Longitudinal Stent Compression : A Not So New Percutaneous Coronary Angioplasty (PCI) Complication

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INTRODUCTION

Percutaneous coronary angioplasty(PCI) has evolved from plain old balloon angioplasty(POBA) only to more challenging angioplasty in complex coronary artery disease(CAD) lesions as a result of continuous improvement of stent designs. However, every generation, or new type of stents, has advantages and complications related to the design of the stents which maybe be discovered only in the post-marketing period. Stent compression is a recent entity reportedly happening in a variety of stents and we wish to highlight our local experience with this phenomenon with a particular drug eluting coronary stent associated with coronary wire entrapment.

CASE REPORT

A 60 year old male came to the outpatient clinic with frequent exertional chest pain Canadian Cardiovascular Society Angina Class II. His cardiovascular risk factors were diabetes mellitus type II, prior smoking and hypertension. An elective diagnostic coronary catheterisation showed 60-70% stenosis in mid-distal left anterior descending artery(LAD), mid left circumflex(LCX) 80% stenosis and ostial obtuse marginal (OM) 60% stenosis with bifurcation lesion Medina 1,1,1 classification. Ad hoc percutaneous coronary angioplasty(PCI) was initiated with 6F EBU 3.5 guiding catheter to engage the left main stem. 2 BMW Universal II Guide wires(Abbott Vascular) were used to track down the LCX and main OM respectively. A Promus Element 2.5x20mm stent(Boston Scientific) was deployed from the mid to distal LCX across the main OM. The second BMW wire(Abbott Vascular) in the main OM was removed before postdilation with noncompliant Sprinter 2.75x12mm balloon(Medtronic). After postdilatation of the Promus Element stent(Boston Scientific) in the main branch(MB), there was haziness at the bifurcation area and jailing of the OM. The main OM was a moderate-large caliber vessel with a significant area of distribution. Hence, we changed to a culotte bifurcation stenting strategy. We encountered difficulty reentering the ostium of the main OM with the second BMW wire(Abbott Vascular) and instead, wired down the terminal LCX to exchange with the in-situ first BMW wire(Abbott Vascular) but the wire was pulled out inadvertently into proximal LCX. We then rewired down the terminal LCX.

Finally, the second BMW wire(Abbott Vascular) managed to cross into the main OM to enable predilation of the ostium of the main OM with a Sprinter Legend 1.5x10mm balloon(Medtronic). A Promus Element 3.0x16mm stent(Boston Scientific) was deployed at nomimal pressure from the proximal of the main OM into the stented main branch before attempting to remove the first BMW wire(Abbott Vascular) in the MB. The first BMW wire(Abbott Vascular) could only be pulled back until the overlapped stented segment. Sequential balloon dilatation at the proximal stent edge in the main branch with Sapphire 1.0x10mm balloon(Orbus Neich) and Sprinter Legend 1.2x10mm(Medtronic) managed to free the trapped first BMW wire(Abbott Vascular). Unfortunately, the second BMW wire(Abbott Vascular) in the main OM was inadvertently removed in the process.

We encountered great difficulty in maneuvering the BMW wire(Abbott Vascular) into the inlet of the stent in the MB before finally advancing it until the distal end of the vessel. We tried to pass an Excelsior 1018 Microcatheter(Boston Scientific) and a 1.5x10mm Sprinter Legend balloon(Medtronic) through the inlet of the stented segment but the passage had much grittiness and resistance and we could not advance further. At this juncture, we stopped and repeated angiography of the LCX. We identified unusual stent opacification of the proximal stent segment in the MB compared to the rest of the stent segment. We tried to image the coronary with Dual Source Computed Tomography(Siemens) but there was too much blooming artifact at the stented segment.

Subsequent dobutamine stress ECHO was negative for ischemia and he remained well 3 months after the procedure.

DISCUSSION

The original intention was provisional stenting of the main branch across the main OM vessel which was to be later crossed over to a Culotte bifurcation technique. The damaged tip of the first BMW wire(Abbott Vascular) must have passed under the stent struts during the rewiring stage and got trapped during the deployment of the second stent. Low profile small balloons were used to get under the proximal stent struts in the MB and inflated gently in order to free the trapped first BMW wire(Abbott Vascular).

The aggressive pushing of the low profile small balloon must have induced significant longitudinal compressive force on the proximal stent edge in the MB and the inflation of the

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balloon contributed to lifting, distortion and invagination of the proximal stent struts. It was unusual for low profile Excelsior Microcatheter (Boston Scientific) and a 1.5x10mm Sprinter Legend balloon (Medtronic) to be unable to advance into the stented segment unless the BMW wire (Abbott Vascular) had threaded through multiple layers of lifted stent struts. This precluded the use of intravascular ultrasound (IVUS) or optical coherence tomography (OCT) to confirm the complication and to guide proper expansion of the damaged stent segment as the probe may get caught by the layers of damaged stent struts and caused more procedural complication.

However in this case, it was the intention to apply longitudinal force with the balloon to slightly separate the proximal stent struts to release the entrapped wire and postdilate with noncompliant balloon to expand properly the deformed proximal stent segment which we failed to do. Instead, the increased radio-opacity of the Promus Element stent(Boston Scientific) conferred by its platinum alloy component had easily revealed the proximal stent segment which was compressed in a concertina manner.

Contemporary new generation of drug eluting stents are designed with thinner struts to give better delivery and conformability. This added advantage is at the expense of longitudinal strength and stability whereby more longitudinal stent deformation cases are reported this year. Longitudinal stent deformation has been described with Promus Element (Boston Scientific), Taxus Liberte(Boston Scientific), Endeavour (Medtronic), Biomatrix (Biosensor) and Resolute Integrity (Medtronic) [1,2]. However, in a case series review, the rate of stent deformation was the highest 0.86% with Promus Element (Boston Scientific) [1]. The mechanisms alluded to longitudinal stent compression and deformation included accidental guiding catheter compression for aorto-ostial deployed stents, distal crush of stent with postdilatation balloon and postdilatation balloon deforming the proximal stent edge [1,2].

From the experimental work of Prabhu *et al* [3], it was explained that the offset peak-to-peak Promus Element stent(Boston Scientific) design contributed a great part to its much publicized lower resistance to longitudinal compression rather than a class effect of the stents. The increased radio-opacity characteristic of this stent had actually enabled easy detection of this complication compared to other stent types which may also develop this complication but that may not readily detected by angiography.

From the Malaysian National Cardiovascular Disease Database (NCVD), there were 11,498 PCI procedures done from 2007-2009 [4] and given the reported incidence of 0.86%[1], we should expect at least 33 such cases a year in Malaysia.

The proper way to avoid this complication is scrupulous good technique in performing the procedure and be vigilant in detecting this exceptional new complication.

We would not be avoiding the usage of Promus Element stents(Boston Scientific) as they demonstrate great flexibility, conformability and enhanced radio-opacity but we urged reasonable standard of care, particularly in the use for complex coronary artery disease PCI.

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