SASCI Visiting Professor Evening Lecture Series 2016
Prof Augusto Pichard

Lecture:

Revascularisation in 2016: Indications, strategies and techniques in the laboratory

Made possible by an unconditional educational grant from:

Medtronic
Further, Together

pharma dynamics
EFFECTIVE AFFORDABLE HEALTHCARE

Revascularization in 2016.
Changes in Indications, Strategies and Techniques.

Augusto Pichard, M.D.

Senior Consultant

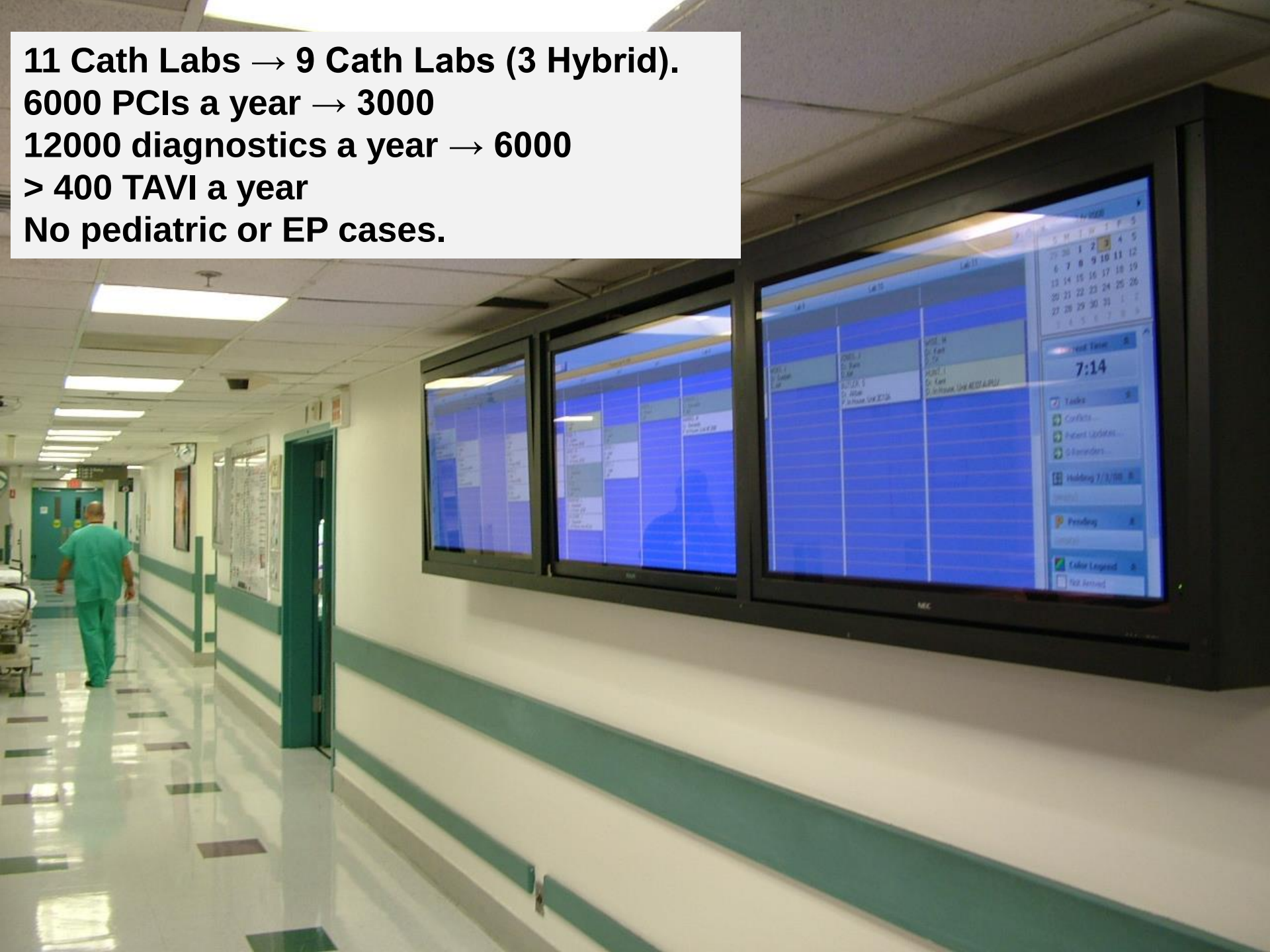
Innovation and Structural Heart Disease,
Medstar Washington Hospital Center.
Professor of Medicine (Cardiology),

Georgetown University Medical School.

Washington, DC

MedStar Heart & Vascular Institute | Cleveland Clinic Heart and Vascular Institute

Washington Hospital Center


11 Cath Labs → 9 Cath Labs (3 Hybrid).
6000 PCIs a year → 3000
12000 diagnostics a year → 6000
> 400 TAVI a year
No pediatric or EP cases.
7:14

Holding Area (Pre and Post Procedure)

Dr. A.Pichard

Swing Lab

Indications for Revascularization in Stable CAD. ESC 2014

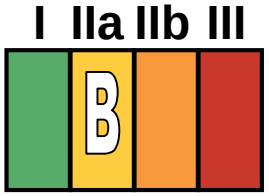
Extent of CAD (anatomical and/or functional)		Class[b]	Level[c]	References
For prognosis	Left main disease with stenosis >50%[a]	I	A	108,134,135
	Any proximal LAD stenosis >50%[a]	I	A	94,108,135,136
	Two-vessel or three-vessel disease with stenosis > 50%[a] with impaired LV function (LVEF<40%)[a]	I	A	93,94,108,112, 121,135,137–142
	Large area of ischaemia (>10% LV)	I	B	54,91,97,99,143,144
	Single remaining patent coronary artery with stenosis >50%[a]	I	C	
For symptoms	Any coronary stenosis >50%[a] in the presence of limiting angina or angina equivalent, unresponsive to medical therapy	I	A	54,96,105,108, 118–120,145

CABG or PCI in Stable CAD
ESC 2014

Extent of CAD	CABG		PCI		
	Class[a]	Level[b]	Class[a]	Level[b]	Ref[c]
One or two-vessel disease without proximal LAD stenosis.	IIb	C	I	C	
One-vessel disease with proximal LAD stenosis.	I	A	I	A	107,108,160, 161,178,17
Two-vessel disease with proximal LAD stenosis.	I	B	I	C	108,135,137
Left main disease with a SYNTAX score ≤ 22.	I	B	I	B	17,134,170
Left main disease with a SYNTAX score 23–32.	I	B	IIa	B	17
Left main disease with a SYNTAX score >32.	I	B	III	B	17
Three-vessel disease with a SYNTAX score ≤ 22.	I	A	I	B	17,157,175,176
Three-vessel disease with a SYNTAX score 23–32.	I	A	III	B	17,157,175,176
Three-vessel disease with a SYNTAX score >32.	I	A	III	B	17,157,175,176

Heart Team Approach

A Heart Team approach to revascularization is recommended in patients with **unprotected left main or complex CAD.**



Calculation of the **STS and SYNTAX scores** is reasonable in patients with unprotected left main and complex CAD.

Revascularization for Stable CAD. ESC 2014

- **Indications:**
  - **>50% lesion**
  - **Persistent symptoms despite optimal medical therapy.**
  - **RCT and Metanalysis of CABG vs. OMC and PCI vs OMC demonstrated**
    - **better angina relief with revascularization**
    - **Improved survival for pts with LMCA and 3VCAD.**
    - **Greater benefit in pts with impaired LV function.**
  - **DES vs. BMS: Current data proves lower stent thrombosis, MI and death with DES.**

Appropriate Use Criteria (AUC) for Diagnostic Angio, for PCI and for CABG.

APPROPRIATENESS CRITERIA

ACCF/SCAI/STS/AATS/AHA/ASNC 2009 Appropriateness Criteria for Coronary Revascularization

A Report of the American College of Cardiology Foundation Appropriateness Criteria Task Force, Society for Cardiovascular Angiography and Interventions, Society of Thoracic Surgeons, American Association for Thoracic Surgery, American Heart Association, and the American Society of Nuclear Cardiology

Endorsed by the American Society of Echocardiography, the Heart Failure Society of America, and the Society of Cardiovascular Computed Tomography

Coronary Revascularization Writing Group

Manesh R. Patel, MD, *Chair*

Gregory J. Dehmer, MD, FACC, FACP, FSCAI, FAHA*
John W. Hirshfeld, MD†
Peter K. Smith, MD, FACC, FSTS‡
John A. Spertus, MD, MPH, FACC†

*Society for Cardiovascular Angiography and Interventions Representative; †American College of Cardiology Foundation Representativ
‡Society of Thoracic Surgeons Representative

Appropriate Use Criteria (AUC) For Revascularization.

