India Live @ TCTAP 2017

Utility of Intravascular Imaging for Resolving Issues During PCI

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Why IVUS?

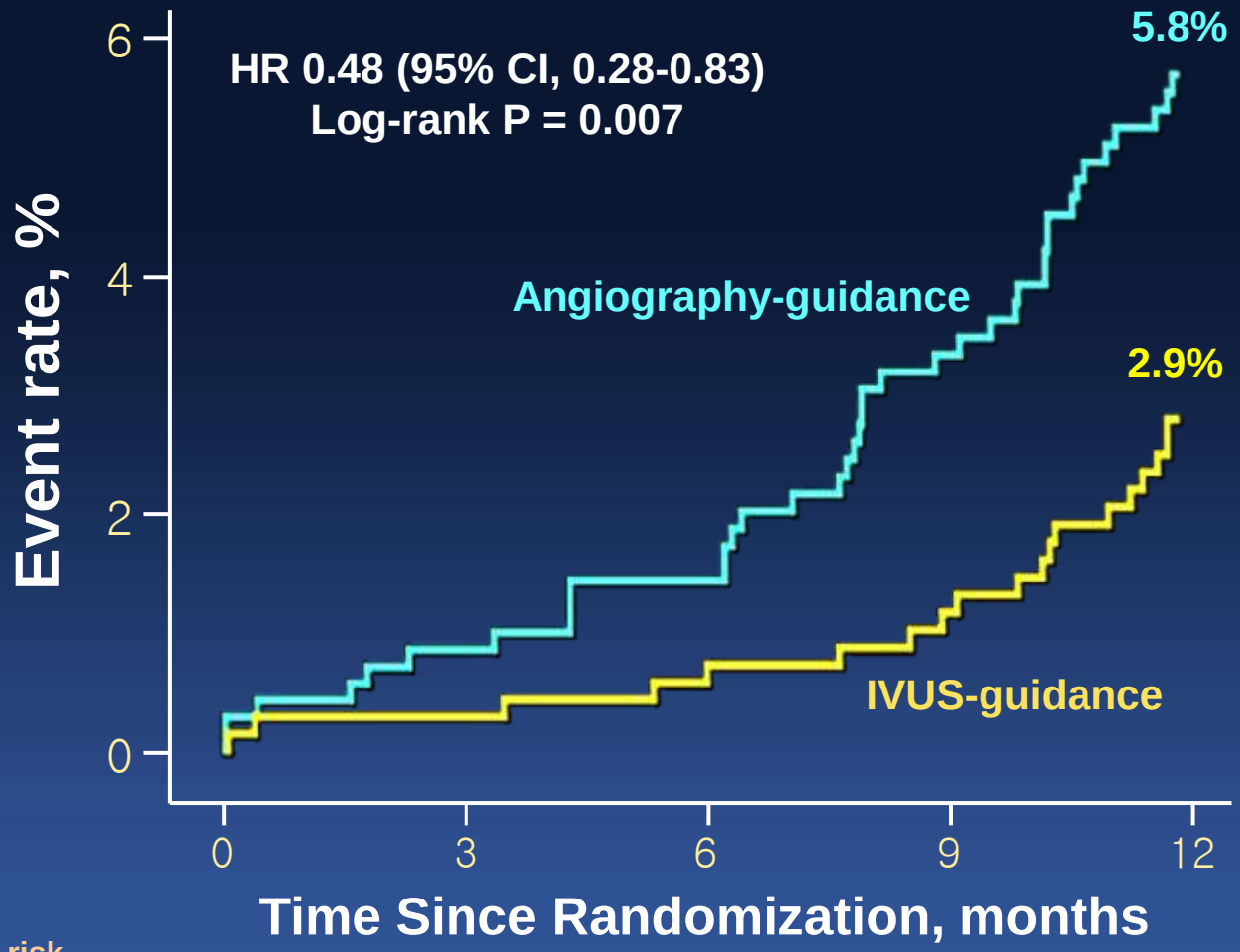
Meta-analysis of 8 Randomized Trials of IVUS vs. Angio-Guided DES Implantation

Study	Year	#		OR	IVUS MACE	Angio MACE
IVUS-XPL	2015	1400		0.49	19/700	39/700
CTO-IVUS	2015	402		0.37	5/201	14/201
AIR-CTO	2015	230		0.82	25/115	29/115
Tan-LM	2015	123		0.42	8/61	17/62
MOZART	2014	83		0.41	2/41	5/42
RESET	2013	543		0.60	12/269	20/274
AVIO	2013	284		0.67	24/142	33/142
Home-DES	2010	210		0.91	11/105	12/105
OVERALL		3275		0.59	106/1634	169/1641
			IVUS better / Angio better		6.5%	10.3%

IVUS-guided PCI is superior to CAG-guided PCI in reducing the risk of MACE

Circ Cardiovasc Interv. 2016 Apr;9(4):e003700

Long Coronary Lesion



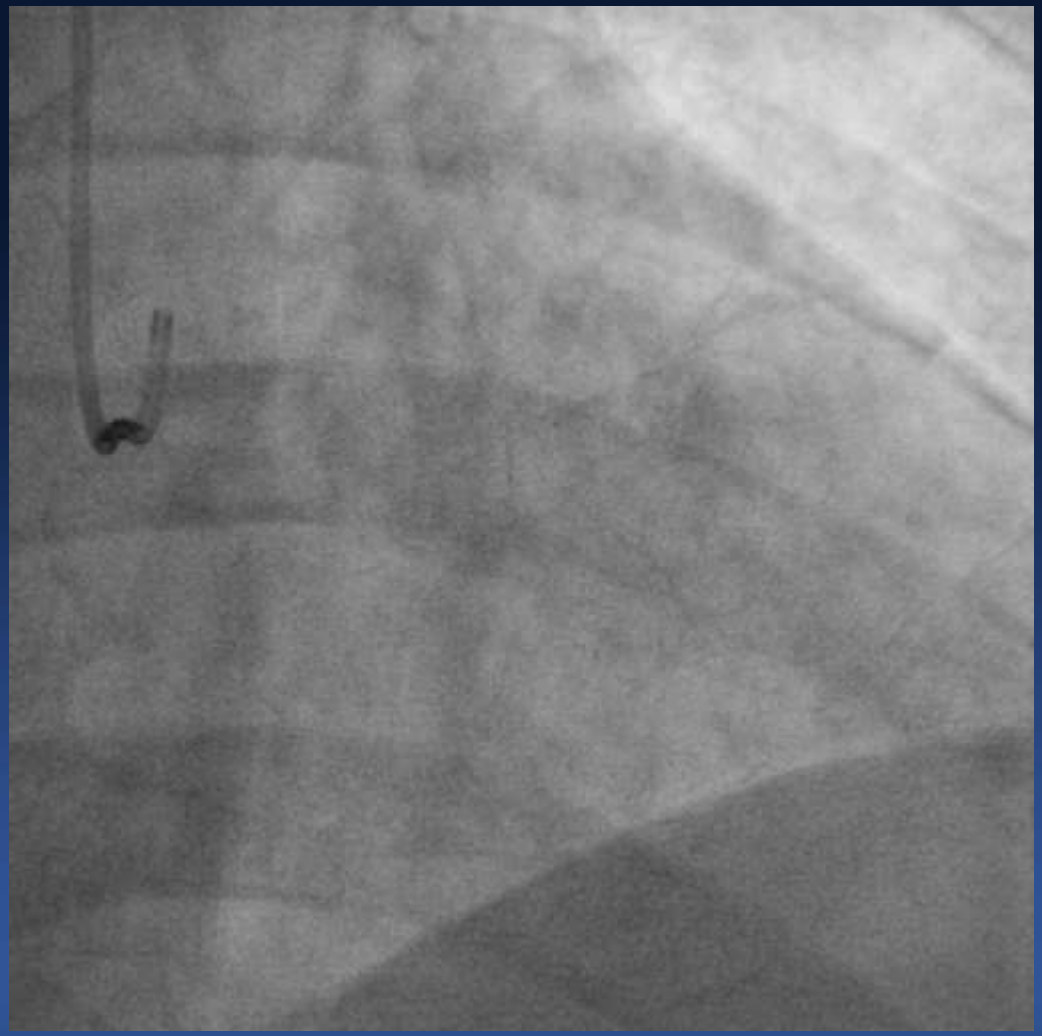
No. at risk					
Angiography arm	700	673	660	643	624
IVUS arm	700	671	665	654	641

Hong et al. JAMA 2015;314:2155-63

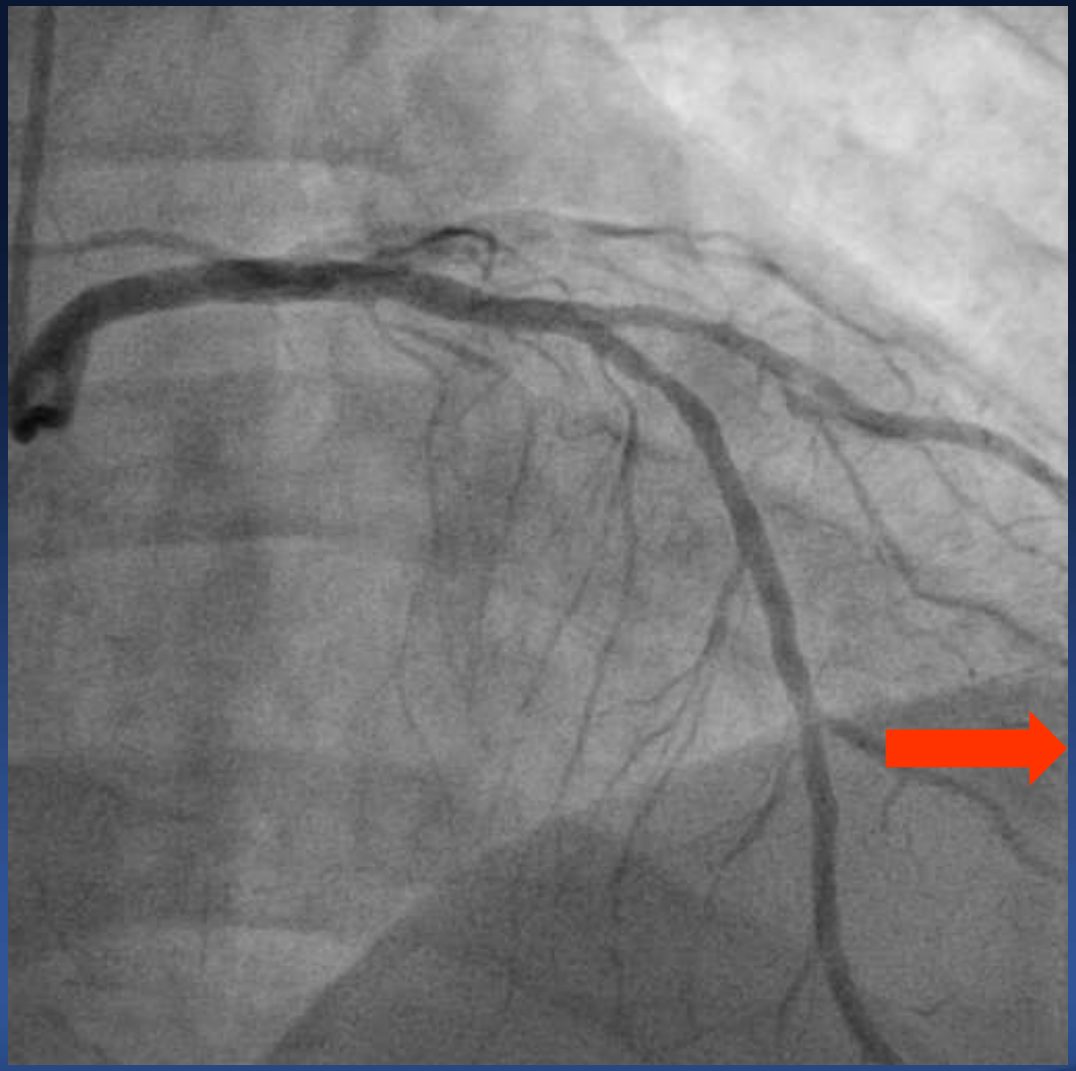
Why IVUS Guided Better ?

- Diagnosis and Lesion Assessment
- Stent Size and Length
- Post Stent Optimization
- Assessment of Stent Failure

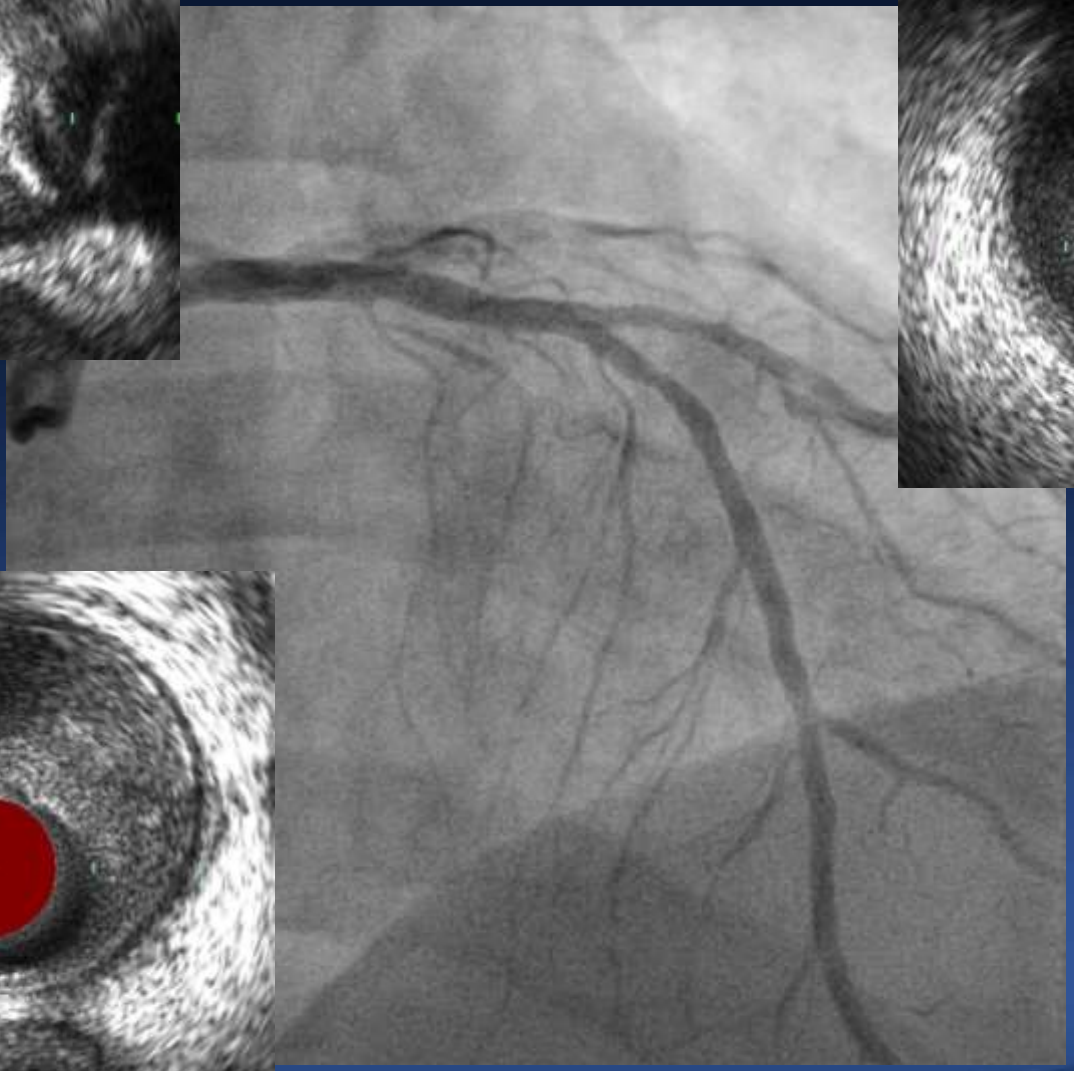
Do You Think “Significant”?

