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Chronic total occlusion: conquering the last frontier of percutaneous coronary intervention

Oclusão crônica: conquistando a última fronteira da intervenção coronária percutânea

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Historically, chronic total occlusions (CTO) comprise the subgroup of the most difficult lesions to be treated by percutaneous techniques. CTO is one of the most important predictors of the need for coronary artery bypass grafting, of incomplete revascularization, and low success rates in attempts for percutaneous recanalization. In addition, CTO has been considered one of the factors associated with higher mortality rates in ST-segment or non-ST-segment elevation myocardial infarction patients. Many obstacles are faced when trying to perform target-vessel recanalization in this subgroup of patients; however many of these historic barriers have been overcome by advancement of technology and development of new devices and materials, as well as new antegrade dissection and reentry techniques,¹ greater adoption of retrograde techniques² and, finally, by using hybrid algorithm.³ Such factors have raised the procedure success in this type of lesion to rates above 90%.

CTO accounts to approximately 15 to 20% of cases found in coronary angiographies,⁴ with a high referral rate for coronary artery bypass grafting, of which less than 5% are attempted percutaneously.⁵ Evaluating retrospective studies and registries, we noticed – in selected patients – there is evidence of treatment aiming to alleviate symptoms, improve quality of life, improve left ventricular function, reduce mortality, improve ischemic burden after revascularization, and increase tolerance to future ischemic events. The randomized study Euro CTO was published in 2018, and definitively demonstrated relief of symptoms and better quality of life in this group of patients.⁶ In the same year, the DECISION study was published with negative results, showing no differences between optimized medical treatment and recanalization of CTO. Nevertheless, the investigation methodology was criticized for lack of sufficient statistical power and large amount of crossing over (patients of the medical treatment arm migrated to the intervention group). Moreover, the study was prematurely interrupted due to difficult patient recruitment – the initial objective was to enroll 1,284 patients but only 834 were included.⁷

The most often used techniques in CTO cases are the so-called antegrade wire escalating (AWE),⁷ basically using a microcatheter, starting with a low-weight polymer guide, and progressively increasing the weight of the tip as required. Although still widely applicable, these techniques still depend directly on anatomical factors. The J-CTO score is the tool more frequently used to measure CTO complexity, and it takes into account five parameters: (1) lesion length greater than 20mm; (2) blunt proximal stump; (3) bending greater than 45°; (4) calcification and (5) prior attempt lesion. Each parameter is given one point – the greater the total sum, the higher the prediction of difficulty in crossing the lesion by antegrade technique.⁸ The current antegrade dissection and reentry techniques may be used as part of the hybrid algorithm, when the guidewire passes from the intimal to the subintimal space, especially in cases of poorly developed collateral circulation, or operators with little experience in the retrograde technique.⁹

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Finally, we come to the retrograde technique, first described by Kahn et al., in 1990, when performing a balloon angioplasty of the left anterior descending artery through a saphenous vein bypass.¹⁰ The advantages of retrograde techniques are easier crossing of the proximal stump because it is often cone-shaped, and the distal stump is usually softer and less ambiguous, as compared to the proximal one. Then a new era began with evolution and development of retrograde techniques. The CART technique was first described in 2006, by Katoh,¹¹ who later reported, in 2010, the most important and more often performed retrograde technique to this day, called reverse CART.¹² The analysis and description of these techniques are beyond the scope of this editorial.

This issue brings an article by Medeiros et al.,¹³ with an elegant and interesting analysis of data from the national registry CENIC, and the inherent barriers that all registries have. It shows higher risk of death in patients with the following characteristics: advanced age, female sex, associated left main coronary artery lesion, and use of glycoprotein IIb/IIIa inhibitors. Many of these findings are corroborated by previous reviews, associated with a higher rate of coronary perforation in this subgroup of patients, and this may be one of the explanations. Moreover, as already mentioned, some aspects hinder their application in the real and current world. Many of the findings, such as high success rate (above 90%), absence of classification of complexity of the treated occlusions, no reporting of all failures, scarce availability of materials dedicated for this type of lesions in Brazil, among others, are factors that may explain the discrepancy of some data presented.

The main message of this editorial is the possibility of changing paradigms in interventional cardiology, to make the treatment of CTO a new subspecialty. As this field develops, we will train not only interventional cardiologists, but also CTO experts. These initiatives have resulted in revival of interest in the topic in our country, led by the Board of the *Sociedade Brasileira de Hemodinâmica e Cardiologia Intervencionista* (SBHCI), with the annual meeting CTO Summit Brazil, which will have its third edition in 2019, in addition with the SBHCI CTO registry together with other Latin American countries.

