PCI for Left Anterior Descending Artery Ostial Stenosis

Why do you hesitate PCI for LAD ostial stenosis ?

LAD Ostial Lesion

Limitations of PCI

- **High elastic recoil**
- **Involvement of the distal left main coronary artery**
- **Concern for major side branch occlusion**

Is it sate to stent in LAD ostium ?

Yes we believe it.

LAD Ostial Lesion
Stenting..

- **Stenting with precise location may be a safe and feasible technique with an acceptable clinical outcome.**

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

LAD Ostial Lesion
Stenting..

- Subjects:

  111 patients, 111 Lesions

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

In-Hosptial Outcomes

Procedure success	**108 (97.5%)**
Death	**0 (0%)**
Stent thrombosis	**0 (0%)**
NonQ-MI	**4 (3.6%)**
Emergency CABG	**1 (0.9%)**

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

QCA Data

Ref. diameter(mm)	**3.5 ± 0.6**
Pre-MLD(mm)	**0.8 ± 0.5**
Post-MLD(mm)	**3.6 ± 0.6**
Acute gain(mm)	**2.8 ± 0.7**
Late loss(mm)	**1.4 ± 1.0**

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Angiographic Restenosis

26.1 %

Involvement of LCX ostium (n=6, 5.4%)

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

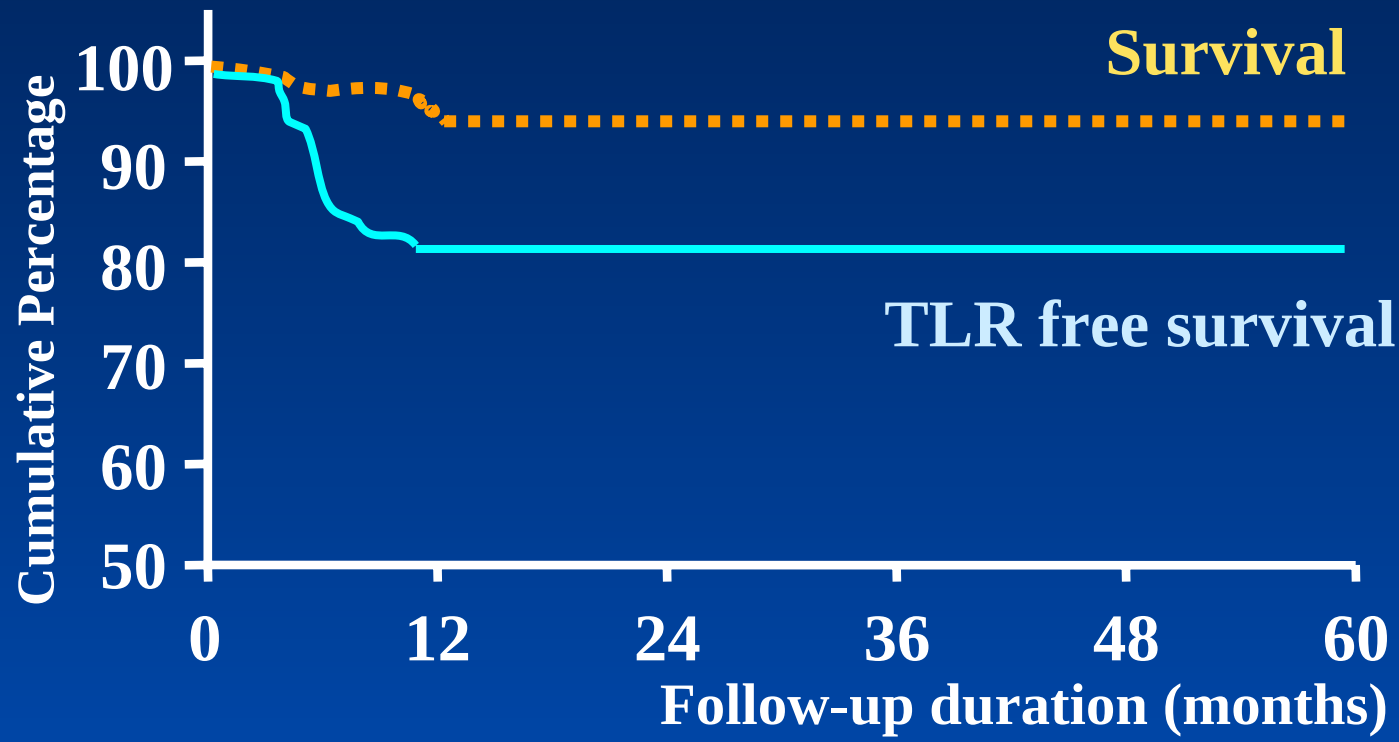
Only Predictor for Restenosis

Stenting at LAD Ostial Lesions

- **Final MLD after Stenting**

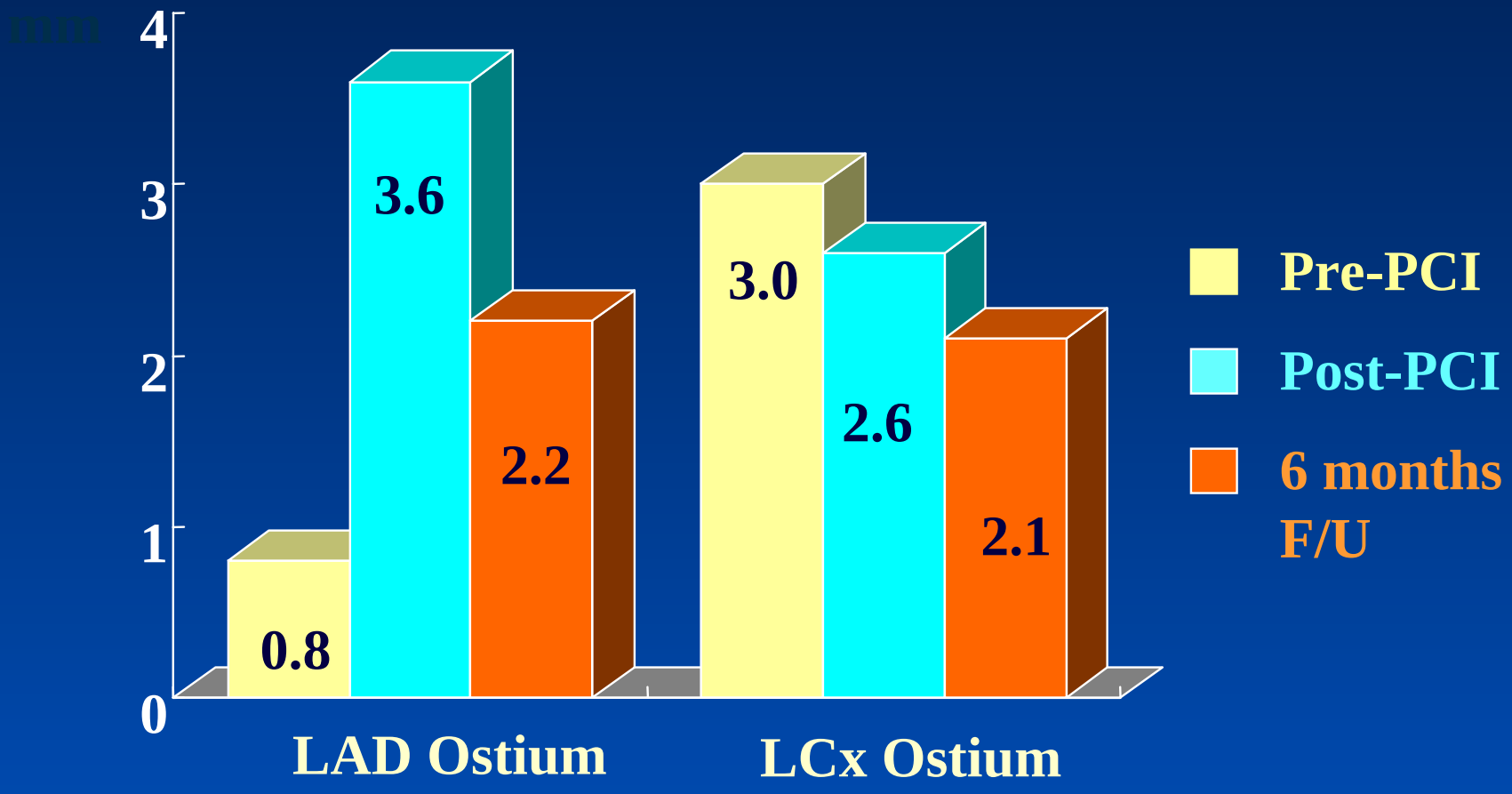
Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Long-term Outcome



Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Minimal Luminal Diameter



Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Patterns of Restenosis

- **In-stent restenosis (n=18)**
  - **Focal type(n=10)**
  - **Diffuse type(n=8)**
- **Involvement of LCX ostium(n=6)**

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Which Stent is better ?

