Unprotected Left Main Coronary Artery Intervention in the Era of Drug Eluting Stent

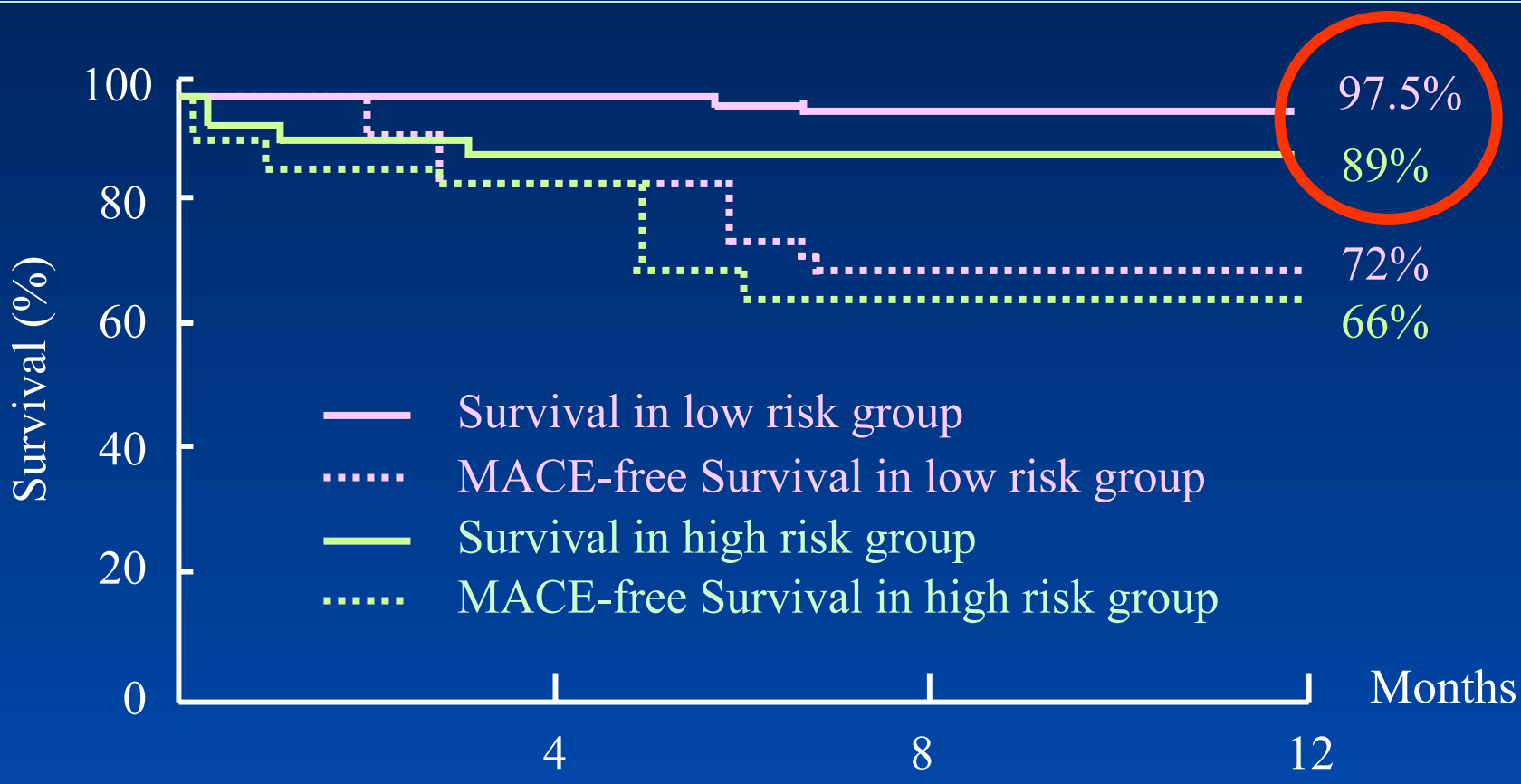
Safety of LMCA Intervention

Already Proved !

in the previous clinical studies with use of bare metal stent

One-Year Outcome

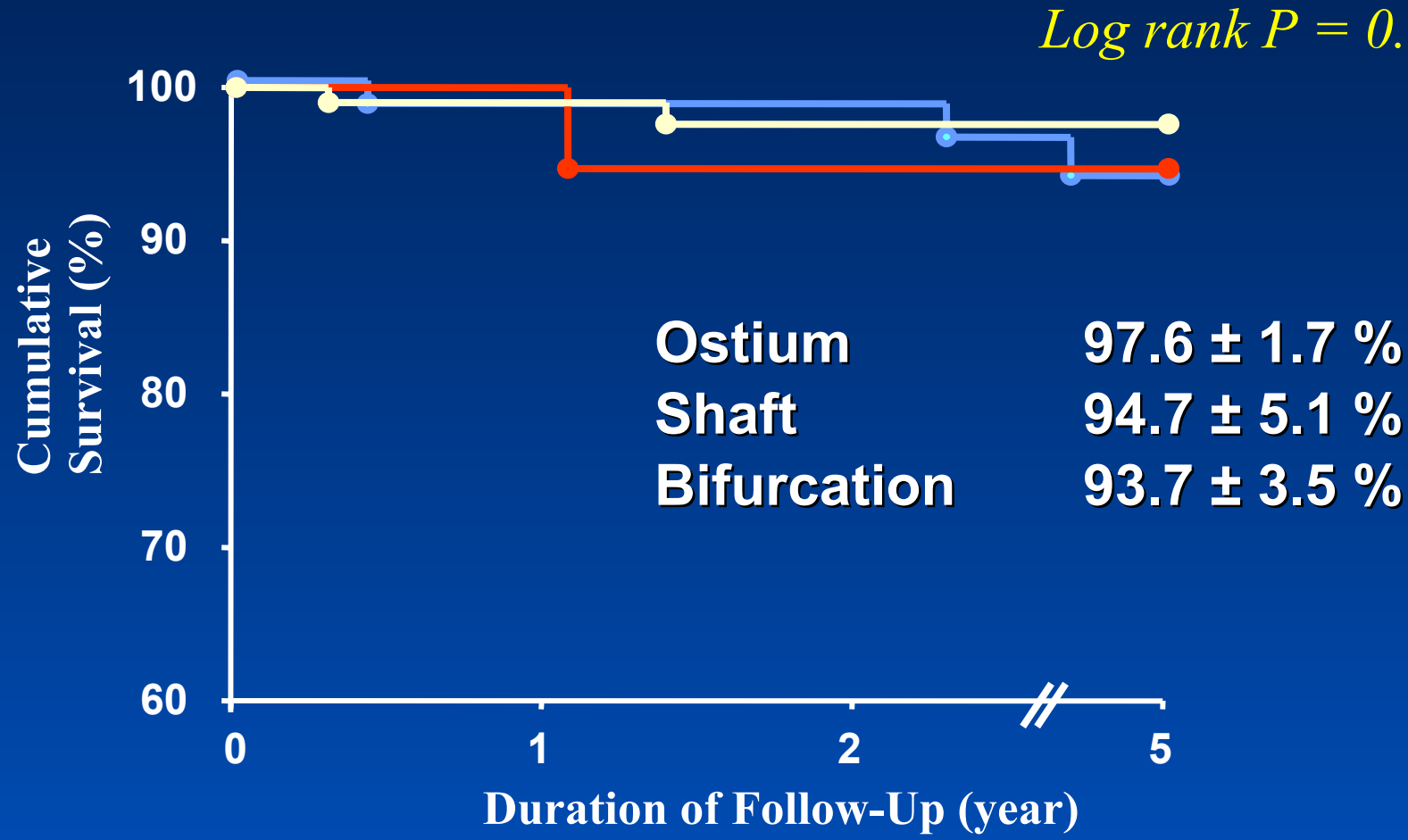
Safe in Low Risk Patients



Silvestri M et al. J Am Coll Cardiol 2000;35:1543

5 Year Survival

Safe in All Lesion Locations (AMC data)



