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Case Report
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Coronary Stent Avulsion by Jailed Side-Branch Pressure Wire

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Abstract

We describe a case report of coronary stent avulsion by a jailed side-branch pressure wire. Diagnosis was confirmed by angiographic and intravascular ultrasound imaging. The avulsed stent was treated by crushing to the vessel wall by a second stent.

Keywords: Coronary stent avulsion; Complication; Jailed pressure wire

Introduction

Provisional stenting is advocated as the default bifurcation stenting technique which jails a side-branch wire. The jailed wire keeps side-branch open and increases success of intervention if it occludes [1]. However, complications like jailed wire fracture/unravelling, stent avulsion or vessel injury during jailed wire retrieval may occur. Stent avulsion is a rare complication of percutaneous coronary intervention (PCI) where stent segment is displaced from original implantation site due to interaction with intracoronary devices like guidewires or balloon catheters while the intact stent segment remained in the intended area. The avulsed stent becomes stretched and deformed [2]. There is no consensus for managing this complication. We describe a case report of coronary stent avulsion during retrieval of an entrapped side-branch pressure wire.

Case Report

A 60-year-old male with angina underwent coronary angiogram which showed proximal to mid LAD diffuse disease (Figures 1 and 2). EBU 3.0 6Fr guiding catheter was used for LAD fractional flow reserve (FFR) measurement using Pressure Wire X (Abbott, IL, USA). FFR was 0.75. Stenting of proximal to mid LAD was decided. LAD was wired with Sion Blue to provide support to deliver a long stent and pressure wire was repositioned to D2 (Figure 3). After predilatation, CRE8 Evo 2.75 x 46 mm stent (Alvimedica, Turkey) was positioned in LAD using its radiopaque markers. Stent was deployed (Figure 4) and post-dilated with non-compliant 3.0 x 15 mm balloon. Satisfactory result was achieved with proximal stent marker in proximal LAD (Figure 5 and 6). Resistance was felt when removing the jailed pressure wire. Pressure wire was successfully removed with disengagement of guiding catheter and forcefully pulling on the wire. Angiogram showed hazy defect in proximal LAD (Figure 7). Proximal stent marker was displaced to the left coronary cusp (LCC) (Figure 8). LAD was rewired and dilated with 3.0 x15 mm balloon. Intravascular ultrasound (IVUS) confirmed stent integrity beyond D2. Stent was deformed proximal to D2. It elongated through left main artery (LM) and protruded into LCC. There was incomplete stent apposition and plaque protrusion in proximal LAD (Figure 9). Examination of pressure wire showed no missing segment. Decision was made to stent and crush the deformed stent from ostial LM to mid LAD leaving a segment of unraveled stent in LCC. This was a safer alternative to an attempted snare retrieval of the stent with high likelihood of vessel injury. Surgery was declined by the patient. To reduce the likelihood of deformation of the second stent by the unraveled stent, a 6F Boosting guider extension catheter was positioned in mid LAD. A CRE8 3.5 x 46 mm stent was deployed from ostial LM to mid LAD beyond D2. The stent was post-dilated with non-compliant 3.5 and 4.0 mm balloons (Figure 10). IVUS showed that the second stent crushed the unraveled stent to the vessel wall (Figure 11). A segment of avulsed stent remained beyond LM in LCC. Patient was pain-free during procedure and was discharged

the following day. He was prescribed lifelong dual anti-platelet therapy (DAPT). He was reviewed in clinic after 6 months with no angina or hospitalization.

