Outcomes of percutaneous coronary interventions for chronic total occlusion performed by highly experienced Japanese specialists
the 2nd report from the Japanese CTO-PCI expert registry

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Back Ground

- Y. Suzuki et al reported the outcomes of 2,846 cases from 2014-2015 and the overall technical success rate of procedures in CTO-PCI was high (89.9%) (##).
- In addition, severe lesion calcification was a strong predictor of failed CTO-PCI.
- We here report the outcomes in CTO-PCI in 2016 and analyzed whether technical success rate in 2016 improved in comparison with the rate from 2014-2015.

##JACC:CARDIOVASCULARINTERVENTIONSVOL.10,NO.21,2017Suzuki et al.
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Outcomes of Percutaneous Coronary Interventions for Chronic Total Occlusion Performed by Highly Experienced Japanese Specialists

The First Report From the Japanese CTO-PCI Expert Registry

	Overall (N = 2,596)	PAA (n = 1,872)	PRA (n = 724)	PAA vs. PRA p Value
GW success	92.0	92.9	90.1	0.016
Technical success	89.9	91.0	87.3	0.006
Procedural success	88.8	90.3	85.0	<0.0001

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Multivariate Analyses Investigating Possible Predictors of Failed CTO-PCIs

	Overall		
	OR	95% CI	p Value
Prior CABG	1.47	0.765–2.715	0.219
Prior PCI	1.276	0.928–1.756	0.134
Diabetes	1.12	0.850–1.476	0.421
eGFR >60 ml/min/1.73 m^2	0.764	0.576–1.012	0.061
Reattempt	1.131	0.811–1.577	0.469
Target (LAD)	1.26	0.878–1.808	0.211
CTO length ≥20 mm	1.42	1.036–1.946	0.029
Severe calcification	3.101	2.057–4.675	<0.001
Tortuosity of CTO lesion	1.972	1.438–2.703	<0.001
Dyslipidemia			
Side branch at proximal cap			

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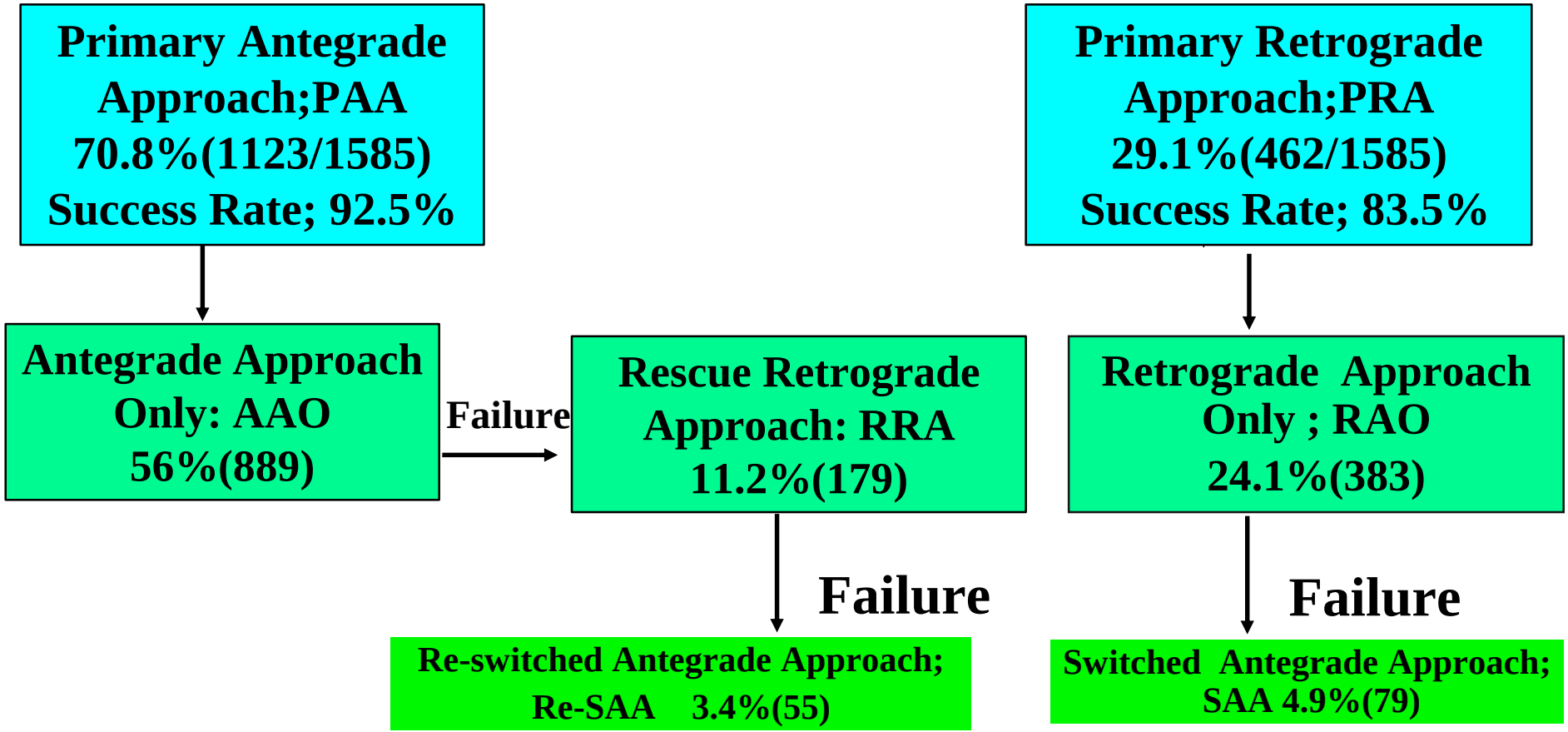
Methods

