What is the Practical Approach to LM/MVD Revascularization ?

Make It Simple !

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Current Status of PCI vs. CABG for Left Main Disease

PCI vs. CABG
for Left Main Disease

1. MAIN COMPARE Registry
2. SYNTAX, LM subgroup
3. PRECOMBAT
4. Combined Patient Level Meta-Analysis
5. Temporal Changes of LM Revascularization (*AMC Main Registry, IRIS Main Registry)*
6. EXCEL, NOBLE

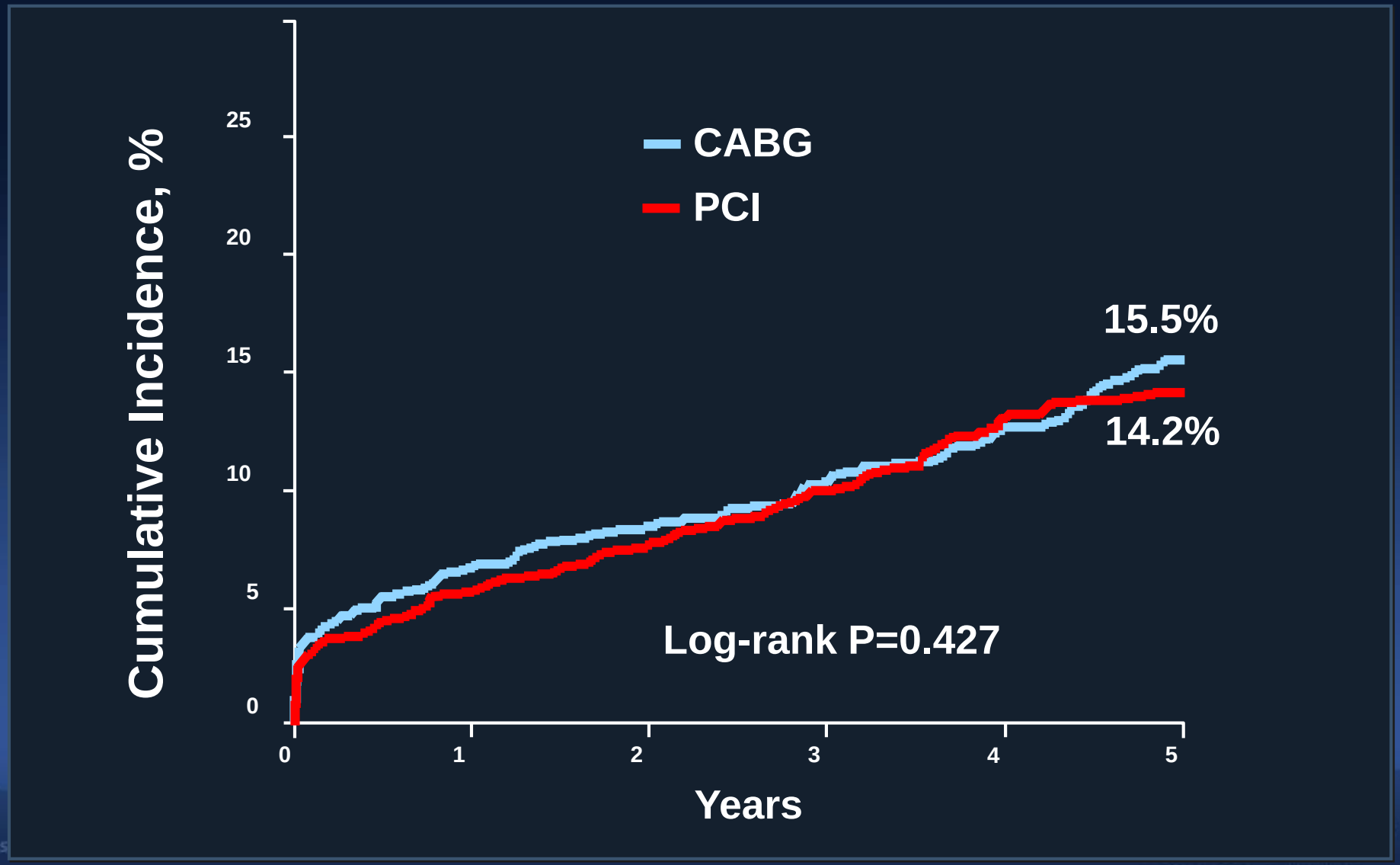
Patient-Level Meta-Analysis (n=3,280)

Database Pooling of
SYNTAX (n=1800, PES),
BEST (n=880, EES), and
PRECOMBAT (n=600, SES) trials.

Lee CW, Park SJ et al, Meta-Analysis from SYNTAX, BEST and PRECOMBAT, 2016

Patient-Level Meta-Analysis (n=1,293)

LM Subset / Death, MI or Stroke



Updated Meta-analysis
PCI vs. CABG at 5 year

PCI vs. CABG	HR (95% CI)	*P*
Revascularization	1.74 (1.47-2.07)	<0.0001

Only Difference Is Revascularization !

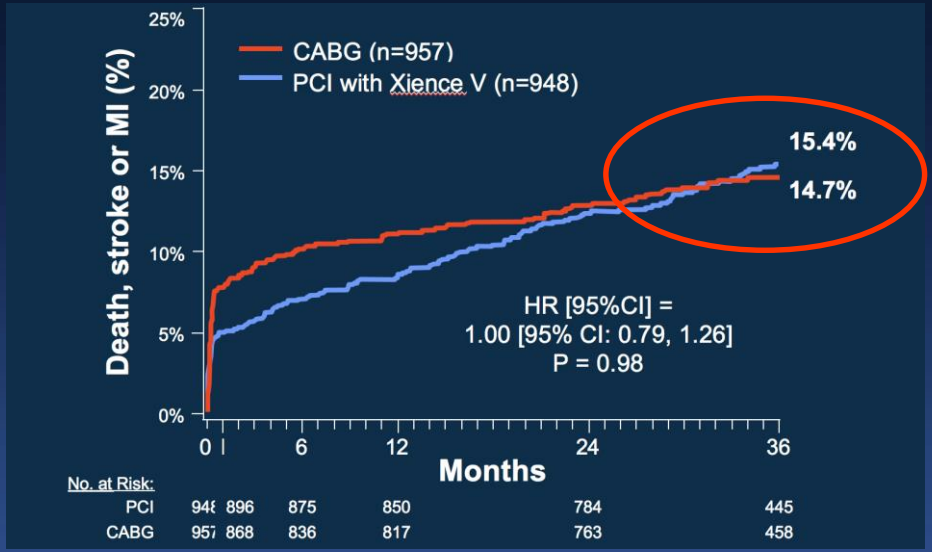
6 RCTs, n=4,686 pts, Boudriot, LE MANS, PRECOMBAT, SYNTAX, NOBLE, EXCEL

Palmerini T et al. Am Heart J 2017;190:54-63

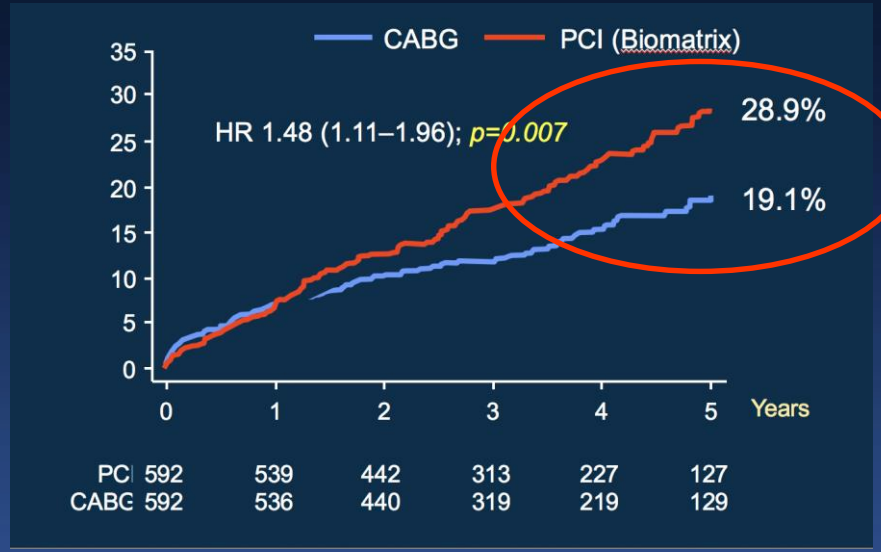
We Need Long-Term Comparative Outcomes of PCI vs. CABG in LM Disease?

There Is Some Signals...

