

PCI for Unprotected Left Main Coronary Artery Stenosis

Current Recommendation for unprotected LMCA Stenosis

- Class IIb C in ESC guideline (2005) and Class III in ACC guideline (2006) in patients eligible for CABG
- Class III is the conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful/ effective and in some cases may be harmful.

Evidence of the Superiority of CABG

Very Old Study

Trial	Enroll	F/U	Survival rate		P
			Medicine	CABG	
Veteran Administration Cooperative Study	1972-1974	3.5 years	65% N=43	88% N=48	0.01
European Coronary Surgical Study	1973-1976	5 years	62% N=31	93% N=28	<0.05
Coronary Artery Surgery Study	1974-1979	4 years	63% N=309	88% N=1,183	<0.0001
Pooled data	1972-1979	3.5-5 years	62% N=405	88% N=1,259	<0.0001

**Unprotected left main stenting is still
premature in general practice...**



Compare to Surgery,

High Mortality in PCI ?

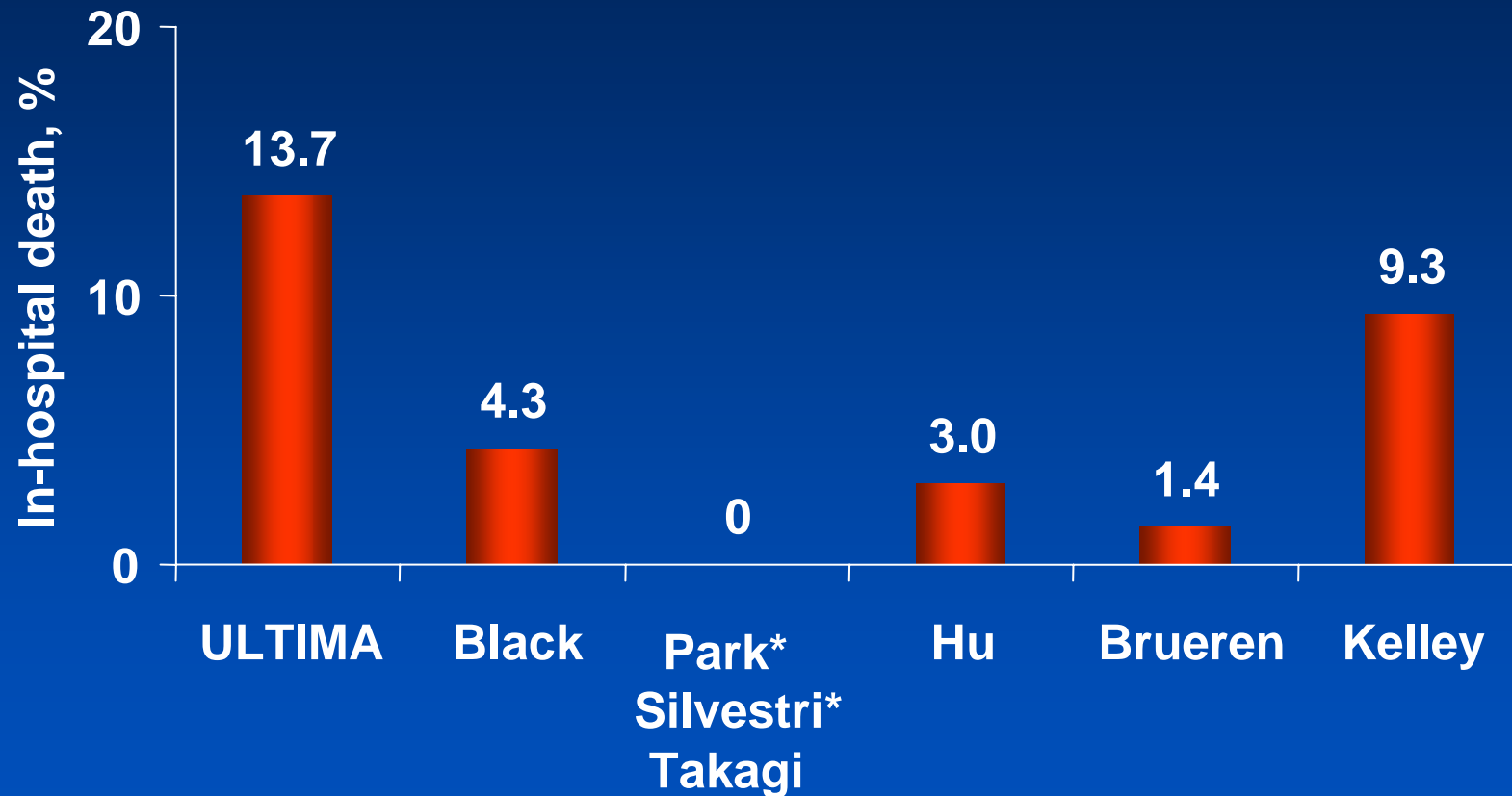


Left Main PCI with BMS

Study	Site(s)	Years	Pts #	Procedure success
Park et al, 1998	Asan Medical Center & WHC	1995-1997	42	100%
Silvestri et al	Marcielle, France	1993-1998	140	100%
Park et al	Asian Pacific Multicenter Registry	1995-2000	270	98.9%
Hu et al	Moriyama, Japan	1994-2002	67	92.6%
Brueren et al	St Antonius Hospital, Nieuwegein, Netherlands	1991-2001	71	94.4%
Takagi et al	Columbus Hospital & San Raffaele Hospital, Milan	1993-2001	67	91%
Ellis et al	16 hospitals (ULTIMA Registry)	1994-1996	107	98%

In-Hospital Mortality

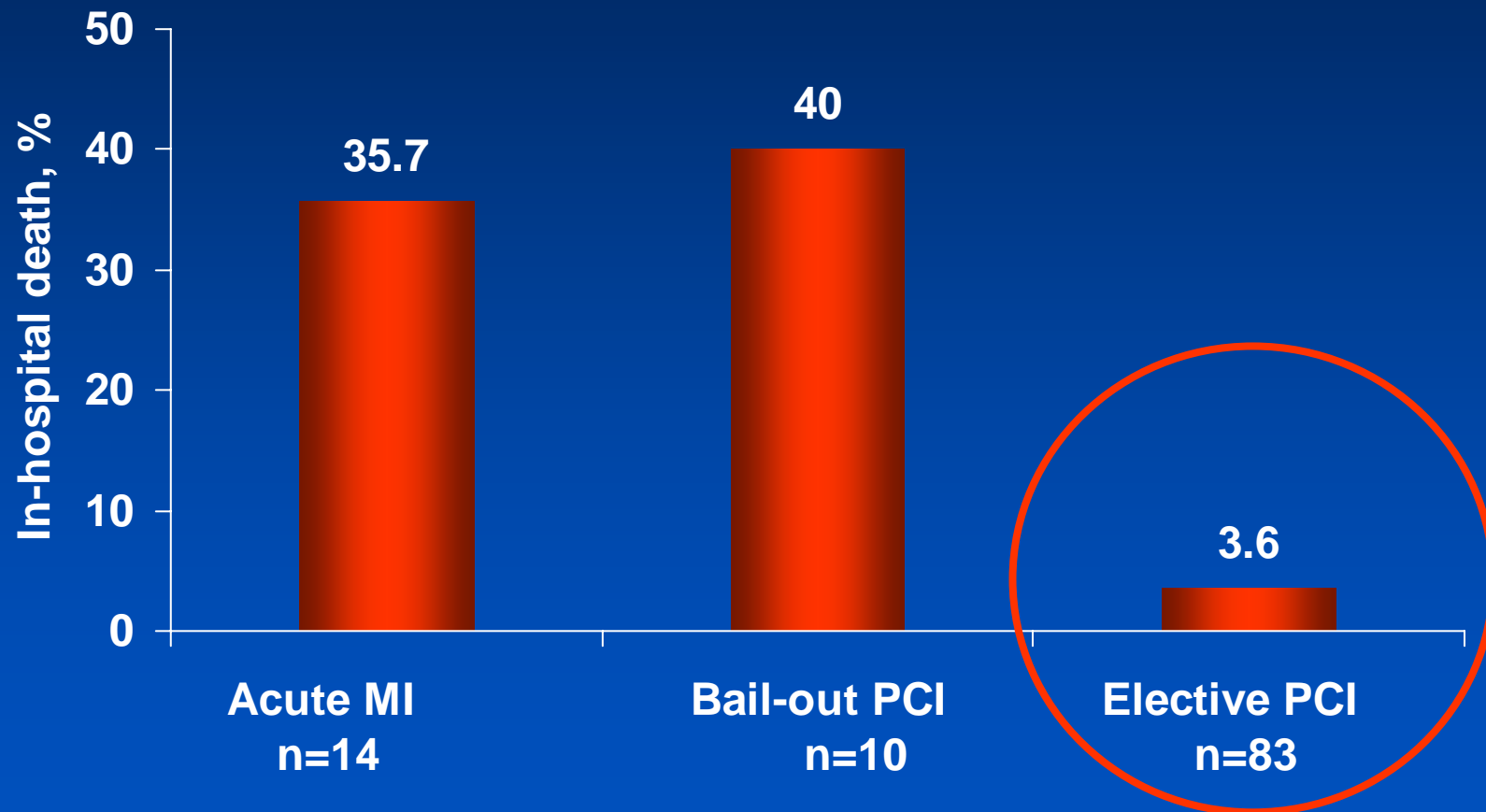
PCI with BMS



* Low-risk surgical candidates

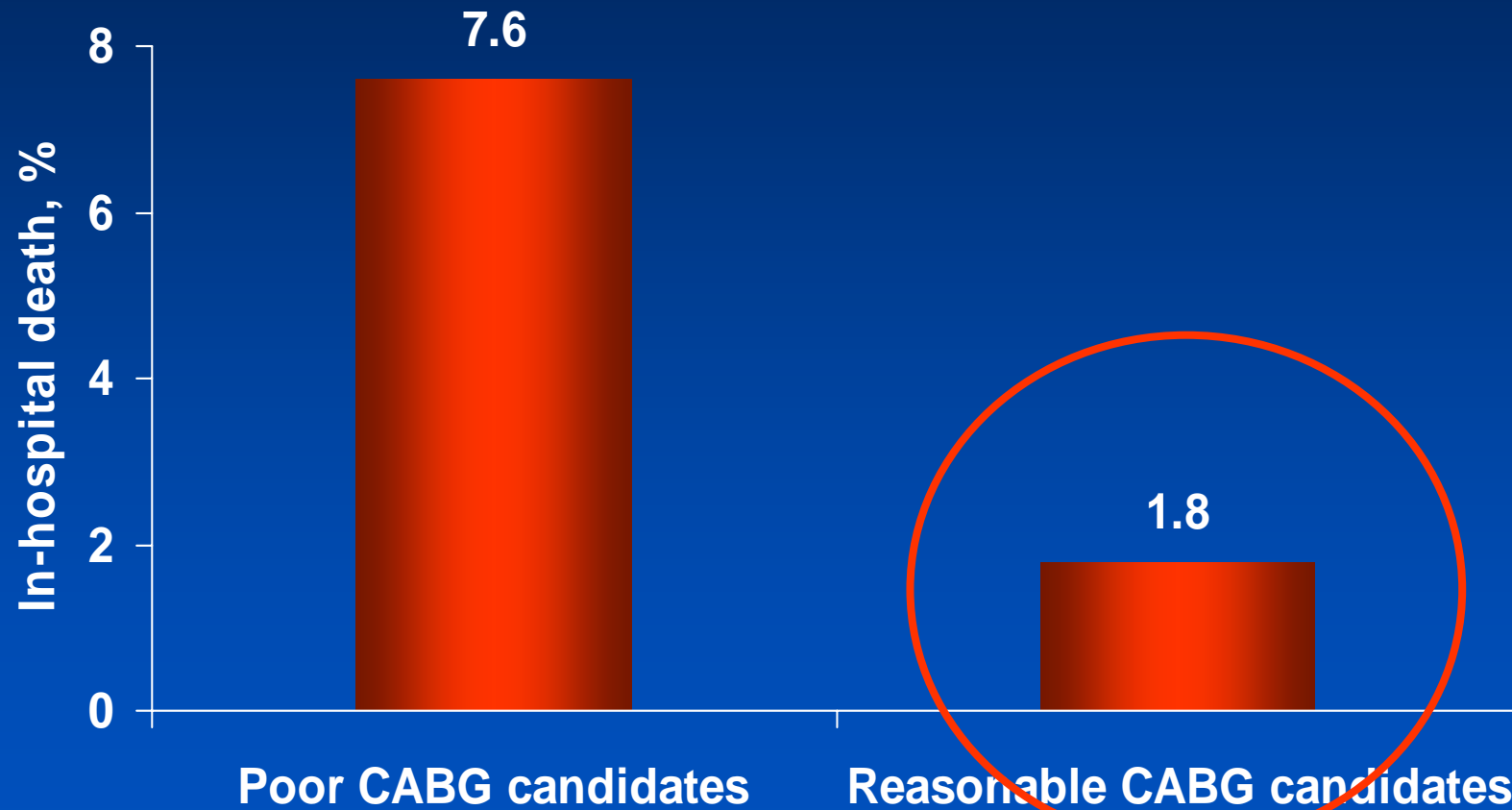
In-Hospital Mortality

In High-Risk vs. Low-Risk Patients



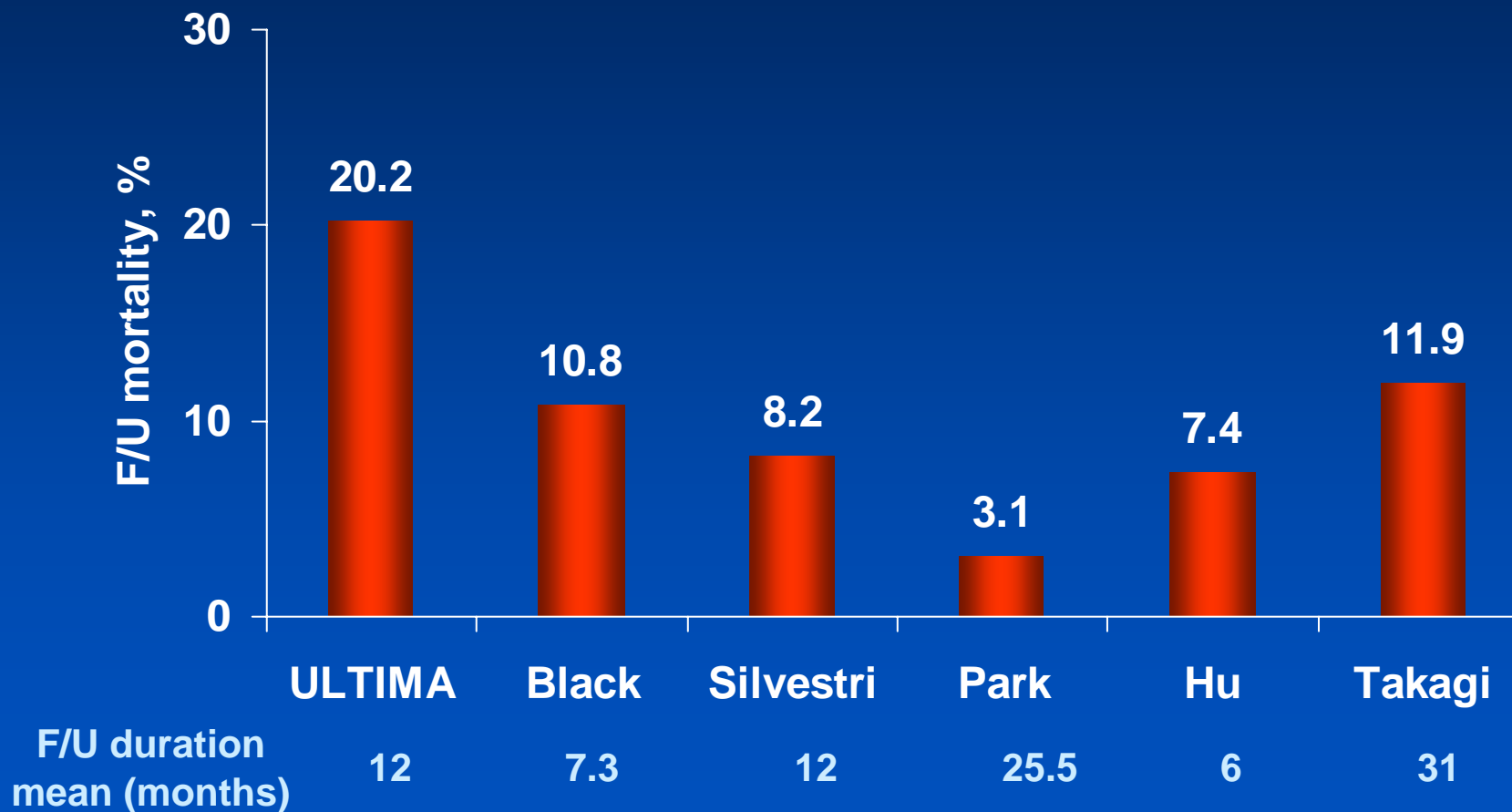
Kosuga et al, AJC, 1999

Low in-Hospital Mortality for good candidate for Surgery



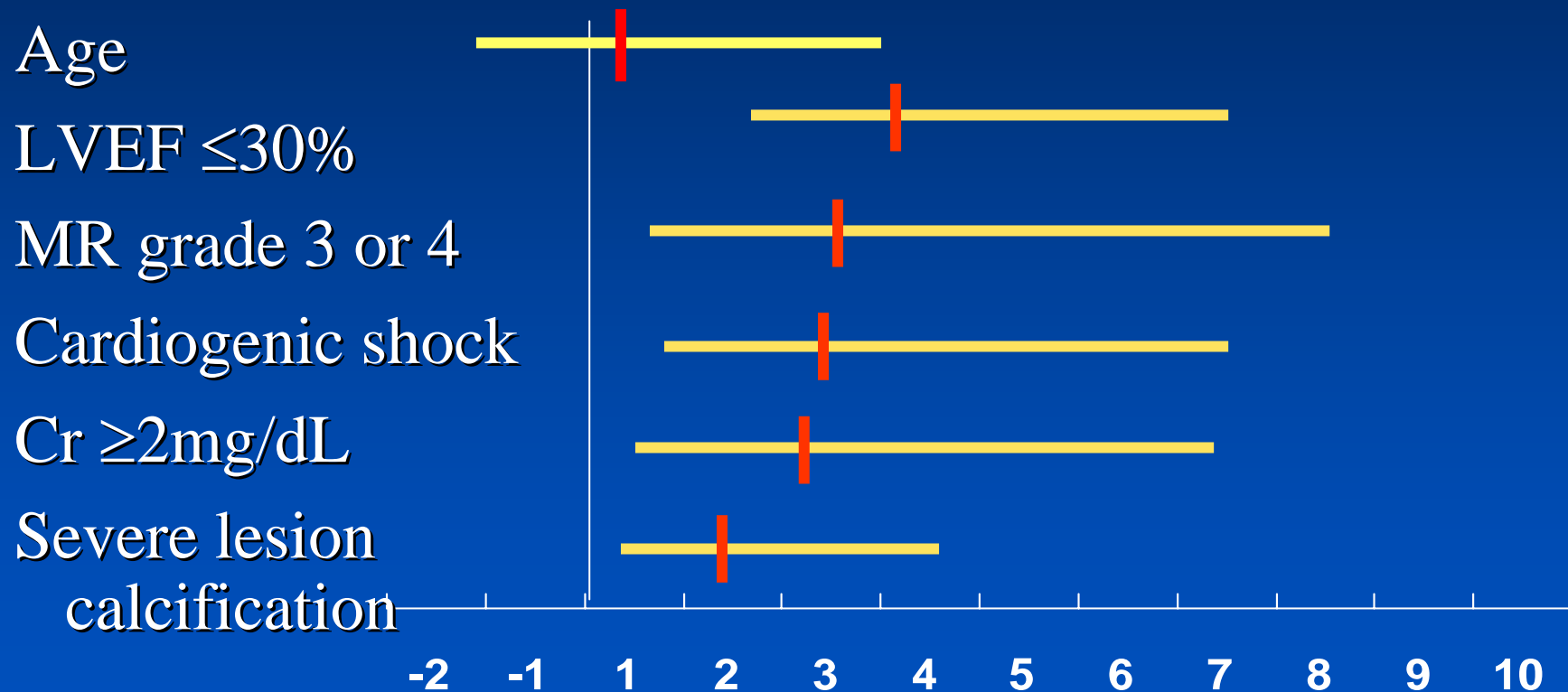
Black et al, JACC, 2001

Long-term Mortality at Follow-up in PCI Series with BMS on Unprotected LM



Relative Risk of Mortality in LMCA Stenting

ULTIMA Registry (279 pts), PCI with BMS



Nalysnyk L, Heart 2003, 89:767

Published Unprotected Left Main PCI with DES

Study	Site(s)	Years	Pts #	Stent	Debulking %	Comment
Park et al	Asan Medical Center, Seoul, Korea	2003-2004	102	SES	2.9%	EF ≤ 40% excluded
Valgimigli et al	Erasmus Medical Center, Netherlands	2001-2003	95	SES or PES	3.1%	AMI & bail-out included
Chieffo et al	Columbus Hosp. & San Raffaele Hosp.	2002-2004	85	SES or PES	2.3%	45% poor surgical candidates
De Lezo et al	Reina Sofia Hospital, Spain	2002-2004	52	SES	-	45% poor surgical candidates
Gershlick et al	E-Cypher registry, 79 centers	Since 2002	220	SES	NA	Real world cases
Price et al	Scripps Clinic	2002-2004	50	SES	NA	24% had EF ≤ 40%
Lefevre et al*	LM TAXUS pilot study	2003-2004	130	PES	NA	76% bifurcation
Nakamura et al	New Tokyo Hosp., Matsudo, Japan	NA	138	SES or PES	NA	-
Di Salvo et al	Ferrarotto Hospital, Catania, Italy	2002-2004	80	SES or PES	NA	-

