

Rotational atherectomy treatment before drug-eluting stent implantation in severe calcific coronary lesion

Mehmet Kışık¹, Nezih Barış¹

Department of Cardiology, Dokuz Eylül University Faculty of Medicine, İzmir, Türkiye

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ABSTRACT

Rotational atherectomy can effectively destroy calcified plaques and facilitate stent insertion and expansion in many cases. In this article, we present a successful application of rotational atherectomy with rotablator and drug-eluting stent implantation treatment in a 43-year-old male patient with severe calcific stenosis in the right coronary artery that could not be dilated with a high-pressure balloon. During the follow-up, the patient did not have any complaints as long as he was hospitalized, and no recent adverse events, such as acute stent thrombosis and bleeding, were observed.

Keywords: Calcific coronary artery stenosis, drug-eluting stent implantation, rotational atherectomy.

Drug-eluting stents (DES) have significantly reduced restenosis rates in randomized clinical trials evaluating simple coronary artery lesions.^[1,2] In a study of 216 patients who underwent primary percutaneous coronary intervention for ST elevation myocardial infarction (STEMI), DES implantation was performed in all patients, and normal coronary artery flow was achieved in 84.3% of the patients. In-hospital mortality and postprocedure ventricular arrhythmia rates were found to be low.^[3] Drug-eluting stents also showed favorable results when implanted in complex lesions, but higher rates of major adverse cardiovascular events were observed in subgroups of patients with complex lesions (e.g., bifurcation lesions) compared to patients with simple coronary lesions.^[4,5]

Heavily calcified lesions pose a particular challenge due to resistant plaque burden, which may result in failure of stent deployment or expansion. This may increase the possibility of stent thrombosis or restenosis. In addition, heavily calcified lesions may pose a particular threat to DES; both damage to the polymer/drug coating during vigorous propagation and insufficient diffusion into the subintima may contribute to the ineffectiveness of DES.^[5,6]

Rotational atherectomy (RA) can effectively destroy calcified plaques and facilitate stent insertion and expansion in many cases. However, when used alone or combined with bare metal stents, the risk

of late restenosis remains high.^[7] Recently, some observational studies have suggested a favorable long-term outcome of RA followed by DES implantation.^[8,9] Theoretically, RA and DES can act synergistically in complex lesions as RA can prevent damage to the stent, and DES can effectively suppress neointimal proliferation. Therefore, RA of heavily calcified lesions may increase the efficacy of DES.^[6] We present a case of severe calcific stenosis of the right coronary artery (RCA) successfully treated with rotablation and DES implantation.

CASE REPORT

A 43-year-old male patient who underwent coronary angiography and stent implantation with a known diagnosis of coronary artery disease 10 years ago presented to our clinic. The patient had comorbid hypertension and hyperlipidemia. Coronary angiography was performed in another clinic due to complaints of chest pain and exertional dyspnea. Upon

Corresponding author: Mehmet Kışık, MD, Dokuz Eylül Üniversitesi Tıp Fakültesi Kardiyoloji Kliniği, 35340 İnciraltı, İzmir, Türkiye.
E-mail: drmehmet.kis@hotmail.com

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detection of a severe calcific obstructive lesion in the RCA, balloon dilatation was performed, but it was unsuccessful. The patient was admitted to our clinic for further examination and treatment.

The patient was using nebivolol/hydrochlorothiazide 5/12.5 mg, acetylsalicylic acid 100 mg, clopidogrel 75 mg, perindopril/amlodipine 10/5 mg, atorvastatin 10 mg, fenofibrate 250 mg. Electrocardiography showed a sinus rhythm and T wave negativity in the inferior leads. In echocardiography, left ventricular ejection fraction was 60%, right ventricular ejection fraction was normal, left ventricular end-diastolic diameter was 4.5 cm, and left ventricular end-systolic diameter was 3.0 cm, with mild mitral valve regurgitation. Laboratory findings revealed hemoglobin 12.7 g/dL, creatinine 0.73 mg/dL, and low-density lipoprotein cholesterol 86.8 mg/dL.

In coronary angiography, RCA proximal and distal lesions were passed with a floppy guide wire.