EXCEL



NOBLE



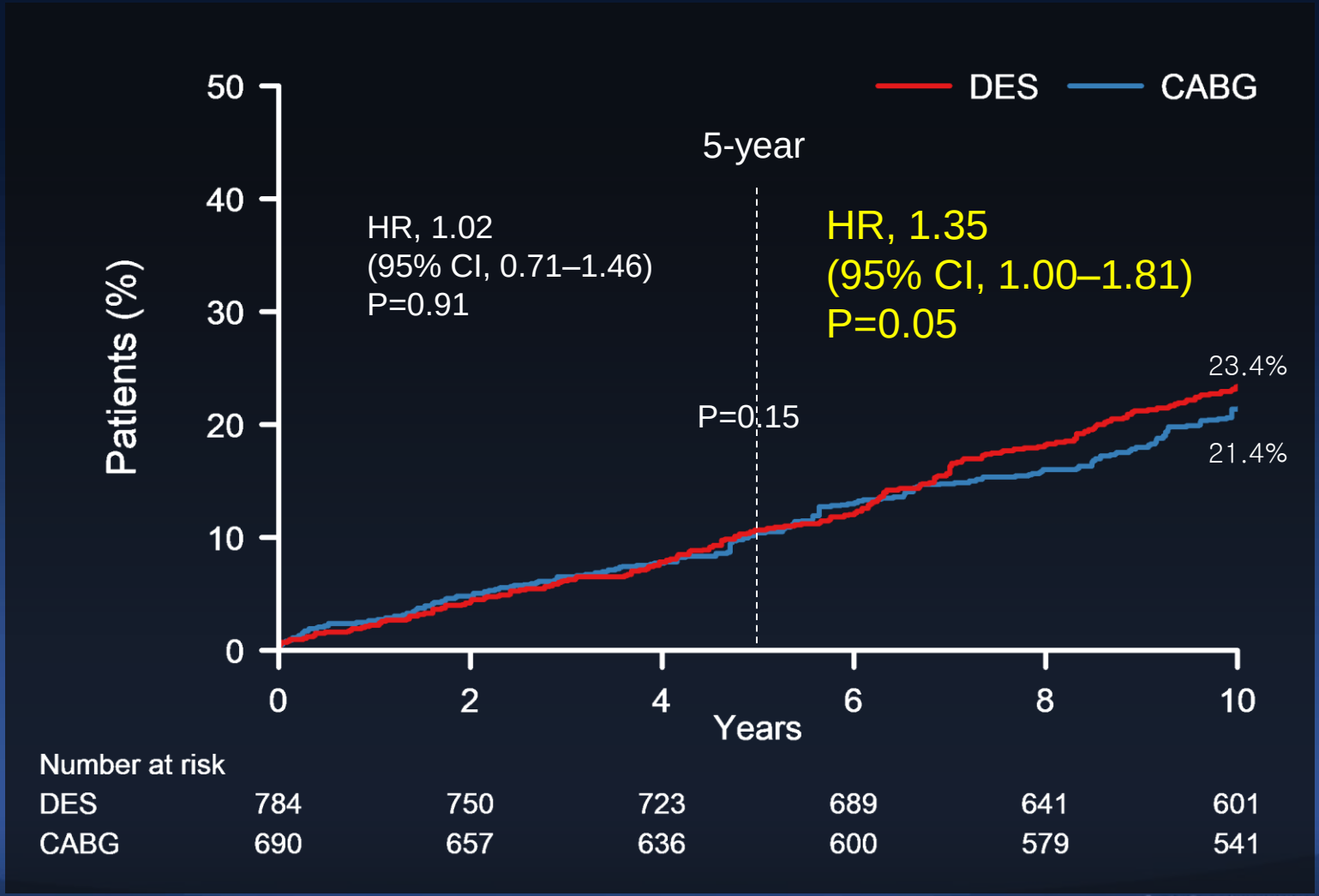
Longer-term follow-up (beyond 5 years) is necessary to examine additional differences between PCI and CABG over time.

EXCEL

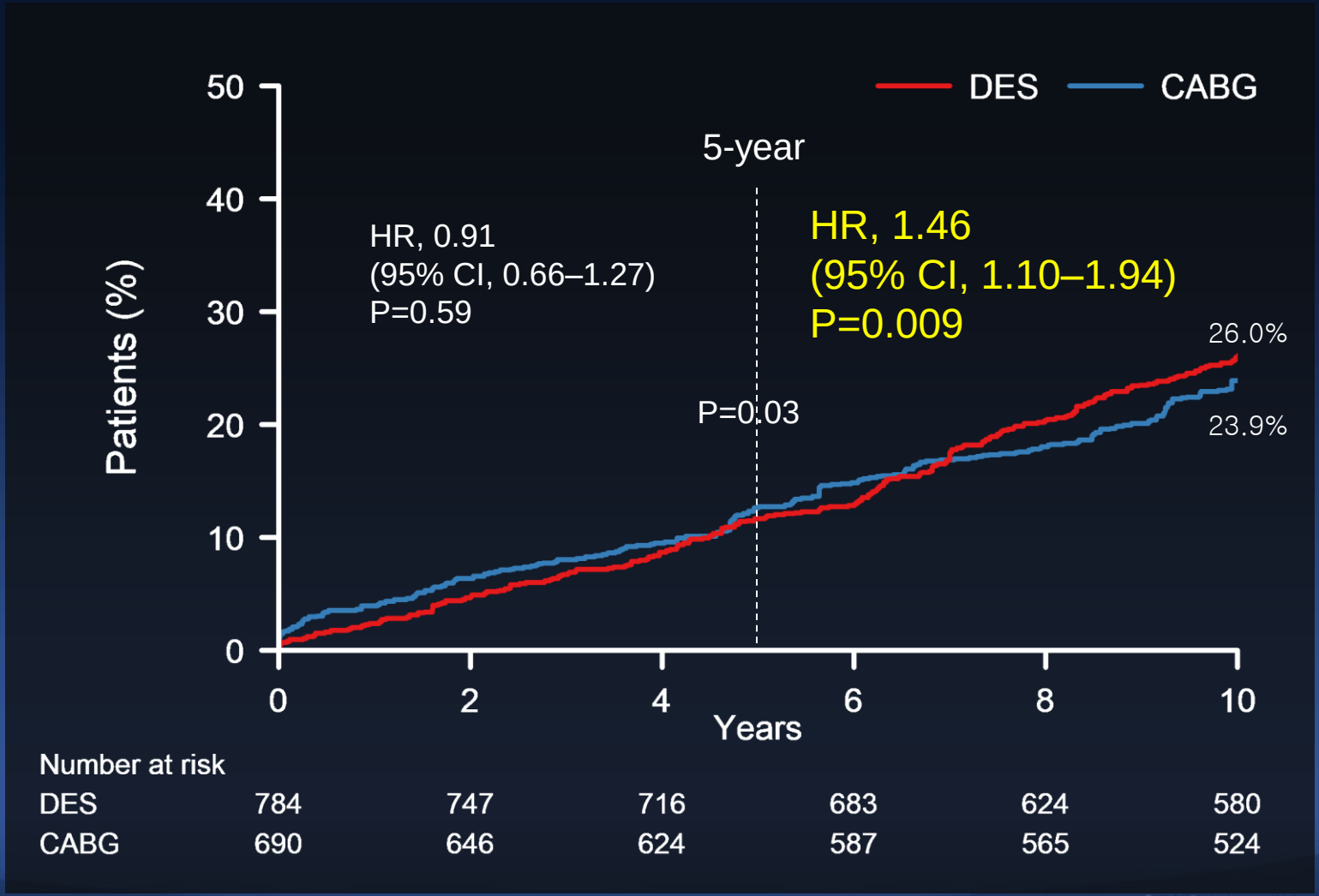
Adjudicated Outcomes at 4 Years (i)

	PCI (n=948)	CABG (n=957)	HR [95%CI]	P-value
Death, stroke or MI (1˚ endpoint)	18.6%	16.7%	1.10 [0.88, 1.36]	0.40
- Death	10.3%	7.4%	1.39 [1.02, 1.89]	0.04
- Definite cardiovascular	4.3%	3.6%	1.17 [0.74, 1.86]	0.50
- Definite non-cardiovascular	5.3%	3.3%	1.61 [1.01, 2.56]	0.04
- Undetermined cause	1.1%	0.7%	1.49 [0.53, 4.19]	0.45
- Stroke	2.6%	3.3%	0.76 [0.44, 1.31]	0.32
- MI	9.5%	8.8%	1.05 [0.77, 1.42]	0.76
- Peri-procedural	3.9%	6.1%	0.65 [0.43, 0.98]	0.04
- Spontaneous	5.7%	3.2%	1.77 [1.12, 2.82]	0.01
- STEMI	1.9%	2.8%	0.65 [0.35, 1.19]	0.16
- Non-STEMI	7.8%	6.3%	1.22 [0.86, 1.72]	0.26

IPTW-Adjusted, DES vs CABG
Death



IPTW-Adjusted, DES vs CABG
Death, Q-MI, or Stroke



ESC Guidelines 2018
Elective PCI for LM Stenosis

Remaining Issue :