In-Hospital Outcomes: DES in Left Main PCI Series: 944 Patients

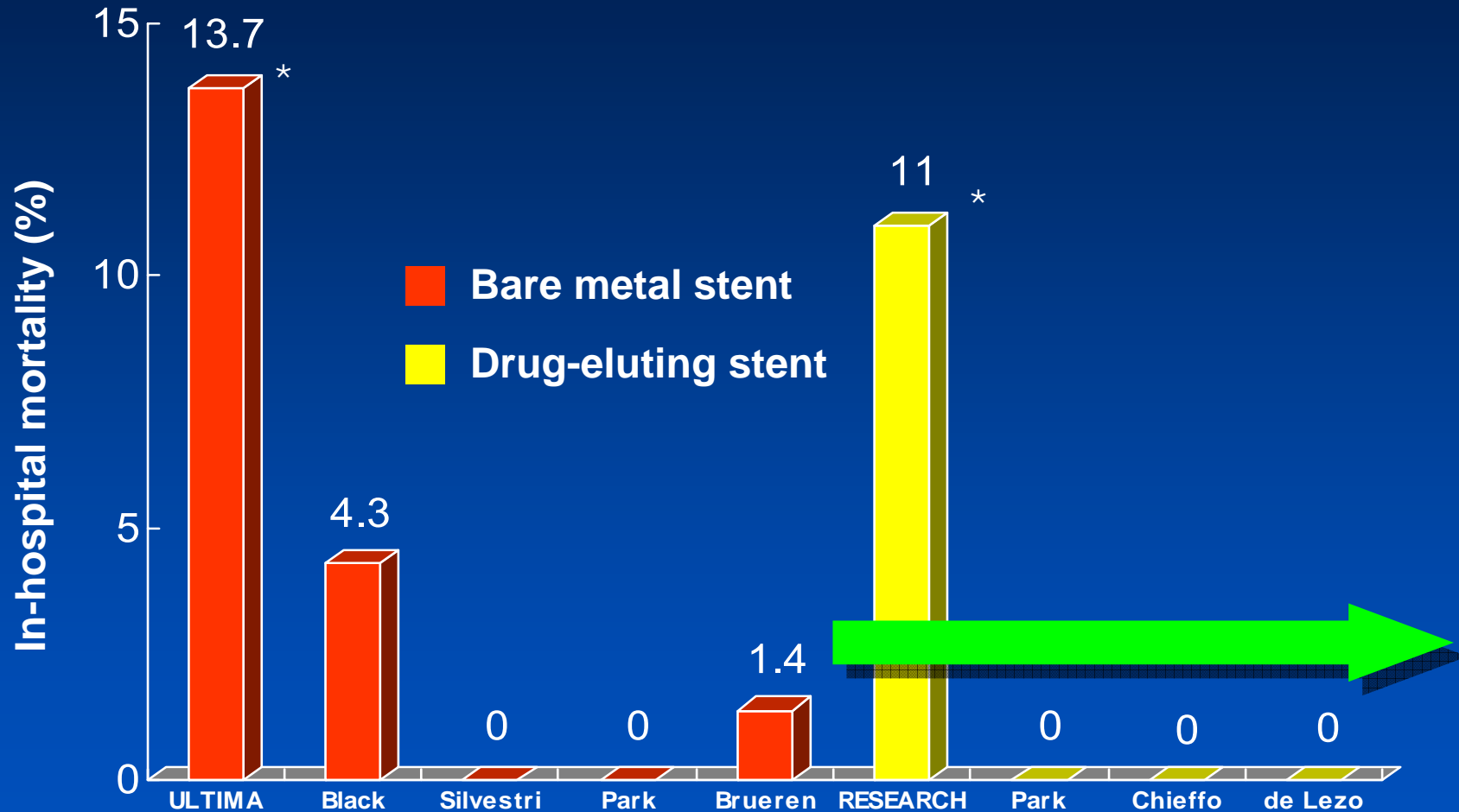
Series	Procedure success	Death
Park et al	100%	0
Chieffo et al	100%	0
Valgimigli et al	99%	1.0%
De Lezo et al	96%	0
Gershlick et al	100%	0
Lefevre et al*	96.9%	0.8%
Costa et al*	100%	0
Nakamura et al*	100%	0
Di Salvo et al*	98.7%	0

* Abstracts



In-Hospital Mortality

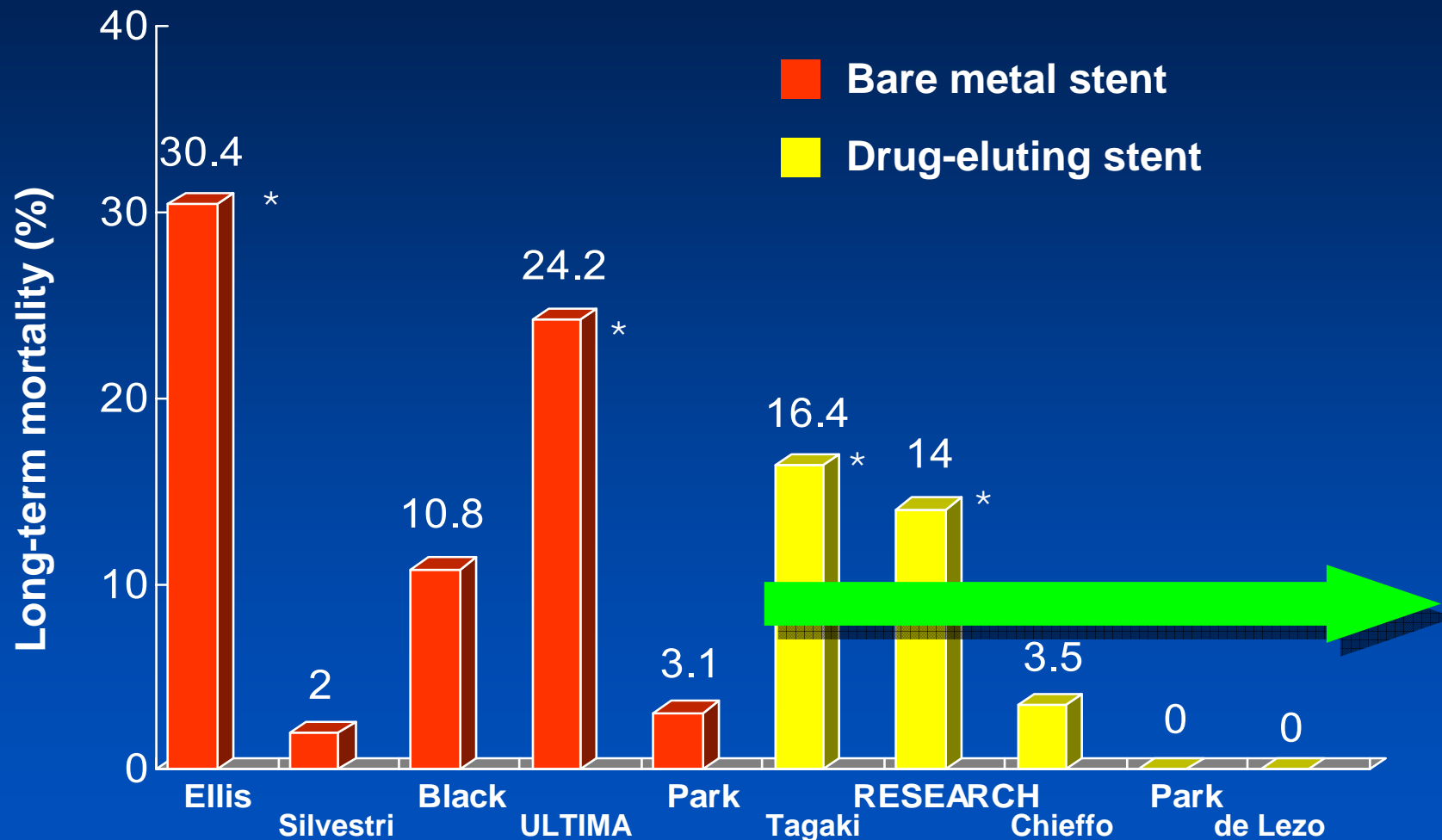
Low in the patients at a low risk !



* High-risk surgical candidates

Long-term Mortality (after 6 Mo)

Acceptable in the patients at a low risk !



* High-risk surgical candidates



Predictors of Death/ MI in Unprotected LM stenting

324 patients

who underwent elective coronary stenting for
the treatment of unprotected LMCA

(DES 176, BMS 148 Pts)

* Exclusion of ST elevation MI within 24 hours

Kim YH, Am J Cardiol 2006; 98:1567-70



Overall Incidence of Death/ MI 13.0% (42 patients)

In-Hospital

- Periprocedural MI *: 334 pts (10.2%)
- Death or SAT: None

Clinical F/U

(98%, median 26 months)

- Deaths: 5 pts (1.6 %)
4 cardiac
1 non-cardiac
- Non-fatal MI : 4 pts (1.2%)
- TLR : 36 pts (11.1%),
16 PCI, 20 CABG

* CKMB rise >3times

Kim YH, Am J Cardiol 2006; 98:1567-70



Baseline Characteristics

Variables	Death/MI (n=42)	No death/MI (n=282)	P
Age (yrs)	60.6±11.4	58.5±12.0	0.309
Men	30 (71.4%)	194 (68.8%)	0.730
Diabetes mellitus	8 (19.0%)	72 (25.5%)	0.363
Hypercholesterolemia (>200mg/dL)	11 (26.2%)	61 (21.6%)	0.507
Smoking	15 (35.7%)	85 (30.1%)	0.466
Hypertension	15 (35.7%)	123 (43.6%)	0.334
Previous PCI	5 (11.9%)	44 (15.6%)	0.649
Previous CABG	1 (2.4%)	1 (0.4%)	0.243

Kim YH, Am J Cardiol 2006; 98:1567-70

Clinical Characteristics

Variables	Death/MI (n=42)	No death/MI (n=282)	P
LVEF	62.0 %	62.0 %	0.456
ACS	26 (61.9%)	133 (47.2%)	0.075
Renal failure	0 (0%)	4 (1.4%)	1.000
EuroSCORE	3.0 (2.0-6.0)	2.0 (1.0-4.0)	0.022
Parsonnet score	7.0 (6.0-13.0)	7.0 (6.0-8.3)	0.175
CRP, mg/dL	2.4 (1.1-3.9)	2.0 (0.9-4.0)	0.736
Lipoprotein(a), mg/L	20.9 (12.1-35.4)	21.5 (9.4-37.2)	0.888
Homocysteine, μ mol/L	12.7 (9.9-15.0)	12.4 (10.2-15.1)	0.778

Kim YH, Am J Cardiol 2006; 98:1567-70



Angiographic Characteristics

Variables	Death/MI (n=42)	No death/MI (n=282)	P
Bifurcation involvement	29 (69.0%)	157 (55.7%)	0.102
Multivessel disease (≥ 2) except for the left main	29 (69.0%)	137 (48.6%)	0.013
Reference diameter, mm	3.56 \pm 0.80	3.69 \pm 0.70	0.314
Pre-procedural MLD, mm	1.28 \pm 0.61	1.48 \pm 0.66	0.066
Post-procedural MLD, mm	3.52 \pm 0.65	3.72 \pm 0.64	0.069
Lesion length, mm	12.1	11.8	0.133

Kim YH, Am J Cardiol 2006; 98:1567-70

Procedural Characteristics

Variables	Death/MI (n=42)	No death/MI (n=282)	P
Multivessel PCI	23 (54.8%)	119 (42.2%)	0.126
Stenting in the side branch	9 (21.4%)	62 (22.0%)	0.935
Total stent length, mm	18.0	18.0	0.089
Used stents at the LMCA	1.0	1.0	0.956
Number of total used stents	2.0	1.0	0.015
Debulking atherectomy	8 (19.0%)	53 (18.8%)	0.969
Rotabulating atherectomy	0 (0%)	4 (1.4%)	1.000

Kim YH, Am J Cardiol 2006; 98:1567-70

Procedural Characteristics

Variables	Death/MI (n=42)	No death/MI (n=282)	P
Cutting balloon angioplasty	2 (4.8%)	8 (2.8%)	0.501
Direct stenting	10 (23.8%)	88 (31.2%)	0.330
Maximal device diameter, mm	4.19±0.52	4.44±0.59	0.120
Intra-aortic balloon pump	8 (19.0%)	16 (5.7%)	0.002
Glycoprotein IIb/IIIa inhibitor	8 (19.0%)	13 (4.6%)	<0.001
Guidance of IVUS	30 (71.4%)	202 (71.6%)	0.978
DES (Sirolimus-eluting stent)	23 (54.8%)	153 (54.3%)	0.951

Kim YH, Am J Cardiol 2006; 98:1567-70



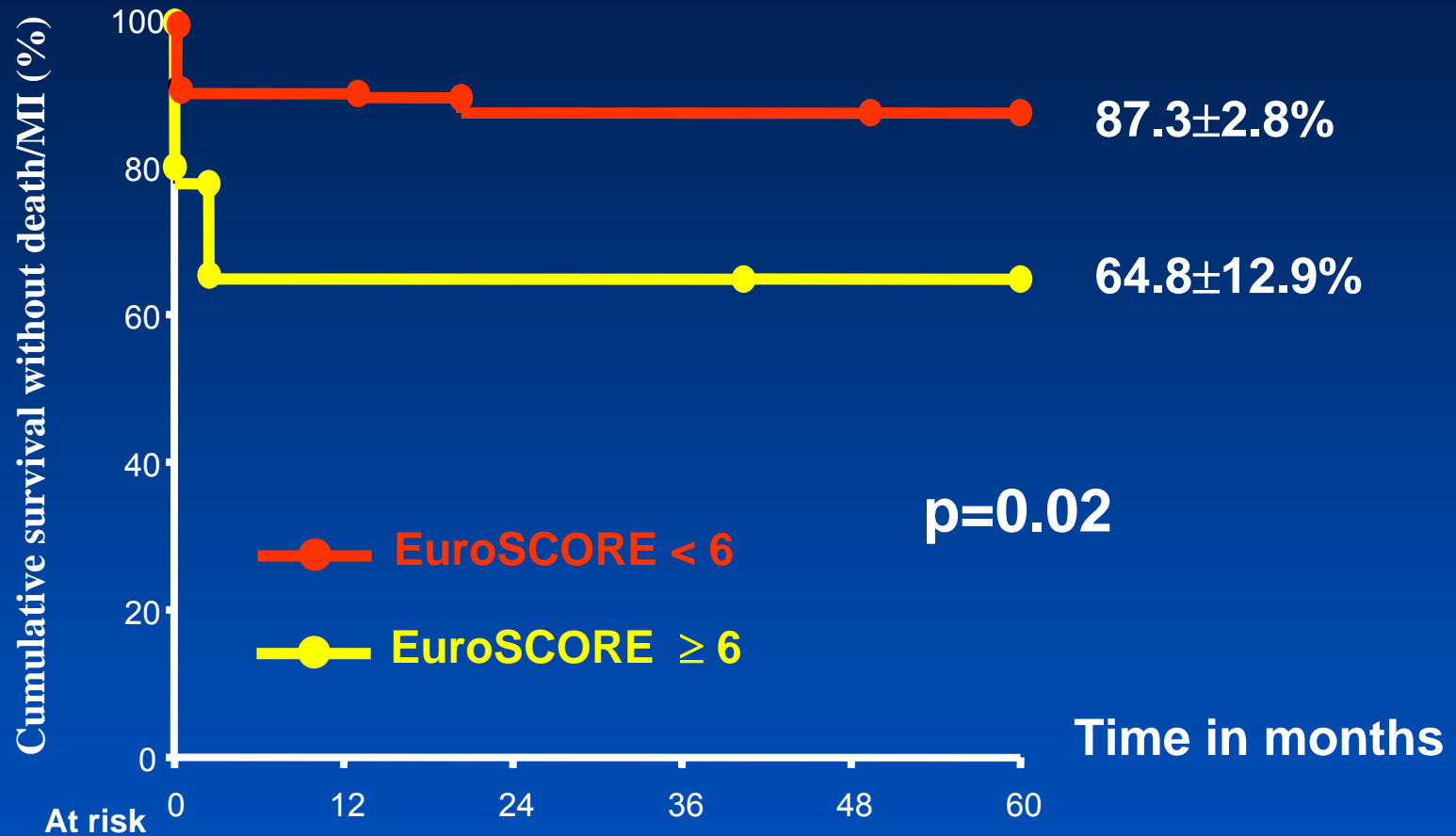
Major Predictors of Death/MI in Unprotected LM stenting

By Multivariate Analysis

	Hazard ratio	95% CI	P value
1. High EuroSCORE (≥ 6)	3.362	1.181 – 9.574	0.023
2. No. of total used stents	1.792	1.021 – 3.146	0.042
3. Use of GP IIb/IIIa inhibitor	8.640	2.722 – 27.418	<0.001

Kim YH, Am J Cardiol 2006; 98:1567-70

MI-free Survival Curve



EuroSCORE

≥ 6	45	30	19	9	4	2
< 6	279	210	147	94	47	19

Kim YH, Am J Cardiol 2006; 98:1567-70



Risk of Mortality in Unprotected Left main stenting

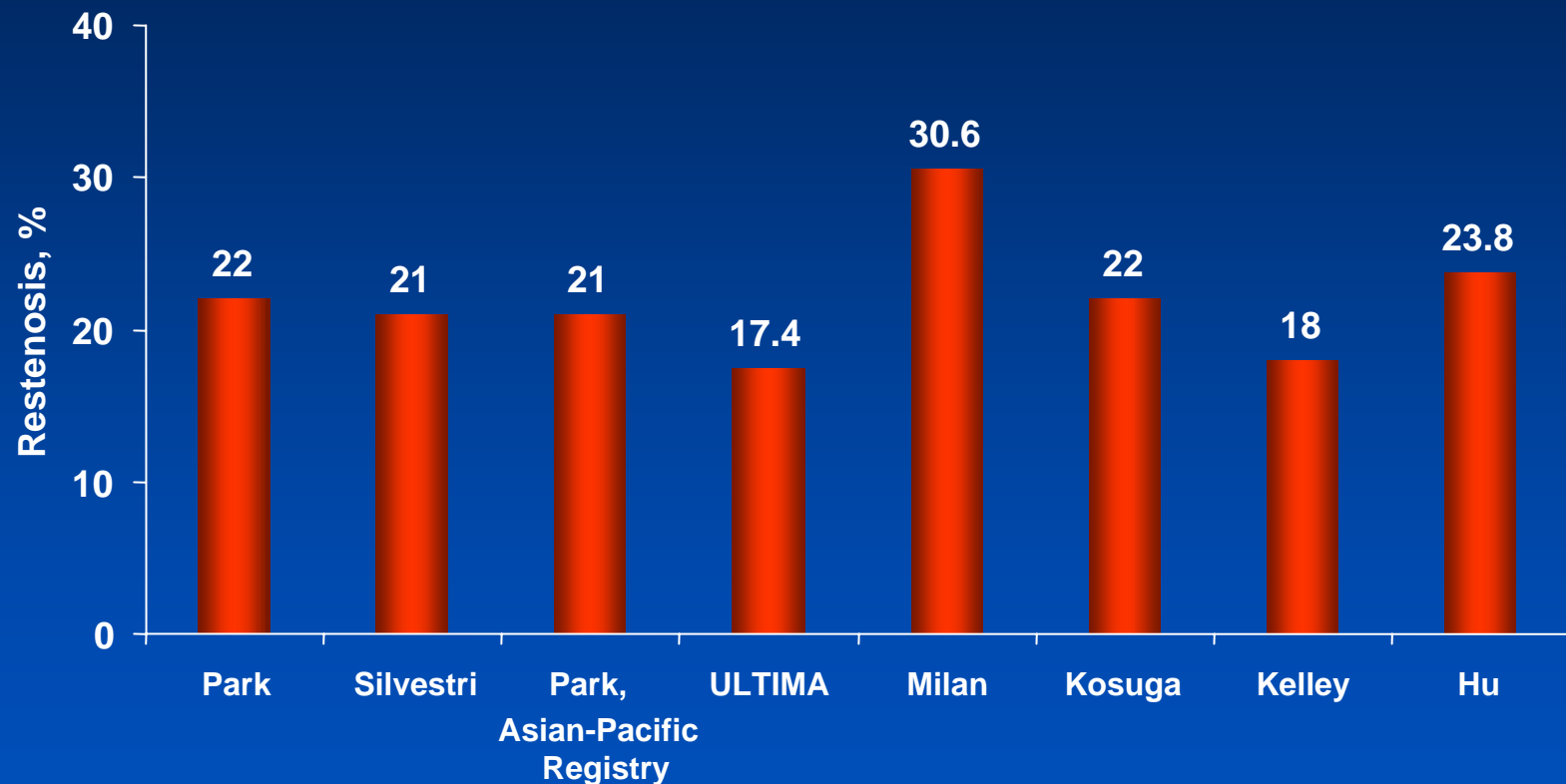
- In the reviewed series, outcomes of PCI are highly correlated with pre-procedure clinical risk profile of the patient (low mortality in low risk patients)
- Good candidate for surgery is good candidate for PCI

PCI in Unprotected LM

Efficacy concerns...