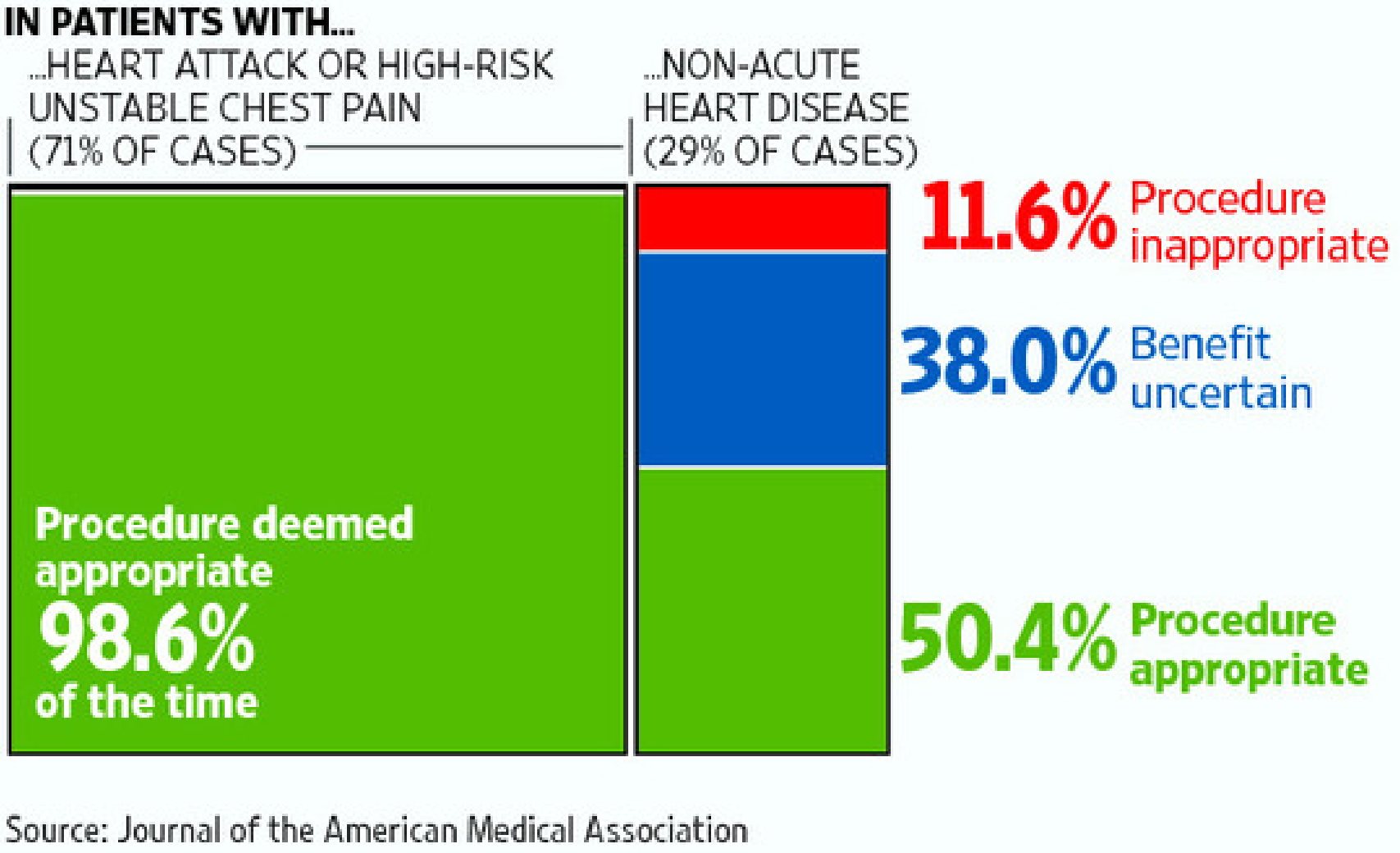
Low Risk Findings on Noninvasive Study					
Symptoms **Med. Rx**					
Class III or IV Max Rx	U	A	A	A	A
Class I or II Max Rx	U	U	A	A	A
Asymptomatic Max Rx	I	I	U	U	U
Class III or IV No/min Rx	I	U	A	A	A
Class I or II No/min Rx	I	I	U	U	U
Asymptomatic No/min Rx	I	I	U	U	U
Coronary Anatomy	CTO of 1 vz.; no other disease	1-2 vz. disease; no Prox. LAD	1 vz. disease of Prox. LAD	2 vz. disease with Prox. LAD	3 vz. disease; no Left Main

Appropriate Use Criteria (AUC) For Revascularization.

Asymptomatic					
Stress Test Med. Rx					
High Risk Max Rx	U	A	A	A	A
High Risk No/min Rx	U	U	A	A	A
Int. Risk Max Rx	U	U	U	U	A
Int. Risk No/min Rx	I	I	U	U	A
Low Risk Max Rx	I	I	U	U	U
Low Risk No/min Rx	I	I	U	U	U
Coronary Anatomy	CTO of 1 vz.; no other disease	1-2 vz. disease; no Prox. LAD	1 vz. disease of Prox. LAD	2 vz. disease with Prox. LAD	3 vz. disease; no Left Main

Appropriateness in 500,000 US Cases

JAMA 2011;306:53-61



Society for Cardiac Angiography and Interventions. Appropriateness Criteria Calculation.

“ SCAI AUC Tools “

2014 ACC/AHA/AATS/PCNA/SCAI/STS Focused Update of the Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease.

J Am Coll Cardiol. 2014; doi:10.1016/j.jacc.2014.07.017

- There are no high-quality data on which to base recommendations for performing diagnostic coronary angiography because no study has randomized patients with Stable IHD to either catheterization or no catheterization.
- Additionally, the "incremental benefit" of detecting or excluding CAD by coronary angiography remains to be determined.
- The ISCHEMIA trial is currently randomizing patients with at least moderate ischemia on stress testing to a strategy of optimal medical therapy alone (with coronary angiography reserved for failure of medical therapy) or routine cardiac catheterization followed by revascularization (when appropriate) plus optimal medical therapy.

National Cardiovalscular Data Registry (NCDR) in USA.

Monitors and reports PCI activity

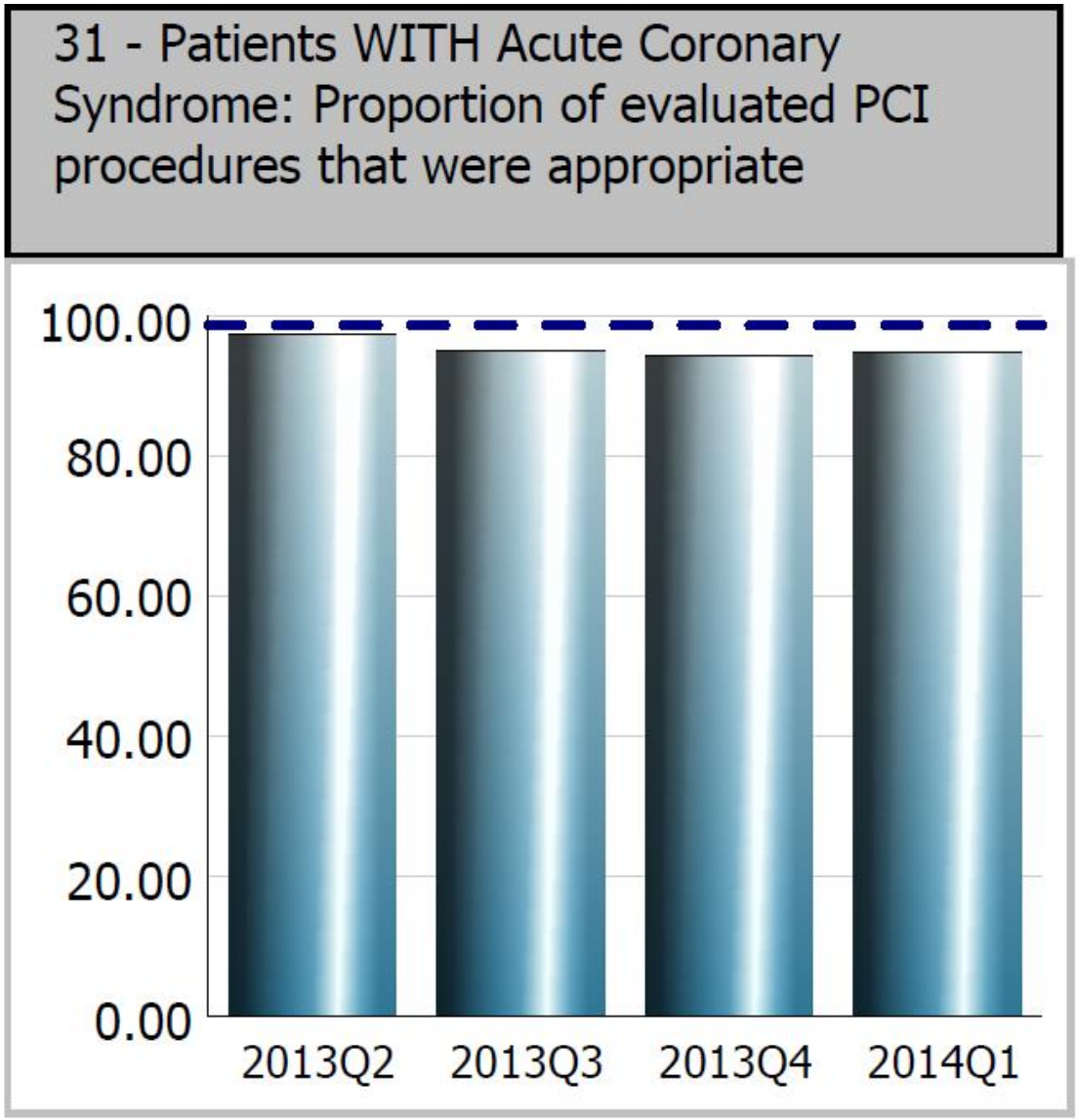
CathPCI Registry®

Washington Hospital Center compared to 50th Percentile value for All US Hospitals - Quarter ending 2014Q1