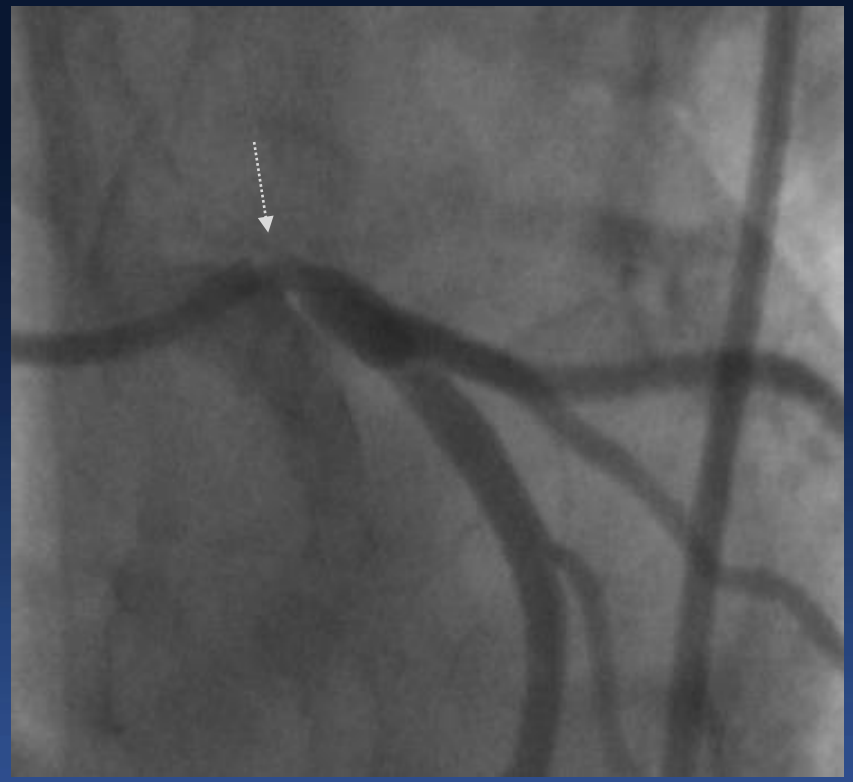
We Are Demanding Very Long-Term (ie,10-Year) Results of PCI and CABG for LM disease

Reference; SYNTAX Study, PRECOMBAT study, MAINCOMPARE registry study and Meta-Analysis. *Patrick, SW et al, NEJM. 2009 March 5;360(10), Park SJ et al, NEJM. 2011 May 5;364(18):1718-27, Levin GN et al. ACC/AHA guidelines. JACC 2011;58:44-122, Capodanno et al, JACC 2011;58:1426-32*

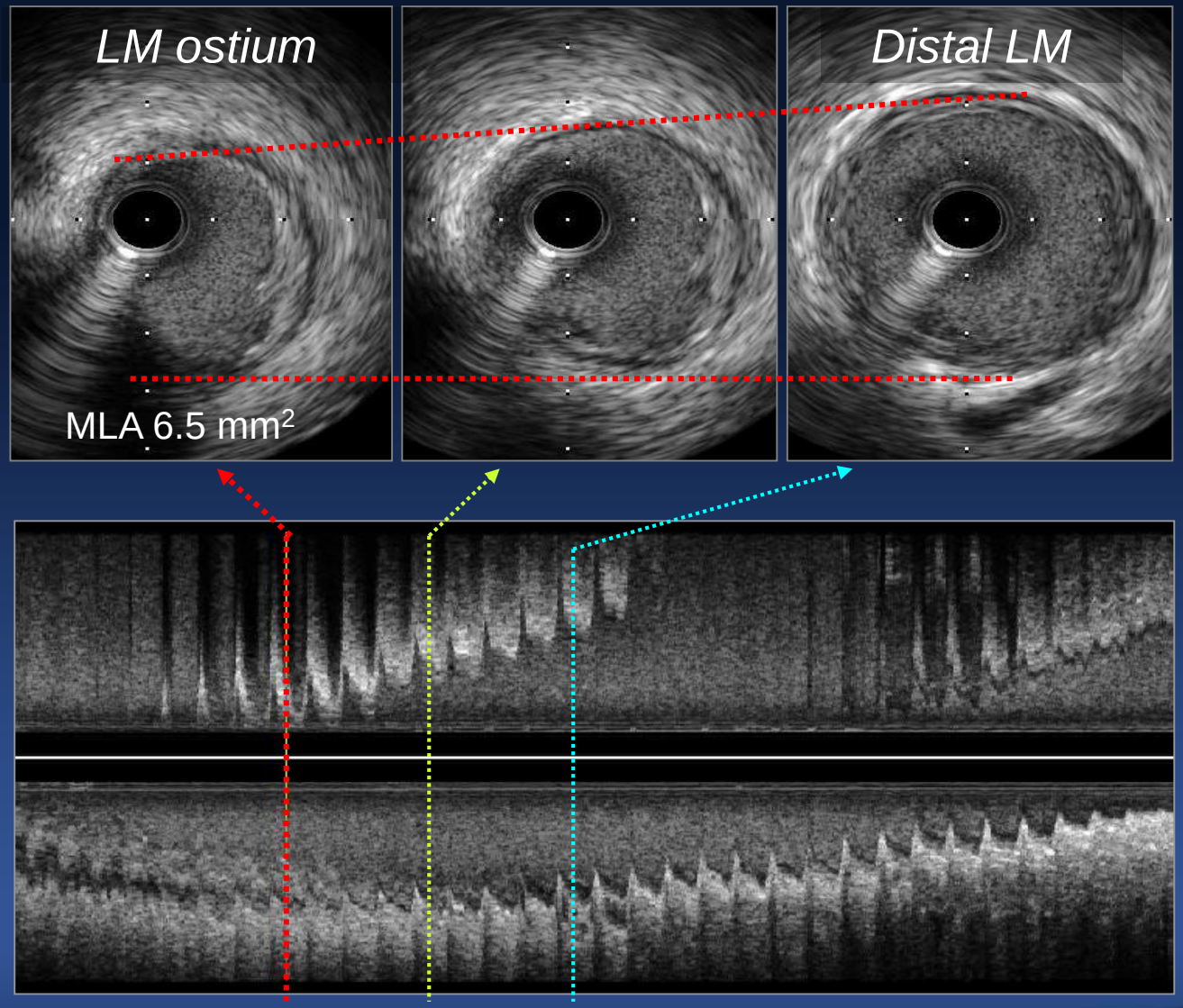
Practical Issue of Left Main PCI;
Make It Simple !

1. FFR Guided Decision Making
2. IVUS Guided Optimization

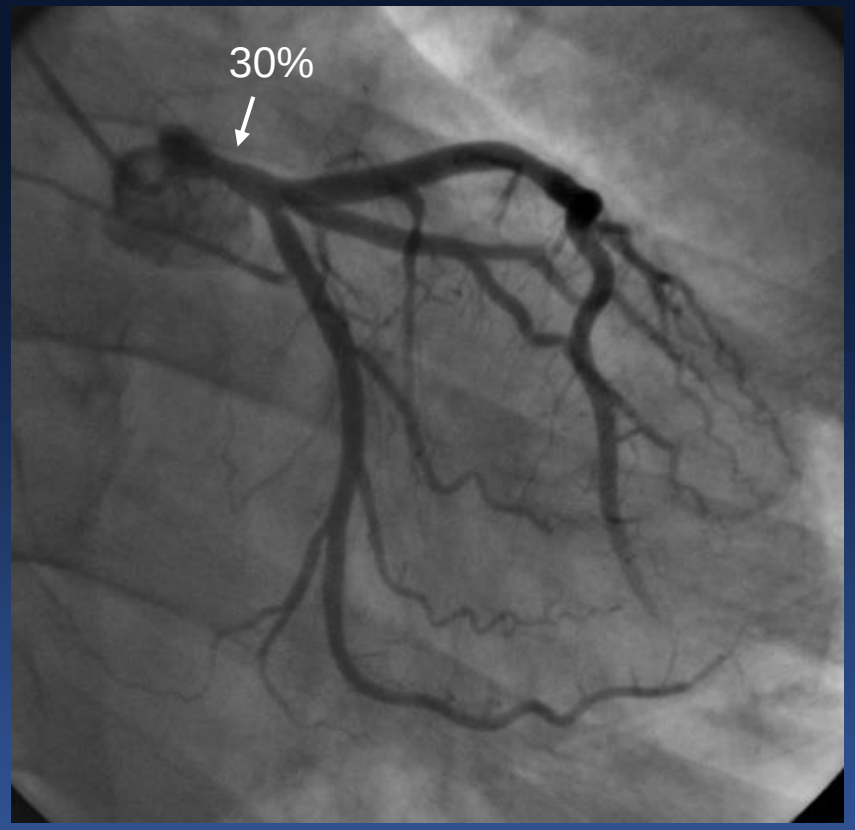
Significant Stenosis,
Negative FFR, 0.80

