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Kasuistika | Case report

Dual-lumen catheter in coronary chronic occlusions

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SOUHRN

Chronický totální uzávěr (chronic total occlusion, CTO) koronární tepny je v současnosti považován za nejnáročnější lézi pro perkutánní koronární intervenci (PCI). Přestože bylo pro léčbu CTO navrženo několik metod, je nejčastější příčinou neúspěšné PCI CTO nemožnost protáhnout vodič skrze CTO. Popisujeme tři případy úspěšného řešení CTO pomocí katétru s dvojitým lumen po neúspěšných pokusech o proniknutí přes uzávěr. Tento snadno ovladatelný katétr představuje spolehlivý nástroj pro řešení podobných situací u pacientů s CTO.

ABSTRACT

Coronary chronic total occlusion (CTO) is currently considered the most complex lesion for percutaneous coronary intervention (PCI). Despite several crossing techniques are available, failure to cross a CTO with a guidewire is still the most common cause for failure of CTO PCI. We report three CTO cases successfully treated using a dual-lumen catheter after other crossing strategies failed to cross the occlusion. This tool is easy and reliable to use and could be useful in similar situations in CTO cases.

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Introduction

Chronic total occlusion (CTO) still represents the most technical challenging lesion subset that interventional cardiologists face [1]. In recent years, the technical success of percutaneous coronary intervention (PCI) for CTO lesions has improved because of the development of novel techniques and devices as well as accumulated experience [2,3]. Although several crossing techniques are available, failure to cross a CTO with a guidewire is still the most common cause for failure of CTO PCI [4].

We report three CTO cases successfully treated using a dual-lumen catheter (DLC) after other crossing strategies failed to cross the occlusion.

Case 1

A 73-year-old man with hypertension, hyperlipidemia and a prior history of coronary disease presented severe and longstanding angina in spite of maximal medical therapy. The echocardiogram showed a normal left ventricular ejection fraction with normal regional wall motion. He had a known chronic in-stent occlusion in the circumflex for the last 15 years with a previous failed attempt at recanalization.

Angiography showed a relatively long in-stent CTO in the proximal circumflex (20–25 mm) and a bifurcation at the distal cap of the occlusion (Fig. 1A).

PCI of the CTO was performed. Because there was not heterocoronary filling we performed unilateral femoral approach with a 7Fr AL2 *guiding catheter (Cordis Corp., Miami Lakes, Florida).*

A Finecross catheter (Terumo Corp., Japan) was used and an Ultimatebros 3 (Asahi intecc co, Japan) crossed the occluded segment and reached the distal obtuse marginal (OM), but the finecross could not cross the CTO because the wire was under struts from the previously placed stents (Fig. 1B and 1C). The wire tip could not be manipulated away from the stent struts. Eventually, the Finecross microcatheter was exchanged for a Crusade DLC (Kaneka corp., Osaka, Japan) and a second Ultimatebros 3 wire achieved to penetrate in a different entry point of the proximal cap keeping in the central lumen and reaching the distal circumflex (Fig. 1D and 1E and Video). After predilating the in-stent CTO segment the OM wire was direct to the center lumen and both wires were exchanged by Sion (Asahi intecc co, Aichi, Japan) wires, then both branches were predilated and the main vessel stented. Final angiogram showed good result including the bifurcation (Fig. 1F).

Case 2

A 75-year-old male with prior history of diabetes, hypertension and dyslipidemia with longstanding effort angina and a positive exercise treadmill test was referred for coronary angiography in our Centre.

The coronary angiography revealed a CTO of the mid LAD just distal to the origin of a large diagonal (Fig. 2A). No other coronary lesions were noted. The site of the occlusion was at an acute angle with a very short straight segment proximal to the occlusion but there was no proximal cap ambiguity and the CTO length was about 12 mm, the distal LAD was filled by homocoronary collateral circulation.

Because there was not heterocoronary filling we performed unilateral radial approach. A 7.5 French special curve 3.5 sheathless catheter (Asahi intecc co, Japan) was used to engage the left main coronary artery.

