Journal of Geriatric Cardiology (2019) 16: 835−839

Letter to the Editor · Open Access ·

A new buddy stingray and stick technique for antegrade dissection and re-entry during chronic total occlusion recanalization: a case report

Bing TIAN[1], Quan-Min JING[2,#], Bin WANG[2], Yan-Bin SU[2]

[1]*Central Hospital affiliated to Shengyang Medical College, Shenyang, China*
[2]*General Hospital of Northern Theater Command, Shenyang, China*

J Geriatr Cardiol 2019; 16: 835−839. doi:10.11909/j.issn.1671-5411.2019.11.009

Keywords: Antegrade dissection; Chronic total occlusions; Percutaneous coronary interventions

Although the retrograde approach was a promising strategy for chronic total occlusions (CTO)-percutaneous coronary interventions (PCI),[1] with the development of coronary interventional therapy technology and interventional instruments, antegrade dissection and re-entry (ADR) are commonly employed in PCI to open CTO of coronary arteries.[2] The successful opening of CTO lesions can increase ventricular systolic function, alleviate angina, and increase activity tolerance. The wide application of ADR technology can significantly enhance the success rate of CTO operations.[3] ADR technology is suitable for clear proximal fibrous caps, with occlusion lengths ≥ 20 mm and a landing zone that is clearer at the distal end. Using the CrossBoss/Stingray system (Boston Scientific, Marlborough, MA), the adoption and success rates of ADR-based CTO PCI has increased.[4,5] However, ADR technology requires a Stingray Balloon (Boston Scientific) which is delivered to the distal landing site through the CrossBoss catheter or Knuckled wire through the subintima,[6] and if occluded vessels are tortuous and angular, the distance between the Stingray Balloon and the true lumen of the vessel is the major cause of ADR failure.

With the development of coronary interventional therapy technology and interventional instruments, ADR are commonly employed in PCI to open the CTO of coronary arteries. ADR technology is suitable for clear proximal fibrous caps, with occlusion lengths ≥ 20 mm and a landing zone that is clearer at the distal end. However, if occluded vessels are tortuous and angular, the distance between the Stingray Balloon and the true lumen of the vessel is the major cause of ADR failure. In this article, we introduce a new ADR technique termed the "Buddy Stingray and Stick". We demonstrate that this technique increases the success rate of the operation by sending the wire to the distal endometrium, closer to the true lumen of the blood vessel through a step-by-step Stingray Balloon.

A 57-year-old male had a three year history of hypertension, diabetes, and old anterior wall myocardial infarction. Two months ago, coronary angiography showed 100% occlusion of the proximal left anterior descending coronary arteries (LAD) and blood flow TIMI of grade 0; 90% stenosis of the distal LCX, and a blood flow TIMI grade 3; 50% stenosis of the proximal RCA, 40%–50% stenosis of the distal RCA, and blood flow TIMI grade 3; and grade 3 collateral branches of PL to LAD. LADCTO with positive interventional therapy failed. The patient had repeated chest pain post-operation (Figure 1A–C).

Coronary angiography was performed following admission: 100% occlusion of the proximal segment of the LAD was accompanied by dissection images. The blood flow TIMI was grade 0. An initial operation to dissect the hematoma was considered (Figure 1D). The preferred Corsair + XT-R wire failed to enter the true lumen. Using wire upgrading technology, Gaia First, Gaia Third, Conquest Pro, and other guides were attempted but failed to pass the lesion, indicating that multiple residual false lumens in the proximal segment of LAD failed. Reverse wire technology was proposed. The Sion wire was pushed through the Corsair 1.5 M microcatheter using surfing technology, and the interstitial collateral circulation channel from the RCA was sent to the proximal area of the LAD (Figure 2A). The XT-R wire was successfully used to guide the catheter through the proximal occlusive segment of the LAD to the left catheter. Rendezvous technology was applied to establish the forward channel (Figure 2B).

After repeated adjustments, the positive wire only entered the septal branch, and a single stent was implanted at the proximal segment of the LAD (Figure 2C). Parallel wire technology was reused but failed to pass through (Figure 2D).

