Unmet Need for FFR in LM PCI

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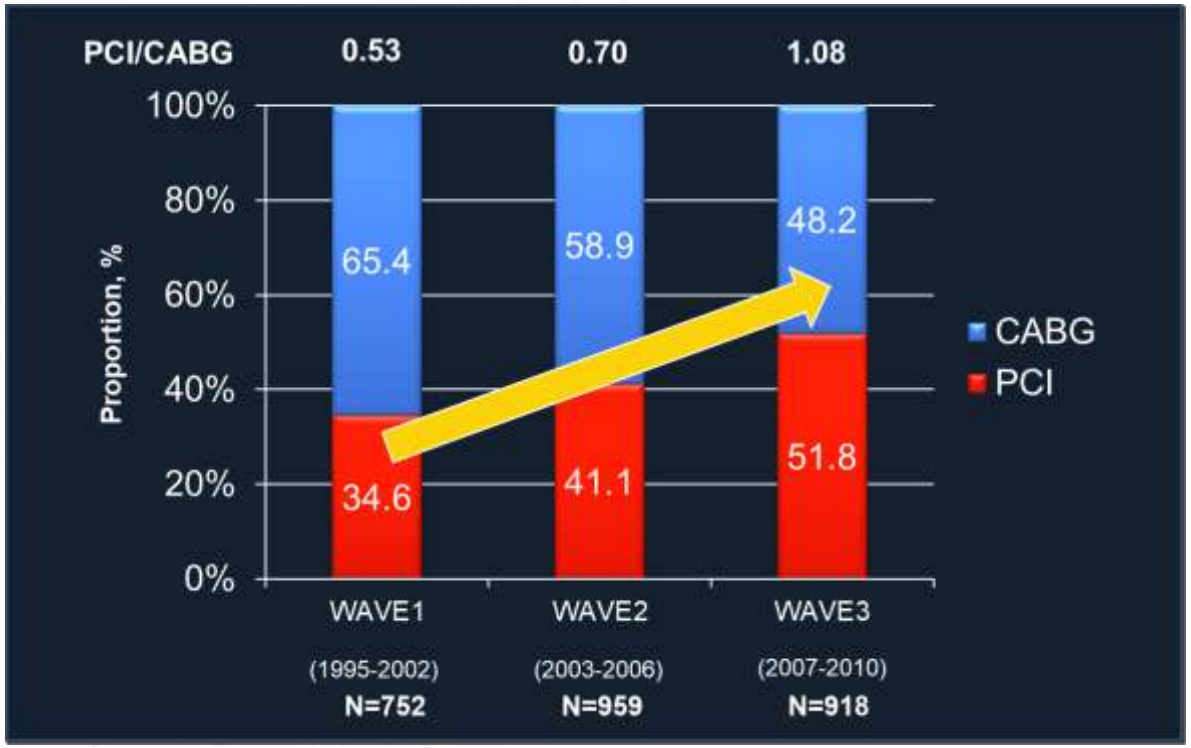
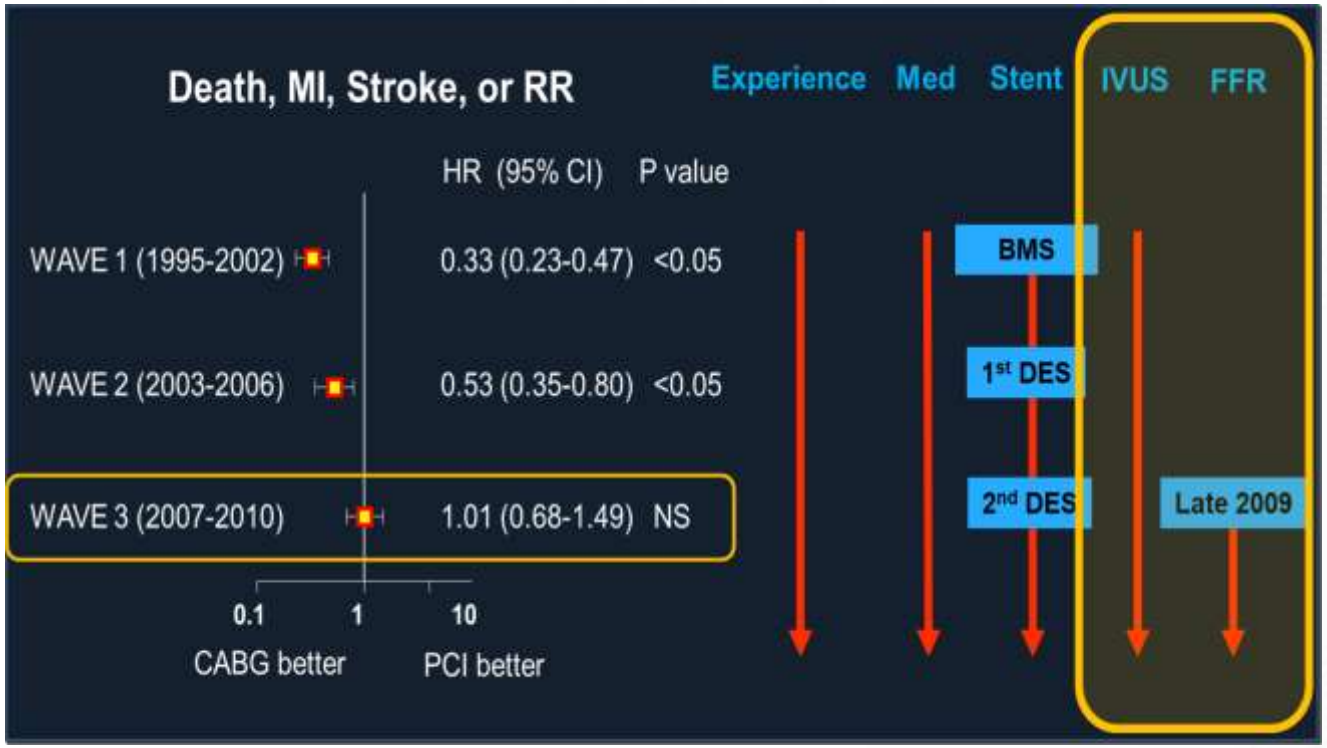
ASAN LM Registry: Revascularization Strategy



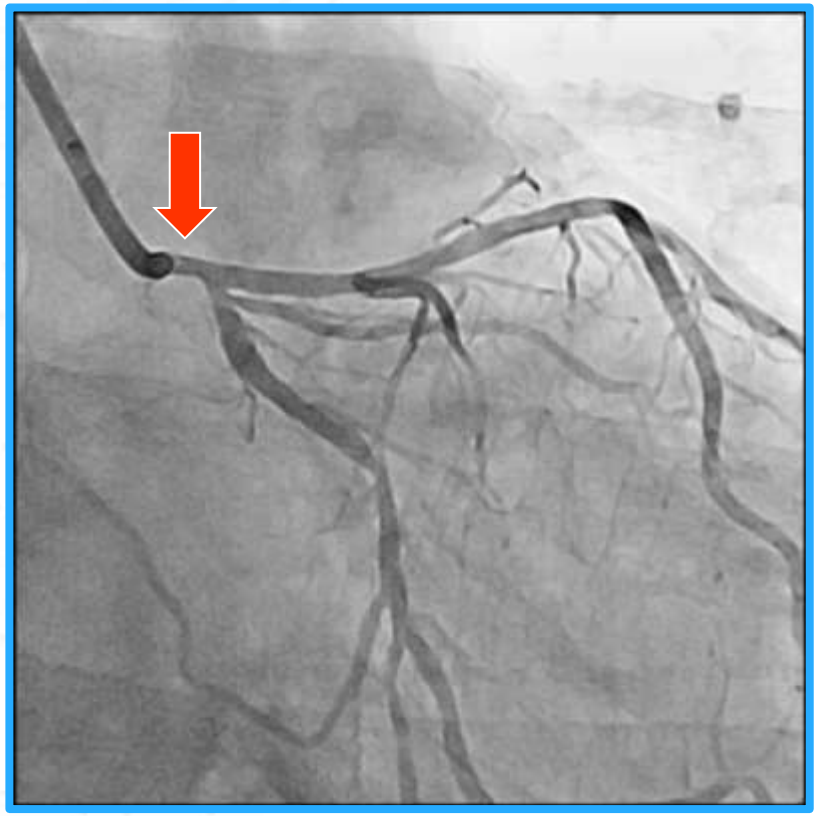


Park SJ, Ahn JM et al. Circ Cardiovasc Interv. 2015 Mar;8(3):e001846

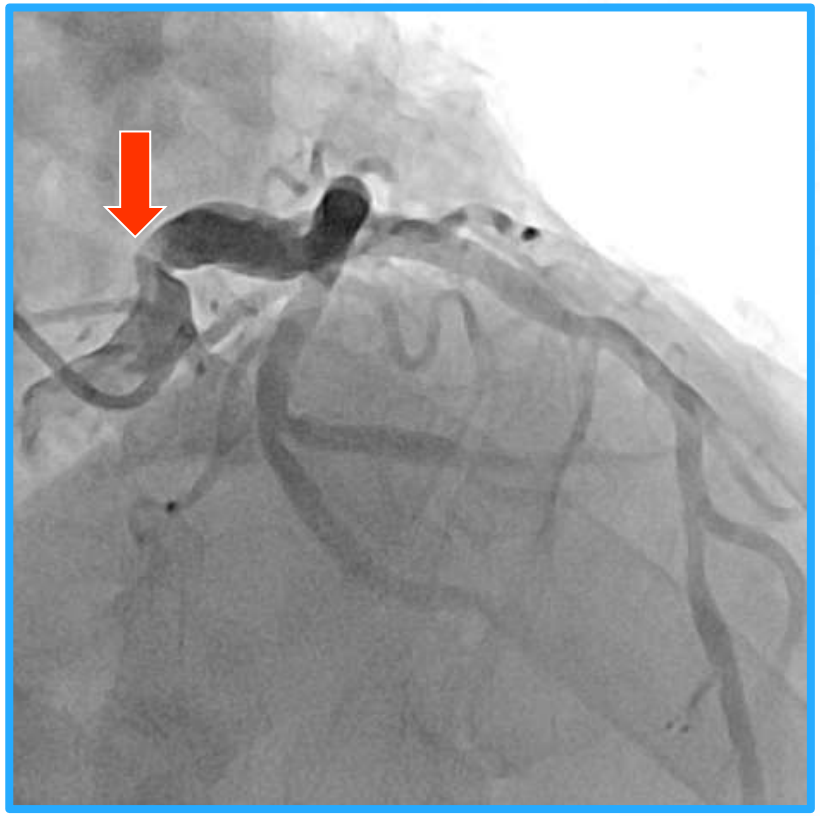
Why FFR in LM disease?

- Inaccuracy of Coronary Angiography.
- Lack or Low Spatial Resolution of Non-Invasive Functional Study.
- FFR Guided PCI in LMCA Showed Favorable Outcomes.

