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Distal side-branch technique: A new use for the Tornus® Catheter

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ABSTRACT

Percutaneous coronary intervention (PCI) outcomes of chronic total occlusions (CTO) lesions have improved in recent years due to a better understanding of the physiopathology of the disease, more effective techniques and improvement in the design of new devices. We describe a new use of the Tornus® Catheter in the anterograde approach for CTO treatment.

1. Introduction

The development of techniques to facilitate recanalization of chronic total occlusions (CTO) is an area of active interest in interventional cardiology and still remains a technical challenge [1]. The difficulty in its treatment is reflected in a lower success rate compared to other lesions (40% vs 98%) [2]. The treatment benefits include symptom relief, improvement in left systolic ventricular function and better long-term survival [3].

The main cause of procedural failure is the inability to cross the CTO with a guide-wire, which may occur in up to 70%–80% of failure cases [4,5]. The presence of a bifurcation or a trifurcation at the proximal or distal entry point of the CTO has been described as an anatomical predictor of failure [5]. When the distal cup of the occlusion ends in a bifurcation it has been reported that the wire tends frequently to advance up to the distal side branch, which is a "locus minori resistentiae" compared to the true distal main vessel lumen [4]. In this situation very often the wire also slides in a sub intimal layer. Exchange for a stiffer wire or the use of the parallel wire technique does not always help to penetrate the stiff distal cap of the CTO. The Tornus© catheter (Asahi Intecc, Aichi, Japan) is a device used in two situations: 1) to give better support compared to a micro-catheter for crossing the CTO in calcified lesions; 2) once the guide-wire has crossed the occlusion the Tornus catheter is able to create a small channel in "a non dilatable CTO" that allows its posterior dilatation [5].

We hereby describe a new technique which can help to cross-distal bifurcated CTO lesions, combining the use of Tornus© catheter into the distal side branch.

2. Technique description

In three different patients with CTO lesions anterograde approach was performed. In all cases the CTO was located in the right coronary artery.

In the first patient after advancing the guide-wire (Fielder XT, Asahi Intecc, Aichi Japan) supported by a micro catheter through the body of the CTO lesion, distal cap was not crossed. By parallel wiring technique with a Miracle 3 (Asahi Intecc, Aichi Japan), distal side branch was reached. After several attempts we never succeeded to progress the wire into the distal true lumen of the main vessel. At this moment the wire was left in the side branch and a Tornus® catheter was advanced creating a micro channel through the CTO body. After removing the Tornus® catheter, we succeeded to redirect the Miracle 3 guide-wire towards the true lumen of the main branch. This is the simplest scenario to apply the described technique (Fig. 1).

The second patient presented failure of redirecting the wire after Tornus® catheter micro-channel to the side branch. At this moment we decided to leave the Fielder guide-wire on the side branch and upgrade to a stiffer wire Confianza (Asahi Intecc, Aichi Japan) to successfully cross the CTO calcified body into the main branch and perform the percutaneous coronary intervention (PCI) (Fig. 2).

In our third patient, after creation of the micro-channel with the Tornus® catheter in direction to the side-branch, a parallel wire technique was applied due to advancement into the sub-intimal space after the bifurcation, allowing the access to the distal true lumen and finishing the PCI.

3. Discussion

Presence of side branch at the proximal or distal edge of CTO lesions represents a technical challenge in the PCI of the CTO, and it has been described as a predictor of failure [5,6]. As the side branch

