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CASE REPORT

ADVANCED

CLINICAL CASE

Rotational Atherectomy and Mechanical Support to Treat Left Main

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ABSTRACT

We describe a complex percutaneous coronary intervention using rotational atherectomy (Rotablator, Boston Scientific, Marlborough, Massachusetts) and mechanical circulatory support (Impella, Abiomed, Danvers, Massachusetts) in a patient with multiple comorbidities scheduled to undergo a left main coronary percutaneous coronary intervention using a 2-stent technique based on angiography. However, intracoronary optical coherence tomography changed our strategy to a successful single-stent procedure. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2019;1:811–4)

An 85-year-old woman was admitted for fractured right radius and her hospitalization was complicated by non-ST-segment elevation myocardial infarction. The cardiac physical exam was normal except for systolic murmurs attributed to moderate valvular aortic stenosis and moderate mitral regurgitation.

LEARNING OBJECTIVES

- To understand the role of intravascular imaging guiding complex PCI.
- To be able to make a decision on when to utilize a single-stent or 2-stent technique strategy based on OCT imaging findings.

PAST MEDICAL HISTORY

The patient had a history of hypertension, dyslipidemia, severe osteoarthritis, coronary artery disease, and previous percutaneous coronary intervention (PCI) to the first obtuse marginal artery.

DIFFERENTIAL DIAGNOSIS

The patient also had a left ventricular ejection fraction of 50%, moderate aortic stenosis, and moderate mitral regurgitation.

INVESTIGATIONS

An angiogram showed multivessel disease, including a severe lesion on the proximal right coronary artery (RCA) and a severe heavily calcified lesion in left

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Informed consent was obtained for this case.

