

Mini-Crush Technique in Left Main Coronary Bifurcation: A Case Report

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ABSTRACT

Percutaneous coronary intervention of Left Main (LM) coronary artery bifurcation disease remains technically challenging. Despite the plethora of techniques in current practice and guidelines advocating provisional strategy (one-stent or main branch-stent only), controversy still persists regarding the two-stent techniques. Moreover, there is improved mindfulness towards various factors affecting LM treatment such as patient selection, stent characteristics, risk stratification, optimum imaging, as well as vessel preparation. The latest generation stent with ultra-thin struts have been safe and efficient in the treatment of LM bifurcation lesions, as they have upgraded designs that aid in the expansion of their diameters to larger extent. Additionally, being ultra-thin leads to lower metal load at the carina, thus improving the long-term outcomes. The authors here present with the case of a 42-year-old patient with LM bifurcation disease who was successfully managed with mini-crush technique using ultra-thin Tetriflex Sirolimus-Eluting Stents (SES). The case depicts that optimum amalgamation of ultrathin strut stents implantation and mini-crush technique would provide very favourable results.

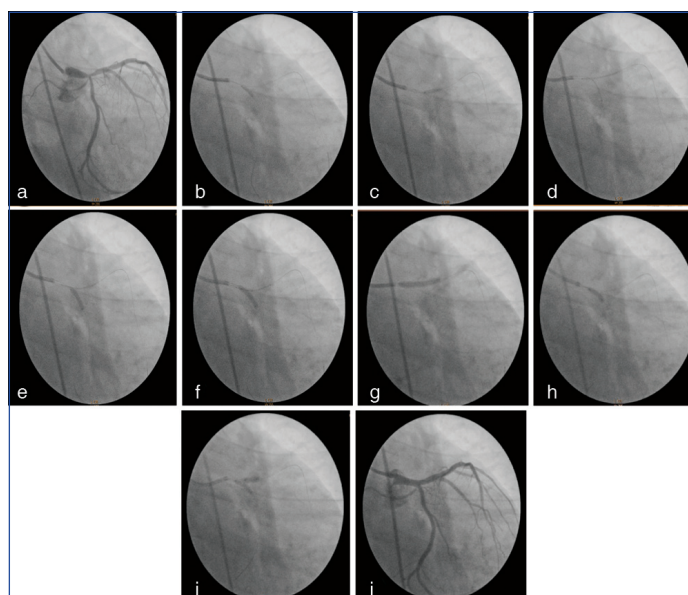
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CASE REPORT

A 42-year-old male patient presented with continuous chest pain along with breathing difficulty two days back and then underwent coronary angiography in another hospital. There, double vessel disease was diagnosed and was advised to undergo revascularisation. Therefore, he was referred to Department of Cardiology, Artemis Hospitals, Gurugram, Haryana, India and was admitted and treated with anticoagulants, antiplatelet, antianginal drugs, statins and other supportive treatment. On admission, the laboratory findings were: Total Leukocyte Count (TLC)-11,600/mm³, Haemoglobin (Hb)-14.6 g/dL, platelet count-2.57 lac per unit volume, urea/creatinine ratio-27.1 mg/dL/0.98 mg/dL, Na⁺/K⁺-135 mEq/L/3.7 mmol/L and viral marker-negative. Two-dimensional echocardiography showed presence of Regional Wall Motion Abnormality (RWMA) (mid antero-septum, apex, mid infero-septum, mid/distal anterior, distal inferior wall hypokinetic), 35-40% left ventricular ejection fraction, normal Right Ventricular (RV) function, Inferior Vena Cava (IVC)-1.2 cm with >50% variation. In view of significant LM-Left Anterior Descending (LAD) artery/Left Circumflex (LCX) artery stenosis (Medina class 1, 1, 1) [Table/Fig-1(a)].

Stenting to LM-LAD/LCX was planned to be done by using Tetriflex (Sahajanand Medical Technologies Ltd., Surat, India) sirolimus-eluting stents of sizes 3.0×12 mm and 3.5×24 mm. After crossing guide wire in LAD and LCX; and lesions were predilated with short length balloon [Table/Fig-1(b,c)]. Then, Tetriflex stent (3.0×12 mm) was negotiated at ostium of LCX and another Tetriflex stent (3.5×24 mm) was negotiated from mid LM to proximal LAD. Subsequently, the 3.0×12 mm stent was inflated in LCX [Table/Fig-1(d,e)]. After postdilatation of first stent [Table/Fig-1(f)], next stent was deployed in LM-LAD by crushing the ostium stent of LCX [Table/Fig-1(g)]. Following implantation, post dilatation was done with short length balloon in LCX ostium [Table/Fig-1(h)] and short length balloons were used as final kissing balloons [Table/Fig-1(i)].

