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Case Report
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Bioresorbable Vascular Scaffold Stent Delivered to Tortuous Lesions by Using the "Five-in-Six" System

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A 5Fr ST01, which is a straight-tip guiding catheter with an inner lumen of 1.5 mm, is frequently used to perform the "child-in-mother" technique, which is also referred to as the "5-in-6" technique. A 6Fr or larger size guiding catheter can facilitate bioresorbable everolimus-eluting vascular scaffold (BVS) delivery. For tortuous lesions, the 5-in-6 technique can facilitate balloon catheters and the BVS in crossing tortuous lesions by increasing the back-up support. However, this maneuver couldn't be used for the larger size of BVS like 3.5-mm. Besides, it is necessary to preload the BVS into 5Fr ST01 guiding catheter to check whether this could really be done.

We present a case in which a 5Fr ST01 catheter and the 5-in-6 technique were successfully used in distal delivery of a BVS to cross a very tortuous right coronary artery lesion.

Key Words: Child-in-mother system • Coronary intervention • Transradial

INTRODUCTION

The bioresorbable everolimus-eluting scaffold (BVS; Abbott Vascular, Santa Clara, CA, USA), which is a bioresorbable scaffold, is made from a bioabsorbable polylactic acid backbone and slow-release everolimus (Novartis, Basel, Switzerland). The ability of the temporary scaffold to be bioabsorbed gives the BVS a potential advantage over other drug-eluting stents (DESs) for late luminal enlargement and late stent/scaffold thrombosis.[1] The scaffold strut of a BVS, which is 156-μm thick, is thicker than current DESs or bare metal stents (BMSs). In addition, the 1.4 mm crossing profile of the BVS is larger than those of other currently available stents. The above characteristics cause delivery to be more difficult for a BVS than for other stents. Current suggestions are to use a 6Fr guiding catheter as a minimal guiding catheter for BVS delivery.[2]

Smaller guiding catheters, like 5 or 6 Fr in size, have been typically used in transradial percutaneous coronary intervention. However, smaller calibers supply less efficient back-up support than larger ones.[3] A 5Fr ST01, which is a straight-tip guiding catheter (Heartrail; Terumo, Japan) with an inner lumen of 1.5 mm, is frequently used to perform the "child-in-mother" technique, which is also known as the "5-in-6" technique.[4] The 5-in-6 system, which is a composite of a 5Fr ST01 inside a 6Fr guiding catheter, can facilitate balloon catheters and stents in crossing tortuous lesions by increasing the back-up support by intubating the 5-in-6 system into the coronary artery. In this report, we present a rare case in which the 5-in-6 system was used to deliver a BVS to and across a very tortuous right coronary artery (RCA) lesion.

CASE REPORT

A 65-year-old man was admitted to our institution

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for stable angina of Canadian Cardiovascular Society class II. His risk factors included presence of dyslpidemia and previous triple vessel coronary artery disease after previous placement of DES to the mid RCA (m-RCA) and of BMS to a diagonal branch. Coronary angiography revealed a proximal RCA (p-RCA) long, diffuse, tortuous lesion. Percutaneous coronary intervention was performed via the left transradial approach using a 6Fr Ikari Left (IL4.0; Terumo) guiding catheter. After crossing the lesion by using a 0.014-inch Runthrough Floppy guidewire, the p-RCA lesion was predilated using an NC Trek 3.0 × 20-mm balloon (Abbott) up to 20 atm. A first 3.0 × 18-mm BVS was successfully deployed to the m-RCA by using a 6Fr IL4.0 guiding catheter to deeply engage p-RCA (Figure 1A). However, use of a 6Fr guiding catheter did not enable delivery of a second BVS to p-RCA. 2nd Runthrough Floppy guidewire was advanced to posterior descending artery as buddy wire to facilitate delivery of second BVS but it didn't work. A Trek 3.0 × 20-mm balloon (Abbott) was used to aggressively optimize the p-RCA lesion and facilitate delivery of the guiding catheter deeply into RCA. After the above efforts, the second BVS still failed to pass the tortuous RCA (Figure 1B). To achieve deep delivery to the RCA, an NC Trek 3.0 × 15-mm balloon (Abbott) was inflated inside the first BVS site to provide an anchoring effect, and the 5-in-6 system composite of a 5Fr ST01 guiding catheter inside a 6Fr IL 4 was advanced into the p-RCA. After deflating the NC Trek 3.0 × 15-mm balloon, the 5-in-6 system was able to successfully engage the first BVS site. The second 3.0 × 18-mm BVS was deployed to the proximal part of the p-RCA after drawing the 5Fr ST01 guiding catheter back and overlapping both BVS scaffold edges (Figures 1C, 1D). A good RCA angiographic result was achieved after BVS deployment and further postdilation (Figures 1E, 1F).

