

Should We Open Every CTO ? : DECISION-CTO

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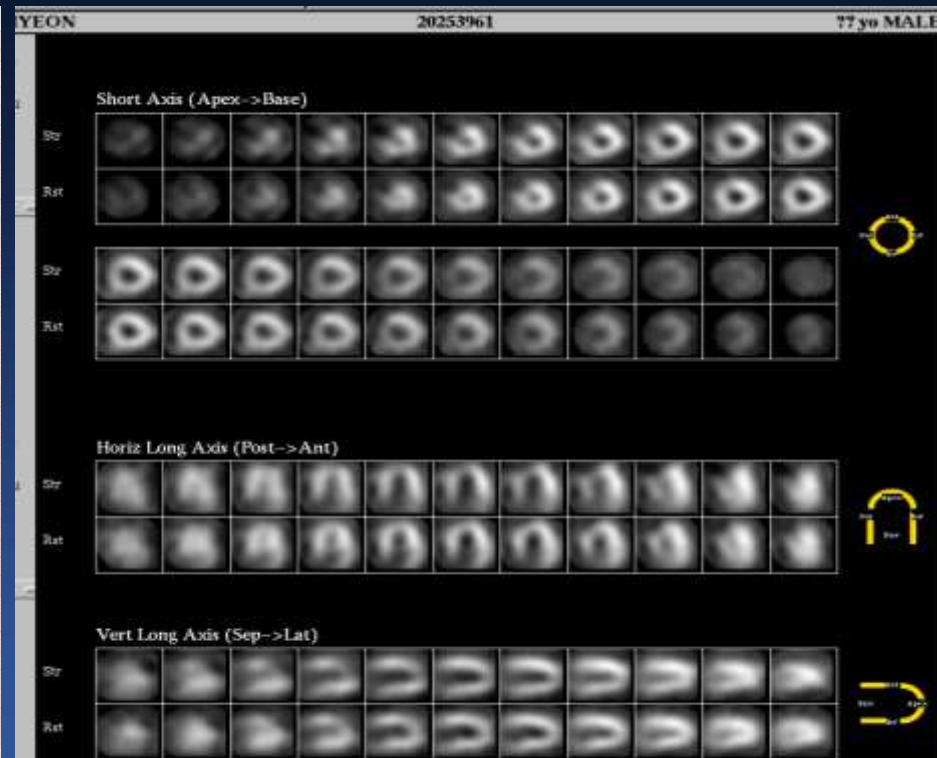
Proximal LAD – CTO

53 aged male,
no symptom, good exercise performance



Proximal LAD - CTO

Negative TMT at stage 4
Small reversible defect in apex



Proximal LAD - CTO

53 aged male,

no symptom, good exercise performance

Negative TMT at stage 4

Small reversible thallium defect in apex

Followed the patients last 10 years

Quality of life is excellent with some medications.

(Aspirin 100mg, Tenormin 50 mg, Any-statin, QD)

Do you still want to do PCI ?

CTO-PCI

- **2012 ACCF/SCAI/STS.. Guideline**
 - PCI for CTO (IIa)
- **2010 ESC Guideline**
 - CTO revascularization (IIa)

2012 ACCF/SCAI/STS.. Guideline

Patients Without Prior Bypass Surgery

Indication	Appropriate Use Score (1-9)		
	Asymptomatic	I or II	III or IV
CCS Angina Class			

Ischemic burden on non-invasive testing:
High
level of anti-ischemic medical treatment:
Maximal
symptom status: Symptomatic

	testing • Maximal anti-ischemic therapy			
28.	• Isolated CTO of 1 major coronary artery • High risk finding on non invasive testing • Minimal/No anti-ischemic therapy	U (4)	U (5)	A (7)
29.	• Isolated CTO of 1 major coronary artery • High risk finding on non invasive testing • Maximal anti-ischemic therapy	U (5)	A (7)	A (8)

