Retrograde Approach for Chronic Total Occlusion Percutaneous Coronary Intervention
The Paradox of Choice

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Large multicenter registries reporting outcomes associated with percutaneous coronary intervention (PCI) for the treatment of chronic total occlusions (CTO) have shown progressively increasing rates of overall procedural success with acceptably low complication rates in highly experienced centers. The significantly enhanced success rates of percutaneous CTO revascularization can be attributed to the introduction of advanced CTO crossing techniques, equipment, and technologies, along with increasing experience of dedicated operators. The CTO recanalization through retrograde septal and epicardial collaterals is among the techniques that have revolutionized the treatment of coronary CTO, enabling the successful treatment of CTO lesion with a broader complexity spectrum, despite it carrying a potential increased risk of complications compared with anterograde guidewire strategies. The retrograde approach was pioneered and developed in Japan, where this technique has been demonstrated to be feasible and effective (technical retrograde success 70%, procedural success 84%), while being also safe (major adverse cardiac events <2%).

This promising technique has been applied in other countries, and data on the reproducibility of Japanese outcomes in other settings have been reported, showing similar positive results. The largest experience with the retrograde approach has been recently published by the European Registry of Chronic Total Occlusion (ERCETO) group, reporting in-hospital and at-follow-up outcomes associated with retrograde CTO PCI in 1582 lesions treated from 2008 to 2012 in 44 European hospitals.

In the ERCETO registry, use of the retrograde approach increased from 11.8% in 2008 to 25% of all PCIs for CTOs in 2012. Procedural and clinical success rates were 75.3% and 71.2%, respectively. Procedural success increased from 73.5% in 2008 to 79.2% in 2012, whereas complications occurred in 6.8% of cases, mainly driven by collateral channel perforation or hematoma and donor vessel injury, but the rate of overall in-hospital rate of major adverse cardiac events was only 0.8%.

Data on the utilization and outcomes of the retrograde approach in more recent years, during which more advanced antegrade crossing strategies have been developed, are missing.

See Article by Karmpaliotis et al

In this issue of *Circulation: Cardiovascular Interventions*, investigators of the US multicenter PROGRESS CTO (Prospective Global Registry for the Study of Chronic Total Occlusion Intervention) registry report technical and procedural outcomes of the most contemporary experience on the retrograde approach for CTO PCI procedures performed in 11 centers from 2012 to 2015. Among a total of 1301 CTO PCIs, 41.4% of lesions (n=539) were treated by a retrograde approach, which was used as primary approach (n=248, 46%) in the index session and as secondary approach after antegrade crossing failure during the same procedure (n=291, 54%). Consistent with the reported experience of the Japanese Retrograde Summit Group, the technical success of the overall retrograde approach group, including both primary and secondary cases, was 84.8%, of which 22% (n=121) was achieved by finally going back to the antegrade route. Technical success rates were similar between the primary and secondary retrograde approach (85.5% versus 84.2%, respectively), though the final switching to the antegrade crossing technique was more common in the secondary retrograde approach (28.5%). Overall, the retrograde approach contributed to 28.7% of all technical success at a cost of a higher air kerma radiation dose (4.8 [3.0–6.6] versus 2.6 [1.6–4.2] Gray; P<0.001), longer procedure time (183 [128–234] versus 100 [68–135] min; P<0.001), and more frequent use of a hemodynamic support device (6.5% versus 2.1%; P<0.001) compared with antegrade-only cases, respectively. Rates of inhospital major adverse cardiac events, including death, myocardial infarction, urgent repeat revascularization, tamponade requiring either pericardiocentesis or surgery, and stroke, were 2.4%, 4.3%, and 1.1% in the overall, retrograde, and antegrade cases, respectively. The difference in major adverse cardiac events between the retrograde and antegrade approach was mostly driven by rates of myocardial infarction (2.1% versus 0.3%, respectively; P=0.003) and emergency pericardiocentesis (1.3% versus 0.3%, respectively; P=0.039).