Which is a Significant Stenosis

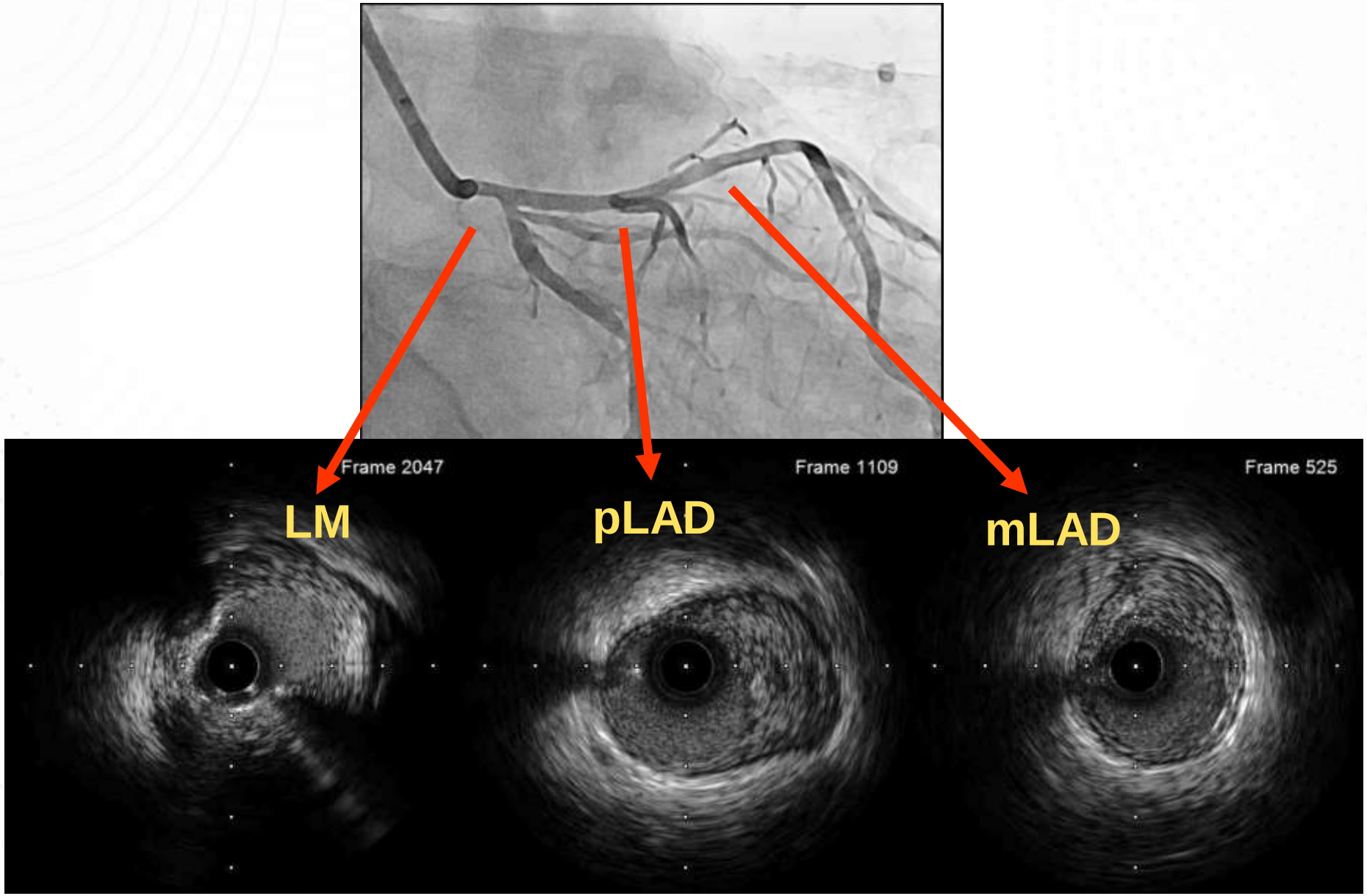


FFR 0.71

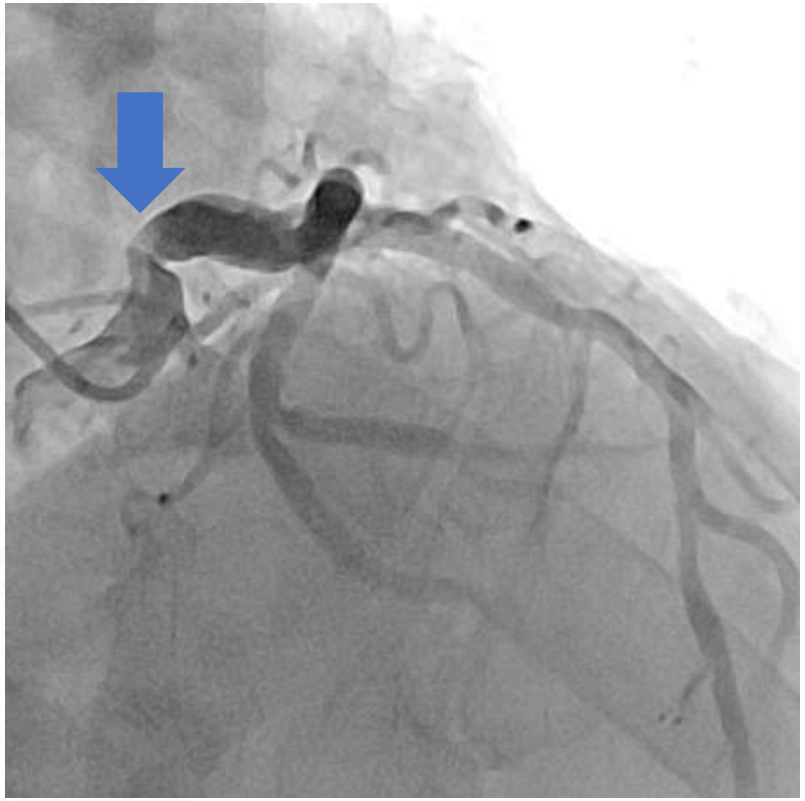


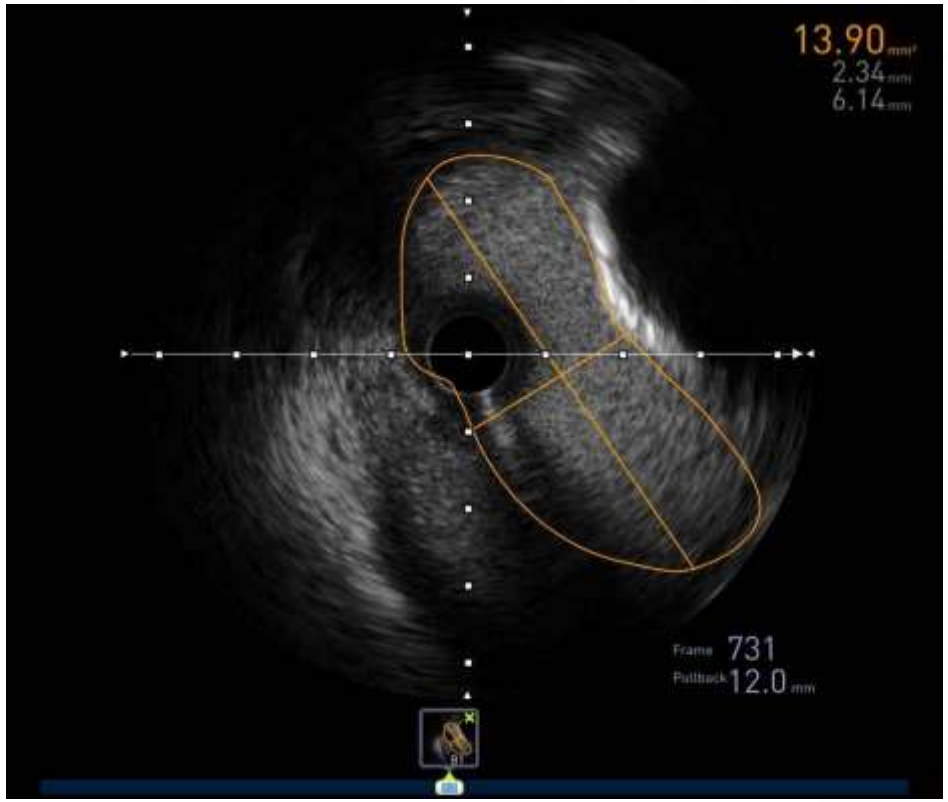
FFR 0.89

Diffuse Atherosclerosis



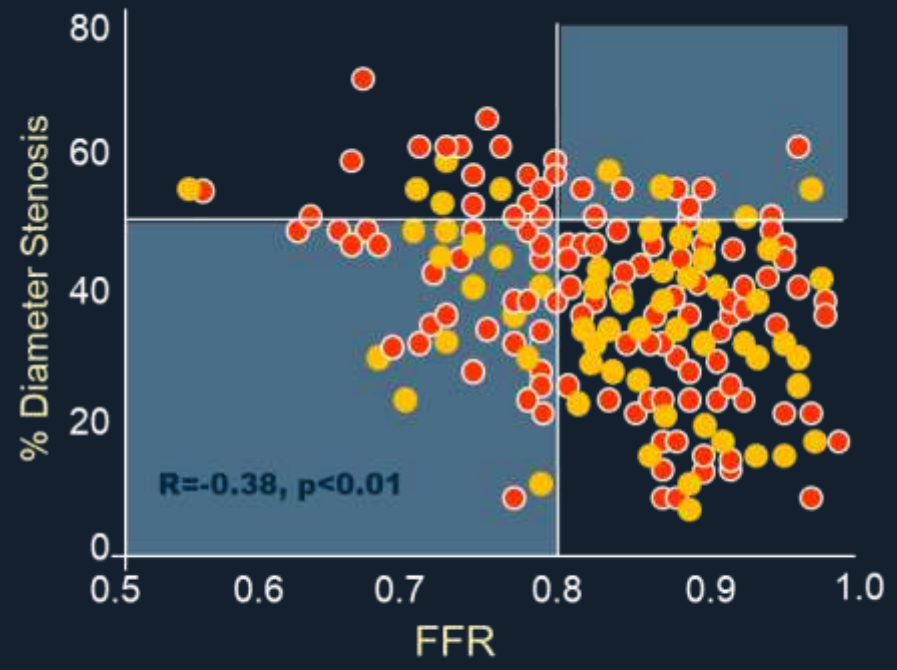
MLA 8.8-13.9mm^2





Inaccurate Coronary Angiography

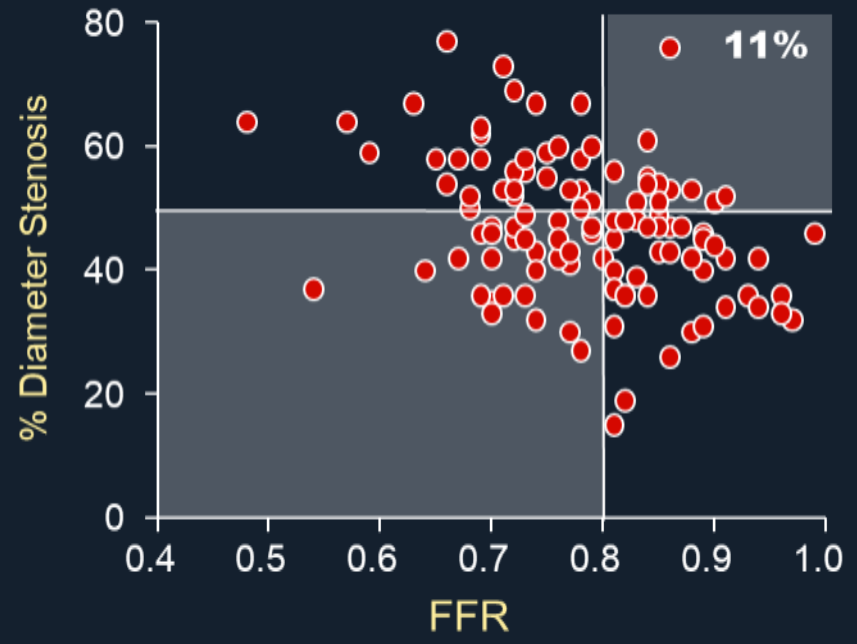
"Mismatch" is 29% in equivocal LMCA



Hamilos et al
Circulation 2009;120:1505-1512

● Isolated LMCA disease

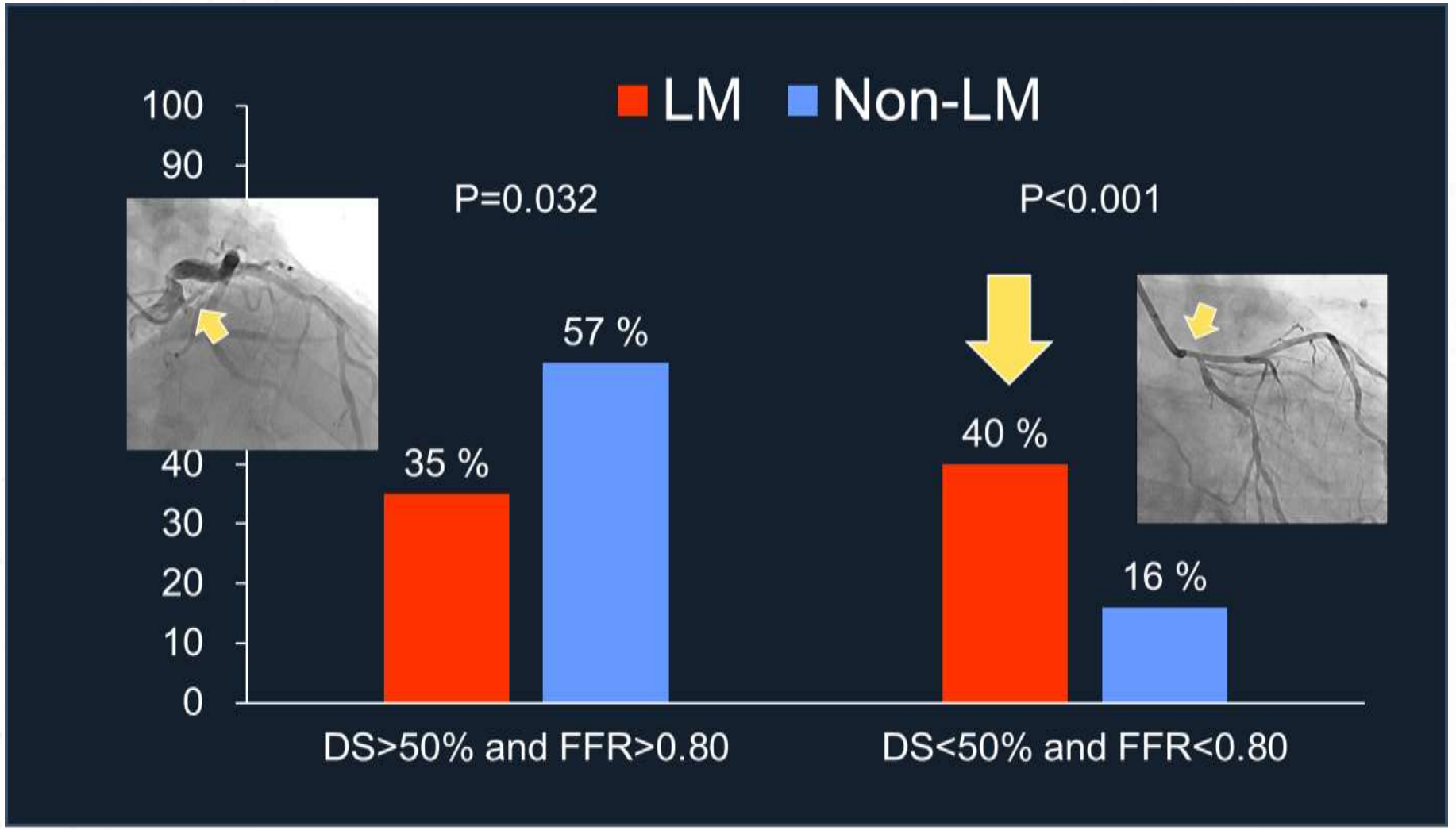
"Mismatch" is 37% in equivocal LMCA



Park SJ, Ahn JM et al
JACC Cardiovasc Interv. 2014 ;7(8):868-74

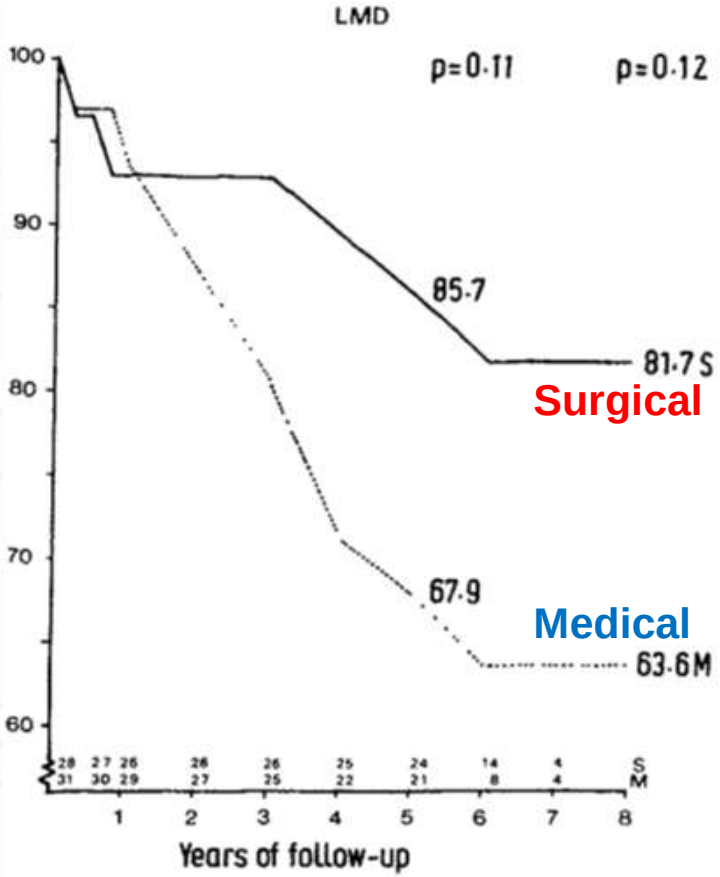
Left Main Supplies Large Myocardium

In symptomatic patients, ambiguous LM stenosis should be evaluated by FFR

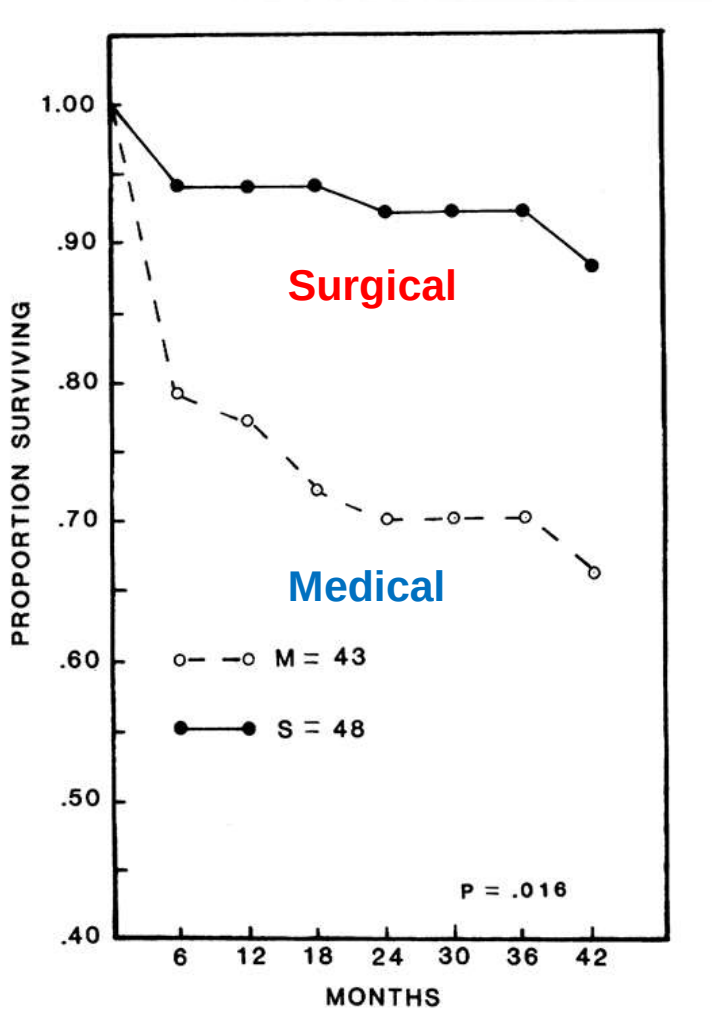


Park SJ et al JACC Cardiovasc Interv. 2012;5:1029-36

Significant Left Main Disease (DS>50%)



ECSS Group Lancet 1982 Nov 27;2(8309):1173-80



Takaro et al. Circulation 1982;66:14-22

Significant Left Main Disease (DS>50%)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease

Seung-Jung Park, M.D., Young-Hak Kim, M.D., Duk-Woo Park, M.D., Sung-Cheol Yun, Ph.D., Jung-Min Ahn, M.D., Hae Geun Song, M.D., Jong-Young Lee, M.D., Won-Jang Kim, M.D., Soo-Jin Kang, M.D., Seung-Whan Lee, M.D., Cheol Whan Lee, M.D., Seong-Wook Park, M.D., Cheol-Hyun Chung, M.D., Jae-Won Lee, M.D., Do-Sun Lim, M.D., Seung-Woon Rha, M.D., Sang-Gon Lee, M.D., Hyeon-Cheol Gwon, M.D., Hyo-Soo Kim, M.D., In-Ho Chae, M.D., Yangsoo Jang, M.D., Myung-Ho Jeong, M.D., Seung-Jea Tahk, M.D., and Ki Bae Seung, M.D.

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 8, 2016 VOL. 375 NO. 23

Everolimus-Eluting Stents or Bypass Surgery for Left Main Coronary Artery Disease

G.W. Stone, J.F. Sabik, P.W. Serruys, C.A. Simonton, P. Généreux, J. Puskas, D.E. Kandzari, M.-C. Morice, N. Lembo, W.M. Brown III, D.P. Taggart, A. Banning, B. Merkely, F. Horkay, P.W. Boonstra, A.J. van Boven, I. Ungi, G. Bogáts, S. Mansour, N. Noiseux, M. Sabaté, J. Pomar, M. Hickey, A. Gershlick, P. Buszman, A. Bochenek, E. Schampaert, P. Pagé, O. Dressler, I. Kosmidou, R. Mehran, S.J. Pocock, and A.P. Kappetein, for the EXCEL Trial Investigators*

ABSTRACT

All patients had to have newly diagnosed unprotected stenosis of more than 50% of the diameter of the left main coronary artery, as estimated visually

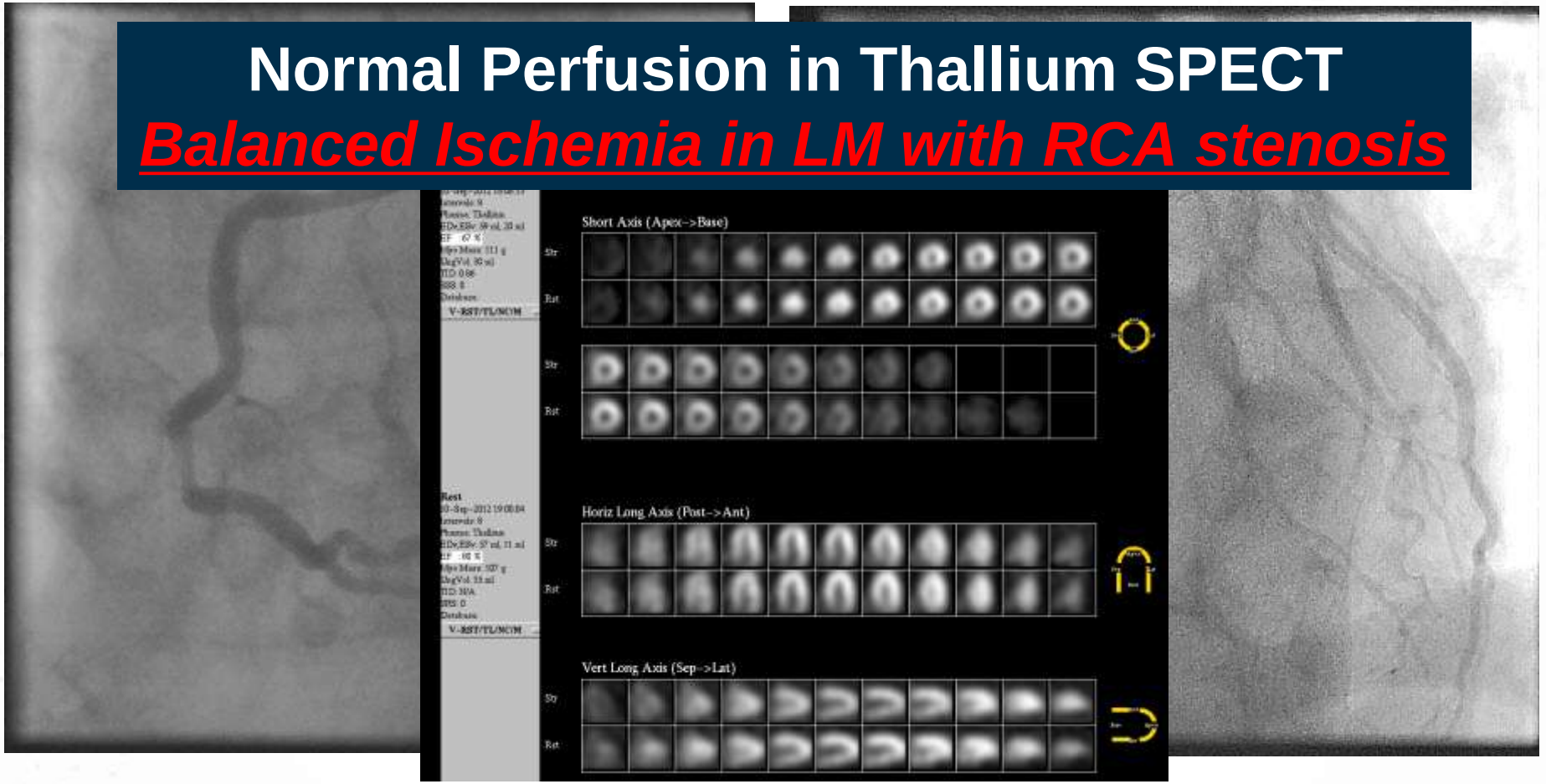
Stenosis of the LMCA of 70% or more, as estimated visually, or stenosis of 50% to less than 70% if determined by means of noninvasive or invasive testing to be hemodynamically significant