Metric Name	My Hospital 2014Q1	
PCI Performance Measures		
1 - PCI in-hospital risk adjusted mortality (all patients)	1.83	B
38 - Composite: Discharge Medications in Eligible PCI Patients	93.6	B
2 - Proportion of elective PCIs with prior positive stress or imaging study	73.77	A
4 - Proportion of STEMI patients receiving immediate PCI w/in 90	80.00	B
5 - Median time from ED arrival at STEMI transferring facility to ED arrival at STEMI receiving facility among transferred patients.	73	A
6 - Median time from ED arrival at STEMI transferring facility to immediate PCI at STEMI receiving facility among transferred patients (in minutes)	111	B
7 - Median fluoro time (in minutes)	10	
8 - Proportion of patients with aspirin prescribed at discharge	96.2	B
9 - Proportion of patients with a P2Y12 inhibitor prescribed at discharge	99.3	B
10 - Statins prescribed at discharge	97.4	A

CathPCI Registry®

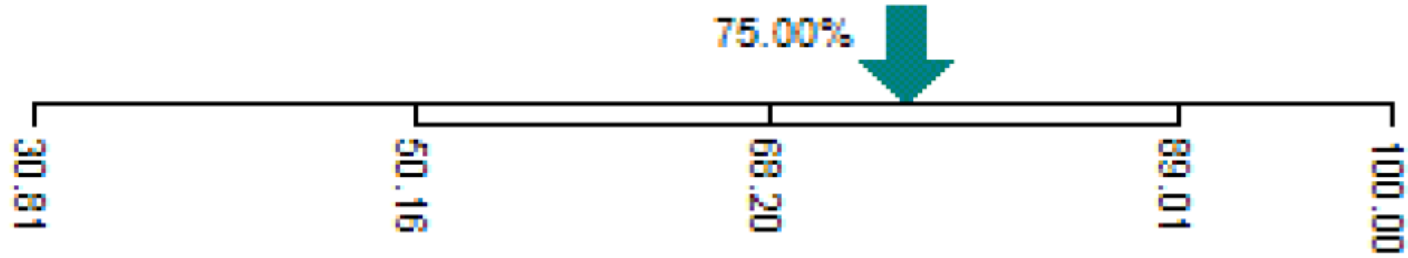
247454 - Washington Hospital Center compared to 50th Percentile value for All US Hospitals - Quarter ending 2014Q1



CathPCI Registry® Physician Dashboard

247454 - MedStar Washington Hospital Center
1669422960 - PICHARD,AUGUSTO

Proportion of elective PCIs with prior positive stress or imaging study



Metric	My Performance	Eligible Patients	US 50th Pctl	US 90th Pctl
Proportion of elective PCI procedures (excluding patients with ACS) with an antecedent stress or imaging study with a positive result (suggestive of ischemia) or with a fractional flow reserve value of <=0.8 during the PCI procedure	75.00%	48	68.2	100

Concerns with Public Reporting.

Washington, Feb 2016

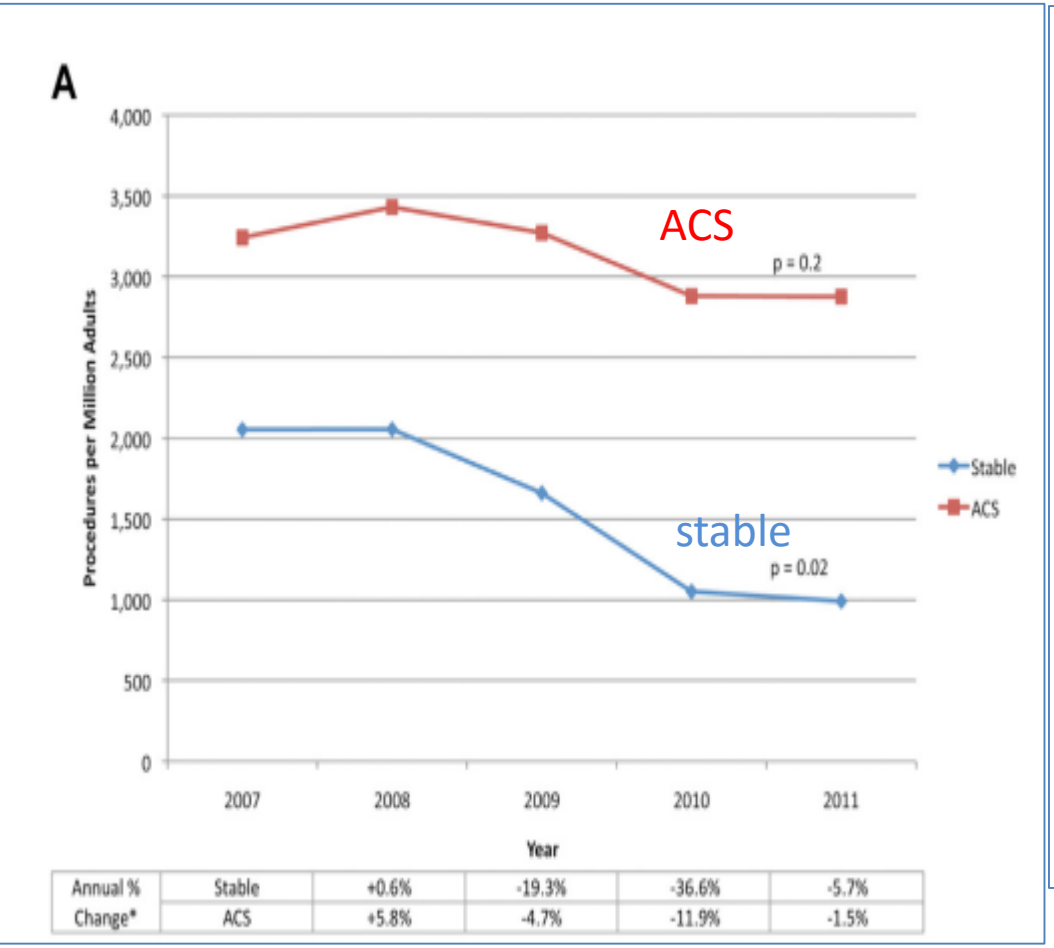
ACC and AHA have proposed to exclude from public reporting patients with OOH cardiac arrest and patients in cardiogenic shock.

Public reporting of Physician PCI Mortality could lead to:

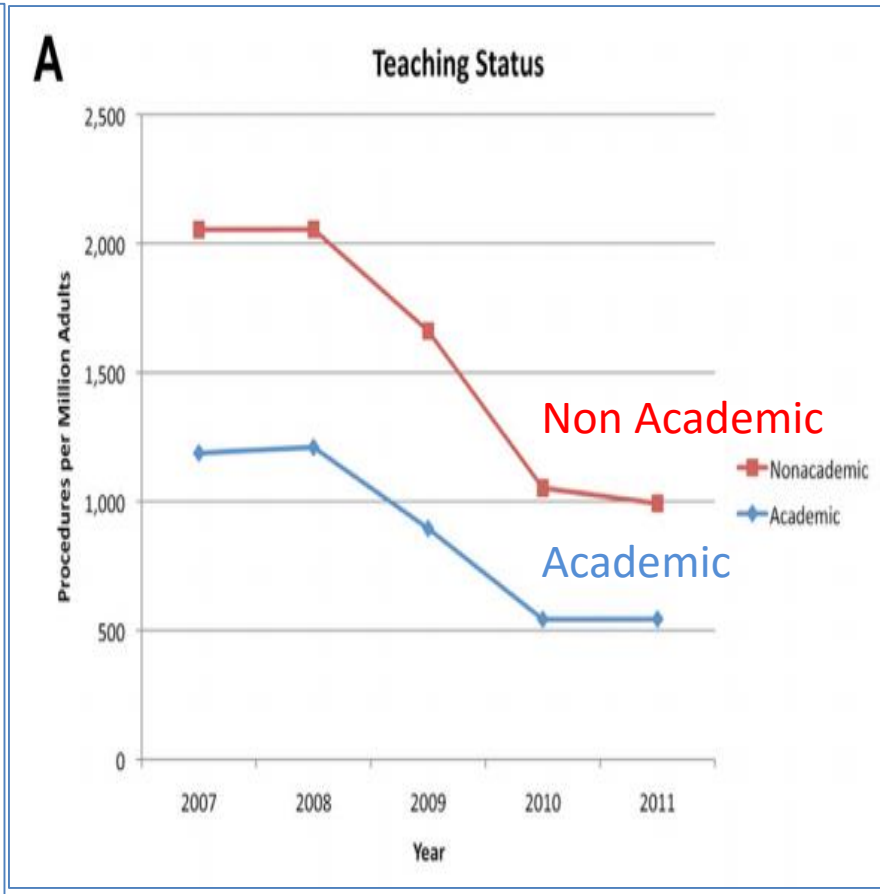
- **"risk-averse behavior" on the part of physicians**
- **encouragement to transfer such patients to other facilities.**

PCI in USA for Stable and Unstable CAD.