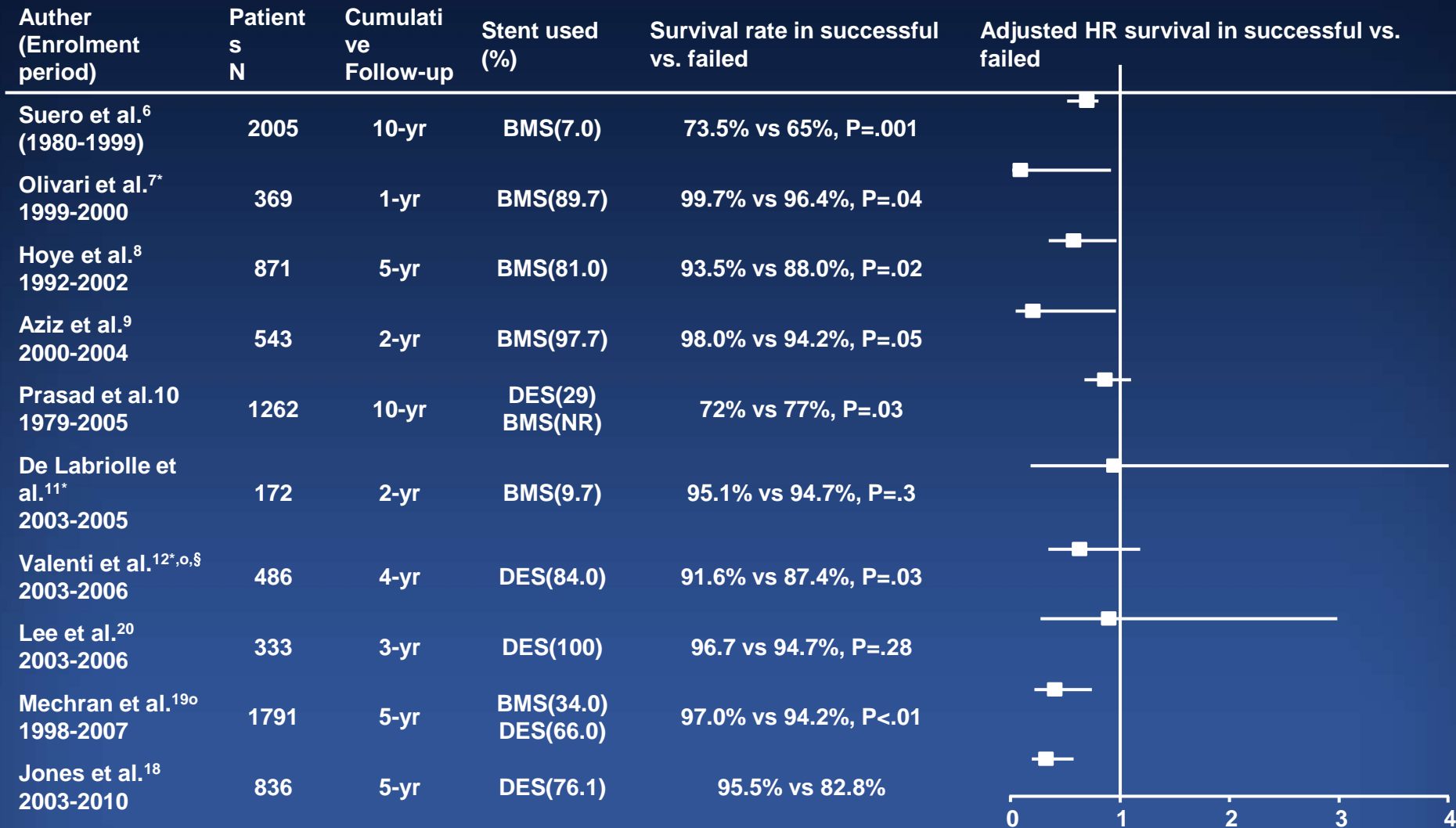
1-3: Inappropriate

4-6: Uncertain

7-9: Appropriate

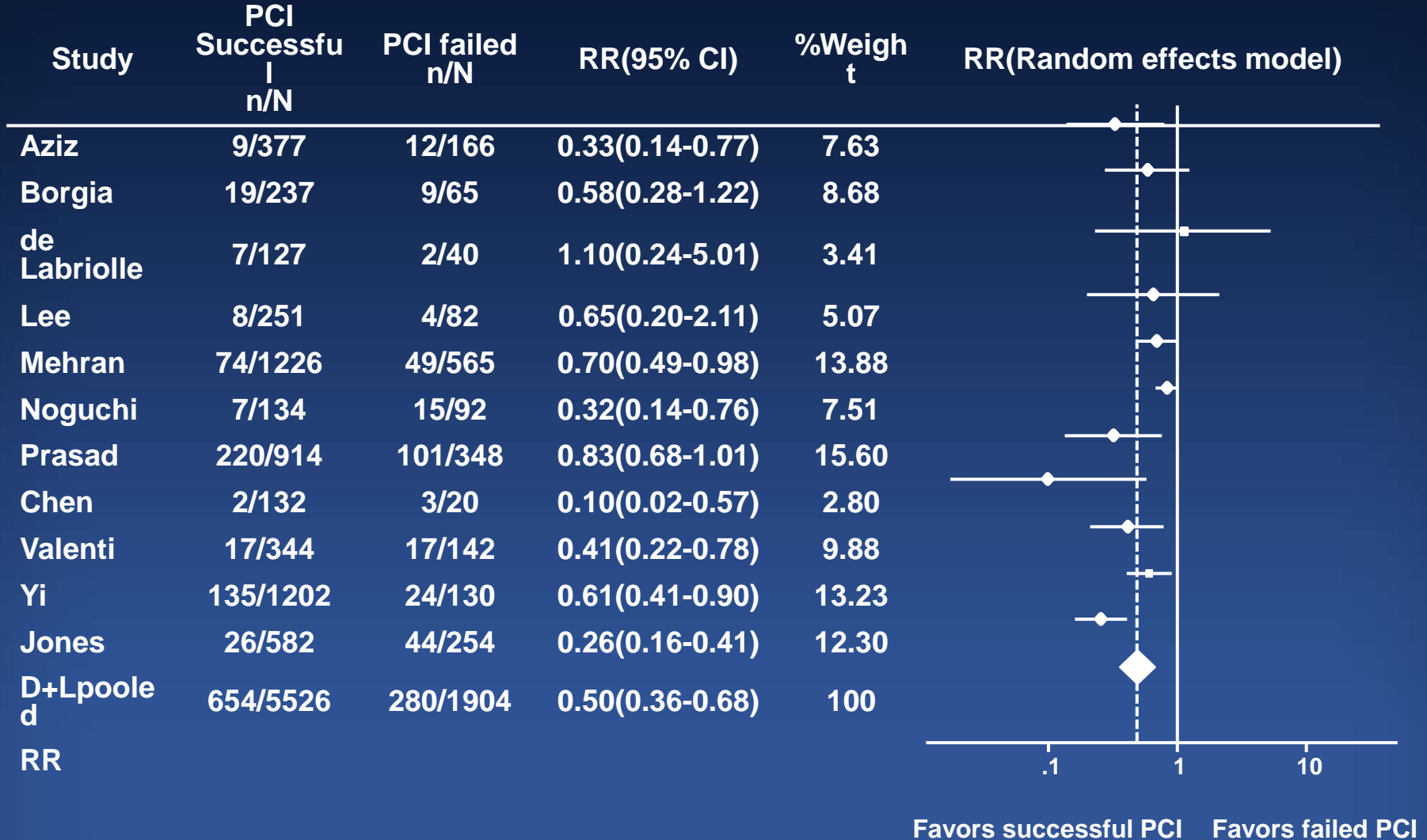
In terms of survival/health outcomes

CTO Meta-Analysis: Survival (I)



Long-term survival rates and relative risk estimates of successful vs failed CTOs PCI in observational studies, including patients treated with stents. In the graph, black squares represent hazard ratios (except for one study in which odds ratio is represented), and bars indicate 95% CI, *Unadjusted hazard ratio. °Cardiac survival. §Odds ratio. HR, hazard ratios.

CTO Meta-Analysis: Survival (II)



Heterogeneity chi-squared = 33.11 (d.f.=10) p=0.000
 I-squared (variation in RR attributable to heterogeneity) = 69.8%
 Estimate of between-study variance Tau-squared=0.1572

CTO Meta-Analysis: Survival (III)

Study name	Statistics for each study					Odds ratio and 95% CI		Relative weight
	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value			
Aziz 2007	0.248	0.095	0.648	-2.846	0.004			5.78
de Labriolle 2008	1.108	0.221	5.563	0.125	0.901			2.05
Drozd 2008	0.944	0.272	3.275	-0.091	0.928			3.45

