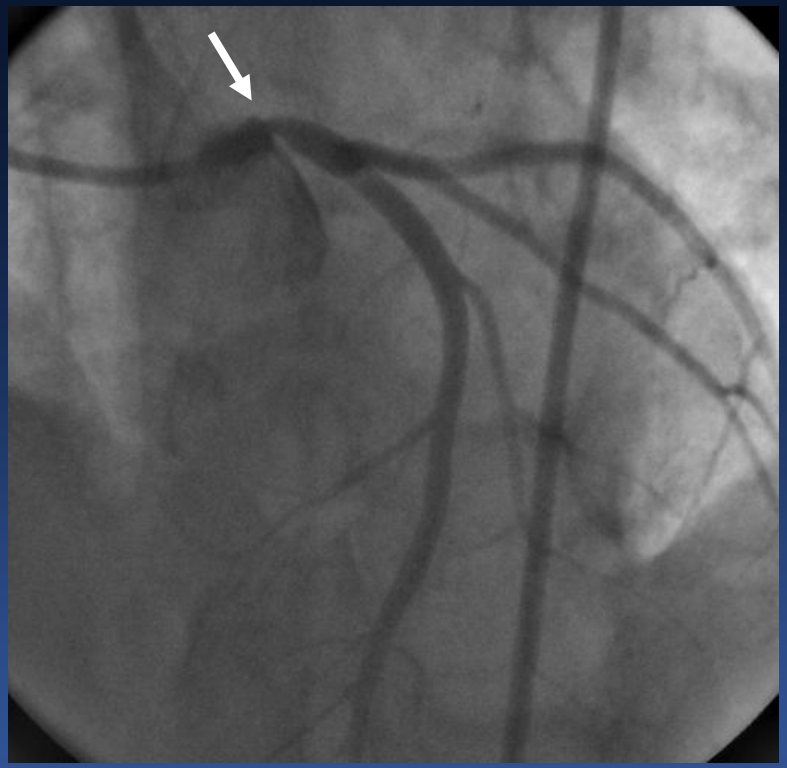
How To Do the Best LM Stenting ?

Functional Evaluation is Necessary !

Seung-Jung Park, MD, PhD

Professor of Medicine, University of Ulsan College of Medicine,
Heart Institute, Asan Medical Center, Seoul, Korea

Visual Functional Mismatch



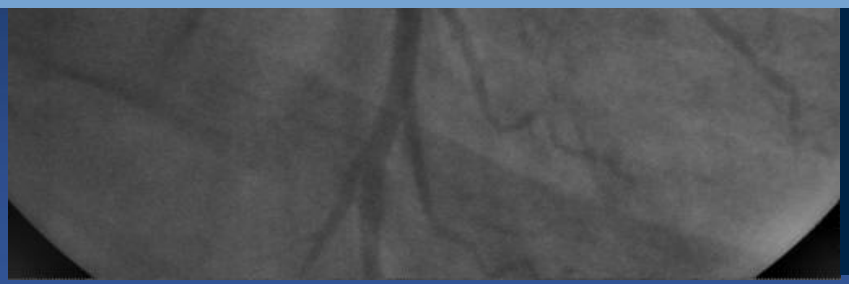
Visual : 80%

FFR : 0.82
Treadmill test : Negative
Thallium spect : Normal
Stress Echo : Negative

Reverse Mismatch

Visual Estimation : 30%

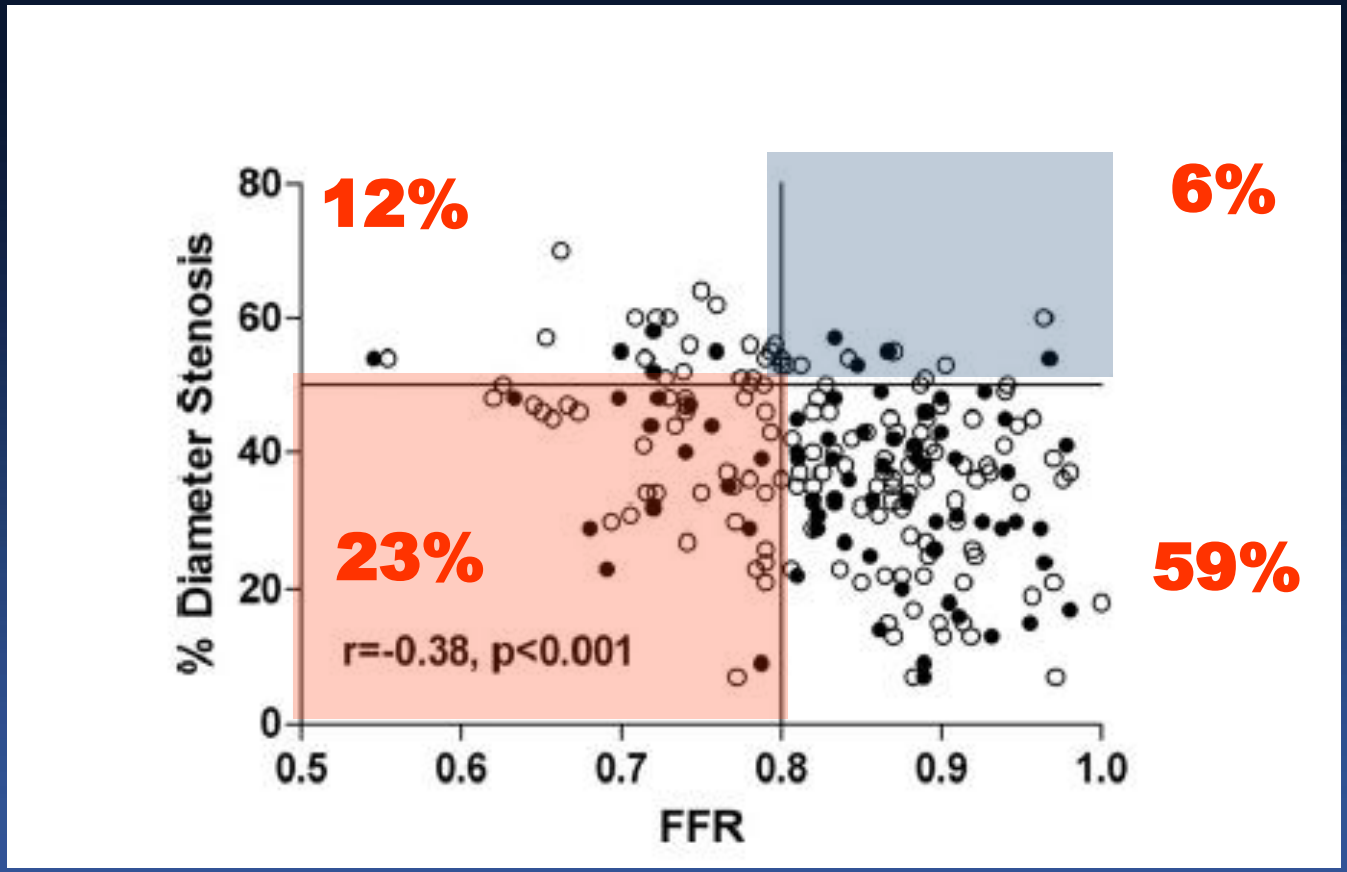
Angiography is Not Always Enough !



Thallium spect : + large LAD

How Many Mismatches ?

