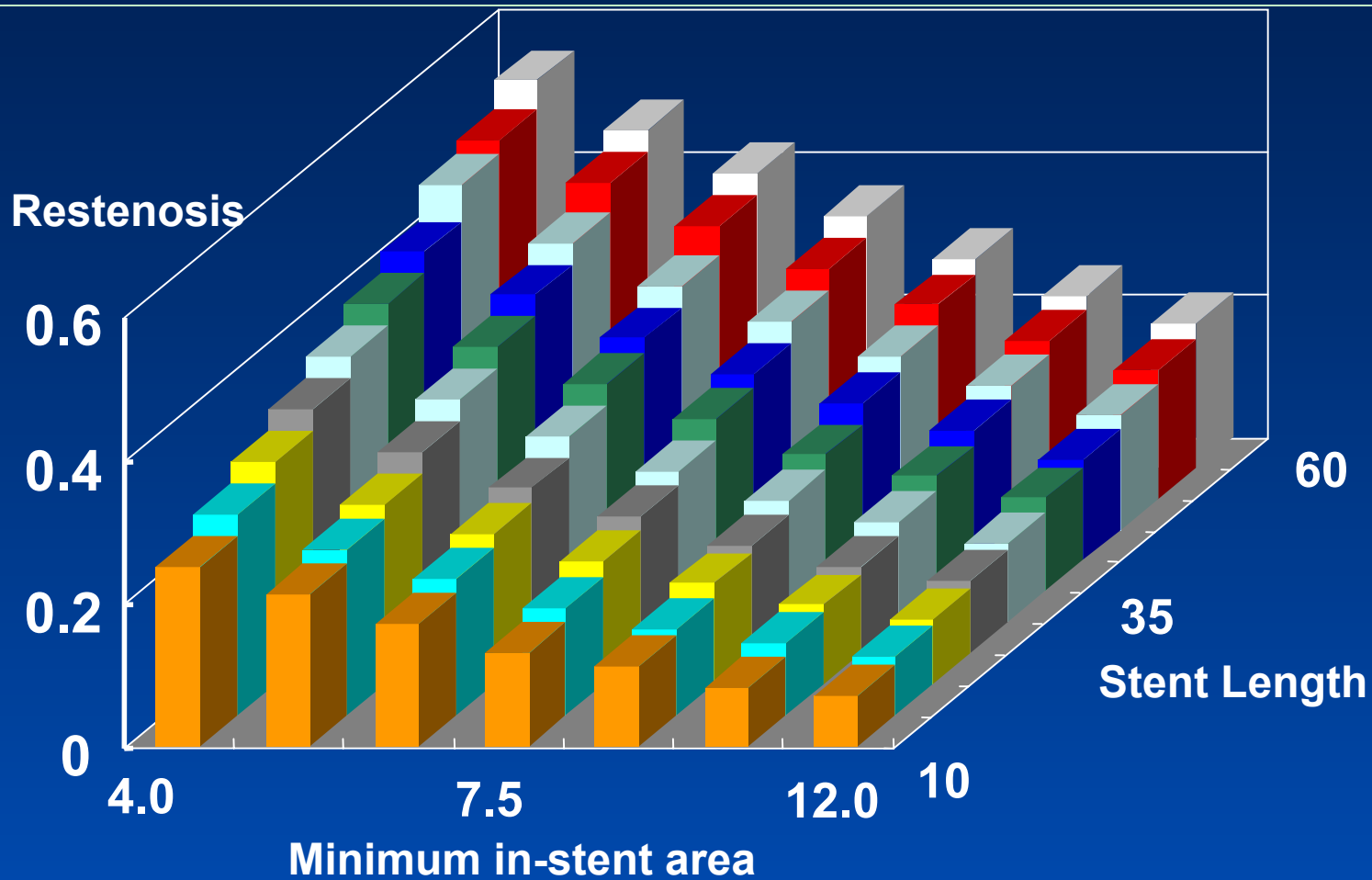


PCI for Long Coronary Lesion

**Shift of a General Idea
with the Introduction of DES**

In the Bare Metal Stent Era

Higher Restenosis Rate With Increasing Stent Length and Decreasing Stent Area



De Feyter. Circulation 1999; 100:1777-83

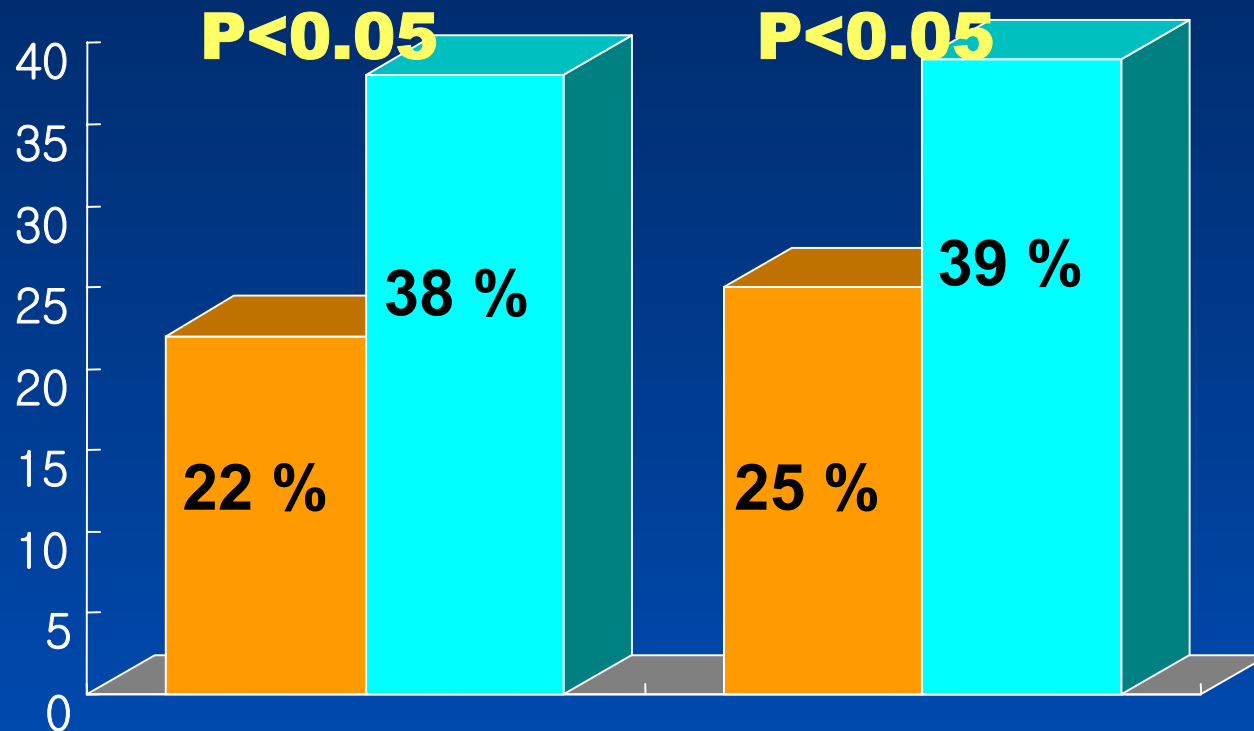
Spot Stenting vs. Long Stent

6 Months MACE

Restenosis Rate

■ Spot stenting

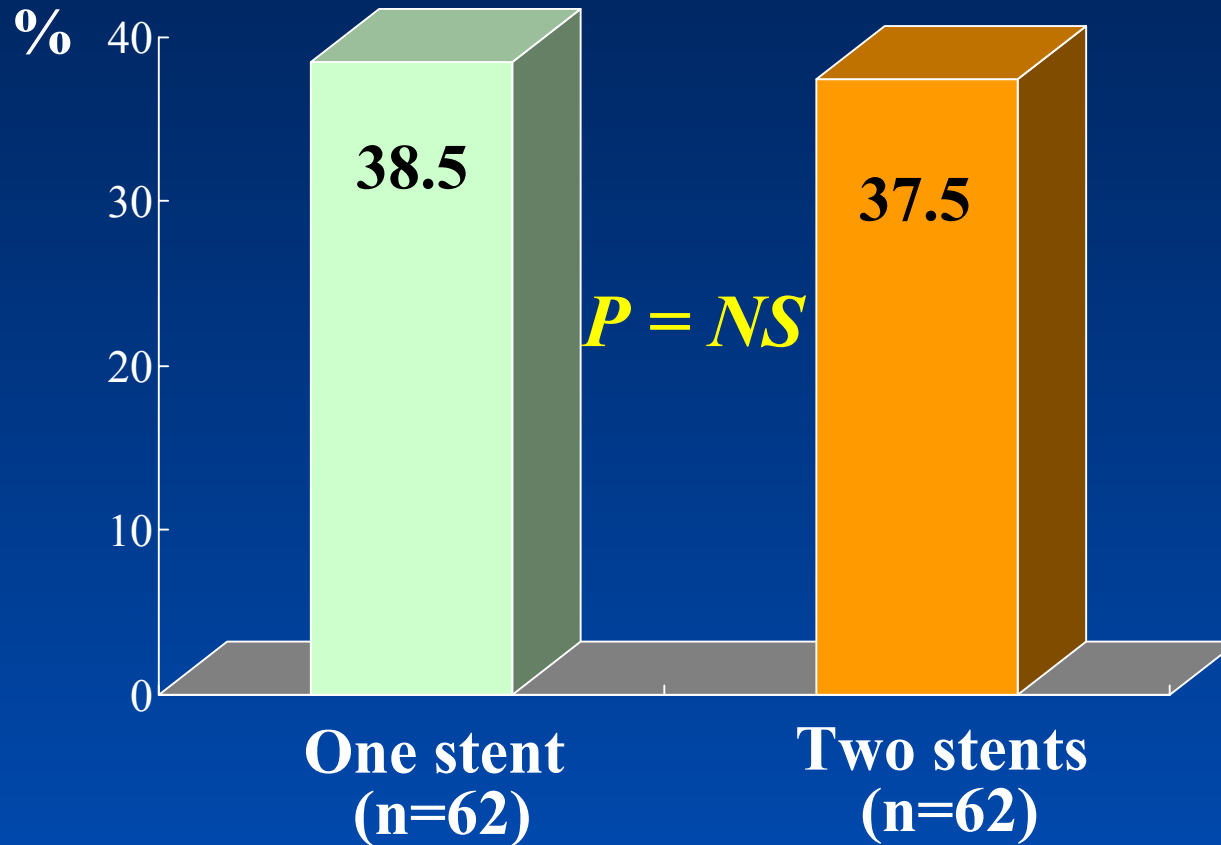
■ Long stenting



Colombo A et al, J Am Coll Cardiol 2001;38:1427-33

Single Stent vs. Multiple Stent

Restenosis Rate



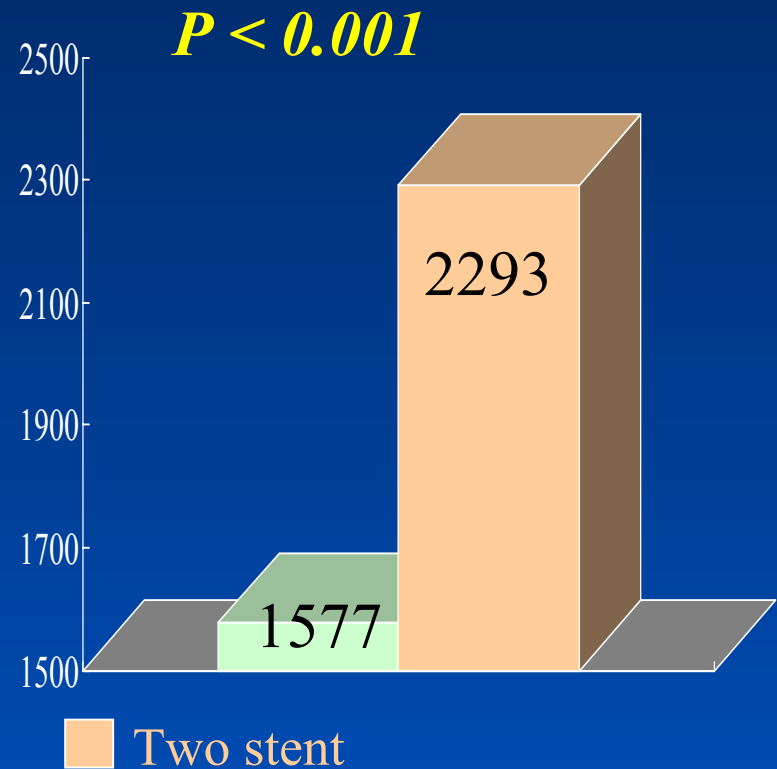
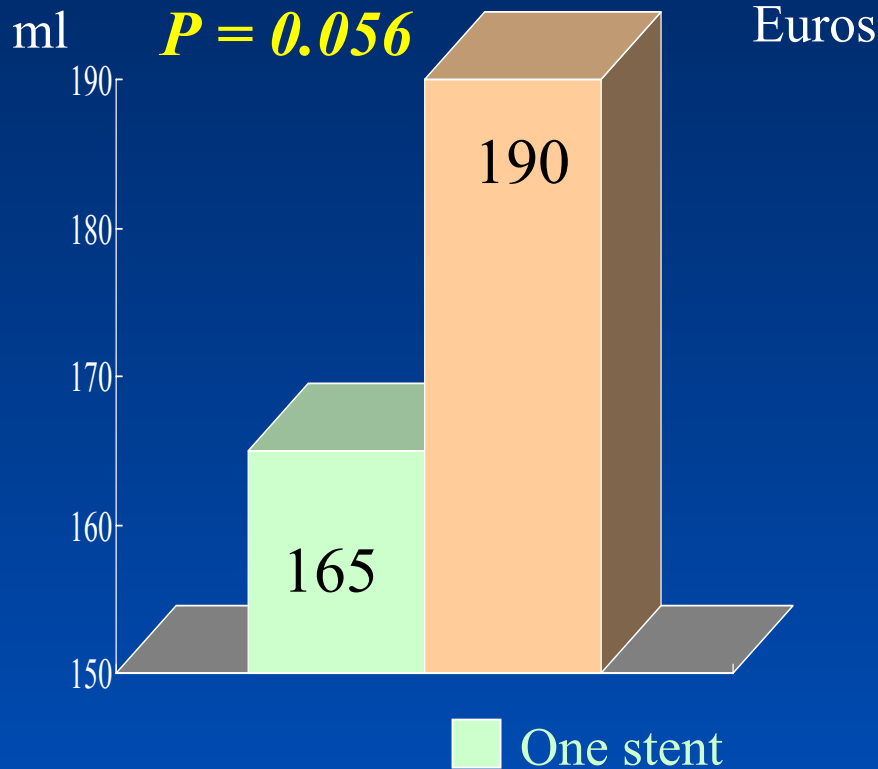
Hoffmann R, et al. Am J Cardiol 2002;90:460-464

Single Stent vs. Multiple Stent

Cost-Effectiveness