Left main stenosis with RCA disease

65yrs/M, Effort chest pain

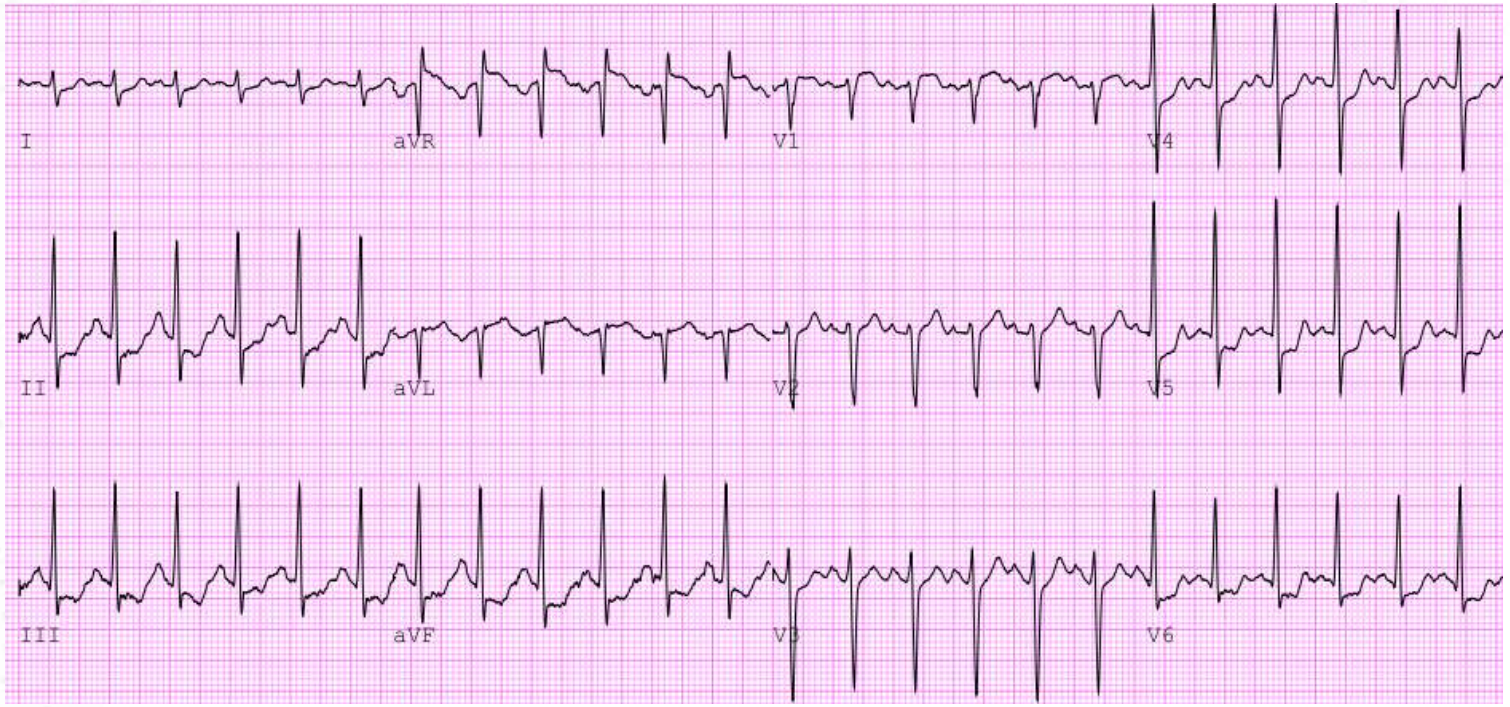
Right Coronary

Left Coronary



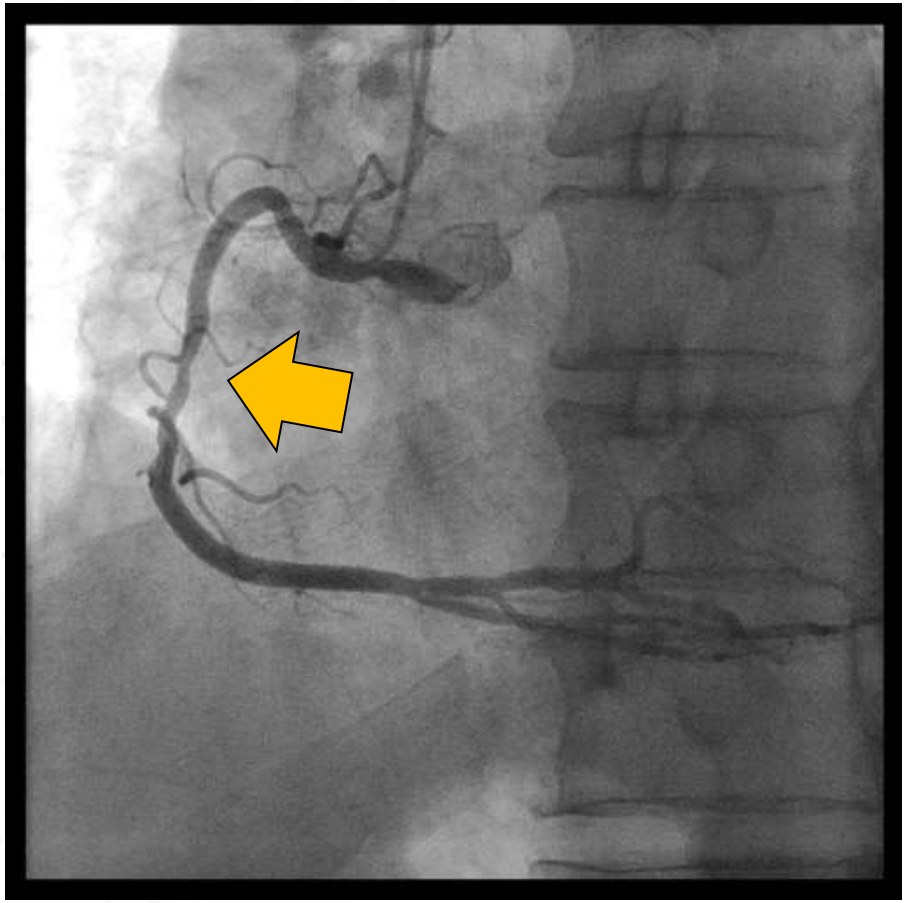
M/76, Effort Chest Pain

Treadmill Test

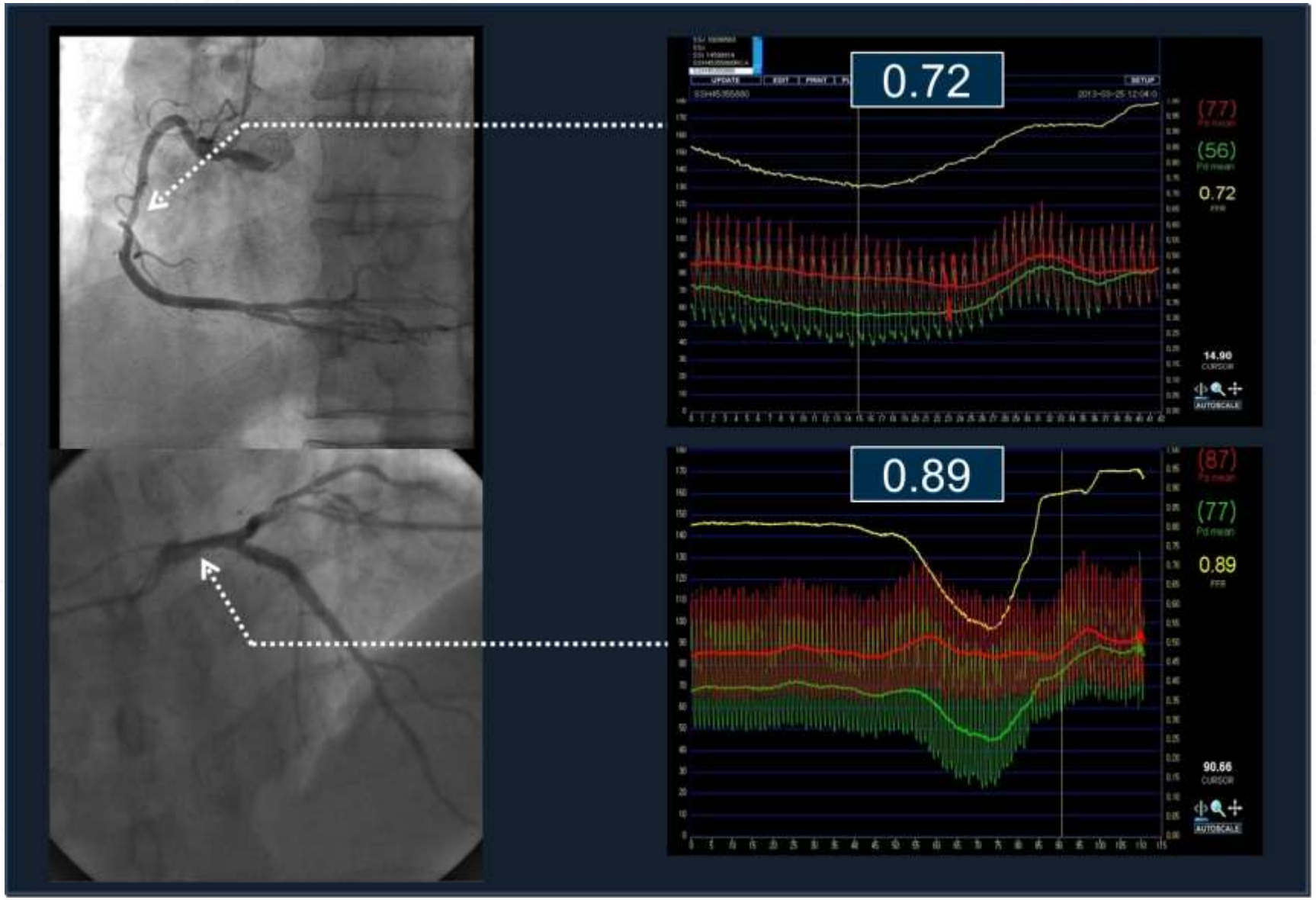


Positive at Stage 4

Coronary Angiography

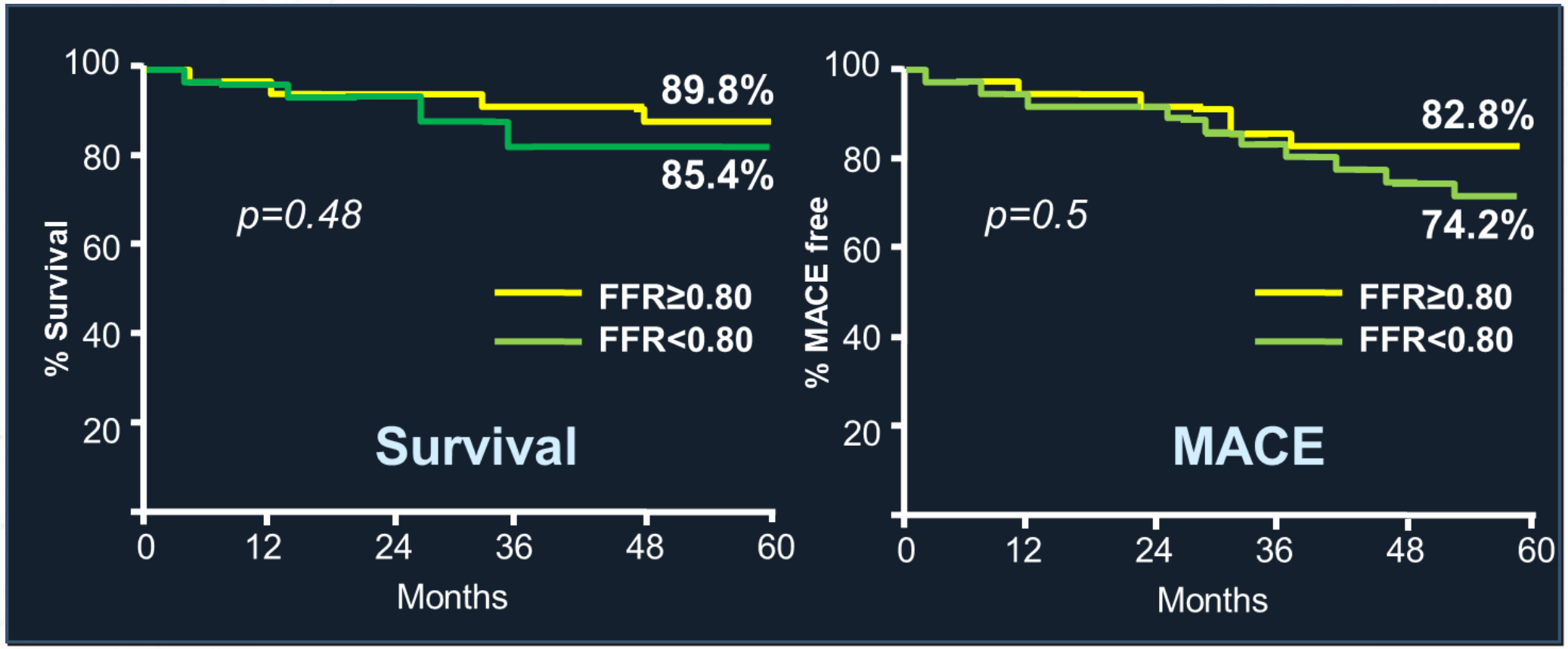


Fractional Flow Reserve



FFR guided PCI in Equivocal LMCA

In 213 patients with an equivocal LMCA stenosis
FFR ≥0.80: Medication (n=138) vs. FFR<0.80: CABG (n=75)



Hamilos M. et al. Circulation. 2009;120:1505-1512

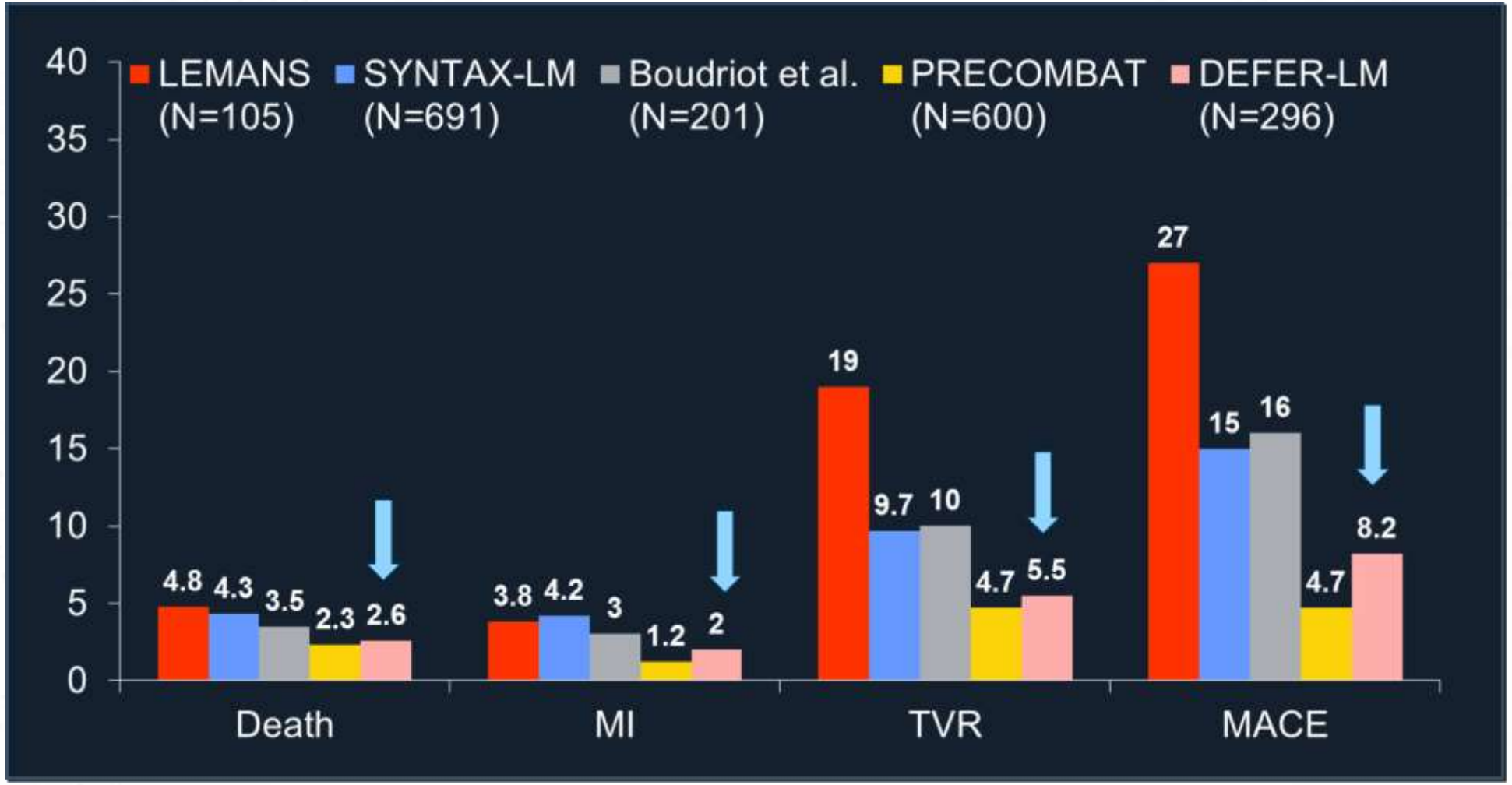
Clinical Outcomes After Deferral of LM Disease

(6 studies, 296 patients)

Outcomes	Incidence (%/year)
All Death	2.6 (1.3-5.2)
Cardiac Death	2.6 (1.3-5.2)
Myocardial Infarction	2.0 (0.7-5.1)
TVR	5.5 (3.3-8.8)
MACE	8.2 (5.5-12.1)

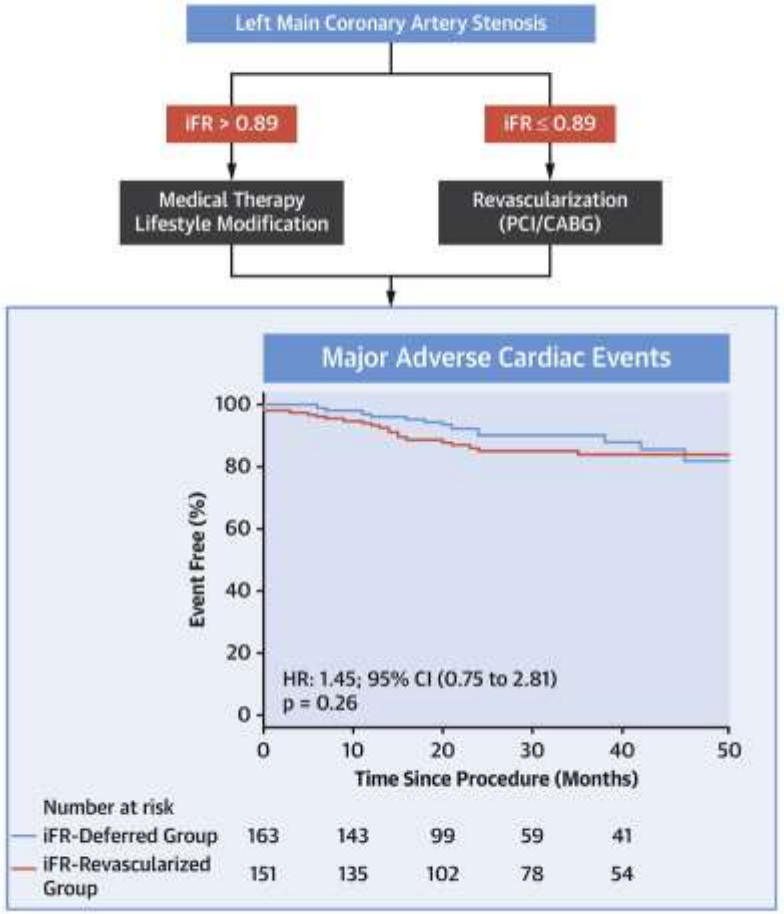
Hamilos M, Circulation. 2009;120:1505-1512
Bech GJ, Heart. 2001;86:547-552
Courtis J, Am J Cardiol. 2009;103:943-949
Lindstaedt M, Am Heart J. 2006;152:151-159
Jasti V, Circulation. 2004;110:2831-2836
Sueman, Heart Vessels. 2005;20:271-7

Safety of Deferred LM Disease



Deferred LM Disease By iFR

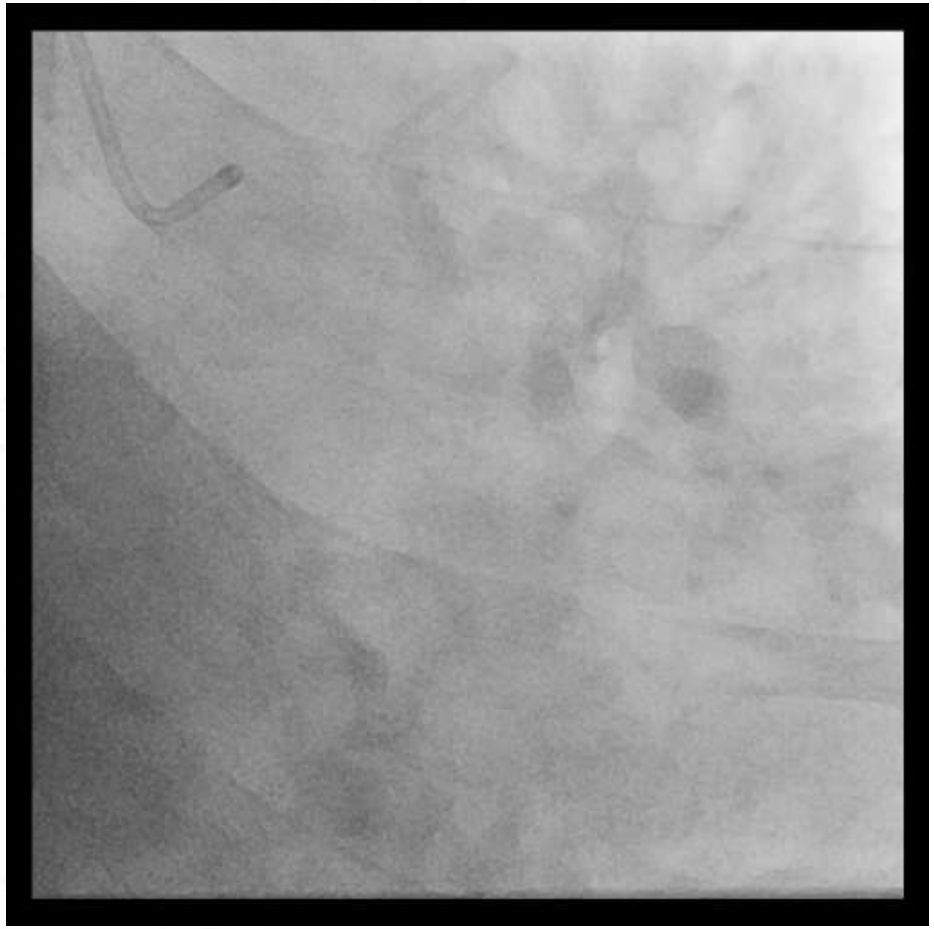
CENTRAL ILLUSTRATION: MACE in Patients With LM Stenosis: Kaplan-Meier Curves



Warisawa, T. et al. J Am Coll Cardiol Intv. 2020;13(14):1655-64.