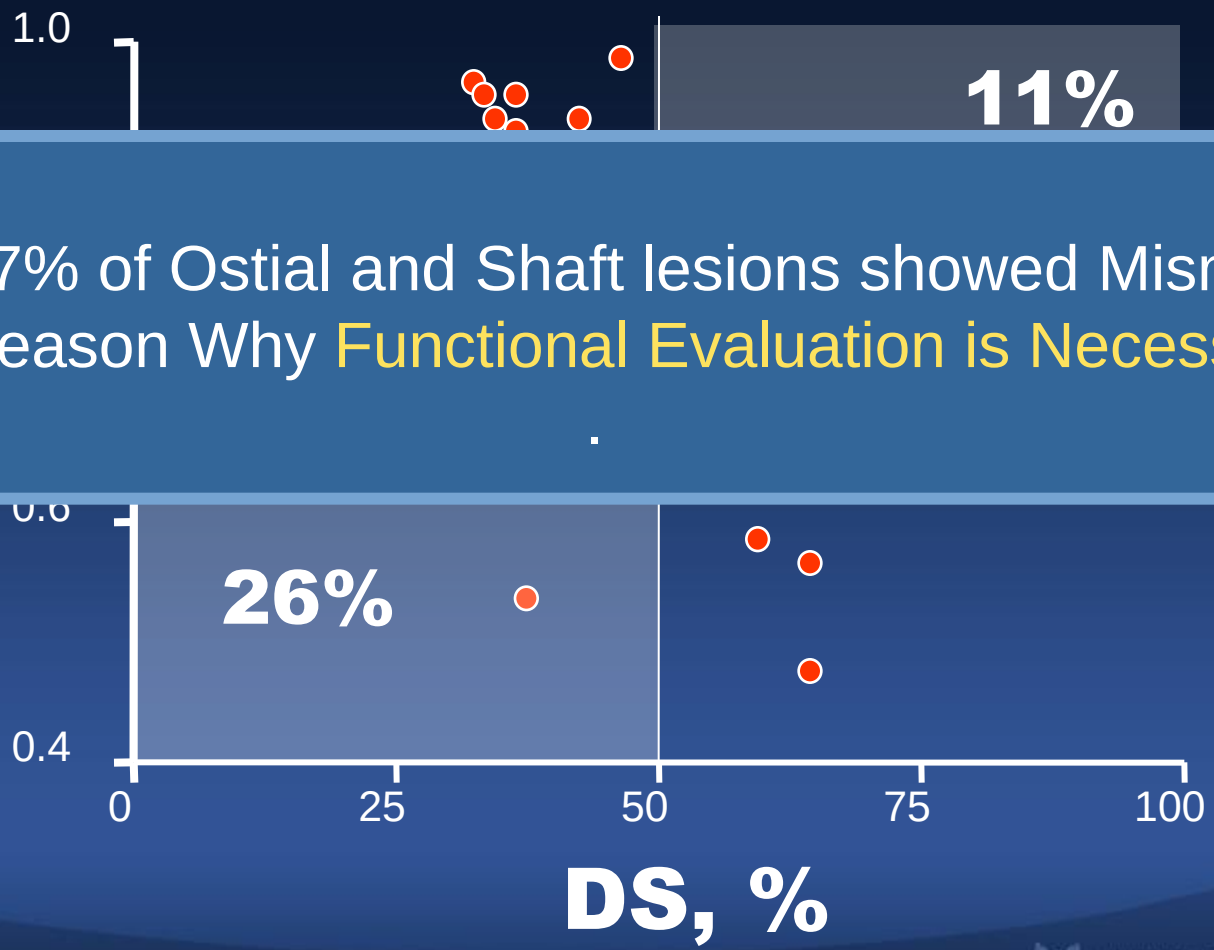
Mismatch
in intermediate LM Disease



Hamilos M, Circulation 2009; 120: 1505-1512

Mismatch

Intermediate LM Ostial and Shaft Disease (AMC data, n=112)



Overall 37% of Ostial and Shaft lesions showed Mismatches.
The Reason Why Functional Evaluation is Necessary !

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Why
Mismatches ?

Multivariable Analysis to Predict Mismatches, Non-LM

IVUS Analysis of Prospective Cohort 1000 Patients

Mismatch Significant Stenosis (>50%) Negative FFR (>0.80)	Reverse Mismatch Insignificant Stenosis (<50%), Positive FFR (<0.80)
Older Age	Younger Age
Non-LAD location	LAD location
Shorter lesion length	Plaque Rupture
Larger MLA by IVUS	Smaller MLA by IVUS
Larger MLD by QCA	Larger PB
Smaller PB	

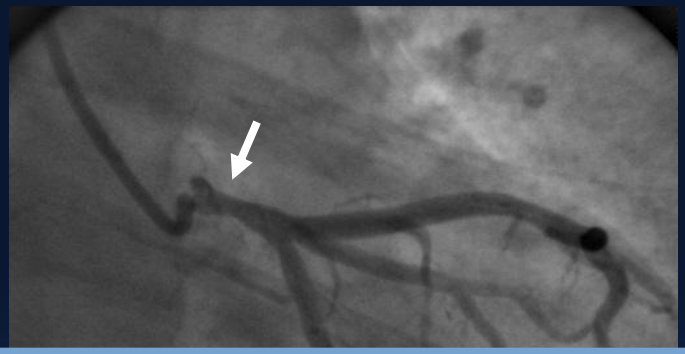
Park SJ et al, JACC Intv 2012;5:1029 –36

Multivariable Analysis to Predict FFR <0.80, LM (n=112)

Variables	OR	95%CI	p-value
Model 1			
Plaque rupture	4.51	1.36-14.9	0.014
BMI, kg/m^2	1.19	1.00-1.40	0.05
Age, year	0.95	0.90-1.00	0.033
MLA, mm^2	0.37	0.25-0.56	<0.001
Model 2			
LV mass, g	1.01	1.00-1.03	0.03
Age, year	0.94	0.90-0.99	0.022
MLA, mm^2	0.34	0.21-0.54	<0.001

Model 1 included clinical, QCA, and IVUS variables
Model 2 included Model 1 plus LV mass assessed by **Echocardiography**

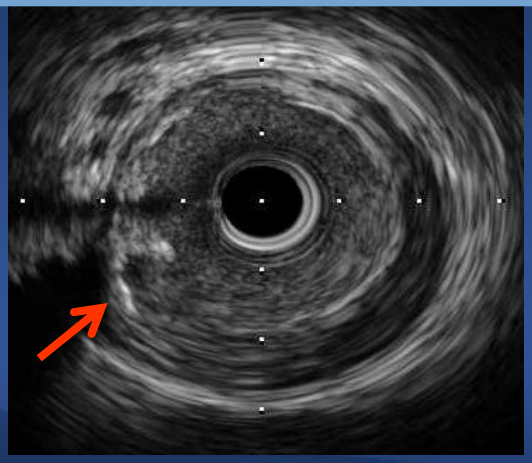
Reverse Mismatch

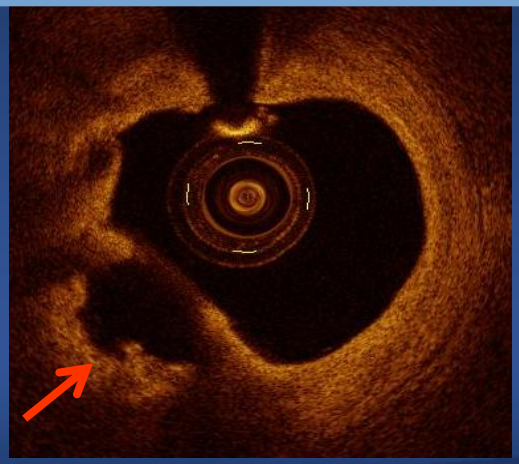


Visual Estimation
30% DS

FFR : 0.70

Plaque Rupture, Smaller MLA and
Large LV mass (Myocardium) Are Related with Positive FFR.





Plaque rupture, MLA 6.2mm^2

Why FFR ?

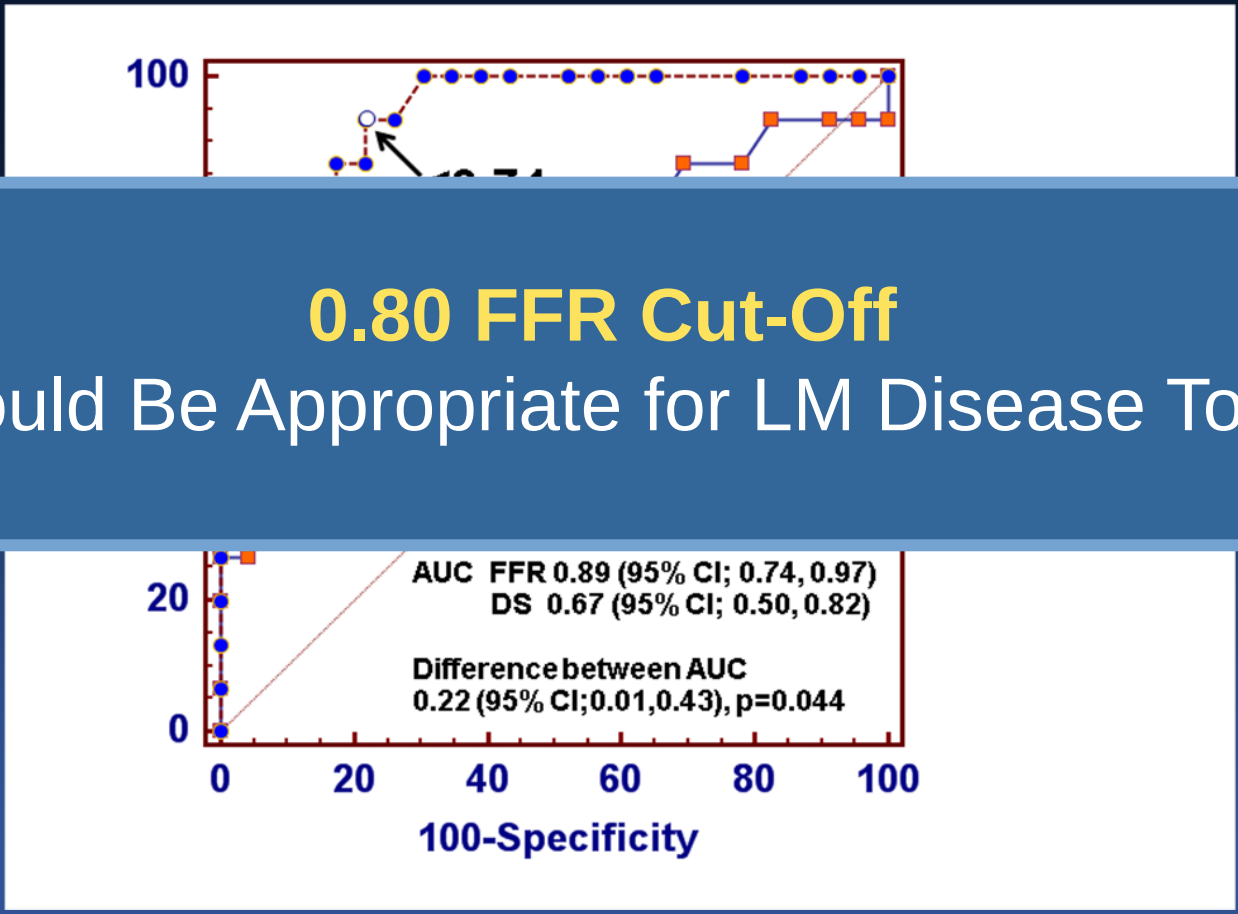
Accurate Diagnosis First !