Kim et al. AJC 2014;114:1003-10



Annual % Change*	Stable	+0.6%	-19.3%	-36.6%	-5.7%
	ACS	+5.8%	-4.7%	-11.9%	-1.5%



Summary

Close scrutiny and public reporting of indications and outcomes for diagnostic and interventional procedures is ongoing.

Intention:

- insure patients are getting maximum benefit from procedures.

- justify the expenses involved in these procedures.

Angiography (and QCA) is no Longer the Gold Standard to Indicate Revascularization

1. **Angiography is adequate for:**
   a. **mild lesions (20-40%).**
   b. **severe lesions (>80-90%).**
2. **Angiography is not adequate for intermediate lesions: 50-80%.**
3. **Angio is least accurate in LMCA disease.**

Medstar Heart Institute

Cleveland Clinic
Heart and Vascular Institute

1. **Angio is no longer the gold standard**
2. **IVUS has been the best for severity analysis**
3. **FFR proven physiologically accurate and clinically useful**
4. **IVUS FFR correlations surprising**
5. **New paradigm: FFR for inervention or not. IVUS for prognosis**

Medstar Heart Institute

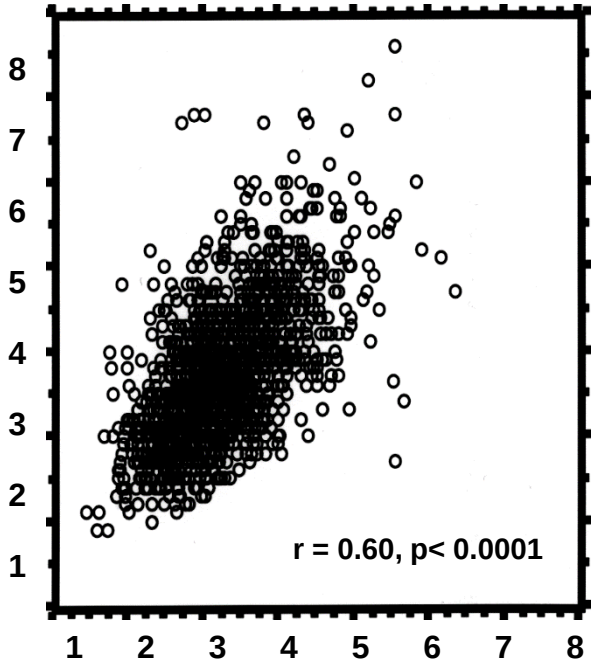
Cleveland Clinic
Heart and Vascular Institute

QCA inaccurate for Lesion Dimensions

WHC: Mintz et al 1996

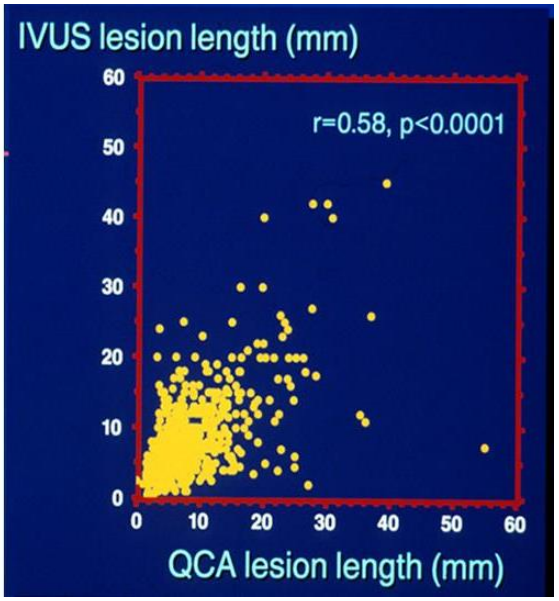
n = 2545 lesions

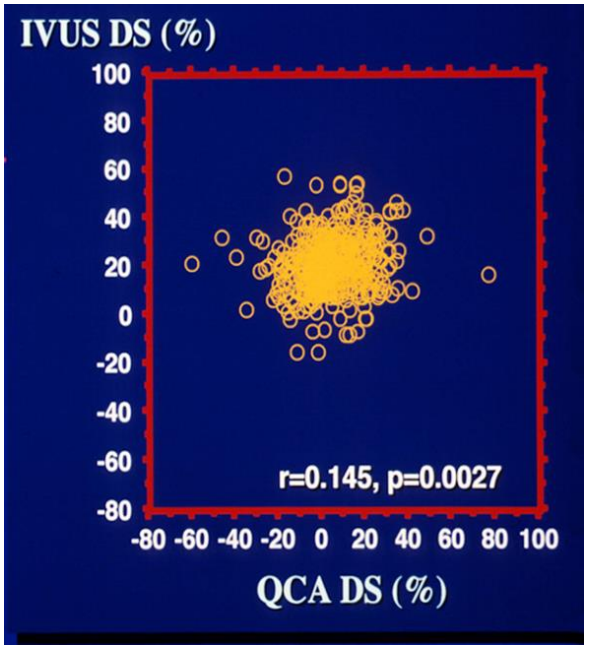
IVUS maximum reference lumen diameter (mm)