Figure 1: *Diffuse LAD stenosis (RAO Cranial).*

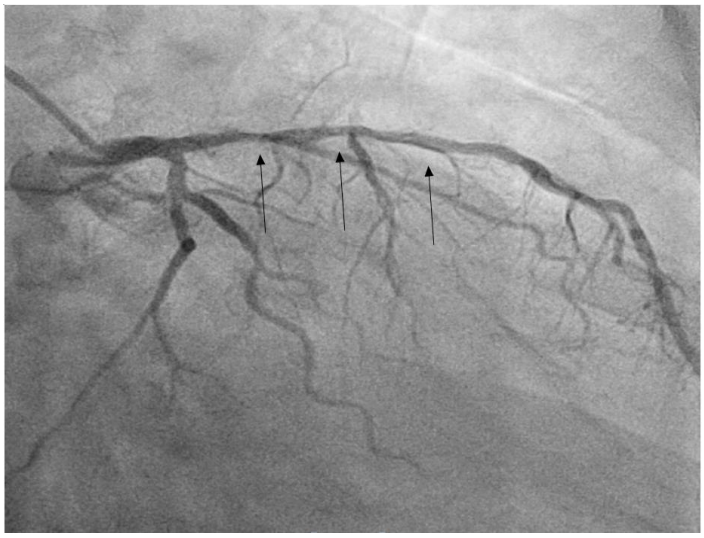

Figure 2: *Diffuse LAD stenosis (RAO Caudal).*

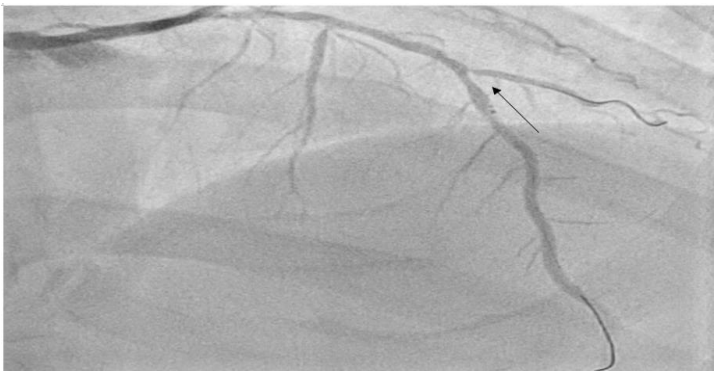

Figure 3: *Pressure wire positioned in D2. Ostial D2 stenosis (arrow).*

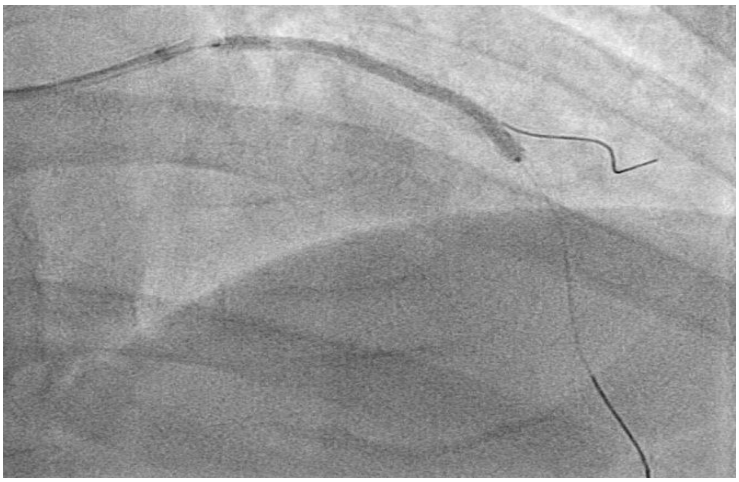

Figure 4: *Deployment of stent.*

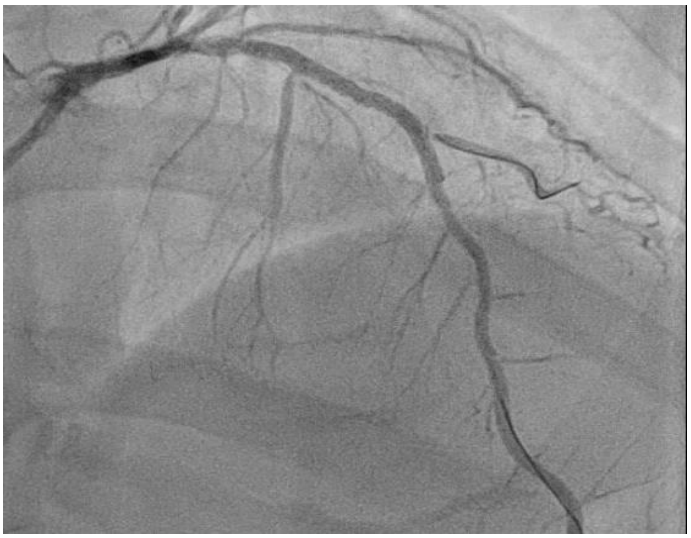

Figure 5: *After stent deployment.*

Figure 6: *Proximal stent marker.*

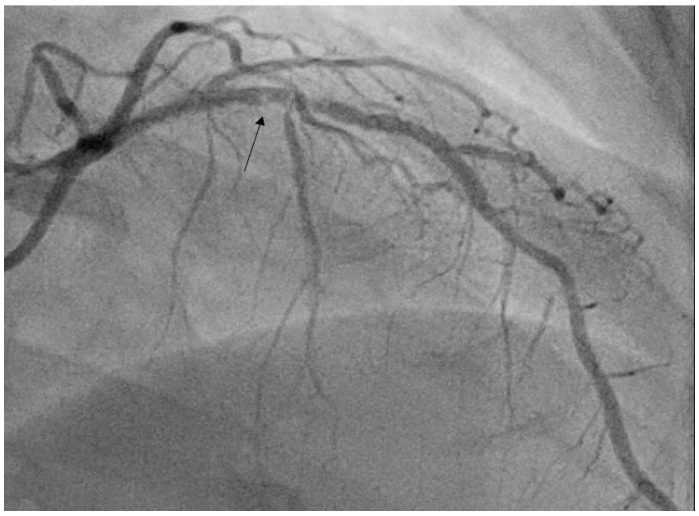

