

The retrograde approach for recanalisation of chronic total occlusions – a risk worth taking?



Gerald S. Werner*, MD, PhD

Medizinische Klinik (Cardiology & Intensive Care), Klinikum Darmstadt GmbH, Darmstadt, Germany

The addition of the retrograde technique to interventional strategies for percutaneous coronary intervention (PCI) of chronic total coronary occlusions (CTO) can be considered to be one of the major advances in PCI¹. Its refinement took it from a very challenging technique in the beginning to a more predictable and structured approach². A major driving force for the successful application of the retrograde approach was the concomitant development of microcatheters for the passage of the collaterals, and of speciality wires with very low tip load and high steerability to overcome even the most tortuous collateral connections, a development that is still continuing. In contemporary registries, the percentage of retrograde procedures which achieve high success rates is presently in the range of 30 to 40%³⁻⁵. However, the retrograde approach using the bilateral transcatheter access increases the complexity of the procedure and thus the potential risks involved^{6,7}.

In the current edition of EuroIntervention, the paper by Tajti et al⁸, which provides a detailed analysis of complications associated with the retrograde approach as compared to the antegrade approach from the large PROGRESS-CTO registry, adds valuable information on the challenges associated with this more complex and demanding strategy.

Article, see page 891

The observation period of this registry was seven years with a changing number of participating centres throughout that period,

which may have influenced the analysis. It is notable that the procedure and fluoroscopy times are rather long compared to contemporary registries^{3,4}. Similarly to the above-mentioned registries, the retrograde approach was used in about one third of cases. The success rate of this approach decreased over the years despite no clear trend in lesion complexity, which is in contrast to other observations in contemporary registries^{3,4}. This may be due to the participation of a variety of operators throughout the observation period, which is a weak point of this analysis.

The most distinct difference between this mainly US-based registry and data from Europe and Asia is the very high rate of post-coronary artery bypass graft (CABG) patients. These patients are at particular risk for complications and also have a lower success rate as compared to non-CABG patients⁹. This may partly explain the differences in procedure and fluoroscopy times. Given such a high prevalence of a particular risk group among the patient collective, specific care needs to be taken to make the retrograde approach as safe as possible.

The risk of perforation is increased with the retrograde approach as, in addition to higher lesion complexity, the passage of the wire and device through frail collateral channels adds an additional component of possible perforation complications. This requires a very careful approach to prevent them, and specific skills to deal with them. Localised deployment of coils, thrombin or fat is required

*Corresponding author: Medizinische Klinik I, Klinikum Darmstadt, Grafenstrasse 9, D-64283 Darmstadt, Germany.
E-mail: gerald.werner@mail.klinikum-darmstadt.de

to solve critical perforations, and sometimes it is necessary to deploy them from both the donor and receiver site of the collateral.

As perforations lead to a higher morbidity and mortality, every effort needs to be made to prevent them. If we look at the specific details presented in the current registry, there are issues which may be associated with a higher risk of perforation for the retrograde approach, especially in relation to the use of epicardial collaterals. The wires for the collateral passage were SION[®], Fielder[™] FC (both Asahi Intecc, Aichi, Japan) and Whisper[®] MS (Abbott Vascular, Santa Clara, CA, USA), of which only the SION is a dedicated wire with advanced tip control. The other two wires were most likely used for “surfing” the collaterals. While the “surfing technique” was ultimately successful, the study by Dautov et al¹⁰ on this specific approach also demonstrated that about one fourth of collaterals were perforated. Even if this event was minor in most cases, one cannot escape the obvious fact that it leads to increased perforations as compared to approaches with selective injection to navigate collaterals which have lower perforation rates³.

About one third of collateral attempts were epicardial connections. These collaterals should not be attempted by surfing as they are not “protected” by the myocardium as septal channels are. The preferred wires should be the SION and, although not available during PROGRESS-CTO, the SUOH 03 wire (Asahi Intecc) with exceptional qualities to pass the most tortuous connections. However, even more important for the risk of complications can be the microcatheter which follows the wire. Especially with epicardial connections, some of them are less distensible than others when a microcatheter follows the wire. Softer microcatheters, such as the more recent Caravel (Asahi Intecc), may be preferred to the more traditional Corsair (Asahi Intecc). The Caravel was in fact used with high prevalence in the present study. As this catheter became available only during the later years of the study period, the temporal use of the different devices may have changed.

It would be wrong to conclude from this study that the retrograde approach should be avoided as this would be to ignore one important fact that has been highlighted by this study – lesion complexity drives the required approach. Most of the patients in whom the CTO was opened because of the retrograde approach would have failed without this option, and procedural failure is a prognostic disadvantage¹¹. It is therefore of the utmost importance to select patients carefully and make sure that they fulfil the clinical criteria to perform a CTO PCI, in terms of symptoms and large viable myocardial territories. Then they will benefit from even complex CTO procedures¹².

Conflict of interest statement

The author has no conflicts of interest to declare.

