Multi-device complete revascularization of severely calcified multi-vessel coronary artery disease with left ventricular support of Impella CP under Swan-Ganz catheter monitoring

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A 66-year-old male with a history of coronary artery bypass grafting was admitted with a diagnosis of acute coronary syndrome and pulmonary edema. Coronary angiography demonstrated multi-vessel disease (MVD) with advanced calcifications, including the left main coronary artery (LMCA). The left internal mammary artery (LIMA) bypass to the diffusely diseased left anterior descending artery (LAD) was patent. A primary percutaneous coronary intervention (pPCI) within the critically stenosed LMCA was unsuccessful and complicated by a large radial hematoma. After 2 days and a multidisciplinary Heart Team consultation, the patient was qualified for MVD PCI with a percutaneous left ventricular support device (pLVAD) due to low left ventricular ejection fraction (LVEF, 22%). Left femoral access (14 F) for Impella CP was used (Abiomed, Danvers, MA, US) with ultrasound assistance. Right femoral venous access was used for the Swan-Ganz catheter to monitor hemodynamic parameters, measure pulmonary capillary wedge pressure, and assess left ventricular filling pressure, which is crucial for proper Impella performance as well as cardiac output and cardiac power output. The single-access PCI technique via the Impella sheath was applied. PCI of the LAD via the LMCA was impossible due to massive, uncrossable calcifications; therefore, it was performed *via* the LIMA, as our tertiary referral center has experience with such interventions and the patient was protected with pLVAD. The procedure was initiated with a non-compliant balloon (NCB), afterwards a 2.5 × 15 mm drug-eluting stent (DES) was implanted, followed by drug-eluting balloon inflation (2.0 × 30 mm, 45 s) distally, with a good angiographic and intravascular ultrasound (IVUS) result (Figure 1A, D). Secondly, PCI of the highly calcified LMCA and the circumflex branch (Cx) was performed. The stenosis was crossed with the Sion Black guidewire (Asahi Intecc, Afigkatsuki-chon, Japan), and a microcatheter was used to deliver a rota-wire to the Cx. Several runs of 1.5 mm bore were implemented, followed by NCB predilatation (2.75 × 12 mm, 20 atm). Due to suboptimal plaque modification assessed by IVUS, intravascular lithotripsy (3.0 × 12 mm) was applied. This allowed for optimal implantation of 3.5 × 26 mm DES from the LMCA to the Cx with the NCB proximal optimization technique (5.0 × 16 mm, 20 atm.), with expansion confirmed by IVUS (Figure 1B, E). Lastly, the heavily calcified right coronary artery (RCA) was treated. The lesion was modified using rotational atherectomy (1.5 mm bore), followed by intravascular lithotripsy (3.0 × 12 mm). Due to a suboptimal result, super high-pressure non-compliant balloons (OPN) (2.0 × 15mm, 2.5 × 15 mm, 40 atm.) were used. This allowed for successful DES (2.75 × 48 mm) implantation with the NCB (4.0 × 16 mm, 16 atm) proximal optimization technique (Figure 1C, F). During the whole procedure, the patient remained hemodynamically stable. The Impella device was removed directly after PCI. The femoral puncture was closed using Perclose Proglide (Abbot Cardiovascular, Plymouth, MN, US) and Angio-Seal 8F (Terumo Medical Corporation,

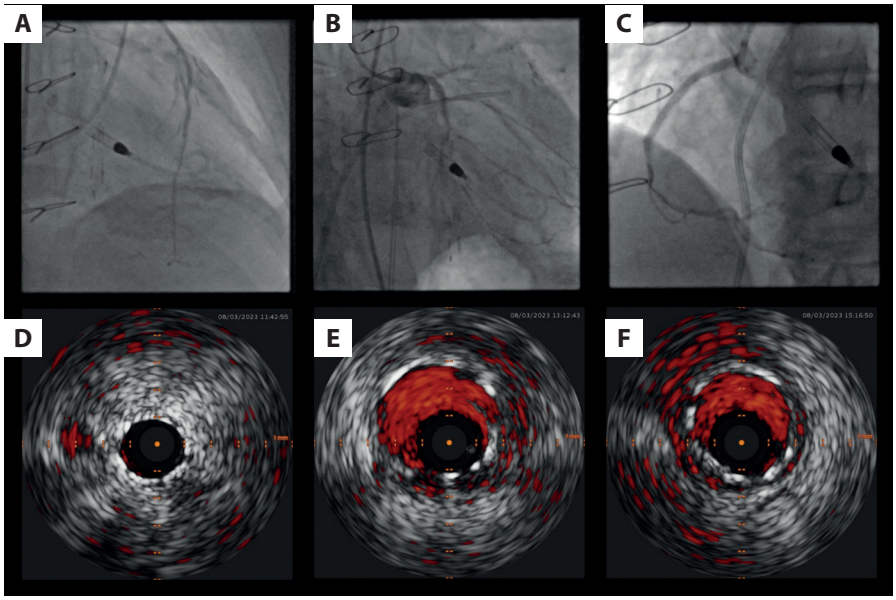

Figure 1. Angiographic and IVUS results of the intervention. **A.** LAD angiography after the intervention. **B.** LAD IVUS after the intervention. **C.** LMCA/Cx angiography after the intervention. **D.** LMCA IVUS after the intervention. **E.** RCA angiography after the intervention. **F.** RCA IVUS after the intervention

Abbreviations: Cx, circumflex; IVUS, intravascular ultrasound; LAD, left anterior descending artery; LMCA, left main coronary artery; RCA; right coronary artery

Somerset, NJ, US). The venous puncture was closed with a mattress suture. The following hospitalization was uneventful, with control LVEF of 25% on day 7 and resolution of chronic angina.

In conclusion, there are various methods for calcified coronary plaque modification and usually just one is sufficient [1]. In selected cases, only a combination of several methods is successful. The Impella device reduces the periprocedural risk for patients with impaired LVEF treated with MVD PCI [2, 3]. It enables the application of all necessary calcium modification techniques while maintaining hemodynamic stability of patients during MVD PCI performed by an experienced operator. Swan-Ganz catheter allows monitoring of hemodynamic parameters and optimizes Impella performance.

Supplementary material

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

Article information

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