

# Does successful chronic total occlusion recanalization fail to improve long-term survival?

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*Provenance:* This is a Guest Editorial commissioned by Section Editor Yue Liu, MD (Department of Cardiology, the First Affiliated Hospital of Harbin Medical University, Harbin, China).

*Comment on:* Lee PH, Lee SW, Park HS, *et al.* Successful Recanalization of Native Coronary Chronic Total Occlusion Is Not Associated With Improved Long-Term Survival. *JACC Cardiovasc Interv* 2016;9:530-8.

Submitted Sep 12, 2016. Accepted for publication Nov 30, 2016.

doi: 10.21037/cdt.2017.01.03

View this article at: <http://dx.doi.org/10.21037/cdt.2017.01.03>

There has been a significant increase in the number of patients undergoing successful CTO PCI in recent years, even though there might remain considerable controversy regarding the clinical benefit of this procedure. Although no randomized controlled clinical trials comparing CTO-PCI with medical therapy have been published to date, there is a growing body of evidence suggesting clinical benefits (1). These benefits include improvement of anginal symptoms, decreased anti-anginal medication intake, improved exercise capacity, improved left ventricular systolic function, decreased risk of arrhythmia, decreased the number of coronary artery bypass graft (CABG) procedures, and improved tolerance of future coronary occlusion events such as acute coronary syndrome among patients with successful versus failed CTO-PCI. Moreover, CTO is the most common reason for failing to achieve complete revascularization, and incomplete revascularization is associated with poorer clinical outcome compared with complete revascularization.

Application of drug-eluting stents (DES) has resulted in significant reduction of target vessel revascularization in non-CTO PCI, and has also led to a surge of interest in CTO-PCI. As a consequence, second-generation DES implantation is the current therapy of choice for percutaneous revascularization of CTO, because it is clear due to supporting clinical evidence in many meta-analyses that implantation of the second-generation DES improves long-term angiographic and clinical outcomes compared

with first-generation DES, bare metal stents, and balloon angioplasty without using stents (2).

In regards to long-term clinical outcomes, the survival benefit of CTO recanalization is less clearly established, although it has been previously suggested in prior studies (3-5).

A recent study published in this issue of *JACC Cardiovasc Interv* describes the long-term survival of CTO-PCI. Lee and colleagues evaluated (6) 1,173 consecutive patients with CTO of native coronary vessels requiring PCI of Asan Medical Center in Seoul between March 2003 and May 2014. The procedure was performed successfully, in 1,004 (85.6%) using DES implantation. However, successful recanalization of CTO PCI using DES was not associated with a reduction in long-term mortality over a median follow-up 4.6 years [hazard ratio (HR), 1.04; 95% confidence interval (CI), 0.53–2.04;  $P=0.94$ ].

This report also described that successful CTO PCI was associated with significant fewer subsequent CABG procedures. In contrast, in the group with failed CTO PCI a substantially higher rates of subsequent TVR (HR, 0.15; 95% CI, 0.10–0.25;  $P<0.001$ ) and CABG procedure (HR, 0.02; 95% CI, 0.006–0.06;  $P<0.001$ ) was observed.

In an evaluation of details of these results, complete revascularization was achieved in 77.2% and 75.9% of patients with failed CTO PCI excluding the CTO lesion and patients with successful CTO PCI within 6 months, respectively ( $P=0.77$ ). Nevertheless, patients with failed CTO PCI had significantly higher rates of TVR (4.4% *vs.*

20.9%;  $P < 0.001$ ) and CABG (0.4% *vs.* 16.7%;  $P < 0.001$ ). Accordingly, the overall incidence of any coronary revascularization and composite of death, Q-wave MI, or TVR were significantly higher in the failed CTO PCI group. Furthermore, in this report, the number of patients with multi-vessel disease is relatively lower (54%) compare with patients cohort in Valenti *et al.* (86%) (7). They found no differences in cardiac mortality between CTO PCI success and CTO PCI failure in patients with single vessel disease ( $P = 0.986$ ), while patients with multi-vessel disease and CTO-PCI success exhibited a higher cardiac survival when compared with CTO-PCI failure ( $91.4\% \pm 2.2\%$  and  $86.6\% \pm 3.1\%$ , respectively;  $P = 0.021$ ). It seems that the benefit of successful CTO recanalization is much higher in patients with diffuse coronary disease.

There are plausible explanations for the contradictory survival findings of these data and previous studies. Firstly, the high rate of surgical revascularization in the failed PCI cohort may have affected the outcomes. The inclusion of patients referred to an elective CABG following failed PCI in the failed PCI group may attenuate the possible long-term mortality benefit of patients in the successful PCI group. Importantly, more complete revascularization regardless of PCI or CABG is consistent with the growing emphasis on complete revascularization, likely achieved in this study by effective use of adjunctive CABG. Secondary, the high rate of revascularization strategy for non CTO vessel may have affected the clinical outcomes. Considering that the impact of collateral circulation is proportional to donor epicardial artery patency, maintaining patency of non-CTO vessels may have a prognostic impact via maintenance of myocardial perfusion at both non CTO and CTO artery-related territories in failed CTO PCI group. Lastly, this report was the single-center design and small sample size.

CTO-PCI has undergone significant evolution in recent years. Excellent results can be achieved with high success rates (8-10) and low complication rates (11) in experienced centers and operators using all available techniques both antegrade approaches including antegrade wire escalation using dedicated guidewires, parallel wire technique and intravascular ultrasound (IVUS)-guided wiring technique, as well as retrograde approaches including reverse controlled antegrade and retrograde subintimal tracking (CART) technique (12) and IVUS guided reverse CART (13).

Following the continuous improvement in procedural techniques, contemporary coronary stent systems, and optical medical therapy in coronary artery disease,

reassessment of the effect of the successful or failed revascularization of CTO PCI in a population with a relatively high success rate of second-generation DES treatment is crucial. Continued retrospective comparative multicenter trials of successful *vs.* unsuccessful CTO PCI will likely to further define the value of this procedure in the near future.

Most importantly, future prospective randomized controlled trials are clearly needed to establish the proper role of CTO PCI in our clinical strategy.

### Acknowledgements

None.

### Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

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**Cite this article as:** Tanabe M. Does successful chronic total occlusion recanalization fail to improve long-term survival? *Cardiovasc Diagn Ther* 2017;7(Suppl 2):S95-S97. doi: 10.21037/cdt.2017.01.03