CTO involves extreme complexity, including the economic barriers that increasingly hinder purchase of appropriate materials and performance of these procedures. Therefore, priority will be given to patient's symptoms and ischemic burden, using angiography to determine the best revascularization strategy for the patient. The interventional community is large, provides support, and works in collaboration to develop techniques and – primarily – enhance quality of life of our patients.

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The authors declare they have no conflicts of interest.

REFERENCES

- Whitlow PL, Burke MN, Lombardi WL, Wyman RM, Moses JW, Brilakis ES, Heuser RR, Rihal CS, Lansky AJ, Thompson CA; FAST-CTOs Trial Investigators. Use of a novel crossing and re-entry system in coronary chronic total occlusions that have failed standard crossing techniques: results of the FAST-CTOs (Facilitated Antegrade Steering Technique in Chronic Total Occlusions) trial. *JACC Cardiovasc Interv.* 2012;5(4):393-401.
- Dash D. Retrograde coronary chronic total occlusion intervention using a novel reverse controlled antegrade and retrograde subintimal tracking. *J Interv Cardiol.* 2016;29(1):70-4.
- Christopoulos G, Karpaliotis D, Alaswad K, Yeh RW, Jaffer FA, Wyman RM, et al. Application and outcomes of a hybrid approach to chronic total occlusion percutaneous coronary intervention in a contemporary multicenter US registry. *Int J Cardiol.* 2015;198:222-8.
- Fefer P, Knudtson ML, Cheema AN, Galbraith PD, Osherov AB, Yalonetsky S, et al. Current perspectives on coronary chronic total occlusions: the Canadian Multicenter Chronic Total Occlusions Registry. *J Am Coll Cardiol.* 2012;59(11):991-7.
- Råmunddal T, Hoebiers LP, Henriques JP, Dworeck C, Angerås O, Odenstedt J, et al. Chronic total occlusions in Sweden—a report from the Swedish Coronary Angiography and Angioplasty Registry (SCAAR). *PLoS One.* 2014;9(8):e103850.
- 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, Bufo A, Lauer B, Bogaerts K, Goicolea J, Spratt JC, Gershlick AH, Galassi AR, Louvard Y; EUROCTO trial investigators et al. A randomized multicentre trial to compare revascularization with optimal medical therapy for the treatment of chronic total coronary occlusions. *Eur Heart J.* 2018;39(26):2484-93.
- Galassi AR, Tomasello SD, Reifart N, Werner GS, Sianos G, Bonnier H, et al. In-hospital outcomes of percutaneous coronary intervention in patients with chronic total occlusion: insights from the ERCTO (European Registry of Chronic Total Occlusion) registry. *EuroIntervention.* 2011;7(4):472-9.
- Morino Y, Abe M, Morimoto T, Kimura T, Hayashi Y, Muramatsu T, Ochiai M, Noguchi Y, Kato K, Shibata Y, Hiasa Y, Doi O, Yamashita T, Hinohara T, Tanaka H, Mitsudo K; J-CTO Registry Investigators, et al. Predicting successful guidewire crossing through chronic total occlusion of native coronary lesions within 30 minutes: the J-CTO (Multicenter CTO Registry in Japan) score as a difficulty grading and time assessment tool. *JACC Cardiovasc Interv.* 2011;4(2):213-21.
- Brilakis ES, Grantham JA, Rinfret S, Wyman RM, Burke MN, Karpaliotis D, et al. A percutaneous treatment algorithm for crossing coronary chronic total occlusions. *JACC Cardiovasc Interv.* 2012;5(4):367-79.
- Kahn JK, Hartzler GO. Retrograde coronary angioplasty of isolated arterial segments through saphenous vein bypass grafts. *Cathet Cardiovasc Diagn.* 1990;20(2):88-93.
- Surmely JF, Tsuchikane E, Katoh O, Nishida Y, Nakayama M, Nakamura S, et al. New concept for CTO recanalization using controlled antegrade and retrograde subintimal tracking: the CART technique. *J Invasive Cardiol.* 2006;18(7):334-8.
- Tsuchikane E, Katoh O, Kimura M, Nasu K, Kinoshita Y, Suzuki T. The first clinical experience with a novel catheter for collateral channel tracking in retrograde approach for chronic coronary total occlusions. *JACC Cardiovasc Interv.* 2010;3(2):165-71.
- Medeiros JP, Pintón FA, Ybarra LF. Registro temporal brasileiro de intervenção coronária percutânea em oclusão crônica. *J Transcat Interv.* 2019;27:eA201810.