Figure 7: *Filling defect in mid LAD.*

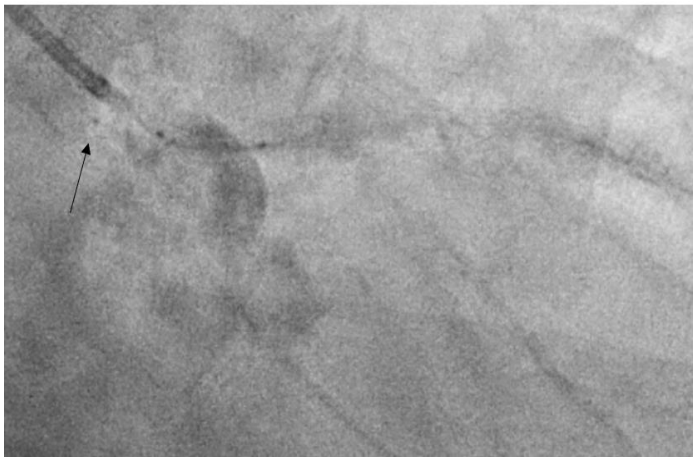

Figure 8: *Displaced proximal stent marker in LCC.*

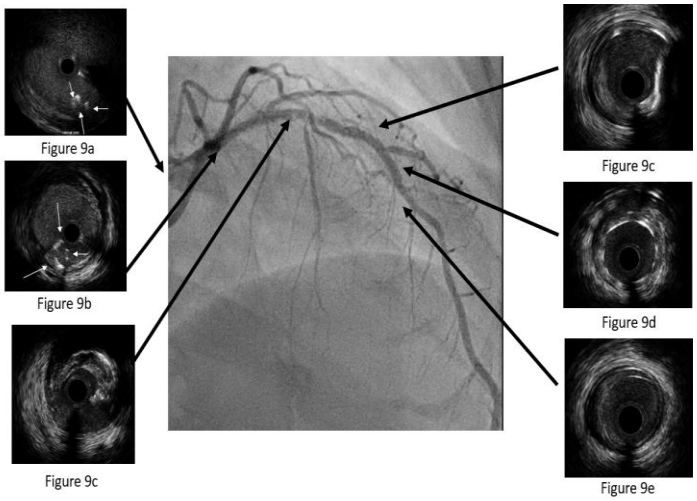

Figure 9: IVUS after stent avulsion
Figure 9a: Protrusion of deformed stent (arrows) into LCC
Figure 9b: Elongated stent (arrows) extending to LM
Figure 9c: Disruption of stent and plaque prolapse
Figure 9d: intact stent distal to D2
Figure 9e: LAD distal to stented segment

