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When Going Gets Tough, ELCA-Tripsy Gets You Going

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Abstract

Coronary calcium is a problem for interventional cardiologists everywhere since it frequently results in stent under-expansion and ischemic events. Although aggressive balloon post-dilatation is often insufficient, several plaque ablation techniques are widely used despite being technically tricky and problematic. Shockwave intravascular lithotripsy (S-IVL), which has a high safety margin, has gained popularity for controlling calcium during percutaneous coronary intervention (PCI). We also believe these techniques are complementary. However, Evidence is lacking regarding the modification of calcified plaques by ELCA. There aren't many published case reports about using intravascular lithotripsy (IVL) with Excimer laser coronary angioplasty (ELCA) during PCI. Here, we describe a case of effectively treated calcified left anterior descending artery (LAD) using shock wave IVL and ELCA assistance. In this case study, we present a 72-year-old male with a history of hypertension, diabetes mellitus type 2. The use of ELCA and Intravascular Lithotripsy (IVL) in this case successfully addressed the heavily calcified lesion in the proximal LAD artery, allowing for optimal stent placement. In calcified lesions that are uncrossable, ELCA should be the strategy of choice, used in combination with other techniques.

1. Abbreviation

ELCA: Excimer laser coronary angioplasty; S-IVL: Shockwave intravascular lithotripsy; PCI: Percutaneous coronary intervention; IVL: Intravascular lithotripsy; LAD: Left anterior descending artery; LCX: Left circumflex artery; OCT: Optical coherence tomography; TR: Tricuspid Regurgitation; MR: Mitral valve regurgitation; PAH: Pulmonary arterial hypertension; TIMI: Thrombolysis in myocardial infarction; TMP: Transmembrane Potential

2. Introduction

One of the significant obstacles for an interventional cardiologist is calcified coronary artery lesions. Stent thrombosis and long-term stent restenosis are two acute issues that can occur due to calcified lesions causing stent under-expansion, a significant predictor of procedural failure [1]. Aggressive balloon dilatation occasionally produces enough room for stent deployment, but the magnitude of luminal gain is constrained. In addition to having minimal effect on the calcified lesion, high-pressure balloon dilatation can overstretch the noncalcified wall in eccentric lesions, increasing the risk of coronary dissection and perforation [2]. In contrast to rotational atherectomy, S-IVL uses ultrasonic waves to terminate the calcium arc and maintain the residual chunks inside the vessel wall. Circumferential lithotripsy improves plaque compliance, according to an optical coherence tomography (OCT) sub-study of the DISRUPT-CAD trial [3]. Furthermore, lithotripsy does not cause distal microembolization, slow or no flow, coronary perforation, or bradycardia that needs the temporary insertion of a pacing lead in rotating atherectomy. Its main limitation is the crossing profile when treating a very tight and severely calcified stenosis where rotational (RA) or orbital atherectomy (OA) are very useful. Evidence is lacking regarding the modification of calcified plaques by ELCA. Although severely calcified plaques have been considered a hostile scenario for this technique, it is known for its good results in other circumstances, such as stent under expansion, in-stent restenosis and chronic total occlusions, where severe calcification is the norm [4,5].

This is a case of 72-year male patient with a history of diabetic, hypertension and CAD presented with chest pain and shortness of breath on exertion and relieved on rest. Echocardiography showed mild tricuspid regurgitation (TR), mild mitral valve regurgitation (MR), moderate PAH, Calcified aortic valve, and severe LV dysfunction (EF 30%). Coronary angiography revealed proximal to mid diffused 90% calcified LAD disease, 50%-60% ostial plague in LCX (FIG. 1). We planned to proceed with immediate PCI of LAD to LCX. Due to heavily calcified lesion 2.5* 12 mm & 1.5* 10 mm balloons couldn't be crossed. Therefore, Excimer laser coronary was done in LAD 9 times at frequency of 45/25 pulses (FIG. 2). Then pre-dilatation was done by 2*10 mm NC trek at 14 atm and 2.5*12 mm Yukon SC at 12 atm (FIG. 3). Thereafter sequentially shockwave IVL was performed using a 2.5*12 mm balloon and 50 pulses of ultrasound energy were successfully delivered. This cycle was repeated 5 times (Fig 4). Bed preparation was done optimally to deploy 2.75*40 mm Vivo ISAR stent (FIG. 5). Post dilatation was done with 2.75* mm balloon. TIMI III flow was achieved.