Final angiogram showed TIMI III flow representing normal epicardial perfusion [Table/Fig-1(j)]. Patient's hospital stay was uneventful and duration of stay remained for three days. On discharge, laboratory findings were: TLC-8,100 cells/mm³, Hb-19.6 g/dL, PC-1.61 per unit volume, urea/creatinine ratio-41 mg/dL/0.91 mg/dL, Na⁺/K⁺-135 mEq/L/3.8 mmol/L. The patient was discharged on medication (Ticagrelor, Aspirin, Rosuvastatin, Metoprolol, Pantoprazole,



[Table/Fig-1]: a) Angiogram showed significant Left Main (LM) -Left Anterior Descending (LAD) artery/Left Circumflex (LCX) artery stenosis; b and c) LCX and LAD lesions were predilated; d) Tetriflex stent was negotiated at ostium of LCX and another Tetriflex stent was negotiated from mid LM to proximal LAD; e) A 3.0×12 mm Tetriflex stent was inflated in LCX; f) Postdilatation of stent; g) Deployment of another Tetriflex stent; h) Post dilatation of stent; i) Final kissing balloon dilatation with short length balloons in LM to LAD and LCX; j) Final angiogram showed Thrombolysis in Myocardial Infarction (TIMI) flow.

Clonazepam and Paracetamol) in stable condition and was in favourable condition at three months follow-up.

DISCUSSION

The LM bifurcation has been the largest and most important bifurcation lesion amongst the entire coronary vasculature as it accompanies the most potential complications and adverse long-term outcomes of target vessel failure and Target Lesion Revascularisation (TLR) [1]. The LM disease is seen to be significant in about 7% of total angiographies, of which around 80% lesions involve bifurcation [2]. With the innovations in managing strategies through years, there has been an enormous shift from coronary artery bypass grafting towards percutaneous coronary intervention. Moreover, there is improved mindfulness towards various factors

affecting LM treatment such as patient selection, risk stratification, optimum imaging, vessel preparation, and stenting techniques [1]. All these together lead to optimised outcomes. From the available stenting techniques, single stent technique is the cross over-provisional technique and for double stenting: T-stenting, T and protrusion, mini-crush, culotte and mini-culotte, K crush, and nano-Crush are widely used [3]. Along with stenting technique, major role is played by stent characteristics. The latest generation stent with ultra-thin struts have been safe and efficient in the treatment of LM bifurcation lesions, as they have upgraded designs that aid in the expansion of their diameters up to even 5 or 6 mm [3]. Moreover, being ultra-thin leads to lower metal load at the carina thus improving the long-term outcomes. In present case, LM bifurcation disease was treated successfully with mini-crush technique using ultra-thin (60 µm) Tetriflex sirolimus-eluting stents.

However, there has been a dilemma about single stenting and double stenting in LM bifurcations. Some studies recommend provisional stenting in LM bifurcations [4-7], while some lesions mandate implantation of two stents. If the length of lesion in LCX is more than 10 mm, then it is denoted as complex lesion requiring double stenting [3]. Moreover, two-stent technique has been allied with maintaining better flow in main branch as well as side branch and thus leading to dodging of the occlusive event in LCX [8]. However, another hurdle for two-stent technique is the variable types of techniques that are available such as T-/TAP-stenting, culotte technique, and mini-crush/double-kissing crush techniques [9]. Myriad of factors affect the choice of stenting technique: caliber of the main vessel and the side branch, calcification, tortuosity, angulation between main and side branch, stent expansion capability, stent design, and stent flexibility [9,10].

In this case, we had chosen mini-crush technique for treating LM bifurcation. Previously the crush technique was widely used for bifurcation stenting. However, the three layers of struts at the side branch ostium in crush technique posed difficulty in final kissing balloon inflation and made the procedure complex. Thus, Mini-crush technique was evolved that comprised least (usually 1-2 mm) evasion of the side branch stent into the main branch, thus dodging a significant area to be covered with three layers of struts and lessening metallic stenosis at the side branch ostium [11]. With passage of time, the mini-crush technique has gained much favourable outcomes as compared to other two-stent strategies. The Milan and New-Tokyo (MITO) registry [8] compared the results of culotte stenting and mini-crush techniques; reported that incidences of myocardial infarction and stent thrombosis were lower in mini-crush group [8]. Moreover, the mini-crush stenting assured the patency of the main branch throughout the procedure when compared to culotte technique [8]. Additionally, a recent meta-analysis that included 14 bifurcation trials with 4285 patients documented that DK crush and mini-crush techniques were associated with fewer Major Adverse Cardiac Events (MACE), Target Vessel Revascularisation (TVR), and TLR rates when compared to other bifurcation strategies [10]. In parallel to the literature, the results of the present study case have been favourable without any immediate or short-term outcomes. The postprocedure TIMI III flow was achieved. Wainstein MV et

al., reported a case with variation where two-stent reverse mini-crush technique with drug eluting stents was described that was applied for treatment of restenosis of ostial LCX stent [12].

To augment the favourable outcomes of the two-stent technique, the stent characteristics also play an important role. The transpiration of stent advancements into ultra-thin strut stents have been a great boon. The least thickness of struts helps in reducing turbulence of blood flow at carina, thus diminishing the rates of adverse events. The thinner stents tend to have greater elasticity, flexibility, and deliverability. Tetriflex SES is one such latest generation stent that has L-605 cobalt chromium alloy platform with a strut thickness of 60 µm. In addition to stent, the interventionists' preference is of utmost importance that should be taken in consideration for selection of the technique as per the expertise and confidence in the chosen technique.

CONCLUSION(S)

The mini-crush technique applied in the treatment of LM bifurcation lesion turns up to be very favourable approach while using an ultra-thin stent. Thus, indigenous ultra-thin stents can be used in difficult approaches with ease of deliverability and would provide favourable outcomes.

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