Contrast agent

Intervention Cost



Hoffmann R, et al. Am J Cardiol 2002;90:460-464

Stenting with Bare Metal Stent for Long Coronary Lesion

It was suggested that...

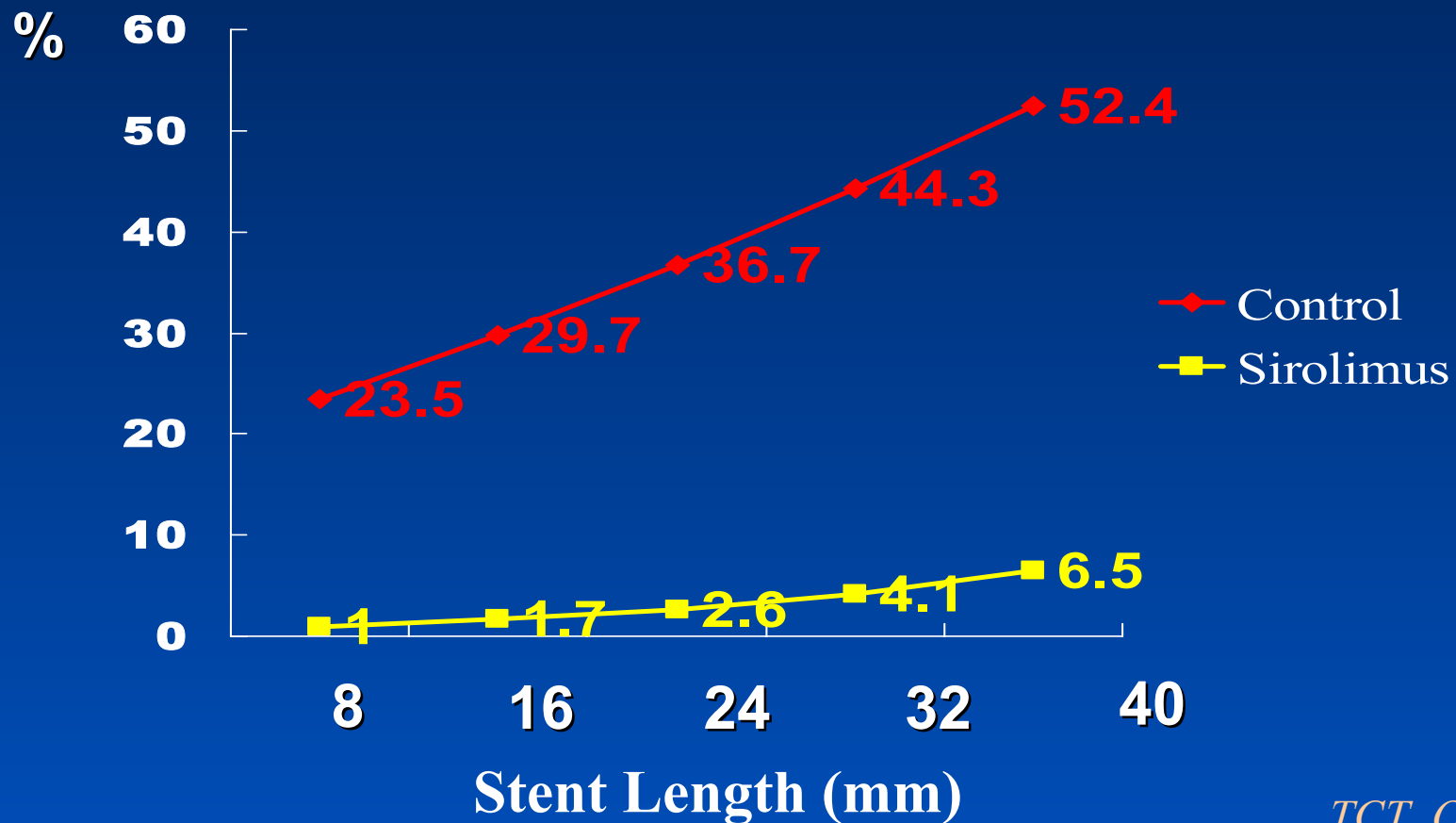
- Spot stenting
- Single stent

What is changing ?

In the Era of Drug Eluting Stent

No Increase of Restenosis with Increasing SES length

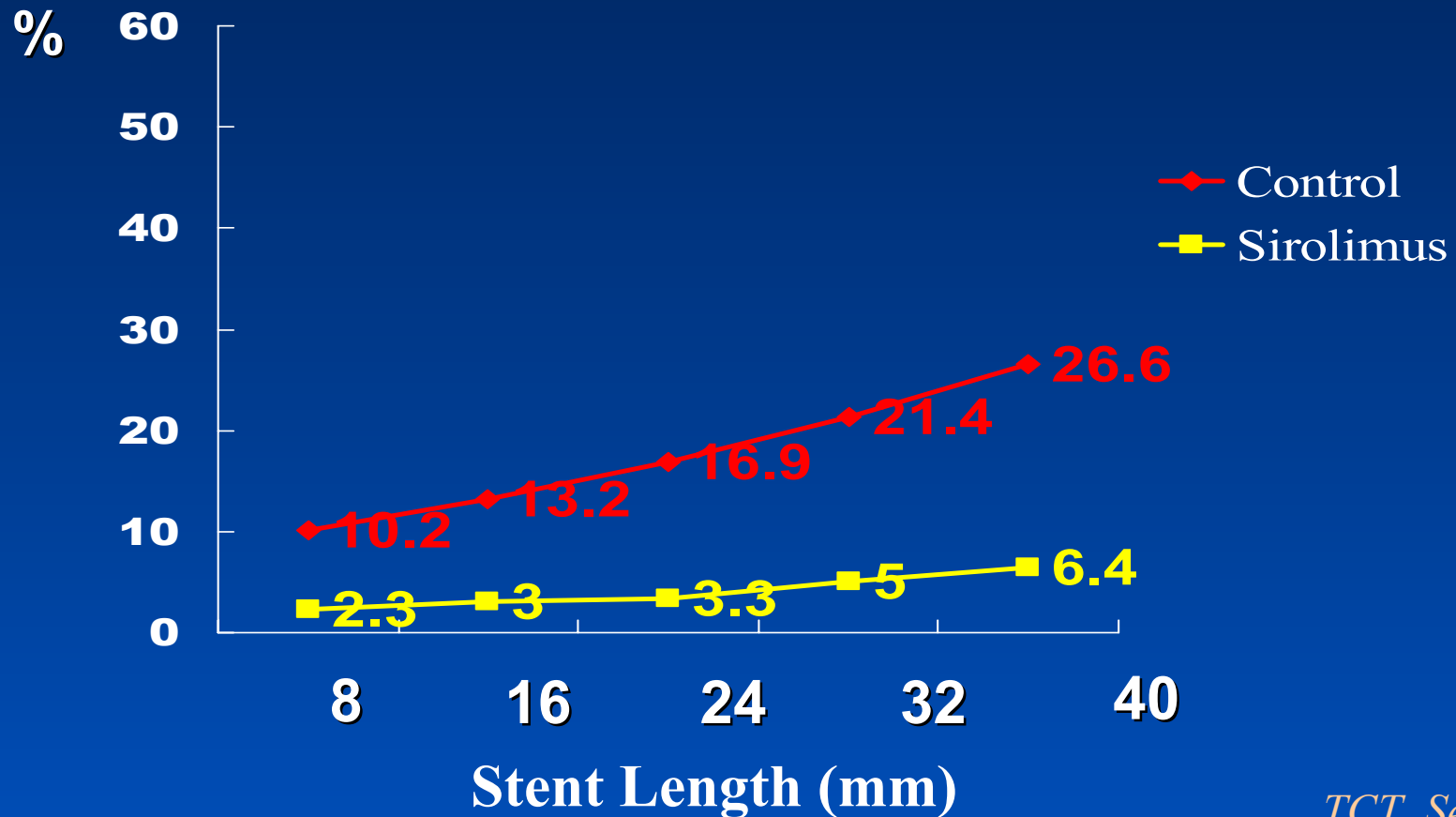
SIRIUS : Sirolimus Eluting Stent



TCT, Oct 2002

TLR vs. Stent Length

SIRIUS : Sirolimus Eluting Stent



TCT, Sep 2003

Relative Reduction of Restenosis

SIRIUS : Sirolimus Eluting Stent

Non-diabetic

Lesion length

	< 12mm	12 – 15 mm	≥ 15mm
Ref Dia > 3.0mm	81.7 %	81.2 %	80.4 %
2.5 – 3.0 mm	79.8 %	79.2 %	77.9 %
< 2.5mm	77.6 %	76.6 %	74.8 %

