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Case Reports

How to perform distal anchoring technique by 6 French radial approach in complex coronary procedures☆

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ABSTRACT

Despite remarkable advances in the interventional landscape, device delivery during percutaneous coronary intervention (PCI) can still present technical challenges especially when performed in complex anatomical settings and through radial approach. To overcome difficult coronary stent delivery, several strategies have been developed. A niche option in such complex cases is the anchoring balloon technique, which involves inflation of a balloon non-coaxially in a side branch or distally to the target lesion in a coaxial fashion, to facilitate stent delivery. However, the main limitation of this technique is the requirement of a large guide catheter (≥7 French) which may preclude the use of radial approach. We describe, step-by-step, the distal anchoring ballooning technique performed by a 6 Fr radial approach to overcome the stent delivery failure in complex anatomical scenarios and to safely and successfully carry out the PCI procedures.

1. Introduction

Despite technological improvement, device delivery during percutaneous coronary intervention (PCI) can be still challenging especially in complex anatomies [1,2]. The presence of severe coronary tortuosity and heavy calcification may indeed enhance the complexity, the duration, and failure rate of PCI [3]. In addition, although associated with a net clinical benefit, the use of radial approach in complex lesion subsets may increase the procedural complexity and limit the success rate [4,5]. A key factor for procedural success remains the ability to deliver stents to the target lesion. Stent delivery failure may occur in up to 5% of PCI and can be associated with suboptimal angiographic result and increased morbidity [1,2]. To enhance the support, the operator usually appeals to tips and tricks such as catheter deep intubation, use of larger guiding catheter (GC) with more supportive shapes through femoral approach, buddy or extra support wires, predilation with progressive balloon sizes, "Child in Mother" technique with dedicated delivery catheters and shorter and more deliverable stents with an improved crossing profile [6,7]. An alternative option to increase the release capability is the anchoring balloon (AB) technique, consisting in the low-pressure inflation of a balloon in a side branch or distally to the target vessel in order to cross the lesion and delivery the stent [8–10]. In the classical non-coaxial AB technique, a balloon is inflated proximally in a side branch of the target coronary vessel, while in the coaxial distal AB technique, a balloon is inflated distal to, or at the target lesion to enhance support for device delivery [11]. However, the distal AB technique is usually performed with large (≥7 Fr) GCs and by femoral approach to allow simultaneous device advancement [8–10]. We sought to describe how the distal anchoring technique can be performed through the 6 Fr radial approach.

The main steps, with tips and tricks to perform the distal AB technique by radial approach are illustrated in Fig. 1. Additionally, the following cases exemplify the potential applications of this technique.

1.1. Case 1

A 74-year-old man with diabetes and moderate renal failure was admitted for a non-ST elevation myocardial infarction. He had a previous history of lateral acute myocardial infarction (MI) treated with PCI on left circumflex artery (LCX) and ramus. Coronary angiography, demonstrated a tight stenosis on the middle right coronary (RCA) that was markedly calcified and tortuous (Fig. 2A, B). A 6 Fr AL1 Launcher (Medtronic, Minneapolis, MN, USA) GC was used to increase the back-up support through right radial approach. A Whisper MS wire (Abbott Vascular, Santa Clara, CA, USA) was advanced distally. Despite repeated lesion predilation and the use of a "buddy" wire technique with an extra-support wire (Floppy II Extra-Support guide wire, Abbott Vascular Santa Clara, CA, USA), a 3.0 × 18 mm Resolute Integrity (Medtronic, Minneapolis, MN, USA) drug eluting stent failed to cross the lesion (Fig. 2C). The distal AB technique was therefore performed, inflating distally to the target lesion a semi-compliant 2.5 × 15 mm Trek (Abbott Vascular Santa Clara, CA, USA) balloon at low-pressure (6 atm),

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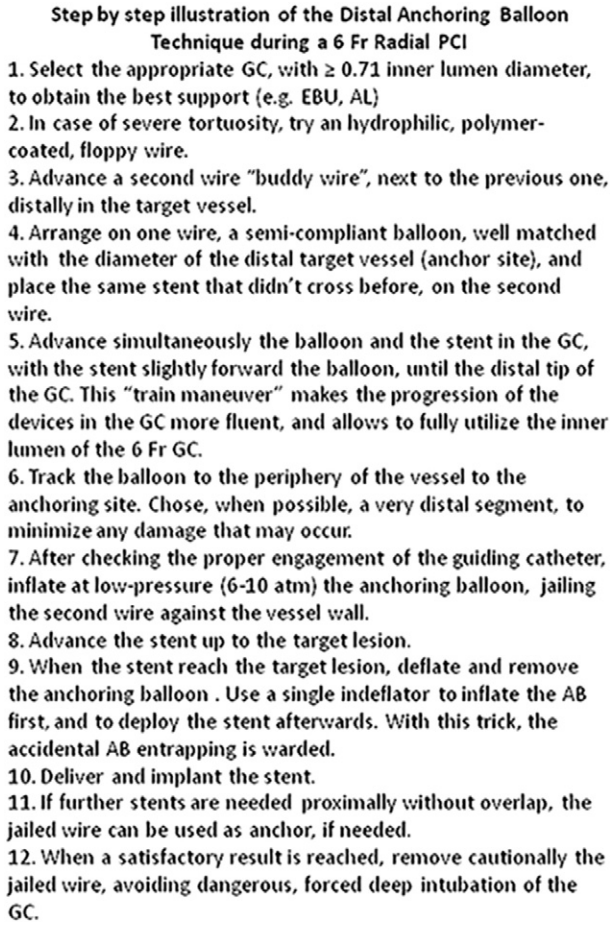

Fig. 1. Flow-chart of the distal anchoring balloon technique performed during a 6 Fr radial PCI. The main steps that describe the distal AB technique by 6 Fr radial approach with the relative tips and tricks are illustrated. GC: guiding catheter; EBU: extra back-up; AL: Amplatz Left; AB: anchor balloon.

allowing the advancement of the same stent (Fig. 2D, E). After the retrieval of the AB, the stent was successfully implanted with satisfactory final angiographic result (Fig. 2E, F). No complications occurred.