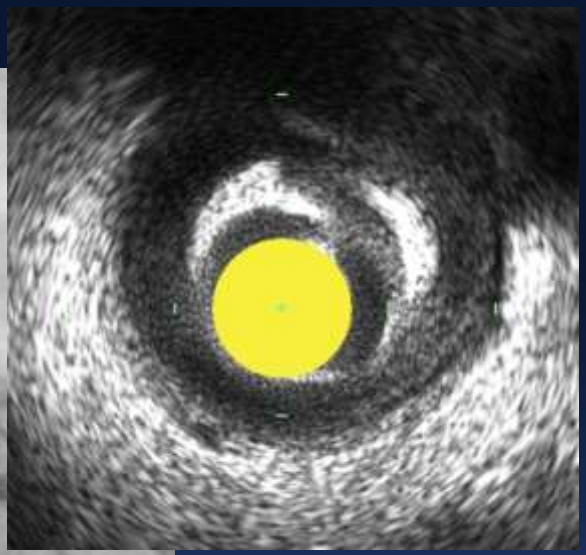


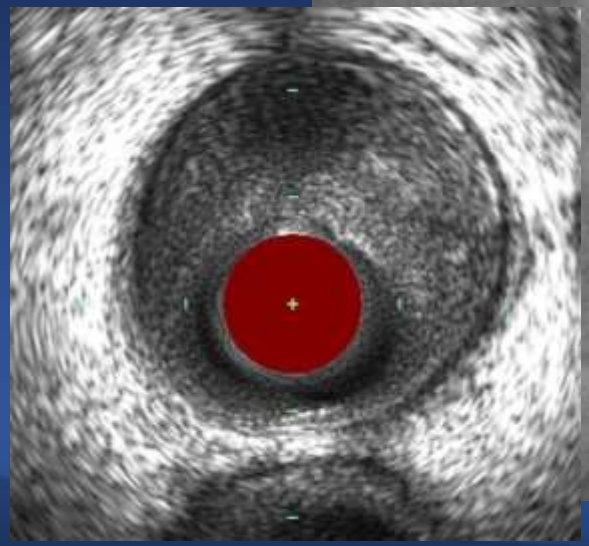
FFR



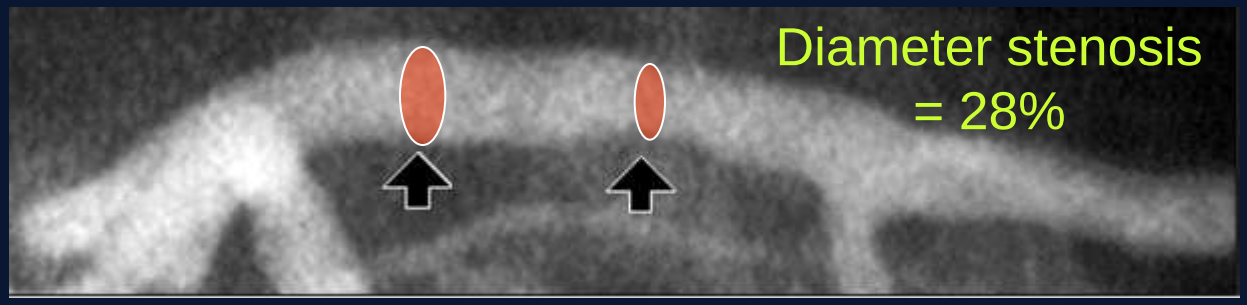
IVUS

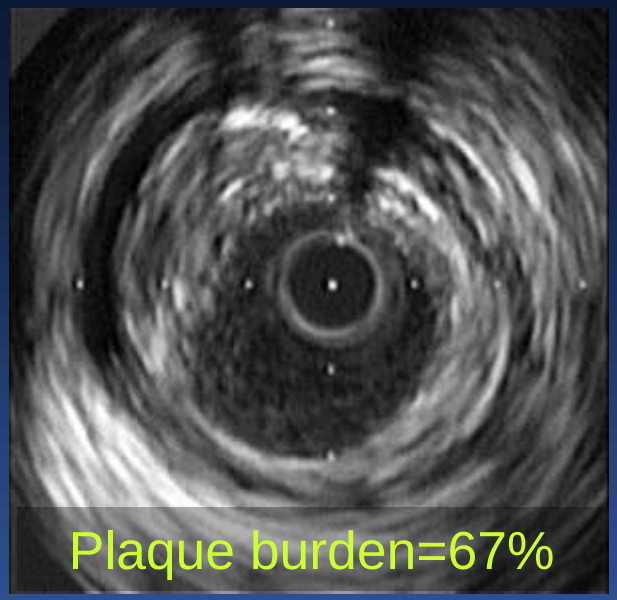


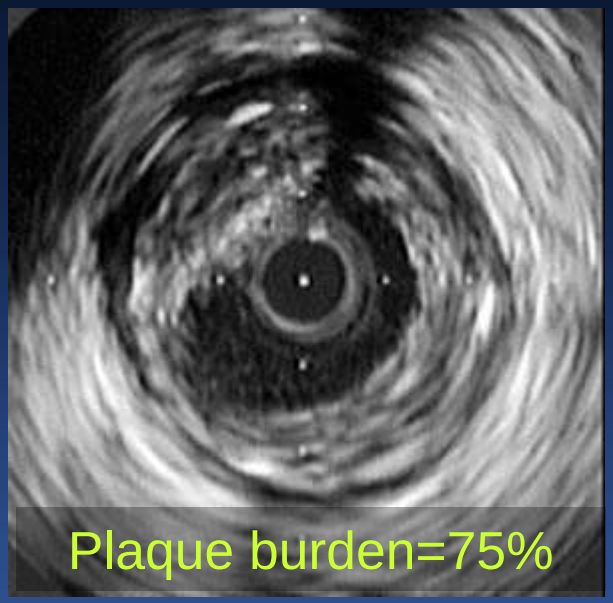




Plaque Burden in Angiographically Silent Disease



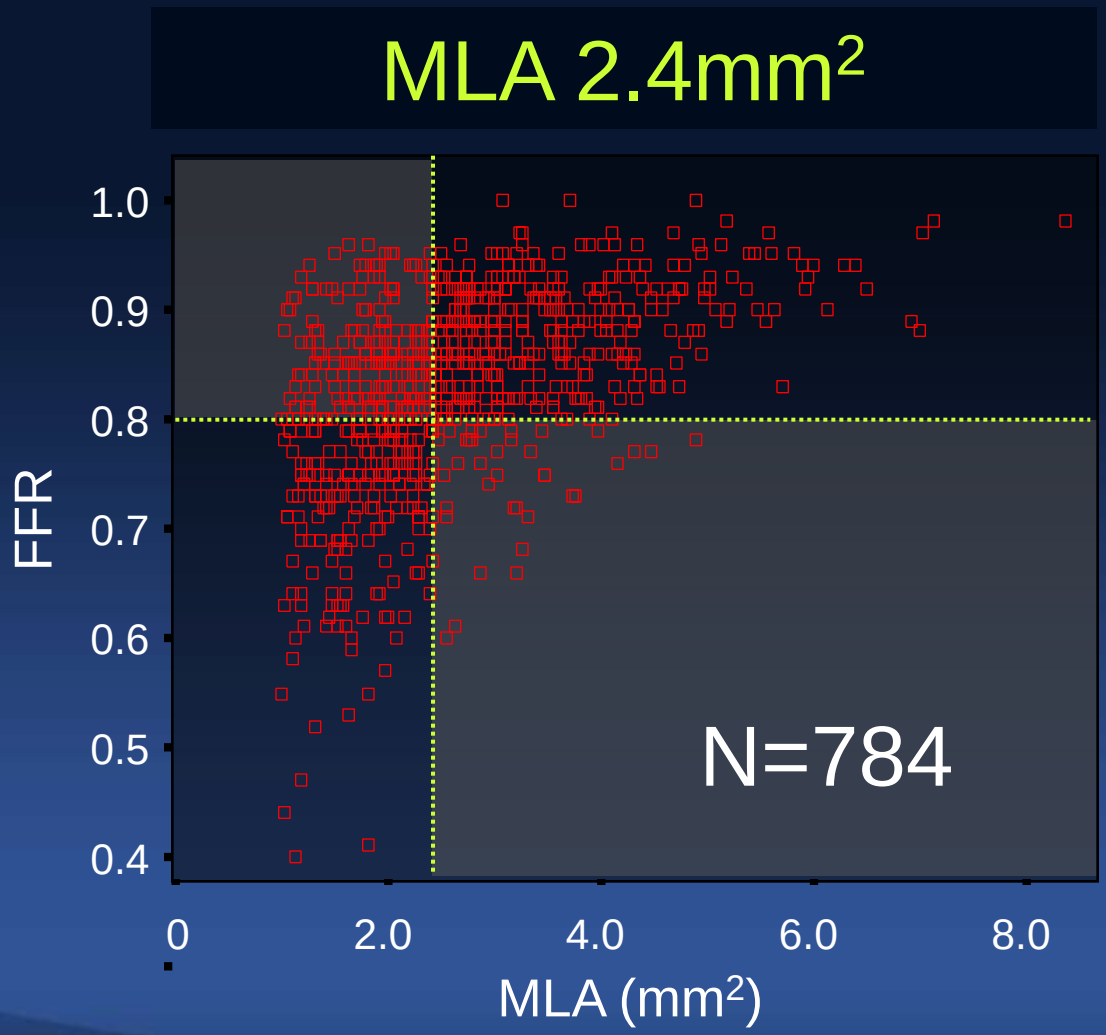


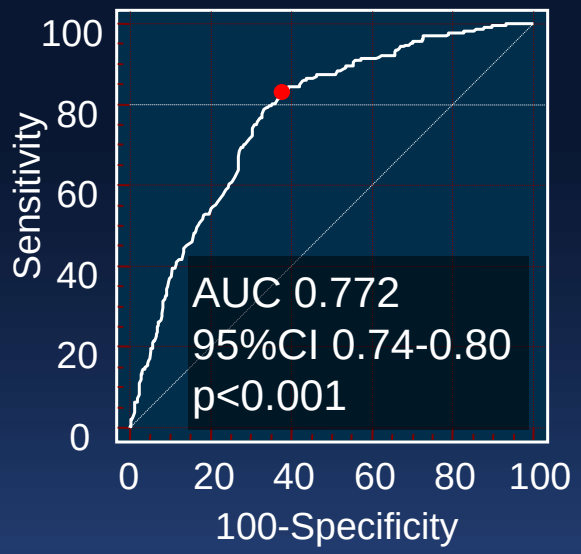


In 884 native coronary arteries, the plaque burden in angiographically normal reference segment was **51±13%**

Mintz et al. J Am Coll Cardiol 1995;25:1479-85

IVUS MLA Can Not Predict Functional Significance



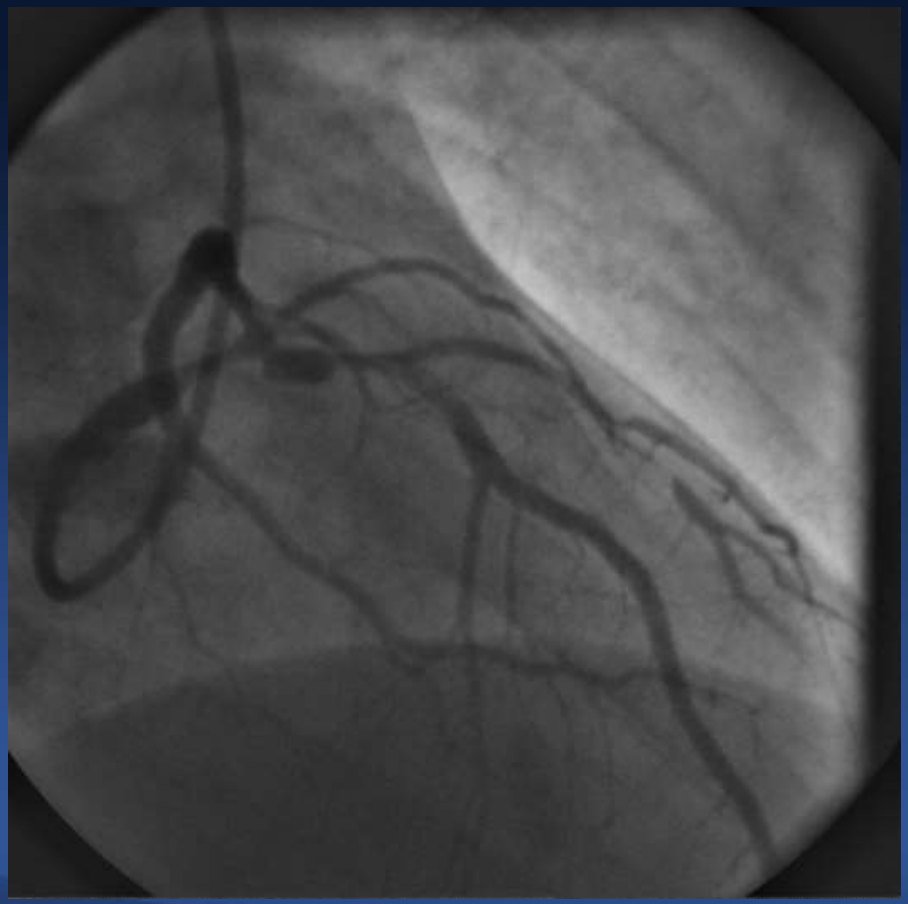


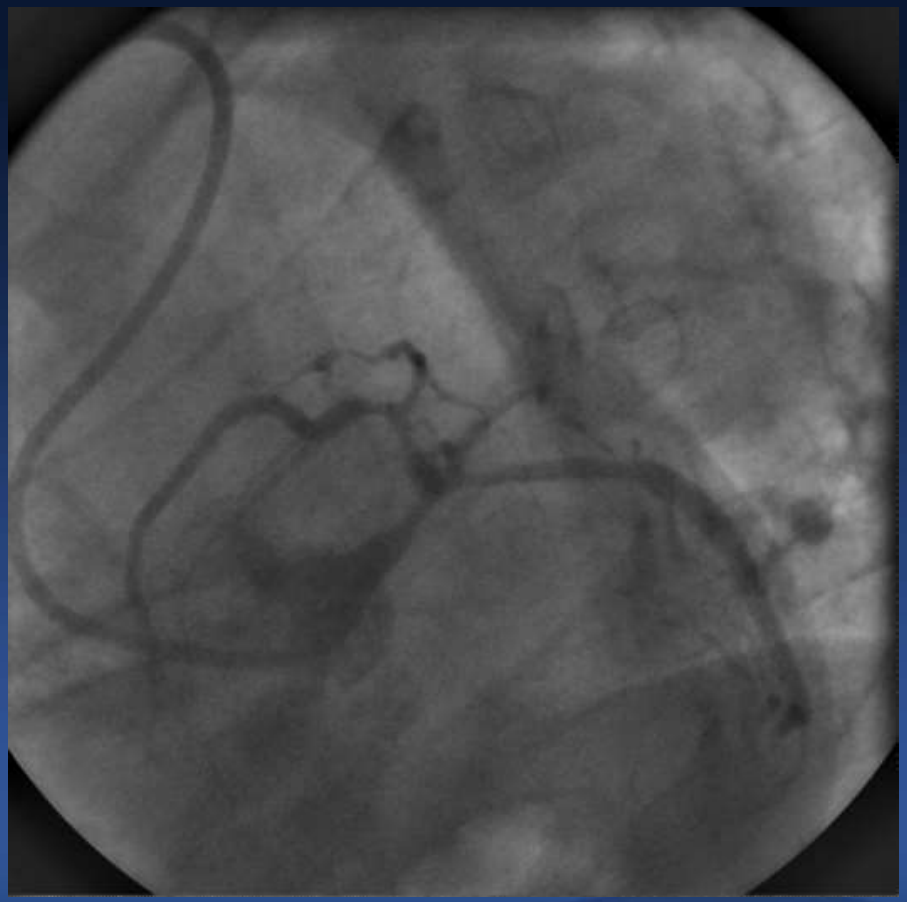
Sens. 84%
Spec. 63%
PPV **48%**
NPV 90%
Accuracy **69%**

Kang et al. Am J Cardiol 2012;109:947-53

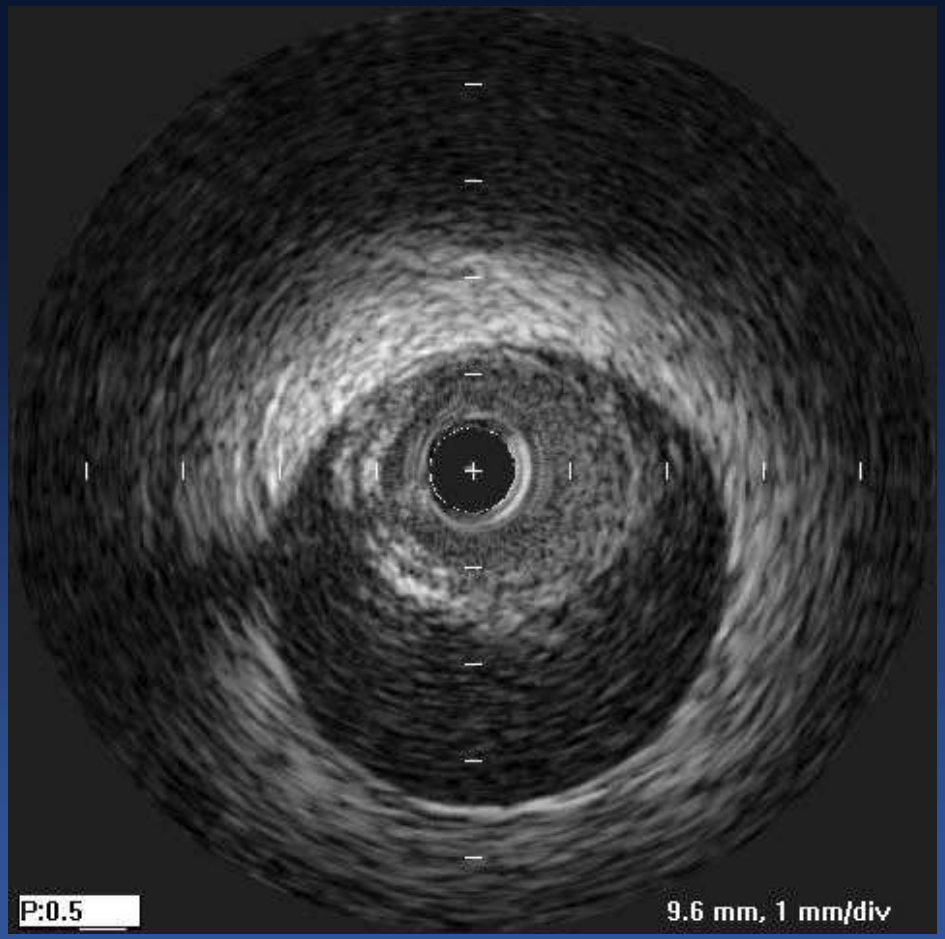
37yo/Female, Post Partum

Diagnosis?

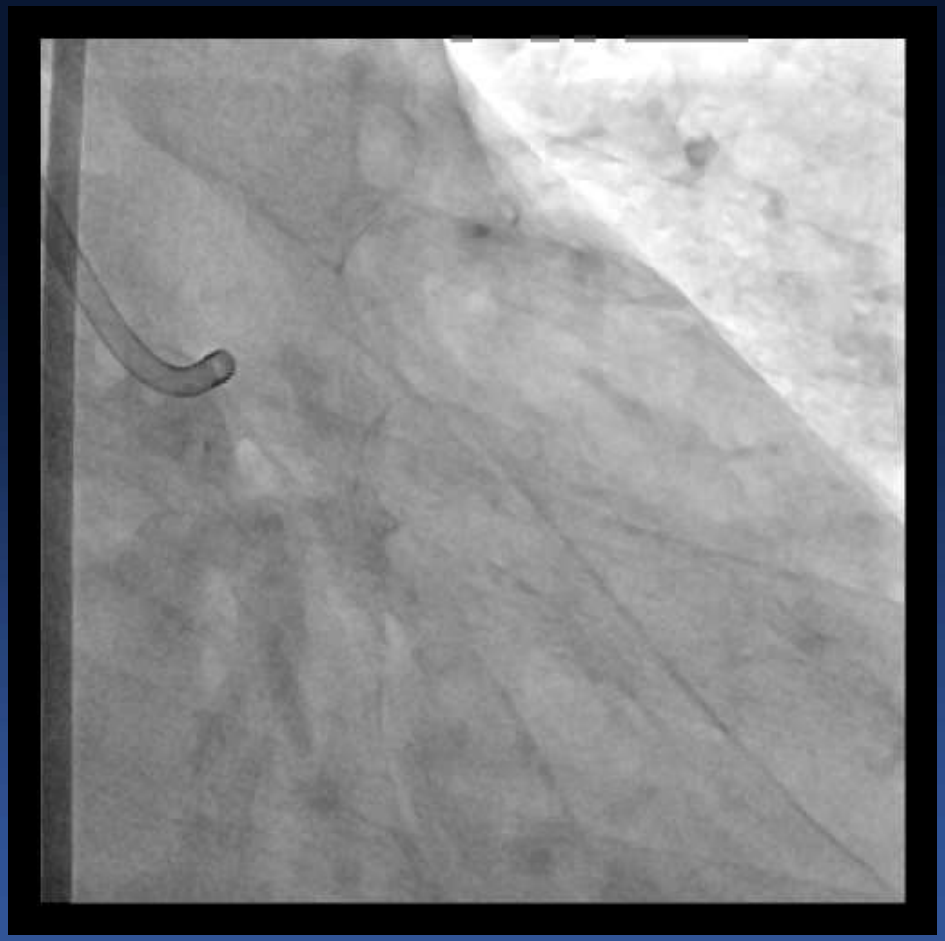


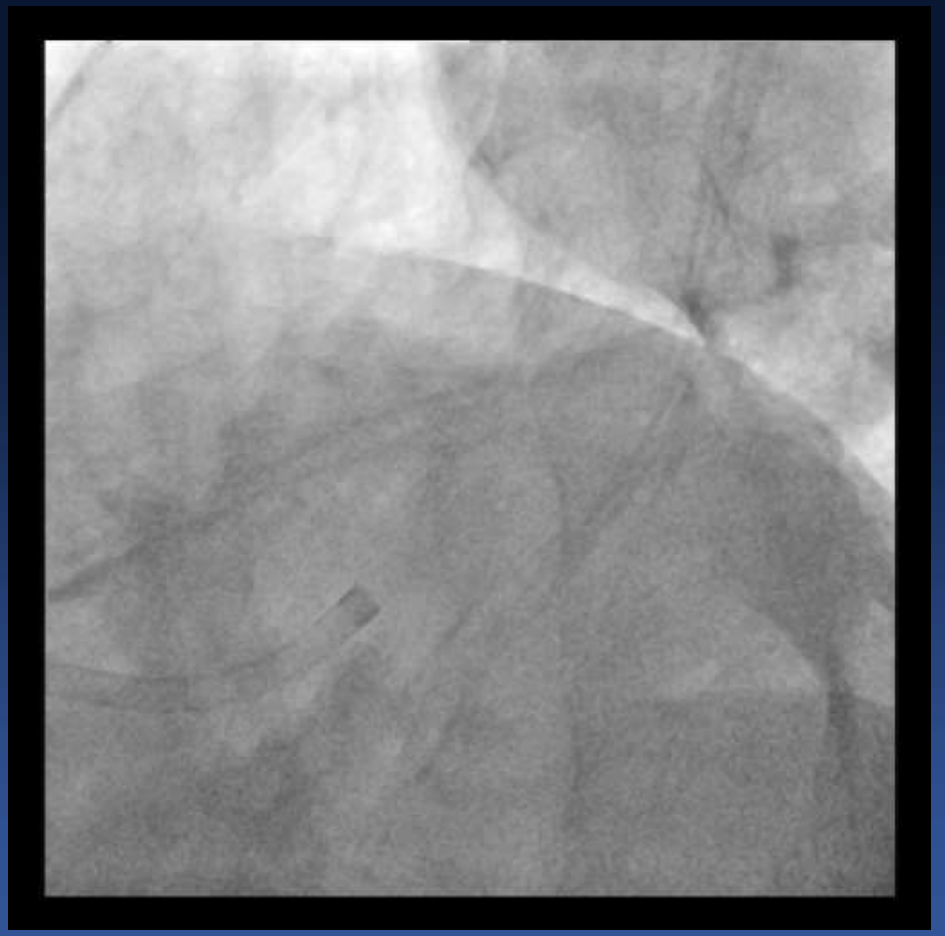


IVUS

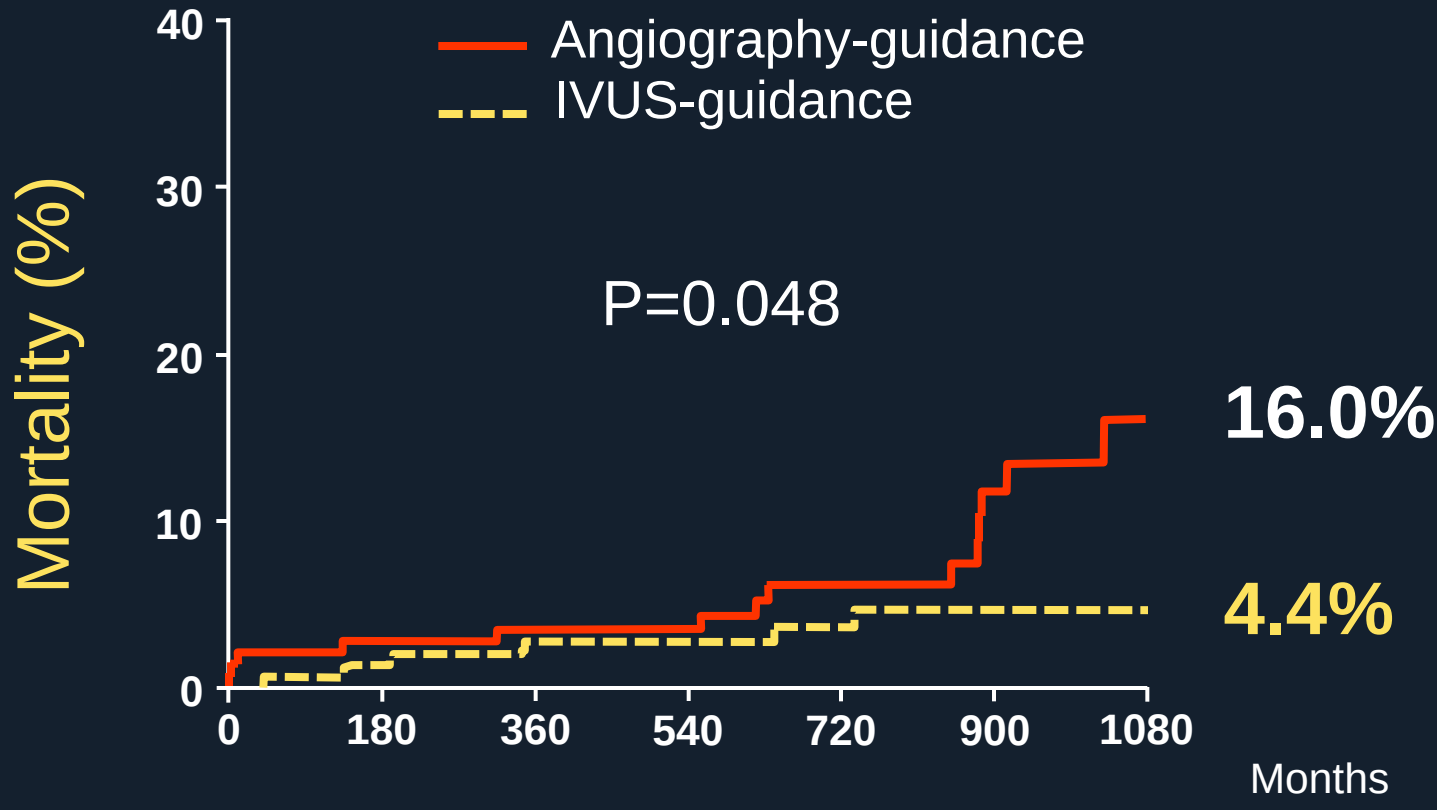


LM Bifurcation Disease





IVUS Guidance Saved Lives !



