Case Report

Case Report: Dedicated Distal Left Main Coronary Stent Implantation —Simplicity and Achievable Outcome

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Abstract

An 81-year-old Vietnamese man presented with worsening angina, with previous coronary angiography and intravascular ultrasonography findings with ostial left anterior descending artery (LAD) narrowing. He flew to our center for a second opinion. We offered intracoronary optical coherence tomography (OCT) evaluation for the measurement of critical ostial LAD, minimal lumen area (MLA). Provisional stent implantation to left main (LM) bifurcation (MEDINA 0,1,0) with dedicated self-apposing stent was performed with good angiographic result and mid-term follow up without major adverse event.

Keywords: left main bifurcation, dedicated self-apposing stent, optical coherence tomography

There has been controversy in specific unprotected left main percutaneous coronary intervention (ULMPCI) compared to coronary artery bypass surgery (CABS).[1,2] Recently the Evaluation of XIENCE versus Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization (EXCEL)[3,4] and NOBLE (Nordic-Baltic British-Left Main Revascularization) demonstrates the superiority of CABS over ULMPCI at 3 years.[5,6]

European Bifurcation Club (EBC) announces the dedicated technique performing UPLMPCI for any interventionists who are performing LM lesions.[7] There is clear evidence that most coronary vessels are tapered in nature. The LM calibers are always larger than 4.5 mm in diameter, especially at the carina which is mostly always an elliptical contour and larger than the runoff. There is a necessity to choose a proper stent size to the distal vessel runoff such as LAD, to avoid plaque shift at the carina, which could result in compressing the side-branch i.e., left circumflex artery (LCX) and higher chances of losing jailed LCX and large myocardial area at risk for larger LCX, resulting into peri-procedural myocardial infarction and death.[8,9]

Introduction of proximal optimization technique (POT) at the much larger proximal LM vessel is mandatory, to avoid unacceptable stent-vessel gap and later stent thrombosis.[10] UPLMPCI is a unique complex high risk-percutaneous coronary intervention (PCI) and require a special technique such as a double kissing crush or a culotte in the true bifurcation or provisional main branch stent implantation for non-true bifurcation (NTB). The operator's skill is essential and directly reflect the initial result. However, we offer a simpler technique using a dedicated self-apposing sirolimus nickle stent for UPLMPCI using a STENTYS Xposition S™ (SXS) (Stentys, SA, Paris, France). The stent was wrapped in a non-circumferential sheath on a 2.5mm balloon in a monorail system. After stent delivery system was in place, a balloon was inflated to split the sheath to allow the stent to be self-expanded to the vessel wall (Figure 1A).[11] As usual, the ostial side-branch will be accessible and being inflated to open the jailed strut. The mechanism of self-apposing of the stent was shown and the ability to disconnect the strut easily at the origin of side branch during side-branch balloon inflation (Figure 1B).[12]

Figure 1: The wrapped self-apposing stent was released on air to be partially expanded up to the edge of the sheath upon sheath pulled back. (Modified from IJsselmuiden AJJ, et al. Comparison between the STENTYS self-apposing bare metal and paclitaxel-eluting coronary stents for the treatment of saphenous vein grafts (ADEPT trial). Neth Heart J 2018;26:94-101.)

