REC Interv Cardiol. 20XX;XX(X):XX-XX
https://doi.org/10.24875/RECICE.M26000575

Editorial

Rational application of excimer laser in complex percutaneous coronary intervention: beyond balloon failure

Uso racional del láser de excímeros en la intervención coronaria percutánea compleja: más allá del fracaso del balón

Alberto Pernigotti,[a] Mohsen Mohandes,[a] and José Luis Ferreiro[a,b,c,d,*]

[a] *Servicio de Cardiología, Hospital Universitari Joan XXIII de Tarragona, Tarragona, Spain*
[b] *Institut de Recerca Biomèdica Catalunya Sud (IRBCatSud), Tarragona, Spain*
[c] *Universitat Rovira i Virgili, Tarragona, Spain*
[d] *Centro de Investigación Biomédica en Red de Enfermedades Cardiovasculares (CIBERCV), Instituto de Salud Carlos III, Madrid, Spain*

SEE RELATED CONTENT:
https://doi.org/10.24875/RECICE.M25000560

Balloon failure during percutaneous coronary intervention (PCI), which occurs particularly in severely stenotic and extensively calcified lesions, remains one of the most complex and frustrating scenarios for the interventional cardiologist. In addition, initial balloon failure is associated with prolonged procedures, greater resource consumption, and an increased risk of complications.[1] All this occurs despite the development and availability of different plaque-modification techniques, including excimer laser coronary atherectomy (ELCA).[2,3]

Across different studies over the years, the concept of balloon failure has encompassed various scenarios, including both uncrossable and undilatable lesions. This terminological imprecision may affect the interpretation of the available results from these studies, which in turn may have an impact on decision-making in clinical practice.

In the context of PCI for complex uncrossable or undilatable lesions, a better understanding of the underlying anatomical mechanisms is essential. This may be facilitated by a more systematic use of intracoronary imaging modalities. Nevertheless, dedicated studies in this setting are clearly needed. Their results may help improve lesion characterization and optimize the therapeutic approach through more appropriate selection of plaque-modification techniques.[2,3]

In a recent article published in *REC: Interventional Cardiology*, Jurado-Román et al.[4] present the design of the LUDICO study (Coronary laser in undilatable and uncrossable lesions; NCT07206082), a prospective, multicenter, single-arm observational trial to evaluate the safety and efficacy profile of ELCA in 230 patients with an indication for PCI and lesions in which balloon failure has occurred. The main strength of the study lies in its methodological approach, as it explicitly distinguishes between uncrossable and undilatable lesions. This distinction may contribute to a better understanding of the role and positioning of this technique, given that in both scenarios—after failure to cross or dilate the lesion with a balloon—ELCA would represent the first plaque-modification strategy to be used. Another relevant aspect of the study is the recommendation to use intracoronary imaging, specifically optical coherence tomography. This approach allows assessment not only of procedural success but also of the structural changes induced in the lesion. Currently, these changes have been poorly characterized in the context of ELCA, particularly in cases of in-stent restenosis.[5]

The most evident limitation of the study, appropriately acknowledged by the authors, is the absence of a control group, which makes direct comparison with other plaque-modification techniques impossible. A comparison between these techniques has recently been performed in PCI for complex lesions in the randomized ROLLERCOASTR-EPIC22 study (Rotational atherectomy, lithotripsy or laser for the treatment of calcified stenosis).[6] Such a comparison could also have been of interest in the specific context of the study under discussion. Another aspect worth noting is that the definition of an undilatable lesion is based on an objective criterion (balloon expansion < 80% after 1:1 noncompliant balloon inflation at 18 atm). In contrast, a stricter or more precise definition of an uncrossable lesion is lacking. In this study, an uncrossable lesion was defined after failure to advance a low-profile balloon despite adequate guide support at the operator's discretion. This approach may introduce a degree of variability that should be considered when interpreting the results.