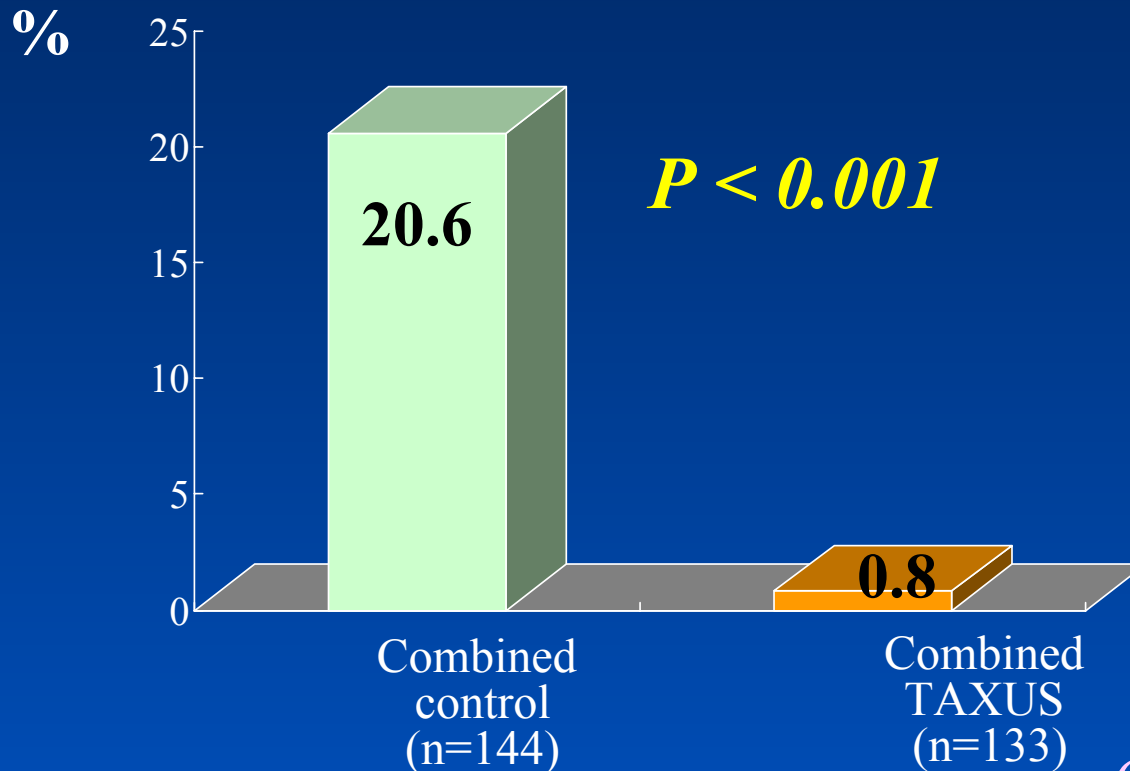
Diabetic

	< 12mm	12 – 15 mm	≥ 15mm
Ref Dia > 3.0mm	78.0 %	77.0 %	75.3 %
2.5 – 3.0 mm	74.1 %	72.7 %	70.2 %
< 2.5mm	69.6 %	67.8 %	64.5 %

TCT, Oct 2002

Restenosis in Lesions ≥ 10 mm in stented segment

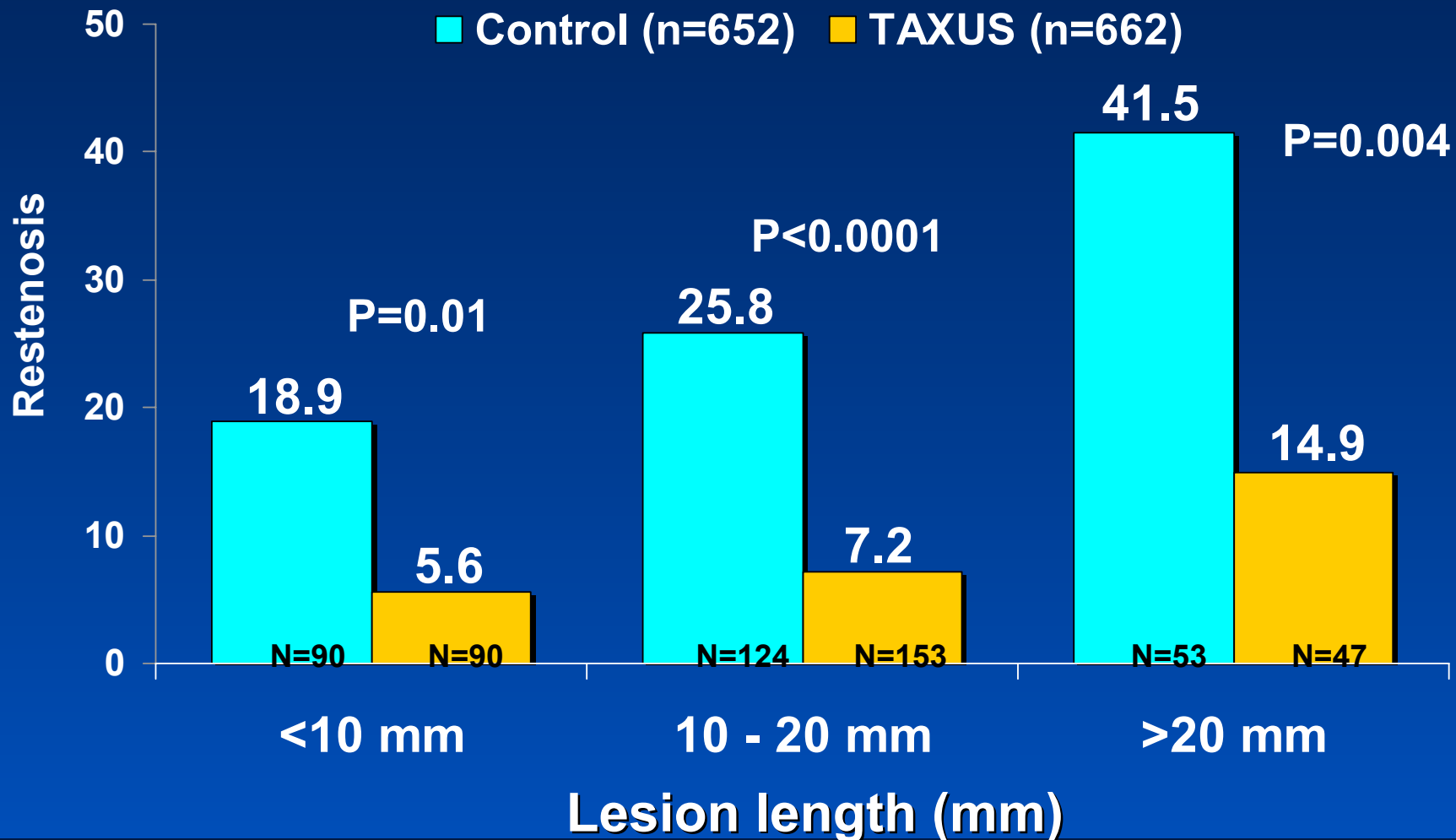
TAXUS II : Paclitaxel Eluting Stent



Grube E, ACC, 2003

Impact of Lesion Length in TAXUS IV

Restenosis (analysis segment)



Full Metal Jacket in DES

71 patients (153 lesion, 209 SES)

Lesion length : 52.1 ± 23.1 mm

- Reference vessel diameter: 2.59 ± 0.58 mm
- Stented segment : 83.6 ± 23.9 mm
- Glycoprotein IIb/IIIa inhibitors: 65%

Orlic D, ACC, 2004

Full Metal Jacket in DES

Sirolimus
(n=71)

In-hospital events (postprocedure)

Q-MI

1(1.4%)

Non Q-MI (CK-MB>3 normal)

15(21.1%)

30 days outcomes

Subacute stent thrombosis

1(1.4%)

Death due to MI

1(1.4%)

6-month follow-up

TLR

7.2%

Orlic D, ACC, 2004

RESEARCH registry

Stented length > 36 mm (de novo lesion)

Study population	96 pts(102 lesions)
Stented length	62 ± 21mm(41-134 mm)
Stents per lesion	2.7 ± 0.9 (2-6)
6-month angiography	67 patients (71%)

Binary restenosis (DS > 50%) : 11.9%

Serruys PW ACC, 2004

6-month Angiographic Follow-Up

RESEARCH registry

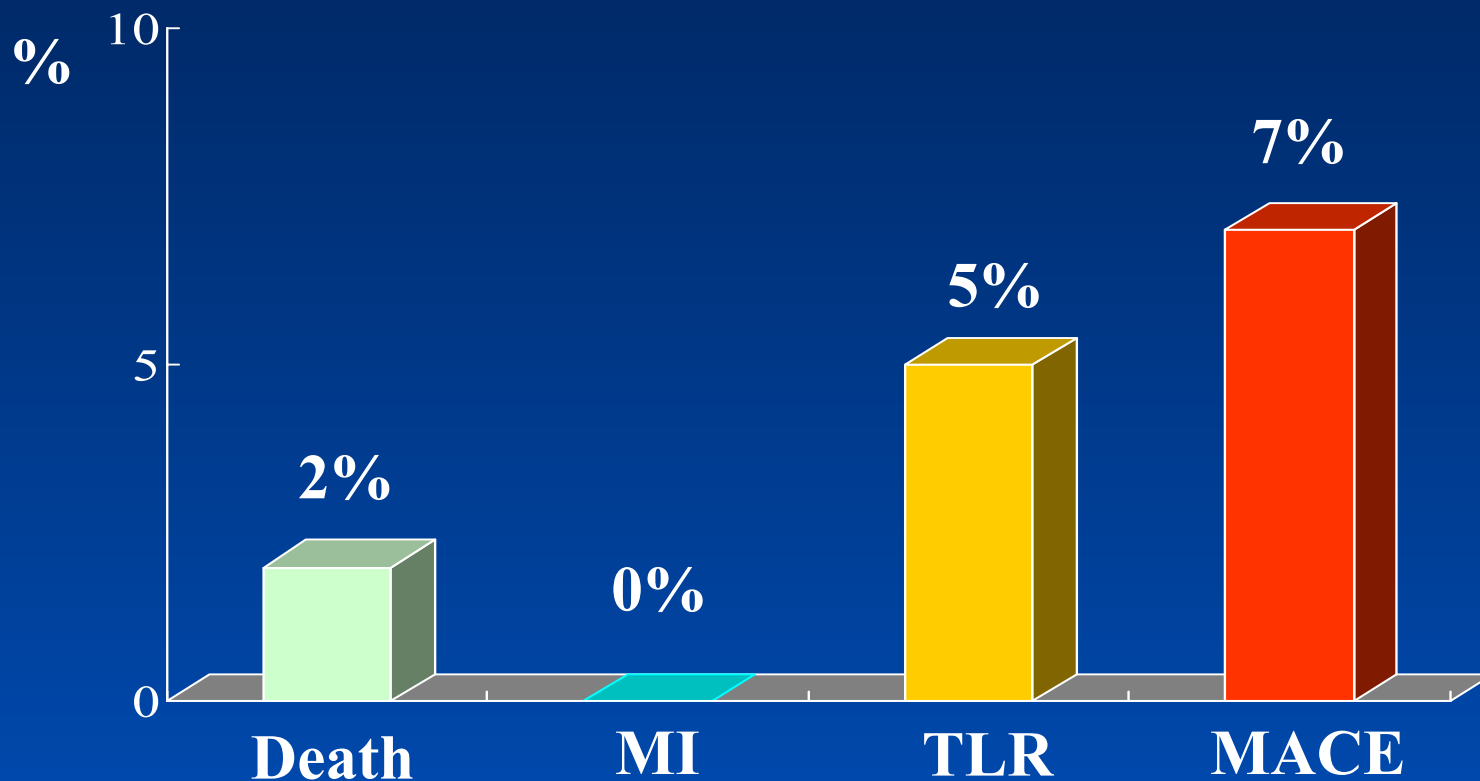
	Proximal	In-stent	Distal
Reference vs1 diameter	3.30	2.82	2.63
Minimal lumen diameter	2.74	2.04	2.12
% diameter stenosis	17	27	19
Late lumen loss	0.02	0.13	-0.16