QCA reference diameter

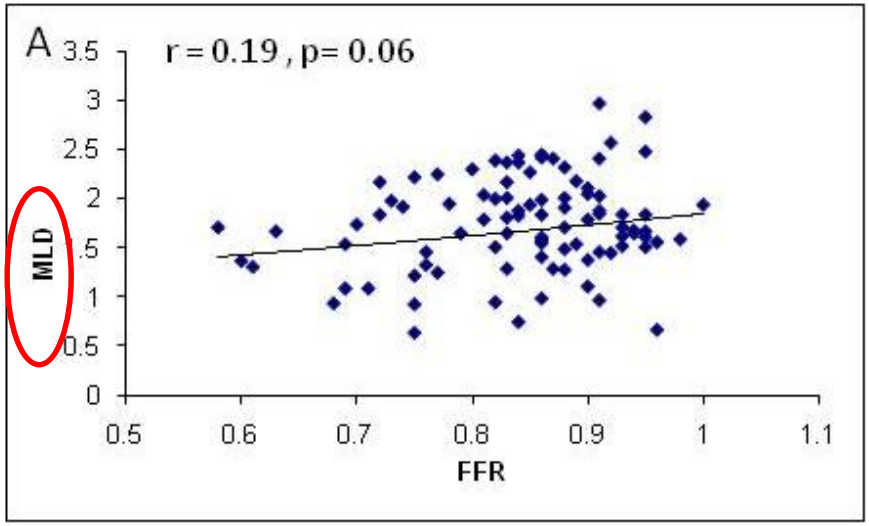
n= 616 stents

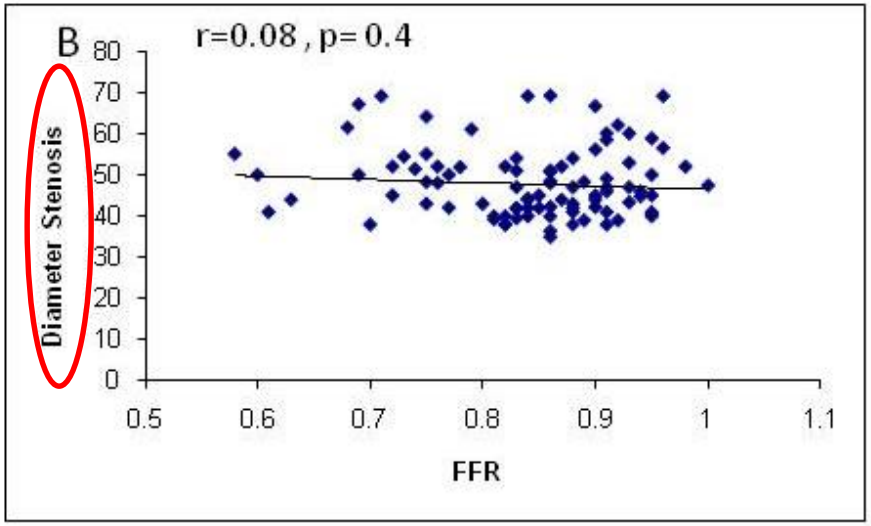


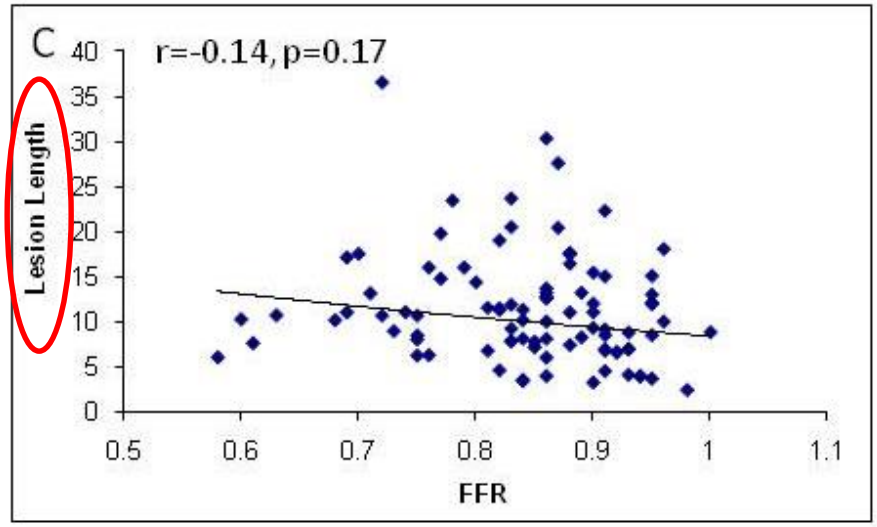


FFR vs QCA

WHC: Ben-Dor et al. Eurointervension 2011 7:225-33

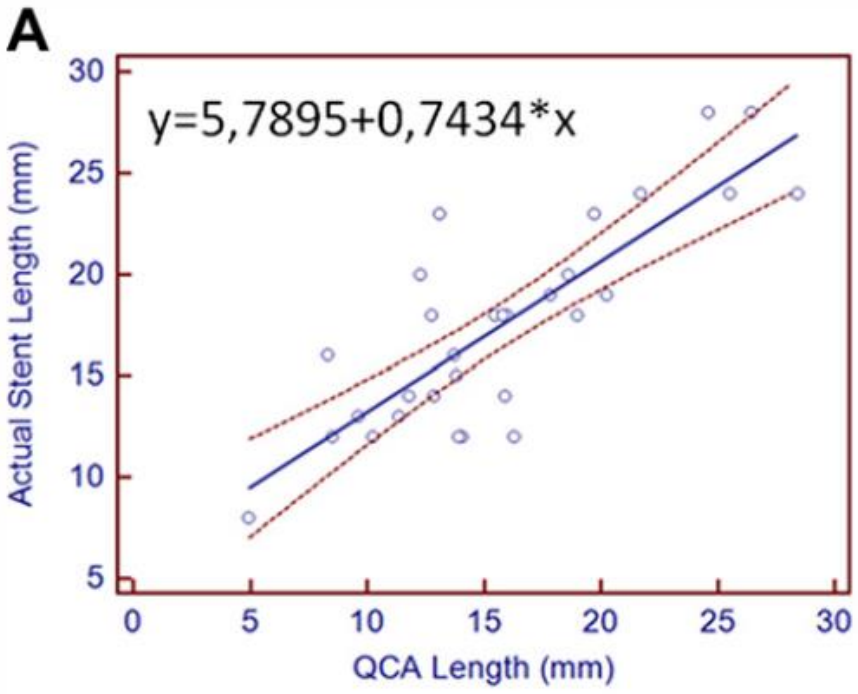


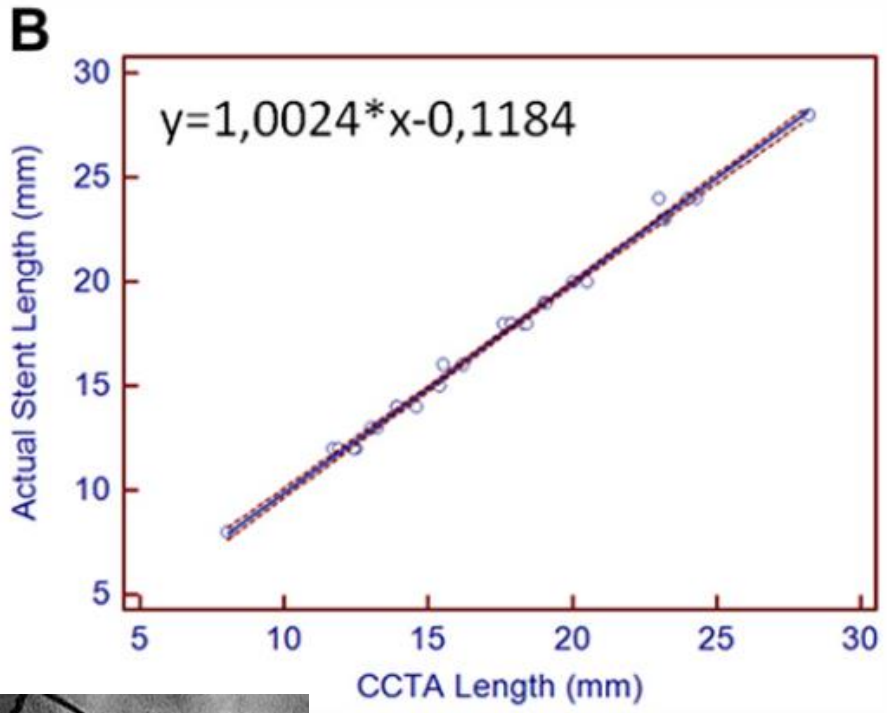