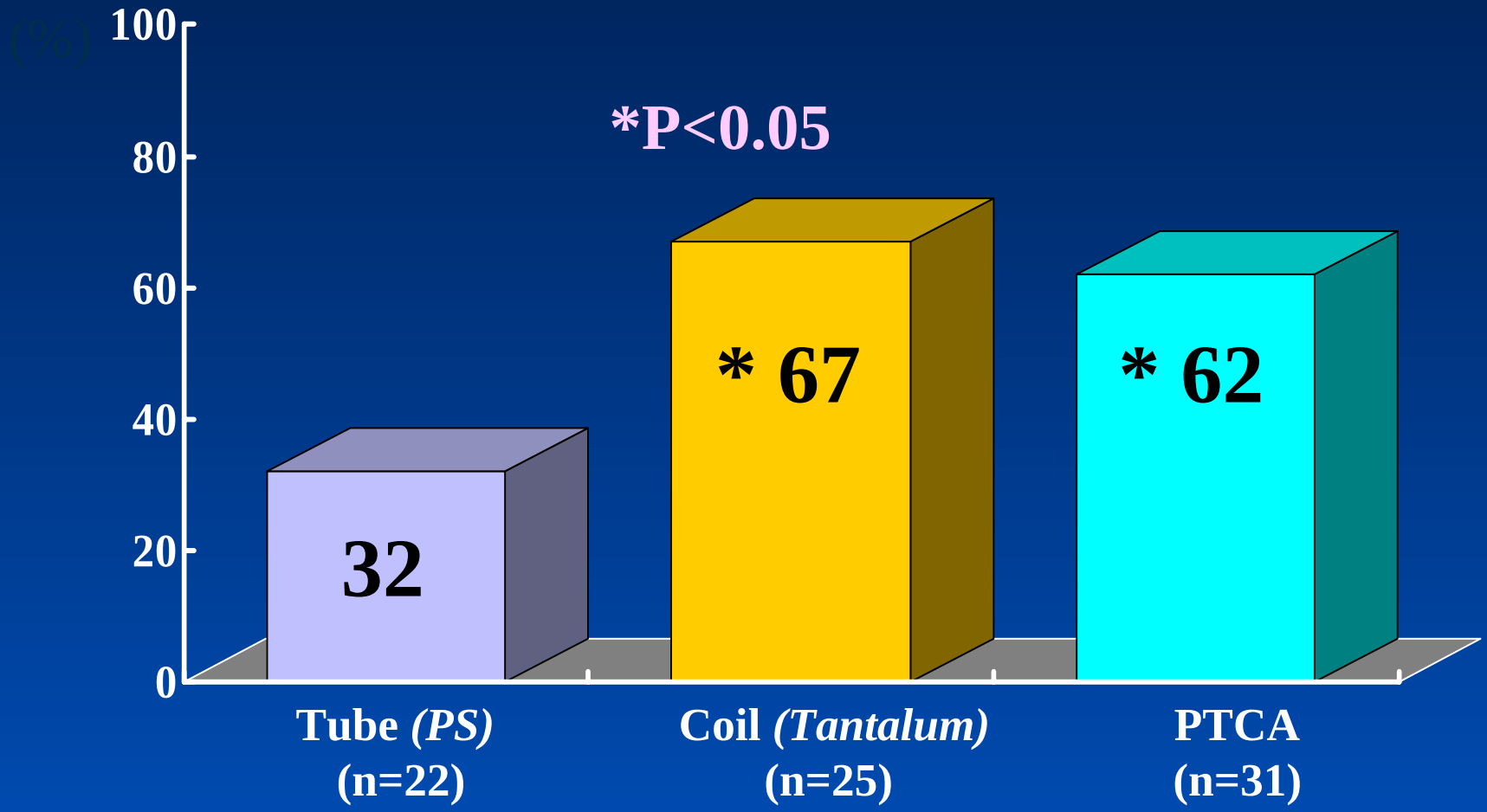
LAD Ostial Lesion

- **High radial force**
- **Good visibility**

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Coil vs Tube Stent

Restenosis Rate



Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Is side branch occlusion disastrous as expected ?

Yes, but we have a tips.

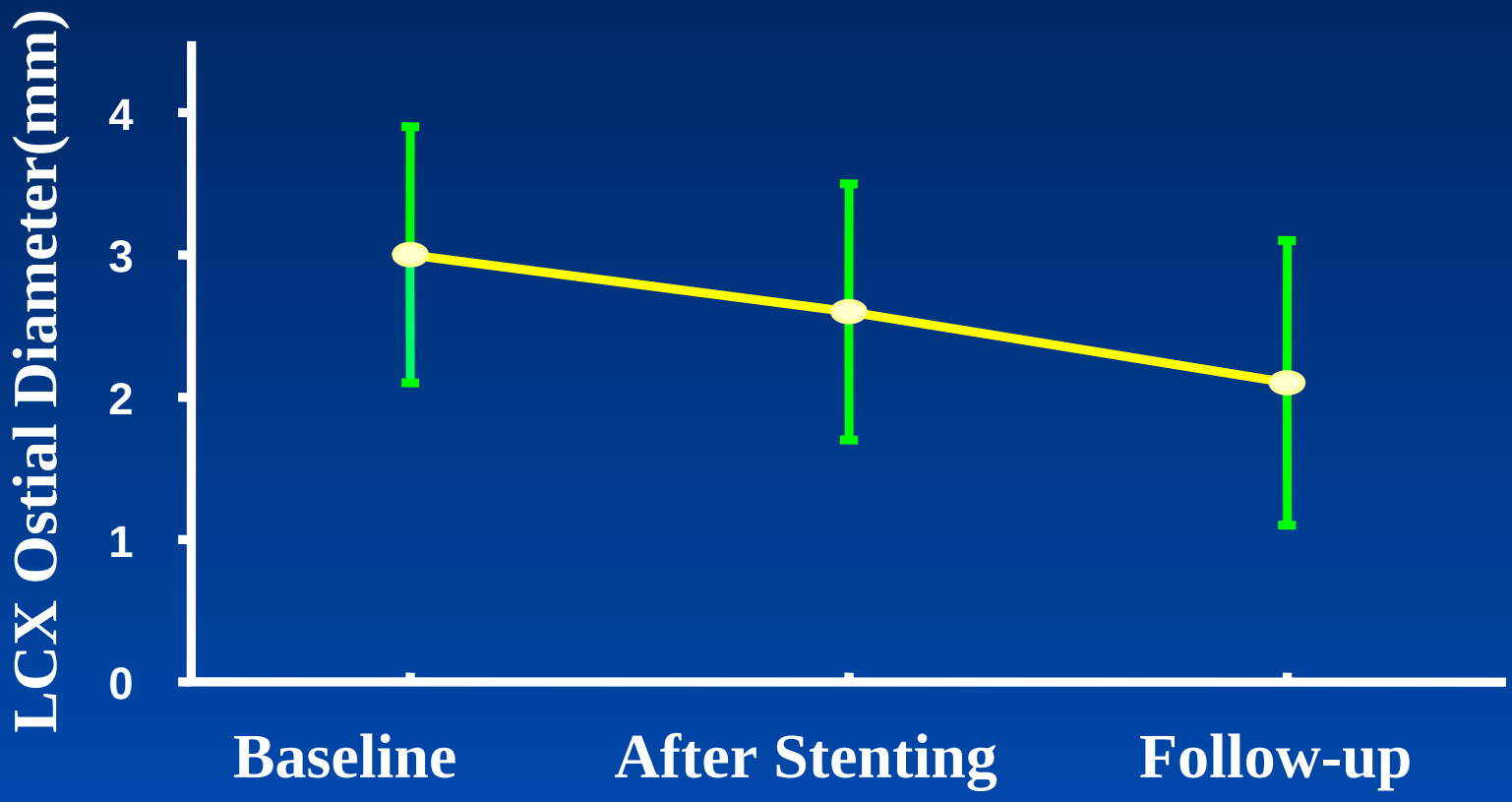
LCX Occlusion during PCI

LCX ostial compromise **after stenting may be related with clinical recurrence. (20% of restenosis cases)**

However…..

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Changes of LCX Ostial Diameter after Stenting



Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Factors *associated with the LCX ostial diameter change*

Variables	*r* value	*p* value
Stent jail(>50%)	0.47	0.001
LAD-LCX angle(≥80°)	0.005	0.96
LCX ostial diameter	0.17	0.07
Debulking procedure	0.11	0.27

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Only Factors Associated with the LCX Ostial Diameter Change

- **The presence of stent coverage of the LCX ostium>50%**

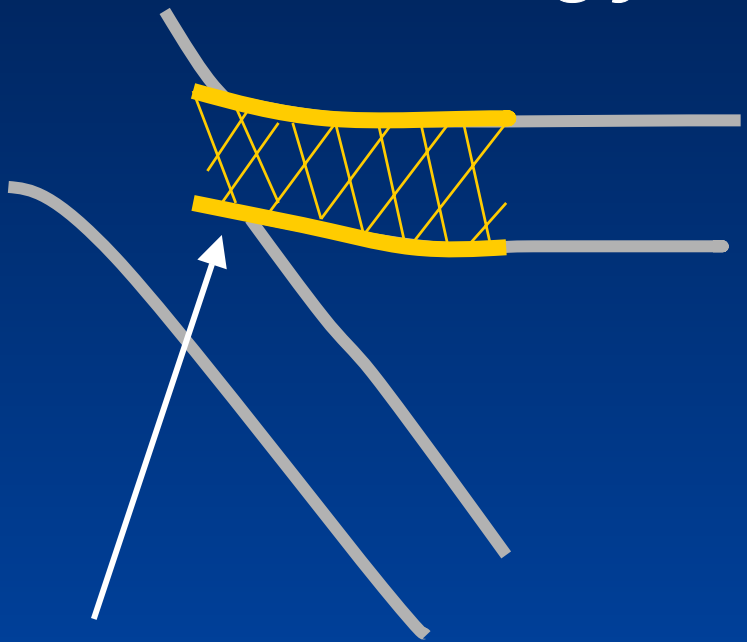
Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

For the Optimal Positioning of the Stents

- **Superzooming technique(x 8)**
- **RAO caudal or LAD caudal view**
- **Stents with visible markers**

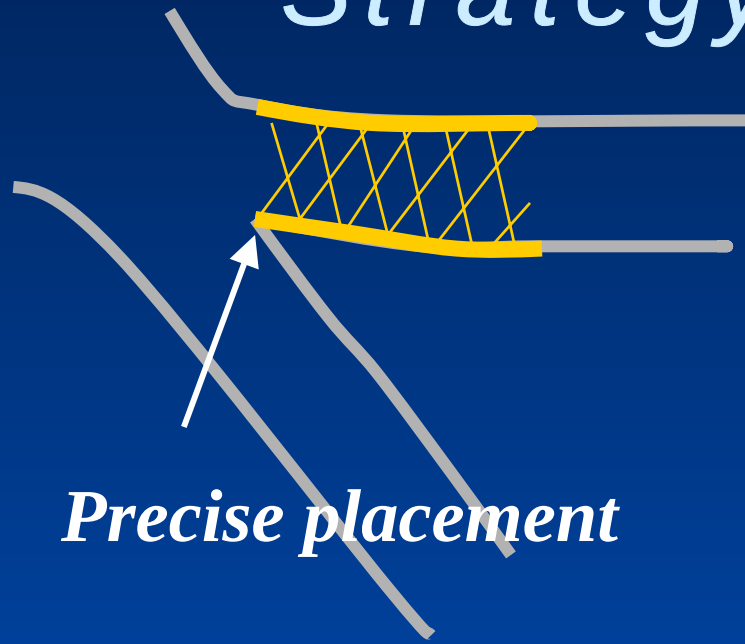
Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Past Strategy



Proximal strut of stent extended into the distal LM

Current recommended Strategy



Precise placement

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Conclusions

- **Stenting of ostial LAD stenosis may be a safe and feasible technique with an acceptable clinical outcome.**

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Can debulking be a useful adjunct to stenting ?

