Case Report: Left Main Coronary Artery Bifurcation Stenting, Rotational Atherectomy and Instantaneous Wave-free Ratio

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Abstract

Rotational atherectomy (RA) is an effective device for plaque modification and successful percutaneous coronary intervention (PCI) can be achieved even with severely calcified lesions.However, there are limited data about the safety, periprocedural risk and prognosis in this setting, especially for nonagenarians. Here we report a 91-year-old man presenting with non-ST elevation myocardial infarction with distal left main and triple vessel disease. RA was used for distal LM, left anterior descending andleft circumflex coronary artery. In addition, instantaneous wave-free ratio, a new adenosine-independent index of coronary stenosis severity, was used to assess in-stent restenosis of the left circumflex coronary artery at follow-up. This elder patient tolerated the procedure well and is completely symptom-free at present.

Keywords: bifurcation, left main, rotational atherectomy, iFFR

Introduction

Coronary artery bypass surgery (CABG) is a difficult option sometimesin high-risk patients with critical left main coronary artery (LMCA) disease. Patients with complex calcified left main (LM) disease may have both a high surgical risk and a high lesion complexity, leading to a therapeutic dilemma.[1-3] Rotational atherectomy (RA) is an effective device for plaque modification and successful percutaneous coronary intervention (PCI) can be achieved even with severely calcified lesions. RA prior to stent implantation is an option for a subset of patients with severely calcified bifurcation lesions. However, patients with LM disease were excluded from the randomized ROTAXUS trial.[4] Only limited data about RA of the LM bifurcation lesions are available.[1-3] The safety and effectiveness of rotational atherectomy in octogenarians for highly calcified LMCA diseasehas also beenlimited.[5] Here we report a case of RA fordistal LM coronary artery disease with high surgical risk. In addition, instantaneous wave-free ratio (iFR), a new adenosine-independent index of coronary stenosis severityis also discussed.

Case report

Mr. Tan, a 91-year-old man with a prior history of gout, diabetes mellitus, hypertension and dyslipidemia for ten years was found to have

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three-vessel disease: RCA 50-60%, LAD 90-95%, LCX 80-85% and distal LM 95-98% 1 month prior to admission. He had been a heavy smoker but had quit many years before. He has hearing impairment but still can walk and eat on his own. After discussion, the patient and his family refused CABG. He had been prescribed both aspirin 100 mg and clopidogrel 75 mg everyday since the elective coronary angiogram. One month later, he presented to us with acute coronary syndrome without ST-segment elevation (NSTE- ACS). He felt chest tightness and dyspnea on the day of admission and was brought to our emergency room (ER) for help. He had orthopnea and bilateral lower leg pitting edema. He also had oliguria 2~3 days prior to admission. In the ER, his vital signs were as follows: blood pressure 156/96 mmHg, pulse rate 110 bpm and respiratory rate 26 breaths/min. CXR revealed acute pulmonary edema and cardiomegaly (Figure 1A and B). 12 lead EKG revealed V2~6, I, a VL ST depression (Figure 1C). Troponin I was 2.95 ng/