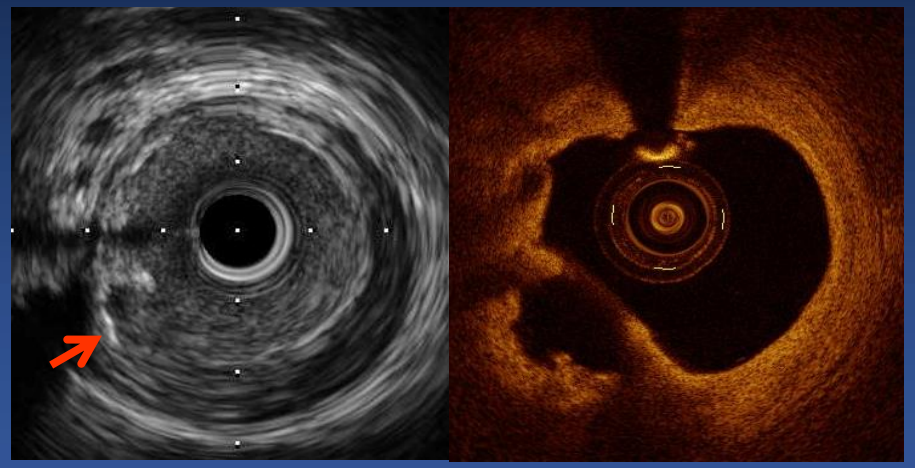


Negative Remodeling



Insignificant Stenosis,
Positive FFR, 0.70

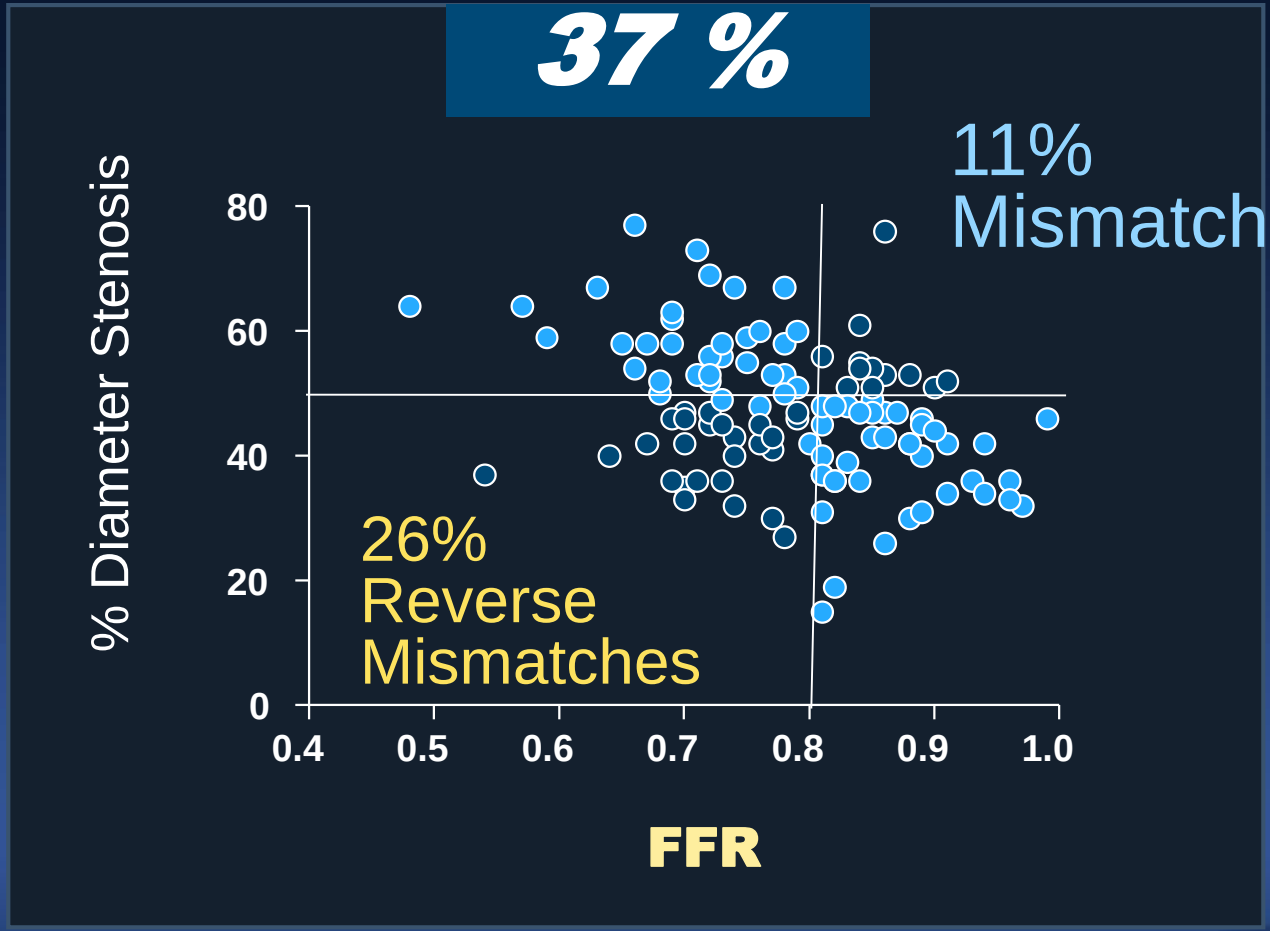




Plaque Rupture
MLA 6.2mm^2

Intermediate LM Disease, Os/Shaft

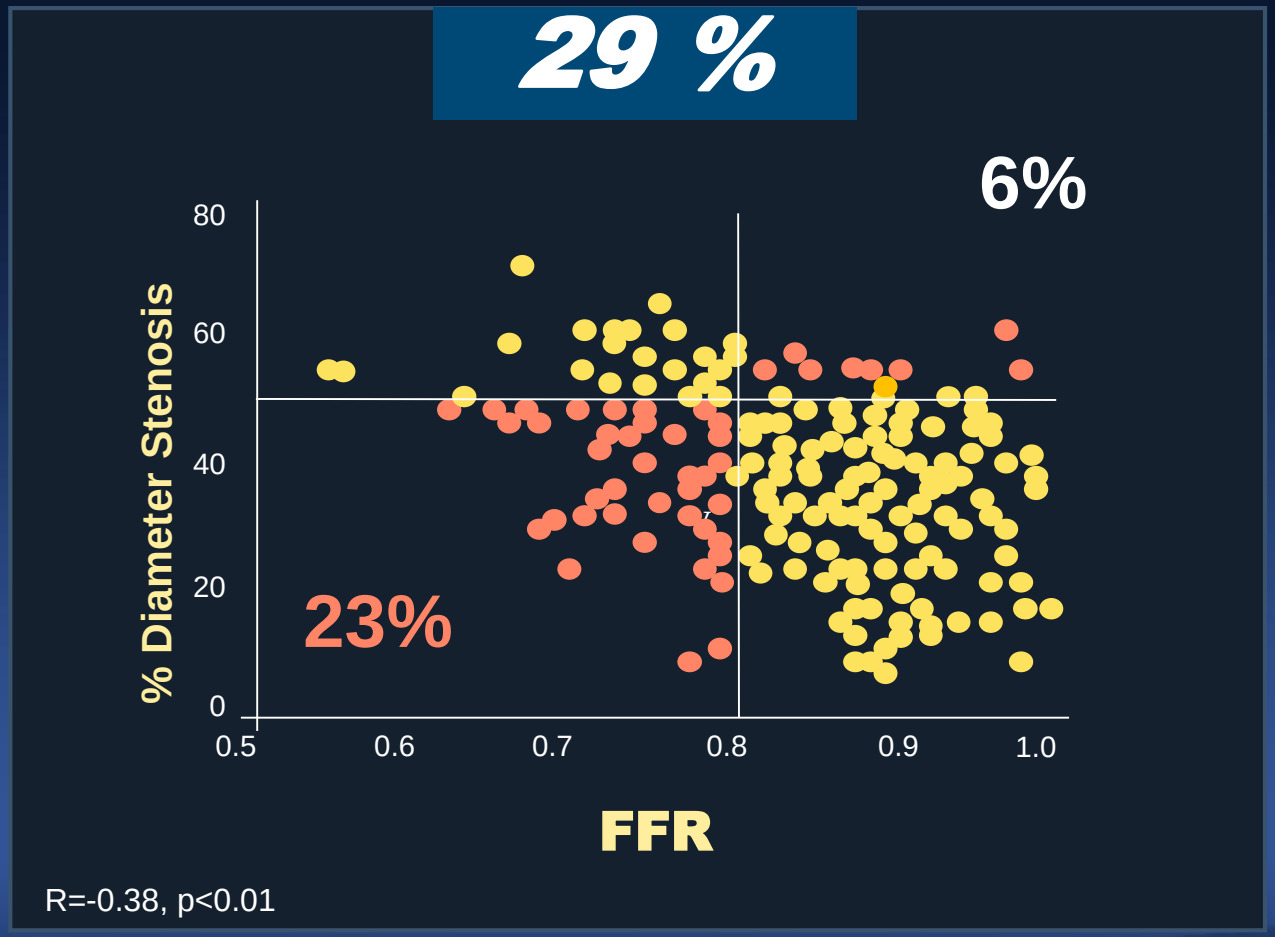
Mismatches



Park SJ et al. *JACC Interv, 2014;7(8):868-874*

Intermediate LM Disease with Downstream Disease

Mismatches



Hamilos M et al. *Circulation 2009;120:1505-1512*

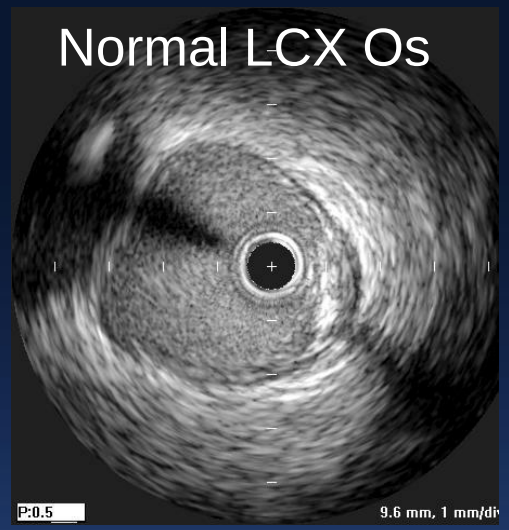
LM Bifurcation PCI

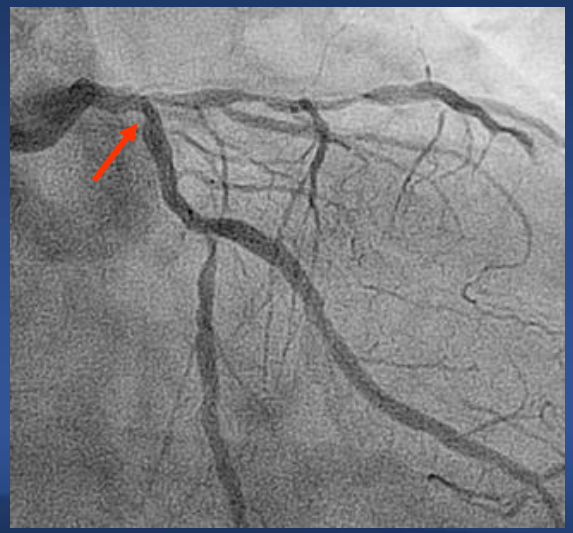
1 Stent	***Normal or Diminutive LCX, (Medina 1.1.0., 1.0.0)*** Small LCX with < 2.5 mm in diameter, Focal disease in distal LCX