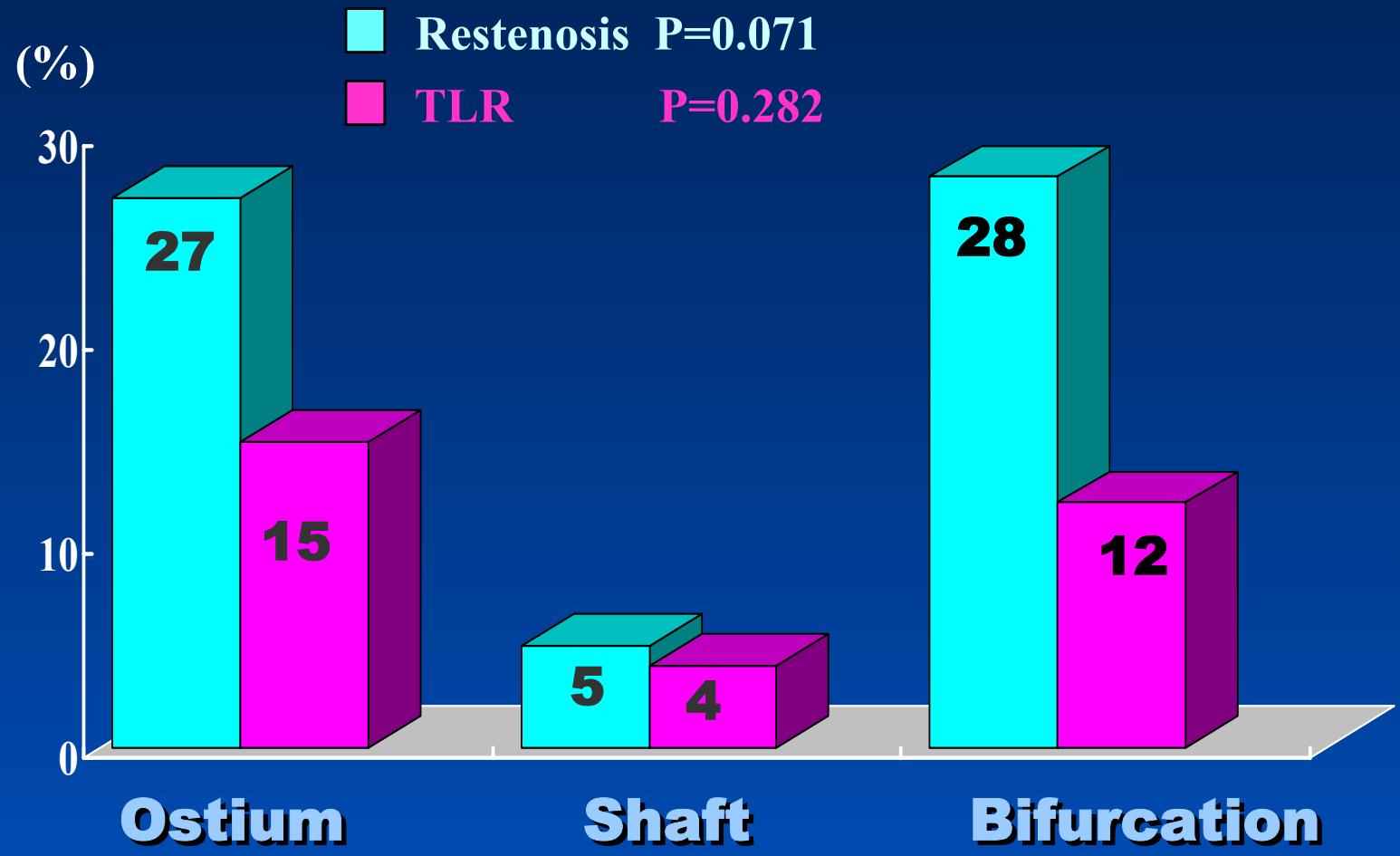
Park SJ, Am J Cardiol 2003;

Feasibility of LMCA Intervention

Acceptable !

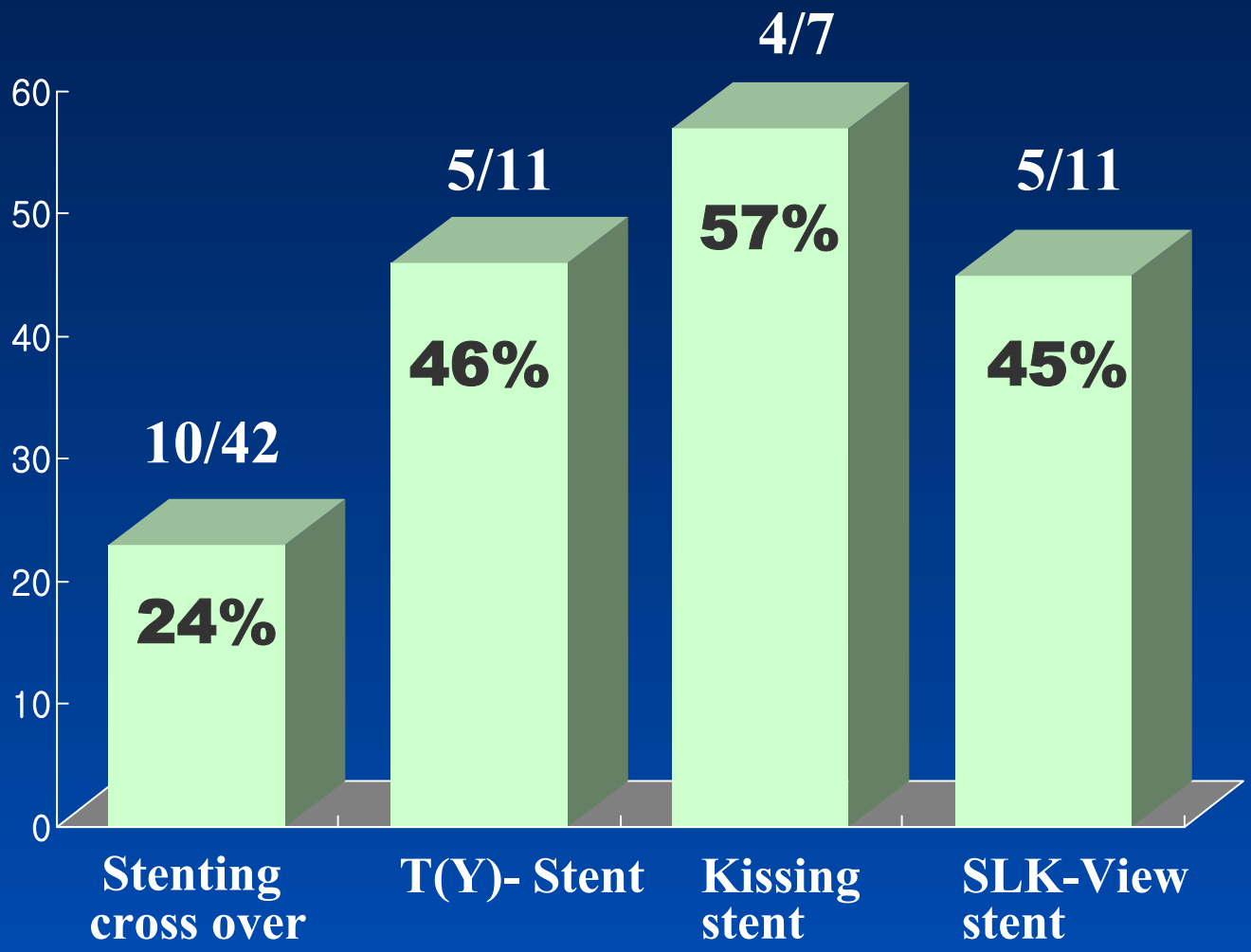
in the previous clinical studies with use of bare metal stent

Restenosis Rate & TLR (overall)