Angiographic Restenosis

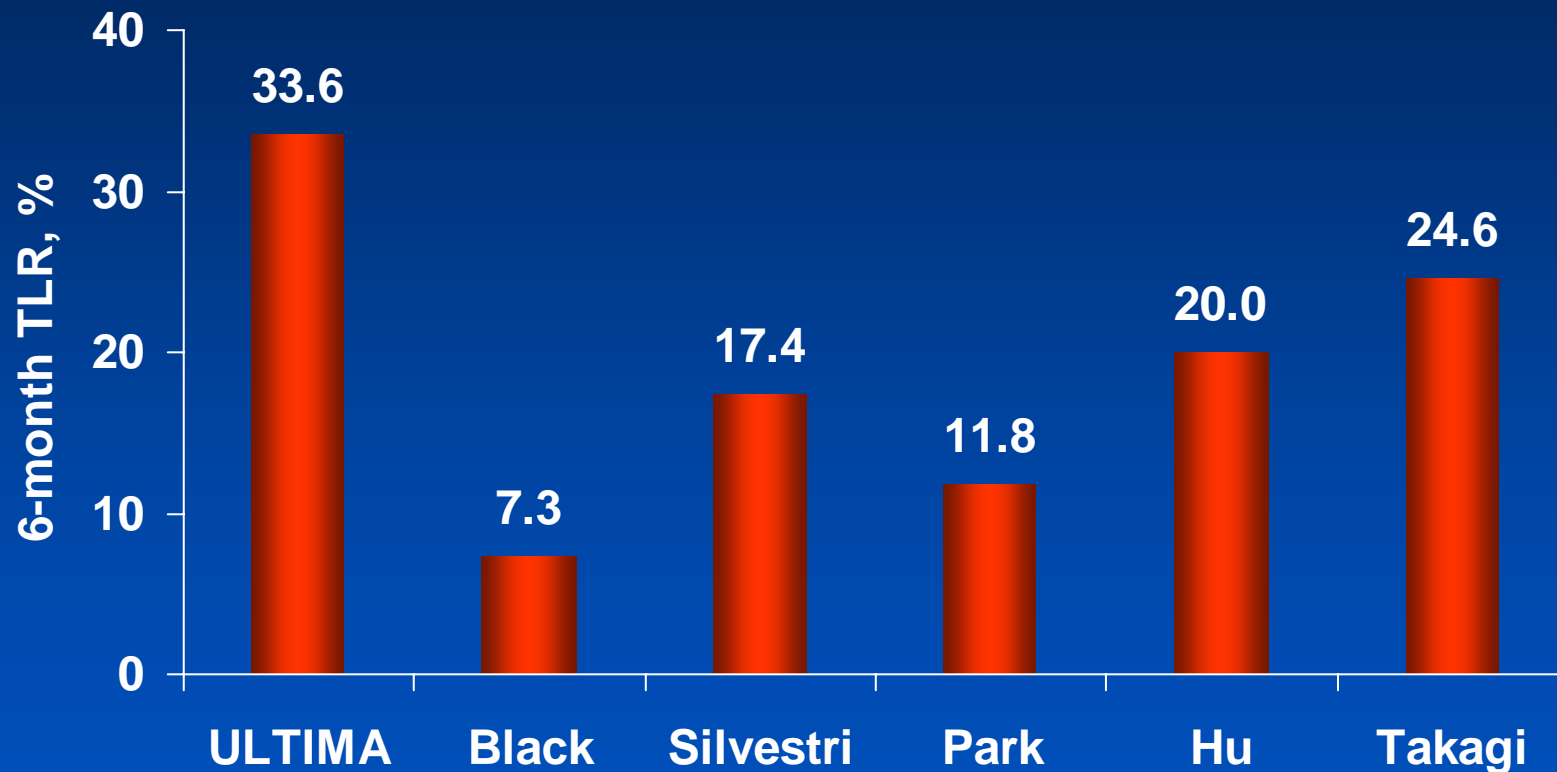
in PCI series with BMS on unprotected LM



F/U duration (months)	10	NA	32	15	6	35	12	6
F/U completeness (%)	NA	NA	87.8%	98.8%	NA	97%	55%	94%

Six-Month TLR

in PCI Series with BMS on Unprotected LM



Efficacy concerns of PCI for LM disease

Compare to surgery: BMS

- PCI have comparable clinical outcomes at least one year follow-up period. There is no difference in rates of death, MI or stroke.
- Repeat revascularization is the only problem in PCI

In the era of DES...



Angiographic Restenosis

in PCI series with DES on unprotected LM

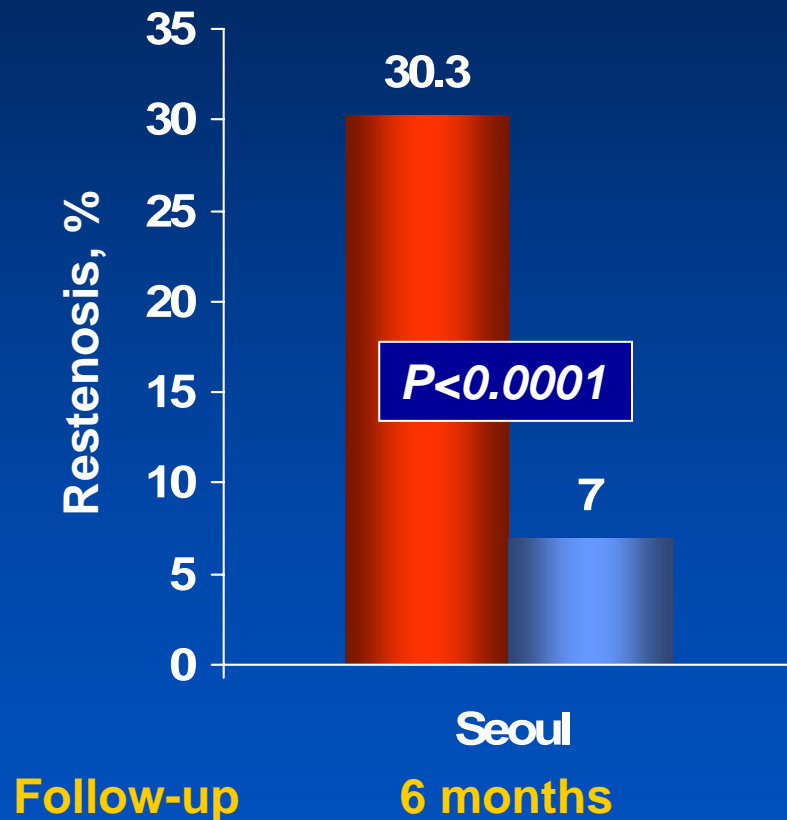
Series	Restenosis Rate
Chieffo et al	19%
Valgimigli et al	11%
Park et al	7%
De Lezo et al	0%
Price et al	42%
Lefevre et al*	9.6%
Nakamura et al*	SES: 2.7% PES: 3.0%
Di Salvo et al*	6.9%

* Abstracts



Angiographic Restenosis in Two DES vs. BMS Left Main PCI Series

■ BMS ■ DES

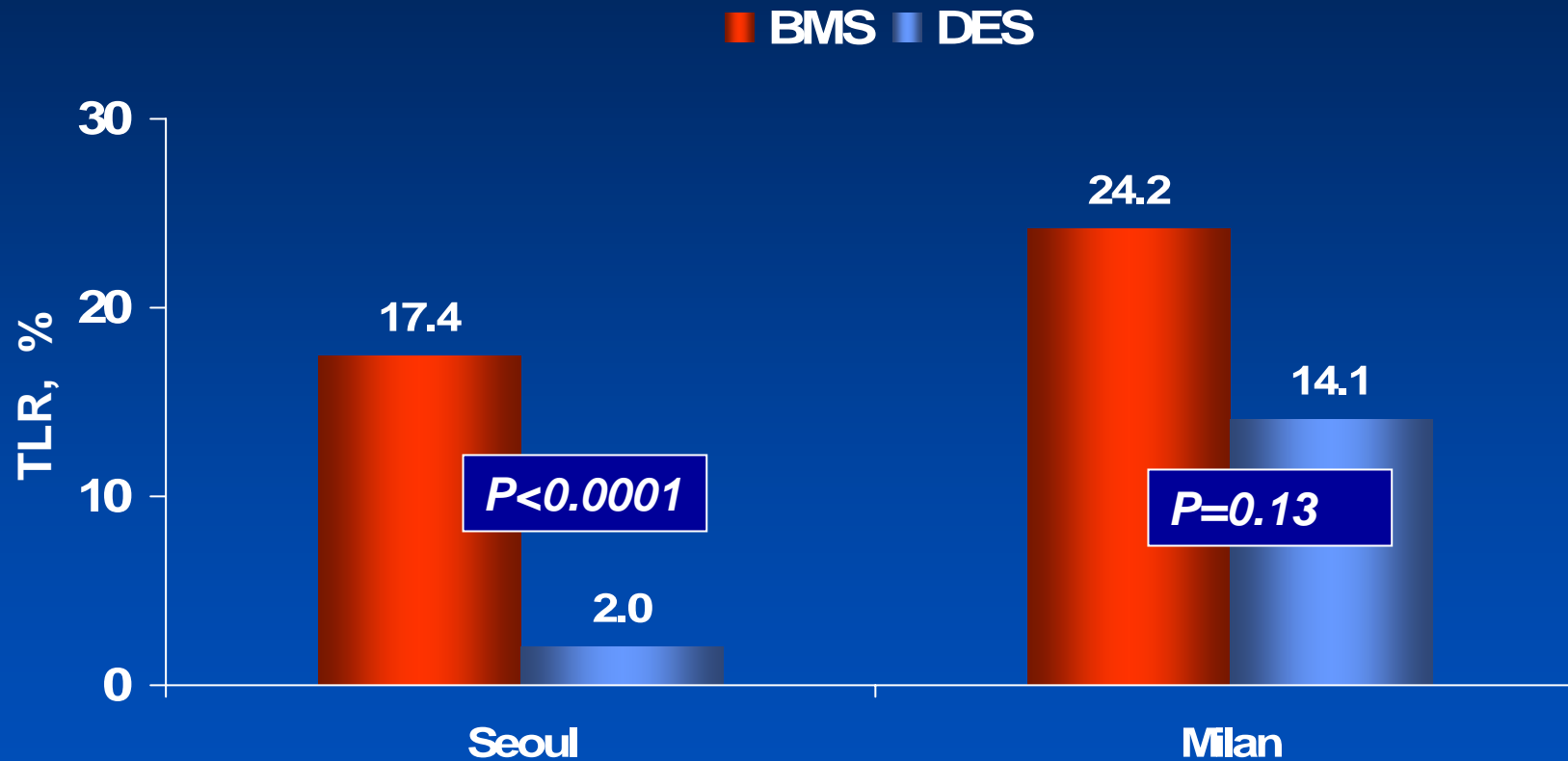


Park et al, JACC 2005



Chieffo et al, Circulation 2005

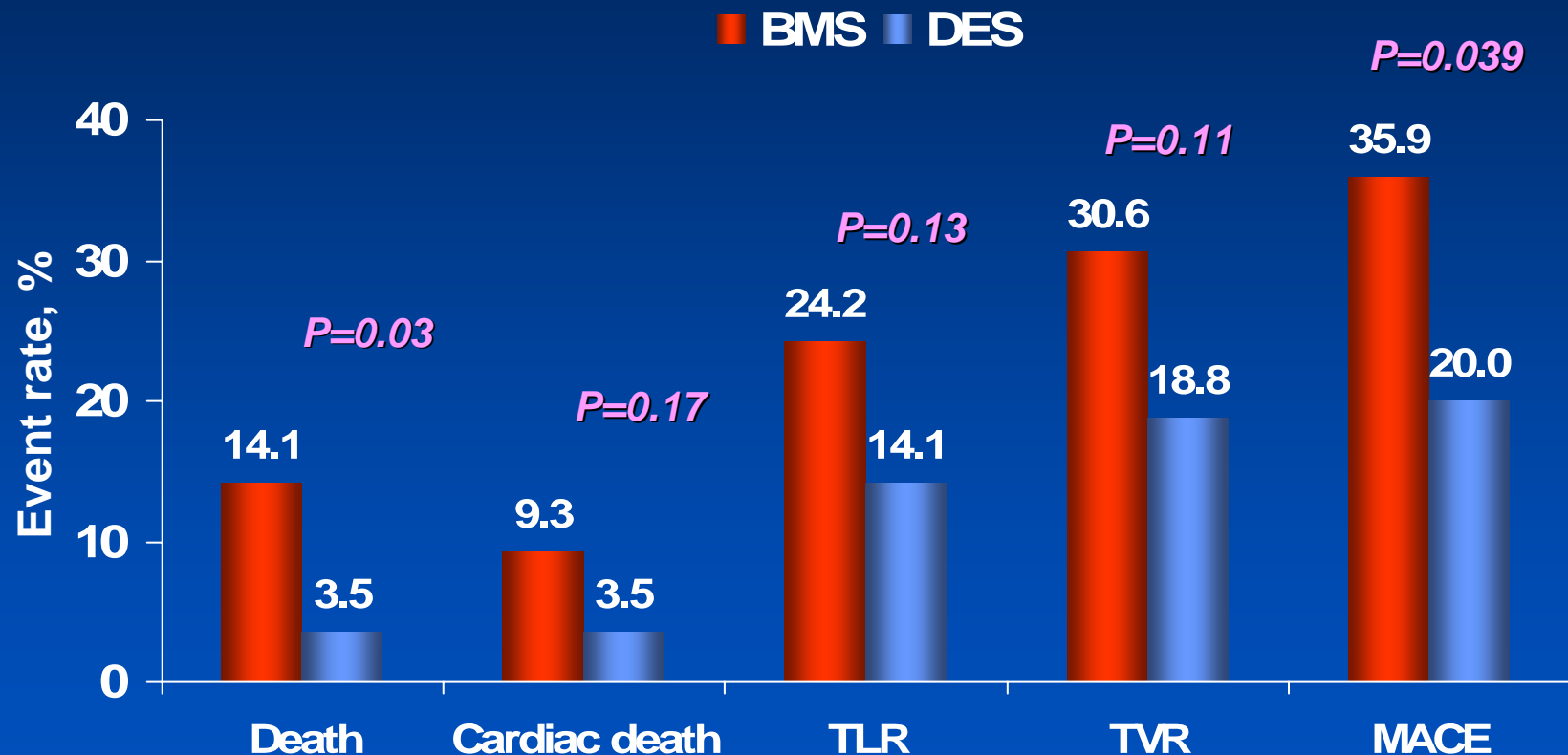
TLR in Cypher vs. BMS in Left Main PCI Series