2 Stent	***Diseased LCX, (Medina 1.1.1., 1.0.1)*** Large LCX with ≥ 2.5 mm in diameter Diseased left dominant coronary system Diffuse disease in distal LCX

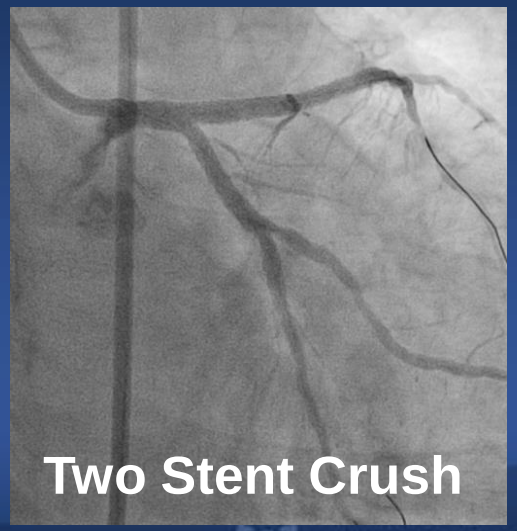
Park SJ, Textbook of Bifurcation Stenting 2007

IVUS Guided LM PCI

1 or 2 Stents
According to LCX Disease by IVUS





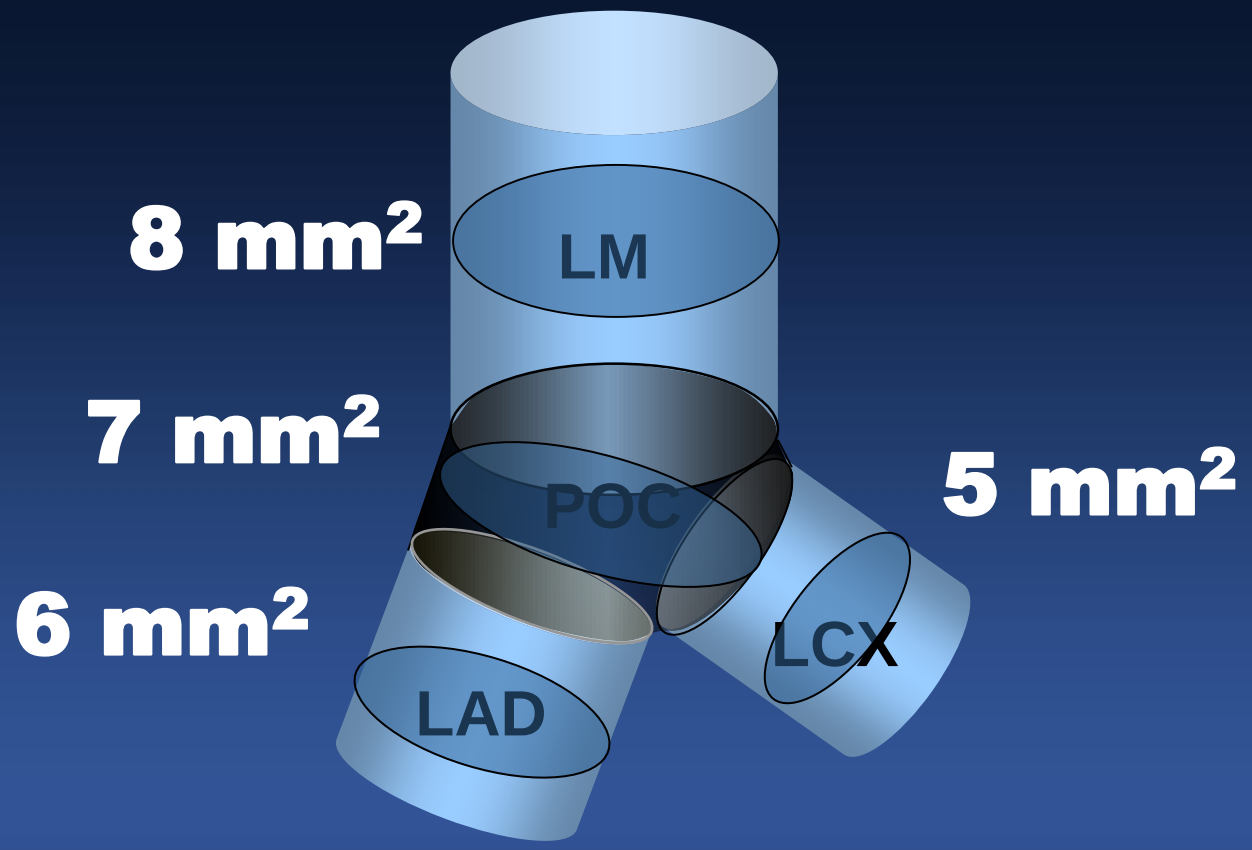


Whatever,
Any 2 Stent Techniques

- Mini-crush (or step crush), DKC
- T-stent, modified T-stent or TAP
- Culotte
- V-stent
- Y-stent (SKS-simultaneous kissing stents)

Effective Stent Area (5,6,7,8 mm^2) Can Make A Good Clinical Outcomes

Restenosis < 5%, TLR < 2%



Kang et al. Circ Cardiovasc Interv 2011;4:1168-74

Practical Guideline

LM Bifurcation PCI

Single Stent
(75%)

After Stent Cross-Over

Any 2 Stents
(25%)

