The First Report from the Japanese CTO PCI Expert Registry

Yoriyasu Suzuki, MD, Etsuo Tsuchikane, MD, PhD

on behalf of
Japanese Board of CTO Interventional Specialist

Japanese CTO-PCI Registry

Currently,

'Retrograde Summit General Registry'

and

'Japanese CTO PCI Expert Registry'

are being conducted in Japan.

Japanese CTO PCI Expert Registry

- The Japanese Board of CTO Interventional Specialists was established in 2013 to accumulate quantitative data to identify issues such as stagnation in the development of CTO-PCI techniques
- Starting from 2014, Japanese CTO PCI Expert Registry began establishing a database of CTO-PCI performed by certified expert physicians who have a certain level of CTO-PCI skills
- Patients are enrolled by certified expert operators.
- Procedure success is adjudicated by a Corelab

Registry Overview

	Retrograde Summit		Japanese CTO PCI Expert Registry
	Registry	General Registry	
Pts. Enrollment	Jan. 2009～ Dec. 2013	Jan. 2014～	Jan. 2014～
Participants As of Jun. 2015	56 of Japanese Centers	40 of	42 of Japanese Expert physicians
Criteria for Participants	• Centers approved by Retrograde Summit • Cases treated by Expert are excluded		• More than 300 cases of experience of CTO-PCI • More than 50 cases of CTO-PCI per year • Recommendation from two or more steering committee member
Core lab	None		Adjudication of Indication and Procedure Success
Organization	Retrograde Summit		Japanese Board of CTO interventional specialist
Chairman	Habara (initiated by Tsuchikane)		Tsuchikane (initiated by Katoh, late Mitsudo)

Data Unification

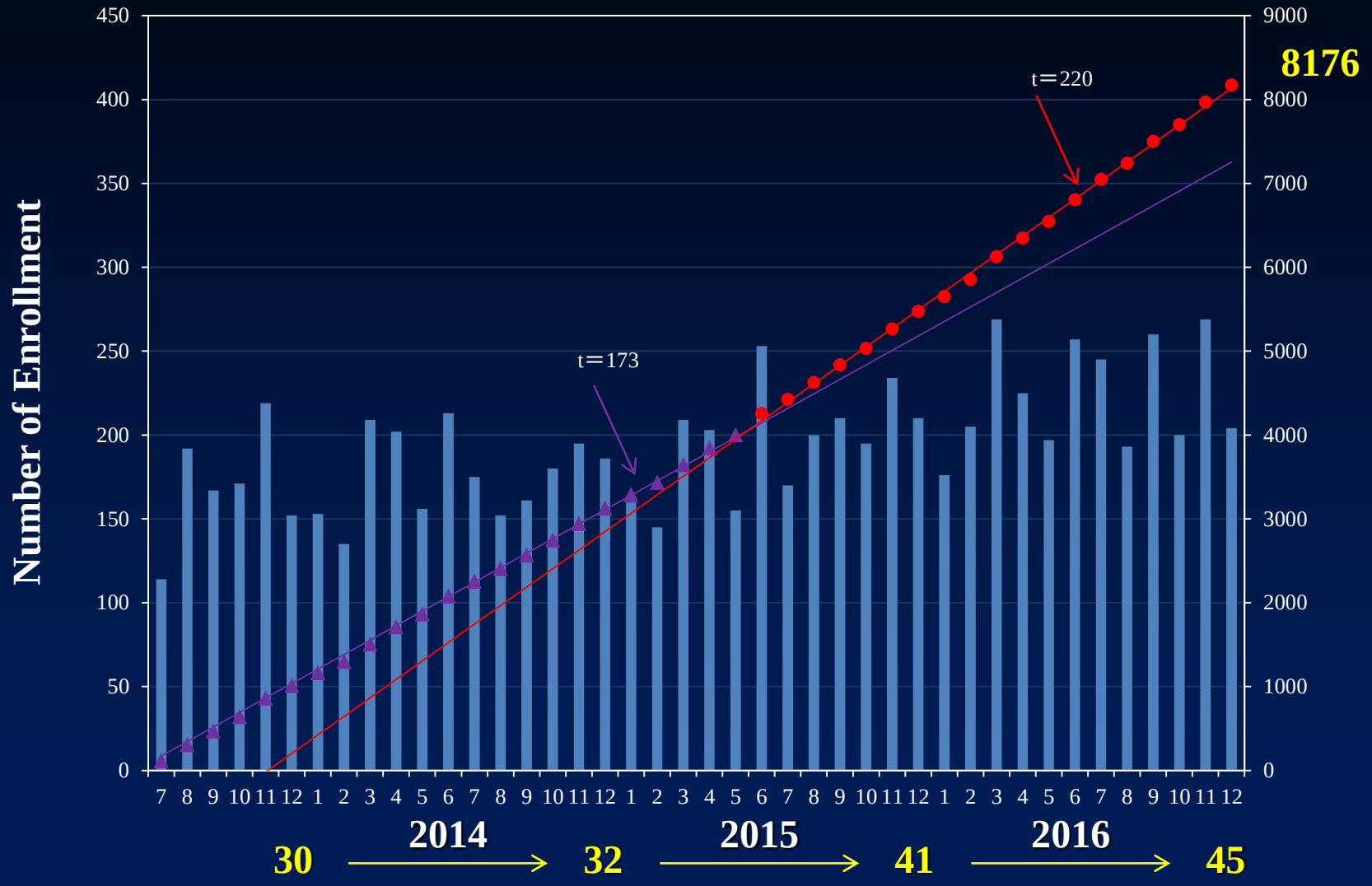
- The database for Retrograde Summit general registry has already been modified to collect same dataset as Japanese CTO PCI Expert Registry

