Intravascular lithotripsy to treat an ostial left main coronary artery stenosis due to porcelain aorta in a patient with congenital high-density lipoprotein deficiency

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Introduction

The management of calcified coronary lesions remains a challenge in percutaneous coronary intervention (PCI) and intravascular lithotripsy (IVL) may be an innovative helpful option.

Case Report

A 67-year-old patient with high-density lipoprotein (HDL) deficiency and undetectable HDL, hypertension, diabetes mellitus, and chronic preterminal renal failure as cardiovascular risk factors was hospitalized for unstable angina. She was known to have severe vascular disease with massive calcifications of the ascending portion (porcelain aorta), previous surgical replacement of the abdominal aorta, and previous iliac and bilateral renal stenting, as well as carotid endarterectomy. Because of a severely depressed renal function (estimated glomerular filtration rate, 19 ml/min/1.73m^2), we first performed ischemia detection and quantification with positron emission tomography, which showed severe ischemia in the left anterior descending and circumflex coronary artery territories, as well as moderate ischemia in the right coronary artery (RCA) territory. Left ventricular (LV) ejection fraction was preserved. Despite maximal medical management, the patient had recurrent symptoms. Coronary angiography showed a significant stenosis of the left main trunk (LMT) owing to calcified aorto-ostial disease (Video 1), a severe distal RCA stenosis, and an intermediate stenosis of the ostial left circumflex coronary artery (Fig. 1). During engagement of the LMT with a diagnostic 5-Fr catheter, a dumping of the pressure was observed and the patient had prolonged chest pain requiring intracoronary nitroglycerin. The Heart Team opted for off-pump bypass surgery, as no cross-clamping of the ascending aorta was possible owing to the massive calcifications. However, in the preoperative work-up, a significant stenosis of the left subclavian artery was detected, which precluded the utilization of the left internal mammary artery in situ, and the patient was recused by the surgical team. Therefore, we opted for PCI with a provisional stent strategy, despite the concern of an insufficient stent expansion in the LMT. A 14-Fr sheath was inserted via the right femoral artery and a microaxial pump assist device (Impella CP; Abiomed, Danvers, MA, USA) was positioned in the LV over a 0.018-inch guidewire to maintain up to 3.5 L of cardiac output (Video 2). The RCA was stented via a 7-Fr left femoral approach with good angiographic result (Fig. 1). Subsequently, the LMT was engaged with a 7-Fr Judkins left 3.5 guiding catheter, and the LMT lesion was prepared with a 3.5x12 mm Euphora non-compliant balloon (Medtronic Inc, Minneapolis, MN, USA) at 20 atmospheres. IVL was performed using a 4.00x12 mm balloon (Shockwave Medical Inc, Fremont, CA, USA) inflated to 4 atmospheres and 10 pulses were successively delivered, followed by further dilation to the nominal pressure of 6 atmospheres. The IVL treatment was repeated for a total of 6 cycles lasting approximately 20 seconds each, allowing for complete IVL balloon expansion (Fig. 1). The Shockwave balloon expanded completely. During the inflations, the LV was unloaded, and the systemic circulation was supported by the assist device. The lesion was subsequently treated with a 4.00x08 mm Resolute Onyx stent (Medtronic Inc, Minneapolis, MN, USA), and postdilatation was performed with a 4.0 Euphora balloon at 20 atmospheres. Final images showed good stent expansion and no residual stenosis or recoil (Fig. 1, Video 3). At the end of the procedure, the Impella was removed and vascular access was sealed with closure devices (2 Proglides; Abbott Vascular, Santa Clara, CA, USA) placed at the time of sheath insertion. Complete hemostasis was documented by digital subtraction angiography performed via crossover access from the contralateral site (Video 4). In addition to aspirin and full anticoagulation with unfractionated heparin, the patient received ticagrelor (180 mg), and dual antiplatelet therapy was recommended for 1 year. The clinical course was uneventful. At the 3-month follow-up evaluation, the patient was free of cardiac symptoms and the estimated glomerular filtration rate was 16 ml/min/1.73 m^2.

