Successful intravascular lithotripsy for covered stent underexpansion due to severely calcified plaque

Authors: Sylwia Iwańczyk, Andrzej Siniawski, Marek Panowicz, Marek Grygier, Maciej Lesiak

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Title: Successful intravascular lithotripsy for covered stent underexpansion due to severely calcified plaque

Short title: S-IVL for covered stent underexpansion.

Sylwia Iwańczyk¹, Andrzej Siniawski¹, Marek Panowicz², Marek Grygier¹, Maciej Lesiak¹

¹ 1st Department of Cardiology, University of Medical Sciences, Poznań, Poland

² Department of Cardiology, Szpital Pomnik Chrztu Polski, Gniezno, Poland

Corresponding Author: Sylwia Iwańczyk, MD;

e-mail: sylwia.iwanczyk@skpp.edu.pl, phone: +48662712627

1st Department of Cardiology, University of Medical Sciences, Poznań, Poland,

Długa 1/2, 61-848, Poznań, Poland

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Calcified coronary lesions increase the risk of periprocedural complications and long-term adverse clinical outcomes, especially in patients with myocardial infarction [1]. The gold standard for accurate lesion assessment, especially calcium detection is an intravascular imaging (OCT, IVUS) [2]. The greater arc, length, or thickness of calcium on OCT and/or IVUS increases the likelihood of stent under-expansion and malapposition. In the setting of resistance of the lesion to high-pressure and modified balloon catheters, such as cutting and scoring balloons, the orbital and rotational atherectomy (RA) is recommended in selected patients [3]. However, in the case of inadequate expansion of a metal stent, RA is associated with a higher risk of procedural complications. Shockwave intravascular lithotripsy (S-IVL) has emerged as a new treatment for heavily calcified coronary lesions, especially useful when other treatments were ineffective or impossible to apply [4]. Following the presented case, S-IVL is also effective as a bail-out strategy inside the implanted stent and covered stent.

A 76-year-old female with hypertension, rheumatoid arthritis, hyperlipidemia without previous history of coronary artery disease was admitted to a local hospital with non-ST elevation myocardial infarction. An emergency angiography revealed critical stenosis in the proximal segment of left anterior descending artery (LAD) and proximal as well as a distal segment of left circumflex artery (LCx). LAD was recognized as a culprit artery and was successfully treated with percutaneous coronary intervention (PCI). During the same procedure, unsuccessful PCI of distal LCx with the incomplete stent deployment was performed (figure A-B). The patient was referred to our center two days later to continue coronary revascularization.

First, we decided to postdilate the unexpanded stent with NC balloon (3.0 x 15 mm) to high pressure (26 atm), obtaining a complete expansion of the balloon. However, the control contrast injection revealed the perforation type III in the area of the implanted stent (figure C).
Immediately, the balloon at the perforation site with low pressure (6 atm) was inflated. Due to ineffective prolonged balloon inflations, we successfully implanted the covered stent (Bentley, 3,0 x 24 mm). However, the obtained IVUS image showed the presence of calcium cracks in both segments of LCx and suboptimal stent-graft expansion (figure E). We decided to use S-IVL (3,0 x 12 mm). In total, sixty applications (at 4 atm) in the proximal and distal LCx were delivered, obtaining a complete expansion of the S-IVL balloon at 6 atm. Then, we implanted drug-eluting stent (3,0 x 24 mm) in the proximal segment of LCx (figure D). The optimal effect of the procedure was confirmed in IVUS (figure F). No further complications occurred during hospitalization. On the basis of presented case, it is worth emphasizing that direct use of S-IVL instead of high-pressure NCB postdilatation of underexpanded stent become a new standard of care with lower risk of procedural complications.

References:
Figure 1A – AP caudal angiographic view pre-PCI. Significant stenosis of proximal LCx and unexpanded stent distally, invisible in angiographic scan. B – Stent under-expansion by StentBoost enhanced image. C – Perforation of LCx after postdilatation. D - AP caudal angiographic view post-PCI. E – IVUS cross-sections of distal LCx after covered stent implantation and before S-IVL. F – IVUS cross-sections after S-IVL inside the covered stent.