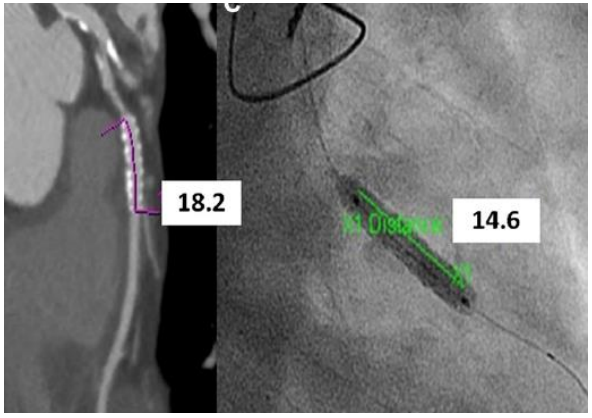


Angio vs CT for Stent Length

Ciszewski et al. AJC 2013;111:1111-6

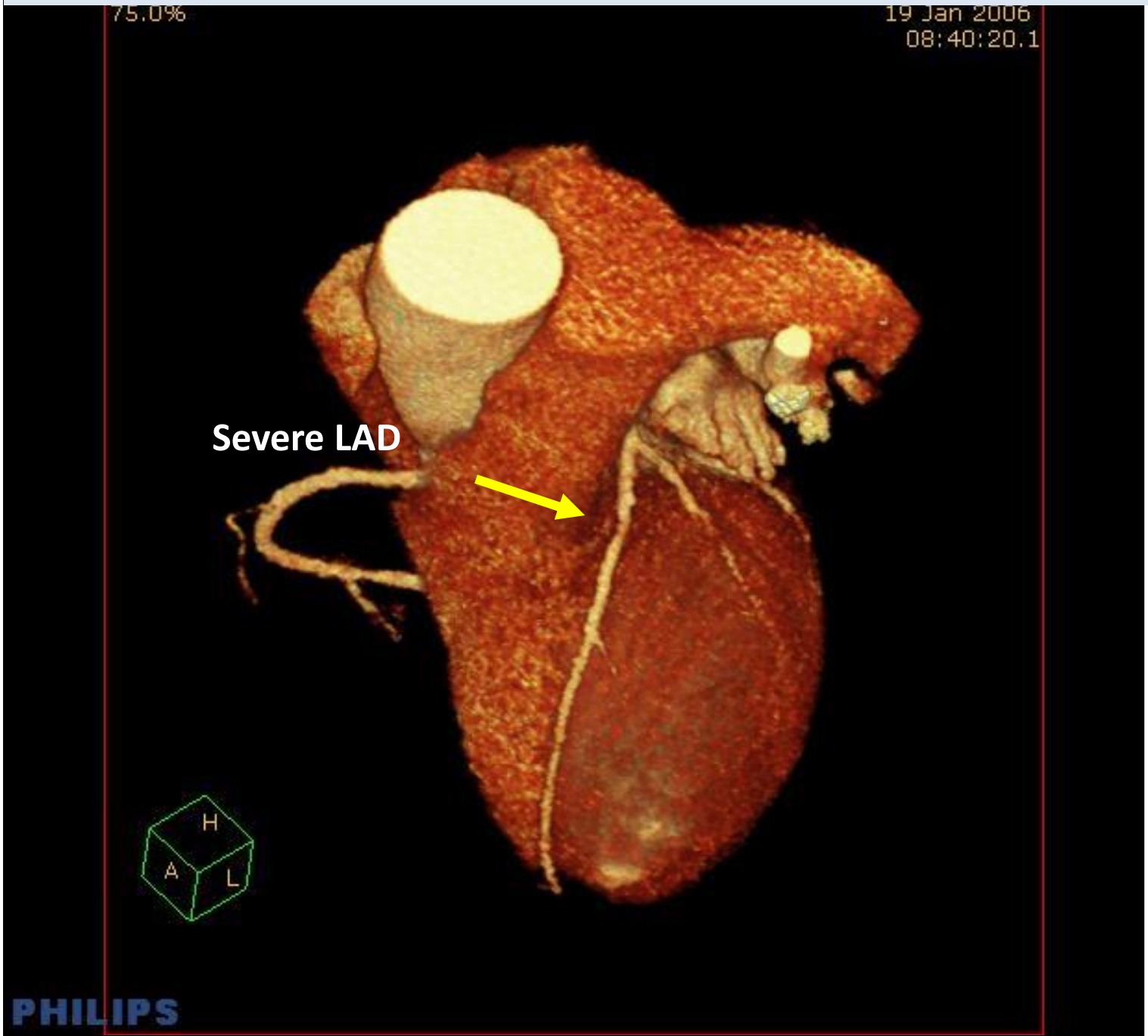






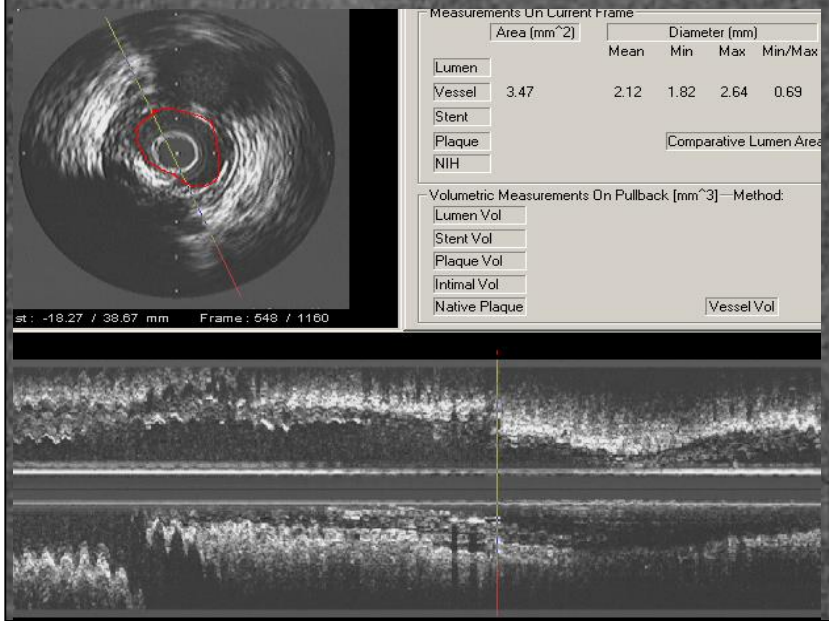
Angiography can under estimate severe CAD

Patient with angina FC2 and anterior perfusion defect.

