Cracking circular calcium with orbital atherectomy

Aleksandra Gąsecka[1], Daniele Vaino[2], Janusz Kochman[1], Zenon Huczek[1], Arkadiusz Pietrasik[1]

[1]1st Chair and Department of Cardiology, Medical University of Warsaw, Warszawa, Poland
[2]Department of Cardiology, University of Torino, Torino, Italy

Correspondence to:
Assist. Prof. Aleksandra Gąsecka, MD, PhD,
1st Chair and Department of Cardiology,
Medical University of Warsaw,
Banacha 1a,
02–097 Warszawa, Poland,
phone: +48 22 599 19 51,
e-mail: aleksandra.gasecka@wum.edu.pl

DOI: 10.33963/v.phj.98836

Received:
November 8, 2023

Accepted:
January 7, 2024

Early publication date:
February 2, 2024

A 49-year-old man with multivessel coronary artery disease, hypercholesterolemia, hypertension and smoking was admitted for elective percutaneous coronary intervention (PCI) of the left anterior descending (LAD) artery. Two weeks earlier he underwent a non-ST-segment elevation myocardial infarction treated with PCI of the right coronary artery with drug-eluting stent (DES) implantation. Echocardiography showed hypokinesis of the inferior and posterior wall with left ventricle ejection fraction of 50%. Angiography confirmed critical stenosis of the proximal and mid LAD, with 360° calcium arch in the mid part on intravascular ultrasound (IVUS) (Figure 1A–B). Orbital atherectomy (OA) (CSI Diamond Coronary Orbital Atherectomy System) was performed at 80 000 rounds per min (rpm), but severe underexpansion of the 2.5 mm non-compliant (NC) balloon was still seen on angiography (Figure 1C). Several OA rounds with 120 000 rpm were repeated, allowing for calcium crack, confirmed on IVUS (Figure 1D). Following pre-dilatation with 2.5- and 3.5-mm NC balloons, two overlapping DES (2.75 × 15 mm, 3.5 × 38 mm) were implanted and post-dilated with a 3.5 mm NC balloon. Final angiography and IVUS showed good stent expansion and apposition, no edge dissection, no significant plaque in the distal landing zone and no stent protrusion into the left main coronary artery (Figure 1E–F). The patient was discharged home the next day. The 1-month follow-up was uneventful.

Orbital atherectomy is a relatively recent calcium modification technique, recommended in highly calcified (<180° calcium arch) and balloon uncrossable lesions [1]. It consists of a diamond-coated 1.25 mm crown, compatible with a 6F catheter, connected to a drive shaft and a controller [1, 2]. The crown is advanced over a dedicated 0.014-inch Viper wire, with superior maneuverability compared with the 0.009-inch Rotawire. The crown's orbital diameter expands with increasing burr speed, allowing for control of the ablation depth without the need to change the burr. In contrast to rotational atherectomy (RA), OA can be performed both during antegrade and retrograde motion, reducing the risk of burr entrapment [2]. Retrograde OA motion is safer than RA in tortuous vessels, whereas antegrade RA is more efficient in uncrossable lesions. The theoretical advantages of OA include selective action on the calcified plaque component, smaller size of the released plaque debris (2 vs. 5–10 μm in RA), and no interruption in blood flow. OA allows for more extensive calcium modification, as demonstrated by intravascular imaging, especially in vessels larger than 3.5 mm in diameter [3]. The risk of coronary perforation and dissection seems to be similar with both techniques (0.4% and 1.3%, respectively), although the risk of myocardial infarction is lower with OA (6.7% vs. 13.8%) [4]. In the case of heavily calcified coronary lesions, both OA and RA can be combined with intravascular lithotripsy [5]. The ongoing ECLIPSE trial, which compares OA and balloon angioplasty before DES implantation in 2000 patients with severely calcified lesions, may shed more light on OA safety and efficacy in autumn 2024. Since currently there are no data regarding the superiority of OA over RA, it is crucial to be familiar with both techniques and tailor their use to the specific features of calcified lesions and coronary anatomy [1].

Article information

Conflict of interest: None declared.

Funding: None.

