APCTO CLUB registry: Outcomes and Lessons

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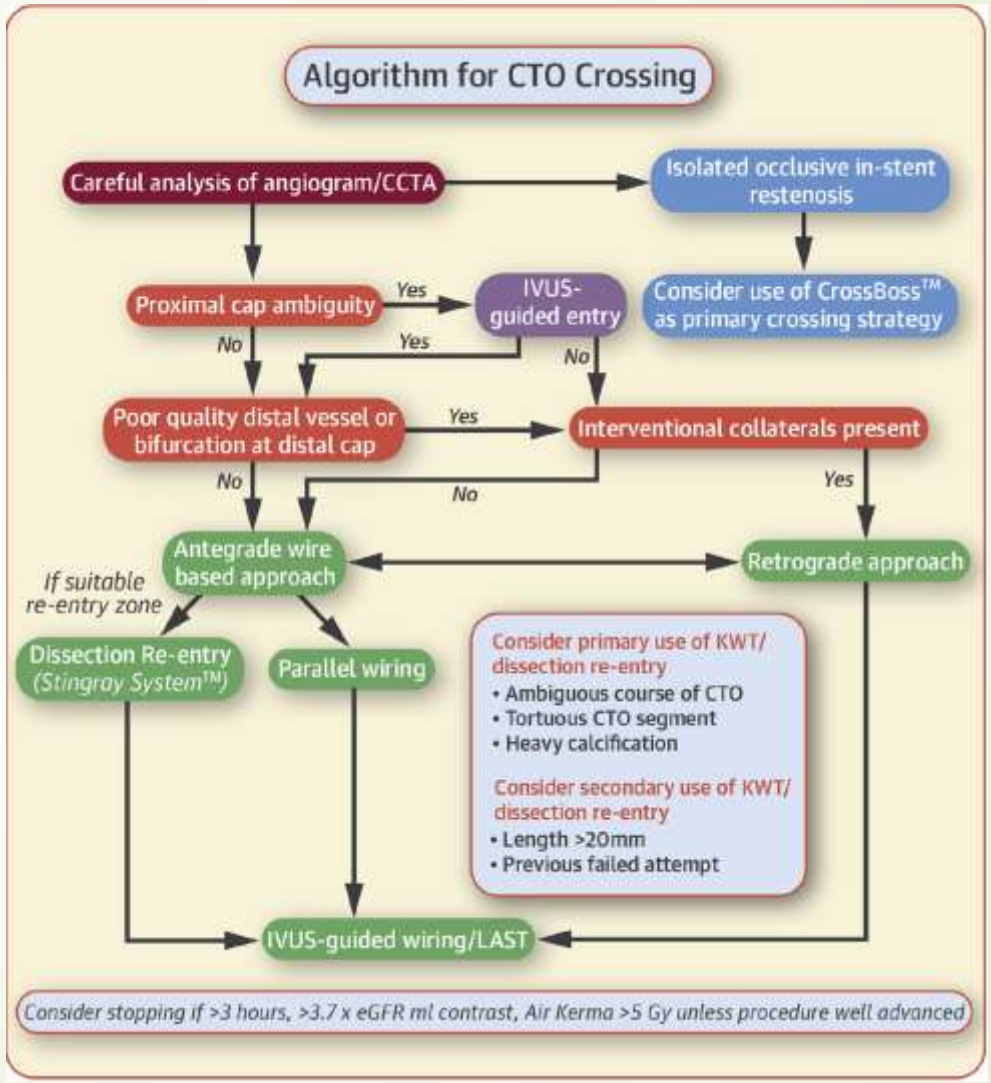
APCTO Club:


CTO Club
The 16th Seminar of
Angioplasty of Chronic Total Occlusions

APCTO algorithm



APCTO CTOPCI registry.

- 1st January 2016 to 31st December 2016.
- Consecutive patients undergoing CTO PCI performed entirely by eight high volume CTO operators.
- Countries: China, Hong Kong, Japan, Taiwan, Korea, Singapore, New Zealand and Australia.
- Exclusions: CTO cases where the operator was proctoring another operator who performed part of the case as first operator were excluded. No other exclusions were made.
- Procedural techniques, radiation dosage, contrast use, and outcome variables were collected by the operator and entered into a database used for the Japanese CTO registry

Patient Characteristics.

