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Introduction

Modified balloons are important devices for the treatment of complex coronary lesions because they concentrate dilatation force on the scoring elements, providing effective lesion modification while minimizing excessive coronary dissection. The Scoreflex® QUAD (OrbusNeich Medical, Hong Kong) is a modified balloon equipped with three nitinol integral wires that provides excellent dilatation performance. However, compared with conventional balloons, its crossability may be reduced, particularly in severely calcified and tortuous lesions. We developed a simple technique to improve the crossability of the Scoreflex® QUAD by re-wrapping the balloon profile after initial inflation, which we named the Re-wrap technique. We herein report a case in which this technique enabled successful PCI for a severely calcified bifurcation lesion in the left anterior descending artery (LAD).

Case Presentation

A woman in her seventies presented with progressive exertional dyspnea that had developed one week before admission and gradually worsened, eventually accompanied by orthopnea. She was referred to our hospital because of suspected heart failure. Transthoracic echocardiography demonstrated reduced left ventricular systolic function with an ejection fraction of 31% and moderate mitral regurgitation. She was admitted with a diagnosis of heart failure and received optimal medical therapy. After stabilization, coronary angiography revealed diffuse 90% stenosis in segment #7 of the LAD and severe 99% stenosis in a relatively large first diagonal branch (D1). Ischemic heart failure was diagnosed, and elective PCI was scheduled.

Procedure

PCI was performed via the right radial artery using a 7-Fr Launcher EBU 3.5 guiding catheter. A Runthrough NS Extra Floppy guidewire successfully crossed the LAD lesion, and intravascular ultrasound (IVUS) was performed. IVUS demonstrated circumferential calcification in the proximal portion of segment #7 and less than 270° calcification in the mid portion. The lesion fulfilled the following IVUS criteria: calcium length >5 mm, vessel diameter <3.5 mm, and no calcified nodule, resulting in an IVUS calcium score of 2. Therefore, intravascular lithotripsy (IVL) was considered not indicated. Because of the patient's severely reduced left ventricular function, plaque modification with atherectomy devices was avoided.

The D1 lesion could not be crossed with a SION guidewire alone and required additional support with a Teleport XT microcatheter. IVUS could not cross the D1 lesion. A Scoreflex® QUAD 1.75 × 15 mm balloon also failed to cross the lesion. We considered severe vessel tortuosity to be the main cause of the poor crossability. To improve balloon flexibility, the balloon was inflated to 6 atm immediately proximal to the lesion, followed by manual re-wrapping. After this maneuver, the balloon successfully crossed the lesion. Following pre-dilatation, IVUS was advanced for lesion assessment, and subsequent high-pressure dilatation was performed using the same balloon.

An Ultimaster Nagomi 2.75 × 33 mm drug-eluting stent was then implanted in the LAD. Considering the number of balloons required for bifurcation treatment, the Jailed Teleport technique was selected for side-branch protection. Proximal optimization technique (POT) was subsequently performed using an NC Kamui 3.5 × 12 mm balloon. Final IVUS confirmed adequate stent expansion and apposition. Final angiography demonstrated no major dissection in the D1, and the residual stenosis improved from 99% to 50%, completing the procedure successfully.

Discussion

In this case, treatment was required not only for a severely calcified LAD lesion but also for a large D1 supplying a broad myocardial territory. The IVUS calcium score of the LAD was 2, indicating that IVL was not appropriate. Furthermore, the D1 lesion was severely calcified, small in diameter, and markedly tortuous. Because even IVUS could not cross the lesion, successful delivery of an IVL balloon was also considered unlikely.

In addition, the patient had severely impaired left ventricular systolic function and a history of lumbar compression fracture, making prolonged supine positioning difficult. Therefore, lengthy procedures using coronary atherectomy devices and their associated procedural risks were considered undesirable. Based on these considerations, the Scoreflex® QUAD was selected because of its favorable safety profile and procedural simplicity.

Compared with the Scoreflex® TRIO, the Scoreflex® QUAD incorporates an additional integral wire, resulting in four scoring elements and improved lesion modification efficiency. However, the increased number of integral wires also reduces balloon flexibility, which may compromise crossability in severely tortuous lesions. In the present case, the Scoreflex® QUAD initially failed to cross the D1 lesion. However, application of the Re-wrap technique, consisting of balloon inflation followed by manual re-wrapping, improved balloon flexibility sufficiently to enable lesion crossing, despite the fact that IVUS itself could not cross the lesion.

The Re-wrap technique is a simple modification that appears to improve the crossability of a modified balloon without compromising its lesion modification capability. This technique may therefore represent a useful option for treating complex coronary lesions characterized by both severe calcification and marked tortuosity.