LAD Ostial Lesion
Debulking ..

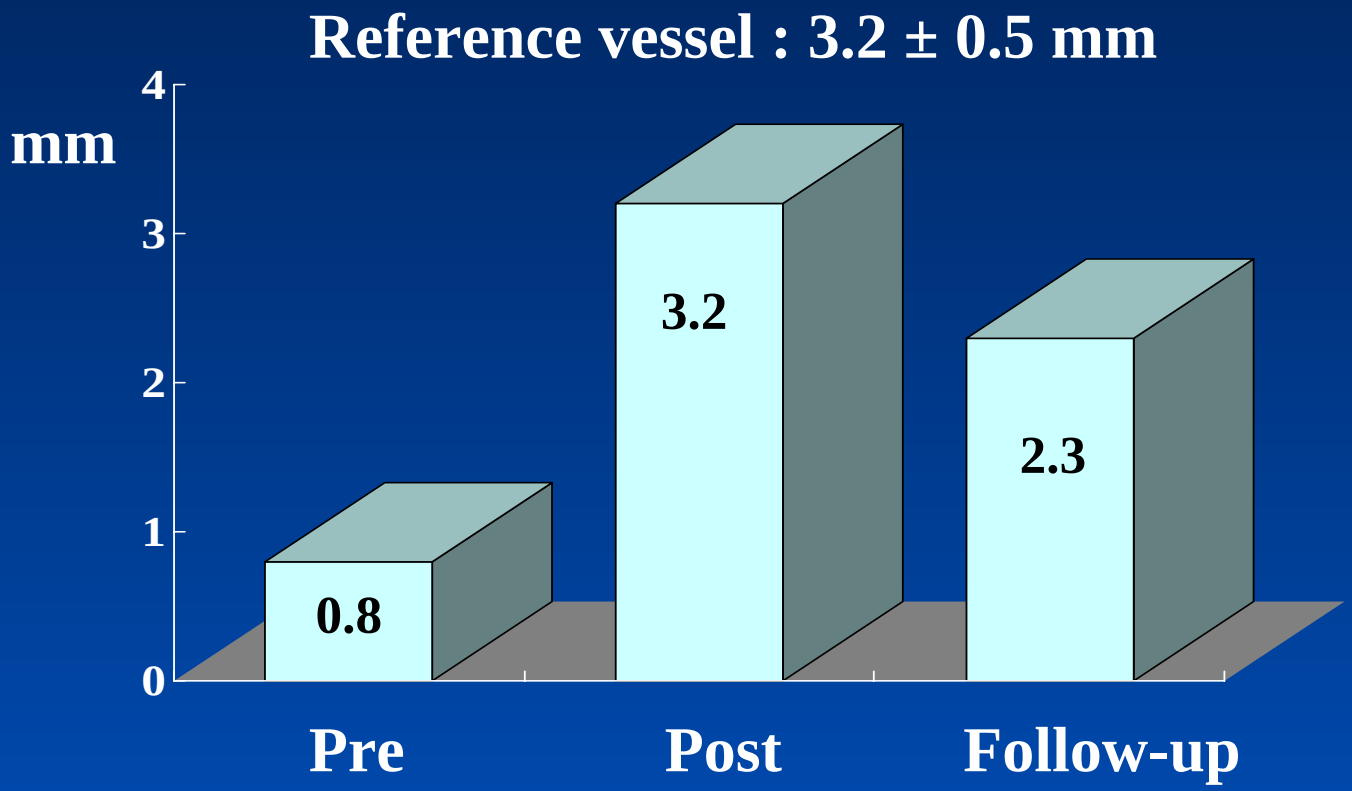
- **Aggressive debulking might reduce the residual plaque burden and subsequently the restenosis.**
- **However, it has limitation to prevent elastic recoil.**

LAD Ostial Lesion
Debulking and Stenting

- **Synergistic effect may be expected to combine removal of plaque and inhibition of elastic recoil.**

Debulking and Stenting

Minimal lumen diameter



Bramucci E, et al, Am J Med. 90:1074-1078, 2002

Debulking and Stenting

Restenosis rate :
13.2%

Bramucci E, et al, Am J Med. 90:1074-1078, 2002

Randomized Comparison of Debulking Followed by Stenting Versus Stenting Alone for LAD Ostial Stenosis

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SJ Park, et al, J Am Coll Cardiol (In press)

Purpose

Since March 2000

Prospective Randomized Comparison Study of DCA Followed by Stenting and Stenting Alone for LAD Ostial Stenosis

SJ Park, et al, J Am Coll Cardiol (In press)

Inclusions

- **Ostial stenosis : > 50% diameter Stenosis arising within 3 mm of the LAD orifice**
- **All patients were either symptomatic or ischemic by non-invasive testing**
- ***De novo* lesion**

SJ Park, et al, J Am Coll Cardiol (In press)

Procedures

- **Various types of stents were used**
- **Prospective randomized trial**
- **Directional Coronary Atherectomy**
  with Atherocath GTO system

SJ Park, et al, J Am Coll Cardiol (In press)

Methods

- Angiographic Analysis
- IVUS Analysis

SJ Park, et al, J Am Coll Cardiol (In press)

Follow-up

Clinical follow-up was performed by making out patients clinic and telephone interview each 3 month and follow-up coronary angiography was taken at 6 months later.

SJ Park, et al, J Am Coll Cardiol (In press)

Antithrombotic Regimen

Aspirin 200 mg QD indefinitely,

Ticlopidine 250 mg BID or

Clopidogrel 75 mg QD for 1 month

SJ Park, et al, J Am Coll Cardiol (In press)

LAD Ostial Stenting (n=86)

DCA prior to Stent (n=44)	Stent Alone (n=42)

SJ Park, et al, J Am Coll Cardiol (In press)

Baseline Clinical Findings

	D + S (n=44)	S (n=42)	P
Age (years)	59 ± 7	57 ± 9	0.305
Men / women	36 / 8	33 / 9	0.705
Unstable angina (%)	33 (75%)	28 (67%)	0.395
LV EF (%)	65 ± 8	61 ± 11	0.143
Multivessel (≥ 2)	5 (11%)	7 (17%)	0.478

SJ Park, et al, J Am Coll Cardiol (In press)

Risk Factors

	D + S (n=44)	S (n=42)	P
Current smoker	18 (41%)	23 (55%)	0.199
Diabetes mellitus	7 (16%)	9 (21%)	0.511
Hypercholesterolmia (> 200 mg/dL)	12 (27%)	14 (33%)	0.541
Systemic HTN	12 (27%)	15 (36%)	0.399
Previous MI	2 (5%)	2 (5%)	0.962

SJ Park, et al, J Am Coll Cardiol (In press)

Angiographic Findings

	D + S (n=44)	S (n=42)	P
Type B2, C	23 (52%)	13 (31%)	0.045
Lesion length (mm)	11.9 ± 3.9	12.0 ± 5.2	0.912
Stent length (mm)	15.0 ± 3.5	17.9 ± 6.2	0.008
Ball to Art ratio	1.1 ± 0.2	1.1 ± 0.2	0.798
Max inf press (atm)	12.8 ± 2.6	14.5 ± 2.9	0.008

SJ Park, et al, J Am Coll Cardiol (In press)

Angiographic Findings

	D + S (n=44)	S (n=42)	P
Reference size (mm)	**3.6 ± 0.5**	**3.6 ± 0.6**	**0.435**
MLD (mm)			
Baseline	**1.1 ± 0.4**	**1.0 ± 0.5**	**0.168**
Final	**4.0 ± 0.4**	**3.5 ± 0.5**	**< 0.001**
Follow-up	**2.3 ± 0.9**	**2.0 ± 0.9**	**0.187**

SJ Park, et al, J Am Coll Cardiol (In press)