	Antegrade Only (n=259)	Retrograde used (n=226)	Total (n=485)	P value
Age, years, mean±SD	62.2±11	60.6±11.9	61.4±11.4	0.12
Age>=75 years	30 (11.6%)	28 (12.5%)	58 (12%)	0.77
Male	229 (88.8%)	198 (88%)	427 (88.4%)	0.77
Prior CABG	14 (5.4%)	15 (6.6%)	29 (6%)	0.57
Prior PCI	133 (51.4%)	175 (77.4%)	308 (63.5%)	<0.001
History of myocardial infarction	91 (35.1%)	71 (31.4%)	162 (33.4%)	0.39
Hypertension	189 (73%)	164 (72.6%)	353 (72.8%)	0.92
Diabetes mellitus	90 (34.7%)	76 (33.6%)	166 (34.2%)	0.80
Insulin-treated	10 (3.9%)	12 (5.3%)	22 (4.5%)	
Hyperlipidemia	149 (57.5%)	134 (59.3%)	283 (58.4%)	0.69
Smoking	121 (46.7%)	126 (55.8%)	247 (50.9%)	0.047
Current smokers	64 (24.7%)	78 (34.5%)	142 (29.3%)	0.02
Peripheral arterial disease	13 (5%)	9 (4%)	22 (4.5%)	0.58
Family History	17 (6.6%)	28 (12.4%)	45 (9.3%)	0.03
Stroke	16 (6.2%)	9 (4%)	25 (5.2%)	0.28
Clinical Indication				
OMI	47 (18.2%)	32 (14.2%)	79 (16.3%)	0.02
AMI	0 (0%)	2 (0.9%)	2 (0.4%)	
Unstable angina	29 (11.2%)	12 (5.3%)	41 (8.5%)	
Stable angina	155 (60.1%)	162 (71.7%)	317 (65.5%)	
Asymptomatic	27 (10.5%)	18 (8%)	45 (9.3%)	
LVEF, %, median (IQR)	59 (49-64)	58 (49-64)	58.1 (49-64)	0.90
Low LVEF (<=40%), %	29 (13.7%)	22 (12%)	51 (12.9%)	0.61
Multivessel disease	153 (59.1%)	158 (69.9%)	311 (64.1%)	0.01

Angiographic Characteristics

	Antegrade-Only	Retrograde	Total	P
	N=269	N=228	N=497	
J-CTO scores	2.5±1.2	3.4±1.0	2.9±1.2	<0.001
Easy (0)	10 (3.8%)	0 (0%)	10 (2%)	<0.001
Intermediate (1)	46 (17.3%)	7 (3.1%)	53 (10.8%)	
Difficult (2)	71 (26.7%)	36 (15.9%)	107 (21.7%)	
Very difficult (>=3)	139 (52.3%)	183 (81.0%)	322 (65.4%)	
CTO target vessels				
RCA	107 (38.2%)	134 (58%)	241 (47.2%)	<0.001
LAD	121 (43.2%)	82 (35.5%)	203 (39.7%)	
LCX	52 (18.6%)	14 (6.1%)	66 (12.9%)	
LX/ LMT/ SVG	0 (0%)	1 (0.4%)	1 (0.2%)	
In-stent restenosis	34 (12.6%)	13 (5.7%)	47 (9.5%)	0.01
Moderate/ Severe tortuosity	56 (20.9%)	40 (17.5%)	96 (19.4%)	0.35
Reattempt lesion	62 (23.0%)	109 (47.8%)	171 (34.4%)	<0.001
Occlusion length ≥20mm	165 (61.6%)	187 (82.4%)	352 (71.1%)	<0.001
Lesion Calcification				
Presence	178 (66.7%)	177 (78.0%)	355 (71.9%)	0.01
Moderate/ Severe	103 (38.6%)	114 (50.2%)	217 (43.9%)	0.01