DISCUSSION

Because of the thicker scaffold strut and larger crossing profile of BVS than those of current DESs, a 6Fr

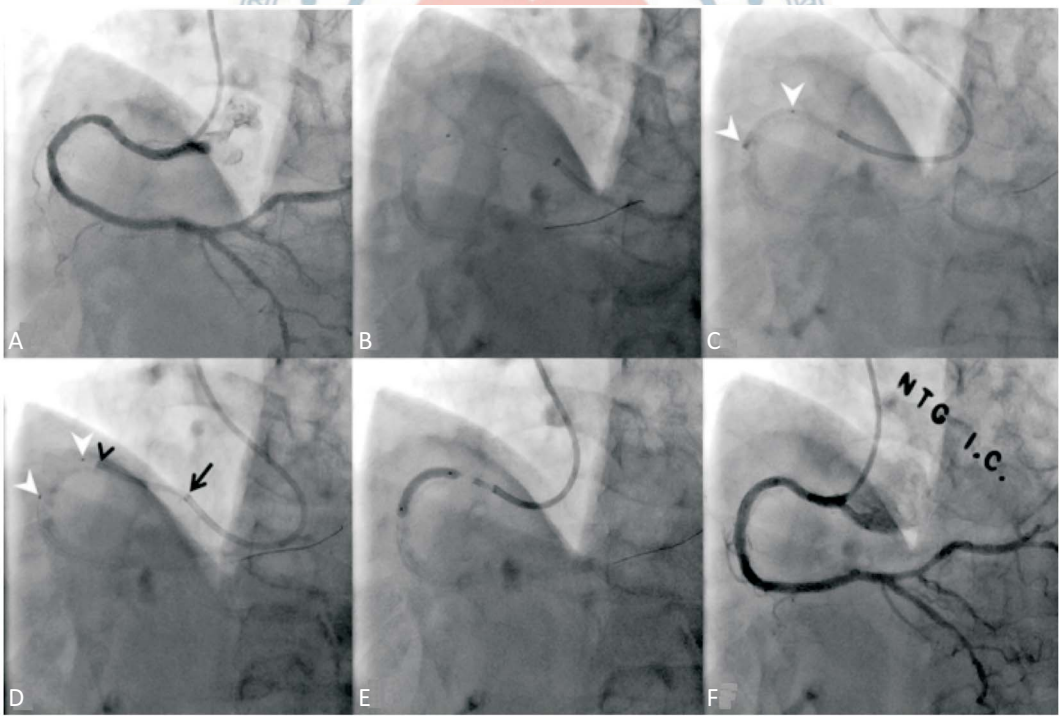

Figure 1. *(A) RCA angiography after first BVS 3.0 × 18 mm deployed to distal part of p-RCA. (B) Second BVS was difficultly delivered to proximal part of p-RCA exactly to overlap first BVS even by 6FR IL GC deeply engaging RCA. (C) Second BVS 3.0 × 18 mm was delivered by 5Fr ST01 GC (white arrow head: second BVS). (D) Second BVS 3.0 × 18 mm was deployed to proximal part of p-RCA after drawing the 5Fr ST01 GC backing and both BVS edges overlapped (white arrow head: second BVS; black arrow head: 5Fr ST01 GC; black arrow: 6Fr IL4 GC). (E) Second BVS 3.0 × 18 mm was inflated after overlapping both BVS edges (white arrow head: second BVS). (F) Final RCA angiogram.*

or larger guiding catheter with a minimum inner diameter of 0.070 inch (1.8 mm) is suggested for facilitation of stent delivery.[2] This means that use of a 5Fr guiding catheter is off-label use for delivery of a BVS. A 5-in-6 catheter (1.5 mm inner lumen) is not suggested because it has smaller than required inner lumen.[2] In addition, to prevent resistance in the course of BVS introduction, predilation in lesion preparation is strongly recommended. For this reason, a noncompliant balloon for predilation is further suggested. If a highly resistant or calcified lesion is found, use of a cutting balloon or rotablator should be considered before BVS deployment.[2]