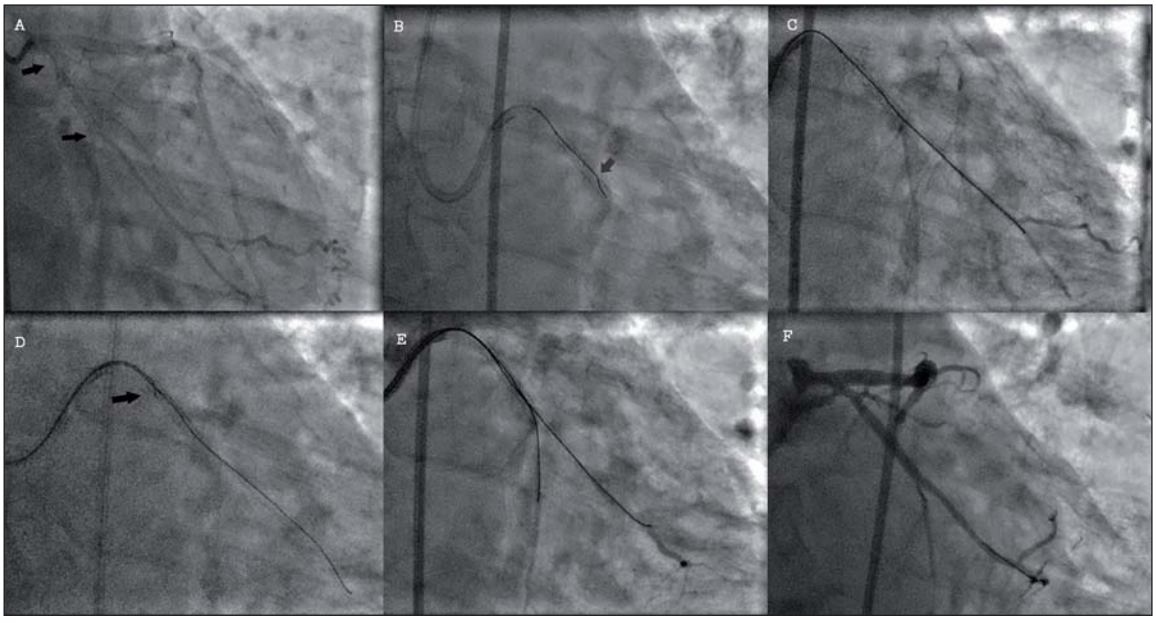

Fig. 1 – (A) Intra-stent chronic total occlusion (CTO) involving a distal bifurcation. (B) and (C) The wire crossed to the obtuse marginal (OM) but was under struts from the previously placed stents (arrow). (D) and (E) Crusade dual-lumen catheter allowed the guidewire to penetrate in a different entry point of the proximal cap keeping in the central lumen and reaching the distal circumflex. (F) Final result.

