Successful shockwave intravascular lithotripsy of an under-expanded stent after a month from primary implantation

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We present a case of a 58-year-old male, with hypertension, hyperlipidemia, a past medical history of percutaneous coronary intervention (PCI) in the left anterior descending artery (LAD) in 2006, and with a history of inferior wall ST-segment elevation myocardial infarction (STEMI) one month before current hospitalization, treated with PCI in a regional Cardiology Department.

During the index procedure, coronary angiography (CA) revealed critical stenosis in the right coronary artery (RCA) and an additional lesion in the left circumflex artery (LCx). PCI-RCA with 3.0 × 30 mm drug-eluting stent (DES) implantation was performed successfully. Due to ongoing ischemia, a predilatation of LCx with a 2.0 × 15 mm non-compliant (NC) balloon at 12 atm was performed and followed by a 3.5 × 30 mm DES Resolute Onyx (Medtronic, Galway, Ireland) implantation at 16 atm. Due to significant stent under-expansion, unsuccessful optimization with a 3.5 × 15 mm NC at 22 atm was performed (significant "dog bone effect"). Additional postdilatation with an ultra-high-pressure 3.5 × 10 mm OPN-NC balloon at 35 atm was performed. Despite aggressive postdilatation, full stent expansion was not obtained. The patient was discharged with symptoms of angina, class II according to the Canadian Cardiovascular Society (CCS) scale.

One month later, the patient was referred to our Cardiology Department with exacerbation of angina symptoms (CCS class III). CA and fluoroscopic digital stent enhancement (DSE) revealed incomplete stent expansion in LCx (residual stenosis 80%) (Figure 1A). Additional evaluation in optical coherence tomography (OCT) revealed massive calcifications with coexisting impaired endothelialization on the under-expanded struts (Figure 1E and Supplementary material, *Video S1*). Initially, we performed unsuccessful postdilatation with a 3.5 × 15 mm NC balloon (20 atm) (Figure 1B). Therefore, we used the Shockwave Intravascular Lithotripsy (S-IVL) (Shockwave Medical Inc, Santa Clara, CA, USA) 3.5 × 12 mm balloon and after 40 ultrasonic pulses, we achieved full scaffold expansion (Figure 1C). Finally, we optimized the stent with a –3.75 × 15 mm NC balloon (16 atm). Control CA, DSE, and OCT confirmed adequate stent expansion without any residual stenosis (Figure 1D, 1F, and Supplementary material, *Video S2*). The patient was discharged two days after the procedure without any in-hospital complications.

In the presented case, at the primary PCI, the scaffold was implanted despite insufficient lesion preparation with an undersized balloon catheter, which resulted in significant post-PCI stent under-expansion and should not be part of contemporary practice.

Impaired stent expansion is associated with a higher risk of complications, mainly in-stent thrombosis and restenosis. To improve outcome, an appropriate lesion preparation before scaffold implantation with dedicated balloon-dependent devices (non-compliant, scoring, cutting, OPN) or atherectomy devices (rotational, orbital, laser) is fundamental [1, 2]. However, when the stent under-expansion occurs the armamentarium of treatment methods is limited [3, 4]. In our case, one of the major therapeutic options for stent

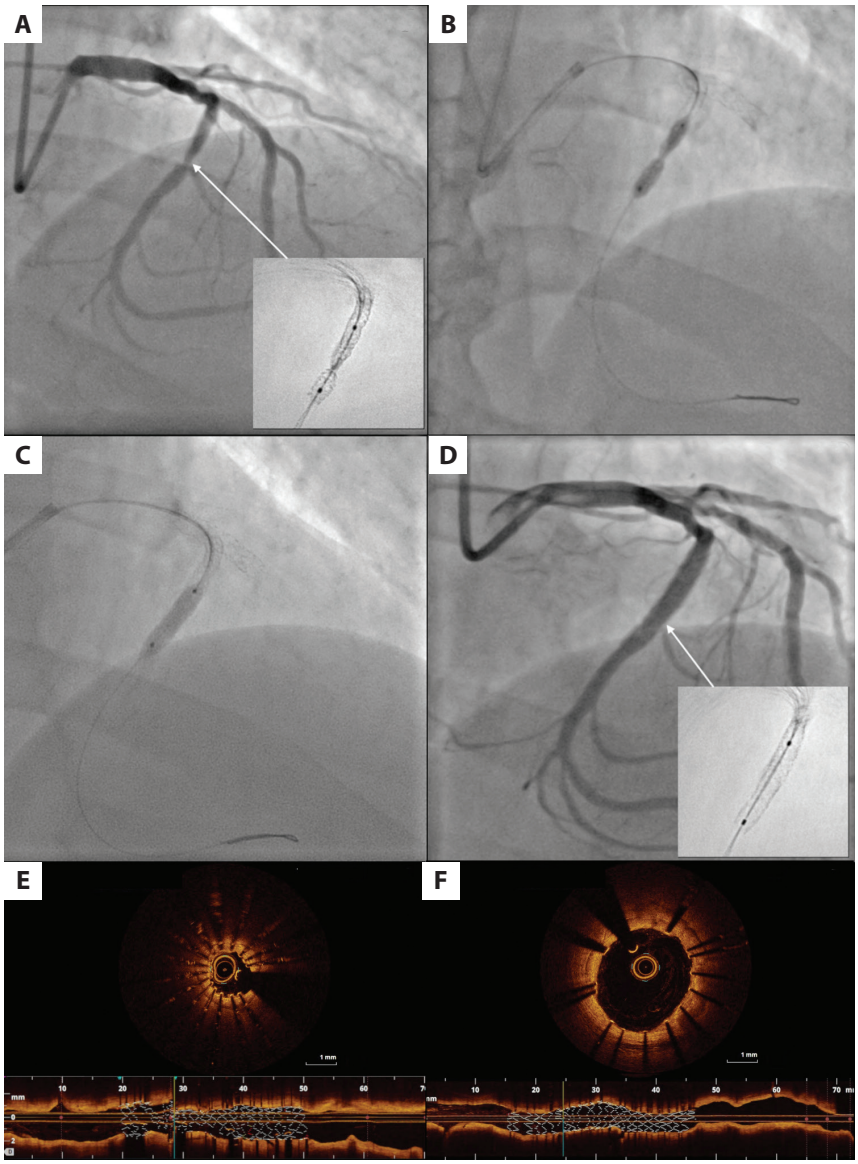

Figure 1. A. Coronary angiography of culprit lesion in the left circumflex artery and significant stent under-expansion visible in fluoroscopic digital stent enhancement. **B.** Significant under-expansion on the 3.5 mm non-compliant balloon catheter. **C.** Full expansion of the shockwave intravascular lithotripsy 3.5 × 12 mm balloon catheter. **D.** Final angiographic result of the procedure with adequate scaffold expansion visible in fluoroscopic digital stent enhancement. **E.** Initial lesion evaluated on optical coherence tomography. **F.** Final result confirmed on optical coherence tomography

under-expansion — postdiltation with the OPN balloon — turned out to be ineffective. Therefore, we used S-IVL as a bail-out technique. Although we did not observe any complications, the safety concerns are not unfounded — some data suggest that S-IVL may lead to disruption of scaffold integrity [5]. Nevertheless, in the presented case, the clinical benefits of the method outweighed its potential risk. We demonstrated that S-IVL with the additional support of OCT is a safe approach to a stent failure, even a month after the primary procedure.

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/kardiologia_polska.

Article information

Conflict of interest: None declared.

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