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Successful Intravascular Ultrasound-Guided Shockwave Intravascular Lithotripsy for a Severely Calcified and Resistant Proximal Left Anterior Descending Coronary Artery Lesion in a Patient with ST-Segment Elevation Myocardial Infarction

ST-Segment Yükselmeli Miyokard Enfarktüslü Bir Hastada İleri Derecede Kalsifiye ve Dirençli Proksimal Sol Ön İnen Koroner Arter Lezyonu için Başarılı İntravasküler Ultrason Kılavuzluğunda Şok Dalgası İntravasküler Litotripsi

A 77-year-old active smoker female with type II diabetes, underwent an emergency coronary angiogram due to an anterior ST-segment elevation myocardial infarction (STEMI) (Supplementary Material, Figure 1). The angiogram revealed a subtotal occlusion in the proximal, severely calcified left anterior descending (LAD) artery with a Thrombolysis in Myocardial Infarction (TIMI) flow grade of 1 (Figure 1A, Supplementary Material, Videos 1 and 2).

Primary percutaneous coronary intervention (PPCI) was performed via the right femoral artery. Pre-dilations using a 2.5 × 15 mm non-compliant balloon (NCB) and a 2.5 × 15 mm Scoreflex scoring balloon (OrbusNeich, Hoevelaken, The Netherlands) were suboptimal (Figure 1B). Even high-pressure pre-dilations with 2.75 × 15 mm and 3.0 × 15 mm NCBs failed to adequately "modify" the lesion (white asterisk) (Figure 1C, Supplementary Material, Video 3). Intravascular ultrasound (IVUS) imaging using an Eagle Eye Platinum digital IVUS catheter (Philips) revealed a 360° concentric calcium distribution (Figure 1D). Consequently, Shockwave Intravascular Lithotripsy (S-IVL) was performed using a 3.0 × 12 mm integrated balloon (Shockwave Medical, Inc.; Santa Clara, CA, USA). Following the application of 20 ultrasonic pulses (Figure 1E-F, Supplementary Material, Videos 4 and 5), plaque fracture was achieved (Figure 1H), and full expansion of a 3.0 × 15 mm NCB was attained (Figure 1I). An excellent final angiographic result was obtained after implanting a 3.5 × 18 mm drug-eluting stent, followed by post-dilation with a 3.75 × 15 mm NCB (Figure 1J, Supplementary Material, Video 6). The patient recovered well, and a pre-discharge echocardiogram indicated only mild left ventricular impairment.

Moderate to severe calcification, present in approximately 38% of culprit lesions in STEMI, adversely affects the safety and efficacy of PPCI and is associated with worse post-percutaneous coronary intervention (PCI) outcomes. Existing tools for calcium modification have limitations in the STEMI setting, which may restrict their use. Repeated high-pressure balloon dilatations in a thrombotic lesion can cause distal embolization. Rotational atherectomy in STEMI is relatively contraindicated due to the risk of no-reflow caused by embolization of atheromatous debris. IVL may mitigate the adverse consequences of severe calcification. As a balloon-based therapy, IVL has a short learning curve compared to other calcium modification techniques and, considering its low complication rates, it may have an advantage over the above-mentioned existing tools, even in STEMI patients. However, the Disruption of Coronary Artery Disease (DISRUPT-CAD) trials have excluded patients with STEMI. The safety of IVL in 'STEMI' lesions is unknown, and its "off-label" use in acute STEMI is not currently

CASE IMAGE
OLGU GÖRÜNTÜSÜ

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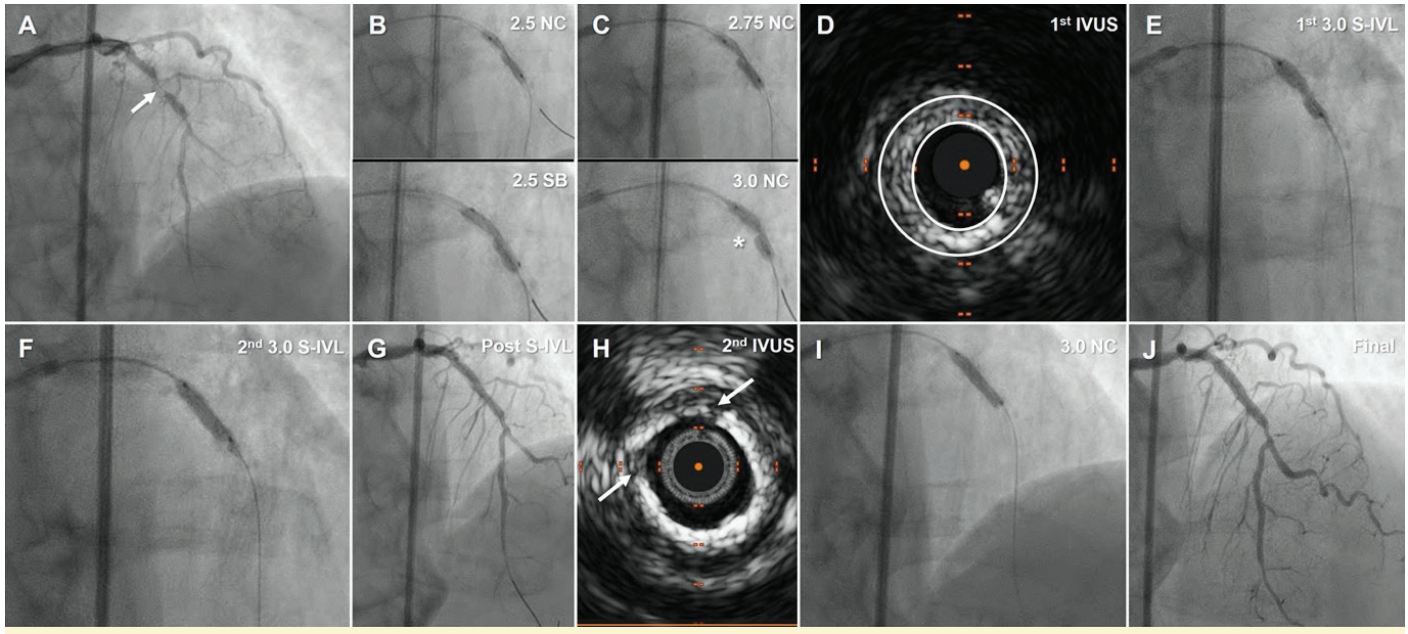