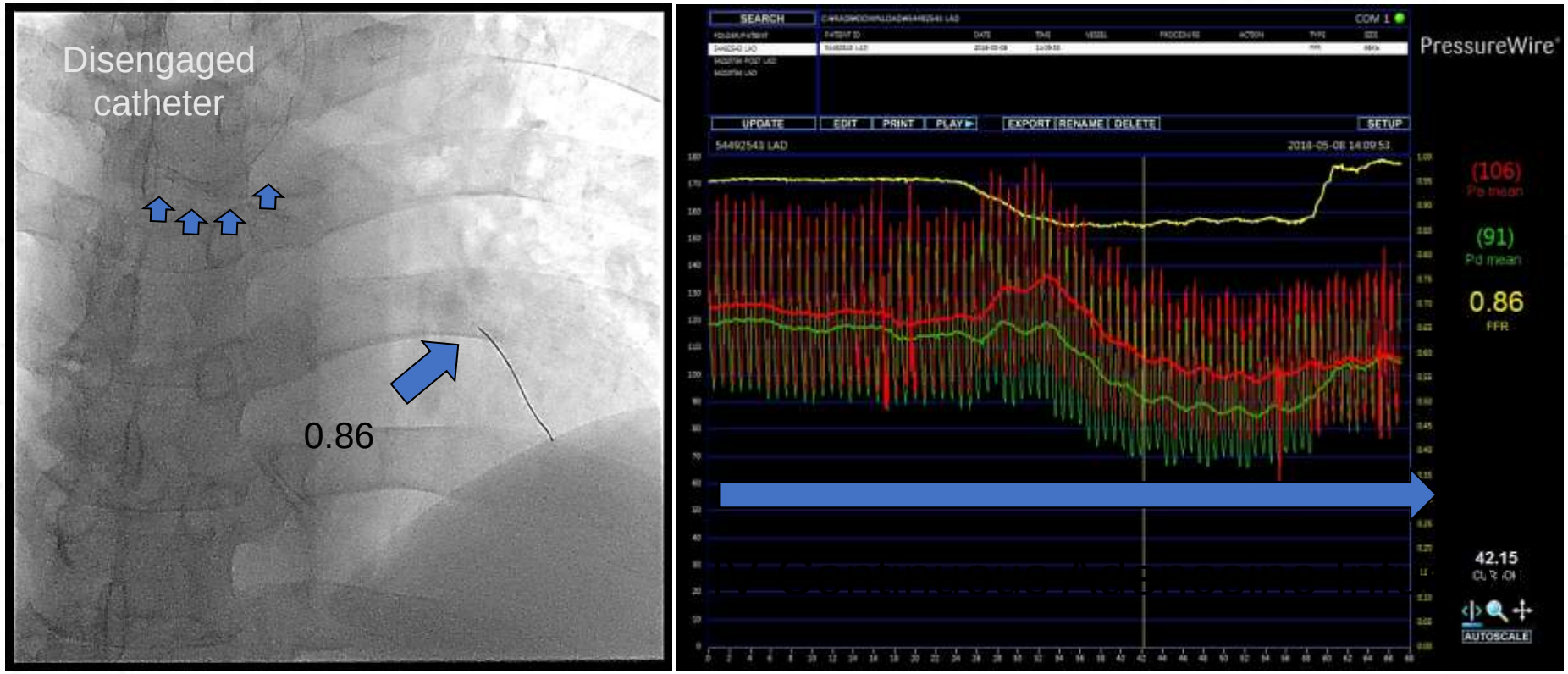
Technical Issues

Left Main Ostial Evaluation



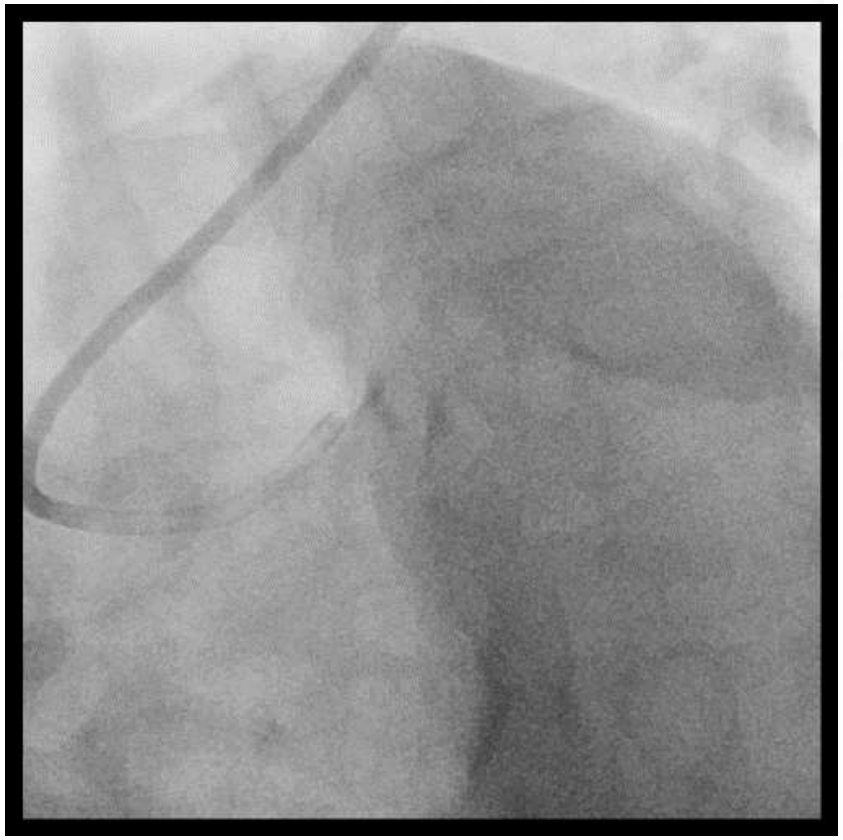
Left Main Ostial Evaluation

Guiding Catheter Disengagement

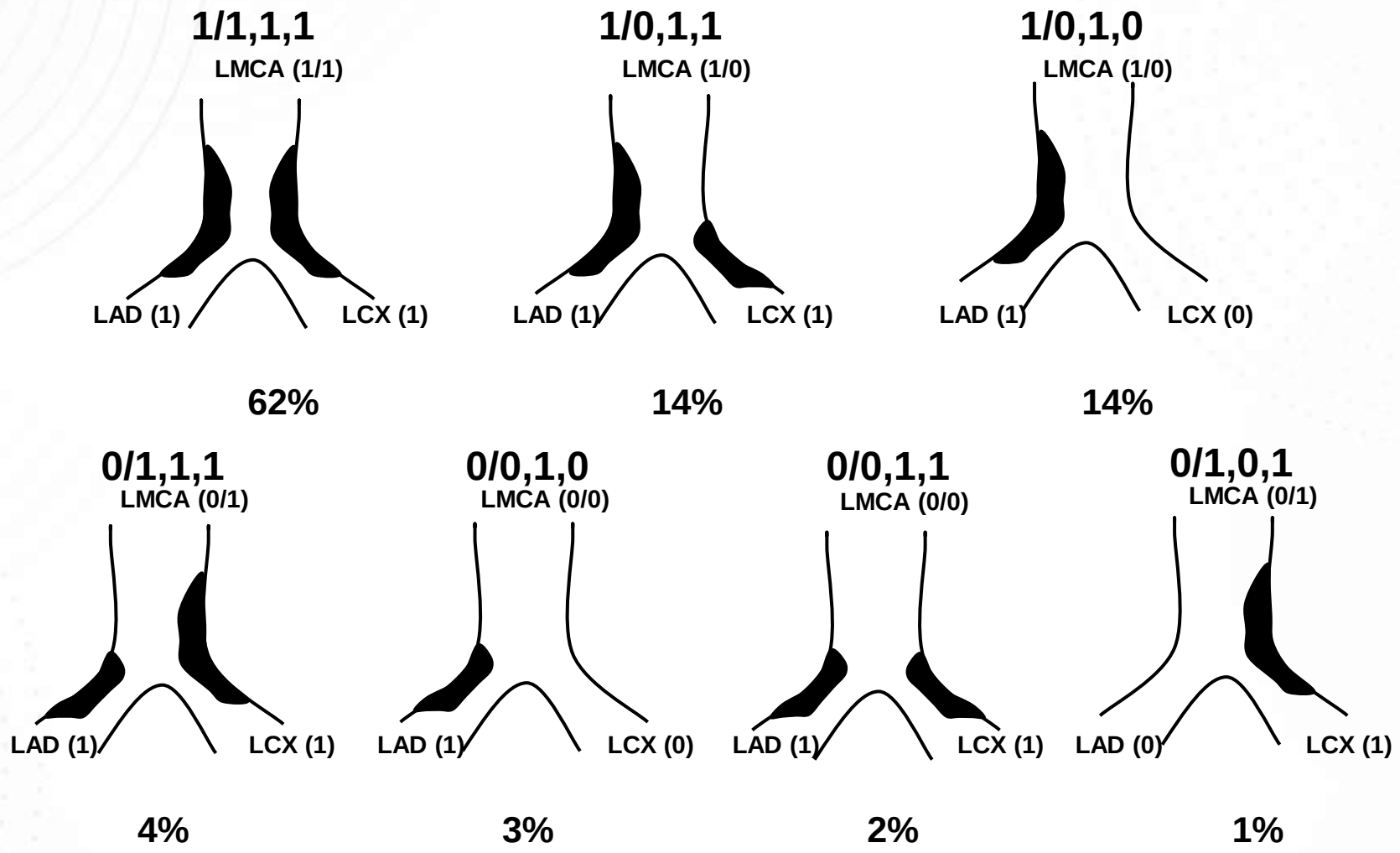


LM, FFR 0.86

LM Bifurcation Evaluation



LM Bifurcation Evaluation

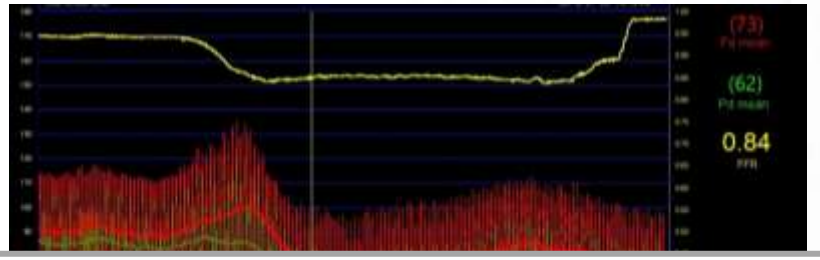


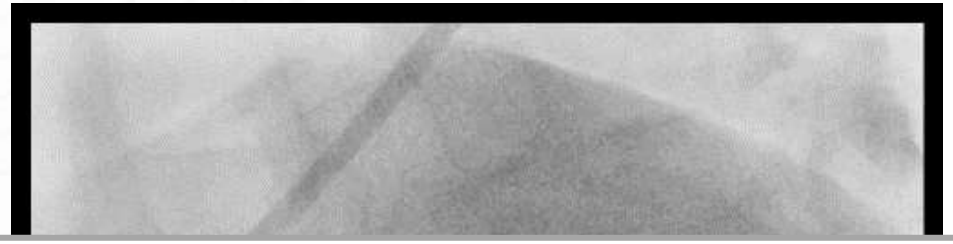
In 90% plaque extends from LMCA-LAD

Oviedo C et al. Circ Cardiovasc Interv 2010;3:105-12.

LM Bifurcation Evaluation

LAD Pull Back

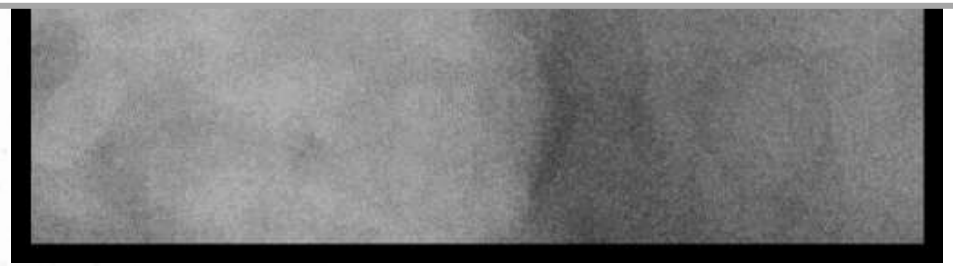


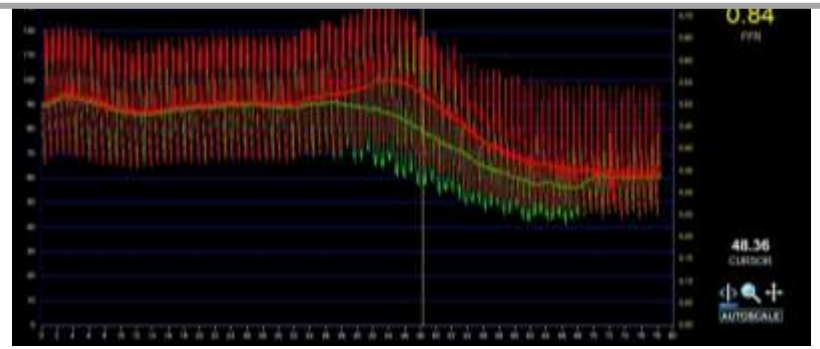


If either FFR is Positive,

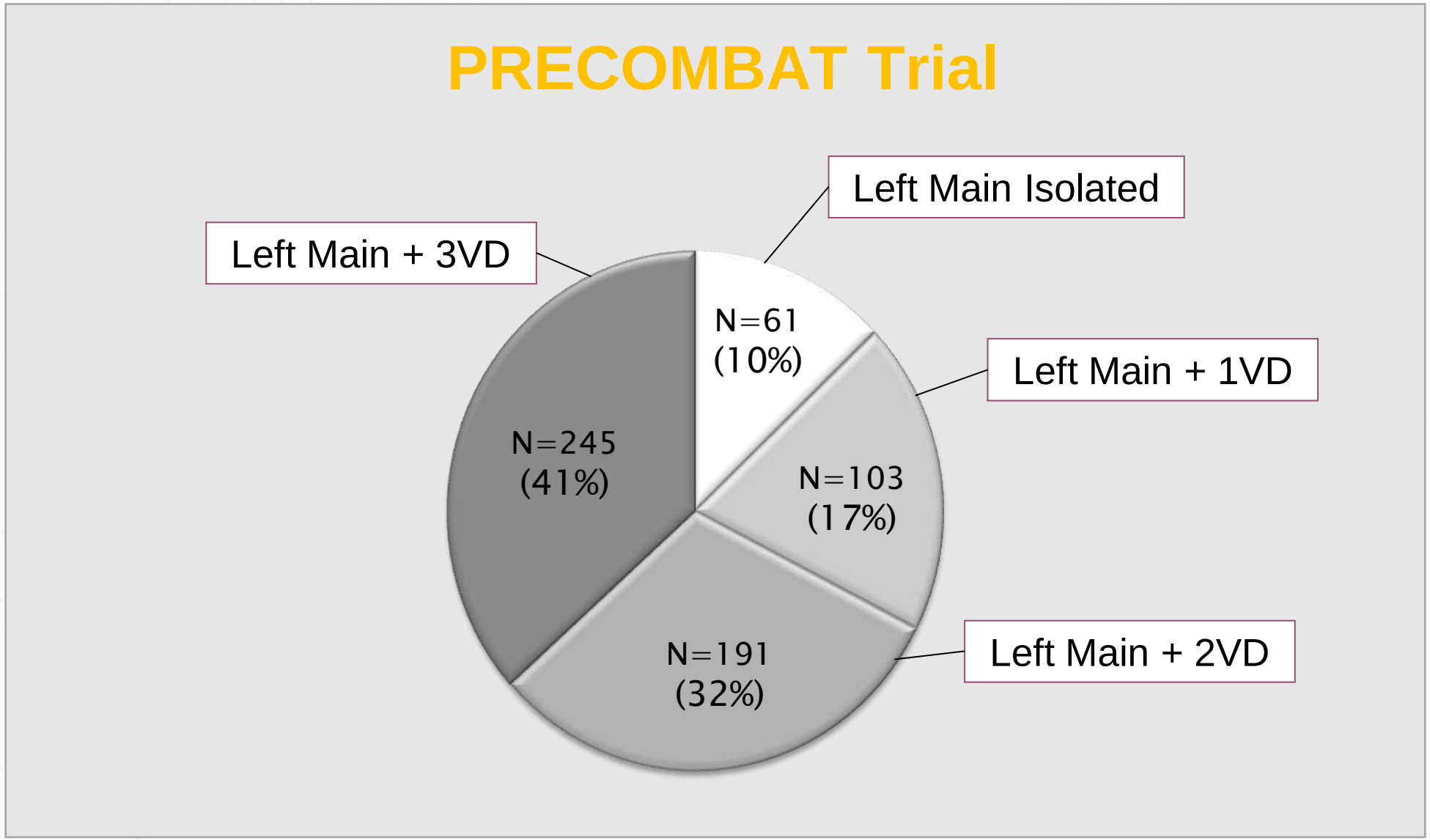
- We have to treat LM bifurcation (single disease unit).
- We cannot separately treat it.