In-lesion binary restenosis : 11.9%

Serruys PW ACC, 2004

Clinical Follow-Up at 320 Days

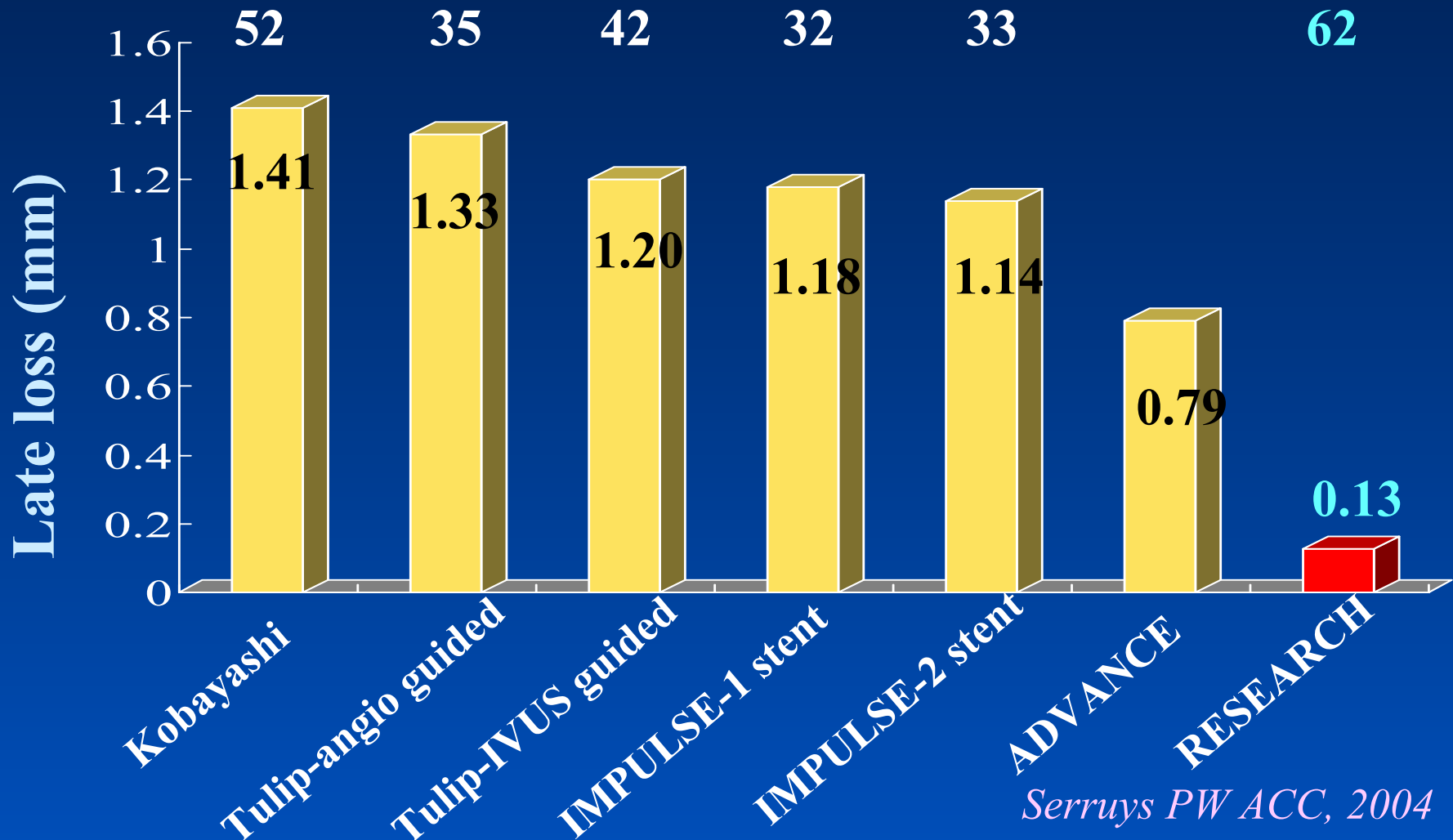
RESEARCH registry



Serruys PW ACC, 2004

Comparison of Late Loss

Stented length (mm)



Serruys PW ACC, 2004

“Long Cypher”

Multicenter Prospective non-Randomized Registry study for DES in Very Long Lesion ;

-Preliminary Data-

• Coordinating center : Asan Medical Center,

SJ Park

• Collaborating centers

Ajou University Medical Center,

Catholic University of Korea, St Mary's Hospital,

Chonnam Nat'l University Hospital,

Keimyung University Dongsan Medical Center,

Korea University Kuro Hospital,

Samsung Medical Center,

Seoul National University Hospital,

Yonsei University Severance Hospital,

Yonsei University Wonju Christian Hospital,

SJ Tahk

KB Seung

MH Jeong

KS Kim

DJ Oh

HC Gwon

Lee MM, Koo BK

YS Jang

JH Yoon

“Long Cypher”

Prospective, Non-randomized
Multicenter, Registry Study in Korea

From March 2003 - February 2004

**De-novo Lesions
($\geq 24\text{mm}$)**

487 patients, 597 lesions

**Cypher stent
($\geq 28\text{mm}$)**

338 patients, 424 lesions
Mean stent length : 41mm

(28- 92 mm)

**BMS stent
($\geq 28\text{mm}$)**

149 patients, 173 lesions
Mean stent length : 37mm
(28 – 73 mm)

Lesion Characteristics

	Cypher (n=424)	Control (n=173)	P value
Lesion length (mm)	33.0 ± 13.1	29.9 ± 12.7	0.012
Proximal reference (mm)	3.02 ± 0.46	3.27 ± 0.55	<0.001
Distal reference (mm)	2.63 ± 0.47	2.81 ± 0.59	<0.001
MLD (mm)	0.72 ± 0.46	0.78 ± 0.52	0.146
Diameter stenosis (%)	74.2 ± 16.3	74.0 ± 16.7	0.898

Stenting Procedure

	Cypher (n=424)	Control (n=173)	P value
Used No of stents	1.55 ± 0.68	1.29 ± 0.54	<0.001
Overlapping	196 (46%)	44 (25%)	<0.001
Contiguous stent length (mm)	40.8 ± 15.0	36.6 ± 12.4	0.001
Maximal inflation pressure (atm)	15.4 ± 3.6	11.7 ± 3.3	<0.001
Maximal balloon size	3.31 ± 0.38	3.41 ± 0.51	0.008
Balloon-to-artery ratio	1.11 ± 0.16	1.06 ± 0.14	<0.001
IVUS guidance	303 (72%)	71 (41%)	<0.001
Use of Abciximab	11 (3%)	7 (4%)	0.492

Post-Procedure QCA Analysis

	Cypher (n=424)	Control (n=173)	P value
Proximal reference (mm)	3.09 ± 0.49	3.33 ± 0.55	<0.001
Distal reference (mm)	2.56 ± 0.45	2.85 ± 0.52	<0.001
MLD (mm)	2.72 ± 0.43	2.92 ± 0.54	<0.001
Diameter stenosis (%)	2.7 ± 14.9	5.3 ± 14.4	0.062
Acute gain	2.00 ± 0.61	2.13 ± 0.68	0.022

Angiographically normal reference vessels actually had 28 - 38% plaque burden when seen by IVUS

N

67

Proximal reference (mm²)

EEM CSA (mm²) 15.4 ± 3.6

Lumen CSA (mm²) 9.6 ± 3.0

✓ Plaque burden (%) 27.9 ± 6.7

Distal reference

EEM CSA (mm²) 9.4 ± 3.3

Lumen CSA (mm²) 6.8 ± 2.5

✓ Plaque burden (%) 37.9 ± 10.6

Postprocedural Stent CSA

N

67

Stent (mm²)

EEM CSA

9.4 ± 3.3

Stent CSA

6.8 ± 2.5

In-Hospital Outcomes

“Long Cypher”

	Cypher (n=338)	Control (n=149)	P value
Procedural success *	97.8%	94.8%	0.051
Death	0	1 (0.7%) **	1.000
MI	29 (9%)	18 (12%)	0.228
Q wave	0	0	
Non-Q wave ***	29 (9%)	18 (12%)	
Stent thrombosis	0	0	1.000
TLR	0	0	1.000
TVR	0	0	1.000

* Final TIMI flow ≥ 2 and residual diameter stenosis $\leq 30\%$

** No reflow after multivessel PCI

*** CK-MB ≥ 3 times normal value

30-Day Outcomes

	Cypher (n=338)	Control (n=149)	P value
Death	1 (0.3%) *	1 (0.7%)	0.519
Non-cardiac	1 (0.3%)	0	
Cardiac	0	1 (0.7%)	
MI	0	0	1.000
Q wave	0	0	
Non-Q wave	0	0	
Sent thrombosis	0	0	1.000
TLR	0	0	1.000
TVR	0	0	1.000

* Due to intracranial hemorrhage, 5 days after intervention

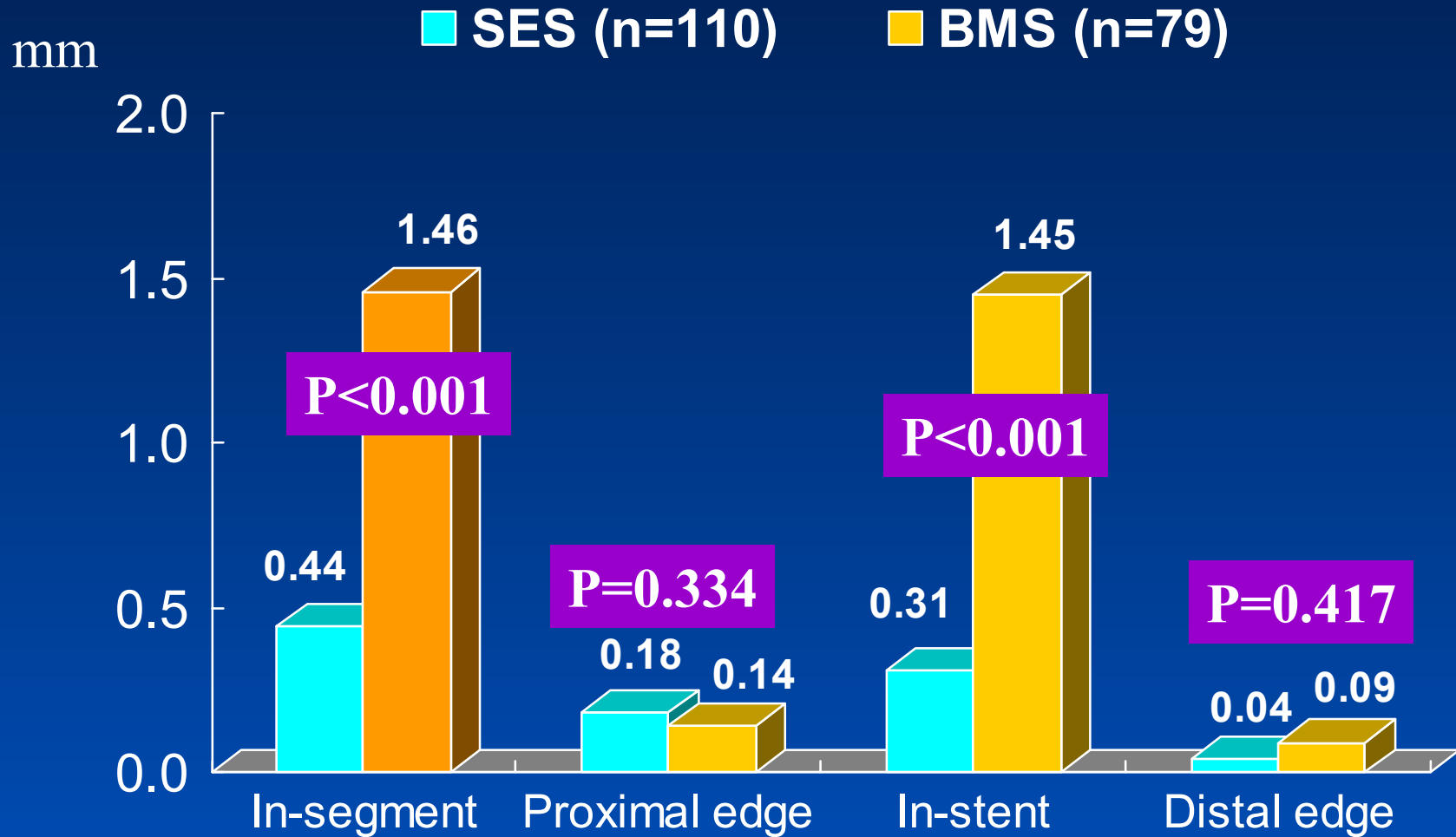
6-Month Outcomes

	Cypher (n=162)	Control (n=127)	P value
Death	1 (0.6%)	1 (0.8%)	1.000
Non-cardiac	1 (0.6%)	0	
Cardiac	0	1 (0.8%)	
MI	0	0	1.000
Q wave	0	0	
Non-Q wave	0	0	
Stent thrombosis	0	0	1.000
✓ TLR	1 (0.6%)	18 (14.2%)	<0.001
Repeat PCI	0	16	
CABG	1	2	
MACE	2 (1.1%)	19 (15.0%)	<0.001

6-Month QCA Analysis

	Cypher (n=117)	Control (n=97)	P value
Proximal reference(mm)	3.00 ± 0.49	3.64 ± 0.45	0.172
Distal reference (mm)	2.60 ± 0.43	2.69 ± 0.58	0.241
MLD (mm)	2.54 ± 0.53	1.53 ± 0.76	<0.001
Diameter stenosis (%)	9.3 ± 17.4	48.0 ± 22.2	<0.001
Late loss (mm)	✓ 0.31 ± 0.57	1.45 ± 0.72	<0.001
Restenosis	✓ <u>3 (2.6%)</u>	42 (43.3%)	<0.001