- Operators who have experience of performing CTO-PCI more than 50 cases annually and total more than 300 cases are selected as CTO PCI SPECIALIST (CPS).
- The CPS registered all the consecutive CTO-PCI cases in 2016
- The primary endpoint is to assess technical success rate of CTO-PCI cases performed in 2016.
- The secondary endpoint is to evaluate hospital mortality, major adverse cardiovascular and cerebrovascular events (MACCE)
- We assessed cases based on ITT classification (PRA, PAA), categorized them into 5 groups based on approaches used (AAO, RRA, Re-SAA, RAO, SAA).

2016;Total 1585 CTO Lesions



Patient/Lesion Back Ground

	2016(1585)	PAA 2016	PRA 2016	P value
		70.8%(1123/1585)	29.1%(462/1585)	
Age	66.7±10.8	67.0±10.8	65.94±10.9	0.559
BMI	24.7±3.7	24.65±3.7	24.89±3.6	0.670
LVEF	55.1±12.7	55.4±12.7	54.47±12.3	0.177
eGFR	61.5±23.5	61.7±23.7	61.2±23.0	0.367
Male gender, %	85.4	83.9	89.0	0.010
Hypertension, %	77.3	77.1	77.8	0.790
Dyslipidemia, %	77.9	77.1	79.8	0.136
Diabetes, %	45.8	46.9	43.0	0.388
Current smoking, %	55.4	54.8	56.7	0.199
OMI, %	48.5	47.8	50.4	0.713
Prior CABG, %	6.6	5.0	10.4	<0.001
Prior PCI, %	67.2	65.5	71.3	0.036
Reattempt, %	19.5	13.5	34.1	<0.001
Syntax score	15.88±8.5	18.49±9.0	17.07±9.4	0.882
J-CTO score	1.80±1.1	1.59±1.1	2.33±1.1	<0.001
0-2(%)	42.3			<0.001
2<(%)	57.7	49.8	77.3	<0.001
Target vessel, %				
LAD	33.1	36.1	26.0	
LCX	17.4	21.2	8.0	
LMT	0.3	0.1	0.6	
RCA	49.3	42.7	65.3	<0.001

Lesion Back Ground

	2016(1585)	PAA 2016	PRA 2016	P value
In-stent occlusion, %	11.6	13.7	6.3	<0.001
Distal run off (<3.0mm), %	71.9	73.0	69.3	0.345
CTO length (≥20mm), %	52.7	45.7	69.7	<0.001
Side branch at proximal cap, %	39.9	39.9	39.8	0.980
Collateral filling, %				<0.001
Contralateral	48.8	42.9	63.2	
Ipsilateral	38.1	41.4	29.9	
Both	12.5	14.8	6.9	
None	0.6	0.9	0.0	
Lesion calcification, %	49.9	48.2	54.1	0.036
Severe calcification, %	7.5	6.6	9.7	0.036
Proximal tortuosity, %	50.5	50.5	50.4	1.000
Tortuosity of CTO lesion, %	20.3	17.9	26.2	<0.001
Morphology of proximal cap, %				<0.001
Blunt	18.8	17.5	21.9	
No stump	17.2	14.7	23.4	
Tapered/tunnel	62.5	66.6	52.6	