Park et al, JACC 2005
Chieffo et al, Circulation 2005

DES vs. BMS in Left Main PCI

Six-Month Follow-up : Milan Series

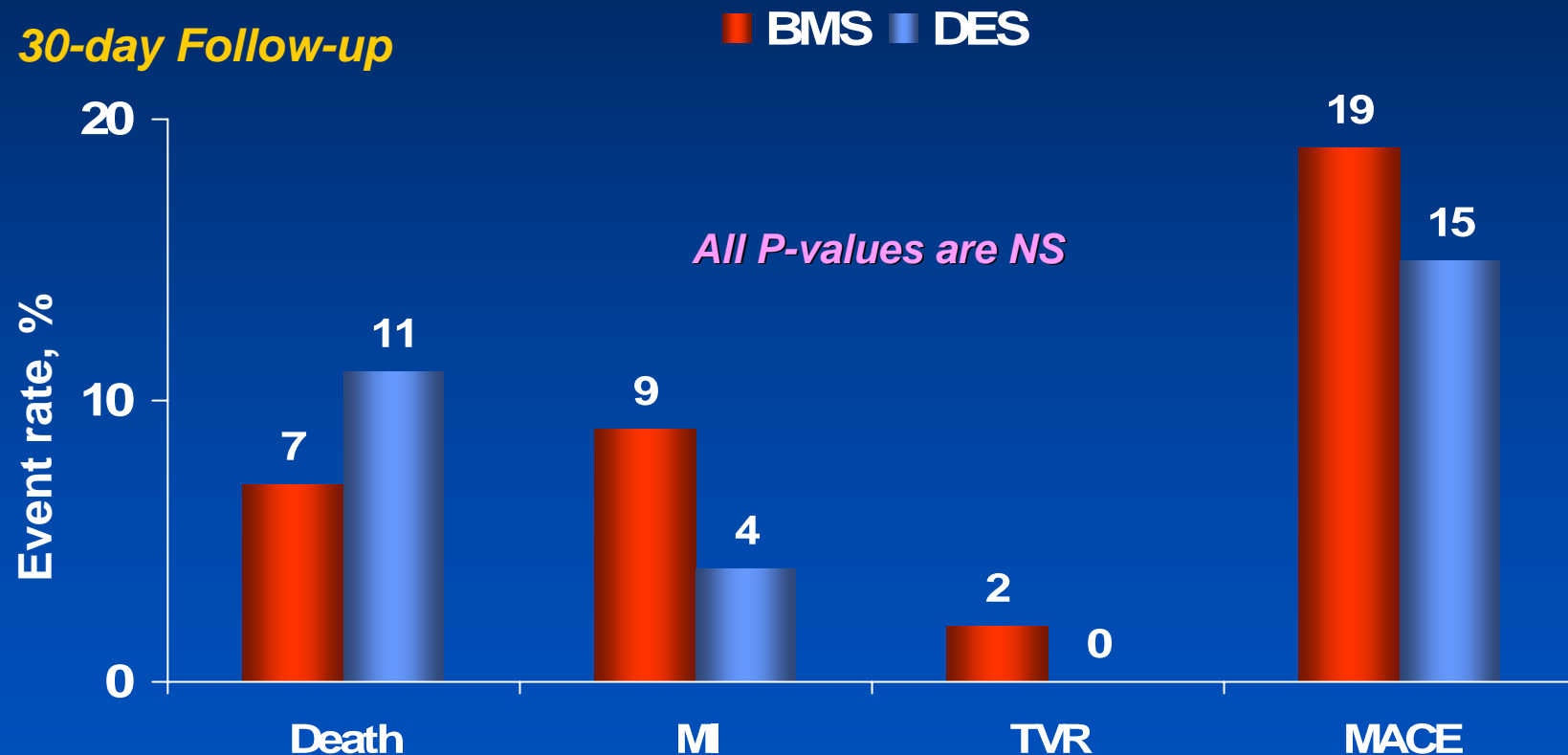


Chieffo et al, Circulation 2005

DES vs. BMS in Left Main PCI

RESEARCH and T-SEARCH Registries

30-day Follow-up



Valgimigli et al, JACC 2005

DES vs. BMS in Left Main PCI

RESEARCH and T-SEARCH Registries

Median Follow-up 503 days

■ BMS ■ DES

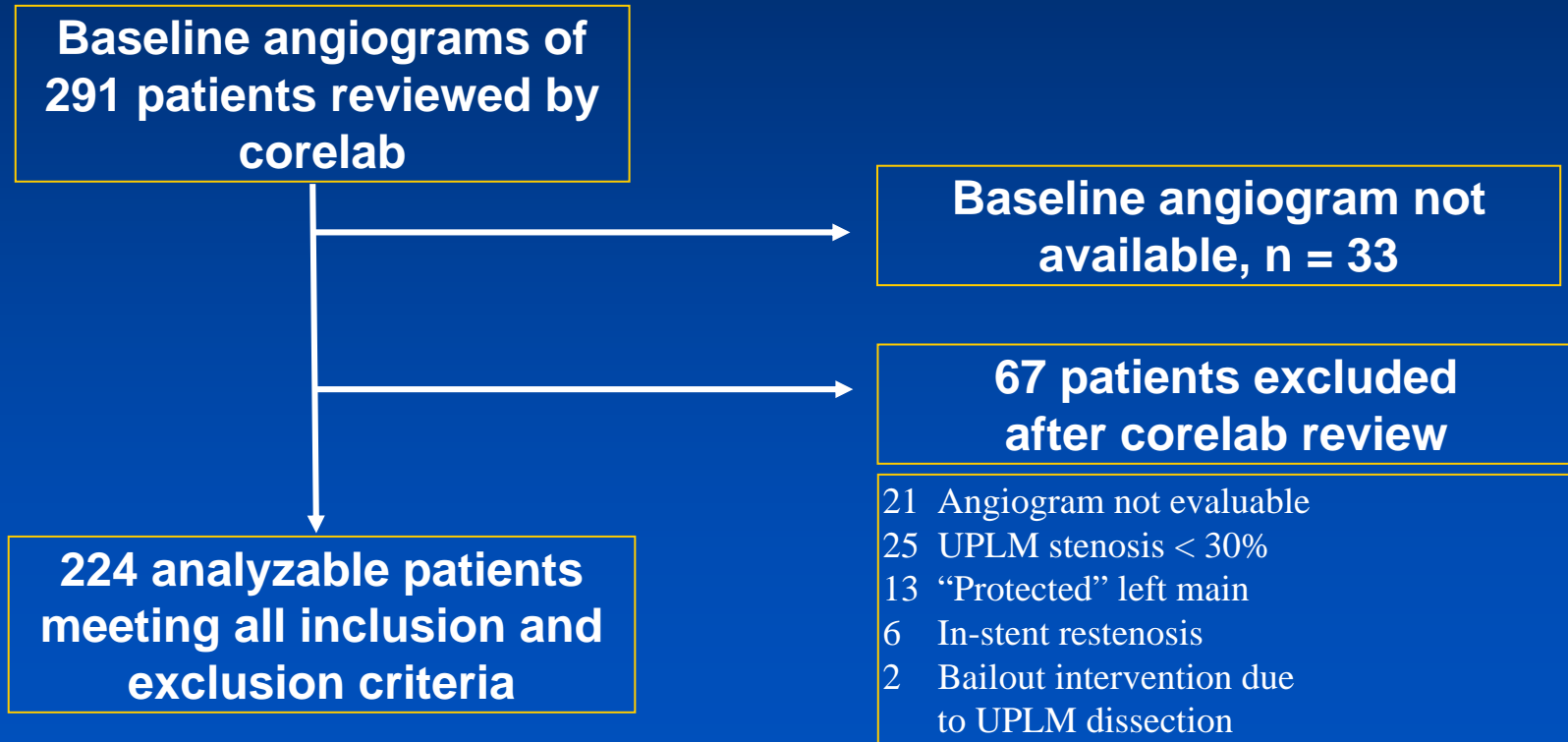


Valgimigli et al, JACC 2005



E-Cypher Prospective Internet Based Multicenter Registry

324 patients initially enrolled in e-CRF database



Fajadet et al, ESC 2006

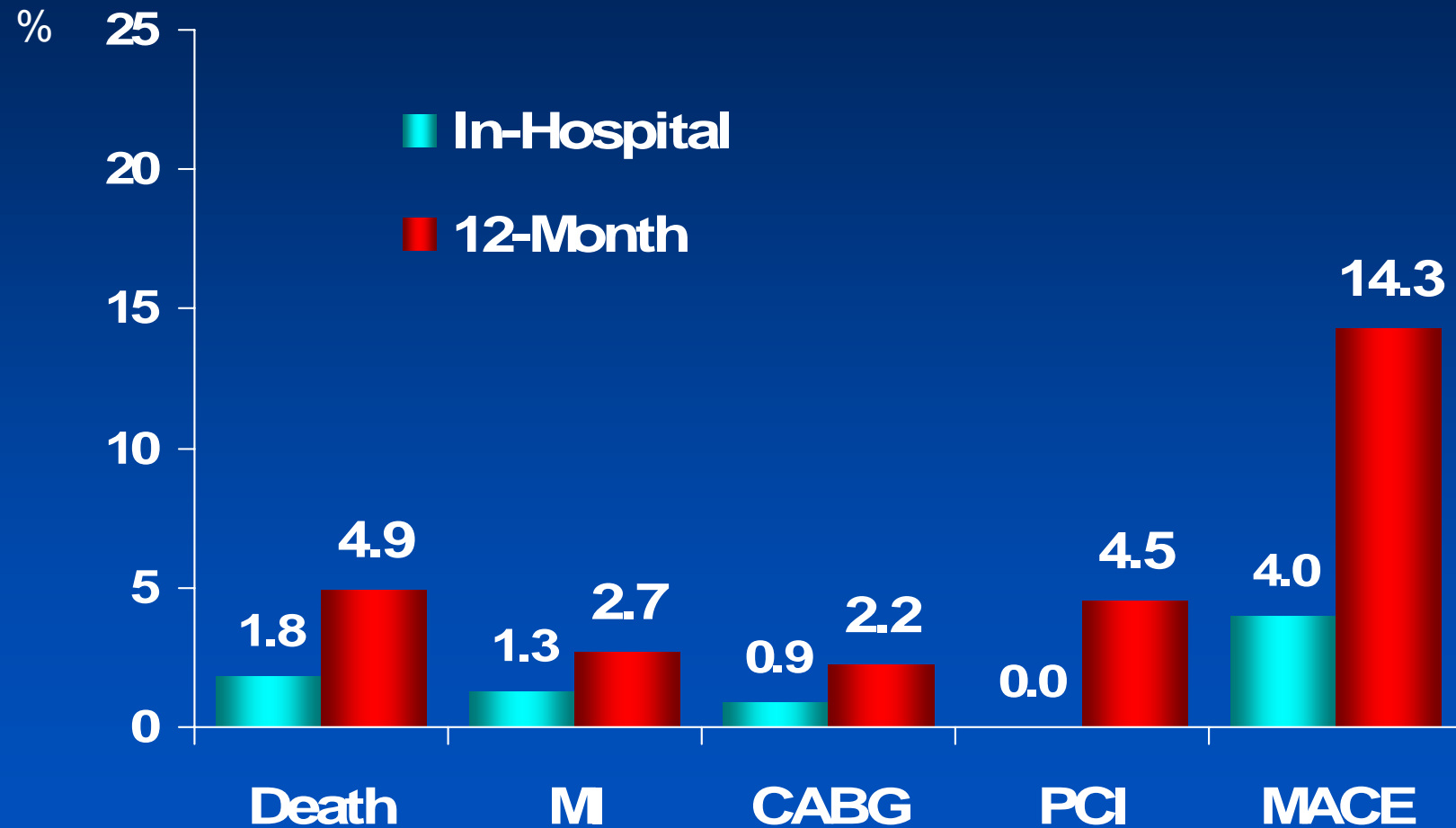
E-Cypher Multicenter Registry

	SES (n = 224)
Male	81 %
Age,	68.0 (year)
Prior MI (> 72 hours pre-PCI) (%)	31
Prior PCI (%)	33
Hypertension (%)	64
Hyperlipidemia (%)	64
Diabetes (%)	27
Unstable angina (%)	40
Distal location (%)	56
Single stenting for bifurcation (%)	60
EUROSCORE (additive; median, range)	5.0 (0 – 19)

Fajadet et al, ESC 2006



E-Cypher Prospective Internet Based Multicenter Registry

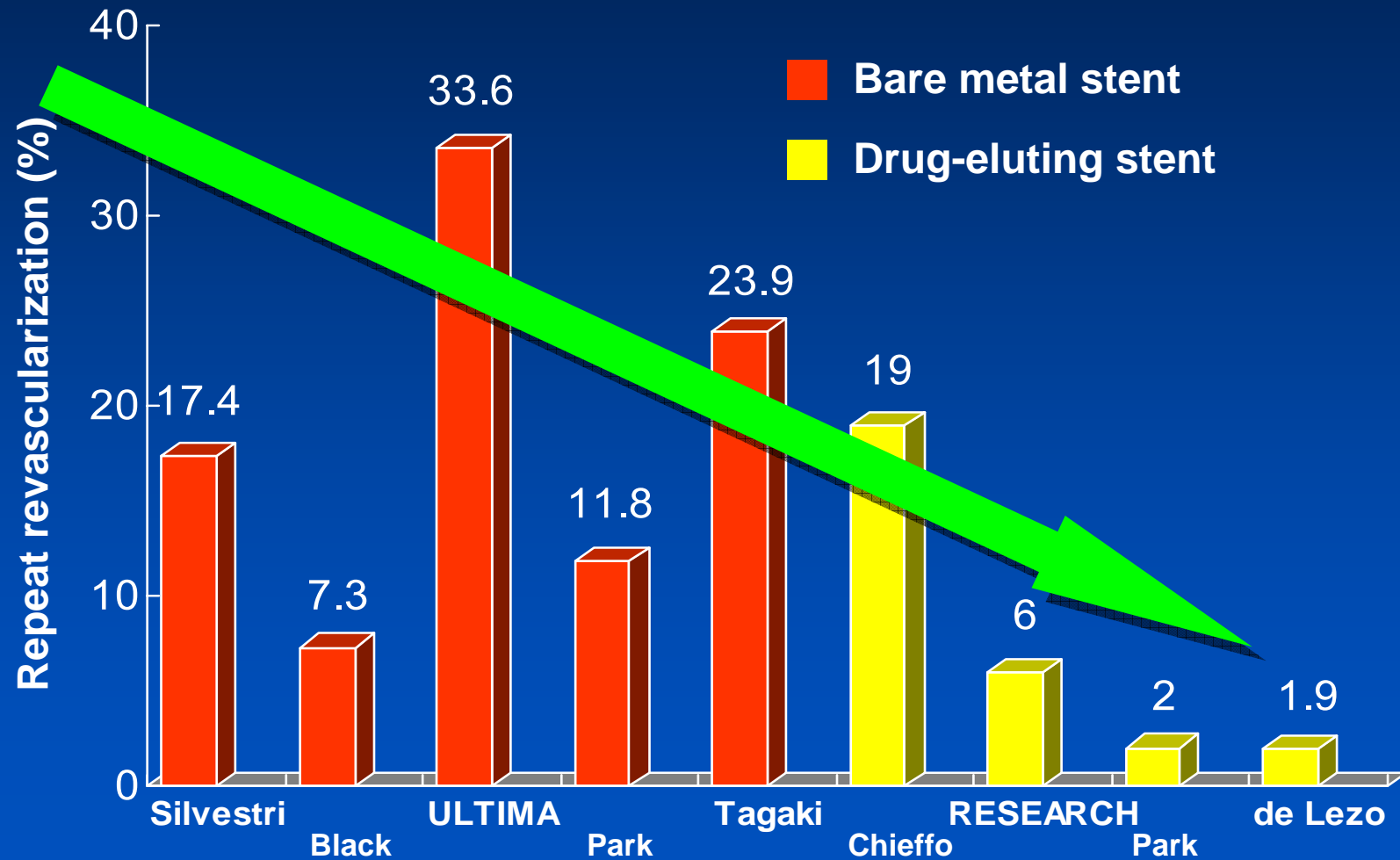


Fajadet et al, ESC 2006



Significant Reduction of TLR with DES

Unprotected Left main stenting



DES for Ostial or Shaft LMCA Stenosis ?

Experience of Asan Medical Center

Ostial and Shaft LM PCI

51 patients

Lesion length, mm	9.3 ± 5.4
Reference, mm	3.49 ± 0.53
Used stent	Single in all pts
IVUS guidance	41 (80%)
Acute gain, mm	2.18 ± 0.66
Late loss, mm	0.10 ± 0.23
Restenosis	1/38 (2.6%)
TLR	1 (2.0%)
Stent thrombosis	0

Park SJ, J Am Coll Cardiol 2005; 45:351-5



DES for Ostial or Shaft LMCA Stenosis

No	Mortality
2.6%	Restenosis
2%	TLR

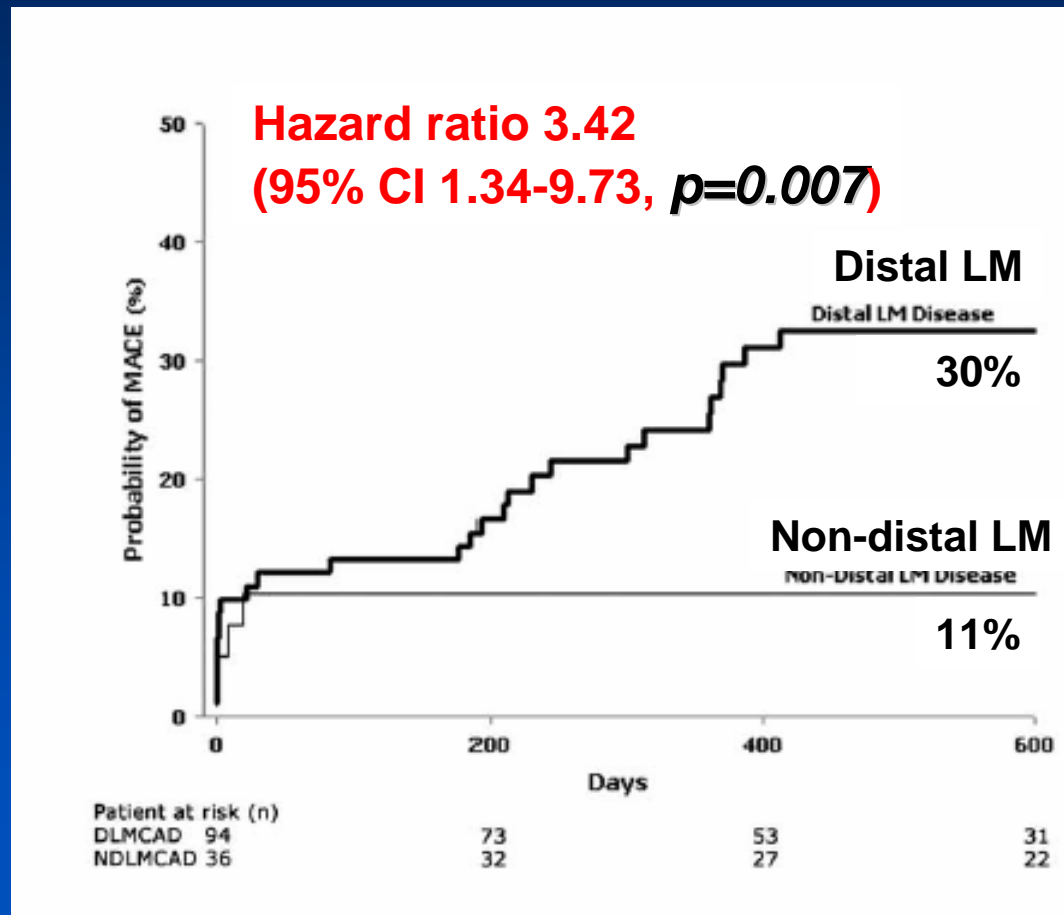
Would be an effective alternative and even better compare to surgery...

What about DES for Bifurcation LMCA Stenosis ?

This is more challenging
even in the DES era...

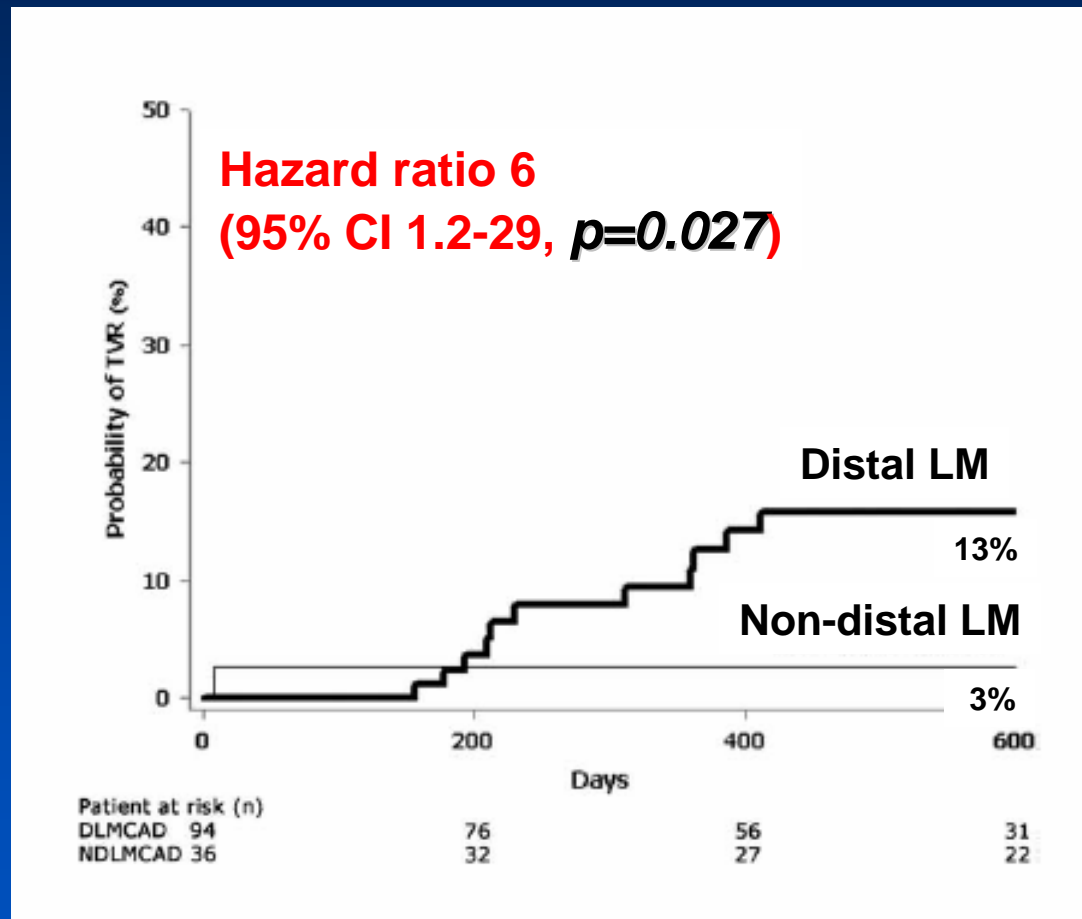
Distal Location is An Independent Predictors of MACE

94 Distal vs. 36 Non-distal



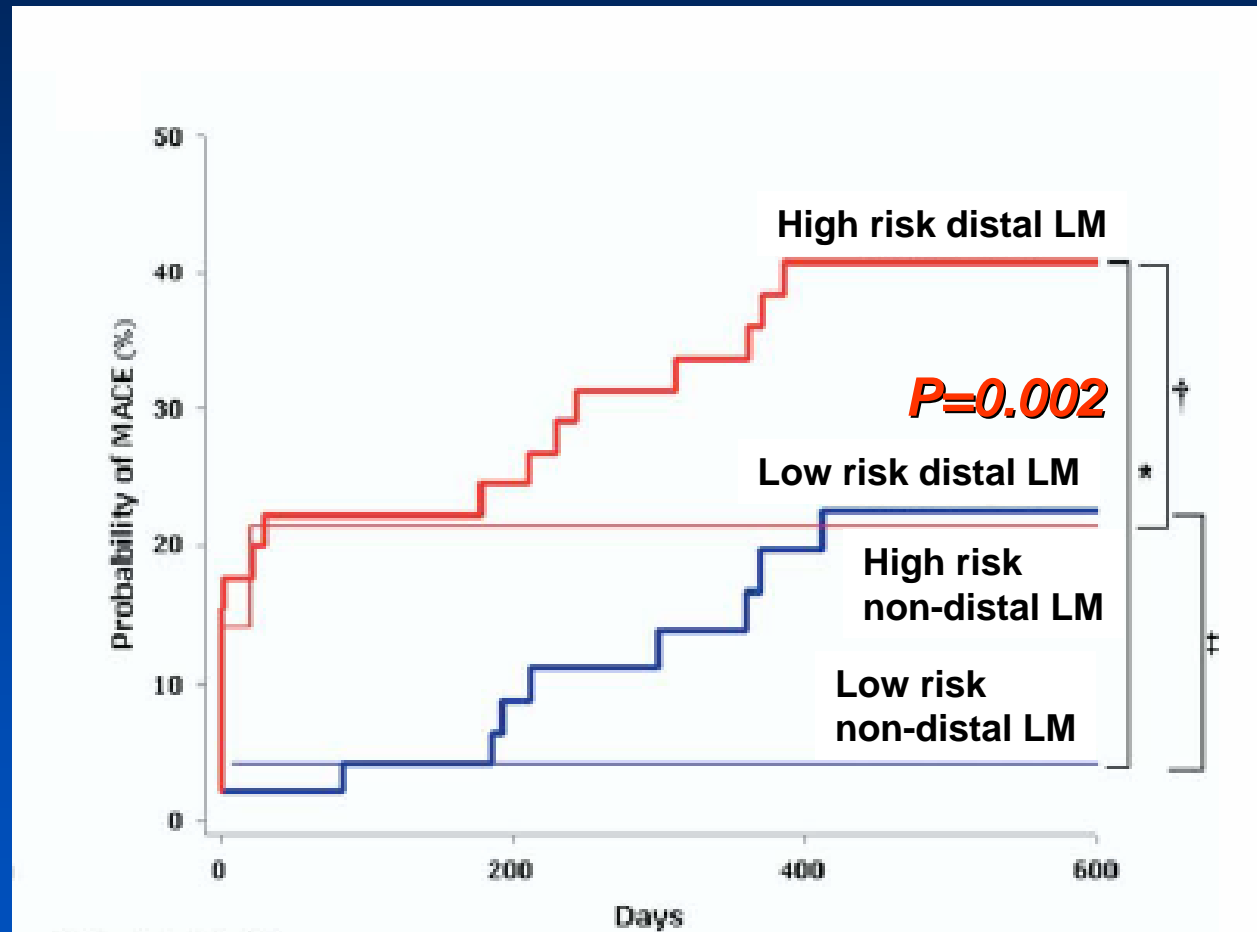
Valgimigli et al, J Am Coll Cardiol 2006

Poor Prognosis of Distal Location was Driven by Higher TVR Rate



Valgimigli et al, J Am Coll Cardiol 2006

Distal Location and High Surgical Risk are Important Determinants of MACE



Valgimigli et al, J Am Coll Cardiol 2006

Comparison of Three Major Papers for LM Stenting Using DES

	Colombo A	Serruys PW	Park SJ
Patient	85	95	102
Age	63.2±11.7	64±12	60.3±11.1
Male	70 (84.3%)	66%	87 (71.9%)
Diabetes mellitus	18 (21.2%)	30%	29 (84.4%)
Ejection fraction, %	51.1±11	41±14	60.4±8.4
Acute MI	NA	17%	10 (9.8%)
Cardiogenic shock	NA	9%	0
Multivessel disease	NA	80%	59 (58.4%)
Distal location	69 (81.2%)	65%	72 (70.6%)

TLR rates of DES remains diverse.