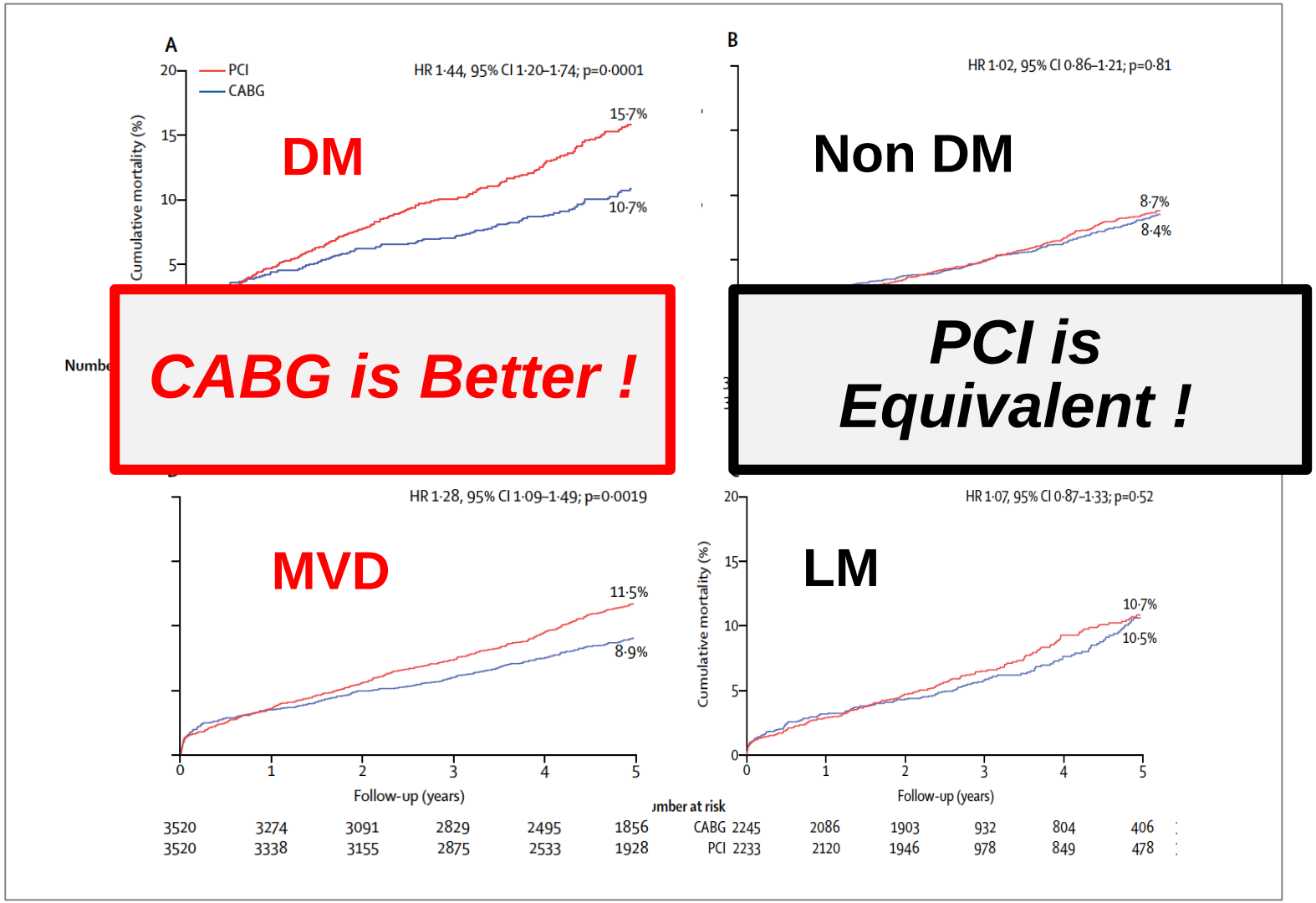
How to Optimize ?

- Do You Want to Treat the Jailed Side Branch ?
- How to Treat ?

IVUS Minimal Stent CSA Criteria 5-6-7-8 mm^2
May Improve Long-term Clinical Outcomes.

Current Status of PCI vs. CABG for Multi-Vessel Disease

Cumulative Mortality



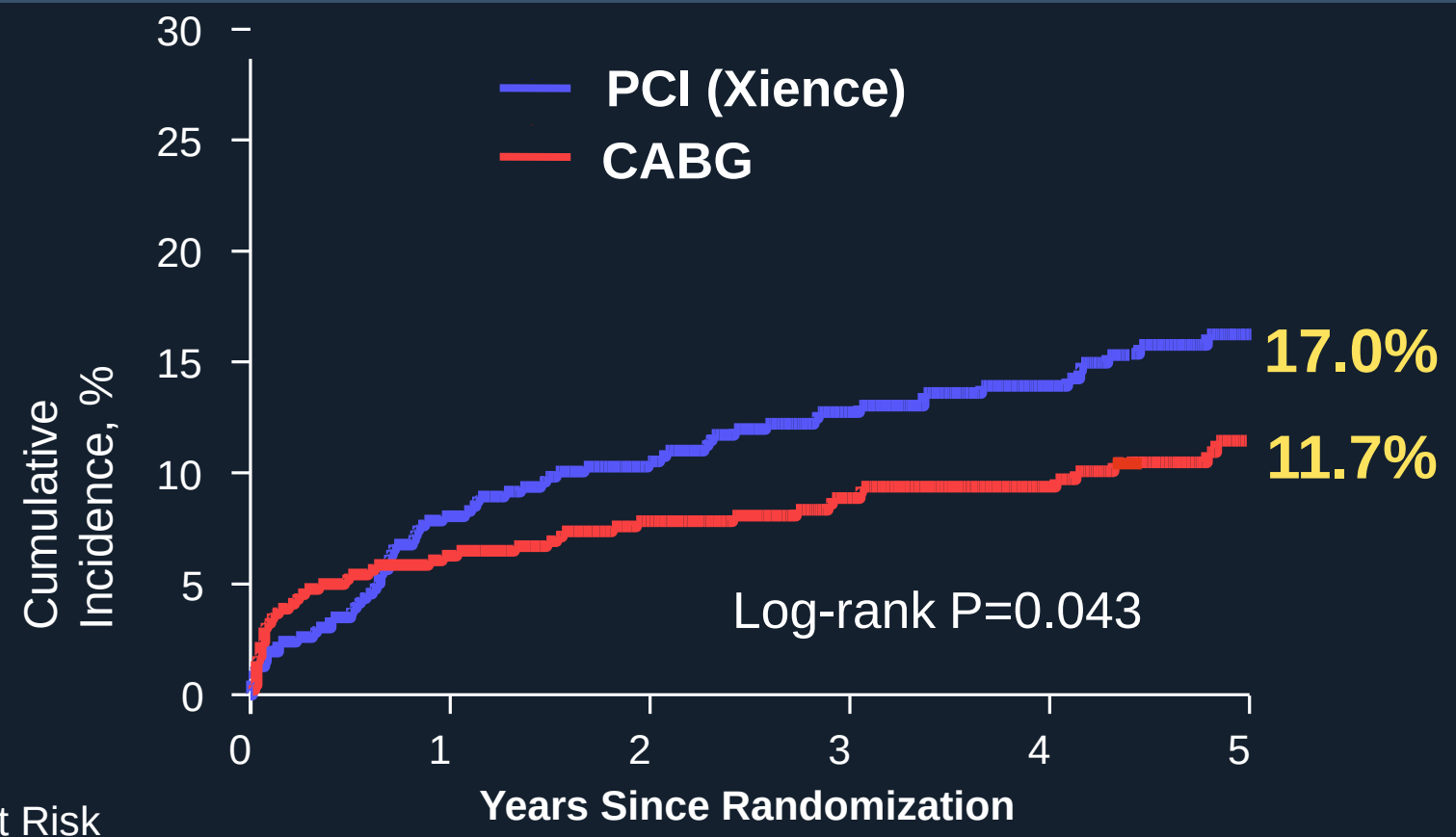
Head SJ et al. Lancet February 22, 2018 ; *Patient-level Meta-Analysis of 11,518 Patients with 11 RCTs (ERACI II, ARTS, MASS-II, SoS, SYNTAX, PRECOMBAT, FREEDOM, VA CARDS, BEST, NOBLE, and EXCEL)*

DES vs. CABG
for Multi-Vessel Disease 2019

CABG was superior to PCI with DESs in patients with diabetes and advanced CAD (predominantly, 3 VD).