From a broader perspective, the use of ELCA in clinical practice remains limited. This may be partly explained, in addition to the relatively scarce scientific evidence, by a certain paradox: although the technique is technically straightforward from the operator's standpoint, its application entails a degree of conceptual complexity. Specifically, the procedural parameters must be adjusted according to the clinical scenario in which the device is used. This may help explain its relatively limited adoption in catheterization laboratories across Spain.[6] Indeed, the safety and efficacy of ELCA largely depend on several procedural decisions that remain incompletely standardized. These include the optimal timing of ELCA use during the procedure, the selection of catheter diameter, the potential

* **Corresponding author.**
E-mail address: jferreiro.hj23.ics@gencat.cat (J.L. Ferreiro).
𝕏 @DrJLFerreiro

Online 24 March 2026.
2604-7322 / © 2026 Sociedad Española de Cardiología. Published by Permanyer Publications. This is an open access journal under the CC BY-NC-ND 4.0 license.

Please cite this article in press as: Pernigotti A, et al. Rational application of excimer laser in complex percutaneous coronary intervention: beyond balloon failure. *REC Interv Cardiol.* 2026. https://doi.org/10.24875/RECICE.M26000575.

Table 1. Proposed excimer laser configuration in different scenarios

Clinical scenario	Frequency (Hz)	Energy (mJ/mm²)	Adjunctive use of contrast	Practical comments
Underexpanded stent	60-80 (high)	60–80 (high)	No, according to device labeling. Observational studies support the usefulness of contrast amplification in lesions resistant to ELCA with saline solution	Start with high parameters if saline solution is used. If contrast is used, it is prudent to initially reduce ELCA parameters (frequency 25–40 Hz, energy 30–45 mJ/mm²), and they may be progressively increased with caution
Severely calcified lesion	60-80 (high)	60–80 (high)	No, according to device labeling. Limited evidence supports the potential usefulness of contrast in lesions resistant to ELCA with saline solution	Start with high parameters if saline solution is used. The use of contrast is not well established; if used, it is reasonable to consider an initial reduction in frequency and energy, which may then be progressively increased with caution
Thrombotic lesion	25-40 (low/ medium)	30–60 (low/ medium)	No	In "pure" thrombotic lesions, low energy and frequency are generally sufficient. In cases of thrombus with a large plaque burden, energy and frequency parameters may be gradually increased

ELCA, excimer laser coronary angioplasty.

combination with other plaque-modification techniques, and the appropriate selection and modulation of device parameters. These parameters include energy intensity and frequency, application duration, total number of pulses, and even the adjunctive use of contrast medium (amplification).[7] Table 1 proposes a practical framework for adjusting ELCA parameters according to the clinical context in which it is used. In conclusion, although ELCA is not technically demanding from an operator-handling perspective, its optimal use requires a certain degree of experience. Maximizing its benefits depends on a thorough understanding of the predominant mechanism underlying each lesion, a process that can be facilitated by the performance and appropriate interpretation of intracoronary imaging.

When examining the available evidence on ELCA, which remains generally limited, the technique has demonstrated clearer usefulness in certain specific scenarios.[8] One of these is the treatment of uncrossable lesions,[9] in which ELCA can advance over the same angioplasty guidewire. This represents a clear advantage and suggests that ELCA could be considered one of the preferred plaque-modification techniques in this setting. Moreover, ELCA may facilitate subsequent device advancement in extremely hostile anatomies and assist in the management of undilatable lesions, particularly those related to stent underexpansion. In these cases, its ability to modify both the underlying plaque and resistant neointimal tissue may allow more effective subsequent expansion.[10] In another challenging scenario—the treatment of lesions with a high thrombotic burden—ELCA has also shown potential usefulness.[11] Supporting this application, a contemporary series of patients undergoing primary PCI demonstrated that ELCA can "vaporize" thrombotic material, reducing it to microscopic particles and improving coronary flow, thereby facilitating safer and more effective stent implantation.[12]

In conclusion, the LUDICO study represents a valuable initiative, and the investigators should be congratulated, since it will contribute very useful knowledge on the safety and efficacy of ELCA in a setting still marked by relatively limited scientific evidence. In the current landscape of PCI for complex and calcified lesions, in which several plaque-modification techniques coexist, progress will depend not only on the development of new devices, but also on the ability to use them in the most rigorous and precise way, ideally guided by strategies based on evidence provided by high-quality studies.

