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Navigating an Entrapped Guide Wire in RCA CTO PCI: A Case Report

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Abstract

Background: Guide wire fracture and entrapment during coronary intervention are rare but serious complications. These incidents can lead to thromboembolism, vessel perforation, and thrombosis, necessitating immediate and careful intervention.

Case Report: We present a case involving a male patient undergoing PCI for a chronic total occlusion (CTO) of the right coronary artery (RCA), where a guide wire became entangled and entrapped under a deployed stent, requiring complex percutaneous techniques. Despite prolonged efforts using multiple retrieval strategies, the wire fractured. The remnant was securely embedded with a stent and post-dilated. The patient recovered without event.

Conclusion: Entrapped guide wires represent a rare yet serious complication in PCI. When extraction is unfeasible, stenting over the remnant with adequate post-dilation is a viable and safe alternative.

Keywords: Guide wire entrapment; PCI; Wire fracture; Chronic total occlusion

Background

Percutaneous coronary intervention (PCI) remains a technically complex procedure, especially when addressing chronic total occlusions (CTOs) [1,2]. Despite advancements in equipment and operator skill, complications like guide wire fracture and entrapment remain critical concerns [3,4]. Such events can result in vessel injury, thrombosis, and the need for surgical intervention [5]. This case highlights a particularly complex scenario involving RCA CTO PCI where wire entrapment under a stent required multiple percutaneous maneuvers, ultimately culminating in wire fracture and stent-embedding of the fragment.

Case Presentation

A 48-year-old man presented with exertional chest discomfort and dyspnea, categorized as NYHA Class III. He remained symptomatic despite being on maximally tolerated anti-anginal therapy, which included bisoprolol 5 mg once daily, nitroglycerin 5 mg twice daily, and ranalozine 375 mg twice daily. His medical background included dyslipidemia and tobacco use, and he was previously diagnosed with chronic coronary syndrome.

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His previous cardiac interventions included provisional PCI involving the left main using a 4.0 × 22 mm drug-eluting stent (DES), the left circumflex artery (LCx) using a 2.5 × 16 mm DES, and the first diagonal branch (D1) using a 2.5 × 12 mm DES. Two previous RCA CTO PCI attempts at other hospitals were unsuccessful.

Echocardiography revealed preserved systolic function (LVEF 75.4%). Coronary angiography demonstrated patent stents in LM-LAD, LCx, and D1. The distal LCx artery supplied collateral circulation to the distal RCA. A CTO was identified in the mid RCA, distant to the RV branch, with a 2 J-CTO score and considerable tortuosity. Cardiac CT imaging revealed a predominantly non-calcified plaque with focal calcification, causing complete occlusion of the mid-RCA. The lesion had a tapered entry, short length (9-11 mm), and eccentric calcification proximal to the occlusion. Two side branches (RV branch and acute marginal branch) were present near the occlusion.

Given the tortuous anatomy and prior procedural challenges, access was gained via bilateral femoral sheaths (7 Fr). The RCA and LCA were engaged with AL 1.7 Fr and JL 3.5 catheters, respectively. Balloon anchoring (1.0/15 mm) in the RV branch was employed as an anchoring technique to improve support (Figure 1).