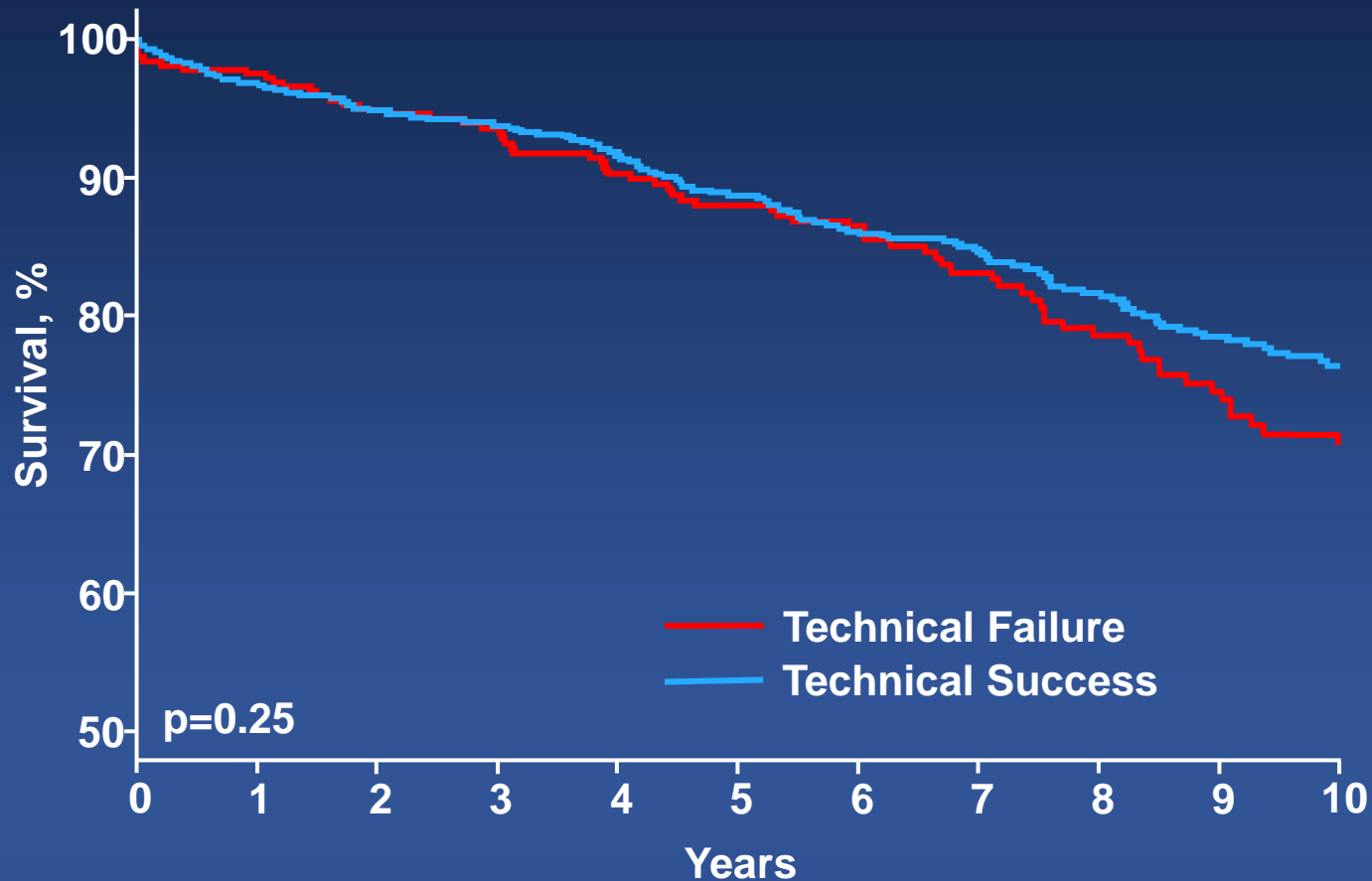
Successful CTO-PCI using a predominantly stent-based strategy is associated with a significant reduction in short- and long-term mortality compared to unsuccessful CTO-PCI

Joncoeur 2012	0.014	0.194	1.943	-0.830	0.408			4.01
Arslan 2006	0.409	0.218	0.766	-2.792	0.005			13.53
Lee 2011	0.171	0.074	0.395	-4.140	0.000			7.64
	0.391	0.311	0.493	-7.957	0.000			

Favors successful CTO-PCI Favors unsuccessful CTO-PCI

CTO: The Mayo Clinic 25-Year Experience

1,262 CTO pts analyzed: Technical failure to treat CTO was not an independent predictor of long-term mortality. (HR=1.16; [95% CI 0.90-1.5], p=0.25)



Long-Term Outcomes After Percutaneous Coronary Intervention for Chronic Total Occlusion (from the CREDO-Kyoto Registry Cohort-2)

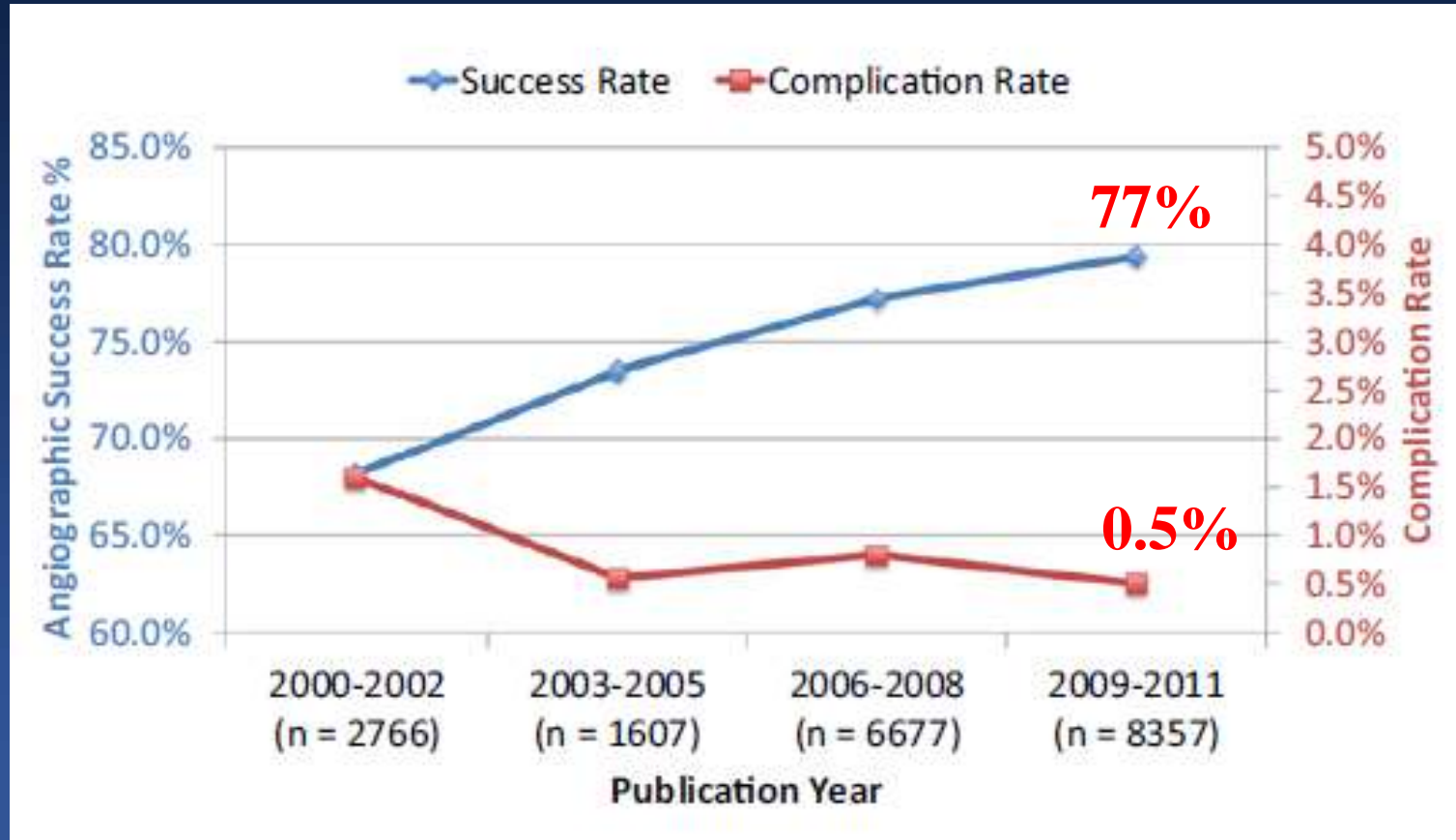
Erika Yamamoto, MD^a, Masahiro Natsuaki, MD^{a*}, Takeshi Morimoto, MD^b, Yutaka Furukawa, MD^c, Yoshihisa Nakagawa, MD^d, Koh Ono, MD^a, Kazuaki Mitsudo, MD^e, Masakiyo Nobuyoshi, MD^f, Osamu Doi, MD^g, Takashi Tamura, MD^h, Masaru Tanaka, MDⁱ, and Takeshi Kimura, MD^a,
on behalf of the CREDO-Kyoto PCI/CABG Registry Cohort-2 Investigators