Park SJ, Am J Cardiol 2003

Restenosis Rate at Bifurcation



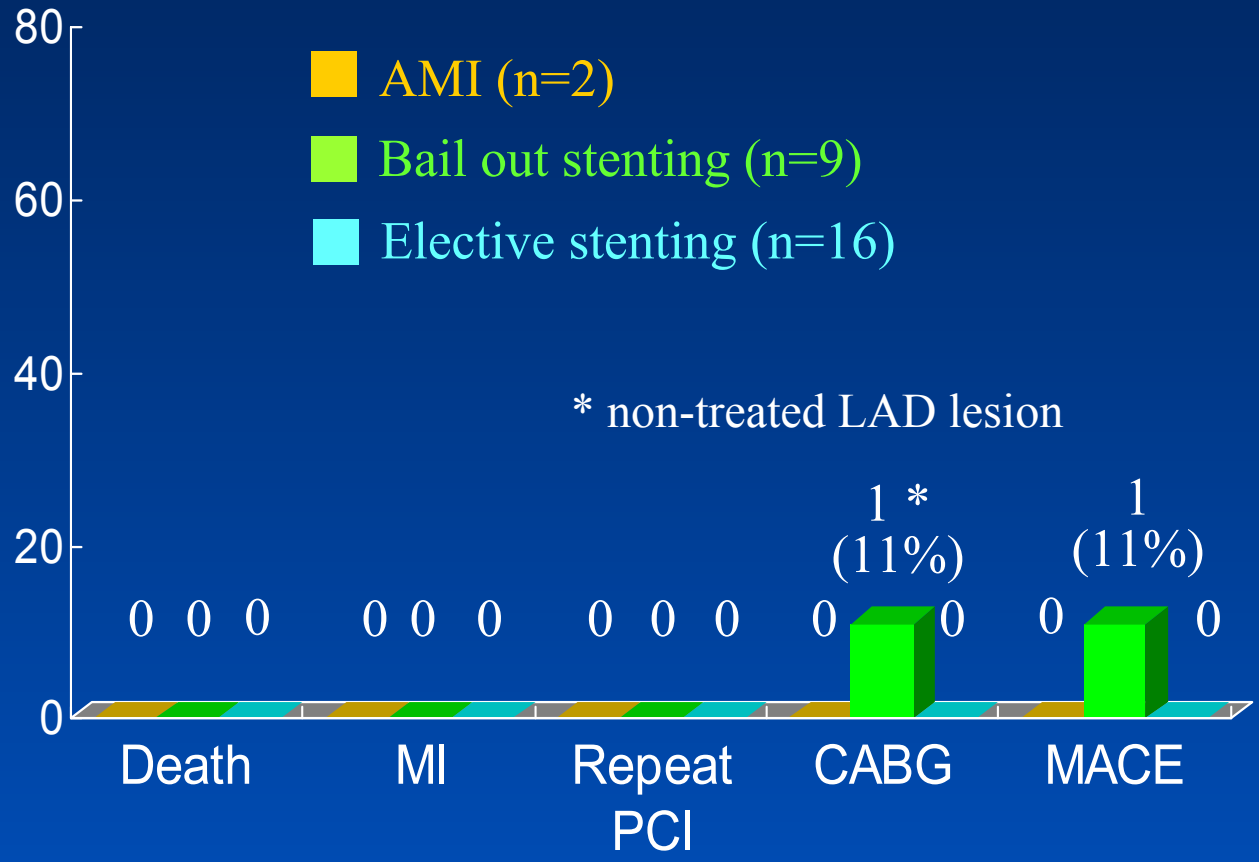
Park SJ, Am J Cardiol 2003

What is changing in DES era

- Simplified technique
- Stent only technique
- Very low recurrence

Cypher for Unprotected LM

Post-discharge Outcomes of 27 pts

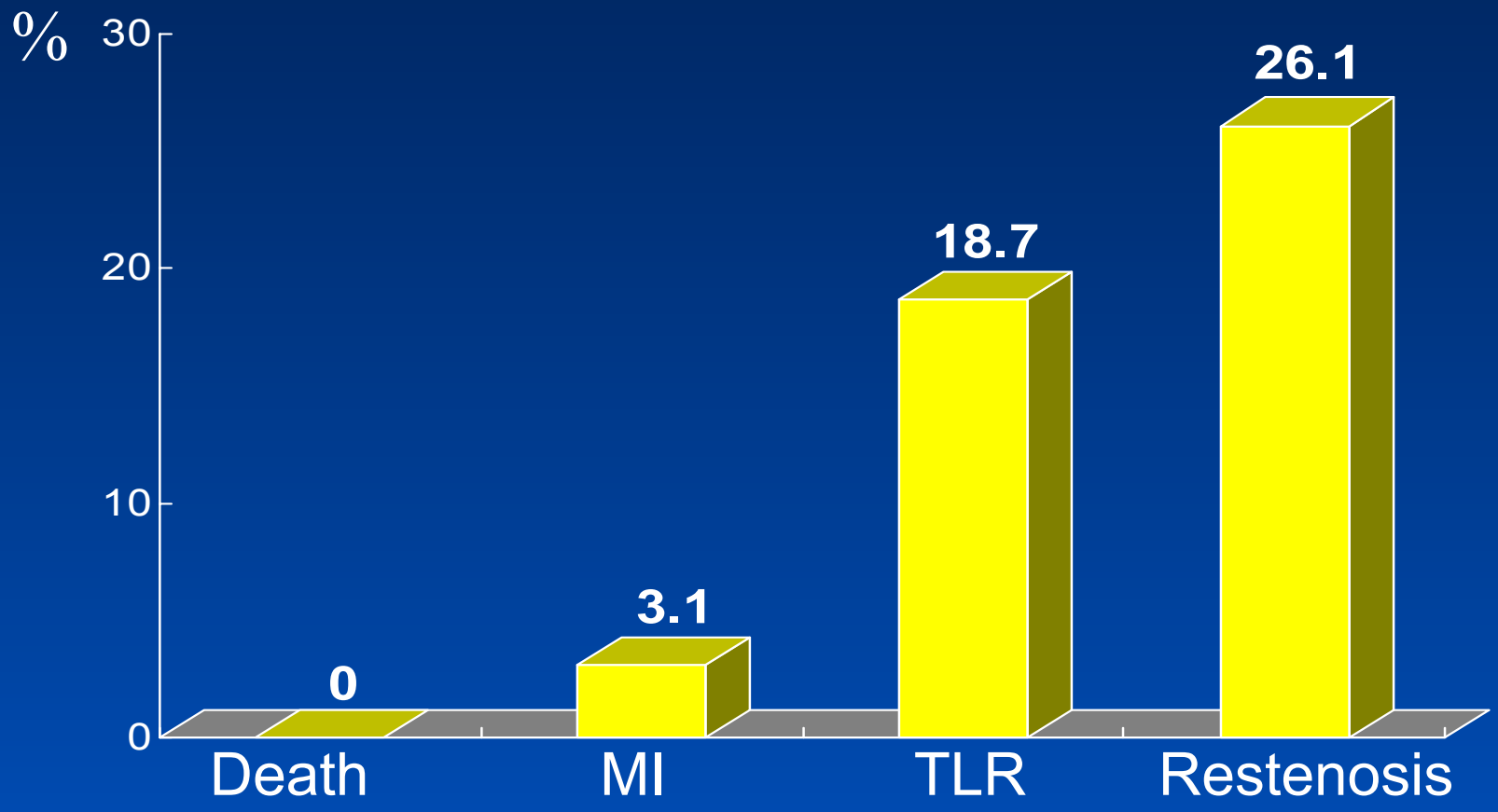


Arampatzis CA et al. Am J Cardiol 2003;92:327

Cypher for Unprotected LM

Total 32 pts (27 distal location)

Treated with Only 3.0mm Cypher



ACC 2004

Unprotected Left Main Coronary Artery Intervention in the Era of Drug Eluting Stent

AMC Experience

Inclusion Criteria

- **Patients with unprotected LMCA stenosis (diameter stenosis ≥ 50%) who refused surgery**

Exclusion Criteria

- Contraindication to antiplatelet agents
- Bailout stenting
- Primary angioplasty in AMI
- An inability to follow the protocol

Subjects

February 19,2003 ~ February 19, 2004

Total 109 patients who underwent elective senting for unprotected LMCA stenosis were included.

Antiplatelet Regimens

Triple combination

Aspirin indefinitely

Cilostazol 100 mg BID for 1 month

Clopidogrel 75 mg QD for 1 year

*** Use of Reopro : 8 cases (7.3 %) at operator's discretion**

Baseline Demographics

	n=109
Age,yrs	60 ± 11.1 (29-86)
Men	81 (74 %)
Diabetes	33 (30 %)
Hypertension	46 (42 %)
Current smoker	24 (22 %)
Hypercholesterolemia	19 (17 %)
LV ejection fraction (%)	58.8 ± 9.1 (26-76)

Lesion Location

Total 109 patients

Proximal involvement	**28 (26 %)**
Ostium	**24**
Shaft	**4**
Distal involvement	**81 (74 %)**

Baseline Demographics

	Proximal (n=28)	Distal (n=81)
Prior PCI	7 (25%)	17 (21%)
Clinical diagnosis		
Stable angina	12 (43%)	30 (37%)
Unstable angina	12 (43%)	45 (55%)
Acute MI	4 (14%)	6 (4%)

Lesion Characteristics

	Proximal (n=28)	Distal (n=81)
In-stent restenosis	1 (7%)	11 (13%)
Diseased vessel		
1 vessel	5 (18%)	23 (28%)
2 vessel	10 (36%)	17 (21%)
3 vessel	9 (32%)	22 (27%)
LMCA only	4 (14%)	19 (24%)

Lesion Characteristics

	Proximal (n=28)	Distal (n=81)
Reference vessel (mm)	3.61±0.64	3.66±0.74
Lesion length (mm)	9.0±5.9	24.5±14.5
MLD (mm)	1.45±0.39	1.13±0.45
Diameter stenosis (%)	58.9±9.2	67.2±13.3

Used Cypher Stents

	Proximal (n=28)	Distal (n=81)
Used No. of stents	29	140
Single stent	27 (96%)	36 (44%)
Two stents	1 (4%) *	33 (41%)
Three stents	0	10 (12%)
Four stents	0	2 (3%)
Mean No of stents	1.04 ± 0.19	1.76 ± 0.80

* Stent overlap due to incomplete lesion coverage with single stent

Used Cypher Stents

	Proximal (n=28)	Distal (n=81)
Used stent size		
2.5 mm	0	7 (5%)
2.75 mm	0	13 (9%)
3.0 mm	9 (40%)	67 (48%)
3.5 mm	20 (60%)	53 (38%)