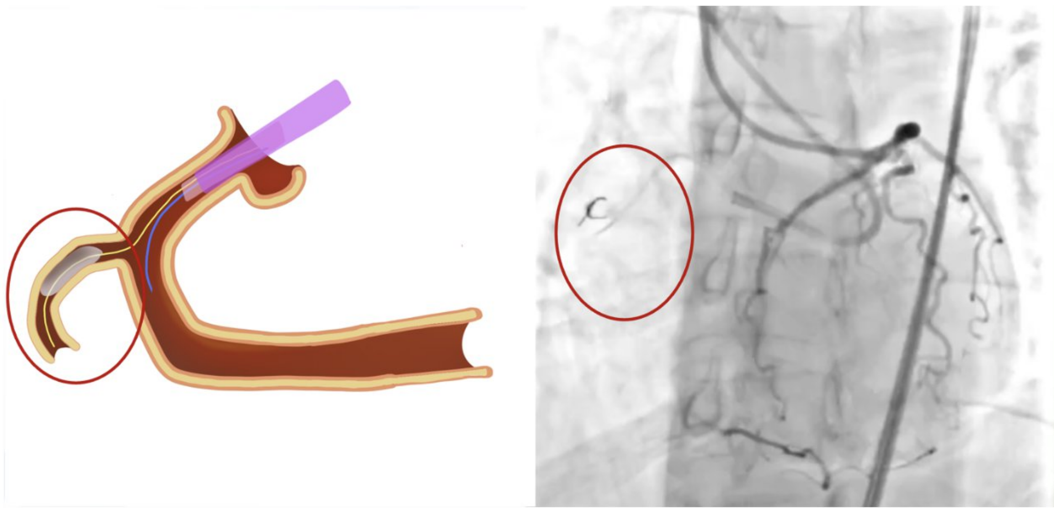

Figure 1: Balloon anchoring technique illustration. A small balloon (1.0/15 mm) inflated in the RV branch to provide support for device delivery in a tortuous RCA anatomy.

Wire escalation was attempted using Hypercoat, XTR, XTA, and Gaia First wires via a Teleport microcatheter was unsuccessful. Parallel wiring with a dual-lumen catheter (Sasuke) allowed successful passage of the XTR wire into the PL branch. Serial dilatation was done using 1.25, 2.0, and 2.5 mm SCB balloons.

Pre-PCI OCT revealed dominant fibrous plaque. Further preparation with a Score flex (3.0/15 mm) scoring balloon was performed via a Guide Extension Catheter (GEC).

Before deploying a 3.0/38 mm DES Xience Expedition stent from the right posterolateral branch (RPL) to the mid-distal RCA, a hydrophilic wire (Runthrough hypercoat), was placed in the PDA to protect the RPDA; however, the tip of the wire accidentally formed a knuckle.

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Rewiring of the RPDA and retrieval of the jailed wire were initially planned; however, the attempt to retrieve the jailed wire was unsuccessful, marking the onset of a complex procedural complication. Multiple small semi-compliant balloons (1.25/10 mm to 2.0/10 mm) were inflated behind the stent and facilitated wire extraction (Figure 2), but these efforts failed. Several microcatheters, including Teleport, Caravel, and Corsair Pro, were also utilized in conjunction with balloon inflation, yet wire retrieval remained unsuccessful. We suspected that the knuckled jailed wire had become entangled within the stent struts. A balloon was placed distal to the stent to stabilize the distorted stent structure during numerous retrieval attempts. After four hours of unsuccessful efforts, a final maneuver was performed: deep intubation of both the guiding catheter and a Guide Extension Catheter (GEC) into the proximal RCA to apply direct traction (Figure 3). This resulted in wire fracture, leaving the distal segment embedded within the stent (Figure 4).

Fluoroscopy confirmed that the fractured wire tip was retained within the deployed stent in the mid-RCA. It did not extend into the PDA or beyond the stent margins. Since the fragment appeared trapped between the stent struts and the vessel wall, with no protrusion into the lumen, no further attempt to sandwich the remnant wire with an additional stent in the PDA was performed. Given the patient's hemodynamic stability and the diminutive size of the retained wire tip, it was decided to leave the wire fragment in place. A 3.5/15 mm non-compliant balloon was subsequently utilized for post-dilation to secure the wire fragment and minimize thrombotic risk. Two extra stents were implanted to finalize the procedure: a Cruz Superflex 3.5 × 44 mm in the mid RCA and a Xience Xpedition 3.5 × 28 mm in the proximal-ostial RCA. Final angiography demonstrated TIMI 3 flow in the RCA and its right ventricular branches. After an uneventful recovery, the patient was discharged two days later. During the follow-up visit six months later, angiography confirmed that the stents remained patent and the retained wire fragment was still in place, without any evidence of stenosis or thrombus formation.

