

PCI for Long Coronary Lesion

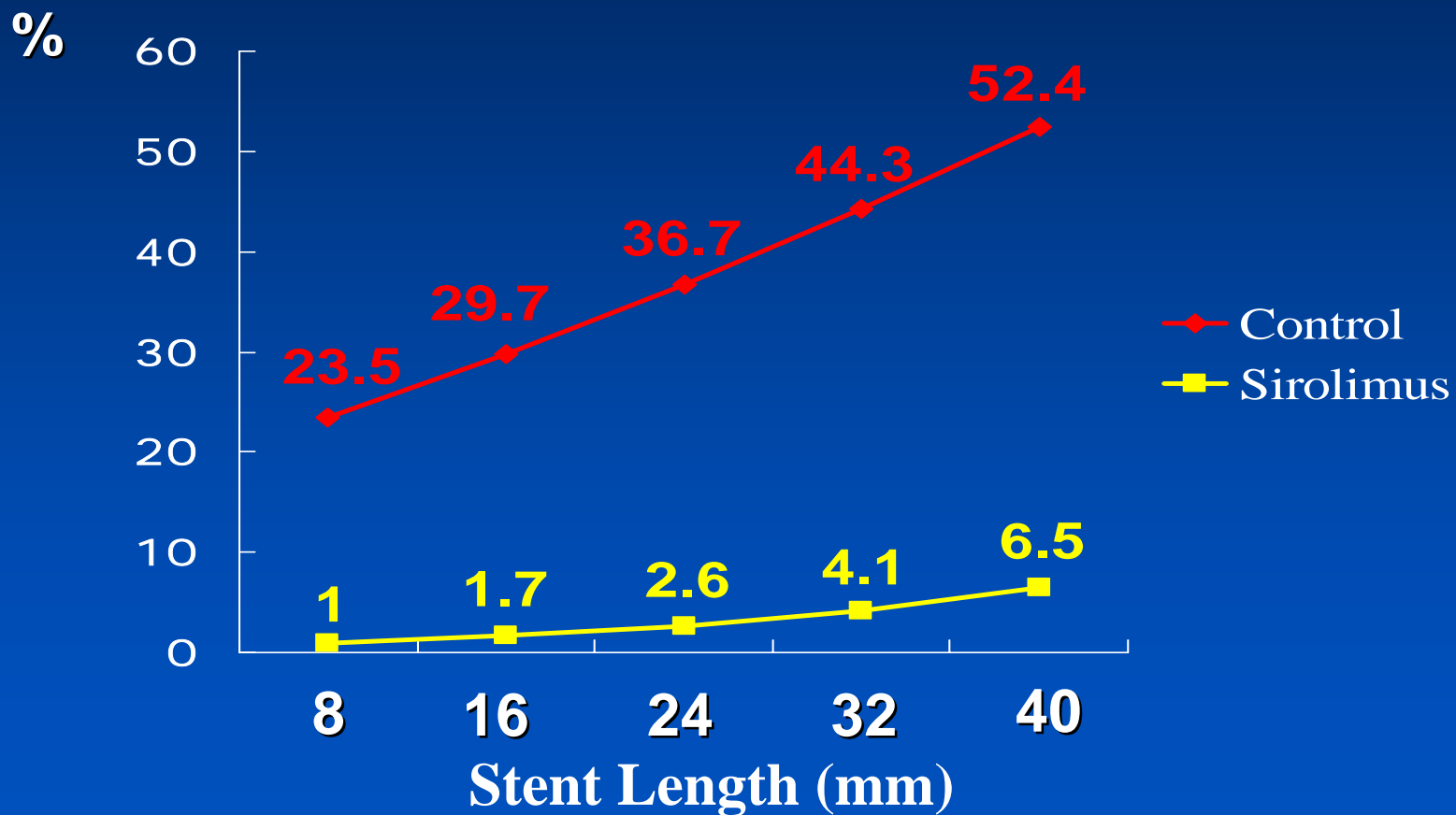


In the Era of Drug Eluting Stent



Sirolimus-Eluting Stent in SIRIUS

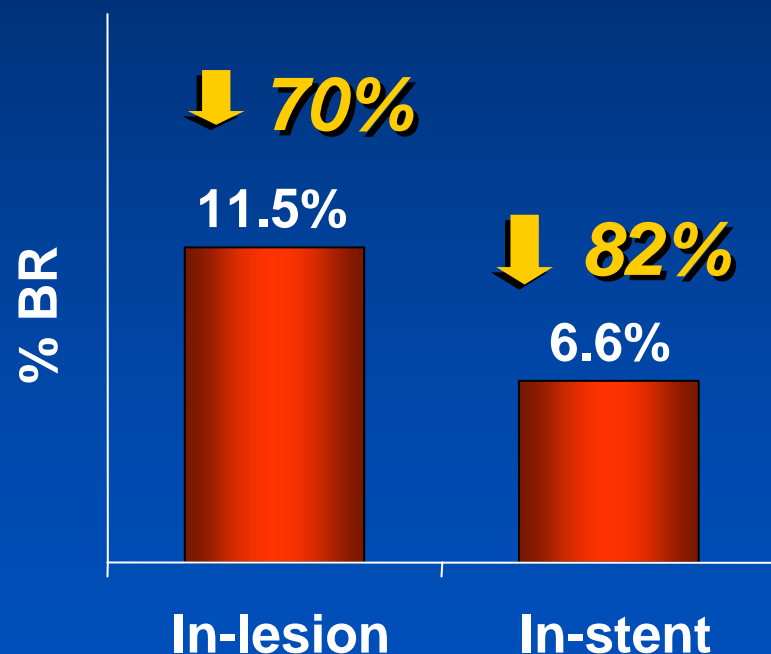
Minimal Increase of Restenosis With Increasing Stent Length



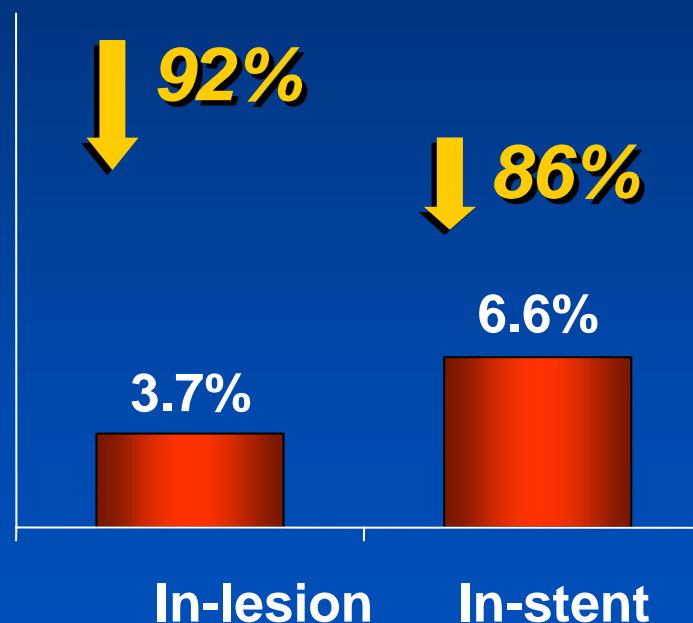
Improving Outcomes in Long Lesions

Binary Restenosis

SIRIUS



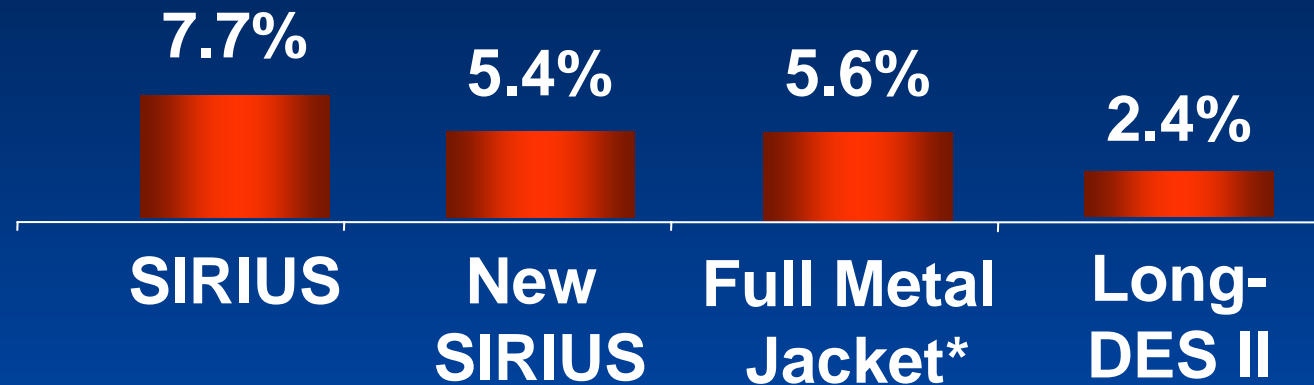
New SIRIUS



Sirolimus-Eluting Stent

Consistent Results in Long Lesions

TLR %



Follow-up

12 mo

12 mo

6 mo

9 mo

Lesion Length

20.5mm

19.9mm

25.7mm

33.9mm

Stent/Lesion
ratio

1.2

1.4

1.6

1.4

* Colombo



Multiple, long SES(>40mm)

in Real world Clinical Practice

113 de novo lesions in 113 patients

Stent length (mm) : 58 ± 14

Stent diameter (mm) : 3.0 ± 0.3

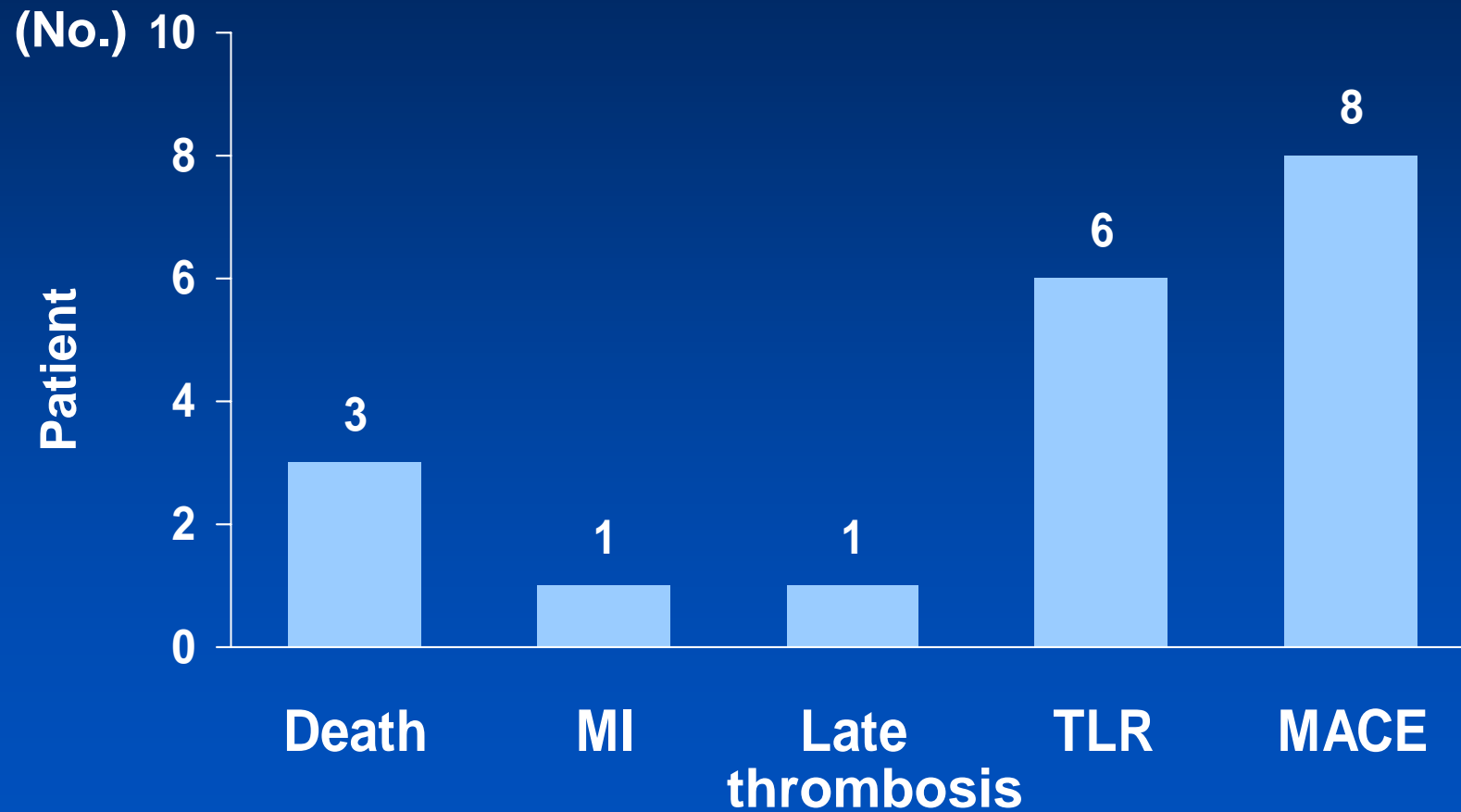
Stent number/pts : 2.2

Park SJ et al, ACC 2006



Clinical & Angiographic Outcomes

Multiple, long SES (>40mm)