To Treat or Not To Treat Concerns

Is FFR Cut-Off 0.80, Validated in LM Disease Too ?

Validation of FFR Cut-Off for LM Disease; 0.74

(Matched with Thallium Perfusion Scan, n=38)



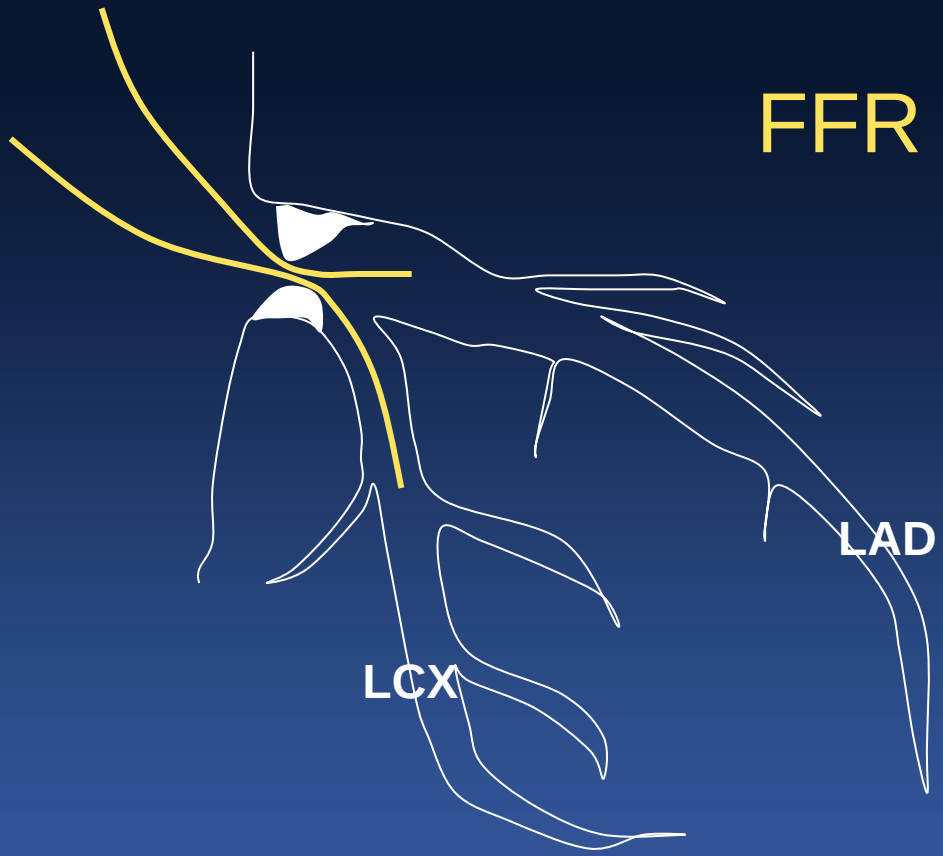
0.80 FFR Cut-Off

Would Be Appropriate for LM Disease Too.

AMC FFR Registry data

How I Implement FFR in Real Practice ?

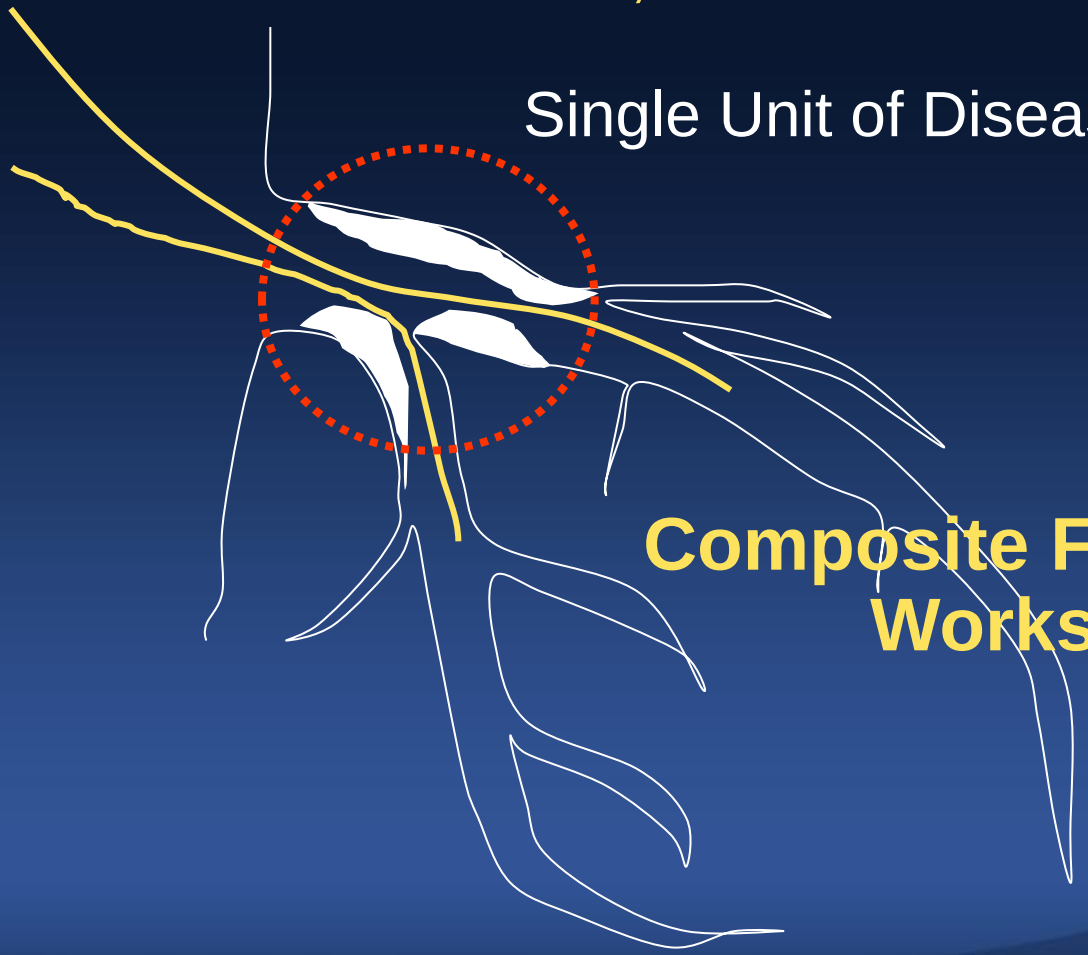
For the Undetermined, Intermediate Ostial and Shaft LM Lesion,



FFR is Crucial

For the Intermediate LM Bifurcation Lesion,

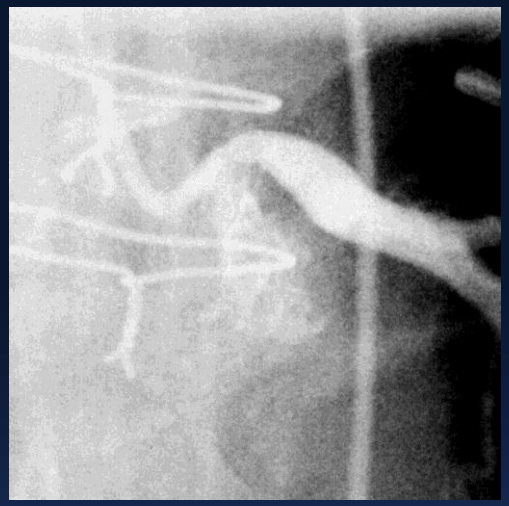
If Transducer Placed Beyond Bifurcation
in both LAD and LCX,



Single Unit of Disease

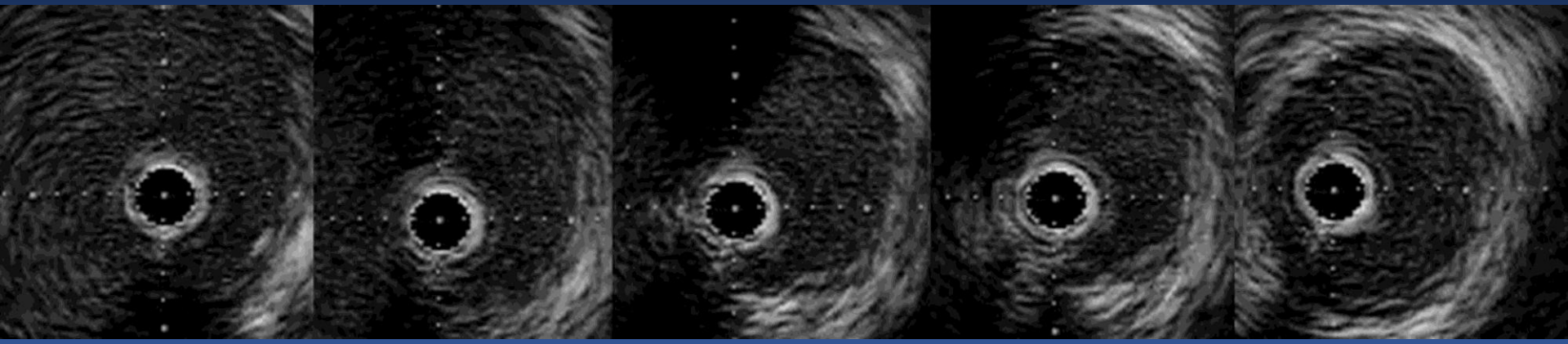
Composite FFR still Works.