Result ; Procedure

Result	2016(1585)	PAA 2016	PRA 2016	P value
collateral crossing, %				
Try	44.1(699/1585)			
Collateral Crossing Success	80.8(565/699)	79.8(190/238)	81.3(375/461)	0.685
Success %				
GW success, %	92.2	94.8	85.7	<0.001
Technical success, %	89.9	92.5	83.5	<0.001
Procedural success, %	88.1	91.0	81.1	<0.001
Procedure time	154.5±87.3	133.7±79.3	205.0±85.2	0.046
Contrast volume	210.6±95.3	202.5±93.6	230.1±96.7	0.200
Complication				
Death	0.4	0.3	0.3	0.753
Myocardial Infarction	1.1	0.8	2.1	0.001
Stent thrombosis	0.2	0.1	0.3	0.681
Coronary artery occlusion	0.3	0.1	0.5	0.039
Cerebral infarction	0.4	0.2	0.4	0.345
Coronary Perfolation	4.1	3.3	8.1	<0.001
Blood Access complication	1.9	1.4	1.9	0.259
Emergency PCI	0.1	0.2	0.1	0.466
Emergency CABG	0.1	0	1	1.000
Contrast Induced Nephropathy	8.9	2.7	4.3	0.113
Radiation Dermatitis	8.2	0	0.5	<0.001

Multivariate Analysis for Unsuccessful procedure factor

2016	OR	CI	P-value
eGFR	0.841	0.525-1.346	0.470
Procedure time 143min	2.005	0.960-4.189	0.064
Contrast Volume 230ml	1.085	0.680-1.731	0.734
Fluoro time	1.094	0.639-1.875	0.743
OMI	1.501	0.947-2.379	0.084
Re attempt Lesion after PCI	1.261	0.773-2.056	0.353
CTO length (≥20mm)	1.748	0.990-3.087	0.054
Collateral channel (contralateral)	0.502	0.229-1.100	0.085
Collateral channel (ipsi + contralateral)	0.336	0.142-0.791	0.013
Severe calcification	2.856	1.389-5.873	0.004
Proximal tortuosity	0.650	0.166-2.548	0.537
Tortuosity of CTO lesion	1.610	0.976-2.658	0.062
Morphology of proximal Tapered	1.011	0.505-2.022	0.976
Morphology of proximal no stump	1.033	0.581-1.835	0.913
Retrograde channel unsuccess	7.140	4.344-11.735	<0.001