Park SJ et al, ACC 2006

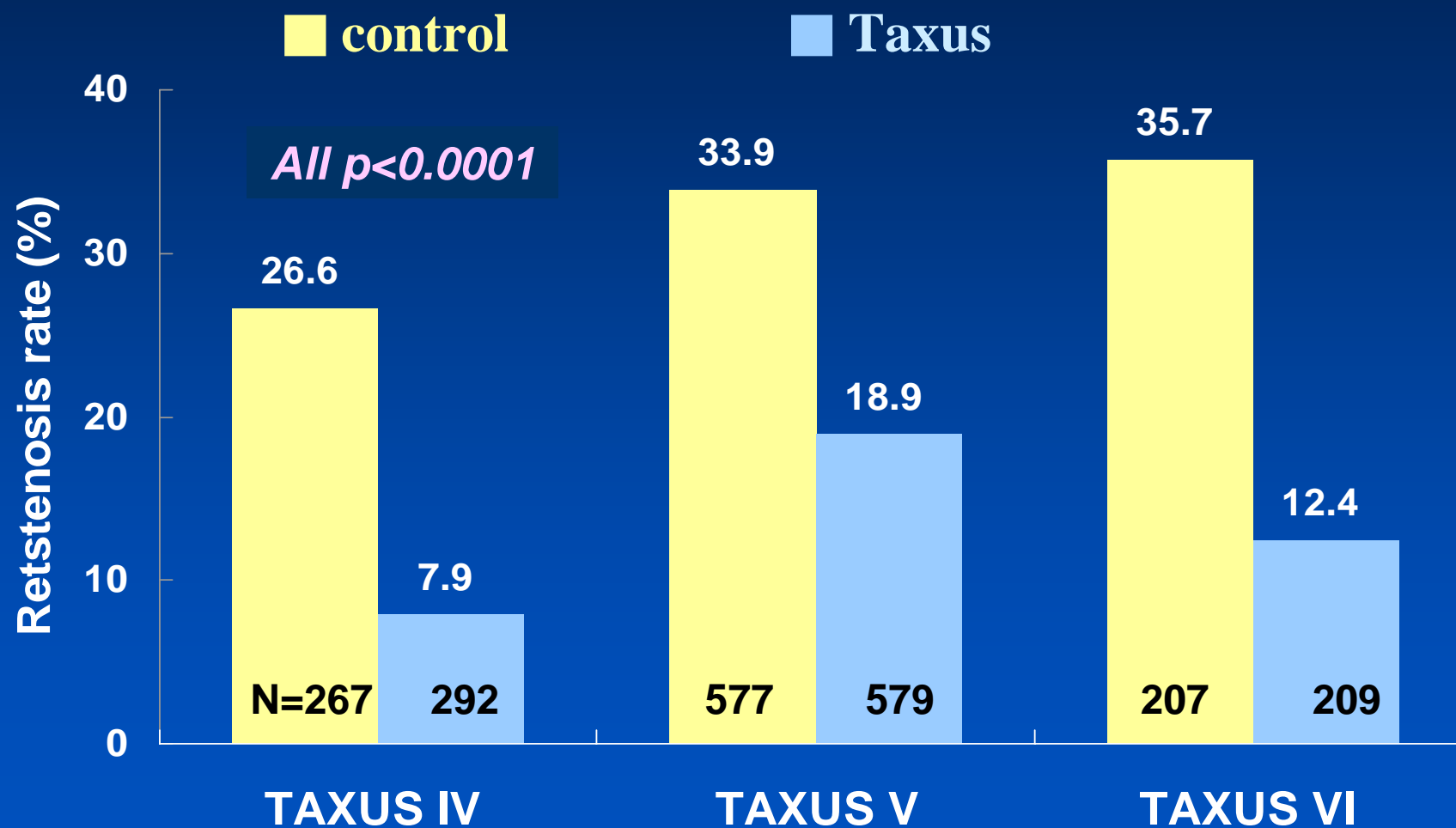


Paclitaxel-Eluting Stent

More involvement of long lesions

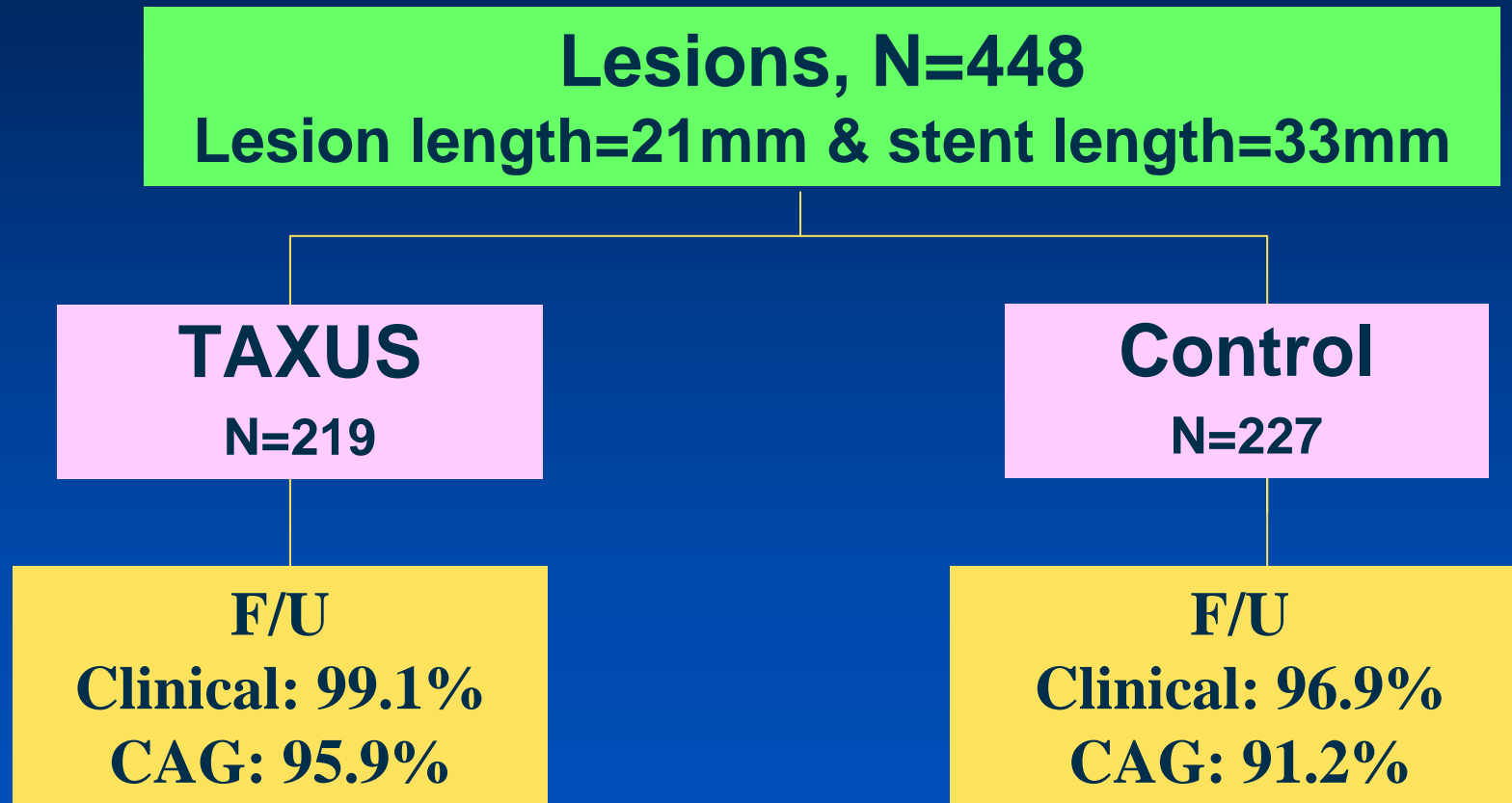
	TAXUS IV	TAXUS V	TAXUS VI
No of patients	1,314	1,156	446
Lesion length (mm)	14.4	17.3	20.6
Stent length (mm)	21.9	28.7	33.4
AHA/ACC type C lesions (%)	20.3	36.8	55.6
Small vessels (<2.5mm) (%)	32.1	18.7	27.8
Overlapping stent (%)	Not permit	29.1	27.8
Diabetes mellitus (%)	23.4	31.7	20.0

Sustained Reduction of In-segment Restenosis



TAXUS-VI

for Long Lesion Involvement



Dawkins KD et al, Circulation 2005;112:3306-13



Angiographic Outcomes

TAXUS-VI

	TAXUS (n=219)	Control (n=227)	<i>p</i>
Baseline reference, mm	2.81±0.49	2.77±0.46	0.41
MLD, mm			
Before procedure	0.84±0.35	0.87±0.33	0.39
After procedure	2.58±0.41	2.57±0.36	0.68
9-month	2.20±0.60	1.58±0.66	<0.0001
Diameter stenosis, %			
Before procedure	70.2±10.7	68.6±10.7	0.12
After procedure	8.3±10.4	7.7±10.1	0.60
9-month	22.2±19.2	42.8±20.9	<0.0001

Dawkins KD et al, Circulation 2005;112:3306-13



Angiographic Outcomes

TAXUS-VI

	TAXUS (n=219)	Control (n=227)	<i>p</i>
Binary restenosis			
In-stent	9.1% (19/209)	32.9% (68/207)	<0.0001
Analysis segment	12.4% (26/210)	35.7% (74/207)	<0.0001
Late loss, mm			
In-stent	0.39±0.56	0.99±0.59	<0.0001
Analysis segment	0.24±0.57	0.66±0.62	<0.0001
Proximal edge	0.16±0.54	0.33±0.53	0.0019
Distal edge	-0.02±0.41	0.11±0.37	0.0013

Dawkins KD et al, Circulation 2005;112:3306-13



Nine-months Outcomes

TAXUS-VI

	TAXUS (n=219)	Control (n=227)	<i>p</i>
MACE, overall	16.4% (36)	22.5% (51)	0.12
Cardiac death	0 (0)	0.9% (2)	0.50
MI	8.2% (18)	6.2% (14)	0.46
TVR, overall	9.1% (20)	19.4% (44)	0.0027
TLR, overall	6.8% (15)	18.9% (43)	0.0001
TVR, nontarget lesion	3.2% (7)	0.9% (2)	0.10
TVF	16.0% (35)	22.0% (50)	0.12

Dawkins KD et al, Circulation 2005;112:3306-13



Three-years Outcomes in longer lesions, multiple stents

TAXUS-VI

	Longer lesion $\geq 26\text{mm}$		Multiple stents	
	PES (N=45)	BMS (N=37)	PES (N=83)	BMS (N=83)
TVR	11.1%	27.8%	13.4%*	27.2%*
TLR	4.4%*	27.8%*	8.5%*	25.9%*
Cardiac death	0.0%	0.0%	0.0%	2.5%
Stent thrombosis	2.2%	0.0%	1.2%	0.0%

* p<0.05

Dawkins KD et al, TCT 2006, ESC 2006



Very long PES ($\geq 40\text{mm}$) in Asian Multicenter Registry

258 patients with 322 lesions

Reference diameter (mm) : 2.84 ± 0.66

Lesion length (mm) : 45.9 ± 12.0

Stent length (mm) : 54.8 ± 14.0

Number of stents/pt (No.) : 2.8 ± 0.8

Nakamura S et al, TCT 2006



Two-years Outcomes

Very long PES ($\geq 40\text{mm}$)

In-hospital MACE at 30 days	1.2 %
MLD (mm)	
post procedure	2.70 ± 0.62
at 12 months	2.40 ± 0.70
at 24 months	2.41 ± 0.66
Restenosis rate	
at 12 months	8.8 %
at 24 months	8.8 %

Nakamura S et al, TCT 2006

Registries with DES

In the Era of Drug Eluting Stent

One-year Clinical Outcomes In RESEARCH

Stented length of 79 mm (64 ~ 168)

	All (n=122)	SES (n=81)	PES (n=41)	<i>p</i>
Death (%)	4.1	2.5	7.3	0.2
MI (%)	10.0	11.2	7.4	0.53
TVR (%)	7.5	7.5	7.6	0.96
MACE (%)	18.0	18.5	17.1	0.87

Aoki J et al, Am Heart J 2005;150:994-9



Multiple Overlapping in the LAD

Milan Experience

66 patients (27 PES, 39 SES)

Reference vessel diameter: 2.53 ± 0.6 mm

Diameter stenosis(%): 68.5 ± 19.3

Stented segment : $64 \pm 18 (\geq 60)$ mm

Glycoprotein IIb/IIIa inhibitors: 47%

Tsagalou E et al, J Am Coll Cardiol 2005;45:1570-3



Six- months Outcomes

Multiple Overlapping DES in the LAD

	Baseline	After procedure	Follow-up
RVD	2.43±0.6	2.86±0.48	2.88±0.56
MLD	0.76±0.5	2.54±0.5	2.22±0.86
% diameter stenosis	68.5±19.3	11.4±7.8	24.2±22.8
Late lumen loss			0.44±0.77

Binary restenosis rate : 19.6%

Tsagalou E et al, J Am Coll Cardiol 2005;45:1570-3

One-year Clinical Outcomes

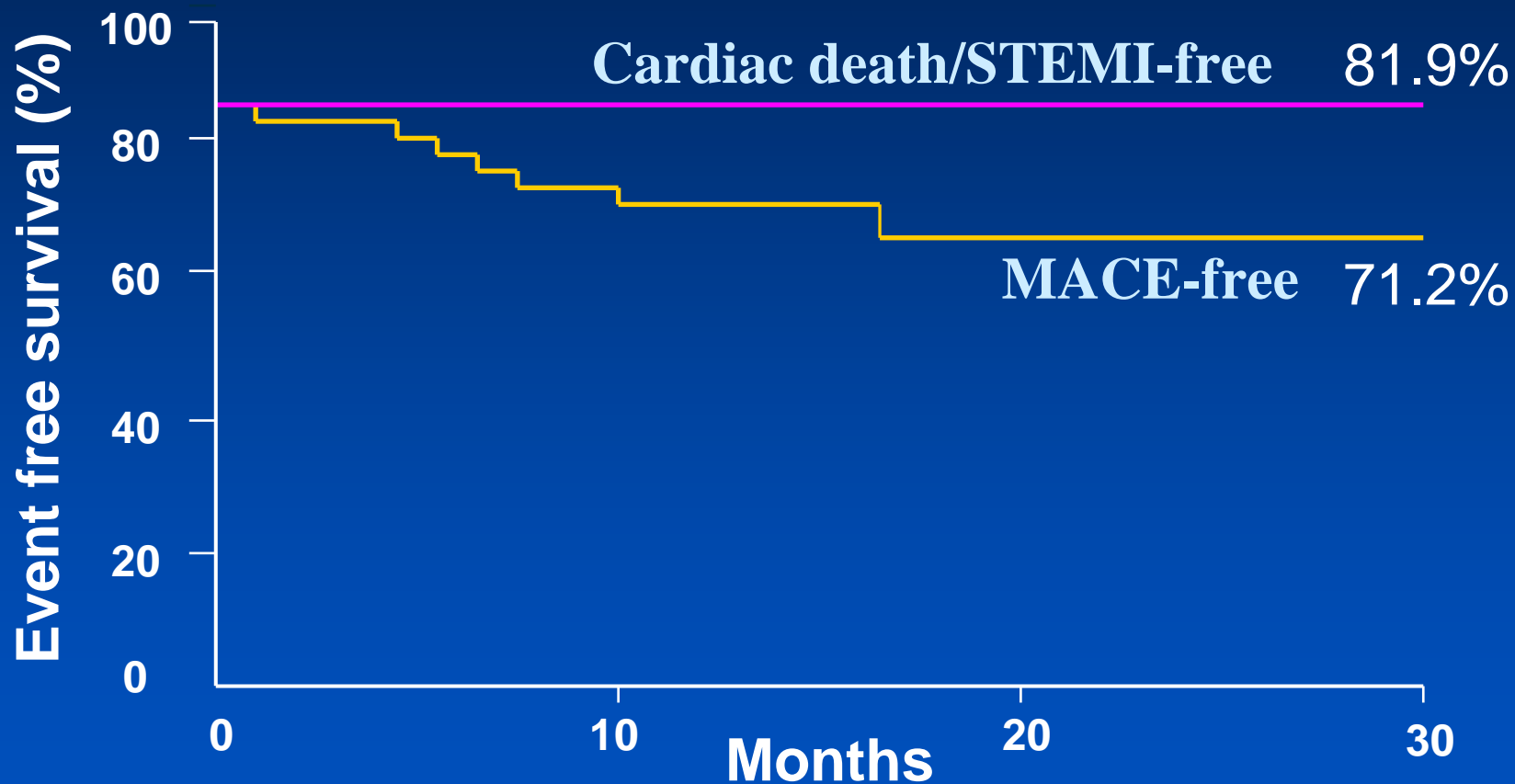
Multiple Overlapping DES in the LAD

	In-hospital (n=66)	Follow-up (n=66)
Death	0	0
Q wave MI	0	0
Non-Q wave MI	11 (16.6%)	1 (1.5%)
Thrombosis	1 (1.5%)	0
TVR	0	10 (15%)
CABG	0	1 (1.5%)

Tsagalou E et al, J Am Coll Cardiol 2005;45:1570-3

Kaplan-Meyer Curve

Multiple Overlapping DES in the LAD



Tsagalou E et al, J Am Coll Cardiol 2005;45:1570-3

Multiple Overlapping DES in AMC

352 lesions (266 SES, 86 PES)

Reference vessel diameter: 2.82 ± 0.40 mm

Diameter stenosis(%): 68.5 ± 13.5 mm

Target lesion length: 55.8 ± 12.9 mm

Stented segment : $71.9 \pm 13.7 (\geq 60)$ mm

Lee CW et al, Am J Cardiol 2006;98:918-922



Six-month Angiographic Outcomes

Multiple Overlapping DES

	Pre-procedure	Post-procedure	Follow-up
MLD (mm)	0.66 ± 0.53	2.66 ± 0.40	2.14 ± 0.68
% diameter stenosis	68.5 ± 13.5	4.50 ± 13.4	22.9 ± 23.8
Late lumen loss			0.52 ± 0.67
Restenosis			37 %
SES			11.1% (20/180)
PES			22.2% (12/54)

