

Application of Excimer Laser Coronary Atherectomy Guided by Optical Coherence Tomography in the Treatment of a Severe Calcified Coronary Lesion

Fang-Jie Hou^{1,2}, Yu-Jie Zhou¹, Wei Liu¹, Yong-He Guo¹, Shi-Wei Yang¹, Bright Eric Ohene¹, Zheng-Zhong Wang², Jun Guan²

¹Department of Cardiology, 12th Ward, Beijing Anzhen Hospital, Capital Medical University, Beijing Institute of Heart Lung and Blood Vessel Disease, Beijing Key Laboratory of Precision Medicine of Coronary Atherosclerotic Disease, Clinical Center for Coronary Heart Disease, Beijing 100029, China

²Department of Cardiology, Qingdao Municipal Hospital, Qingdao, Shandong 266011, China

To the Editor: A 73-year-old female was referred to our hospital for evaluation of unstable angina pectoris. She had a greater than 10-year history of hypertension. Coronary angiography (CAG) was performed in another hospital in March 2017, which showed diffuse calcific stenosis (about 90%) in the proximal and mid-left anterior descending (LAD) artery, 70% stenosis in the ostial obtuse marginal branch, and no apparent stenosis in the right coronary artery. The lesion in the LAD could not be intervened because the 2.0 mm × 15.0 mm Sprinter balloon (Medtronic, USA) could not be expanded and the 2.5 mm × 15.0 mm NC Sprinter balloon (Medtronic, USA) could not pass through the lesion.

After obtaining informed consent, percutaneous coronary intervention for the LAD lesion was performed. A 6-Fr EBU 3.75 guiding catheter (Medtronic, USA) was inserted from the radial artery. A Balance Middle Weight Universal II guide wire (Abbott, USA) was successfully introduced into the distal LAD. An optical coherence tomography (OCT) catheter (St. Jude Medical, USA) failed to pass through the proximal lesion. Excimer laser coronary atherectomy (ELCA) was initiated using a 0.9-mm eccentric catheter (Spectranetics, USA) at 45/45 (fluence/Hz), then 45/60 (fluence/Hz), 45/80 (fluence/Hz), and 80/80 (fluence/Hz), but there was no progress. We repeatedly dilated the lesion with a 1.5 mm × 15.0 mm Sprinter balloon at 10–12 atm. Then, we successfully performed ELCA at 45/45 (fluence/Hz). OCT assessment was performed after the laser catheter passed through the lesion and severe calcifications were noted [Figure 1A1–A3]. A culprit lesion was dilated repeatedly with a 2.5 mm × 15.0 mm NC Sprinter balloon at 12–14 atm. Two stents [2.50 mm × 28.00 mm Xience Xpedition; Abbott, USA] and [2.75 mm × 24.00 mm Endeavor Resolute; Medtronic, USA] were placed from far to near at 12 atm. Finally, postdilation was performed with the stents at 14–20 atm with a 3.0 mm × 15.0 mm NC Sprinter balloon. CAG showed an acceptable result, and the final OCT results showed no apparent dissection malapposition or underexpansion [Figure 1B1–B3], and the minimum lumen area was 4.17 mm².

The therapeutic effect of excimer laser technology is mainly achieved by the following three kinds of actions: photochemical, photothermal, and photomechanical effects. The depth of action is 0.1 mm. Excimer laser technology can break the molecular bonds of tissues and produce small debris, including water, gas, and small particles (90% <10 μm).^[1] The laser advantages include delivery of flexible catheters in curvature anatomy, precision of controlled penetration into the lesion, and circumferential or eccentric distribution of laser rays, which create a smooth “pilot channel.” In addition, the laser interacts favorably with a thrombus and uniquely suppresses platelet activity, thus reducing the risk of thrombosis within the newly revascularized site.^[2] Previous studies have shown that ELCA can be used for the treatment of coronary thrombosis in patients with acute coronary syndrome, chronic total occlusion lesions, saphenous vein graft occlusions, stent restenosis, and mild-to-moderate calcifications.^[1,3,4] A 0.9-mm eccentric catheter is a xenon-chlorine (excimer)-pulsed laser catheter that is capable of delivering higher energy density with lower heat production (smaller area of ablation) and has been suggested as a treatment option for these calcified lesions.^[1] This catheter could deliver excimer energy (wave length, 308 nm; pulse length, 185 nanoseconds) from 30 to 80 mJ/mm² (fluences) at pulse repetition rates (frequency) from 25 to 80 Hz using a 10-s on and 5-s off lasing cycle. This finding compares with other excimer catheter technology (1.4-, 1.7-, and 2.0-mm catheters) delivering 30–60 mJ/mm² at 25–40 Hz using a 5-s on and 10-s off lasing cycle. These improvements in laser energy delivery were proposed to maximize tissue penetration while controlling complications within acceptable limits.^[1] ELCA is usually performed during intracoronary saline infusion to minimize the risk of vapor bubble formation that can lead to arterial dissection;^[1]

Address for correspondence: Dr. Yu-Jie Zhou,
Department of Cardiology, Beijing Anzhen Hospital, Capital Medical
University, Beijing 100029, China
E-Mail: azzyj12@163.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

© 2018 Chinese Medical Journal | Produced by Wolters Kluwer - Medknow

Received: 19-12-2017 **Edited by:** Yi Cui

How to cite this article: Hou FJ, Zhou YJ, Liu W, Guo YH, Yang SW, Ohene BE, Wang ZZ, Guan J. Application of Excimer Laser Coronary Atherectomy Guided by Optical Coherence Tomography in the Treatment of a Severe Calcified Coronary Lesion. *Chin Med J* 2018;131:1001-2.