Can We Make A Better Clinical Outcomes *Using New DES ?*

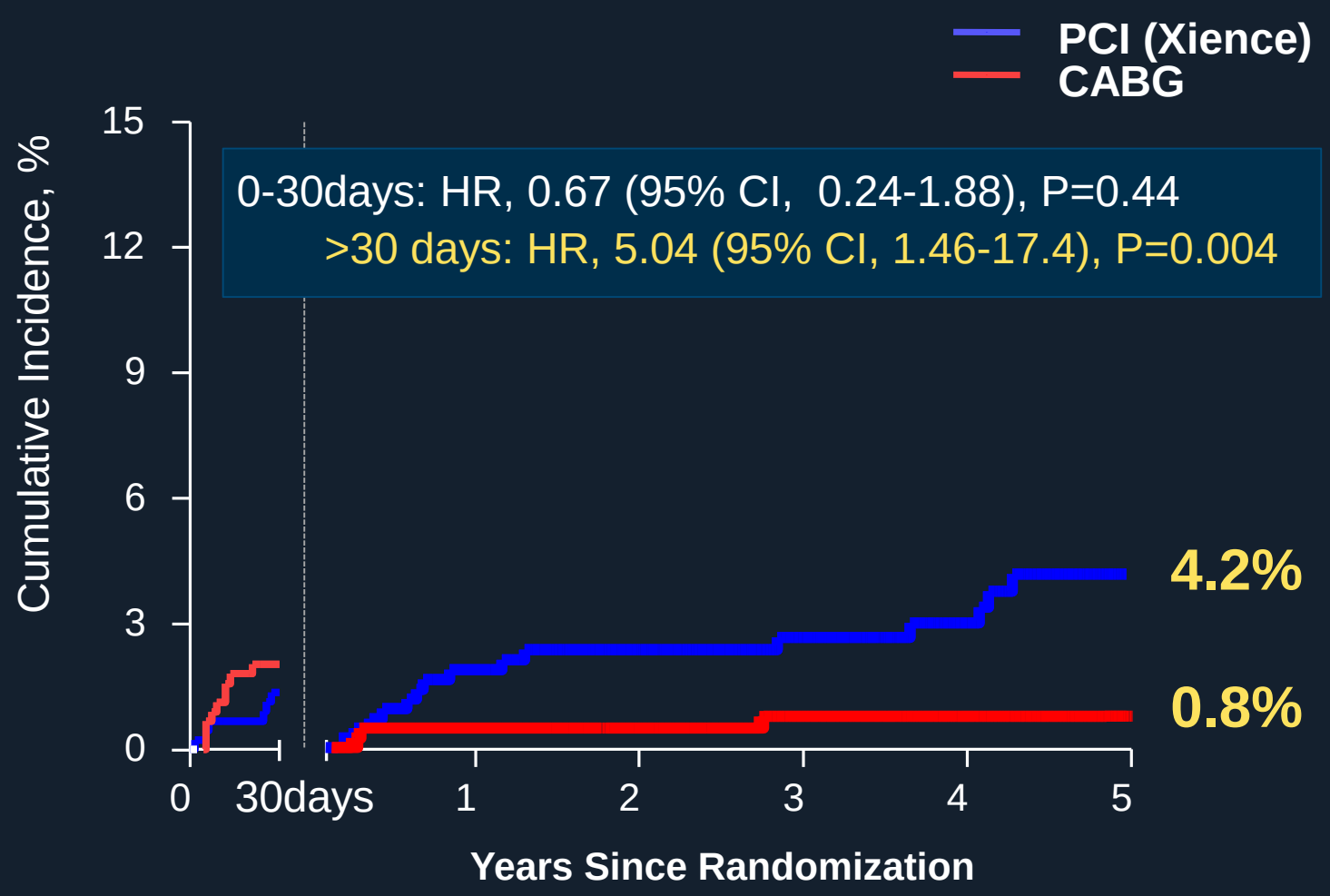
BEST
Death, MI or TVR at 5 Year



No. at Risk						
PCI	438	402	362	305	242	126
CABG	442	415	377	326	262	145

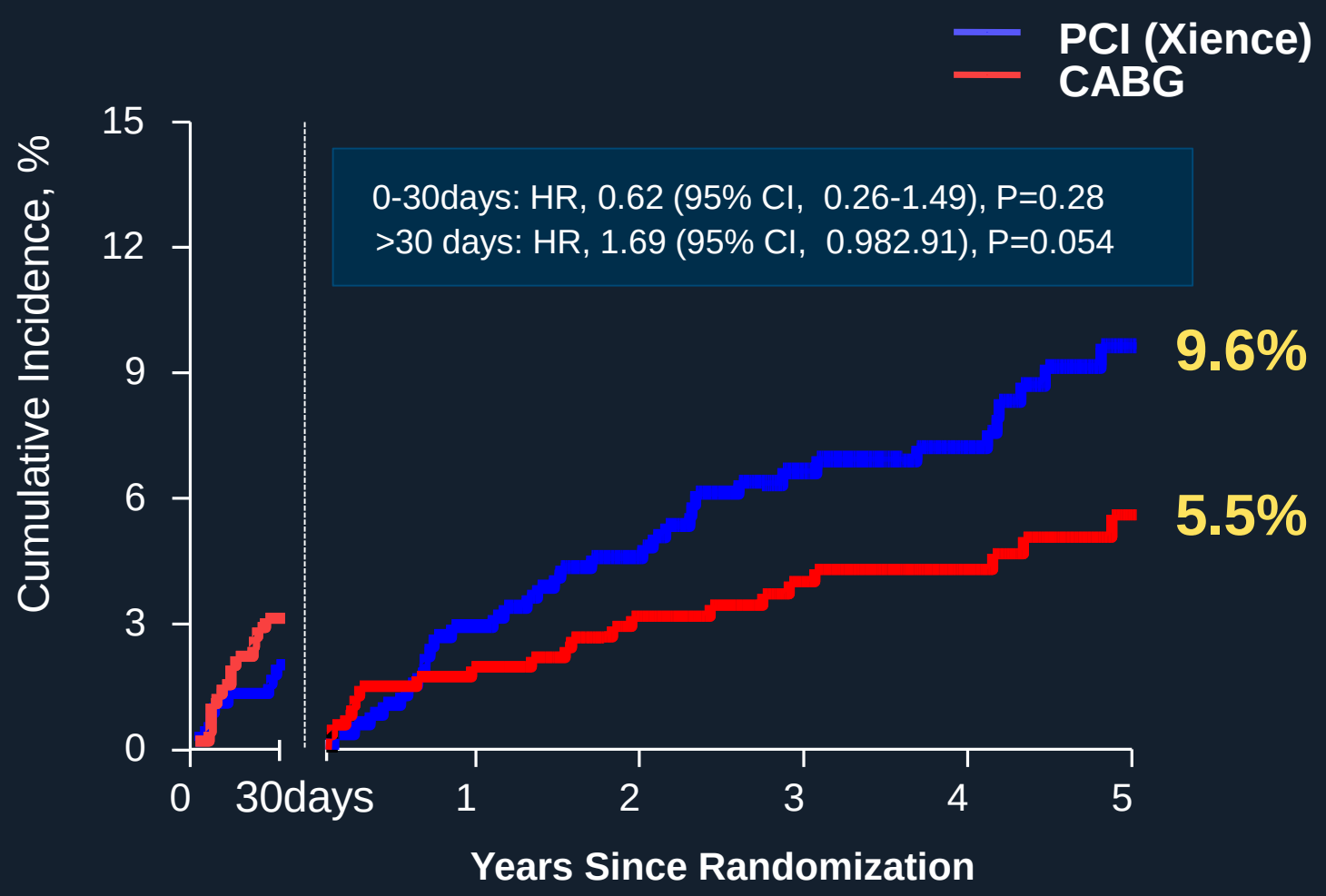
Park SJ et al, NEJM. 2015; 372: 1204-1212

Land Mark Analysis of MI



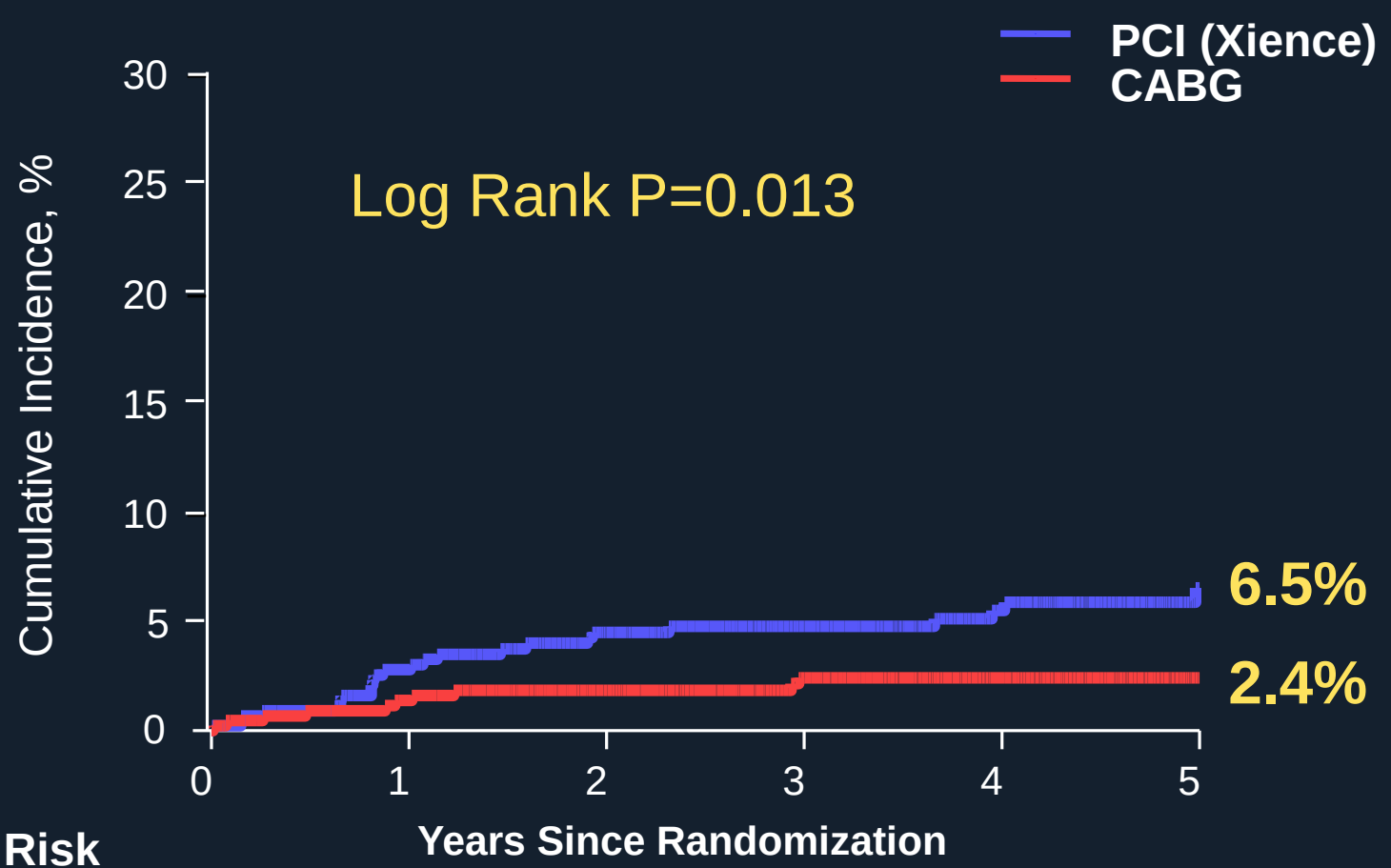
Event rates were derived from Kaplan-Meier estimates