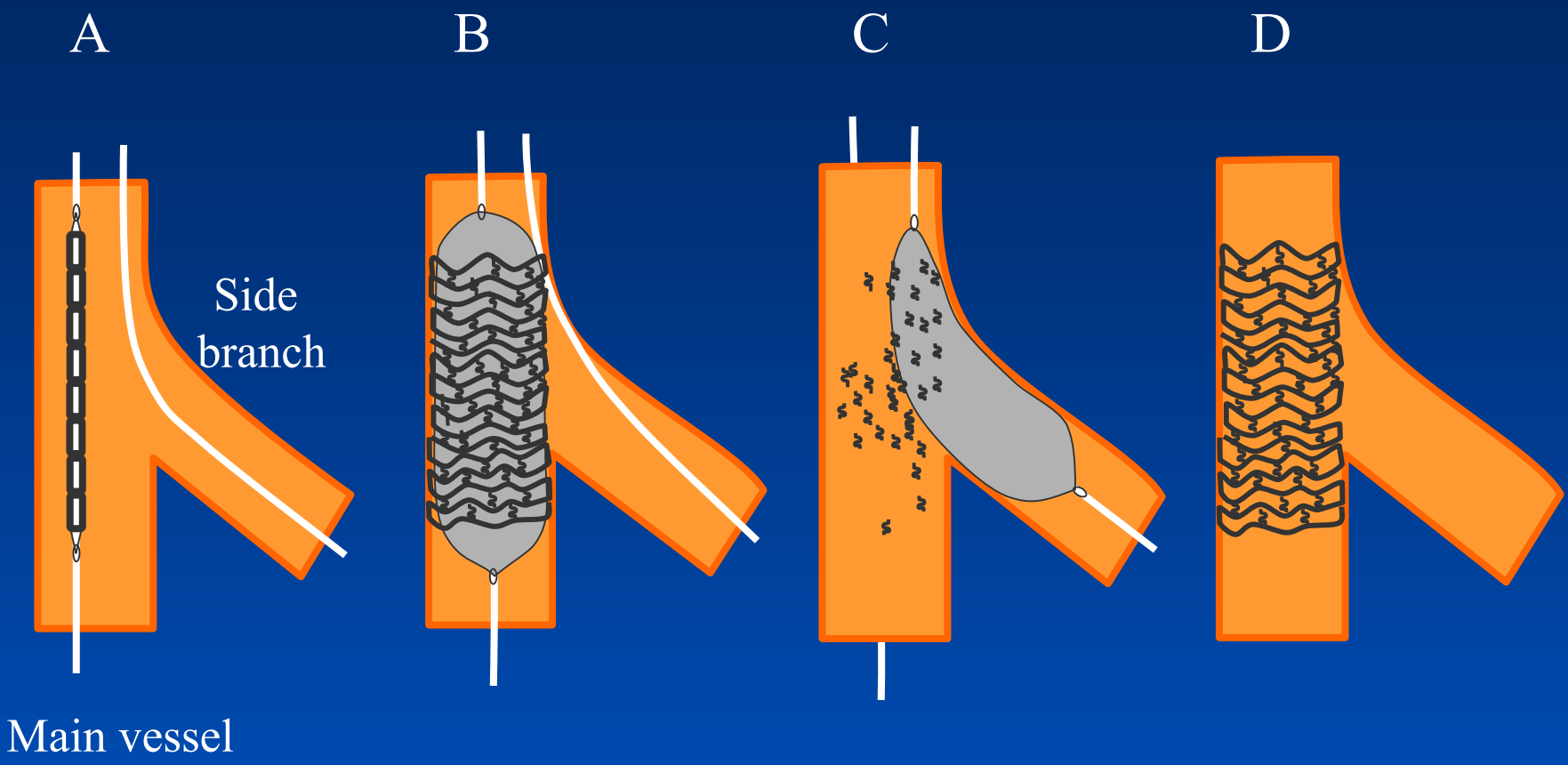
Stenting Procedure

	Proximal (n=28)	Distal (n=81)
Use of Abciximab	1 (4%)	7 (9%)
Debulking atherectomy	0	3 (4%)
IVUS guidance	21 (75%)	74 (91%)
Direct stenting	16 (57%)	28 (35%)
Use of a additional high pressure balloon	19 (68%)	45 (56%)
Maximal inflation pressure (atm)	18.7 ± 2.4	17.8 ± 3.4
Maximal balloon diameter (mm)	4.0 ± 0.4	3.8 ± 0.4
Balloon-to-artery ratio	1.17 ± 0.18	1.12 ± 0.28