Access this article online

Quick Response Code:



Website:
www.cmj.org

DOI:
10.4103/0366-6999.229901

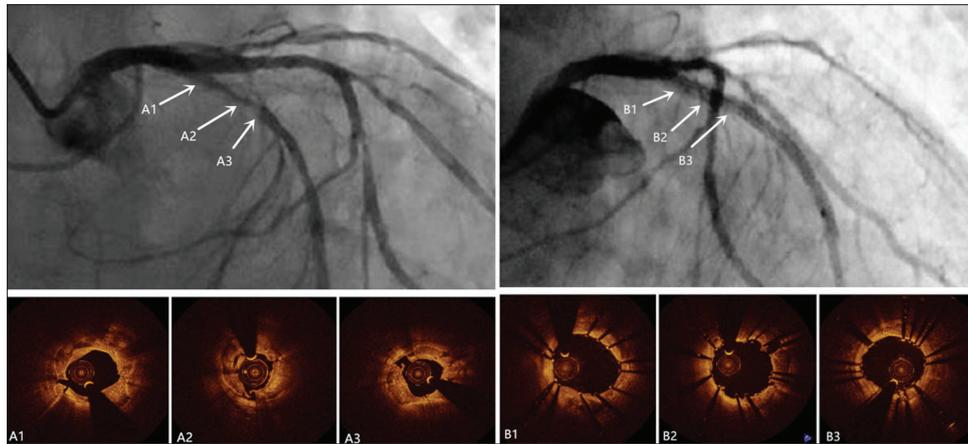


Figure 1: (A1–A3) OCT assessment was performed after the laser catheter passed through the lesion and severe calcifications were noted. (B1–B3) The final OCT results showed no apparent dissection malapposition or underexpansion. OCT: Optical coherence tomography.

however, a case report^[5] discussed the injection of contrast before laser activation for treating an underexpanded stent (negating the established instruction for use that mandates meticulous contrast removal from the guiding catheter before activation). Due to the known effect of contrast on amplification of laser waves, this maneuver can extend the depth of energy distribution to soften the calcium. Indeed, such laser manipulation may cause complications as well, from spasm and dissections to perforations.

Our case is the first report involving treatment of a severe calcified lesion with a 0.9-mm catheter guided by OCT. Alternative use of ELCA and balloon dilation could alter calcified plaque morphology and achieve better results. ELCA with contrast injection should be used infrequently and with great caution. Severe calcified lesions more easily lead to malapposition and underexpansion. OCT is the highest resolution intracavity imaging examination at present, which could provide accurate evaluation. These methods can improve the procedure's success rate and optimize the procedure.

Declaration of patient consent

The authors certify that they have obtained the patient's consent form. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understand that her name and initials will not be published and due efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Bilodeau L, Fretz EB, Taeymans Y, Koolen J, Taylor K, Hilton DJ, *et al.* Novel use of a high-energy excimer laser catheter for calcified and complex coronary artery lesions. *Catheter Cardiovasc Interv* 2004;62:155-61. doi: 10.1002/ccd.20053.
2. Topaz O. CTO revascularization: Obstacles and options in balloon nonpenetrable lesions. *Catheter Cardiovasc Interv* 2017;90:21-2. doi: 10.1002/ccd.27167.
3. Ambrosini V, Golino L, Niccoli G, Roberto M, Lisanti P, Ceravolo R, *et al.* The combined use of drug-eluting balloon and excimer laser for coronary artery restenosis in-stent treatment: The DERIST study. *Cardiovasc Revasc Med* 2017;18:165-8. doi: 10.1016/j.carrev.2016.12.012.
4. Nishino M, Mori N, Takiuchi S, Shishikura D, Doi N, Kataoka T, *et al.* Indications and outcomes of excimer laser coronary atherectomy: Efficacy and safety for thrombotic lesions-the ULTRAMAN registry. *J Cardiol* 2017;69:314-9. doi: 10.1016/j.jjcc.2016.05.018.
5. Karacsonyi J, Danek BA, Karatasakis A, Ungi I, Banerjee S, Brilakis ES, *et al.* Laser coronary atherectomy during contrast injection for treating an underexpanded stent. *JACC Cardiovasc Interv* 2016;9:e147-8. doi: 10.1016/j.jcin.2016.04.040.