Procedural Outcomes

	Antegrade-Only	Retrograde	Total	P
	N=269	N=228	N=497	
Technical success	258 (95.9%)	208 (91.2%)	466 (93.8%)	0.03
Use of IVUS	92 (34.2%)	92 (40.4%)	184 (37%)	0.16
Stenting	255 (94.8%)	206 (90.4%)	461 (92.8%)	0.06
DES use	254 (99.6%)	205 (99.5%)	459 (99.6%)	1.00
BMS only	1 (0.4%)	1 (0.5%)	2 (0.4%)	
No. of stent implanted at CTO vessel	2 (1-3)	2 (2-3)	2 (2-3)	<0.001
Total stent length	57 (38-76)	76 (61-99)	66 (47.8-87)	<0.001
Procedure time (min)	70 (50-110)	120 (100-180)	100 (60-140)	<0.001
Fluoroscopy time (min)	31.5 (22-49.2)	67.5 (48-95)	47.3 (28-72)	<0.001
Wire crossing time (min)	22.5 (10.3-40)	55 (36.5-83)	37 (18-60)	<0.001

In Hospital MACE

	N=269	N=228	N=497	
Procedual success	254 (94.4%)	193 (84.6%)	447 (89.9%)	<0.001
MACE	4 (1.5%)	15 (6.6%)	19 (3.8%)	0.003
***Death**	0 (0%)	1 (0.4%)	1 (0.2%)	0.46
***MI**	4 (1.5%)	13 (5.7%)	17 (3.4%)	0.01
***Hemorrhagic stroke**	0 (0%)	1 (0.4%)	1 (0.2%)	0.46
***Emergency CABG**	0	0	0	
***Emergency PCI**	0	0	0	
***Emergency pericardiocentesis**	0 (0%)	1 (0.4%)	1 (0.2%)	0.46
Stent thrombosis	1 (0.4%)	1 (0.4%)	2 (0.4%)	1.00
Coronary embolism	1 (0.4%)	0 (0%)	1 (0.2%)	1.00
Coronary perforation	2 (0.7%)	7 (3.1%)	9 (1.8%)	0.09

Figure 1. Flowchart illustrating the crossing strategies used for the CTO PCI procedures.