Practically, I measured LAD FFR > LCX FFR



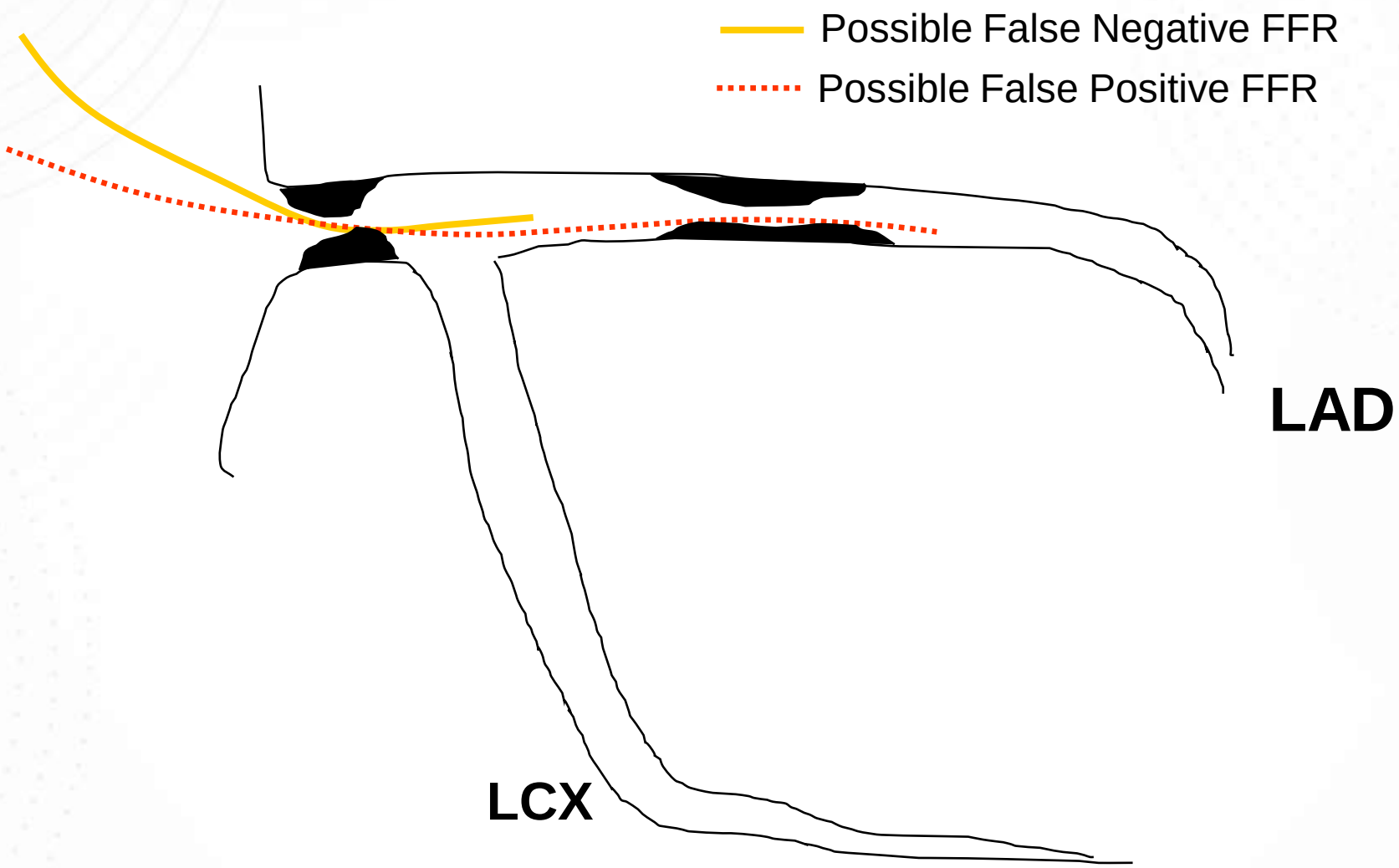


Down Stream Disease



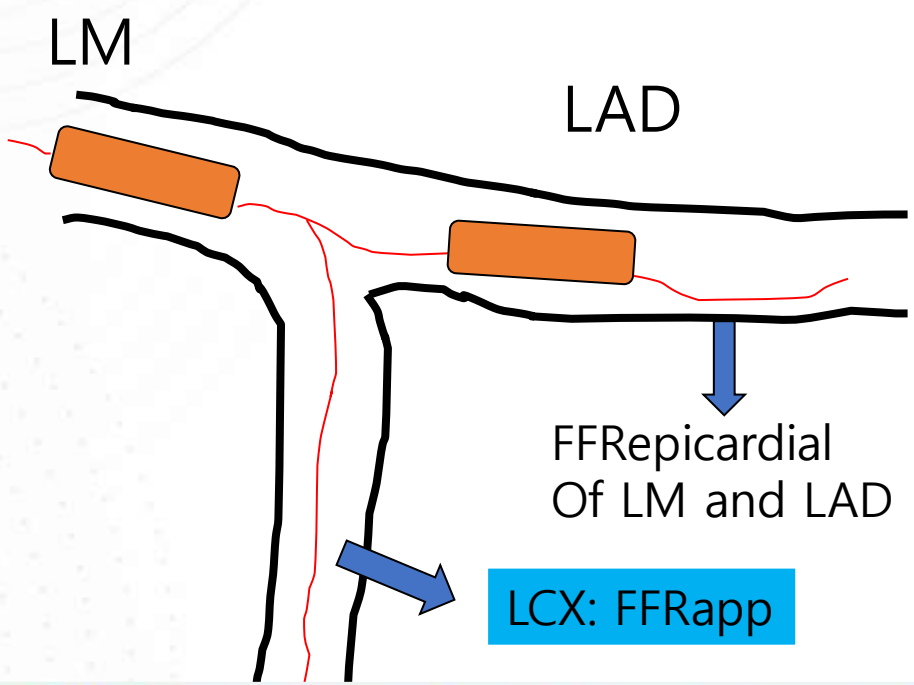
Ahn JM et al. J Am Coll Cardiol 2015;65:2198-2206

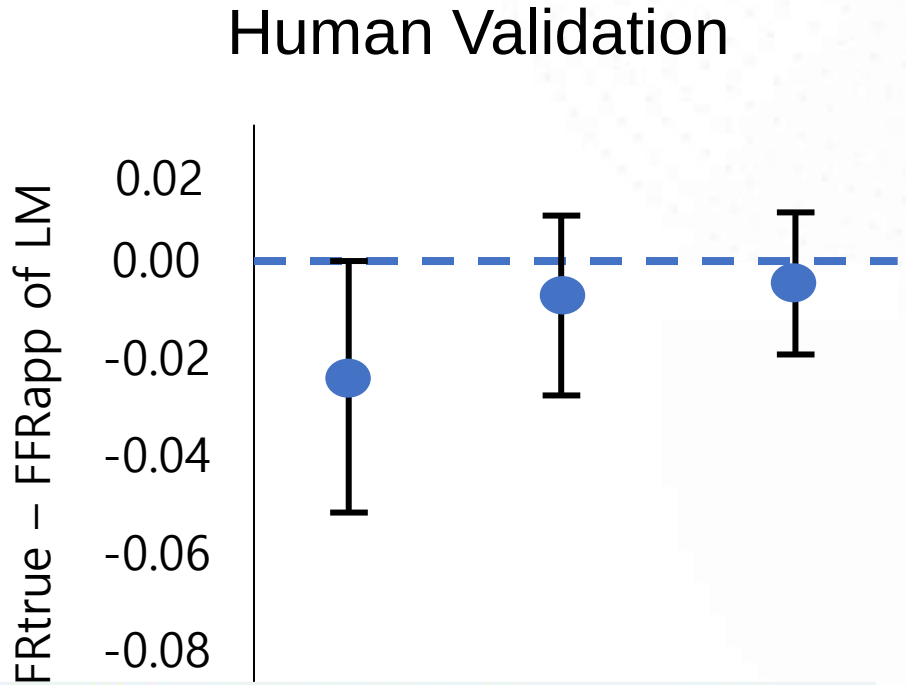
Down Stream Disease



Down Stream Disease

Unless downstream stenosis is very significant, its impact is mild

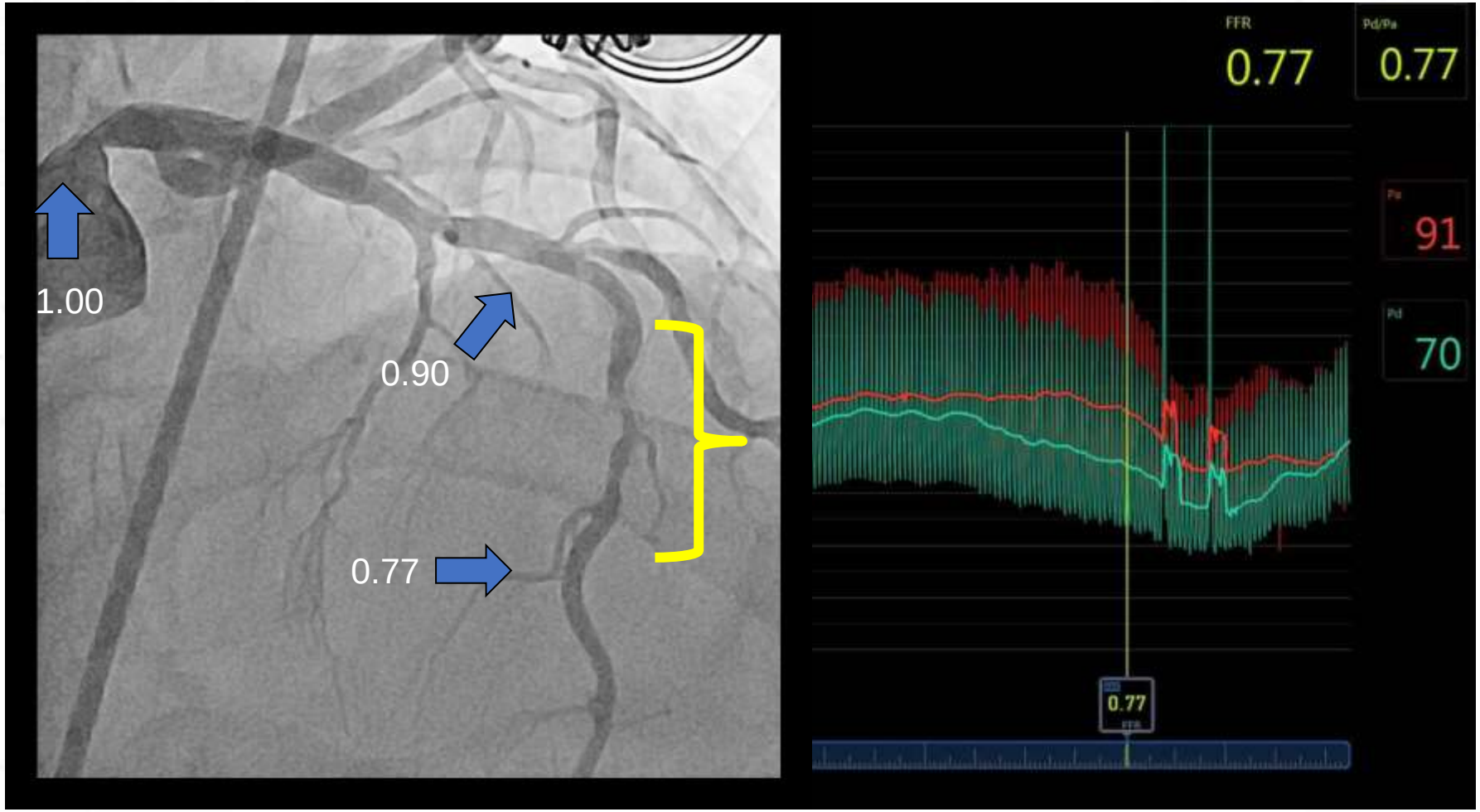




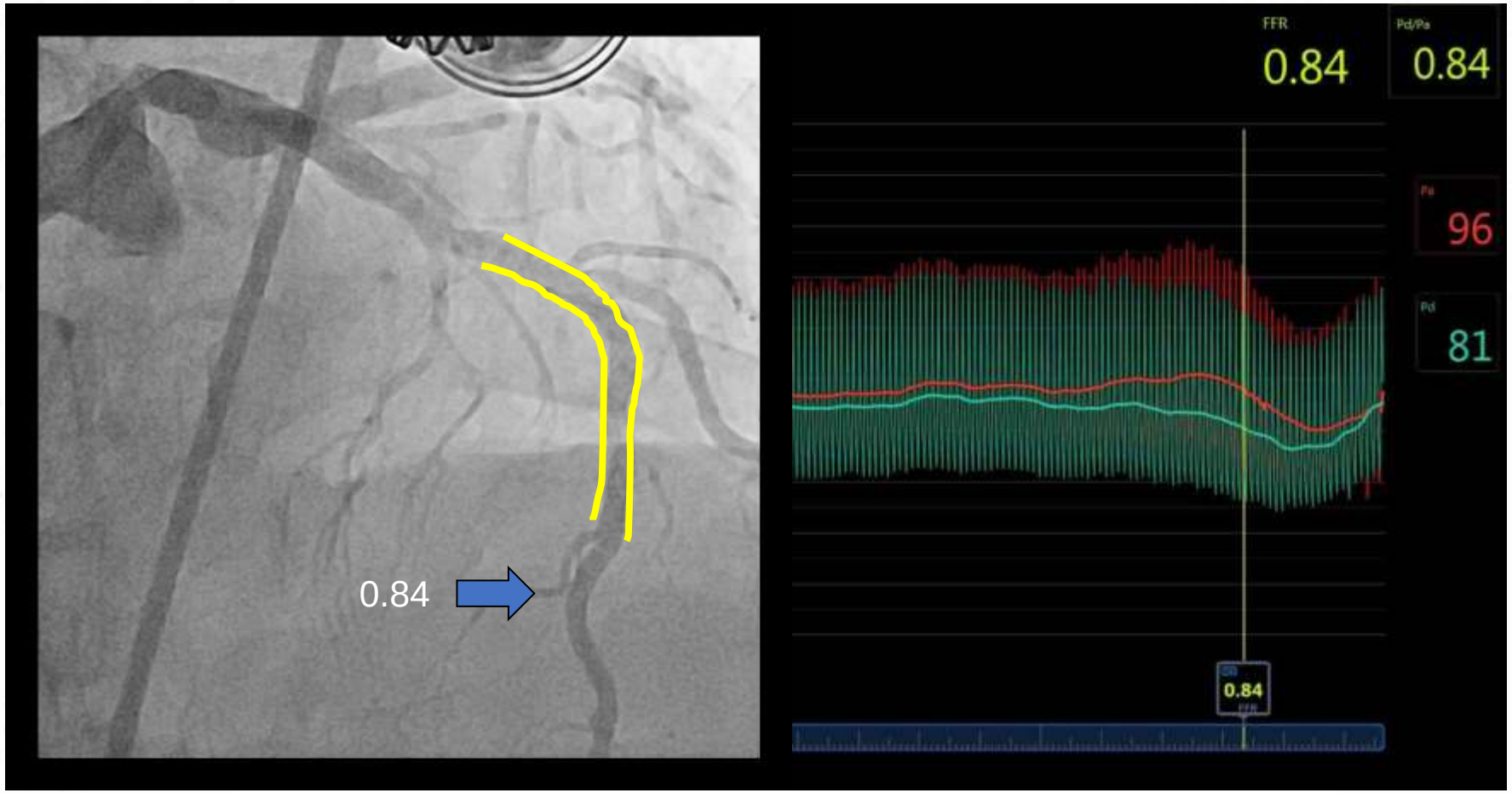
RESULTS In 25 patients, 91 pairs of measurements were made, 71 with LAD stenosis and 20 with LCx stenosis. FFR_{true} of the LMCA was significantly lower than FFR_{app} (0.81 ± 0.08 vs. 0.83 ± 0.08, $p < 0.001$), although the numerical difference was small. This difference correlated with the severity of the downstream disease ($r = 0.35$, $p < 0.001$). In all cases in which FFR_{app} was >0.85, FFR_{true} was >0.80.

Fearon WF, et al JACC Cardiovasc Interv. 2015 Mar;8(3):398-403

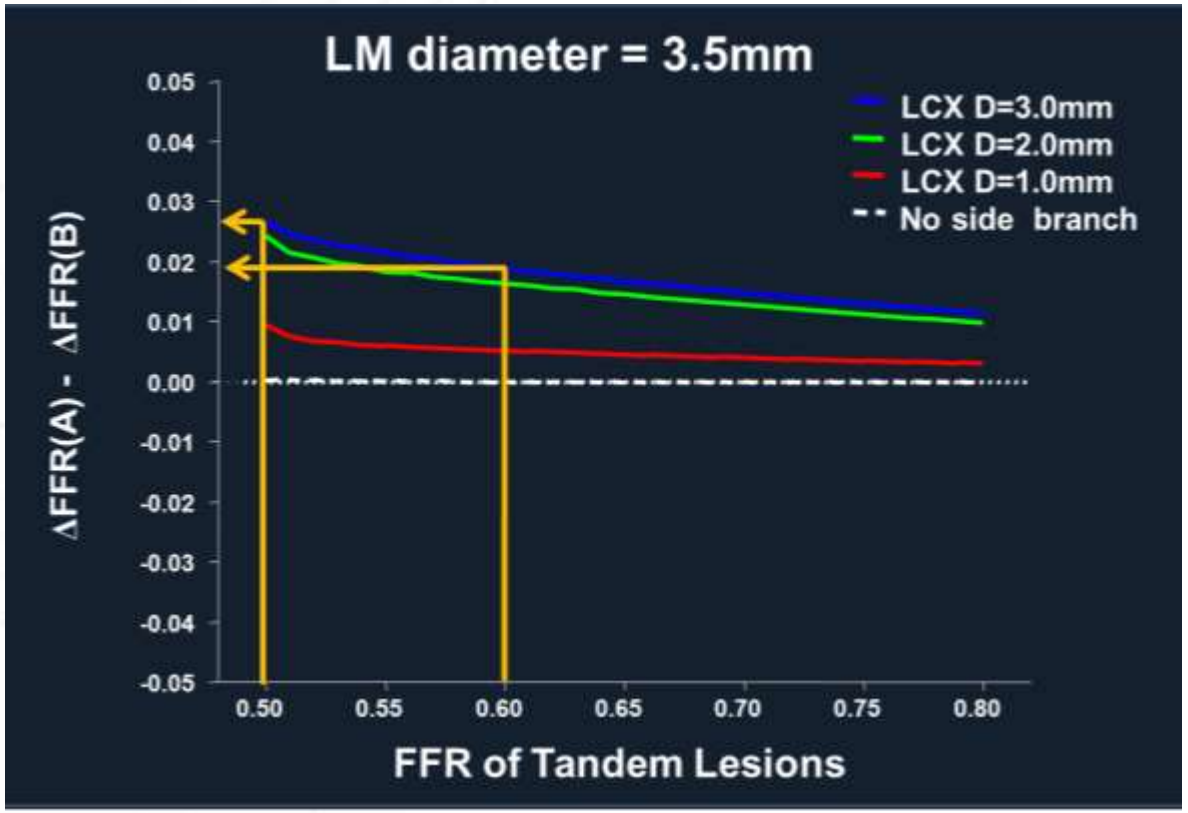
Concept of Tandem Lesion
Pressure Wire Pull Back

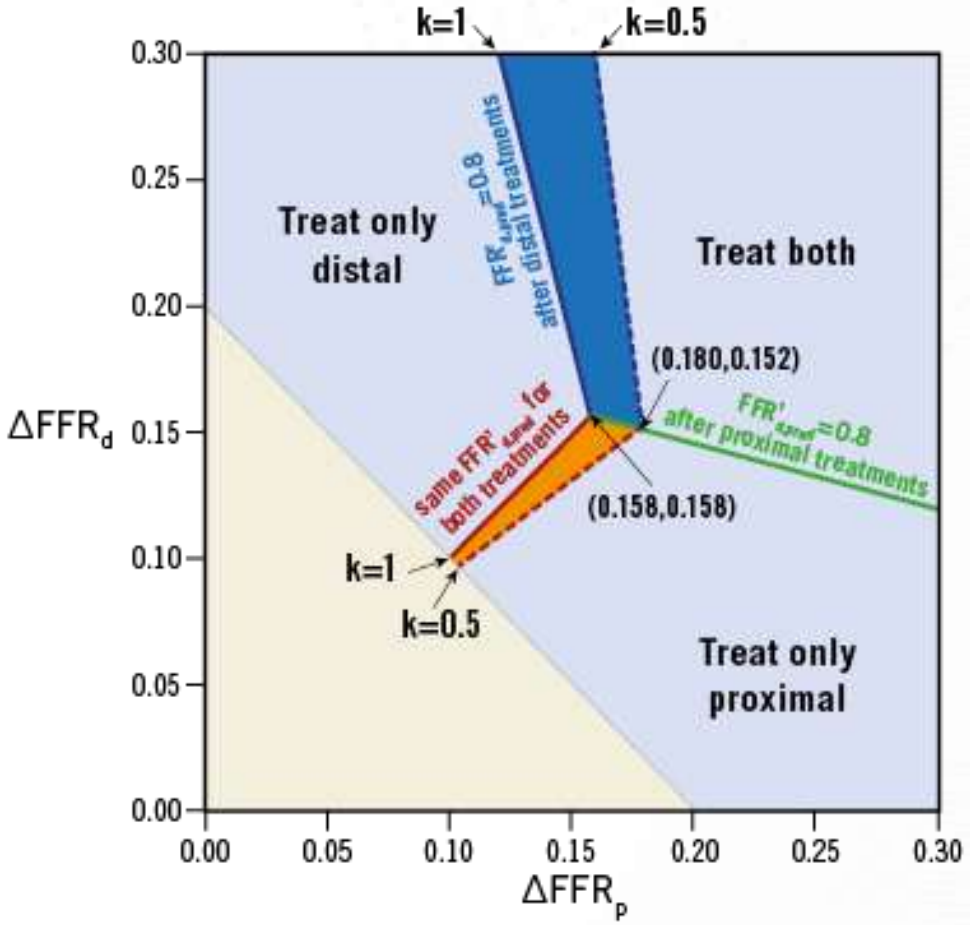


Concept of Tandem Lesion
Pressure Wire Pull Back



The impact of big side branch (LCX) on **Δ FFR** is about <0.02-0.03.
This number may be below the clinical significance.