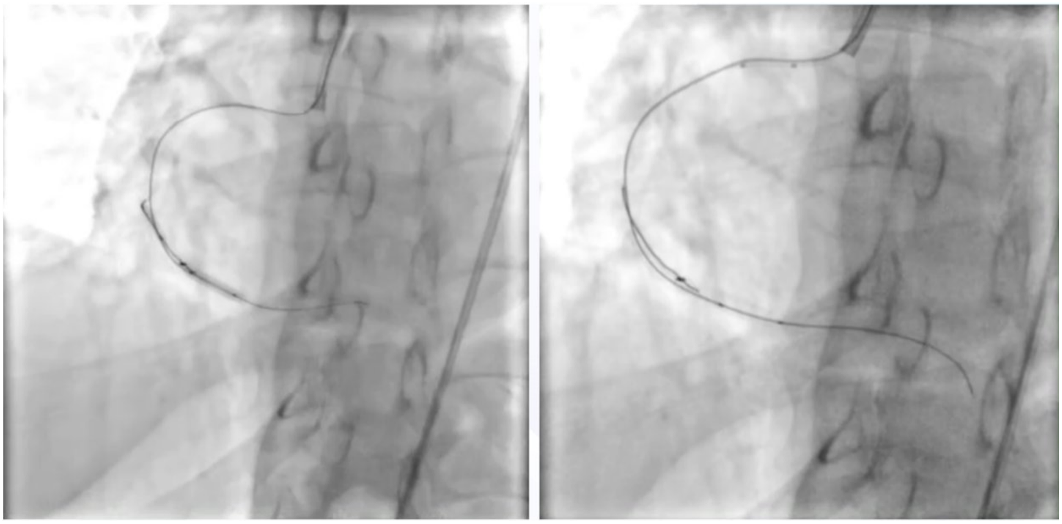

Figure 2: Stepwise use of small balloons (1.25/10 mm, 1.5/10 mm, and 2.0/10 mm) positioned behind the stent struts in an attempt to dislodge the entrapped guide wire. The retrieval was unsuccessful.

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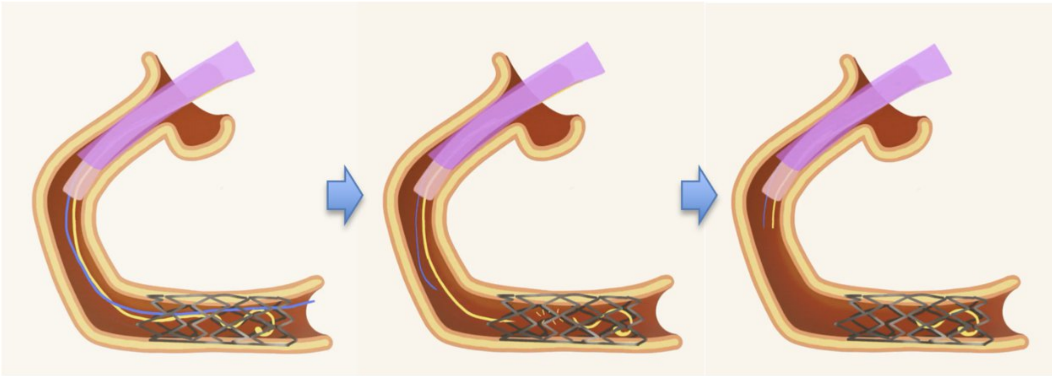

Figure 3: Illustration of final retrieval attempt: Deep intubation of the guiding catheter and guide extension catheter applied direct traction to the wire, resulting in fracture and retention of the distal wire segment.