LMCA
Bifurcation Lesions

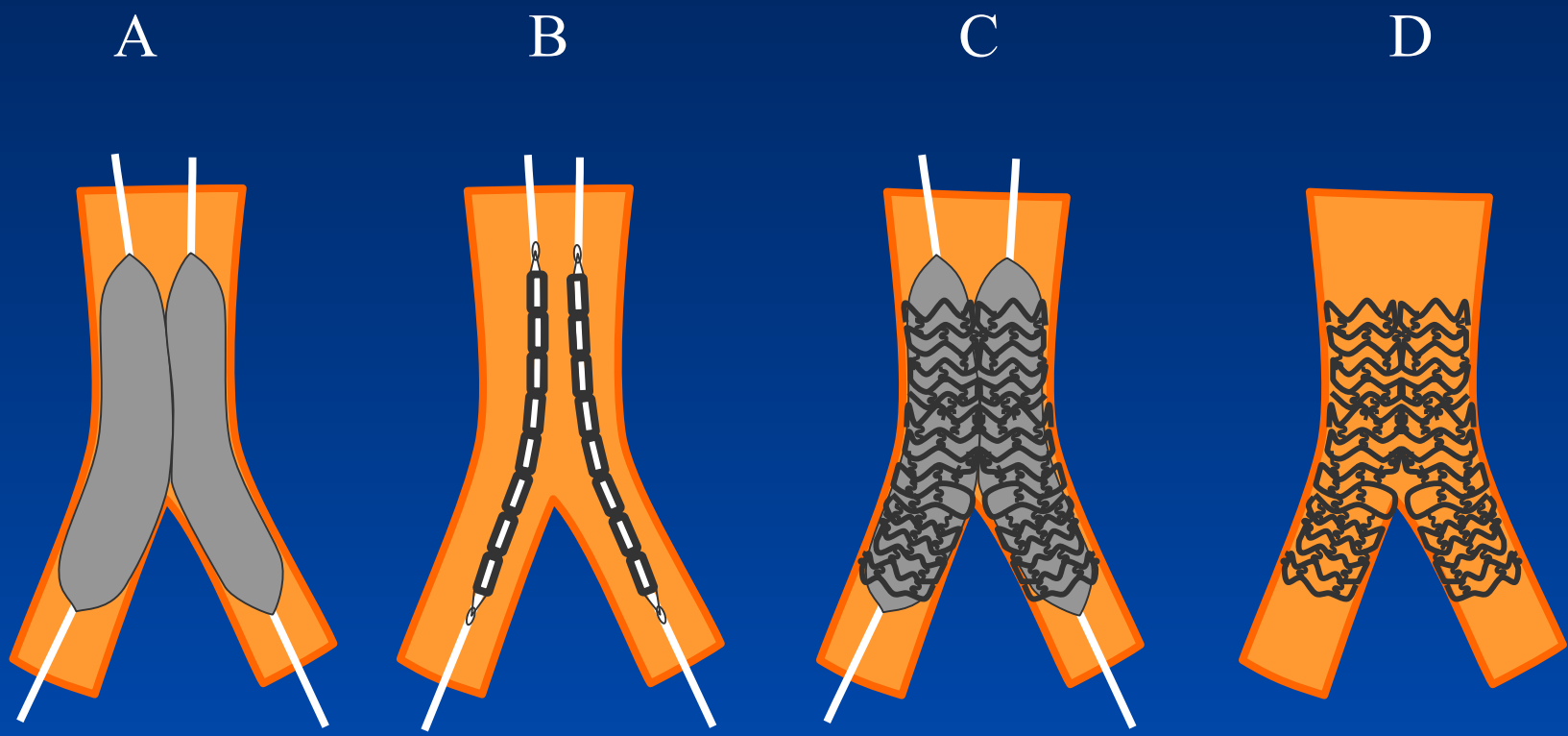
Stenting Crossing Side Branch

Normal or diminutive circumflex artery



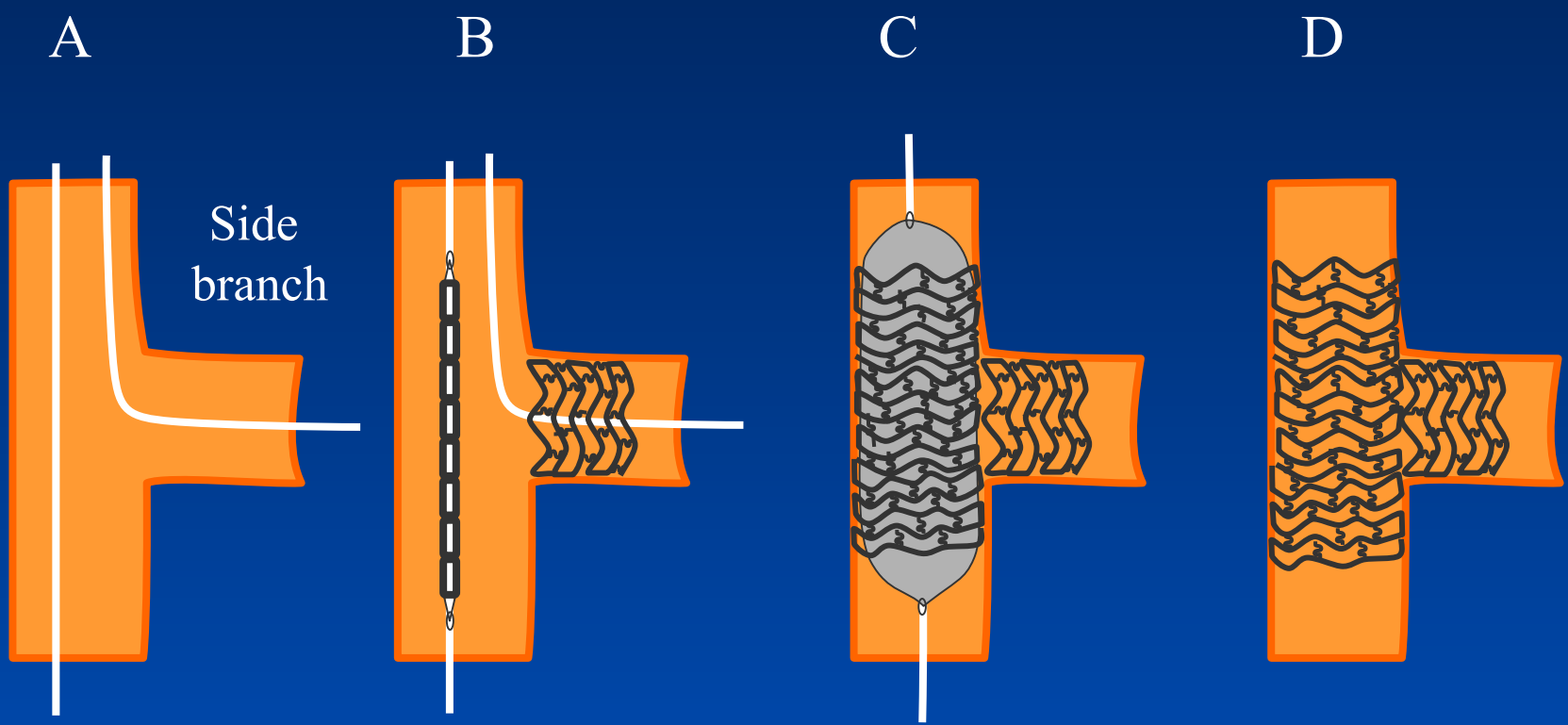
Kissing Stenting

Large proximal reference size



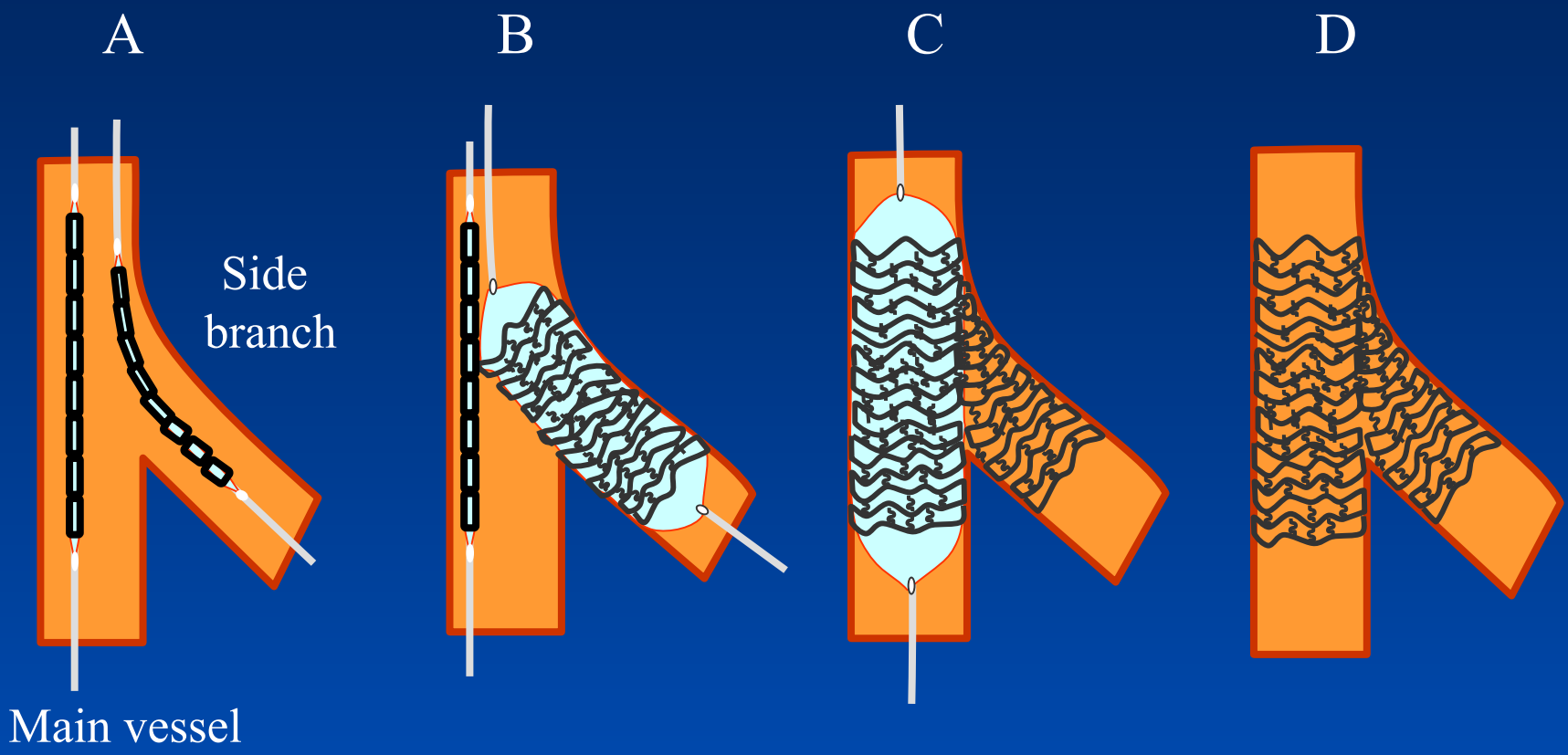
T Stenting

Angle between LAD and circumflex ~ 90 °



Stent - Crush

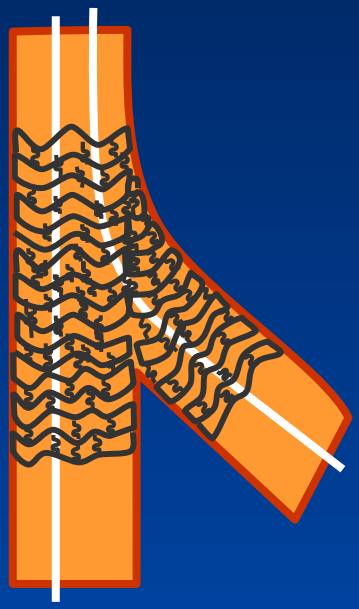
Not large LMCA and diseased circumflex



One More Step of Stent - Crush

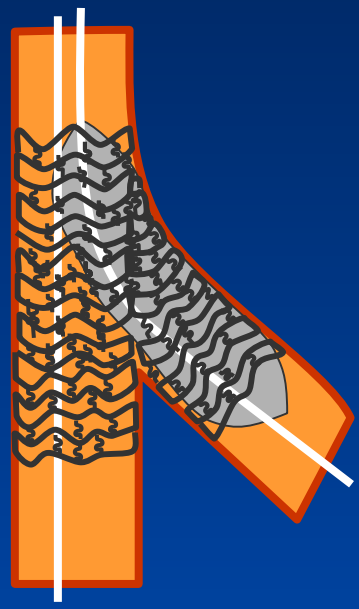
Final Kissing Balloon Dilatation

E



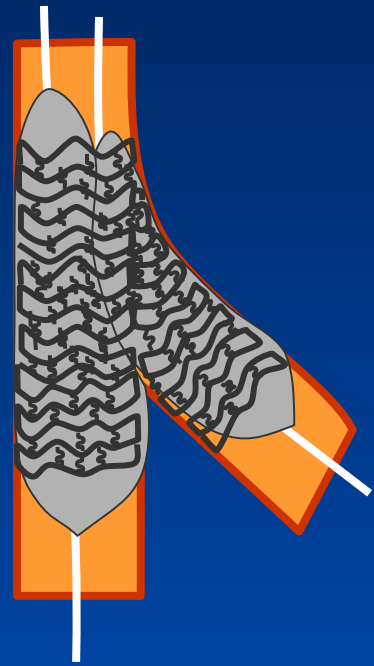
Re-advancement of wire into the side branch

F



Opening of the side branch ostium

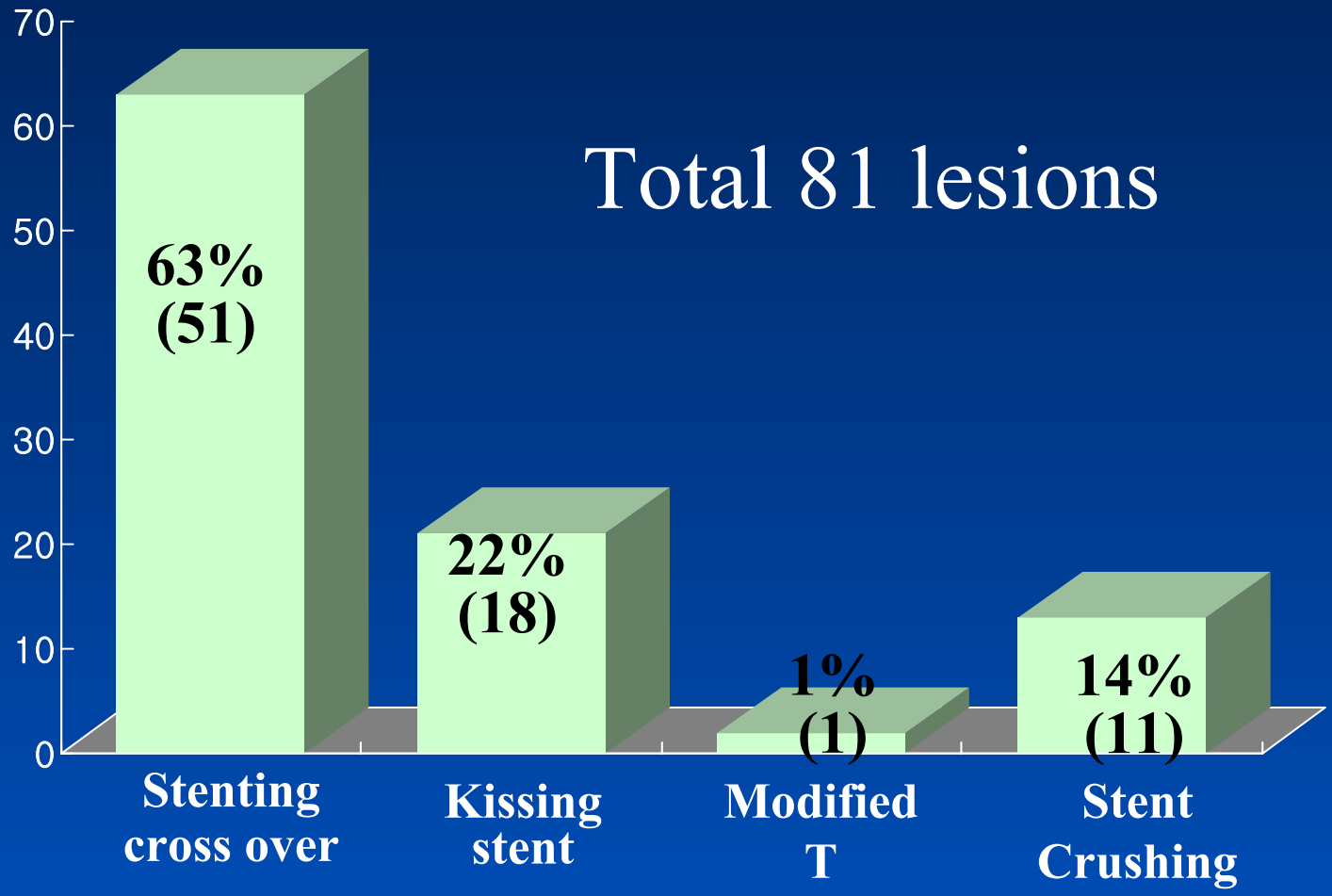
G



Final kissing balloon inflation

Different Stenting Technique

for Distal Bifurcation LMCA Narrowing



Initial Results

In-Hospital Outcomes

Procedural success 100%

	Proximal (n=28)	Distal (n=81)
Death	0	0
Q MI	0	0
Non Q MI *	2 (7 %)	9 (11%)
Stent thrombosis	0	0
Emergent CABG	0	0
Repeat PCI	0	0