A noteworthy aspect of this study is that it includes the highest percentage of the retrograde approach strategy among published series, in which the proportion of retrograde CTO PCIs ranged between 12% and 34%. Although this may be in part attributed to the current general trend toward the increased use over time of the retrograde approach, especially during the early learning and refinement curves, the extensive adoption of a hybrid algorithm, which encourages a premature change...
of strategy, may have been a key determinant of the higher use of the retrograde technique in this study. Indeed, the group undergoing a secondary retrograde approach represents the 27.6% of patients in whom the antegrade approach was initially chosen and afterward changed to retrograde because of difficulty in crossing the occlusion. In other words, this means an overall technical success of the antegrade approach of only 67.4% (714 antegrade success lesions out of 1053 lesions approached antegrade first). This latter rate of technical success can be considered low for current reported standard with the antegrade approach. For instance, in the ERCTO registry, the rates of procedural success reached with the antegrade approach ranged from 81.9% in 2008 to 88.1% in 2012. Of note, in the PROGRESS CTO registry, the overall procedural success (88.6%) achieved among all 1301 CTO cases was similar to that reported in the ERCTO registry, despite the lower proportion of retrograde use in this latter (41% versus 16%, respectively). This can be because of the suboptimal performance of the antegrade approach in the PROGRESS CTO registry. Consistent with what the authors have previously demonstrated, the hybrid algorithm was very effective because it was associated with a technical success rate of 86.0%, accounting for 24% of the overall CTO PCI success. However, the crossover approach probably led to an increased work burden with an overdue of the retrograde approach. The fact that the antegrade attempt before the retrograde crossover was not so vigorous may be suggested by 2 factors, the slight differences in procedure time between the primary and secondary antegrade approach (170 min [112–236] versus 187 min [142–234], respectively) and the 28.5% rate of reswisching to antegrade approach. Given the higher potential for complications with the retrograde strategies, an initial, more vigorous antegrade attempt may be appropriate in most CTO patients. In the PROGRESS CTO registry, the complication rate, which remains acceptably low especially if considering the complexity of population, might have been even lower with a more selective use of the retrograde approach.

The overall good acute results of the PROGRESS CTO registry provide further positive evidence on the reached high-reliability degree of CTO PCI in the hands of expert operators committed to a dedicated CTO practice and whose skills were expanded over a not-negligible period of time. The reported favorable results of CTO PCI should temper the general skepticism surrounding this procedure, encouraging clinical and interventional cardiologists to select PCI for CTO more frequently for those patients where it could be considered an appropriate option. In clinical practice, in cath-labs without a local CTO expertise, it is common that patients with a CTO not referred to surgery are treated with medical therapy as first choice, often without indication for an appropriate ischemia assessment. In presence of a CTO, cardiologists should evaluate symptoms, carefully considering those atypical, yet functionally limiting, patient quality of life and extent of myocardial ischemia. It is difficult to clearly identify factors that might substantially affect the frequency of CTO PCI procedures, but it is easy to recognize that a negative influencing factor is the failure in expanding the CTO skill domain. The best strategies and paths to spread out the skill sets of CTO PCI are yet unclear. For instance, it would be desirable for interventional cardiology societies to promote dedicated CTO PCI training and for the experts to laudably share their experience with colleagues who are interested in developing a CTO PCI program.

The better overall procedural outcomes, along with accumulating evidences showing the clinical benefits of CTO PCI, would enforce a reconsideration of a long-standing issue that historically has plagued the field of CTO intervention: should clinical indications or guidelines for CTO revascularization be expanded or revised? This is a particularly complex issue that has been appropriately addressed in recent comprehensive overviews. In general, several registries have shown promising results on the clinical benefits of CTO PCI in wide-ranging populations, but these data are still influenced by some confounders (ie, higher comorbidities burden of medically treated patients) to drive effective indications change. Results from ongoing randomized CTO trials (EuroCTO [European Study on the Utilization of Revascularization Versus Optimal Medical Therapy for the Treatment of Chronic Total Coronary Occlusions] and DECISION-CTO [Drug-Eluting Stent Implantation Versus Optimal Medical Treatment in Patients With Chronic Total Occlusion]) and from the ISCHEMIA (International Study of Comparative Health Effectiveness With Medical and Invasive Approaches) trial assessing the impact of an invasive strategy versus optimal medical therapy in patients with moderate to severe ischemia will provide new important insights on optimal patient selection for CTO recanalization. Although we are waiting for additional more conclusive studies, if a CTO revascularization is indicated based on a careful clinical evaluation, there is overall supportive evidence to choose PCI. Cardiologists can be reassured by the fact that among several crossing strategies, an expert CTO operator will carefully select the one providing the best balance between safety and effectiveness, without unnecessarily going too far with more complex and relatively less safe, though fashionable, techniques. Choice among many different techniques is crucial to get broader good results and is a key factor in medical art. On the contrary, having more choices available might create anxiety of using some of them prematurely with potentially less overall results and higher resources use, making the paradox of choice. The CTO operators, although excellent connoisseurs of more elegant and sophisticated techniques such as the retrograde approach, when choosing their initial strategy should not fall into the paradox of choice, being mindful that sometimes “the more is less.”

Disclosures
None.

References


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