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CASE REPORT

ADVANCED

CLINICAL CASE

A Case of Rota-Shock-Pella

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ABSTRACT

Severe calcified coronary lesions are frequently encountered in today's percutaneous coronary intervention practice and remain a challenging entity in complex and high-risk patients. The present case illustrates the contemporary approach to management of this coronary problem from hemodynamic support, optical coherence tomography assessment, and plaque modification technique. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2019;1:765–70)

PRESENTATION

A 74-year-old gentleman presented to the emergency department for acute decompensated heart failure. He had 2-week history of progressive exertional dyspnea and lower limb edema before admission. He did not have angina, palpitation, or syncope.

MEDICAL HISTORY

The patient had history of hypertension, hyperlipidemia, and diabetes mellitus. He was a nonsmoker.

LEARNING OBJECTIVES

- To understand the limitation of angiograms and the usefulness of optical coherence tomography in the assessment of coronary calcification.
- To understand the latest contemporary approach of interventional treatment of severe coronary calcified disease.
- To be familiar with the latest technology for treating calcified coronary disease by using Shockwave lithotripsy.

INVESTIGATION

Laboratory tests showed normal renal function and troponin level. Electrocardiogram showed sinus tachycardia whereas chest radiography revealed cardiomegaly and congested lung field. Echocardiography showed globally impaired left ventricular ejection fraction of 25% to 30% and with multiple regional wall motion abnormalities. There was only mild mitral regurgitation. Coronary angiography (**Figure 1**, Videos 1 and 2) performed as part of the ischemic workup showed a nondominant LCX and diffuse severe calcification along the left main, LAD, and RCA. There was severe stenosis in the distal left main, proximal LAD and proximal RCA. Mid LAD and mid RCA were totally occluded. Nuclear stress imaging showed multiple regions of ischemia without infarct.

MANAGEMENT

The patient was stabilized with anti-heart failure medication. The case was discussed among the heart team, but bypass surgery posed too high risk and was turned down as the distal targets were poor. High-risk percutaneous coronary intervention (PCI)

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Informed consent was obtained for this case.

