VIA MEDICA

TECHNOLOGY NOTE

Cardiology Journal
2023, Vol. 30, No. 5, 843–845
DOI: 10.5603/cj.92864

ISSN 1897–5593
eISSN 1898–018X

Stiff wire scratching to fenestration, de-escalation, and re-entry technique (SSDR): A novel wire-based antegrade dissection/re-entry technique for coronary chronic total occlusion recanalization

Mihajlo Kovačić

Department of Interventional Cardiology, County Hospital Čakovec, Croatia

Introduction

The introduction of extraplaque dissection techniques in chronic total occlusion (CTO) percutaneous coronary interventions has substantially improved success rates. In antegrade dissection/re-entry (ADR) strategies, the guidewire intentionally advances extraplaque into a dissection plane before re-entering the distal vessel lumen at, or beyond the distal cap [1].

Older techniques like subintimal tracking and re-entry and limited antegrade subintimal tracking, havemostly been abandoned, except for the bailout and so-called "investment" procedures. The anterograde fenestration and re-entry (AFR) technique is limited because it is prone to forming a big subintimal hematoma [2]. Stingray-based ADR is limited by high procedural costs, the need for proctored training, and a relatively high rate of failure [3, 4]. Recross-based ADR is also limited by the steep learning curve, cost, and harder deliverability of the device.

A novel wire-based procedure from extraplaque to intraplaque re-entry technique, dubbed "stiff wire scratching to fenestration, de-escalation, and re-entry technique" (SSDR) is hereby described.

Method

In both anterograde or retrograde wire escalation techniques (AWE, RWE) techniques, if the wire exits extraplaque, the strategy usually switches to ADR or retrograde dissection and re-entry (RDR). Reentry then becomes the most challenging step in the technique. The SSDR technique is an alternative option to ease reentry in such cases is described as follows.

The microcatheter is progressed over the extraplaque wire to a point immediately preceding the anterograde or retrograde cap. Then the wire is exchanged for a stiff wire (eg. Gaia second or third/ConfianzaPro12/Hornet14/Warrior/InfiltracPlus/Judo6). Wire configuration is made prior to insertion through the microcatheter. The operator moves the stiff wire back and forth, repeatedly, with changing wire rotation until completing a 360° circle. Depending on the anatomy of the vessel, the stiff wire can be progressed in variable lengths into the target, usually around 10–40 mm. This foramination maneuver creates multiple micro connections between the extraplaque and intraplaque space. Wire knuckling should be prevented from the beginning because it would further expand the dissection. Since stiff wires are difficult to control and redirect, the operator should not try to track the target vessel lumen with the perforating stiff wire. Instead, the stiff wire in the SSDR technique is exchanged for a low or intermediate-tip load polymer-jacketed wire, like Fielder XT-A/Pilot 200/GladiusEX, keeping the microcatheter in place. This de-escalation improves the free movement of the wire and facilitates a smooth and harmless reentry into the target true lumen (Fig. 1).

The reentry occurs mostly by chance, after repeated careful attempts changing the rotation of the

Address for correspondence: Mihajlo Kovačić, MD, Department of Interventional Cardiology, County Hospital Čakovec, Ivana Gorana Kovačića 1E, 40000 Čakovec, Croatia, tel: +385 98 266 774/+385 40 375 444, e-mail: mihajlo1983@gmail.com