Since the 2.0×15 mm balloon did not pass through the lesion, a microcatheter was advanced to the RCA. Subsequently, the responsible lesions were tried to be predilated with a 2.5×15 mm balloon, but RCA patency could not be achieved. Considering these findings, it was decided to continue with a rotablator. The rotablator guidewire was advanced through the microcatheter. The rotablator procedure was performed with a 1.75 mm rotablator burr. Then, the distal lesion was predilated with a 3.0×15 mm balloon. A 3.5×16 mm DES was implanted into the distal lesion, and a 4.0×16 mm DES was implanted into the proximal lesion. The junction of both stents was dilated with a stent balloon. Right coronary artery patency was achieved. The procedure was completed without complications. During the follow-up, the patient did not have any complaints during hospitalization, and no recent adverse events, such as acute stent thrombosis and bleeding, were observed. The patient was discharged in good health.

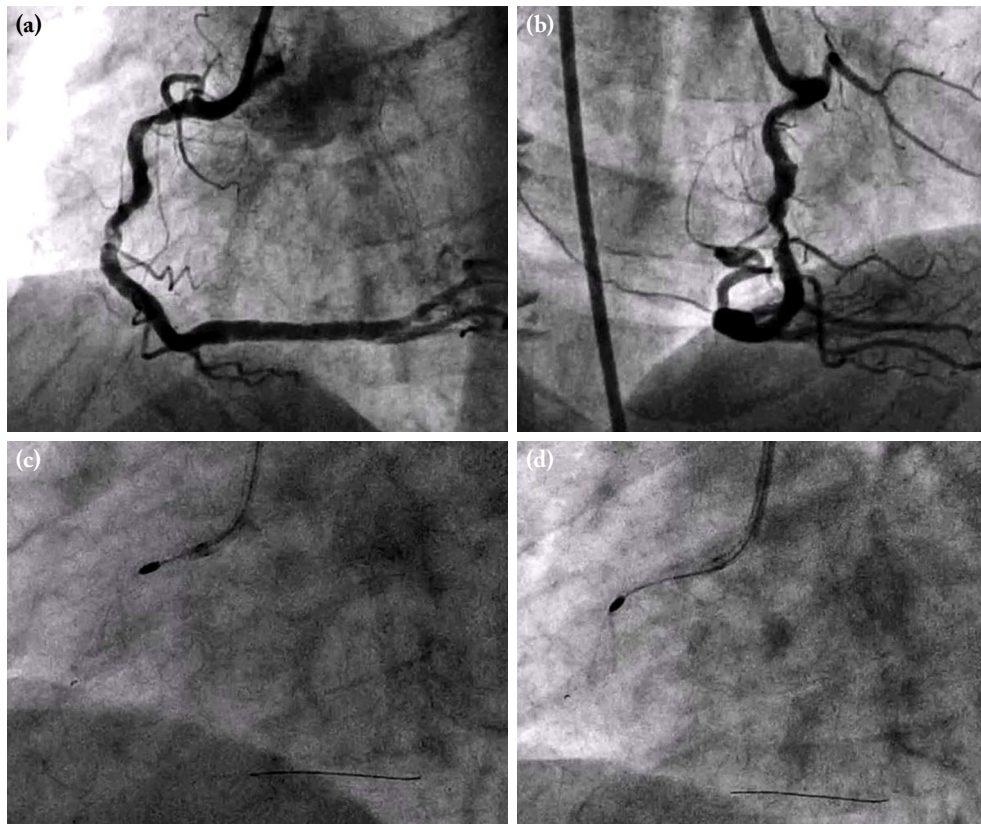


Figure 1. (a, b) Presence of severe and calcified lesions in the proximal and distal part of the RCA. (c, d) Application of rotational atherectomy for RCA stenosis.

RCA: Right coronary artery.