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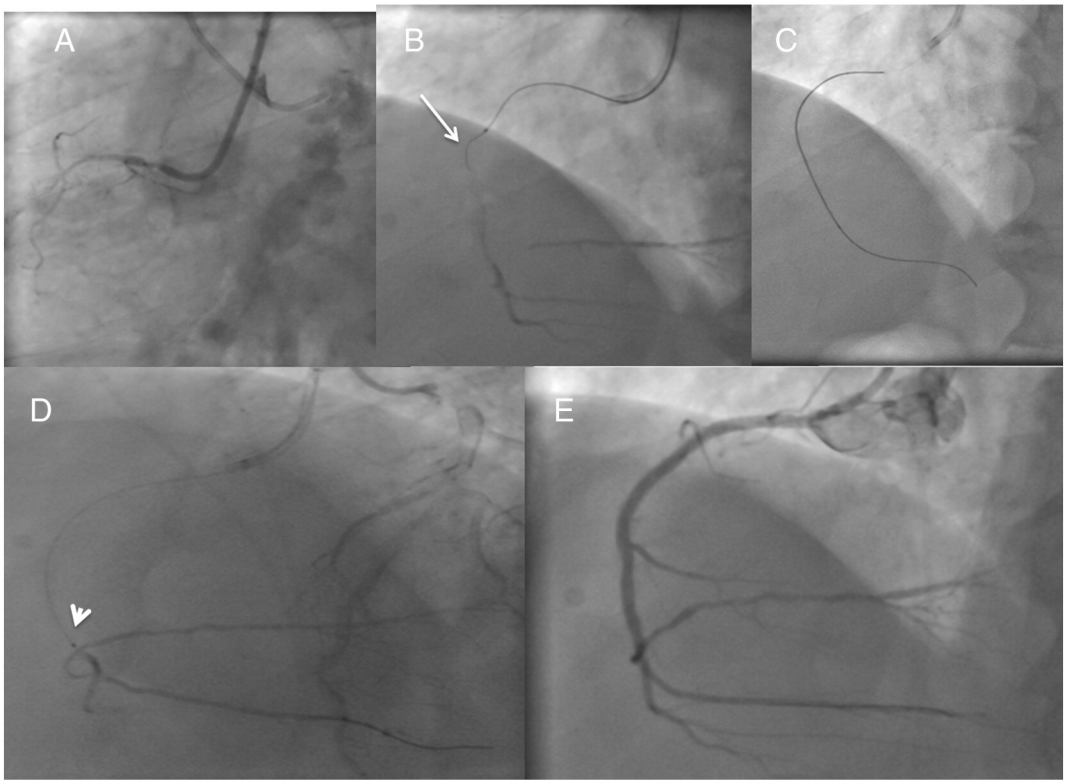

Fig. 1. (A) Anterograde injection of right coronary artery. (B) Fielder guide wire into the side branch (white arrow). (C) Tornus© catheter over a Miracle 3 in the side branch. (D) Contralateral injection shows guide wire on the micro catheter located in posterior descendent artery (White arrowhead). (E) Final result.

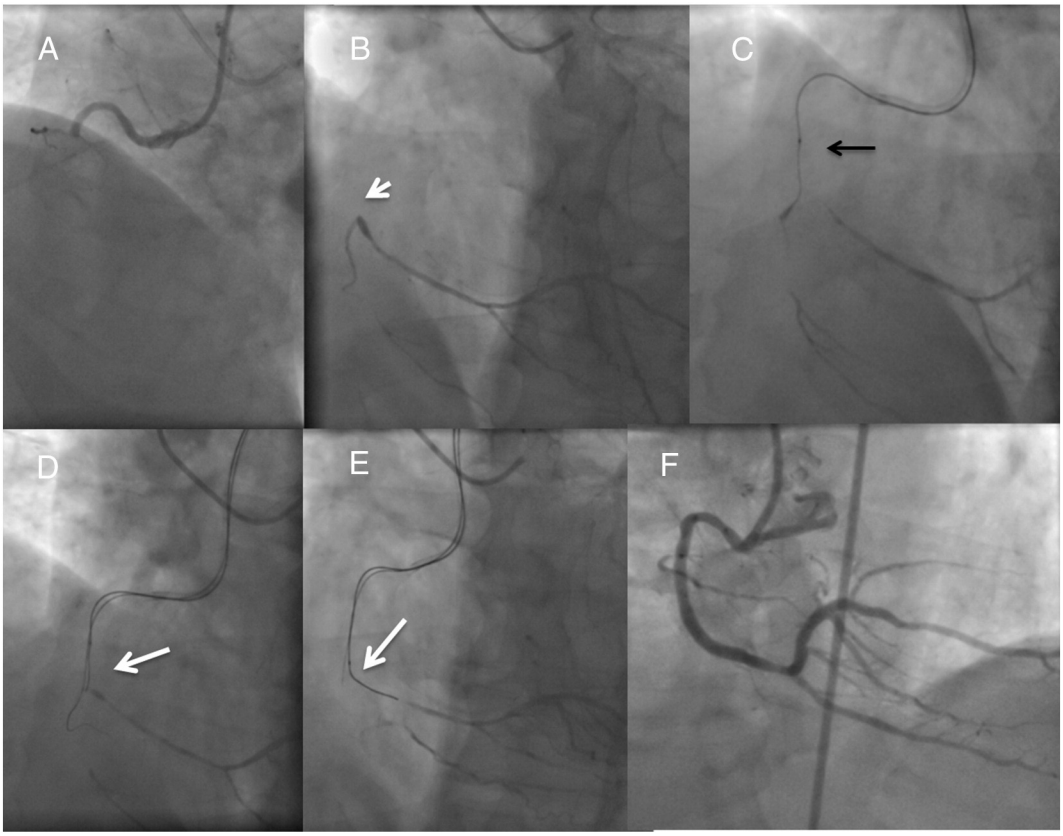

Fig. 2. (A) Right coronary artery: occlusion in the middle segment. (B) Collateral circulation from left coronary artery, distal cup of the occlusion ends in a bifurcation. (C, Arrowhead) Guide-wire advanced into the distal side branch and Tornus© catheter advancement. (D–E, Black Arrow) Fielder in the side branch a second stiffer wire as "parallel wire technique". (F, White arrow) Final Result.