Lee CW et al, Am J Cardiol 2006;98:918-922

One- year Clinical Outcomes

Multiple Overlapping DES

AMC

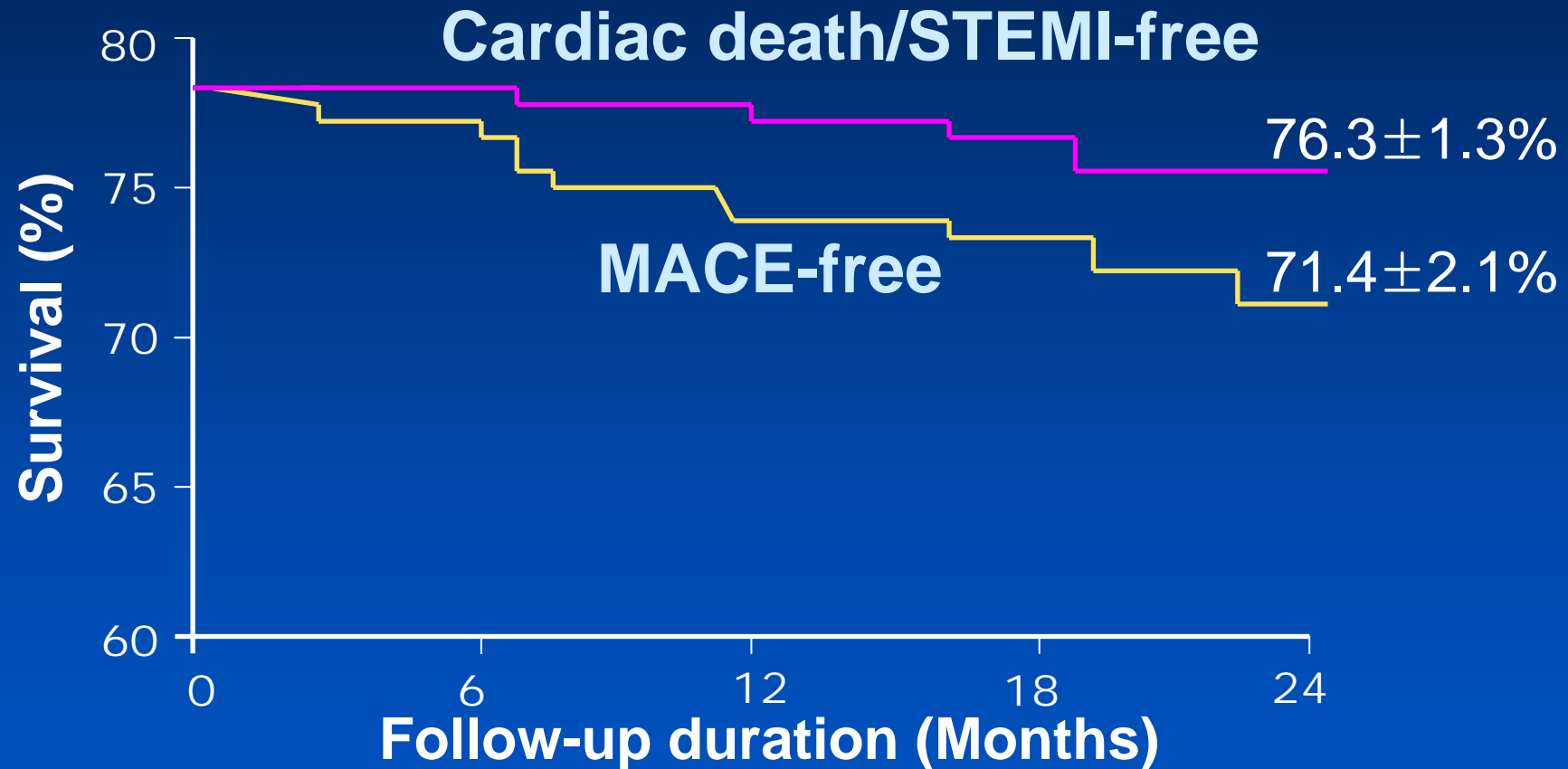
	In-hospital (n=347)	Follow-up (n=346)
Death	1 (0.3%)	9 (2.6%)
Cardiac	1 (0.3%)	6 (1.7%)
Myocardial infarction	70 (20.2%)	1 (0.3%)
Q wave	2 (0.6%)	1 (0.3%)
Non-Q wave	68 (19.6%)	0
TLR	2 (0.6%)	13 (3.8%)
PCI	2 (0.6%)	12 (3.5%)
CABG	0	1 (0.3%)

Lee CW et al, Am J Cardiol 2006;98:918-922



Kaplan-Meyer Survival Curves

Multiple Overlapping DES



Lee CW et al, Am J Cardiol 2006;98:918-922

Multiple overlapping in TAXUS IV

124 patients (27.8%)

Mean lesion length ; 25.1 mm

Mean stent length ; 43.6 mm

	PES	Control	<i>p</i>
Stent thrombosis	0	0	NS
Binary restenosis	4.8%	45.5%	<0.0001
TVR	1.6%	25.0%	≤0.0001
TLR	1.6%	23.3%	0.0002
MACE	9.5%	25.0%	0.0305

Dawkins KD et al, AHA 2006



Full Metal Jacket for diffuse disease

315 DES for 103 patients (108 long lesion)

88 men and 15 women

Median stented length : 63.66mm

Number of stents : 2.89 ± 0.91

Gp IIb/IIIa inhibitor : 65%

Graidis C et al, ESC 2006



Clinical Follow up

Full Metal Jacket for diffuse disease

Clinical follow up at 7 months : 63/103

Sudden Death	1/103
Periprocedural MI	4/103 (3.9%)
TVR	5/62 (8.0%)
MACE (death, MI, TVR)	10/63 (15.8%)

Graidis C et al, ESC 2006



Full Metal Jacket in Single Coronary Lesion

	$\geq 50\text{mm}$ (n=99)	$\leq 24\text{mm}$ (n=46)	<i>p</i>
At 30 days, n (%)			
Death	1 (1.1)	5 (1.3)	1.00
TLR-MACE	5 (5.7)	7 (1.8)	0.05
Stent thromobsis	1 (1.0)	5 (1.1)	1.00
At 6 months, n (%)			
Death	3 (4.0)	10 (2.8)	0.48
TLR	5 (6.7)	5 (1.4)	0.02
TLR-MACE	9 (12.0)	18 (5.0)	0.03

Mishra S et al, ACC 2006



Full metal jacket with SES

MATIRX Registry

Stented segment length (mm)	≤35 (n=478)	36-70 (n=352)	>70 (n=145)	<i>p</i>
Overlapping stents	4.9%	22.3%	34.1%	<0.0001
Procedural success	97.5%	94.9%	86.9%	<0.0001
In-hospital events				
NQMI	0.4%	2.3%	6.9%	<0.0001
TVF*	0.4%	2.3%	7.6%	<0.0001
6-months events				
NQMI	1.2%	3.0%	10.2%	<0.0001
TVF*	4.0%	8.0%	16.7%	<0.0001

TVF*; death, MI, TVR

Mehran R et al, TCT 2006



Comparison between DESs

In the Era of Drug Eluting Stent

Clinical Outcomes at 6 Mo

Stented Segment \geq 60mm

	SES (n=69)	PES (n=52)	<i>p</i> value
6 month			
TVR-MACE (%)	9(19)	6(16)	0.76
TLR-MACE(%)	8(17)	5(14)	0.69
TVR(%)	6(13)	5(14)	1.00
Death(%)	3(6)	1(3)	0.63
Late thrombosis	0	0	-

Mishra et al, AHA 2005



Long DES-I Registry Study

From March 2003 - to February 2004

De-novo Lesions

($\geq 24\text{mm}$)

637 patients, 739 lesions

CYPHER

($\geq 28\text{mm}$)

294 patients

344 lesions

TAXUS

($\geq 28\text{mm}$)

166 patients

194 lesions

Bare Metal

($\geq 28\text{mm}$)