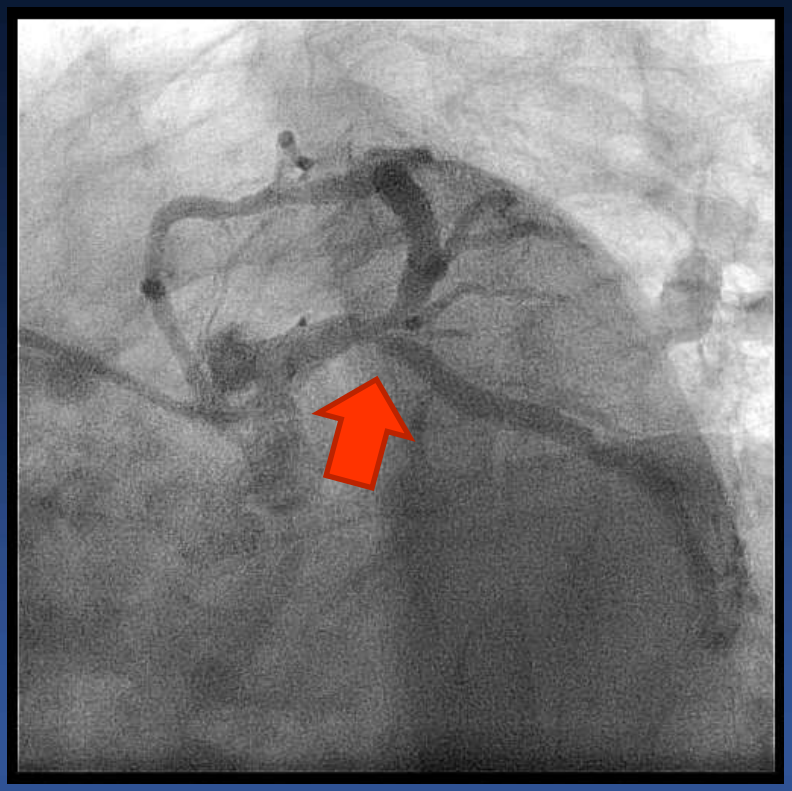
Patients after risk				
IVUS-guidance	145	140	98	37
Angiography-guidance	145	137	88	29

Park SJ et al, Circulation. Cardiovasc Interv. 2009;2(3):167-77.

How to Treat: PCI Strategy

Ostial and Shaft Disease

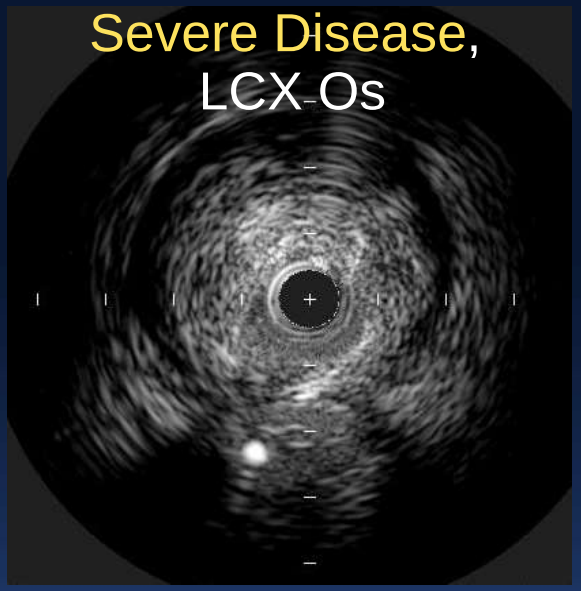
Bifurcation Disease

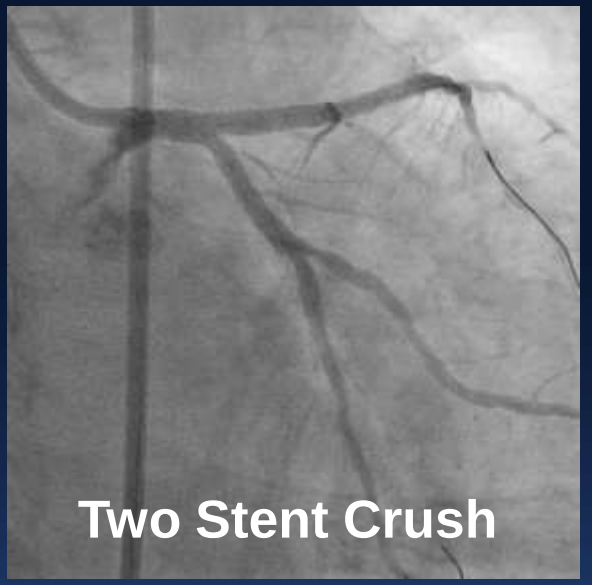


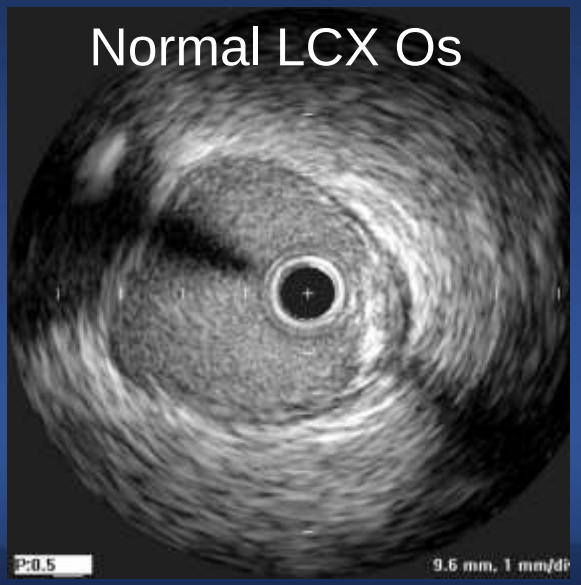
LM Bifurcation

Stent Cross Over	***Normal Ostial LCX (Medina 1.1.0., 1.0.0)*** Normal or Diminutive LCX Small LCX with < 2.5 mm in diameter Focal disease in distal LCX
Two Stent	***Diseased LCX (Medina 1.1.1., 1.0.1)*** Large LCX with ≥ 2.5 mm in diameter Diseased left dominant coronary system Concomitant diffuse disease in distal LCX

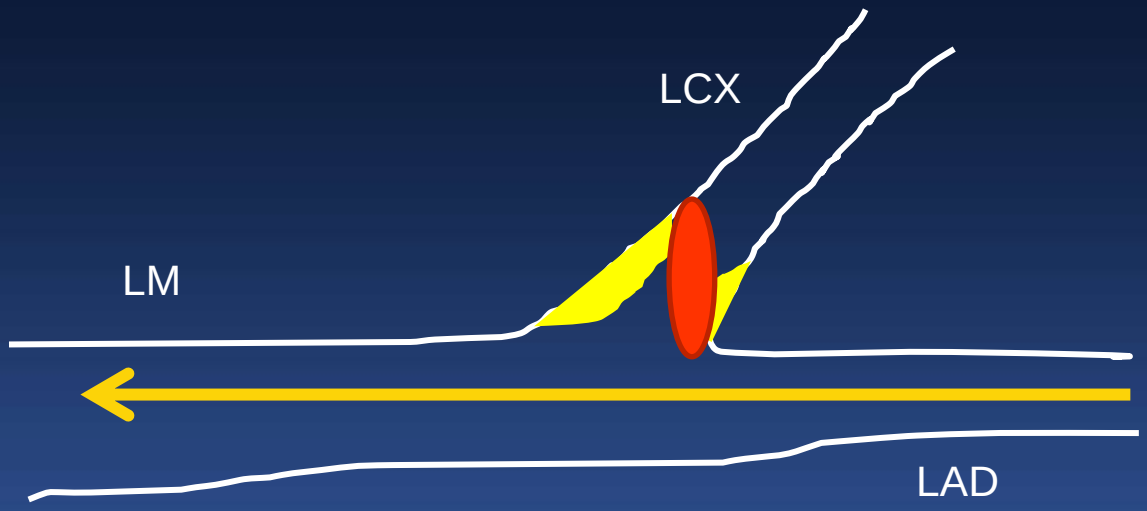
Direct LCX pullback IVUS
LAD pullback overestimates LCX ostial MLA



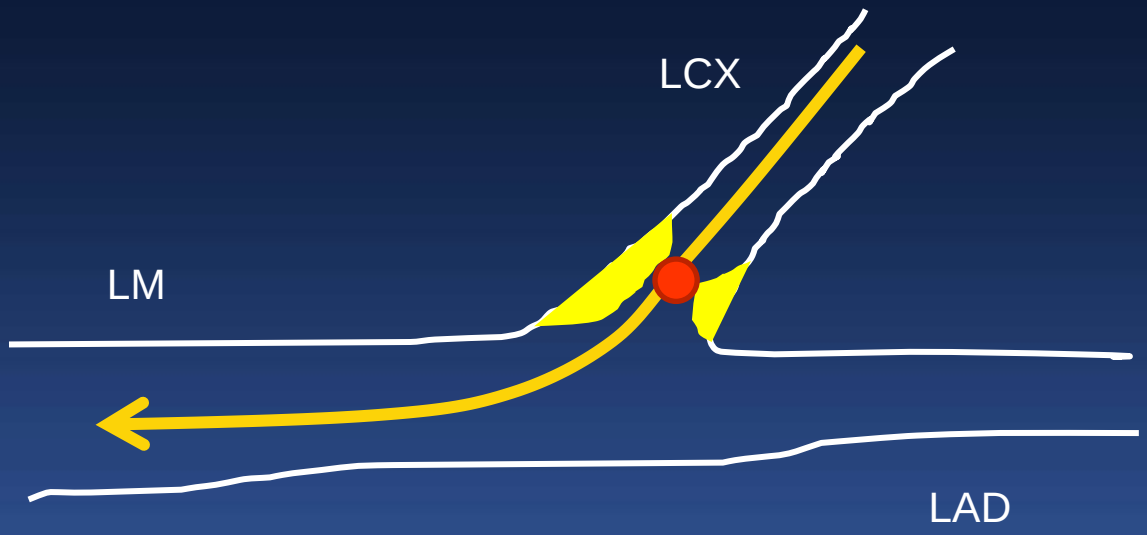




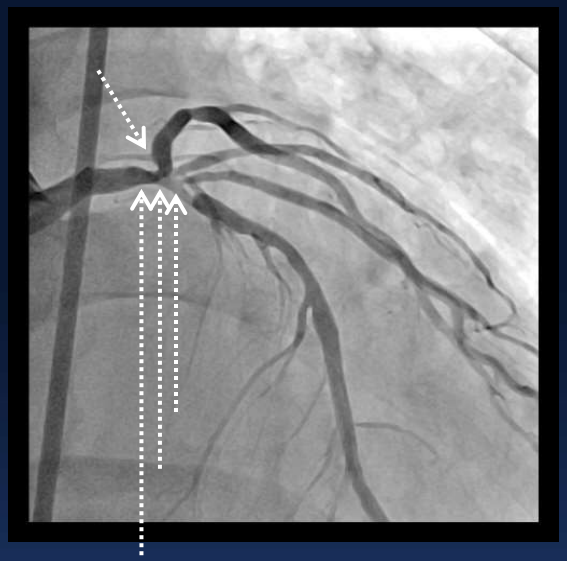
Direct LCX pullback IVUS
LAD pullback overestimates LCX ostial MLA

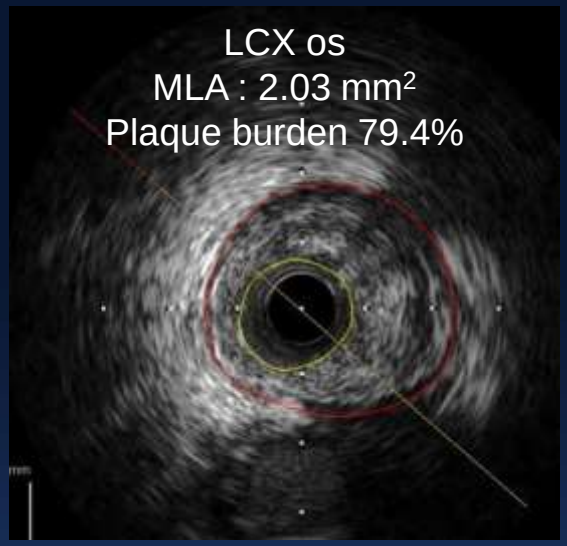


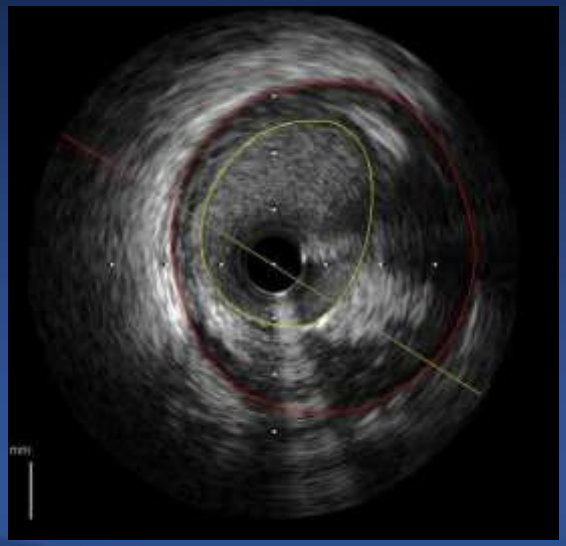
Direct LCX pullback IVUS
LAD pullback overestimates LCX ostial MLA



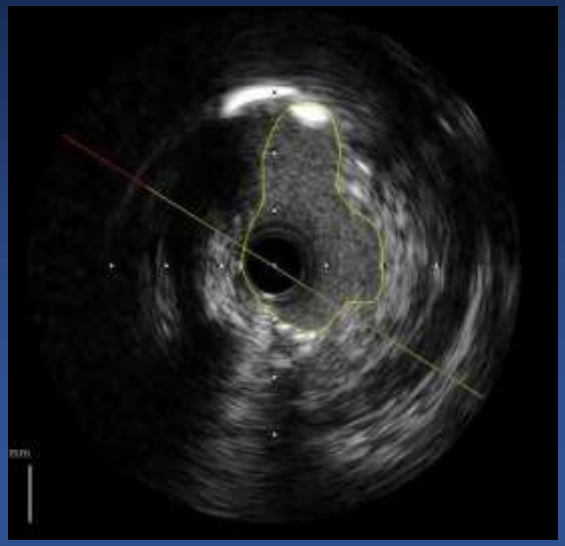
Pre-PCI IVUS



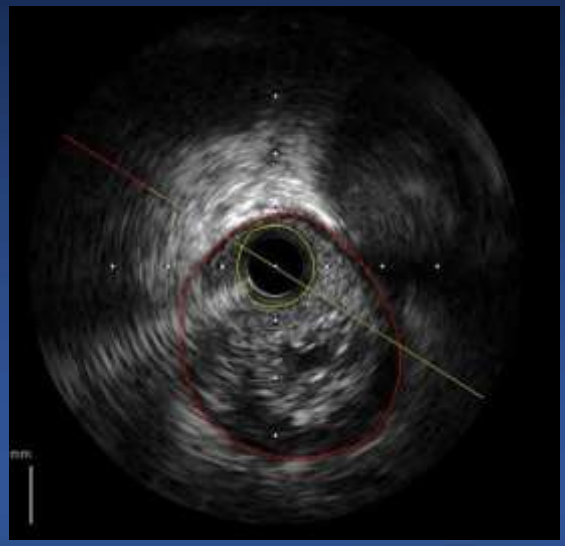




Distal LM
MLA : 8.82 mm²
Plaque burden 65.1%

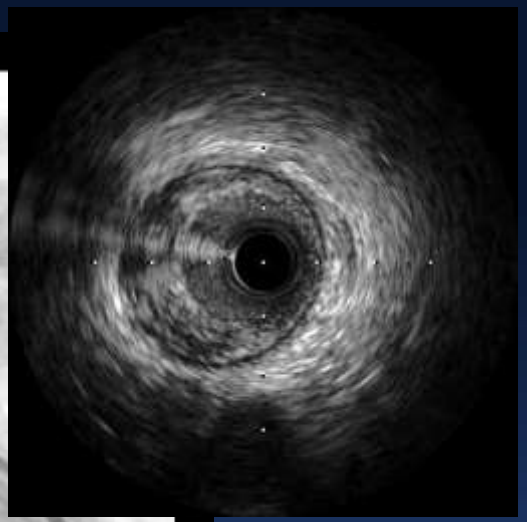


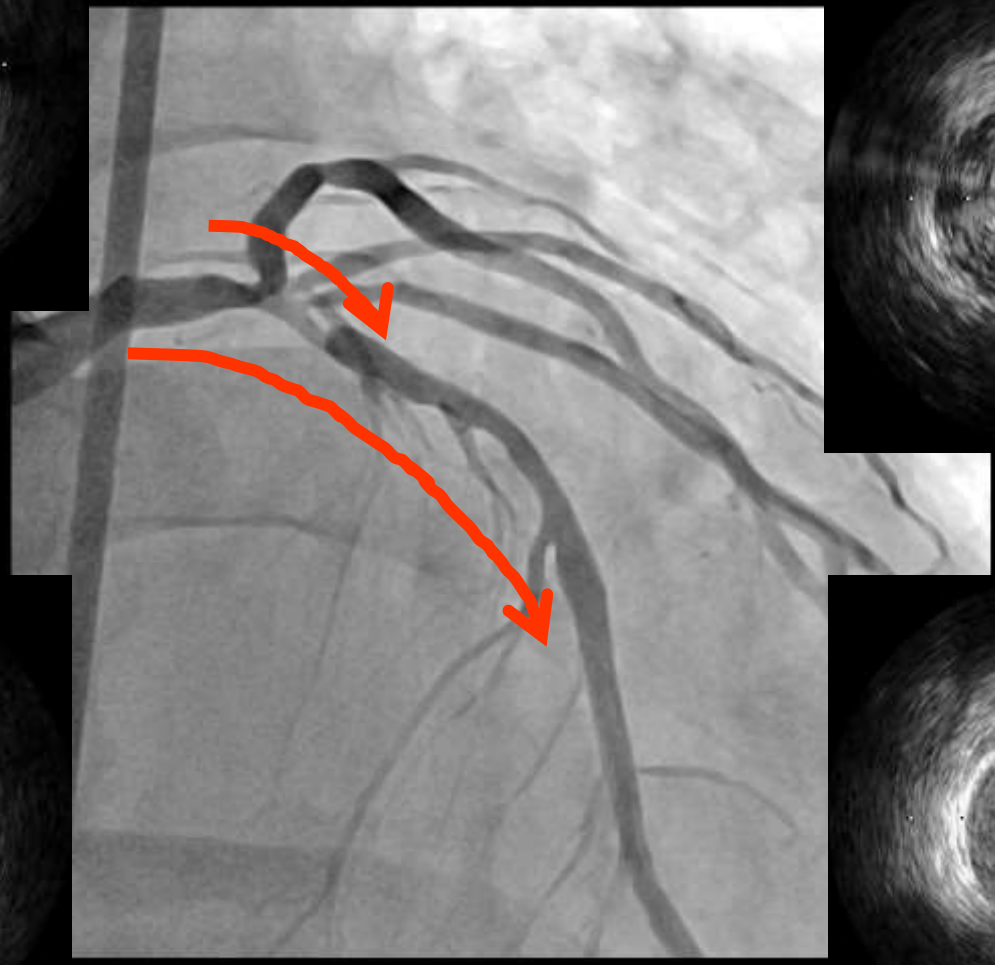
POC
MLA : 6.56 mm²

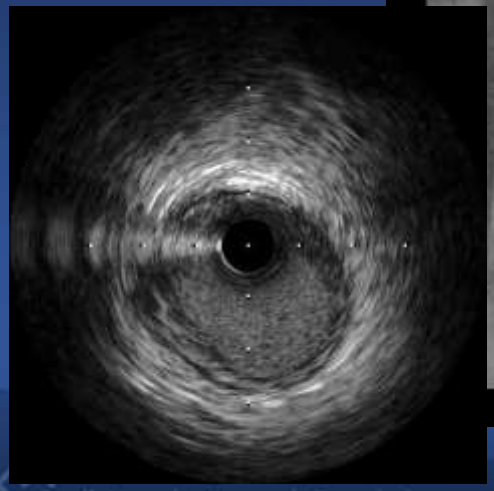


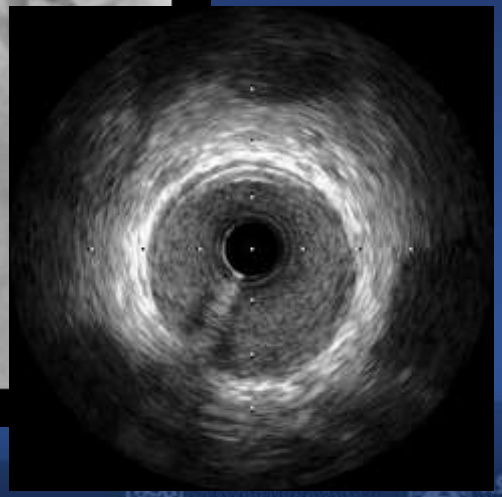
Proximal LAD
MLA : 1.5 mm²
Plaque burden 88.6%

How Long ?