Received: 22.11.2022 Accepted: 26.08.2023 Early publication date: 12.09.2023

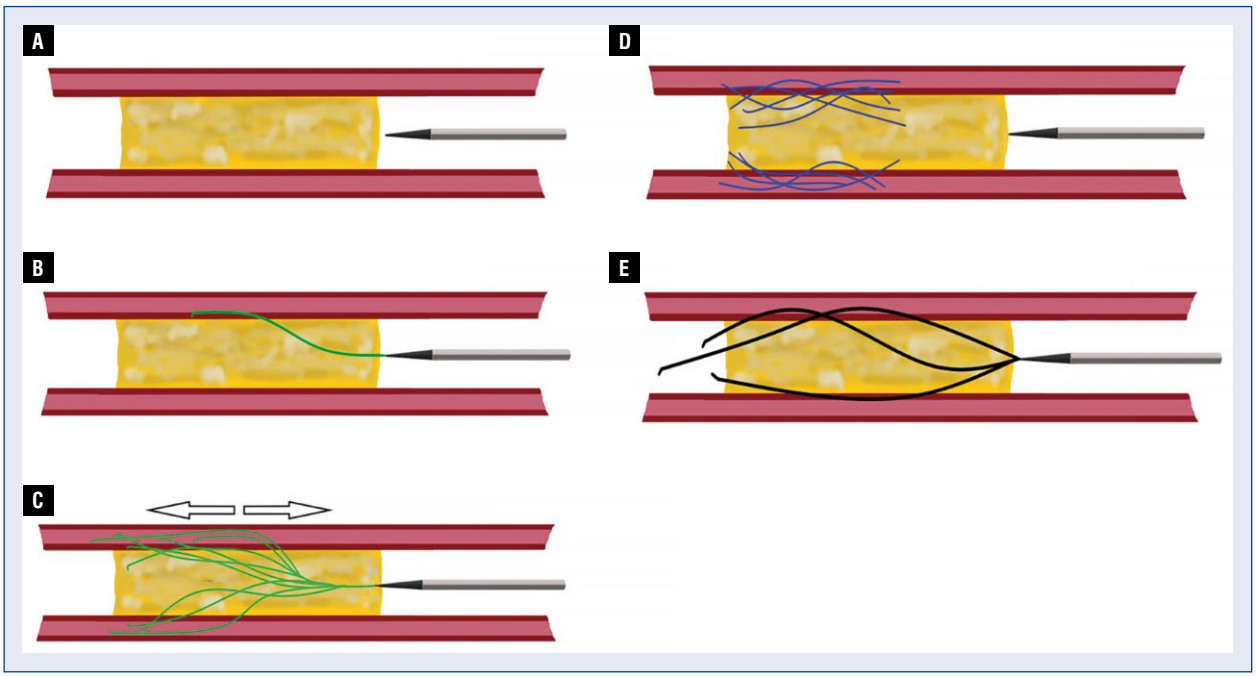

Figure 1. Stiff wire scratching to fenestration, de-escalation, and re-entry technique (SSDR) steps; **A.** Microcatheter is parked on the chronic total occlusion (CTO) cap in standard fashion; **B.** Cap is penetrated with the wire, but the wire is positioned extraplaque; **C.** The wire is exchanged for a stiff wire if the stiff wire was not used previously. Two curves are placed on the wire, a small first "typical CTO" curve 40–50 degrees 1–2 mm proximal to the tip and the second curve 15–30 degrees 6–7 mm proximal to the tip. The operator moves the stiff wire back and forth, repeatedly, with changing wire rotation until completing a 360° circle; **D.** This scratching/foramination maneuver creates multiple micro connections between the extraplaque and intraplaque space; **E.** The stiff wire is exchanged for a low or intermediate-tip load polymer-jacketed wire, keeping the microcatheter in place. This de-escalation improves the free movement of the wire and facilitates reentry into the target true lumen.

tip, until the wire finds the right micro-connection by chance. After pushing forward the polymer jacketed wire into the target vessel, the distal wire position should be checked with contralateral injection and simultaneous movement of the wire to reassure the distal luminal position (Fig. 2).

Discussion

In cases of ADR or RDR strategies, the SSDR technique is an interesting alternative to ease reentry into the true lumen. Among the assets of SSDR, we could highlight its technical simplicity, and its time- and cost-efficiency, especially if compared with device-based techniques. In most cases, it just demands one additional wire without further expenditure on dedicated devices. Therefore, it could be proposed as a default reentry strategy after switching to dissection-reentry techniques, because other reentry techniques, like Stingray/ /Recross/AFR definitely consume much more time and resources than this uncomplicated alternative.

Limited antegrade subintimal tracking technique [5], as originally described, starts after the guidewire advancement in the subintimal/extra plaque plane. Guidewires are mostly advanced in the knuckle fashion and followed by microcatheter distal to the distal cap. Then a stiff-tip, highly penetrating guidewire (like Confianza Pro 12) with a steep curve is used for reentry into the distal true lumen. In SSDR micro connections are made with the stiff wire between the extraplaque and intraplaque plane, mostly inside the CTO body. The microcatheter is not moved forward from the initial position, and the wires were not in the knuckle position, therefore the chance for extraplaque hematoma formation is greatly reduced.

In case of SSDR failure, the abovementioned reentry techniques can still be tried without penalty and eventually the switch to retrograde or antegrade strategies in the hybrid approach also remains a bailout option.

Caution is needed due to the risk of perforation with stiff wires. The technique is most suitable in