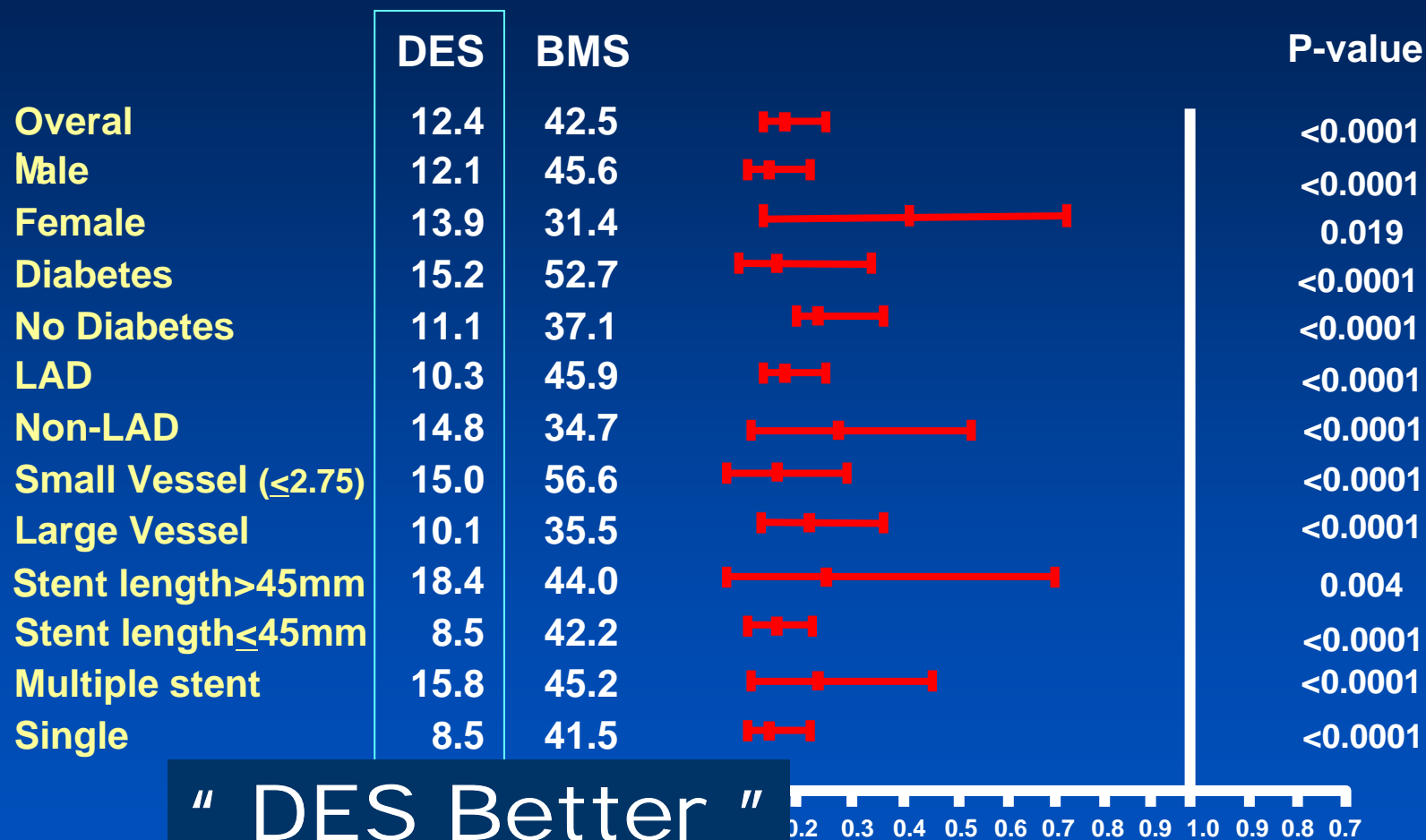
177 patients

201 lesions

Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

DES vs. BMS

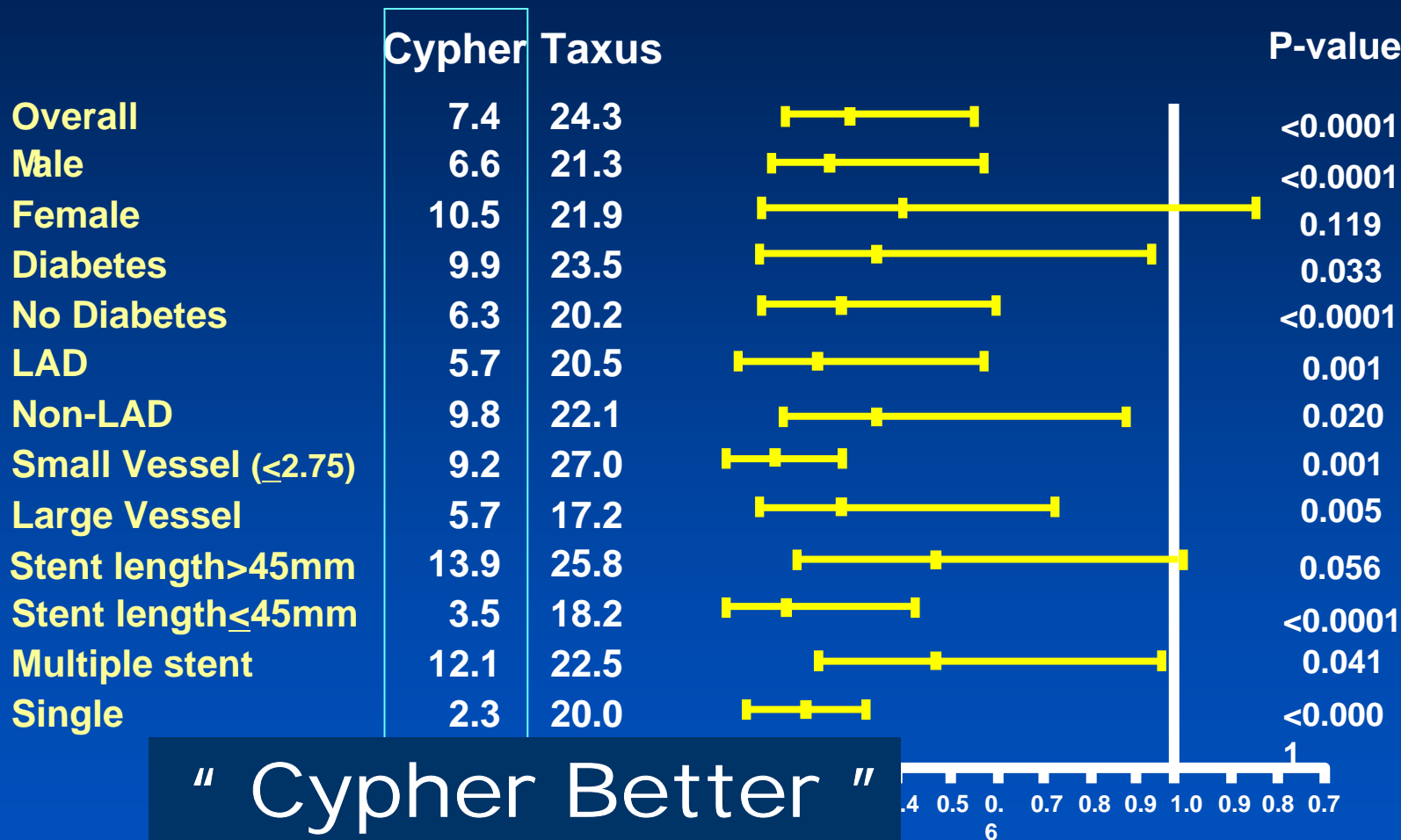
Angiographic Restenosis



Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Cypher vs. Taxus

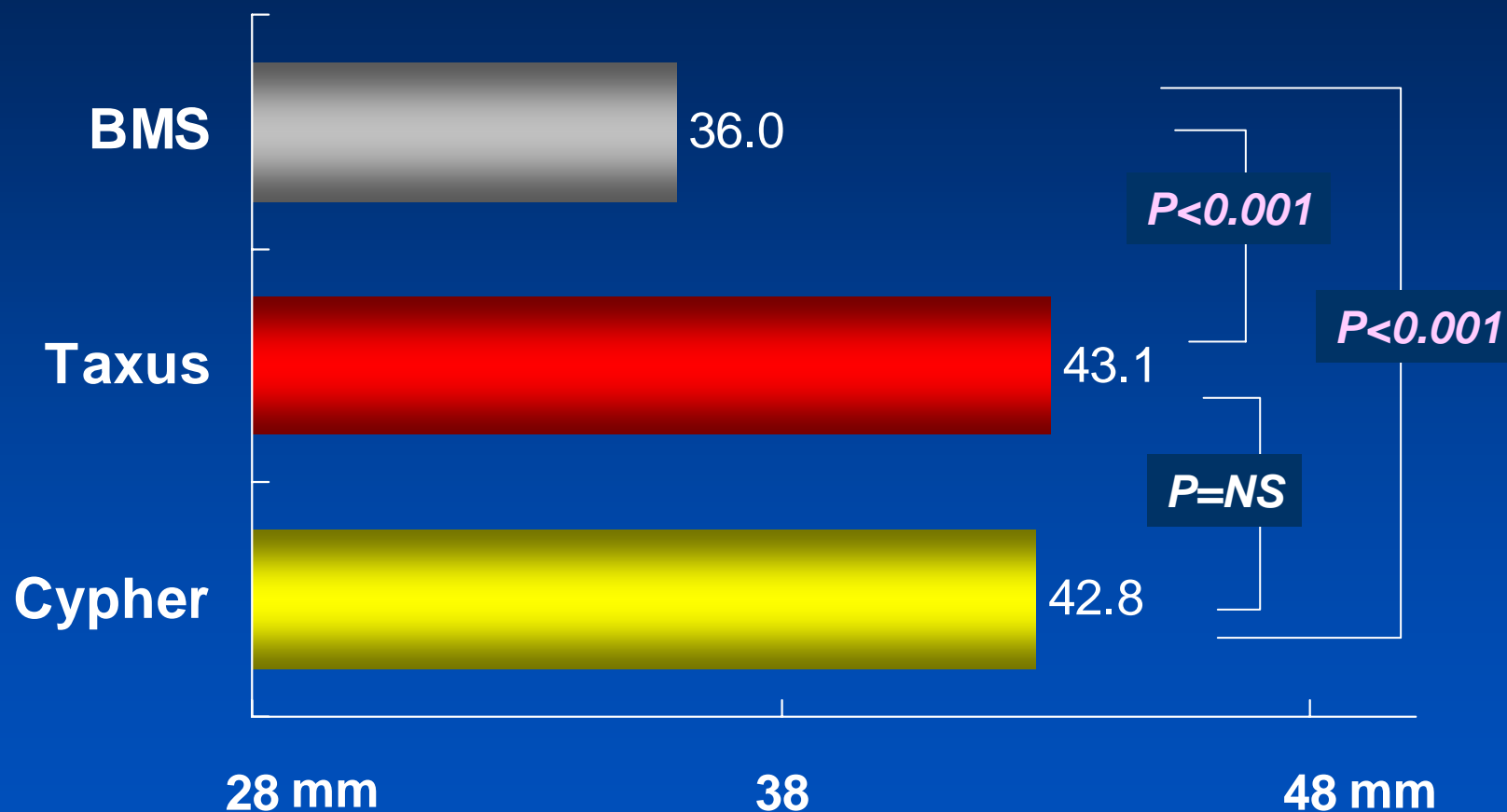
Angiographic Restenosis



Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Total Stent Length Treated

Long DES-I Registry



Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Procedural Characteristics

Long DES-I Registry

	Cypher (n=337)	Taxus (n=194)	Control (n=201)
Used stents	1.65±0.71 #	1.63±0.70 **	1.28±0.49
Overlapping	179 (53%) #	100 (52%) **	52 (26%)
Maximal pressure, atm	16.0±3.6 * #	13.2±3.9 **	12.0±3.3
Maximal device diameter, mm	3.35±0.37 *	3.40±0.41	3.47±0.52
IVUS guidance	266 (79%) #	144 (74%) **	96 (48%)

Between groups: * p<0.025 Cypher vs Taxus; # p<0.025 Cypher vs BMS; **, p<0.025 Taxus vs. BMS

Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

In-Hospital Outcomes

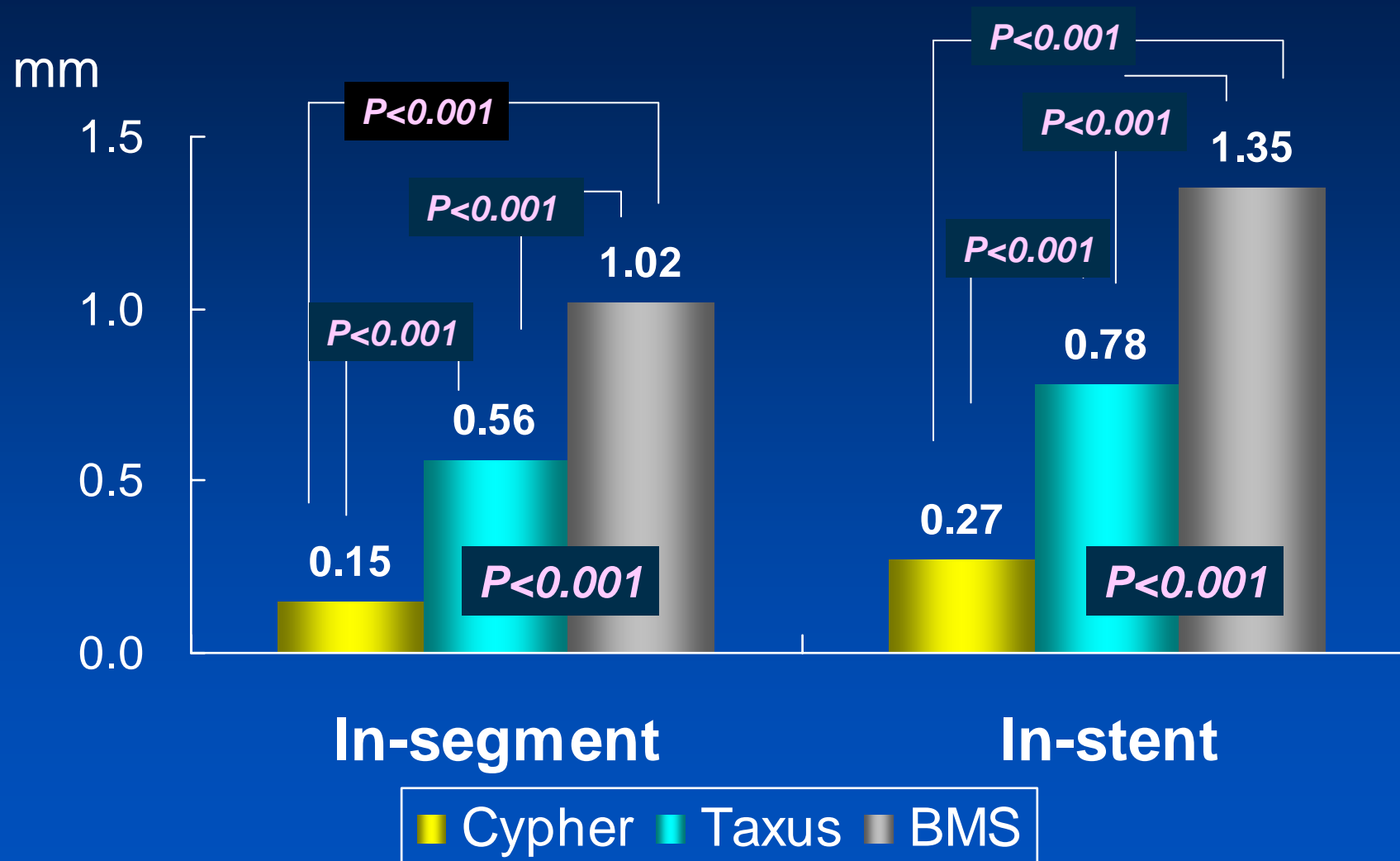
Long DES-I Registry

	Cypher (n=294)	Taxus (n=166)	Control (n=177)	p value
Angiographic Success (%)	329 (98)	191 (99)	193 (96)	0.296
Death	0 (0)	0 (0)	1 (0.6)	0.422
MI Q wave	0 (0)	0 (0)	1 (0.6)	0.272
Non-Q wave	26 (8.8)	16 (9.6)	14 (7.9)	0.852
Stent thrombosis	0 (0)	0 (0)	1 (0.6)	0.272
TLR	0 (0)	0 (0)	1 (0.6)	0.272
MACE	26 (8.8)	16 (9.6)	15 (8.5)	0.928

Between groups: * p<0.025 Cypher vs Taxus; # p<0.025 Cypher vs BMS; **, p<0.025 Taxus vs. BMS

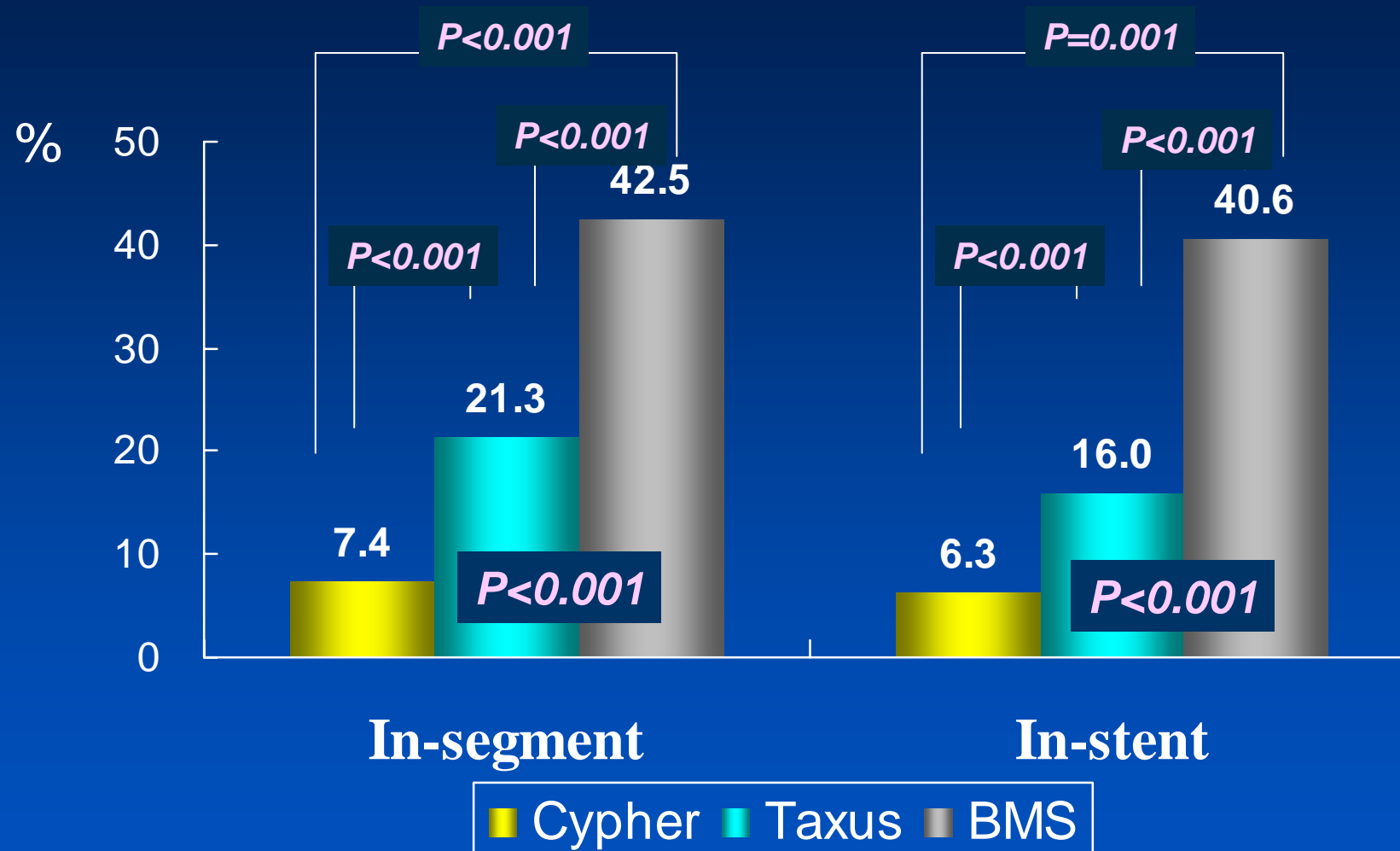
Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Late Loss in Long DES-I



Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Restenosis in Long DES-I



Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Predictors of Restenosis

Overall Group

Variables	Relative Risk	95% C.I.	<i>p</i>
Bare metal stent	8.01	4.90-13.11	<0.001
Lesion length (10mm)	1.29	1.10-1.51	0.002
MLD after procedure (mm)	0.32	0.19-0.53	<0.001

Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Predictors of Restenosis

DES subgroup

Variables	Relative Risk	95% C.I.	<i>p</i> value
Taxus stent	3.65	1.96-6.79	<0.001
Lesion length (10mm)	1.31	1.08-1.60	0.006
MLD after procedure (mm)	0.29	0.13-0.61	0.001

Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Predictors of Restenosis

Cypher or Taxus subgroup

		R.R	95% C.I.
Cypher	Multiples stent	5.62	1.60-19.68
	MLD after procedure (mm)	0.19	0.05-0.57
Taxus	Lesion length(10mm)	1.36	1.02-1.82
	MLD after procedure (mm)	0.31	0.15-0.64
BMS	Diabetes mellitus	2.00	1.01-3.98

Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Nine- Months Outcomes

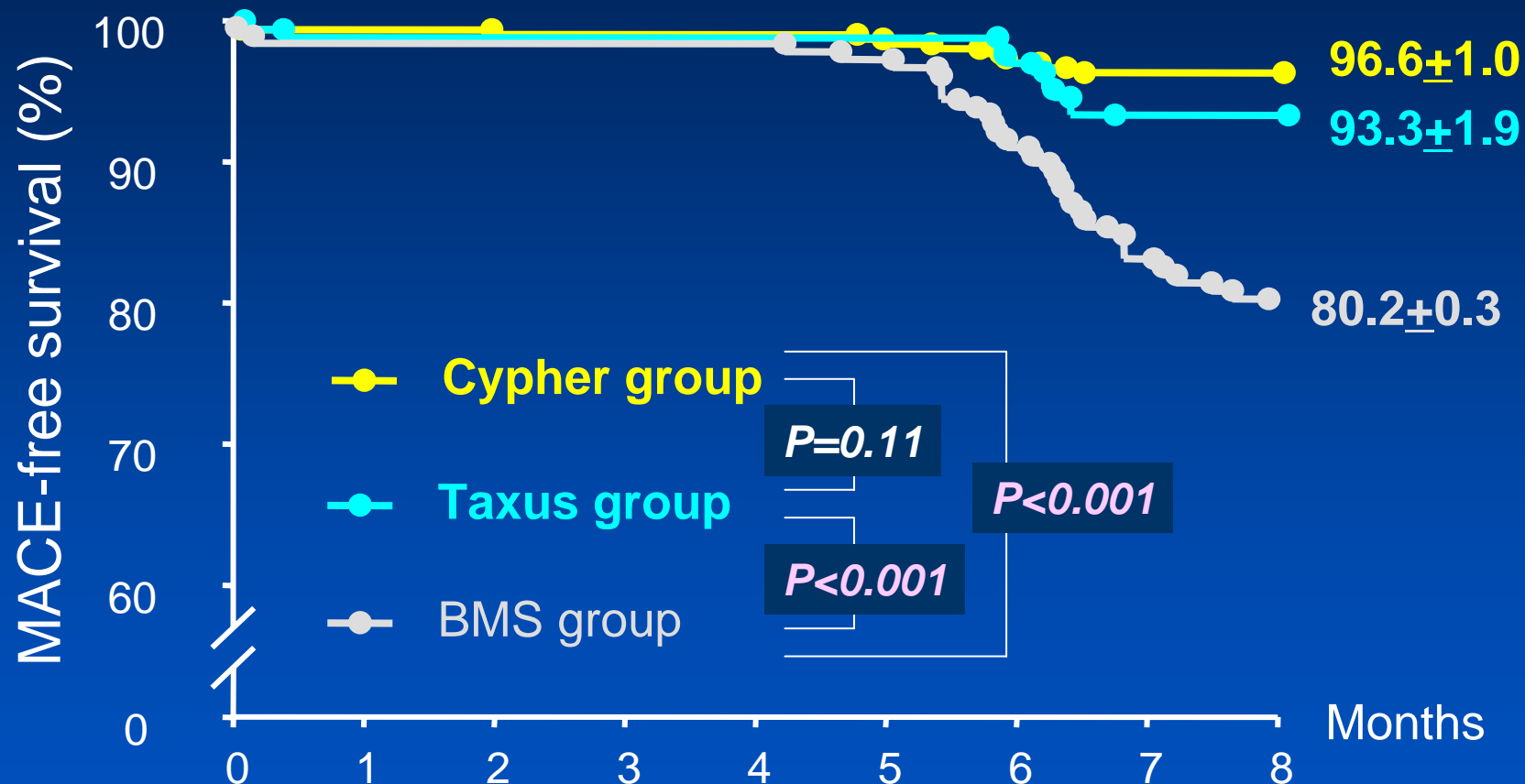
	Cypher (n=294)	Taxus (n=166)	Control (n=177)
Death	2 (0.7)	1 (0.6)	1 (0.6)
MI Q-wave	0 (0)	0 (0)	1 (0.6)
Non-Q wave	0 (0)	0 (0)	0 (0)
Stent thrombosis	0 (0)	0 (0)	1 (0.6)
TLR	8 (2.7) #	10 (6.0) **	34 (19.2)
Repeat PCI	7	7	32
CABG	1	2	2
MACE	10 (3.4) #	11 (6.6) **	35 (19.8)