CTO-PCI: Success vs. Failure

variable	Adjusted HR (95% CI)	p
All-cause death	0.93 (0.64-1.37)	0.69
Cardiac death	0.71 (0.44-1.16)	0.16
MI	0.60 (0.33-1.13)	0.11
Stroke	0.81 (0.49-1.40)	0.45
Coronary bypass	0.09 (0.06-0.15)	<0.0001
Any revascularization	0.50 (0.41-0.60)	<0.0001

Trend of Success & Complications

Meta Analysis of 18,061 Patients

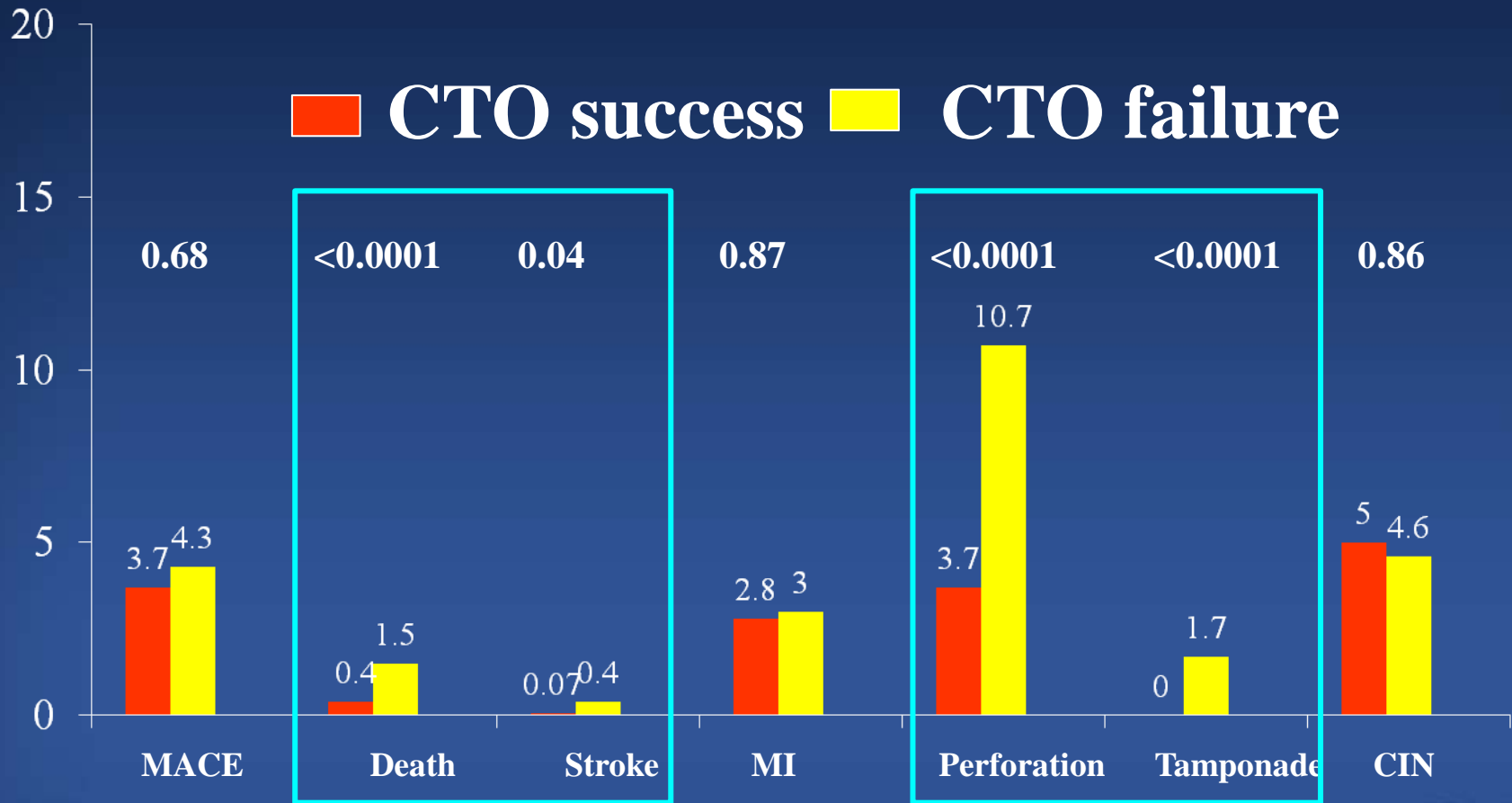


Emergency CABG 0.1%

Tamponade 0.3%

CTO-PCI Complications

Meta Analysis of 18,061 Patients



AMC CTO-PCI registry

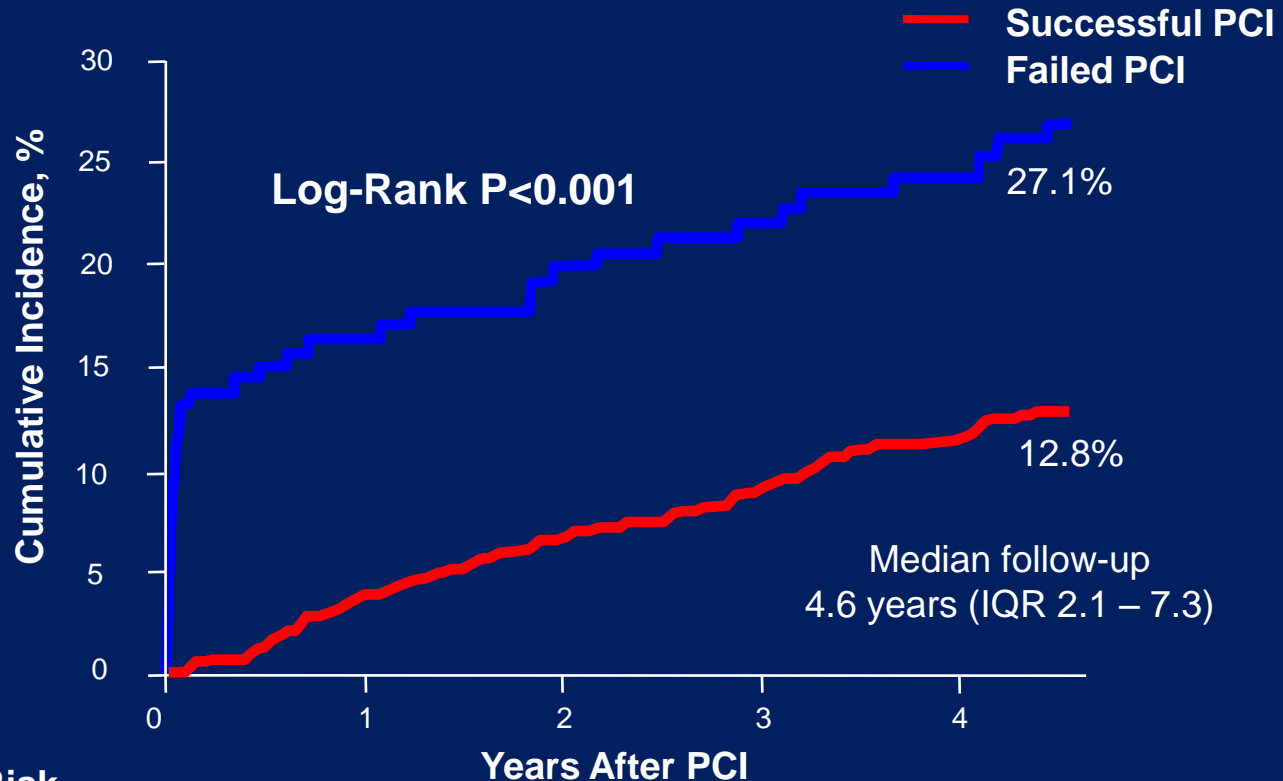
SUCCESS (N=1008) VS. Failure (n=169)

4.5-year follow-up

Unadjusted Kaplan-Meier Curve

Primary End Point

(Death, Q-MI, or Target Vessel Revascularization)