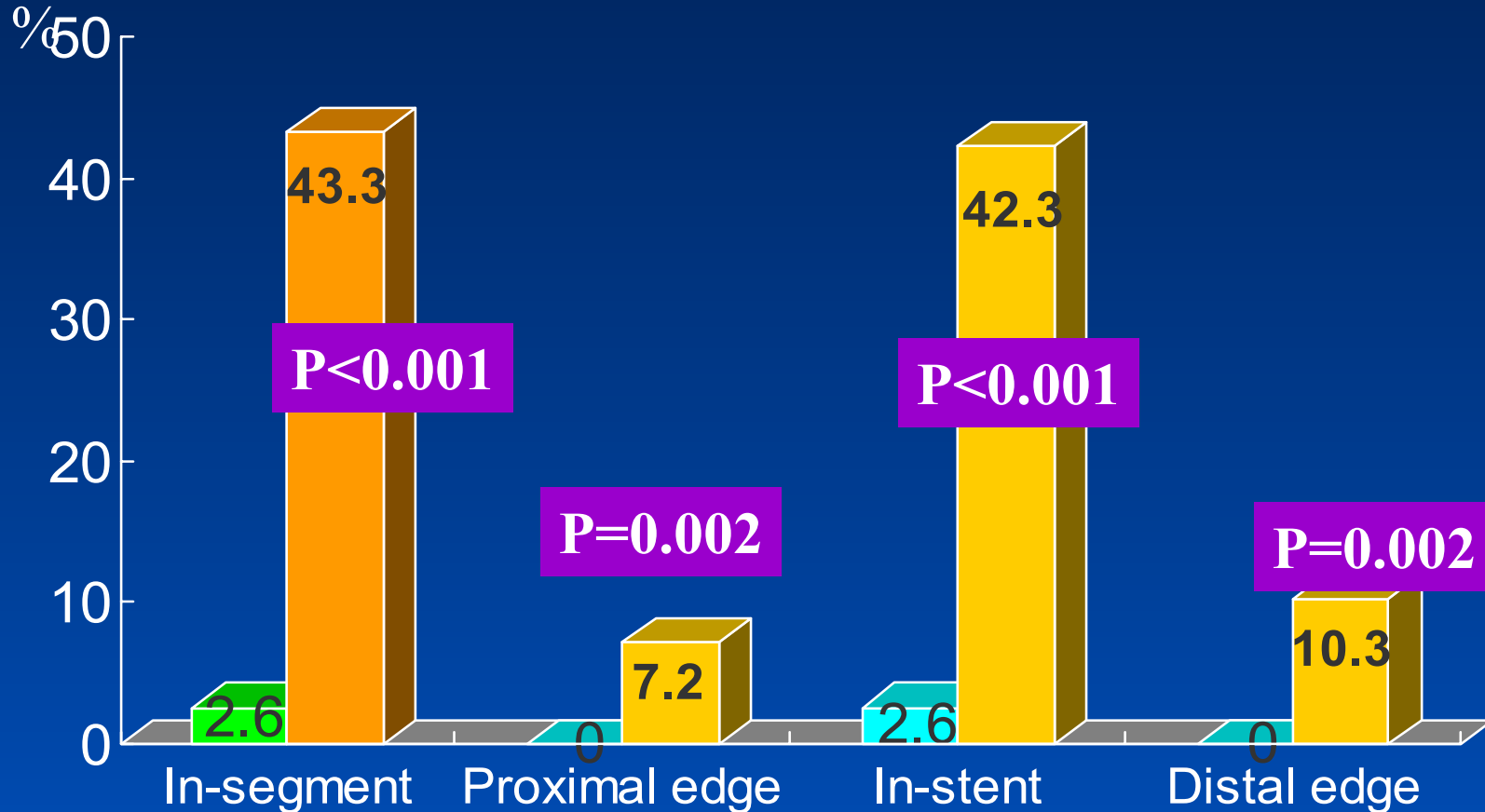
Late Loss



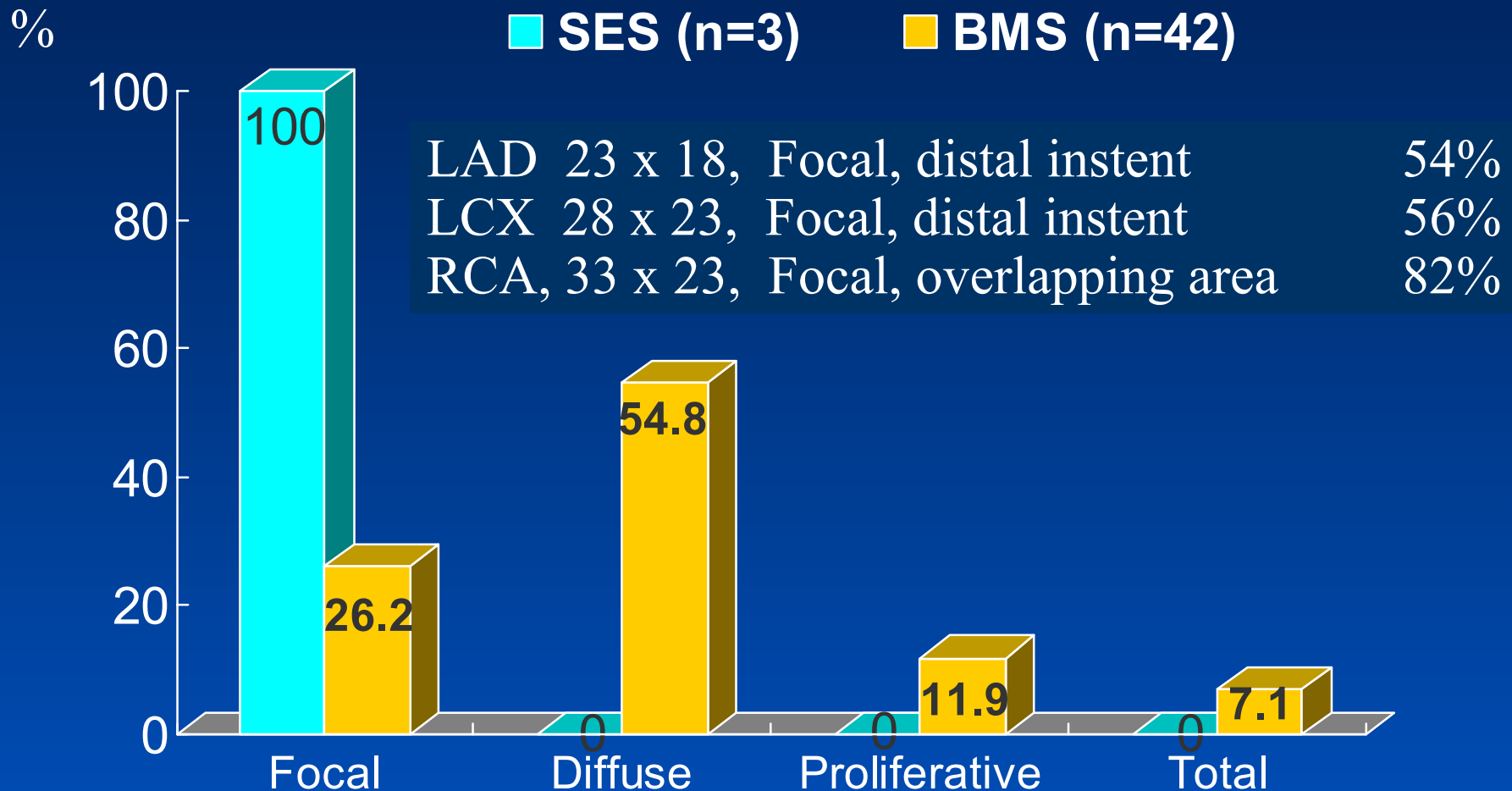
Restenosis Rate

■ SES (n=110)

■ BMS (n=79)



Pattern of 3 Restenotic Cases



Why not stent-overlap ?

Multiple Stent vs. Single Stent

Impact of Stent Overlapping

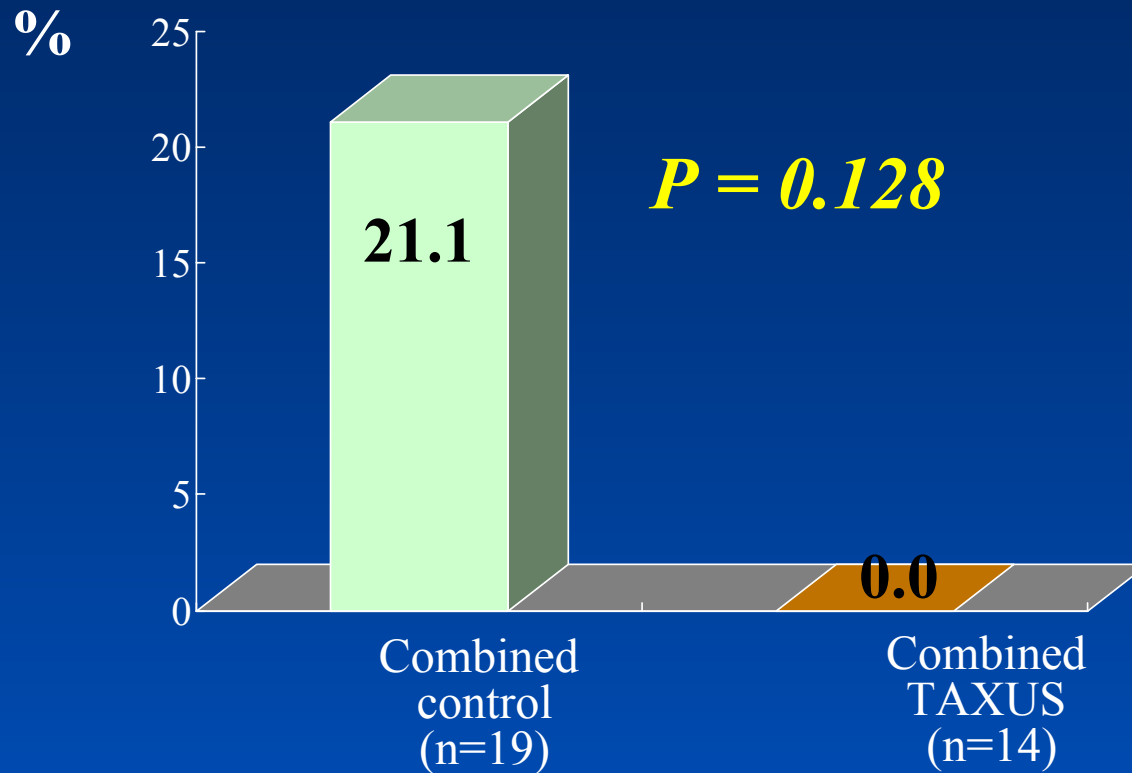
SIRIUS : Sirolimus Eluting Stent

	Sirolimus (n=176)	Control (n=168)	P value
Late loss (mm)			
In-stent	0.23	1.14	<0.001
In-segment	0.20	0.93	<0.001
Restenosis (%)			
In-stent	7.1	42.7	<0.001
In-segment	8.8	42.7	<0.001