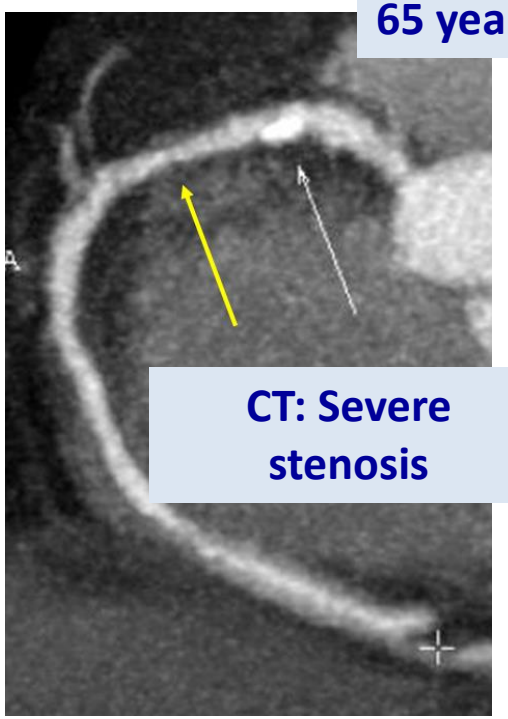


Mild angio stenosis

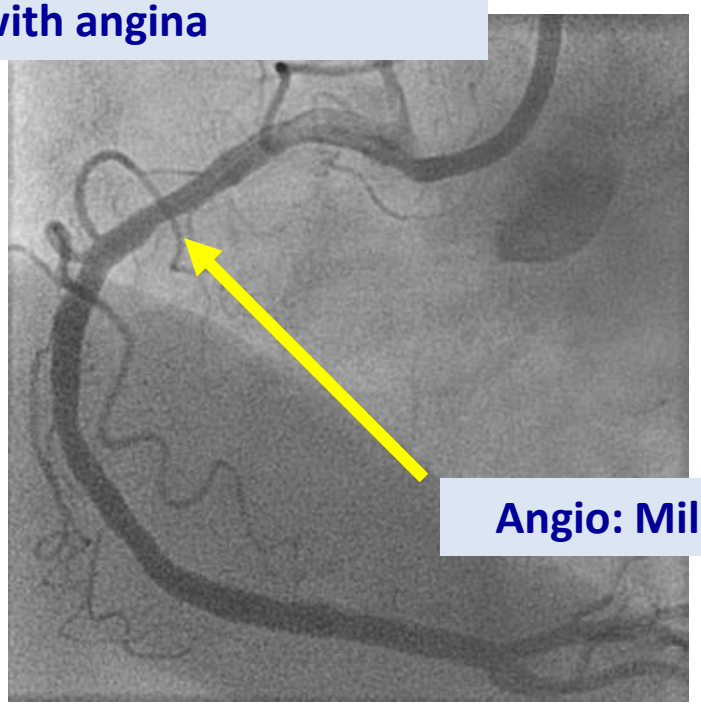
Severe IVUS stenosis: area 3.4 mm^2



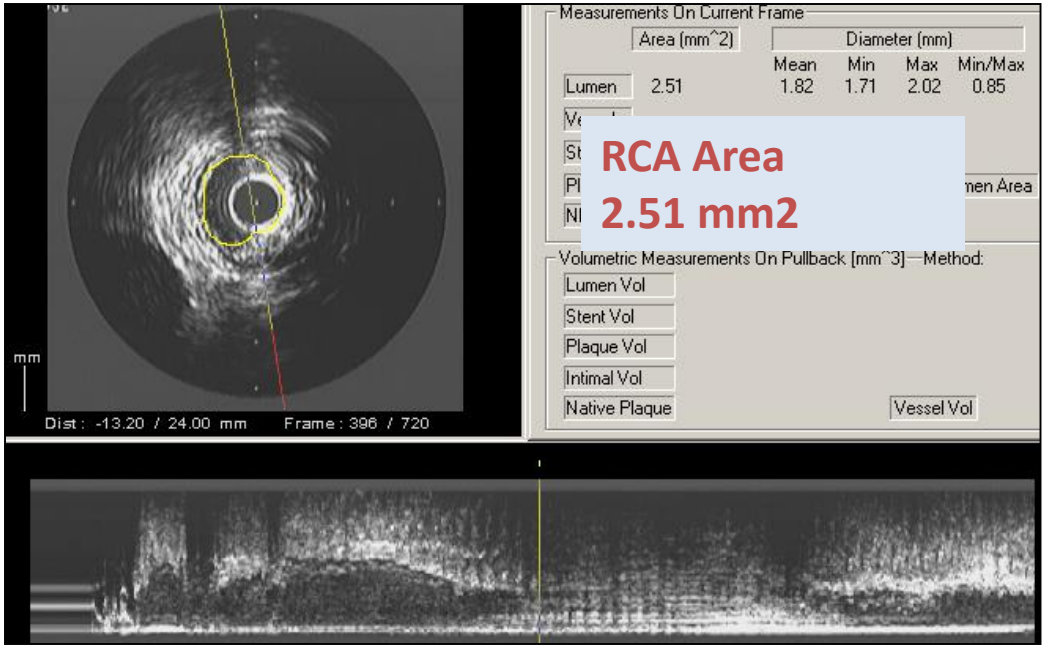
65 year old man with angina



CT: Severe stenosis

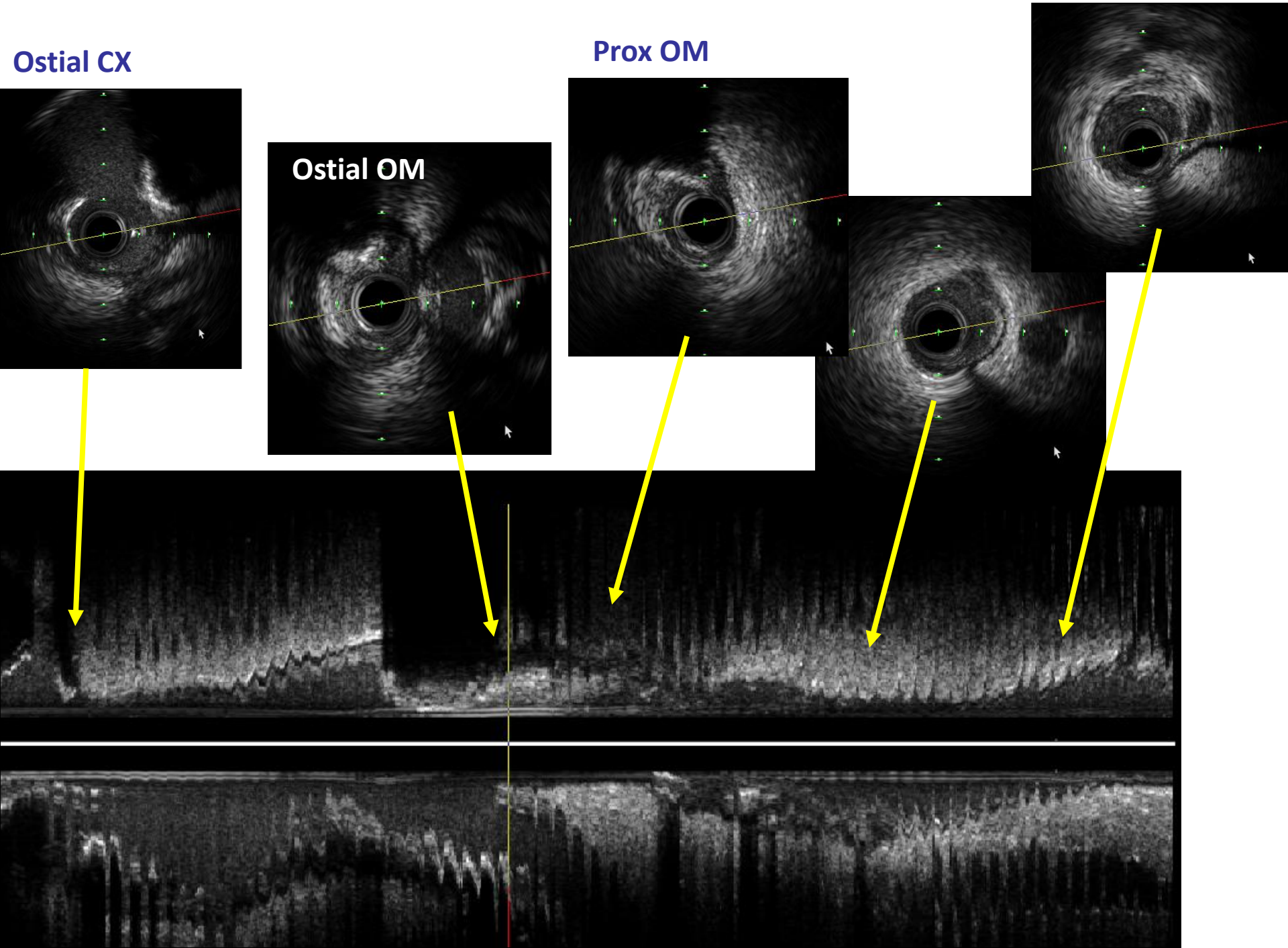


Angio: Mild stenosis

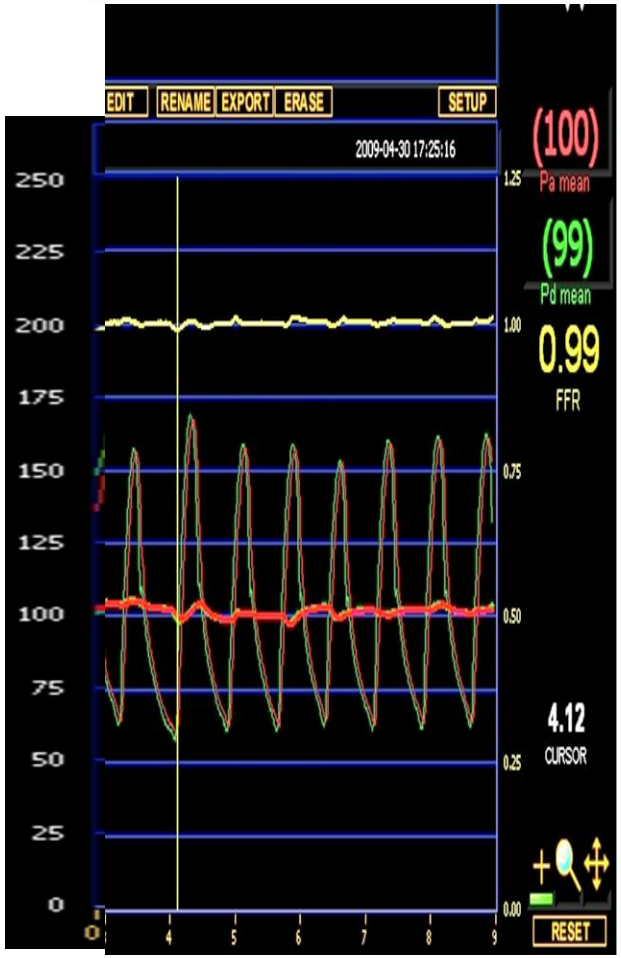


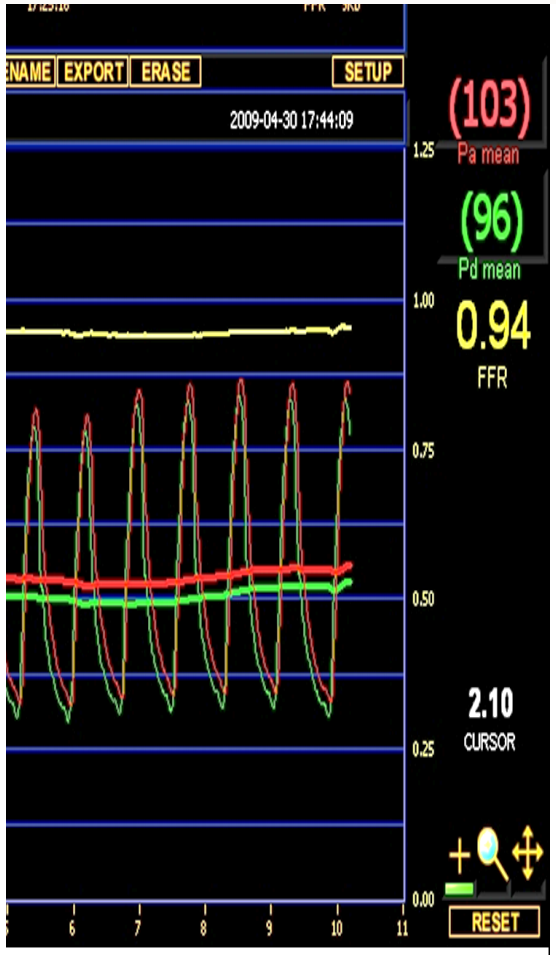
Angiography can also over estimate lesion severity. Contribution of FFR

