

## Are catheter extension devices one step forward for complex coronary interventions?

Complex percutaneous coronary interventions (PCI) are increasing day by day. However, there are still some anatomical features (such as marked calcification, tortuosity, and chronic total occlusions) that remain a challenge for the delivery of angioplasty balloons and stents, leading to a considerable percentage of stent deployment failure (around 3–5%) (1). In this context, there are several techniques aimed at improving PCI success, which can be grouped into three categories: i) increase in back-up support, mainly driven by guide catheter, ii) increase in guide-wire support (stiffer wires, “buddy wire,” anchoring, etc.), and iii) plaque modification (aggressive predilatation, cutting balloon, rotational atherectomy, etc.) (2–4). All of them are useful in daily clinical practice as complementary strategies; nevertheless, there is no evidence of direct comparison among them. Back-up support depends on two components: passive support given by the guide back-up against the opposite aortic wall and the stiffness of the guide, and active support achieved by coaxiality and deep engagement of the guide. Among these techniques, there are guide catheter extension devices, such as the GuideLiner® catheter (Vascular Solutions Inc.), that allow a deep intubation and provide greater support and coaxiality while the guiding catheter remains steady in the aorta (5).

The GuideLiner® catheter extension device consists of a monorail system, which extends the distal end of the guide catheter (“mother–child” fashion), with a length of 25 cm and thickness of 1 French less than the guide. GuideLiner® is inserted into the guide catheter through the hemostatic valve and advanced until it reaches the coronary artery. It allows deep intubation into the artery, which provides great coaxiality and enhanced support. Therefore, the use of GuideLiner® is suitable when facing unexpected delivery challenges during PCI without the need for guide catheter exchange. There are also other commercially available monorail guide extender catheters, such as Guidezilla™ (Boston Scientific), Kiwami (Terumo, Tokyo, Japan), and Cockatte (Asahi Intecc).

In this issue of the *Anatolian Journal of Cardiology*, Author et al. (6) reported one of the largest published series using the GuideLiner® catheter. This series includes 64 consecutive patients from 2 centers in a period of 2 years. GuideLiner® was used mainly to increase back-up support while treating complex coronary stenosis (90.6% B2 or C AHA/ACC lesions) in arteries with heavy calcification, marked tortuosity or other challeng-

ing situations such as chronic total occlusion or saphenous vein graft. The device was successfully used (i.e., adequately placed in the selected coronary artery with the desired deep intubation) in 96.9% of the cases, with a mean depth of intubation of 30.3±21.6 mm. In this study, this device showed an excellent safety profile since no coronary dissection was induced. The presence of significant proximal lesion was the reason for device failure. In all those cases when GuideLiner® was properly used except for one, a coronary stent could be deployed, providing a high procedural success (95.3%). It is to note that only a minor complication was reported: a case of stent dislodgement inside the guide catheter, which was easily managed.

Author’s results are in concordance with and support the findings of other published series (6–13). With this available evidence, we can draw the following conclusions:

- A) GuideLiner® use is feasible in selected cases of challenging PCI. Reported success is consistently high (ranging from 90% to 100%) when the proximal artery segment is large (vessel diameter of at least 2.5 mm), no excessive tortuosity, and relatively free from disease (7,14). Therefore, careful case selection is mandatory.
- B) GuideLiner® shows a good safety profile. Its specific design is less traumatic to the arterial wall than deep intubation with conventional guide catheters, minimizing the risk of coronary dissection. When GuideLiner® has been associated to coronary dissections, these have occurred mainly in proximal segments of smaller arteries (11). Deformation or even dislodgement of the stent may occur at the transition between the hypotube and the monorail; to avoid this complication, it is advisable to advance the stent within the extensor area while it is in the straight part of the guide catheter (7, 13, 15). Other complications have been anecdotally described, such as air embolism and deformation of the extensor or displacement of the GuideLiner® catheter distal marker (7, 15). Other concerns for its use, such as ischemia induced by deep intubation, have not reported to be a major clinical issue.
- C) The high procedural success—optimal angiographic result with successful stent deployment in over 90% of cases (7)—should be interpreted with caution. PCI success in these complex scenarios cannot be attributed to a single device or strategy; it is rather the result of a sum of detailed and individualized steps applied. Moreover, all the evidence sup-

**Address for correspondence:** Sergio García-Blas, MD, Department of Cardiology, Hospital Clínico Universitario de Valencia, Valencia-Spain  
E-mail: sergiogarciablas@gmail.com

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porting the use of GuideLiner® is derived from observational studies subject to a number of confounders. Further studies comparing the safety and the efficacy of this device against other techniques in complex coronary interventions are warranted.

- D) There are several other applications for guide extension devices that are non-common situations but also challenging, such as engagement of anomalous origin of a coronary artery (16), coronary artery bypass grafts (17), selective contrast injection (7, 8), distal lesions in ectatic arteries, (8) and the anecdotally reported use for thrombus aspiration (18). These are examples of the potential utility of GuideLiner® in other challenging scenarios.
- E) It may be a particularly useful tool when using the radial approach. There is growing evidence stating the benefits of this vascular access regarding safety and even major cardiovascular events, but it provides a significantly lower support, which can be offset by GuideLiner® use. In the series published in the Anatolian Journal of Cardiology, all patients were treated by the femoral approach, but other available series reported GuideLiner® use with the radial approach, showing similarly successful results (13).
- F) A 5-in-6-Fr GuideLiner® is the most commonly used strategy, but the development of the 6-in-7Fr GuideLiner® allows the passage of larger devices, such as bioresorbable vascular scaffolds or rotablator burrs.

In summary, catheter extension devices have emerged as useful tools for increasing the efficacy in complex coronary procedures with an optimal safety profile. Prospective and comparative studies are still needed to establish the optimal role of these devices in the cath lab.

**Sergio García-Blas, Julio Núñez**

**Department of Cardiology, Hospital Clínico Universitario de Valencia, Valencia-Spain**

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