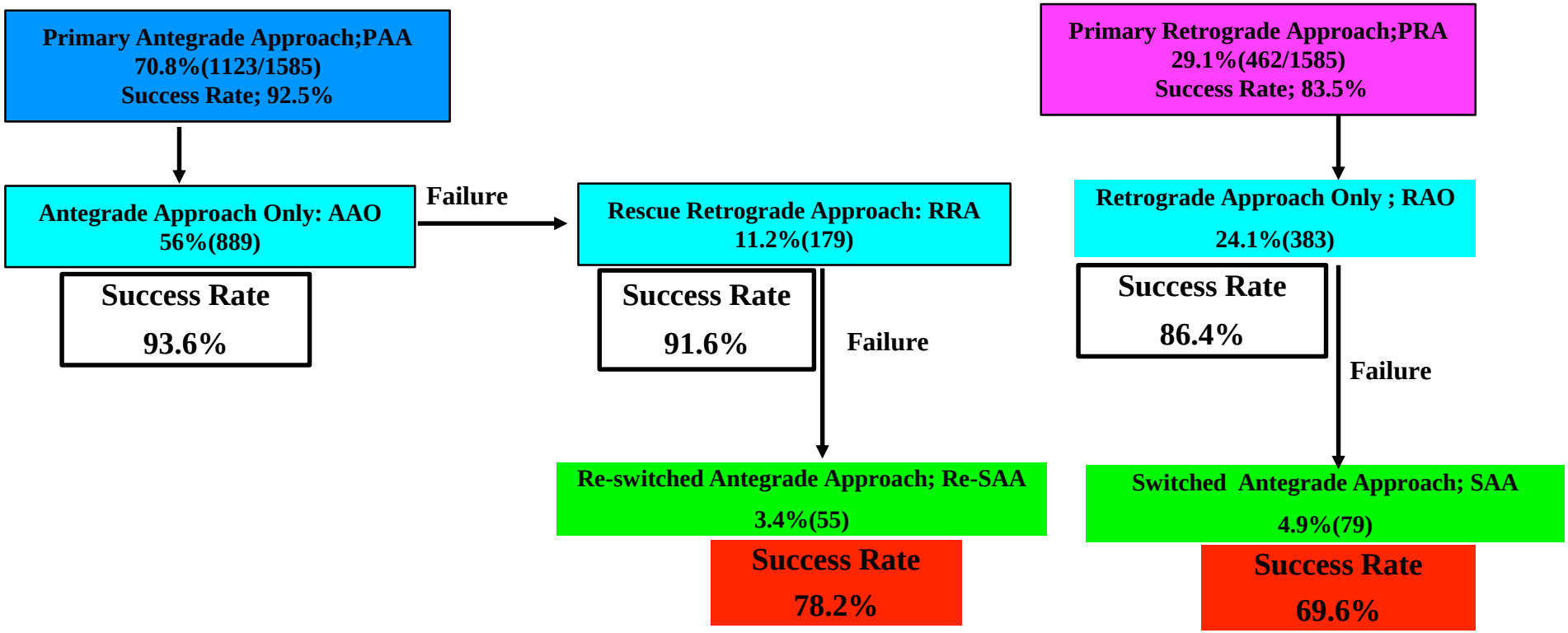
Multivariate Analysis PAA/PRA in 2016

	PAA				PRA		
	OR	CI	P-value		OR	CI	P-value
eGFR	0.474	0.180-1.251	0.132	Procedure Time 143min	1.698	0.712-4.049	0.232
Procedure Time 143min	2.664	0.611-11.623	0.192	Contrast volume 230ml	1.354	0.079-2.320	0.270
Fluoro Time 90min	0.706	0.234-2.129	0.537	Fluoro Time 90min	1.195	0.641-2.227	0.576
Distal run off (<3.0mm)	1.002	0.332-3.024	0.997	OMI	1.736	1.011-2.981	0.046
CTO length (≥20mm)	0.886	0.332-2.367	0.809	CTO length (≥20mm)	2.527	1.260-5.065	0.009
Branching CTO	1.680	0.658-4.284	0.278	Severe calcification	2.526	1.116-5.719	0.026
Collateral channel (Ipsi)			0.455	Tortuosity of CTO lesion	1.448	0.808-2.594	0.214
Collateral channel (contralateral)	0.475	0.095-2.362	0.363	Retrograde channel unsuccess	5.747	3.174-10.404	<0.001
Collateral channel (ipsi + contralateral)	0.342	0.063-1.859	0.214				
Severe calcification	4.389	0.862-22.350	0.075				