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ABBREVIATIONS AND ACRONYMS

CTO = chronic total occlusion

LAD = left anterior descending artery

LCX = left circumflex artery

OCT = optical coherence tomography

PCI = percutaneous coronary intervention

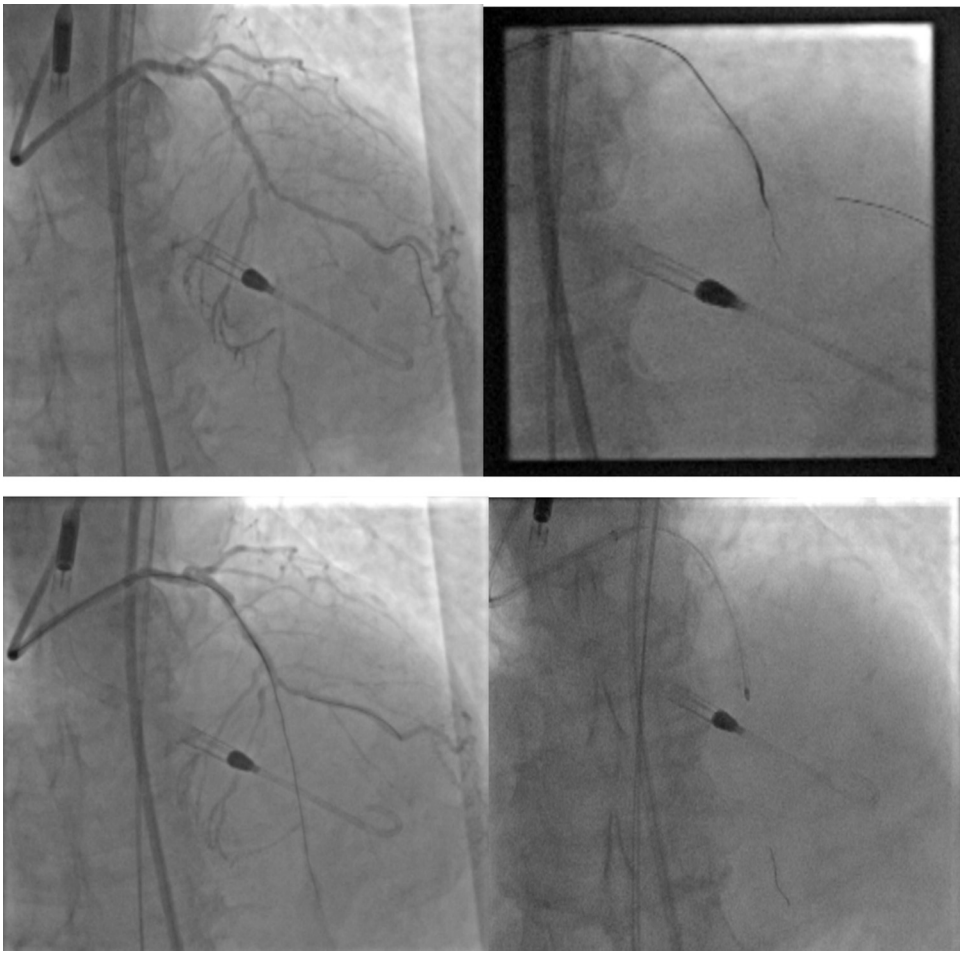
RCA = right coronary artery

with Impella (Abiomed, Danvers, Massachusetts) support to the left main/LAD chronic total occlusion (CTO) was performed at first stage and PCI to RCA CTO was planned in a staged procedure for complete revascularization. A hemodynamically supported device was used for the first procedure in view of poor left heart function, a single surviving vessel, and anticipated atherectomy for severe calcification. After using the crossover technique for left common femoral access and pre-close with 1 Proglide suture (Abbott Vascular Devices, Temecula, California), an Impella CP was implanted, and an 8-F extra back up 3.5 guide (Medtronic, Minneapolis, Minnesota) from the right femoral was used to engage the left main (Video 3). Mid calcified LAD CTO lesion was crossed using the Fielder XT-R (Asahi Intec, Nagoya, Japan) supported by the Turnpike Spiral microcatheter (Vascular Solutions, Minneapolis, Minnesota). The CTO segment was crossed by the microcatheter with difficulty because of severe calcification, and an initial atherectomy was planned. Rotablation using a 1.5 mm (Boston Scientific, Natick, Massachusetts) was used, and a multiple brief pecking motion was performed at 160,000 rpm (**Figure 2**). There was brief stunning of the myocardium during rotablation, which was fully supported by the Impella CP. Thrombolysis in myocardial infarction 3 flow was established, and optical coherence tomography (OCT) was performed. There was a thick (>0.5 mm), long (>5 mm), and circumferential calcification along the whole LAD (**Figure 3**, Video 4). After wiring the big diagonal

FIGURE 1 Baseline Angiogram

See Videos 1 and 2.