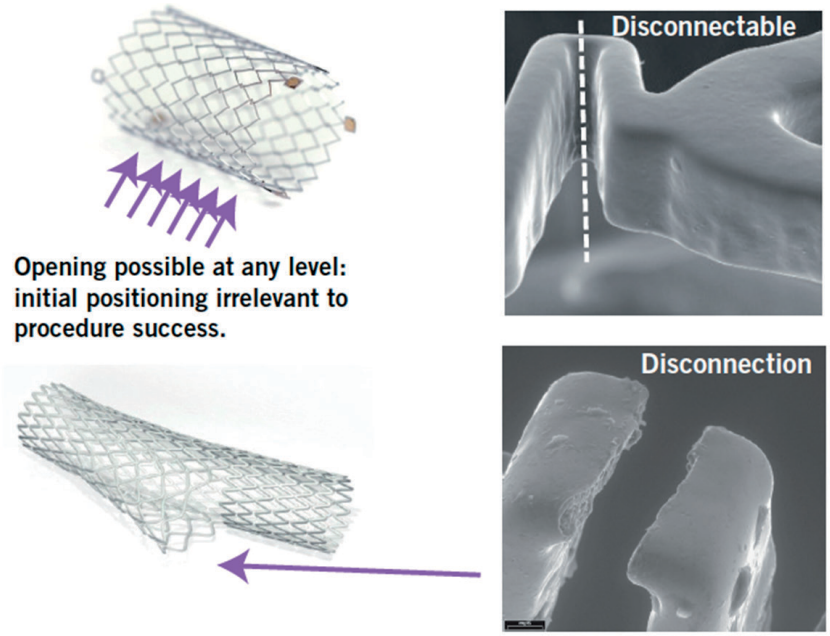

Figure 1B: The thin disconnectable stent strut could easily be breakable by inserting another wire into the side-branch, followed by 2.5mm balloon inflation to allow the strut to self-exposed to the side-branch. This might not associate with stent deformation like an ordinary stent. (Modified from Jilaihawi H, et al. The use of self-expanding stents in coronary bifurcations and beyond: a paradigm revisited. Eurointervention 2009;4:669-75.)

Case report

An 81-year-old Vietnamese man was referred due to new worsening angina, progressive dyspnea on exertion. Anti-ischemic medications and antiplatelet was administered. He underwent diagnostic coronary angiography (CAG) and intravascular ultrasonography (IVUS) investigation due to new onset exertional angina, revealed 50% luminal area stenosis of ostial LAD. He refused CABS. Atherogenic risks were hypertension and hypercholesterolemia. Previous history shows that he underwent stent-assisted percutaneous coronary intervention (PCI) with 2 overlapping drug-eluting stents at mid LAD during the past two years.

At our center, he still complained of rest angina without electrocardiogram (ECG) change, thorough method and technique for PCI has been explained and well accepted by the patient including UPLMPCI with planned use of a dedicated SXS implantation. UPLMPCI was consented before the procedure. We scheduled him for elective PCI via right radial approach, using a 6/7 Fr. Slender sheath (Terumo). 7F EBU 3.5 (Extra backup guiding catheter, curve 3.5) was used for left coronary artery (LCA) engagement.

Findings: Target vessel was 50% ostial LAD, patent in-stent mid LAD (previous PCI) and patent ostial, large and dominant LCX (Figure 2) and small right coronary artery (RCA). From visualization the LM caliber is larger than 4.5mm and the proximal LAD is smaller as usual around 3.5mm.

After wiring both LAD and LCX, an OCT was performed to yield the reference vessel diameter and luminal area of target vessel both mid LAD and LM-LAD, the landing zone for stent placement. OCT findings was shown as mild intimal hyperplasia of the in-stent LAD and uncovered stent strut with a small gap between stent strut and vessel wall at the more proximal stented segment (Figure 3). A large lipid core at the distal LM was shown, the MLA at the ostial LAD =5.04 mm^2 and the expected diameter of the distal landing zone (proximal LAD) was 3.45x3.78 mm, target ostial LAD was 2.33x2.69 mm, MLA at the ostial LAD =5.04 mm^2 and the proximal landing zone (LM) of 5.28x5.54 mm was shown respectively (Figure 4). The ostial LAD was pre-dilated with 3.5x8 mm non-compliant balloon, followed by stent implantation using a 3.5-4.5 mm x17 mm SXS (Figure 5). The technique of SXS deployment was described elsewhere.[13,14]

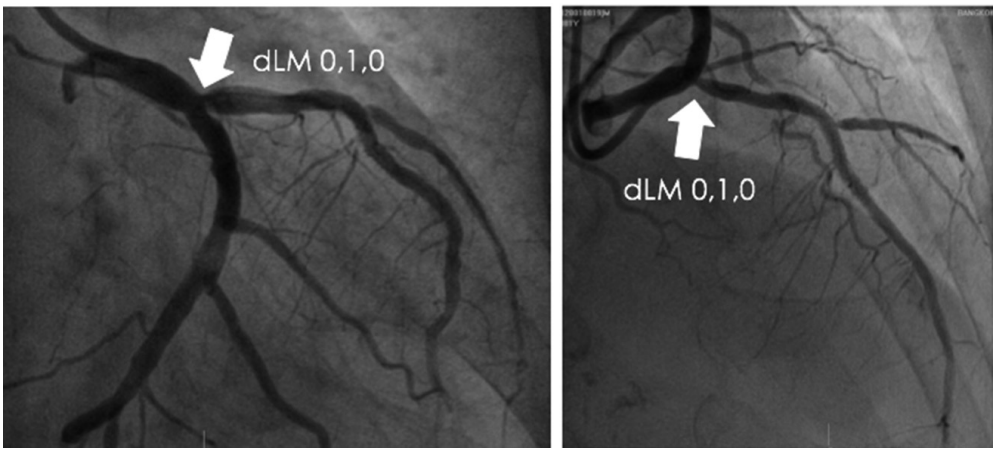

Figure 2: Left coronary artery (left caudal view). Bold arrow indicated ostial LAD stenosis. Noted that left main caliber was larger than the LAD.