Proximal tortuosity	1.080	0.072-16.306	0.956				
Tortuosity of CTO lesion	1.937	0.699-5.365	0.203				
Morphology of proximal Blunt			0.434				
Morphology of proximal Tapered	2.594	0.501-13.440	0.256				
Morphology of proximal no stump	1.264	0.318-5.025	0.740				
Retrograde channel unsuccess	14.202	5.203-38.760	<0.001				

Summary

- There are no significant difference of success rate between 2014-2015 and 2016 (89.9% vs 89.9%, P=1.000).
- Procedure complication were acceptable (death; 0.4%, myocardial infarction; 1.1%, coronary perfolation 4.1%, blood access complication; 1.9%, contrast-induced nephropathy; 8.9%).
- In a multivariate analysis, retrograde channel unsuccess and severe lesion calcification were strongly independent factors of failed procedure.

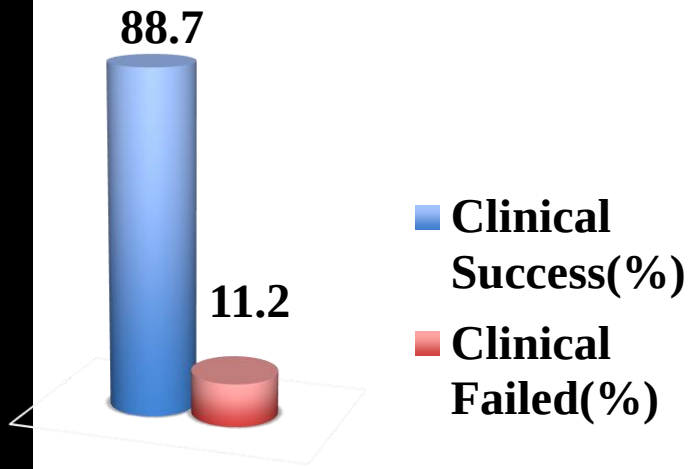
2016;ITT analysis



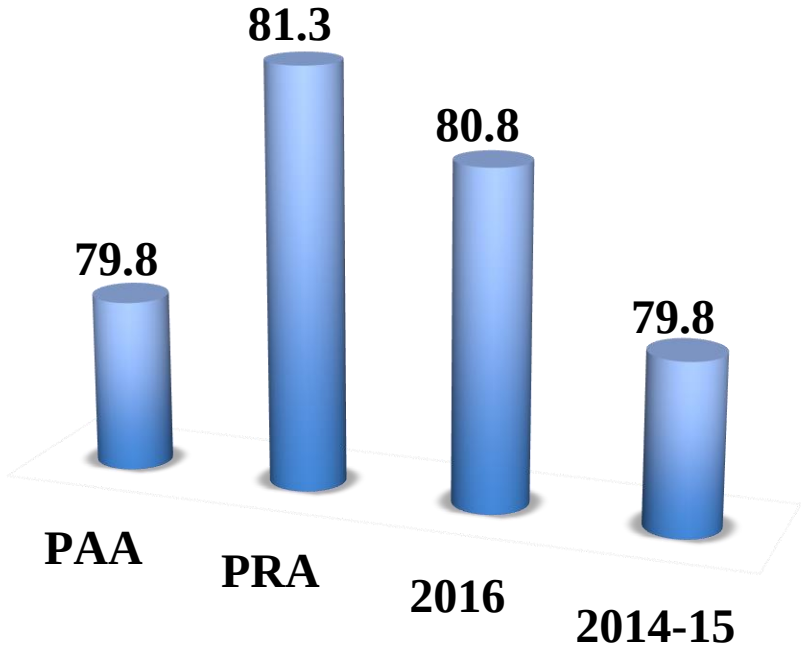
AAO, RRA and RAO were High success rates (93.6%,91.6% and 86.4%).