#**Correspondence to:** qmjdr08_sea@163.com

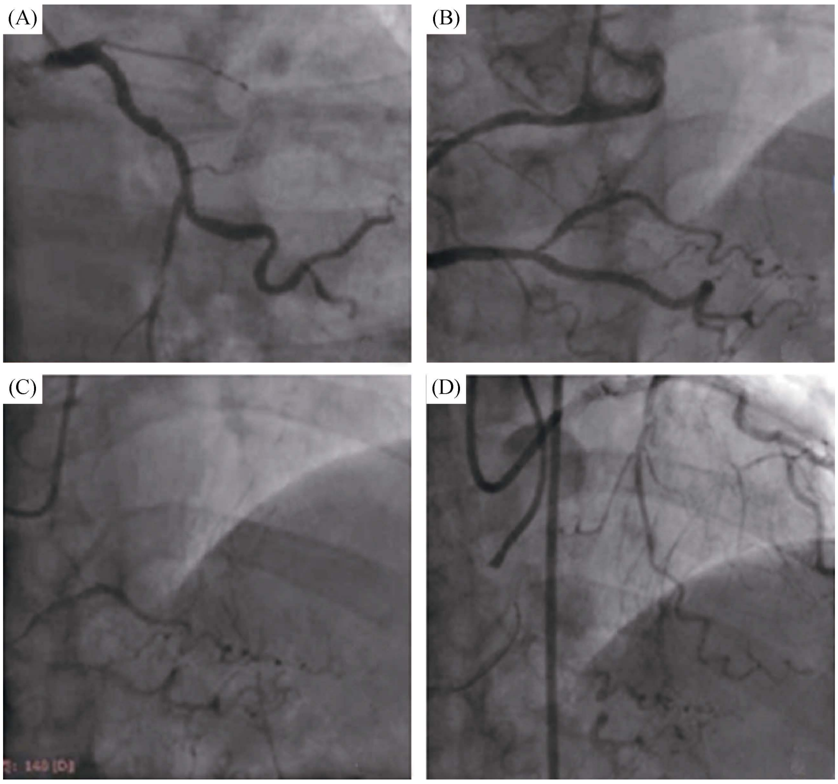

Figure 1. Coronary angiography showing 100% occlusion of the proximal LAD (A); 90% stenosis of the distal LCX (B); and Grade 3 collateral branches of PL (C) to LAD (D). LAD: left anterior descending coronary arteries; LCX: left circumflex; PL: posterior left ventricular artery.

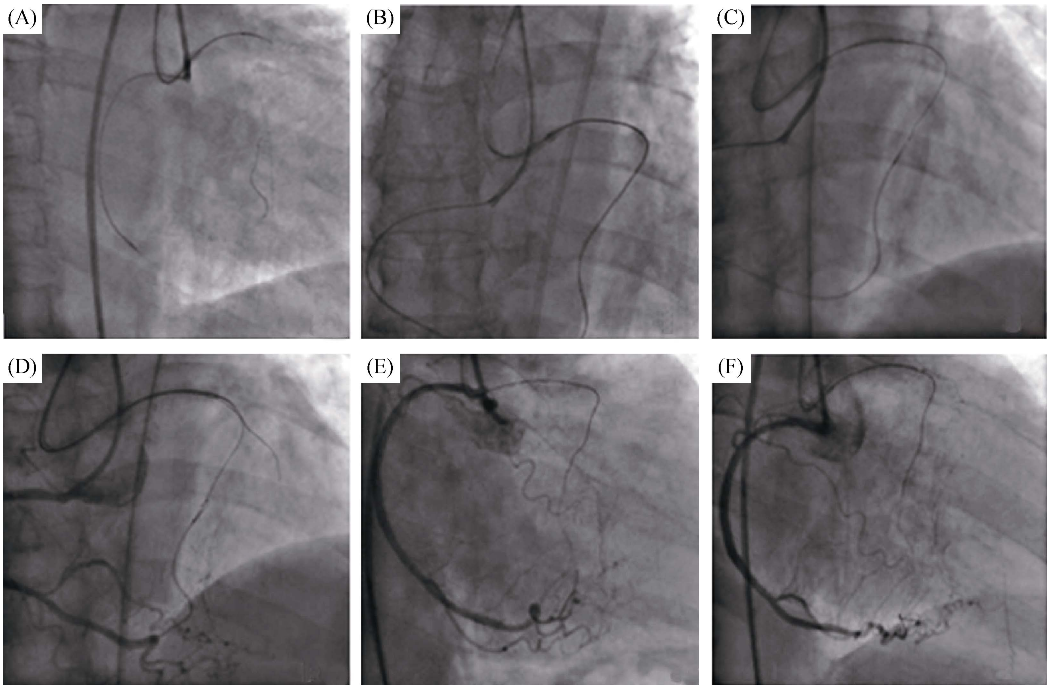

Figure 2. PCI for proximal LAD. (A): The Sion wire was pushed through the Corsair 1.5 M microcatheter using surfing technology and the interstitial collateral circulation channel from the RCA was sent to the proximal area of the LAD; (B): rendezvous technology was used to establish the forward channel; (C): the antegrade wire only entered the septal branch and a 3.0 ×18 mm stent was implanted at the proximal segment of the LAD; (D): parallel wires failed to pass through; (E): retrograde interventional therapy of the RCA-PL distal vessels was attempted; and (F): the PL was complex and failed to pass through. LAD: left anterior descending coronary arteries; PCI: percutaneous coronary intervention; PL: posterior left ventricular artery; RCA: right coronary artery.