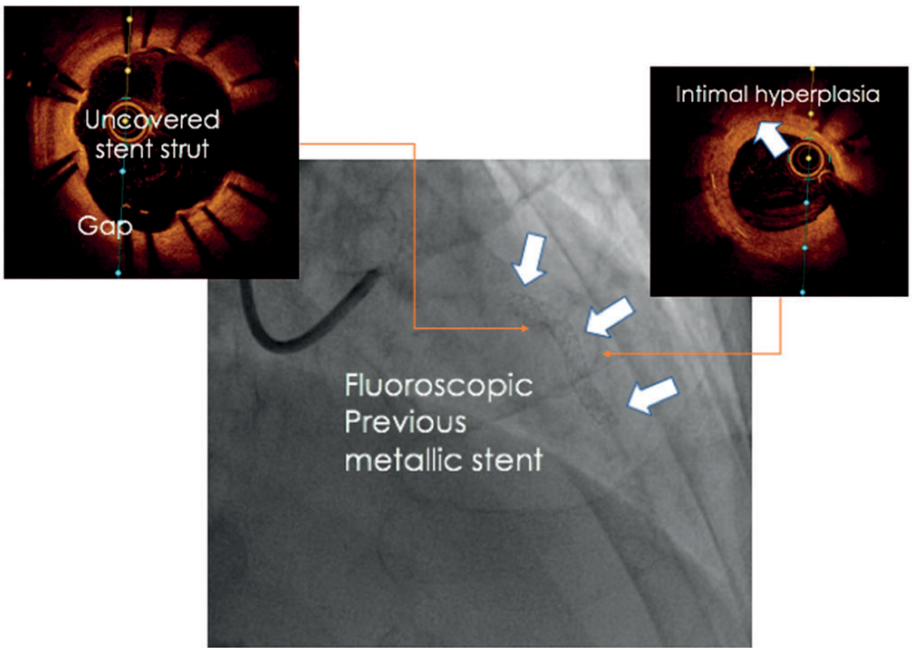

Figure 3: Fluoroscopic image showed previous stent at mid LAD and OCT findings of the intimal hyperplasia in-stent LAD (arrowhead) and uncovered strut with small gap between stent strut and vessel wall (mal-apposition).

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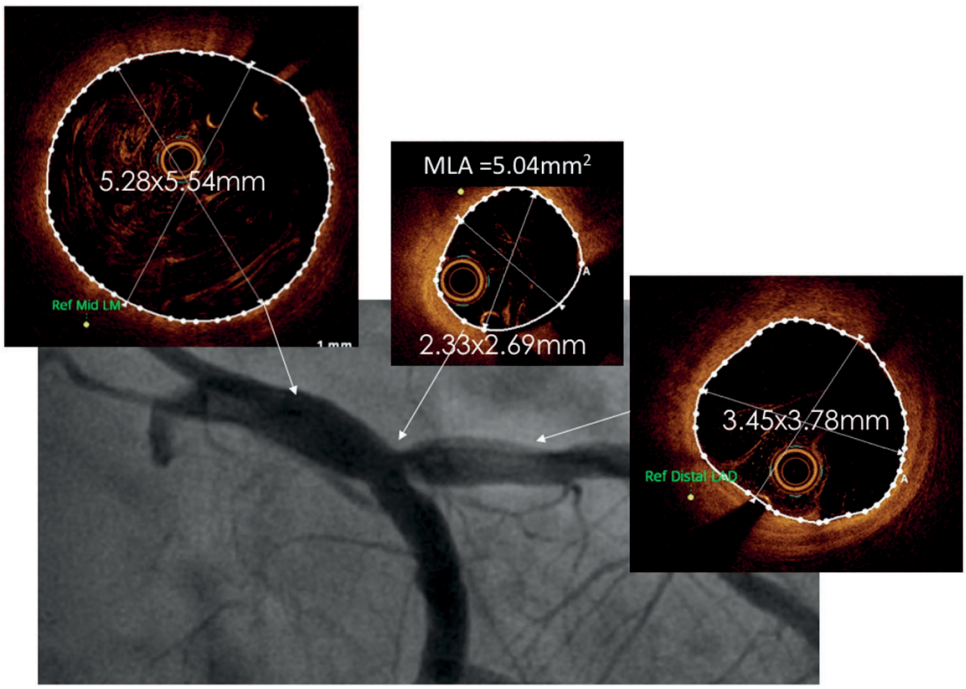