- The outcome from both Retrograde Summit General Registry and Japanese CTO PCI Expert Registry will be compared and reported in the near future

Features of Expert Registry

- Officially started from January 2014, will end in December 2022
- All clinical data including patient background data and details of the procedures are input via an electronic capture system
- Pre-procedural CAG and CTA (optional), and procedural angiograms and IVUS images are sent as DICOM data to an independent core laboratory
- Annual clinical follow-up data are collected for 5 years (only in domestic pts)

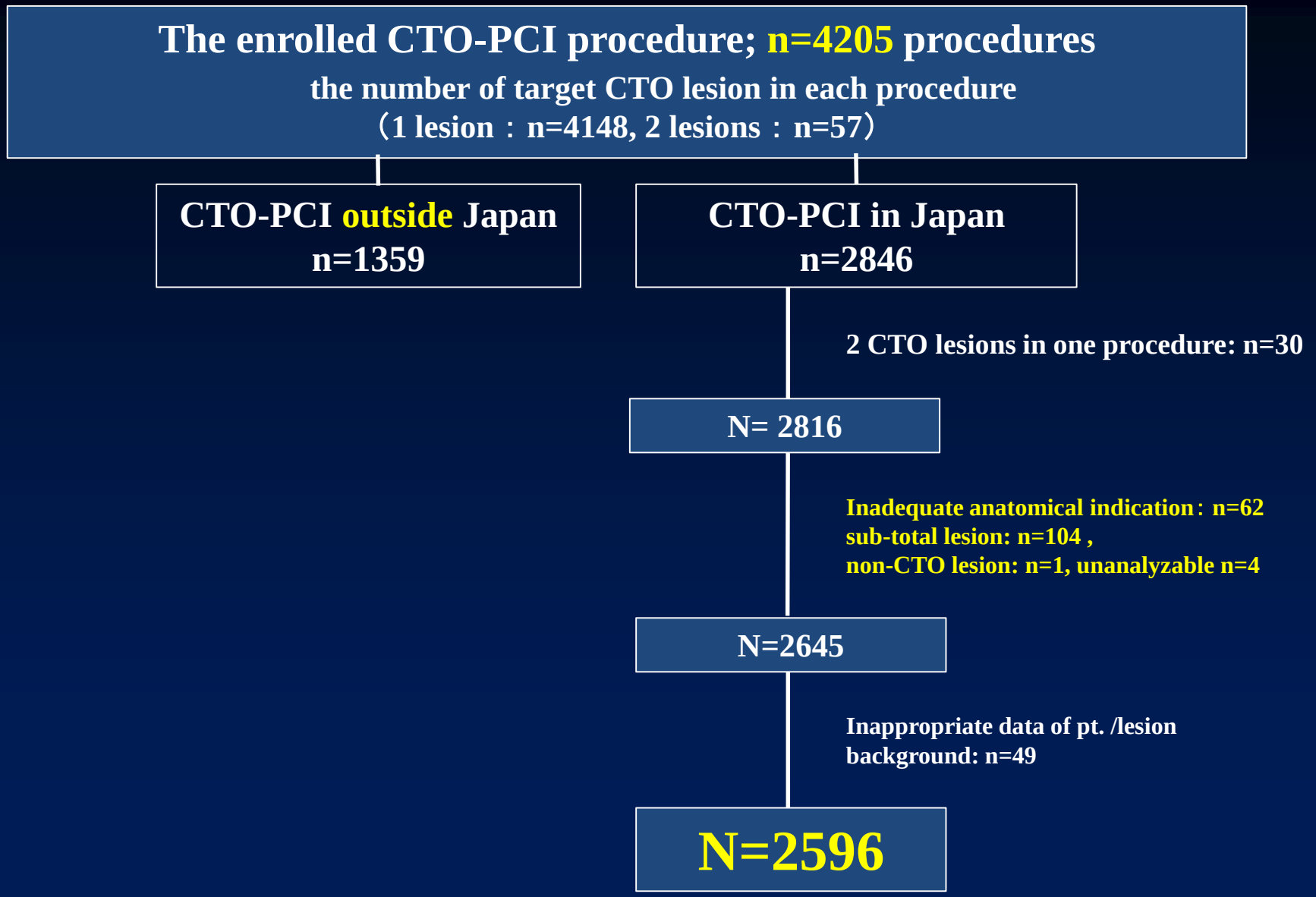
Patient Enrollment



The Initial Outcomes from Japanese CTO PCI Expert Registry

2014-2015

Patient Enrollment



Definitions

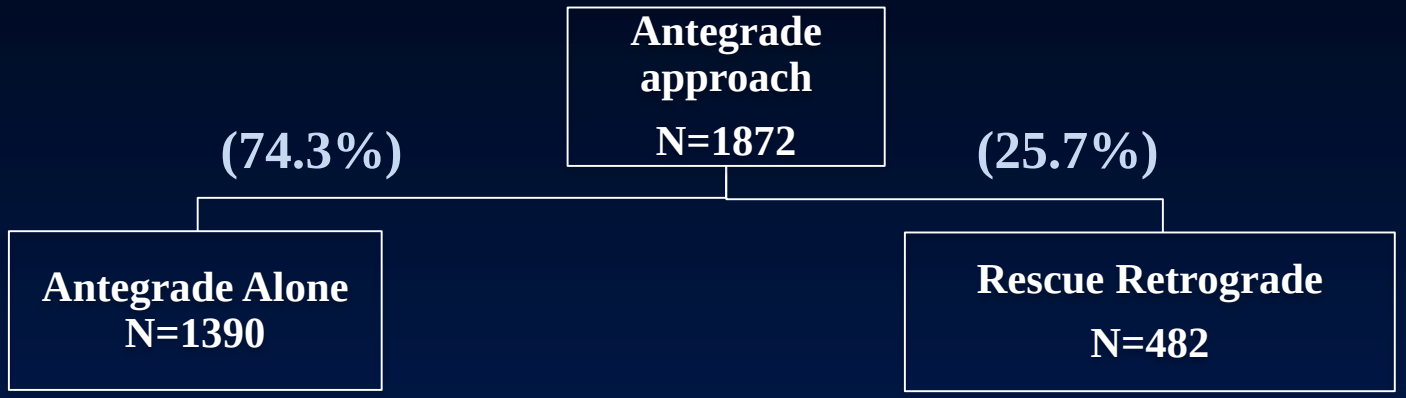
- The procedure was defined here as retrograde approach (RA) where an attempt was made to cross the collateral channel for retrograde revascularization techniques.
- Cases were divided into 3 groups based on ITT principle; primary antegrade approach (PAA), primary RA (PRA), and rescue RA (RRA).
- PAA included rescue RA and re-switched antegrade approach.
- No antegrade dissection and reentry device was used.

	Overall	PAA	PRA	PAA vs. PRA
	N=2596	N=1872	N=724	P-value
		72.1%	27.9%	
Age	66.9±10.9	66.8±10.9	66.9±10.7	0.863
BMI	24.7±3.8	24.7±3.8	24.6±3.8	0.413
LVEF	54.8±12.9	54.9±12.9	54.6±12.8	0.458
eGFR	64.9±29.0	65.1±30.2	64.3±25.7	0.458
Male gender, %	86.1	85.1	88.4	0.018
Hypertension, %	78.5	78.0	80.8	0.12
Dyslipidemia, %	77.5	76.1	82.1	0.001
Diabetes, %	44.9	44.9	45.8	0.35