Between groups: * p<0.025 Cypher vs Taxus; # p<0.025 Cypher vs BMS; **, p<0.025 Taxus vs. BMS

Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

MACE-free Survival

Long DES-I Registry

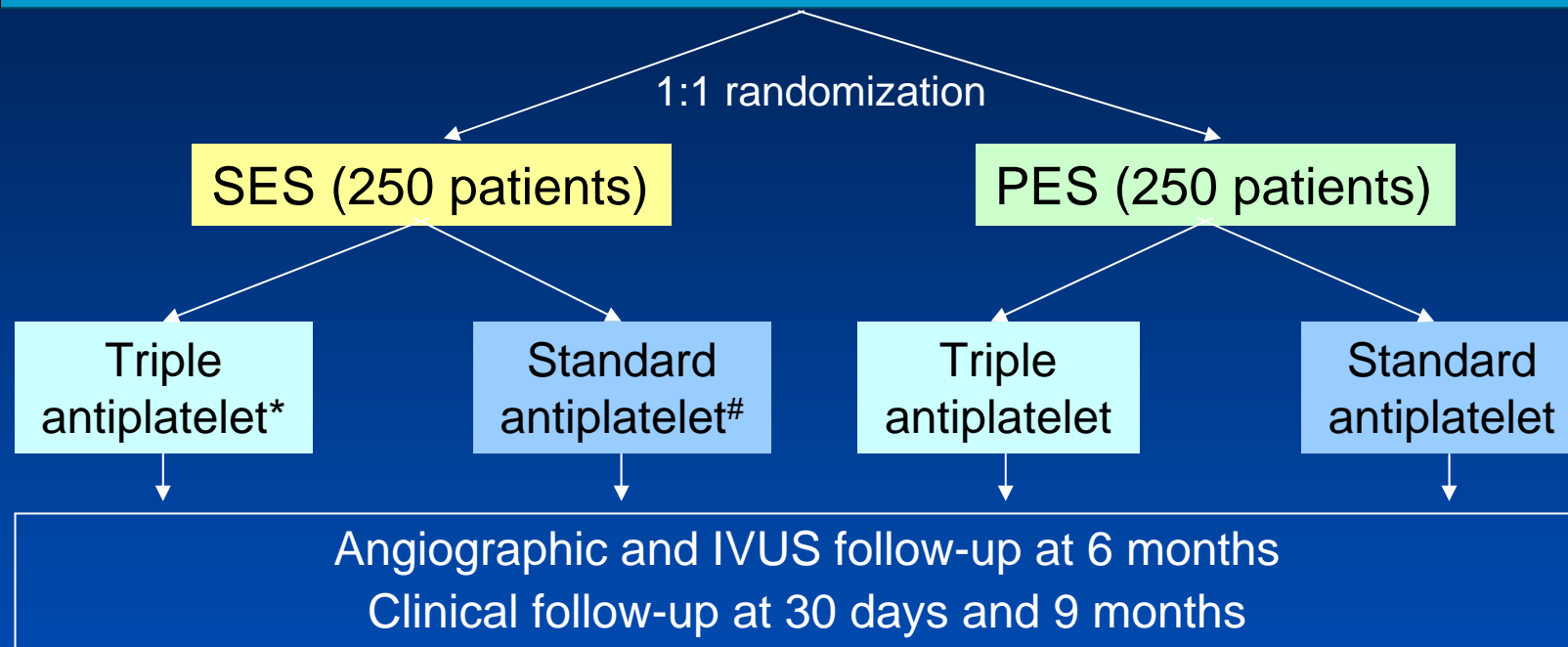


Kim YH et al, Catheter Cardiovasc Interv 2006;67:181-7

Long-DES-II Study

AMC

Long coronary lesions (>25mm) requiring single or multiple DES
(planned total stent length \geq 32mm)



* Triple antiplatelet : aspirin plus clopidogrel plus cilostazol for 6 months

Standard antiplatelet : aspirin plus clopidogrel for 6 months

Primary endpoint:

1. Comparison of SES or PES: binary in-segment restenosis at 6 months
2. Comparison of triple and standard antiplatelet: in-stent late loss at 6 months

Kim YH et al, Circulation 2006;114:2148-53



QCA before Procedure

Long DES-II

	SES (n=250)	PES (n=250)	<i>p</i> <i>value</i>
Reference vessel, mm	2.84±0.48	2.82±0.46	0.711
Lesion length, mm	33.9 ±11.6	34.5 ±12.6	0.527
MLD, mm	0.70±0.50	0.70±0.46	0.999
Diameter stenosis, %	73.5±16.8	73.5±15.7	0.953

Kim YH et al, Circulation 2006;114:2148-53

Procedural Findings

Long DES-II

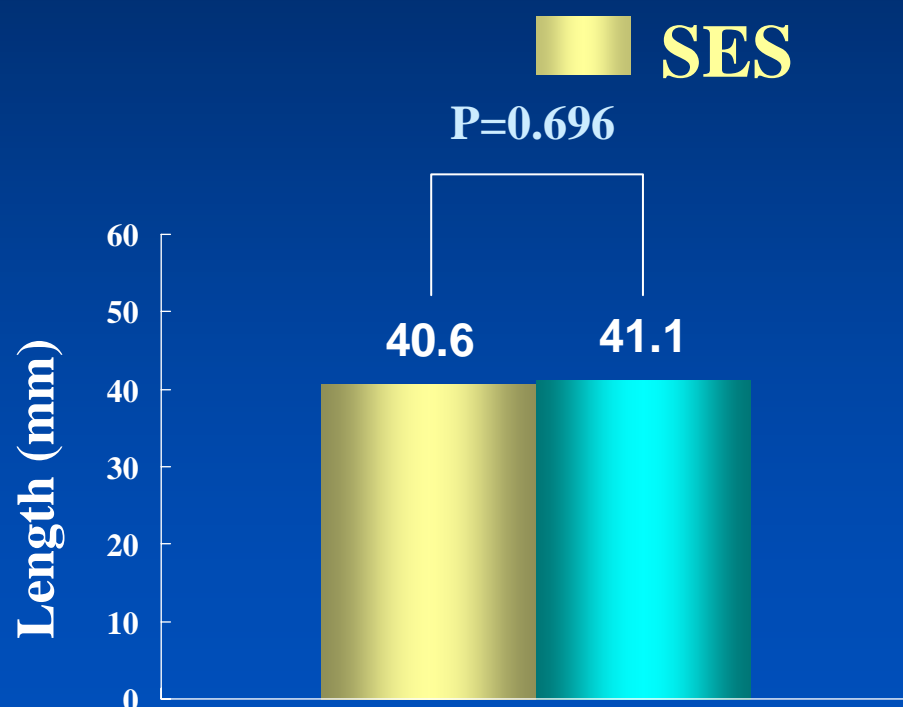
	SES (n=250)	PES (n=250)	<i>p</i> <i>value</i>
Procedural success *	99.2%	99.2%	1.000
Maximal device diameter, mm	3.48±0.41	3.50±0.40	0.357
Maximal pressure, atm	15.9±3.4	14.9±3.7	0.013
Use of <u>IVUS</u>	105(42.0)	99(39.6)	0.585
Use of GP IIb/IIIa inhibitor	2(0.8)	6(2.4)	0.177

* Procedural success was defined as post-procedural DS in analysis segment <30% without death, Q-MI, or emergent revascularization during hospitalization

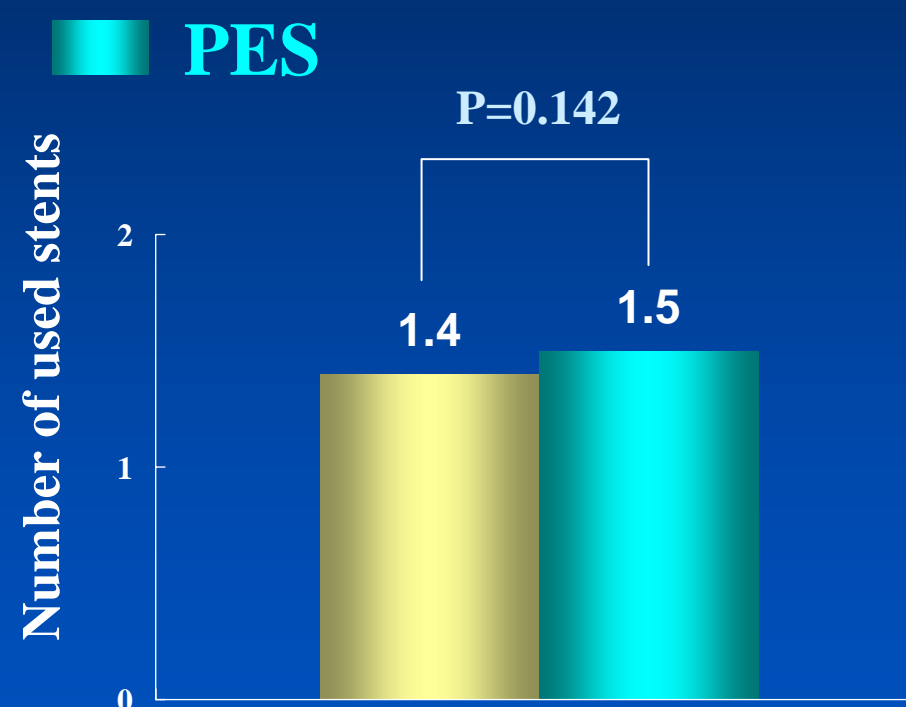
Kim YH et al, Circulation 2006;114:2148-53

Length & No. of Used DESs

Length of stented segment



No. of stents per lesion



Kim YH et al, Circulation 2006;114:2148-53

QCA after Procedure

	SES (n=250)	PES (n=250)	<i>p</i> <i>value</i>
Reference vessel (mm)	2.84±0.48	2.82±0.46	0.711
MLD (mm)			
In-stent	2.35±0.49	2.50±0.37	0.504
In-segment	2.16±0.46	2.18±0.46	0.616
Acute gain (mm)			
In-stent	1.78±0.55	1.80±0.54	0.662
In-segment	1.46±0.61	1.48±0.60	0.701
Diameter stenosis (%)			
In-stent	6.4±16.1	5.7±16.3	0.652
In-segment	16.7±11.6	15.9±11.8	0.450

Kim YH et al, Circulation 2006;114:2148-53

One-Month Clinical Outcomes

	SES (n=250)	PES (n=250)
Death	0	0
Myocardial infarction	21(8.4%)	27(10.8%)
Non-Q MI	21(8.4%)	27(10.8%)
Q-MI	0	0
TLR	1(0.4%)	0
TVR	1(0.4%)	0
Stent thrombosis	1(0.4%)	0
MACE	21(8.4%)	27

Kim YH et al, Circulation 2006;114:2148-53

QCA at Follow-up

Long DES-II

	SES (n=210)	PES (n=205)	<i>p</i> <i>value</i>
Reference vessel (mm)	2.79±0.48	2.74±0.55	0.339
MLD (mm)			
In-stent	2.39±0.46	2.04±0.65	<0.001
In-segment	2.17±0.50	1.92±0.53	<0.001
Diameter stenosis (%)			
In-stent	13.0±17.8	23.6±20.7	<0.001
In-segment	21.3±14.5	30.0±16.0	<0.001

Kim YH et al, Circulation 2006;114:2148-53

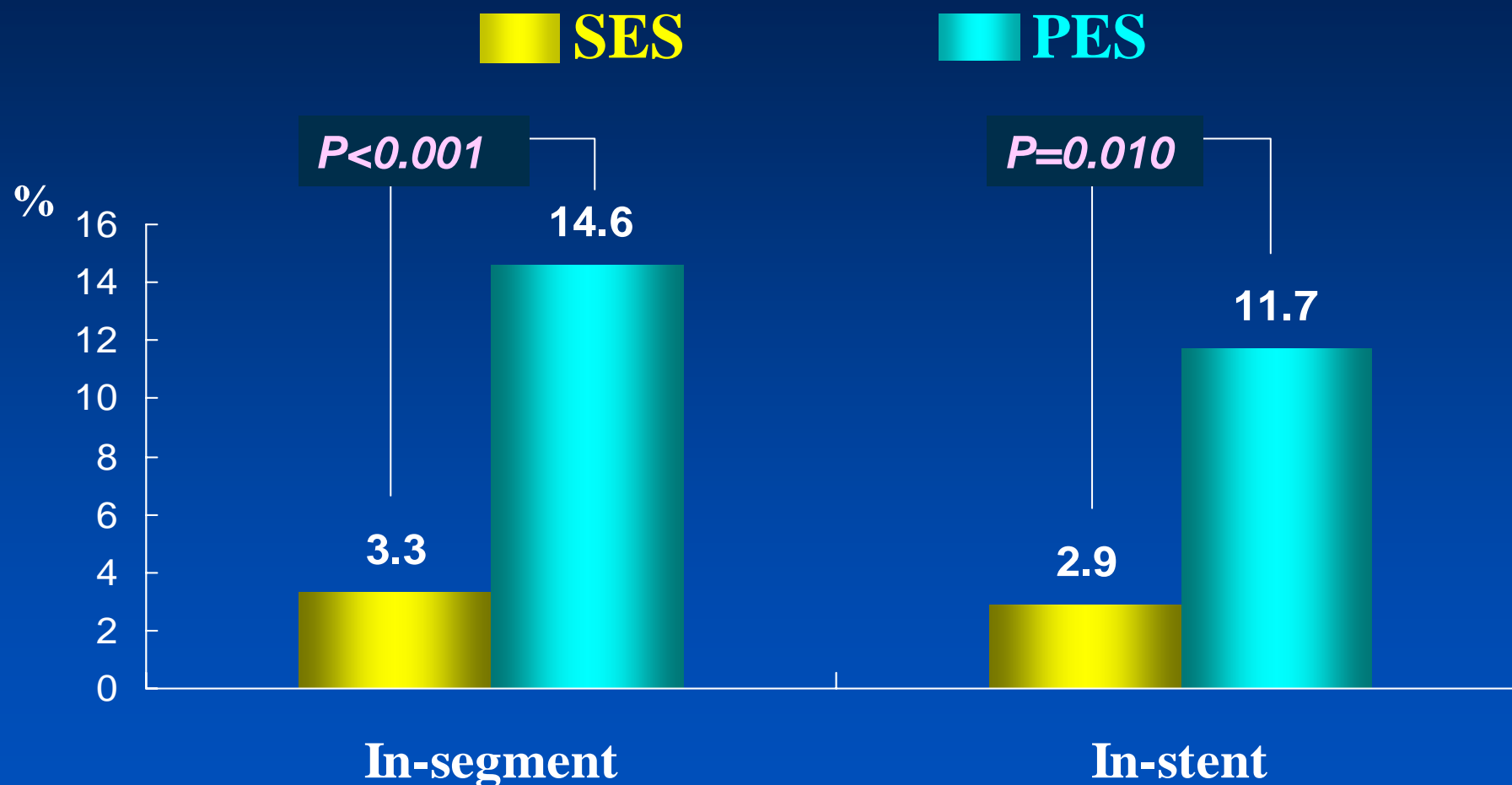
QCA at Follow-up

Long DES-II

	SES (n=210)	PES (n=205)	<i>p</i> <i>value</i>
Late loss (mm)			
In-stent	0.09±0.37	0.45±0.55	<0.001
In-segment	0.24±0.38	0.61±0.54	<0.001
Loss index			
In-stent	0.05±0.22	0.25±0.35	<0.001
In-segment	0.17±0.36	0.49±0.69	<0.001