FUNDING

None declared.

CONFLICTS OF INTEREST

A. Pernigotti declares having received consulting fees from Iberhospitex and B.Braun. M. Mohandes declares having received consulting fees from Philips. J.L. Ferreiro declares having received speaker or consulting fees from Eli Lilly Co, Daiichi Sankyo, Inc., AstraZeneca, Pfizer, Abbott, Boston Scientific, Boehringer Ingelheim, Bristol-Myers Squibb, Rovi, Terumo, Sahajanand Medical Technologies, Iberhospitex, and Ferrer, and a research grant from AstraZeneca.

REFERENCES

1. Pesarini G, Hellig F, Seth A, Shlofmitz RA, Ribichini FL. Percutaneous coronary intervention for calcified and resistant lesions. *EuroIntervention.* 2025;21:e339-e355.
2. Riley RF, Patel MP, Abbott JD, et al. SCAI expert consensus statement on the management of calcified coronary lesions. *J Soc Cardiovasc Angiogr Interv*. 2024;3:101259.
3. Jurado-Román A, Gómez-Menchero A, Gonzalo N, et al. Plaque modification techniques to treat calcified coronary lesions. Position paper from the ACI-SEC. *REC Interv Cardiol*. 2023;5:46-61.
4. Jurado-Román A, Zubiaur J, Basile M, et al. Design of the LUDICO study: effectiveness and safety of coronary laser in undilatable or uncrossable lesions. *REC Interv Cardiol*. 2025. https://doi.org/10.24875/RECICE.M25000560.
5. Lee T, Shlofmitz RA, Song L, et al. The effectiveness of excimer laser angioplasty to treat coronary instent restenosis with peri-stent calcium as assessed by optical coherence tomography. *EuroIntervention.* 2019; 15:e279-288.
6. Jurado-Román A, Gómez-Menchero A, Rivero-Santana B, et al. Rotational atherectomy, lithotripsy, or laser for calcified coronary stenosis: the ROLLER COASTR-EPIC22 trial. *JACC Cardiovasc Interv*. 2025;18:606-618.
7. Mohandes M, Pernigotti A, Moreno C, et al. Coronary laser with simultaneous contrast injection for the treatment of stent underexpansion. *Cardiol J*. 2024;31:235-242.
8. Golino L, Caiazzo G, Calabrò P, et al. Excimer laser technology in percutaneous coronary interventions: Cardiovascular Laser Society's position paper. *Int J Cardiol*. 2022;350:19-26.
9. Ojeda S, Azzalini L, Suárez de Lezo J, et al. Excimer laser coronary atherectomy for uncrossable coronary lesions: a multicenter registry. *Catheter Cardiovasc Interv.* 2021;98:1241-1249.
10. Vizzari G, Caminiti R, Ielasi A, et al. Contrast-enhanced excimer laser stepwise approach during PCI for resistant coronary lesions. *Catheter Cardiovasc Interv.* 2024;104:220-226.
11. Topaz O, Ebersole D, Das T, et al. Excimer laser angioplasty in acute myocardial infarction (the CARMEL multicenter trial). *Am J Cardiol.* 2004;93:694-701.
12. Mohandes M, Pernigotti A, Torres M, et al. Safety and efficacy profile of excimer laser coronary angioplasty for thrombus removal in STEMI. *REC Interv Cardiol.* 2026;8:26-31.

Please cite this article in press as: Pernigotti A, et al. Rational application of excimer laser in complex percutaneous coronary intervention: beyond balloon failure. *REC Interv Cardiol*. 2026. https://doi.org/10.24875/RECICE.M26000575.