Current smoking, %	54.4	58.0	62.3	0.057
OMI, %	51.0	51.7	51.3	0.895
Prior CABG, %	7.9	7.4	9.4	0.105
Prior PCI, %	63.2	61.8	67.5	0.007
Reattempt, %	20.6	15.1	34.8	<0.0001
Syntax score	15.9±8.6	16.0±8.4	15.6±8.9	0.062
J-CTO score	2.0±1.1	1.9±1.1	2.4±1.1	<0.0001
Target vessel, %				<0.0001
LAD	30.9	32.9	25.7	
LCX	17.1	20.4	8.6	
LMT	0.6	0.6	0.6	
RCA	51.5	46.2	65.2	

	Overall	PAA	PRA	PAA vs. PRA
	N=2596	N=1872	N=724	P-value
In-stent occlusion, %	13.6	16.9	5.1	<0.0001
Distal run off (<3.0mm), %	65.0	64.9	67.2	0.274
CTO length (≥20mm), %	60.5	57.0	69.6	<0.0001
Side branch at proximal cap, %	34.1	34.8	32.0	0.181
Collateral filling, %				<0.0001
Contralateral	50.7	47.6	58.8	
Ipsilateral	13.3	15.9	6.6	
Both	35.2	35.5	34.4	
None	0.7	1.0	0.1	
Lesion calcification, %	52.3	50.5	56.9	0.003
Proximal tortuosity, %	50.7	49.1	49.3	0.108
Tortuosity of CTO lesion, %	24.6	21.6	32.5	<0.0001
Morphology of proximal cap, %				0.002
Blunt	23.7	23.6	23.9	
No stump	19.1	17.7	22.7	
Tapered/tunnel	56.7	58.3	52.3	

	Overall	PAA	PRA	PAA vs. PRA
	N=2596	N=1872	N=724	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
Procedure time	160.4±89.6	143.8±81.9	201.5±94.4	<0.0001
Contrast volume	230.8±105.9	224.7±104.5	245.8±108.0	<0.0001
In hospital death, %	0.2	0.2	0.4	0.362
MI, %	1.2	0.8	2.0	0.018
Acute stent thrombosis, %	0.2	0.2	0.1	1.000
Stroke, %	0.2	0.2	0.3	0.628
Emergent CABG, %	0	0	0	
Emergent PCI	0.2	0.2	0.1	1.000
Coronary embolism, %	0.2	0.1	0.6	0.06
Coronary perforation (tamponade), %	0.4	0.2	0.9	<0.0001
Complications of puncture site, %	1.3	1.2	1.4	0.844
CIN, %	1.7	1.2	3.1	0.031