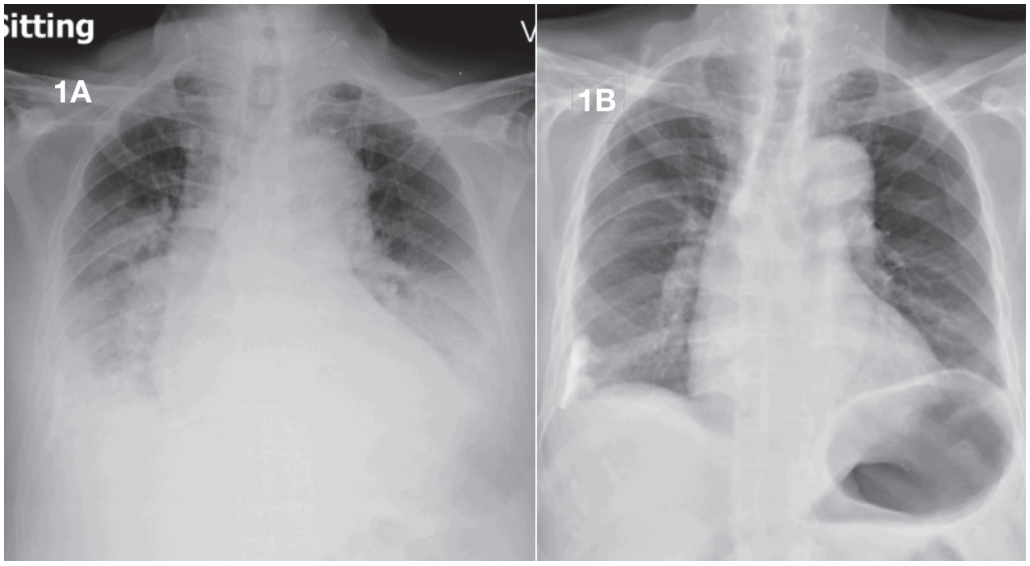

Figure 1A. Acute heart failure with pulmonary edema.
Figure 1B. Resolved pulmonary edema.

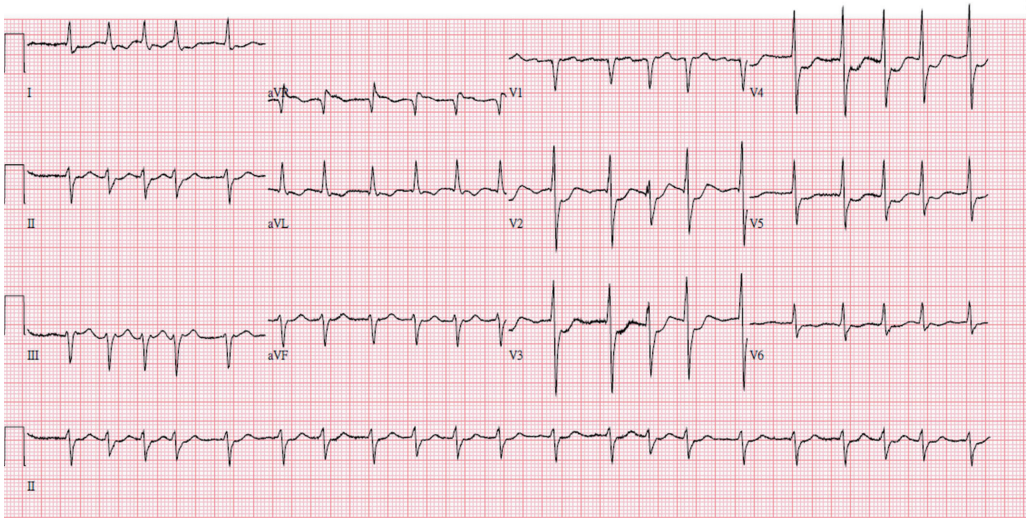

Figure 1C. ECG shows V2 to V5, I, II, aVL ST depression and aVR ST elevation.

ml and elevated to 3.77 ng/ml after a few hours. NT-proBNP was 19569 pg/mL. He received O_2 therapy with non-rebreathing mask for marked SaO_2 desaturation. Furosemide bolus of 40 mg and nitroglycerin IV infusion were prescribed. He was admitted to ICU with the diagnosis of NSTE-ACS, complicated with acute decompensated heart failure and impending respiratory failure. After receiving treatmenthis condition stabilized and coronary intervention was arranged after informed consent. Coronary angiogram showed tight distal LM bifurcation stenosis with severe calcification (Figure 2A). The LM and LAD were wired first andthe wire was exchanged for Rota-Floppy guidewire with the help of micro-catheter. Rotational atherectomy was first performed in the LAD with a 1.25 burr at 170000 rpm which wasupsized to a 1.75 burr at 160000 rpm. The LCX was then wired with Rota-Floppy guidewire (Figure 2B). A 1.25 mm burr was used to debulk the ostial LCX calcified plaque at 150000 rpm (Figure 2B). DK crush stenting technique was then performed. (Figure 2C, 2D, 2E) After PCI, the patient's condition improved dramatically.