TCT, Oct 2002

Restenosis in > 1 Stent in stented segment

TAXUS II : Paclitaxel Eluting Stent

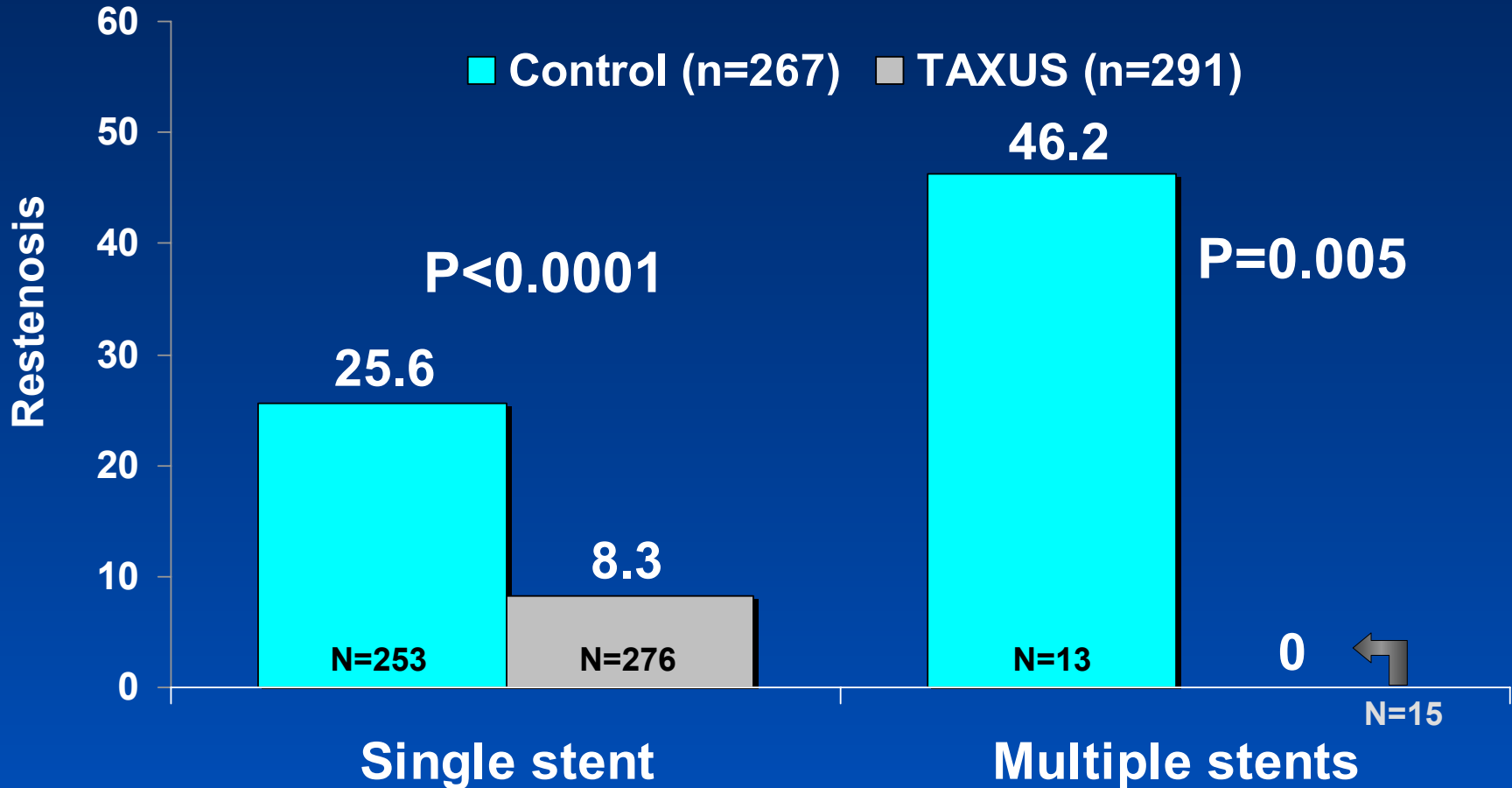


Grube E, ACC, 2003

Impact of Multiple Stents

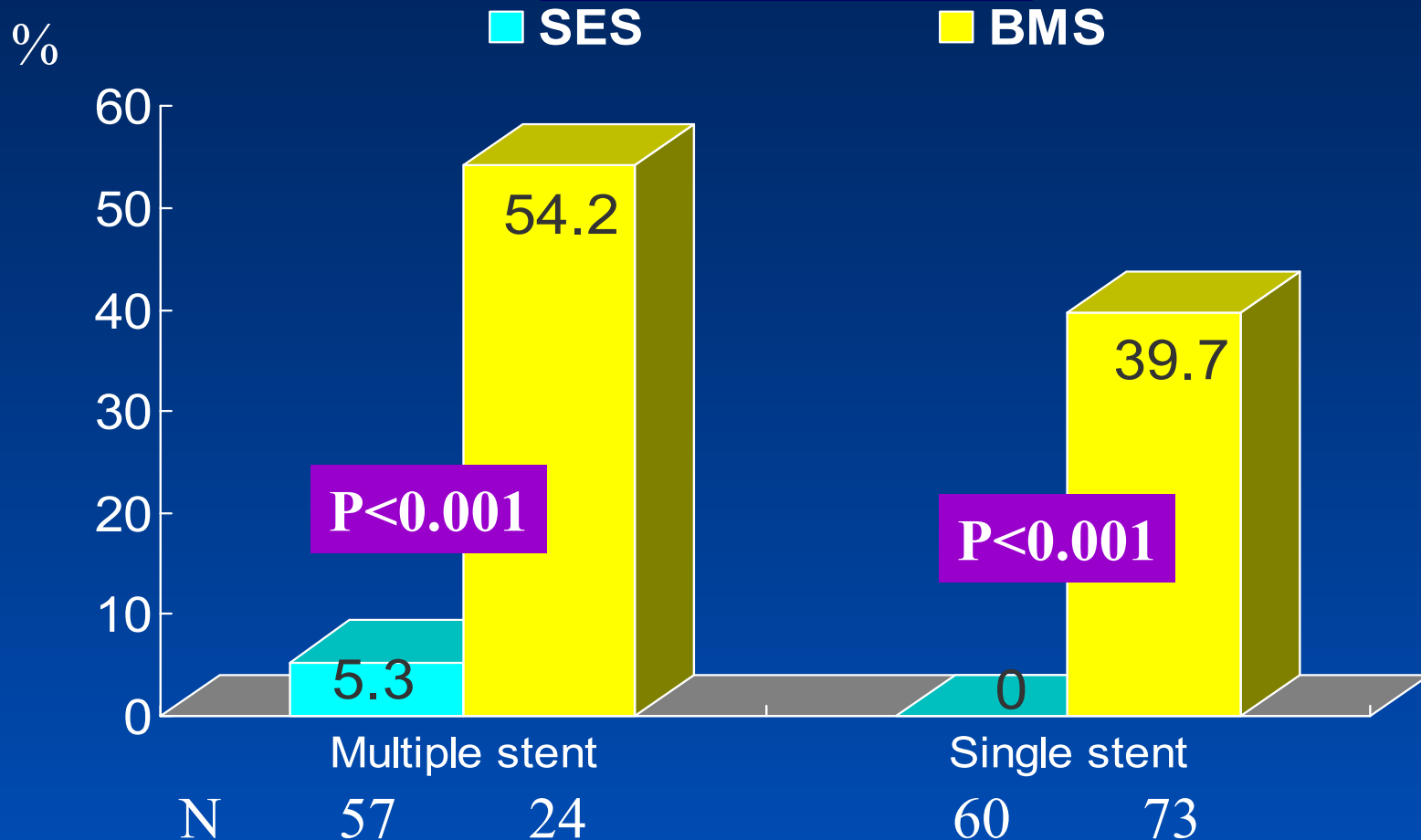
Restenosis (analysis segment)

TAXUS IV



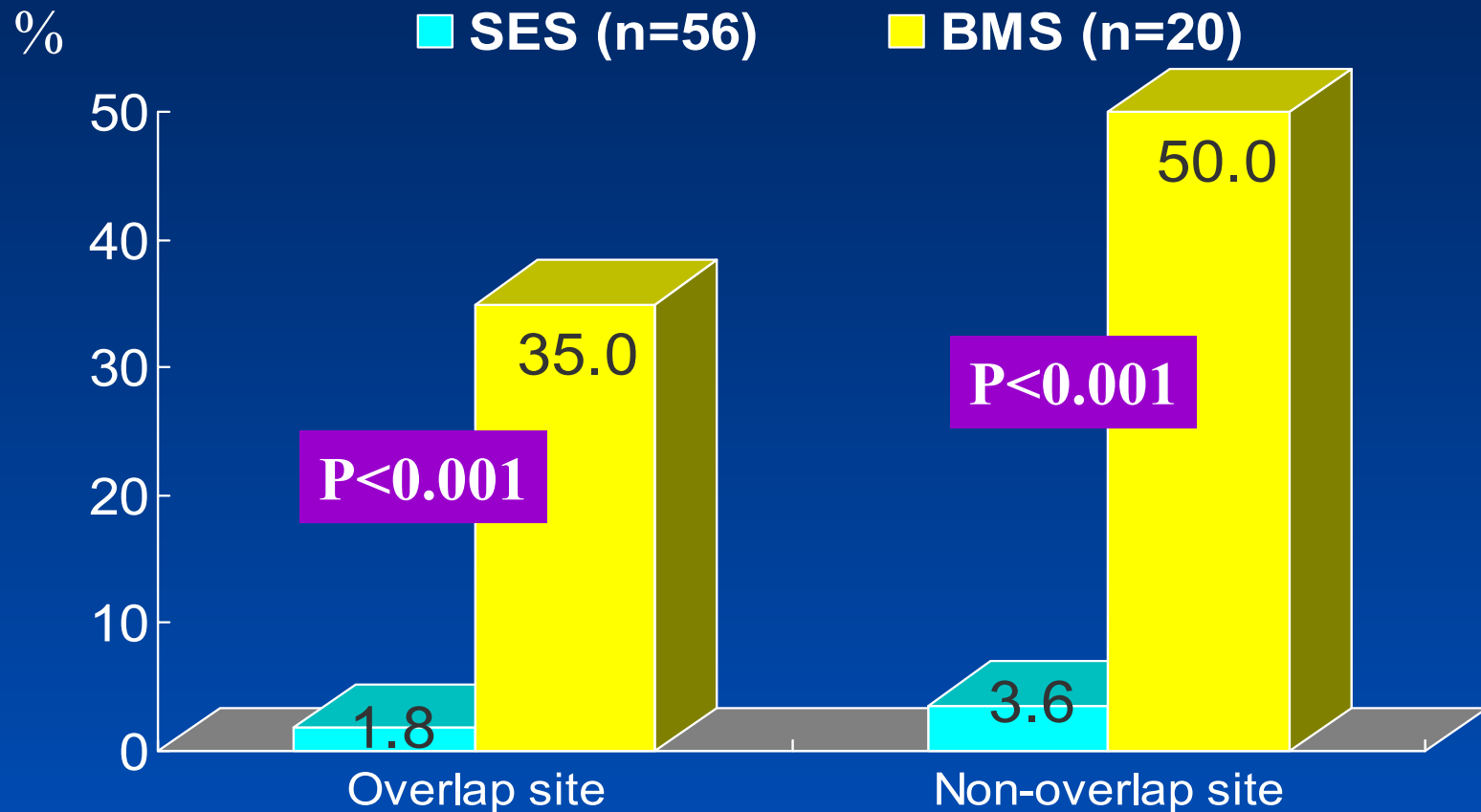
Restenosis Rate According to Multiple Stenting

“Long Cypher”



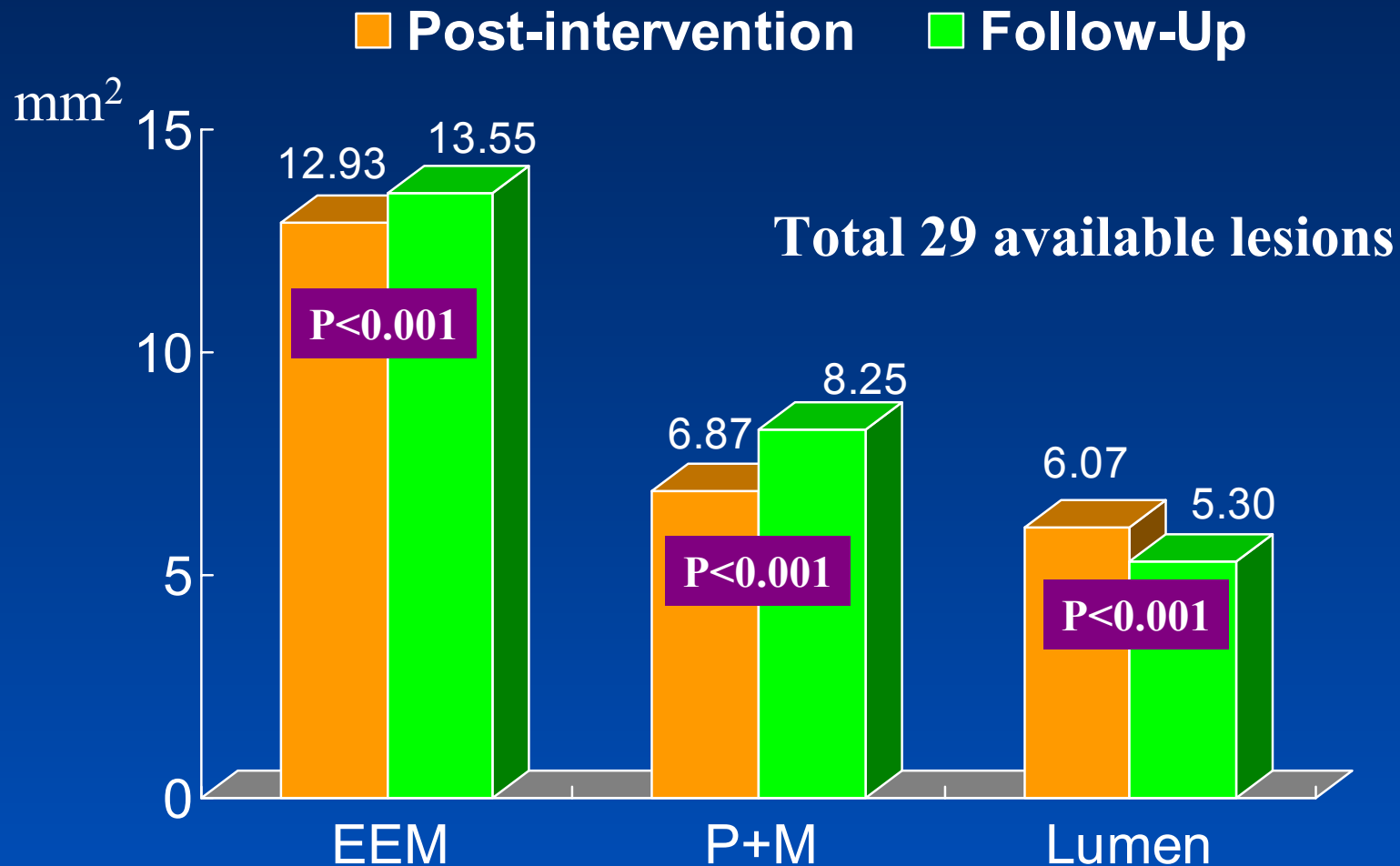
Restenosis Rate According to Stent Overlap