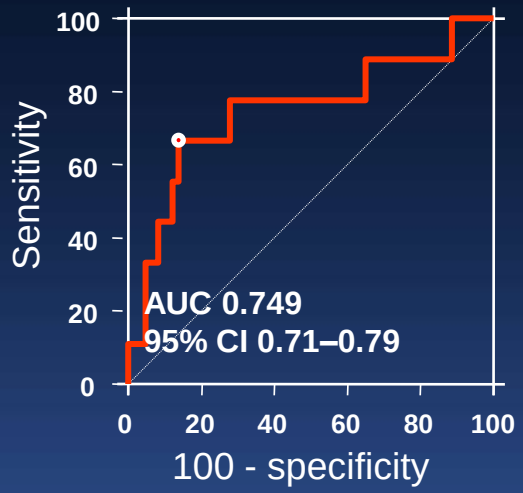






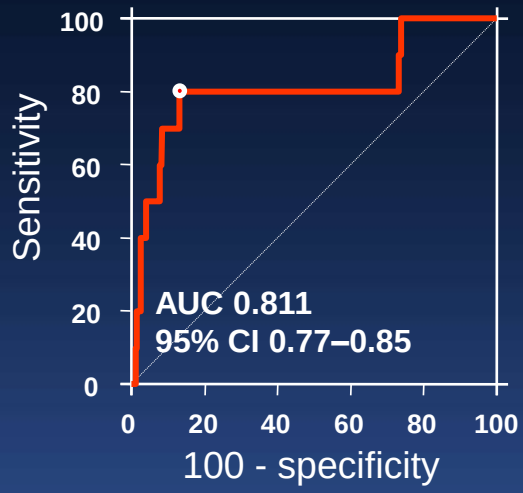
IVUS Predictors of Edge Restenosis after Second Generation DES

433 E-ZES



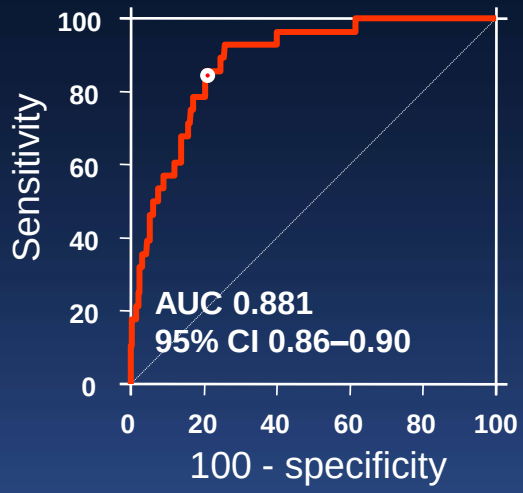
Plaque burden=56.3%
Sensitivity 67%
Specificity 86%

422 R-ZES



Plaque burden=57.3%
Sensitivity 80%
Specificity 87%

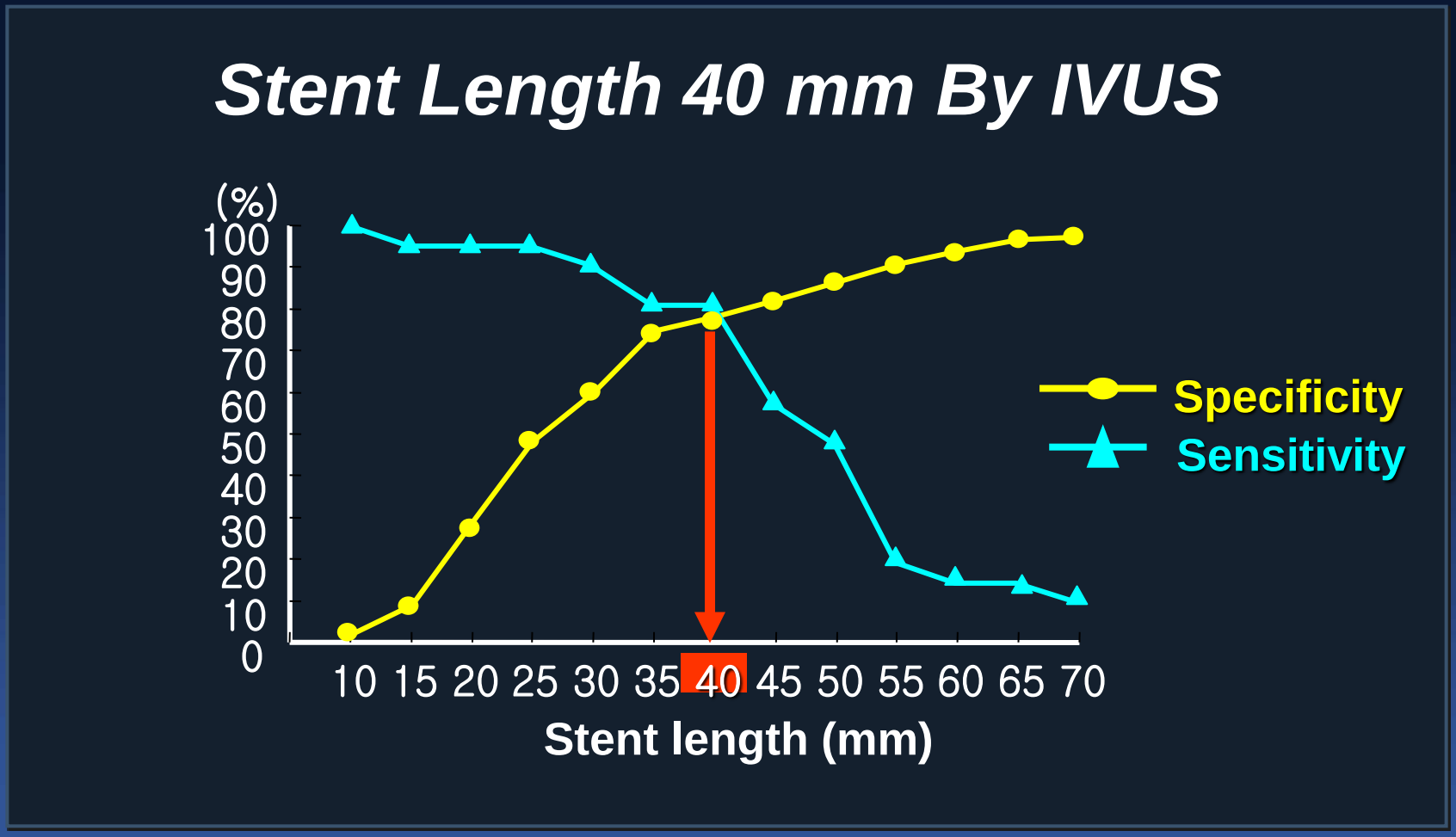
813 EES



Plaque Burden=**54.2%**
Sensitivity 86%
Specificity 80%

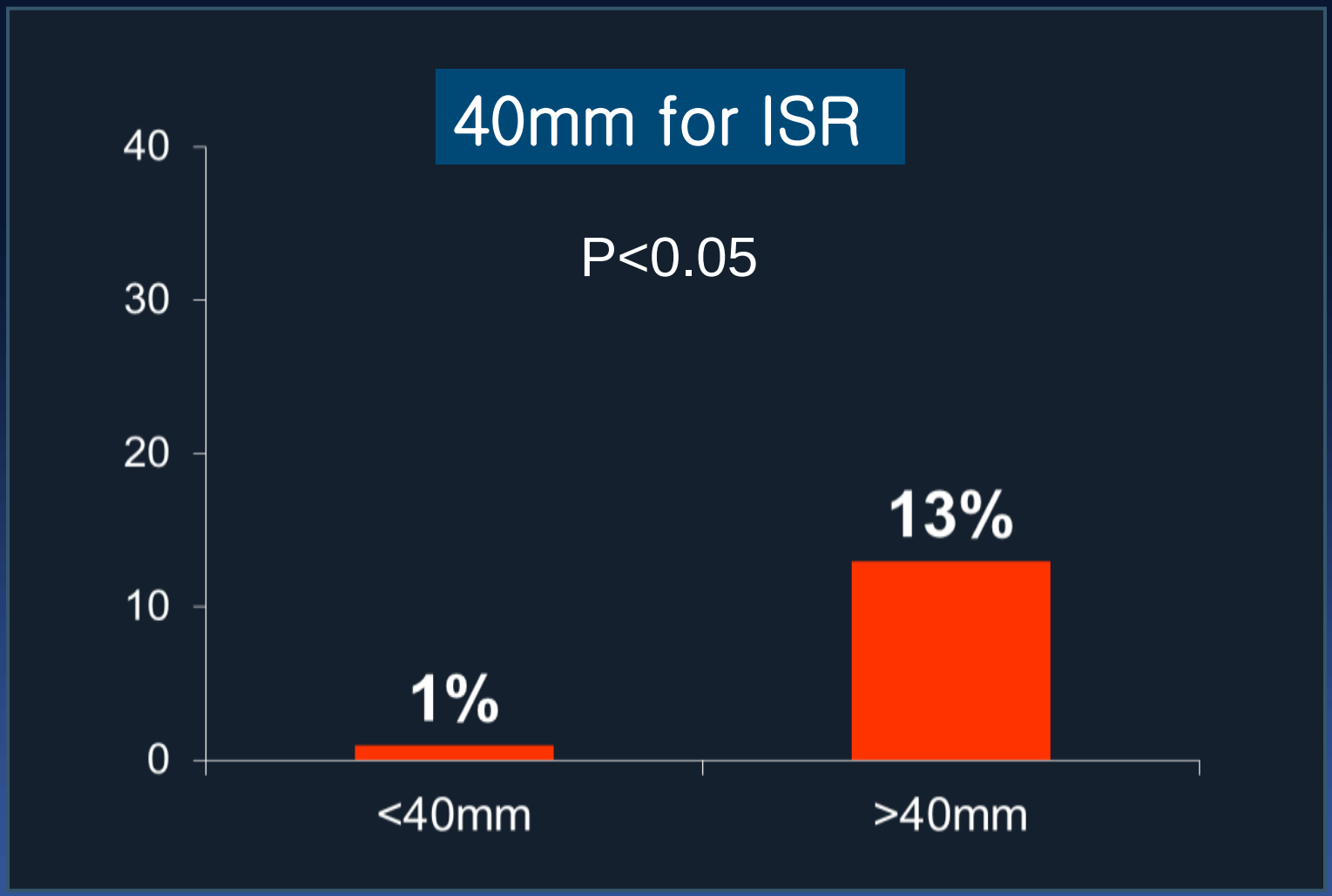
Kang et al. Am J Cardiol 2013;111:1408-14

How Long?



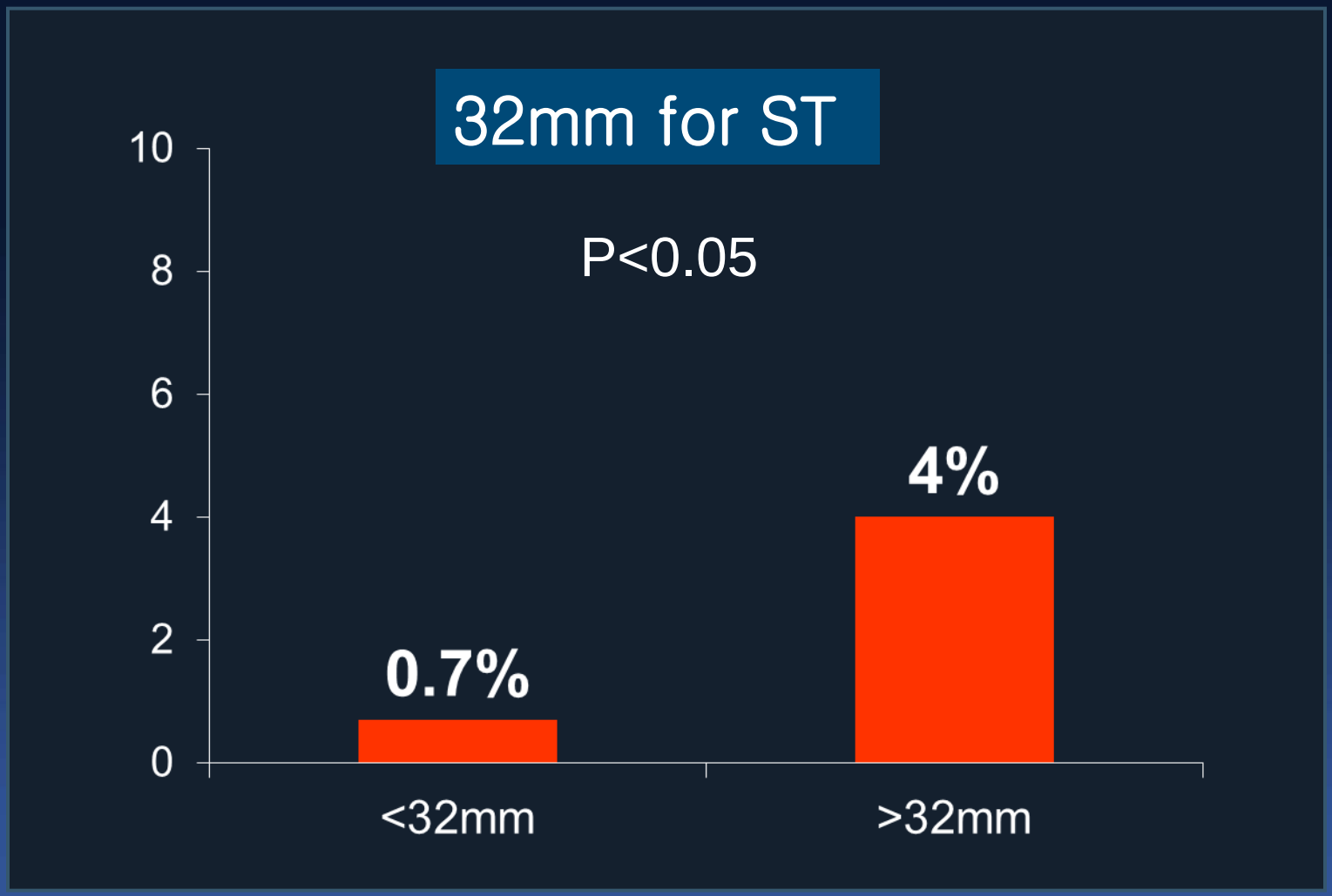
Hong MK, Park SJ, et al. Eur Heart J 2006 Jun;27(11):1305-10

How Long? In-Stent Restenosis



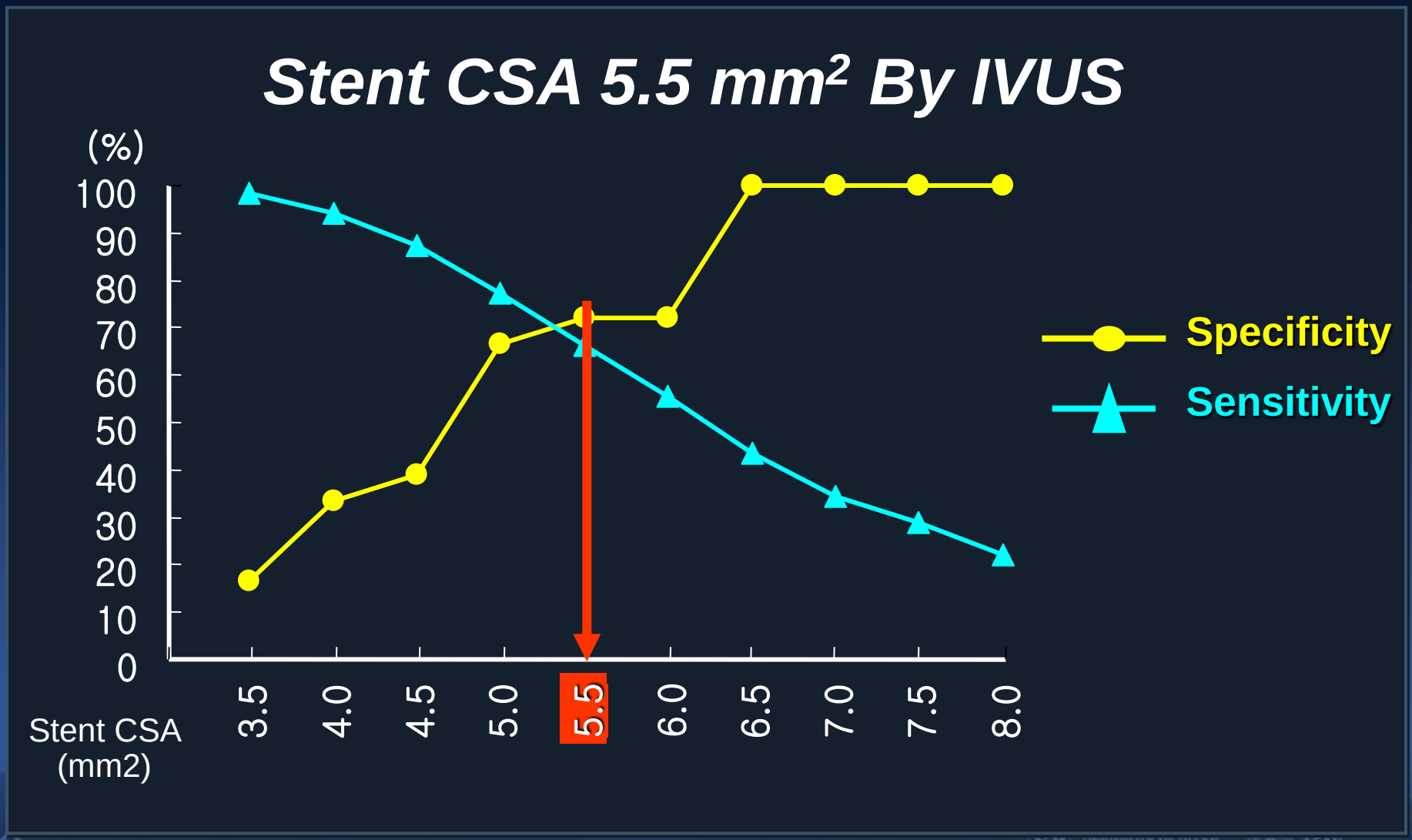
Hong MK, Park SJ, et al. Eur Heart J 2006 Jun;27(11):1305-10

How Long? Stent Thrombosis



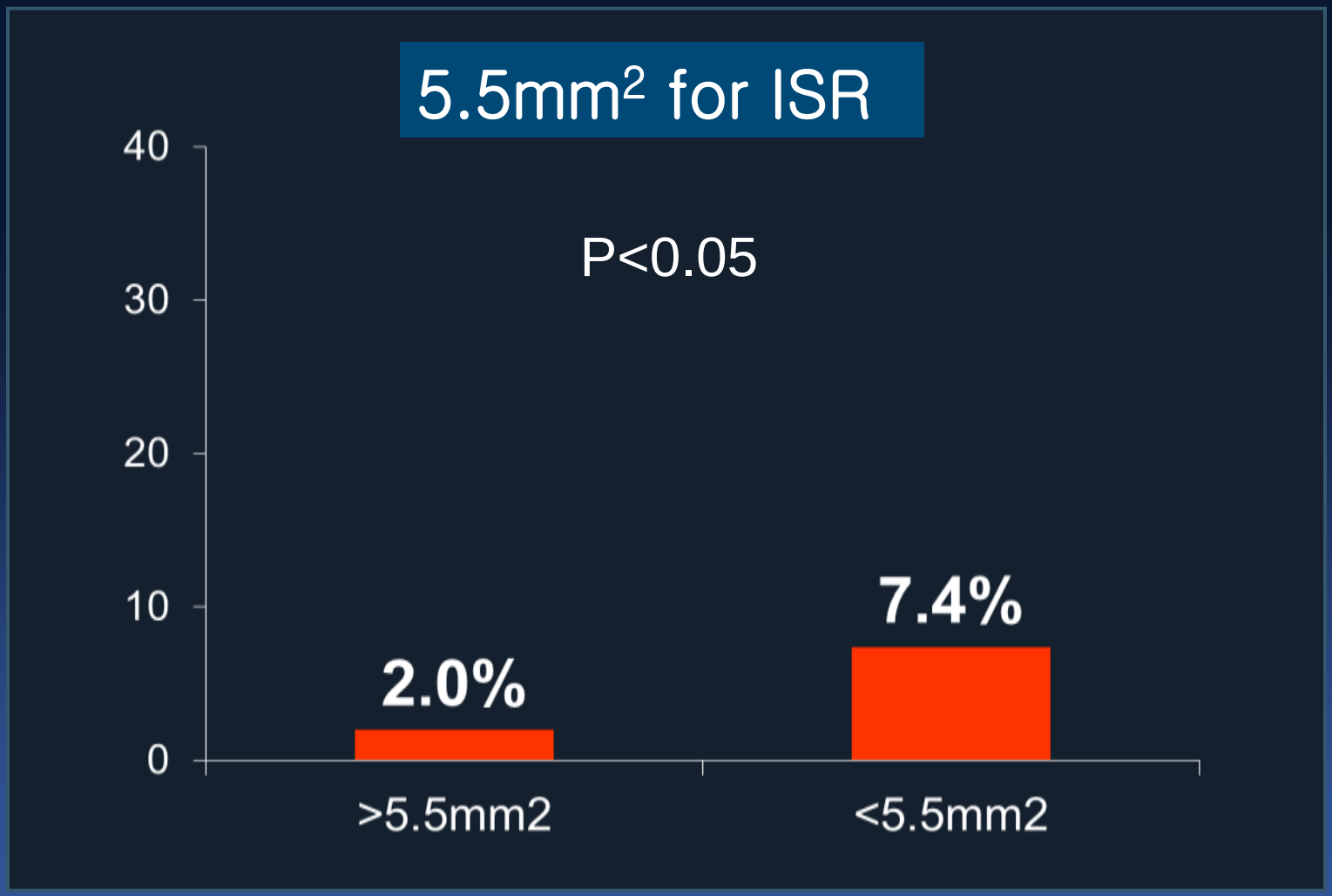
Suh J, Park SJ, et al. JACC Cardiovascular interventions 2010;3:383-9

How Big?