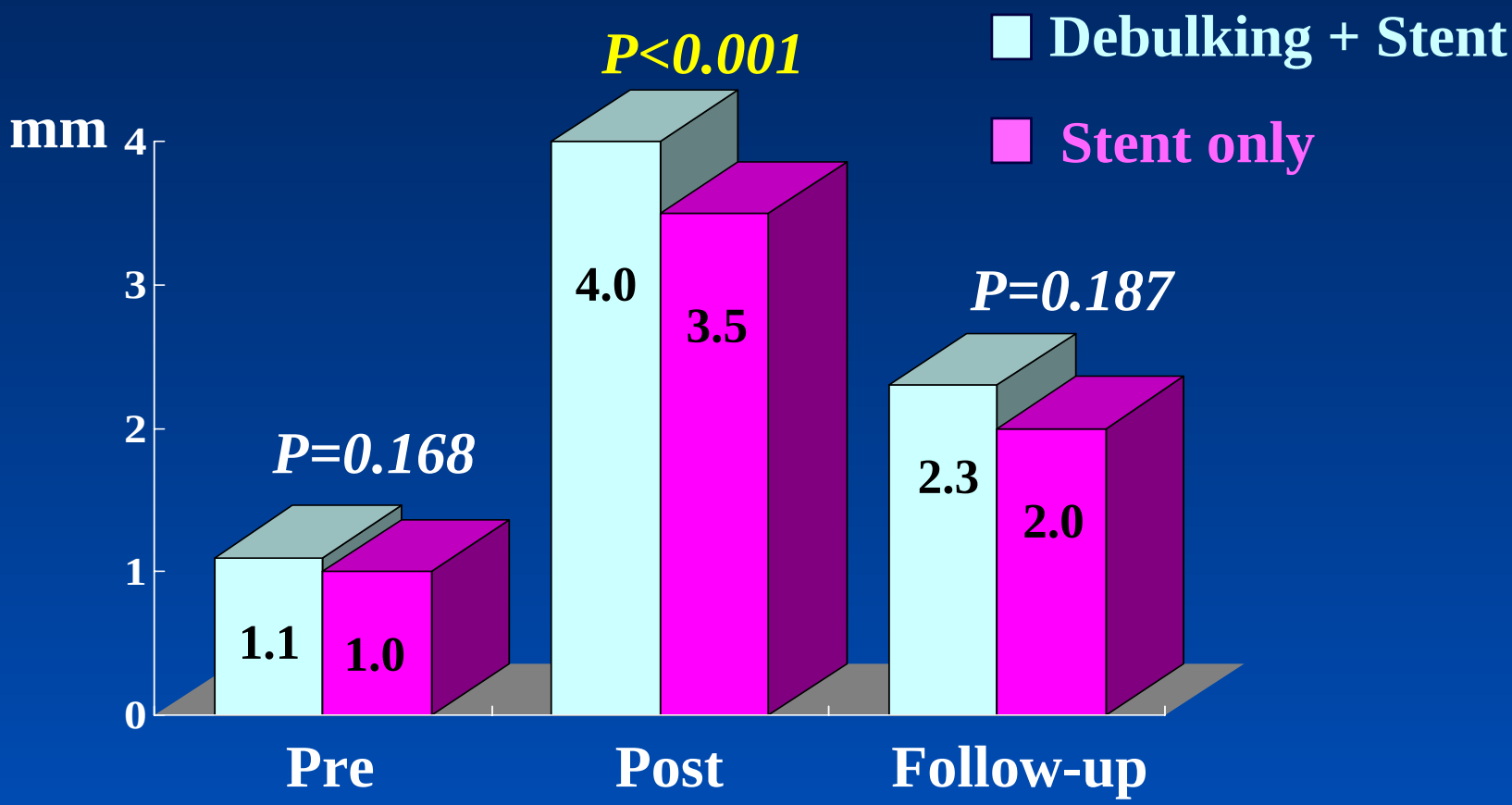
Diameter Stenosis (%)

	D + S (n=44)	S (n=42)	P
Baseline	**68.6 ± 10.4**	**71.9 ± 14.2**	**0.217**
Final	**-10.0 ± 13.4**	**1.5 ± 12.2**	**< 0.001**
Follow-up	**37.3 ± 28.5**	**44.8 ± 21.8**	**0.250**

SJ Park, et al, J Am Coll Cardiol (In press)

Role of Debulking

Minimal lumen diameter



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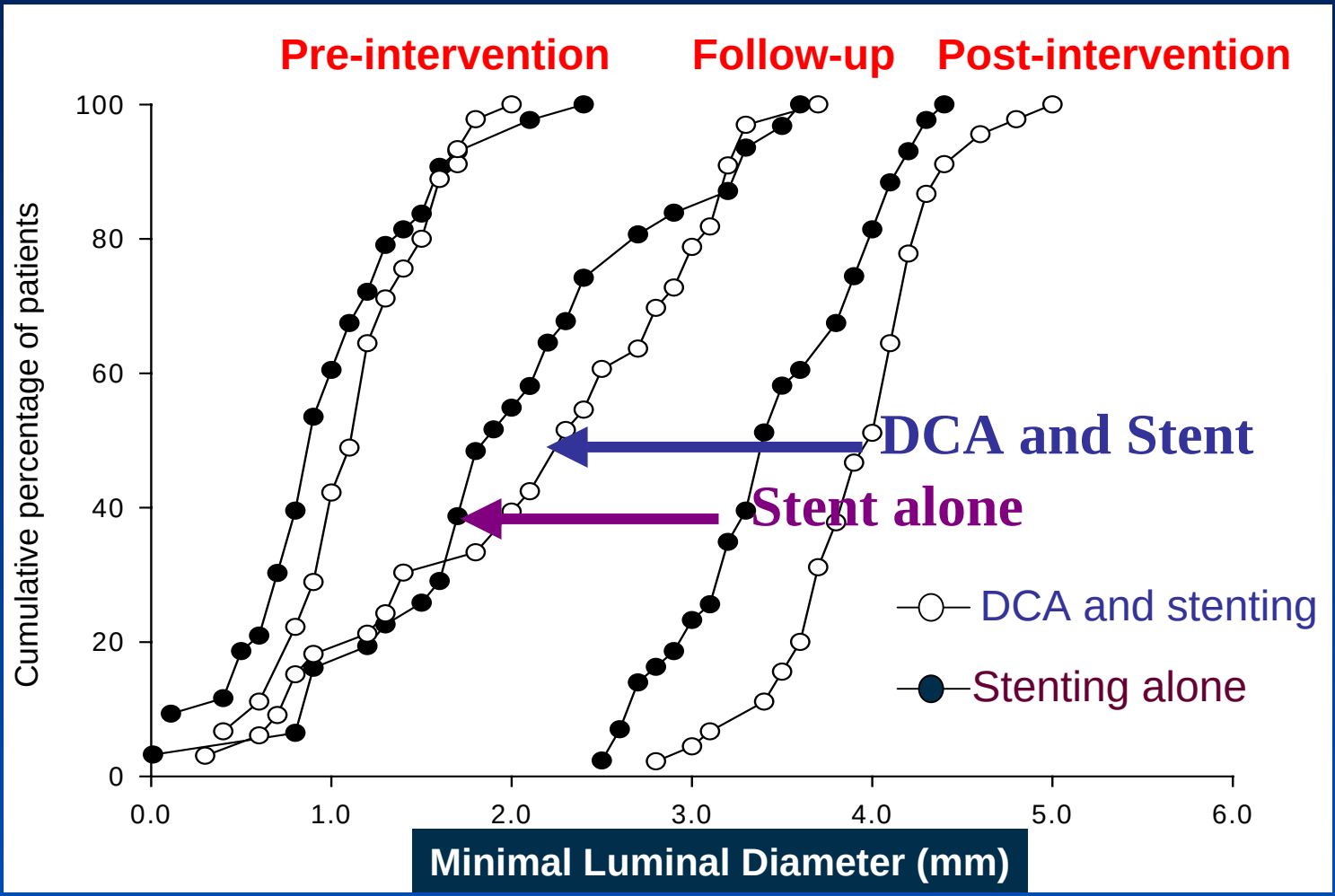
Cumulative Percentage of patients (%)



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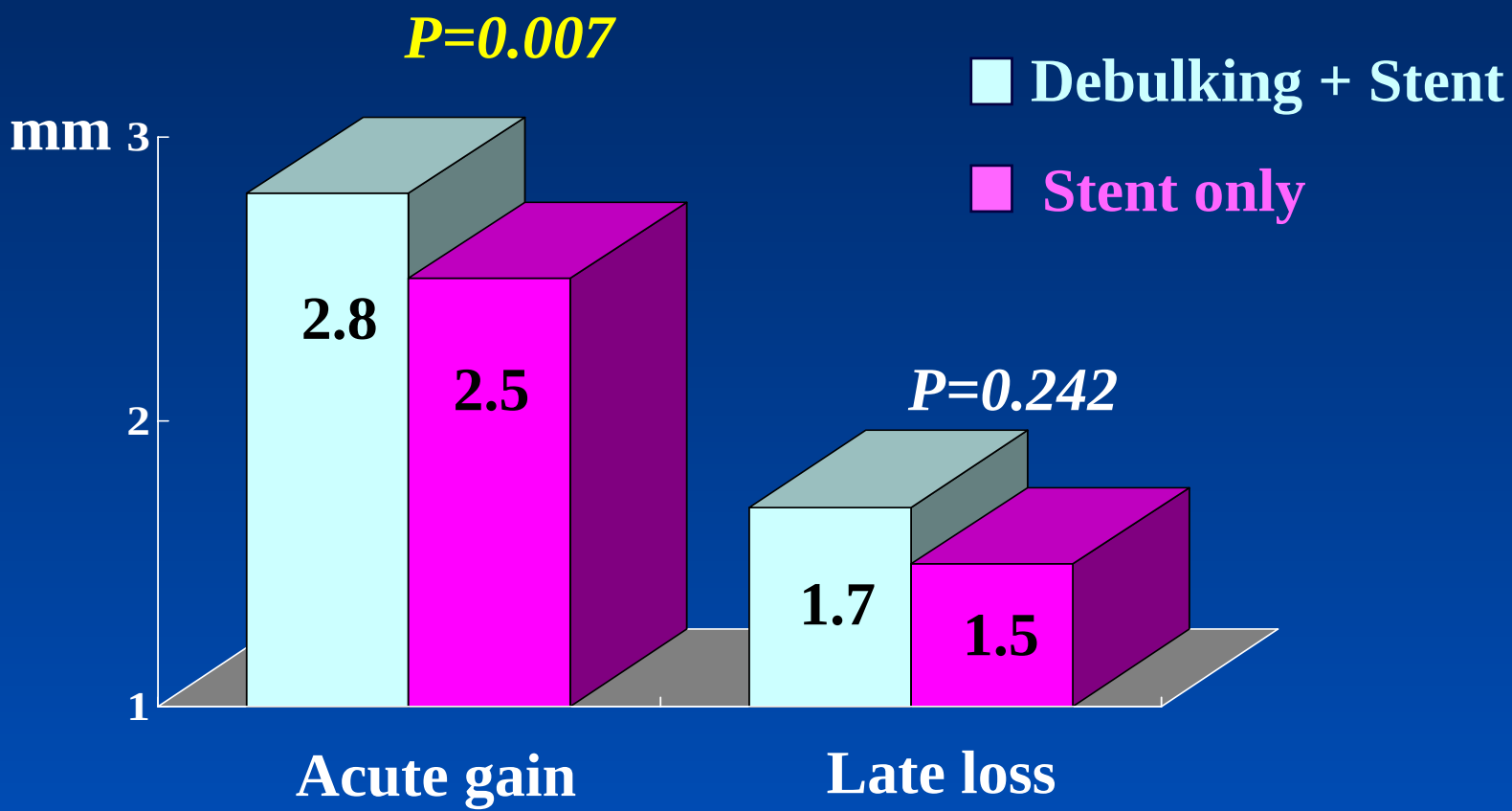
Role of Debulking