“Long Cypher”



Area Change of Overlap Site

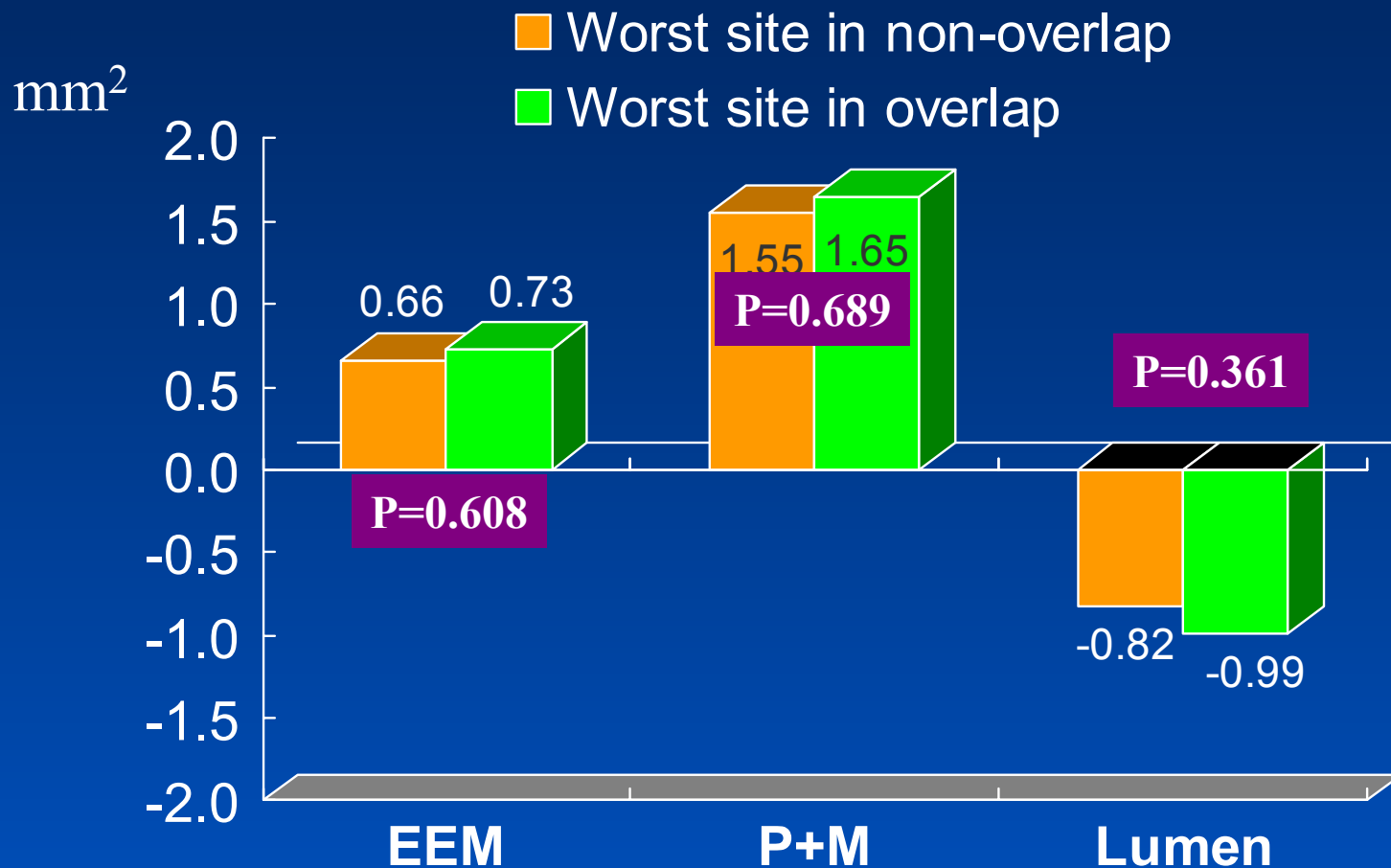
“Long Cypher”



Stent-overlap did not show any difference

“Long Cypher”

Area changes at 6 months F/U



Shift of an Idea for Long Lesion with DES

“ the longer, the better ”

- Full lesion coverage
- Acceptance of stent-overlap

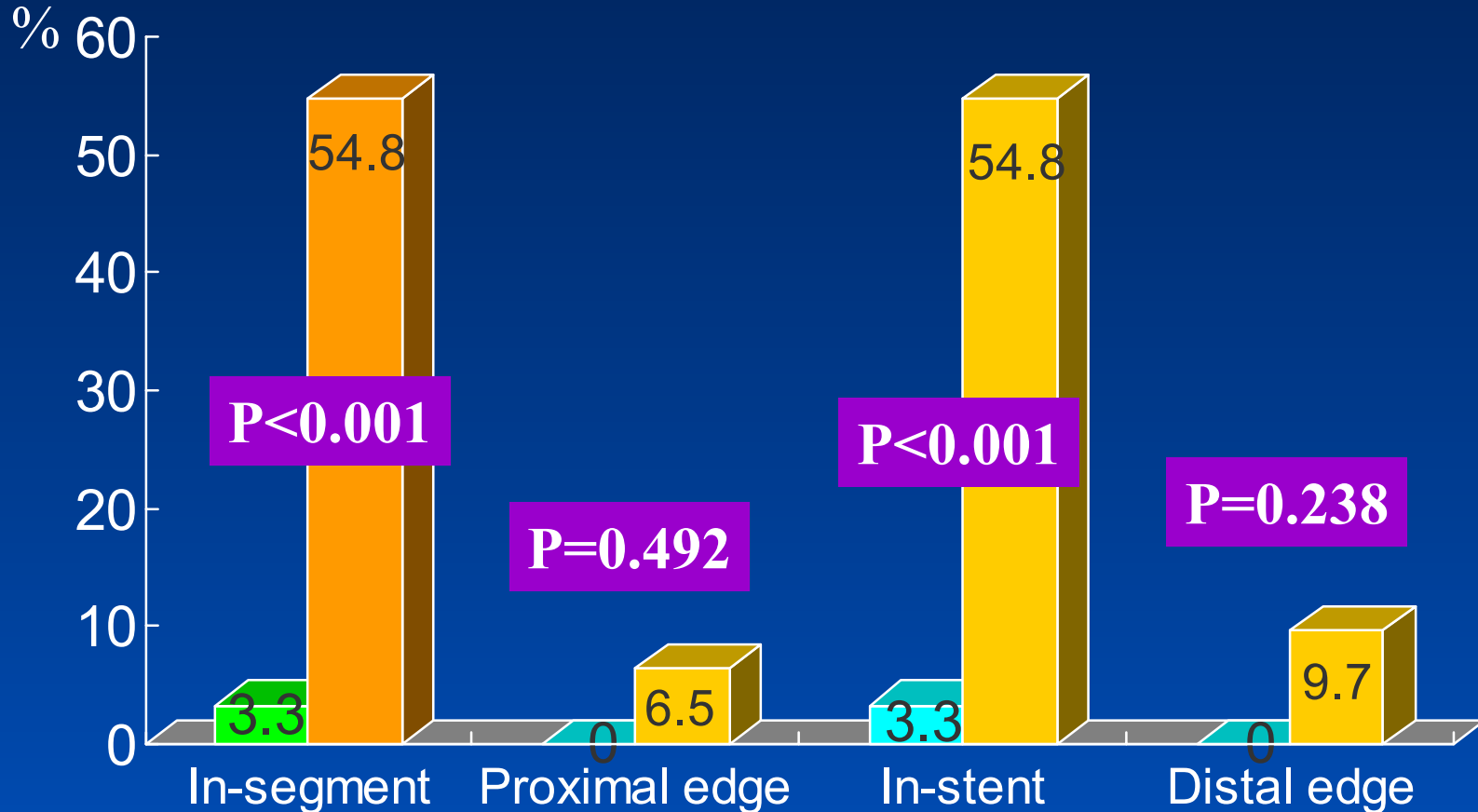
In Subgroups

**Does it applied to
all patients and lesion subsets ?**

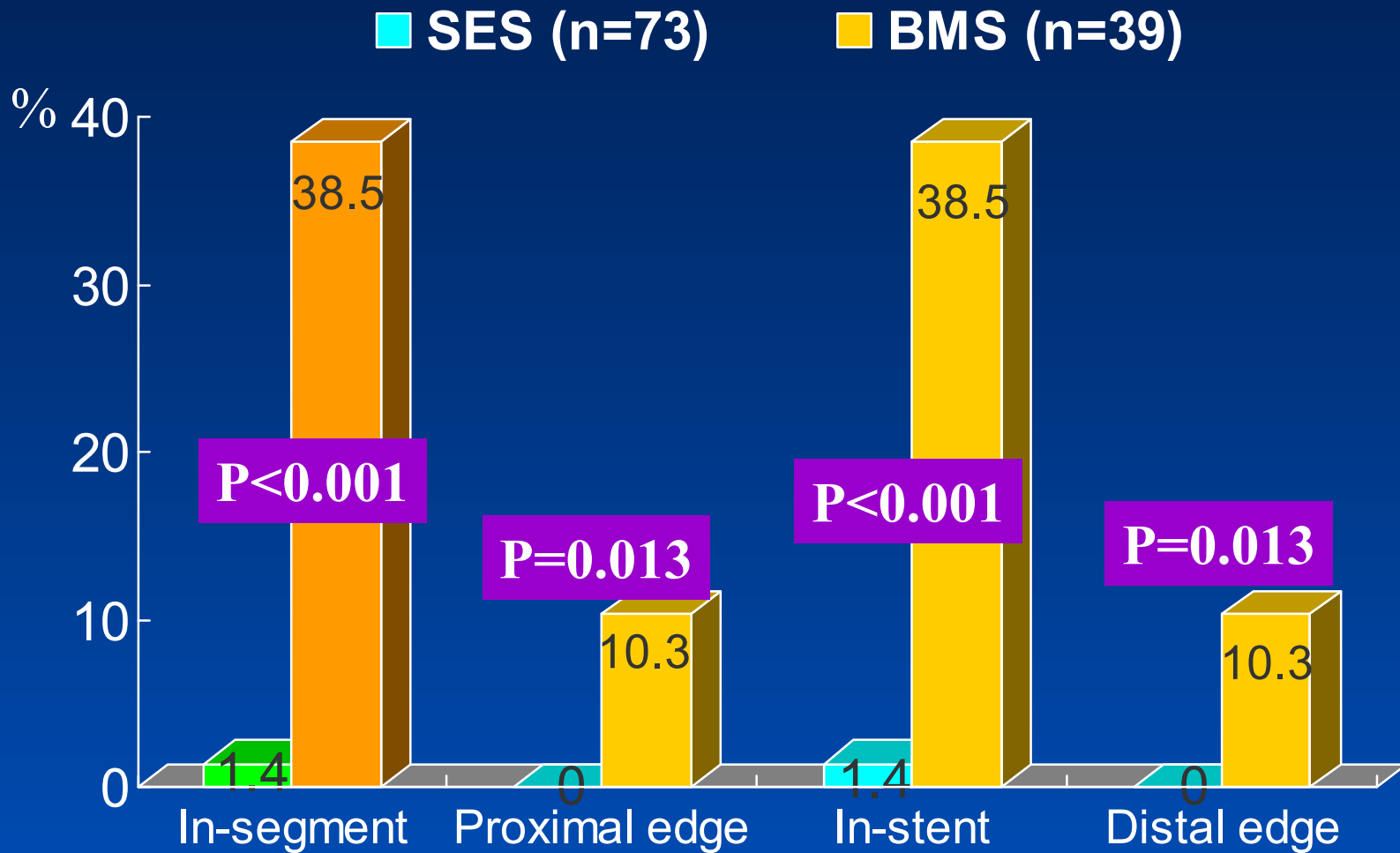
Restenosis Rate in DM

■ SES (n=30)