Figure 4: OCT findings before PCI at the target vessel from left to right as left main body (proximal landing zone), ostial LAD (target lesion of interest) and proximal LAD (distal landing zone).

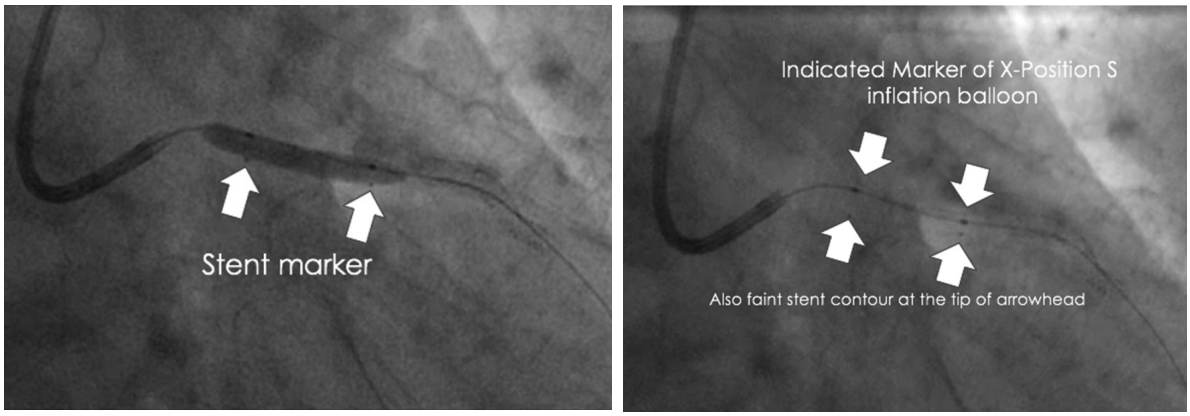

Figure 5: During STENTYS Xposition S™ self-apposing stent deployment, inflated delivery balloon (splitting the sheath), allow STENTYS Xposition S™ self-apposing stent to expand, noted the stent marker and edge balloon marker. Post stent deployment fluoroscopic conical shape stent at LM was shown.

After stent deployment, post-stent inflation was done at the distal half of the stent using the previous balloon. OCT was repeated and revealed good stent apposition and expansion at the LAD site, stent cross-sectional area (SCA) =9.23 mm², at the LM SCA =23.2 mm² but stent malapposition was visualized, the gap between stent strut and vessel wall was 770 micron seen between the LM edge and the carina (Figure 6). Another wire was inserted into the LCX artery for protection. POT was done using a 5.0x8 mm NC EMERGE™ balloon (Figure 7). Final OCT showed good stent optimization, gap was decreased to 200 microns.

Final angiography showed no residual stenosis, without jailed ostial LCX, good flow distal LAD and myocardial blush. No edge dissection was seen on both stent edges (Figure 8). Post PCI overnight ECG showed no new Q wave or ST-T change, no angina. Overnight high sensitivity cardiac troponin I was elevated to 417 ng/L (or 12-fold of upper reference limit), creatinine kinase =78 Unit/L. He was discharged home with dual antiplatelet therapy. Due to his residence in Vietnam, he was not available for an office visit. Telephone calls were completed at 30-day and 18-months post index procedure with no symptom.

