Which strategy for calcified coronary plaque modification in patients with low ejection fraction?

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DOI: 10.33963/KP.a2023.0130

Received:
March 3, 2023

Accepted:
May 22, 2023

Early publication date:
June 4, 2023

In the era when more and more complex patients require percutaneous coronary treatment, a combination of different interventional methods is necessary. In patients with heavily calcified coronary lesions and, additionally, poor left ventricular ejection fraction, the simultaneous use of the plaque modification technique along with mechanical circulatory support can contribute to final success.

A 44-year-old man with symptomatic chronic coronary syndrome and diagnosed advanced heart failure was admitted to our center to complete his diagnostics and be qualified for further treatment. The patient was obese with a body mass index of 33, a smoker, and with a positive cardiovascular family history and pancreatitis in anamnesis. On echocardiography, his left ventricle was dilated with ejection fraction of 23% and inferior wall dyskinesis. Coronary angiography revealed multivessel disease including 80%–90% stenosis of the left main (LM) and left anterior descending arteries and with the proximally occluded right coronary artery (Figure 1A). After discussion, the Heart Team disqualified the patient from open heart surgery (mainly because of very low ejection fraction) and qualified him for complex percutaneous coronary intervention.

In initially performed high-definition intravascular ultrasound examination, significant calcifications including the LM (300°–360°) were seen (Figure 1B). This finding substantially increased the risk of the procedure because some kind of plaque modification technique would be necessary as well as, possibly, left ventricular support. First, from currently available calcification modification devices, we chose intravascular lithotripsy (IVL, Shockwave Medical, Fremont, CA, US), instead of rotational and orbital atherectomy. Second, we decided to use Impella CP support (Abiomed, Danvers, CO, US), but only if necessary. Our strategy was to place a pigtail catheter in the left ventricle to monitor end-diastolic pressure during balloon inflation. However, even during 5 seconds of IVL use, blood pressure was decreasing, and left ventricular end-diastolic pressure was increasing, which prevented us from achieving full balloon deployment (Figure 1C). Impella support was, therefore, necessary to finish the procedure.

With functioning Impella, full 8 cycles of IVL were applied with visible temporary ventricular-aortic uncoupling on the Impella monitor. We managed to deploy the balloon fully after that (Figure 1D). Finally, 3 stents in the LM and left anterior descending arteries were implanted without complications and with patent side branches (Figure 1E). Final confirmation of the widening of the calcified lesions and proper stents apposition was obtained by intravascular ultrasound (Figure 1F).

When percutaneous intervention with calcified plaque modification is necessary, different methods can be considered, including cutting/scoring balloons, very high-pressure balloons, rotational atherectomy, orbital atherectomy, and IVL. The risk is higher in cases of complex lesions and accompanying heart failure [1, 2]. Every strategy has its advantages and disadvantages. For instance, rotational and orbital atherectomy carry an increased risk of no/slow-flow phenomenon. On the other hand, an IVL balloon requires 10 seconds of vessel occlusion, which in the case of LM disease is of great importance. Bal-

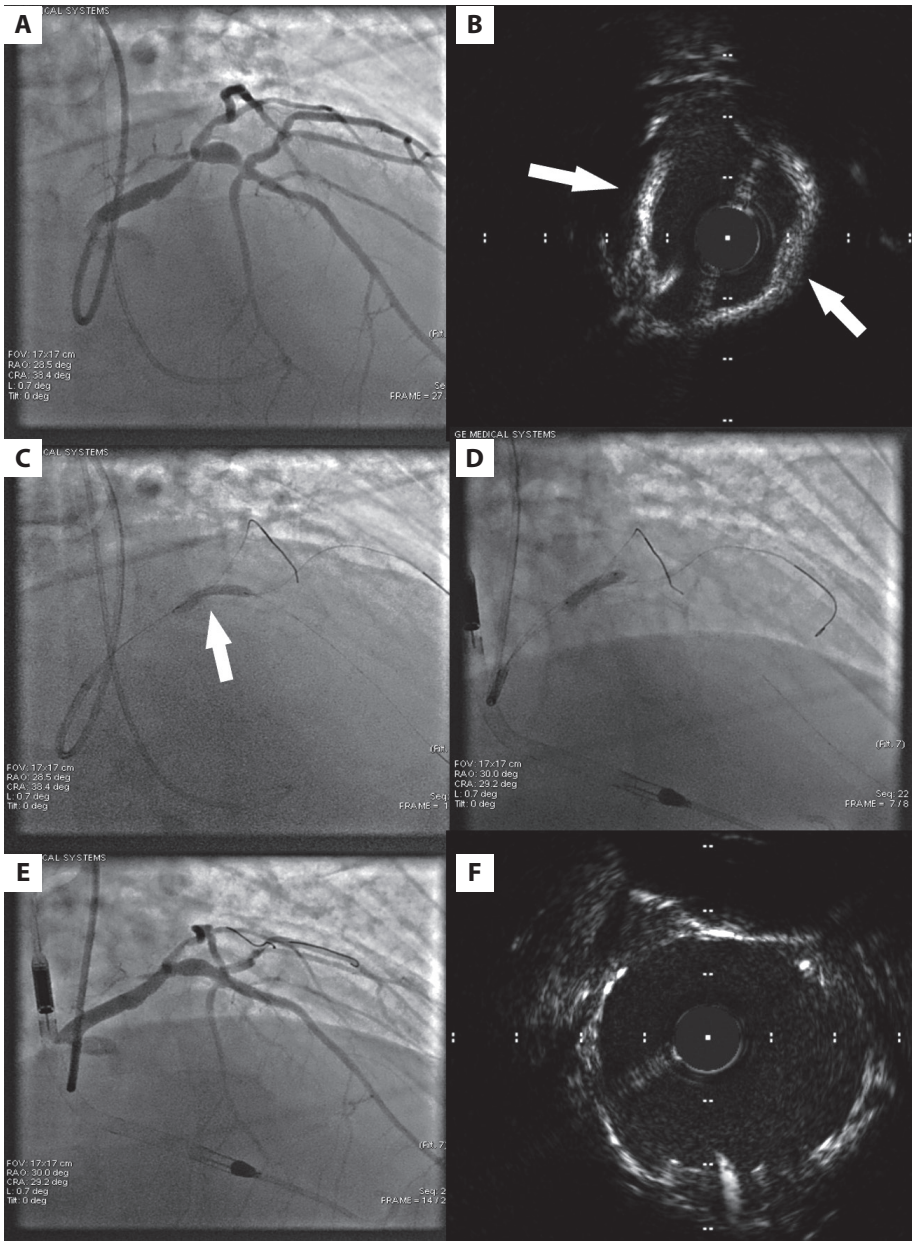

Figure 1. A. Coronary angiography revealing tight stenoses in the left main and left anterior descending arteries. **B.** Intravascular ultrasound with visible excessive calcifications in the left main (white arrows). **C.** Not fully deployed balloon (white arrow) during predilatation and with a pigtail catheter in the left ventricle. **D.** Full balloon opening after using intravascular lithotripsy with a functioning Impella device. **E.** Final coronary angiography after implantation of 3 stents. **F.** Intravascular ultrasound showing proper stent apposition in the calcified plaques.

loon techniques can modify deep calcium, while atherectomy devices are more effective in tight stenoses [3]. After deep analysis of coronary angiography and, importantly, intravascular imaging, we are better prepared to choose a proper device for each patient. Notably, sometimes each of the 3 calcium debulking methods can be acceptable, and sometimes we have to use 2 of them together [4].

Article information

Conflict of interest: None declared.

Funding: None.

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