

# Using “Cart” (Controlled Antegrade and Retrograde Sub-intimal Tracking) Technique for Recanalization of a Sub-clavian Artery Occlusion

Alev Kilicgedik\*, Muslum Sahin, Can Yucel Karabay and Cevat Kirma

Kartal Koşuyolu Heart and Research Hospital, Department of Cardiology, Turkey

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## Introduction

Chronic Total Occlusions (CTOs) of coronary arteries are challenging cases of interventional procedures and require improved techniques and expertise. CART technique is one of those novel techniques that facilitates the recanalization of CTOs by aggressive wire manipulation from both ends of the lesions [1]. It may be feasible using this novel technique in noncoronary challenging occlusions. In so far as we know there is not much use of CART technique in noncoronary occlusions. We present a case about successful recanalization of a subclavian artery occlusion using CART technique in a patient with CABG operation.

## Case Report

A 67 year-old woman was admitted to our hospital with the complaint of pain of the left arm. She had a history of CABG operation 6 years ago and hypertension. On physical examination right arm blood pressure was 150/90 mmHg and left arm pressure was 110/70 mmHg. There was no specific ST-T changes on electrocardiography. No laboratory abnormality was found. Myocardial perfusion scintigraphy was performed and showed apical ischemia. A coronary angiography was planned. Coronary angiography showed that the graft vessels (LIMA-LAD, Ao-RCA, Ao-CX) were open and left subclavian artery was cut off after vertebral artery and LIMA branch (Figure 1A). Given the signs and symptoms of the patient, left subclavian artery was planned to open. A 7F sheath was inserted into the right femoral artery. A right Judkins catheter was advanced through the sheath into the left subclavian artery. A Conquest 12 guidewire was advanced antegradely and subintimally with a microcatheter support but the lesion couldn't be passed. Then a 6F sheath was inserted into the left brachial artery and a Conquest 12 guidewire - starting from a soft guidewire to a stiff guidewire - was advanced through the sheath with a microcatheter support and the lesion was passed subintimally towards the antegrade guidewire (Figure 1B). A predilatation with a 5,0x10 mm balloon was applied retrogradely (Figure 1C). Then the antegrade guidewire was advanced to the lumen that occurred after ballooning through the retrograde way. And then a 8.0x60 mm self expandable stent was implanted into the distal part of the lesion through the antegrade way. A 9.0x40 mm self expandable stent was implanted into the mid part of the lesion and 8.0x18 mm balloon expandable stent was implanted into the proximal part of the lesion antegradely. After that a postdilatation with a 8,0x40 mm balloon was applied. Complete revascularization was achieved (Figure 1D). No complication was occurred. Dual antiplatelet therapy for four weeks and aspirin therapy for long term have recommended.

## Discussion

Recanalization of chronic total coronary occlusions may relieve the regional ischemia. A Controlled Antegrade and Retrograde Subintimal Tracking (CART) is a technique developed to facilitate the recanalization of CTOs by aggressive wire manipulation from both ends of the lesions [1]. In the classic CART, a balloon (1,25- 2,5 mm)

is positioned in the CTO and inflated over the retrograde wire into the retrograde subintimal space, parallel to the antegrade wire. The antegrade wire is manipulated to connect with the enlarged retrograde subintimal space to ultimately exit into the distal true lumen [2]. A bilateral approach for CTO lesions using the CART technique is feasible, safe and had higher success rate than previous approaches [3,4].

Subclavian artery stenosis can be a cause of significant morbidity as it can lead to symptomatic ischemic issues affecting the upper extremities, brain and in some cases the heart. The left subclavian artery is four times more likely to be affected than the right or innominate arteries. In our case atherosclerosis is thought to be the reason for the stenosis

Indications for treatment include disabling upper limb ischemia, including claudication, rest pain and digital embolization; vertebrobasilar insufficiency from steal syndrome; anginal symptoms from coronary steal via IMA graft; leg claudication in the setting of axillo-femoral grafts; and to increase flow before surgical procedures such as CABG using the IMA as an arterial conduit or creation of dialysis arteriovenous fistula. While some argue for conservative management with medications, most agree that in the setting of symptoms surgical or endovascular therapy is indicated. When an intervention is indicated, a percutaneous approach is favored over surgical intervention in the current era of angioplasty and stenting. The technical success rate of percutaneous treatment for stenoses with stents ranging from 91 to 100 percent have been reported in some case series. Equally important has been the success rate of treatment of total occlusions which has ranged from 83 to 94 percent. The success rate is improving with techniques including recanalization via simultaneous femoral (antegrade) and brachial (retrograde) approaches [5].