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ABBREVIATIONS AND ACRONYMS

LAD = left anterior descending artery

LCx = left circumflex artery

LM = left main coronary artery

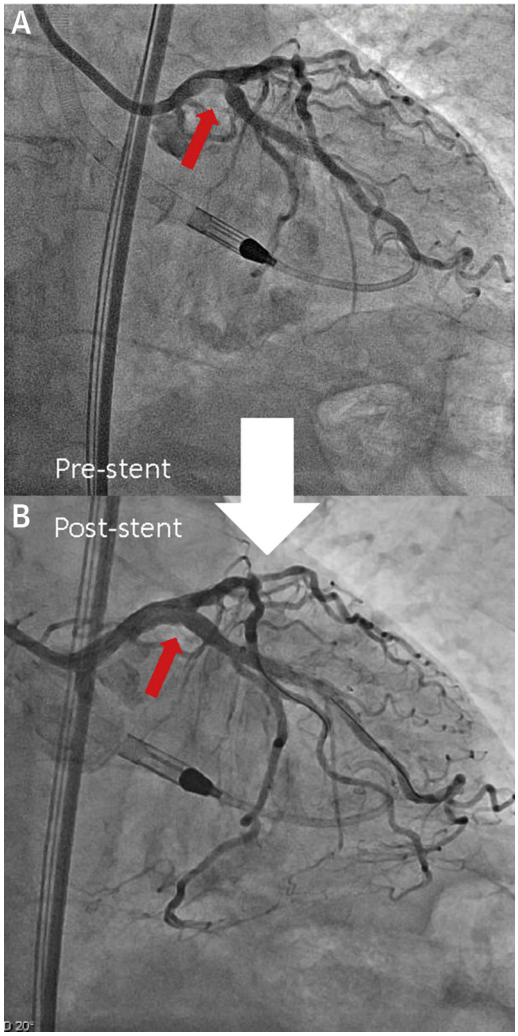
NC = noncompliant

PCI = percutaneous coronary intervention

RCA = right coronary artery

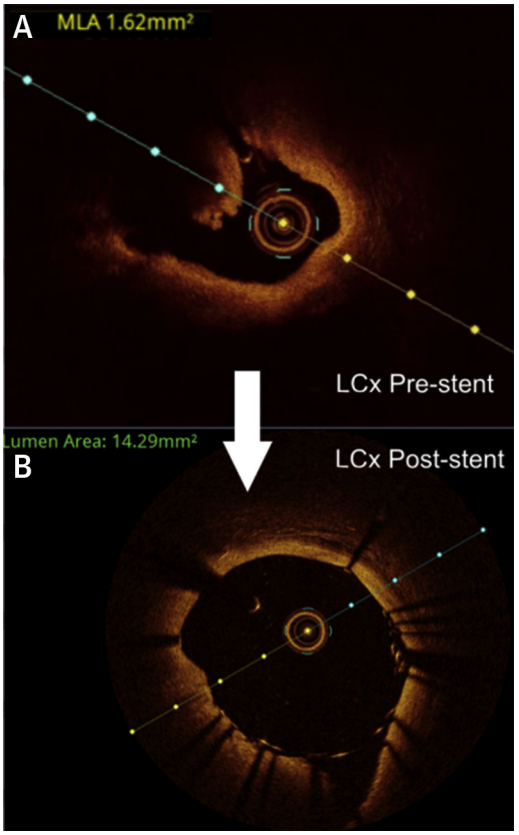
main coronary artery (LM) bifurcation, apparently involving the ostium of both left circumflex artery (LCx) and left anterior descending artery (LAD), Medina classification 1,1,1, and SYNTAX score 40 (Figure 1A). Surgery was not recommended by the Heart Team owing to frailty and anticipated difficult rehabilitation (multiple falls, arthritis), so she was referred for PCI of the LM bifurcation lesion with circulatory device support, and staged treatment of the RCA disease.

FIGURE 1 Coronary Angiography



(A) Left main coronary artery (LM) bifurcation with severe lesions involving the left anterior artery (LAD) and the left circumflex artery (LCx) **(red arrow)**. **(B)** LM and LCx satisfactory result after stent treatment **(red arrow)**.

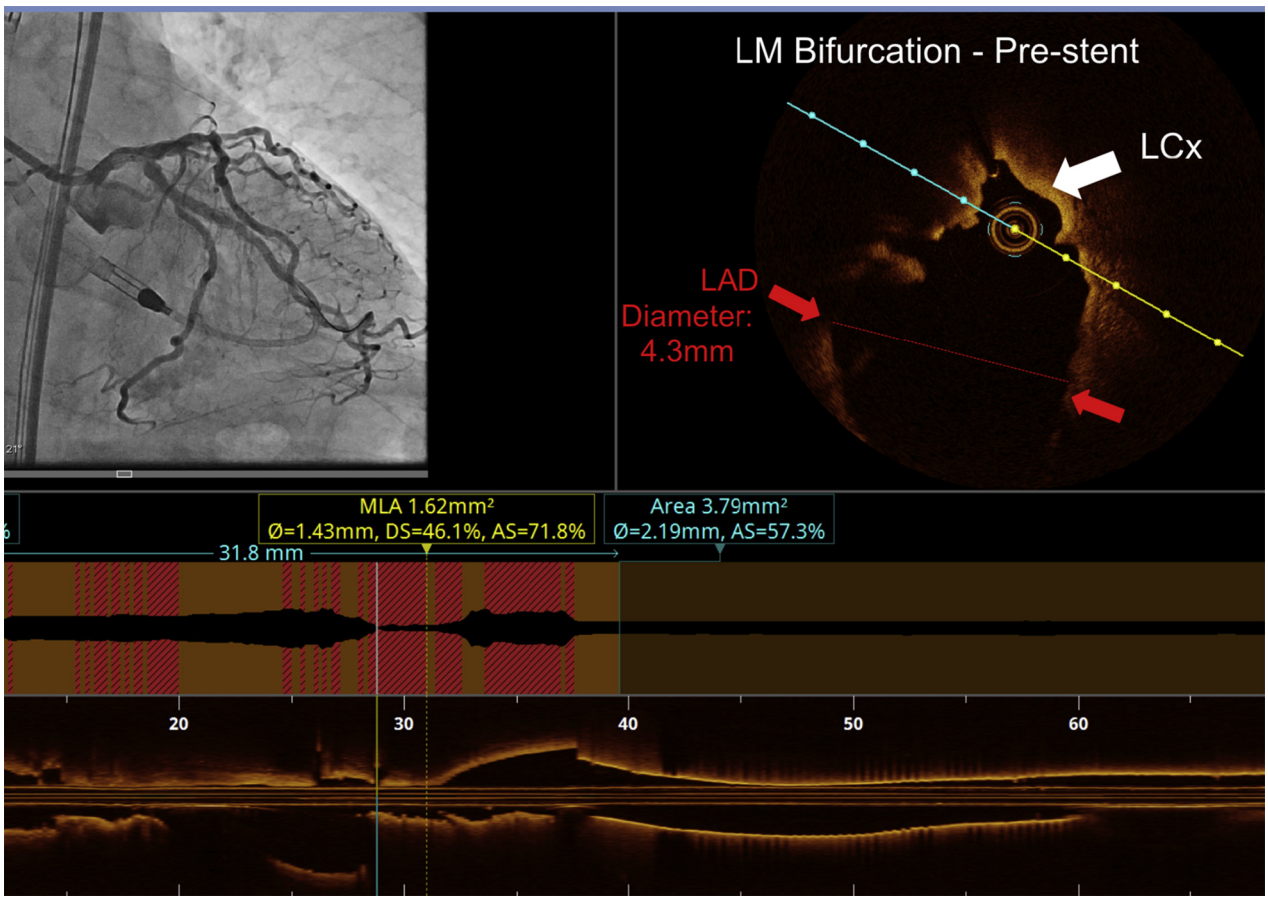
FIGURE 2 Intravascular Optical Coherence Tomography Showing Cross-Sections in the Same Region of the MLA