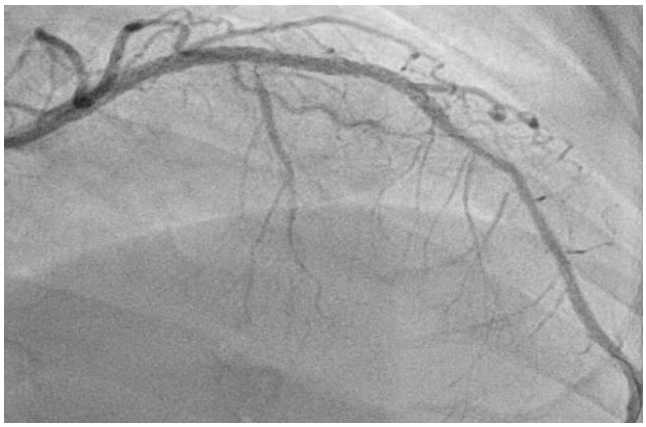

Figure 10: *Angiogram after deployment of second stent.*

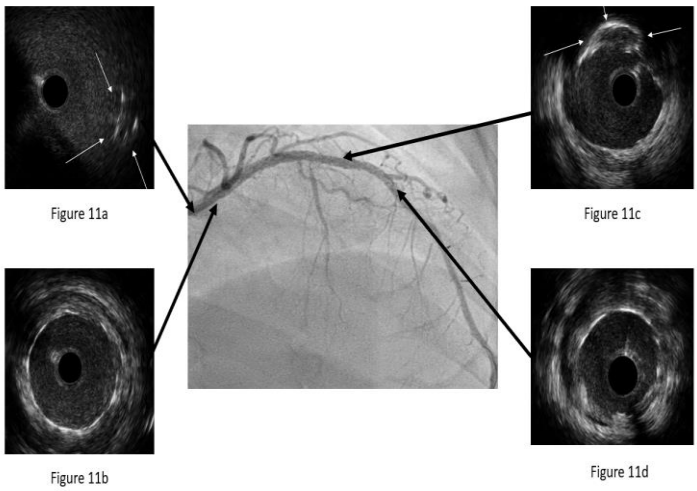

Figure 11: *IVUS after deployment of second stent*

Figure 11a: Protrusion of deformed stent (arrows) into LCC

Figure 11b: Good expansion and apposition of second stent in LM

Figure 11c: Deformed stent (arrows) crushed to vessel wall by second stent

Figure 11d: Good expansion and apposition of stent distal to D2.

Discussion

To the best of our knowledge, this is the first case report of coronary stent avulsion by an entrapped side-branch pressure wire. Entrapment of a side-branch wire is rare. Factors that predispose to entrapment include heavy coronary calcification, long jailed wire segment under stent struts, increased stent-to-coronary artery diameter ratio and high-pressure balloon post-dilatation [3-6]. In our patient, pressure wire in the jailed side-

branch is an additional risk factor. Design improvements of new-generation pressure wires facilitates the use of one coronary wire both for physiological evaluation and PCI [8]. However, subtle differences between the pressure wire and dedicated coronary guidewires are present and can result in complications when using pressure wires in PCI. Case reports of pressure wires being trapped by coronary stent struts have been reported with entrapment occurring at level of the pressure transducer. Increased wire diameter and uneven surface at level of pressure sensor are postulated to be causes of entrapment [7]. In our patient, the pressure wire was entrapped, and forceful withdrawal of the jailed pressure wire resulted in stent avulsion. Pressure wires are not recommended to use as jailed wire due to potential entrapment. When guidewire entrapment occurs, small-caliber devices like low-profile balloons or micro-catheters can be advanced over jailed guidewire with selectively forceful retrieval to avoid stent deformation (5, 6, and 9). Strong index of suspicion aid recognition of stent avulsion which can be missed with serious consequences like stent thrombosis and may make subsequent PCI more complex. Intracoronary imaging IVUS or optical coherence tomography (OCT) is of paramount importance to ascertain diagnosis and guide management. Management strategies of stent avulsion include (i) deployment of additional stent to crush the deformed stent against vessel wall, (ii) percutaneous retrieval of the avulsed stent and re-stenting of coronary artery segment and (iii) surgery where the deformed stent is retrieved and bypass grafting performed. Deployment of additional stent was performed for our patient. This is less invasive compared to surgery with less risk of vessel injury compared to percutaneous retrieval. However, a segment of the avulsed stent is left in LCC. The avulsed stent crushed by the additional stent may result in reduced vessel wall apposition and a smaller luminal diameter post-stenting. Long term effects of these changes are unknown. Percutaneous retrieval of stent can be attempted with snares. This represents the most complete solution as the deformed stent is completely removed. However, risks of coronary artery injuries like dissection and perforation, loss of coronary wire position when the deformed stent/snare/wire is removed en-bloc, and abrupt coronary artery closure are potential side-effects. Surgery, with stent retrieval and coronary artery bypass, may represent a complete but invasive solution. This option was discussed and rejected by our patient. Crushing the avulsed stent to the vessel wall with additional stent in our patient enabled quick resolution of the complication, completion of PCI and at least good short-term result. Optimal duration of DAPT is unknown. Risk of thrombosis versus bleeding risks need to be considered. Our patient was placed on lifelong DAPT unless bleeding event occurs.

Conclusion

Our case report illustrates the potential dangers of using pressure wire as a jailed side-branch wire during provisional bifurcation stenting. IVUS confirmed this diagnosis and facilitated management. Additional stenting to crush the avulsed stent to vessel wall resulted in good short-term outcome. Avoidance of pressure wire as jailed side-branch wire and techniques to retrieve an entrapped wire should be considered to avoid stent avulsion.

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Authors' Contribution

All authors have participated in drafting, reviewing and revising the manuscript and have approved its submission.

Conflicts of interest disclosure

All authors state there are no conflicts of interest.

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