	Colombo A	Serruys PW	Park SJ
Number	85	95 (15 protected)	102
DES used	Cypher	Cypher+Taxus	Cypher
Technical success (%)	100	99	100
In-hospital			
Cardiac death	0	1 (1%)	0
MI (Q and Non-Q)	5 (5.9%)	1 (1%)	7 (6.9%)
CABG	0	0	0
Long-term	6-Mo	1-Yr	1-Yr
Cardiac death	3 (3.5%)	13 (14%)	0
MI	0	4 (4%)	0
TLR	12 (14.1%)	6 (6%)	2 (2.0%)

Antonio likes two stenting strategy because bifurcation stenting is his unique invention !

	Colombo A	Serruys PW	Park SJ
Reference, mm	3.73±0.6	3.25±0.5	3.46±0.65
MLD, pre, mm	1.34±0.5	1.09±0.44	1.31±0.57
Treated lesions	2.9±1.6	NA	43 (42.2%)
Stent length, mm	24.3±12	24±13	26.6±18.1
DCA, mm	2 (2.3%)	0	3 (2.9%)
MLD, post, mm	3.3±0.6	2.83±0.49	3.36±0.47
Bifurcation stenting	51 (74%)	40%	29 (41%)
Culotte	5 (10%)	36%	0
T technique	4 (8%)	44%	1 (3%)
Crush	30 (59%)	12%	11 (38%)
Kissing	12 (24%)	8%	17 (59%)

However, a high TLR rate has been paid for the complex stenting strategy

	Colombo A	Serruys PW	Park SJ
Bifurcation stenting	51 (74%)	40%	29 (41%)
Culotte	5 (10%)	36%	0
T technique	4 (8%)	44%	1 (3%)
Crush	30 (59%)	12%	11 (38%)
Kissing	12 (24%)	8%	17 (59%)
TLR	12 (14.1%)	6 (6%)	2 (2.0%)

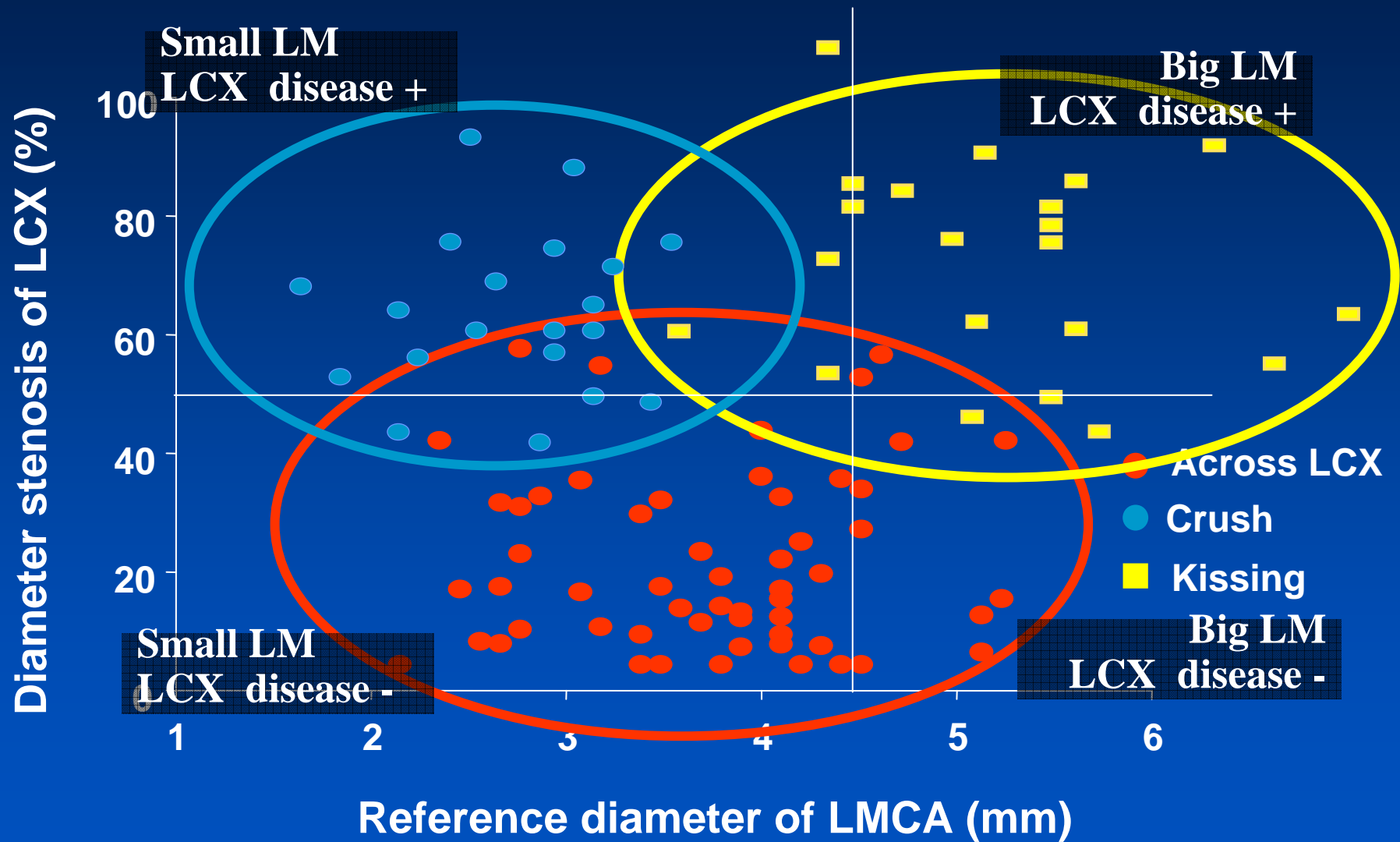
Recommended Treatment Strategy for LMCA bifurcation lesions

Stenting Cross-over
(provisional T stenting)

Kissing Stenting
Stent Crushing

Different Treatment in AMC

According to LM size and LCX involvement



Different Treatment in AMC

Baseline Characteristics

Characteristic	Stent Cross-over	Complex tech.	P value
Patients	67	49	
Age, yr	59.6±12.0	60.6±8.5	0.604
Males	48 (71.6)	38 (77.6)	0.473
Cardiac risk factors			
Hypertension	34 (50.7)	17 (34.7)	0.085
Diabetes mellitus	24 (35.8)	11 (22.4)	0.121
Hypercholesterolemia	17 (25.4)	8 (16.3)	0.242
Current smoking	13 (19.4)	15 (30.6)	0.163
Previous PCI	8 (11.9)	9 (18.4)	0.334
ACS	34 (50.7)	29 (52.2)	0.368
Multivessel involvement	46 (68.7)	42 (85.7)	0.047
Left ventricular EF, %	59.2±8.0	61.5±7.3	0.110

Kim YH, Am J Cardiol 2006;97:1597-601



Procedural Data

Characteristic	Cross-over.	Complex tech.	P value
Patients	67	49	
Multiple lesion intervention	25 (37.3)	18 (36.7)	0.949
Debulking atherectomy	4 (6.0)	3 (6.1)	0.973
Use of GP IIb/IIIa inhibitor	3 (4.5)	9 (18.4)	0.027
Intravascular ultrasound guidance	60 (89.6)	43 (87.8)	0.762
Stent length in LM, mm	31.8±19.3	35.4±18.3	0.314
Stents used per lesion	1.4±0.7	2.6±0.8	<0.001
Use of IABP	5 (7.5)	2 (4.1)	0.697

Kim YH, Am J Cardiol 2006;97:1597-601



QCA Analysis at Main Vessel

	Cross-over	Complex tech.	<i>p</i>
Patients	67	49	
Follow-up CAG	57 (85)	41 (85)	
Proximal RVD, mm	3.61±0.72	3.77±0.74	0.240
Distal RVD, mm	2.81±0.60	2.75±0.45	0.557
MLD, mm			
Before procedure	1.11±0.47	1.01±0.47	0.269
After procedure	2.97±0.52	2.98±0.36	0.931
At follow-up	2.91±0.53	2.56±0.67	0.006
Lesion length, mm	25.8±17.1	26.2±14.5	0.918
Acute gain, mm	1.86±0.58	1.96±0.45	0.295
Late loss, mm	0.13±0.40	0.42±0.63	0.009

Kim YH, Am J Cardiol 2006;97:1597-601

QCA Analysis at Circumflex Artery

	Cross-over	Complex tech.	<i>p</i>
Patients	67	49	
Follow-up CAG	57 (85)	41 (85)	
Distal RVD, mm	2.78±0.66	2.64±0.49	0.209
MLD, mm			
Before procedure	2.25±0.76	1.39±0.64	<0.001
After procedure	2.21±0.77	2.65±0.40	<0.001
At follow-up	1.98±0.80	1.97±0.81	0.958
Acute gain, mm	-0.04±0.66	1.26±0.60	<0.001
Late loss, mm	0.20±0.59	0.69±0.72	<0.001

Kim YH, Am J Cardiol 2006;97:1597-601



IVUS Analysis at Distal LMCA

	Cross-over	Complex tech.	<i>p</i>
Patients	46	39	
Before procedure			
EEM CSA, mm ²	21.7±6.0	20.6±4.0	0.391
Lumen CSA, mm ²	6.2±2.2	4.8±1.7	0.003
Plaque burden, %	70.8±8.9	76.1±9.1	0.012
After procedure			
EEM CSA, mm ²	23.9±5.7	24.0±3.9	0.905
Lumen CSA, mm ²	11.7±2.7	12.5±2.7	0.191
Plaque burden, %	50.2±8.4	47.7±8.8	0.184

Kim YH, Am J Cardiol 2006;97:1597-601



IVUS Analysis at Ostial LAD

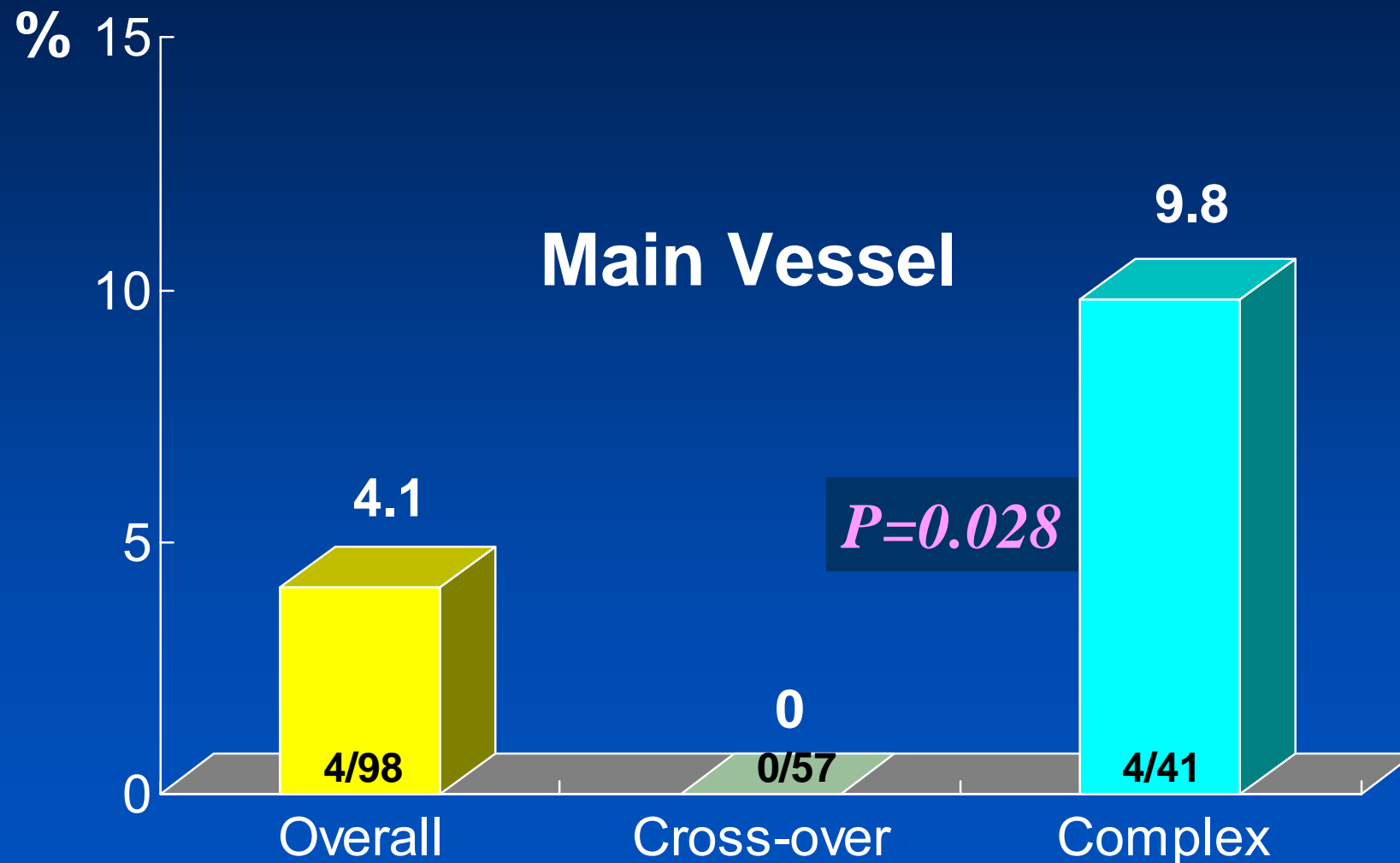
Under-expansion in complex stenting

	Cross-over	Complex tech.	<i>p</i>
Patients	46	39	
Before procedure			
EEM CSA, mm ²	15.2±4.4	14.4±3.3	0.339
Lumen CSA, mm ²	4.5±2.0	4.2±1.8	0.548
Plaque burden, %	69.7±11.8	70.6±9.9	0.707
After procedure			
EEM CSA, mm ²	18.2±4.0	17.7±2.6	0.523
Lumen CSA, mm ²	9.7±2.0	8.0±1.7	<0.001
Plaque burden, %	45.8±10.2	54.8±7.5	<0.001

