Balloon-Anchored CoKatte® for Successfully Delivering Balloons for an Occluded Anomalous Right Coronary Artery

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Abstract

Keywords

- percutaneous coronary intervention
- coronary vessel anomalies
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- CTO

Percutaneous coronary intervention (PCI) for anomalous right coronary artery (RCA), originating from the left coronary cusp is challenging, because of the difficulty in engaging the guiding catheter coaxially, and delivering balloons and stents. A 65-year-old man with effort angina underwent PCI for anomalous RCA. This report describes the method we used. Although, delivering the balloon was difficult in short of the guiding catheter's backup force, we finally succeeded by using one more guiding catheter and the balloon-anchored CoKatte®, a novel, straight 4.5-French child catheter, to strengthen the backup force.

The abnormal origin of the right coronary artery (RCA) from the left aortic sinus of Valsalva is a rare congenital anomaly found in 0.15 to 0.28% cases of coronary angiography. Of all these cases, an estimated 0.06% of patients undergo percutaneous coronary intervention (PCI).^{1,2} Performing PCI for an anomalous origin of the RCA from the left aortic sinus of Valsalva is challenging, because of the difficulty in engaging the guiding catheter coaxially, and delivering balloons and stents. Adequate guiding support for an anomalous RCA is necessary for successful PCI. In previous case reports, the Amplatz left catheter or Judkins left catheter was successfully used in PCI for anomalous RCA.^{3,4} Nevertheless, we often experience difficulty in engaging these guiding catheters. In another report, use of the steam-deformed Judkins left guiding catheter with the GuideLiner® catheter (Japan Lifeline, Tokyo, Japan) was promising to deliver stents for anomalous RCA, as it overcame the problem of incorrect coaxiality.⁵ In the case of PCI for a chronic occluded coronary artery, stronger backup support is needed, because the lesion solidity obstructs balloons. The CoKatte® (Asahi Intecc, Nagoya, Japan) is a novel, straight 4.5-French (F) child catheter that produces coaxial guiding catheter extension. We describe the case of an occluded, anomalous RCA, in

which the balloon-anchored CoKatte® was effective for delivering balloons in PCI.

Case Report

A 65-year-old man with a history of a previous PCI for anomalous RCA, originating from the left aortic sinus of Valsalva, for unstable angina 8 years ago was referred for effort angina. He was found to have stenosis of the proximal RCA and chronic total occlusion of the mid RCA, as detected by coronary angiography with a 4-F diagnostic catheter (►Fig. 1A). Retrograde filling of the distal RCA occurred via a septal perforator from the left anterior descending artery (►Fig. 1B). After discussion, the patient opted to undergo PCI. We used a 7-F sheath (Terumo, Tokyo, Japan) via the right femoral artery and tried to engage a 7-F Judkins left 5 guiding catheter (Mach 1®, Boston Scientific, MA, USA); however, this did not work. Therefore, we used a 7-F sheath (Glidesheath slender®) via the right brachial artery and succeeded in engaging the same guiding catheter. Nevertheless, coaxially engaging the catheters was difficult. First, we delivered a 3.5 × 18 mm drug-eluting stent (Ultimaster®, Terumo) into the proximal lesion (►Fig. 2A) and inserted a 4.5-F CoKatte®

Fig. 1 Diagnostic coronary angiogram of the right coronary artery and the occluded site (arrow); (A) the right coronary artery originates from the left coronary cusp in the left anterior oblique view; and (B) retrograde filling of the distal right coronary artery (RCA) is shown via a septal perforator (arrow) from the left anterior descending artery.

into the proximal RCA for the purpose of strengthening the backup force. A tapered hydrophilic guidewire (Gaia Third, Asahi Intecc) with an extra support microcatheter (Caravel®, Asahi Intecc) was not successfully advanced into the occluded segment due to insufficient backup force. There-

fore, we manipulated the wire during inflation of a 1.5 mm monorail balloon (Tazuna®, Terumo) through the wire lumen and succeeded in advancing it through the occluded segment (►Fig. 2B). However, no microcatheter or balloon could be advanced through the segment, because the lesion was very

