Case Report

Calcified coronary artery disease — CABG or PCI

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Coronary artery calcification (CAC) is highly prevalent in patients with coronary artery disease (CAD) and is associated with major adverse cardiovascular events. Heavily calcified coronary diseases remain a formidable challenge for percutaneous interventions (PCI). This article highlights the use of Rotational Atherectomy as a primary strategy for treating calcified lesions in order to facilitate optimal stent delivery and expansion as well as the importance of SYNTAX 2 score for determing the optimal strategy of either PCI or Coronary artery bypass surgery (CABG) as treatment modality.

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Multi vessel calcified coronary artery disease is one of the commonest causes of referral for coronary artery bypass surgery. But the advent of rotablation has changed the paradigm of treatment. Here we report a case of multi vessel calcified coronary artery disease which was successfully managed with percutaneous coronary intervention (PCI) and rotablation.

Case Report

A 79 years old male, known case of hypertension and chronic obstructive pulmonary disease presented with post infarction angina following an inferior wall myocardial infarction (MI). Routine examination was unremarkable except for presence of bibasal crepitations and diffuse rhonchi. ECG revealed evolved inferior wall MI and there was hypokinesia of basal segment on echocardiogram with an ejection fraction of 45%. Coronary angiography revealed 90% stenosis in mid part of the right coronary artery (RCA) with significant calcification and critical stenosis in the proximal to mid part of the left anterior descending artery (LAD) with severe calcification and discrete 90% stenosis in the distal LAD.

A heart team approach was take and the patient was deemed as a high risk case for coronary artery bypass surgery (CABG). Predicted 4 year mortality as per Syntax 2 score in this case was 17.6% with PCI *versus* 34.5% with CABG. Syntax score was 23. After discussion with the patient and family, angioplasty was planned after obtaining proper informed consent.

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PCI was done through right femoral approach. 6F JR 3.5 guide catheter was used to engage the right coronary artery (RCA). Initially sion blue wire was used to cross the lesion and attempts of pre-dilations were made but it was impossible to cross even with an 1.5 mm balloon due to the severe calcification. Hence, a rotablation was considered and rota wire was used to recross the lesion. We used the Rotalink plus system, Boston Scientific Inc. with the exchange-length rotablator floppy wire. Rotational burr speed was set between 160000 to 180000 revolutions per minute (RPM). Additionally, a pressurised saline solution containing verapamil 5 mg/500 ml, nitroglycerine 2mg/500 ml and heparin 5000 IU/500 ml were used for continuous flushing of the rotablator system to prevent thrombosis, cooling and coronary spasm. Rotablation was done with 1.5 mm bar Rotalink Plus. Asahi Sion Blue guide wire was used to recross the lesion. Sequential pre-dilatations were done with semi-compliant (SC) balloons. An Everolimus eluting stent 4.0 x 32 mm was deployed in proximal-mid RCA. Stent boost guided post dilatation was done with NC balloon 4.0 x 8. Post procedure TIMI III flow was achieved in RCA.

6F CLS 3.5 guide catheter was used to engage the left coronary artery. Initially Rota wire placed to distal LAD. Rotablation was done to proximal LAD with 1.5 mm bar Rotalink Plus. Pre dilatation was done with 2.75 x 12 balloon. An everolimus eluting 4.0 x 37 mm stent was deployed in proximal LAD at 10 atm. Stent boost guided post dilatation was done with NC balloon 4.0 x 8.0mm. Another Everolimus eluting stent 3.0 x 16 mm stent was deployed in distal LAD. Post procedure TIMI III flow was achieved in LAD. A total of 14000 units of unfractionated heparin was used. Patient was discharged in stable condition and is doing well on follow up.

Discussion

This article highlights the importance of heart team approach and Syntax 2 score[1] which takes into account additional clinical parameters, apart from the coronary anatomy (Syntax score)[2] in deciding PCI *versus* CABG. Also, in CABG it is difficult to anastomose the grafts on the calcified native arteries. Thus, PCI with debulking or plaque modifying strategies can definitely provide better outcomes.

Rotational atherectomy is used as a lesion preparation and plaque modification tool in severely calcified coronary arteries prior to stent implantation[3,4,5]. Debulking complex atherosclerotic lesions and plaque modification prior to stenting results in better luminal gain with less late luminal loss[6]. The success of the intervention depends on the rotablation technique (burr-to-artery ratio, RPM) and operators' experience[7,8]. Complications include coronary artery dissection (risk 6-8%), perforation (risk 0-1.5%), slow-flow phenomenon (risk 1.2-7.6%), severe spasm (risk 1.6-6.6%) or abrupt vessel closure (risk 1.8-11.2%), and emergency CABG (risk 1.0-2.5%)[9]. Fundamental elements of optimal technique include use of a single burr with burr-to-artery ratio of at least 0.5 to 0.6-rotational speed of 140,000 to 150,000 RPM. Optimal antiplatelet therapy, vasodilators, flush solution, and provisional use of atropine, temporary pacing, vasopressors, and mechanical support may prevent slow-flow/no-flow. In a comparative study of rotational atherectomy with CABG for patients with failed PCI, there was no significant difference in major cardiovascular events but rotational atherectomy carried a lower risk of periprocedural complications and a higher rate of target vessel revascularisation[10].