Why IVUS Is Necessary Too?



Angiographic 80% LM Ostial Disease,
And, Patient received CABG,
But, IVUS finding is Free of Disease.

Angiography Is Not Always Enough,
To Define Clinical Ischemia.



IVUS Is Recommended

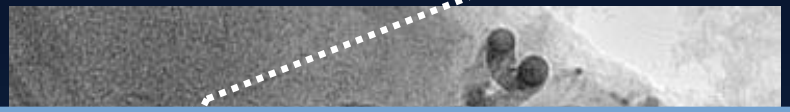
1. Assessment of LM Ostium, Reference Vessel Diameter, Pattern of Remodeling, and Vulnerability of Plaque.
2. Separate IVUS Run of LCX Can Clarify the Disease Status of LCX Ostium and its Reference Vessel Size. Therefore, Treatment Strategy Would be Simplified.

LM Bifurcation Disease with Minimal LCX Disease

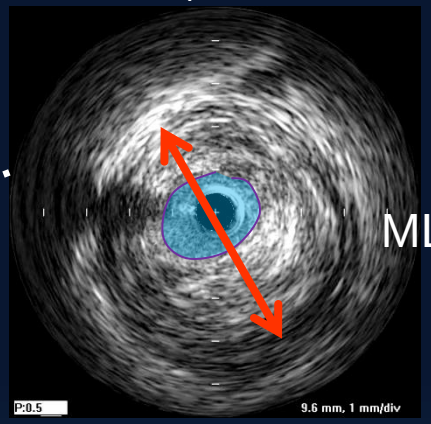
55/M, Stable angina, TMT (+), Thallium scan (-)

By IVUS

in Both LAD and LCX,

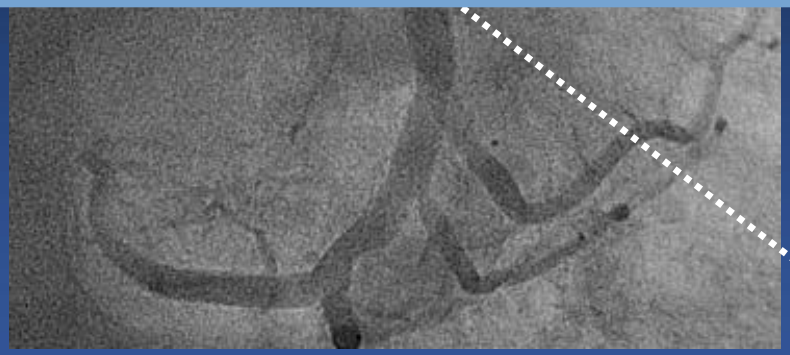


Distal LM, RVD 6.2mm

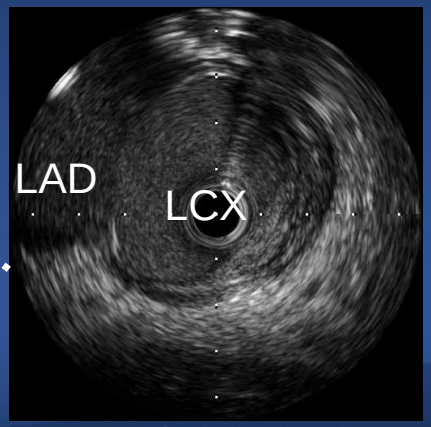


MLA 3.0mm^2

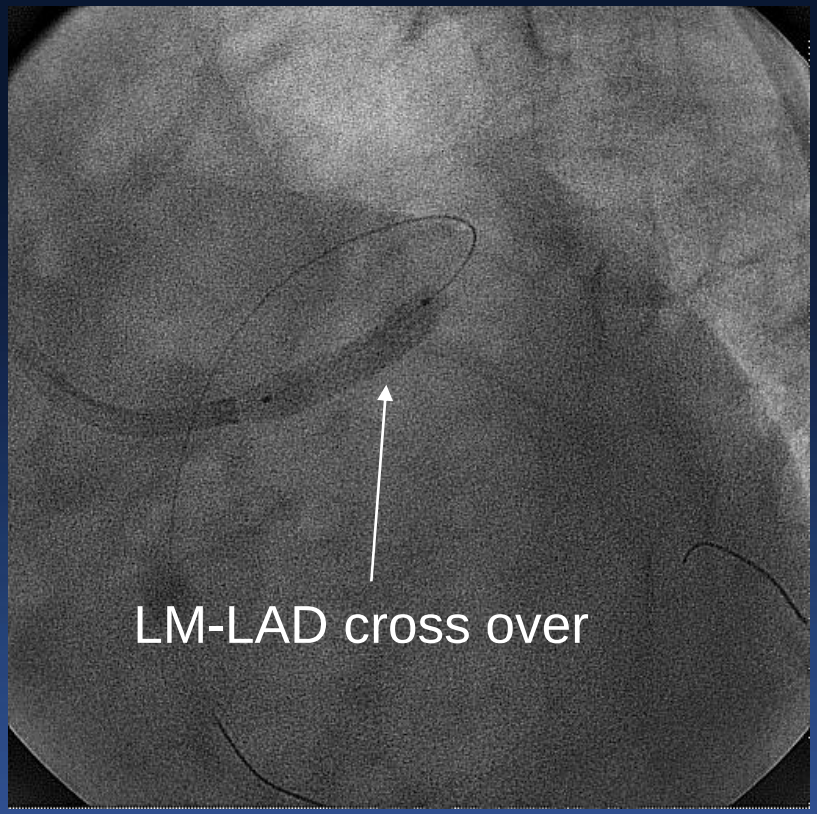
By IVUS, Reference Vessel Diameters of LM and LAD are Bigger than Angiographic Assessment, and the LCX ostium Showed Free of Disease.



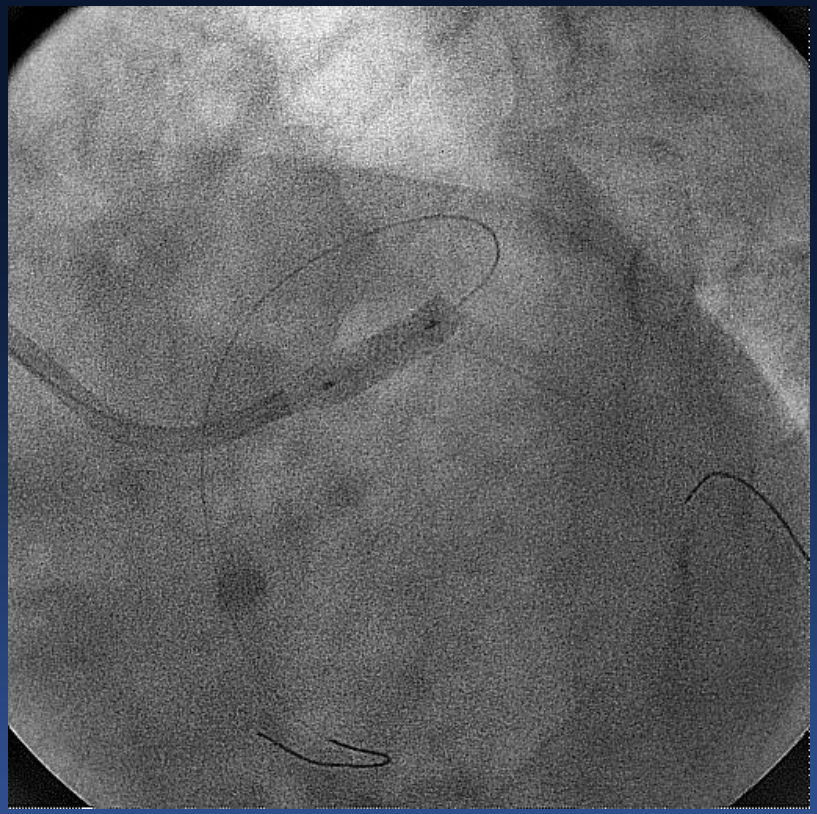
Minimal disease at LCX ostium



We Did
Just Single Stent Cross-Over !

