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Case Report

Culotte Stenting as a Bailout to Crush the Failure in a Case of Failed Crush Stenting

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Abstract

Among the various bifurcation techniques, the mini-crush technique is commonly used technique because of its technical simplicity and good coverage of the side branch (SB) ostium. A 62 year-old male with chronic stable angina was referred for percutaneous coronary intervention of true bifurcation lesion of proximal left anterior descending (LAD) involving large diagonal branch (D1). Mini-crush strategy was planned. Both LAD and D1 were wired and lesions were predilated. Small perforation was noted distal to distal edge of D1 stent (Xience Prime; Abott Vascular, USA) and was persistent even after prolonged inflation with stent balloon. Undeployed stent of LAD was pulled out and perforation was successfully sealed with 2 x 10 mm semicompliant balloon. Mini-crush strategy was modified into step-crush. However, the protruding stent hampered movement of balloon into LAD which lead to failure to crush D1 stent. Our strategy was switched to culotte stenting. Another 3 x 23 mm Xience Prime stent was deployed into proximal LAD overlapping with previously deployed stent in D1 (cross over stenting) after removing wire from LAD. Main vessel (LAD) was stented with 3 x 38 mm Xience Prime stent after performing proximal optimization using culotte technique. D1 was rewired and final kissing inflation was performed using 3x10 mm non-compliant balloon in LAD and D1 respectively achieving TIMI III flow with well apposed stents. He was discharged in stable condition with appropriate advice.

Keywords: *Bifurcation Lesion; Kissing Balloon Inflation; Mini-Crush Technique; Step Crush; Culotte Technique*

Introduction

In percutaneous coronary intervention (PCI) for bifurcation lesions, single stenting of the main branch is the preferred approach and stenting of the side branch is only recommended for inadequate results of the side branch [1-3]. With this strategy, dedicated stenting of both, the main and the side branch, is currently still needed in 5 - 36% of bifurcation procedures. Among the dedicated bifurcation stenting technique, T-and-protrusion (TAP) stenting, culotte, and mini-crush are among the available approaches. Culotte stenting is technically more difficult and is associated with double layering of stent struts, but it can be performed through a 6-F guide. Mini-crush stenting is though simple and quick, recrossing the crushed stent for final kissing inflation is the most difficult part of the procedure [4].

Case Report

A 62-year-old male, diabetic, and hypertensive, a known case of chronic coronary syndrome for past four years, presented with unstable angina. Coronary angiography was performed after proper consent which revealed true bifurcation lesion of proximal left anterior descending (LAD) artery involving critical subtotal occlusion of large tortuous diagonal branch (D1) (Figure 1A). Angiographically, it was labelled as Medina class 1, 1, 1 as main branch (MB) and side branch (SB) were all diseased [5]. As it was true bifurcation (angle < 70°),

mini-crush strategy was planned. Left main artery was cannulated with 7F extra backup (EBU) guide catheter (Medtronic, USA). Both LAD and D1 were wired with Sion black wire (Ashahi, Japan). D1 was wired with difficulty as it was very tortuous. LAD and D1 was predilated using 2.5 x 10 mm Sprinter semicompliant balloon (Medtronic, USA). A 3 x 38 mm and 2.75 x 23 mm Xience Prime everolimus eluting stent (Abott Vasc, USA) were placed in LAD and D1 respectively. D1 stent was retracted (1 - 2 mm) into LAD (Figure 1B) and deployed at 12 atm pressure (Figure 1C). Check angiogram revealed a small grade-I perforation of D1 branch distal to distal edge of stent. The stent balloon was inflated at 2 atm but the leak was persistent after 2 minutes. At this moment, there were two options- either to go ahead with traditional mini-crush or to seal the perforation by inflating a smaller balloon at the leak site followed by LAD stenting. The potential drawback of mini-crush would have been persistent leak and failure to rewire D1. Therefore, we decided to deal with the complication first. The Undeployed stent of LAD was taken out and perforation was successfully sealed with a 2 x 10 mm sprinter balloon (Figure 2). Our strategy was changed to modified crush where SB stent is firstly crushed with a balloon and followed by stent deployment in main vessel which also crushes SB further and final kissing balloon inflation (FKBI) is performed in standard fashion. However, protruding stent of D1 hampered the movement of balloon into LAD and therefore SB stent could not be crushed. It was then decided to perform culotte stenting. A 3 x 23 mm Xience Prime stent was deployed into proximal LAD overlapping with previously deployed stent in D1 (Figure 3A). Proximal optimization technique (POT) was performed in proximal LAD using 3.5 x 10 mm Sprinter non-compliant (NC) balloon. LAD was rewired with Sion black after removing SB wire and its strut were opened with 2x10 balloons (Figure 3B and 3C). LAD was stented with 3 x 38 mm Xience Prime stent with its proximal end overlapping with previously deployed stent (Figure 4A). POT was again performed in its proximal part to facilitate wiring of D1 branch. Once SB was rewired, final kissing balloon inflation was performed using 3 x 10 mm and 2.75 x 10 mm Sprinter NC balloon in LAD and D1 respectively at 18 atm pressure (Figure 4B and 4C). Post procedure showed TIMI III flow with well apposed stents in LAD and D1 (Figure 5). He was discharged in stable condition with ticagrelor- 180 mg, aspirin-75 mg, rosuvastatin- 40 mg, metoprolol-100 mg, ramipril-10 mg and glibenclamide - 2 mg once daily. He is in regular follow up since then. ART

