A Fractional Flow Reserve Guidewire Causing Longitudinal Stent Compression and Successful Recovery

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ABSTRACT

Longitudinal stent deformation (LSD) is a rare complication but can occur during coronary intervention. We report a case with LSD of the distal edge, documented by an optical coherence tomography investigation and successfully recovered.

Key words: Optical coherence tomography imaging, percutaneous coronary intervention, stent deformation

INTRODUCTION

The stent design is a balance between several characteristics that contribute to performance, flexibility, radiopacity, and longitudinal and radial strength of the stent.[1,2] Longitudinal stent deformation (LSD) in deployed coronary stents is a rare complication that can happen as consequence of different mechanisms.[3] In most of the cases, the LSD not only affects the proximal stent edge (attempting to pass secondary device into stent, guide catheter compression) but can also affect the distal aspect (attempting to withdraw secondary device through stent).[4]

We present a complication encountered using a fractional flow reserve (FFR) guidewire, 2 weeks after stent deployment, documented by an optical coherence tomography (OCT) investigation, and successfully recovered.

CASE PRESENTATION

A 62-year-old male was admitted in emergency to our intensive care unit for a myocardial infarction without ST-elevation. The coronary angiography (CAG) revealed a suboclusion of the proximal left anterior descending (LAD) artery and an intermediate stenosis of the mid-LAD [Figure 1]. We therefore performed an urgent percutaneous coronary intervention (PCI) of the proximal LAD using a 6 French EBU-3.5 guiding catheter system through the right radial artery. After predilatation of the proximal LAD with 3.0 mm semicompliant...
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balloon (Trek, Abbott-Vascular®), we deployed a 3.5 mm × 15 mm everolimus-eluting stent (EES) Xience Alpine (Abbott Vascular®) at 14 atmospheres. The stent was then impacted with a 4.0 noncompliant balloon (NC Trek, Abbott Vascular) at 16 atmospheres. At the end of the procedure, the angiographic aspect was successful [Figure 2] with a TIMI 3 flow. The follow-up showed no chest pain with a normal electrocardiogram and the peak of troponin was 11 ng/ml.

We planned to realize a new coronary angiography (CAG) two weeks later to measure FFR of the mid-LAD stenosis.

CAG confirmed a good result of the previous angioplasty in the proximal LAD. We therefore performed a measurement of FFR in the mid-LAD with a 6 Fr EBU-3.5 guide catheter system through the right radial artery. The FFR wire (Saint Jude Medical®) was placed in the distal LAD without encountering any difficulty or any resistance. The FFR after adenosine intracoronary injection was 0.90. When retrieving the FFR wire, some resistance was felt. The wire was stuck at the level of EES and was retrieved by progressive application of force. The resistance decreased and the wire could progressively be retrieved. When inspecting the retrieved wire, the distal coil appeared elongated on its total length [Figure 3]. Moreover, on CAG, the EES appears on angiography shorter and more radiopaque [Figure 4].

At this stage, we decided to recross the deformed stent with several types of guidewire (a hydrophilic-coated floppy [Terumo®], a distal coil Asahi Sion Blue [Biosensors]) and we finally succeeded to cross the EES with a hydrophilic-coated whisper 0.004" wire (Abbott). To assess the position of the wire, we used first a balloon catheter which glued to the tip of the LAD without any resistance. Then, we introduced an OCT catheter (St. Jude Medical®) to visualize the wire position in relation to the stent as well as to document the longitudinally deformed stent [Figure 5].

Only after these two verifications, we reopened the distorted EES using sequentially a 2.0 balloon (mini-Trek, Abbott), then a noncompliant 3.0 balloon (NC Trek, Abbott) to compress the deformed stent.

Finally, a new 3.5 mm × 15 mm bare metal stent (BMS) (Pro-Kinetic, Biotronik®) was deployed to the lesion to cover the deformed EES as well as the traumatized distal vessel segment. The stent was further impacted with a 4.0 noncompliant balloon (NC Trek, Abbott®) [Figure 6]. We ended with an OCT (St Jude Medical®) interrogation to confirm optimal EES and BMS impaction [Figure 7]. Again, the patient suffered no adverse sequelae and remains well at follow-up.

DISCUSSION
Complications such as LSD can occur during coronary intervention despite the developments in PCI technology. We reported a case with a rare complication of the deployed stent being severely shortened. We successfully treated this complication with a hydrophilic-coated Whisper 0.014 wire.

This case is summarized below:
- Even we impacted a 3.5 EES with a 4.0 noncompliant ballooning, the FFR wire passed through the distal stent edge
- We retrieved the stuck wire by force, which shortened distal stent edge
- We succeed to cross the EES with a hydrophilic coated Whisper 0.004" wire
- Finally, the deformed stent could be redilated and compressed toward the vessel wall using a new BMS.

In this case, the stent has been deformed and looked like a “lump of metal.” Deformation of the stent...
strut usually affects the proximal stent edge.[4-7] The majority of LSD affects the proximal aspect of the stent and is due to attempts to withdraw secondary equipment, most commonly an IVUS catheter, filter wire device, and previously inflated balloon.

The main causes of this complication were thought to be the accidental deep engagement of the FFR wire through the distal edge of the stent and retrieving the FFR wire by force. In addition, despite the stent was impacted with a noncompliant ballooning, the possible stent malapposition may have also affected the development of this complication.

**CONCLUSION**

LSD can also affect the distal edge of the stent and may occur even if the stent was impacted with a noncompliant ballooning. Because it is unfeasible
to retrieve a deformed stent from the coronary, compression of the deformed stent using ballooning and another stent is desirable. In this case, the OCT investigation may confirm LSD and the final impaction.

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Conflicts of interest
There are no conflicts of interest.

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