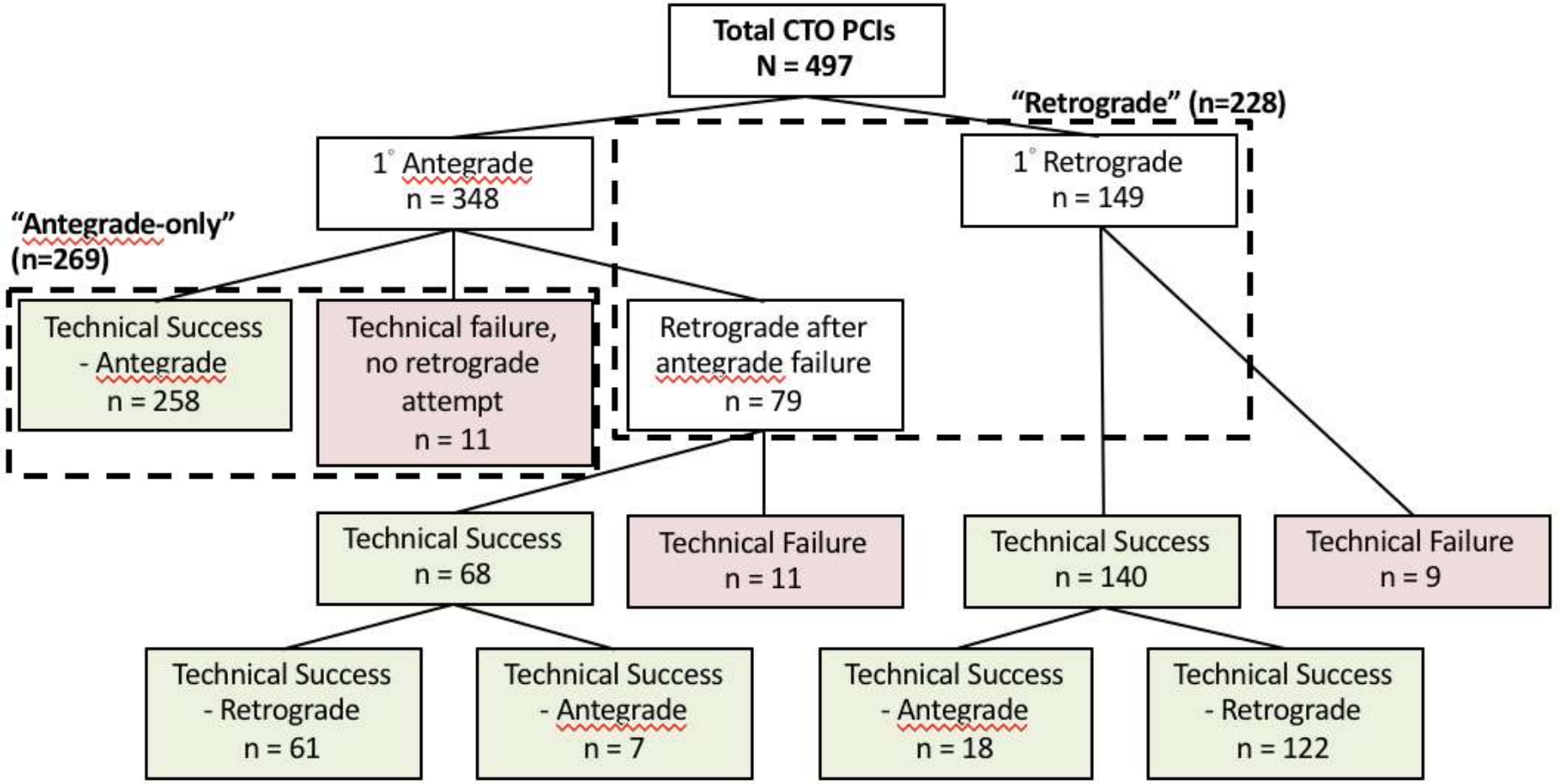
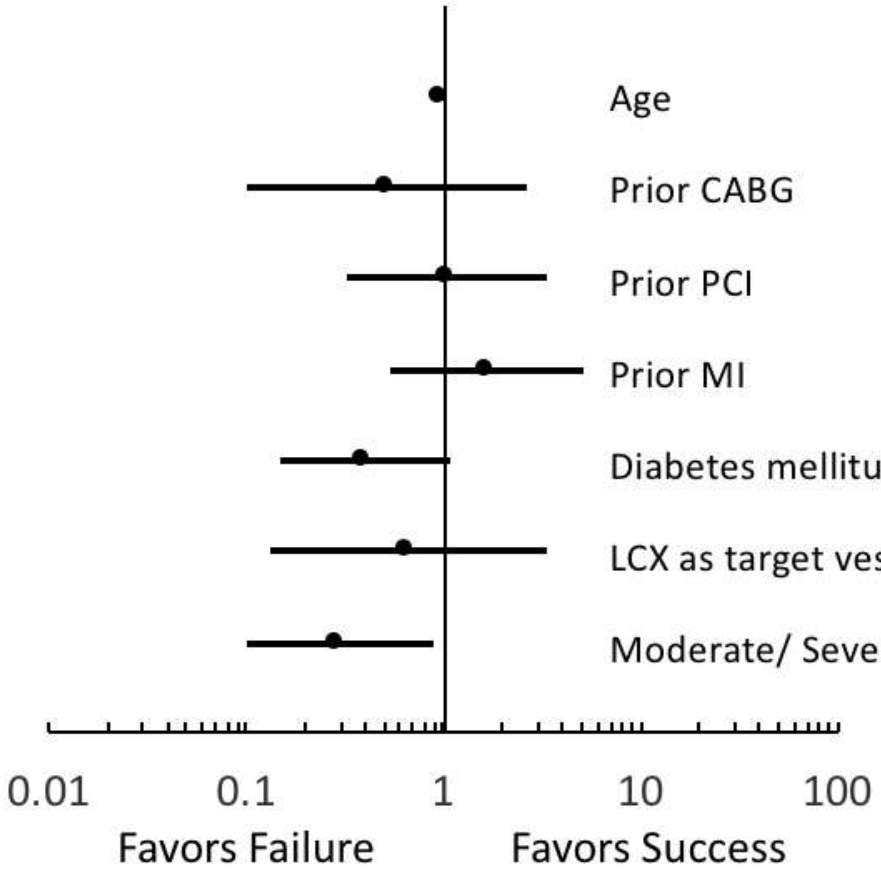


Figure 3. Retrograde success – multivariate predictors of technical success.



