Extreme Coronary Guide Catheter Support: A Case of a Novel Telescopic Guide Catheter System with a Contralateral Aortic Wall Support

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ABSTRACT: Extra support of the guide catheter is necessary in some cases of percutaneous coronary intervention (PCI). We describe a successful case of PCI of a very calcified and tortuous right coronary artery in which a modification of a novel telescopic guide system was applied. A long sheath that "armored" the guide catheter allowed extreme support derived from the contralateral aortic wall. The operator can adjust the support of the guide system from soft to extremely stiff.

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Severe calcification and/or tortuosity of the coronary artery decrease the success of percutaneous coronary intervention (PCI).[1] In such cases, adequate support of the guide catheter is of paramount importance. We describe a case involving a very calcified right coronary artery (RCA) in which a modification of our previously described method was used to support drug-eluting stent (DES) delivery.[2]

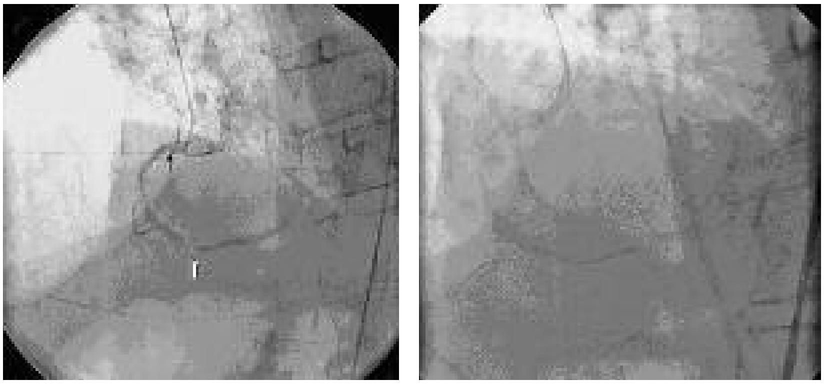

Figure 1. *RCA in LAO projection. Left: angiogram with a 4 Fr JR4 catheter showing a critical lesion in the distal part of the vessel (white arrow). Right: RCA before contrast injection (a 6 Fr FR guide) with severe calcification throughout its course. The guide was unable to be advanced deeper into the RCA due to a bend in its proximal part.*

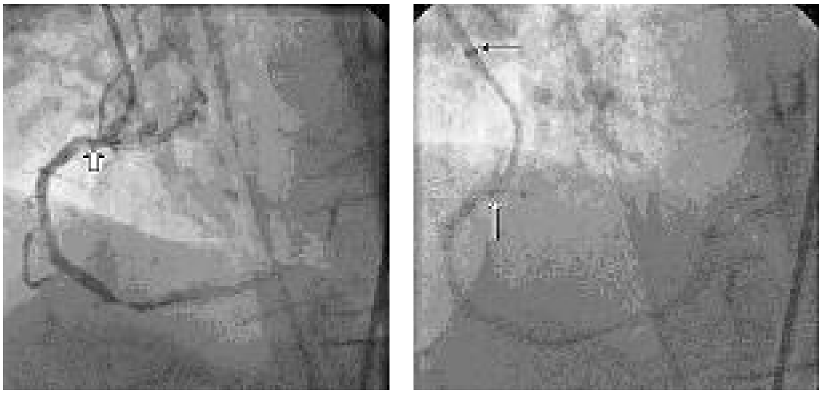

Figure 2. *RCA in LAO projection. A JR 4 6 Fr guide is "armored" with a peripheral sheath (black arrow points to its tip). The guide derives longitudinal support from the stiffening effect of the peripheral sheath as well as 2 guidewires and the balloon catheter. This "armored guide catheter" technique allowed passage of 2 guidewires and a balloon only (not a stent) due to a very proximal bend in the RCA (white arrow) and an inability to engage its ostium deeply enough.*

Case Report. *An 82-year-old male presented with unstable angina. There was no evidence of heart failure on physical exam and chest X-ray. Eectrocardiography revealed dynamic inferior wall ST-depressions with T-wave changes. Cardiac catheterization showed no obstructive disease in the left coronary system, but a large RCA was severely calcified and had a 70% mid and 99% distal stenosis (Figure 1). Collateral vessels from the left coronary artery to the RCA were evident. Echocardiography showed normal global left ventricular function with inferior hypokinesis and no significant valvular disease.*

