Impella protected percutaneous coronary intervention on the last remaining highly calcified coronary artery facilitated by shockwave intravascular lithotripsy and levosimendan infusion

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A 67-year-old male, with hyperlipidemia, hypertension, type 2 diabetes mellitus, and persistent atrial fibrillation was admitted to the Department of Cardiology with a non-ST segment elevation myocardial infarction. Physical examination revealed tachycardia, dyspnea with rales and crackles on auscultation (Killip-Kimball II). Transthoracic echocardiography showed the enlarged hypokinetic left ventricular with coexisting akinesia of the inferior wall (left ventricular end-diastolic/left ventricular end-systolic diameters of 59 mm/53 mm), reduced left ventricular ejection fraction (25%), severe functional mitral regurgitation, and a moderate amount of fluid in both pleural cavities.

After initial pharmacological stabilization, coronary angiogram was performed and revealed a chronic total occlusion of the right coronary artery (Figure 1A) and circumflex, with coexisting significant highly calcified stenosis of the left main artery (LM) and multilevel high-grade stenosis of the left anterior descending artery (LAD) (Figure 1B). The patient was referred to the local Heart Team and due to high risk (SYNTAX Score = 49.5 points; EuroSCORE II = 9%) and subtotal occlusion of the distal part of the LAD, he was unsuitable for surgery and a rescue percutaneous coronary intervention (PCI) was proposed.

In order to optimize the treatment of heart failure before PCI, we performed a puncture of both pleural cavities and beyond standard pharmacotherapy (beta-blocker, intravenous loop diuretic, angiotensin-converting-enzyme inhibitors, mineralocorticoid receptor antagonist) we administrated 24-hour intravenous infusion of levosimendan (0.1 μg/kg/min — cumulative dose 12.5 mg). Two days later, we performed PCI by the right radial approach using the EBU 3.5 Guide Catheter (7F) (Medtronic Ireland, Galway, Ireland) with additional Impella CP (Abiomed, Denver, CO, USA) support (flow 3.3 l/min), implemented by the right femoral access. After wiring the LAD with Fielder XT (Asahi-INTECC Co., Aichi, Japan) enhanced by Caravel microcatheter (Asahi-INTECC) and subsequent exchange of a guidewire on Sion blue ES (Asahi-INTECC), we performed multiple high pressure (up to 22 atm) inflation of the semi-compliant 1.5 × 20 mm and non-compliant (NC) 2.5 × 20 mm and 3.0 × 20 mm balloon catheter. Three overlapping drug-eluting stents (DES) Resolute Onyx (Medtronic) were implanted from the middle to distal the part of the LAD — 2.5 × 30 mm (18 atm); 2.25 × 38 mm (16 atm); 2.0 × 26 mm (14 atm). In the next step, we performed pre-dilation of the LM and proximal part of the LAD. However, despite using high-pressure inflation (24 atm), we observed a significant "dogbone effect" on the 3.0 mm NC-catheter (Figure 1C).

Hence, we performed the shockwave intravascular lithotripsy (S-IVL) using a 3.0 × 12 mm catheter (Shockwave Medical Inc, Santa Clara, CA, USA), and after 80 ultrasonic pulses, we achieved full expansion (Figure 1D). From the proximal part of the LM, we implanted two additional overlapping DES (3.5 × 18 mm and

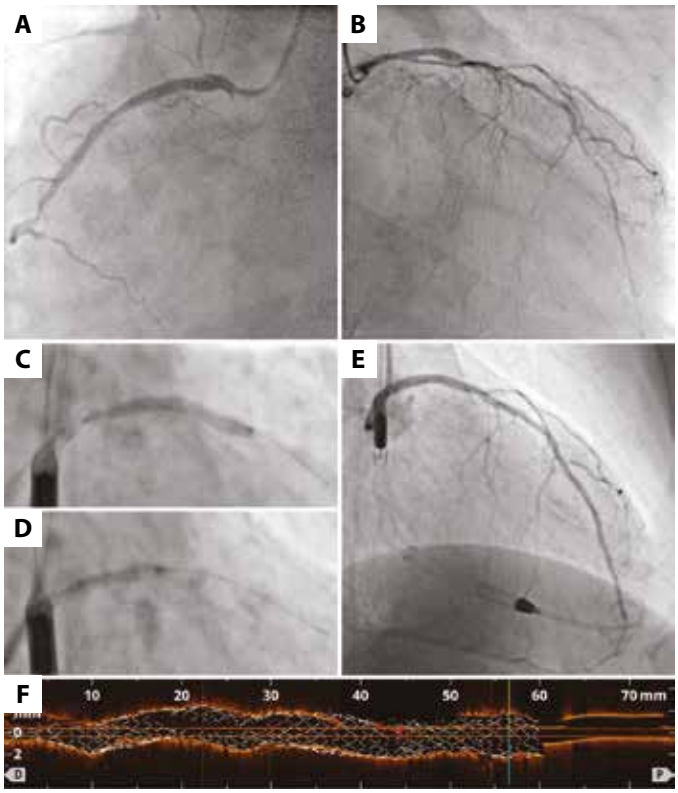

Figure 1. A. Coronary angiography of the right coronary artery. **B.** Coronary angiography of the left main and the left anterior descending. **C.** Significant under-expansion on the 3.0 mm non-complaint balloon catheter. **D.** Full expansion of Shockwave Intravascular Lithotripsy 3.0 × 12 mm balloon catheter. **E.** Final angiographic result of the procedure. **F.** Final result confirmed in optical coherence tomography.

3.0 × 38 mm). Finally, a proximal optimization technique was performed with NC 4.0 × 15 mm (20 atm). The reasonable angiographic result (Figure 1E) was confirmed by the optical coherence tomography imaging (Figure 1F). The support pump was removed immediately after the procedure-vascular access point was closed with 2 co-acting AngioSeal 8F (Terumo Corporation, Tokyo, Japan) vascular closure devices. The patient was discharged after 13 days of hospitalization with a mild improvement of the LV function (ejection fraction of 35%) and with reduced (moderate) mitral regurgitation.

PCI to the last remaining patent vessel is a high-risk procedure, as evidenced by the fact that about a quarter of patients die at 1-year follow-up [1]. In the therapy of a patient with such a poor clinical prognosis, any available armamentarium that may improve the prognosis should be involved in the therapeutic process. In this challenging case, we used a wide range of factors potentially affecting the outcome — an intravenous infusion of levosimendan [2], mechanical circulatory support with Impella [3], and plaque modification with S-IVL [4, 5] in order to obtain a favorable clinical outcome. Initial intensive heart-failure pharmacotherapy allowed to restrict hemodynamic support to the periprocedural period. If adequate optimization could not be achieved earlier, maintaining Impella CP assistance might be a valuable support to conventional HF therapy; yet bleeding or access-related complications may affect potential benefits.

Article information

Conflict of interest: None declared.

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