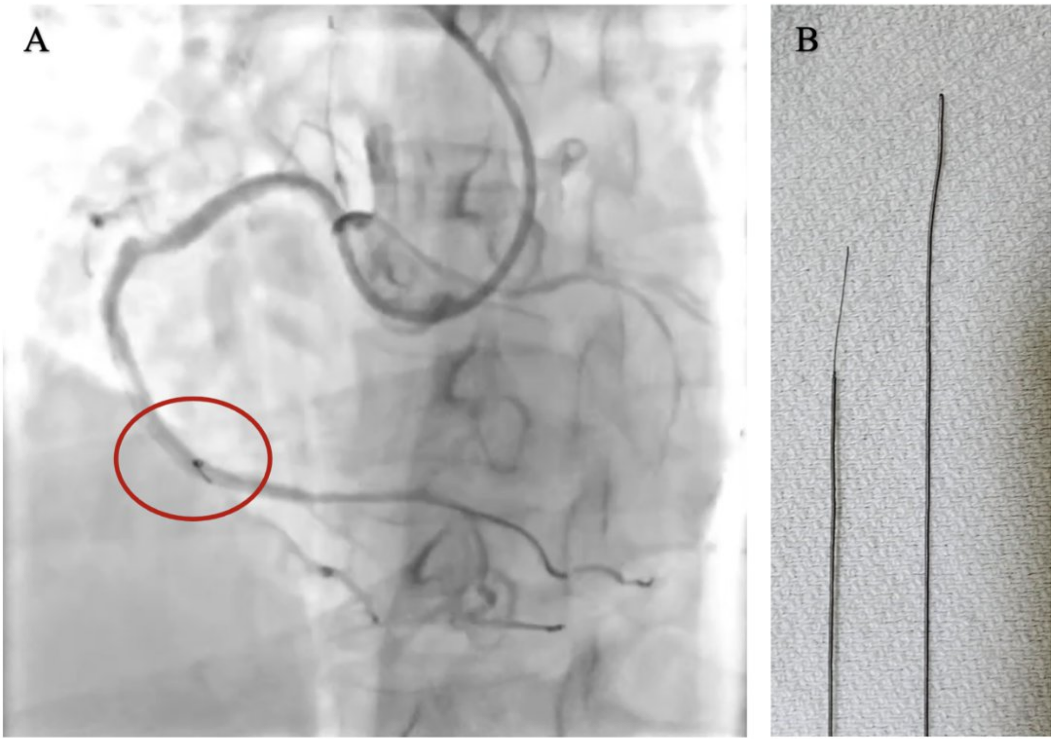

Figure 4A: Fluoroscopic view showing the retained distal tip of the fractured hydrophilic guide wire embedded in the stent. **B:** Picture of the fracture wire.

Discussion

Rare but possibly fatal side effects of PCI include guide wire entrapment and fracture [2]. Retained fragments may provoke coronary thrombosis, distal embolization, dissection, or vessel perforation [1,4]. Management options include surgical removal, percutaneous retrieval, or embedding and stenting the fragment in place, depending on anatomical feasibility and patient stability [3].

Various techniques have been proposed for retrieval, such as snaring, balloon trapping, and deep intubation of the guiding catheter. The American Heart Association has published an algorithm to assist in managing retained intracoronary hardware (Figure 5). Delivering force as close as possible to the entrapment site and pulling components as a single unit increases success rates. In some cases, guide extensions, microcatheters, or multiple wires are needed to manipulate and dislodge the fragment [3,6].

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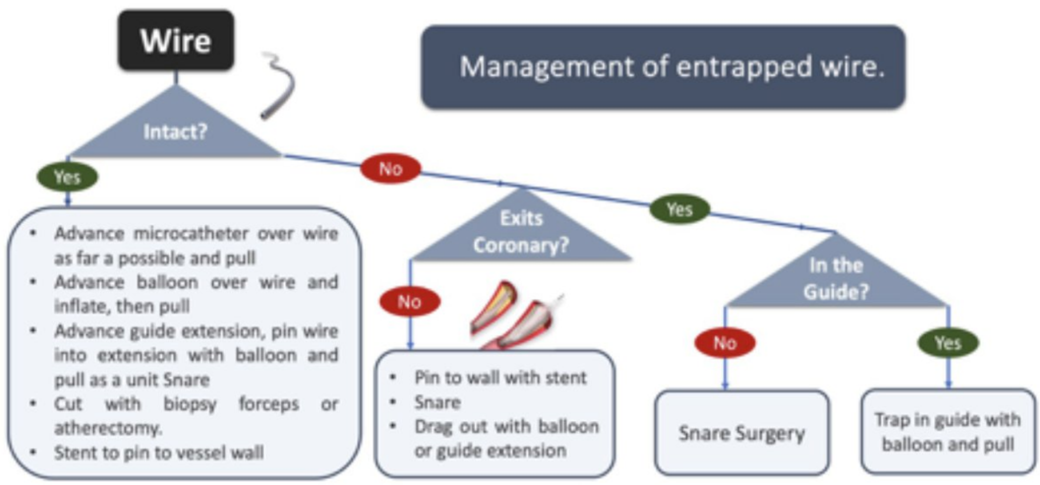