* All procedure related, CK-MB ≥ 3 times normal value

Post-procedure QCA Analysis

	Proximal (n=28)	Distal (n=81)
Reference vessel (mm)	3.61±0.62	3.66±0.65
MLD (mm)	3.57±0.38	3.38±0.42
Diameter stenosis (%)	-0.5±13.4	6.1±11.2
Acute gain	2.12±0.40	2.25±0.58

IVUS Analysis

	Baseline	Postprocedure
Vulnerable plaque	34 %	
Proximal reference		
EEM CSA	19.9 ± 5.3	22.4 ± 0.2
Lumen CSA	11.1 ± 2.9	12.2 ± 0.6
Target segment		
EEM CSA	18.5 ± 5.3	19.7 ± 6.0
Lumen CSA	3.0 ± 0.7	9.3 ± 2.3
Distal reference segment		
EEM CSA	17.1 ± 5.0	16.9 ± 5.4
Lumen CSA	10.1 ± 3.3	10.4 ± 4.3
Stent inapposition		18 %

EEM=external elastic membrane, CSA=cross sectional area

30-Day Clinical Results

No additional MACE after discharge

	Proximal (n=28)	Distal (n=81)
Death	0	0
Q MI	0	0
Non Q MI	0	0
Stent thrombosis	0	0
Emergent CABG	0	0
Repeat PCI	0	0

Follow-Up Results

6-Month QCA Analysis

	Proximal (n=17)	Distal (n=56)
Angiographic F/U	13 (76%)	48 (86%)
Reference vessel (mm)	3.56±0.44	3.58±0.65
MLD (mm)	3.59±0.32	3.26±0.59
Diameter stenosis (%)	-1.8±8.1	7.5±17.0
Late loss (mm)	0.17±0.21	0.23±0.50
Restenosis	0 %	3 (6%)

6-Month Clinical Results

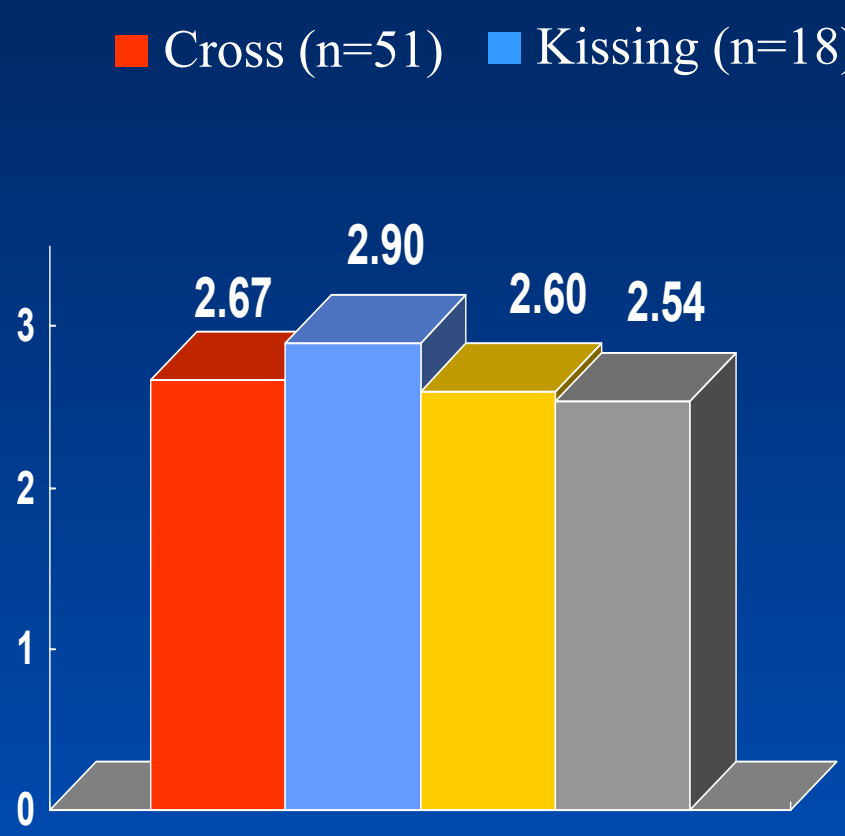
Only 1 TLR due to Edge Restenosis

	Proximal (n=17)	Distal (n=56)
Death	0	0
Q MI	0	0
Non Q MI	0	0
Stent thrombosis	0	0
Emergent CABG	0	0
Repeat PCI	0	1 (1.8%)

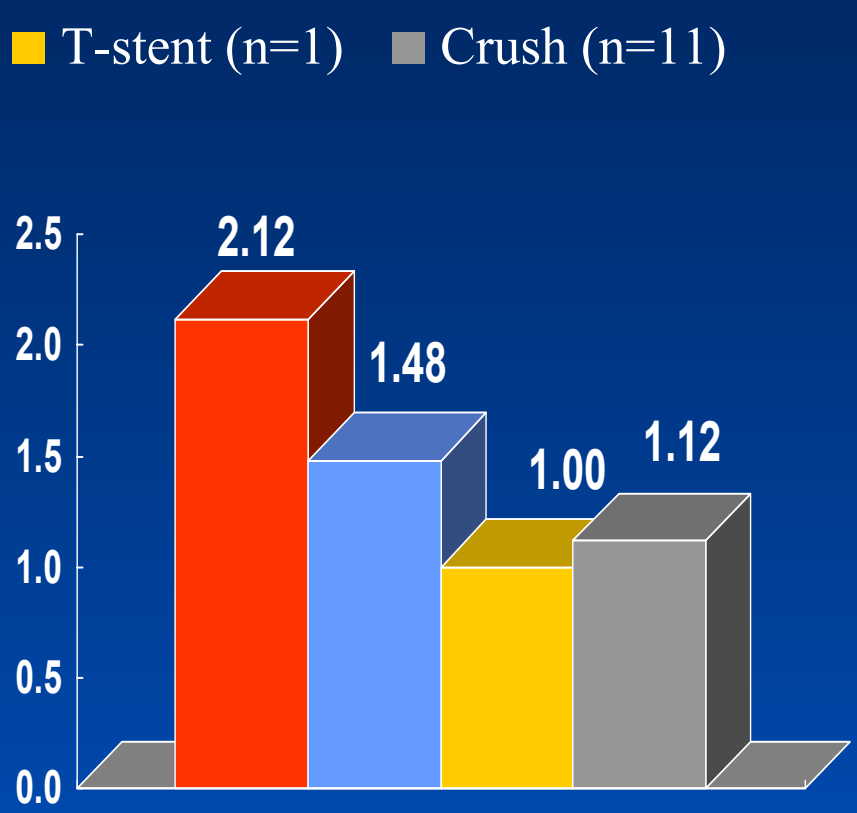
Impact of DES on the Circumflex

Circumflex Artery

Reference size (mm)



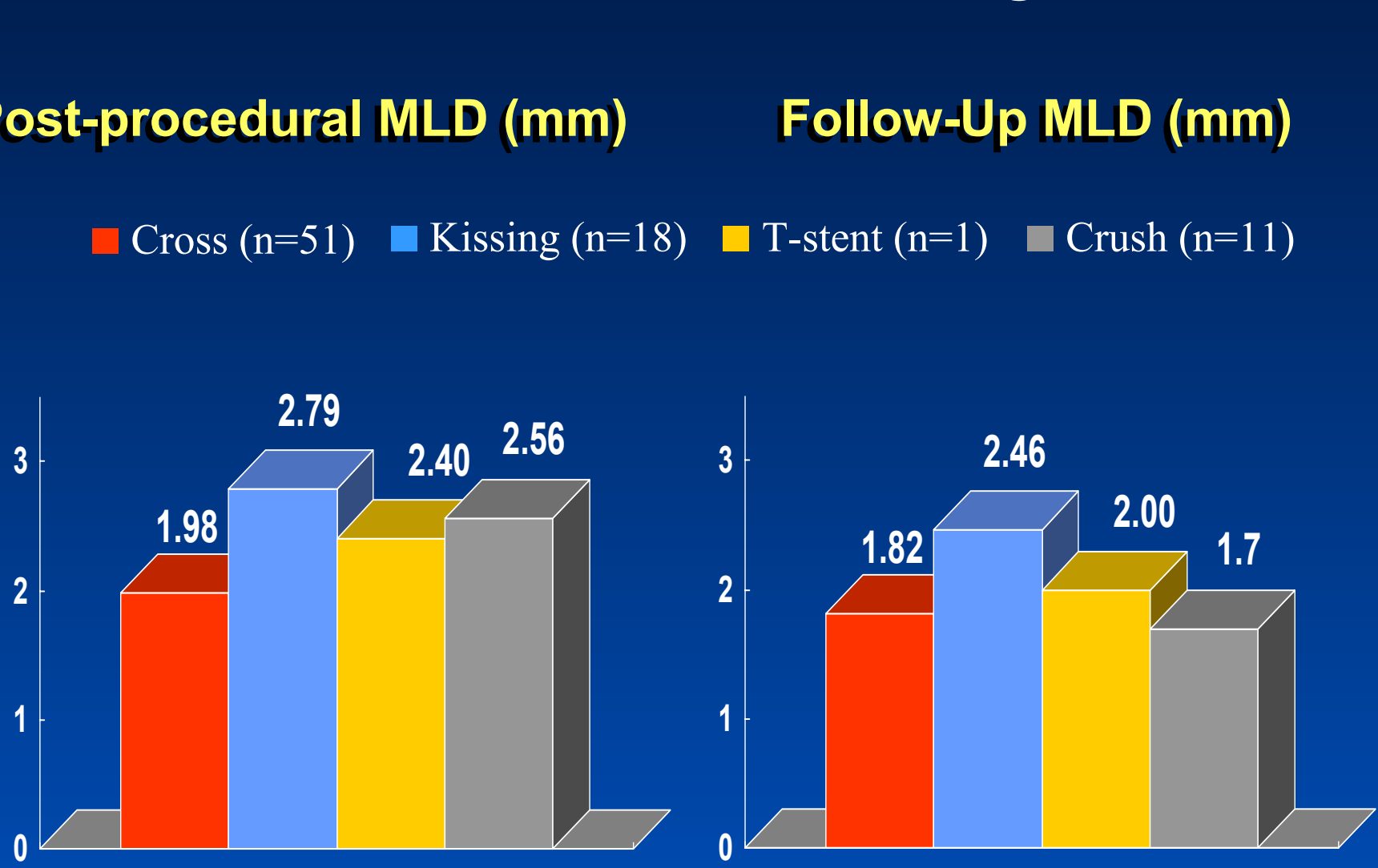
Pre-procedural MLD (mm)



