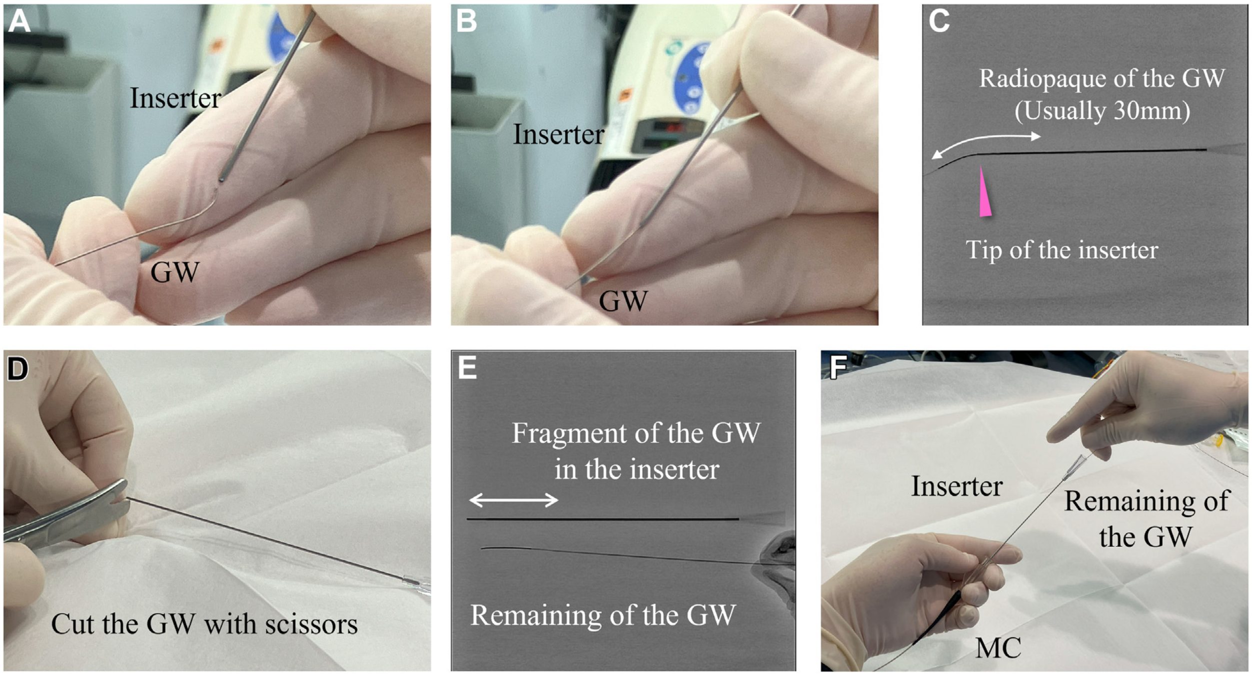
After discharge, the patient received dual antiplatelet therapy for 1 month, and her chest symptoms did not recur after 3 months.

DISCUSSION

Untreated wire perforation during PCI can lead to serious complications (eg, cardiac tamponade).[1,2] Various methods exist for achieving hemostasis after wire perforations. The placement of covered stents can be problematic because they may reduce blood flow to other side branches. Fat and clot embolization have been reported to result in inadequate hemostasis.[3] Coil embolization is considered one of the most reliable methods.[4] Commercial microcoils of an appropriate length and shape are not always available. In this case, only curl-type microcoils were available; however, their shape caused the microcatheter tip to bend, hindering delivery to the bleeding point. Consequently, commercial microcoils could not be used.

In PCI procedures, improvised devices are occasionally used when standard equipment is lacking. Previously, we described fashioning a handmade snare from common PCI tools.[5] Other handmade hemostatic methods (eg, cutting the balloon tip,[6] absorbable suture) have also been documented.[7] In this case, we used familiar devices readily accessible during PCI. Moreover, our approach was similar to

FIGURE 3 **Preparing the Handmade Coil**



(A and B) GW tip introduced into the inserter from the tip outside the body. (C) Fluoroscopy adjustment of GW length within the inserter (arrowhead). (D and E) GW cut using scissors at the inserter tip. (F) GW fragment (2-headed arrow) pushed into the microcatheter. GW = guidewire; MC = microcatheter.

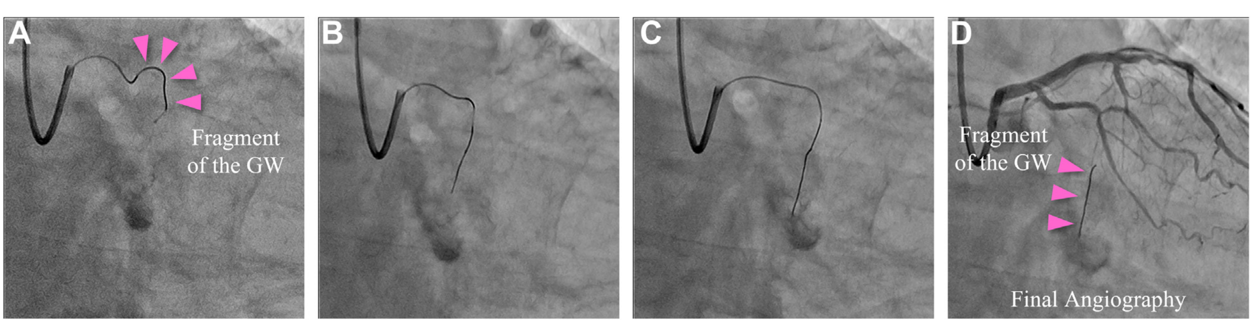
that used for commercial microcoil implantation. Operators should select these methods based on their familiarity and the perforation size.

Finally, although knowing how to manage wire perforation during PCI is crucial, it is equally important for operators to prevent perforations by monitoring the position of the distally advanced guidewire and promptly correcting any deviations.

CONCLUSIONS

We achieved hemostasis of the guidewire perforation during PCI using a handmade coil created from available devices. This approach was necessary due to challenges with commercial microcoils. The adaptability of the length and shape of handmade coils allows for application by any operator.

FIGURE 4 **Handmade Coil Is Placed at the Bleeding Point**



(A to C) Microcatheter advances GW fragment (arrowheads) to the bleeding point, unlike with the curled coil. (D) Handmade coil (arrowheads) successfully achieves hemostasis. GW = guidewire.

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KEY WORDS case report, complication, coronary angiography, percutaneous coronary intervention

APPENDIX For supplemental videos, please see the online version of this paper.