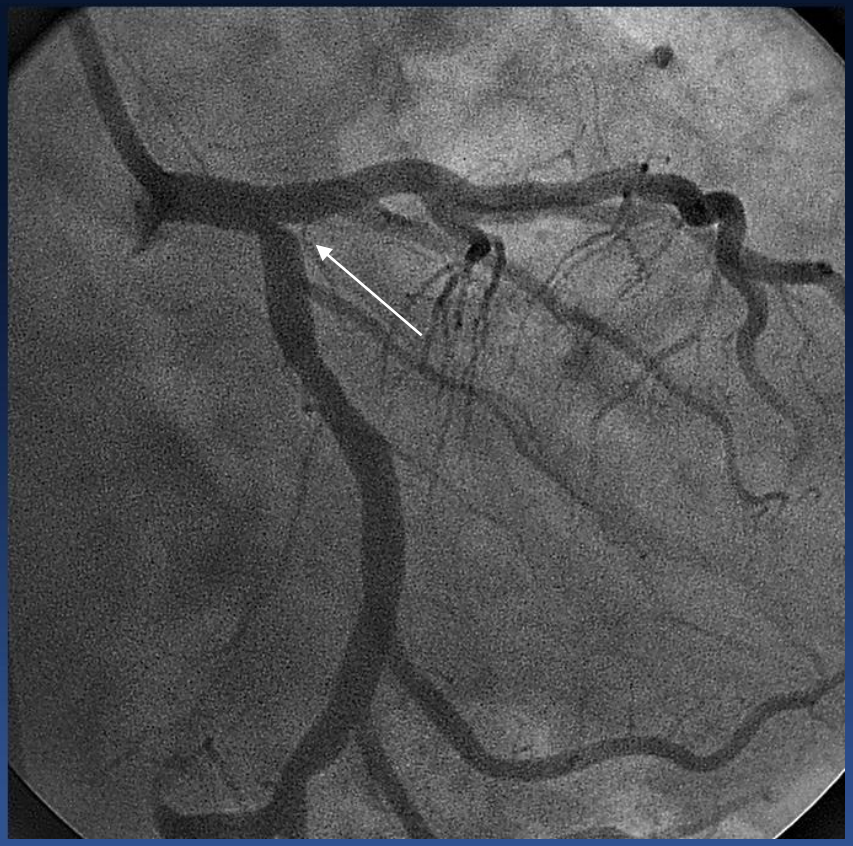


Promus Element 4.0x20



Additional high pressure
Inflation with 4.0 mm
non-compliant balloon

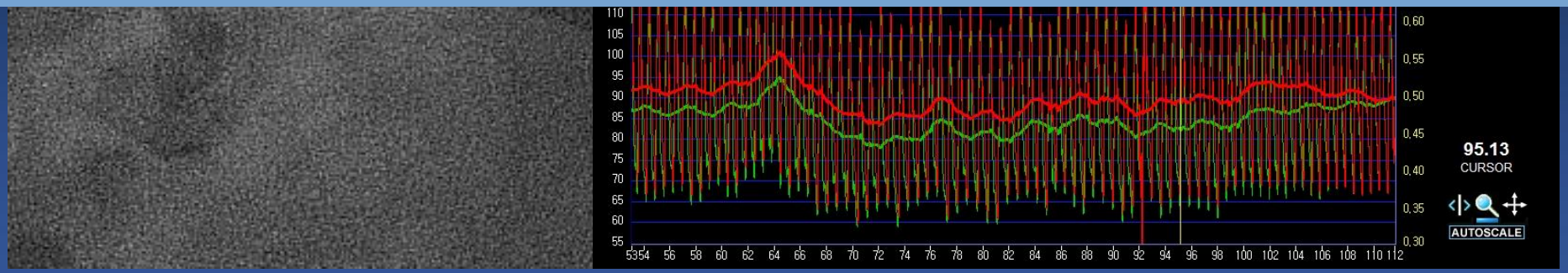
After Stent Cross-Over, LCX Ostium Was Jailed !



What Would You Do ?

Do You Want to Treat Jailed Side Branch ?
Consider FFR, First !

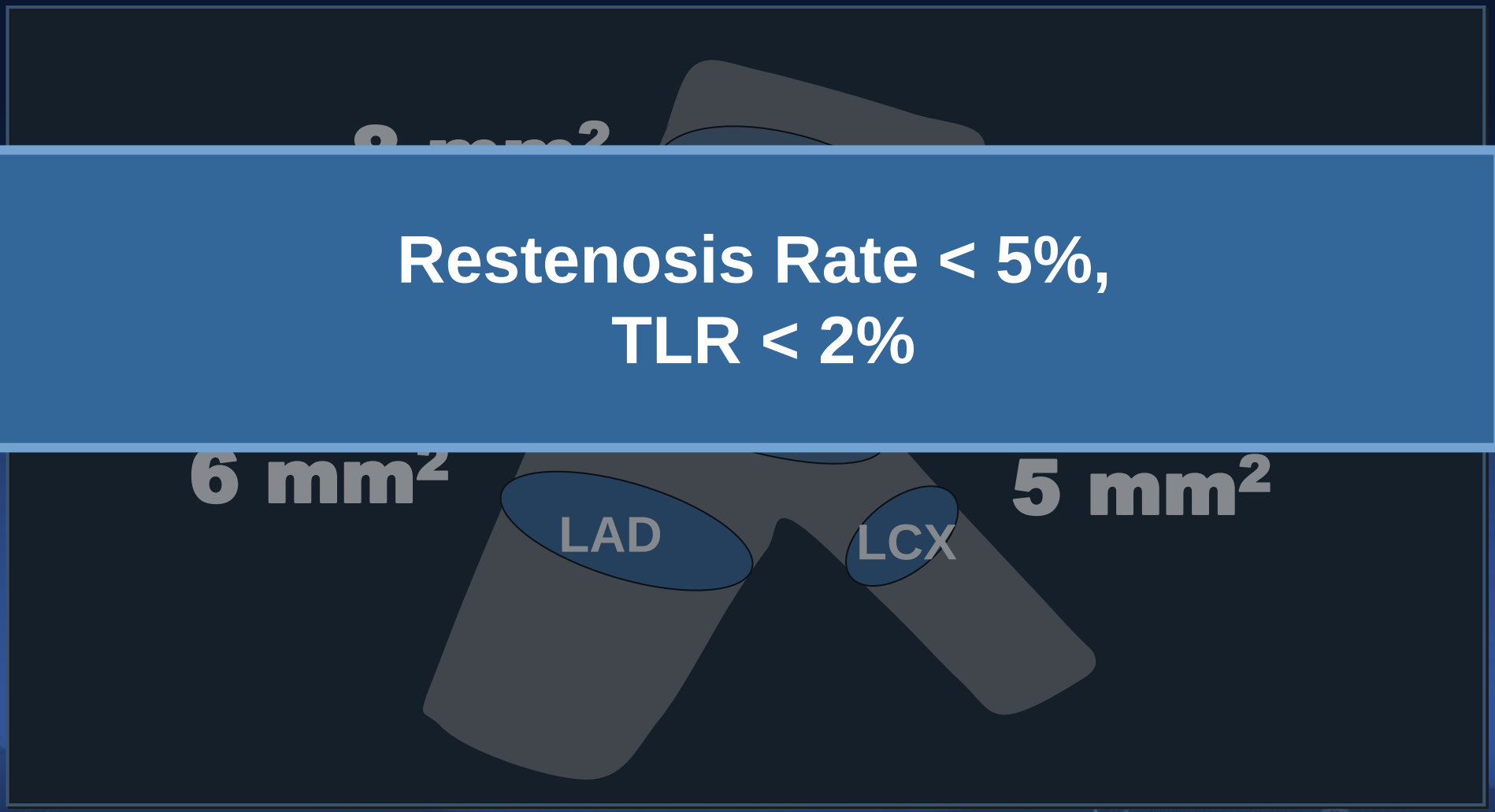
Just Defer !
It's Safe and Effective.



Why IVUS Too ?

1. Assessment of LM Ostium, Reference Vessel Diameter, Pattern of Remodeling, and Vulnerability of Plaque.
2. Separate IVUS Run of LCX Can Clarify the Disease Status of LCX Ostium and its Reference Vessel Size. Therefore, Treatment Strategy Would be Simplified.
3. IVUS Guided Stent Optimization and Effective Stent CSA Can Make a Good Clinical Outcomes.
4. IVUS Guidance Reduced Death/MI and Saved Lives.

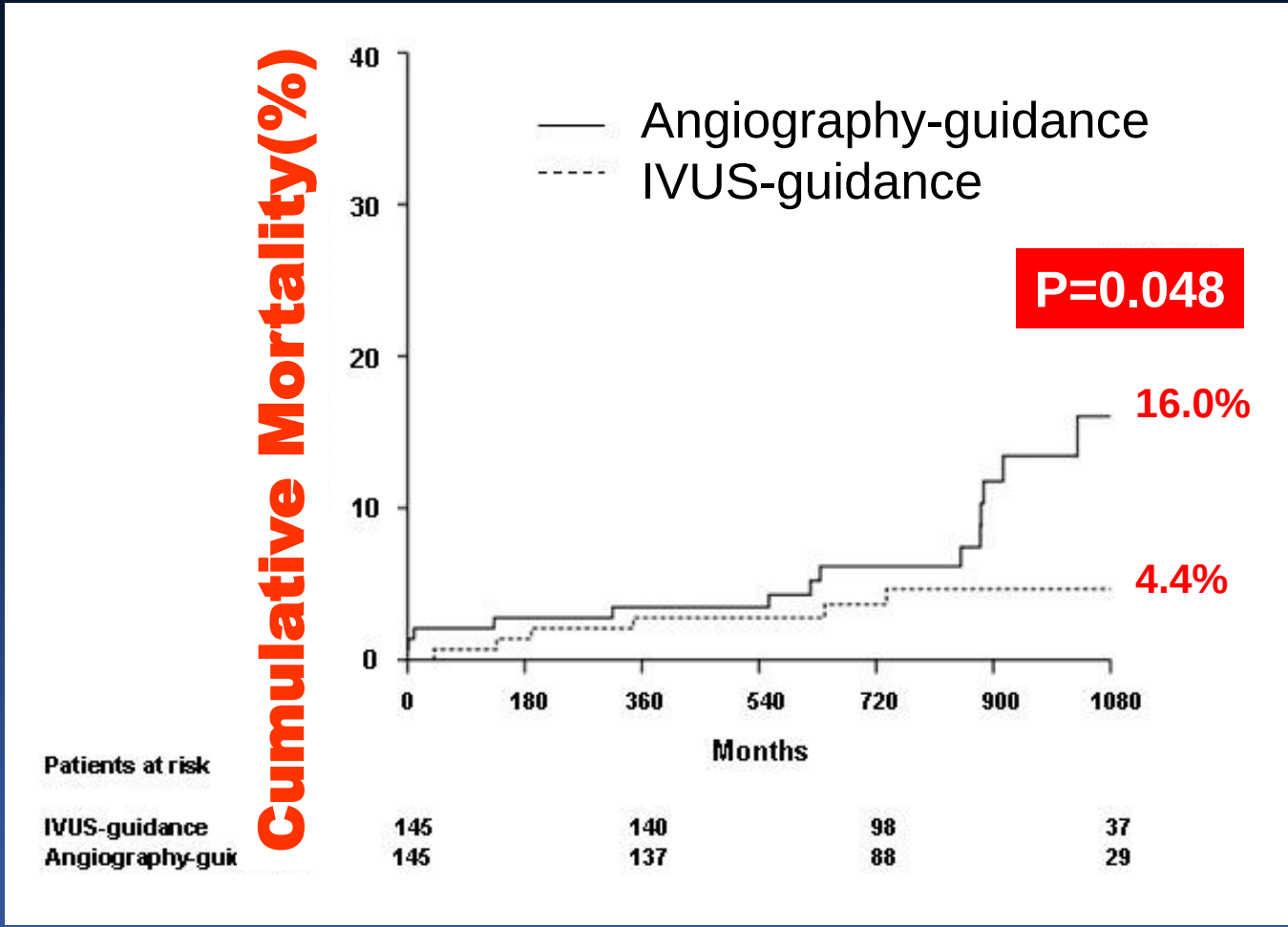
IVUS Stent Area to Reduce Restenosis (Rule of 5,6,7,8)