Due to a very severe calcification of the proximal RCA and its tortuosity (90º bend a few millimeters from the ostium), difficulties with PCI device delivery were anticipated. Thus, a 7 Fr 90 cm long straight Raabe sheath (Cook, Inc., Bloomington, Indiana) was inserted via the femoral artery and its tip advanced to the level of the ascending aorta. Through this sheath, a 6 Fr FR4 guide catheter was inserted and used to engage the RCA ostium. Deep engagement of the coronary ostium with the guide was not possible due to calcification and a sharp bend a few millimeters from the ostium, even with a 0.014 inch BMW guidewire (Guidant Corp., Indianapolis, Indiana) and a balloon catheter placed in the artery. The peripheral sheath was advanced in a

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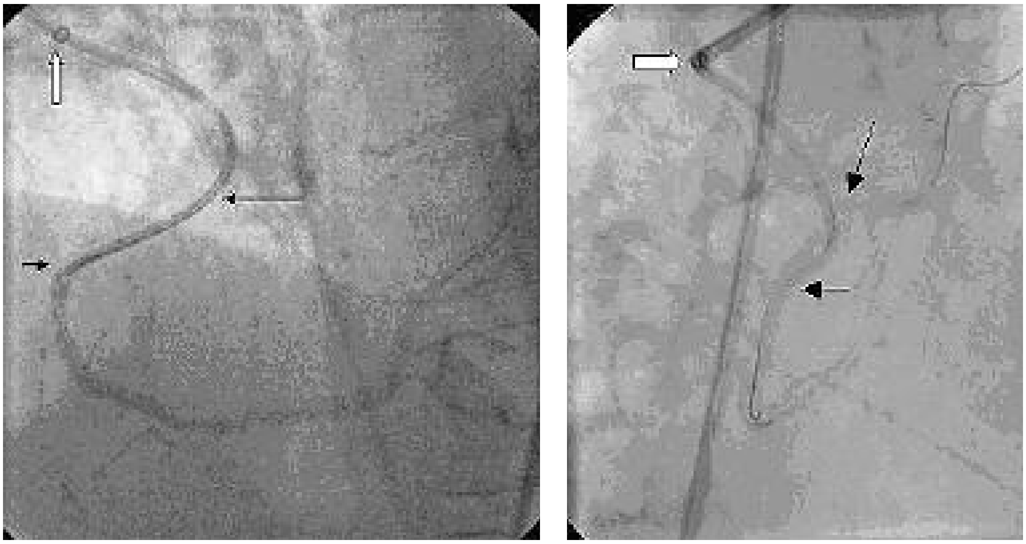

Figure 3. *RCA in LAO and RAO views engaged with a 6 Fr FR4 guide "armored" with a 7 Fr straight sheath. The sheath tip (white arrow) is pointing towards the contralateral aortic wall and the guide tip is in the mid RCA (short black arrow). The long black arrow points to the RCA ostium.*

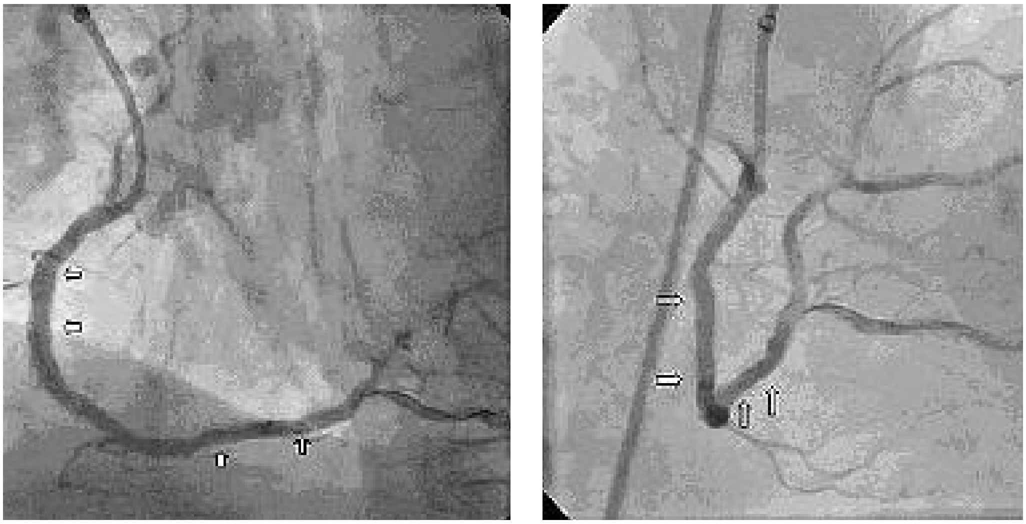

Figure 4. . *Final result with arrows pointing to the segments covered by the stents.*