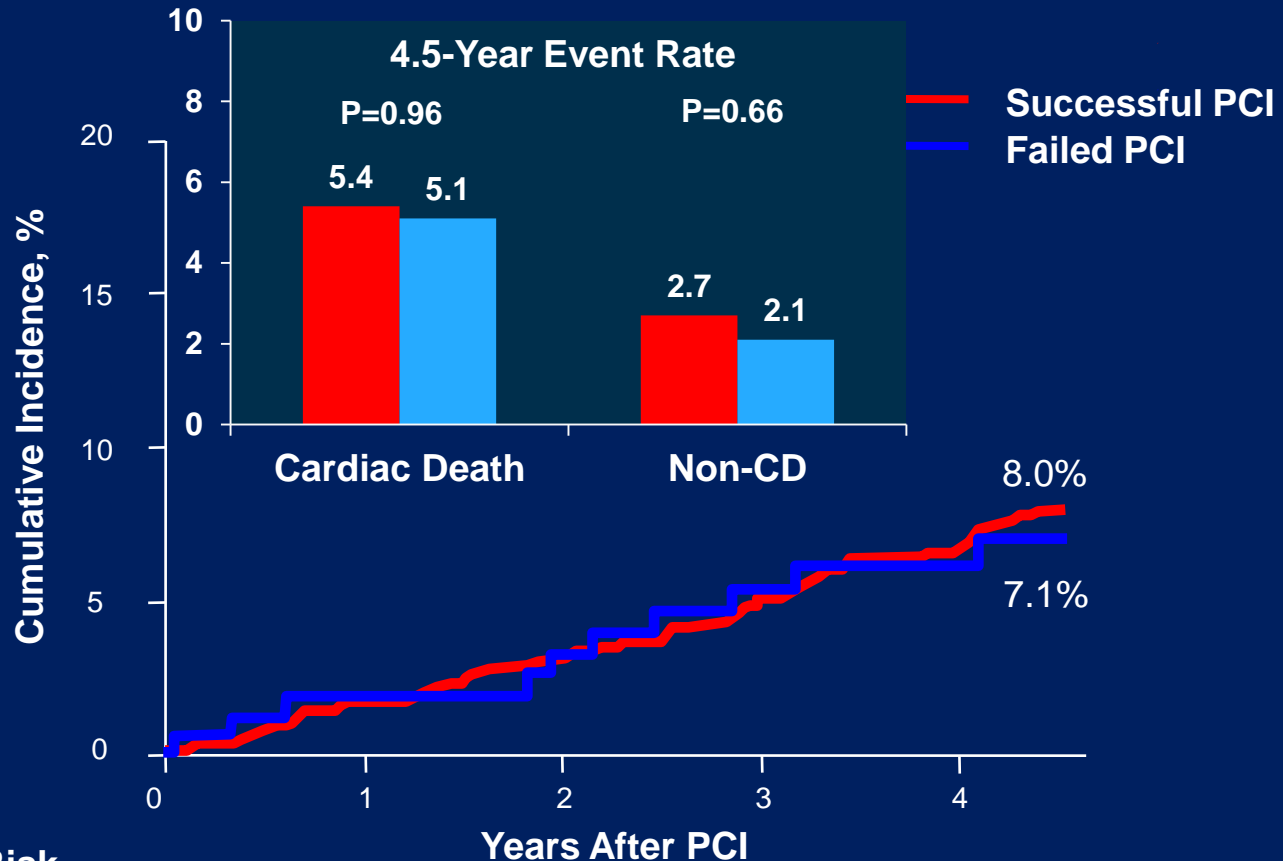
No. at Risk

Successful PCI	1008	873	736	612	518
Failed PCI	169	126	115	104	90

Unadjusted Kaplan-Meier Curve

*Kaplan-Meier estimates

Death

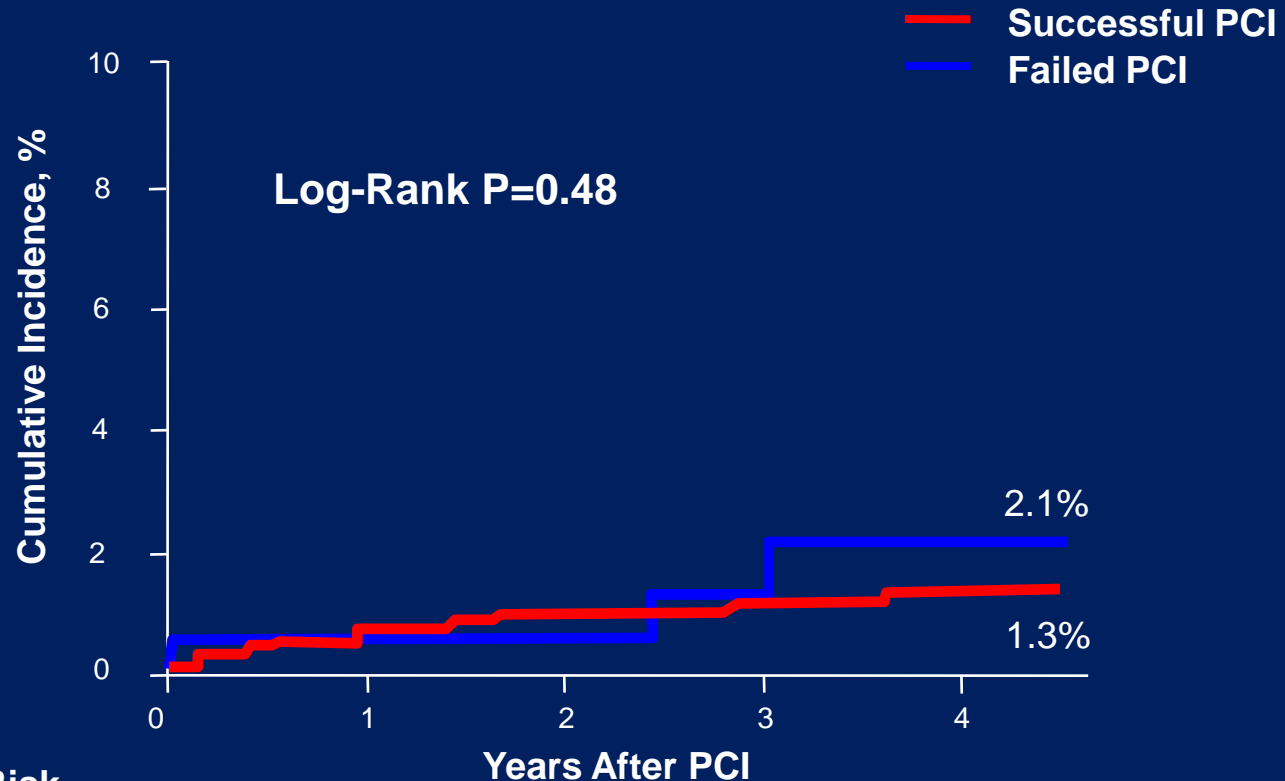


No. at Risk

	0	1	2	3	4
Successful PCI	1008	893	764	639	544
Failed PCI	169	147	139	126	111

Unadjusted Kaplan-Meier Curve

Q-wave myocardial infarction

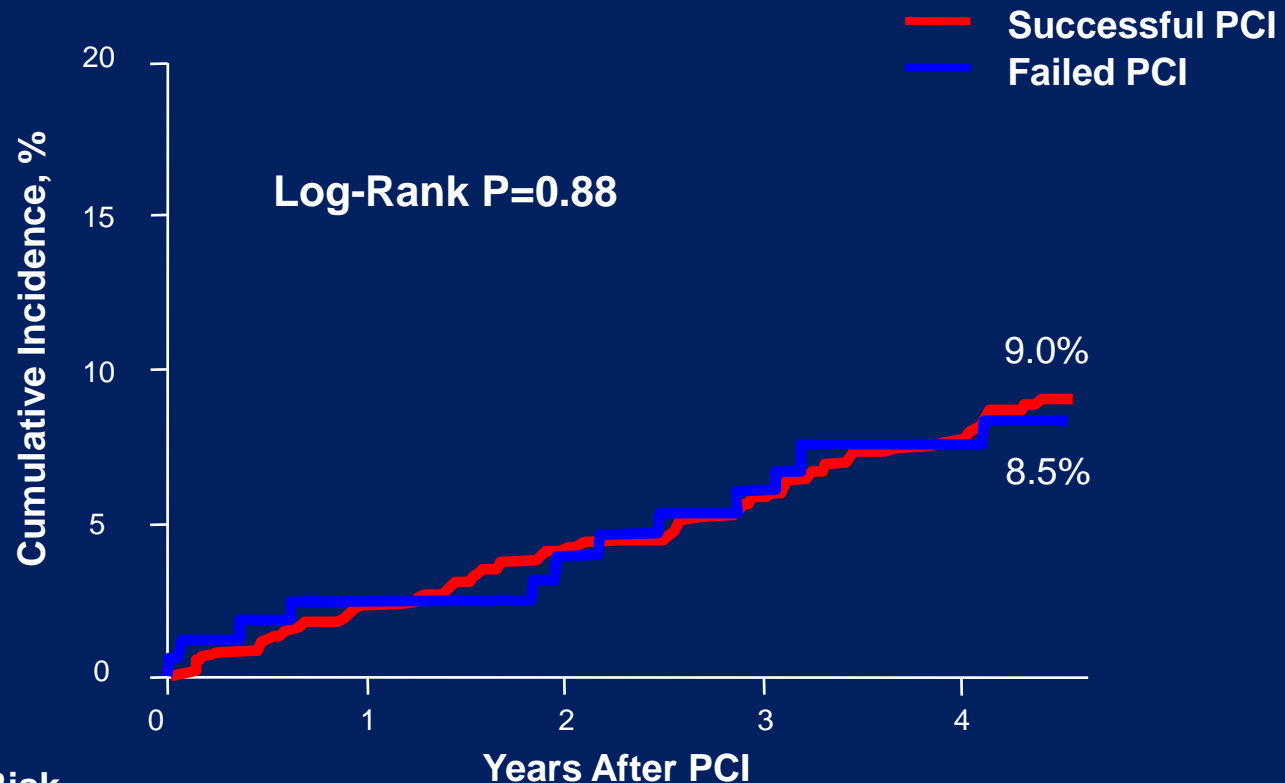


No. at Risk

Successful PCI	1008	887	757	633	539
Failed PCI	169	146	138	126	110

Unadjusted Kaplan-Meier Curve

Death or Q-wave MI

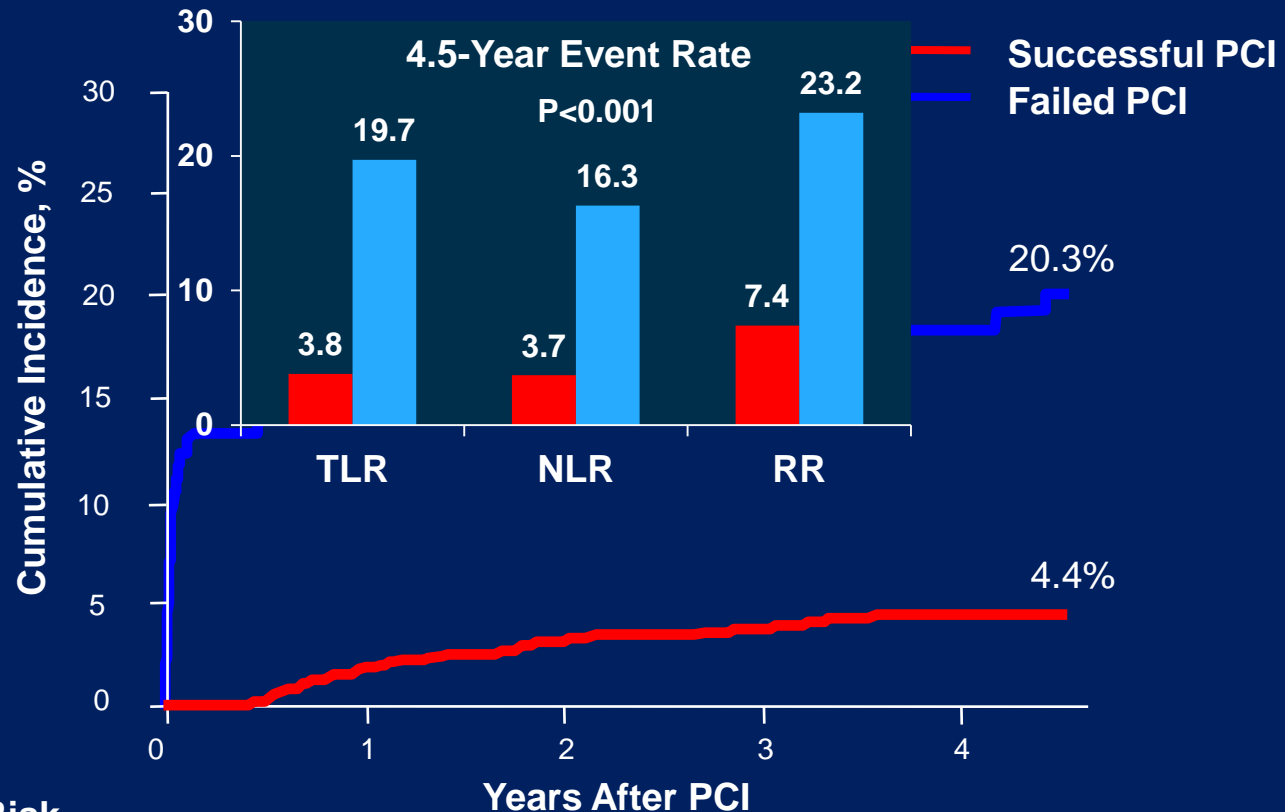


No. at Risk

Successful PCI	1008	887	757	633	539
Failed PCI	169	146	138	126	110

Unadjusted Kaplan-Meier Curve

TVR



No. at Risk