Hong MK, Eur Heart J, 2006:27:1305 (AMC Cypher Registry)

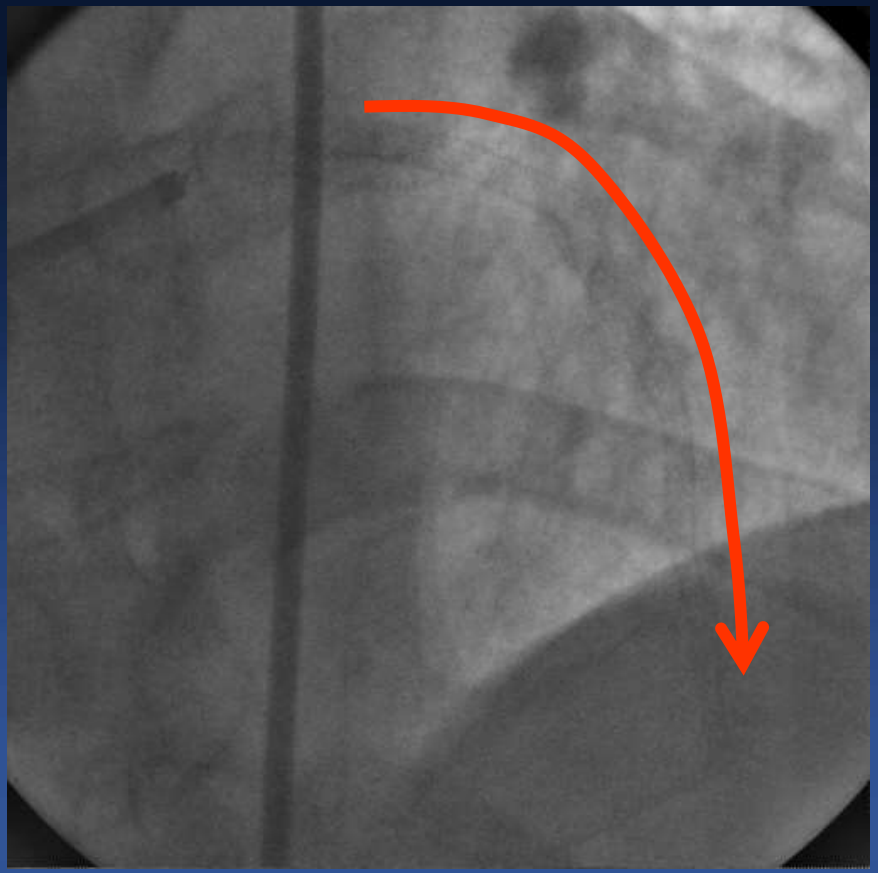
How Big? In-Stent Restenosis



Hong MK, Park SJ, et al. Eur Heart J 2006 Jun;27(11):1305-10

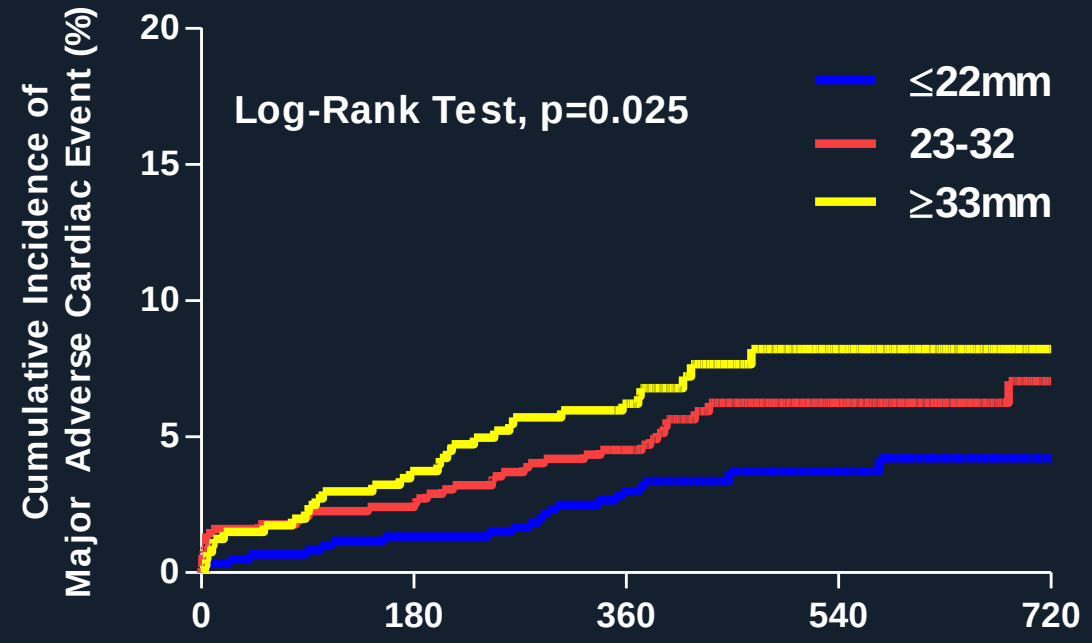
“Full Metal Jacket”

Multiple or overlapping stent implantation



IVUS Utilization Modify the Stent Length Effect On Clinical Outcomes

Without IVUS

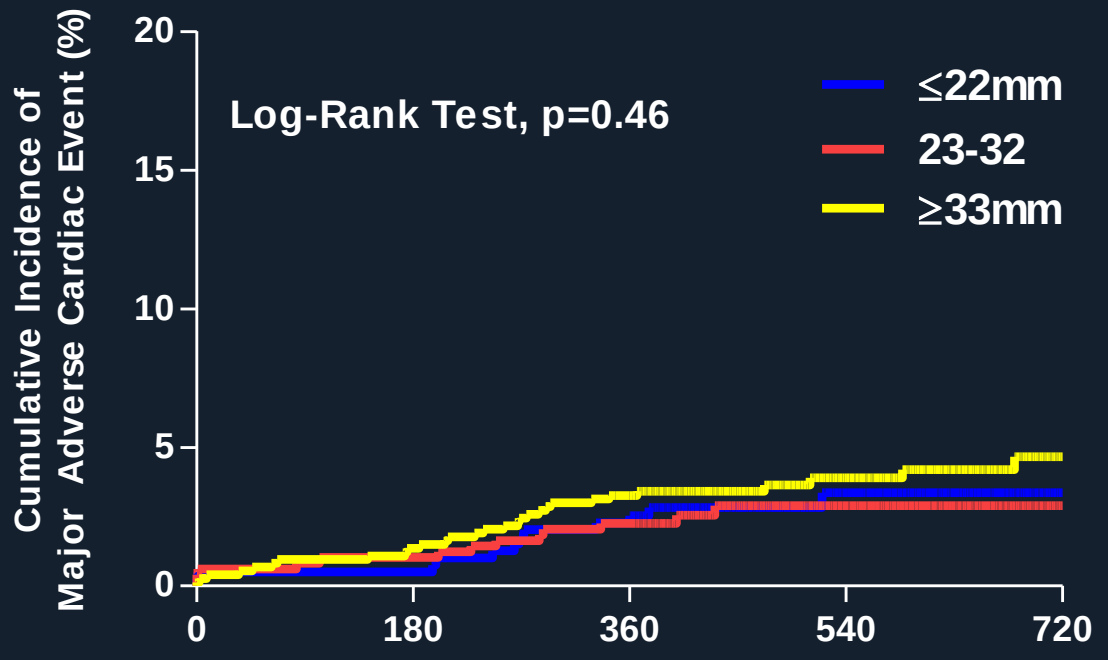


No. at risk					
≤22mm	603	595	582	214	100
23-32mm	622	607	592	219	81
≥33mm	403	388	376	125	38

Ahn JM, Park SJ et al. Am J Cardiol 2013;111:829–35

IVUS Utilization Modify the Stent Length Effect On Clinical Outcomes

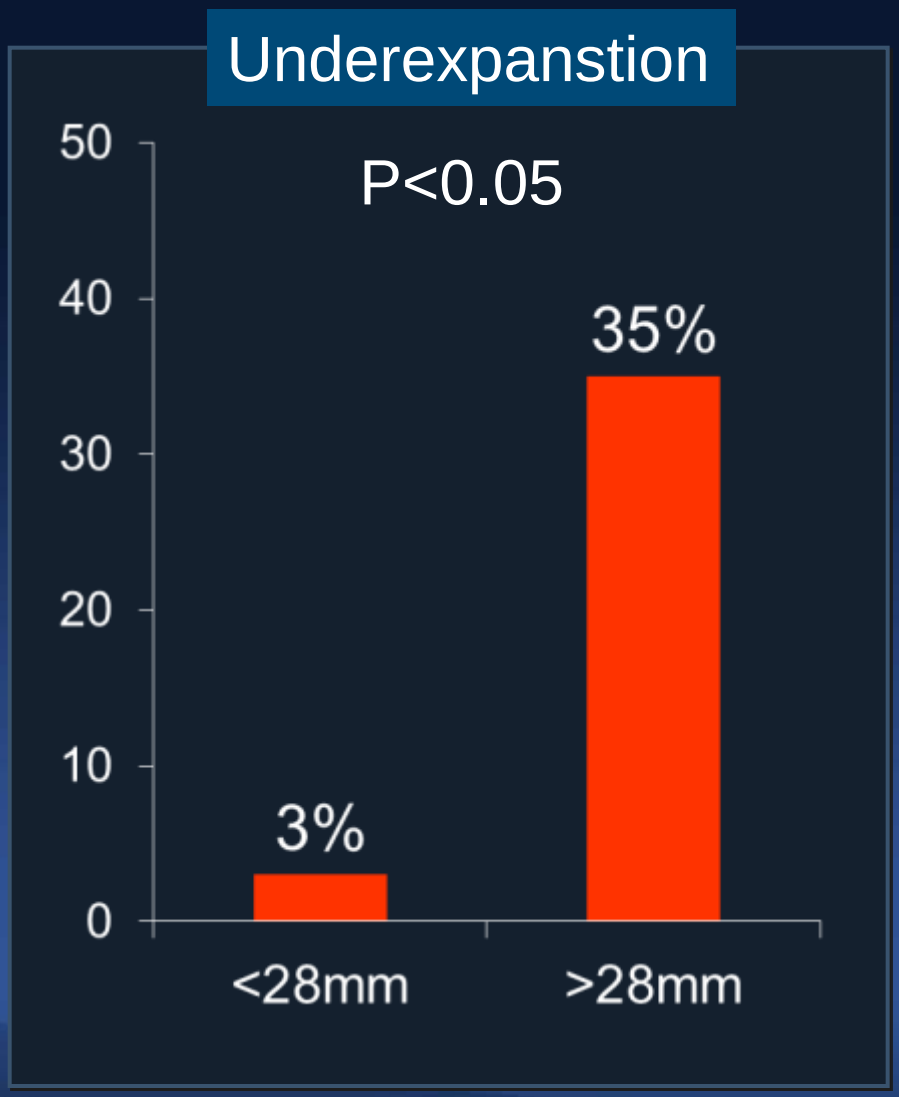
With IVUS

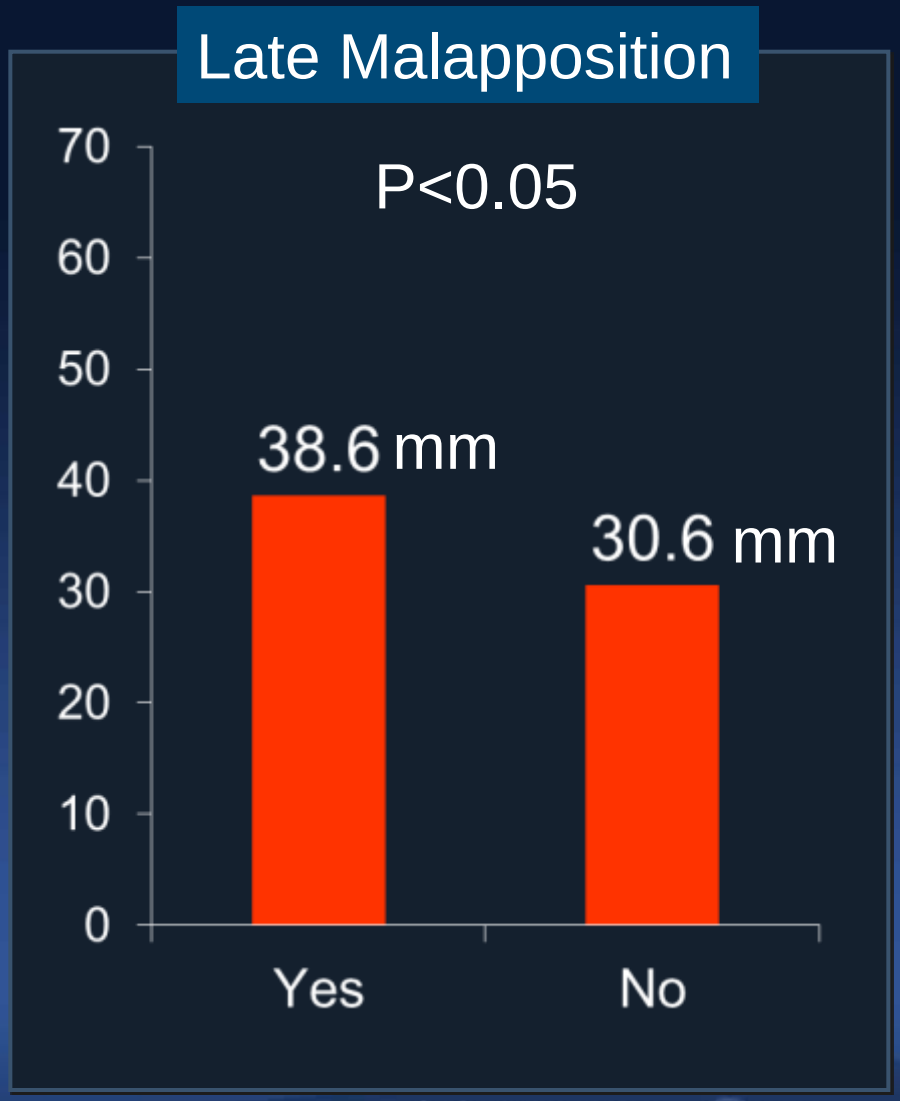


No. at risk					
≤22mm	395	393	386	169	55
23-32mm	487	482	476	221	72
≥33mm	734	724	709	355	116

Ahn JM, Park SJ et al. Am J Cardiol 2013;111:829–35

Stent Length and Optimal Stenting



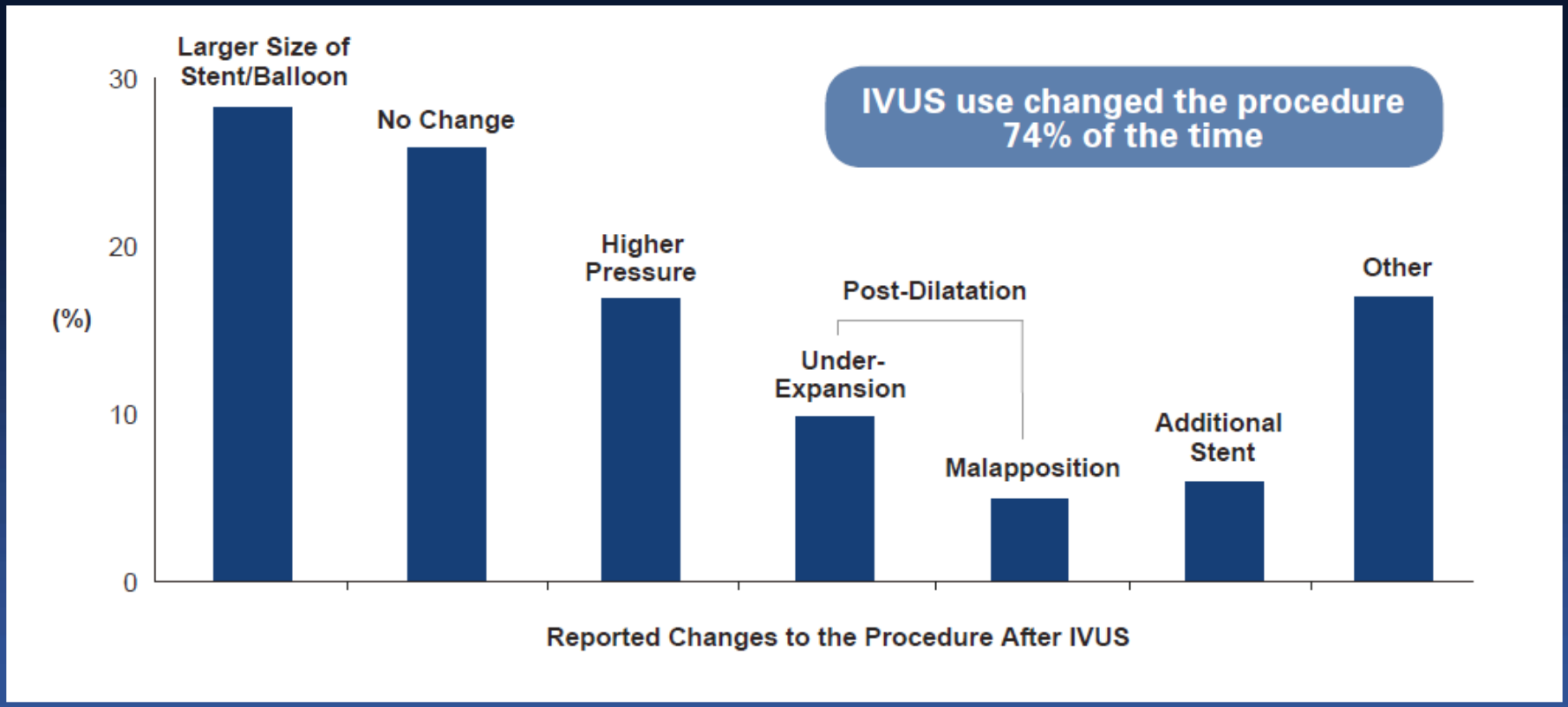


Kang SJ, et al Circ Cardiovasc Interv 2011;4:9-14

Hong MK, et al Circulation 2006;113:414-419

IVUS Changed the Procedure

ADAPT-DES Sub-Study

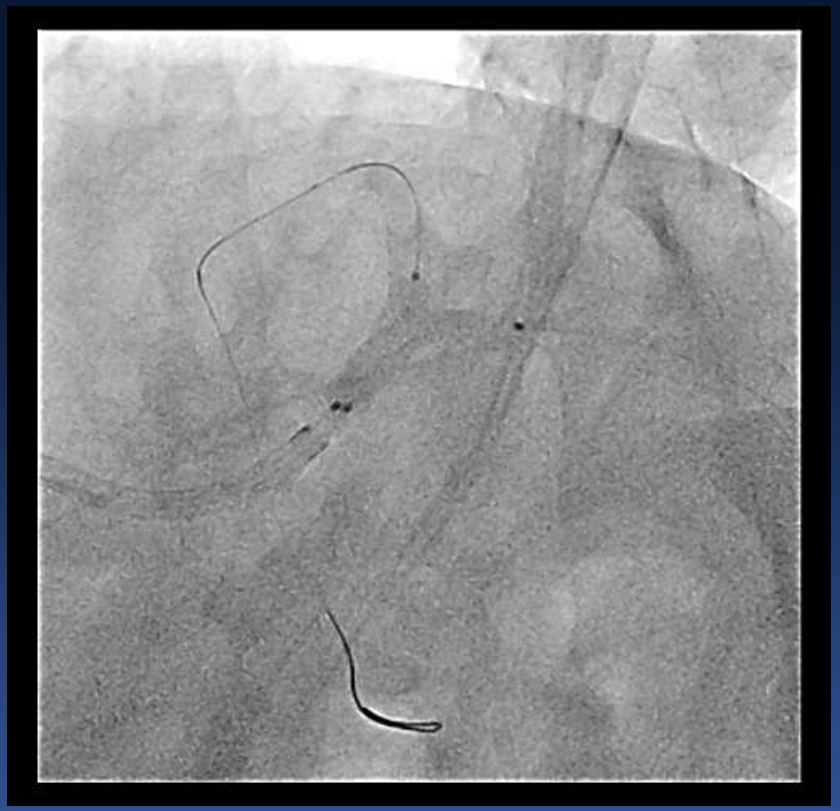


Witzenbichler B et al. Circulation. 2014 Jan 28;129(4):463-70

PCI procedure

Balloon Crush
LCX : Xience Alpine 3.0 x 28 mm upto 18 atm
LAD : Emerge NC 3.0 x 20 mm upto 16 atm