Figure 5: Simplified algorithm (adapted from the AHA Task Force algorithm) for the management and retrieval of retained guide wires during PCI, adapted from current interventional guidelines [6].

In our case, despite the use of small balloons, microcatheters, and multiple guidewires, extraction of the trapped wire was unsuccessful. Following prolonged attempts, a controlled traction maneuver led to wire fracture. Given the patient's stable condition and the location of the retained segment, we elected to leave the remnant wire in situ and proceeded with high-pressure post-dilation of the stent. This strategy restored vessel patency, minimized thrombotic risk, and avoided further vascular injury. Although surgical extraction may be warranted in select cases, stenting over the retained segment with optimal post-dilation remains a safe and pragmatic approach, particularly in high-risk or clinically stable patients. When percutaneous retrieval techniques are unsuccessful or when a retained fragment lies in a proximal location, surgical removal remains a valid therapeutic option. Kotoulas et al reported that surgical extraction through coronary arteriotomy with direct wire removal can be performed effectively, yielding good short-term outcomes [7]. Thus, recognizing the point at which further percutaneous maneuvers are unlikely to succeed is critical, and timely referral for surgical intervention should be pursued if the retained fragment threatens major epicardial vessel flow or carries a risk of embolic complications. In terms of wire remnant management, fluoroscopic imaging showed that the retained segment was securely embedded within the deployed stent in the mid-RCA. The wire did not extend into the PDA or the vessel lumen. Therefore, additional sandwiching stents were not deployed, as the position of the fragment did not pose further risk of migration or compromise blood flow. This conservative approach also minimized the risk of over-stenting and subsequent restenosis.

The long-term presence of retained guide wire fragments, particularly hydrophilic wires, may increase the risk of thrombosis or in-stent restenosis. However, several reports have demonstrated that embedding the fragment with a stent followed by high-pressure post-dilation can significantly mitigate this risk by minimizing wire mobility and ensuring optimal stent apposition [3,4]. In such cases, dual antiplatelet therapy (DAPT) is generally recommended for at least 12 months. For retained wires involving proximal segments or longer fragments, extended or even lifelong DAPT may be considered, although no formal guidelines exist. Regular follow-up using imaging modalities such as coronary CT angiography or invasive angiography is advisable to monitor for late complications. In our patient, DAPT with aspirin and ticagrelor was maintained, and follow-up angiography at six months confirmed patent stents with no evidence of thrombus or restenosis. Nevertheless, continued long-term surveillance is essential to identify any delayed adverse outcomes.

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From the operator's perspective, this complication was likely multifactorial. The entrapment and eventual fracture may have been precipitated by the hydrophilic nature of the jailed wire, its knuckled tip, and its positioning beneath the stent struts. In hindsight, preventive measures could include selecting a wire with better torque control for side branch protection, confirming wire alignment before stent deployment, and avoiding deep knuckling in confined segments. Should a similar situation arise, we would consider to strengthen the tip of the knuckle wire before early rewiring. Additionally, employing retrieval techniques such as dedicated snare devices earlier in the process may improve success rates and avoid wire fracture. This case reinforces the value of anticipating entrapment risk during complex CTO PCI and highlights the need for a structured escalation strategy when retrieval becomes difficult.

Conclusions

In rare cases where guidewire entrapment and fracture occur during PCI and extraction is not feasible, embedding the wire fragment with a stent and adequate balloon dilation is a viable and safe solution. This approach prevents migration, restores blood flow, and reduces thrombotic risk. Long-term follow-up and extended antiplatelet therapy may be warranted.

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