1.2. Case 2

An 80-year-old male, with a previous inferior MI, was admitted for worsening effort angina. Coronary angiography revealed a known chronic total occlusion (CTO) of the RCA, a mild stenosis of distal left main and a critical calcific stenosis of the proximal left anterior descending (LAD), involving the first diagonal branch (D1) with a 90 degree bend (Fig. 3A). PCI of the bifurcation LAD-D1 was attempted by 6 Fr radial approach. The left main was engaged with a 6 Fr EBU4 Launcher GC. After several predilations of the D1 branch and of the calcific proximal LAD with non-compliant balloons up to 3.0 × 15 mm, a 2.75 × 22 mm Resolute Integrity failed to cross the bend at the LAD lesion (Fig. 3B). On a buddy-wire, a semi-compliant 2.5 × 12 mm Trek balloon was then advanced distally into the LAD and inflated up to 8 atm, anchoring the main wire and the GC (Fig. 3C). The same stent was therefore easily advanced beyond the calcific bend of the LAD. After withdrawal of the AB, the stent was implanted with optimal final angiographic result (Fig. 3D).

1.3. Case 3

A 55-year-old man with new onset effort angina and low threshold inducible ischemia underwent coronary angiography by 6 Fr radial approach. The culprit lesion was a tight stenosis of mid LCX (Fig. 4A, B). Direct stenting with a 3.0 × 24 mm Resolute Integrity was attempted, but unexpectedly, the stent did not cross the 90 degree angle between the left main and LCX. Despite aggressive predilation of the stenosis on the LCX, and the use of an extra back-up wire (Floppy II Extra-Support guide wire, Abbott Vascular Santa Clara, CA, USA), it was impossible to reach the target site with the stent (Fig. 4C). Distal coaxial AB with an Emerge 2.5 × 12 mm balloon (Boston Scientific Corporation, Natick, MA, USA) inflated at 8 atm, allowed the easy progression of the stent (Fig. 4D, E). After balloon retrieval, the stent was deployed, jailing the second wire (Fig. 4F), that was subsequently retracted. After postdilation with a short non-compliant balloon a satisfactory final result was achieved (Fig. 4G, H). The subsequent hospitalization and 1-year follow-up were uneventful.

2. Discussion

The three cases here presented demonstrate how in selected PCI performed by 6 Fr radial approach the distal AB technique can be a safe and useful tool that enables stent delivery through challenging anatomy. The AB technique consists in the inflation of a balloon in a side branch (non-coaxial) or in the target vessel distally to the target lesion (distal, coaxial AB). The two variations of this technique are usually performed in chronic total occlusions (CTO), in tortuous vessels and in bifurcation lesions with straight angles using 7 Fr GCs and through the femoral approach [8–11]. To the best of our knowledge, only one case of non-coaxial AB performed by 6 Fr radial approach was described [12].

The peculiarity of the distal AB technique here described relies in the use of lower size GC by radial approach. Although our experience has been made mainly with one type of GC, we believe that any GC with internal lumen ≥0.071 in. may be used (e.g. Adroit GC, Cordis Corporation; Convey GC Boston Scientific Corporation; Heartrail (Ikari) GC, Terumo Interventional Systems; Launcher GC, Medtronic, Inc). Advantages of this technique are: (i) major support when compared with a non-coaxial AB technique, because the balloon, besides to prevent the retraction of the GC, jails the second wire distal to the lesion further increasing the support of the system; (ii) the stent delivery through challenging anatomy even in the absence of appropriate sized side branches proximal to the target lesion (condition sine qua non to perform the classical non-coaxial AB technique); (iii) the use of a 6 Fr radial approach even in challenging anatomical scenarios with all consequent benefits, such as the reduction of bleeding, patient comfort enhancement, and hospitalization time shortening [4,5]. Of course, sheatless 7 or 8 French GC, that allows nearly all balloon/stent combinations for distal anchoring, can be a valid alternative to a standard 6 Fr GC. Anyway, when the problem in advancing the stent occur during a standard procedure, in which the complexity is not clearly evident from the beginning, and we already started with a 6 Fr GC, like in the third case presented, the best strategy is to try to carry out the PCI with the same GC, utilizing the distal AB technique as a bail-out option.

A challenging step of this procedure is the advancement of a balloon and a stent in the 6 Fr GC mostly in case of tortuosity of epiaortic vessels. To allow the sliding of the devices in the lumen of the 6 Fr GC, we suggest to advance both simultaneously, with the stent slightly forward the balloon, until the distal tip of the GC. This maneuver, that we named "train maneuver", allows to fully utilize the inner lumen of the 6 Fr GC and to track up to a 3.5 mm actual stent (Fig. 5). Although in our practice we have, sometimes, reutilized a refolded balloon as distal AB, we suggest, mainly in the early experience, to use a new balloon. In our experience, we routinely utilize balloons up to 3.0 mm in diameter. Larger balloons are usually not necessary, considering that distal AB should be attempted in the periphery of the vessel, in order to minimize the eventual damage of the vessel wall. We are confident, that any kind of currently available balloon can be tracked in a 6 Fr 0.071 GC, together with an up to 3.5 mm stent, appealing to the "train maneuver".