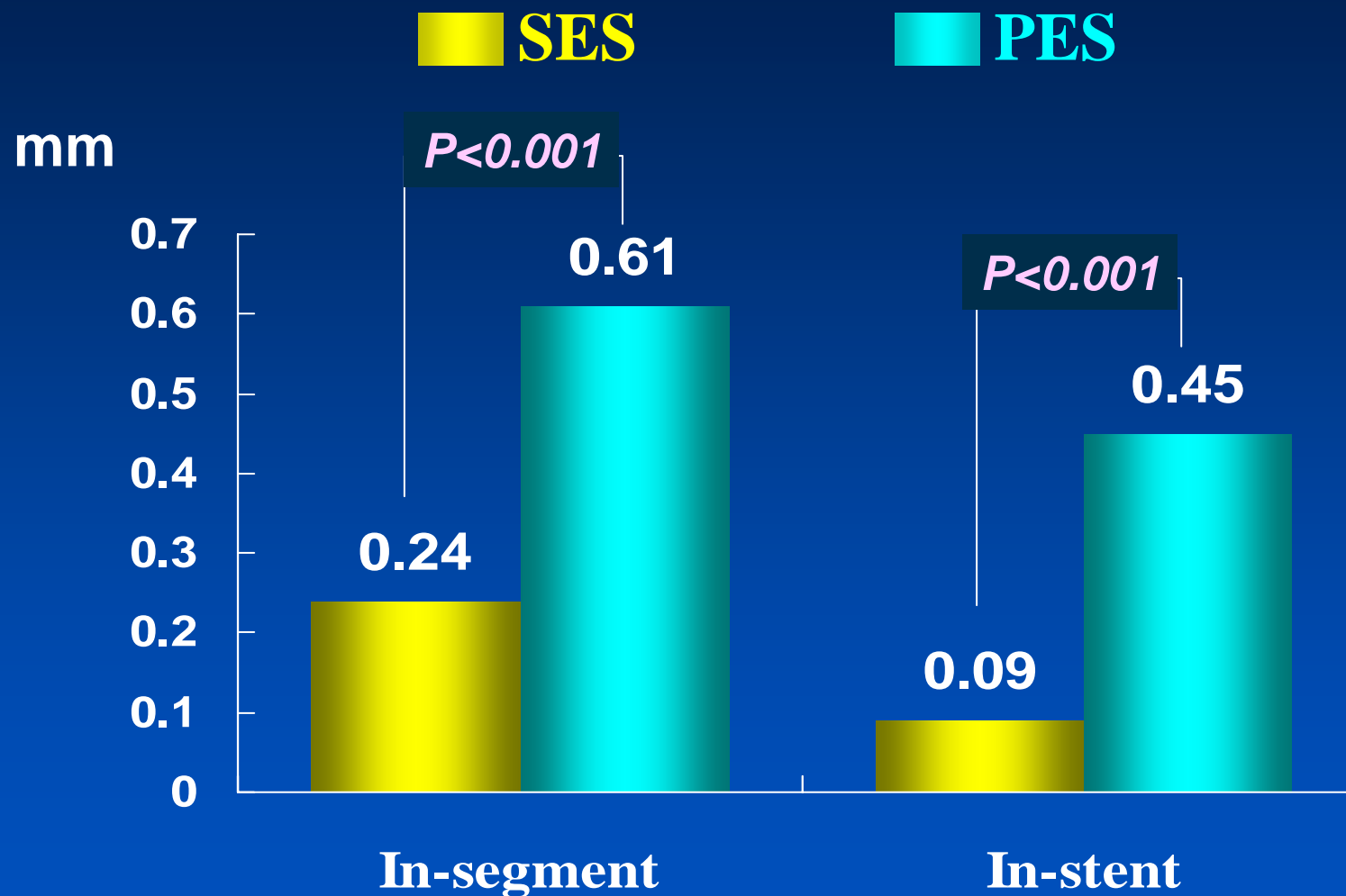
Kim YH et al, Circulation 2006;114:2148-53

Restenosis rate



Kim YH et al, Circulation 2006;114:2148-53

Late loss



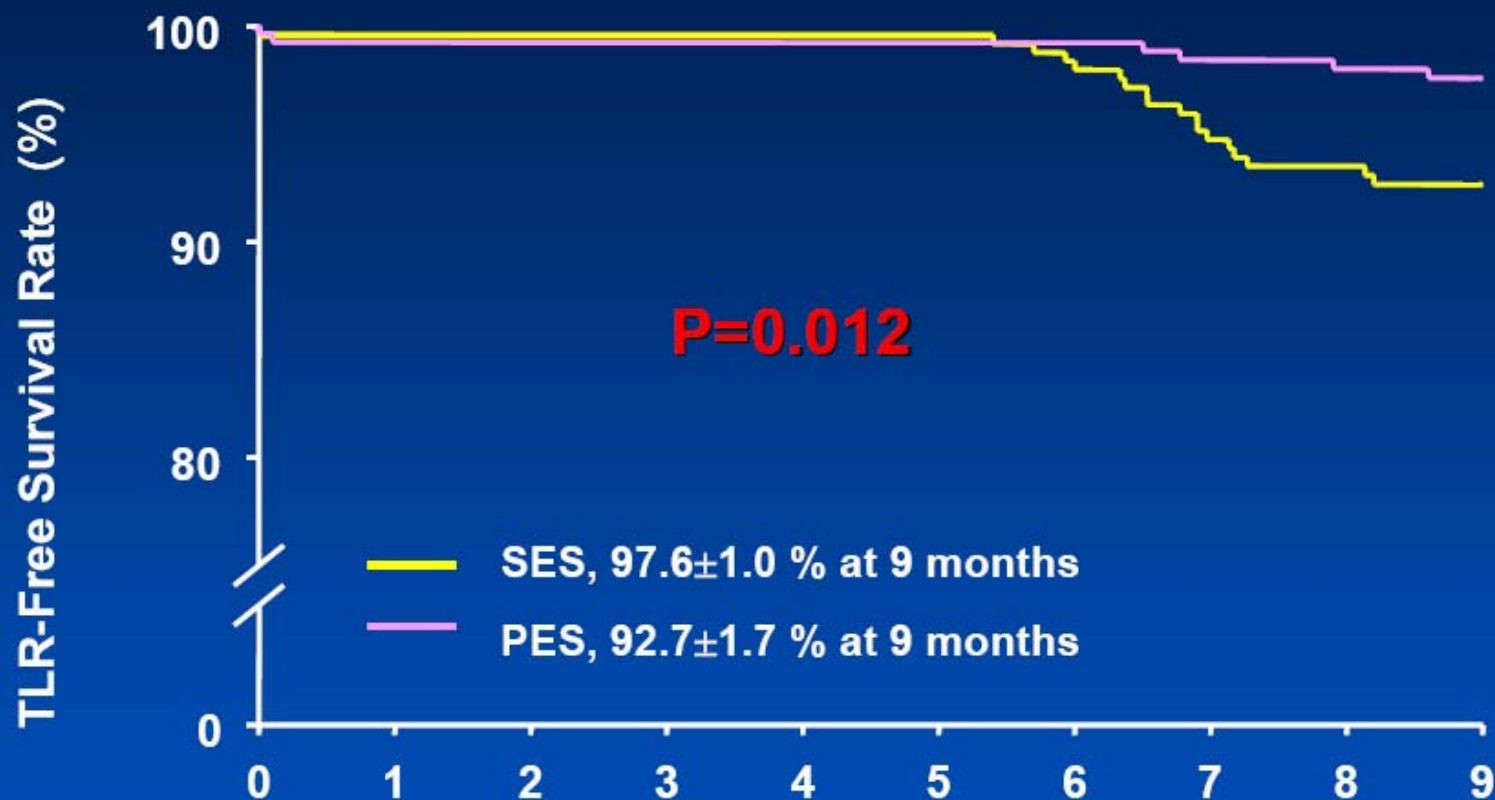
Kim YH et al, Circulation 2006;114:2148-53

Nine- months Clinical Outcomes

	SES (n=249)	PES (n=245)	<i>p</i> <i>value</i>
Death	2(0.8%)	0	0.499
Myocardial infarction	22(8.8%)	27(10.8%)	0.452
Non-Q MI	21(8.4%)	27(10.8%)	0.362
Q-MI	1(0.4%)	0	1.000
TLR	6(2.4%)	18(7.2%)	0.012
TVR	8(3.2%)	19(7.6%)	0.030
Stent thrombosis	2(0.8%)	0	0.499
MACE	28(11.2%)	42(16.8%)	0.071

Kim YH et al, Circulation 2006;114:2148-53

TLR-Free Survival Curves



No. at Risk	Months of Follow-up									
	0	1	2	3	4	5	6	7	8	9
SES	250	249	249	247	247	247	247	244	243	241
PES	250	250	250	250	250	250	246	236	232	227

Kim YH et al, Circulation 2006;114:2148-53

SES vs TES

CORPAL-II Study

Follow up at 6 months

	SES (n=56)	TES (n=52)
MLD post procedure (mm)	2.58±0.35	2.53±0.43
Late loss (mm)	0.6±0.9	1.1±0.8
Neointimal area at 6 mo (mm ²)	0.9±1.3	3.2±1.5
TLR	1(1.7%)	6(12%)
In-hospital death	0	0

TES; tacrolimus eluting stent

Delgado A et al, AHA 2006



Very Long Lesions($\geq 40\text{mm}$) Multicenter Registry in Asia

	SES	PES	ZES	TES
Patients (No.)	368	288	83	49
Patients/Lesions (No.)	408	322	90	53
Lesion length (mm)	47.8	46.3	42.9	45.5
Stent length (mm)	57.9	59.9	54.8	52.9
Proximal reference diameter (mm)	2.88	2.80	2.78	2.83

ZES; zotarolimus eluting stent, TES; tacrolimus eluting stent

Nakamura S et al, TCT 2006, AHA 2006



Follow-up Outcomes

Very Long Lesions ($\geq 40\text{mm}$)

	SES	PES	ZES*	TES*
MLD post procedure, mm	2.60	2.52	2.55	2.60
MLD at 9 months, mm	2.51	2.19	1.98	2.10
Subacute thrombosis, %	0.3	0.7	1.2	0
Restenosis at 9 months, %	7.6*	9.0	19.3	12.2
TLR at 9 months, %	7.6*	9.0	14.5	10.2
In-hospital MACE, %	0.8	1.2	1.2	0

* $p < 0.05$ vs ZES, TES

Nakamura S et al, TCT 2006, AHA 2006



Impact of Lesion Length

In the Era of Drug Eluting Stent

Multivariate Predictors of In-Segment Restenosis after SES

RESEARCH Registry

	OR	95% CI	<i>p value</i>
ISR	4.16	1.63-11.01	<0.01
Ostial lesion	4.84	1.81-12.07	<0.01
DM	2.63	1.14-6.31	0.02
Stent length	1.42	1.21-1.68	<0.01
Reference diameter	0.46	0.24-0.87	0.03
LAD	0.30	0.10-0.69	<0.01

Lemos PA et al. Circulation 2004;109:1366-1370

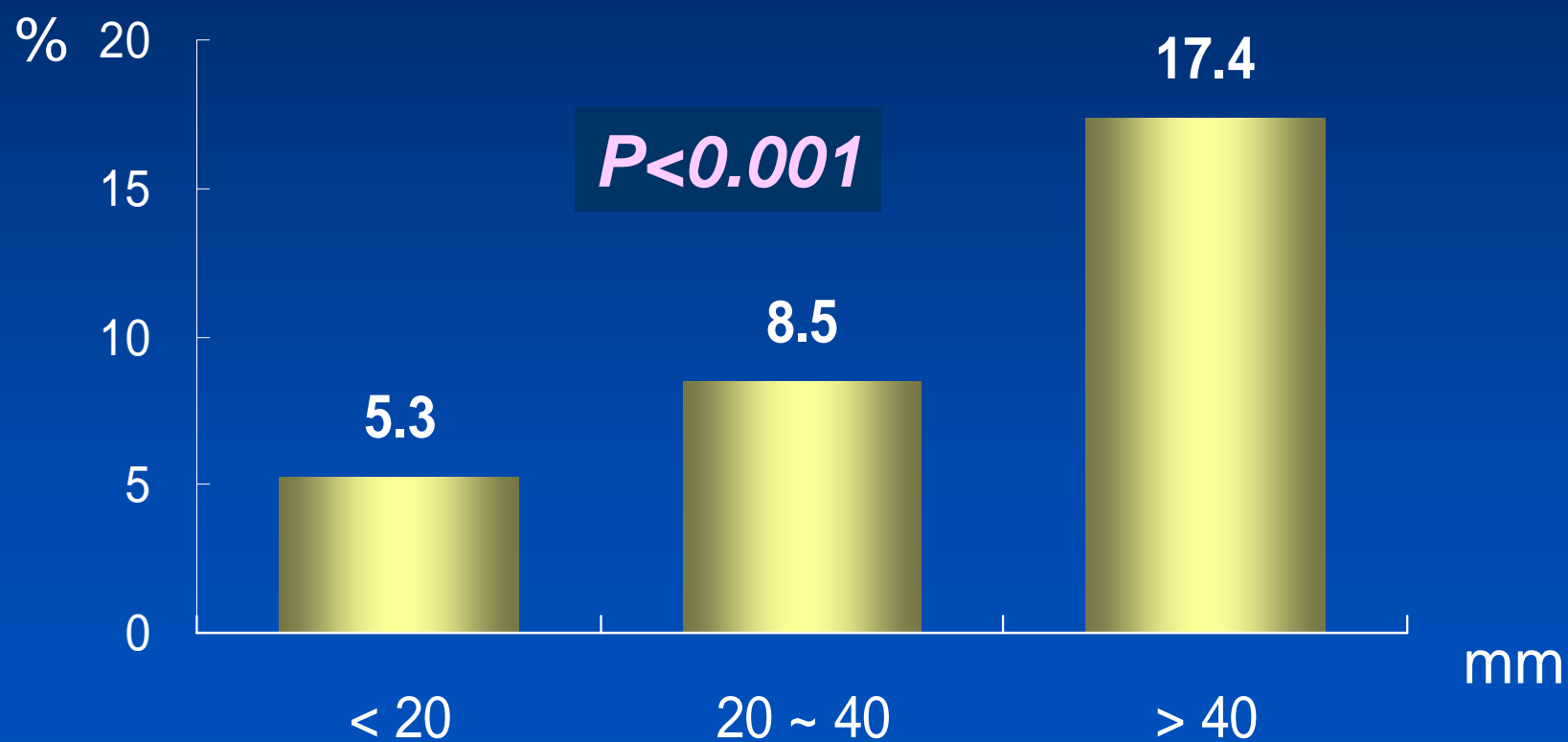


Multivariate Predictors of In-Segment Restenosis after DES

	OR	95% CI	<i>p value</i>
Lesion length, mm	1.023	1.010-1.035	<0.001
Post-intervention MLD, mm	0.319	0.202-0.503	<0.001
Use of TAXUS stent	4.637	2.899-6.579	<0.001