(A) Baseline ostium left circumflex artery (LCx) with severe calcified lesion before stent deployment. **(B)** Ostium LCx with great expansion after stent treatment. MLA = minimum lumen area.

The initial planned strategy was a 2-stent bifurcation technique using rotational atherectomy system (Rotablator, Boston Scientific, Marlborough, Massachusetts) of the unprotected LM supported by the Impella CP mechanical circulatory support system (Abiomed, Danvers, Massachusetts) guided by optical coherence tomography (OCT). A 14-F sheath was used for the Impella side in the right common femoral artery and a 7-F sheath for the PCI site in the left common femoral artery. Rotational atherectomy with 1.5- and 2-mm burrs (160,000 rpm) were performed to the LM and LCx. OCTs to LM and LCx and LAD showed a severe lesion in the ostium LCx (Figure 2A) but only moderate atherosclerotic disease with minimum lumen area of the proximal LAD of >4 mm^2, which was interpreted as likely to be nonischemic (Figure 3, Video 1). On that basis, we decided to change our plan to a provisional single-stent strategy.

FIGURE 3 **Intravascular Optical Coherence Tomography Showing a Cross-Section in the LM Bifurcation**



Intravascular optical coherence tomography (OCT) with the guidewire inside the LCx, with a cross-section in the LM bifurcation showing a severe lesion in the ostium LCx **(white arrow)** but only moderate lesion in the ostium LAD with MLA >4 mm^2. See Video 1. AS = area stenosis (%); DS = diameter stenosis (%); other abbreviations as in **Figures 1 and 2**.

Stenting went from the LM into the proximal LCx, which was performed by pre-dilation with a non-compliant (NC) balloon (3.5 × 12 mm) at 12 atm, stented with a drug-eluting stent (3.5 × 23 mm) at 12 atm, and post-dilated with 2 NC balloons (3.5 × 12 mm and 4.5 × 8 mm) at 24 atm (**Figure 1B**). Post-stenting OCT pullback showed excellent stent expansion (minimum expansion index 85%) without compromising the ostium of the LAD (**Figure 2B**). The patient remained hemodynamically stable during the entire procedure. At the end of the procedure, the Impella CP was successfully weaned off and removed.

