**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
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. 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, who later reported, in 2010, the most important and more often performed retrograde technique to this day, called reverse CART. The analysis and description of these techniques are beyond the scope of this editorial.

This issue brings an article by Medeiros et al., 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 intervention 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 an increasing number of operators that perform this technique with great skills and accuracy, enhancing the quality of life of our patients.

CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

REFERENCES