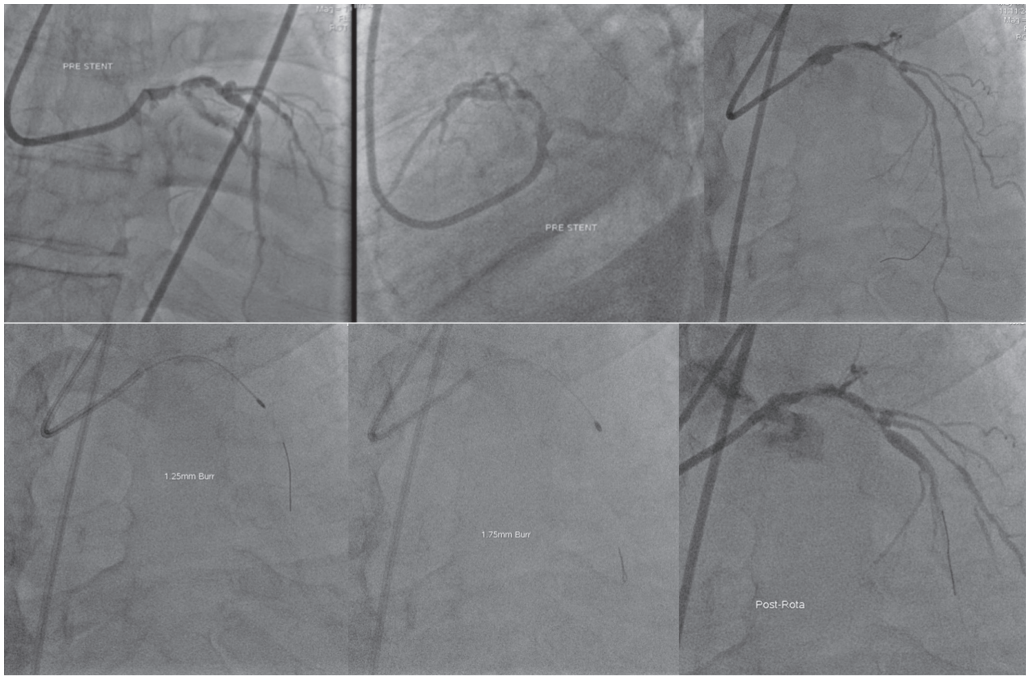

Figure 2A. Distal LM bifurcation angiogram and following1.25 mm burr and 1.75 mm burr to LAD.

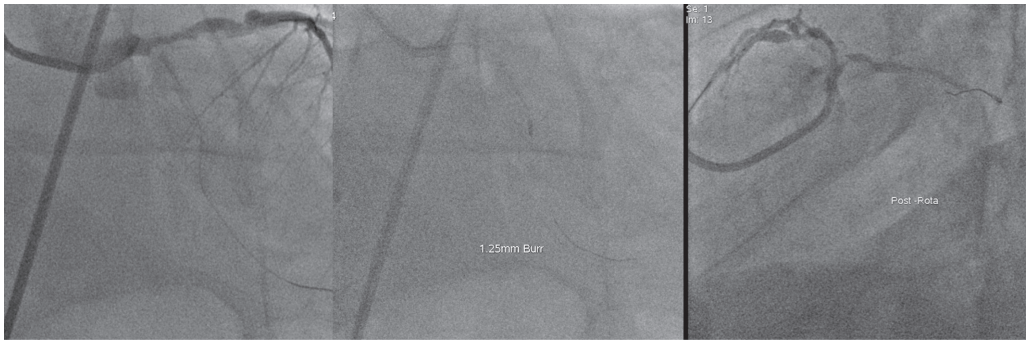

Figure 2B. 1.25 mm burr to LCX.