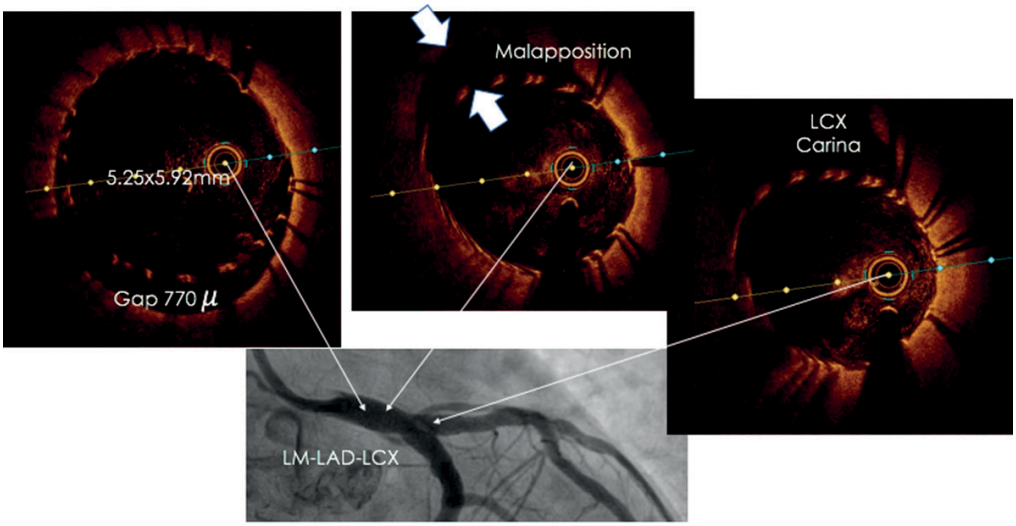

Figure 6: OCT findings post STENTYS Xposition S™ self-apposing stent deployment was shown from right to left as images of the stent at the carina, more proximally into distal LM and proximal LM (noted the mal-apposition stented segment between stent strut and the vessel wall). The widest gap was 770 microns.

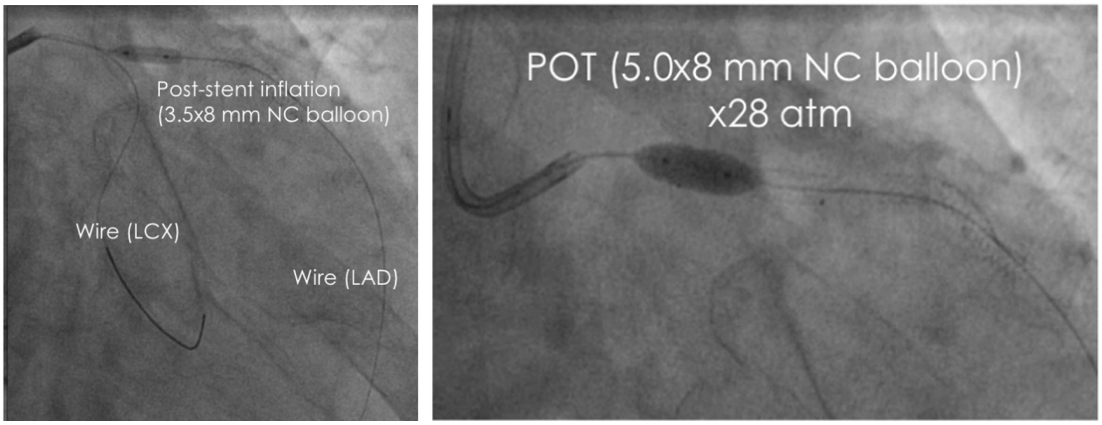

Figure 7: Balloon inflation at the target lesion and proximal optimization technique (POT) was shown.