Lee CW et al. Am J Cardiol 2006;97:506-511

Restenosis Rate According to Lesion Length



Lee CW et al. Am J Cardiol 2006;97:506-511

Influence of diffuse disease on ISR

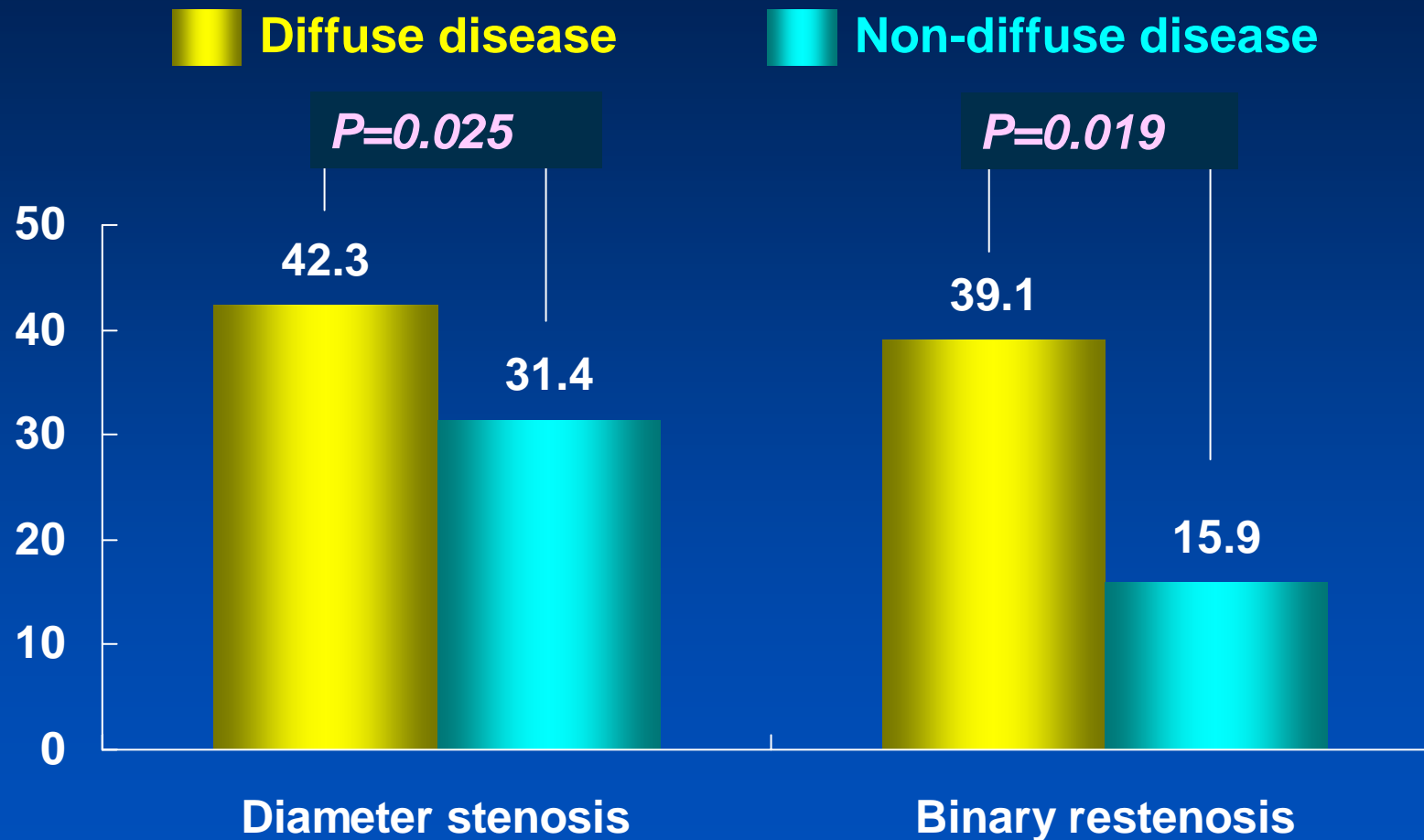
	Diffuse (n=46)	Non diffuse (n=44)	<i>p</i> <i>value</i>
Pre intervention			
DS (%)	66.0±13.3	69.5±13.4	NS
FFR	0.62±0.18	0.69±0.21	NS
Post intervention			
FFR distal in artery	0.87±0.11	0.97±0.05	<0001
FFR distal to stent	0.95±0.07	0.97±0.06	NS
FFR proximal to stent	0.98±0.06	0.98±0.05	NS
FFR ostium	1.00±0.04	0.99±0.04	NS

FFR ; fractinal flow reserve

Jensen LO et al, ESC 2006



Follow up at 9 months

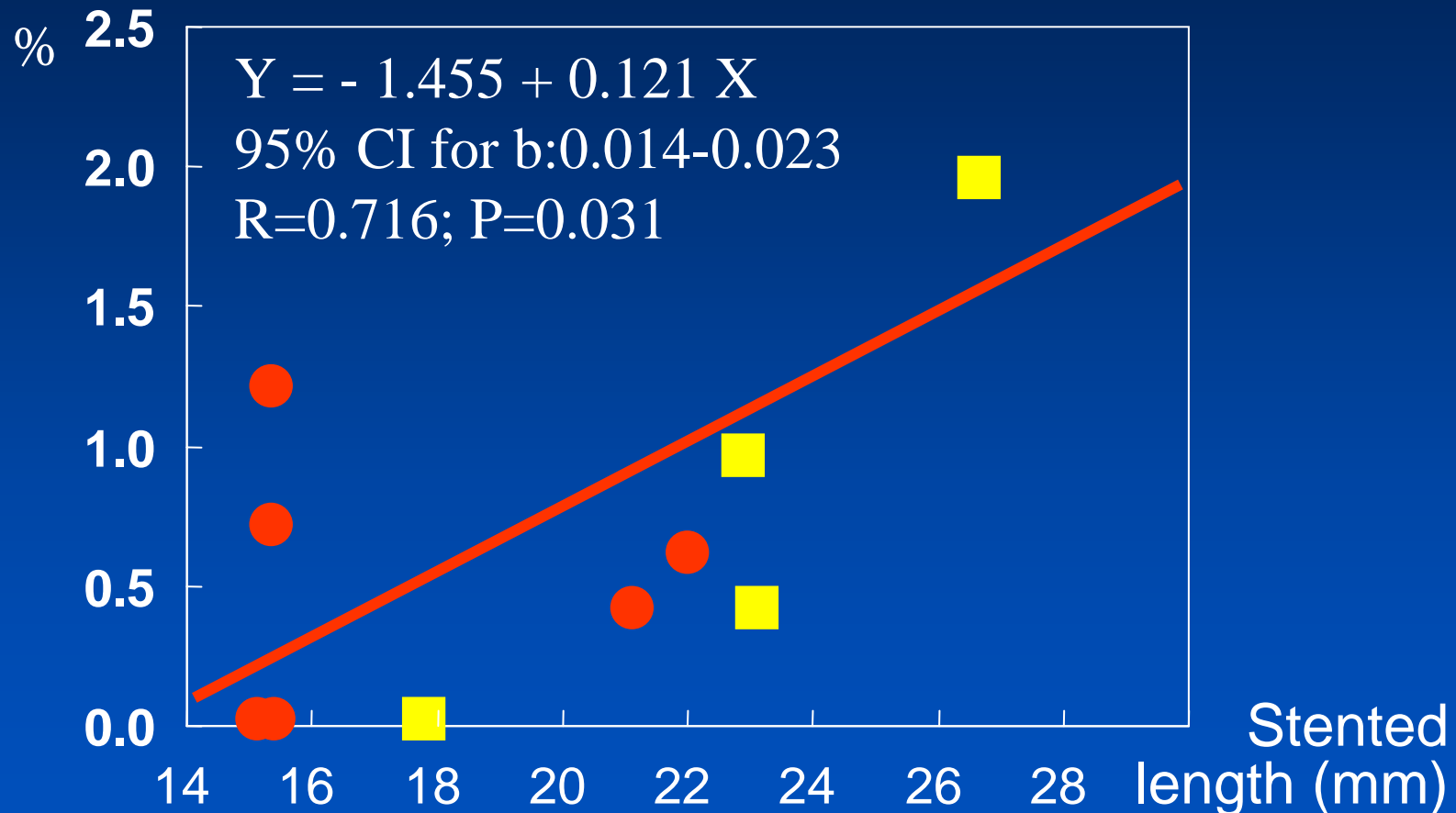


Jensen LO et al, ESC 2006



Stented Length and Thrombosis

Stent thrombosis rate by meta-analysis



Moreno R et al. J Am Coll Cardiol 2005;45:954

Predictors of Subacute Stent Thrombosis

Analysis of 2229 pts treated with DES

Variables	Hazard Ratio (95% CI)	<i>p</i> value
Premature antiplatelet discontinuation	161.17 (26.03-997.94)	<0.001
Renal failure	5.96 (1.90-18.68)	<0.001
Bifurcation lesion	5.96 (1.90-18.68)	0.002
Diabetes	5.84 (1.74-19.56)	0.004
LVEF per 10% decrease	1.12 (1.06-1.19)	<0.001
Stent length/1mm increase	1.03 (1.00-1.05)	0.01

Iakovou I et al. JAMA 2005;293:2126



Predictors of TLR

One-year Outcome of j-Cypher Registry

Variables	OR	95% CI	<i>p value</i>
Elective 2 stents	5.41	2.44-11.0	<0.0001
Ostial RCA	4.75	2.46-9.18	<0.0001
Hemodialysis	2.96	1.45-6.06	0.0029
ISR	2.12	1.36-3.32	0.0009
DM	1.99	1.34-2.95	0.0006
Severe calcification	1.82	1.06-3.14	0.031
Total stented length,mm	1.02	1.01-1.03	<0.0001
Post % DS	1.02	1.01-1.04	0.0095
Pre MLD, mm	0.49	0.31-0.76	0.0018

Nakagawa Y et al, AHA 2006



Predictors of TLR

DES cover Registry

	Unadjusted HR (95% CI)	<i>p</i>	Adjusted HR (95% CI)	<i>p</i>
Stented length				
16-22 mm	0.96(0.66-1.4)	0.84	0.94(0.63-1.42)	0.77
23-32 mm	1.11(0.77-1.61)	0.59	1.13(0.75-1.69)	0.55
>32 mm	1.53(1.07-2.18)	0.02	1.45(0.97-2.17)	0.07
No. of Stents				
2	1.40(1.06-1.86)	0.02	1.36(1.00-1.84)	0.05
>3	1.87(1.26-2.78)	0.002	1.66(1.06-2.62)	0.03

Mulukutla SR et al, TCT 2006



Predictor of MACE after DES

Variables	OR	95% CI	<i>p</i>
DM	2.04	1.43-2.89	0.001
Renal failure requiring dialysis	17.8	1.79-177.14	0.014
Need for IABP	2.9	1.43-5.9	0.003
Total stent length per patients	1.00	1.00-1.01	0.001

Melzi G et al, TCT 2006

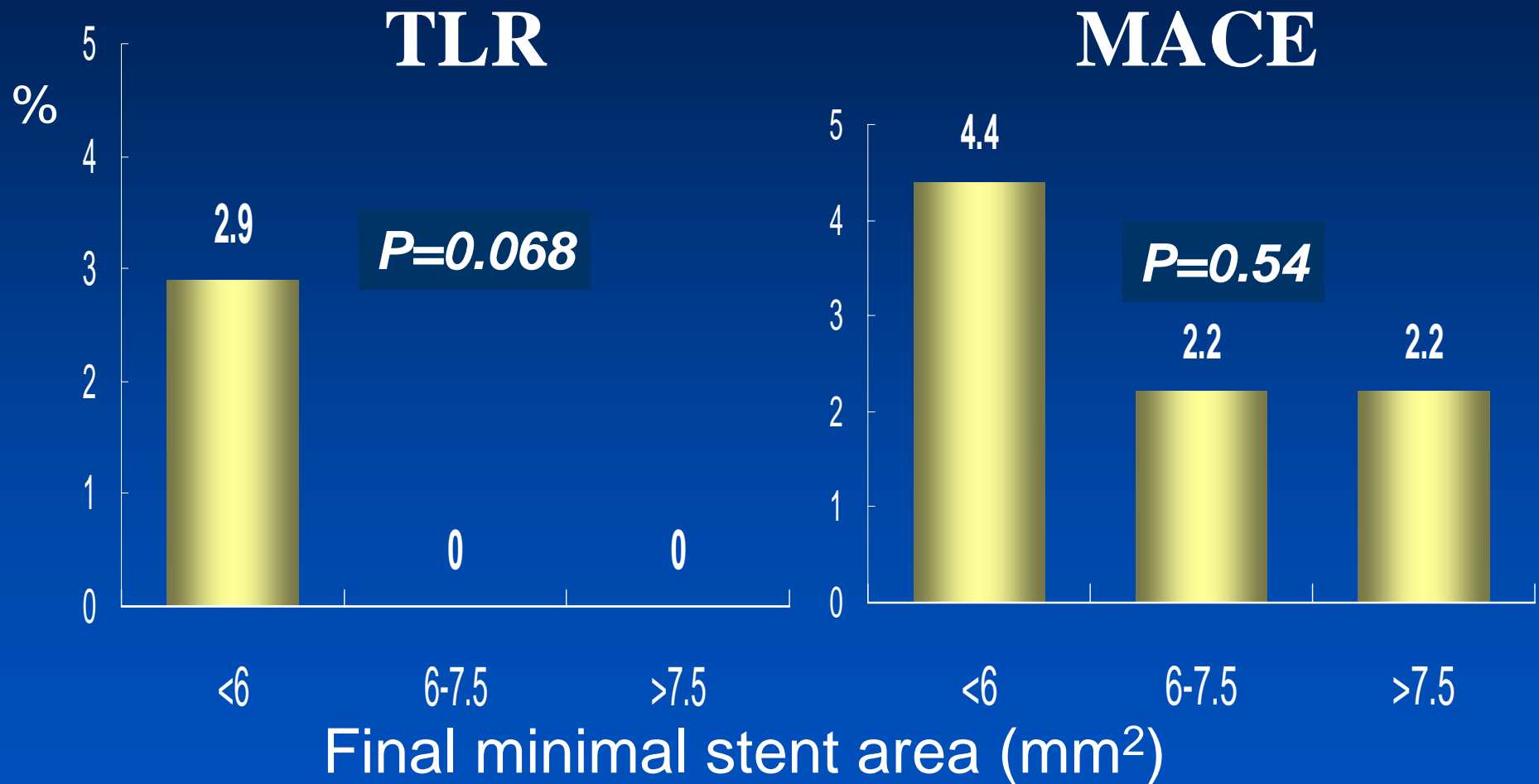


How to do ?