DISCUSSION

In this clinical case, our initial plan was a 2-stent treatment strategy based on angiography, but OCT imaging was especially important because it changed our treatment to a single-stent strategy (1,2). OCT provided proper identification of plaque characteristics and lesion anatomy, showing a stenotic calcified lesion involving only the ostial LCx and the LM, without involvement of the ostial LAD. Thus, OCT guided appropriate treatment of the LCx and LM with a single stent. This prevented the stenting of the ostial LAD, which would have required a 2-stent bifurcation technique, with inherent risks and higher rates of stent restenosis and adverse outcomes in the long-term follow-up (3–5). Intravascular ultrasound would also show calcification, but its characteristic acoustic shadow could prejudice the appropriate evaluation of the calcification pattern, so in this particular case, OCT was the best option for a calcified anatomy evaluation (6).

This case also highlights the importance of detailed pre-procedural planning. We anticipated possible fatal complications, such as acute LM occlusion and severe hypotension, and implanted a mechanical circulatory support before the intervention, which provided hemodynamic stability during the procedure (7,8).

Last, rotational atherectomy is an adjuvant therapy to PCI for the treatment of complex lesions requiring plaque modification and debulking of heavy calcification. In this case, it was especially important to increase lumen diameter and acute lumen gain with lower risk of long-term in-stent restenosis (9,10).

FOLLOW UP. The patient was discharged home the following day without complications.

CONCLUSIONS

The Impella CP provided hemodynamic support during a high-risk PCI procedure allowing time for adequate lesion preparation, intracoronary imaging, and stent optimization. Intravascular imaging changed the initially planned treatment strategy. The immediate outcome was good and the patient was discharged uneventfully the next day.

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REFERENCES

1. Nakamura D, Wijns W, Price MJ, et al. New volumetric analysis method for stent expansion and its correlation with final fractional flow reserve and clinical outcome: an ILUMIEN I substudy. J Am Coll Cardiol Intv 2018;11:1467–78.

2. Dallan LAP, Tensol Rodrigues Pereira G, et al. Laser imaging: unraveling laser atherectomy mechanisms of action with optical coherence tomography. Curr Cardiovasc Imaging Rep 2019;12:33.

3. Ford TJ, McCartney P, Corcoran D, et al. Single- versus 2-stent strategies for coronary bifurcation lesions: a systematic review and meta-analysis of randomized trials with long-term follow-up. J Am Heart Assoc 2018;7:e008730.

4. Takagi K, Naganuma T, Chieffo A, et al. Comparison between 1- and 2-stent strategies in unprotected distal left main disease. Circ Cardiovasc Interv 2016;9:e003359.

5. Chieffo A, Hildick-Smith D. The European Bifurcation Club Left Main Study (EBC MAIN): rationale and design of an international, multicentre, randomised comparison of two stent strategies for the treatment of left main coronary bifurcation disease. EuroIntervention 2016;12:47–52.

6. Bezerra HG, Attizzani GF, Sirbu V, et al. Optical coherence tomography versus intravascular ultrasound to evaluate coronary artery disease and percutaneous coronary intervention. J Am Coll Cardiol Intv 2013;6:228–36.

7. O'Neill WW, Kleiman NS, Moses J, et al. A prospective, randomized clinical trial of hemodynamic support with Impella 2.5 versus intra-aortic balloon pump in patients undergoing high-risk percutaneous coronary intervention: the PROTECT II study. Circulation 2012;126:1717–27.

8. Burzotta F, Trani C, Doshi SN, et al. Impella ventricular support in clinical practice: collaborative viewpoint from a European expert user group. Int J Cardiol 2015;201:684–91.

9. Gorol J, Tajstra M, Hudzik B, Lekston A, Gąsior M. Comparison of outcomes in patients undergoing rotational atherectomy after unsuccessful coronary angioplasty versus elective rotational atherectomy. Postepy Kardiol Interwencyjnej 2018;14:128–34.

10. Ai H, Wang X, Suo M, et al. Acute- and long-term outcomes of rotational atherectomy followed by cutting balloon versus plain balloon before drug-eluting stent implantation for calcified coronary lesions. Chin Med J (Engl) 2018;131:2025–31.

KEY WORDS coronary bifurcation lesion, mechanical circulatory support, OCT, optical coherence tomography, percutaneous coronary intervention, PCI, rotational atherectomy, stent expansion

APPENDIX For a supplemental video, please see the online version of this paper.