Restenosis Rate < 5%,
TLR < 2%

Kang SJ et al. Circulation. Cardiovasc Interv 2011 Dec 1;4(6):562-9.

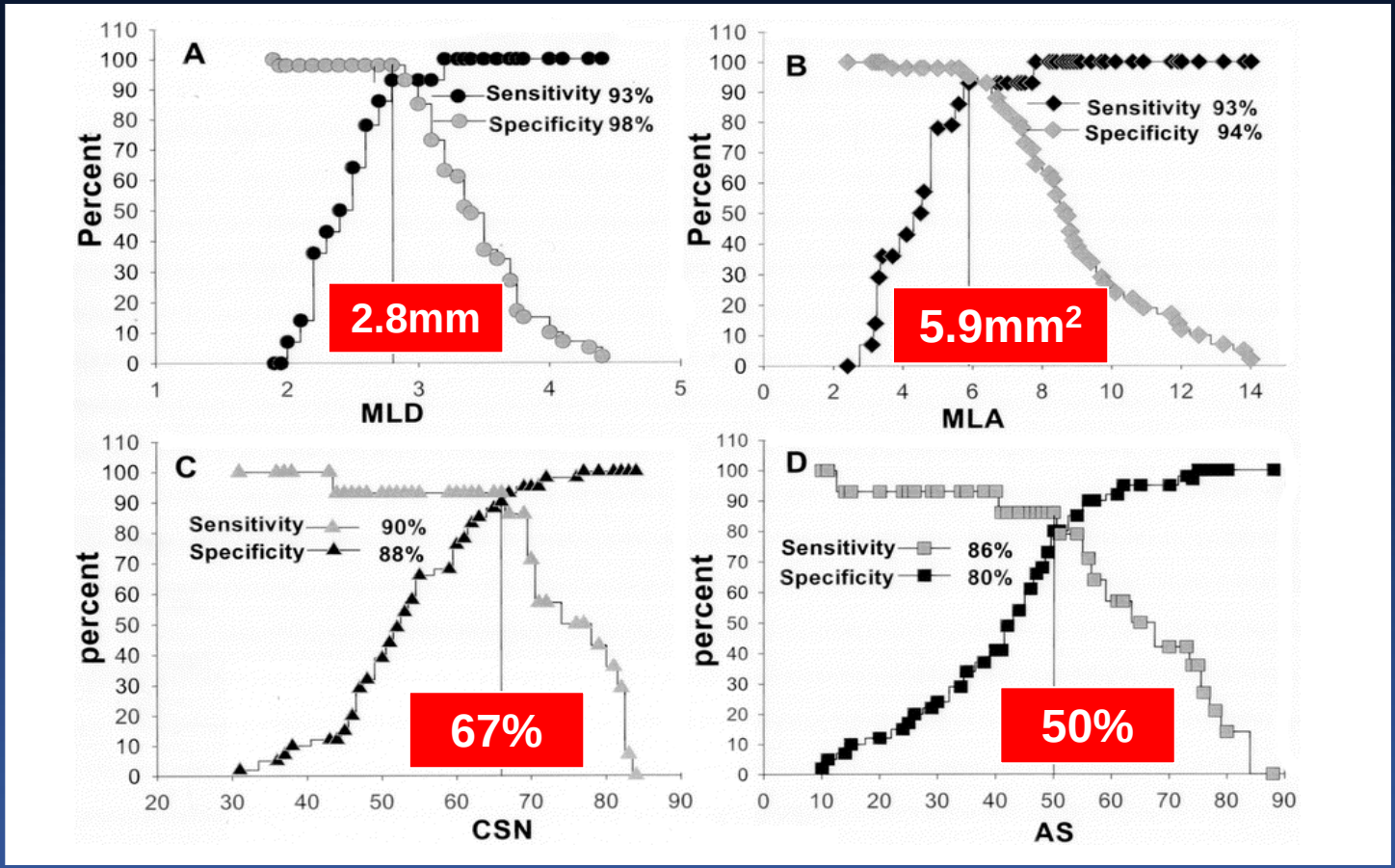
IVUS Guidance Saves Lives in LM PCI



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

Can IVUS MLA Predict the Functional Significance of Stenosis In LM Disease ?

IVUS MLA < 6.0 mm²
is matched with FFR <0.75

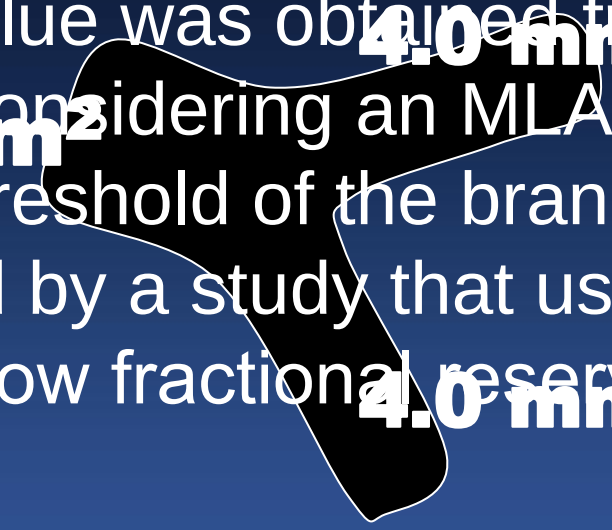


Jasti V et al. Circulation 2004;110:2831-6

Why 6 mm^2 IVUS MLA Is Not Appropriate ?

Background, Geometric Abstraction

“ The 6-mm^2 value was obtained from Murray’s law (considering an MLA of 4 mm^2 as the ischemic threshold of the branches) and has been supported by a study that used IVUS and pressure wire flow fractional reserve (FFR).”



De La Torre Hernandez et al. JACC 2011;58:351-8
Jasti V et al. Circulation 2004;110:2831-6

IVUS MLA Matched with FFR, Non-LM

New Published Data

	N	FFR	RLA	MLA mm^2	AUC	Sens	Spec	PPV	NPV	Accu
Briguori (2001, AJC)	53	0.75	7.8	4.0	–	92%	56%	38%	96%	64%
Takaki (1999, Circ)	51	0.75	9.3	3.0	–	83%	92%	–	–	–
Waksman (2013, JACC)	350	0.80	8.6	3.07	0.65	64%	65%	–	–	65%
Kang (2012, AJC)	784	0.80	8.2	2.4	0.77	84%	63%	48%	90%	69%
Kang (2011, Circ int)	236	0.80	7.6	2.4	0.80	90%	60%	37%	96%	68%
Gonzalo (2012, JACC)	47	0.80	7.1	2.36 IVUS	0.63	67%	65%	67%	65%	66%
Gonzalo (2012, JACC)	61	0.80	7.1	1.95 OCT	0.70	82%	63%	66%	80%	72%
Koo (2011, JACC int)	267	0.80	6.8	2.75	0.81	69%	65%	27%	81%	67%
Lee (2010, AJC)	94	0.75	5.9	2.0	0.80	82%	81%	–	–	81%

Murray's Law, Finet's Law, Huo and Kassab (HK)'s Law,

Ischemic Threshold of Branches Would Be
< 3 mm^2 Based on the Current Data. The 6 mm^2 of IVUS MLA is
Not Appropriate Anymore from Geometric Abstraction
with Murray's Law, Finet's Law, and HK's Law.

