

Calcified lesions treated with rotational atherectomy—much more advantages than real hazards

Piotr Kübler^{1,2}, Krzysztof Reczuch^{1,2}

¹Department of Heart Diseases, Wrocław Medical University, Wrocław, Poland; ²Military Hospital, Wrocław, Poland

Correspondence to: Piotr Kübler, MD, PhD. Department of Heart Diseases, Wrocław Medical University, Weigla 5, 50-981 Wrocław, Poland.

Email: pkubler75@gmail.com.

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The presence of coronary artery calcifications is a known predictive factor of poor prognosis in patients undergoing percutaneous coronary interventions (PCI). Despite the development of more technologically advanced devices and methods such as supportive catheters, cutting balloons, very high pressure and low-profile balloons, laser and orbital atherectomy or Lithoplasty—rotational atherectomy (RA) still remains the most commonly used worldwide technique to modify calcified plaques. Due to ageing of the population, more and more elderly patients with calcified lesions and arteries are being referred to PCI instead of coronary artery bypass grafting (CABG) regarding too high or prohibitive risk of surgery (1). There is no doubt that this trend will continue. There are two main indications for RA: so called uncrossable lesions and lesions which cannot be sufficiently dilated with a balloon (2). The uncrossable lesion is a tight lesion which can be crossed with a wire but cannot be crossed even with the smallest balloon despite good guiding catheter support. In this setting many devices like high pressure balloons, cutting balloons or Lithoplasty balloons are not an effective option because of their profile—it is impossible to insert these bulky devices into tight lesions. There are more therapeutic options in case of undilatable lesions but RA, particularly if performed in experienced centers, is much more predictable in comparison to much less controlled high-pressure inflation. High or very high-pressure inflation may be complicated by artery perforation

and in each case of high pressure inflation an interventional cardiologist must be ready to seal the leak with a covered stent. It is important to stress that it may be very difficult or even impossible to deliver a covered stent into a heavily calcified coronary lesion or artery, not to mention having proper device in terms of diameter and length. In some cases, an operation performed by cardiac surgeons may be live-saving.

In many centers there are more indications for RA than above mentioned widely accepted ones. Heavy calcifications on angiogram or intracoronary imaging may constitute sufficient indication for primary RA i.e., without earlier attempts to try conventional PCI. Rotablation may also be used in order to avoid plaque shifting in case of bifurcation treatment. Last but not least many operators use RA before a bioabsorbable vascular scaffold implantation.

The prevalence of coronary calcifications depends on the method which is used for detection. Unfortunately, angiography has low sensitivity in calcium detection. In over 1,100 patients undergoing PCI, calcium was detected by angiography in 38% cases and in 12% of them with severe calcification. In the same patients, calcium on intravascular ultrasound imaging (IVUS) was detected in >70% of lesions (3). The evaluation by IVUS is, however, limited because high-intensity reflection with acoustic shadowing makes the assessment of calcium thickness unavailable. Optical coherence tomography (OCT) detects calcium

similar to IVUS but it can quantify the amount of calcium better, because it can penetrate through and measure calcium thickness (4). Both IVUS and OCT evaluations of calcification still slightly underestimated those of the histological examination. Computed tomography angiography (CTA) is another sensitive and noninvasive method of coronary calcium detection. Moreover, high CTA-derived coronary artery calcium score is a significant predictor of cardiac events after revascularization (5).

Noteworthy, coronary calcium is a marker of advanced disease. Such patients with calcific lesions pose a specific and particular risk of complications and are very often burdened with comorbid conditions such as heart failure, peripheral vascular disease, complex lesions, diabetes, advanced age, myocardial infarction or prior surgeries (6,7). As aforementioned, heavily calcified coronary lesions become more and more common in aging population and present a special challenge for percutaneous treatment, due to their resistant plaque burden, which may lead to failure of stent delivery or expansion and, therefore, may increase the likelihood of stent restenosis or thrombosis (8,9). Treating patients with calcified lesions is always demanding and an exceptional experience of operators is necessary. On the other hand, these are the patients who benefit in particular from the intervention. Thus, there is an unmet need in public health to expand the role of RA not only among interventional cardiologists but among all healthcare providers dealing with heart diseases. In European countries, the rate of RA as a measure among all PCI procedures is low and ranges between 0.8 and 3.1% (2), in the US slightly exceeds 3.1% (10). Therefore, elderly patients with calcified lesions are still undertreated. Fortunately, an evident rise in the number of researches on RA show that its role is steadily increasing.

