

# Crusade Dual Lumen Catheter Assisted Successful Revascularization of Chronic Total Occlusion - Technical Consideration

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## Abstract

Penetration of proximal cap and entry into distal true lumen is soul of successful recanalization of Chronic Total Occlusion (CTO). However, blunt tip with large side branch coming just before the cut-off makes wire entry into proximal cap extremely tough as it is prone to prolapse into side branch. Here, we report a case of a 61-year-old, hypertensive and smoker male who presented intractable angina caused by CTO of mid LAD. Proximal cap was blunt and large septal branch was coming out just proximal to the cap. A Run through wire was parked into septal branch of LAD through rapid exchange guidewire port of Crusade dual lumen catheter (Kaneka, Japan) and proximal cap was successfully penetrated by Conquest Pro 12 by pushing it through over the wire port of catheter. Once wire was in true lumen, Crusade catheter was withdrawn, lesion was pre-dilated and wire was exchanged with another workhorse wire. LAD was stented by deploying 3x44 mm Yukon Choice PC sirolimus eluting stent (Translumina Inc, Germany) achieving TIMI III flow. For such complex lesions, duel lumen Crusade catheter offers great help as it provides a firm support and enhances the advancing force of the guidewire to penetrate the angulated targeted branch by holding a wire placed at the non-targeted branch.

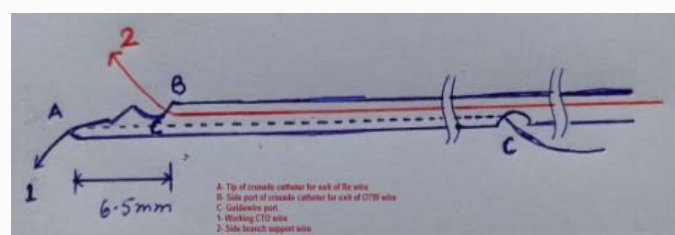
**Keywords:** Chronic total occlusion; Proximal cap; Crusade catheter; Dual lumen catheter

## Introduction

Successful penetration of proximal cap and entry of wire into distal true lumen is essential prerequisite to successful recanalization of Chronic Total Occlusion (CTO). However, blunt tip with large side branch coming just before the cut-off, and bending  $>45^\circ$  of CTO segment is considered as marker of poor success of recanalization as wiring becomes tough as the wire is prone to prolapse into non-targeted branches. For such lesions, the double-lumen Crusade catheter (Kaneka, Osaka, Japan) offers great help as it provides a firm support and enhances the advancing force of the guidewire to penetrate the angulated targeted branch by holding a wire placed at the non-targeted branch [1]. Furthermore, entry of proximal cap may require wire escalation technique multiple wire exchange. In such situation, crusade catheter allows one to have this facility as principal wire passes through the Over The Wire (OTW) port of crusade catheter while support wire comes out through rapid exchange port (Figure1).

## Case Report

A 61-year-old, hypertensive and smoker male for past 14 years, presented with exertional angina- Canadian Cardiovascular Society (CCS) class III angina despite guideline directed medical treatment for past three years with recent worsening. His treadmill test was strongly



**Figure 1:** Crusade dual lumen catheters are the type of micro-catheter that have both rapid exchange port (Rx) and Over The Wire (OTW) lumen.

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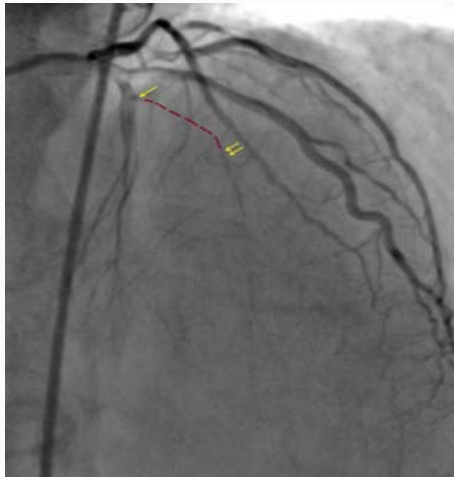
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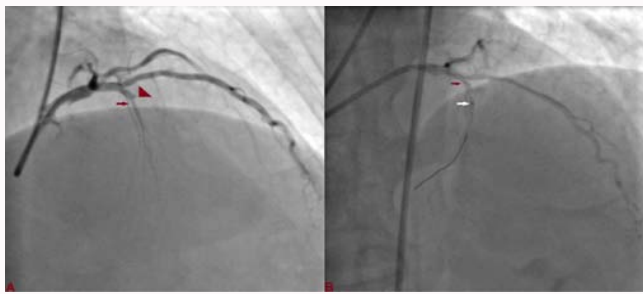
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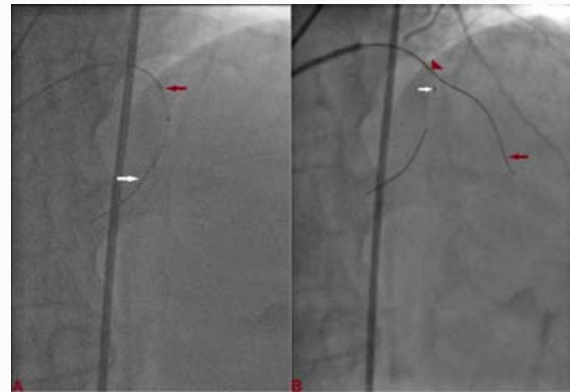


**Figure 2:** Coronary angiography revealed Chronic Total Occlusion (CTO) of mid Left Anterior Descending (LAD) artery with Rentrop's grade I ipsilateral collaterals (yellow arrow- proximal and distal cap; red broken line- body of CTO).

