Bifurcation Intervention in Single Coronary Artery Kissing Balloon Inflation Using Guide Extension Catheter and 0.014/0.010-Inch System

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Summary

A 77-year-old man was referred to our hospital for angina on effort. Coronary angiography and computed tomography demonstrated a single coronary artery arising from the right sinus of Valsalva. The left circumflex coronary artery (LCx) anomalously deriving near from the ostium of right coronary artery exhibited severe stenosis in the bifurcation of the obtuse marginal branch. Although the bifurcation lesion still remains a therapeutic challenge for guide extension catheter (GEC)-based percutaneous coronary intervention, under the guidance of intravascular ultrasound imaging, we successfully implanted an everolimus-eluting stent at the bifurcated LCx lesion and performed kissing balloon inflation using 0.014- and 0.010-inch systems through GECs.

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Key words: Computed tomography, Percutaneous coronary intervention, Intravascular ultrasound, Bifurcation lesion

Nowadays, guide extension catheter (GEC) is becoming a safe and user-friendly device as a “child-in-mother” technique. It is frequently used during complex percutaneous coronary intervention (PCI) in daily practice. Target lesions requiring GEC-based PCI include diffuse calcified lesions, severely bending lesions, far distal lesions, or long chronic total occlusions.^{1,2)} However, it is not easy to perform GEC-supported bifurcation PCI using conventional 0.014-inch system alone owing to the small internal diameter of GEC.

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Here, we describe our experience with an unusual case of single coronary artery (SCA) complicated with bifurcation lesion, where we successfully implanted an everolimus-eluting stent and performed kissing balloon inflation (KBI) using 0.014- and 0.010-inch system through GECs.

Case Report

A 77-year-old man with history of smoking and dyslipidemia was referred to our hospital for angina on effort. He had undergone abdominal aortic aneurysm replacement 1 year ago. Electrocardiography at admission was normal, and transthoracic echocardiography showed no asynergy. Coronary angiography (CAG) indicated a dominant right coronary artery (RCA) as well as both the left anterior descending coronary artery (LAD) and left

circumflex coronary artery (LCx) anomalously deriving from near the ostium of the RCA (Figure 1A-C). The LCx had a severe stenosis in the bifurcation of obtuse marginal (OM) branch (Figure 1B). Coronary computed tomography (CT) confirmed CAG findings and SCA diagnosis arising from the right sinus of Valsalva (Figure 1D, E). Based on the distribution of calcification, the distal LCx would be preferable to the OM branch as a distal stent-edge site (Figure 1F, white arrow). Because of difficulty in engaging guiding catheter, we used a 7 Fr-matched GEC (Guideliner, Vascular Solutions Inc., MN, USA) through a 7 Fr amplatz left-type guiding catheter via the left radial artery, and advanced a guidewire (Sion blue, Asahi Intecc Co., Aichi, Japan) into the distal LCx. The 7 Fr-matched GEC tended to be in the wedged position. Thus, we exchanged the GEC for a downsized 6 Fr-matched GEC (GUIDE PLUS, NIPRO, Osaka, Japan), and performed pre-procedural CAG and intravascular ultrasound imaging (IVUS) (Figure 2A, B and Figure 3). We confirmed the presence of significant lumen narrowing at a site just proximal to the bifurcation of the OM branch on IVUS (Figure 3D). The proximal reference (Figure 3 E), distal (Figure 3B), and minimal lumen areas (Figure 3 D) were 9.56 mm² (mean lumen diameter, 3.49 mm), 6.30 mm² (mean lumen diameter, 2.83 mm), and 1.65 mm² (mean diameter lumen, 1.45 mm), respectively. After crossing another guidewire (Fielder, Asahi Intecc) across the OM branch as a protection wire and predilating using a balloon catheter (Scoreflex, 2.5/10 mm, OrbusNeich, Hong Kong, China) at 10 atm, we implanted an

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Figure 1. CAG (A: Left anterior view; B: Right anterior caudal view; C: Anterior-posterior cranial view). Volume-rendered three-dimensional images (D: Anterior-posterior cranial view; E: Right anterior caudal view) and slab maximum intensity projection image (F: Right anterior caudal view) of the coronary CT. An anomalous LCx arising from the just proximal RCA traverses anterior to pulmonary artery (green color).

Figure 2. PCI for the bifurcated lesion of the anomalous LCx in SCA (A-F: Right anterior caudal view), using a 7 Fr guiding catheter (black arrowheads) and 6 Fr-matched GEC (A, white arrowhead) or 7 Fr-matched GEC (E, white arrowhead).