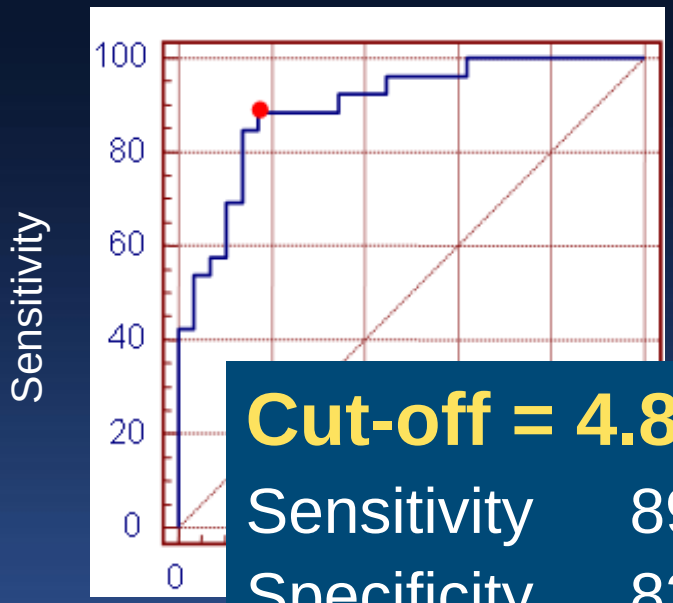
New IVUS MLA In LM Disease (n=112)

AMC FFR Registry, New Data

New LM IVUS MLA

Matched with FFR <0.80, Ostial and Shaft LM Disease

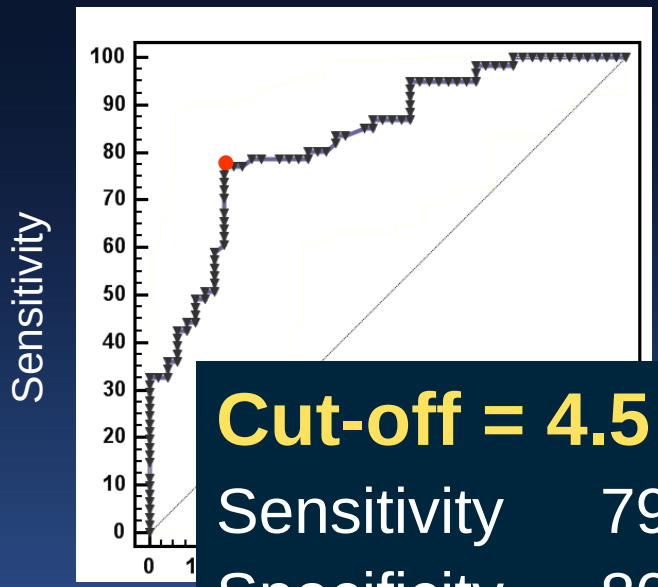
(n=55 lesions)



Cut-off = 4.8 mm²

Sensitivity	89%
Specificity	83%
PPV	82%
NPV	89%
Accuracy	86%

(n=112 lesions)



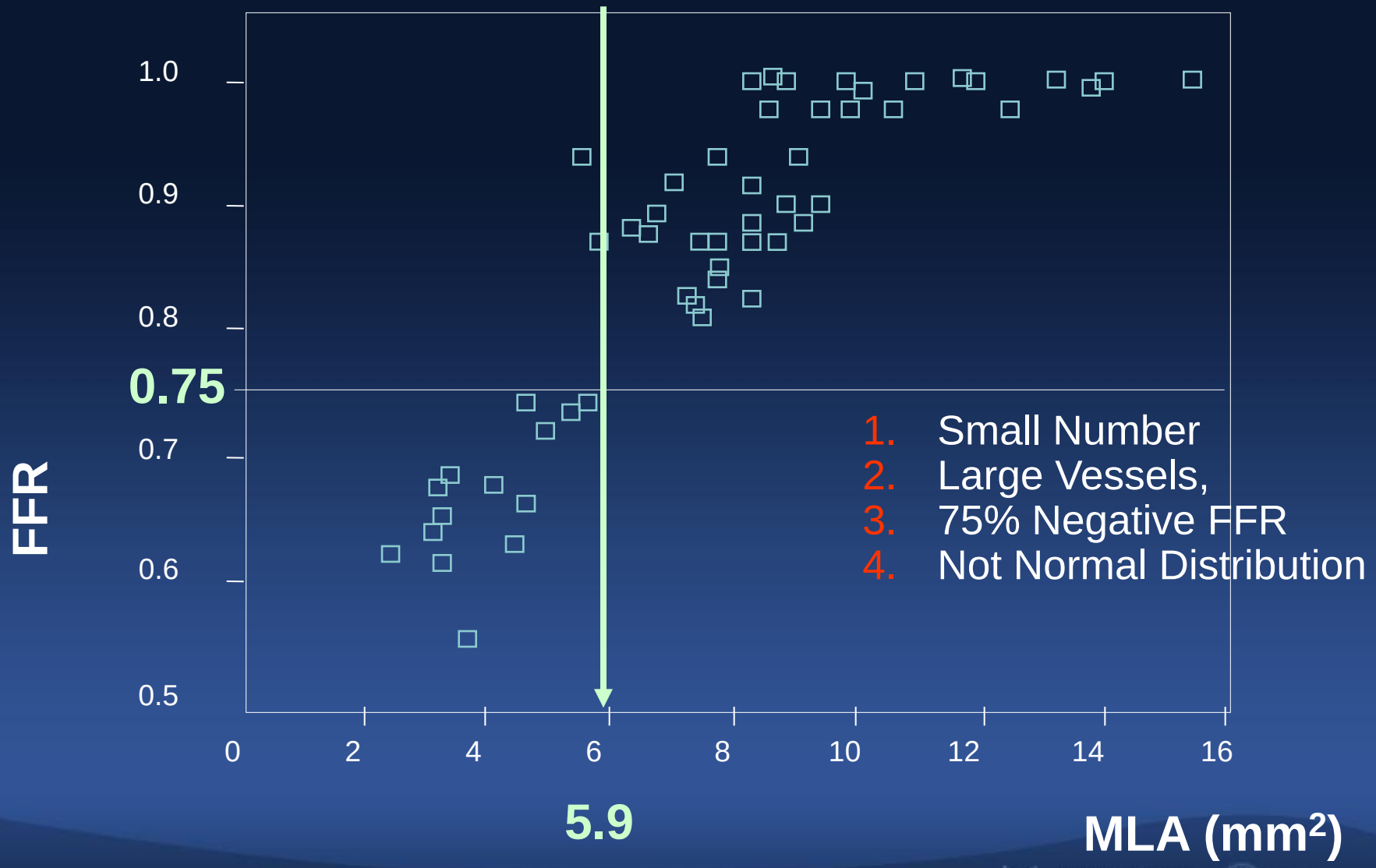
Cut-off = 4.5 mm²

Sensitivity	79%
Specificity	80%
PPV	83%
NPV	76%
Accuracy	80%

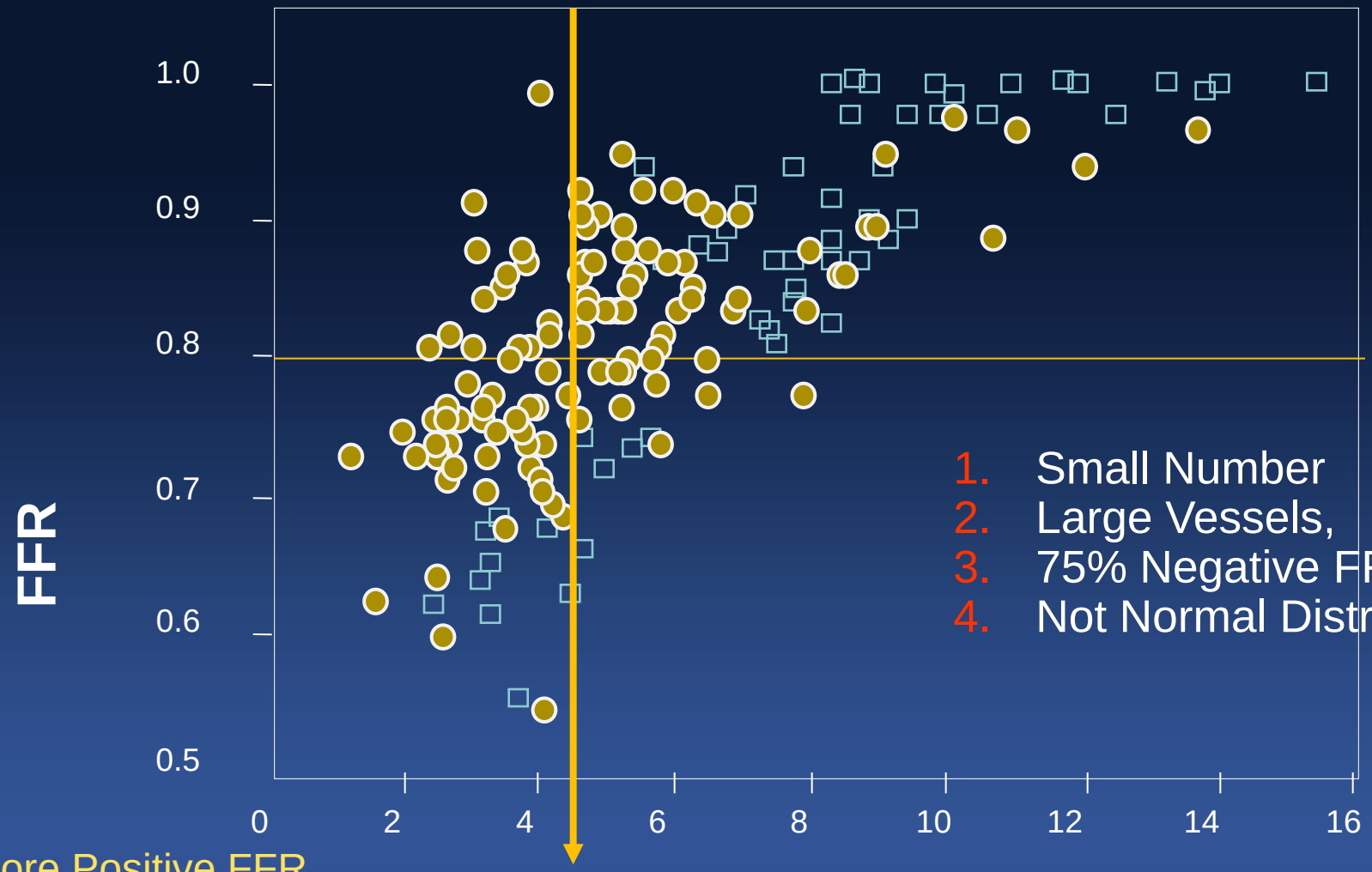
Kang SJ et al,
JACC. Cardiovasc Interv. 2011 Nov;4(11):1168-74.