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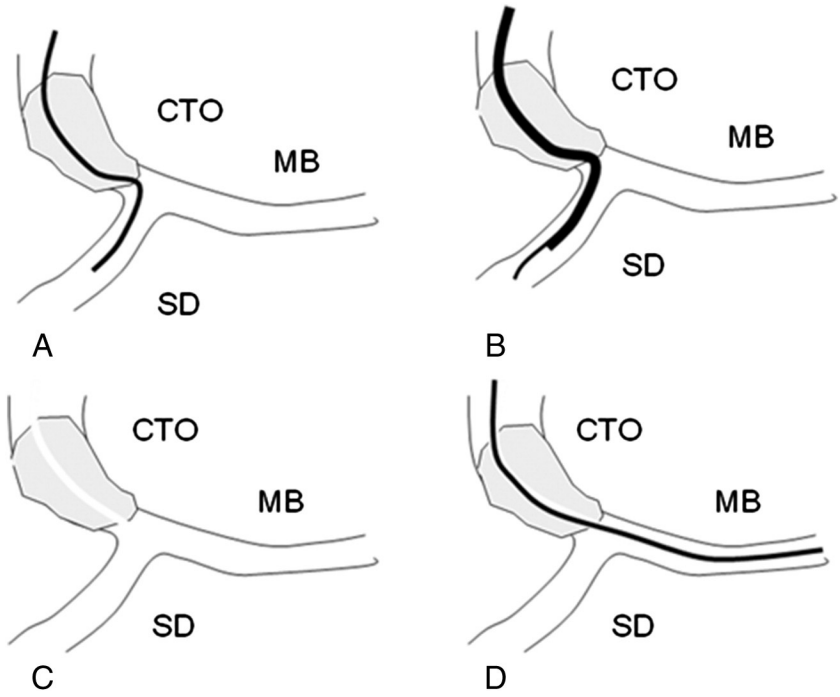

Fig. 3. Technique: Guide-wire progressed into the distal side branch (A). Advance of the Tornus® catheter into the side branch (B). Microchannel created in CTO body (C). Guide-wire redirected into the main branch (D). CTO = chronic total occlusion SB = side-branch MB = main-branch.

presents less stiffness than the proximal/distal cap of the CTO, the crossing-wire often tends to direct here.

There are many described techniques to solve this problem when the side branch is located near the proximal cup of de CTO. One of these techniques involves the use of intravascular ultrasound (IVUS) to clarify the entry site of the CTO [7]. The "Open Sesame" technique described by Saito refers to the use of high support guide wire and/or balloon inflation in the side branch that changes the geometrical conformation of the CTO with an increase in the success of crossing the lesion with the guide-wire into the true distal lumen [8]. Katoh previously described the usefulness of dilating the ostium of the proximal side branch at the entry point of the CTO with a small size balloon or a Tornus® Catheter device, weakening the entry point of the occlusion, before attempting to cross the distal site of the occlusion [9].

As far as we know, there has been no previously described technique to solve the problem by anterograde approach when CTO distal cup ends in a bifurcation.

We have applied the same principle developed by Katoh to the distal side branch (Fig. 3). The use of the Tornus® catheter into the distal side branch changes the geometrical morphology of the CTO, weakening in particular the tissue surrounding the inner part of the less-calcified distal CTO cap and allowing therefore the crossing of a guide-wire into the distal CTO part to reach the true lumen. We have found no difficulties of the basic principle applicability in different scenarios.

Our report demonstrates the following: (1) wiring into a side branch at the CTO distal cap and subsequently performing Tornus® catheter advancement into the side branch can help in penetrating the distal main branch by creating a micro channel. (2) Distal side branch access can help to redirect a second guide-wire to the main vessel in the same manner as parallel wire technique.

The utility of this easy and non-time-consuming technique, avoids the use of a more complex retrograde approach in some selected cases. The main limitation of this approach is that the side branch should be large enough to allow Tornus® catheter 2.1 Fr. Although we have not had complications with the Tornus® catheter, its advancement into a side branch may cause its dissection or occlusion.

3. Conclusions

The "distal side-branch" technique is easy, non-time consuming and can increase the success rate of bifurcation CTO lesions by anterograde approach avoiding the use in selected cases of a more complex retrograde approach.

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