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EDITORIAL COMMENT

Rotational atherectomy in the drug-eluting stent era: The revival of a forgotten technique?☆

Aterectomia rotacional na era dos *drug-eluting stents*. O ressurgimento duma técnica esquecida?

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Although rotational atherectomy (RA) was first introduced in 1986 as a technique for mechanical thrombectomy,[1] it was its potential to reduce barotrauma and hence restenosis that sparked the interest of researchers.[2–6] Unlike balloon angioplasty, in which acute luminal gain is obtained through stretching of the arterial wall,[7–9] RA works by abrading and thereby debulking atherosclerotic plaques.[10] The hope was that RA would reduce restenosis by decreasing the quantity of residual plaque after angioplasty, which several intravascular ultrasound studies have shown is one of the most important predictors of restenosis.[11] However, it was found that the loss index, a measure of late luminal loss and thus of the efficacy of the technique in terms of restenosis, was no better than with balloon angioplasty.[3] In some series in the pre-stent era, RA was associated with restenosis rates as high as 40%, despite apparently reducing barotrauma and the number of dissections.[3]

Several studies including DART,[3] ERBAC,[4] STRATAS[5] and CARAT,[6] as well as meta-analyses,[12] did not support the use of RA as a means of reducing restenosis. As a result the technique fell out of favor and is currently employed in less than 5% of procedures in Europe.

The widespread use of bare-metal stents, particularly after 1995, led to a new phenomenon, in-stent restenosis. RA was the obvious technique to treat this since it enabled removal of newly formed plaque, and it thus found a new niche. However, the results of the ARTIST trial failed to confirm the benefits of this strategy in such situations.[13] Following the introduction of drug-eluting stents, use of RA again decreased since the new stents were also used to treat in-stent restenosis using the stent sandwich technique.[14]

Various other uses of RA have been described; all of which arose mainly from its technical potential, but these have not been clinically validated. Examples include treatment of stent-jailed side branch stenosis,[15] crushed stents with restenosis in bifurcations,[16] and debulking of occlusions in calcified vessels and ostial lesions, mainly of the right coronary artery and bypass grafts.[17]

In this issue of the *Journal*, Seca et al. report the results of their experience using RA to prepare calcified atherosclerotic plaques prior to drug-eluting stent implantation. It should be noted that this study had a high percentage of patients who had been refused for surgery (65%), considerably higher than in most other published studies. Although the factors prompting such refusal are not specifically stated, a large proportion of patients had unfavorable clinical or angiographic characteristics, including diabetes (55%), renal failure (21%) and type C lesions C (69%). The most commonly used single burr was 1.25 mm (62%), mean burr size being 1.43 mm and mean burr-to-vessel ratio 0.46, reflecting the operators' decision to adopt a strategy of plaque modification rather than debulking.

Mean angioplasty time was 110.2±30 min, which reflects the greater technical complexity of the procedure, but no information is given on the amount of contrast used, an important factor in a population with a high prevalence of

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diabetes and renal failure. In a relatively short follow-up of nine months, there were no deaths and the number of major cardiac events was low considering the study population, which leads the authors to conclude that RA followed by drug-eluting stent implantation in patients with heavily calcified lesions has a low rate of complications and good long-term results during a nine-month follow-up.

Despite these excellent results, RA was used in only 2.5% of cases in this center, although this is higher than the national average of 1.36% according to the latest data from the National Cardiology Data Collection Center (CNCDC) for 2010–2011.

Heavily calcified lesions remain a major challenge for the interventional cardiologist, due not only to the difficulties in crossing calcified lesions to implant stents but also to the greater number of complications associated with this type of anatomy. For such patients, RA is in fact the only technique available to prepare the vessel for stent implantation, particularly in lesions with superficial calcium.

The rationale behind RA prior to stent implantation is based on the assumption that it will reduce the risks of: (1) acute occlusion by creating a smoother lumen with less barotrauma; (2) in-stent restenosis by increasing luminal gain; (3) in-stent restenosis by reducing the quantity of residual plaque; and (4) acute stent thrombosis through improved stent expansion and apposition.

Since use of drug-eluting stents is currently the main therapeutic strategy of interventional cardiologists, it is essential to ensure proper expansion and apposition to the vessel wall in patients with heavily calcified lesions, as stent underexpansion is one of the strongest predictors of acute and late thrombosis, as well as restenosis.[18]

Other recent studies in the drug-eluting stent era, with follow-up periods of up to four years, have shown high rates of immediate success (97.1%), with mortality of 4.9% in a mean follow-up of 15 months.[19] However, the incidence of stent thrombosis was 4.8%, reflecting the high-risk anatomy of these patients.

With regard to the rotablator technique, various studies[20,21] including STRATAS have led to modifications of the initial methodology, with significant reductions in the incidence of no reflow and periprocedural infarction. It is now recommended that the RA catheter be advanced slowly in small to-and-fro movements (pecking), with shorter ablation times (less than 30 s), lower burr speeds (140.000–150.000 rpm), and avoiding speed decreases of more than 5000 rpm.

Finally, since preparation of plaques by RA increases vessel distensibility, drug-eluting balloon angioplasty can be considered for patients with more diffuse disease.