FIGURE 2 **Interventional Setup and Details**



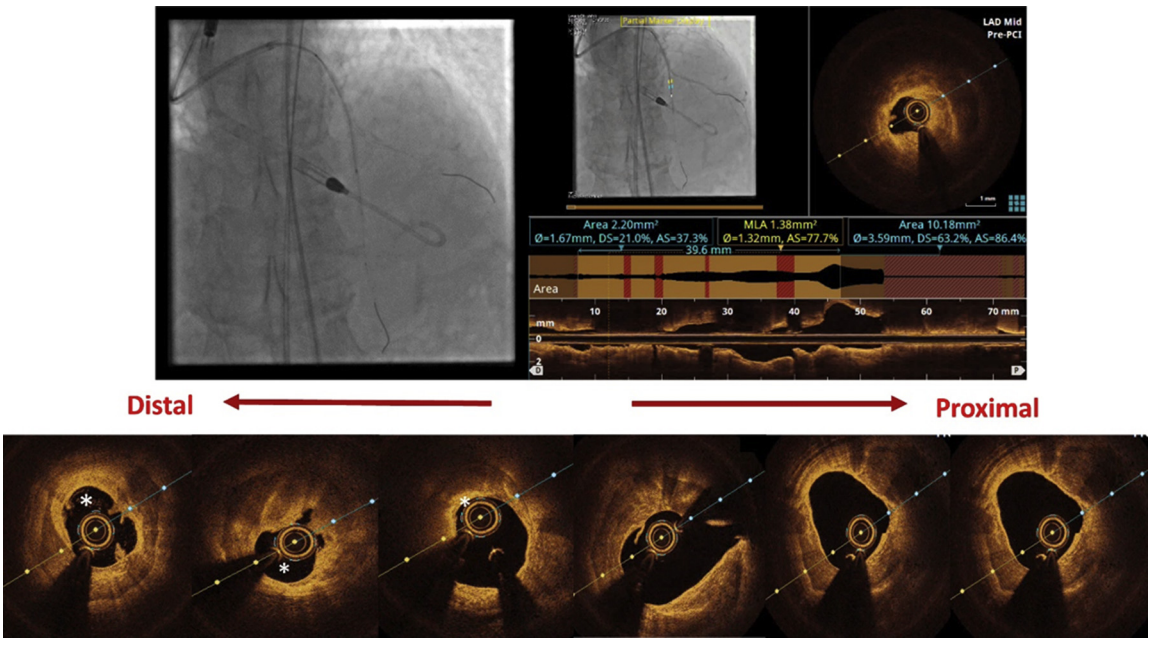
See Video 3.

branch and the small LCX artery, further lesion preparation was performed by using a Shockwave lithotripsy balloon (Shockwave Medical, Fremont, California). A 2.5-mm Shockwave balloon was inflated to 4 atm, and therapy was given along the mid LAD segment in 8 cycles of 10 pulses each, while a 3-mm Shockwave balloon was used to treat the distal left main and proximal LAD in a similar fashion. Post-Shockwave OCT showed deep fracture of the calcified plaque along the LAD and with satisfactory luminal gain (**Figure 4**, Video 5). Left main to distal LAD were stented with long overlapping Xience Sierra stents (3.5 mm, 3.0 mm, 2.5 mm, and 2.25 mm; Abbott Vascular). After adequate post-dilation, finishing angiogram and OCT showed satisfactory result with good stent expansion and apposition (**Figure 5**, Videos 6, 7, and 8). The Impella CP was removed, and left femoral access was closed with original Proglide (Abbott Vascular) sutures and 1 additional 8-F Angioseal (Terumo, Somerset, New Jersey).

