Case Report

Septal Wire Entrapment During Recanalisation of a Chronic Total Occlusion with the Retrograde Approach

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We report the case of an unsuccessful attempt at recanalisation of a chronic total occlusion via the retrograde approach, and describe a rare complication, guide wire entrapment in the donor artery and septal branch. Several conventional attempts to retrieve the guide wire were unsuccessful and led to wire fracture. A new approach, involving very deep guiding catheter intubation followed by a double guide wire rotary motion, was then used to retrieve the proximal end of the wire fragment and re-engage the uncoiled segment within the distal part of the donor artery. After assessment of the length of the remaining distal end of the wire segment with intravascular ultrasound, stent implantation crushed the wire filament to the vessel wall.

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Breakage and retention of wire fragments in coronary arteries is an infrequent but serious complication of percutaneous coronary interventions (PCIs) that has been reported since their early days in the 1980s.[1,2] Although the technological advance of PCI hardware has limited the cases of mechanical failure derived from manufacturing or design defects, the increasing application of PCI in treating complex lesions, such as chronic total occlusions (CTOs), is still followed by complications involving wire entrapment and fracture.[3] Retained intracoronary fragments may be either left permanently within the artery, or removed percutaneously or surgically.[1,4,5]

The recently introduced retrograde techniques for treating CTOs utilise the small collateral branches, mainly septal, feeding the chronically occluded vessels, with a view to recanalising the occlusion via the retrograde approach. This is believed to be advantageous, particularly in the most complex of the CTOs. However, these are highly demanding techniques, which are also limited by the occurrence of certain complications.[6]

In this report, we describe a case of guide wire entrapment in the donor artery and septal branch following an unsuccessful attempt at retrograde CTO recanalisation. We also present the particularities of our strategy for the management of the retained wire.

Case presentation

A 68-year-old male with hypertension and dyslipidaemia and a 6-year history of chronic stable angina pectoris presented with 2 months of crescendo angina pectoris. An exercise electrocardiogram was strongly positive at moderate workload. Coronary angiography was performed at the referring institution, with findings of an occluded left anterior descending artery (LAD) with features of chronicity, specifically septal collateral filling from the right coronary artery. Furthermore, there was an 80% severity stenosis in the proximal left circumflex artery (LCx). An

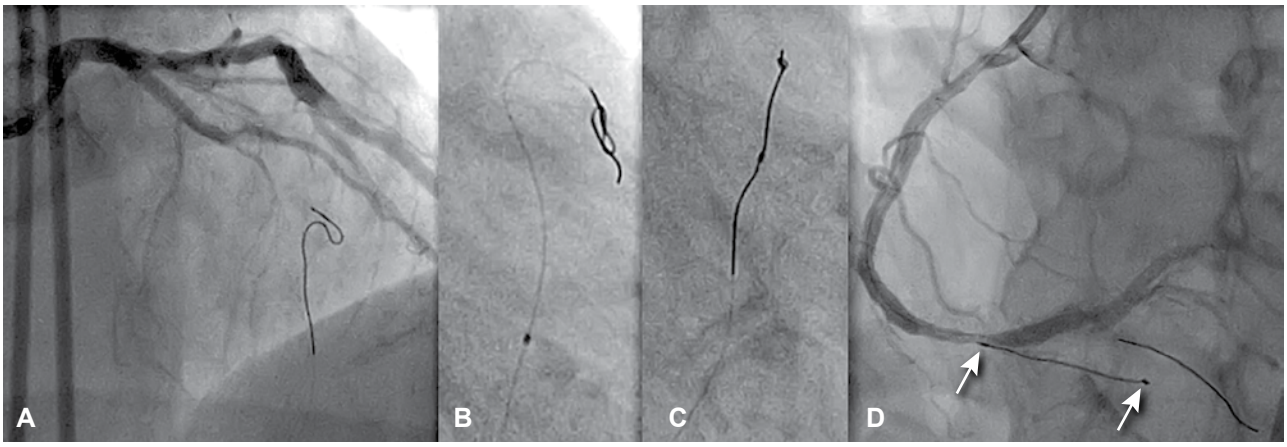

Figure 1. A. Positioning of the retrograde wire in the distal left anterior descending coronary artery after successful negotiation of the septal channel. B & C. Retrograde wire folding at the level of the distal radio-opaque tip. D. Retrograde wire (arrows) entrapment in the septal channel.

immediate attempt at recanalisation via an antegrade approach to the LAD was unsuccessful and coronary artery bypass grafting (CABG) was recommended. As the patient remained ambivalent regarding CABG, a further attempt at LAD recanalisation was arranged after 2 months at our institution.