manner previously described over the fixed guide, guidewire, and balloon catheter system until its tip was 2–3 cm from the guide tip.[2] The guidewire placed across the distal RCA lesion would not advance further until a balloon catheter was inserted over it to the mid RCA for additional support. We previously described this "armored guide catheter" system which, in this case, allowed dilatation of the distal and mid RCA lesions with a Voyager Rx 2.0 mm x 12 mm balloon catheter (Guidant). However, it was not supportive enough (even with an additional "buddy" BMW guidewire) to pass a Taxus® stent (Boston Scientific Corp., Natick, Massachusetts) to the distal lesion. The stent would not cross the mid lesion. A few millimeters of the proximal RCA gained by the guide tip did not provide enough support to prevent it from coming out of the artery, in spite of the increased system stiffness derived from the peripheral sheath (Figure 2).

The RCA had a horizontal takeoff, thus the forward force on the guide would displace it downward out of the RCA, rather than deeper into it. At this point, the peripheral sheath was pulled back 5–10 cm over the fixed guide catheter, which decreased the stiffness and changed the geometry of the system, allowing advancement of the guide deeper into the proximal RCA over the guidewire and the stent catheter (positioned in the mid RCA). With this maneuver, the guide catheter was bent in such a way that it touched the contralateral aortic wall. Next, the Raabe sheath was advanced forward over the fixed guide so that its tip reached the contralateral wall of the ascending aorta, providing the support for further advancement of the guide into mid RCA (Figure 3).

The 3.0 mm x 12 mm Taxus stent was delivered to the distal lesion, and the mid lesion was stented with 3.0 mm x 16 mm and 3.5 mm x 12 mm Taxus stents without difficulty. The final result was very good (Figure 4). The patient had an uncomplicated hospital course and was discharged home in good condition.

Discussion. In order to increase the success of PCI device delivery, a multitude of techniques has been advocated including extra backup guide types, larger guide diameters, specialty guidewires, "buddy" wires, and deep-seating of guides.[1,3,4] The guide size, the angle between the guide and aorta on its reverse side, as well as the contact area of aorta with the guide, have been found to be associated with the increased backup force *in vitro*.[5]

We recently described an "armored guide catheter system" technique that provides up to extreme, yet adjustable, guide support without deeply intubating the coronary ostium. The technique uses a peripheral sheath that slides over the guide;

the closer the sheath tip is to the engaged with the guide tip coronary ostium, the more supportive the system becomes.[2] We have tried this technique successfully for downward and horizontal coronary artery takeoffs. In the current case, the RCA had a horizontal takeoff; however, due to a very proximal bend and calcification, the guide could not be seated deep enough to take advantage of the peripheral sheath providing longitudinal support. In spite of the very stiff telescopic guide system, the guide prolapsed into the aorta with attempts at DES delivery. The ability of regulating the stiffness and geometry of the system allowed us to deeply engage the RCA using the contralateral aortic wall for support. Although the maneuvers involved in the technique described above might appear complex at first, we found them quite intuitive and reproducible.

In the case described here, DES implantation was possible as a direct result of an extremely supportive telescopic guide catheter system. The long sheath can stiffen and support the guiding catheter to the required extent depending on how close one advances it towards the tip of the guide, as we described in previous cases.[2] However, the current case required a modification of this technique, which involved deep intubation of the RCA with the guide, taking advantage of the adjustable stiffness of the system. Different degrees of support can be obtained by regulating the distance between the tips of the sheath and the guide; however, in this case, the peripheral sheath tip was placed at the contralateral aortic wall, rather than close to the guide tip, allowing the guide to be “bounced off” the aortic wall deep into the coronary artery.

In our case, alternatives to facilitate DES delivery included an aggressive guide (*i.e.*, Amplatz), rotational atherectomy, and the classic telescopic guide method. An Amplatz catheter typically provides excellent backup, as long as it is seated well in the RCA; however, problems with deep-seating due to the proximal tortuosity/calcium were anticipated. These, in turn, increase a risk of ostium/aortic injury. Guidewire passage difficulties practically precluded rotational atherectomy, as we needed to strengthen the guide with the peripheral sheath and derive some additional support from a balloon catheter to pass even the guidewire far enough into the vessel. Once the “armored guide” system was in place, atherectomy was not necessary to facilitate DES delivery, although it would also have provided debulking of the lesions.