Retrograde interventional therapy of the RCA-PL distal vessels attempted, but the PL was complex and failed to pass through (Figure 2E and 2F). The first operation in the middle of LAD resulted in unclear images of the hematoma (Figure 3A). The forward was reinitiated. Using ADR technology, the wire was accurately adjusted near to the true lumen of the LAD (Figure 3B). However, it was impossible to turn the wire into the distal true lumen (Figure 3C).

Using the Buddy Stingray Balloon and Stick technique, the first Stingray Balloon was positioned, and the puncture was performed using a hardwire Conquest. The wire passed through the turning point and was closer to the true lumen following the turning point of the LAD (Figure 4A and 4B). A second Stingray Balloon was added, and the wire puncture was again successful (Figure 4C and 4D). The intravenous ultrasound (IVUS) examination following Balloon

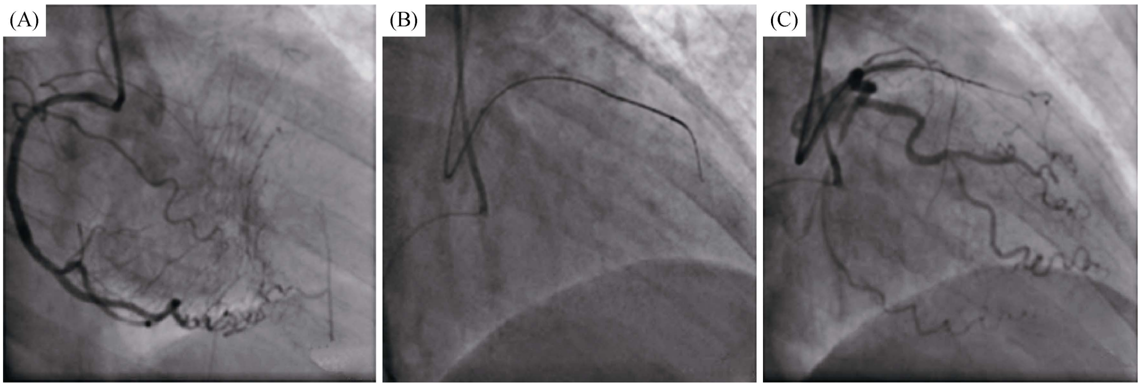

Figure 3. ADR technology in the middle of LAD. (A): The initial operation in the middle LAD resulted in unclear images of the hematoma; (B): the forward operation was therefore reinitiated. Using ADR technology, the wire was accurately adjusted near to the true lumen of the LAD; (C): it was not possible to turn the wire into the true distal lumen. ADR: antegrade dissection re-entry; LAD: left anterior descending artery.