Change of lumen diameter



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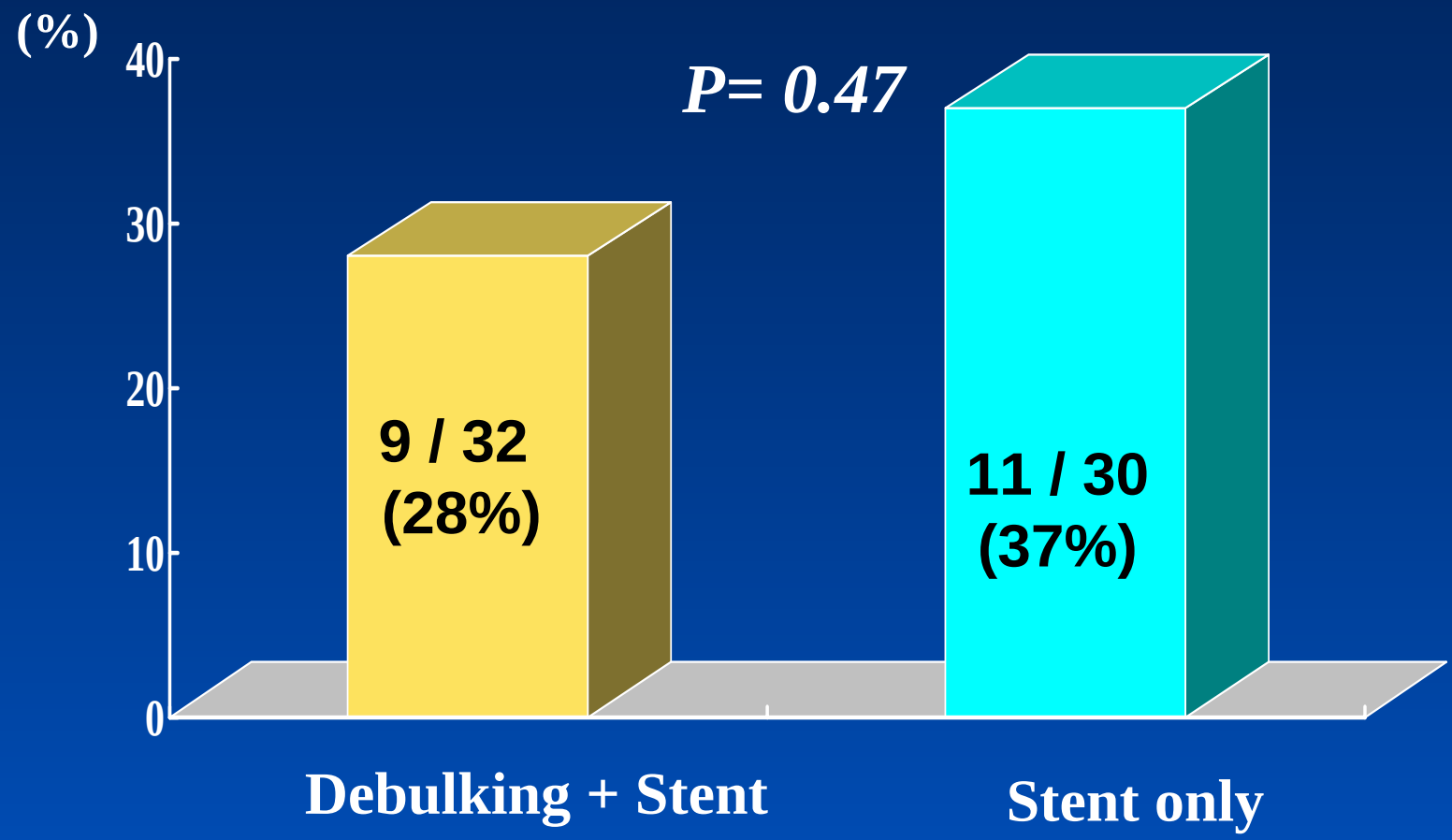
Role of Debulking

Restenosis rate



SJ Park, et al, J Am Coll Cardiol (In press)

Conclusions

- **Debulking procedure with stenting gained greater luminal area, but it did not lead to lower restenosis rate due to the tendency of higher late loss.**

SJ Park, et al, J Am Coll Cardiol (In press)

IVUS analysis

- **Serial (pre-intervention, post-DCA, post-intervention) IVUS evaluation : 67 (78%) patients**

SJ Park, et al, J Am Coll Cardiol (In press)

IVUS Findings
Reference segment

	D + S (n=35)	S (n=32)	P
EEM CSA (mm^2)			
Pre-intervention	**15.0 ± 3.0**	**14.9 ± 3.7**	**0.920**
Post-DCA	**15.3 ± 3.2**		
Post-intervention	**15.5 ± 2.8**	**15.3 ± 3.6**	**0.851**
Lumen CSA (mm^2)			
Pre-intervention	**9.5 ± 2.1**	**9.7 ± 2.7**	**0.840**
Post-DCA	**10.0 ± 2.4**		
Post-intervention	**10.3 ± 2.0**	**9.1 ± 2.4**	**0.783**

SJ Park, et al, J Am Coll Cardiol (In press)

IVUS Findings
Lesion segment

	D + S (n=35)	S (n=32)	P
EEM CSA (mm^2)			
Pre-intervention	**14.2 ± 3.7**	**13.7 ± 3.9**	**0.576**
Post-DCA	**16.1 ± 3.9**		
Post-intervention	**18.3 ± 3.2**	**18.2 ± 3.6**	**0.897**
Lumen CSA (mm^2)			
Pre-intervention	**1.9 ± 0.3**	**1.9 ± 0.3**	**0.952**
Post-DCA	**7.8 ± 1.7**		
Post-intervention	**10.0 ± 1.5**	**9.0 ± 2.4**	**0.075**

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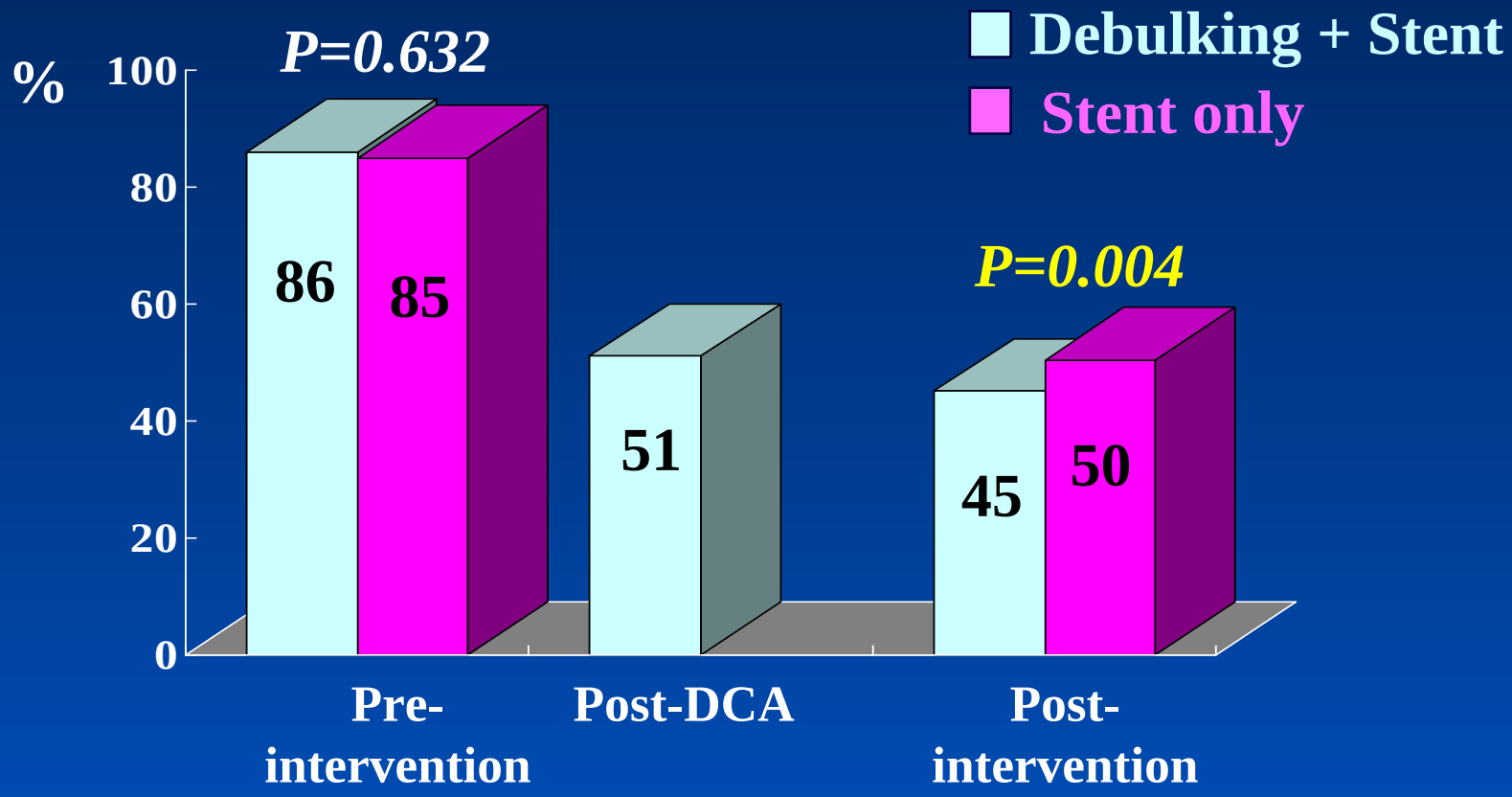
Role of Debulking