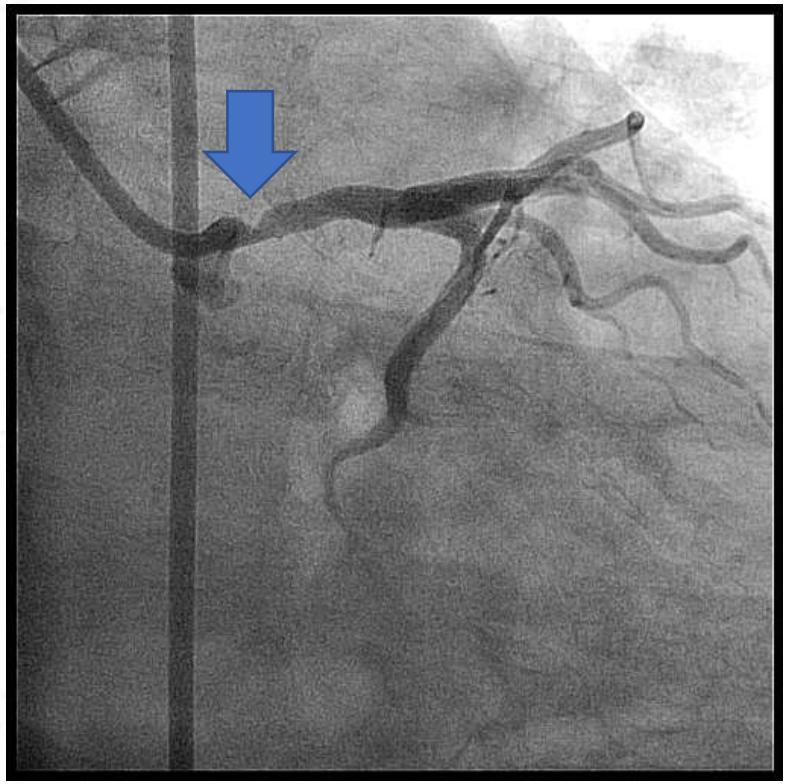


EuroIntervention 2016;12:e1375-e1384

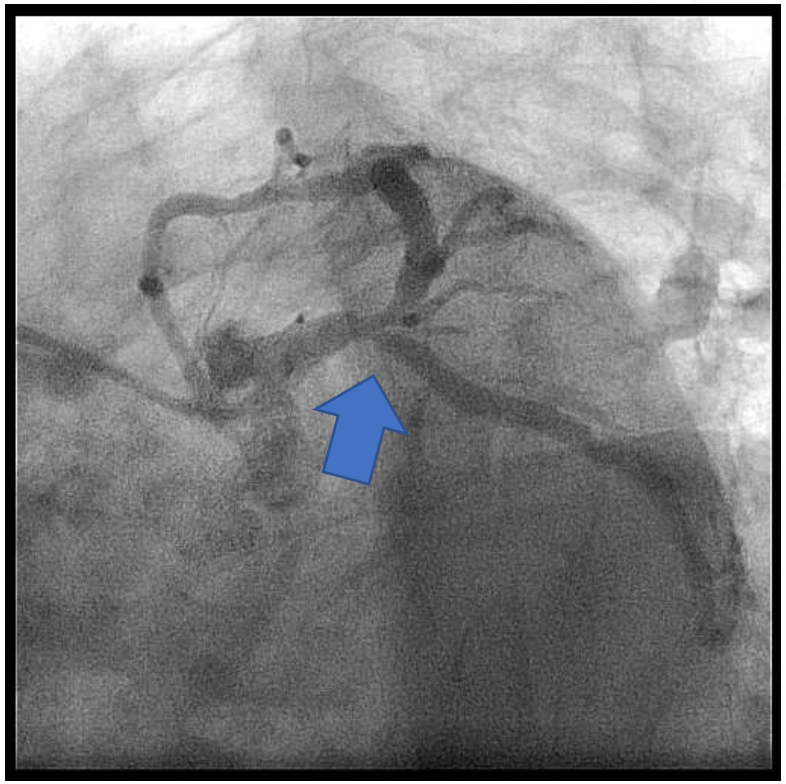
How to Treat LM disease by PCI

LM PCI Strategy

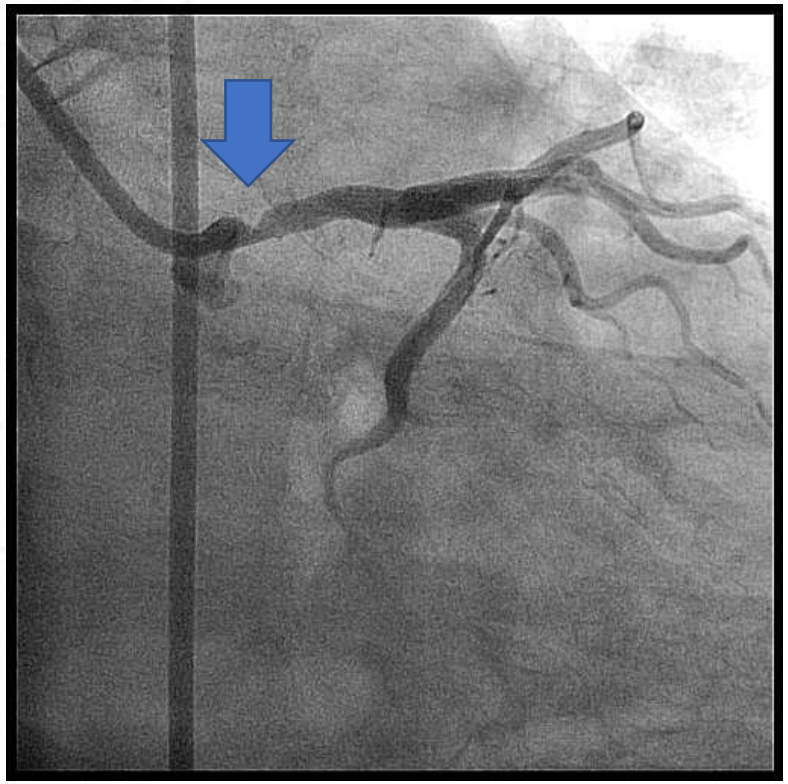
Ostial and Shaft Disease



Bifurcation Disease

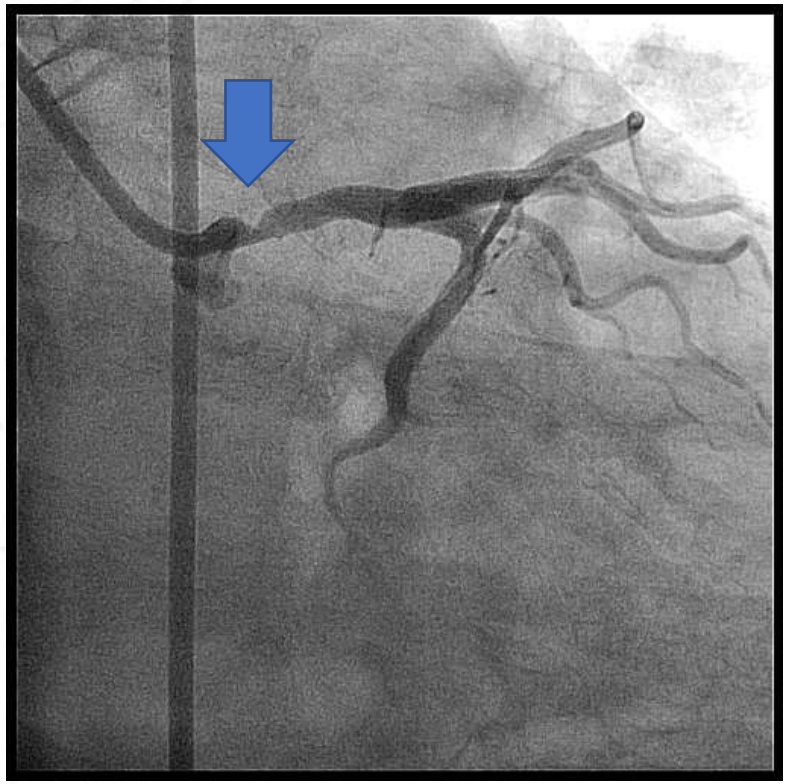


Ostial or Shaft Stenosis

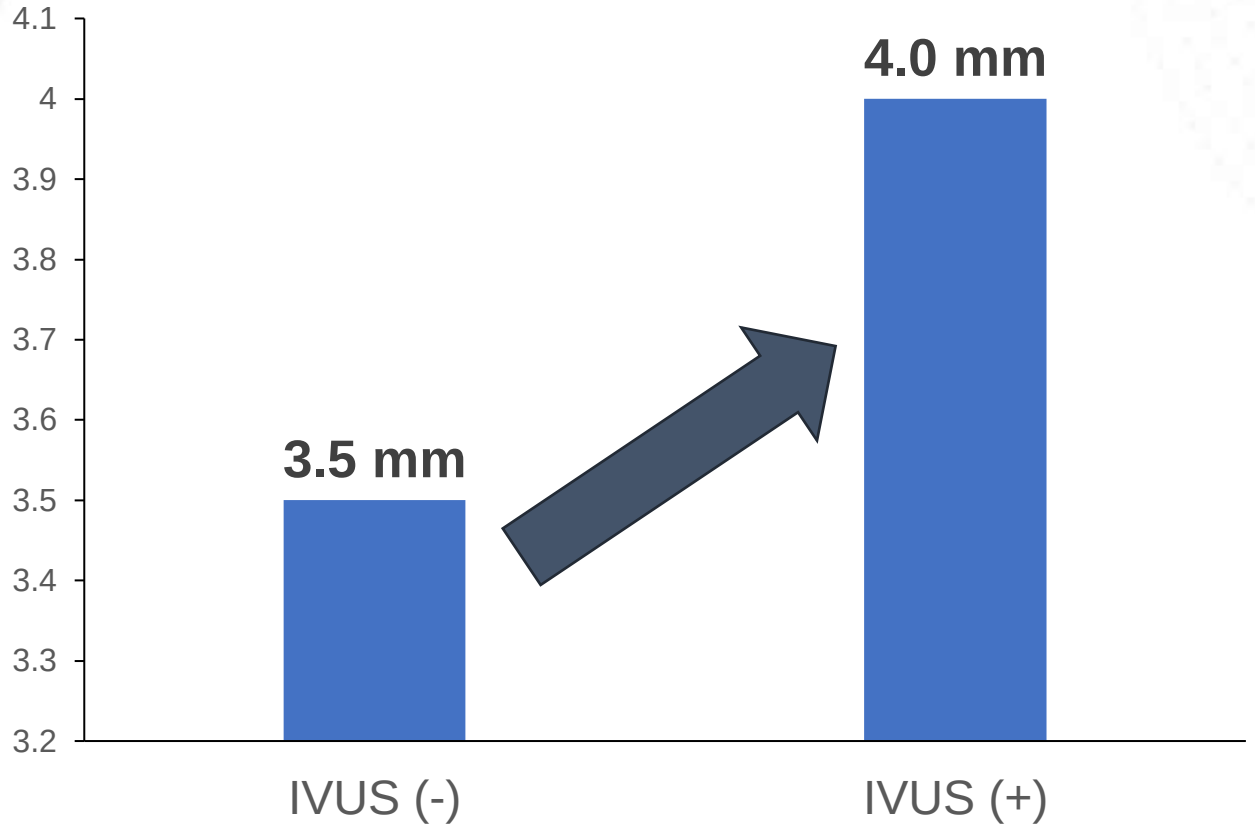


Ostial or Shaft Stenosis

Just Stent it

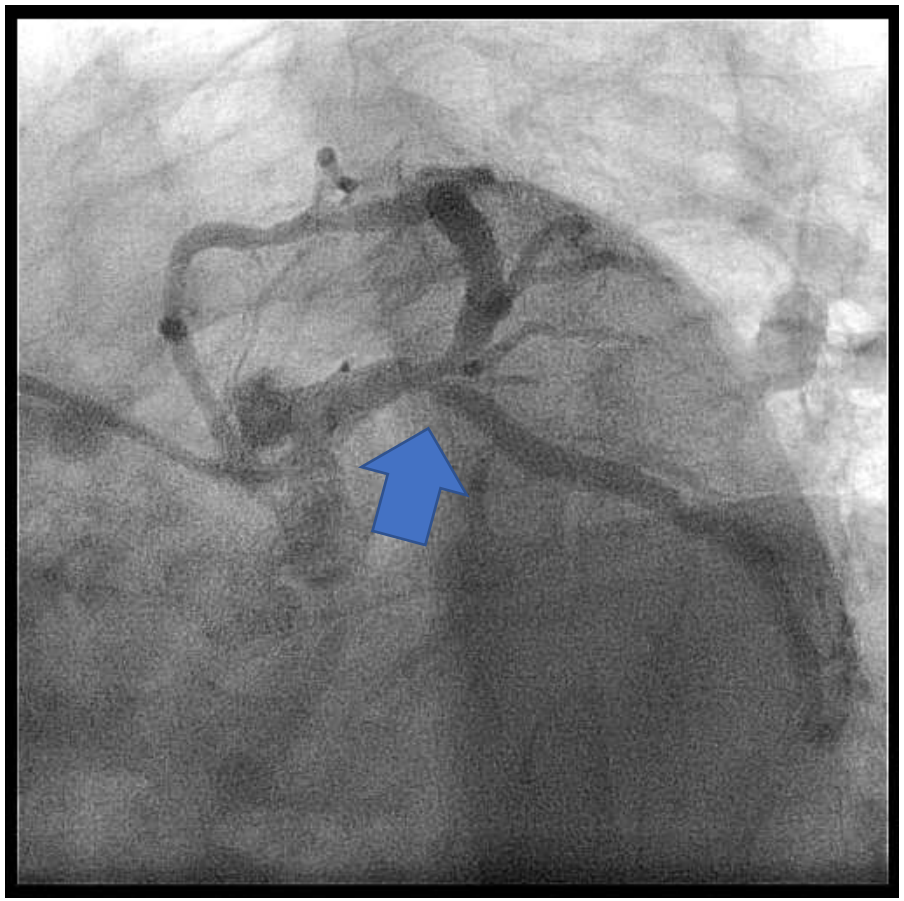


You Can Select Bigger Stent When You Use IVUS

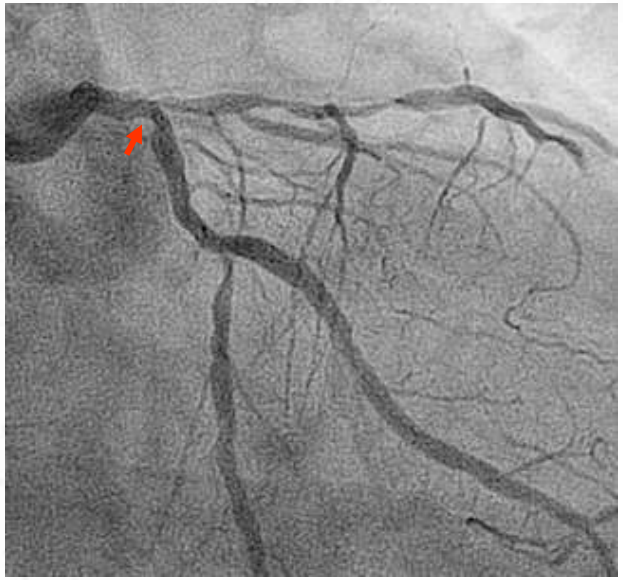


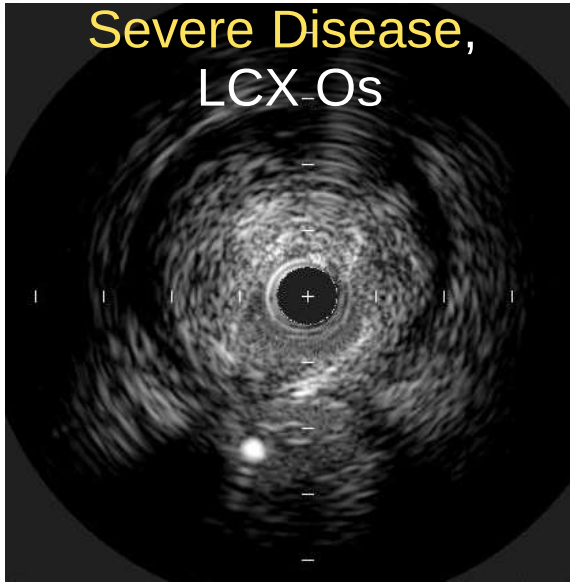
Andell P et al. Circ Cardiovasc Interv. 2017;10:e004813