Conflicts of interest

The authors have no conflicts of interest to declare.

References

1. Ritchie JL, Hansen DD, Vracko R, et al. Mechanical thrombolysis: a new rotational catheter approach for acute thrombi. Circulation. 1986;73:1006–12.
2. Fourrier JL, Bertrand ME, Auth DC, et al. Percutaneous coronary rotational angioplasty in humans: preliminary report. J Am Coll Cardiol. 1989;14:1278–82.
3. Mauri L, Reisman M, Buchbinder M, et al. Comparison of rotational atherectomy with conventional balloon angioplasty in the prevention of restenosis of small coronary arteries: results of the Dilatation vs Ablation Revascularization Trial Targeting Restenosis (DART). Am Heart J. 2003;145:847–54.
4. Reifart N, Vandormael M, Krajcar M, et al. Randomized comparison of angioplasty of complex coronary lesions at a single center. Excimer Laser, Rotational Atherectomy, and Balloon Angioplasty Comparison (ERBAC) study. Circulation. 1997;96:91–8.
5. Whitlow PL, Bass TA, Kipperman RM, et al. Results of the study to determine rotablator and transluminal angioplasty strategy (STRATAS). Am J Cardiol. 2001;15:699–705.
6. Safian RD, Feldman T, Muller DW, et al. Coronary angioplasty and rotablator atherectomy trial (CARAT): immediate and late results of a prospective multicenter randomized trial. Catheter Cardiovasc Interv. 2001;53:213–20.
7. Baptista J, di Mario C, Serruys PW, et al. Impact of plaque morphology and composition on the mechanisms of lumen enlargement using intracoronary ultrasound and quantitative angiography after balloon angioplasty. Am J Cardiol. 1996;77-2:115–21.
8. Baptista J, di Mario C, Escaned J, et al. Intracoronary two-dimensional ultrasound imaging in the assessment of plaque morphologic features and the planning of coronary interventions. Am Heart J. 1995;129:177–87.
9. Potkin BN, Keren G, Mintz GS, et al. Arterial responses to balloon coronary angioplasty: an intravascular ultrasound study. J Am Coll Cardiol. 1992;20:942–51.
10. Kovach JA, Mintz GS, Pichard AD, et al. Sequential intravascular ultrasound characterization of the mechanisms of rotational atherectomy and adjunct balloon angioplasty. J Am Coll Cardiol. 1993;23:1024–32.
11. Mintz GS, Popma JJ, Leon MB. Intravascular ultrasound predictors of restenosis after percutaneous transcatheter coronary revascularization. J Am Coll Cardiol. 1996;27:1678–87.
12. Bittl JA, Chew DP, Topol EJ, et al. Meta-analysis of randomized trials of percutaneous transluminal coronary angioplasty versus atherectomy, cutting balloon atherotomy, or laser angioplasty. J Am Coll Cardiol. 2004;43:936–42.
13. vom Dahl J, Dietz U, Haager PK, et al. Rotational atherectomy does not reduce recurrent in-stent restenosis: results of the angioplasty versus rotational atherectomy for treatment of diffuse in-stent restenosis trial (ARTIST). Circulation. 2002;105:583–8.
14. Mehilli J, Byrne R, Tiroch K, et al. Randomized trial of paclitaxel-versus sirolimus-eluting stents for treatment of coronary restenosis in sirolimus-eluting stents: the ISAR-DESIRE 2 (intracoronary stenting and angiographic results: drug eluting stents for in-stent restenosis 2) study. J Am Coll Cardiol. 2010;55:2710–6.
15. Sperling RT, Ho K, James D, et al. Treatment of stent-jailed side branch stenoses with rotational atherectomy. J Invasive Cardiol. 2006;18:354–8.
16. Okamura A, Ito H, Fujii K. Rotational atherectomy is useful to treat restenosis lesions due to crushing of a sirolimus-eluting stent implanted in severely calcified lesions: experimental study and initial clinical experience. J Invasive Cardiol. 2009;10:E191–6.
17. Tsuchikane E, Suzuki T, Asakura Y, et al. Debulking of chronic coronary total occlusions with rotational or directional atherectomy before stenting: final results of DOCTORS study. Inter J Cardiol. 2008;125:397–403.

18. Liu X, Doi H, Maehara A, et al. A volumetric intravascular ultrasound comparison of early drug-eluting stent thrombosis versus restenosis. J Am Coll Cardiol Intv. 2009;2:428–34.
19. Benezet J, Díaz de la Llera LS, Cubero JM, et al. Drug-eluting stents following rotational atherectomy for heavily calcified coronary lesions: long-term clinical outcomes. J Invasive Cardiol. 2011;23:28–32.
20. Kini A, Marmur J, Duvvuri S, et al. Rotational atherectomy: improved procedural outcome with evolution of technique and equipment—single-center results of first 1,000 patients. Catheter Cardiovasc Interv. 1999;46:305–11.
21. Whitlow PL, Bass TA, Kipperman RM, et al. Results of the study to determine rotablator and transluminal angioplasty strategy (STRATAS). Am J Cardiol. 2001;87:699–705.