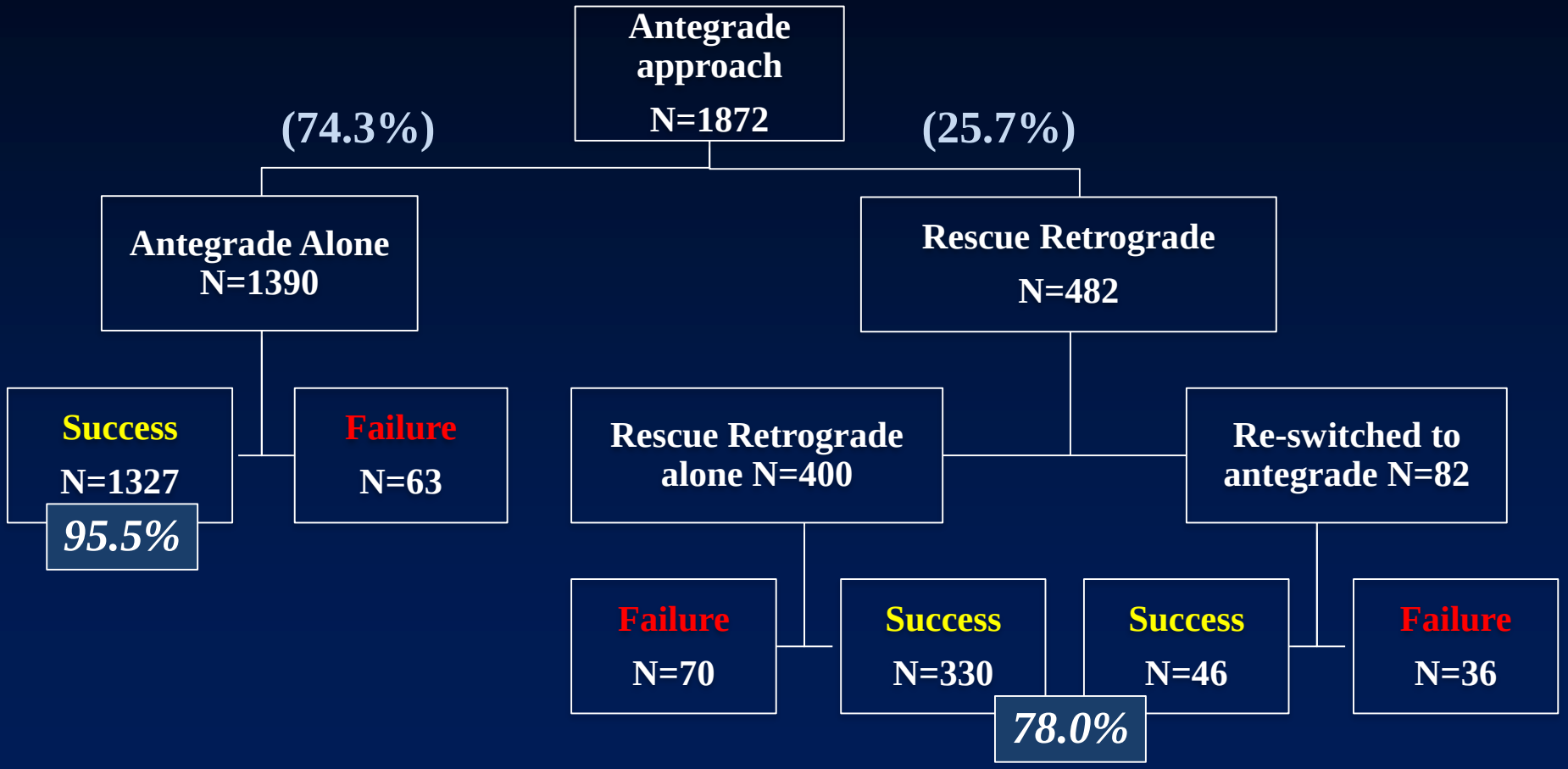
Primary Antegrade



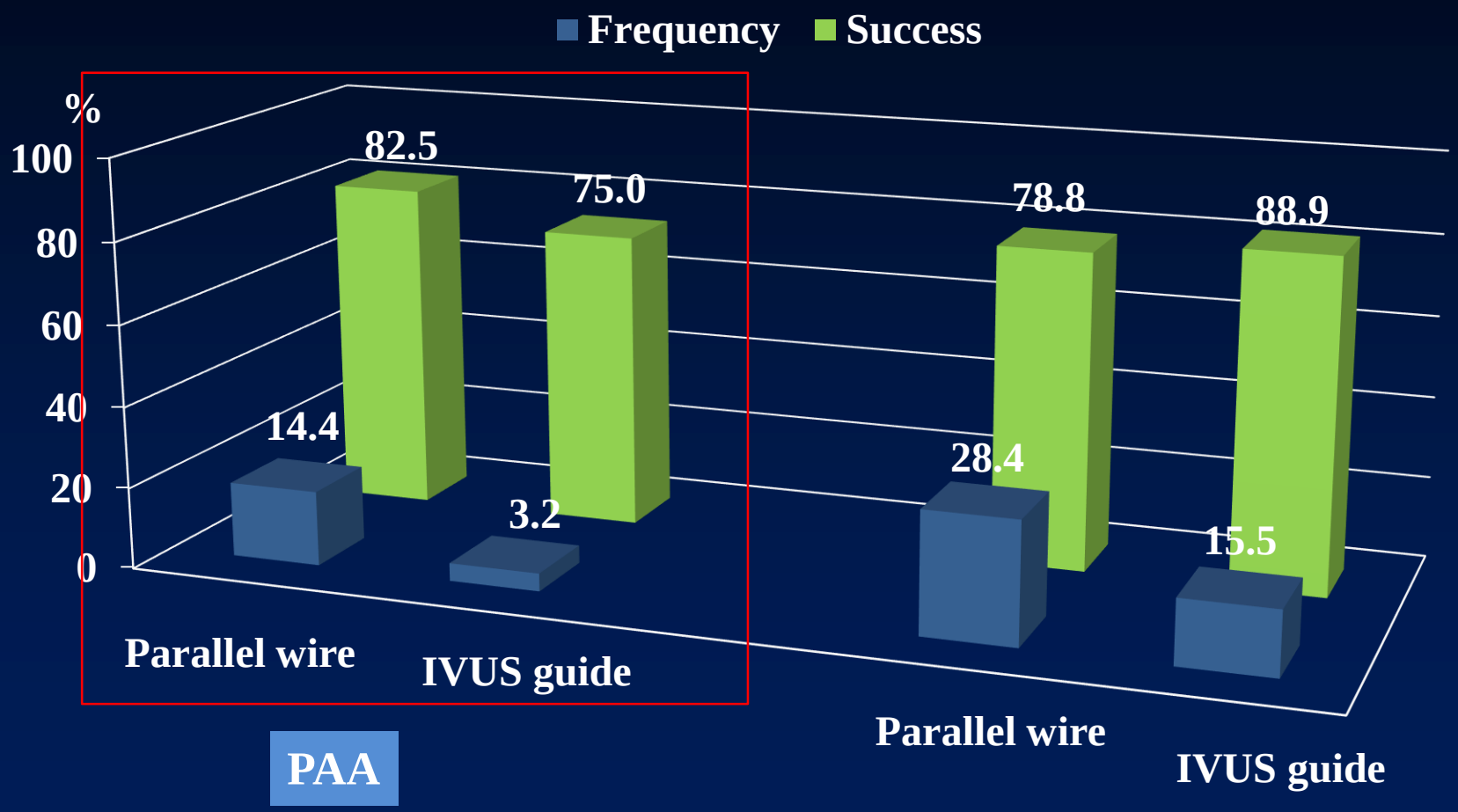
	Antegrade alone	RRA	Ant vs. RRA
	N=1390	N=482	P-value
Age	67.1±11.0	66.2±10.8	0.171
BMI	24.6±3.7	24.8±3.9	0.370
LVEF	55.0±13.0	54.6±12.8	0.434
eGFR	64.5±30.8	66.6±28.4	0.277
Male gender, %	84.1	88.2	0.031
Hypertension, %	77.6	78.0	0.784
Dyslipidemia, %	75.2	77.8	0.166
Diabetes, %	44.7	44.5	0.434
Current smoking, %	51.9	57.1	0.137
OMI, %	49.7	55.0	0.120
Prior CABG, %	6.6	9.6	0.096
Prior PCI, %	59.9	65.5	0.025
Syntax score	16.1±8.5	15.8±8.1	0.797
J-CTO score	1.7±1.1	2.2±1.1	<0.0001
Target vessel, %			<0.0001
LAD	33.9	29.9	
LCX	22.9	13.3	
LMT	0.6	0.4	
RCA	42.6	56.4	

	Antegrade alone	RRA	Ant vs. RRA
	N=1390	N=482	P-value
Reattempt, %	12.7	22.2	<0.0001
In-stent occlusion, %	20.2	7.3	<0.0001
Distal run off (<3.0mm), %	64.2	65.1	0.762
CTO length (≥20mm), %	53.5	67.2	<0.0001
Side branch at proximal cap, %	35.5	33.0	0.325
Collateral filling, %			<0.0001
Contralateral	46.6	50.4	
Ipsilateral	18.4	8.9	
Both	33.8	40.5	
None	1.2	0.2	
Lesion calcification, %	48.8	55.4	0.013
Proximal tortuosity, %	49.2	49.0	0.836
Tortuosity of CTO lesion, %	18.7	29.9	<0.0001
Morphology of proximal cap, %			0.008
Blunt	24.6	20.7	
No stump	16.0	22.6	
Tapered/tunnel	59.1	56.2	