Re-SAA and SAA (after retrograde approach failed in PAA and PRA) were low success rate (78.2% and 69.6%).

Retrograde Channel success rate is limited

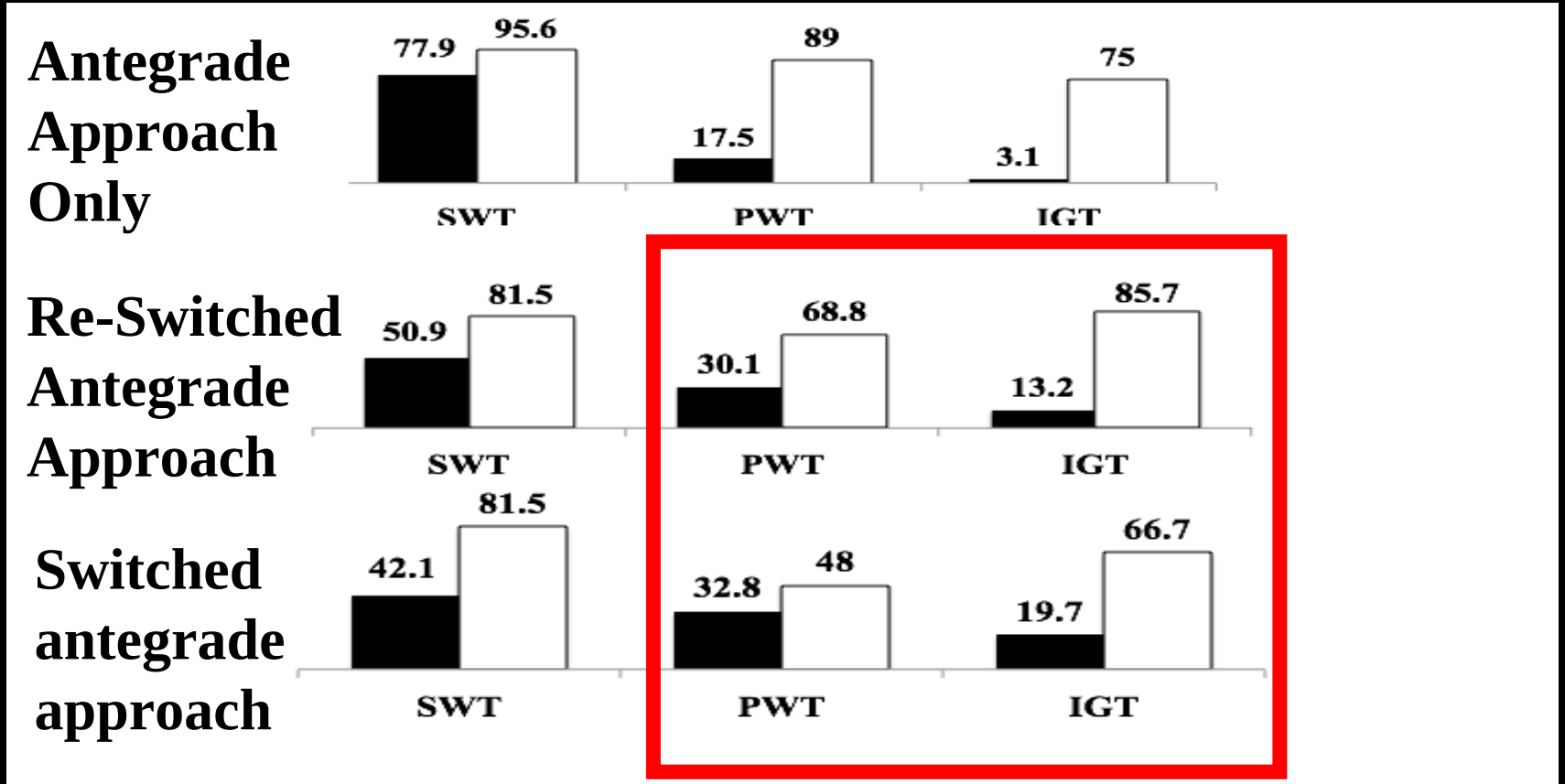


Clinical Success Rate (%)
after Retrograde Channel Success



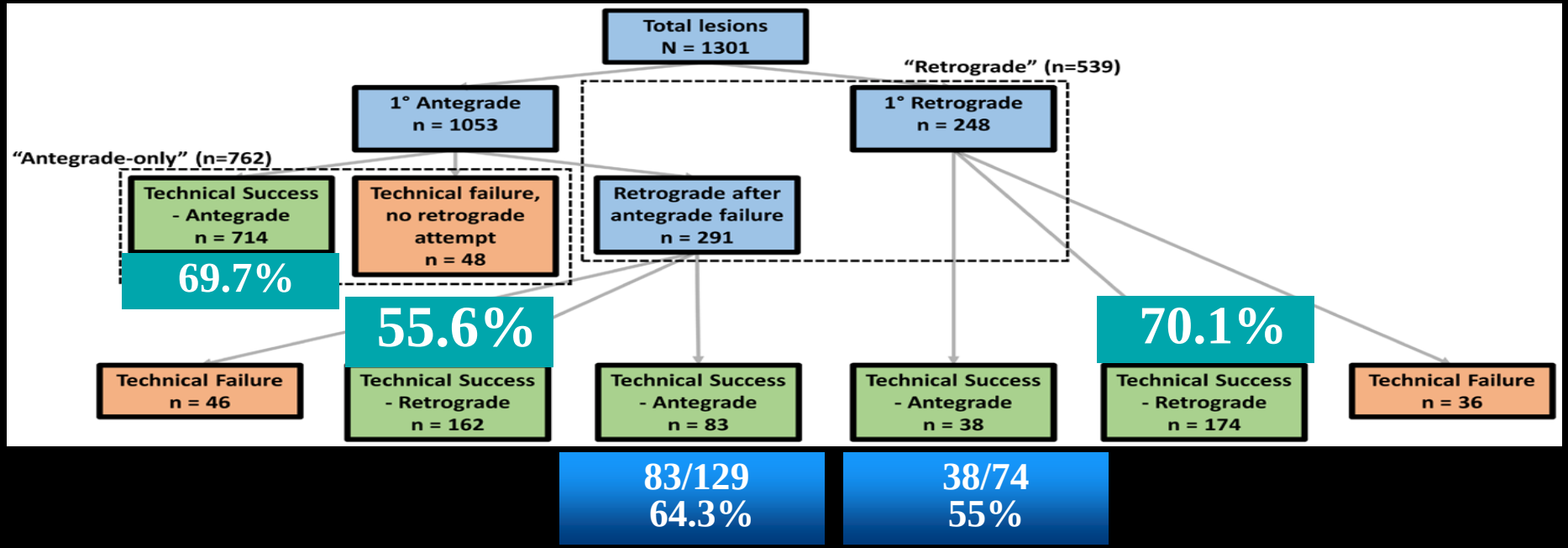
Retrograde Channel Success Rate(%)

Detail of antegrade procedure analysis



SWT; Single Wire Technique,
PWT; Parallel wire technique,
IGT;IVUS guide technique

