

Chronic total occlusion (CTO) in Japan



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Chronic total occlusion (CTO) was once called an unexplored frontier for interventional cardiologists. The need for a high level of technical expertise, longer procedure time, a higher rate of procedure-related complications, and other available treatment options prevented general cardiologists from revascularising CTO^{1,2}. Also, there was a paucity of reliable data supporting the clinical benefit of CTO revascularisation.

However, Japanese expert interventionalists have tackled this challenging subset of coronary lesions. The struggle for the conquest of CTO can be traced from the balloon angioplasty and bare metal stent era as if turning the pages of the history of CTO-PCI. Muramatsu et al reported an early success rate of 76.4% before 2003³. Another report by Saito et al showed a success rate of 67% between 1997 and 1999⁴. These unsatisfactory procedural success rates of CTO revascularisation gradually improved with the appearance of novel equipment and revascularisation strategies. The CONFianza PRO (ASAHI Intecc, Aichi, Japan), a tapered and stiff-tip guidewire still indispensable in contemporary CTO-PCI, greatly contributed to the higher success rate^{3,5}. Another epoch-making idea for the solution of the failed antegrade approach is the retrograde approach. Interestingly, the report by Kahn et al describing the retrograde approach via a bypass graft dates back

to 1990⁶. Dilated septal collateral channels were often attempted as safely and easily crossable routes for the retrograde approach⁷. Afterwards, the controlled antegrade and retrograde subintimal tracking (CART) technique was developed as an improved form⁸. Additionally, the Corsair (ASAHI Intecc), a microcatheter mainly used for channel dilation, was introduced in order to make channel dilation safer and more feasible⁹. The CART technique was epoch-making in that intentional subintimal tracking enabled the antegrade or retrograde wire to reach the opposite true lumen. Tsuchikane et al described the reverse CART technique: it was the most frequently employed using the Corsair and a 300 cm guidewire. The method of retrograde wire externalisation was also one of the advantages facilitating the reverse CART technique because of more back-up force and no need for balloon dilation in the retrograde direction^{10,11}. These excellent techniques and supporting devices have delineated the overall picture of contemporary CTO-PCI, increasing the procedural success rate of CTO-PCI to as high as about 90%^{10,12,13}.

Another milestone in our CTO history is the development of the J-CTO score system as a predictor of successful antegrade wiring¹⁴. One of the points in the J-CTO registry was the minute assessment of periprocedural variables, ranging from contrast

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volume and fluoroscopic time to guidewire manipulation time¹³. The J-CTO score was also unique and convenient in two respects: the prediction rule adopted simple, “presence-or-absence” style variables¹⁴. The easy scoring was one of the advantages for its widespread and continued use among clinicians. The other point was the introduction of the time required for guidewire crossing. The concept was very practical because many interventionalists had a time limit for the procedure and a prolonged procedure resulted in more complications. This predicting tool’s qualities of being simple, convenient and clinically relevant were statistically confirmed and validated in other studies^{15,16}.

Currently, CTO-PCI is performed by a stepwise approach with the support of intravascular ultrasound (IVUS) as in IVUS guidance in the reverse CART technique or IVUS-guided antegrade wire penetration^{11,17}. Now, we have reached a satisfactory level regarding procedural results in the second-generation drug-eluting stent era. However, the current results depend on highly skilled experienced operators and high case volumes. Therefore, the next course that we should pursue is to improve the level of general interventionalists by spreading the knowledge which is essential for successful CTO-PCI. This will certainly lead to the achievement of better mortality rates, which currently remains a topic of debate due to inconsistent results^{18,19}. Randomised data, including the minute assessment of myocardial viability and the degree of restoration of ejection fraction, are warranted to elucidate the true clinical relevance of CTO-PCI.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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