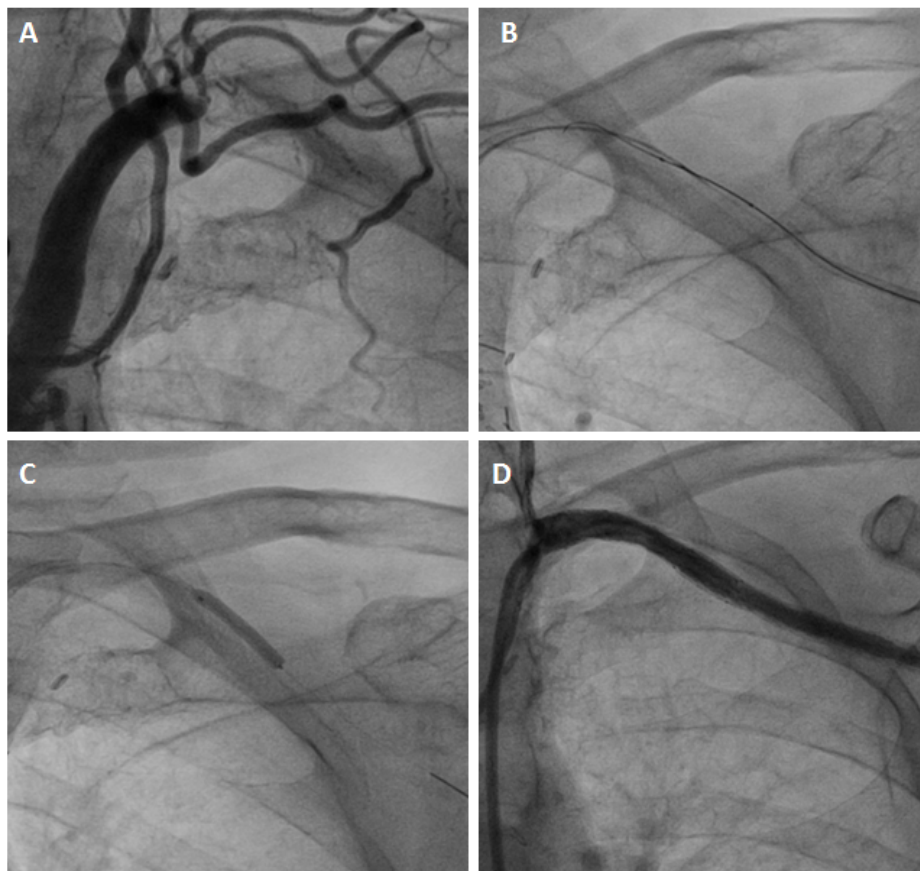
There are some reports about CART technique used noncoronary occlusions including external iliac artery occlusions [6]. We present a case with subclavian artery stenoses which was recanalized by using CART technique that generally used for CTOs of coronary arteries. Our case had coronary artery disease and CABG operation and the stenosis was after LIMA branch and vertebral artery. As the LIMA branch was supplying blood to the LAD vessel, it was a chance for the patient that this situation didn't cause an obstruction or a steal syndrome but it made the recanalization technique challenging. At first we tried to pass the lesion antegradely but couldn't achieve, so we had to use the

**\*Corresponding author:** Alev Kilicgedik, Kartal Koşuyolu Heart and Research Hospital, Cardiology Clinic, 34846- Kartal, Istanbul, Turkey, Tel: 90216-4594041; Fax: 0216-4596321; E-mail: [akilicgedik@yahoo.com](mailto:akilicgedik@yahoo.com)

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**Figure 1:** A: The subclavian artery stenosis after LIMA branch and vertebral artery. B: Subintimally antegrade and retrograde parallel wiring of the subclavian artery stenosis. C: Subintimal retrograde ballooning of the stenosis. D: The subclavian artery after revascularization

retrograde approach and this technique had a risk for the occlusion of LIMA branch. After ballooning the vessel retrogradely, we advanced the antegrade wire to distal side of the vessel and implanted stents. 3 stents -2 self expandible and a balloon expandible stents-were used. As the stents were implanted antegradely starting from distal part of the vessel, accurate sizing of the lesion was problematic considering the LIMA branch.

In conclusion, in challenging non-coronary occlusions including sub-clavian artery stenoses, hybrid techniques that used in coronary occlusions including CTOs can be used. CART technique is one of those useful and helpful techniques used in challenging CTO cases and can be used sub-clavian artery stenoses that couldn't be passed by conventional techniques. Additionally previous CABG operation and the localization and clinical importance of LIMA and vertebral artery can help us choosing the technique.

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