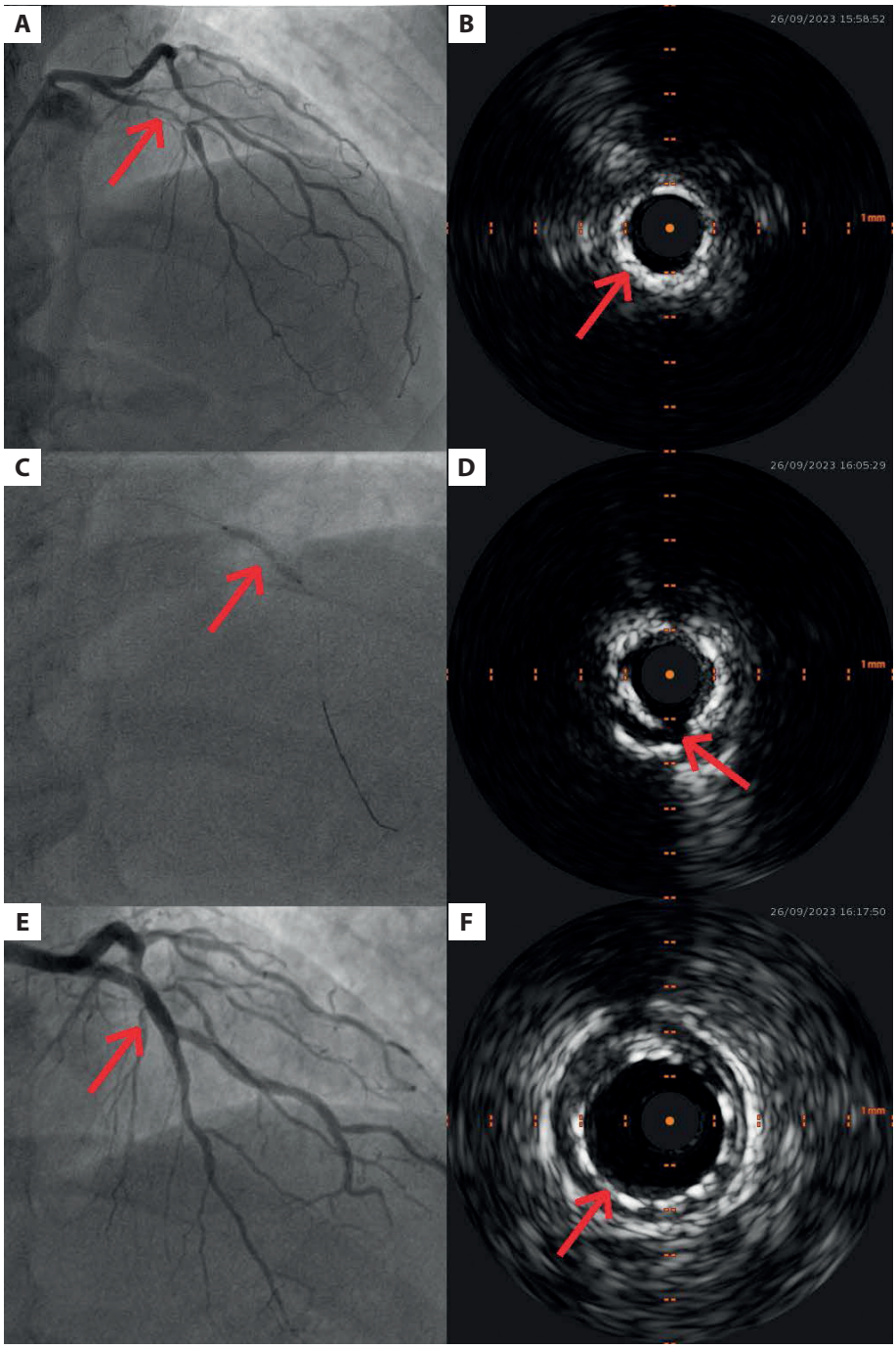

Figure 1. Percutaneous coronary intervention of the left anterior descending (LAD) artery with orbital atherectomy (OA). **A**. Angiography showing critical, calcified stenosis of the proximal and mid LAD (red arrow). **B**. Intravascular ultrasound (IVUS) showing circumferential, superficial, and deep calcifications in the mid-LAD part (red arrow). **C.** Severe underexpansion of the 2.5 mm non-compliant balloon on angiography after OA performed at 80 000 rpm (red arrow). **D**. Calcium crack confirmed on IVUS after several OA rounds at 120 000 rpm (red arrow). **E**. Final angiographic result (red arrow). **F**. Final IVUS result (red arrow)

REFERENCES

1. Kralisz P, Legutko J, Tajstra M, et al. Use of orbital atherectomy in coronary artery disease with severe calcification: A preliminary study. Kardiol Pol. 2023; 81(1): 61–63, doi: 10.33963/KP.a2022.0289, indexed in Pubmed: 36573609.
2. Rola P, Furtan Ł, Włodarczak S, et al. Orbital atherectomy for treatment of calcified coronary artery lesions. First experiences in Poland: Short-term outcomes of the Lower-Silesia Orbital Atherectomy Registry (LOAR). Kardiol Pol. 2023; 81(2): 174–176, doi: 10.33963/KP.a2023.0003, indexed in Pubmed: 36594531.
3. Yamamoto MH, Maehara A, Karimi Galougahi K, et al. Mechanisms of Orbital Versus Rotational Atherectomy Plaque Modification in Severely Calcified Lesions Assessed by Optical Coherence Tomography. JACC Cardiovasc Interv. 2017; 10(24): 2584–2586, doi: 10.1016/j.jcin.2017.09.031, indexed in Pubmed: 29268891.
4. Meraj PM, Shlofmitz E, Kaplan B, et al. Clinical outcomes of atherectomy prior to percutaneous coronary intervention: A comparison of outcomes following rotational versus orbital atherectomy (COAP-PCI study). J Interv Cardiol. 2018; 31(4): 478–485, doi: 10.1111/joic.12511, indexed in Pubmed: 29707807.
5. Włodarczak S, Rola P, Furtan Ł, et al. Orbital-Tripsy - orbital atherectomy facilitated by Shockwave Intravascular Lithotripsy: Novel bailout strategy in percutaneous coronary intervention in heavily calcified coronary lesions. Kardiol Pol. 2023; 81(3): 296–297, doi: 10.33963/KP.a2023.0005, indexed in Pubmed: 36573605.