CXR showed resolution of pulmonary edema. The patient haddyspnea on exertion 4 months later and follow-up angiogram was arranged. It showed in-stent restenosis at the ostial LCX (Figure 3A). The iFR of LAD and LCX were 0.93 and 0.51 (Figure 3B). PCI was performed in the LCX with DEB after proper dilatation of LCX in-stent restenosis. The post-PCI angiogram showed no residual stenosis (Figure 3C). The iFR of LAD and LCX were 0.98 and 1.00, respectively (Figure 3D). The patient is completely symptom free at present.

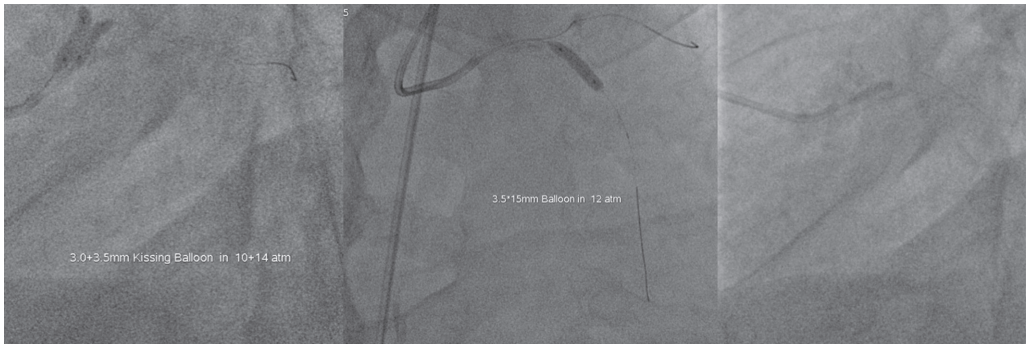

Figure 2C. Kissing balloon dilatation to distal left main bifurcation after rotational atherectomy.

Figure 2D. Second simultaneous kissing balloon for distal LM bifurcation stenting.

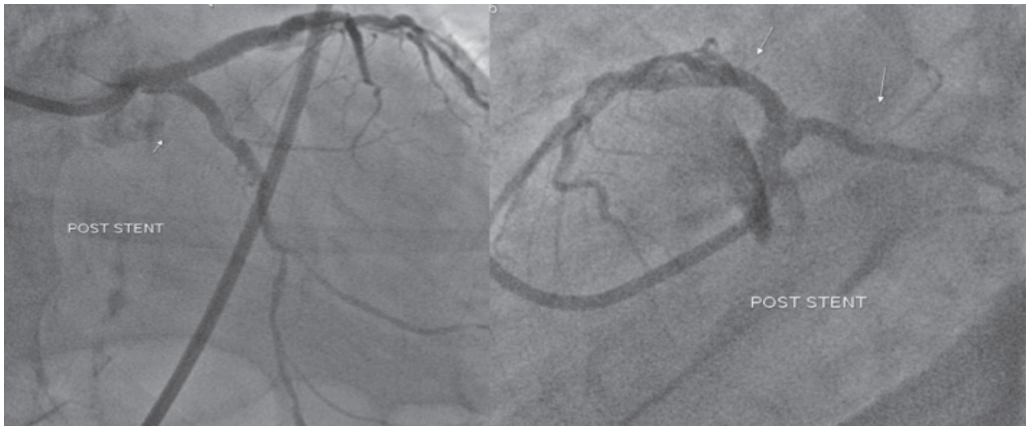

Figure 2E. Final angiogram after double kissing balloon.