	Odds Ratio	95% CI	p
Age	0.95	0.91-1.00	**0.04**
Prior CABG	0.52	0.10-2.60	0.42
Prior PCI	1.04	0.32-3.37	0.95
Prior MI	1.67	0.54-5.20	0.38
Diabetes mellitus	0.39	0.15-1.06	**0.06**
LCX as target vessel	0.66	0.13-3.37	0.62
Moderate/ Severe tortuosity	0.29	0.10-0.88	**0.03**

CABG = coronary artery bypass grafting; PCI= percutaneous coronary intervention; MI= myocardial infarction; LCX= Left Circumflex artery; CI= confidence interval.

COMPARISON TO OTHERS

Author	Country	Duration of recruitment	n	Technical success	Procedural success	JCTO score	Percent Retrograde	Cx or MACE
Lee 2017 [13]	Taiwan	2012-2013	321	96.9%	94.1%	3.3	53%	0.6%
Retrograde				96.4%	92.8%			0.7%
Antegrade				97.4%	95.4%			0.6%
Michael 2013 [23]	US	2006-2011	1361	85.5%	84.2%		34%	1.8%
Retrograde				80.9%	78.5%			3.4%
Antegrade				87.8%	87.1%			0.9%
Karmpaliotis 2016 [10]	US	2012-2015	1301	90%	89%	2.5	41.4%	2.4%
Retrograde				84.8%	81.9%	3.1		4.3%
Antegrade				93.7%	93.3%	2.1		1.1%
Tsuchikane 2013 [24]	Japan	2009-2010	801	84.8%	83.8%		26.6%	1.6%
Retrograde				71.2%	70.3%			
Maeremons 2016 [18]	RECHARGE	2014-2015	1253	86%		2	34%	2.6%
Retrograde	Europe			62%				
Christensen 2017 [25]	Denmark	2010-2015	594	69%		3	17%	4%
Retrograde				65%				
Antegrade				72%				
Suzuki 2017 [26]	Japan	2014-2015	2846	89.9%	88.8%	2	27.8%	1.1%
Retrograde				87.3%	85%	2.4		2.3%
Antegrade				91%	90.3%	1.9		0.7%
Wu current	Asiapacific	2016-2016	497	93.8%	89.9%	2.9	46%	3.8%
Retrograde				91.2%	84.6%	3.4		6.6%
Antegrade				95.9%	94.4%	2.5		1.5%

Comparison of contrast and radiation.

Author	Contrast/mls	Fluoro time/mins	Radiation/ Gy	Procedure time/mins
Lee 2017 [13]	265.5	42	5.5	105
Retrograde	287.3	50	6.5	122.5
Antegrade	241.3	33	4.3	85
Michael 2013 [23]	294	42	4.7	113
Retrograde	343	61	6.4	150
Antegrade	268	32	3.7	95
Karmpaliotis 2016 [10]	260	45.6	3.5	125
Retrograde	300	73.8	4.8	183
Antegrade	245	31.8	2.6	100
Maeremons 2016 [18]	250	35	1.6	90
Suzuki 2017 [26]	230			160
Retrograde	246			202
Antegrade	225			144
Wu 2018	250	47.3	3	100
Retrograde	300	67.5	4	120
Antegrade	210	31.5	2	70

Lessons?

- Retrograde success is very high – with "pure retrograde success" (defined as success through retrograde wire passing/ all cases with any retrograde attempt) is 80% - this compares to 62% in Karmpaliotis and 72% in Japanese expert registry – this explains our high success rate
- Therefore, there can be room for improvement of retrograde techniques that can achieve higher rates.
- Tortuosity remains a predictor for failure in our cases – perhaps this reflects still some reluctance to use knuckle wiring when it is needed – since the US data does not have such a predictor.
- The use of an algorithm may contribute to quicker changes to alternative techniques, more efficient procedure, and increased awareness of radiation and contrast dosage

Conclusions.

- The retrograde approach, when used by experienced operators who have been trained by a master of retrograde, can produce higher retrograde success (80%) in complex CTO lesions.
- The use of an algorithm approach may improve procedural efficiency, reduce contrast and radiation dosage, and reduce the time spent in failure mode.
- These tools remain vital to the development of future CTO PCI.