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Treatment of a long, tortuous and heavily calcified left descending anterior artery successfully pre-dilated with new semi-compliant balloon catheters

Background

Resistant coronary lesions due to calcification or fibrosis remain a challenge for modern percutaneous interventional cardiology. The conventional approach to treating such lesions with a balloon includes high-pressure inflation, balloon oversizing and the use of non-compliant balloons. These approaches are often unsuccessful and can lead to plaque shift, balloon rupture, and extensive vessel dissection or even rupture. Furthermore, lesion calcification imposes a rigid obstacle to optimal stent expansion and results in a smaller gain in lumen size compared to that which can be achieved in non-calcified lesions. Optimal stent expansion reduces restenosis rate, whilst uniform stent expansion ensures better long-term prognosis, ensuring improved drug delivery and diffusion into the vessel wall.

It is generally accepted that rotational atherectomy can be a more effective treatment for heavily calcified lesions; however, access to this technique remains restricted to a limited number of cardiologists because of its technical challenges, high cost and the potential risk of complications.¹ The modern armamentarium in interventional cardiology for the treatment of calcified lesions includes Cutting Balloon (Boston Scientific Corporation, Boston, MA, USA)

and the AngioSculpt (AngioScore, Inc., Fremont, CA, USA), which can reduce vessel stretching and subsequent injury by predictably scoring the lesion and reducing the risk of uncontrolled disruption of the plaque.^{2,3}

In this case, we report the successful treatment of severely calcified lesions in the left anterior descending artery (LAD) with the newly available semi-compliant balloon catheter, Euphora™ (Medtronic, Santa Rosa, CA, USA) (figure 1). This was followed by implantation of three drug-eluting stents and the final angiographic result was optimal.

Case presentation

An 87-year-old man was admitted to our institution because of persistent angina. He had previously experienced a non-ST segment elevated myocardial infarction, which was managed with medical treatment. He had a high comorbidity burden, including diabetes, chronic renal disease and permanent atrial fibrillation. Moderate to severe aortic stenosis was also present and the ejection fraction was moderately reduced (40%).

Coronary angiography showed severe three-vessel coronary disease, with severe stenosis of the proximal right coronary artery and a calcified culprit lesion of the proximal-mid left descending artery. The calcified and long lesion involved bifurcation of the first diagonal branch (Medina 1,1,1) (figure 2).

Management

After formal discussion, we decided to pre-dilate the lesion with a Euphora™ (Medtronic) semi-compliant balloon catheter. This balloon has excellent pushability and crossability, which are fundamental in the treatment of extremely tortuous lesions. We started by treating the first diagonal branch with a 1.5 mm balloon inflated to 10 atmospheres, with good angiographic results.

fig. 1

Euphora™
semi-compliant
balloon catheter

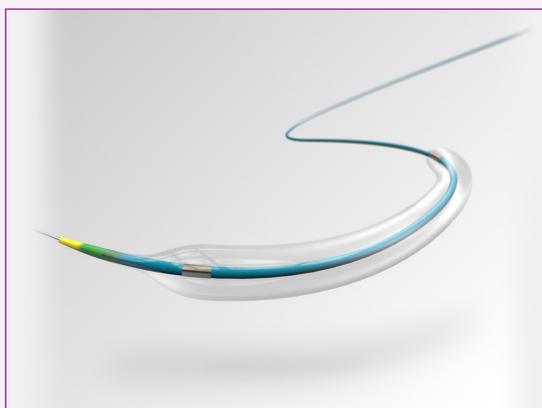
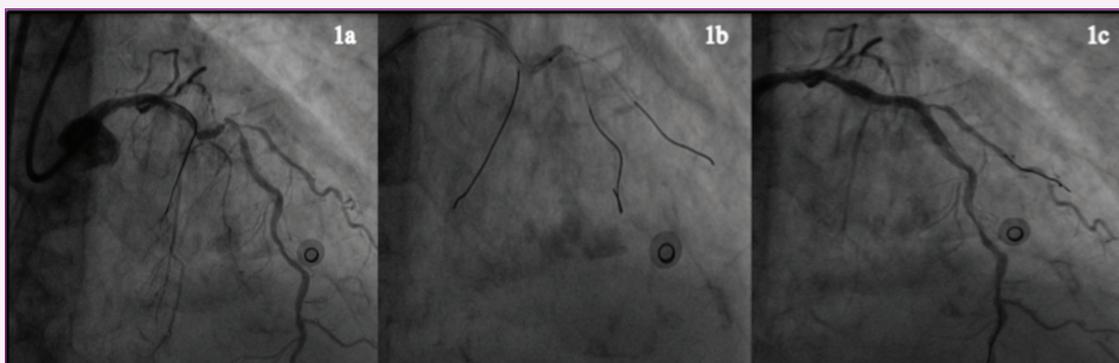


fig. 2

- a) Angiography showed a tortuous left descending artery with calcific stenosis of the proximal-mid tract
- b) The lesion was treated with semi-compliant balloons starting with a 1.5 mm diameter
- c) At 3 months, the final angiogram showed a good result after implantation of three drug-eluting stents



Quiz Questions

1. What is an appropriate strategy for treating a long, calcified lesion extending from proximal to mid-left descending artery?

A long, calcified lesion can benefit from treatment with Cutting Balloon, AngioSculpt and rotational atherectomy. As alternative, a pre-dilatation with semi-compliant balloon can be used in order to prepare the lesion for subsequent stenting.

2. What strategy is appropriate for the treatment of the left descending artery first diagonal bifurcation?

The treatment of a bifurcation depends on the grade of the angle between the two vessels, the caliber of the side branch and the anatomy. In our case, a provisional strategy was appropriate in order to reduce the risk of complications.

3. Is post-dilatation mandatory after the delivery of stents in calcified lesions?

Post-dilatation is recommended to avoid stent under expansion in presence of calcified lesions.

The same diameter of balloon was used for the treatment of the long stenotic lesion involving the LAD. A first dilatation at 12 atmospheres was used in the mid-segment, with an immediate good angiographic result. The subsequent dilatation of the mid-proximal LAD with 2.0, 2.5 and 3.0 mm semi-compliant balloons was successful (figure 2b). A limited coronary dissection was present in mid-LAD without involvement of the side branch. Thanks to the optimal angiographic result, the previously planned rotational atherectomy was not deemed necessary. We used a provisional stenting strategy, implanting three drug-eluting stents of 2.5 x 15 mm, 2.25 x 15 mm and 2.25 x 8 mm (Xience Pro X, Abbott Vascular, Santa Clara, CA, USA) from proximal to mid-LAD. A post-dilatation with a Hiryu non-compliant 3.0 x 22 mm balloon (Terumo Medical Corporation, Somerset, NJ, USA) was performed to optimise the result. The side branch was left untreated because of the good angiographic result (figure 2c). At 3 months' follow up the patient had experienced improvement in his angina together with normalisation of the ejection

Take-home messages

This case report outlines some practical aspects that can be useful in the treatment of complex lesions:

- Pre-dilatation of complex lesions can be a challenge. In particular, with calcified lesions in tortuous vessels there is a greater risk of an unsuccessful procedure with poor angiographic results.
- Good delivery and expansion of drug eluting stents depends on the prior effective preparation of the lesion.
- Cutting balloons, AngioSculpt (Biotronik, Berlin, Germany) and rotational atherectomy remain the cornerstones for the treatment of heavily calcified coronary lesions. However, the use of semi-compliant balloons with good pushability and crossability can be useful in selected patients.

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