The procedure was performed using a bilateral femoral approach with contralateral injection from the right coronary artery (RCA). Initial set-up images demonstrated a relatively straight and continuous septal channel from the distal RCA, filling the LAD beyond the occlusion retrogradely. Given the prior failed antegrade attempt, an initial retrograde strategy was adopted with a 6F Judkins 4.0 guiding catheter and a Fielder guide wire (Asahi-Intecc, Japan). The wire successfully negotiated the septal channel, entering the LAD just distal to the distal cup. An attempt to penetrate the occlusion with this wire failed and it was finally positioned in the distal LAD (Figure 1A). A 1.25 x 10 mm Rujijn over-the-wire (OTW) balloon (Terumo, Japan) supporting the wire was used to cross and dilate the septal channel, but it was not possible to advance it beyond the mid segment despite significant effort. During this manoeuvring, the wire was moving back and forth in the LAD and was observed to become folded at the level of the distal radio-opaque tip (Figure 1B). During an attempt to retrieve the wire within the OTW balloon, its tip folded even further (Figure 1C). Both the OTW balloon and the Fielder wire were pulled back as a unit, but this was only possible as far as the take-off of the septal branch from the posterior descending branch, where considerable resistance was noted, indicating wire entrapment in the septal channel (Figure 1D).

Further attempts to remove the wire resulted in partial (Figure 2A) and complete uncoiling of the wire (Figure 2B). In an attempt to release the trapped tip a new wire was used to re-cross the septal channel in a plan to further dilate with a balloon, but this strategy failed. Another approach adopted was to dilate a balloon in the guiding catheter and extract the wire together with the new guide wire, but this too was unsuccessful and led to fracture of the wire, with its distal core remaining in the guiding catheter and throughout the entire length of the RCA. A novel approach, involving very deep guiding catheter intubation (which provided increased backup support) up to the crux, and vigorous and simultaneous rotation of two BMW (Guidant) guide wires, was used to retrieve the proximal end of the wire fragment and reengage the uncoiled segment within the distal RCA (Figure 2C). Intravascular ultrasound (IVUS) was then used to assess the length of the distal segment of the trapped wire. Subsequently, two Xience V stents (Abbott-Vascular) were implanted from the take-off of the septal branch to the middle segment of the RCA to crush the fragmented wire along its entire length against the arterial wall "burying" it under the stent struts, as confirmed by control IVUS. The final angiographic result is depicted in Figure 2D.

The LAD occlusion was next approached antegradely and a Terumo NT wire successfully crossed the occlusion. Stenting using two Xience V stents was performed, followed by IVUS. The procedure ended