PCI procedure

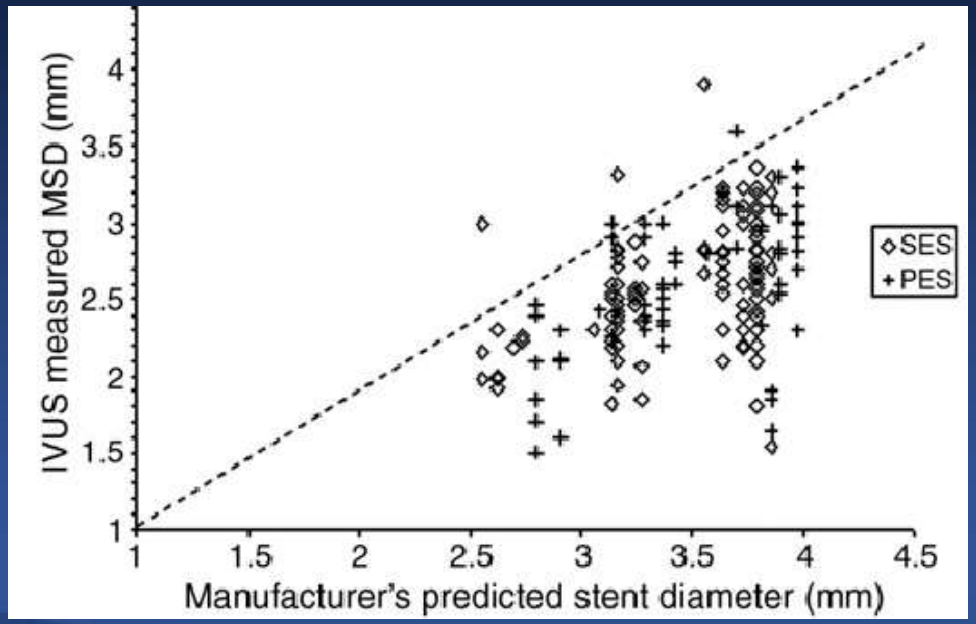


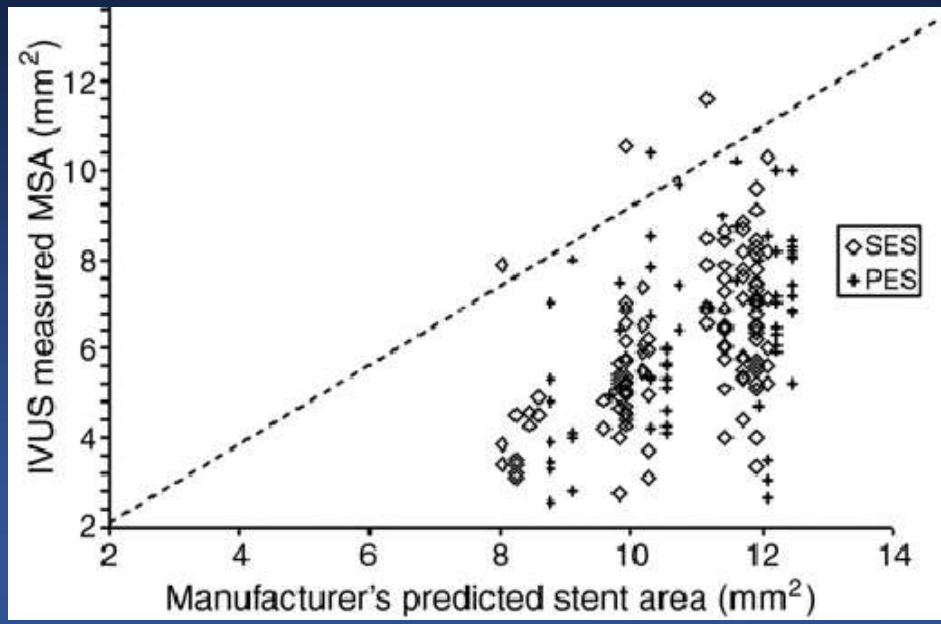
Kissing balloon
LCX : Emerge balloon 3.0 x 20 mm upto 8 atm
LM-LAD : Xience Alpine 3.5 x 23 mm upto 18 atm
NC TREK 4.0 x 15 mm upto 6 atm

Why Adjuvant High Pressure?

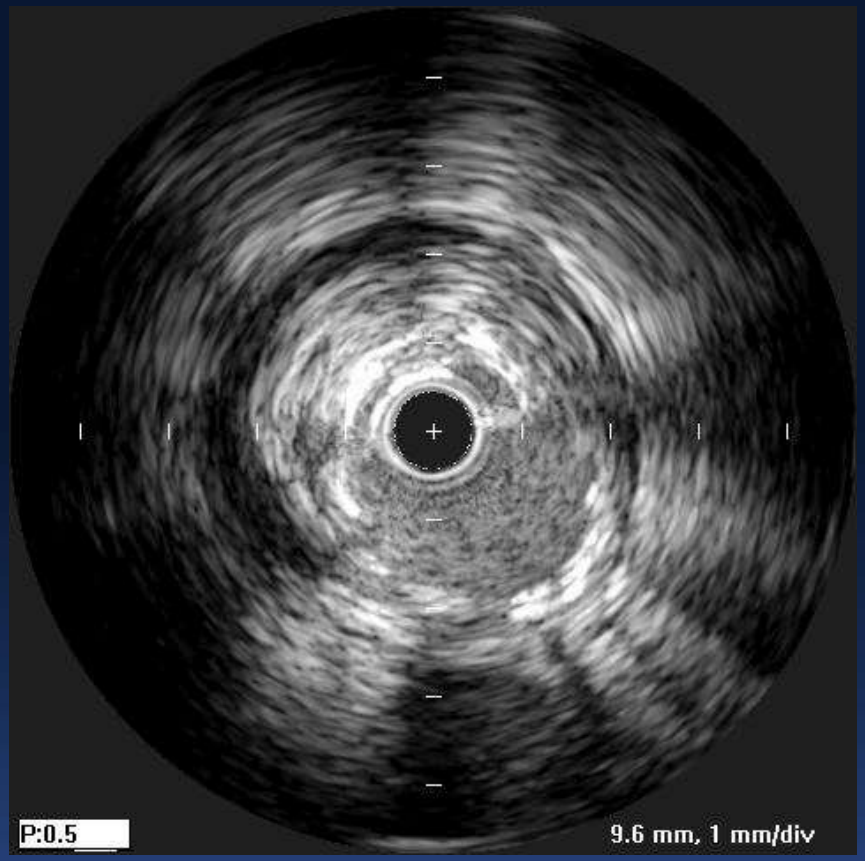
Manufacturer's Compliance Charts Cannot Guarantee Adequate Stent Expansion

- Comparison of IVUS-measured MSD and MSA with the predicted values (Cypher, n=133; Taxus, n=67)
- DES achieve an average of only 75% of predicted MSD, and 66% of MSA





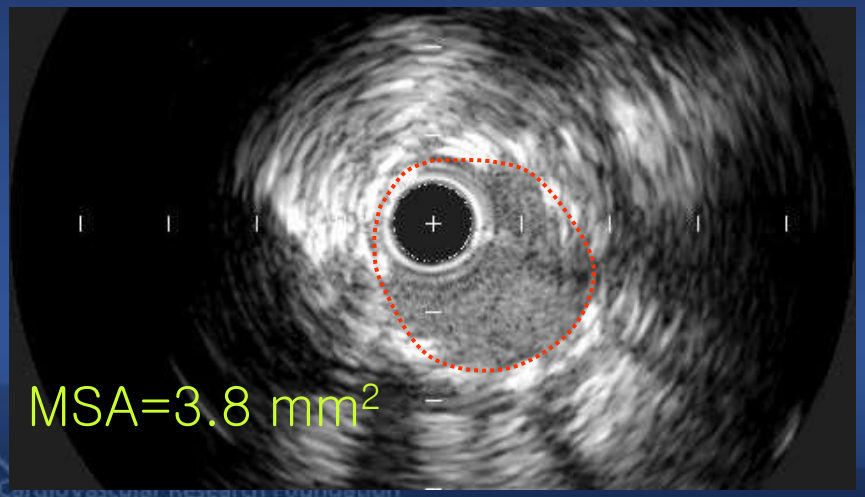
Costa et al. Am Heart J 2007;153:297-303



50 year-old male

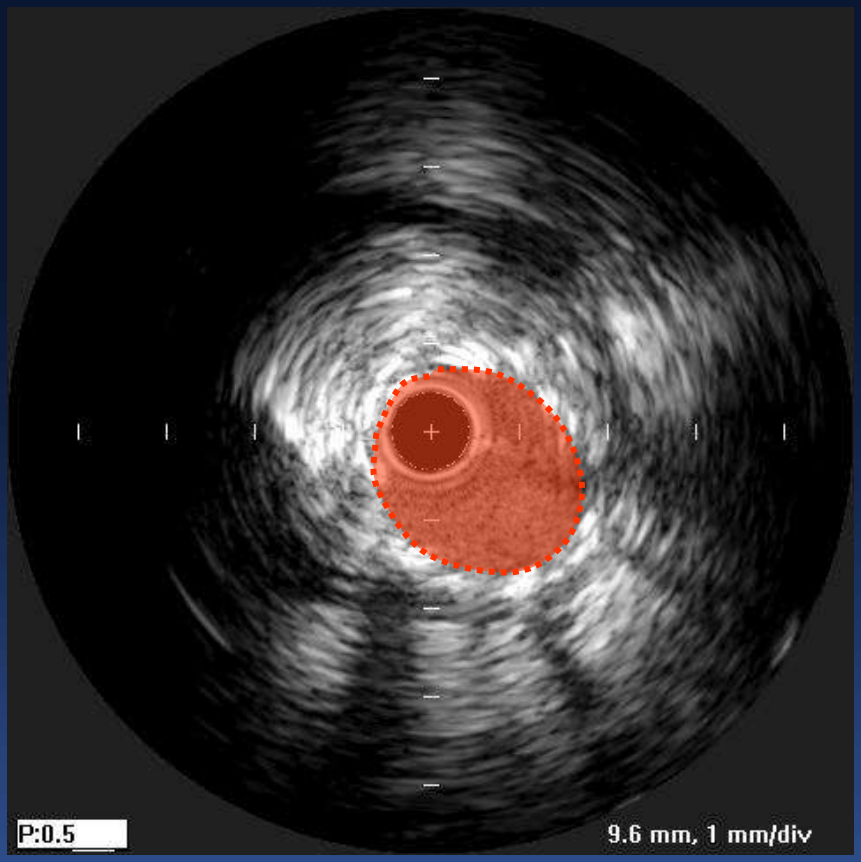
- Stable angina
- Proximal LAD 80-90%
- TAXUS 3.5(20)

Immediate post-stenting IVUS



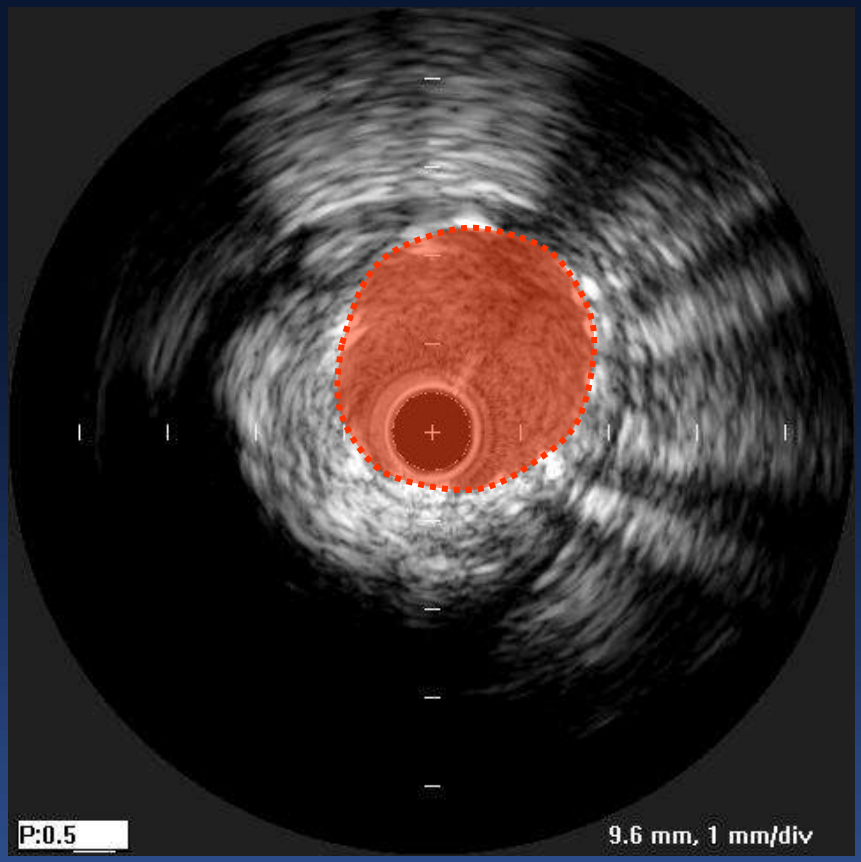
- Can it be an optimal result?

Underexpansion after Cypher 3.5 implantation



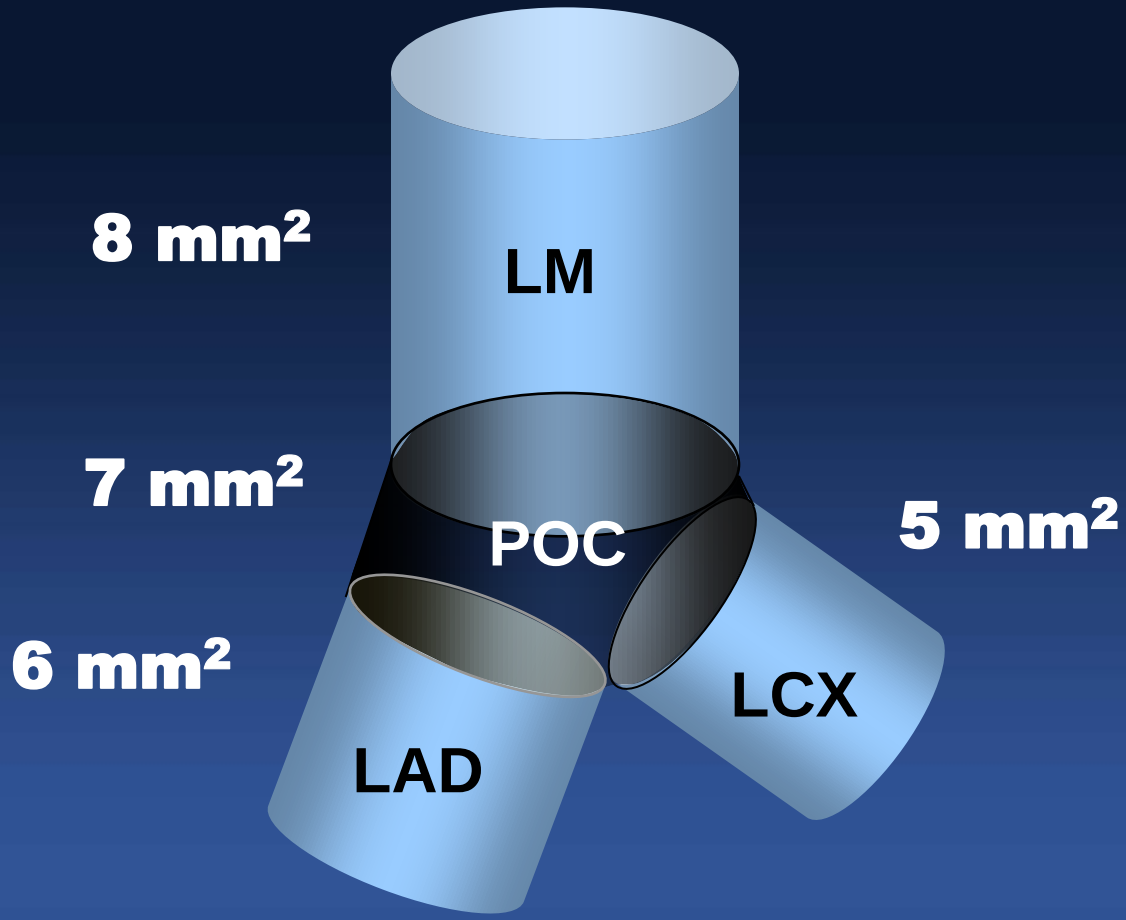
Minimal stent area 3.7 mm^2
Mean stent diameter 2.2 mm

Well-expanded after additional HP balloon



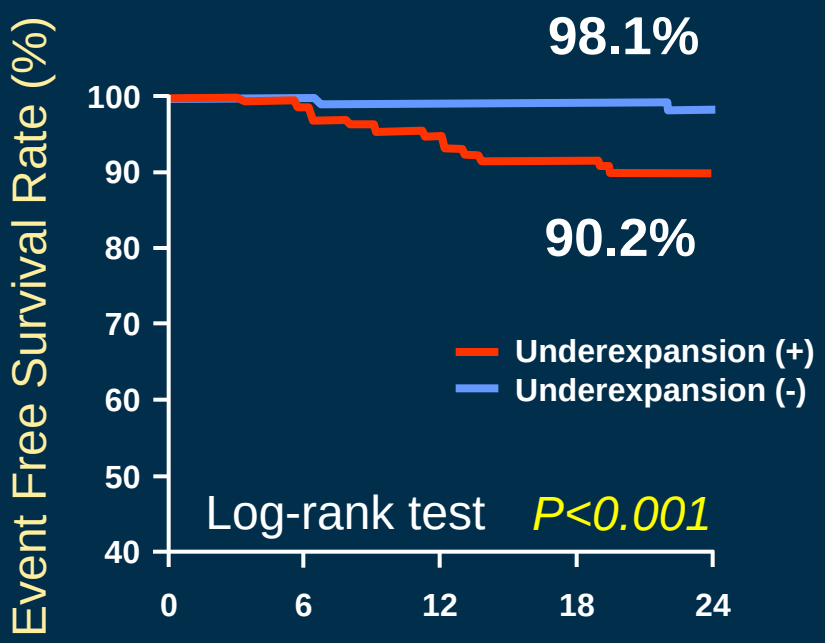
Minimal stent area 6.5 mm^2
Mean stent diameter 3.0 mm

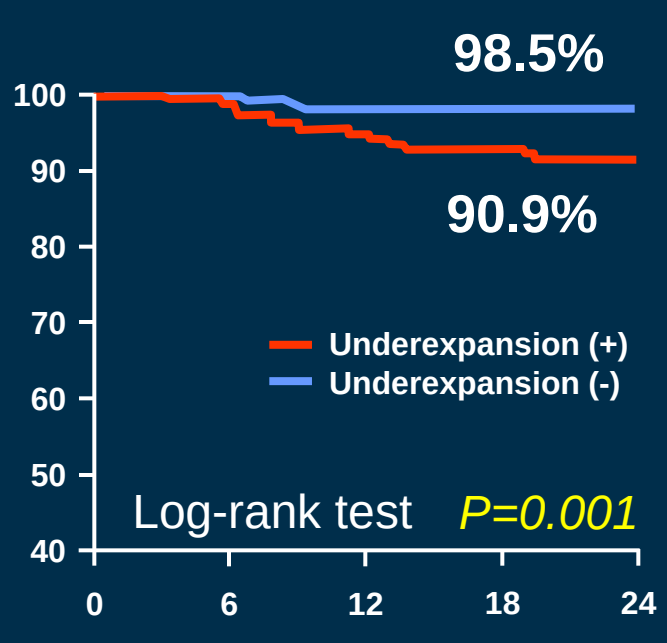
Effective IVUS Stent Area (Rule of 5,6,7,8) Can Reduce Restenosis Rate