Figure 3. Pre-procedural (B-E: Corresponding to arrows in A) and post-procedural images (F corresponding to D) from IVUS. A: Magnified right anterior caudal view of pre-procedural CAG. B: Image at distal reference site showing a focal superficial calcification, consistent with the CT findings (Figure 1F). C: Image at bifurcation of the obtuse marginal branch. D: Image at site just proximal to the bifurcation showing much plaque with heterogeneous echo intensity. E: Image at the proximal reference site. F: Image at the same site of D showing optimal expansion and apposition of the stent.

everolimus-eluting stent (Xience Alpine, 3.0/12 mm, Abbott, CA, USA) at 10 atm (Figure 2C). After recrossing a 0.010-inch guidewire (ATHLETE eel SLENDER, Japan Lifeline, Tokyo, Japan) into the OM branch, we dilated the just proximal OM branch lesion with a 0.010-inch-wire-compatible balloon catheter (IKAZUCHI X Hyp, 2.0/15 mm, KANEKA, Osaka, Japan) at 8 atm. We then post-dilated the stent with a balloon catheter (NC Euphora, 3.25/6 mm, Medtronic, MN, USA) at 20 atm. Because of severe residual stenosis at the stent-jailed OM branch (Figure 2D), we exchanged the 6 Fr-matched GEC for the upsized 7 Fr-matched GEC and added KBI [0.014-inch-wire-compatible balloon catheter (IKAZUCHI Zero, 2.5/10 mm, KANEKA) for LCx, 0.010-inch-wire-compatible balloon catheter (IKAZUCHI X Hyp, 2.0/15 mm, KANEKA) for the OM branch] at 8 atm through the 7 Fr-matched GEC (Figure 2E). Despite residual stenosis in the OM branch, final CAG and IVUS showed acceptable results (Figures 2F, 3F). The patient was discharged one day after the procedure and was free of angina.

Discussion

Coronary CT plays an important role in examining the whole, complex coronary structure, including ostial location, anatomical distribution, and transverse trunk course among in patients with SCA. According to Lipton's classification³⁾ and CT findings, this case would be

categorized in the R III group because the SCA derived from the right sinus of Valsalva, the LCx arising from the proximal RCA traversed anterior to the pulmonary artery, and the LAD originating from the proximal RCA ran between the aorta and pulmonary artery. In addition, coronary CT determines optimal working-view angle for PCI, and depicts the distribution of plaque and calcification, leading to optimal single stenting, as shown in this case.⁴⁾

In majority of SCA cases, anomalous vessels tend to have an acute angle takeoff near the SCA ostium. Therefore, it is generally difficult to coaxially engage a guiding catheter to the ostium. Uncoaxial engagement of a guiding catheter has a risk of vessel injury, and flow-limiting dissection around the ostium of SCA during PCI would rapidly lead to catastrophic hemodynamic compromise due to whole heart ischemia. Careful deep insertion of GEC stabilizes the guiding catheter, facilitates device deployment, and might prevent guiding catheter-induced dissection in patients with SCA.⁵⁾

One of the disadvantages of GEC is the difficulty in simultaneously introducing multiple devices through GEC because of its low profile. Recently, PCI using a small-diameter guiding catheter has gained more interest, and 0.010-inch guidewires together with 0.010-inch-wire-compatible balloon catheters are frequently being used in "slender PCI" with a 5 Fr guiding catheter.⁶⁾ Regarding device diameters in this case, the inner diameter of the 7 Fr-matched GEC (Guideliner) was 1.57 mm and that of

the 6 Fr-matched GEC (GUIDE PLUS) was 1.3 mm. The diameter of the 0.014-inch-wire-compatible balloon catheter (IKAZUCHI Zero, 2.5/10) was 0.78 mm and that of the 0.010-inch-wire-compatible balloon catheter (IKAZUCHI X Hyp, 2.0/15) was 0.71 mm. Therefore, the summed maximum diameter of the two balloon catheters was 1.49 mm, and indeed, it was possible to handle these two balloon catheters through the 7 Fr-matched GEC without resistance during KBI procedure. In contrast, because diameters of conventional semi-compliant 0.014-inch-wire-compatible balloon catheters are approximately 0.80-0.85 mm, it is theoretically difficult to deliver two conventional 0.014-inch-wire-compatible balloon catheters through the 7 Fr-matched GEC in general. Although the bifurcation lesion still remains a therapeutic challenge for GEC-based PCI,⁷⁾ based on the findings from coronary CT and IVUS, we successfully implanted an everolimus-eluting stent through 6 Fr-matched GEC and performed KBI using 0.014- and 0.010-inch system through 7 Fr-matched GEC in this case.

Conclusion

This case suggests that GEC-supported PCI using 0.014- and 0.010-inch system under coronary CT and IVUS guidance can be used as a revascularization therapy of choice for patients with SCA with bifurcation lesion.

Disclosures

Conflicts of interest: The authors have no conflicts of interest regarding the content of the manuscript.

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