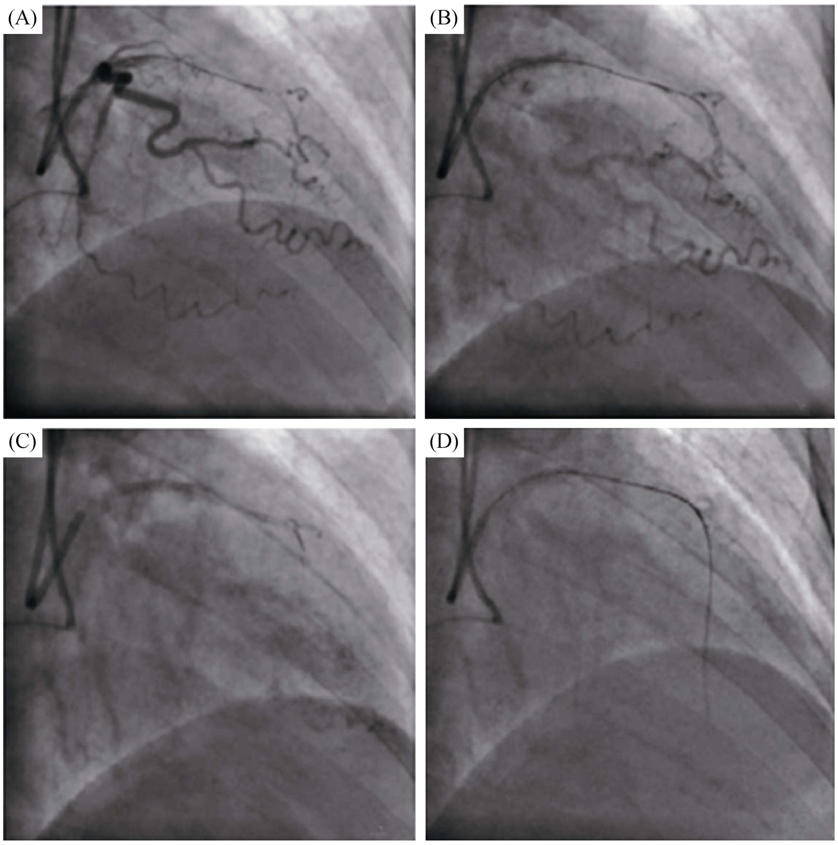

Figure 4. Buddy stingray balloon and stick technique. (A): The initial Stingray Balloon was positioned. (B): The puncture was performed using a hard wire (Conquest). The wire passed through the turning point and was closer to the lumen following the turning point of the LAD. (C): A second Stingray Balloon was included. (D): the wire puncture was again successful. LAD: left anterior descending artery.

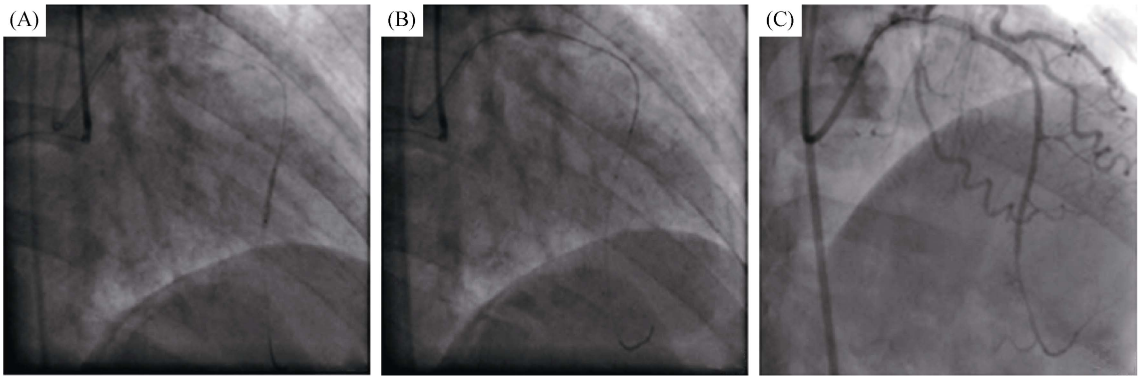

Figure 5. Dilatation and PCI. (A): The 2.0 × 15 mm Balloon dilatation of LAD; (B): IVUS examination final; and (C): PCI results. IVUS: intravenous ultrasound; LAD: left anterior descending artery; PCI: percutaneous coronary intervention.

dilatation (Figure 5A and 5B). The IVUS examination showed that the pseudo lumen in the middle segment of the LAD was small with calcification (Figure 6), and the wire was located in the true lumen in the middle and distal segments. Three stents were implanted under IVUS guidance (Figure 5).

CTO surgery remains the gold standard for coronary interventional surgery, however, the success rate remains low. When forward wire technology and parallel wire technology fail, ADR technology is the preferred choice.[7] The CrossBoss Catheter and Stingray Balloons have greatly improved the success rates of ADR. However, CrossBoss catheters were not employed in this case, due to LAD angular lesions and proximal lesions of the main vessels. The CrossBoss system can result in the loss or perforation of important collateral vessels.[8]