Kang et al. Circ Cardiovasc Interv 2011;4:1168-74

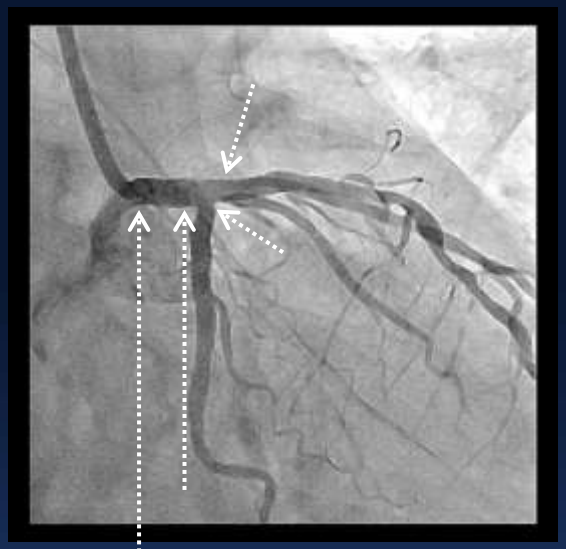
MACE-free and TLR-free Survival

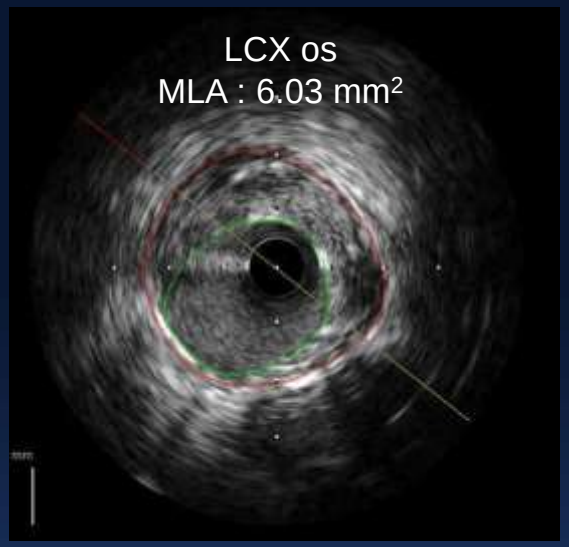


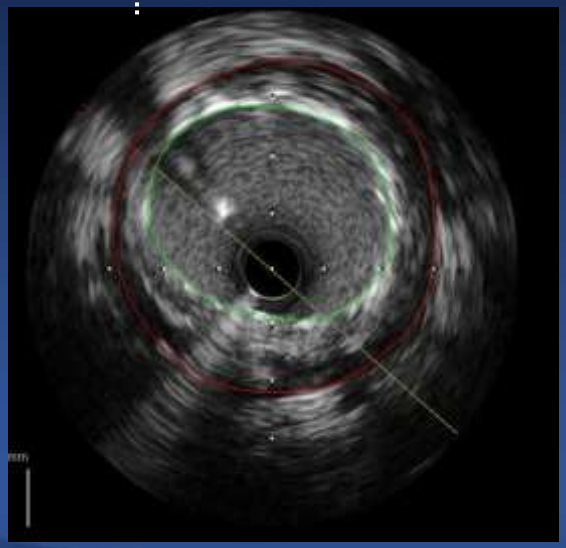


Kang et al. Circ Cardiovasc Interv 2011;4:1168-74

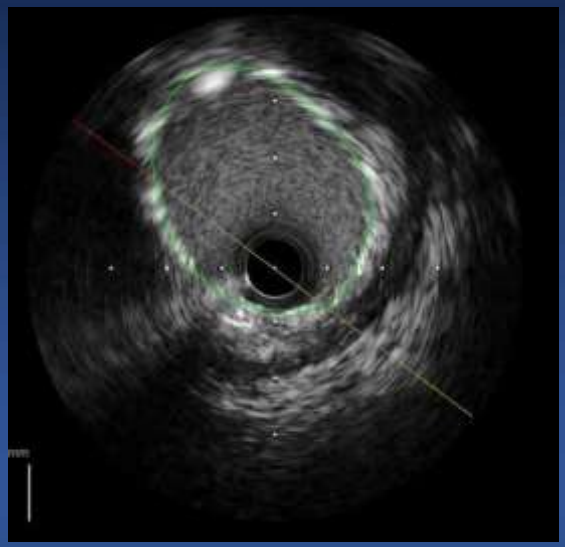
Post-PCI IVUS



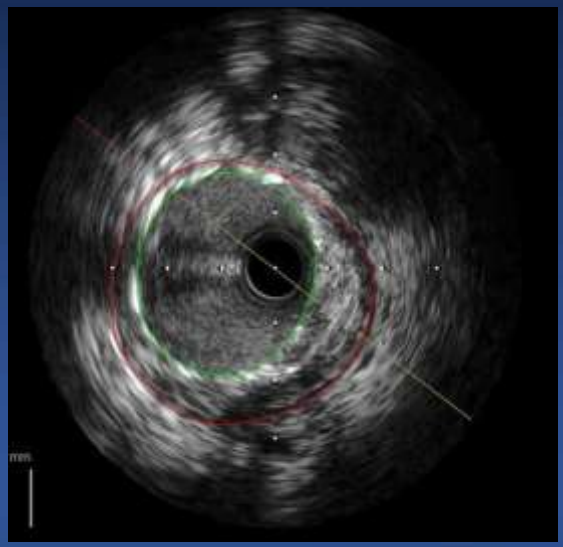




Distal LM
MSA : 13.06 mm²



POC
MSA : 12.79 mm²



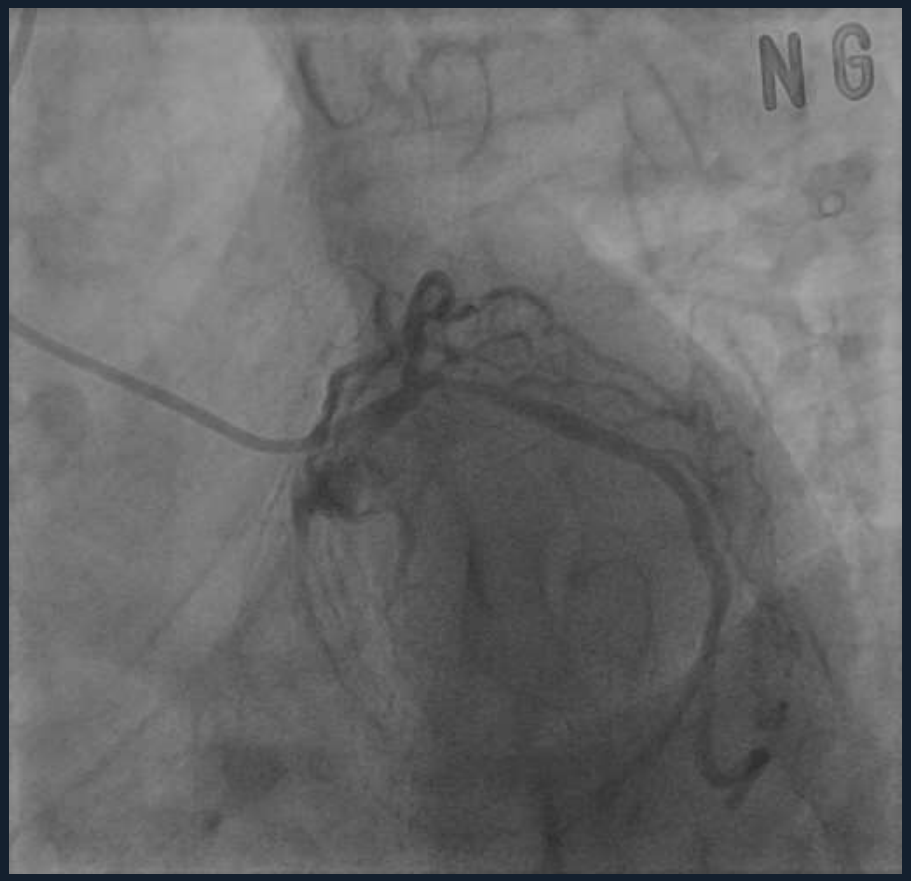
Proximal LAD
MSA : 8.89 mm²

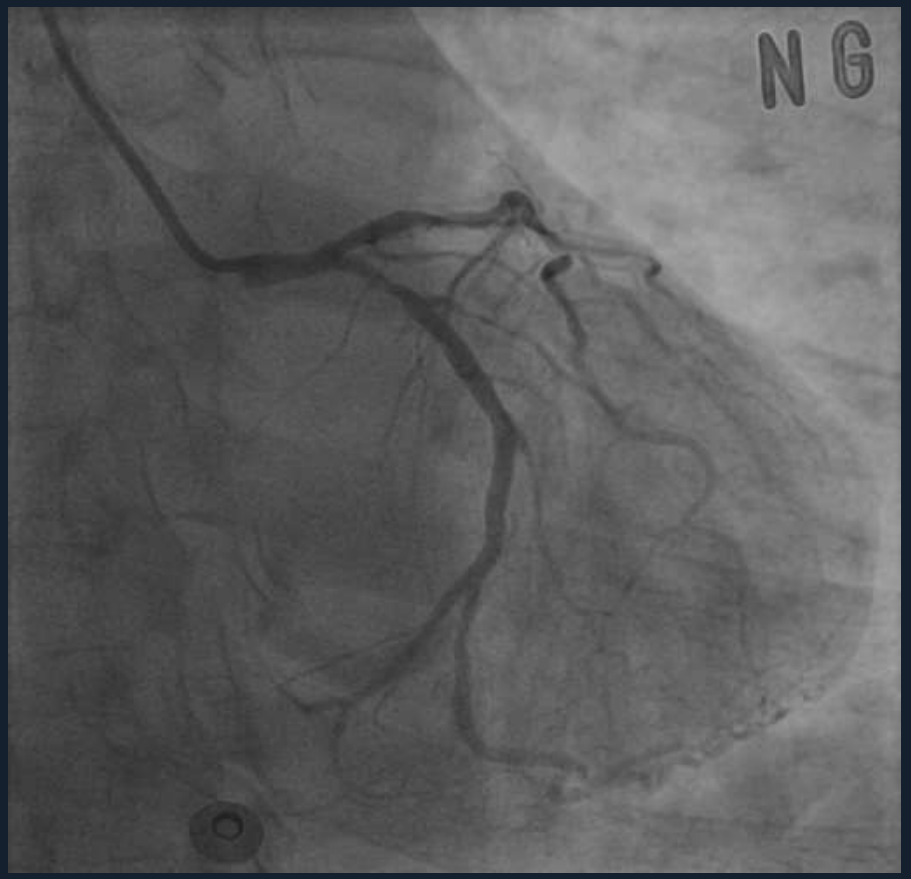
Case

64 YO/Male

- CC: Resting Chest Pain
- Previous PCI: distal LM bifurcation stenting, 1 yr ago at other hospital
- Risk factor: DM
- Cardiac enzyme: not elevated
- Nornal EF without regional wall motion abnormality

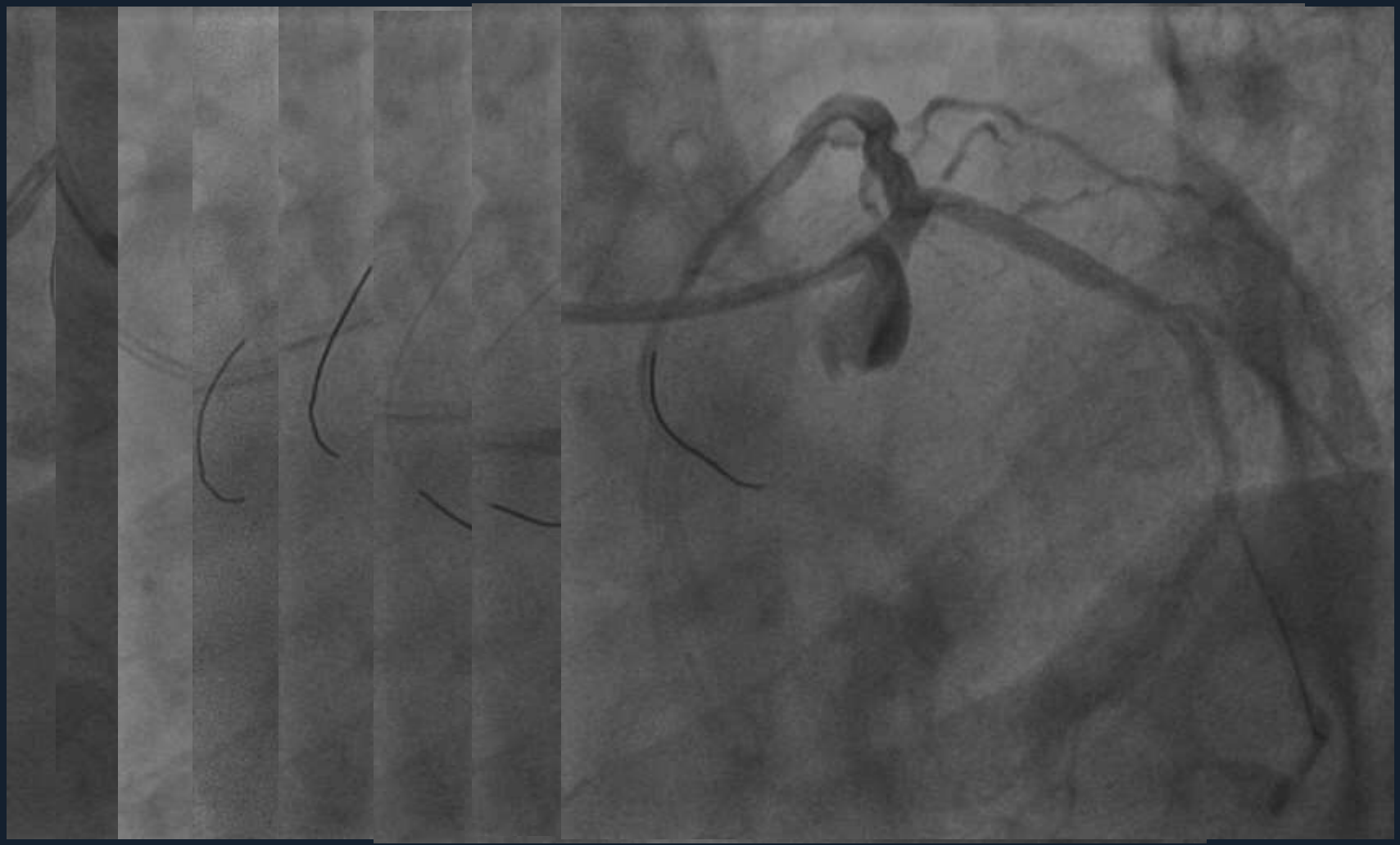
Initial CAG (2011-5-24)



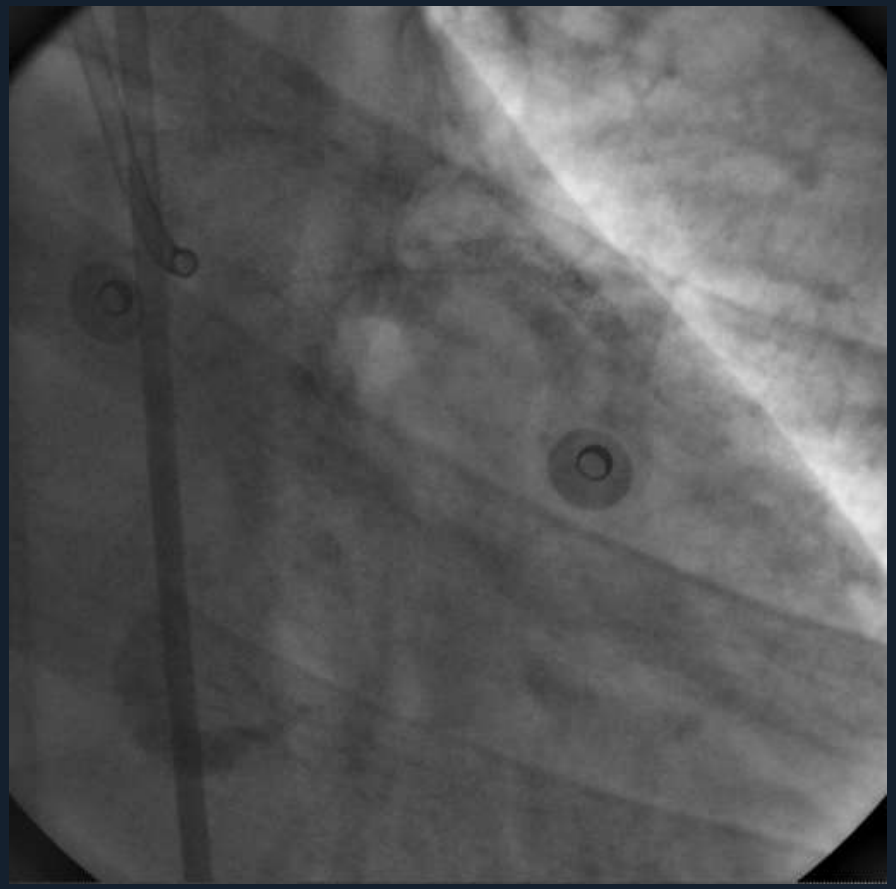


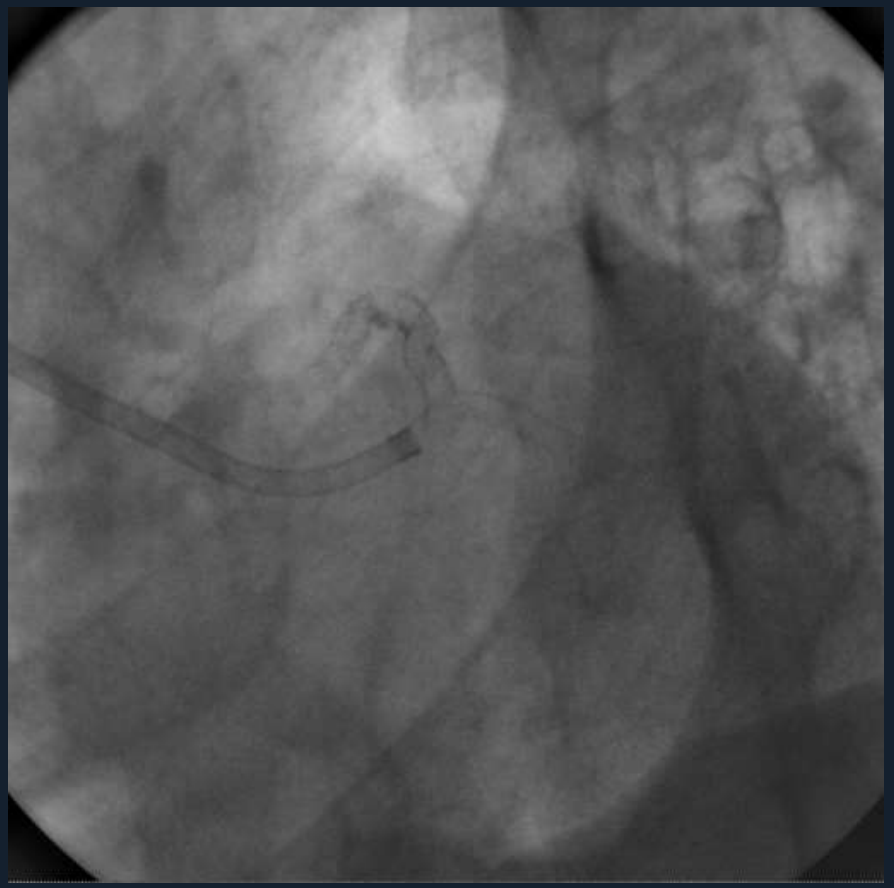
Distal Left Main Bifurcation Stenosis

Initial PCI Procedure (2011-5-24)



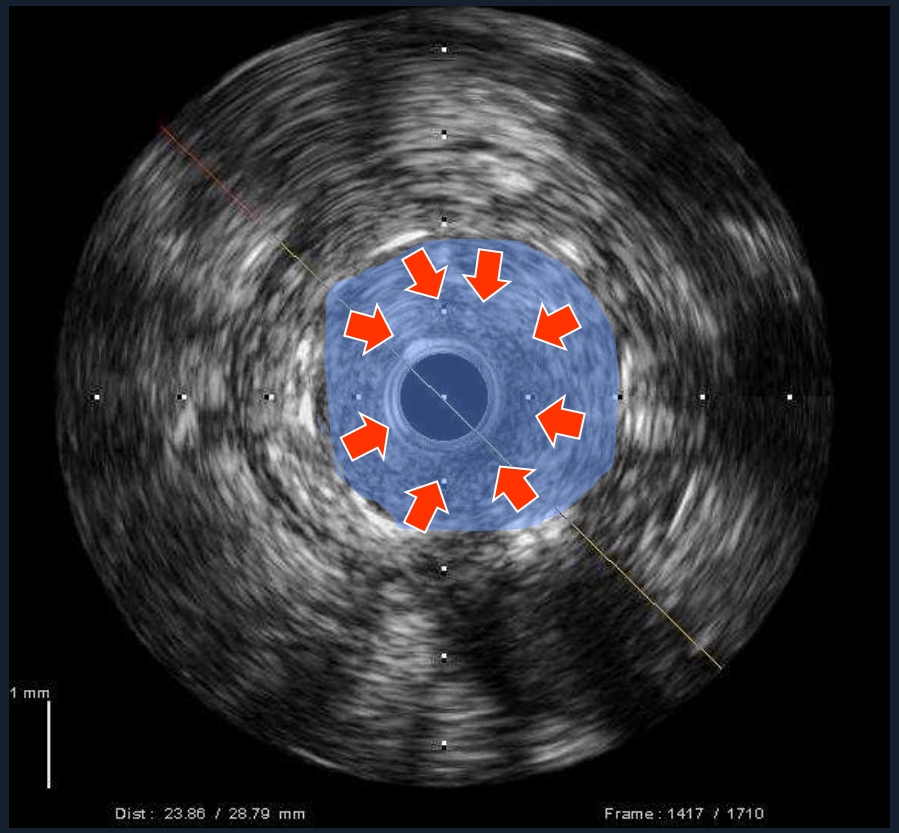
CAG (2012-4-30)