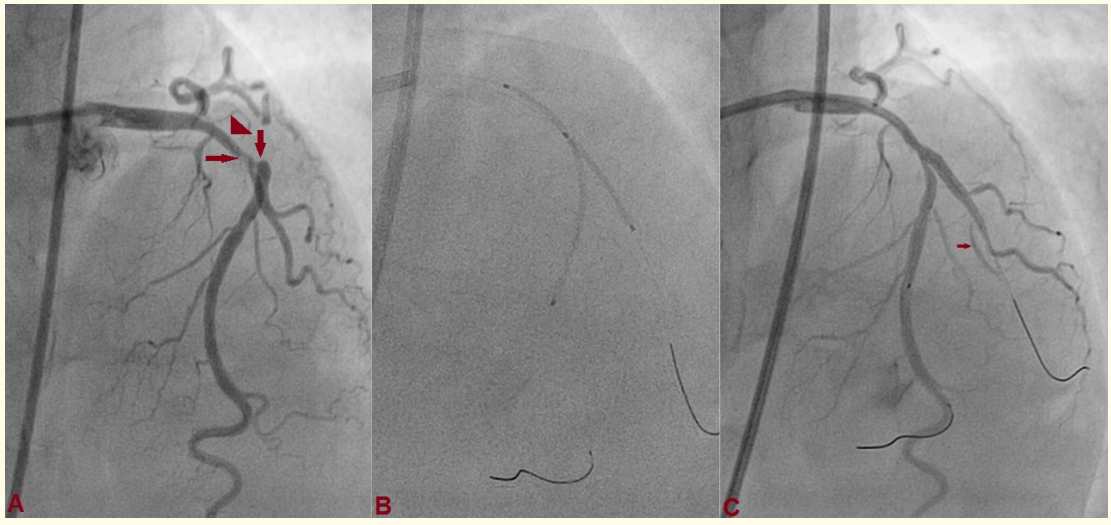

Figure 1: *Coronary angiography showing true bifurcation lesion (Medina- 1,1,1) of proximal left anterior descending (LAD) artery involving critical subtotal occlusion of large diagonal branch (D1-A); Stents- 3 x 38 mm and 2.75 x 23 mm were placed in LAD and D1 respectively, with the D1 stent little retracted into the LAD (B); Small grade-I perforation (red arrow) was seen in D1 beyond the distal edge of stent after its full deployment (C).*

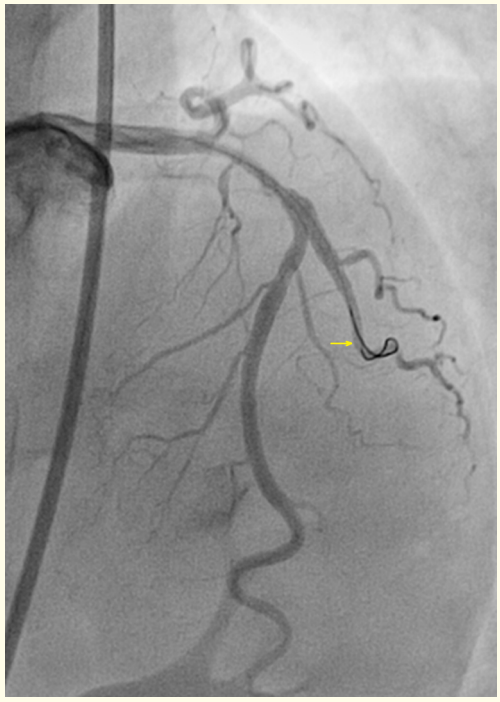

Figure 2: *Angiogram revealing sealing of perforation after intermittent balloon occlusion.*