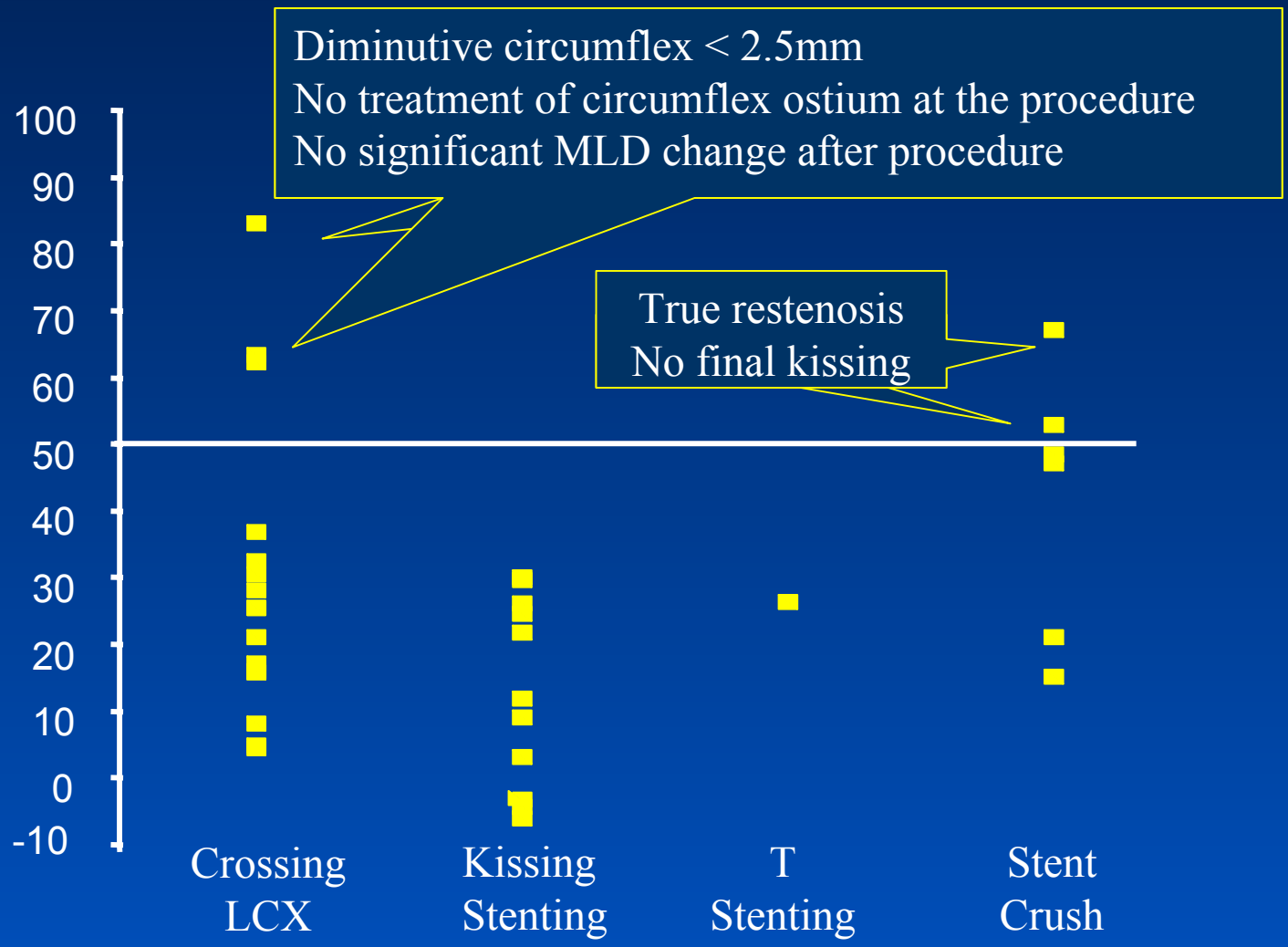
Circumflex Artery

Post-procedural MLD (mm)

Follow-Up MLD (mm)



6 month F/U- DS (%) of Left Circumflex Ostium



What is Different from DES ?

Historical Comparison with Bare Metal Stenting (1995-2002)

Baseline Demographics

	BMS N=257	DES N=109
Age,yrs	56±12	60 ± 11 (29-86)
Men	172 (67%)	81 (74 %)
Diabetes	49 (19%)	33 (30 %)
Hypertension	82 (32%)	46 (42 %)
Current smoker	87 (34%)	24 (22 %)
Hypercholesterolemia	72 (28%)	19 (17 %)
LVEF(%)	62±8	59±10 (26-76)

Yellow character: $p<0.05$

Lesion Location

	BMS N=257	DES N=109
Proximal involvement	159 (62 %)	**28 (26 %)**
Ostium	137	**24**
Shaft	22	**4**
Distal involvement	98 (38 %)	✓ **81 (74 %)**

✓ : $p<0.05$

Lesion Characteristics

	BMS N=257	DES N=109
In-stent restenosis	0	12 (13%)
Three vessel disease	15 (6%)	31 (27%) ✓
Debulking before stenting	95 (37%) ✓	3 (3%)
IVUS guidance	159 (62%)	95 (87%) ✓

In-Hospital Outcomes

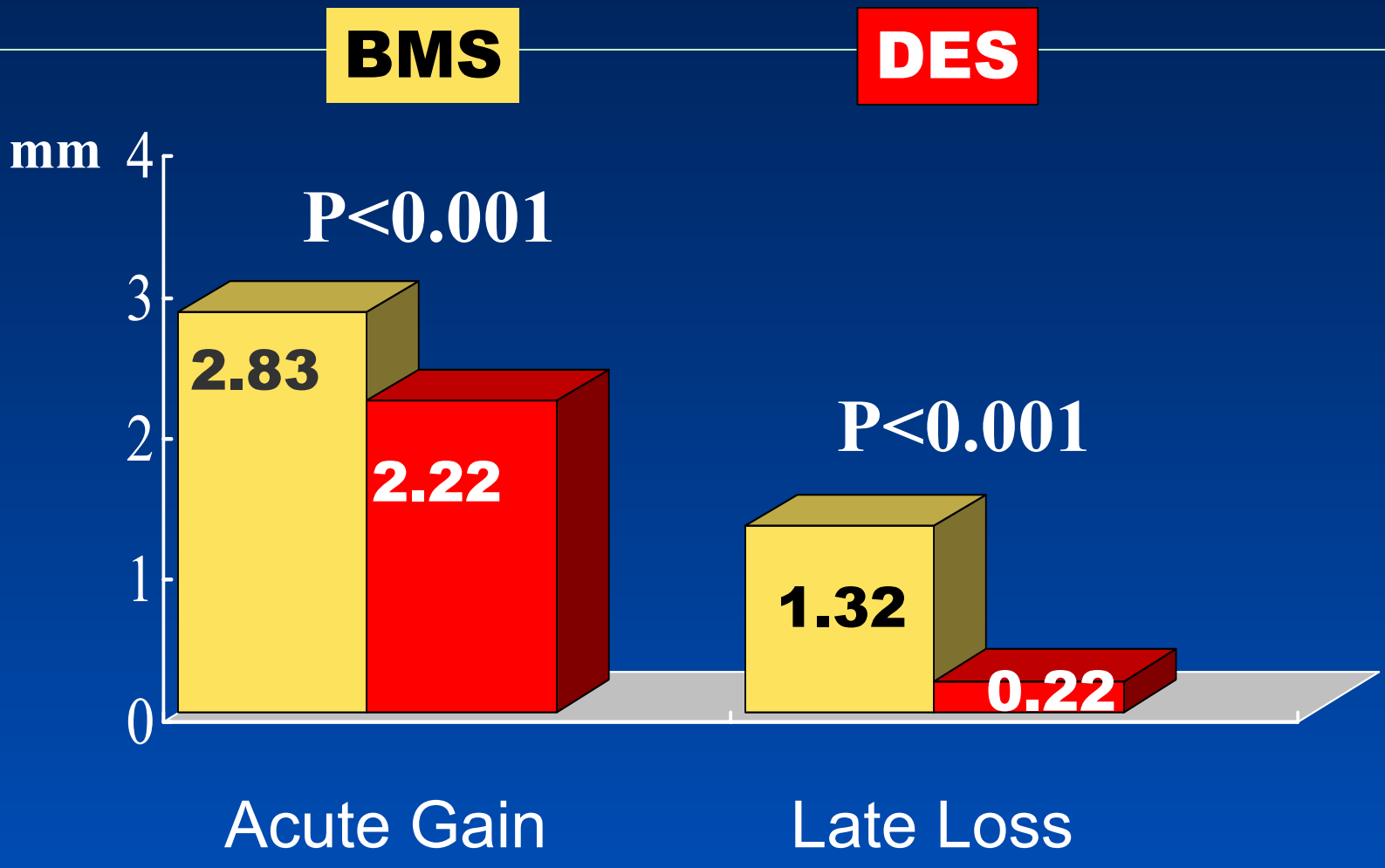
	BMS N=257	DES N=109
Procedure Success (%)	99.1	100
Death	0	0
Q MI	1	0
Non-QMI	19 (7%)	11 (10 %)
SAT	1 (0.9%)	0
Emergent CABG	1	0
Repeat PCI	0	0