Land Mark Analysis of Death and MI



Event rates were derived from Kaplan-Meier estimates

New Lesion Revascularization



No. at Risk						
PCI	438	416	370	317	254	138
CABG	442	427	389	337	270	149

Event rates were derived from Kaplan-Meier estimates

Why Surgery Is Still Better Even using 2nd Generation of DES ?

Issue of Complete vs Incomplete Revascularization

	PCI (Xience)		CABG	HR (95% CI)	P value
Incomplete Revascularization					
Death	3.25%		2.96%	1.03 (0.91-1.17)	0.63
MI	1.98%	>	1.07%	1.66 (1.39-1.98)	<0.001
Stoke	0.80%	<	1.01%	0.66 (0.52-0.83)	0.0004
Revascularization	7.70%	>	3.03%	2.59 (2.34-2.88)	<0.001

data from New York Registry

Issue of Complete vs Incomplete Revascularization

	PCI (Xience)		CABG	HR (95% CI)	P value
Incomplete Revascularization					
Death	3.25%		2.96%	1.03 (0.91-1.17)	0.63
MI	1.98%	>	1.07%	1.66 (1.39-1.98)	<0.001
Stoke	0.80%	<	1.01%	0.66 (0.52-0.83)	0.0004
Revascularization	7.70%	>	3.03%	2.59 (2.34-2.88)	<0.001
Complete Revascularization					
Death	2.54 %		2.50 %	1.08 (0.82-1.42)	0.58
MI	1.43%		1.37%	1.02 (0.71-1.47)	0.93
Stoke	0.42%	<	0.84%	0.43 (0.24-0.75)	0.003
Revascularization	5.46%	>	3.40%	1.55 (1.26-1.90)	<0.001

data from New York Registry

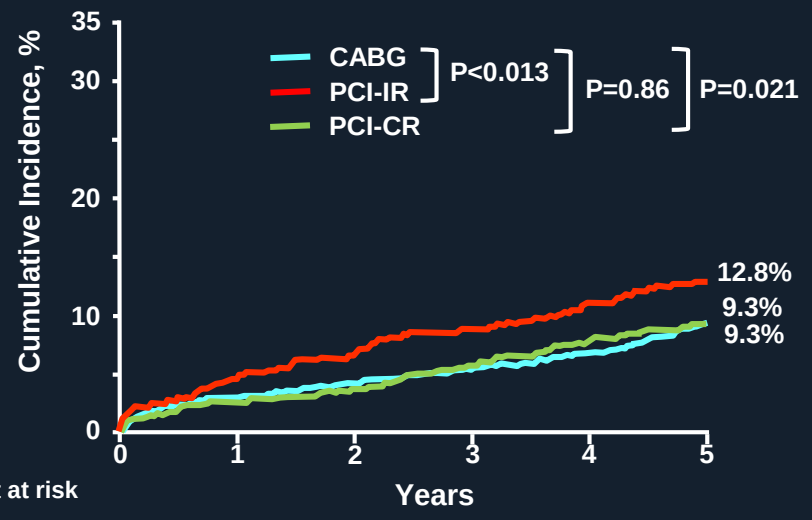
Complete vs Incomplete
from BEST Study

	PCI (Xience)	CABG	HR (95% CI)	P value
Incomplete Revascularization				
Death	6.5%	5.7%	1.22 (0.49-3.02)	0.68
MI	**7.4%** >	1.6%	4.85 (1.11-21.1)	0.036
Death, MI, or Stroke	12.6%	9.0%	1.52 (0.75-3.07)	0.24
Any Repeat Revascularization	15.8%	10.7%	1.58 (0.83-3.00)	0.16
MACC	23.7%	16.4%	1.59 (0.94-2.66)	0.08
Complete Revascularization				
Death	7.0%	4.4%	1.50 (0.71-3.15)	0.29
MI	2.3%	3.1%	0.75 (0.25-2.24)	0.60
Death, MI, or Stroke	11.6%	9.5%	1.18 (0.69-2.02)	0.55
Any repeat revascularization	6.5%	3.4%	1.89 (0.84-4.25)	0.13
MACCE	16.7%	12.2%	1.34 (0.84-2.13)	0.22

Complete vs Incomplete

Patient-Level Meta-Analysis (n=3,280)

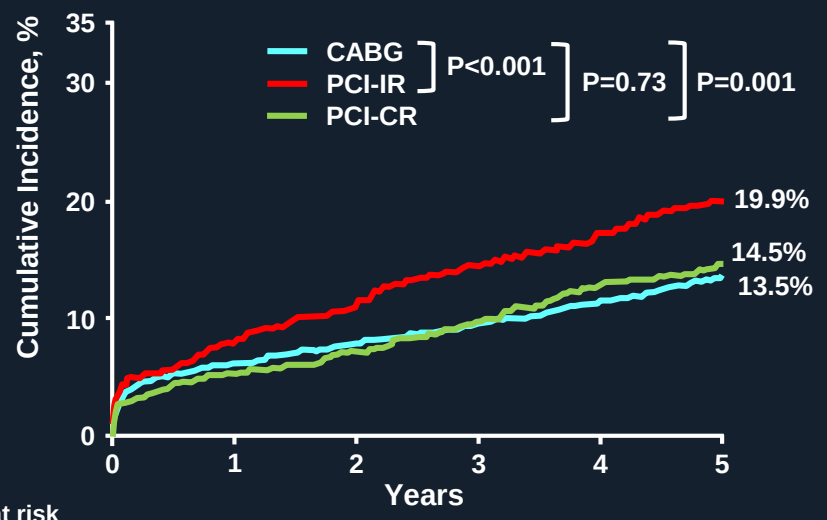
Death From Any Cause



Patient at risk

CABG	1538	1462	1403	1326	1224	549
PCI-IR	724	689	651	601	545	282
PCI-CR	968	941	918	875	819	389

Death, MI, or Stroke



Patient at risk

CABG	1538	1413	1349	1267	1160	565
PCI-IR	724	665	619	564	509	260
PCI-CR	968	916	886	839	776	373

Meta-Analysis from SYNTAX, BEST and PRECOMBAT, 2016

What We've Learned *from These Data*

Complete Revascularization
Is Important Practical Issue !

Park SJ et al, NEJM. 2015; 372: 1204-1212
Bangalore S et al. N Engl J Med 2015; 372:1213-1222

ESC Guidelines 2018
Elective PCI for 3 Vessel Disease

	CABG		PCI	
3-VD without Diabetes Mellitus	**Class**	**Level**	**Class**	**Level**
3 VD with low SYNTAX score (0-22)	I	A	I	A
3 VD with intermediate of high SYNTAX score (>22)	I	A	III	A
3-VD with Diabetes Mellitus				
3 VD with low SYNTAX score (0-22)	I	A	IIb	A
3 VD with intermediate of high SYNTAX score (>22)	I	A	III	A

PCI vs. CABG

Different Concept of Treatment !

PCI,
Focal Treatment

CABG,
Bypass the Whole Atherosclerotic Burden

Practical Guidelines for Multi-Vessel PCI, *Make It Simple !*

1. ***If*** *the Lesion is Functionally Significant and Favorable Anatomy for PCI, Complete Revascularization Should be Considered.*

2. ***If*** *the Lesion is Unfavorable Anatomy for PCI, Send the Patients to Surgery !*

What Is the Definition of Favorable Anatomy for PCI ?

2.5, 5, 50

Can Make A Good Clinical Outcomes.

TLR rate would be <2% !

Hong MK, Eur Heart J, 2006:27:1305

Song HG et al, Catheterization and Cardiovascular Interventions. 2014 :1;83(6):873-8

PCI vs. CABG
In Multi-Vessel Disease, *2019*

We need absolutely new data for the future role of PCI and CABG in functionally significant multi-vessel disease under the integrated concept of FFR and IVUS.

Thank You !!

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