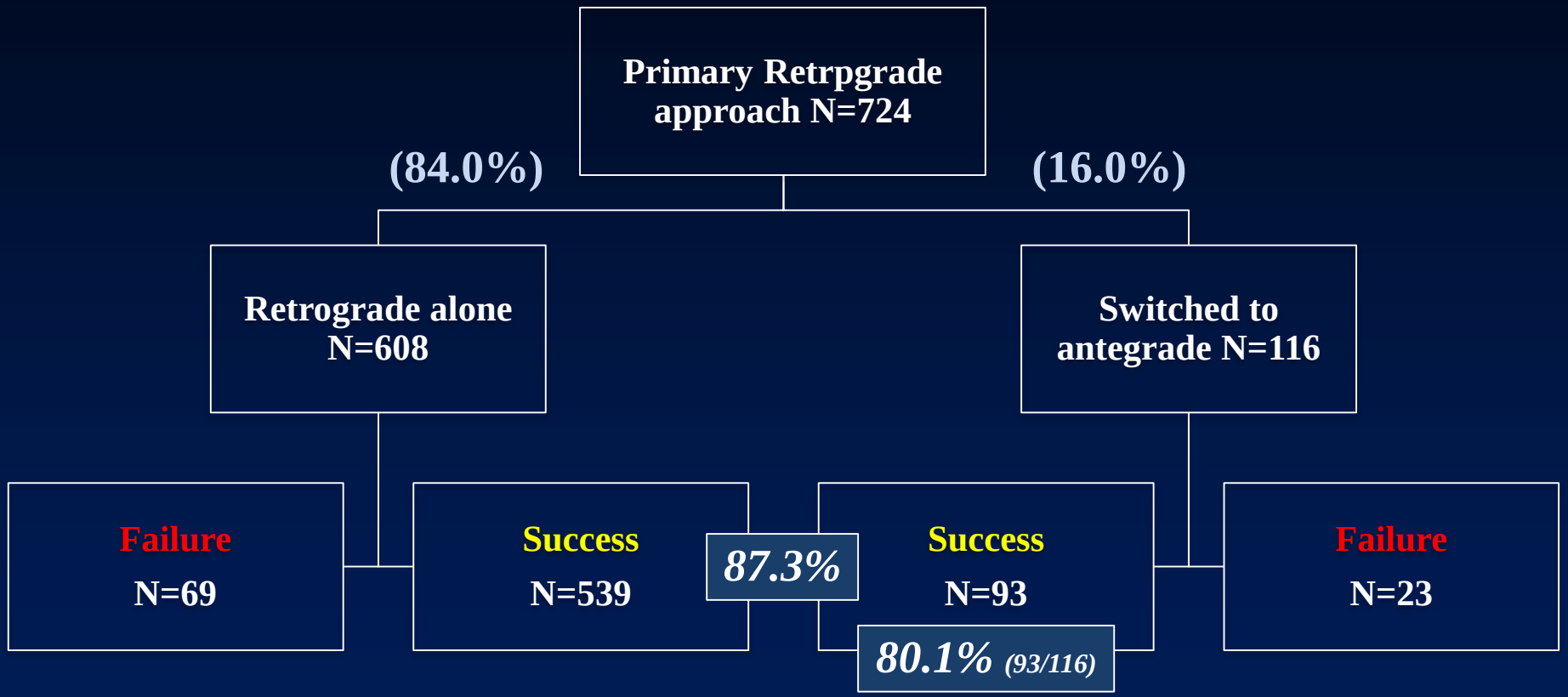
Primary Antegrade



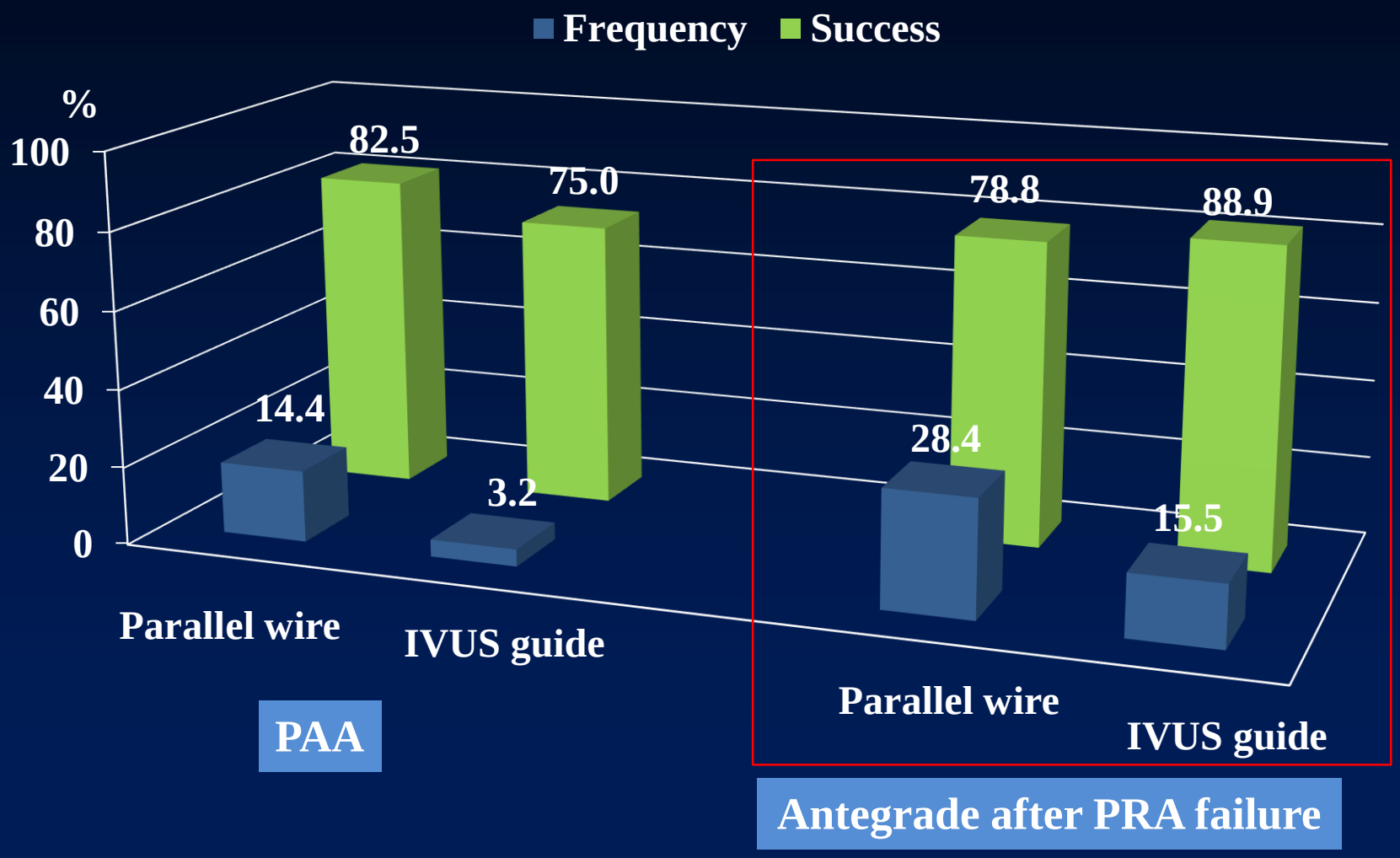
Parallel Wiring and IVUS Guidance



Primary Retrograde



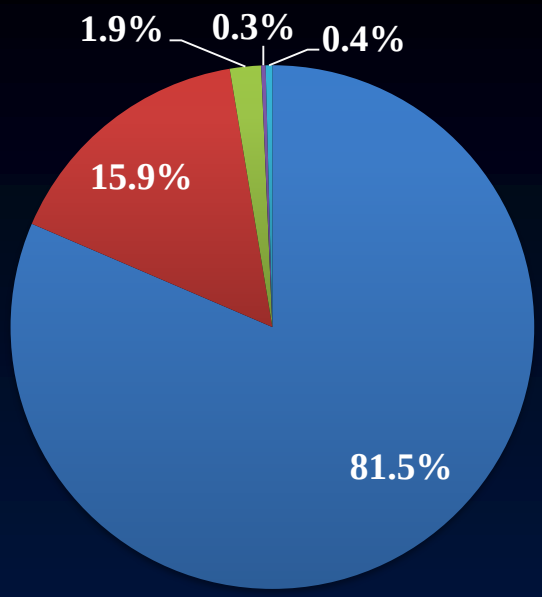
Parallel Wiring and IVUS Guidance



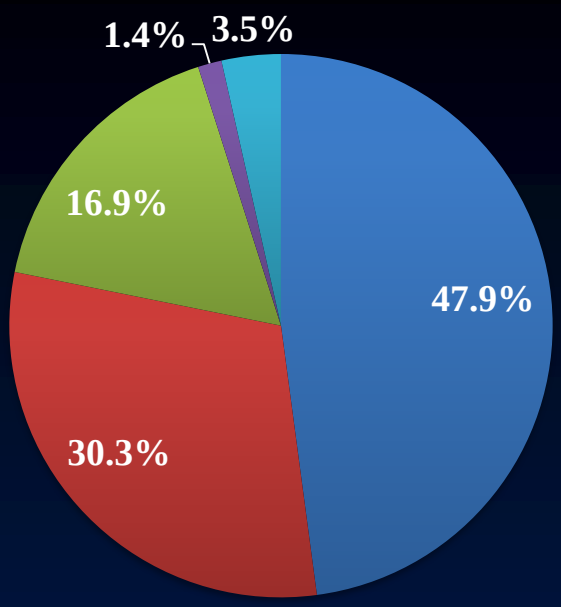
	RRA	PRA	RRA vs. PRA
	N=482	N=724	P-value
Age	66.2±10.8	66.9±10.7	0.289
BMI	24.8±3.9	24.6±3.8	0.227
LVEF	54.6±12.8	54.6±12.9	0.982
eGFR	66.6±28.4	64.3±25.7	0.286
Male gender, %	88.2	88.4	0.927
Hypertension, %	78.0	80.5	0.449
Dyslipidemia, %	77.8	81.9	0.175
Diabetes, %	44.5	45.5	0.906
Current smoking, %	57.1	57.4	0.915
OMI, %	55.0	50.8	0.320
Prior CABG, %	9.6	9.4	0.972
Prior PCI, %	66.5	67.2	0.948
Syntax score	15.8±8.1	15.6±8.9	0.182
J-CTO score	2.2±1.1	2.4±1.1	0.001
Target vessel, %			0.007
LAD	29.9	25.7	
LCX	13.3	8.6	
LMT	0.4	0.5	
RCA	56.4	65.2	

	RRA	PRA	RRA vs. PRA
	N=482	N=724	P-value
Reattempt, %	22.2	34.8	<0.0001
In-stent occlusion, %	7.3	5.1	0.137
Distal run off (<3.0mm), %	65.1	66.4	0.793