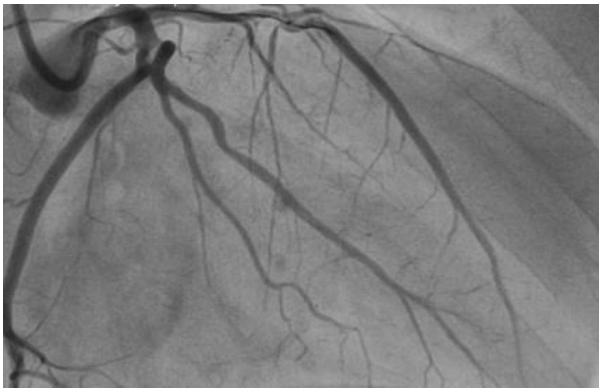

FIG. 1. **Coronary angiography revealed proximal to mid diffused 90% calcified LAD disease & 50%-60% disease in ostial LCX.**

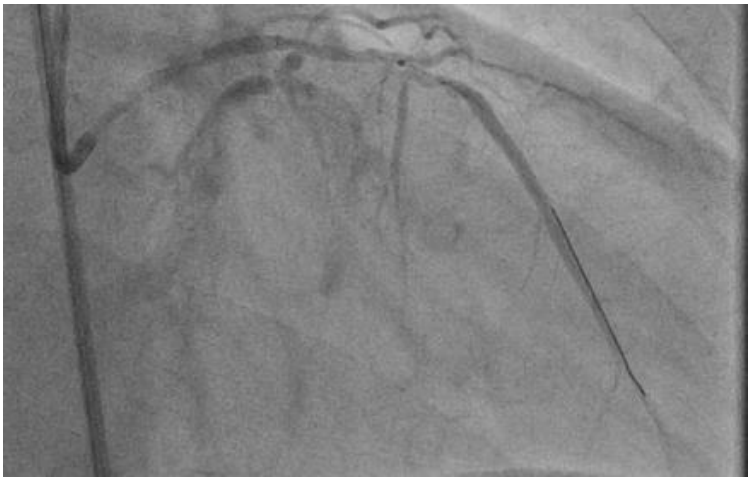

FIG. 2. **Performing ELCA in LAD.**

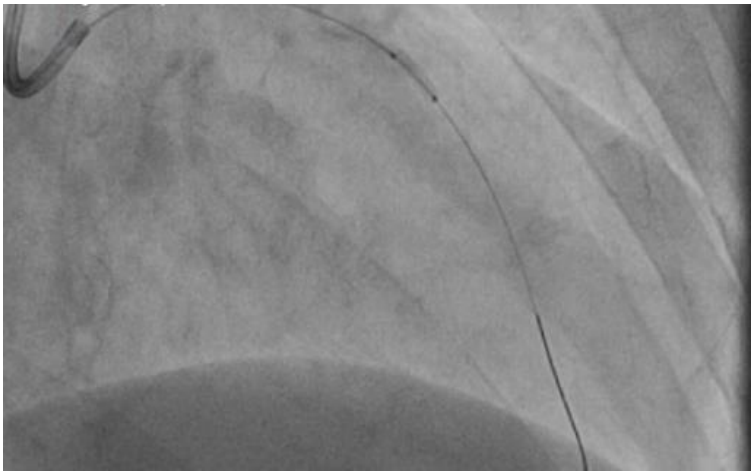

FIG. 3. **Balloon Dilatation at 14 atm.**

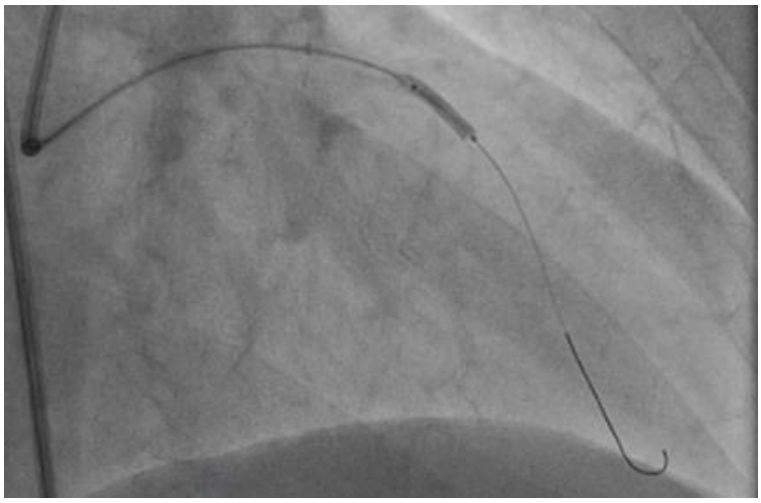

FIG. 4. **2.5*12 mm IVL successfully treats the lesion.**

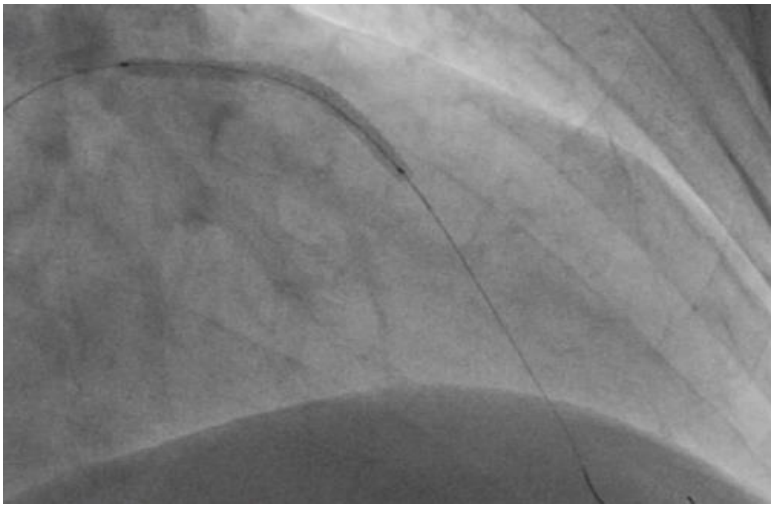

FIG. 5. **2.75*40 mm Vivo ISAR deployed.**

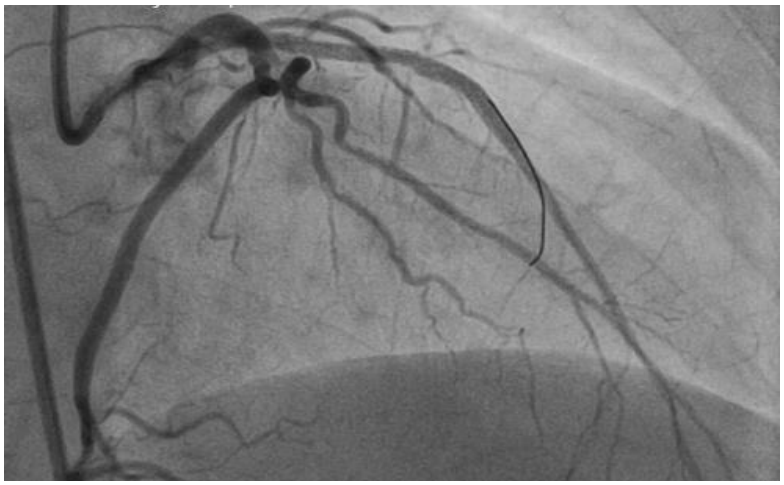

FIG. 6. **TIMI III Flow achieved.**

3. Discussion

Comorbidities and additional cardiovascular risk factors exacerbate coronary calcification, a feature of aging [6]. Numerous techniques, such as rotational/orbital atherectomy, excimer laser, high-pressure noncompliant balloons, scoring balloons, and cutting balloons, are available for plaque modification in severely calcified coronary lesions. These devices can compress or remove plaque but also carry dangers such as perforation, coronary dissection, distal embolisation, and slow blood flow. We also believe these techniques are complementary. However, Evidence is lacking regarding the modification of calcified plaques by ELCA. Because of that, in our opinion, ELCA may play a role in the modification of calcified plaques depending on their characteristics and composition. In addition, ELCA is one of the most useful techniques in calcified lesions that are truly uncrossable [7].

In this case both the techniques were used as the balloons couldn’t be crossed due to heavy calcifications.

The combination of Intravascular Lithotripsy (IVL) and Excimer Laser Coronary Atherectomy (ELCA) can be considered in specific cases where a particularly challenging calcified lesion within a coronary artery requires a more aggressive and multifaceted approach. This combination is sometimes used to address extremely calcified and resistant plaques, but it's essential to note that the decision should be made by an experienced interventional cardiologist, considering the patient's specific condition and the complexity of the lesion.

Using both technologies together may increase the chances of successfully treating complex, calcified lesions and achieving optimal results with angioplasty and stent placement.

The use of ELCA and Intravascular Lithotripsy (IVL) in this case successfully addressed the heavily calcified lesion in the proximal LAD artery, allowing for optimal stent placement. The procedure resulted in significant symptom relief and improved coronary blood flow, with no immediate complications.

4. Conclusion

In conclusion, we agree that IVL is an easy, safe, and effective technique for the percutaneous treatment of calcified coronary stenosis and is complementary to other plaque modification techniques. However, in calcified lesions that are uncrossable, ELCA should be the strategy of choice, used in combination with other techniques. To the best of our knowledge, this is the first reported case of IVL with ELCA in heavily calcified disease.

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