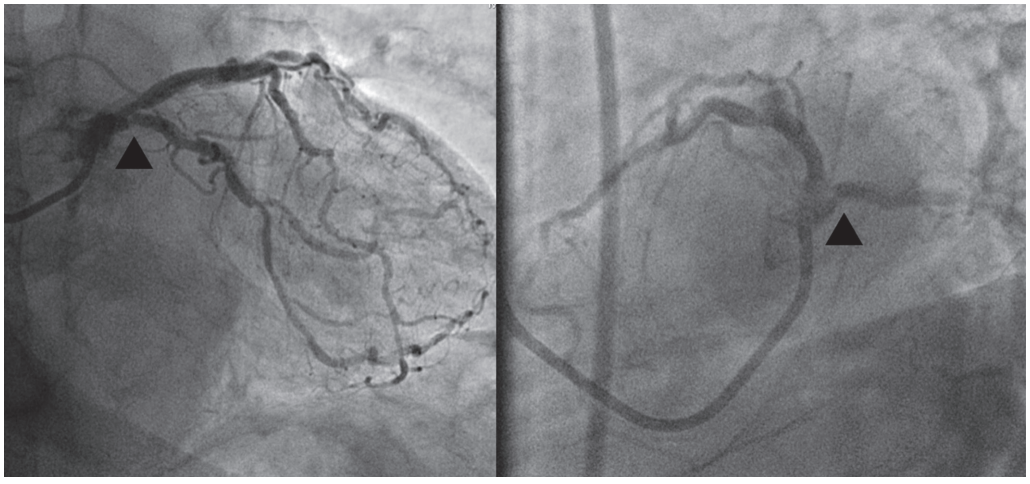

Figure 3A. Follow-up Angiogram: ostial LCX stenosis and equivocal ostial LAD stenosis.

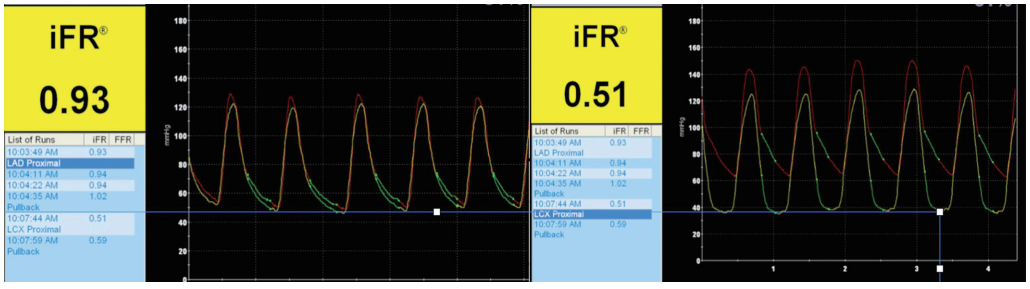

Figure 3B. pre PCI iFR: LAD 0.93, LCX 0.51.

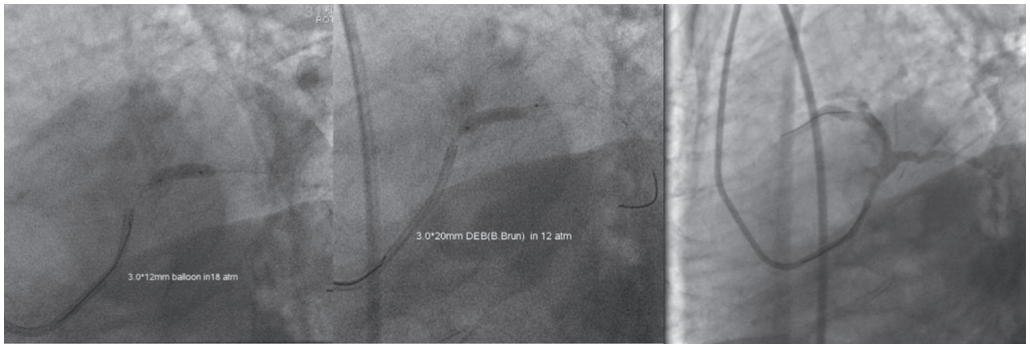

Figure 3C. DEB to LCX and final angiogram afterward.