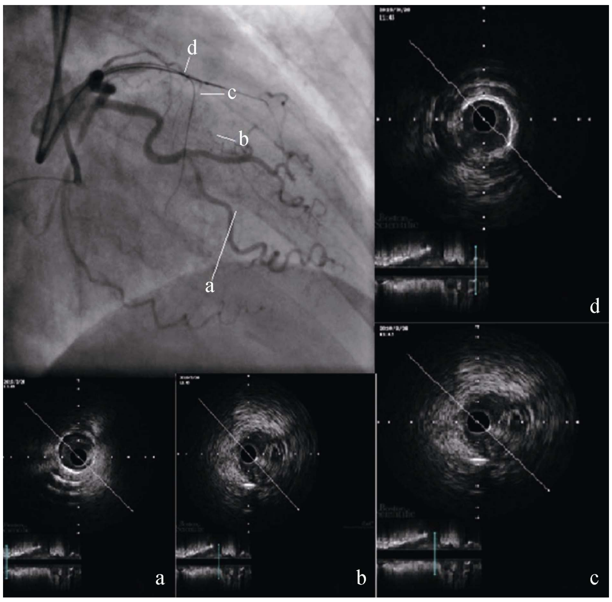

Figure 6. IVUS examinations showed that the pseudo lumen in the middle segment of the LAD was small with calcification. The wire was located in the true lumen in the middle and distal segments. IVUS: intravenous ultrasound; LAD: left anterior descending artery.

The precise adjustment of the wire was employed in the vascular plaque which can significantly reduce perforation, side branch loss, and other complications. In this case, due to proximal and middle segment occlusive lesions with calcification and angulation, it was difficult to pass through the lesion using the wire. The use of this technique in the occluded coronary artery is complex and so the Buddy Stingray Balloon and Stick technique were used to guide the direction of the wire puncture through several Stingray Balloons. This kept the wire in the arterial structure and closer to the true lumen of the blood vessel. The puncture was successfully performed using a second Stingray Balloon. We believe that the Buddy Stingray Balloon and Stick technology requires a lower level of manipulation of the wire and can significantly improve the success rate of surgery.

Current ADR technology can shorten the time of the forward CTO lesion opening. However, Stingray Balloon ADR technology can still fail. The Buddy Stingray and Stick technique require a lower learning curve for the operator. The wire is closer to the true lumen if the first Stingray Balloon is used to adjust the wire, thereby reducing dissection and hematoma of the CTO vessels, in addition to increasing the success rate of the operation.

There are some limitations in this study. Firstly, any subintimal technique might create significant outflow disruption that will compromise runoff, which has been associated with the risk of reocclusion during follow-up.[9] Secondly, two Stingray Balloons had to be employed, leading to increased procedural costs. Thirdly, as the Stingray Balloon is small and soft, both catheters must be maintained without bending or twists.

In conclusion, the Buddy Stingray and Stick technique could increase the success rate of the operation and requires a lower learning curve for the operator.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1 Sianos G, Barlis P, Di Mario C, *et al*. European experience with the retrograde approach for the recanalisation of coronary artery chronic total occlusions. A report on behalf of the eurocto club. *EuroIntervention* 2008; 4: 84–92.
2 Azzalini L, Carlino M, Brilakis ES, *et al*. Subadventitial techniques for chronic total occlusion percutaneous coronary intervention: The concept of vessel architecture. *Catheter Cardiovasc Interv* 2018; 91: 725–734.
3 Azzalini L, Vo M, Dens J, Agostoni P. Myths to debunk to improve management, referral, and outcomes in patients with chronic total occlusion of an epicardia coronary artery. *Am J Cardiol* 2015; 116: 1774–1780.
4 Danek BA, Karatasakis A, Karmpaliotis D, *et al*. Use of antegrade dissection re-entry in coronary chronic total occlusion percutaneous coronary intervention in a contemporary multicenter registry. *Int J Cardiol* 2016; 214: 428–437.
5 Maeremans J, Dens J, Spratt JC, *et al*. Antegrade dissection and reentry as part of the hybrid chronic total occlusion revascularization strategy: A subanalysis of the RECHARGE Registry. *Circ Cardiovasc Interv* 2017; 10: e004791.
6 Carlino M , Azzalini L , Mitomo S, Colombo A. Antegrade fenestration and re-entry: A new controlled subintimal technique for chronic total occlusion recanalization. *Catheter Cardiovasc Interv* 2018; 92: 497–504.
7 Harding SA, Wu EB, Lo S, *et al*. A new algorithm for crossing chronic total occlusions from the Asia Pacific chronic total occlusion club. *JACC Cardiovasc Interv* 2017; 10: 2135–2143.
8 Michael TT, Papayannis AC, Banerjee S, Brilakis ES. Subintimal dissection/reentry strategies in coronary chronic total occlusion interventions. *Circ Cardiovasc Interv* 2012; 5: 729–738.
9 Carlino M, Figini F, Ruparelia N, *et al*. Predictors of restenosis following contemporary subintimal tracking and reentry technique: The importance of final TIMI flow grade. *Catheter Cardiovasc Interv* 2016; 87: 884–892.