* All procedure related, CK-MB ≥ 3 times normal value

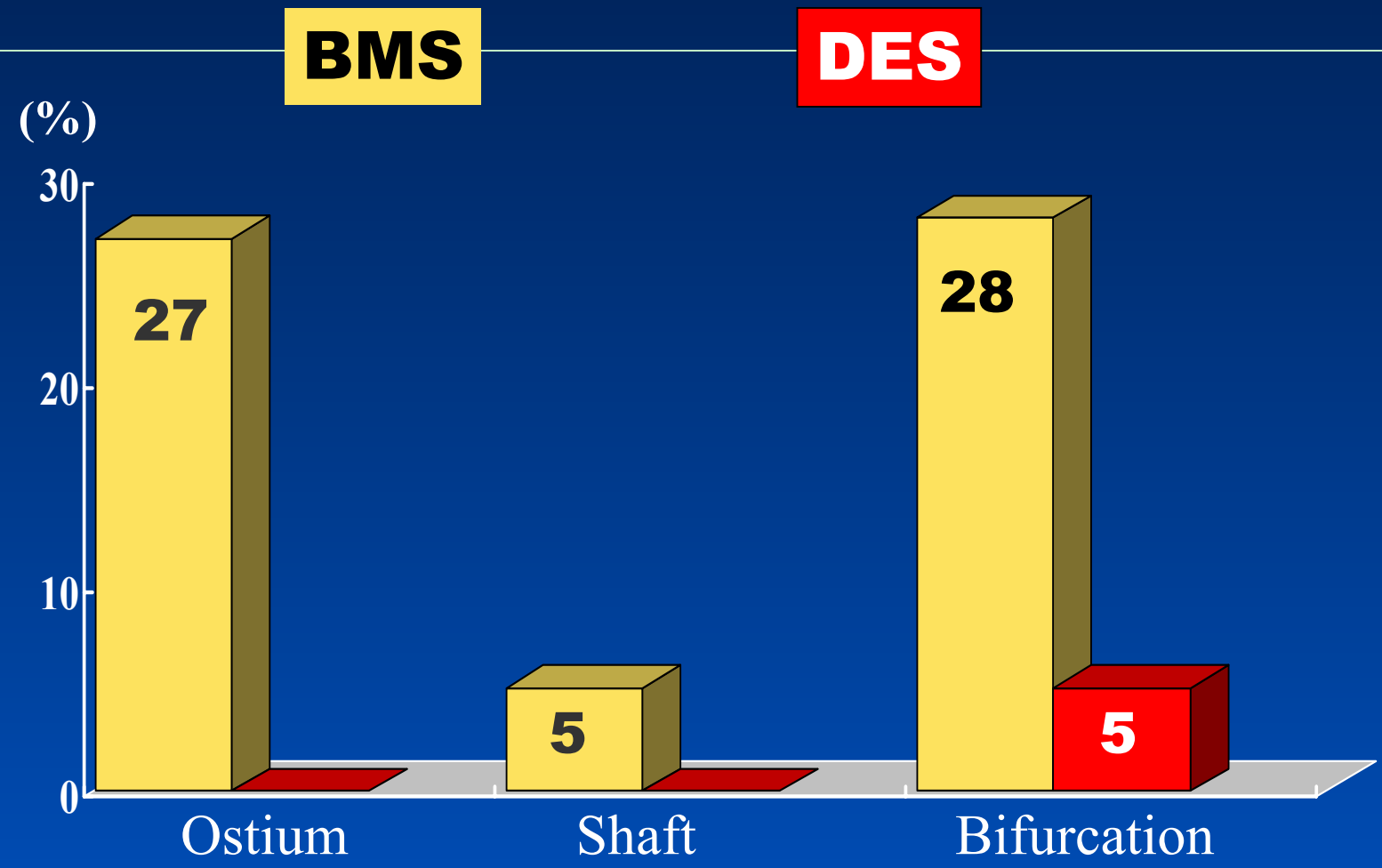
QCA Analysis

Reference diameter (mm)	3.97 ± 0.70	**3.63 ± 0.68**
Minimal lumen diameter (mm)		
Postprocedure	4.11 ± 0.60	**3.43 ± 0.41**
Follow-up	2.79 ± 1.10	**3.34 ± 0.54**
Diameter stenosis (%)		
Postprocedure	-4.1 ± 12.5	**4.4 ± 12.1**
Follow-up	30.2 ± 26.1	**9.7 ± 15.6**
Acute gain (mm)	2.83 ± 0.75	**2.22 ± 0.54**
Late loss (mm)	1.32 ± 0.94	**0.22 ± 0.44**

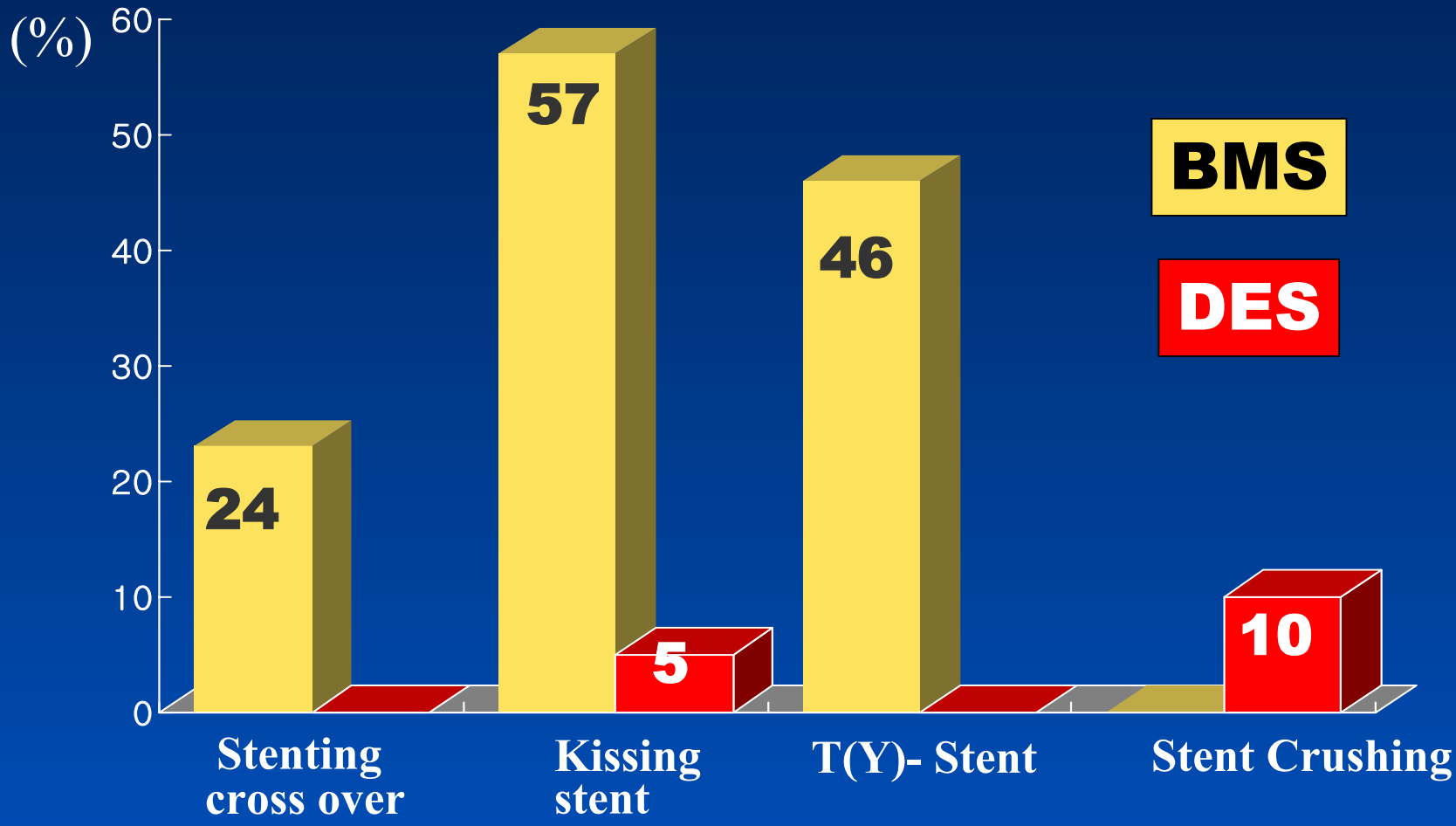
Late Loss


BMS
DES
mm
4
3
2
1
0
P<0.001
2.83
2.22
P<0.001
1.32
0.22
Acute Gain
Late Loss

Restenosis Rate



6 month Angiographic Restenosis
According to different strategy in distal LM



Unprotected LM stenting
In era of Drug Eluting Stent

What is changing now ?

- We tackle more complex lesion groups
  (more LM distal bifurcation lesions, three vessel disease, longer lesions, higher risk patient)
- Simplified procedure – "Just stent it ! "
- Excellent clinical outcomes than we expected in spite of smaller stent CSA