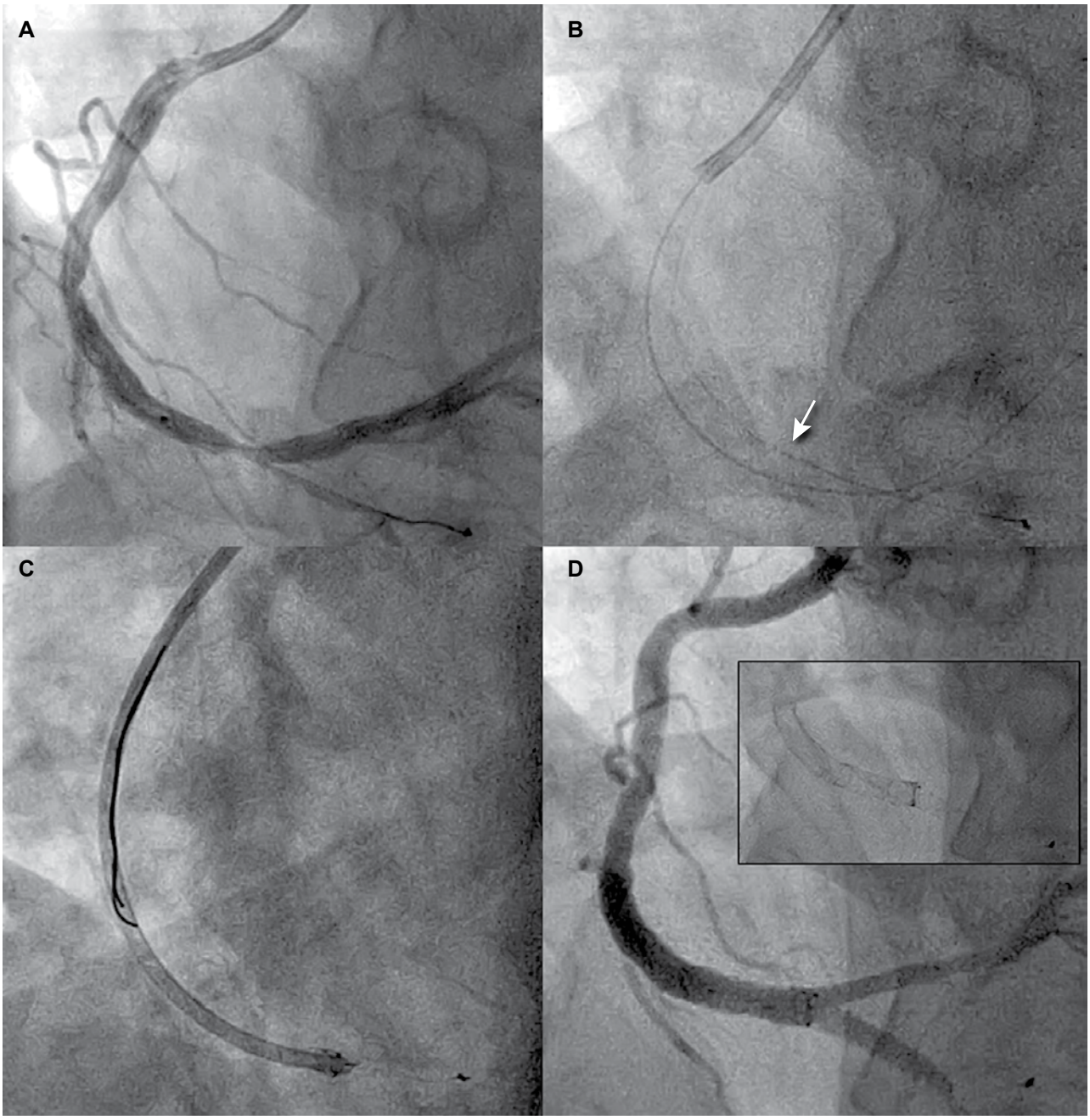

Figure 2. A. Partial uncoiling of the retrograde wire in the right coronary artery (RCA) indicated by the partial shortening of its radio-opaque tip. B. Complete uncoiling of the retrograde wire in the RCA indicated by the complete loss of its radio-opaque tip. C. Deep catheter intubation to re-engage and retain the fractured wire (increased radiopacity) within the RCA after capturing its proximal tip with two BMW wires. D. Final angiographic result in the RCA after stenting and entrapment of the fragmented wire against the arterial wall. The small insert better demonstrates the stents before contrast agent injection.

with treatment of the pre-existing lesion in the proximal LCx. At 12 months' follow up, the patient was asymptomatic and off all anti-anginal therapy, but remained on dual antiplatelet medication with clopidogrel and aspirin. Control angiography revealed widely patent stents in all 3 arteries (Figure 3).