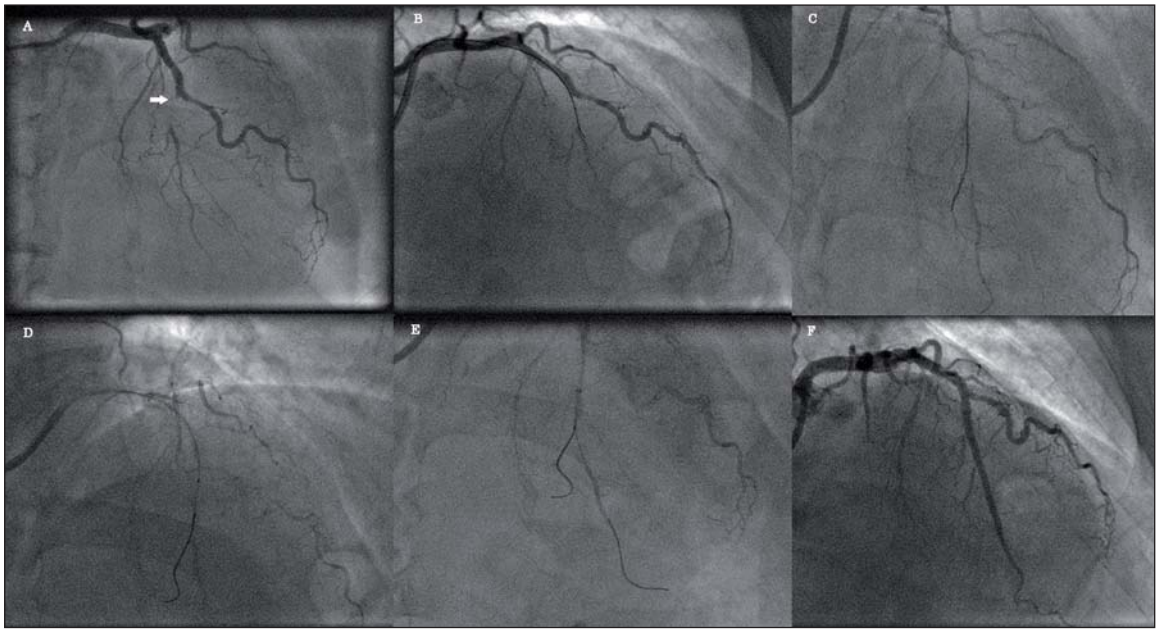

Fig. 2 – (A) Chronic total occlusion (CTO) of the mid left anterior descending (LAD). Located just distal to the origin of a large diagonal. (B) The guidewire in the subintimal space. (C) Pilot 200 guidewire reentered but in a small septal branch. (D) and (E) Twin pass dual catheter allowed the Pilot 200 to cross the distal LAD via the side hole. (F) Final angiographic result.

An anterograde wire escalation approach was initially performed but a Finecross catheter with a Sion and a Fielder XT-A (Asahi intecc co, Japan) wires failed to reach the proximal cap prolapsing into the diagonal branch. A Miracle 6 (Asahi intecc co, Japan) was then used to reach the proximal cap and crossed subintimally through the occlusion (Fig. 2B). Then we tried re-entry according to wire-based techniques using a Pilot 200 (Abbott Vascular, USA) and a Fielder XT wires. A Pilot 200 guidewire reentered but in a small septal branch (Fig. 2C) and multiple attempts to reentry in the LAD were unsuccessful. A Sion wire was then placed in the septal branch over which a Twin-Pass catheter (Vascular solutions) was introduced which allowed the Pilot 200 to cross the distal LAD (Fig. 2D and 2E). The lesion was successfully dilated and stented. Final angiogram showed good angiographic result (Fig. 2F).

Case 3

A 76-year-old man ex-smoker with hypertension, hyperlipidemia and atrial fibrillation was admitted to our department because of angina on effort. The echocardiogram showed a normal ejection fraction. He had a known chronic occlusion in the LAD with a previous failed attempt at recanalization.

The coronary angiography revealed a CTO of the mid LAD involving a bifurcation with a diagonal branch within the occluded segment and a blunt proximal cap. The CTO length was about 25 mm (J CTO of 3). Mild opacification of distal LAD was noted through collateral circulation from a diagonal branch and mild contralateral collateral flow from RCA was found too (Fig. 3A).

A bi-femoral 8Fr approach was performed. Anterograde wire escalation was the initial approach but after crossed subintimally through the occlusion a reentry technique was necessary. We tried re-entry using parallel wires and see-saw techniques with several wires, including a shaped Pilot 200 to facilitate re-entry. Eventually Pilot 200 reentered in a small diagonal branch distal to the distal cap of the CTO (Fig. 3B). Multiple attempts to reentry in the LAD were unsuccessful, then a Crusade DLC was advanced to the bifurcation and a second wire reached the LAD via the side hole of the catheter (Fig. 3C, 3D and 3E). Regarding the within occlusion bifurcation, the secondary and main branches were pre-dilated and the LAD was stented with good angiographic result including the bifurcation (Fig. 3F).

Discussion

The Crusade and Twin pass catheters are dual-lumen multifunctional probing microcatheters with a rapid exchange delivery lumen on the distal segment, and an over the wire lumen that runs the length of the catheter. The guidewire in the monorail lumen protruding from the end helps to stabilize the microcatheter, while the guidewire in the over-the-wire lumen protruding from the side hole can be directed toward the ostium of the intended branch [5,6]. These catheters were designed with the express purpose of managing bifurcation lesions. But beyond this scenario these catheters can be a useful tool in the context of CTO. Three different successful uses of DLC in challenge CTO cases were presented.