Figure 1. (A) Angiography showing a severely calcified lesion in the proximal LAD artery (white arrow) with TIMI 1 flow. (B) Suboptimal pre-dilation performed using a 2.5 x 15 mm NC balloon and a 2.5 x 15 mm scoring (SB) balloon. (C) Despite high-pressure pre-dilation with 2.75 x 15 mm and 3.0 x 15 mm NC balloons, the lesion modification was unsuccessful, displaying a significant "dog-bone effect" (white asterisk). (D) Intravascular ultrasound revealing a 360° concentric calcium distribution (white circles). (E) First therapy with a 3.0 x 12 mm S-IVL balloon. (F) Successful expansion of the lithotripsy balloon during the second IVL therapy. (G) Angiographic result post-IVL. (H) Post-IVL intravascular ultrasound demonstrating fracturing of the calcified plaque (arrows). (I) Full expansion of a 3.0 x 15 mm NC balloon. (J) Excellent final angiographic outcome following the placement of a 3.5 x 18 mm drug-eluting stent, post-dilated with a 3.75 x 15 mm NC balloon, achieving TIMI 3 flow.

LAD, Left Anterior Descending; NC, Non-Compliant; S-IVL, Shockwave Intravascular Lithotripsy, TIMI, Thrombolysis in Myocardial Infarction.

recommended until further data shed light on this high-risk scenario.

Informed Consent: Informed consent was obtained from the patient for the publication of the case image and the accompanying images.

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Video 1. Transfemoral coronary angiography (caudal view) revealing a severely calcified lesion in the proximal LAD with TIMI 1 flow.

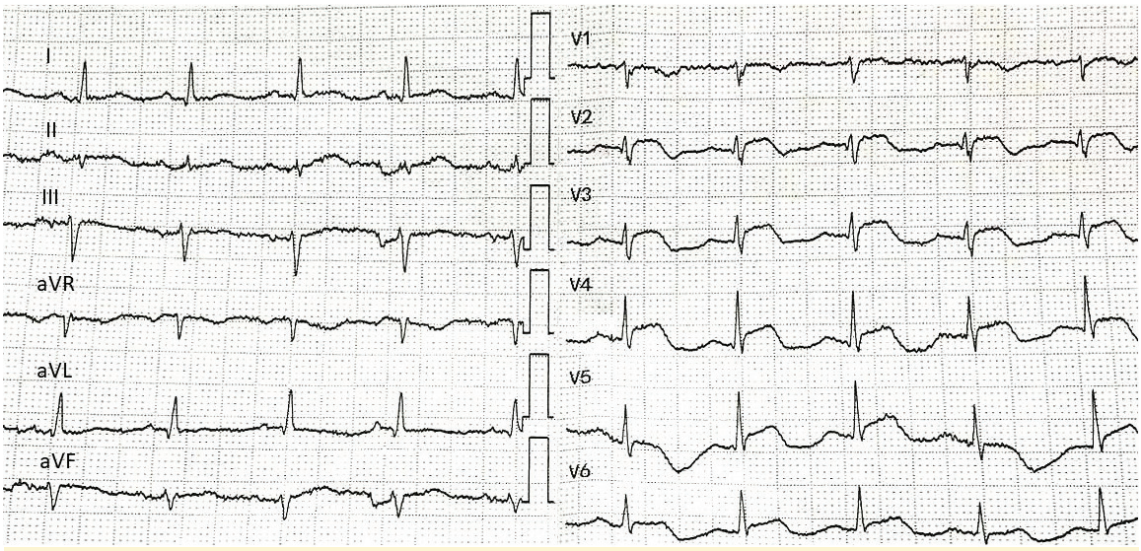
Video 2. Transfemoral coronary angiography (cranial view) displaying a severely calcified lesion in the proximal LAD with TIMI 1 flow.

Video 3. High-pressure pre-dilation with a 3.0 x 15 mm NC balloon unable to effectively "modify" the lesion, with a significant "dog-bone effect" still observed.

Video 4. First S-IVL therapy using a 3.0 x 12 mm lithotripsy balloon demonstrating "cracking" of the calcified plaque.

Video 5. Second IVL therapy showing suitable expansion of the lithotripsy balloon.

Video 6. Excellent final angiographic result with TIMI 3 flow in both the LAD and the first diagonal branch.



Supplementary Figure. Pre-procedural 12-lead ECG displaying subtle ST-elevation in leads V2-V6.