McEntegart *et al.* present one-center prospective study concerning incidence of procedural myocardial infarction following PCI with RA in patients with stable coronary artery disease (11). The authors assessed “near-consecutive” group of 58 patients who underwent elective PCI with RA. The patients underwent 3 times multi-parametric cardiac magnetic resonance (CMR) imaging: before PCI, 7 days and 6 months post PCI. The aim of the study was to determine the incidence of type 4a myocardial infarction (MI) following PCI with RA and investigate the RA-associated injury detected by CMR. The CMR protocol was very meticulous and included assessment of myocardial oedema, regional wall motion abnormalities (WMA), adenosine stress perfusion and late gadolinium enhancement (LGE)

for scar. The authors have shown that the incidence of type 4a MI depended on its definition. The third universal definition type 4a MI (for the definitions see the original text) occurred in 24% of patients, but if it was determined without CMR imaging the incidence was 10%. Using the Society for Cardiac Angiography (SCAI) definition the incidence was lower with 4%. The authors concluded that PCI with RA was associated with a significant risk of type 4a MI although myocardial injury had resolved in most patients at 6 months. The second part of this conclusion is based on the CMR data which have indicated that at 6 months 14% of patients had persistent LGE indicating scar and all WMA and oedema had resolved. What is very important, a sustained reduction in ischemia and angina burden has been observed.

Some aspects of this important study need to be discussed and the most important one is the impact of this study on a daily practice. What practical and clinical inclination it may have for a physician who is not interested in more or less subtle differences between various definitions of type 4a MI but most of all wants to improve prognosis and/or quality of life of his/her patients? Will this physician after reading the paper be eager to refer an elderly patient with stable angina and calcified lesion to RA? Frankly speaking, we afraid that he/she may be rather skeptical. Presumably the majority of readers will understand that every fourth patient will end up with MI so maybe better not to decide to take this risk? Others may understand that according to a more pragmatic SCAI definition only 4% of patients undergo MI which may have an impact on the prognosis. The authors seem to leave a reader alone, avoid a clear stance and just inform us about frequency of MI according to various definitions. Their conclusion and particularly the last sentence in the Discussion section and table 4 indicate that they support the use of the Third Universal Definition of type 4a MI. However, it is not clear which one they prefer? This one which includes CMR imaging (Table 4—MI in 24% of patients) or this described in Results section as the Third Universal Definition type 4a MI “determined without CMR imaging (as done in routine clinical practice)”? This would mean that MI occurred in 10% of patients. From the patients’ and referring physicians’ perspective it makes a big difference. As it was mentioned above the only sign of persistent damage in CMR at 6 months—LGE, was present in 14% of patients. So, 10, 14 or 24%?

In our opinion one should not also forget about clinical assessment. Unfortunately, the authors do not provide data on anginal status at baseline. Furthermore, anginal status at

6 months has not been given for 15 patients (25%) despite that only 1 has died. The given data for 43 patients indicates that only one had class 3 angina, no-one class 4 and the vast majority had class 1. Additionally, we know that there was a significant reduction in ischemic segments. It all means that the vast majority of patients after RA felt much better. Moreover, the frequency of major adverse cardiovascular and cerebrovascular events (MACCE) at 6 months was below 10%. Therefore, we may conclude that the above-mentioned physician should refer his patient for RA, certainly after careful risk and benefit assessment. And one more remark: the authors mention the arrhythmic risk of residual scar but the reader should keep in mind that ischemia generates arrhythmic risk as well, not to mention risk of artery occlusion and a new scar. Furthermore, it is important to stress that RA outcomes and long-term follow-up are strongly dependent on experience, expertise and load volume in particular centers. In one study the institutional volume of RA was a factor inversely associated with the composite life-threatening complications including in-hospital death, cardiac tamponade and emergent surgery (12).

In conclusion, the authors have to be praised for an excellent study which for the first time gives very precise insights into myocardial injury post PCI with RA. They have used very sensitive methods and various MI definitions to assess myocardial injury and MI after PCI with RA. Despite high frequency of myocardial injury, clinical improvement was obvious. Thus, dear physician, if the PCI center you cooperate with is a high-volume experienced RA center you should not hesitate to refer your elderly patient with calcified lesion(s) for revascularization with accompanying RA.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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