Rotablation produces lumen enlargement by physical removal of plaque and reduction in plaque rigidity, facilitating dilation. It ablates plaque using a diamond-encrusted elliptical burr, rotated at high speeds (140,000 to 180,000 RPM) by a helical driveshaft, that advances gradually across a lesion over a guidewire. The burr preferentially ablates hard, inelastic material, such as calcified plaque,

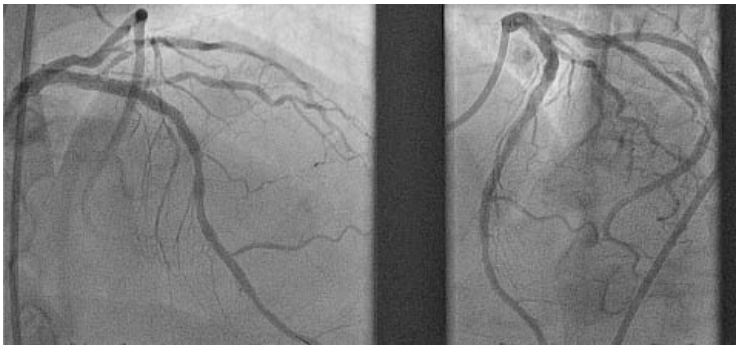

Fig 3 — Critical stenosis in the proximal to mid part of the left anterior descending artery with severe calcification and dicrete 90% stenosis in the distal part. Rotablation of the LAD with 1.5 mm burr

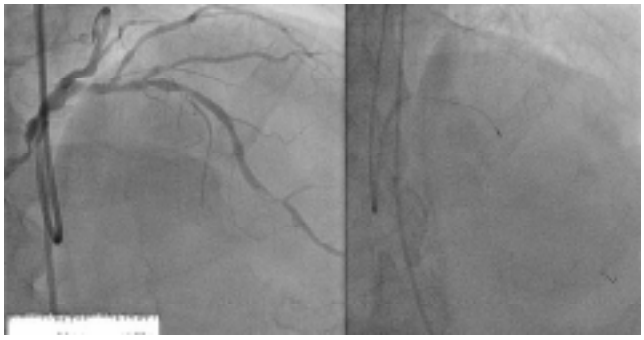

Fig 4 — Final TIMI 3 flow after 4.0 x 37 mm stent proximally and 3.0 x 16 mm stent distally

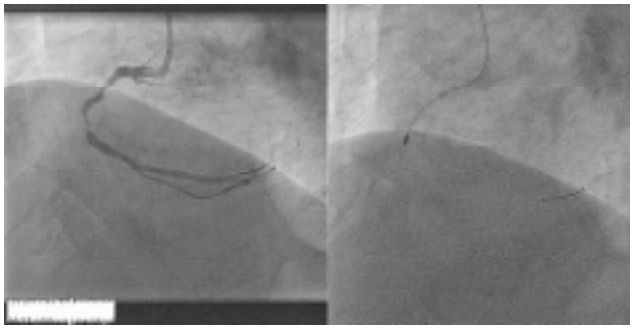

Fig 1 — 90% stenosis in mid part of the right coronary artery with significant calcification. Rotablation with 1.5 mm burr in RCA when balloon dilation couldnot be done

that is less able to stretch away from the advancing burr than is healthy arterial wall (differential cutting). High rotational speeds facilitate longitudinal burr movement across calcific lesions by orthogonal displacement of friction. A guidewire helps to keep the burr's abrasive tip coaxial with the vessel lumen, although wire bias in highly tortuous or angulated segments may predispose to dissection or perforation. Unlike balloon angioplasty, which tends to produce intimal splits and medial dissections in calcified lesions, rotablation yields a relatively smooth luminal surface with cylindrical geometry and minimal tissue injury[11,12].

Fig 2 — Final TIMI 3 flow in RCA with well expanded 4.0 x 32 mm stent

In conclusion, PCI with rotablation is a safe and effective treatment strategy for calcified coronary artery disease particularly for the lesions which are non dilatable with conventional balloons. PCI with rotational atherectomy perhaps superior to CABG in calcified coronary artery disease.

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