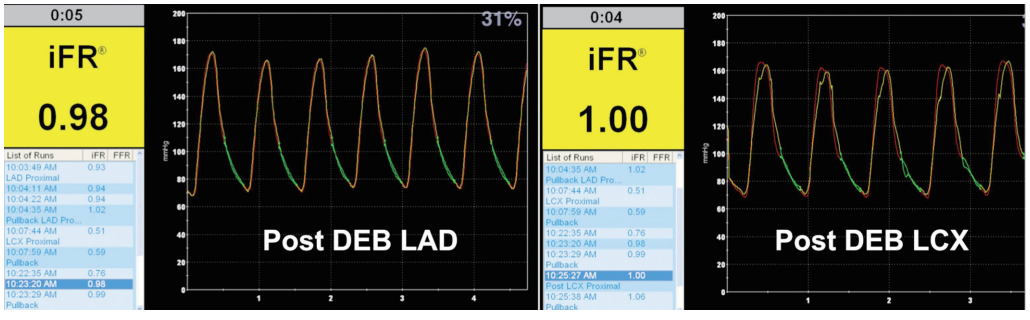

Figure 3D. post PCI iFR: LAD 0.98 and LCX 1.0.

Discussion

LMCA bifurcation stenting is an effective revascularization procedure in high-risk patients who are not candidates for bypass surgery.[3] RA is the superior method for debulking left main calcification prior to LMCA bifurcation stenting. However, there are limited data about the safety, periprocedural risk and prognosisin this setting, especially for nonagenarians. In our experience, rotational atherectomy can be of great help in this subset of patients because it can facilitate smooth delivery of stents by plaque modification and shorten procedural time.

The instantaneous wave-free ratio (iFR) is a new adenosine-independent index of coronary stenosis severity. Real-time iFR measurements are easily acquired with excellent diagnostic performance and adenosine infusion is not required. The excellent agreement between iFR and FFR measurements demonstrates the reliability of iFR measurements. iFR for left main coronary disease may enhance diagnostic accuracy and expose fewer patients to adenosine. However, adenosine-free pressure wire derived indices of stenosis severity may be less accurate for LM/pLAD lesions than for other lesion locations.[6] Overall, iFR is a promising method for the assessment of coronary physiology, but still requires prospective clinical endpoint trial evaluation.[7]

References

1. Moraes Alves de Souza IP, Macedo Aguiar B, Pinheiro Sena J, Bastos Barbosa PJ, Raimundo Brito JC. Multivessel rotational atherectomy in left main coronary artery lesion followed by stent implantation. *Revista Brasileira de Cardiologia Invasiva (English Edition)* 2015;23(4):276-8.
2. Sulimov DS, Abdel-Wahab M, Toelg R, Kassner G, Geist V, Richardt G. High-speed rotational atherectomy of the left main coronary artery: a single-center experience in 50 high-risk patients. *Cardiovasc Revasc Med* 2015;16(5):284-9.
3. Nayak AK, Davis R, Reddy HK, Krishnan MS, Voelker DJ, Aggarwal K. Left main coronary artery rotational atherectomy and stenting. *South Med J* 2000;93(4):415-23.
4. Abdel-Wahab M, Richardt G, Joachim Buttner H, et al. High-speed rotational atherectomy before paclitaxel-eluting stent implantation in complex calcified coronary lesions: the randomized ROTAXUS (Rotational Atherectomy Prior to Taxus Stent Treatment for Complex Native Coronary Artery Disease) trial. *JACC Cardiovasc Interv* 2013;6(1):10-9.
5. Dahdouh Z, Roule V, Dugue AE, Sabatier R, Lognone T, Grollier G. Rotational atherectomy for left main coronary artery disease in octogenarians: transradial approach in a tertiary center and literature review. *J Interv Cardiol* 2013;26(2):173-82.
6. Kobayashi Y, Johnson NP, Berry C, et al. The Influence of lesion location on the diagnostic accuracy of adenosine-free coronary pressure wire measurements. *JACC Cardiovasc Interv* 2016;9(23):2390-9.
7. Härle T, Bojara W, Meyer S, Elsässer A. Comparison of instantaneous wave-free ratio (iFR) and fractional flow reserve (FFR) — First real world experience. *Int J Cardiol* 2015;199:1-7.