DISCUSSION

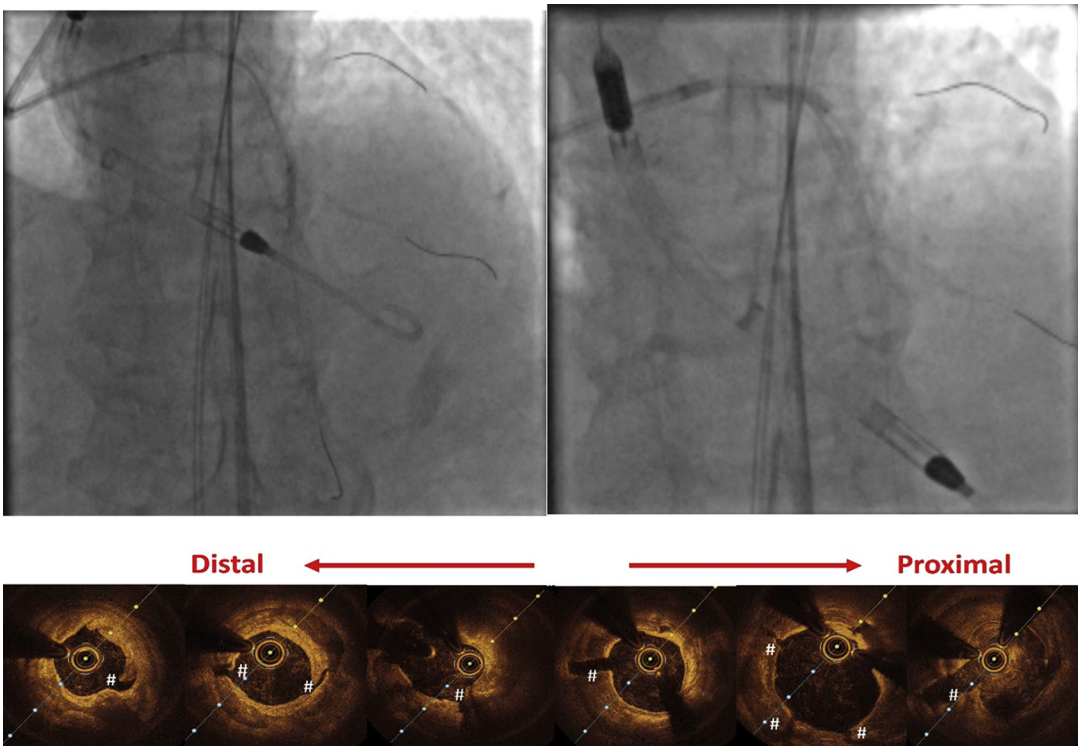
Patients with severe calcified coronary lesions pose a therapeutic challenge to interventional procedure. Coronary calcification is frequently underestimated by angiography alone (1). Intracoronary imaging in particular OCT has a higher sensitivity in detecting coronary calcification (2). OCT allows quantitative assessment of the degree of calcification by measuring the thickness, arc, length, and volume. Such diagnostic accuracy enables a better understanding of the calcified plaque morphology before contemplating PCI. Fujino et al. (3) showed that OCT-

FIGURE 3 **Post-Rotablation OCT**



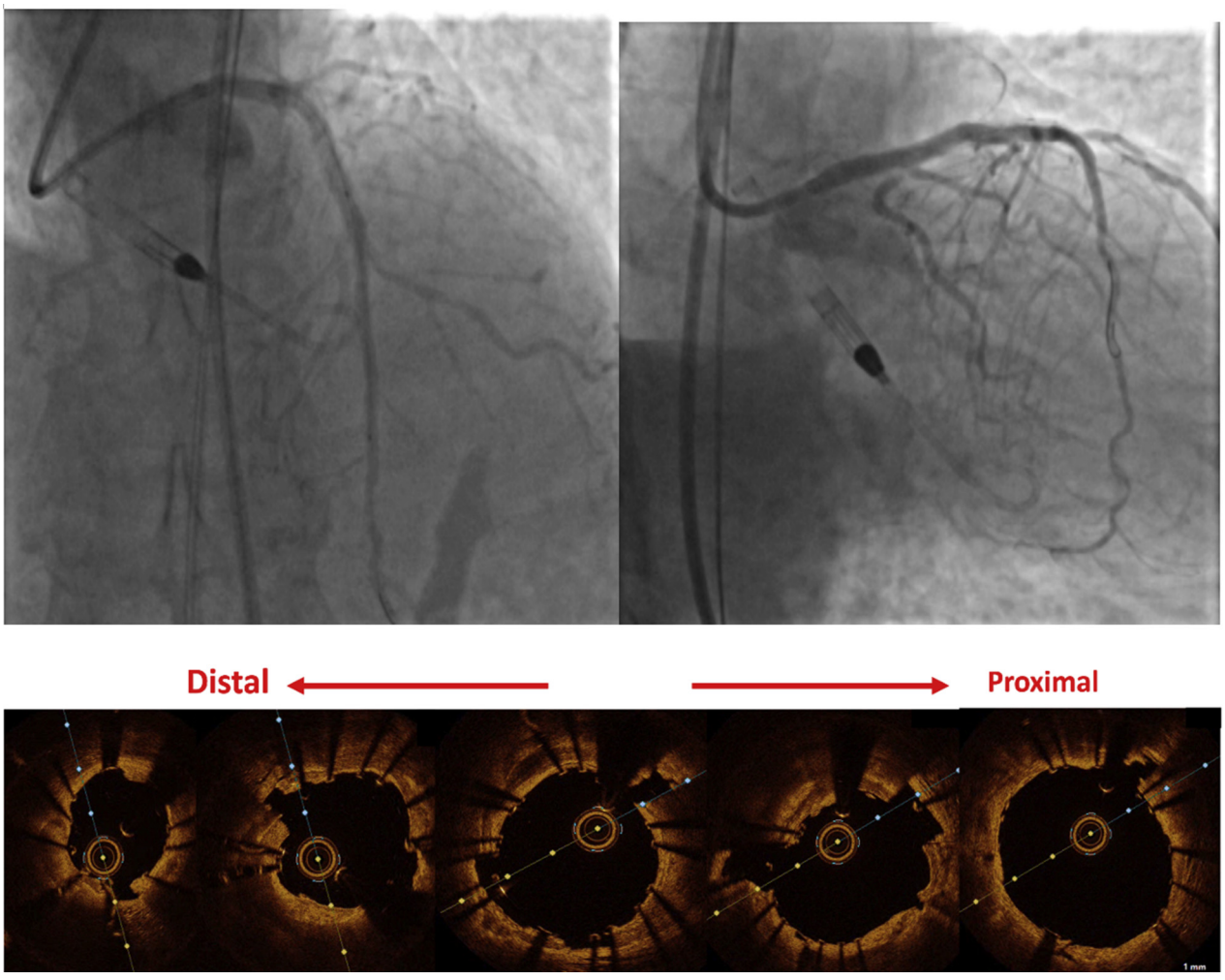
See Video 4. OCT = optical coherence tomography.