Reduction of plaque burden



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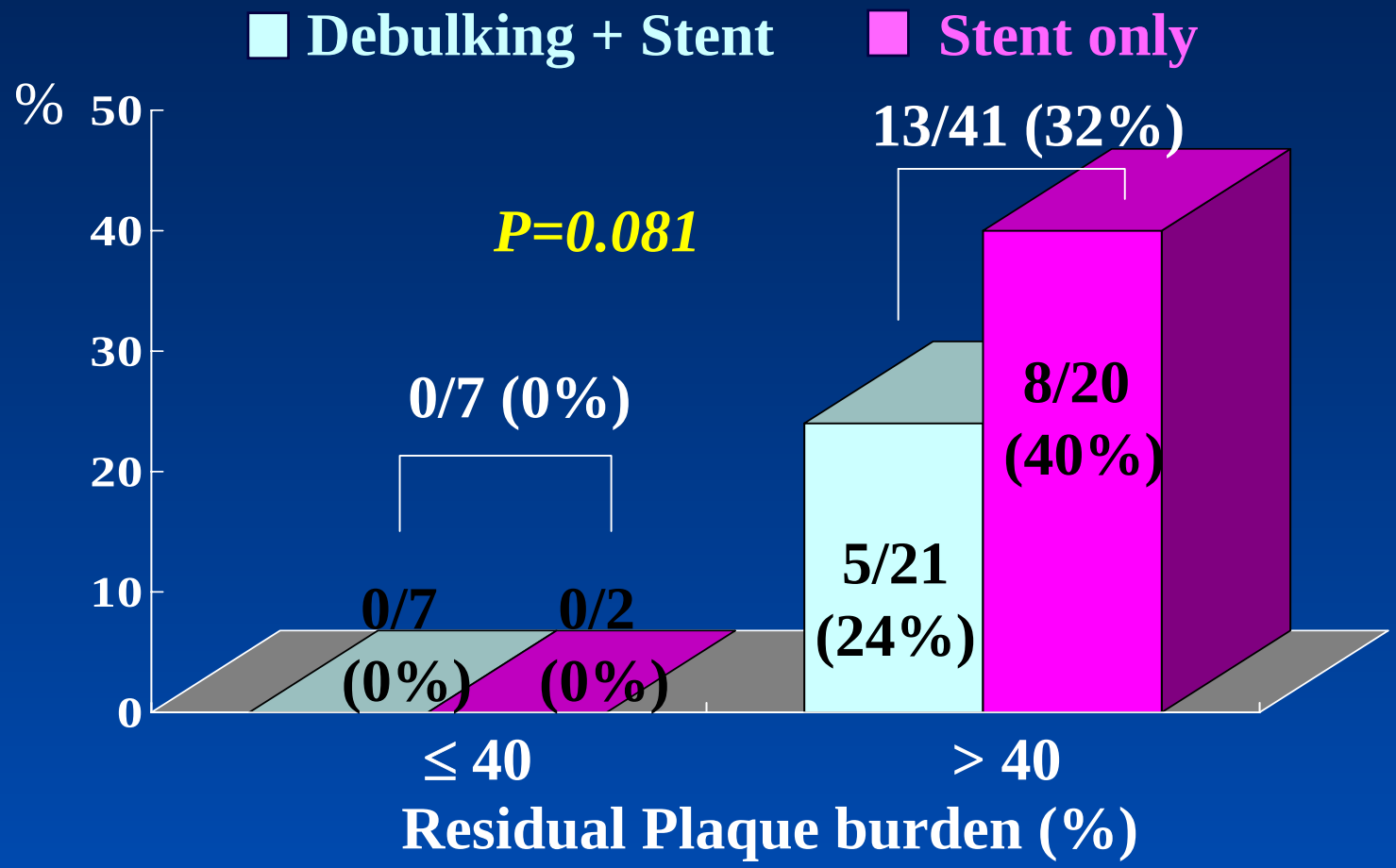
Effect of Residual Plaque

Restenosis rate



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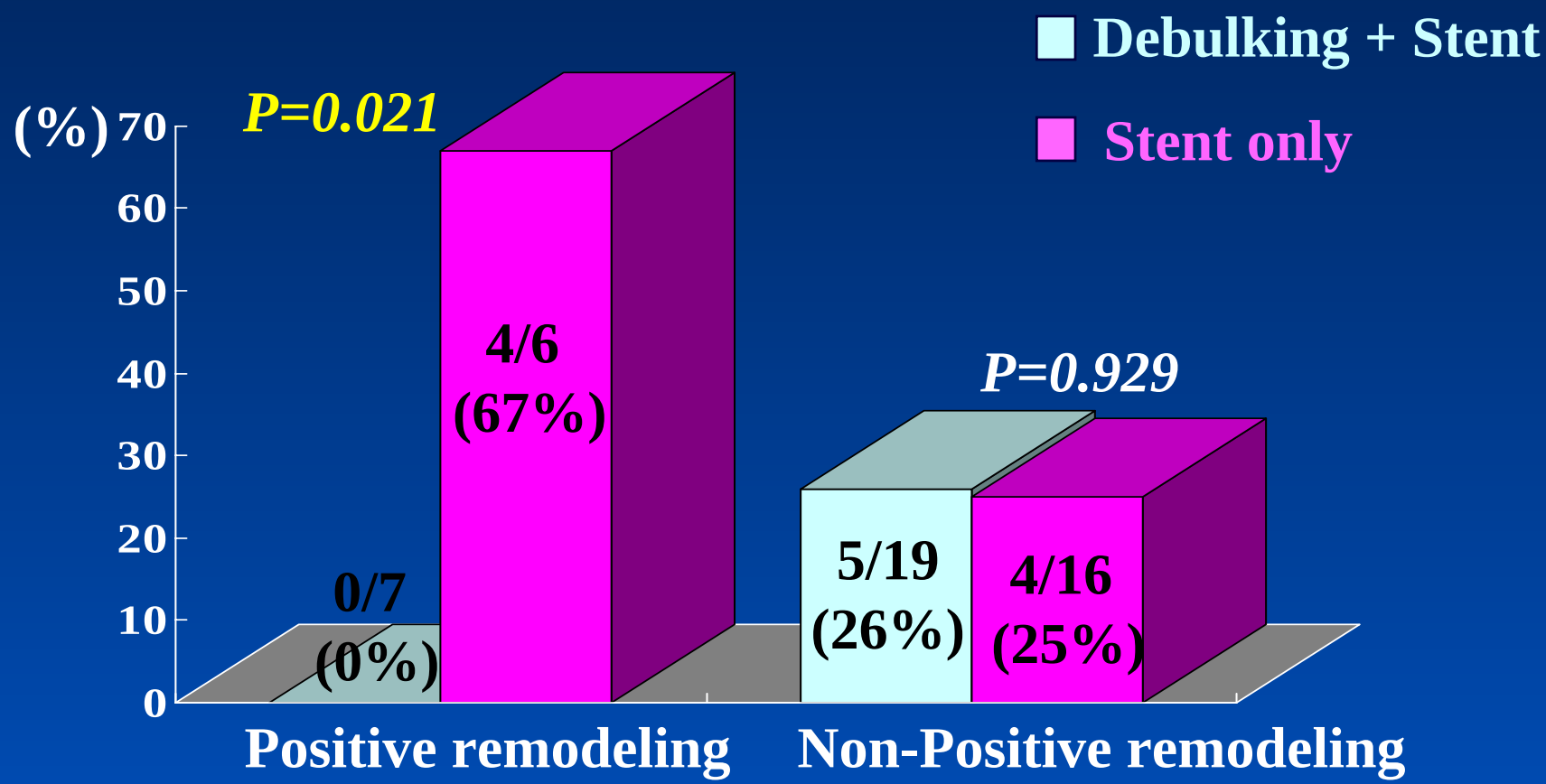
Role of Debulking

Restenosis rate according to remodeling



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Suggestions...