Telescopic systems use has been described in carotid and cerebral angiographic procedures.[6,7] The usual engagement of the artery with a larger guide catheter (*e.g.*, 6 Fr, 100 cm long) and advancing a smaller, longer guide catheter (*i.e.*, 5 Fr, 110 cm guide) deeper into the artery can provide extra support proportional to the depth of intubation. It was not a good option in our case due to the shelf of calcium at the acute bend a few millimeters from the ostium. Our extra backup method is different from the previously described telescopic systems, as deep engagement of the coronary artery is achieved by active changes of the system’s stiffness and support derived from the straight peripheral sheath placed at the aortic contralateral wall. The peripheral sheath, the guide, guidewire(s), and balloon/stent catheter (placed in a coronary) can be manipulated a single component at a time, or in any combination of the parts, to achieve the desired guide position and system geometry/stiffness.

The utmost caution must be exercised when advancing the sheath close to the coronary ostium, and even more caution when advancing the guide deep into the coronary artery, using this “aortic bouncer” system, as the guide tip-induced injury of the coronary artery or the aorta is possible. As the sheath advances over the guide catheter, it will straighten its curves, causing the tip of the guide to move forward.

The Raabe sheath has excellent trackability due to its hydrophilic coating, yet it is quite stiff, providing good support. Also, the Raabe sheath has a tip marker which is necessary to precisely and safely advance it to the desired location. It comes in 5–8 Fr sizes; the larger-diameter sheaths will provide more support. For the described technique, a sheath long enough to reach the ascending aortic contralateral wall must be used, which leaves a choice of 70 cm or 90 cm lengths, depending on the height of the patient.[8] Other peripheral intervention sheaths can also be tried.

This novel telescopic guide catheter system provides extreme support with the versatility of 3 movable components, allowing for the regulation of the degree of support. Other benefits include no need for another introducer sheath in the access artery and, if significant peripheral disease is present, the use of a long and flexible sheath will facilitate coronary PCI. The method’s primary shortcoming will be the increased risk of complications due to the stiffness of the system. The peripheral sheath is much stiffer (and yet deliverable) than the coronary equipment that cardiologists are used to. Thus, pushing it in too deep is a serious concern. Also, exchanging at the access site for a peripheral sheath may increase the risk of bleeding. The cost of the procedure may modestly increase due to the use of a specialty sheath. However, costs may be reduced if the system is used initially, rather than after unsuccessfully attempts with multiple guides and wires. We recommend this telescopic guide catheter system as an option in carefully selected cases when difficulty with introducing the equipment is anticipated and when experienced operators are available.

References

1. Freed MS, Safian RD. Proximal vessel tortuosity and angulated lesions. In: Safian RD, Freed MS. *The Manual of Interventional Cardiology, 3rd Edition.* Royal Oak, Michigan: Physician’s Press. 2001, p.13, pp.237–241.
2. Stys A, Lawson W, Brown D. Extreme coronary guide catheter support: Report of two cases of a novel telescopic guide catheter system. *Catheter Cardiovasc Interv* 2006;67:908 –911.
3. Bartorelli A, Lavarra F, Trabattoni D, et al. Successful stent delivery with deep

seating of 6 French guiding catheters in difficult coronary anatomy. *Catheter Cardiovasc Interv* 1999;48:279–284.
4. Abhaichand R, Lefevre T, Louvard Y, Morice M. Amplatzing a 6 Fr Judkins right guiding catheter for increased success in complex right coronary anatomy. *Catheter Cardiovasc Interv* 2001;53:405–409.
5. Ikari Y, Masakazu N, Kim JY, et al. The physics of guiding catheters for the left coronary artery in transfemoral and transradial interventions. *J Invasive Cardiol* 2005;17:636–641.
6. Voigt K, Djindjan R. Super-selective cerebral angiography, III. Diagnostic use and therapeutic possibilities of the telescopic catheterization technic in the circulation area of the external carotid artery in man. *Rofo* 1976;125:214–218 (in German).
7. Goktekin O, Ru L, Collinson J, di Mario C. Successful crossing of a severe spasm of the brachial artery using a telescopic approach. *Int J Cardiovasc Interv* 2005;7:63–64.
8. Flexor® Check-Flo® Introducers. Raabe modification. Available at http://www.cookmedical.com.