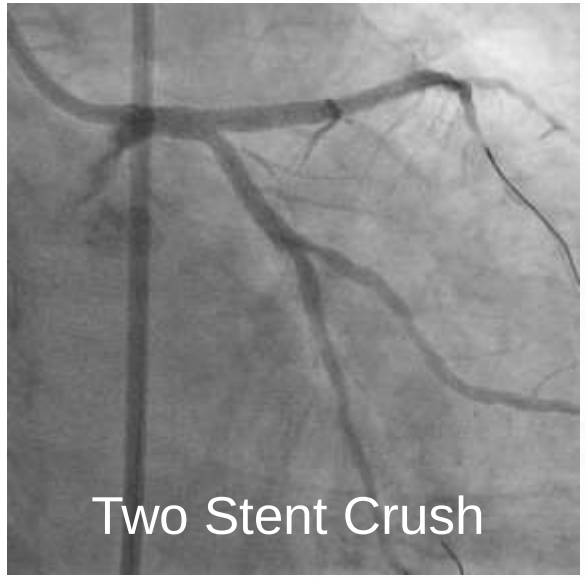
For Bifurcation Stenosis

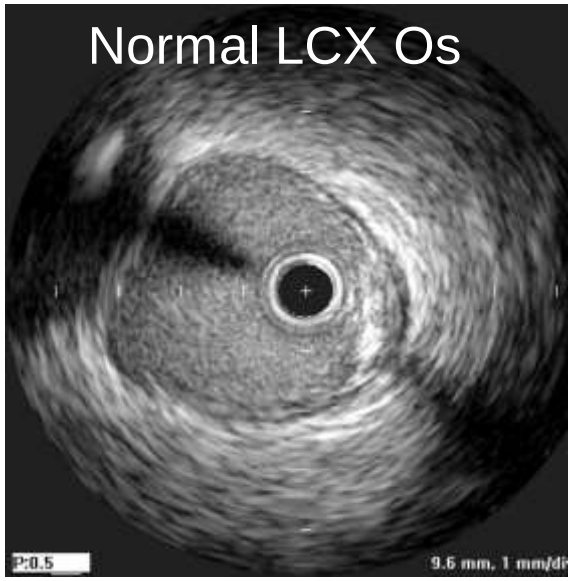


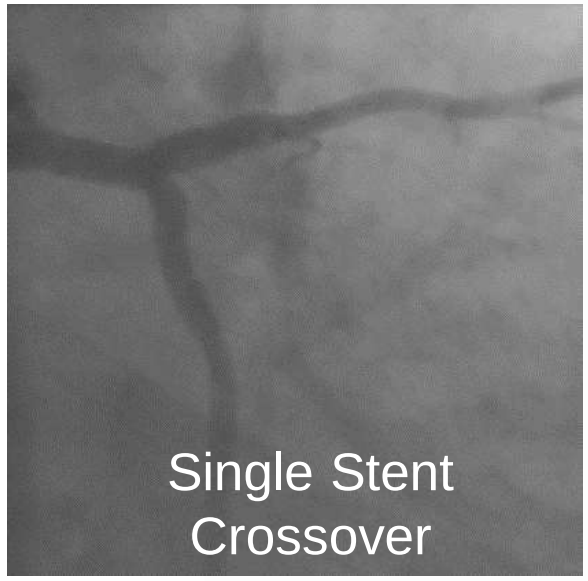
If Either FFR is Positive, LCX Ostial Disease (By IVUS) Determines Strategy







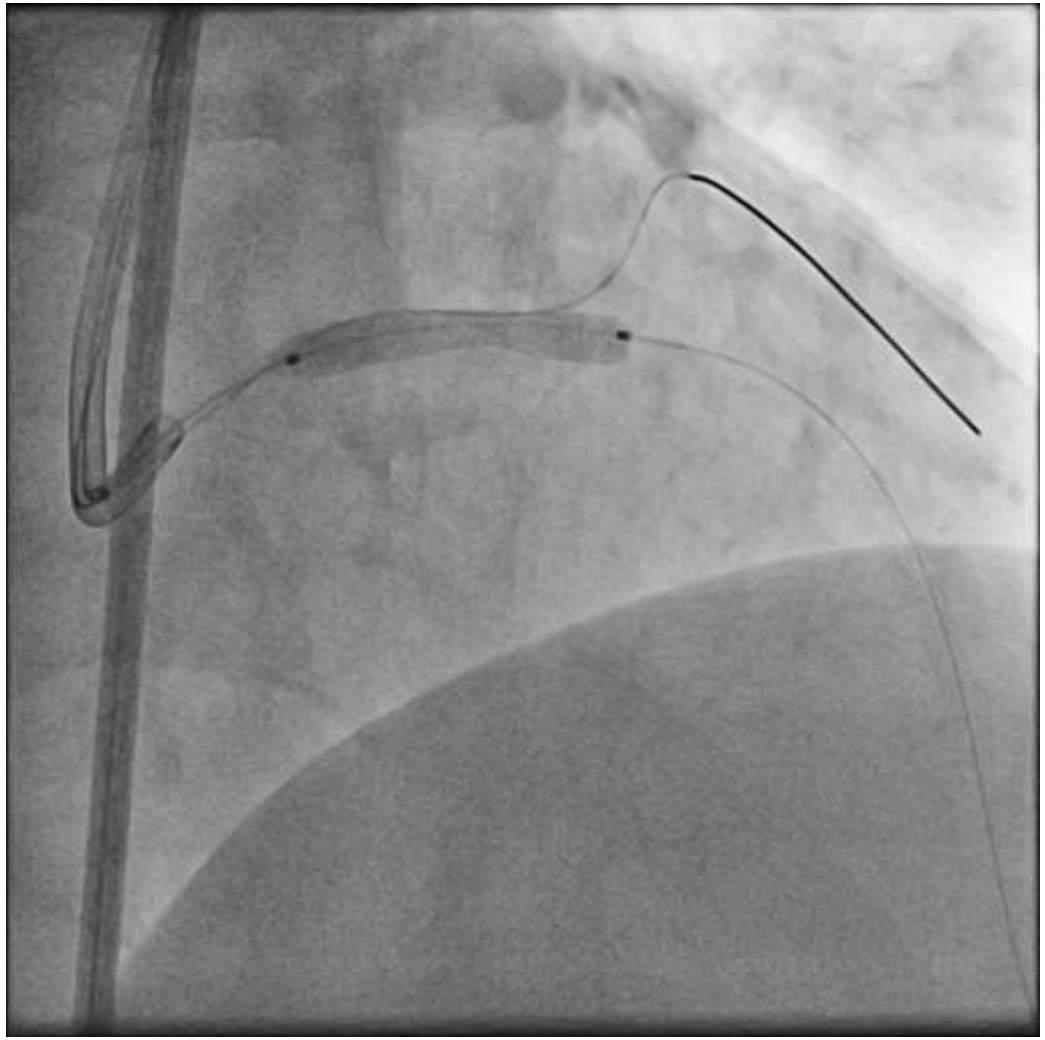




LAD, FFR 0.68

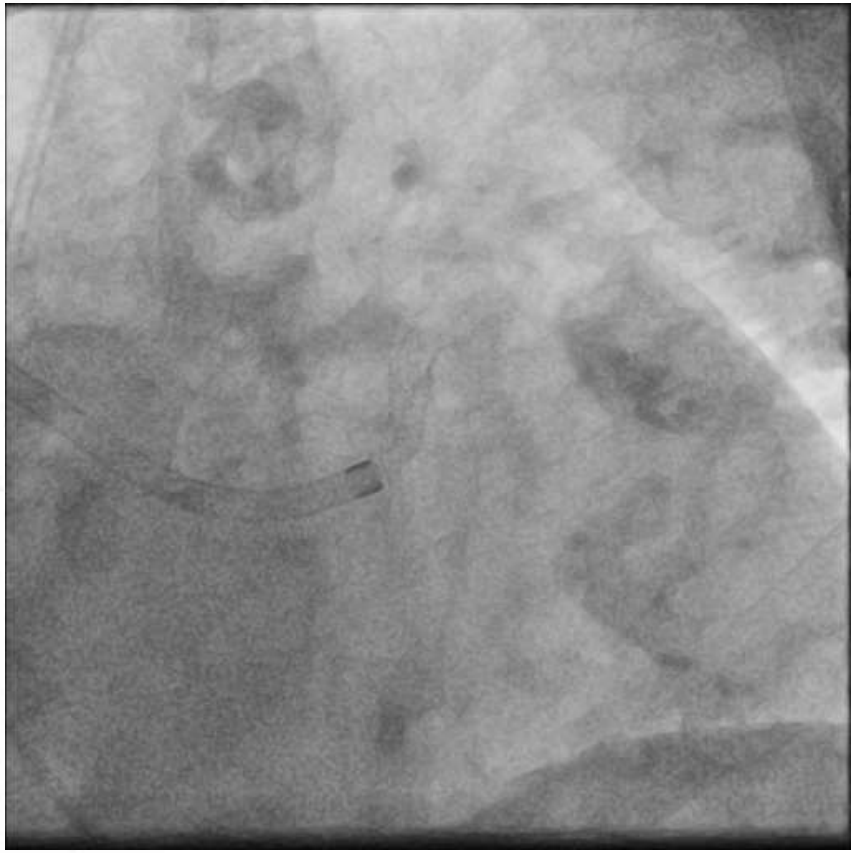

COM 1
PressureWire
EDIT
PRINT
PLAY
EXPORT
RENAME
DELETE
SETUP
2018-01-31 17:41:33
(79)
Pa mean
(54)
Pd mean
0.68
FFR
73.08
CURSOR
AUTOSCALE

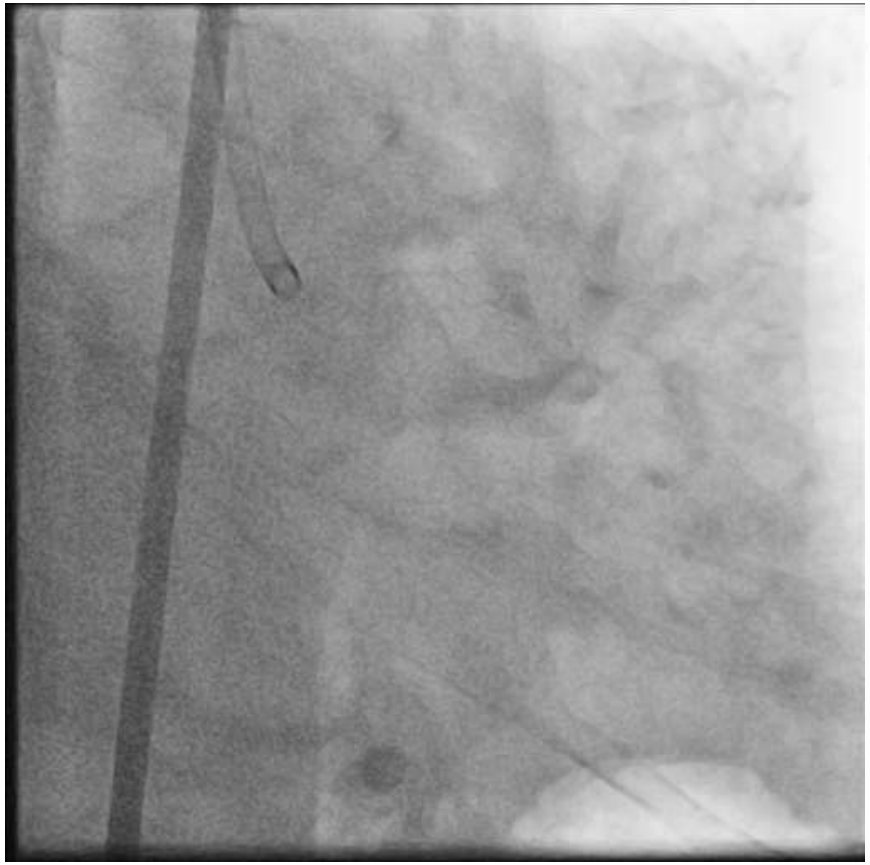
PCI at LM-LAD



LM-pLAD Orsiro 4.0 (22)

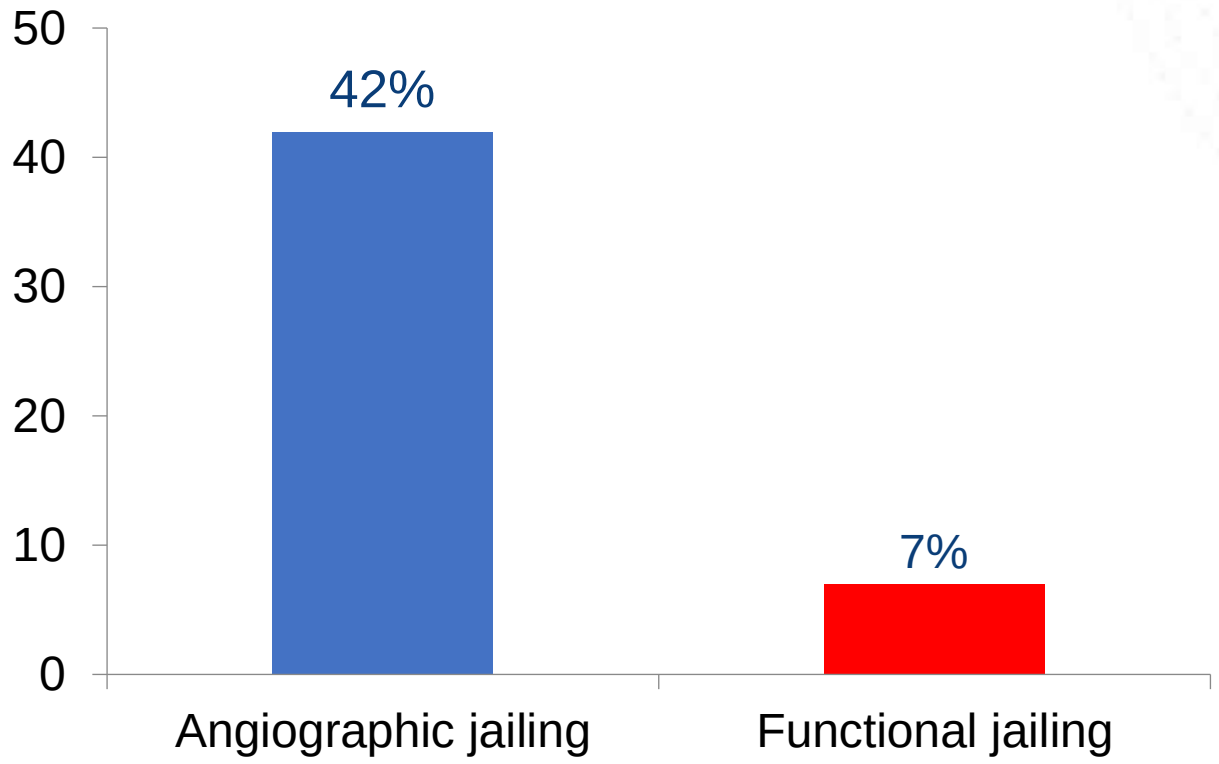
Post Simple Cross Over Stenting





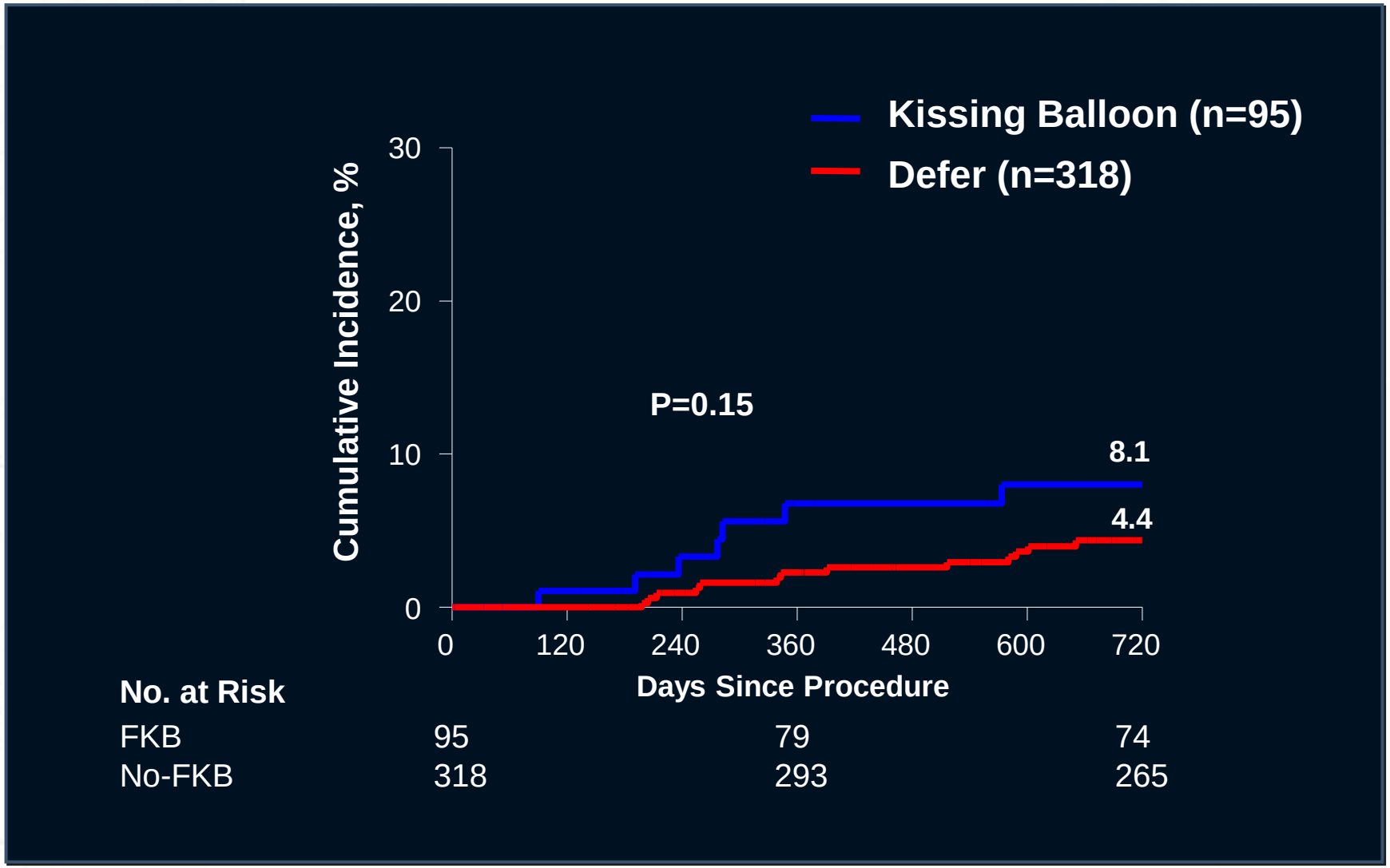
Functionally Significant LCX Jailing

After Stent Crossover (LCX ostial DS<50%)



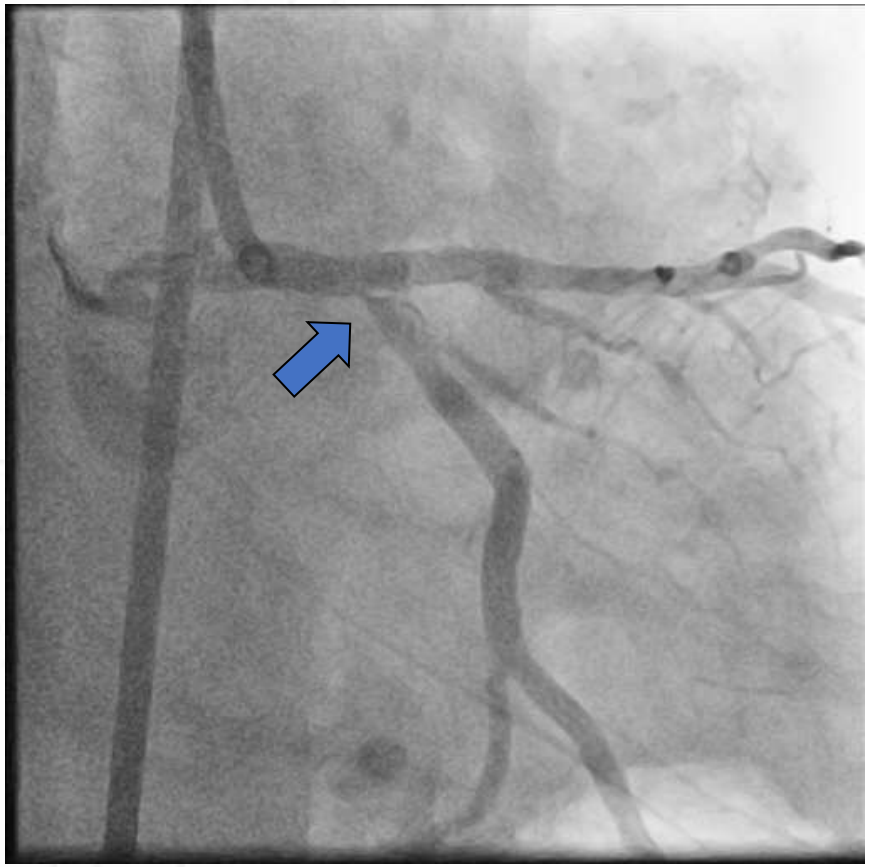
Kang SJ, Catheterization and Cardiovascular Interventions. 2014;83(4):545-52.