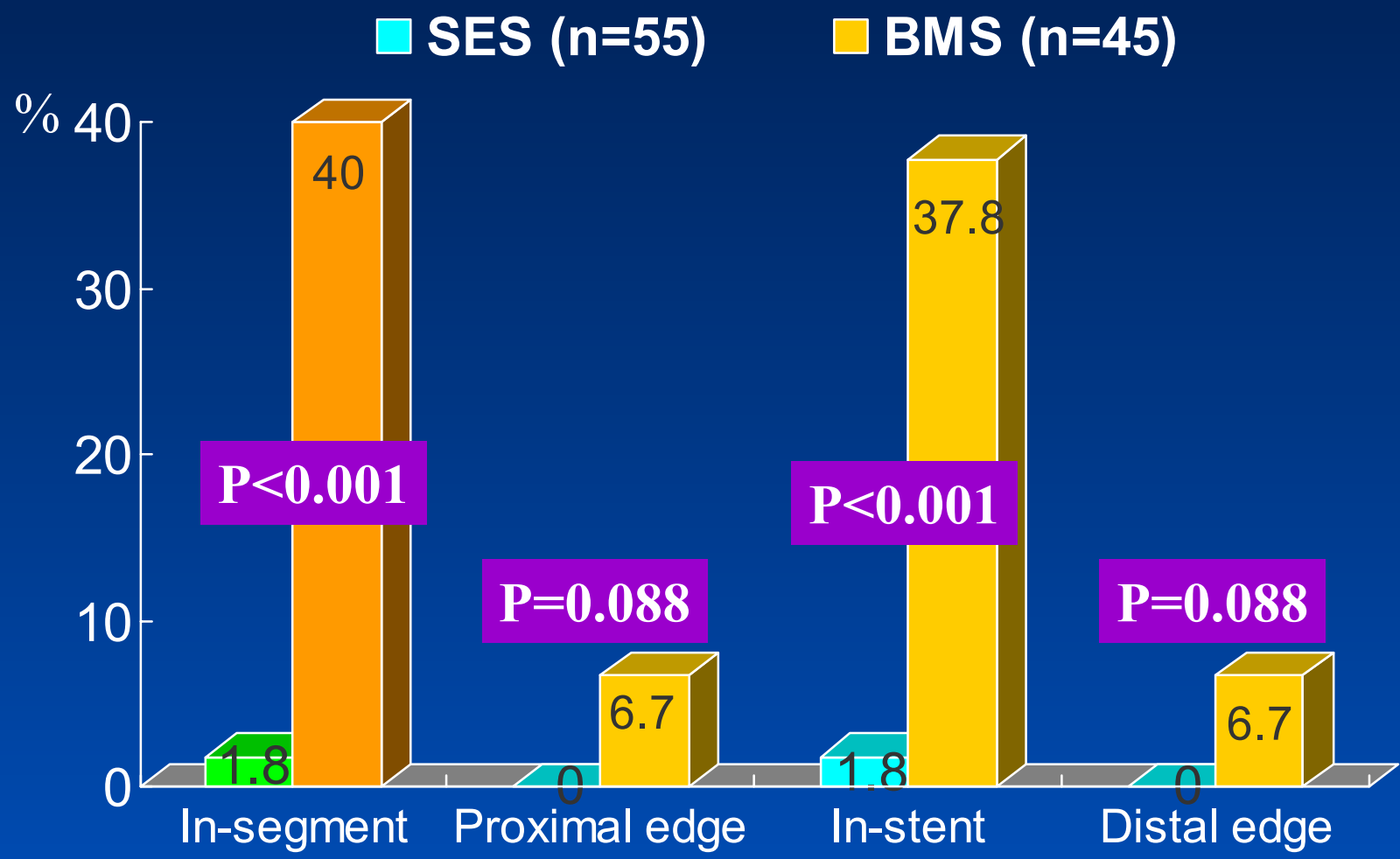
■ BMS (n=31)



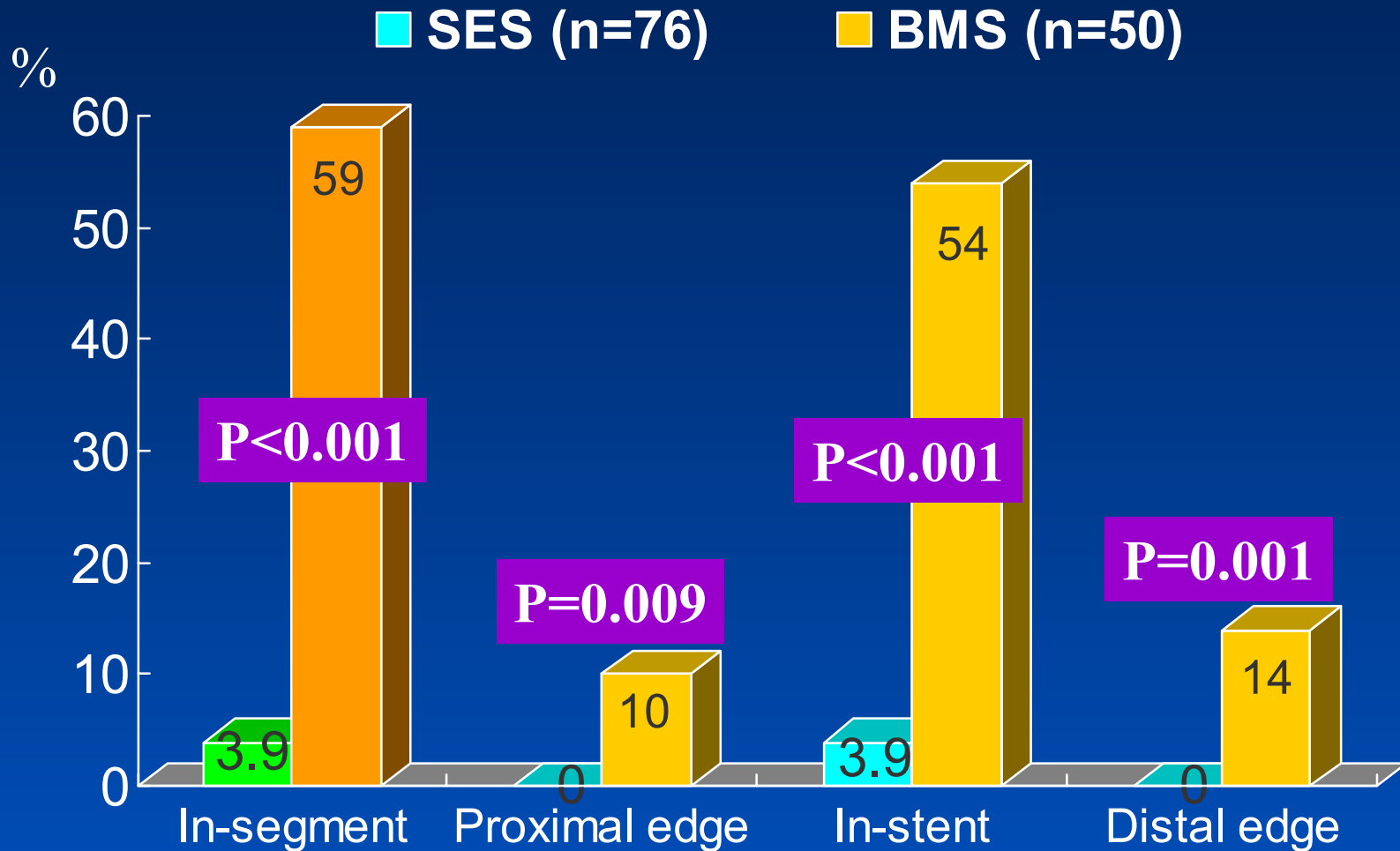
Restenosis Rate in LAD



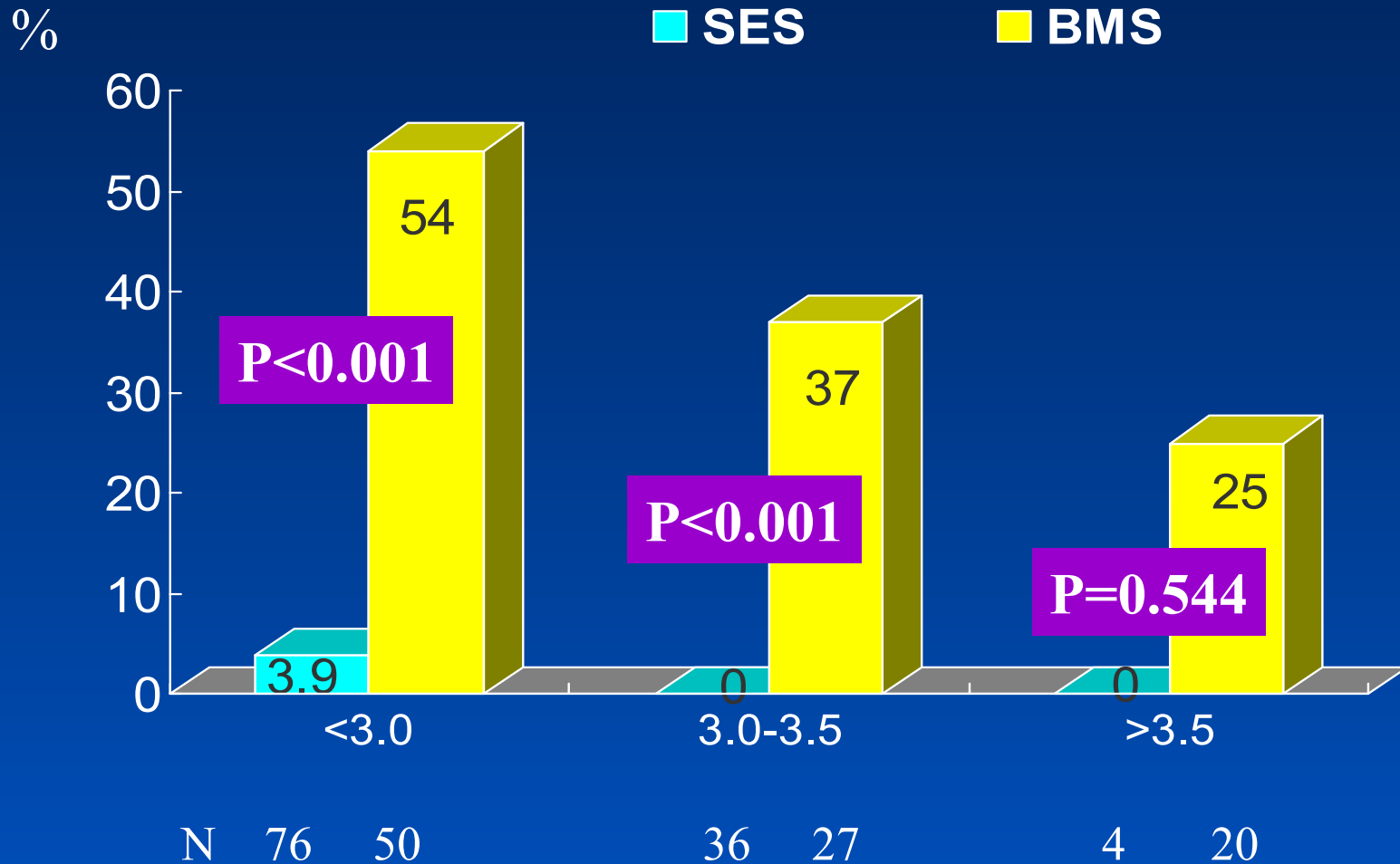
Restenosis Rate in Acute Coronary Syndrome



Restenosis Rate in Small Vessel (<3.0mm)



Restenosis Rate According to Reference Diameter



Angiographic Restenosis