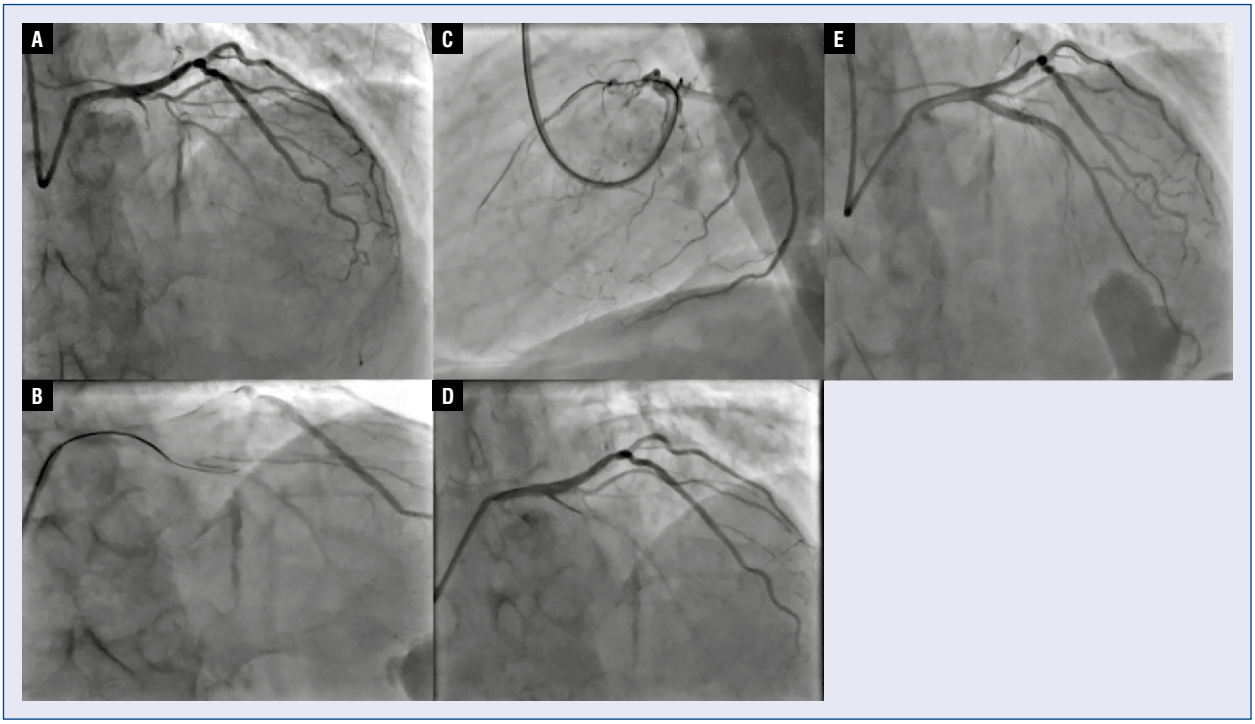

Figure 2. Stiff wire scratching to fenestration, de-escalation, and re-entry technique (SSDR) case example; **A.** Chronic total occlusion (CTO) of the proximal left anterior descending artery (LAD); **B.** Microcatheter is positioned in front of the proximal CTO cap. In anterograde wire escalation fashion cap was punctured. Gaia third wire is positioned extraplaque in the architecture of the LAD; **C.** Lateral projection showing the Gaia third wire at the extraplaque position. A scratching maneuver was made; **D.** With the microcatheter in place, the wire is exchanged for the Pilot 200, which quickly finds a path to the distal true lumen of the LAD; **E.** Final result after treatment with two drug-eluting stents.

straight CTO segments, whilst it can be problematic in tortuous segments. A key element for success is minimizing unnecessary wire manipulation at the distal target, thus mostly perforating within the CTO segment and a short part of the target. Maneuvers potentially resulting in expansion of the intramural hematoma, like antegrade contrast injection or excessive progression of the microcatheter before reentry should be also avoided.

Conclusions

Stiff wire scratching to fenestration, de-escalation, and the re-entry technique is an interesting alternative technique for lumen reentry in ADR or RDR strategies, which due to its simplicity, as to its time- and cost-efficiency might be considered the default first step, before attempting other classical techniques that consume more time and resources.

Conflict of interest: None declared

References

1. 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(4): 725–734, doi: 10.1002/ccd.27025, indexed in Pubmed: 28303648.
2. Carlino M, Azzalini L, Mitomo S, et al. Antegrade fenestration and re-entry: A new controlled subintimal technique for chronic total occlusion recanalization. Catheter Cardiovasc Interv. 2018; 92(3): 497–504, doi: 10.1002/ccd.27470, indexed in Pubmed: 29314567.
3. Maeremans J, Dens Jo, Spratt JC, et al. Antegrade Dissection and Reentry as Part of the Hybrid Chronic Total Occlusion Revascularization Strategy: A Subanalysis of the RECHARGE Registry (Registry of CrossBoss and Hybrid Procedures in France, the Netherlands, Belgium and United Kingdom). Circ Cardiovasc Interv. 2017; 10(6), doi: 10.1161/CIRCINTERVENTIONS.116.004791, indexed in Pubmed: 28625964.
4. Michael TT, Papayannis AC, Banerjee S, et al. Subintimal dissection/reentry strategies in coronary chronic total occlusion interventions. Circ Cardiovasc Interv. 2012; 5(5): 729–738, doi: 10.1161/CIRCINTERVENTIONS.112.969808, indexed in Pubmed: 23074346.
5. Lombardi WL. Retrograde PCI: what will they think of next? J Invasive Cardiol. 2009; 21(10): 543, indexed in Pubmed: 19805844.