Left Main-TLR *at 2 Years*

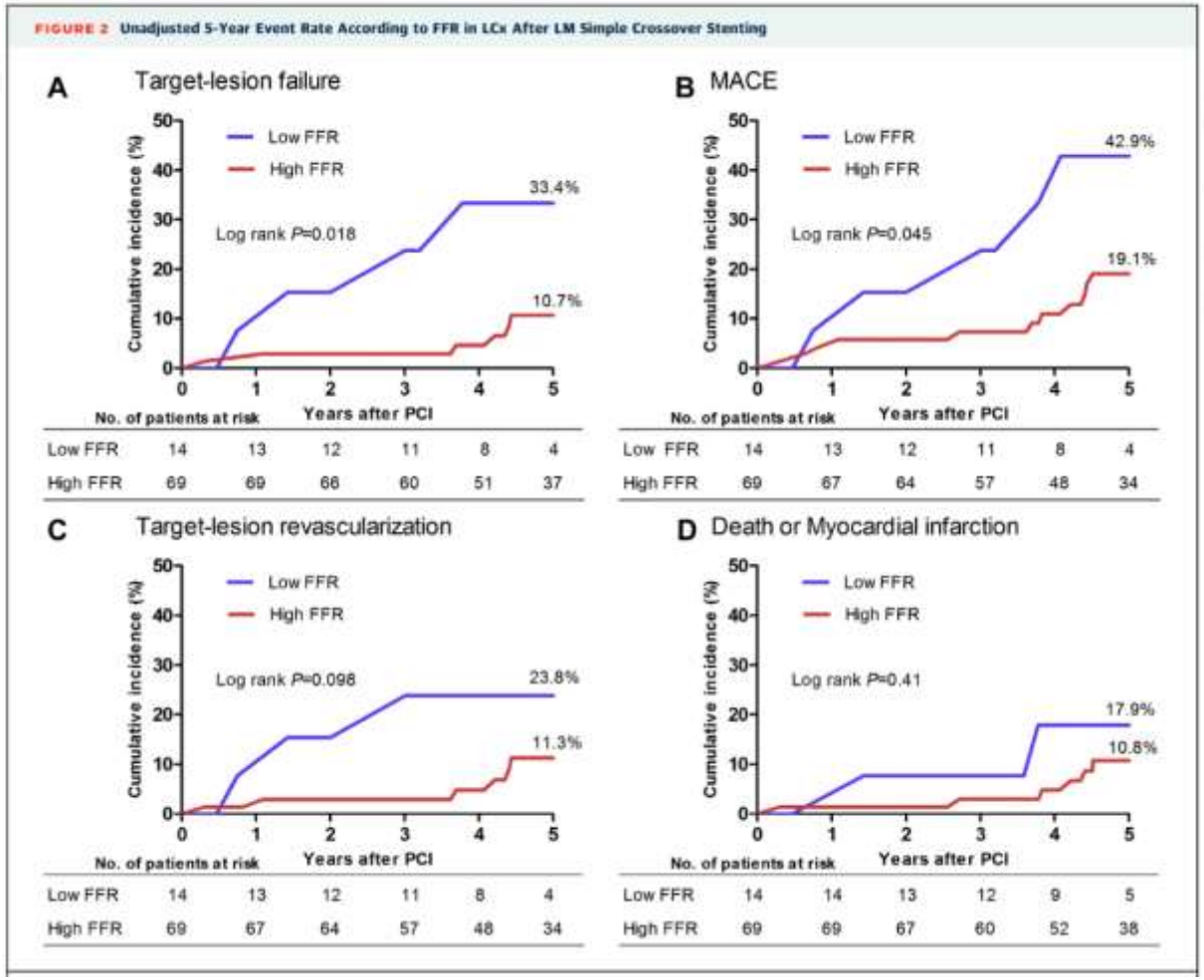


Ahn JM, Park SJ, et al. Am J Cardiol. 2017 Feb 15;119(4):528-534

POST PCI LCX FFR 0.82

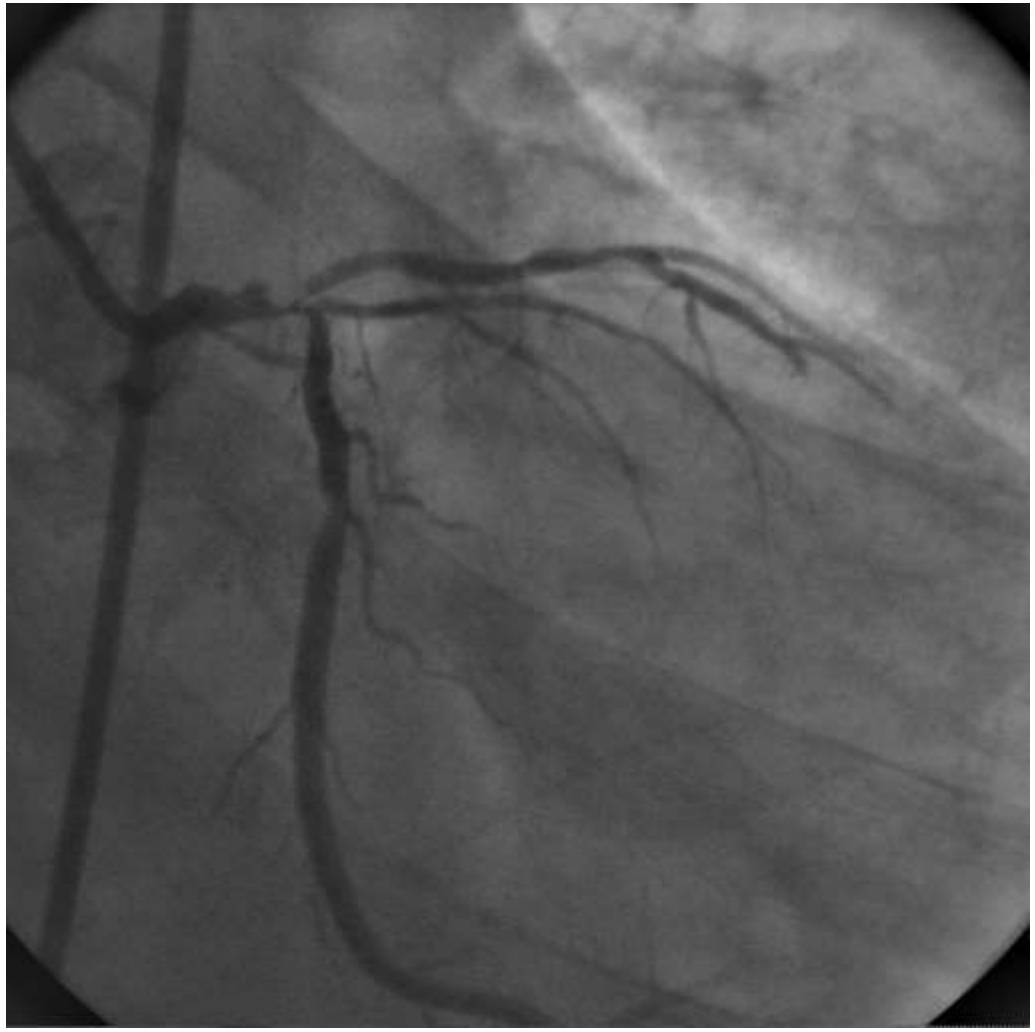


LCX FFR after Simple Cross Over



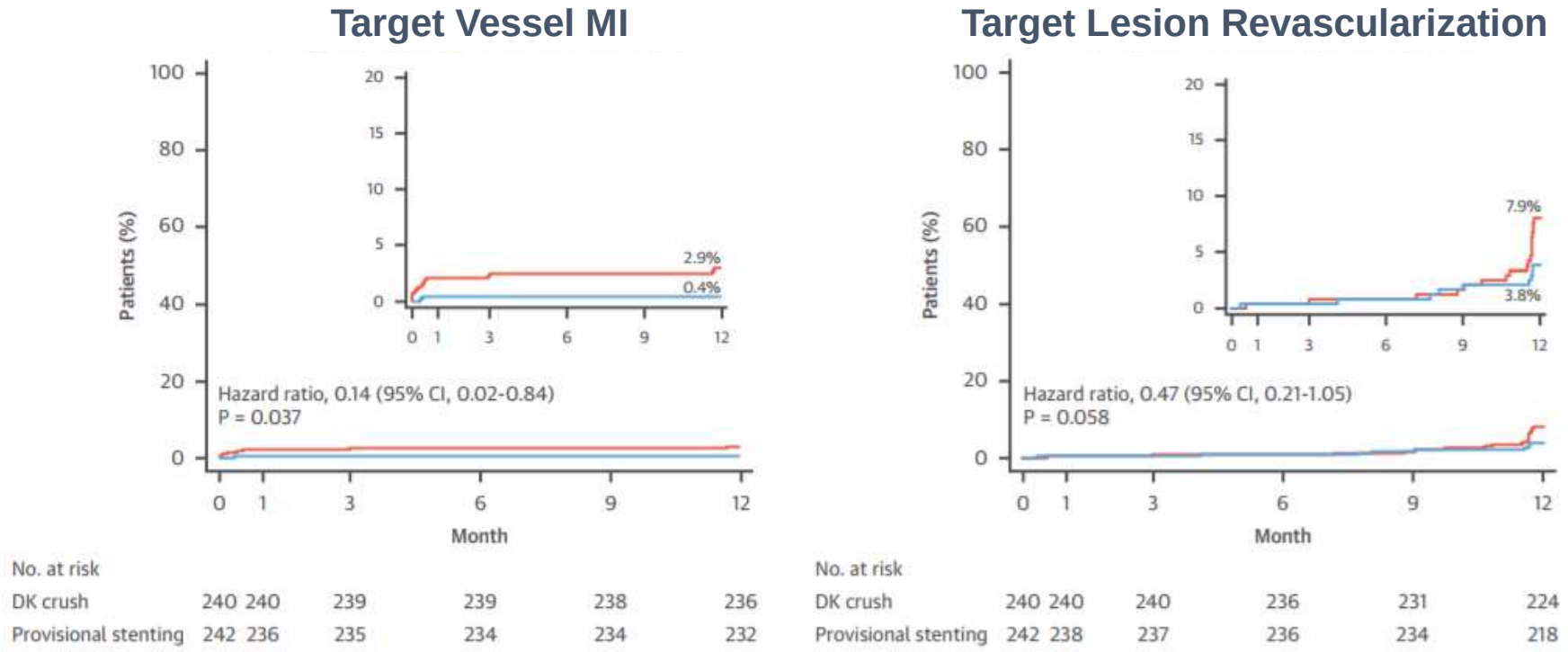
J Am Coll Cardiol Intv 2019;12:847–55

For True Bifurcation



Don’t Do One Stent For ***True*** Bifurcation

DK CRUSH V



Chen SL et al. J Am Coll Cardiol. 2017 Nov 28;70(21):2605-2617

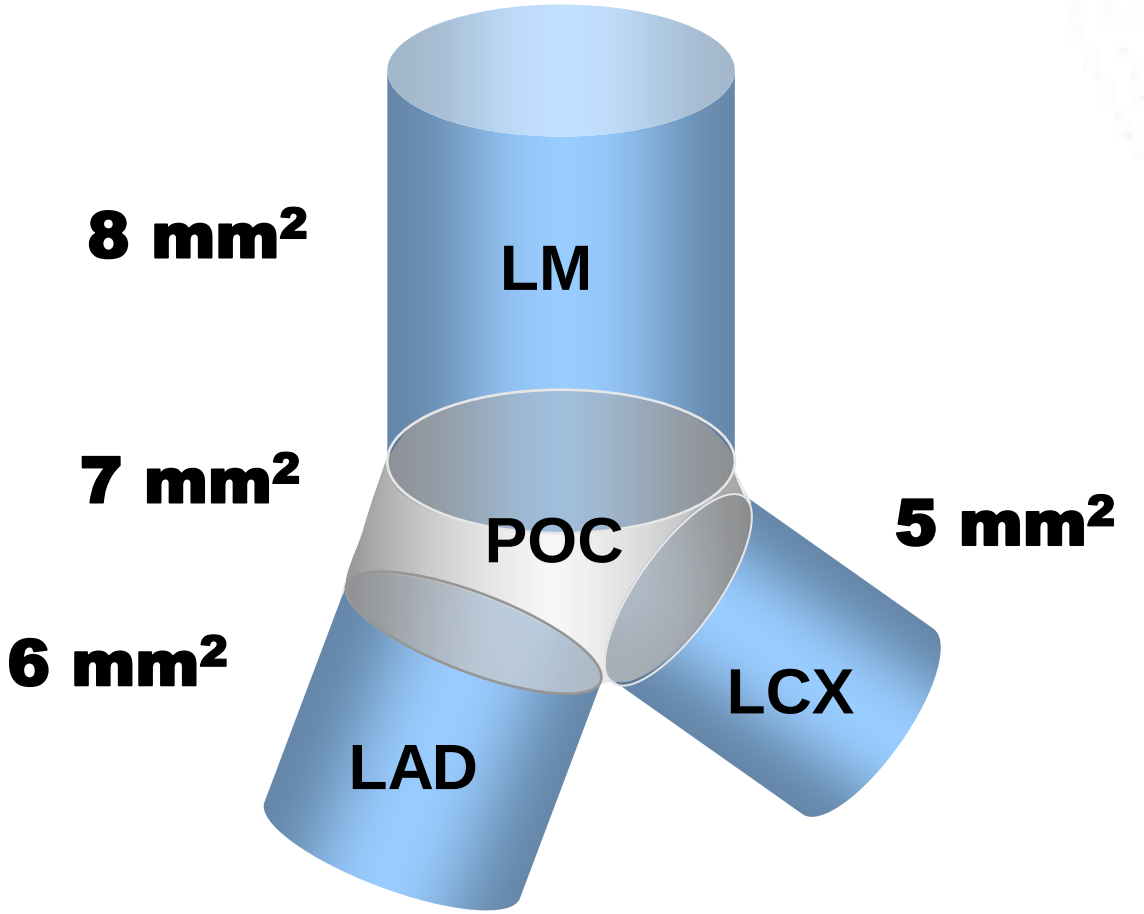
Is There Difference in Outcomes?

	Advantages	Disadvantages
Culotte	Compatible with 6 Fr guider Independent of bifurcation angle Predictable scaffolding	Leaves multiple layers of strut Potential acute closure of MB
Classic crush	Relatively simple Low risk of SB occlusion Good coverage of SB ostium	Difficult FKI Requires 7 or 8 Fr guider Leaves multiple layers of strut
Mini-crush	Minimises multiple layers of strut Good scaffolding at SB ostium Facilitates FKI Compatible with 6 Fr guider using balloon crushing	Still leaves multiple layers of strut
DK-crush	Good scaffolding at SB ostium Facilitates FKI Compatible with 6 Fr guider	Complex procedural steps
Simultaneous kissing stenting	No risk of occlusion for both branches No need to re-cross any stent Technically easy and quick	Requires 7 or 8 Fr guider Leaves long metallic carina Over-dilatation in proximal MB Diaphragmatic membrane formation at the overlapped stents Difficulty in repeat revascularisation
T-stenting	Good SB scaffolding with angles >70°	Potential gap at SB ostium Protrusion of SB stent into the MB (in the case of TAP)

Roh JH et al. Eurointervention 2015;11 Suppl V:V125-8

Post LM Stenting Optimization

Effective IVUS Stent Area (Rule of 5,6,7,8)



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

2018 ESC Guideline

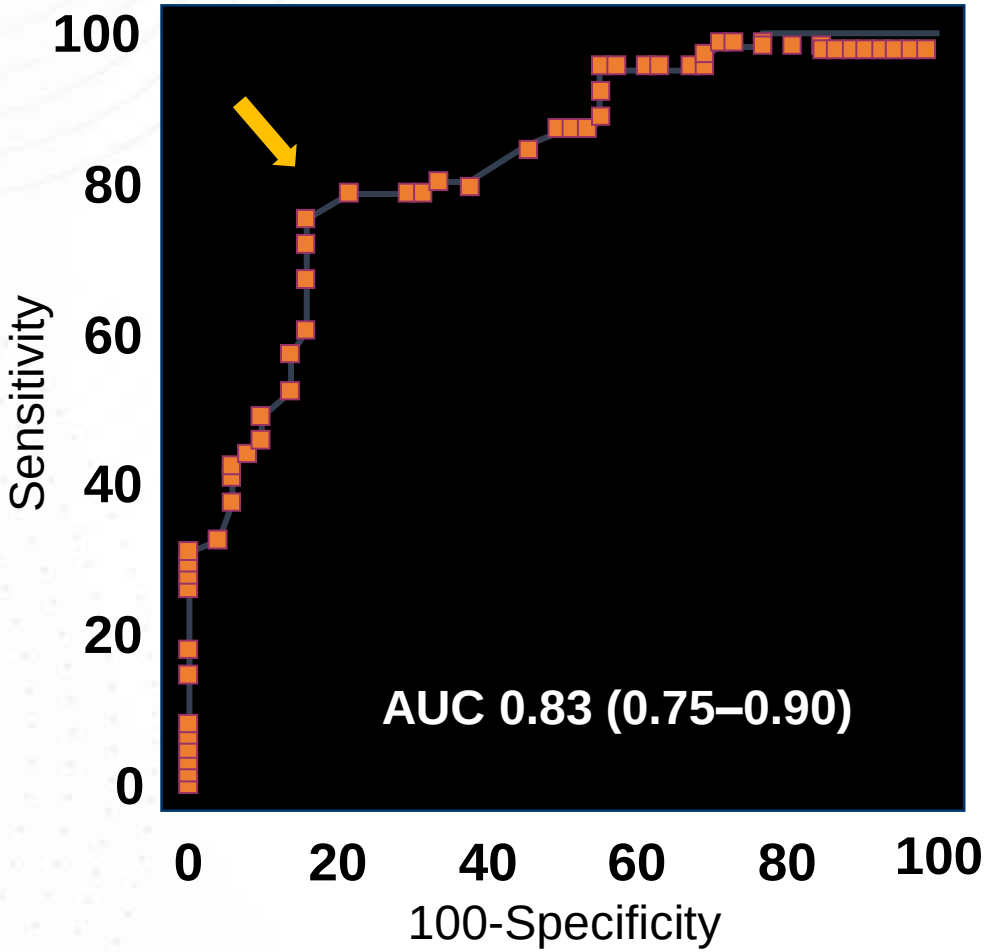
Recommendations on functional testing and intravascular imaging for lesion assessment

Recommendations	Class[a]	Level[b]
When evidence of ischaemia is not available, FFR or iwFR are recommended to assess the haemodynamic relevance of intermediate-grade stenosis.[15,17,18,39]	I	A
FFR-guided PCI should be considered in patients with multivessel disease undergoing PCI.[29,31]	IIa	B
IVUS should be considered to assess the severity of unprotected left main lesions.[35–37]	IIa	B

FFR = fractional flow reserve; iwFR = instantaneous wave-free ratio; IVUS = intravascular ultrasound; PCI = percutaneous coronary intervention.
[a]Class of recommendation.
[b]Level of evidence.

IVUS MLA

Matched with FFR <0.80 (N=112)



Cut-off = 4.5 mm²

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

Park SJ, Ahn JM et al. *JACC Interv, 2014;7(8):868-874*

Unmet Need for FFR in LM PCI

- The concept of FFR use in LMCA has been evaluated in relatively small observational studies. Large randomized clinical trial would be necessary.
- Because of complex nature of LMCA, operator should be careful to measure FFR and interpret the results.