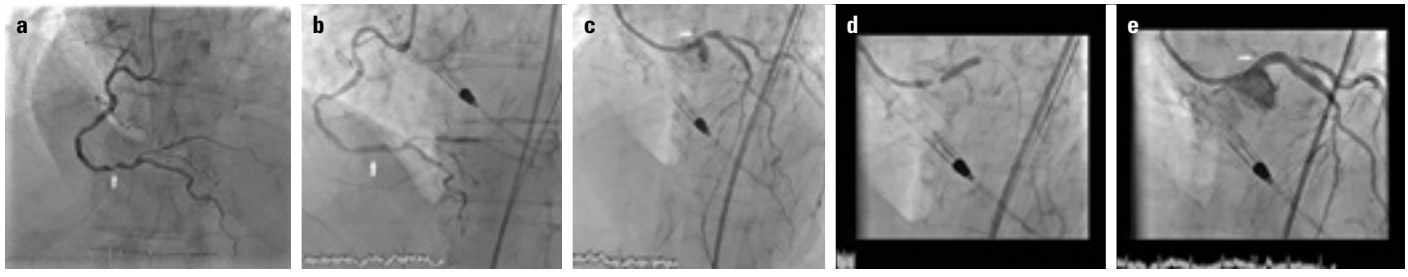

Figure 1. (a) Left-anterior-oblique (LAO) cranial angiography of the right coronary artery (RCA) showing the stenosis on the distal segment (arrow). (b) Angiography showing the final result of the RCA stenting (arrow). (c) LAO cranial angiography showing significant ostial stenosis of the left main trunk (LMT) (arrow). (d) Preparation of the stenosis with intravascular lithotripsy. (e) Final result of the LMT stenting (arrow)

Discussion

The management of calcified coronary artery lesions remains one of the major limitations of PCI (1). IVL has recently emerged as a new technology that may efficaciously address calcified coronary or lower extremity atherosclerotic calcified lesions (2, 3). Via a balloon inflated in the vessel, IVL delivers pulsatile sonic pressure waves converted to mechanical energy that may modify vascular calcium by the induction of calcium fractures, allowing for proper stent expansion (4). Recently, a registry including 71 patients and a prospective study with 120 patients with calcified coronary lesions demonstrated the safety and effectiveness of the IVL technique (5, 6). In some case series, IVL has been used with success in the case of stent underexpansion resistant to conventional approaches (7, 8). Moreover, IVL was shown as a valuable option for modifying femoroiliac stenosis to facilitate delivery of a transfemoral Impella CP (9, 10).

Conclusion

We report the first case of LMT IVL supported by a microaxial pump assist device to facilitate stent expansion in a patient with porcelain aorta owing to congenital HDL deficiency.

Informed consent: The patient was informed, and she gave her consent for publishing this case report.

Video 1. LAO cranial coronary angiography performed via a 7-Fr guiding catheter demonstrating significant stenosis of the LMT artery. In addition, the massive calcifications of the ascending aorta (porcelain aorta) and, specifically, at the level of the LMT origin, are well visualized. A wire is advanced into the left anterior descending coronary artery. The Impella device is placed in the left ventricle.

Video 2. Fluoroscopy showing the advancement of the Impella device over a 0.018-inch wire from the abdominal into the ascending aorta.

Video 3. Left coronary system angiography after angioplasty showing the favorable result at the end of the procedure.

Video 4. Digital subtraction angiography of the right ilio-femoral axis showing femoral complete hemostasis with 2 Proglide suture-based closure devices after Impella sheath removal. The angiography is performed through a 0.035-inch over-the-wire peripheral balloon advanced crossover from the left femoral sheath and used as endovascular clamping at the time of sheath removal.

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An impressive image of unilateral pulmonary artery agenesis associated with coronary collateralization in an adult

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Introduction

Isolated unilateral absence of pulmonary artery (UAPA) is a very rare congenital anomaly in adults. The prevalence of this anomaly is about 1 in 200.000 live births. It is usually diagnosed