- **The device limitation for substantial reduction of plaque burden might explain in part the lack of restenosis-reducing effect of DCA prior to stenting.**
- **More effective debulking with new debulking device might be needed to improve angiographic result.**
- **Debulking might be beneficial in lesions with positive remodeling.**

Park SJ, et al, Cathet Cardiovasc Intervent. 49:267-271, 2000

Determinants of Angiographic Restenosis

- ***QCA and IVUS predictors associated with angiograhic restenosis***

SJ Park, et al, J Am Coll Cardiol (In press)

Angiographic Findings

	Restenosis (n=20)	No restenosis (n=42)	P
Lesion length (mm)	11.6 ± 5.6	10.7 ± 3.8	0.626
Reference size (mm)	3.7 ± 0.5	3.6 ± 0.6	0.853
MLD (mm)			
Baseline	1.2 ± 0.4	1.0 ± 0.5	0.218
Final	3.5 ± 0.6	3.8 ± 0.6	0.055

SJ Park, et al, J Am Coll Cardiol (In press)

IVUS Findings
Reference Segment

	Restenosis (n=20)	No restenosis (n=42)	P
EEM CSA (mm^2)			
Pre-intervention	**13.5 ± 3.8**	**15.5 ± 3.1**	**0.078**
Post-intervention	**13.9 ± 3.2**	**16.0 ± 3.0**	**0.045**
Lumen CSA (mm^2)			
Pre-intervention	**8.8 ± 2.8**	**9.9 ± 2.2**	**0.145**
Post-intervention	**9.2 ± 2.4**	**10.6 ± 2.0**	**0.053**

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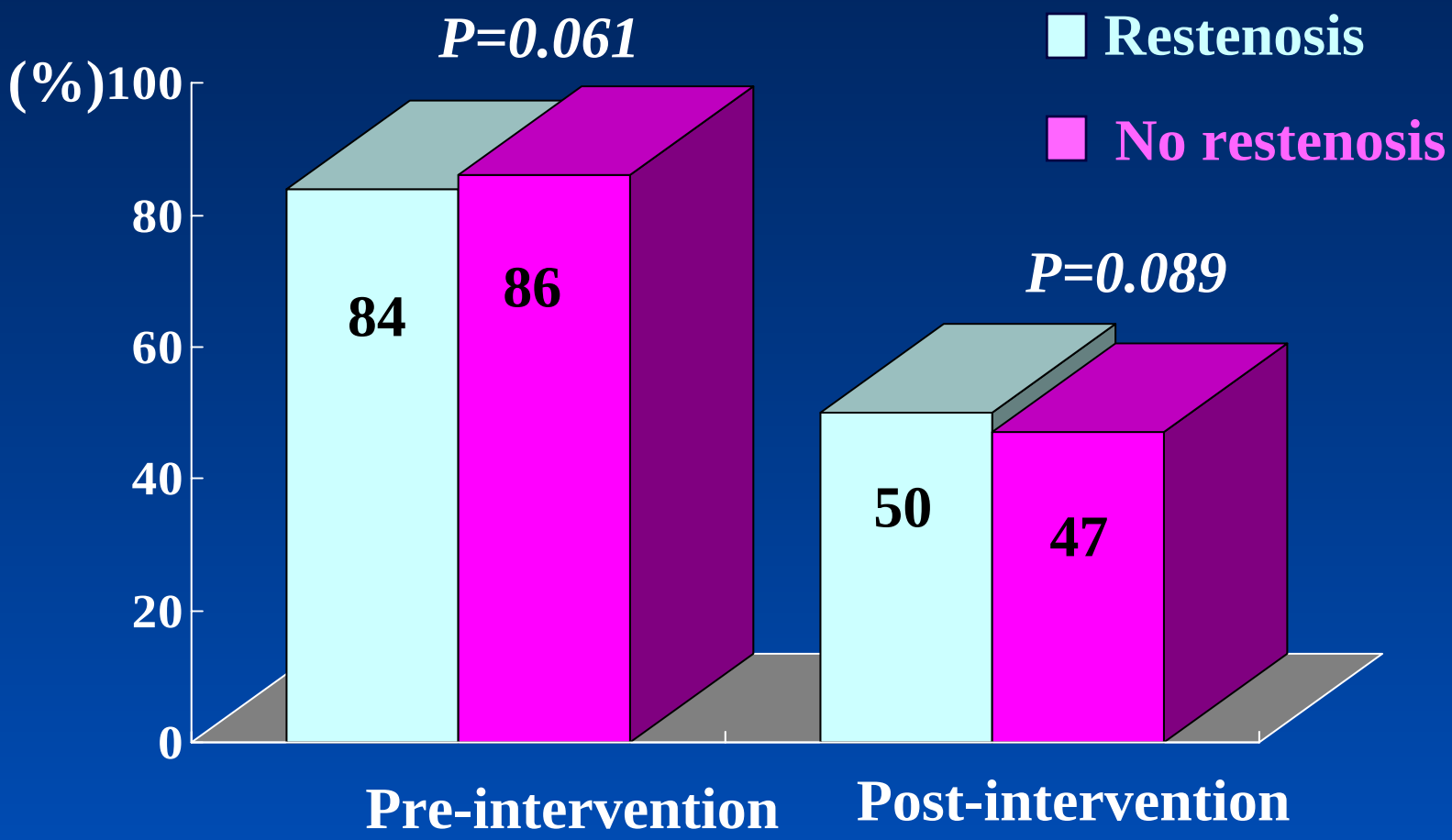
IVUS Findings
Lesion Segment

	Restenosis (n=20)	No restenosis (n=42)	P
EEM CSA (mm^2)			
Pre-intervention	**12.8 ± 4.5**	**14.5 ± 3.4**	**0.173**
Post-intervention	**17.1 ± 3.9**	**18.7 ± 3.1**	**0.145**
Lumen CSA (mm^2)			
Pre-intervention	**1.9 ± 0.3**	**1.9 ± 0.3**	**0.773**
Post-intervention	**8.4 ± 1.9**	**9.9 ± 1.7**	**0.011**

SJ Park, et al, J Am Coll Cardiol (In press)

Association with Plaque Burden and Restenosis



SJ Park, et al, J Am Coll Cardiol (In press)

Predictor of Restenosis

-Multivariate Analysis-

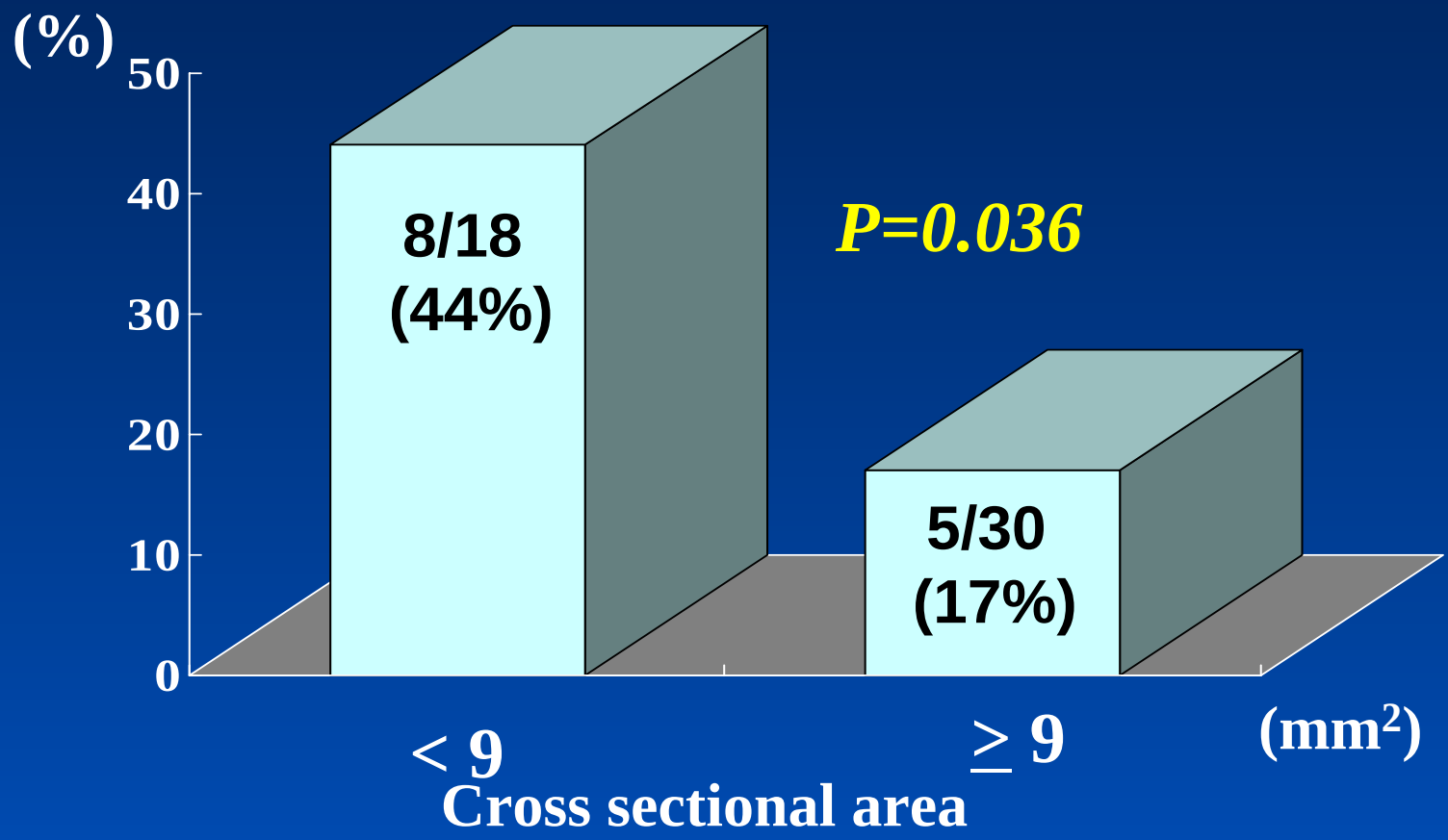
- **Stent CSA after procedure**

  Odds ratio ; 0.61
  95% CI ; 0.41 – 0.92
  P = 0.018

SJ Park, et al, J Am Coll Cardiol (In press)

Stent CSA after Procedure

Restenosis rate



SJ Park, et al, J Am Coll Cardiol (In press)

Clinical Follow-up (n=86)

Mean Duration : **19 ± 9 months**

- TLR — 10 (12%)
  - **DCA + Stenting** — **5 (11%)**
  - **Stenting alone** — **5 (12%)**
- Death — 0
- Q MI — 0

SJ Park, et al, J Am Coll Cardiol (In press)