Mechanism of LM ISR

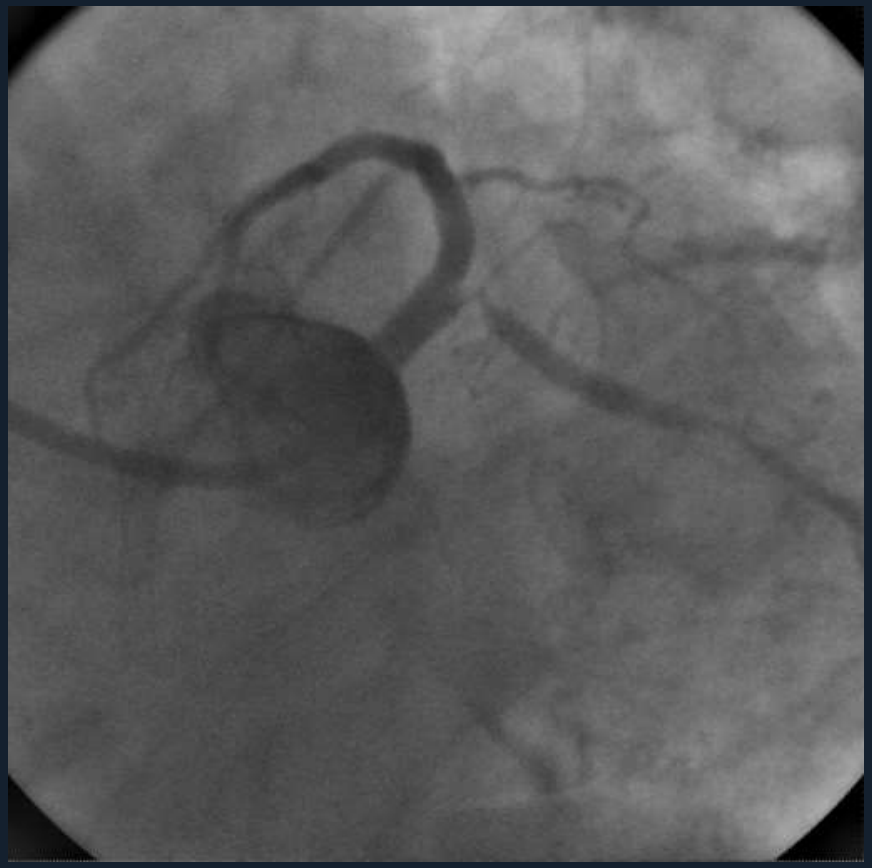
LCX os



dLM bifurcation: Crushing Technique

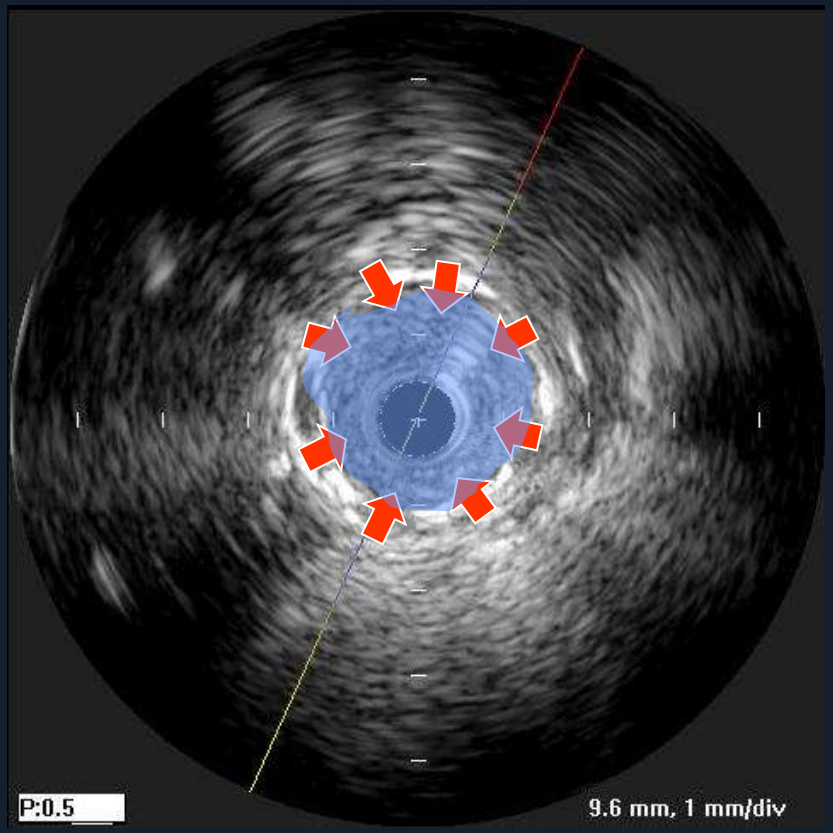
MSA: 9.8mm^2

Mechanism of LM ISR



dLM bifurcation: Crushing Technique

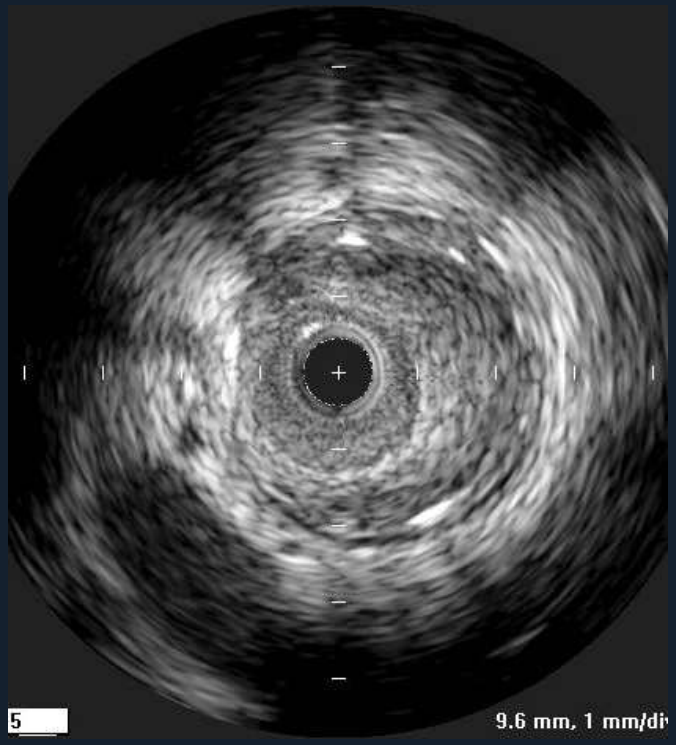
LCX os

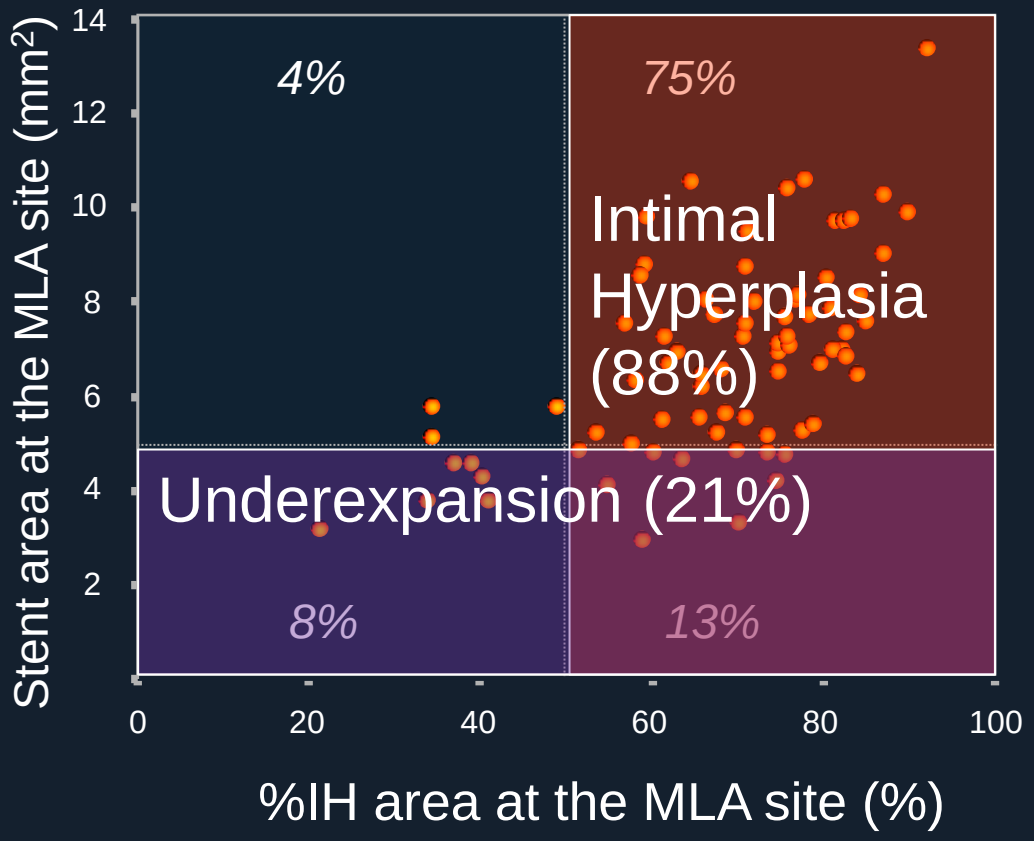


MSA: 4.6mm^2

Mechanism of LM ISR
Not Well Evaluated, yet

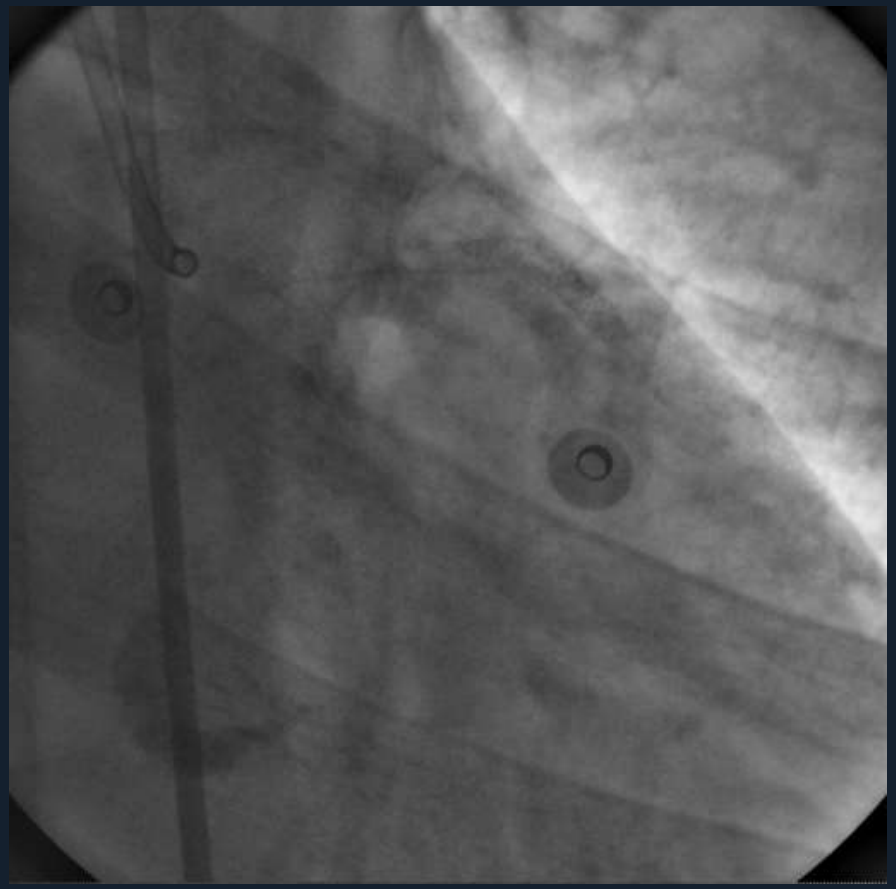
Intimal Hyperplasia and Underexpansion
General Mechanism of ISR after DES Implantation

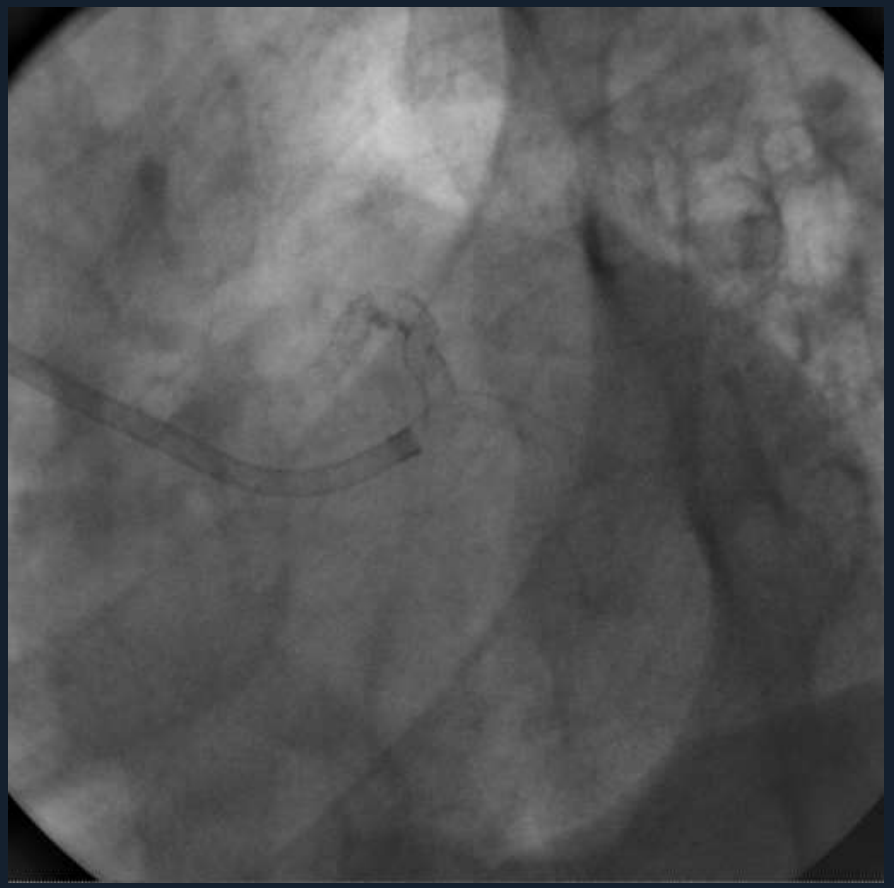




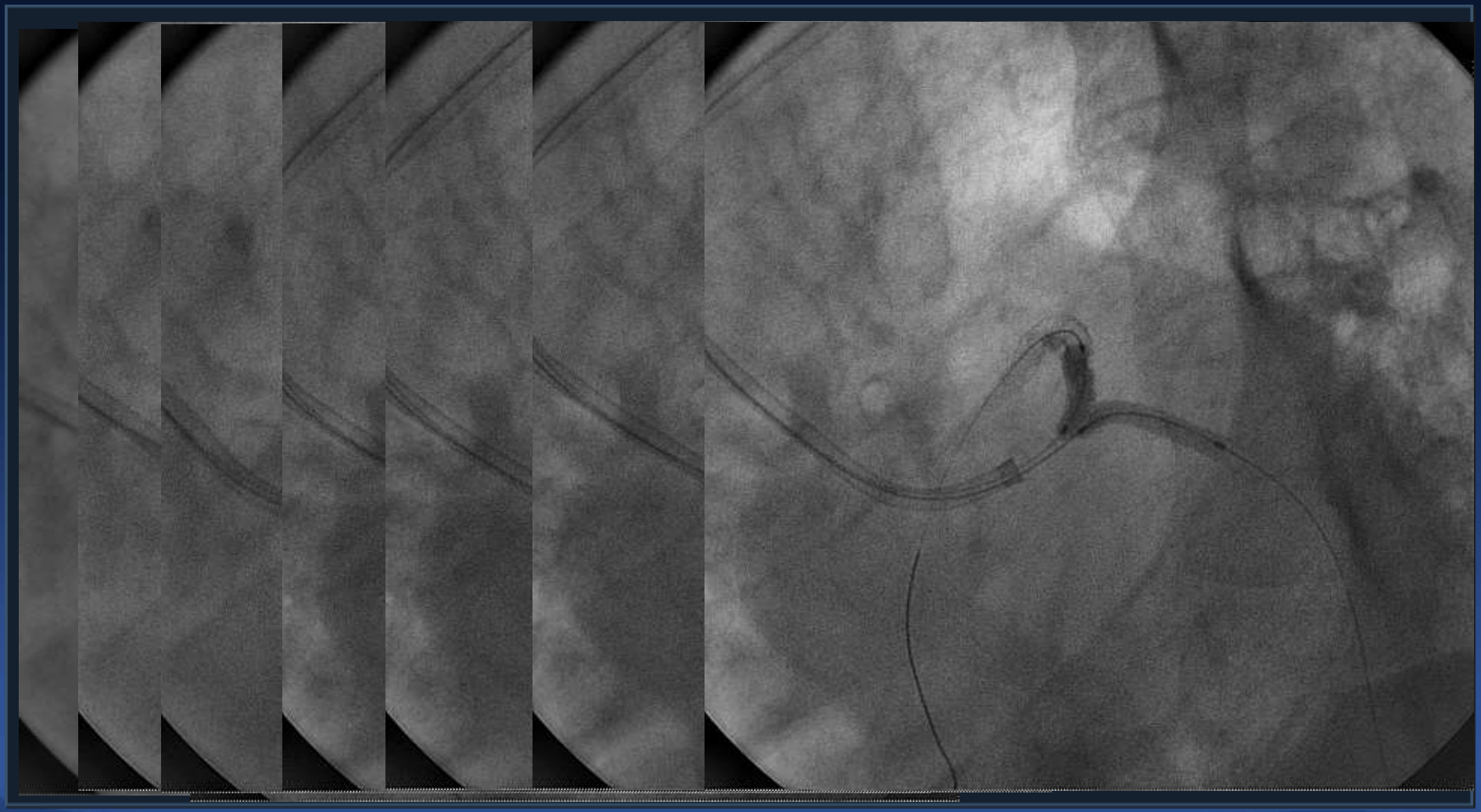
Kang et al. Circ Cardiovasc Interv 2011;4:9-14

How to Treat ?





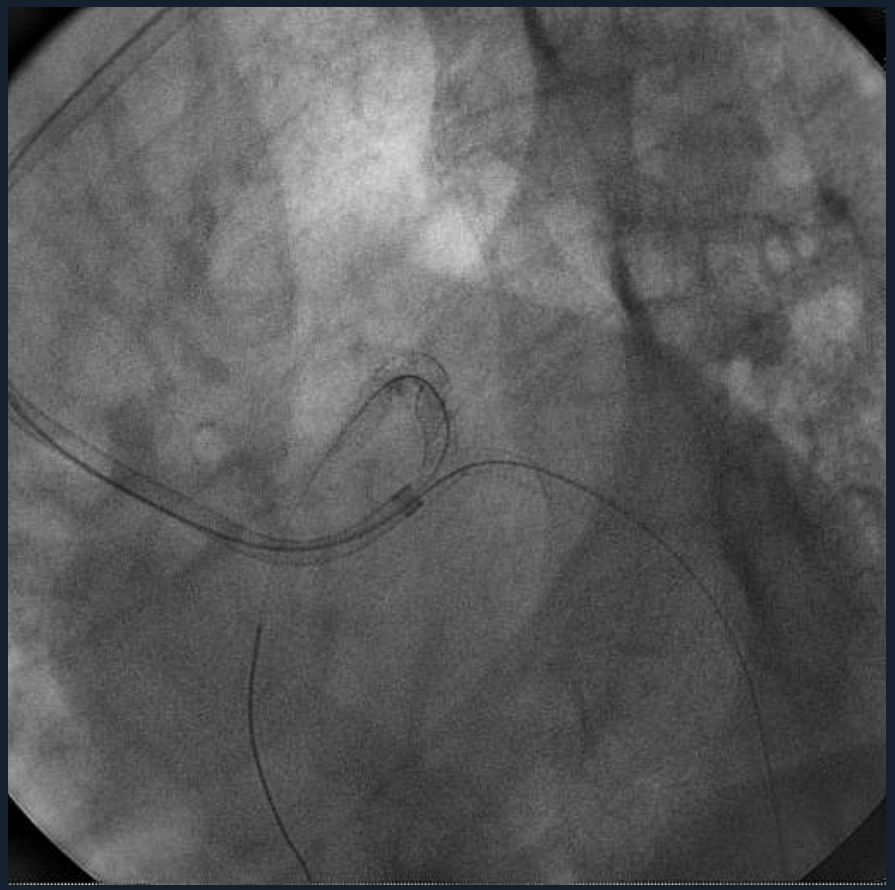
My Solution:
PCI using Drug-Eluting Balloon

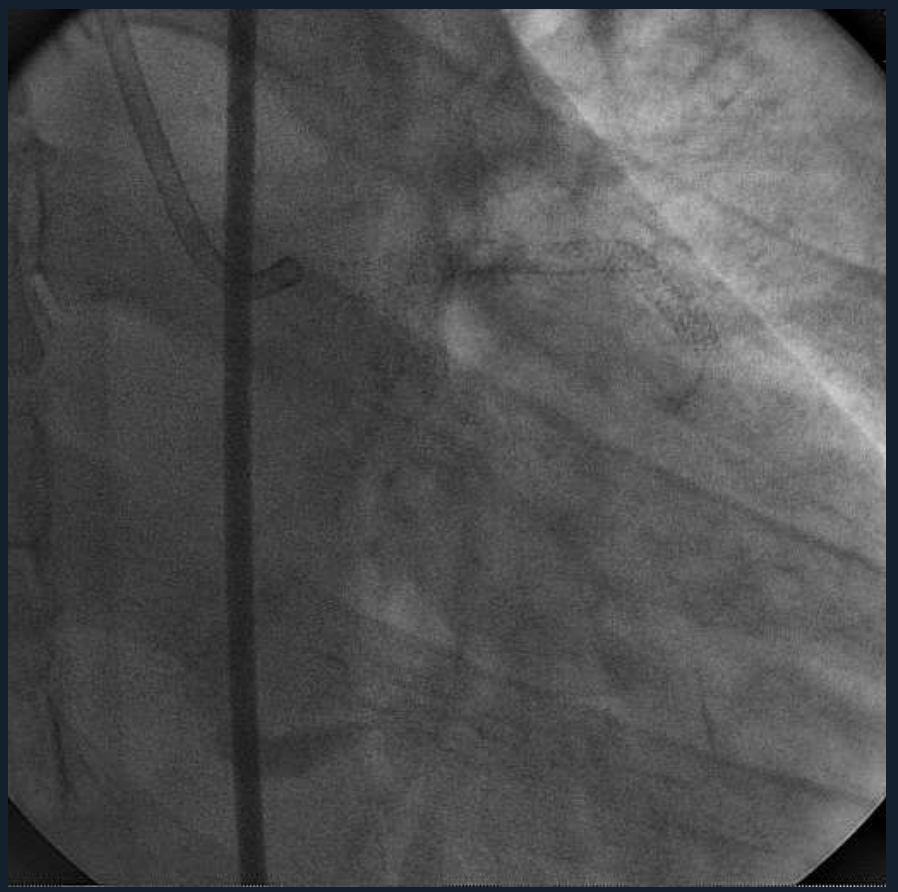


SeQuent Please 3.0(20)/3.

BMW wire IKAZUCHI 2.5(20) Dura Star 3.0(20)/3.5(20)

Final CAG





Thank You !!

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