	0	1	2	3	4
Successful PCI	1008	877	739	614	520
Failed PCI	169	126	115	104	90

Crude Hazard Ratios of Clinical Outcomes

	Event rates at 4.5 years*		Hazard ratio (95% CI)	P value
	Successful PCI	Failed PCI		
Death, Q-wave MI, or TVR	101 (12.8%)	41 (27.1%)	2.62 (1.82-3.76)	<0.001
Secondary outcome				
Death	60 (8.0%)	10 (7.1%)	0.90 (0.46-1.76)	0.77
Cardiac death	39 (5.4%)	7 (5.1%)	0.98 (0.44-2.19)	0.96
Q-wave MI	11 (1.3%)	3 (2.1%)	1.58 (0.44-5.67)	0.48
TVR	36 (4.4%)	31 (20.3%)	5.71 (3.53-9.23)	<0.001
Stroke	4 (0.6%)	2 (1.5%)	2.66 (0.49-14.5)	0.24
Death or Q-wave MI	69 (9.0%)	12 (8.5%)	0.95 (0.52-1.76)	0.88

*Event rates are shown as Kaplan-Meier estimates (No. and percent of events)

Adjusted Hazard Ratios of Clinical Outcomes

	Multivariable adjusted*	P value	Adjusted for propensity	P value
Death, Q-wave MI, or TVR	2.41 (1.66-3.50)	<0.001	2.50 (1.70-3.66)	<0.001
Secondary outcome				
Death	0.95 (0.48-1.89)	0.89	0.81 (0.40-1.62)	0.55
Cardiac death	1.03 (0.45-2.38)	0.94	0.96 (0.42-2.21)	0.92
Q-wave MI	1.96 (0.53-7.23)	0.31	2.22 (0.59-8.29)	0.24
TVR	4.96 (1.73-14.2)	0.003	5.75 (3.46-9.55)	<0.001
Stroke	2.61 (0.48-14.3)	0.27	2.55 (0.42-15.4)	0.31
Death or Q-wave MI	1.00 (0.53-1.87)	1.00	0.90 (0.47-1.69)	0.73

*Adjusted for the baseline clinical, angiographic and procedural characteristics

AMC CTO-PCI registry

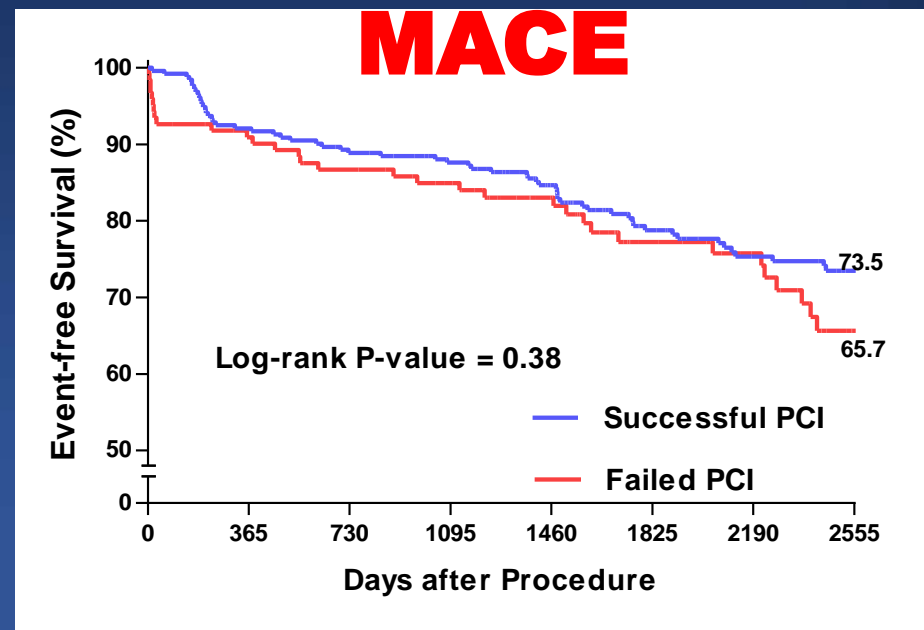
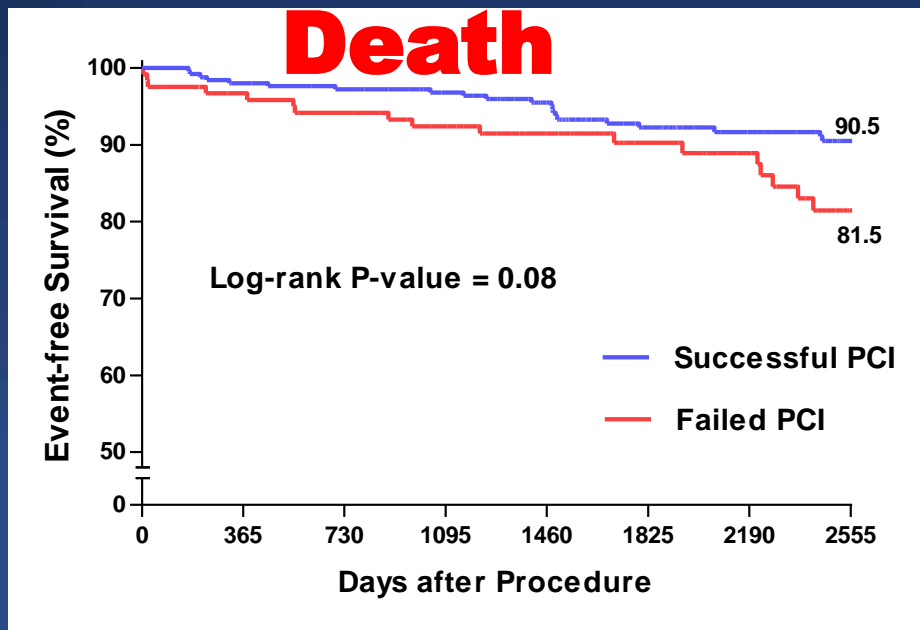
SUCCESS (N=253) VS. Failure (n=124)