Fig. 2 (A) A 3.5 × 18 mm drug-eluting stent (Ultimaster®, Terumo, Tokyo, Japan) is deployed; (B) the wire is manipulated during inflation of a 1.5 mm monorail balloon (Tazuna®, Terumo) through the wire lumen; (C) the CoKatte® is fixed to the vessel wall of the right coronary artery after inflation of a 2.25 mm balloon (Tazuna®, Terumo) with 10 atm at the stented segment; and (D) the final angiogram shows satisfactory antegrade flow after successfully stenting.

hard. We performed side branch anchoring technique in right ventricular branch to strengthen the backup force, but that was not sufficient. Therefore, we decided to use coaxial in-stent anchoring technique. However, because the anchoring point was the proximal of the occluded segment, the anchoring balloon must have locked the shaft of another balloon, which we wanted to advance through the lesion. We inserted a 6-F Judkins left 4 guiding catheter (Mach 1®, Boston Scientific) via the right femoral artery. To fix the CoKatte® to the vessel wall of the proximal RCA, we delivered and inflated a 2.25 mm balloon (Tazuna®, Terumo) from the 6-F Judkins left 4 guiding catheter with 10 atm at the side of the CoKatte® on the stented segment (→Fig. 2C). A 1.0 mm balloon (IKAZUCHI Zero®, Kaneka, Tokyo, Japan) was able to be advanced through the occluded segment and dilated the lesion. After dilatation with the upsized balloon, we delivered three drug-eluting stents (Ultimaster®, Terumo) from the proximal to distal RCA, and the final angiogram showed satisfactory antegrade flow (→Fig. 2D).

The patient was discharged 2 days later without any complication, and he remained asymptomatic at the 1-year follow-up.

Discussion

This case report described use of the balloon-anchored CoKatte® to successfully deliver balloons for an occluded anomalous RCA, for the first time in vivo and in a human. Performing PCI for an anomalous RCA is challenging, because of the difficulty in achieving coaxial engagement of the guiding catheter, and in delivering balloons and stents to the distal side of the lesion. A previous paper suggested that upper limb artery access, not femoral artery access, facilitates PCI of an anomalous RCA.⁶ In line with this report, the brachial artery access facilitated engagement of the guiding catheter to the anomalous RCA in our patient. After successful wiring, delivery of the devices was difficult due to lesion solidity and insufficient guiding backup force. There was no appropriate side branch for balloon-anchoring to obtain backup force. Therefore, we used a child catheter, which has been reported to facilitate PCI of an anomalous RCA,⁵ but it did not work independently. To strengthen the backup force, manipulation of a guidewire during balloon inflation and fixation of a child catheter with an inflated balloon were needed. The 4.5-F CoKatte® catheter is a straight catheter with an outer diameter of 1.5 mm and a length of 120 cm, and it is compatible with a 6-F guiding catheter. The feature of this catheter is the hydrophilic coating over almost the entire length of the catheter (105 cm) to reduce friction during its advancement. Previous reports have described effectiveness of the CoKatte® for stent delivery.⁷ The novelty of this report is the innovative usage of the CoKatte® and another interventional system, which produce the extraordinary strong backup force for successful delivery balloons for an occluded anomalous RCA. In the present report, we could advance the CoKatte® just in front of the occluded segment, but we could not advance any balloon through the

lesion, because of the lack of backup force. Therefore, we introduced another guiding catheter, another guide wire, and another balloon outside the CoKatte®, and fixed it inside the vessel by inflated balloon. This method strengthened the backup force and resulted in the successful PCI. In the present case, an inflated 2.25 mm diameter balloon with 6 atm did not sufficiently fix the CoKatte® to the stent, which was deployed to the proximal RCA with an inner diameter of 3.5 mm. Accordingly, we increased the pressure from 6 to 10 atm and consequently, succeeded in fixing the CoKatte® to the vessel wall. A concern about this method is deformation of the CoKatte® by external force, which might result in some issues, when passing balloons and stents through the inside of the lumen. Fortunately, we felt only a little friction between the CoKatte® and other devices. If intravascular imaging from inside the CoKatte® was performed at the fixed area, it would have been revealed that the deformation was not severe.

Conclusions

Use of the balloon-anchored CoKatte® to successfully deliver balloons is a novel and feasible method for an occluded anomalous RCA. We think this method can be one of the treatment options in a similar situation.

Conflict of Interest

The Authors declare that there is no conflict of interest. Authors obtained informed consent from the patient to publish this paper.

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