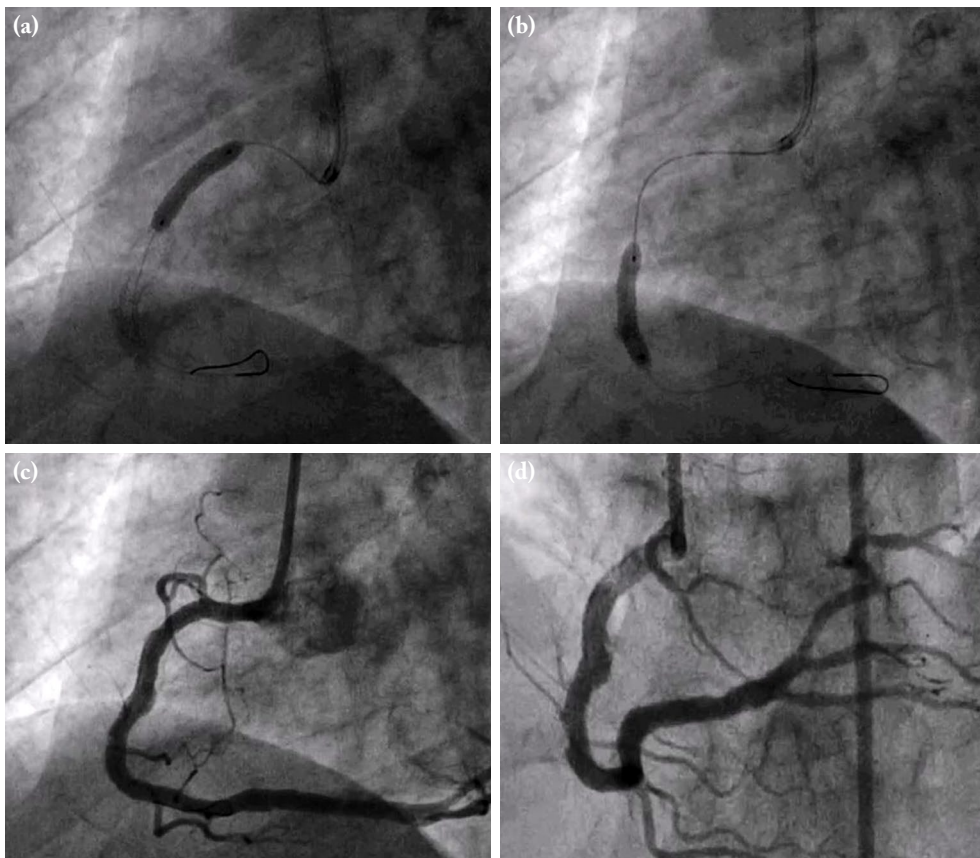


Figure 2. (a) Post-atherectomy drug-eluting stent implantation in the distal RCA calcific lesion. (b) Post-atherectomy drug-eluting stent implantation in the proximal RCA calcific lesion. (c, d) Angiography results. RCA: Right coronary artery.

DISCUSSION

Significant coronary calcification is a major challenge and limitation for percutaneous coronary intervention, as it inhibits stent placement and expansion. This may be associated with poor stent expansion, target lesion restenosis, stent thrombosis, and myocardial infarction (MI).^[10]

In the ROTAXUS (Rotational Atherectomy Before TAXUS Stent Treatment for Complex Native Coronary Artery Disease) study, 240 patients with complex calcified native coronary lesions were randomly assigned to two groups: RA followed by stenting (n=120) and stenting without RA (n=120, standard treatment group). Despite similar baseline characteristics, the strategy resulted in higher success in the rotablator group (92.5% *vs.* 83.3%, $p=0.03$), but

restenosis (10.6% *vs.* 11.4%, $p=0.71$), target lesion revascularization (12.5% *vs.* 11.7%, $p=0.84$), stent thrombosis (0.8% *vs.* 0% $p=1.0$), and major adverse cardiovascular events (24.2% *vs.* 28.3%, $p=0.46$) were similar in both groups.^[6]

Another recent study that included 154 patients showed comparable clinical results at 30-day and one-year follow-ups in those who did or did not undergo the RA procedure in acute MI.^[11] This study demonstrated the safety and efficacy of RA in patients with acute or recent MI and reported that RA is a viable option due to a high procedural success rate. In the literature, RA has been successfully applied to calcific lesion in patients with acute STEMI and subacute MI.^[12,13] In a prospective study of 76 patients with calcific superficial femoral artery lesions longer than 150 mm treated with drug-coated balloon angioplasty (DCB) alone or directional atherectomy

prior to DCB, primary coronary artery patency of the DCB and directional atherectomy with DCB groups at the 12-month follow-up was 66.6% and 82.6%, respectively ($p < 0.05$).^[14]

In light of the information we obtained in our case, the use of a rotator before stent implantation in highly calcified coronary lesions reduces the risk of acute occlusion by providing a smoother lumen, provides increased lumen gain, reduces residual plaques, and reduces the risk of stent thrombosis through stent expansion and placement. Furthermore, RA is a proven procedure to modify the coronary lesions and facilitate stenting in severely calcified lesions when high-pressure balloon angioplasty alone cannot achieve dilation. In our case, the RCA lesion could not be opened despite high pressure with a balloon dilatation, and a combination of RA and DES was used. Rotational atherectomy and DES are complementary techniques in highly calcified lesions. Due to the inadequacy of data in the literature, new randomized clinical trials are needed to accurately evaluate these approaches.

In conclusion, the use of a rotator before stent implantation in severely calcified coronary lesions provides a smoother lumen, reducing the risk of acute occlusion and providing comfortable expansion and placement of the stent.

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Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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