FIGURE 4 **Shockwave Lithotripsy and Post-Therapy OCT**



See Video 5. OCT = optical coherence tomography.

FIGURE 5 Final Angiogram and Optical Computed Tomography



See Videos 6, 7, and 8.

derived calcium scoring (in term of calcium thickness, length, and arc of involvement) could predict stent underexpansion and provided a framework for using an upfront plaque modification technique. Contemporary rotational atherectomy techniques, including choice of burr size, rotational speed, short run of pecking motion, and final polishing run, were well described in both European and U.S. professional societies (4,5). The latest paper by De Maria et al. (6) provided a comprehensive review of the latest technology and treatment algorithm for tackling calcified coronary lesions. Initial atherectomy was recommended for severe calcified disease that could not be crossed by a balloon. OCT could assess the residual calcium plaque burden, as in the present case. Further balloon pre-dilation would usually be required to break or fracture the calcium before stent implantation. It was conventionally achieved by means of a high-pressure noncompliant balloon or by cutting or scoring balloon. It was not without risk of perforation, and it was associated with a high risk of hemodynamic compromise in such vulnerable, complex, and high-risk patients. It was shown in both clinical (7) and OCT studies (8) that satisfactory lesion preparation and calcium fracturing could be achieved by using Shockwave lithotripsy balloon. It only required a low inflation pressure and had minimal risk of coronary perforation. Because of the profile of the current Shockwave balloon, it would not cross those tight calcified lesions before rotablation and hence “Rota-shock” may become a very attractive approach in such scenario. Very satisfactory calcium

fracturing and acute luminal gain can finally be achieved after Shockwave lithotripsy followed by excellent stenting result.

FOLLOW-UP. Follow-up echocardiography showed improved left ventricular ejection fraction of 45% to 50%. Successful PCI to RCA CTO using an antegrade approach was performed 3 months later. The patient was recently seen in the authors' heart failure clinic and remained in New York Heart Association functional class I/II symptoms.

CONCLUSIONS

Severe calcified coronary lesion in complex and high-risk patients can be safely treated with an approach combining Rota-Shock-Pella.

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KEY WORDS Impella, OCT, PCI, rotational atherectomy, Shockwave lithotripsy

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