

# Impact of Crossing Strategy on Intermediate-Term Outcomes After Chronic Total Occlusion Percutaneous Coronary Interventions

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## Introduction

Successful chronic total occlusion (CTO) percutaneous coronary intervention (PCI) has been associated with improved clinical outcomes. However, there is ongoing controversy on the optimal crossing strategy selection for CTO PCI, especially on the relative merits of antegrade dissection/re-entry and the retrograde approach. Crossing strategy selection heavily depends on the angiographic characteristics of the occlusion, but long term patency is still a critical factor, and although early reports on extensive antegrade dissection/re-entry techniques suggested high restenosis rates, limited contemporary data is published on this area.

## Methods

### Patient Population

We examined the procedural techniques and outcomes of 173 consecutive patients who underwent successful CTO PCI at our institution between January 2012 and March 2015. The use of devices and crossing techniques for each patient was at the discretion of the treating interventional cardiologist.

### Definitions and Study Endpoints

Coronary CTOs were defined as coronary lesions with thrombolysis in myocardial infarction (TIMI) grade 0 flow of at least 3-month duration.

Technical success of CTO PCI was defined as successful CTO revascularization with achievement of <30% residual diameter stenosis within the treated segment and restoration of TIMI grade 3 antegrade flow. Procedural success was defined as achievement of technical success with no in-hospital major adverse cardiac events (MACE).

## Results

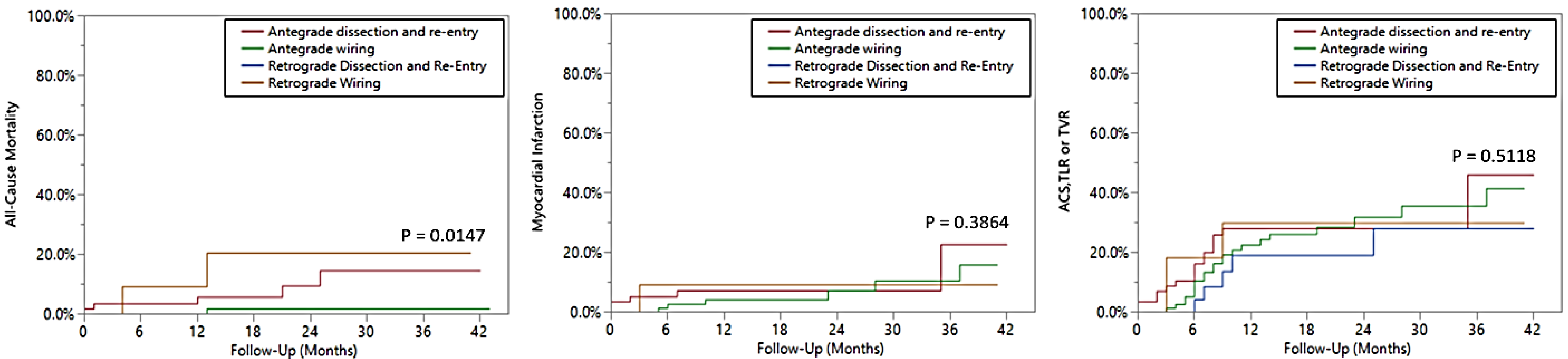
**Table 1.** Clinical characteristics of the study patients, classified according to final successful crossing strategy.

	All patients (n=173)	Antegrade Wire Escalation (n=79)	Antegrade Dissection and Re-Entry (n=58)	Retrograde Wire Escalation (n=11)	Retrograde Dissection and Re-Entry (n=25)	P
Age (years)*	64.9 ± 8.1	64.6 ± 8.4	65.2 ± 7.4	65.9 ± 9.7	64.8 ± 8.6	0.95
Men (%)	98.3	100	96.6	100	96	0.34
Left ventricular ejection fraction (%)*	49.2 ± 14.0	49.4 ± 15.0	52.0 ± 12.4	43.4 ± 10.2	44.4 ± 14.6	0.1
Diabetes mellitus (%)	60.1	67.1	58.6	45.4	48	0.24
Dyslipidemia (%)	93.1	93.7	94.8	90.9	88	0.71
Hypertension (%)	90.7	93.7	87.7	90.9	88	0.65
Smoking (%)	34.1	32.9	31.6	60	33.3	0.55
Prior MI (%)	47.1	41.0	52.6	63.6	45.8	0.38
Prior heart failure (%)	40.5	38.0	37.9	36.4	56	0.4
Prior PCI (%)	54.3	46.8	65.5	36.4	60	0.09
Prior CABG (%)	30.6	27.9	27.6	36.4	44	0.42
Cerebrovascular disease (%)	12.8	13.9	14.0	18.2	4	0.53
Peripheral arterial disease (%)	23.1	25.6	19.6	45.4	12.5	0.15
Baseline creatinine (mg/dL)	1.25 ± 0.84	1.21 ± 0.64	1.32 ± 0.92	1.06 ± 0.49	1.31 ± 1.27	0.74

**Table 2.** Angiographic characteristics of the study lesions, classified according to final successful crossing strategy.

	All patients (n=173)	Antegrade Wire Escalation (n=79)	Antegrade Dissection and Re-Entry (n=58)	Retrograde Wire Escalation (n=11)	Retrograde Dissection and Re-Entry (n=25)	P
Proximal cap ambiguity, (%)	17.7	10.3	19.6	27.3	32	0.06
Side branch at proximal cap, (%)	44.5	40.5	44.8	63.6	48	0.52
Bifurcation at distal cap, (%)	30.2	19.0	35.1	27.3	56	0.004
Interventional collaterals, (%)	43.3	33.8	29.3	72.7	92	<0.0001
Moderate or severe calcification, (%)	43.3	38.5	36.2	72.7	62.5	0.02
Moderate or severe tortuosity, (%)	48.8	51.9	38.6	54.6	60	0.25
Blunt stump (%)	33.5	21.5	39.66	45.4	52	0.01
Prior attempt to open CTO (%)	6.9	5.1	6.9	27.3	4	0.05
CTO due to in-stent restenosis, (%)	16.7	19.0	19.0	0	12	0.38
J-CTO score*	2.34 ± 1.04	2.05 ± 1.02	2.34 ± 1.04	3 ± 1.1	2.96 ± 0.68	0.0002
CTO Occlusion Length (mm)	37.43 ± 26.67	26.04 ± 16.44	46.58 ± 31.16	25.64 ± 11.90	55 ± 27.88	<0.0001
Total DES Stent Length (mm)	73.21 ± 38.36	56.45 ± 30.27	87.75 ± 41.81	62.73 ± 25.46	98.46 ± 32.29	<0.0001

**Figure 1.** Incidence of long-term clinical outcomes of the study patients, classified according to final successful crossing strategy.



## Conclusion

The main findings of our study are that in a contemporary CTO PCI practice:

- A) All available crossing strategies are required for successful recanalization
- B) Antegrade dissection/re-entry and the retrograde approaches are more frequently used in more complex lesions
- C) Favorable intermediate-term clinical outcomes can be achieved after successful CTO PCI regardless of intimal vs. subintimal CTO crossing strategy utilization.

Earlier studies from our institution had suggested a trend for higher rates of target vessel revascularization with use of the retrograde and antegrade dissection/re-entry approaches, but in this study the overall rate of target lesion revascularization was substantially lower and revealed no significant differences between crossing strategies.