A large amount of evidence has shown that the 5-in-6 system increases back-up support of guiding catheters for deployment of stents to challenging lesions, especially when delivery has failed by using conventional methods.[5] A 120-cm 5Fr ST 01 guiding catheter is longer than a 100-cm 6Fr IL4 guiding catheter. In addition, the very soft 13-cm end portion of the 5Fr ST01 helps the 5-in-6 system to negotiate a tortuous coronary artery and to deeply engage the artery.[6]

In this report, we described the importance of back-up support for deployment of BVS in tortuous vessels via the transradial approach. Because of the very tortuous p-RCA, a first BVS deployment is facilitated by use of a 6Fr guiding catheter to deeply engage RCA. Besides tortuosity of p-RCA, for this case, the difficulty in second BVS delivery might be due to that the deployed first BVS scaffold struts block the advance of second BVS. This might be caused by the thickness of strut of BVS. For thicker strut of BVS, challenges to cross lesions are easily encountered. To overcome above condition, it is useful to change to larger size guiding catheter or an extra back-up support guiding catheter to strengthen guiding catheter support. In addition, it is also effective to change guidewire system like Wiggle wire (Abbott Vascular, Santa Clara, California) with series of bends near the tip to aid to deflect the leading edge stents away from previously placed stents.[7] Furthermore, buddy wire technique contributes to increase support to delivery stents. However, usual buddy wire technique didn't work in this case. It might be due to BVS struts thicker than current stents. The crooked buddy wire technique that use a Wiggle wire (Abbott Vascular) alongside an extra support wire perhaps succeed for this case.[7] Anchoring balloon technique is also practical to increase extra support to delivery BVS in such tortuous RCA. However, because of the small size of proximal branch of RCA, anchoring balloon technique was not used in this case. For this case, a second BVS deployment by using a 5Fr ST01 5-in-6 system for deep engagement can be facilitated by distal balloon deflation. Sometimes, use of only the 5-in-6 system cannot achieve deepest coronary artery intubation. After using a distal inflated balloon with the 5-in-6 system, deflation of the distal balloon helps to advance the 5-in-6 system to more distal parts. In this way, the 5-in-6 system can engage coronary arteries most deeply. In addition to the 5-in-6 technique, the Guideliner catheter (Vascular Solutions, Minneapolis, USA) is another useful tool to facilitate the delivery of BVS in calcified and tortuous coronary lesions.[8]

To the best of our knowledge, this is the first report to describe the use of a 5Fr guiding catheter for delivery of a BVS. In this case, we experienced great difficulty in delivering BVS to the tortuous culprit lesion. Because of the larger crossing profile of the BVS, preparing a lesion well is not sufficient. Stronger back-up support by deeply intubating a tortuous coronary via use of the 5-in-6 system is mandatory. Maximizing deep engagement of a coronary artery by inflating and deflating a distal balloon is a useful procedural maneuver.

CONCLUSIONS

In this case, we used a 5Fr guiding catheter and the child-in-mother (5-in-6) technique to distally deliver and deploy a BVS across a very tortuous RCA lesion.

Potential limitations of the technique

This case showed that a 5Fr guiding catheter was suitable for delivery of a 3.0-mm BVS (Figure 2). However, this maneuver couldn't be used for the larger size of BVS like 3.5-mm. Besides, it is necessary to preload the BVS into 5Fr guiding catheter to check whether this could really be done.

NAME OF GRANT

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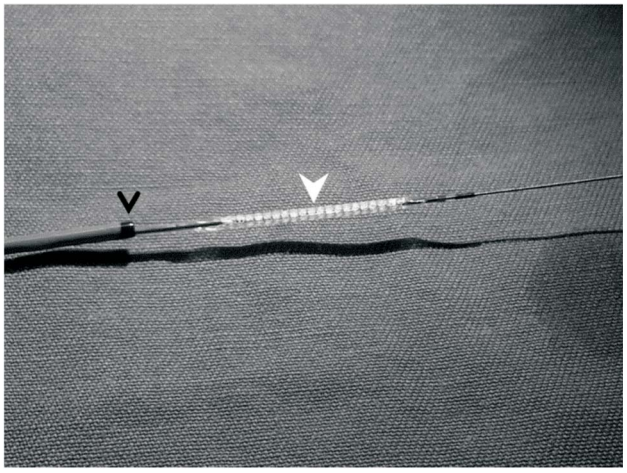

Figure 2. *BVS 3.0 × 28 mm delivered by 5Fr ST01 GC (white arrow head: BVS; black arrow head: 5Fr ST01 GC).*

sultancies, stock ownership or other competing equity interests or patent-licensing arrangements

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