The first case was a CTO due to in-stent occlusion involving a distal bifurcation. In-stent CTO represents 5–25% of the total CTO interventions and can be challenging. In this context, centering the wire into the old stent in an attempt to go "true-to-true" lumen remains difficult and ends up in multiple trials of in and out through stent

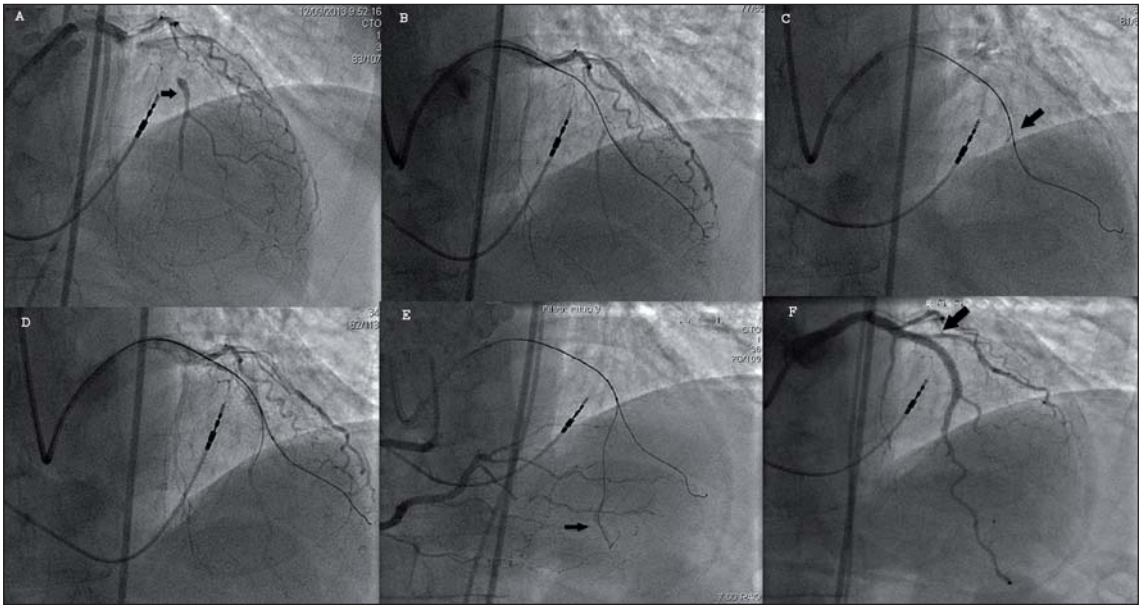

Fig. 3 – (A) Chronic total occlusion (CTO) of the mid left anterior descending (LAD). The J CTO score was 3. (B) The guidewire crossed to a diagonal branch. (C), (D) and (E) Dual-lumen catheter was placed in the bifurcation and allowed the guidewire to reach the distal LAD. (F) Final angiographic good result, including the within occlusion bifurcation (arrow).

struts. Nevertheless, initial attempts to cross should focus on staying in the old stent lumen. However, in case of uncrossable lesions, provisional sub-intimal approach may represent a viable option [7,8]. In our case despite crossing the CTO, the guidewire tip was guided toward the stent struts and the wire tip could not be manipulated away from the stent struts. Eventually the DLC was used to successfully direct a second wire to the center lumen, away from abutting the stents struts, and then was used to treat the distal bifurcation too.

In the second case we performed a modified see-saw technique with a DLC. In the parallel-wire technique when the guidewire enters the subintimal space or a side branch, it is left in place and a second wire is advanced, whereas in a variation of this technique called the see--saw technique, two microcatheters are used to support both guidewires [7]. Alternatively, as in our second and third cases, a DLC can be used to direct the second guidewire as a modified see-saw technique [7].

The last case was a CTO involving a bifurcation. The incidence of bifurcation lesions in the context of CTO located within or distally to the occluded segment is about 25% [9,10]. The presence of a bifurcation lesion in the context of a CTO lesion may represent an additional difficulty. In this context the DLC may represent an ideal support because the wire in the monorail lumen can fix and stabilize the microcatheter, while the wire in the over-the-wire lumen reaches out of the side hole and can be directed towards the culprit lesion [11].

There are a few reported cases using DLC in CTO recanalization procedures [6,11]. Arif et al. reported the use of Twin Pass catheter in recanalization of a CTO using the catheter as an anchor to support the guidewire [6] and Chiu et al. reported the use of Crusade catheter for recanalization of two CTO with bifurcation lesions [11], similar to our first and third cases, although in our cases the bifurcations were located within the occlusion (third case) and in the distal cap (second case). As far as we know this is the first case reported using a DLC to treat an in-stent CTO.

Conclusion

We present three different cases of DLC use in successful recanalization of challenge CTOs. This tool is easy and reliable to use and could be useful in similar situations in CTO cases.

Conflict of interest

None declared.

Funding body

None.

Ethical statement

Authors state that the research was conducted according to ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.crvasa.2017.08.007.

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