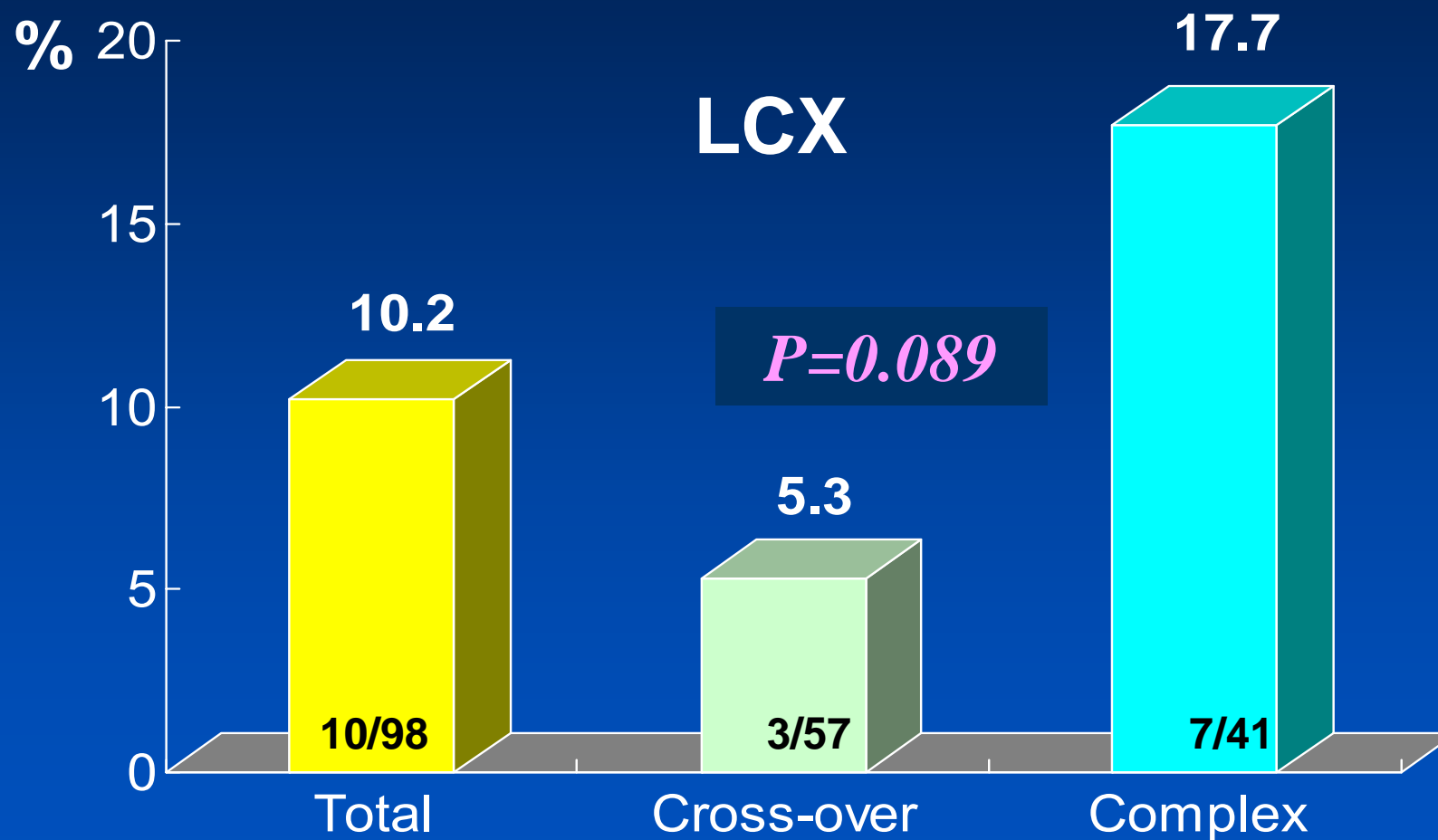
Kim YH, Am J Cardiol 2006;97:1597-601



Restenosis Rate of 124 LM Bifurcation PCI with DES

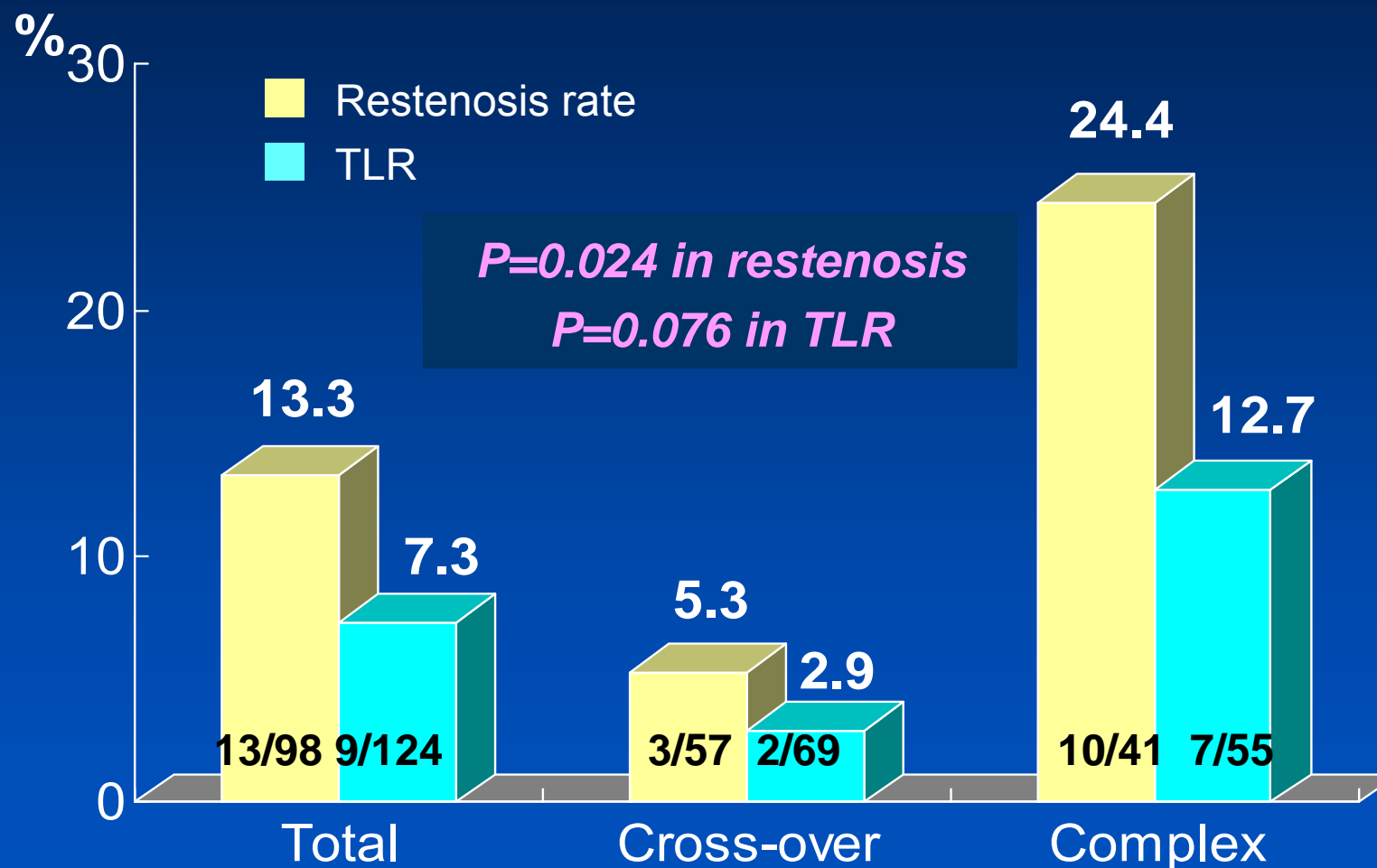


Restenosis Rate of 124 LM Bifurcation PCI with DES



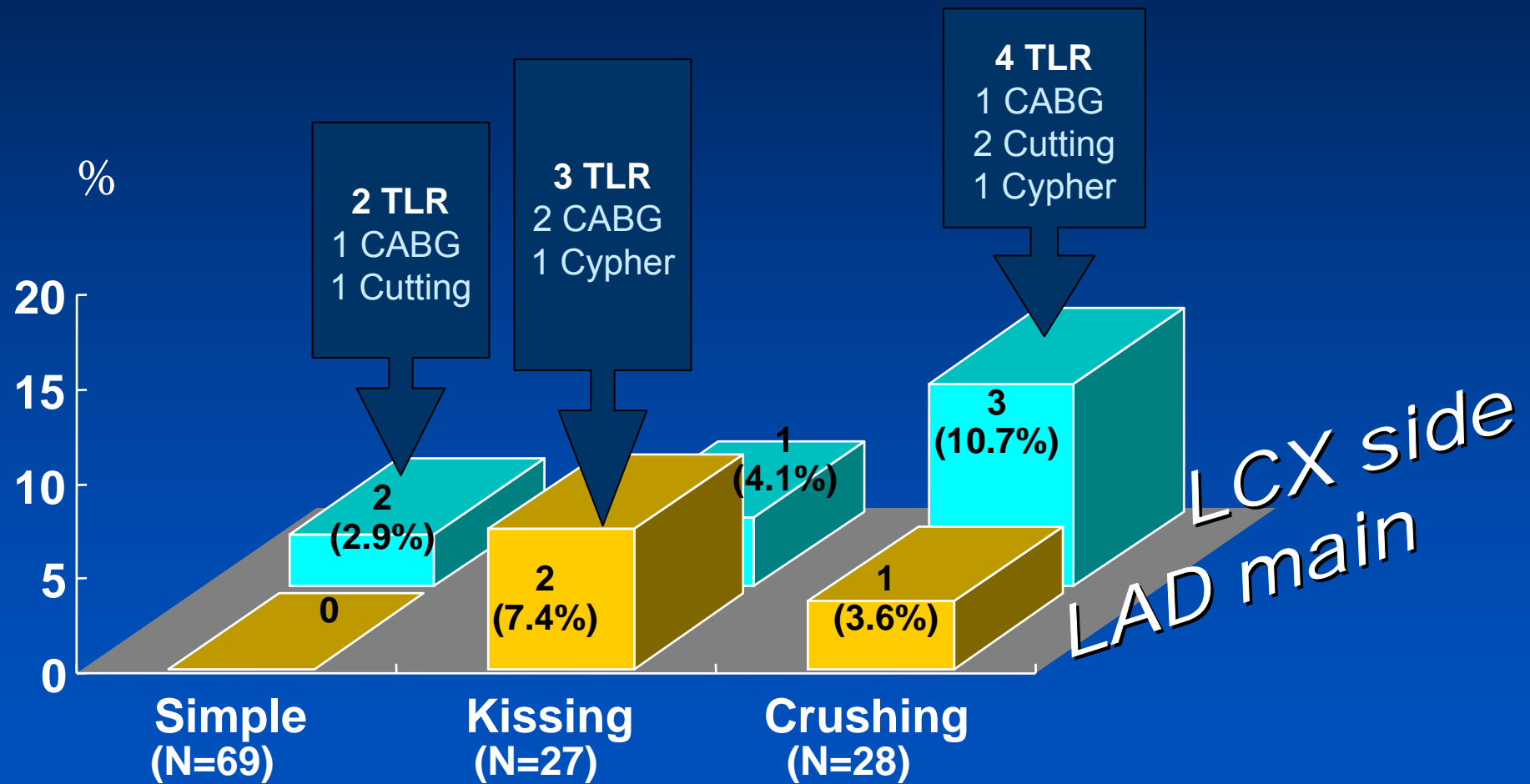
Rates of Restenosis and TLR

Overall LM bifurcation PCI with DES



TLR : 7.3% in LMCA Bifurcation PCI

9/124 patients



Outcomes of Complex Lesion & Complex Procedures

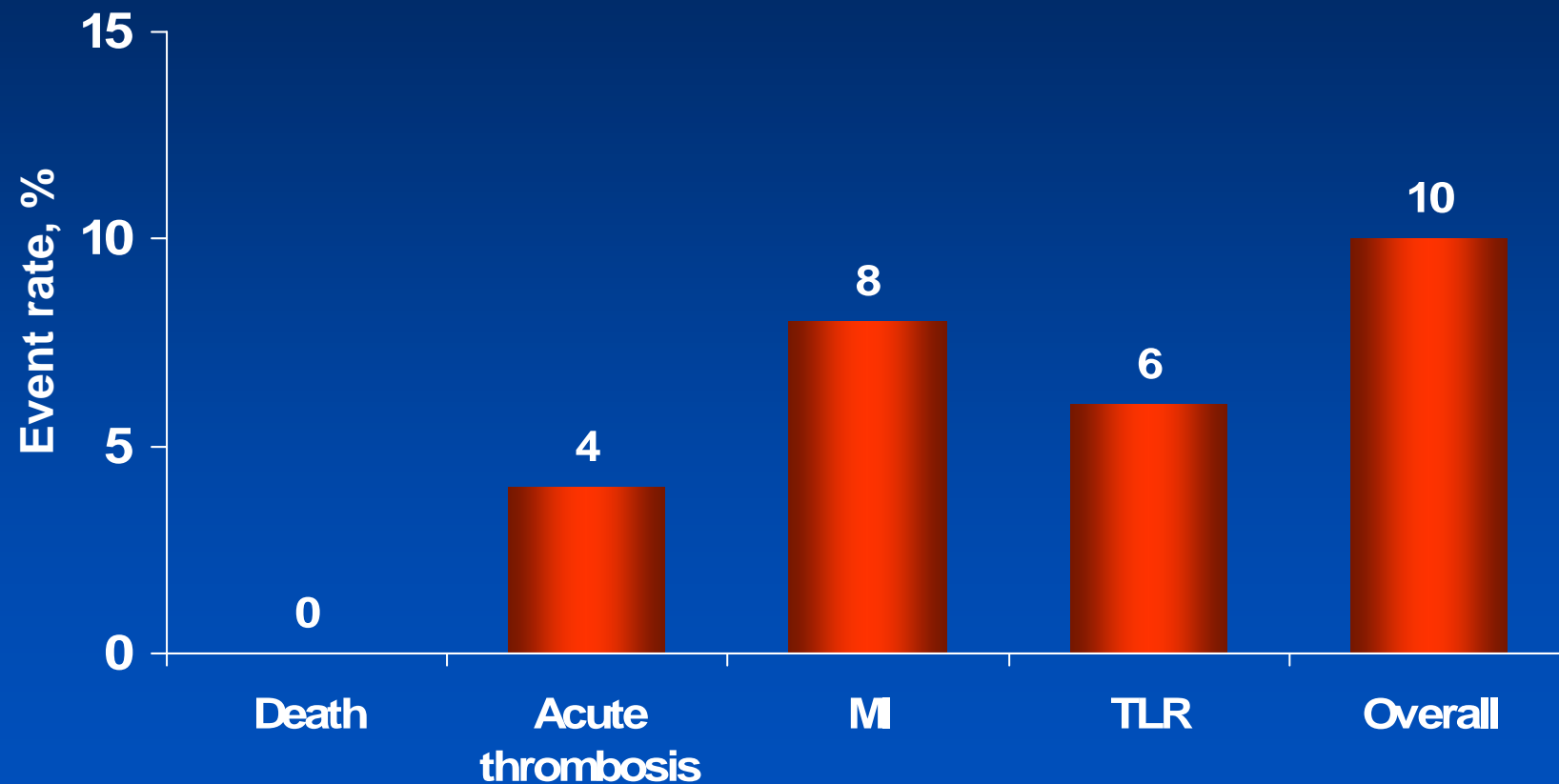
Total patients	50 patients
Bifurcation	47 (94%)
DM	13 (26%)
LV EF \leq 40%	12 (24%)
Ccr \leq 45 ml/h	8 (16%)
Prior MI	18 (36%)
Prior PCI	29 (58%)
IABP	26 (52%)
PCI in non-target lesions	35 (70%)
Stenting in both branches	42 (84%)

Price MJ et al, J Am Coll Cardiol 2006



In-hospital Outcomes of Complex LM

For 50 patients

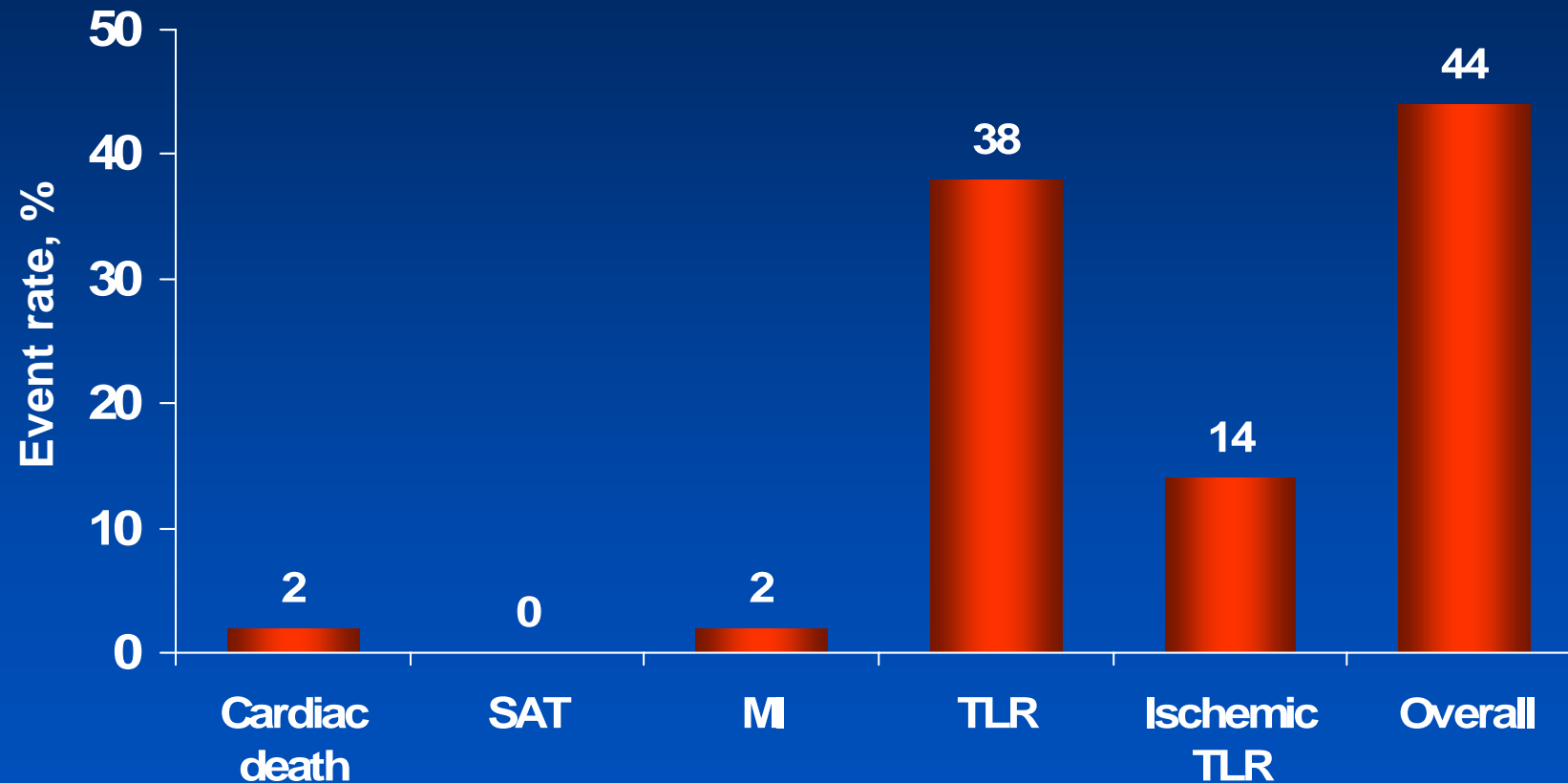


Price MJ et al, J Am Coll Cardiol 2006



Out-of-hospital Outcomes of Complex LM

281 median day for 50 patients



Price MJ et al, J Am Coll Cardiol 2006



Two Different Complex Strategies

What about
Kissing vs. Stent Crushing ?

QCA at Main Vessel

	Kissing stenting	Stent Crushing	<i>p</i>
Patients	24	25	
Follow-up CAG	20 (83)	21 (84)	
Proximal RVD, mm	4.09±0.69	3.46±0.65	0.002
Distal RVD, mm	2.92±0.42	2.59±0.42	0.009
MLD, mm			
Before procedure	0.91±0.52	1.12±0.40	0.111
After procedure	2.97±0.35	2.99±0.37	0.837
At follow-up	2.58±0.70	2.54±0.66	0.865
Lesion length, mm	23.7±13.3	28.6±15.4	0.253
Acute gain, mm	2.06±0.40	1.87±0.49	0.138
Late loss, mm	0.39±0.67	0.44±0.61	0.790
Restenosis	3 (15.0)	1 (4.8)	1.000

Kim YH, Am J Cardiol 2006;97:1597-601



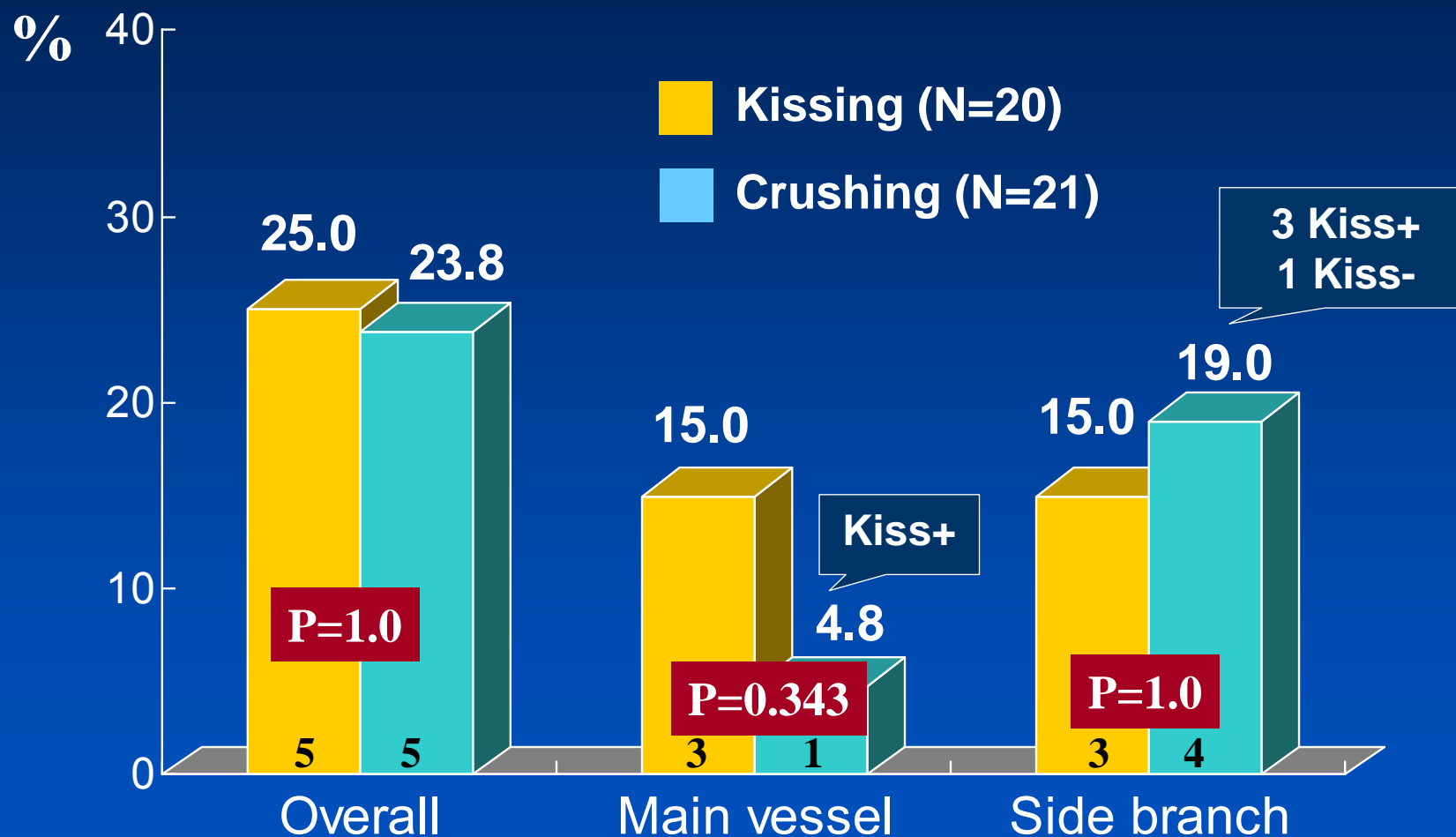
QCA Analysis at LCX

	Kissing stenting	Stent Crushing	<i>p</i>
Patients	24	25	
Follow-up CAG	20 (83)	21 (84)	
Distal RVD, mm	2.73±0.56	2.56±0.40	0.229
MLD, mm			
Before procedure	1.48±0.78	1.30±0.47	0.332
After procedure	2.70±0.36	2.60±0.44	0.387
At follow-up	2.03±0.78	1.91±0.85	0.646
Acute gain, mm	1.22±0.72	1.30±0.46	0.645
Late loss, mm	0.72±0.56	0.67±0.85	0.824
Restenosis	3 (15.0)	4 (19.0)	1.000

Kim YH, Am J Cardiol 2006;97:1597-601



Kissing vs. Crush Restenosis Rate



IVUS Finding at the LMCA

Variable	Cross over (n=43)	Kissing (n=18)	Crushing (n=16)	P value
Before procedure				
EEM area (mm ²)	21.7±6.0	21.5±3.7	19.7±4.2	0.404
Lumen area (mm ²)	6.2±2.2 *	4.6±2.1	5.0±1.3	0.010
Plaque area (mm ²)	15.5±5.1	16.9±3.7	14.7±4.6	0.360
Plaque burden (%)	70.8±8.9 *	78.6±8.7	73.4±8.9	0.011
After procedure				
EEM area (mm ²)	23.9±5.7	25.1±3.6	22.7±3.9	0.334
Lumen area (mm ²)	11.7±2.7	13.0±3.1	11.9±2.0	0.172
Plaque area (mm ²)	12.1±4.4	12.0±2.9	10.9±3.0	0.465
Plaque burden (%)	50.2±8.4	48.1±10.0	47.2±7.4	0.399

* p<0.05/3 between cross-over and Crush, † between cross-over and Kissing, ‡ between Crush and Kissing

IVUS Finding at the Ostial LAD

Variable	Cross over (n=43)	Kissing (n=18)	Crushing (n=16)	P value
Before procedure				
EEM area (mm ²)	15.2±4.4	14.9±3.1	13.7±3.6	0.450
Lumen area (mm ²)	4.5±2.0	4.2±1.8	4.2±1.9	0.831
Plaque area (mm ²)	10.8±4.1	10.7±3.0	9.5±2.5	0.475
Plaque burden (%)	70.0±11.8	71.6±10.6	69.5±9.2	0.796
After procedure				
EEM area (mm ²)	18.2±4.0	18.1±2.2	17.2±3.0	0.615
Lumen area (mm ²)	9.7±2.0 *, †	7.7±1.7	8.3±1.7	<0.001
Plaque area (mm ²)	8.5±3.1 *	10.4±1.9	8.9±2.0	0.024
Plaque burden (%)	45.8±10.2 *, †	57.7±7.5 ‡	51.6±6.3	<0.001

* p<0.05/3 between cross-over and Crush, † between cross-over and Kissing, ‡ between Crush and Kissing

Lessons from AMC data for LM Bifurcation PCI

- Both the presence of ostial LCX disease (diameter stenosis $\geq 50\%$) and the LMCA size by angiographic and IVUS examinations were two important considerations in selecting the stenting strategy.
- Compared to the complex stenting approach, the simple approach (stenting cross-over) was technically easier and appeared to be more effective in improving long-term outcomes for lesions with normal or

DES for Left Main Disease

What about Cypher vs. Taxus ?