New Analysis with 112 LM Disease

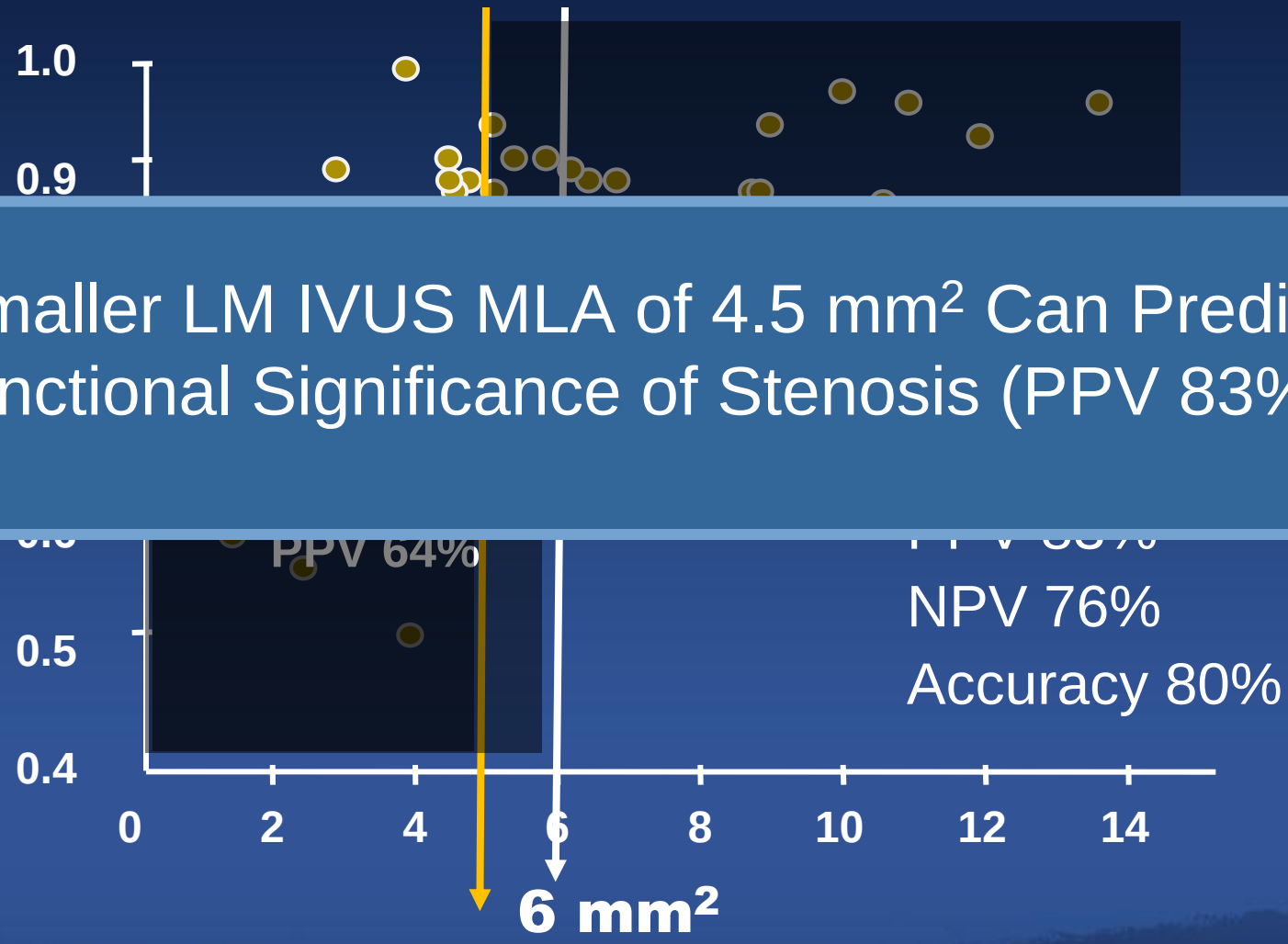
Jasti's data (n=55)



AMC New Data (n=112) Jasti's data (n=55)



In Practice,

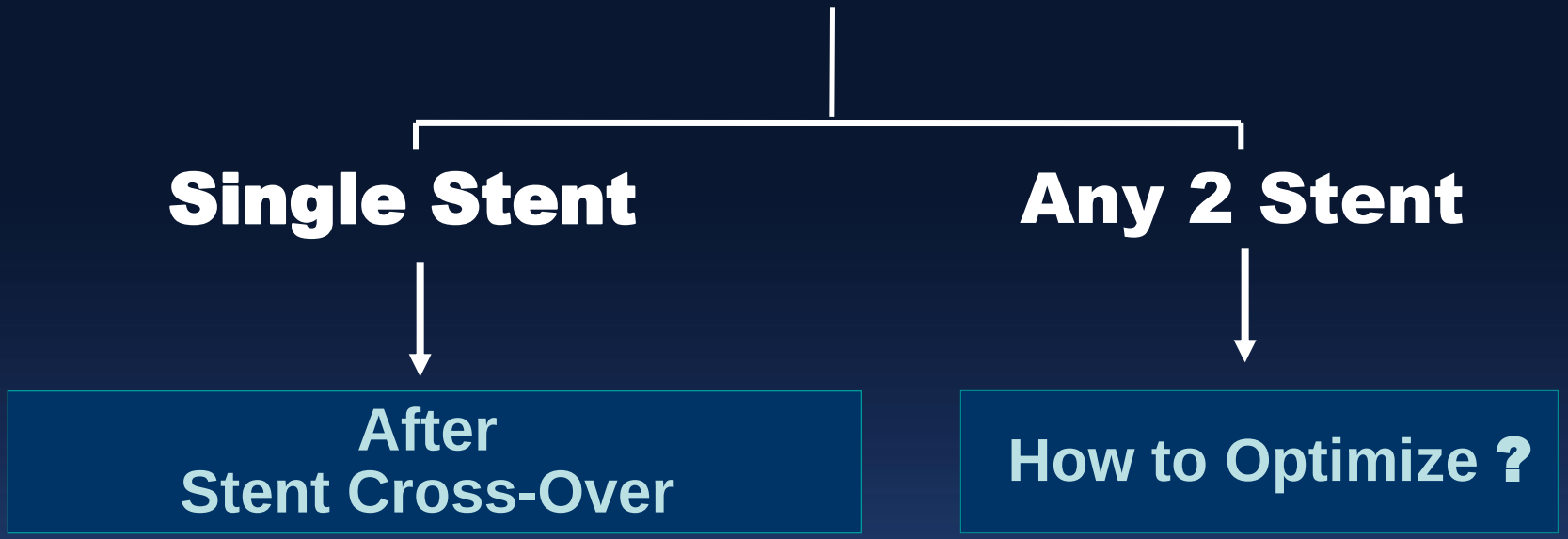


Smaller LM IVUS MLA of 4.5 mm² Can Predict Functional Significance of Stenosis (PPV 83%).

Why IVUS Too ?

1. Assessment of LM Ostium, Reference Vessel Diameter, Pattern of Remodeling, and Vulnerability of Plaque.
2. Separate IVUS Run of LCX Can Clarify the Disease Status of LCX Ostium and its Reference Vessel Size. Therefore, Treatment Strategy Would be Simplified.
3. IVUS Guided Stent Optimization and Effective Stent CSA Can Make a Good Clinical Outcomes.
4. IVUS Guidance Reduced Death/MI and Saved Lives.
5. Smaller IVUS MLA 4.5 mm^2 Can Predict Functional Significance of LM Stenosis.

LM Bifurcation Stenting



- Do You Want to Treat the Jailed Side Branch ?
- How to Treat ?

IVUS Minimal Stent CSA Criteria 5-6-7-8 mm^2
May Improve Long-term Clinical Outcomes.

Why FFR and IVUS ?

1. FFR Guided Decision Making.
2. IVUS Guided Sent Optimization.
3. They are Complementary for the Good Clinical Outcomes.