CTO length (≥20mm), %	67.2	69.6	0.729
Side branch at proximal cap, %	33.0	32.0	0.754
Lesion calcification, %	55.4	56.9	0.635
Proximal tortuosity, %	49.0	49.3	0.401
Tortuosity of CTO lesion, %	29.9	32.5	0.644
Morphology of proximal cap, %			0.303
Blunt	20.7	23.9	
No stump	22.6	22.7	
Tapered/tunnel	56.2	52.3	
Collateral used, %			0.801
Sepal	66.3	69.0	
Epicardial	24.7	23.4	
Arterial	6.4	5.2	
Graft	2.7	2.4	

	RRA	PRA	RRA vs. PRA
	N=482	N=724	P-value
Failed collateral crossing, %	20.2	16.0	0.062
GW success, %	80.3	90.1	<0.0001
Technical success, %	78.0	87.3	<0.0001
Procedural success, %	76.5	85.0	<0.0001
Procedure time	218.0±79.8	201.5±94.4	<0.0001
Contrast volume	279.5±123.9	245.8±108.0	<0.0001
In hospital death, %	0	0.4	0.296
MI, %	1.4	2.0	0.688
Acute stent thrombosis, %	0	0.1	1.000
Stroke, %	0.7	0.3	0.370
Emergent CABG, %	0	0	
Emergent PCI	0.2	0.1	1.000
Coronary embolism, %	0	0.6	0.171
Coronary perforation (tamponade), %	0.4	0.9	0.295
Complications of puncture site, %	1.2	1.4	0.796
CIN, %	2.4	3.1	0.72