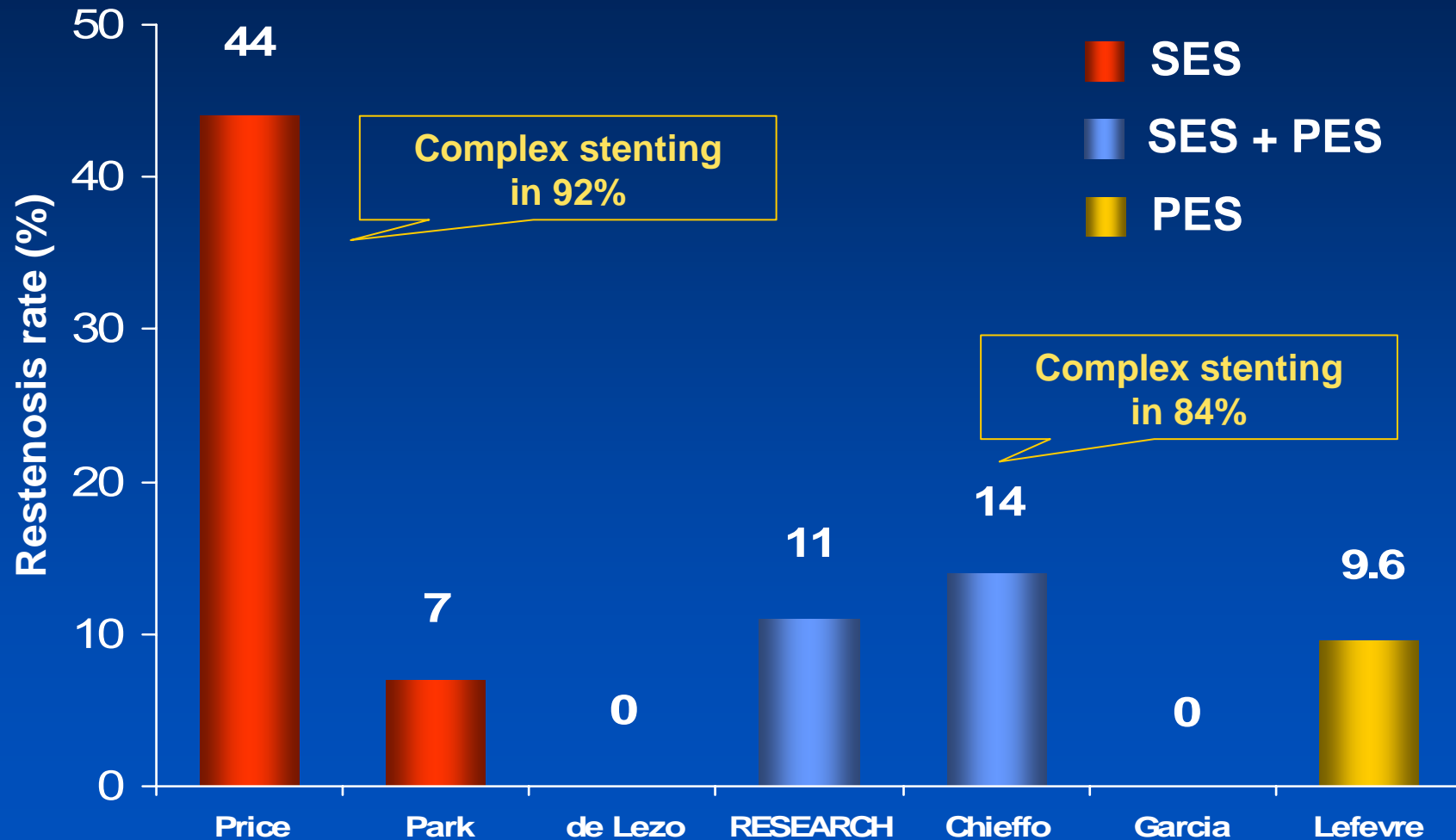


Cypher vs. Taxus

%	Published Studies				Unpublished		
	Park	De Lezo	Price	Valgimigli	Chieffo	Lefevre	Garcia
Number	102	52	50	95	85	291	86
DM	24	35	26	30	21	29	36
Bifurcation	41	42	94	65	81	78	71
LV EF	60	-	<40% in 24%	41	51	59	48
Shock	0	-	8	10	-	-	-
IABP	5	-	58	15	21	-	19
Mlti-vessel	58	-	-	80	-	26 (3VD)	-
DES	SES	SES	SES	52 SES 43 PES	41 SES 44 PES	PES	PES

Restenosis Rate

Depends On The Lesion Complexity



Non-randomized Comparison

RESEARCH vs. T-SEARCH

	CYPHER (n=55)	TAXUS (n=55)	p
Age (years)	64 ± 12	63 ± 12	0.54
Diabetes (%)	34	24	0.29
LV ejection fraction (%)	44 ± 16	44 ± 12	0.95
Shock at entry (%)	9	9	>0.99
Bifurcation (%)	64	76	0.28
LM plus 3 vessel disease (%)	57	53	0.87
Number of implanted stents	1.4 ± 0.5	1.5 ± 0.6	0.49
Nominal stent diameter (mm)	3.00 ± 0.25	3.29 ± 0.28	<0.001
Total stent length / patient (mm)	23 ± 11	27 ± 13	0.07

Valgimigli M et al. J Am Coll Cardiol 2006;47:507



Stenting Technique

RESEARCH vs. T-SEARCH

	CYPHER (n=55)	TAXUS (n=55)	p
Technique at bifurcation (%)			
Crossover	71	67	0.84
Culotte	0	20	0.009
T stenting	20	5	0.05
Crush	7	4	0.67
Kissing stenting	2	4	>0.99
IVUS guidance (%)	33	27	0.53
IABP (%)	20	18	>0.99

Valgimigli M et al. J Am Coll Cardiol 2006;47:507

Angiographic Outcome

RESEARCH vs. T-SEARCH

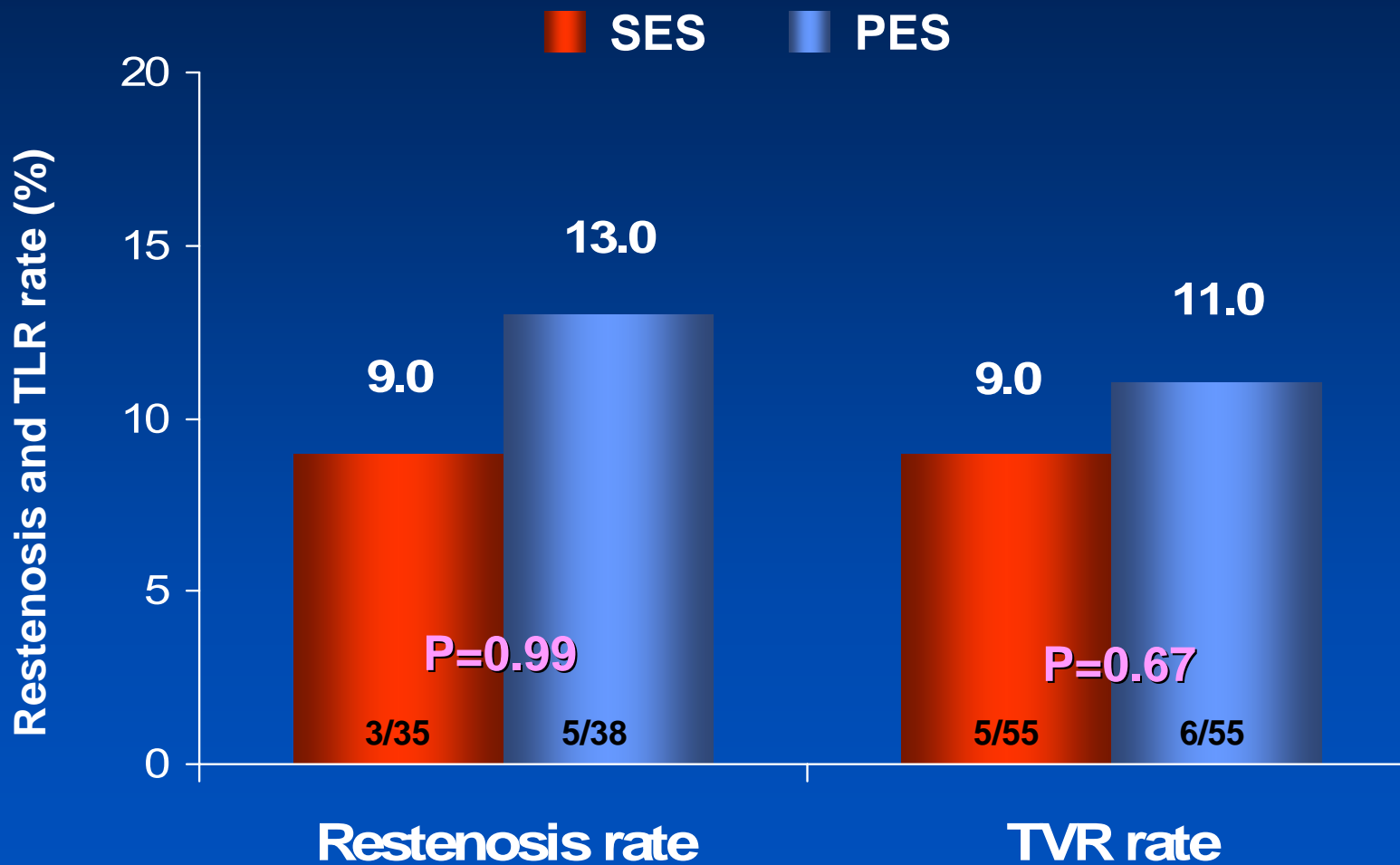
	CYPHER (n=35)	TAXUS (n=38)	p
Reference (mm)	3.20 ± 0.57	3.20 ± 0.73	0.82
Lesion length (mm)	9.5 ± 3.3	10.0 ± 4.4	0.56
In-lesion MLD (mm)			
After procedure	2.47 ± 0.54	2.46 ± 0.58	0.61
At follow-up	2.44 ± 0.85	2.35 ± 0.60	0.60
In-stent late loss (mm)	0.32 ± 0.74	0.46 ± 0.57	0.36
In-segment late loss (mm)	0.22 ± 0.73	0.25 ± 0.46	0.86

Valgimigli M et al. J Am Coll Cardiol 2006;47:507



Restenosis and TVR Rates

RESEARCH vs. T-SEARCH



Valgimigli M et al. J Am Coll Cardiol 2006;47:507

Compare to Surgery,

**Efficacy concerns of
PCI with DES...**

CABG vs. DES

Non-randomized comparison in USA

	CABG (n=123)	PCI (n=50)	P value
Age	70 ± 10	72 ± 15	0.33
Men (%)	76	50	<0.01
Hypercholesterolemia (%)	72	74	0.85
Previous stroke (%)	10	8	0.72
DM (%)	31	36	0.48
Cr ≥ 1.5mg/dL (%)	5	16	0.02
ACS (%)	45	66	0.02
Parsonnet score	13.7 ± 9.7	18.3 ± 10.9	<0.01
LV EF (%)	52 ± 10	51 ± 15	0.64