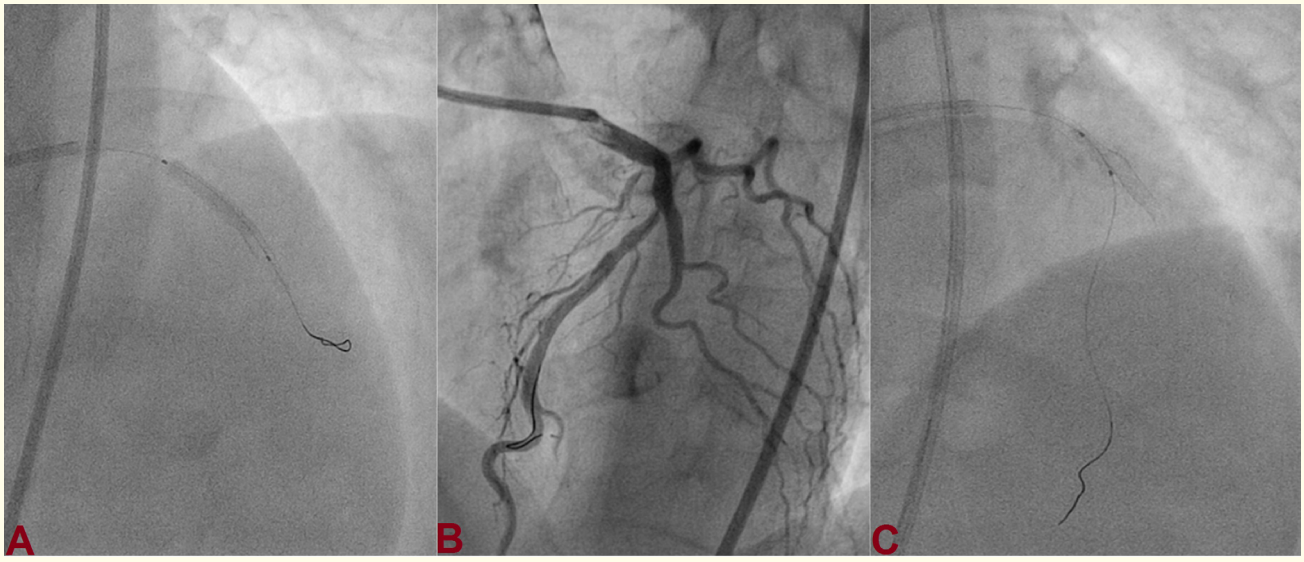

Figure 3: *Another 3 x 23 mm Xience Prime was deployed into proximal LAD overlapping with previously deployed stent in D1 after removing wire from LAD (A); LAD was rewired with sion black after performing POT (B); Strut was opened with 2 x 10 balloon (C).*