7-year follow-up

AMC CTO registry

SUCCESS (N=253) VS. Failure (n=124)

7-year follow-up



No clinical benefit of CTO-PCI

AMC CTO registry

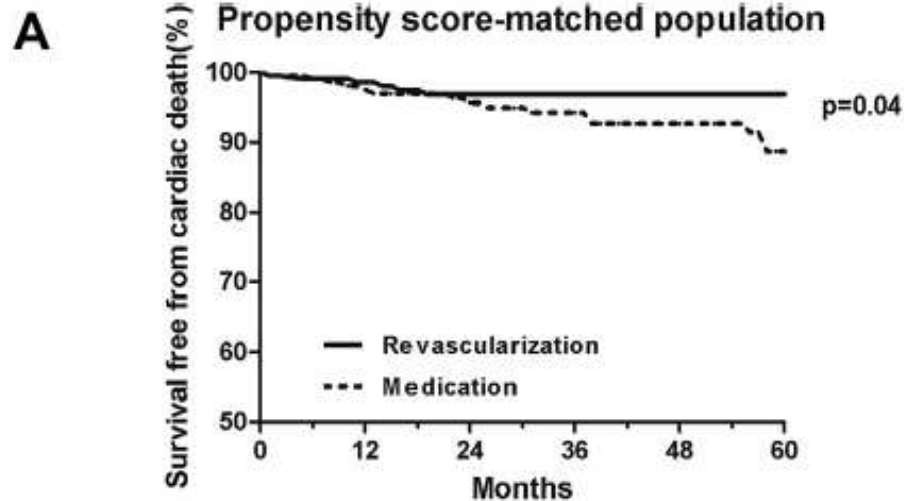
7-year follow-up

CTO-PCI: Success vs. Failure

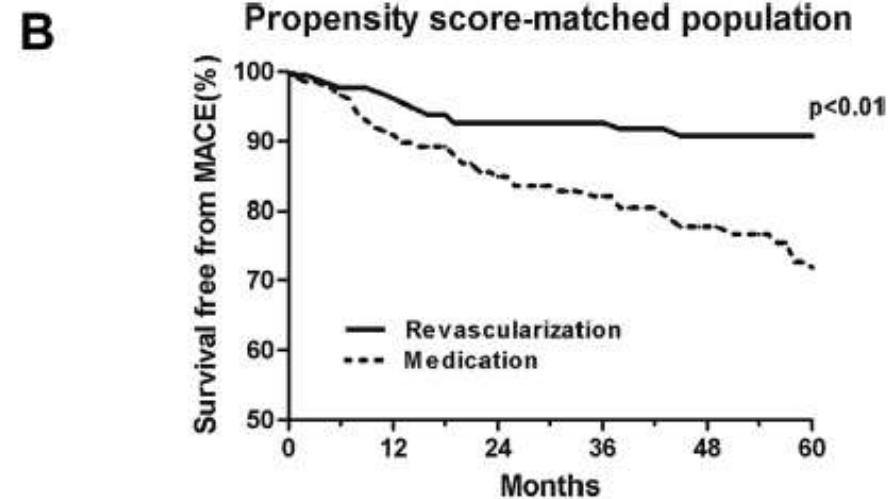
variable	Crude HR (95% CI)	p	IPTW Adjusted HR (95% CI)	P
Death	1.76 (0.94-3.30)	0.07	0.99 (0.47-2.08)	0.98
MI	1.00 (0.26-3.89)	0.99	0.52 (0.13-2.10)	0.36
TVR	1.00 (0.51-1.97)	0.99	0.87 (0.40-1.88)	0.72
Death or MI	1.56 (0.87-2.79)	0.13	0.90 (0.45-1.78)	0.77
Stroke	0.19 (0.02-1.49)	0.11	0.99 (0.13-7.12)	0.99
MACE	1.20 (0.79-1.85)	0.38	1.00 (0.57-1.74)	0.99

Revasc vs. medical treatment in good collateral CTO

738 patients with Rentrop 3 grade collateral circulation
CABG(n=170) or PCI (n=332) vs. medical therapy (n=236),



No. at risk	0	12	24	36	48	60
Revascularization	213	191	152	119	88	65
Medication	209	183	148	128	95	61



No. at risk	0	12	24	36	48	60
Revascularization	212	186	144	112	86	62
Medication	208	169	131	110	82	51

Jang WJ et al. JACC Cardiovasc Interv. 2015;8:271-9.

To Treat or Not To Treat, Still Controversial Issue

Role of CTO-PCI ?

PCI vs. medical treatment

Ongoing Trial:

EUROCTO (n=1200: NCT01760083)

DECISION-CTO (n=1284:NCT0107805)

DECISION-CTO

CTO lesions - eligible for DES implantation
(Single CTO or MVD with 1 or 2 CTOs)

Non-inferiority design

1:1 randomization

Randomization is stratified by CTO location (LAD vs. Non-LAD), DM and Involving center

DES (n=642)

DES in non-CTO lesions,
Treat CTO lesions

Medical Treatment (n=642)

DES in non-CTO lesions,
Not treat CTO lesions

Optimal Medical Treatment

Clinical outcomes at 3 years
(Composite of Death, MI, Stroke and any Revascularization)

Primary end-point: Composite of death, MI, stroke, and any revascularization

Secondary end-point: any revascularization, hospitalization due to acute coronary syndrome. death, MI, LVEF, and angina class, clinical outcomes at 5yr, 10yrs