References

1. Surmely JF, Tsuchikane E, Katoh O, Nishida Y, Nakayama M, Nakamura S, Oida A, Hattori E, Suzuki T. New concept for CTO recanalization using

- controlled antegrade and retrograde subintimal tracking: the CART technique. *J Invasive Cardiol*. 2006;18:334-8.
2. Matsuno S, Tsuchikane E, Harding SA, Wu EB, Kao HL, Brilakis ES, Mashayekhi K, Werner GS. Overview and proposed terminology for the reverse controlled antegrade and retrograde tracking (reverse CART) techniques. *EuroIntervention*. 2018;14:94-101.
3. Suzuki Y, Tsuchikane E, Katoh O, Muramatsu T, Muto M, Kishi K, Hamazaki Y, Oikawa Y, Kawasaki T, Okamura A. Outcomes of Percutaneous Coronary Interventions for Chronic Total Occlusion Performed by Highly Experienced Japanese Specialists: The First Report From the Japanese CTO-PCI Expert Registry. *JACC Cardiovasc Interv*. 2017;10:2144-54.
4. Konstantinidis NV, Werner GS, Deftereos S, Di Mario C, Galassi AR, Buettner JH, Avran A, Reifart N, Goktekin O, Garbo R, Bufe A, Mashayekhi K, Boudou N, Meyer-Gessner M, Lauer B, Elhadad S, Christiansen EH, Escaned J, Hildick-Smith D, Carlino M, Louvard Y, Lefevre T, Angelis L, Giannopoulos G, Sianos G, Euro CTO Club. Temporal Trends in Chronic Total Occlusion Interventions in Europe. *Circ Cardiovasc Interv*. 2018;11:e006229.
5. Werner GS. The retrograde approach for recanalisation of chronic total occlusions - the impact on interventional success. *EuroIntervention*. 2019;15:e310-2.
6. Galassi AR, Sianos G, Werner GS, Escaned J, Tomasello SD, Boukhris M, Castaing M, Buttner JH, Bufe A, Kalnins A, Spratt JC, Garbo R, Hildick-Smith D, Elhadad S, Gagnor A, Lauer B, Bryniarski L, Christiansen EH, Thuesen L, Meyer-Gessner M, Goktekin O, Carlino M, Louvard Y, Lefevre T, Lismanis A, Gelev VL, Serra A, Marza F, Di Mario C, Reifart N, Euro CTO Club. Retrograde Recanalization of Chronic Total Occlusions in Europe: Procedural, In-Hospital, and Long-Term Outcomes From the Multicenter ERCTO Registry. *J Am Coll Cardiol*. 2015;65:2388-400.
7. Riley RF, Sapontis J, Kirtane AJ, Karpaliotis D, Kalra S, Jones PG, Lombardi WL, Grantham JA, McCabe JM. Prevalence, predictors, and health status implications of periprocedural complications during coronary chronic total occlusion angioplasty. *EuroIntervention*. 2018;14:e1199-206.
8. Tajti P, Xenogiannis I, Gargoulas F, Karpaliotis D, Alaswad K, Jaffer FA, Patel M, Burke MN, Garcia S, Krestyaninov O, Koutouzis M, Jaber W, Brilakis ES; Collaborators. Technical and procedural outcomes of the retrograde approach to chronic total occlusion interventions. *EuroIntervention*. 2020;16:e891-9.
9. Megaly M, Abraham B, Pershad A, Rinfret S, Alaswad K, Garcia S, Azzalini L, Gershlick A, Burke MN, Brilakis ES. Outcomes of Chronic Total Occlusion Percutaneous Coronary Intervention in Patients With Prior Bypass Surgery. *JACC Cardiovasc Interv*. 2020;13:900-2.
10. Dautov R, Urena M, Nguyen CM, Gibrat C, Rinfret S. Safety and effectiveness of the surfing technique to cross septal collateral channels during retrograde chronic total occlusion percutaneous coronary intervention. *EuroIntervention*. 2017;12:e1859-67.
11. George S, Cockburn J, Clayton TC, Ludman P, Cotton J, Spratt J, Redwood S, de Belder M, de Belder A, Hill J, Hoye A, Palmer N, Rathore S, Gershlick A, Di Mario C, Hildick-Smith D; British Cardiovascular Intervention Society; National Institute for Cardiovascular Outcomes Research. Long-term follow-up of elective chronic total coronary occlusion angioplasty: analysis from the U.K. Central Cardiac Audit Database. *J Am Coll Cardiol*. 2014;64:235-43.
12. Werner GS, Martin-Yuste V, Hildick-Smith D, Boudou N, Sianos G, Gelev V, Rumoroso JR, Erglis A, Christiansen EH, Escaned J, di Mario C, Hovasse T, Teruel L, Bufe A, Lauer B, Bogaerts K, Goicolea J, Spratt JC, Gershlick AH, Galassi AR, Louvard Y, EUROCTO trial investigators. A randomized multicentre trial to compare revascularization with optimal medical therapy for the treatment of chronic total coronary occlusions. *Eur Heart J*. 2018;39:2484-93.