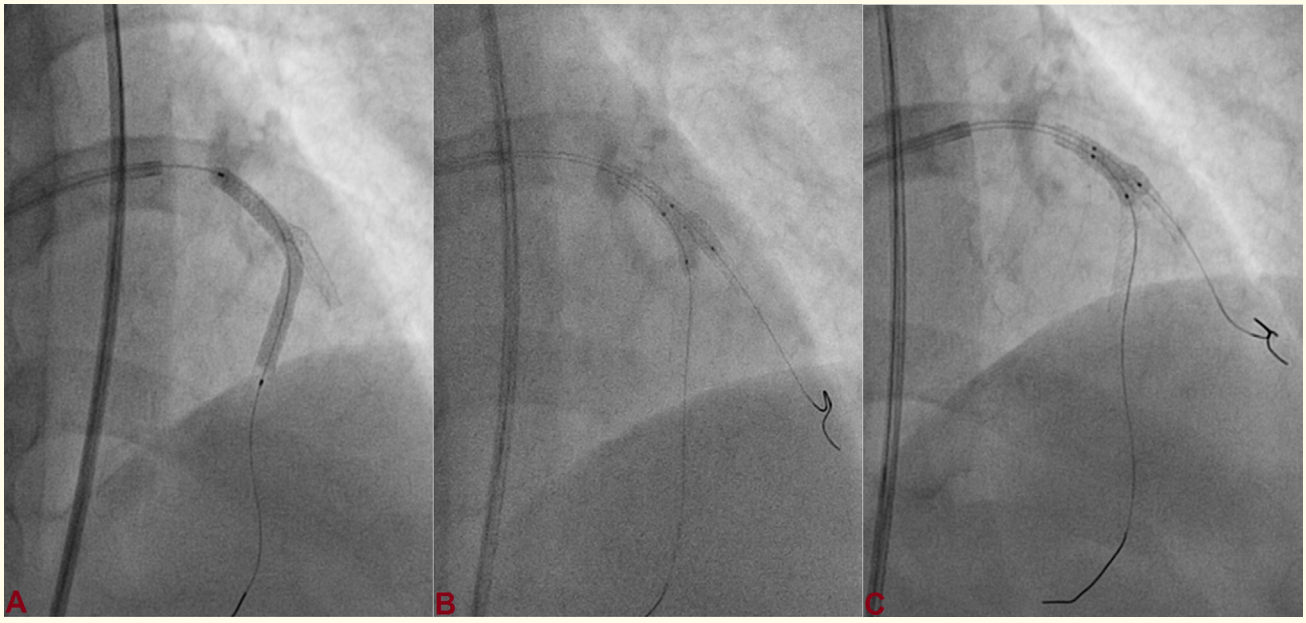

Figure 4: *LAD was stented with 3 x 38 mm Xience Prime stent (A); D1 branch was rewired after performing POT to perform final kissing inflation (B; C).*

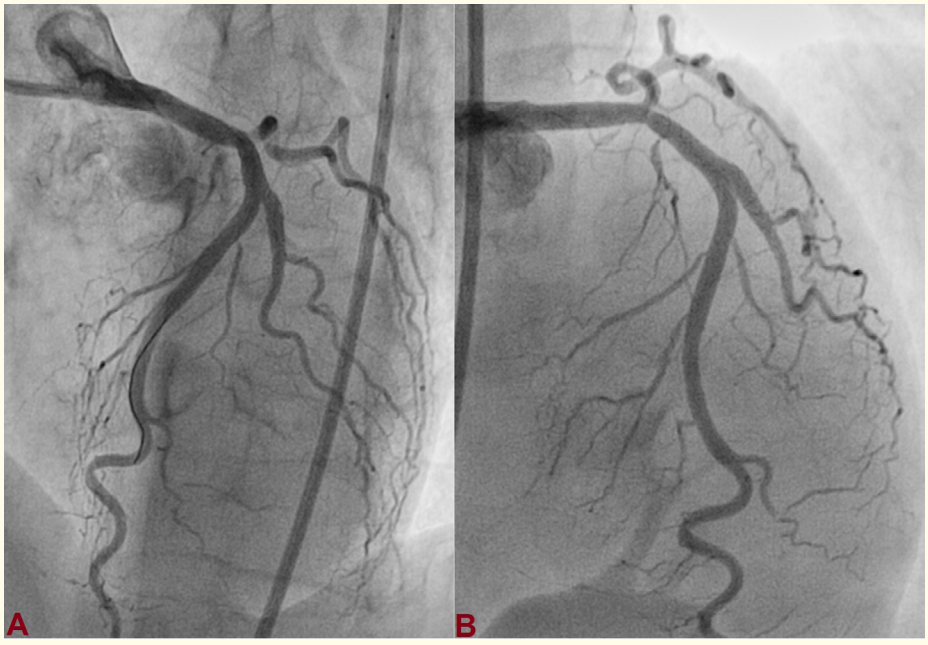

Figure 5: *Post procedure showed TIMI III flow with well apposed stents in LAD and D1 (A- Left anterior oblique with cranial projection; B- Anterior cranial view with cranial projection).*

Discussion

Most of bifurcation lesion can be treated with the provisional approach, but dedicated stenting using 2-stent technique is needed in few cases. There have been several trials to find out the ideal dedicated bifurcation stenting, but the results are quite variable. Bifurcations Bad Krozingen (BBK) II trial reported the superiority of culotte technique over T-stenting in terms of restenosis, but it was found equal to crush technique [4,6]. The most important factors are final maximum luminal area (MLA) and formation of carina than the underlying technique.

While treating the main vessel, shift of plaque or thrombus can lead to side branch occlusion, particularly if the ostium of the side branch is diseased, is of small diameter and thrombus is present. The clinical consequences of loss of side branch will depend on vessel size and amount of myocardium it peruses. Crush technique ensures ostial coverage of side branch and preserves side branch. It is usually performed if side branch and main branch are of different size. It disadvantages are complex procedure, time consuming and rewiring of SB may be difficult.

After deployment of side branch stent, 2 layers of stent strut separates the MB from the SB. These protruding struts may hamper the trackibility of stent, and therefore stent in main branch needs to be precisely positioned before deploying side branch stent. In case of this type of complication, it is always better to tackle it. Moreover, if one finds it difficult to rewire the side branch, step-crush or traditional culotte are the remaining options. Most important thing is to maintain the patency of main vessel.

Conclusion

However, when complication arises with mini-crush, culotte technique may be used to bail out from such situations. This technique is more complex, but gives perfect carina. The operator must be aware of the pitfalls of mini-crush and alternative bail-out strategies.

Conflict of Interest

None.

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