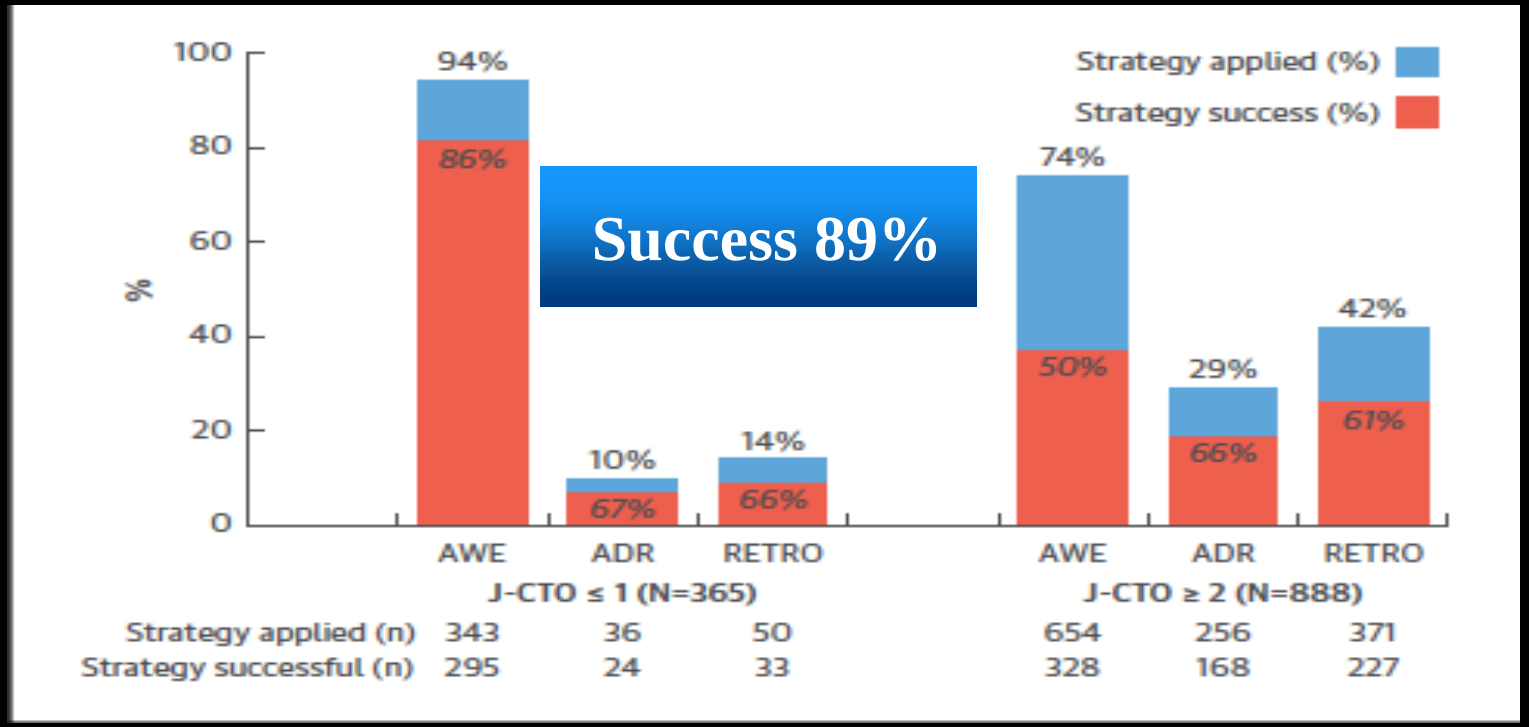
Outcomes With the Use of the Retrograde Approach for Coronary Chronic Total Occlusion Interventions in a Contemporary Multicenter US Registry



(*Circ Cardiovasc Interv*. 2016;9:e003434.
DOI: 10.1161/CIRCINTERVENTIONS.115.003434.

The Hybrid Algorithm for Treating Chronic Total Occlusions in Europe

The RECHARGE Registry



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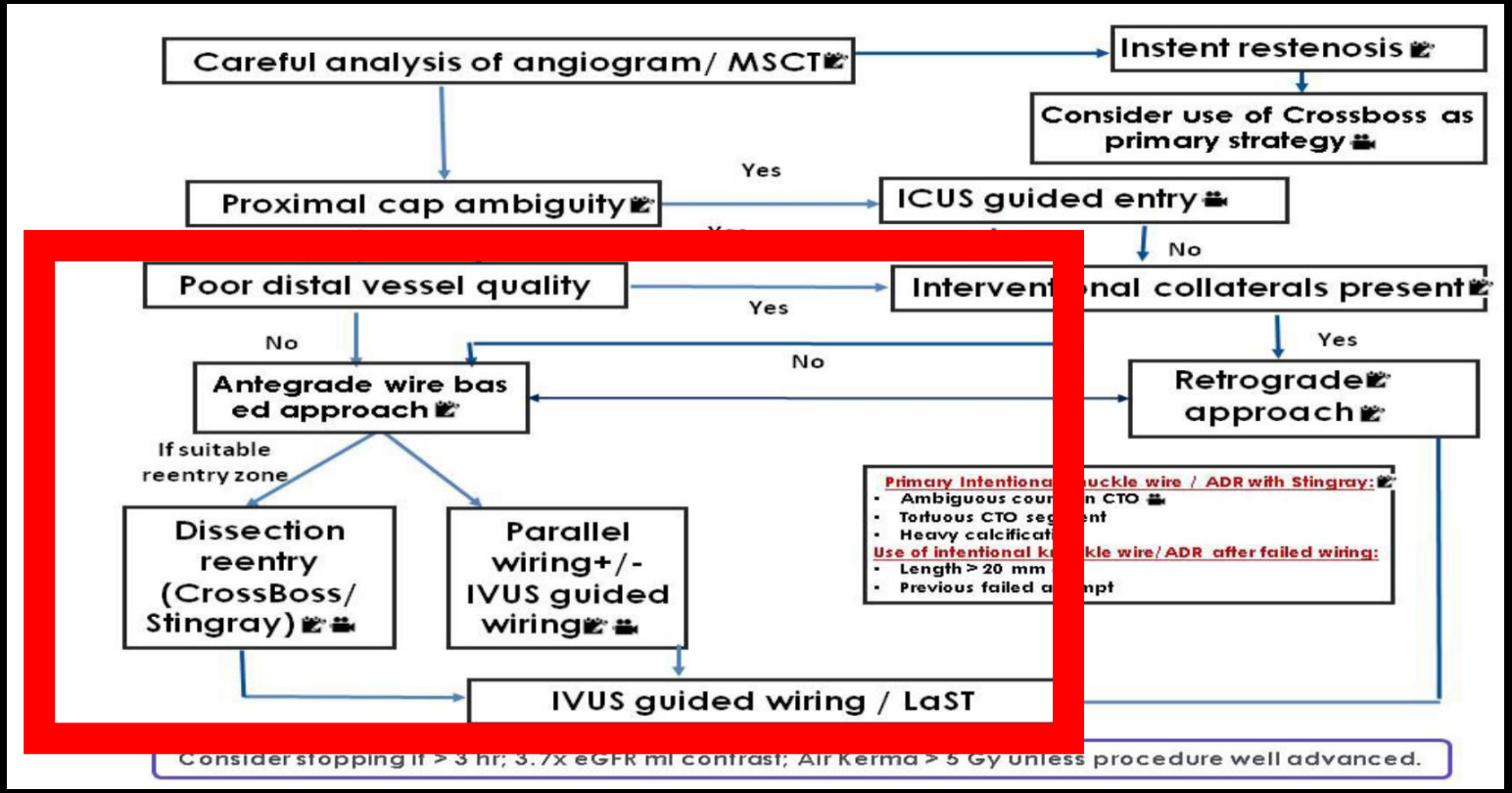
Problem list