Lee et al, J Am Coll Cardiol, 2006

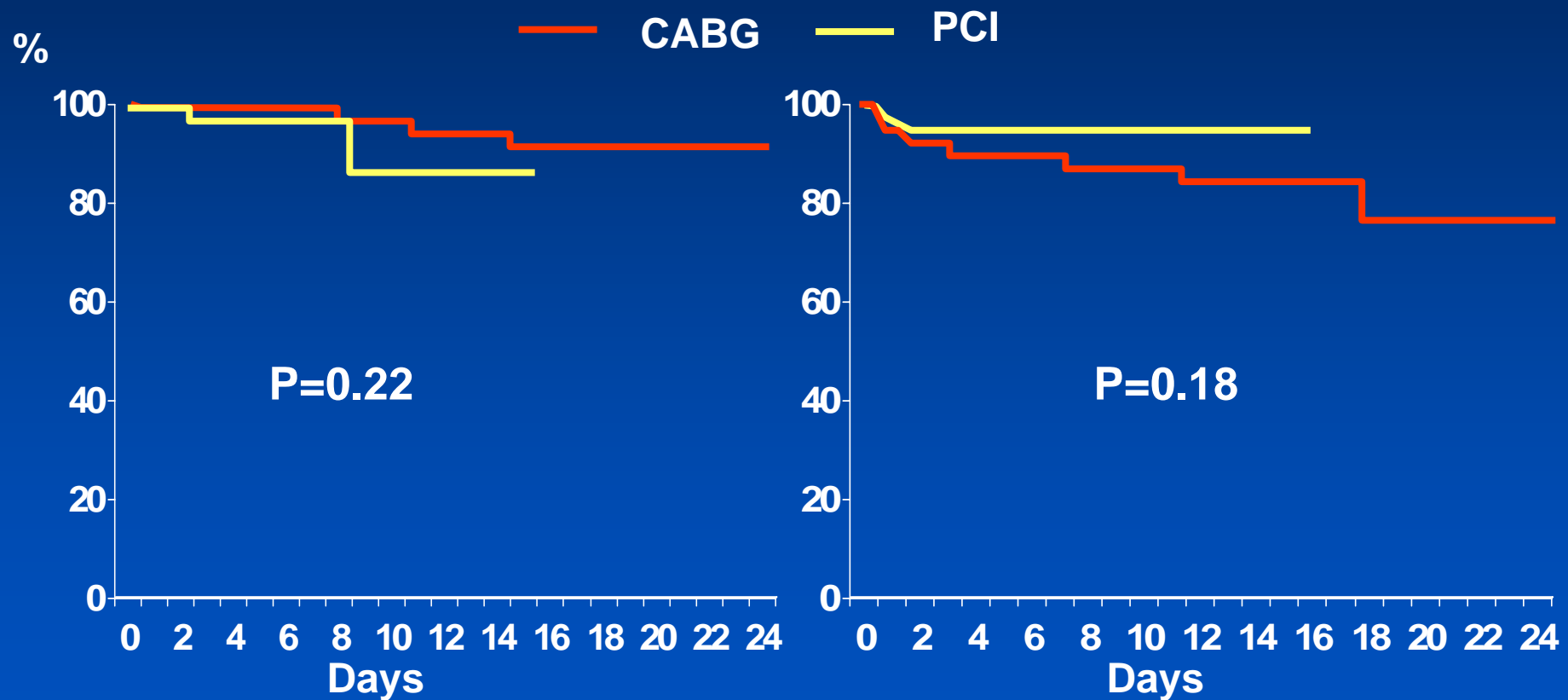


CABG vs. DES

Similar Intermediate-term Outcomes

Survival

MI-free Survival



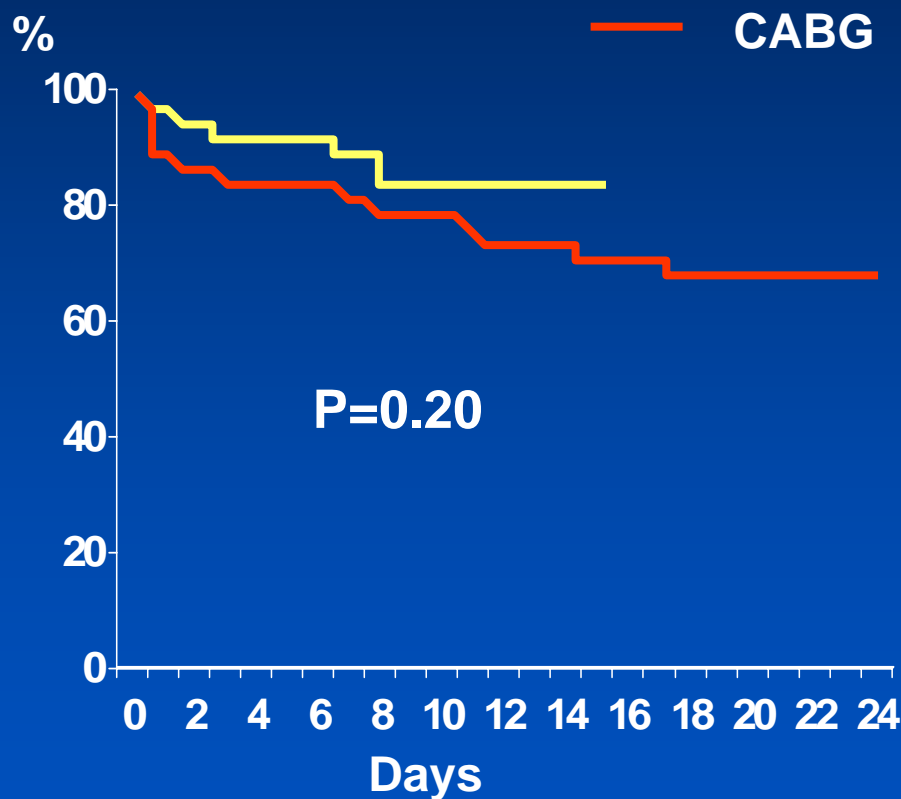
Lee et al, J Am Coll Cardiol, 2006



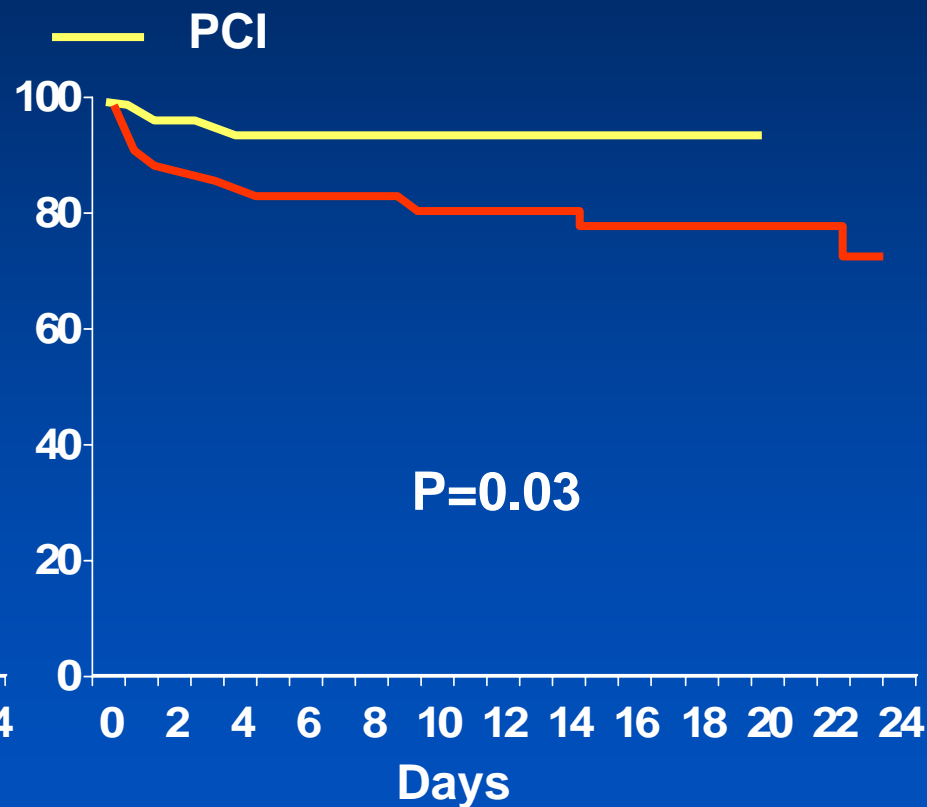
CABG vs. DES

Similar Intermediate-term Outcomes

TLR-Survival



MACE-free Survival

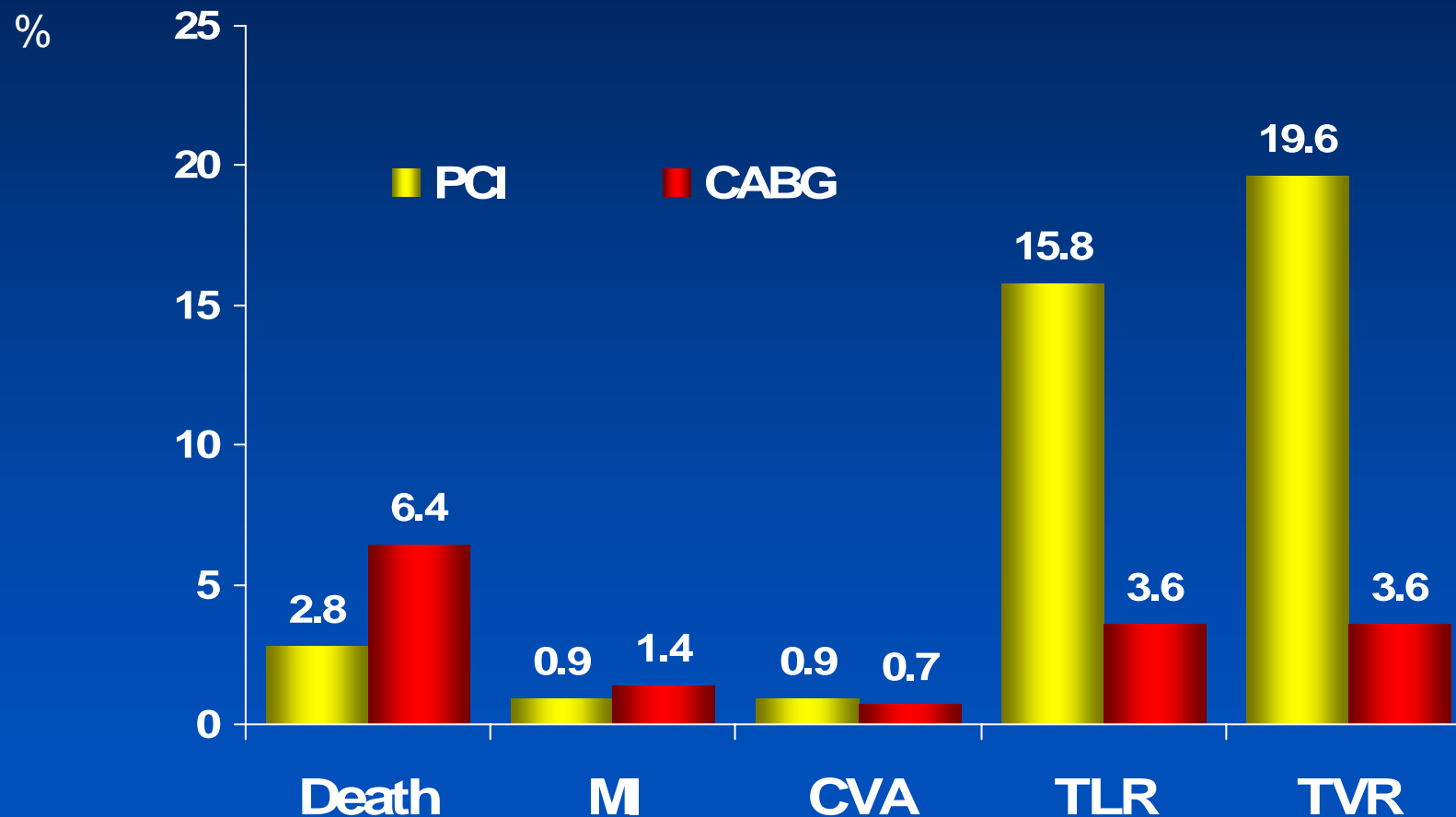


Lee et al, J Am Coll Cardiol, 2006



CABG vs. DES

One-year Outcome for 107 DES and 142 CABG in Milan



Chieffo et al, Circulation, 2006

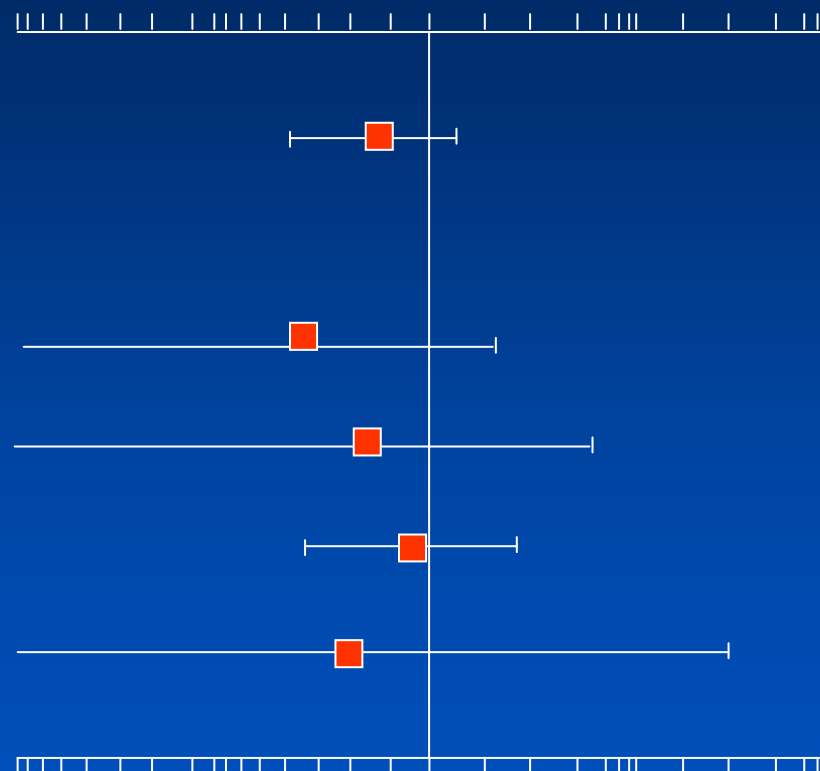


CABG vs. DES for MACCE

Propensity Analysis for 107 DES and 142 CABG in Milan

Odds ratio 95%CI

Total population	249
Propensity Score	
1 Quartile	70
2 Quartile	59
3 Quartile	60
4 Quartile	60



PCI better

CABG better

Chieffo et al, Circulation, 2006



CABG vs. DES

157 PCI (94 DES) and 154 CABG in Italy

	CABG (n=154)	PCI (n=157)	P value
Age (yrs)	69.3 ± 9.5	73.0 ± 10.9	0.002
Men (%)	76	70	0.296
Previous stroke (%)	10	8	0.72
DM (%)	25	26	0.976
Previous MI (%)	35	30	0.398
Stable angina (%)	28	27	0.917
Parsonnet score, median	12.5	16.5	0.004
EuroSCORE, median	5	6	0.032
LV EF ≤ 30% (%)	4	12	0.022
3 vessel disease (%)	46	25	<0.001

Palmerini et al, Am J Cardiol 2006

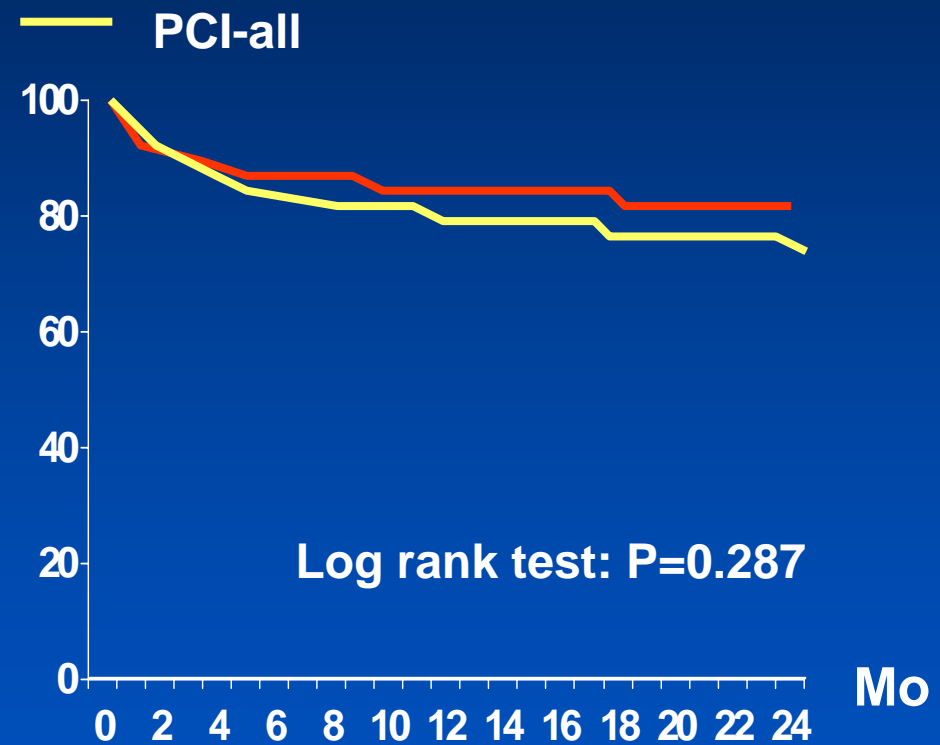
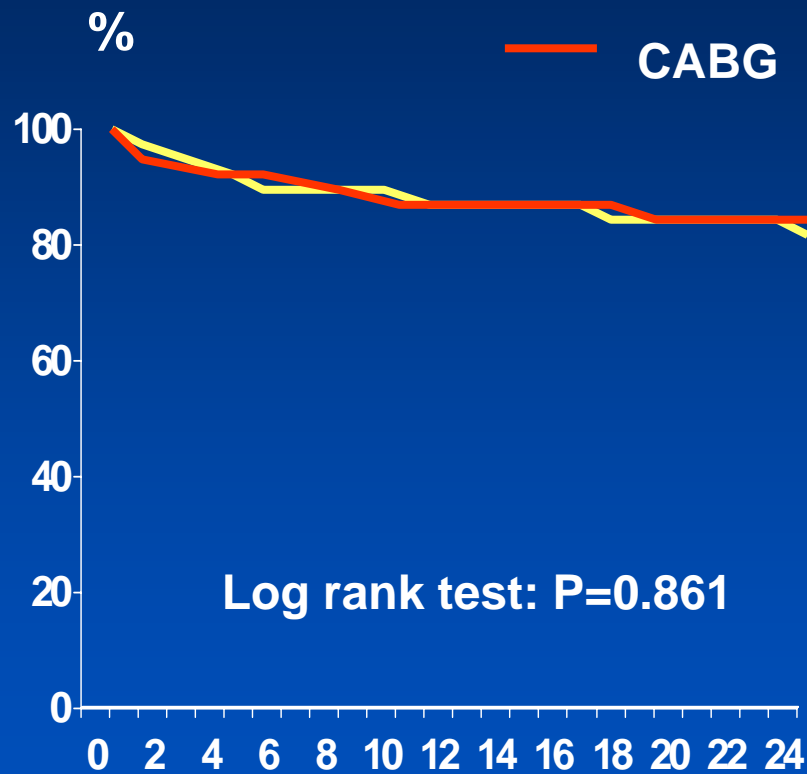


CABG vs. DES

157 PCI (94 DES) and 154 CABG in Italy

Survival

MI-free survival



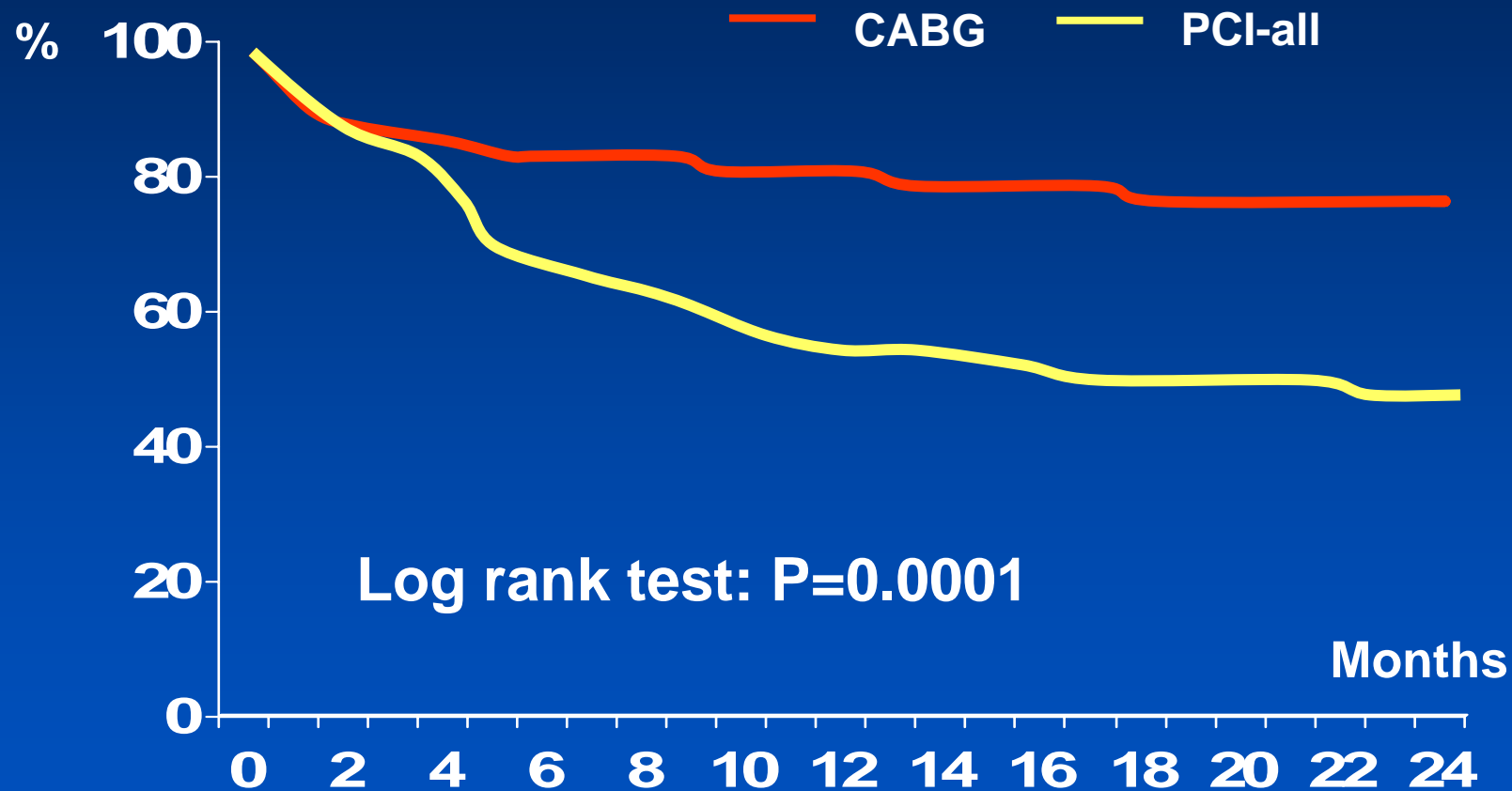
Palmerini et al, Am J Cardiol 2006



CABG vs. DES

157 PCI (94 DES) and 154 CABG in Italy

MACE-free Survival for All PCI



Log rank test: P=0.0001

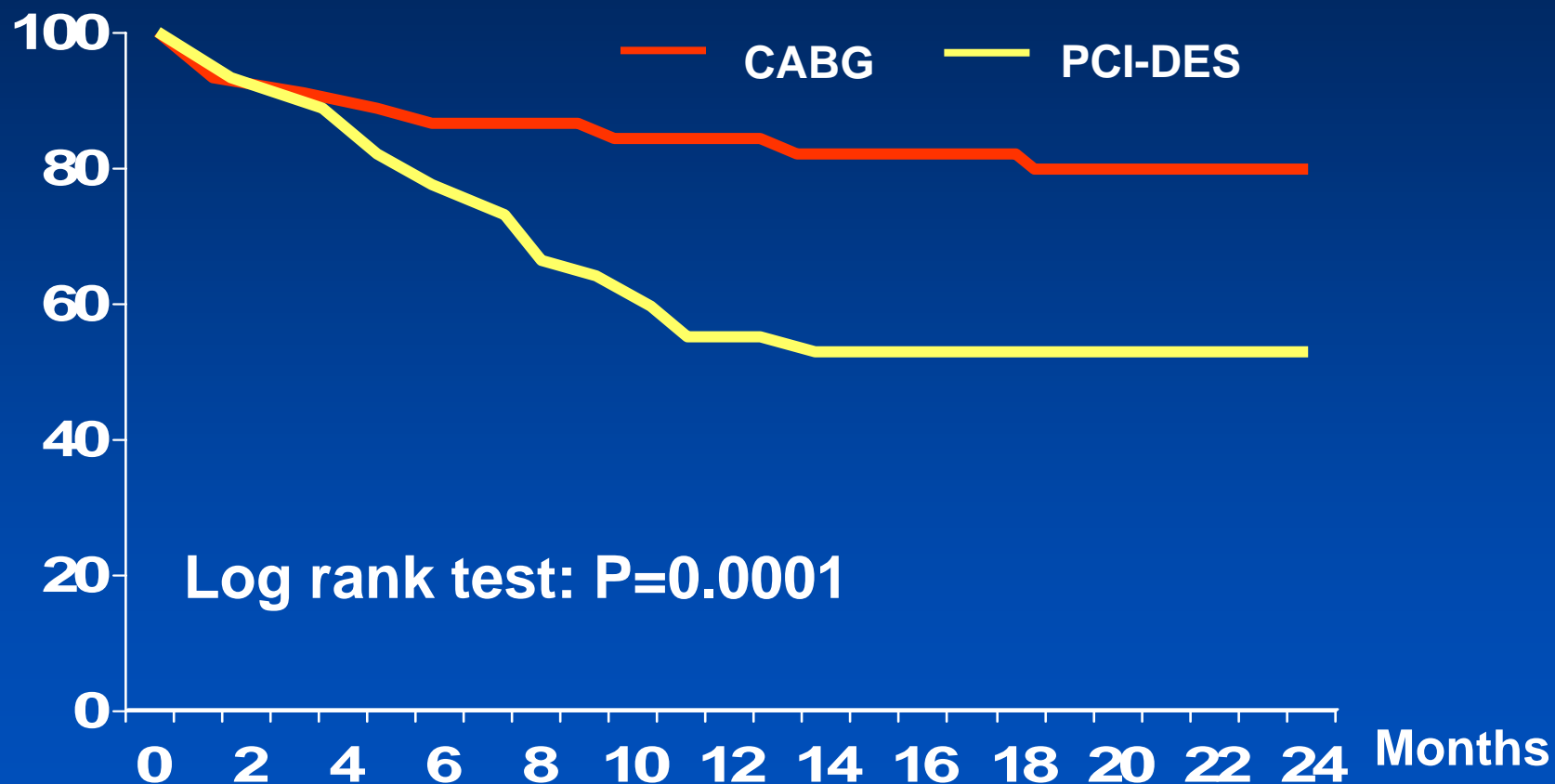
Palmerini et al, Am J Cardiol 2006



CABG vs. DES

157 PCI (94 DES) and 154 CABG in Italy

MACE-free Survival for PCI with DES



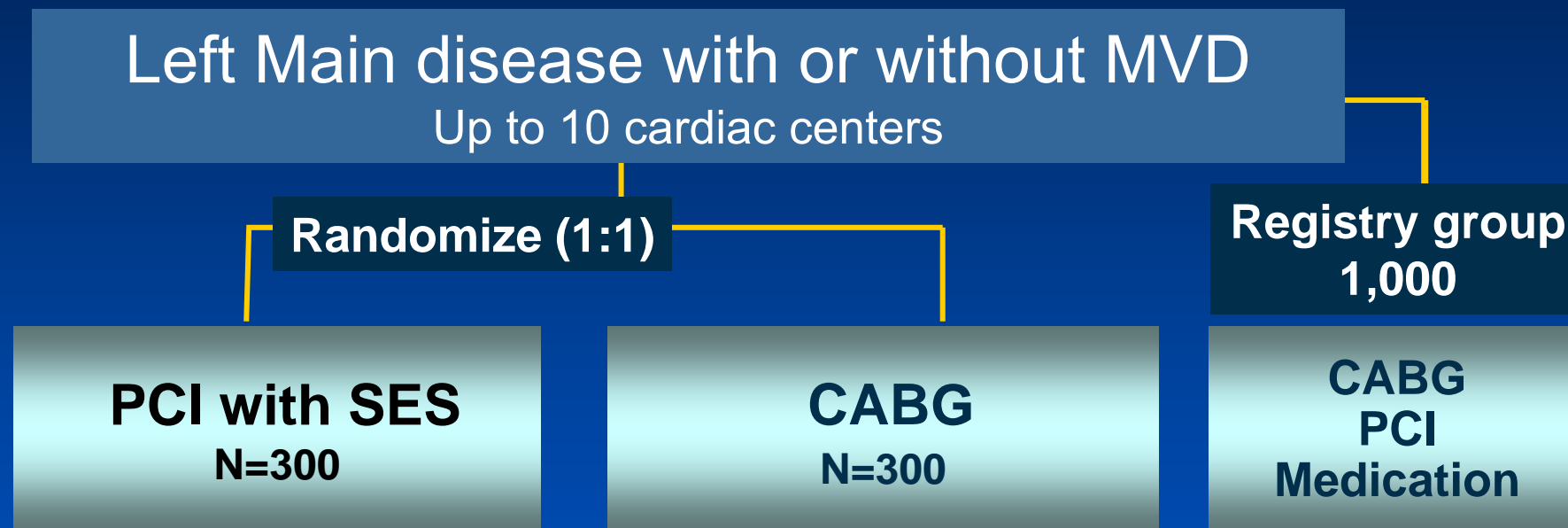
Palmerini et al, Am J Cardiol 2006



How to Prove it ?

PRE-COMBAT Randomized Trial

*PRE*miere of Randomized *COM*parison of *B*ypass Surgery versus *Angioplasty* using Sirolimus-Eluting Stent in Patients with Left Main Coronary Artery Disease



Primary Endpoint: 1-year death, MI, and stroke

Key Secondary Endpoints: MACCE including primary end point and
ischemia-driven TLR

PI: Seung-Jung Park

Conclusions

- In the reviewed series, outcomes of PCI for ULM are highly correlated with pre-procedure clinical risk profile of the patient
- Previous data for elective PCI with DES for ULM is extremely promising
- CABG is not without complications and rate of SVG closure is high early post CABG (PREVENT IV)
- While treatment of unprotected LMCA stenosis with PCI/DES remains controversial, and technically challenging (esp bifurcation), improved outcome through reduced recurrence rates may influence opinion away from the surgical towards the percutaneous approach (already happening in AP)