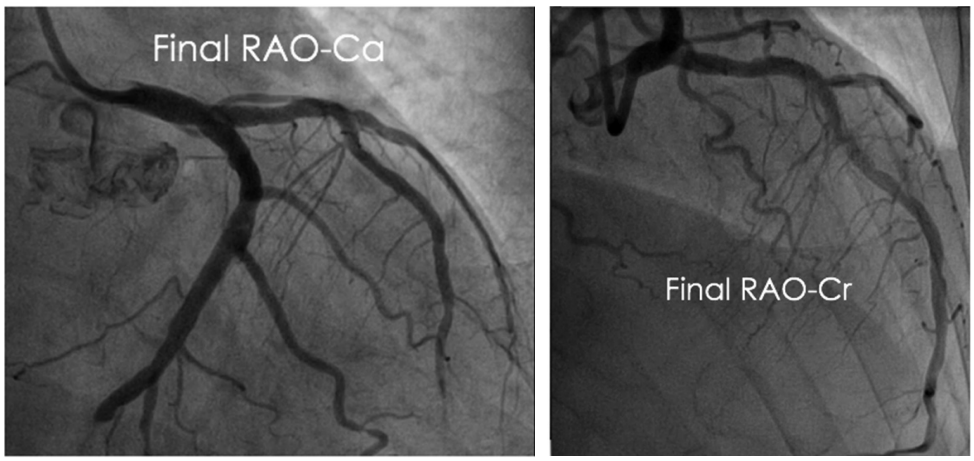

Figure 8: Final angiography both RAO-caudal and RAO-cranial view

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Discussion

UPLMPCI is one of the complex high risk PCI procedures (CHIP) and is controversial as a choice of revascularization. In the randomized controlled trial comparing PCI vs. CABG as EXCEL and NOBLE trial, immediate and medium-term outcomes are quite similar, but there are trends of higher repeated both ischemic-driven target vessel or repeated revascularization in the PCI group. At present, distal LM disease is considered as bifurcation lesions. Medina A et al.,[15] proposed a new classification for bifurcation lesions (so called "MEDINA" classification), which has been used widely as a simple tool to classify the bifurcation complexity.

In SYNTAX II trial (TAXUS Drug-Eluting Stent Versus for the Treatment of Narrowed Coronary Arteries), proposed a combination of physiologic assessment at the lesion prior to PCI followed by IVUS guided stent implantation for stent optimization during multivessel PCI, including the bifurcation lesions resulting in 36% decreased in relative risk reduction of patient-oriented cardiac and cerebrovascular events at 3 years.[16]

The pitfall of UPLMPCI is the side-branch (LCX) restenosis, which has been shown to be related with MEDINA type[17] as true or NTB, angle of the carina (LM-LAD-LCX) and tapered vessel size (choice of stent sizing).[18] EBC consensus recommends proximal optimization technique in all LM stents, considered sizing of LM caliber of more than or equal to 4.5 mm. The use of a small stent size has high impact in PCI-related events as stent thrombosis; in-stent restenosis.

In our case, it was NTB lesion recent study, the true bifurcation lesion (1,1,1, 1,0,1, 0,1,1) needing a more sophisticated technique as the double kissing crush strategy.[19,20] Our case was NTB distal LM stenosis (MEDINA 0,1,0). The initial MLA of ostial LAD (or distal LM-carina-LAD) =5.04mm^2 (Figure 4). We did not apply physiologic measurement in this case, due to worsening angina as the leading cause of this scheduled intervention. Kang et al.,[21] revealed the correlation of IVUS MLA of isolated LM vs. fractional flow reserve (FFR) in isolated LM disease, an IVUS-derived MLA <4.8 mm^2 is a useful criterion for predicting FFR <0.80. For true bifurcation LM stenosis, Chen S et al.,[22] reported the 3-year superiority of DK crush over provisional or culotte stenting in true, complex bifurcation. In this case with 0,1,0 distal LM lesion, with tapered vessel from LM to LAD[23] and a very large LM caliber (5.24x5.58mm) and smaller size LAD (3.45x3.78mm), very typical of a tapered vessel. We chose the only dedicated stent with self-expandable design for bifurcation lesion. The design of SXS was shown elsewhere.[24] The application of SXS showed a very satisfactory result, no clinical event at 18-months follow up. SXS was first performed in acute myocardial infarction,[25] followed by extension indication to coronary bifurcation,[26,27] and LM bifurcation.[28,29] Combination of OCT pre- and post- SXS implantation yielded better stent apposition and clear stent edge as demonstrated in better outcomes.[12,30,31]

In our case, we applied OCT from the beginning of the case for MLA measurement, vessel sizing both distal shoulder in the proximal LAD and at the body LM. Post-stent deployment showed stent mal-apposition, being corrected with POT, final stent cross-sectional area was optimally achieved. This might confirm long-term outcomes. Up to date several clinical impacts of OCT during PCI has been showed in real-life cases, not from randomized trials. In CLI-OPCI II study (Centro per la Lotta contro l'Infarto-Optimisation of Percutaneous Coronary Intervention II), OCT results without edge dissection, stent gap less than 200 microns and SCA larger 4.5mm^2 similar to what we achieved for this UPLMPCI proved to have better long-term outcomes.[32]

Conclusion

An 81-year-old man achieved successful OCT guided provisional SXS implantation in a large, tapered LM vessel with the detected stent mal-apposition and being treated with proximal optimizing technique (POT). Currently, state of the art to treat distal LM bifurcation needs sophisticated stent placement, POT and aid of OCT imaging, resulting in effective outcomes.

Conflict of Interest

None

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