- **Building retrograde system is limited.**
- **Antegrade procedure after retrograde failed is low success rate.**

A New Algorithm for Crossing Chronic Total Occlusions From the Asia Pacific Chronic Total Occlusion Club



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Initial results of a first-in-human study on the PlasmaWire™ System, a new radiofrequency wire for recanalization of chronic total occlusions

Patient initials	Electrical channel creation	Mechanical channel creation	Elapsed time from PW* delivery to CTO crossing	Patient success	Any complication[a] (in-hospital to 30 days)
KN	Success	Success	13 min	Success[b]	None
FK	Success	Success	18 min	Success	None
YS	Success	Success	10 min	Success	None
KB	Success	Success	14 min	Success	None
HS	Success	Success	16 min	Success	None
KY	Success[c]	Success	72 min	Success	None
TH	Success[c]	Success	54 min	Success	None

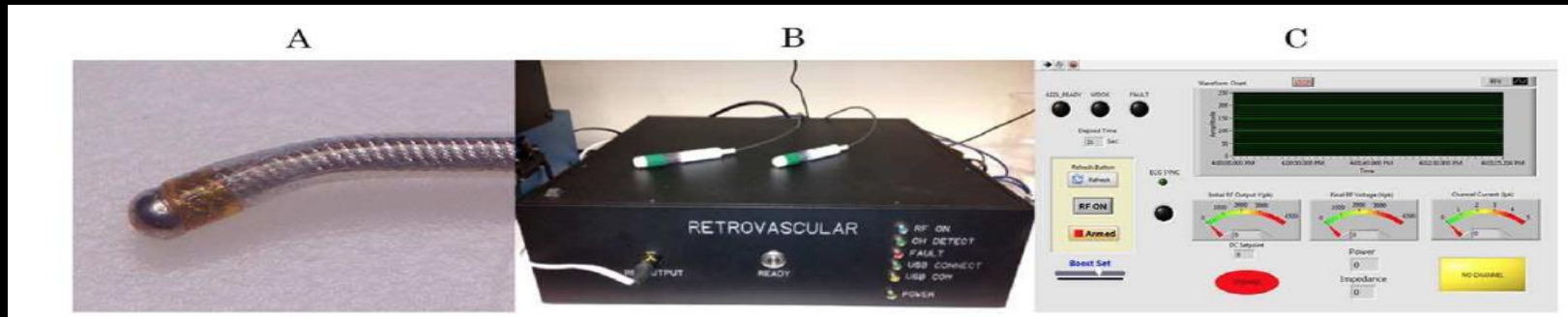

FIGURE 1 PlasmaWire™ System (RetroVascular, Inc.,). (A) Distal Tip of PlasmaWire™, (B) Radiofrequency generator (RFG) with Connector Cable attached, (C) Laptop/user interface

Catheter Cardiovasc Interv. 2018 May 1;91(6):1045-1051

Conclusion

- **CTO-PCI performed by highly experienced specialists kept a high technical success rate.**
- **To get more improvement, retrograde channel crossing was strong failed factor. However retrograde channel success rate was limited.**
- **We need to modify antegrade complex procedure to add antegrade dissection reentry device and plasma wire.**