Conclusions

- **We consistently suggest that the final stent area is the most important determinant for prediction of restenosis.**

- **The final stent area ≥ 9 mm^2 might be a good guideline of optimal PCI for LAD ostial stenosis.**

SJ Park, et al, J Am Coll Cardiol (In press)

Two Representatives of Future Revascularization

Surgeon's View :

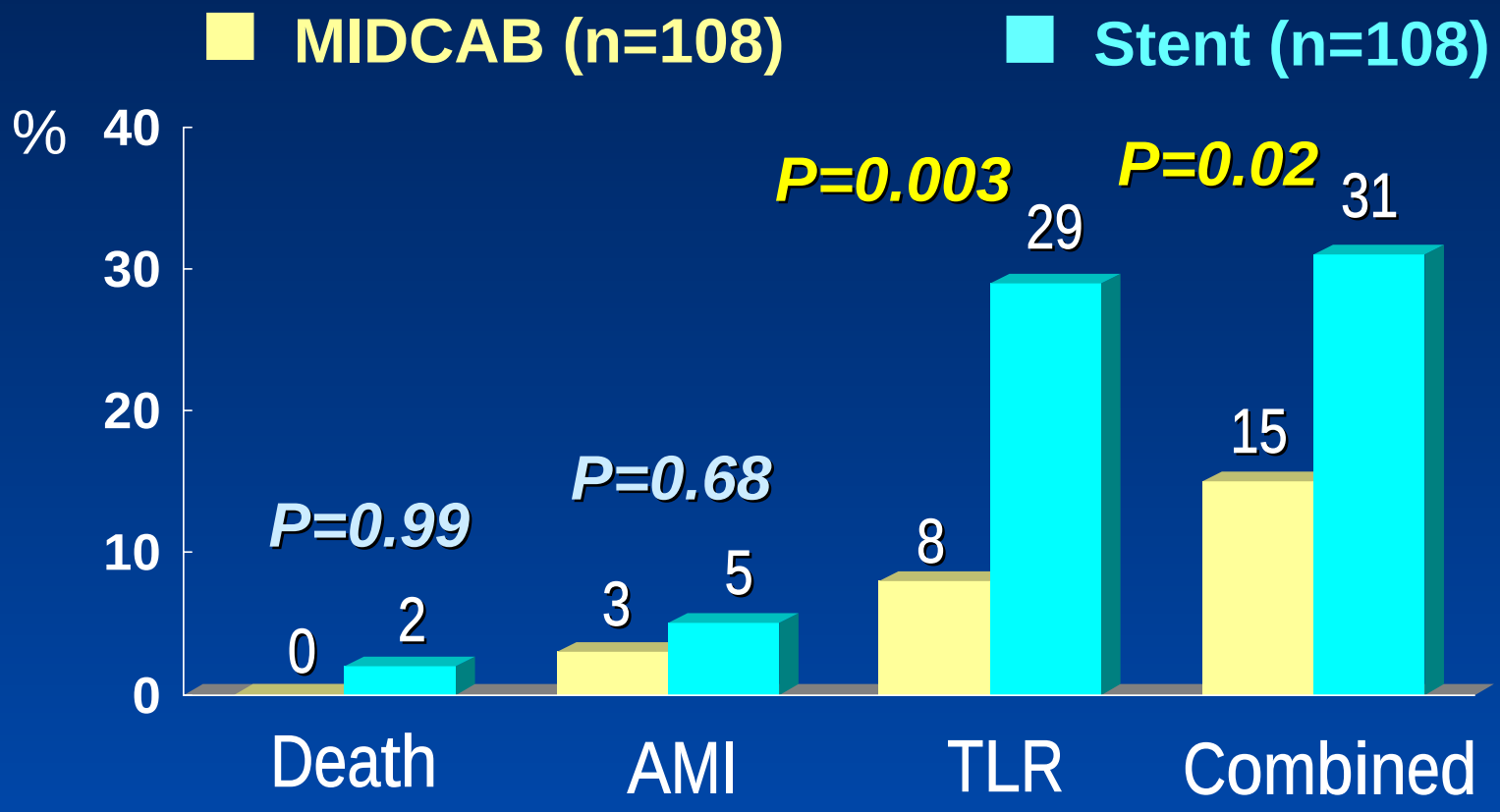
I like MIDCAB.

Interventionist's View :

I believe DES.

MIDCAB vs. Stent

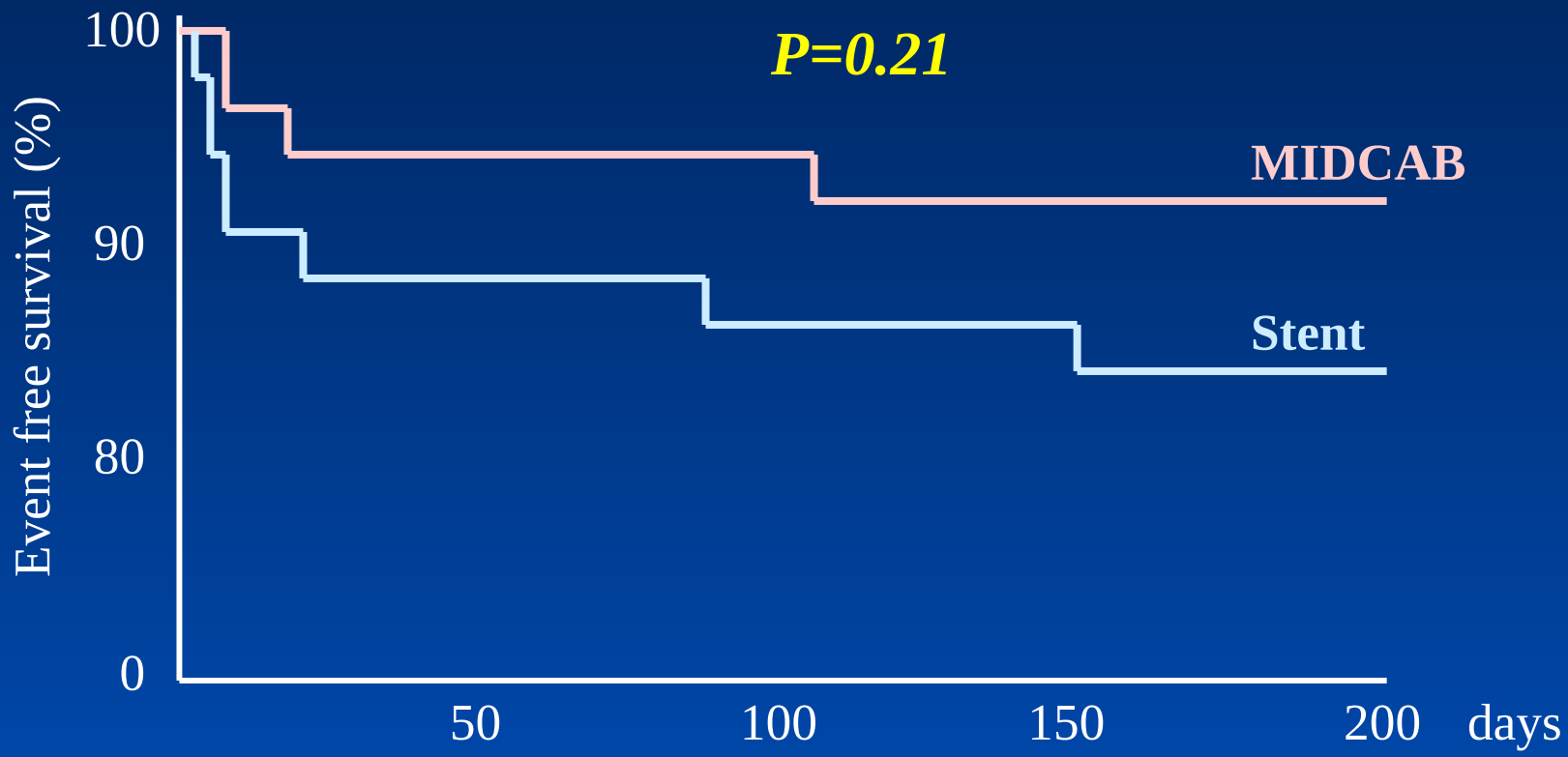
6 months follow-up



Diegeler A, et al, N Engl J Med 2002;347:561

MIDCAB vs. Stent

200 days FU of death, MI, stroke, and TLR



Drenth DJ, et al, J Thorac Cardiovasc Surg 2002;124:130

SIRIUS

Sirolimus Eluting Stent

	Sirolimus (n=234)	Control (n=228)	P value
Late loss (mm)			
In-stent	**0.20**	**1.04**	**<0.001**
In-segment	**0.26**	**0.81**	**<0.001**
Restenosis (%)			
In-stent	**2.0**	**41.6**	**<0.001**
In-segment	**10.1**	**41.6**	**<0.001**
TLR (%)	**5.1**	**19.7**	**<0.001**
MACE (%)	**8.5**	**22.4**	**<0.001**

SIRIUS - TLR Events

	Sirolimus	Control	P-value	# events prevented per 1,000 patients
Overall	4.1	16.6	0.0001	124
Male	4.4	16.6	0.0001	122
Female	3.4	16.5	0.0007	130
Diabetes	6.9	22.3	0.0006	154
No Diabetes	3.2	14.3	0.0001	111
LAD	5.1	19.8	0.0001	147
Non-LAD	3.4	14.3	0.0001	109
Small Vessel (<2.75)	6.3	18.7	0.0001	125
Large Vessel	1.9	14.8	0.0001	128
Short Lesion	3.2	16.1	0.0001	129
Long Lesion (>13.5)	5.2	17.4	0.0001	122
Overlap	4.5	17.7	0.0003	131
No Overlap	3.9	16.1	0.0001	121

In the Future ....

LAD Ostial Lesion

- **Randomized comparison studies about the efficacy of DES, debulking, and MIDCAB are being expected.**