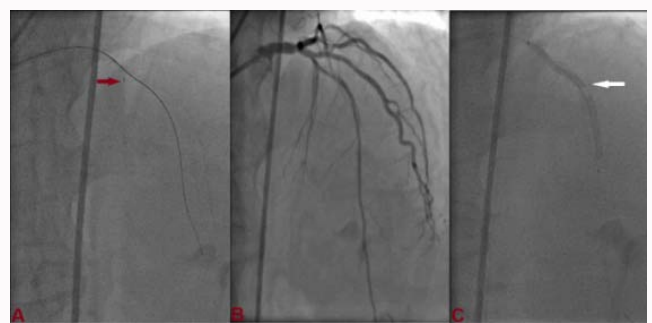


**Figure 3:** Large diagonal and septal branch (red arrow) were coming out before the chronically occluded segment (Red arrowhead); Run through wire was parked into septal branch through rapid exchange port (white arrow) of Crusade catheter.

positive for reversible myocardial ischemia. Coronary angiography was performed after proper consent which revealed Chronic Total Occlusion (CTO) of mid Left Anterior Descending (LAD) artery with Rentrop's grade I ipsilateral collaterals (Figure 2). Large diagonal and septal branch were coming out before the chronically occluded segment. Tip of CTO was blunt. Based on angiographic assessment, his J-CTO score was 2, thus making it amenable to Percutaneous Coronary Intervention (PCI). However, blunt tip and large septal branch were two potential markers for poor success (Figure 3A). Left main artery was cannulated with 7F extra backup (EBU) guide Catheter (Medtronic, USA). Lesion was tried to be crossed with Fielder FC and XT wire (Ashahi, Japan) over finecross microcatheter (Asahi, Japan) support but every time wire was flipping into septal branch and therefore proximal cap could not be penetrated. A Run through wire (Terumo; Japan) was parked into septal branch of LAD through side port of crusade catheter (Figure 3B). Proximal cap was tried to be penetrated by Conquest Pro 12 (Asahi, Japan) by pushing it through OTW port of Crusade catheter. As we were not able to make an inroad, catheter was little pulled so that we could bring the tip of Conquest wire close to proximal cap, and thereby penetrating it successfully (Figure 4A and B). Once it was made sure that conquest wire was in distal true lumen by contrast injection and feel of the wire, run through wire was removed. Conquest wire was advanced distally and crusade catheter was in withdrawn using Nanto



**Figure 4:** Proximal cap was penetrated successfully by Conquest Pro 12 (Asahi, Japan) by pushing it through OTW port (red arrow and arrowhead) of Crusade catheter (A; B).



**Figure 5:** Once conquest wire was in distal true lumen, runthrough wire was removed (A) Small balloon induced dissection flap was visible in distal part of lesion, (B) Lesion was stented by deploying 3x44 mm Yukon Choice PC sirolimus eluting stent (Translumina Inc, Germany- C).

technique (Figure 5A). Lesion was dilated using 1x8 mm Sapphire semicompliant balloon (Orbus Neisch, Netherland). Once LAD was visible, another through run through wire was parked distally and conquest wire was removed. Lesion was further predilated using 2x10 mm and 2.5x10 mm Sapphire balloon. Small balloon induced dissection flap was visible in distal part of lesion (Figure 5B). Lesion was stented by deploying at 14 atm pressure with 3x44 mm Yukon Choice PC sirolimus eluting stent (Translumina Inc, Germany) achieving TIMI III flow (Figure 5C). It was further post dilated with 3x10 mm Sapphire noncompliant balloon. He was discharged in stable condition with ticagrelor-180 mg, aspirin-75 mg, rosuvastatin-40 mg, metoprolol-100 mg, and ramipril-10 mg once daily. He is in regular follow up since then.

## Discussion

Treatment outcomes for CTO and long-term patency rates have dramatically improved in recent years with refinement of hardwares (guidewires and microcatheter), better understanding of CTO, and development of new techniques such as the retrograde approach [2-4]. However, the antegrade approach is still remains the first approach failing which one may choose retrograde approach. Large side branch poses not only problems in bifurcation lesions but also CTO lesions. In such situations, a wire cannot be introduced into the main artery although wiring into the side branch is possible. In this situation, a general technique is tried at first to introduce a wire into the main artery with a crusade microcatheter [5].

Crusade dual lumen catheters are the type of micro-catheter that

have both monorail lumen and Over The Wire (OTW) lumen (Figure 1). They allow the operator to deliver a second wire through the OTW lumen while leaving the guidewire in the rapid exchange port. Mostly used in bifurcation PCI, they offer help in various situations in the CTO-PCI. Majority of cases of CTO are dealt by introducing the first wire in antegrade fashion into the side branch in the monorail lumen, and using second wire in the OTW lumen to penetrate the proximal cap of the CTO as in our case. Sometimes, the first wire enters the false lumen when it is left in place, and using the second wire (typically stiffer and tapered with different tip bend) in the OTW lumen as parallel wire technique [6]. Also, when there is a highly angulated side branch of CTO exit, one can employ reverse wire technique using dual lumen catheter [7]. As for each usage mentioned above, using a dual lumen catheter makes strong backup and improves the operability of the guidewire. The first wire in the monorail lumen can fix and stabilize the micro-catheter, so the movement of the micro-catheter due to heart beat can be controlled.

## Conclusion

Entering into distal true lumen after penetration of proximal is soul of successful recanalization of CTO. However, blunt tip with large side branch coming just before the cut-off makes it extremely challenging. Antegrade dissection and re-entry using Cross Boss catheter is one option. Dual lumen Crusade catheter is an excellent alternative which offers great help as it provides a firm support and enhances the advancing force of the guidewire to penetrate the angulated targeted branch by holding a wire placed at the non-targeted branch.

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