Discussion

Wire rupture associated with unravelling or fracture of the distal tip may be the result of wire entrapment, and occurs especially when the operator engages complex lesions necessitating over-rotation and pro-

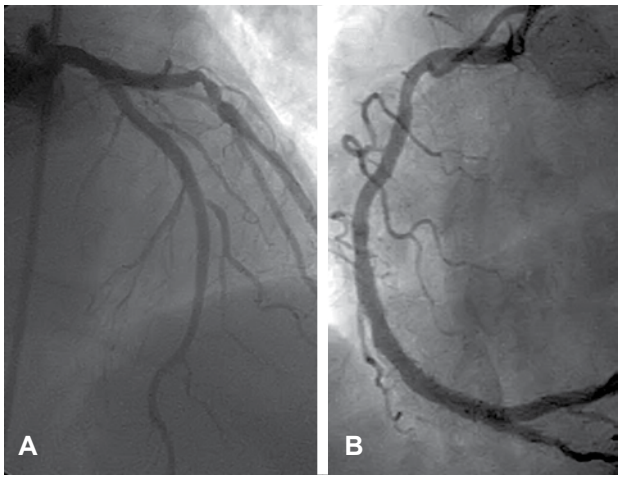

Figure 3. Control angiography at 6 months' follow up revealed patent stents in the left anterior descending and left circumflex coronary arteries (A) and right coronary artery (B).

longed manipulation of the wire. The treatment of severe or heavily calcified stenoses,[3] lesions in tortuous vessels[7,8] and CTOs[1,9] has been reported to predispose to this complication. Furthermore, wire fracture has previously been reported as a result of rotational atherectomy or the use of thrombectomy devices, where direct trauma to the wire is the inherent cause of wire transection.[10,11] A higher risk is seen when the wire is positioned within a small branch that does not allow rotation, and in some circumstances can cause entanglement and fracture.[12] Recently applied techniques for CTO lesions using retrograde access via the tiny collateral channels have drawn considerable attention to the benefits of successful CTO PCI,[6,13-15] but may also increase the risk of complications, such as wire entrapment in our case.

Retained wire fragments in coronary arteries ideally require percutaneous – if possible – removal, since they may cause narrowing of the artery, late perforation, arrhythmia or thrombotic occlusion, especially when they are long and involve a patent coronary artery.[16] Conversely, very small fragments in previously occluded vessels have been reported not to cause adverse sequelae and may be left in the coronary artery.[1] A fashioned or ready-made snare apparatus, with or without the use of a probing catheter,[17,18] gradual withdrawal of an inflated balloon,[1] two or three guide wires torqued with several rotations[9,19] and retrieval devices with forceps[12] have been successfully used for the percutaneous removal of intracoronary fractured wire segments. Furthermore, stent implantation jailing the guide wire tip/fragment, complemented by lifelong double antiplatelet therapy, has been reported as an alternative approach in cases where the fragment is trapped and cannot be removed.[8]

Our case highlights a new technique to help retrieve the retained wire percutaneously. This proved useful after conventional attempts using a balloon inflated in the guiding catheter were unsuccessful. Deep guiding catheter intubation, which has been successfully employed previously in patients with complex coronary anatomy,[20] increased backup support and allowed the re-engagement of the uncoiled segment at the distal part of the RCA after repeated rotary and back-and-forth simultaneous movement of the two wires. IVUS was invaluable for assessing the length of the remaining fractured wire, and then helped guide the final stenting procedure to crush the wire filament to the vessel wall. Other attempts, including snaring the wire out, were inappropriate in our case, given that the entrapment was in the collateral channel, but may be useful in situations where the wire fragment is localised to an epicardial artery.

Conclusion

Wire fracture is a rare but recognised complication during PCI, and the complexities associated with the retrograde technique for CTO recanalisation increase the risk for wire entrapment and subsequent fragmentation due to the passage of dedicated materials through the small-sized collateral channel. If a wire fragment is retained in the coronary circulation, deep guiding catheter intubation and a double wire approach could be applied for retrieving the fragment, and stenting under IVUS guidance could help to rescue percutaneously a challenging situation, if a wire segment is trapped in the coronary artery.

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