In the Era of Drug Eluting Stent



Optimal Stent Expansion

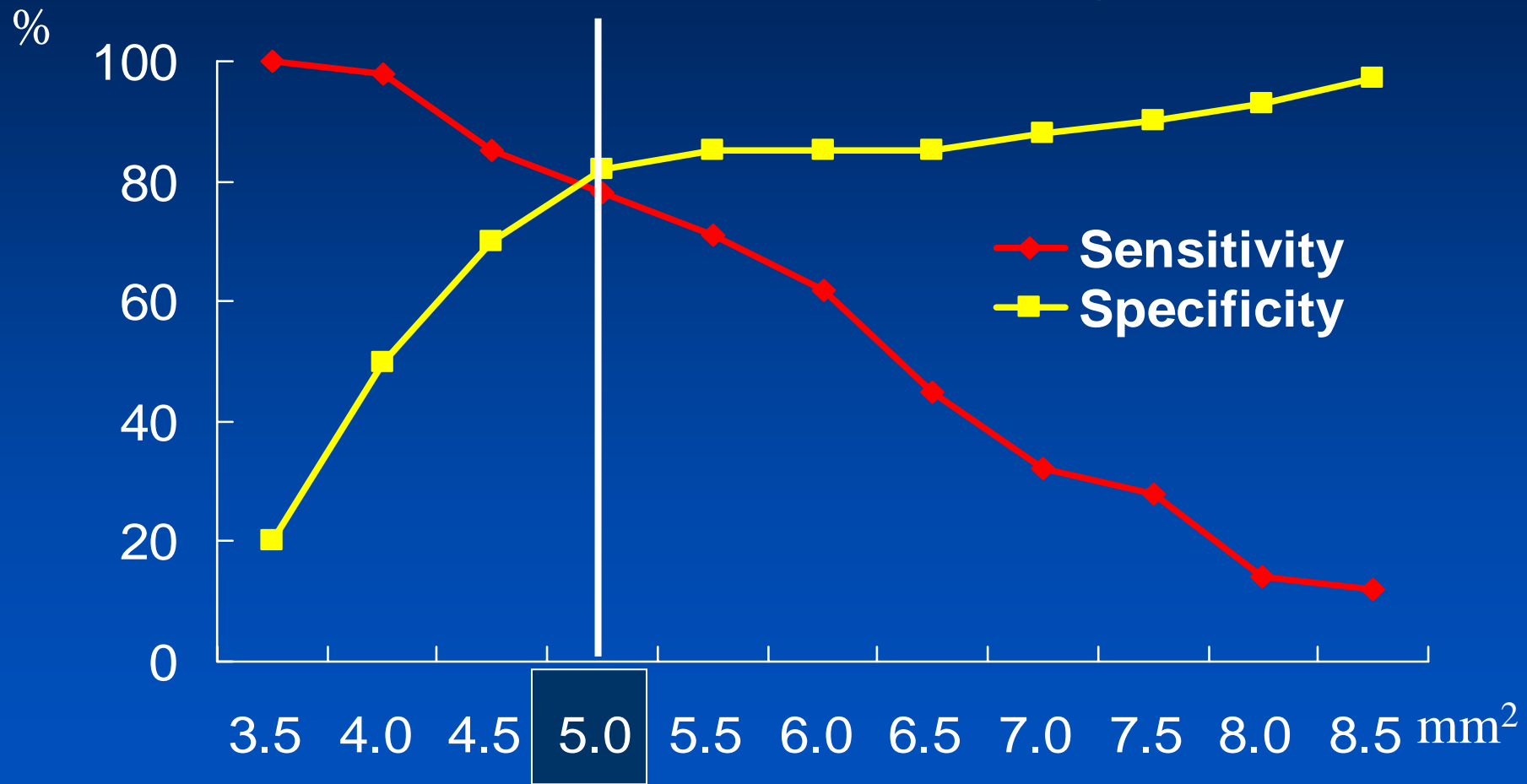


Cheneau E et al. Am J Cardiol 2005;95:1240



Final Stent Area for Prediction of F/U Stent Area

SES in SIRIUS Study

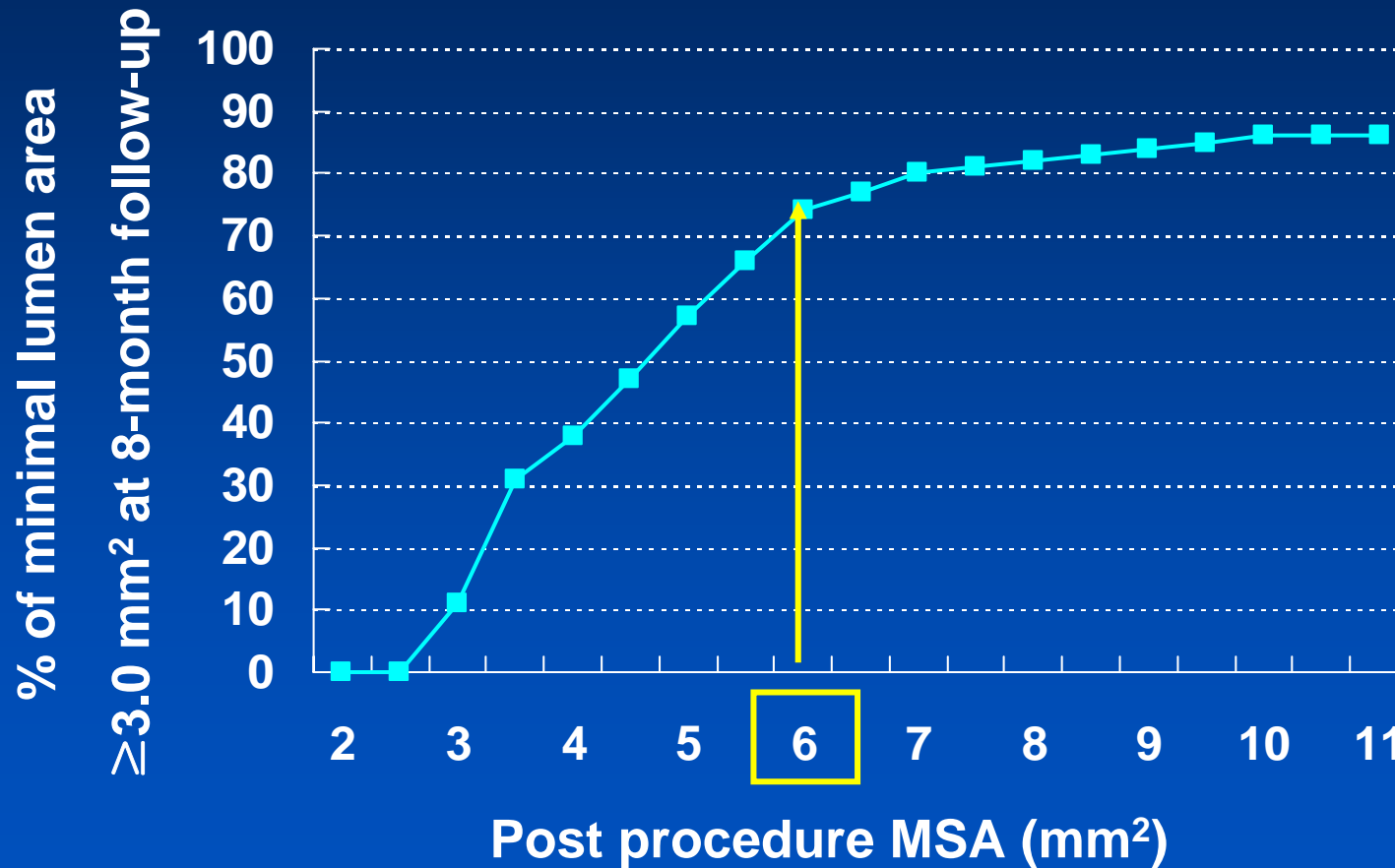


Sonoda S et al. J Am Coll Cardiol 2004;43:1959



Impact of final stent dimension on long-term stent patency

A Serial 3-D IVUS in ENDEAVOR study



Hur SH et al, ACC 2006



Importance of Full-lesion Coverage

SES in SIRIUS Study

	Edge Stenosis		<i>p</i> <i>value</i>
	Yes (n=6)	No (n=162)	
Reference area, mm ²	10.7±3.8	10.7±3.8	0.156
Reference plaque, mm ²	6.7±3.3	7.0±3.2	0.891
Reference minimum lumen area	4.7±2.3	6.4±2.3	0.0498
Edge stent area, mm ²	6.8±3.2	7.3±2.1	0.358
Max. reference plaque area, %	60.5±9.0	48.8±11.5	0.030
Step-up index	1.5±0.3	1.2±0.3	0.011
Edge tear or dissection	0	2 (1%)	1.000

Sakurai R et al. Am J Cardiol 2005;96:1251



Importance of Full-lesion Coverage

Long SES (28mm & 33mm) implantation

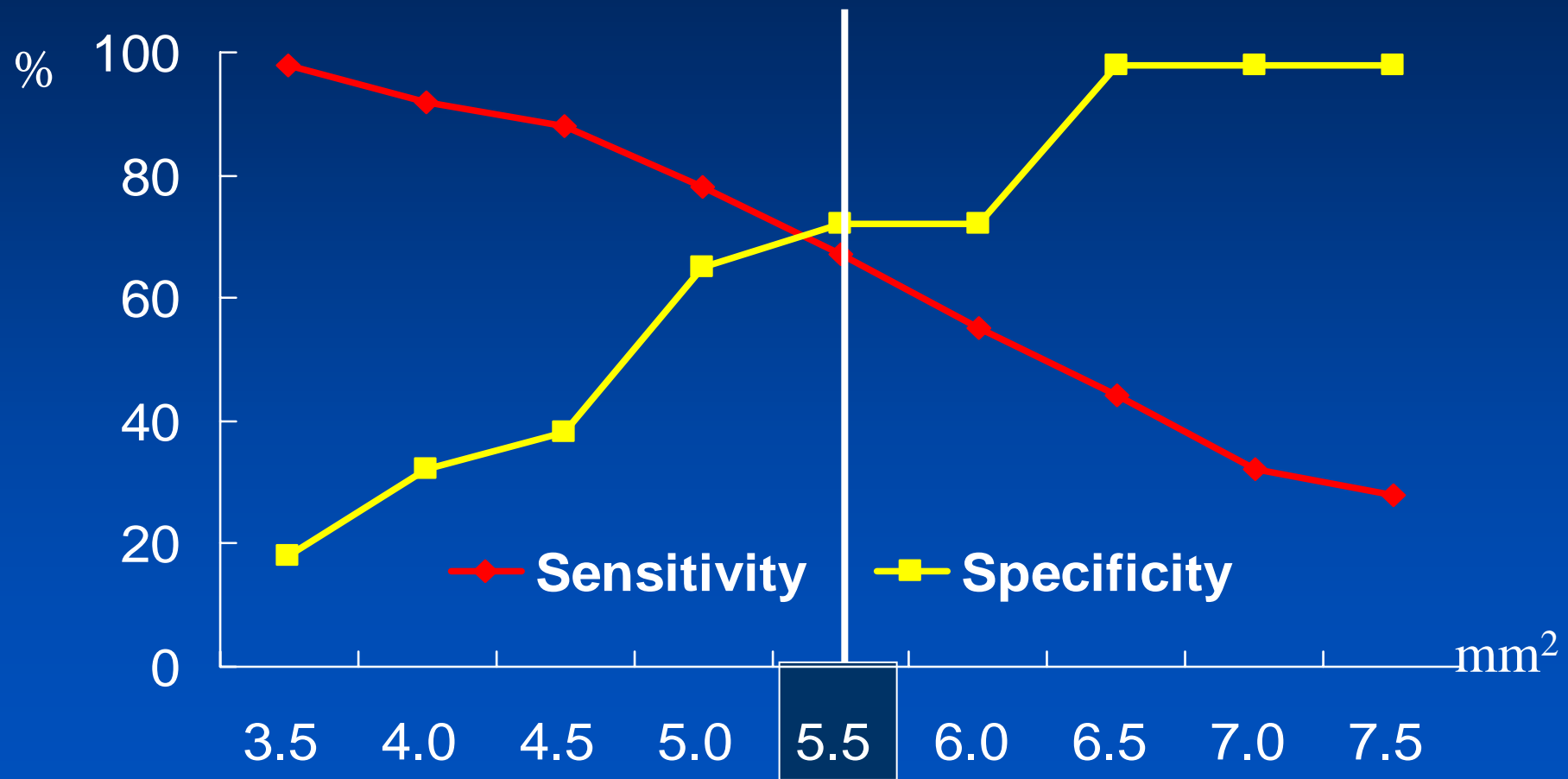
	Edge restenosis		<i>p</i> <i>value</i>
	Yes (n=11)	No (n=15)	
post-stenting edge lumen CSA (mm ²)	5.0±0.3	7.3±0.3	0.004
Post-stenting edge P&M CSA (mm ²)	6.4±0.8	3.4±0.2	0.004
Post-stenting edge plaque burden (%)	55.6±0.5	29.0±4.3	<0.001
% Edge neointimal hyperplasia	27.5±9.2	2.8±0.4	0.019
Δ Edge EEM CSA (mm ²)	1.0±0.8	0.1±0.3	0.004
Δ Edge lumen CSA (mm ²)	-0.9±0.8	-0.1±0.5	0.003
Δ Edge P&M CSA (mm ²)	1.9±0.1	0.2±0.4	<0.001
Δ Edge plaque burden (%)	11.2±0.3	2.1±0.4	0.001

* P & M ; plaque & media

Hong YJ et al, TCT 2006



Final Stent Area for Prediction of Restenosis SES Registry in AMC

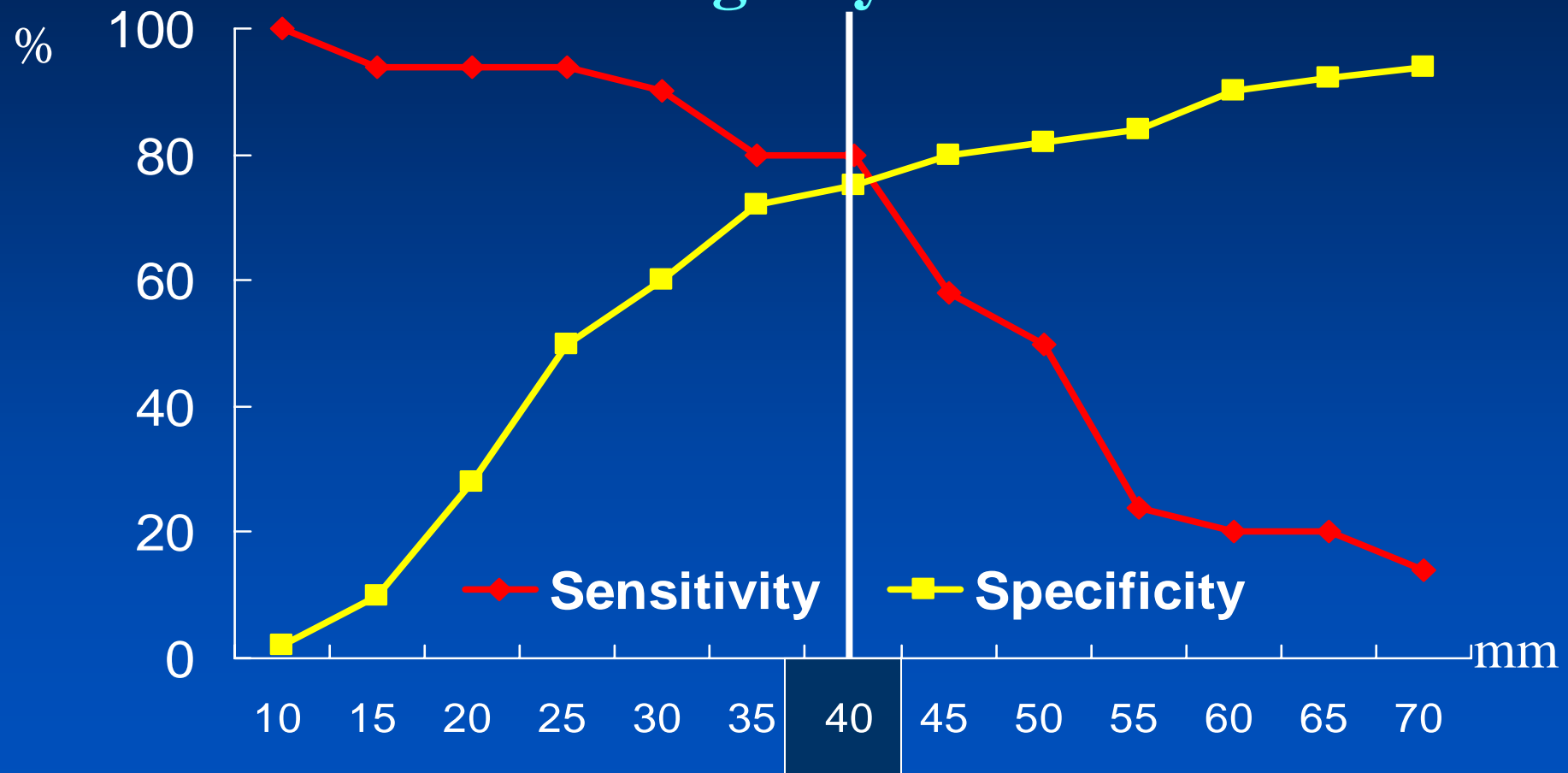


Hong MK et al. E Heart J 2006;27:1305-1310



Stent Length for Prediction of Restenosis

SES Registry in AMC



Hong MK et al. E Heart J 2006;27:1305-1310

IVUS in very late DES thrombosis

	Stent thrombosis		<i>p</i>
	Yes (n=10)	No (n=198)	
Stent length (mm)	36.1±20.6	18.8±9.4	<0.001
Minimum CSA (mm ²)	5.5±1.7	6.5±1.9	<0.05
Stent expansion rate	0.58±0.25	0.81±0.17	<0.001
Incomplete expansion	50%		0.03

Cook S et al, ACC 2006



Conclusions

- Angiographic and clinical benefits of DES compared to the BMS extended to the long coronary lesions.
- Recent registry data also showed that the need of repeat revascularization in very long coverage with DES was within the single digit.
- A multicenter registry and multiple randomized studies including Long DES-I and DES-II study showed that the SES was more effective in reducing the restenosis rate and TLR as compared to the PES or other new DESs in long coronary lesions.

Conclusions

- In spite of the benefit of DES, long lesion and long stented segments remain predictors of adverse clinical outcomes such as relatively high incidence of angiographic restenosis, target lesion revascularization and stent thrombosis.
- Full lesion coverage, full expansion and matching the stented segment properly to the adjacent segment using intravascular ultrasound guidance may improve DES implantation efficacy.
- The optimal cut-off values of final minimum IVUS stent area to predict angiographic restenosis has been reported as 5-6mm².