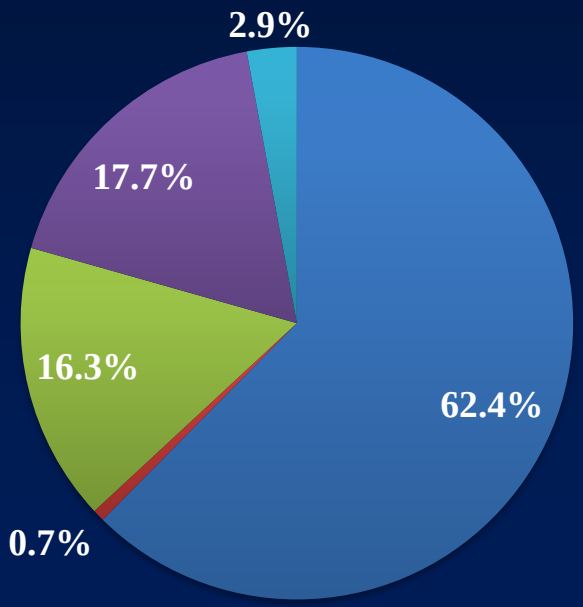


Antegrade alone



Antegrade after failed RA

single wire
parallel wire
IVUS guide crossing
STAR
others



reverse CART
CART
retrograde wire crossing
kissing wire
others

Retrograde

The difference between Success cases and failed cases

	overall			PAA			PBA		
	success N=2209	failure N=278	p-value	success N=1601	failure N=171	p-value	success N=632	failure N=92	p-value
prior CABG, %	7.2	14.7	<0.0001	6.7	14.6	0.001	8.6	15.0	0.084
prior PCI, %	62.0	70.9	0.014	60.5	68.4	0.11	66.1	74.8	0.119
Syntax score	15.7±8.5	17.0±9.2	0.054	15.9±8.5	16.6±8.2	0.276	15.2±8.5	17.6±10.5	0.056
J-CTO score	1.95±1.13	2.48±1.10	<0.001	1.80±1.10	2.29±1.10	<0.0001	2.4±1.1	2.8±1.0	<0.0001
reattemp, %	19.5	28.4	0.001	14.1	20.5	0.026	33.6	41.1	0.152
CTO length (≥20mm), %	58.8	71.6	<0.0001	55.1	68.4	<0.0001	68.6	76.6	0.179
severe lesion calcification, %	5.4	18.3	<0.0001	4.6	18.1	<0.0001	7.4	18.7	0.001
proximal tortuousity, %			<0.0001			0.017			0.018
straight	51.4	44.2		51.7	41.5		50.5	48.6	
mild	35.1	32.0		34.9	36.3		35.7	25.2	
moderate	11.3	19.8		11.6	19.3		10.5	20.6	
severe	2.0	3.6		1.7	2.9		3.0	4.7	
tortuosity of CTO lesion, %	22.8	39.9	<0.0001	19.9	37.4	<0.0001	30.5	43.9	0.026

Predictors of Failure in overall multivariate analysis

	overall		
	OR	CI	p-value
prior CABG	1.47	0.765-2.715	0.219
prior PCI	1.276	0.928-1.756	0.134
Diabetis	1.12	0.850-1.476	0.421
GFR>60	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 (≥20mm)	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

Predictors of Failure in PAA multivariate analysis

	PAA		
	OR	CI	p-value
prior CABG	1.677	0.780-3.604	0.186
prior PCI	1.135	0.759-1.696	538
Diabetis	1.429	0.995-2.052	0.053
GFR>60	0.818	0.565-1.184	0.288
reattempt	0.906	0.552-1.487	0.697
Target (LAD)	0.207	0.041-1.052	0.058
CTO length (≥20mm)	1.262	0.850-1.874	0.249
severe calcification	2.837	1.622-4.963	<0.001
tortuosity of CTO lesion	1.992	1.365-2.907	<0.001

Predictors of Failure in PRA

PRA			
Univariate analysis			
	OR	CI	P-value
Prior CABG	1.87	1.024-3.416	0.042
Dyslipidemia	0.565	0.349-0.915	0.02
Side branch at proximal cap	2.086	1.373-3.167	0.001
Tortuosity of CTO	1.813	1.191-2.760	0.006
Severe lesion calcification	2.876	1.622-5.101	<0.0001
multivariate analysis			
	OR	CI	p-value
Severe lesion calcification	3.264	1.739-6.125	<0.0001
Tortuosity of CTO	1.699	1.075-2.686	0.023
Side branch at proximal cap	2.399	1.524-3.776	<0.0001
Dyslipidemia	0.535	0.322-0.889	0.016

Predictors of Failure in RRA

RRA			
Univariate analysis			
	OR	CI	P-value
Sex	0.328	0.180-0.598	<0.001
BMI	1.604	1.024-2.511	0.039
Diabetes	1.720	1.097-2.698	0.018
eGFR<60	0.630	0.401-0.988	0.044
In-stent occlusion	2.780	1.329-5.814	0.007
Lesion>20mm	1.722	1.039-2.855	0.035
Tortuosity of CTO	1.734	1.087-2.765	0.021
Severe lesion calcification	4.242	2.074-8.677	<0.0001
multivariate analysis			
	OR	CI	p-value
Severe lesion calcification	2.711	1.188-6.185	0.018
Sex	0.302	0.155-0.590	<0.0001
BMI	1.807	1.084-3.012	0.023

Summary

- Japanese experts frequently chose the retrograde approach as the primary strategy (27.9%), especially for more complex CTO lesions, with a technical success rate of about 90%.
- For intermediate CTO lesions (J-CTO score < 2), experts mainly performed the antegrade approach alone, with a very high success rate (more than 95%).
- However, for RRA, the success rate decreased to less than 80%.
- The experts frequently used the parallel wiring and IVUS-guided penetration in antegrade approach, with high technical success (75.0%–88.9%).
- Severe lesion calcification was a strong predictor of failure.

Conclusion

CTO-PCI performed by highly experienced experts achieved a high technical success rate and a low rate of major complications.