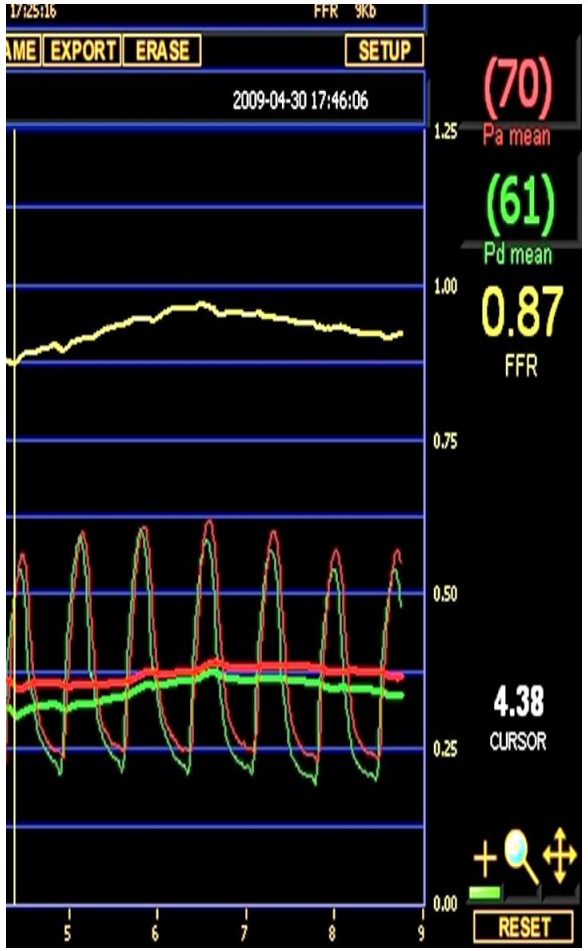
Circumflex Marginal


Ostial CX
Ostial OM
Prox OM

FFR CX







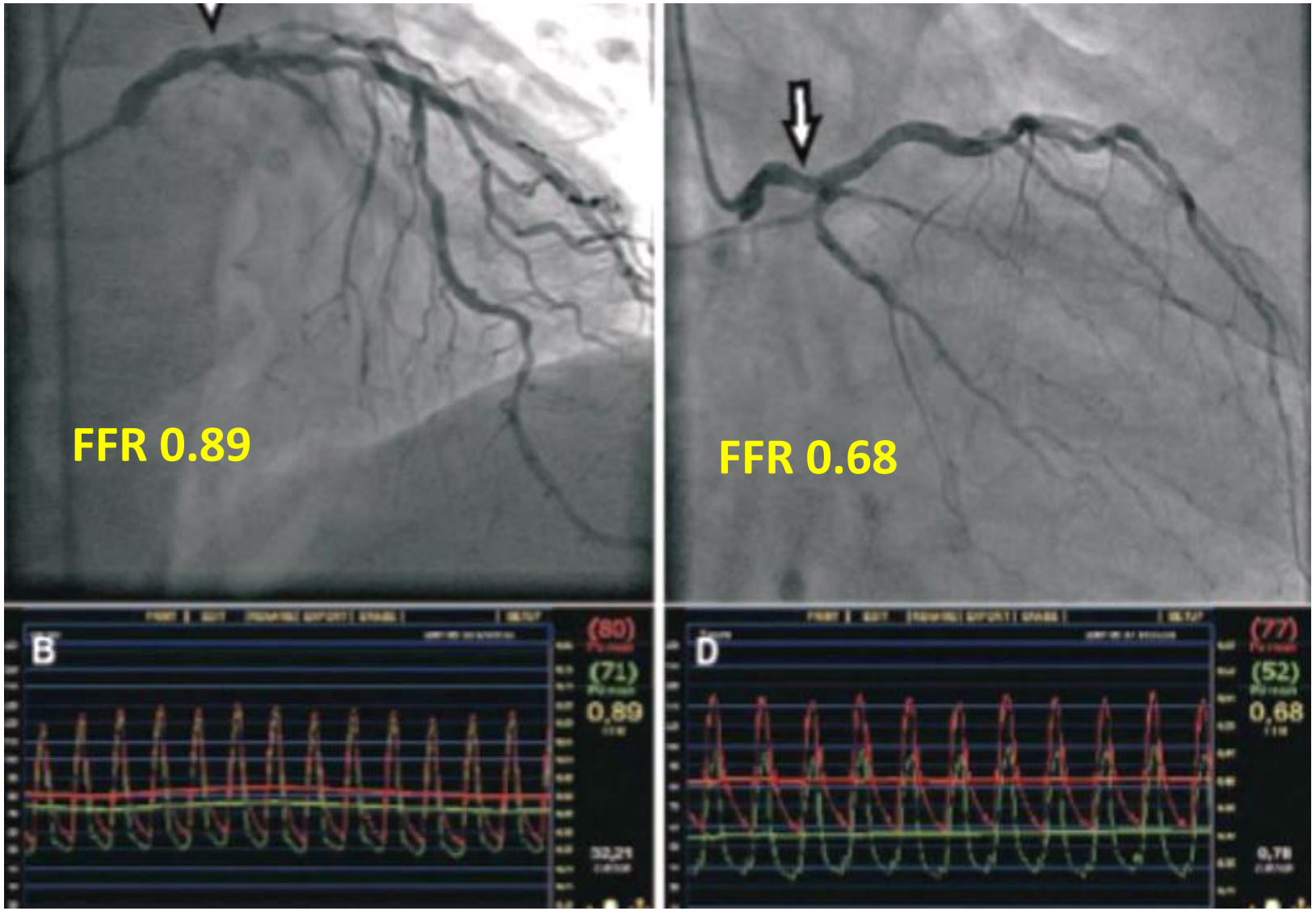
Equalization **Baseline Gradient** **Adenosine 140 mcg**

Clinical Decision

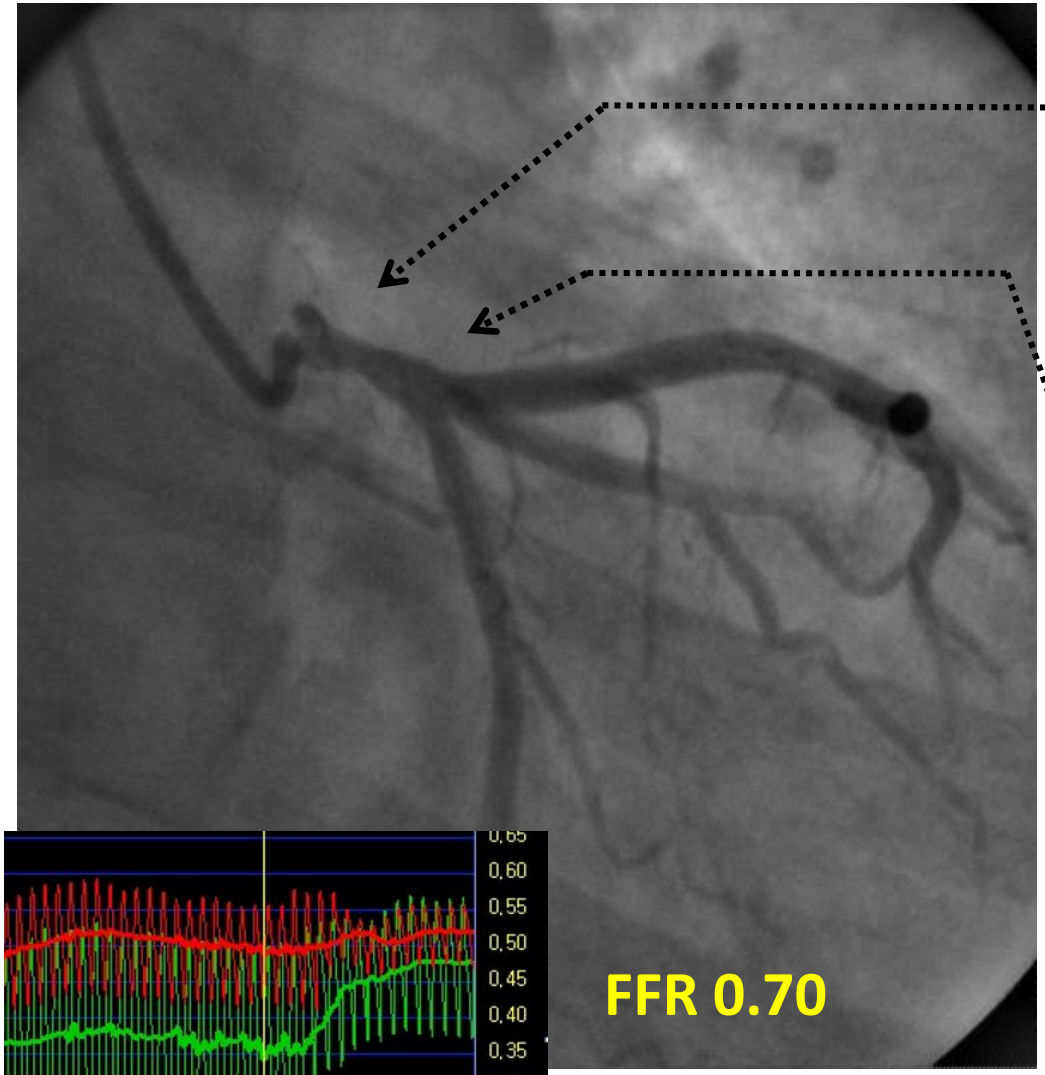
- No PCI now.
- Optimal medical therapy.
- Non invasive follow up.

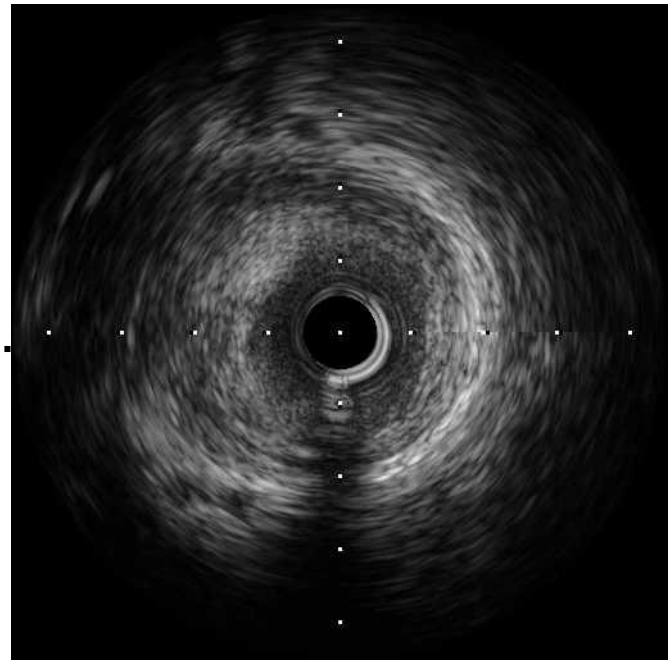
Angio is Most Inaccurate in LM.

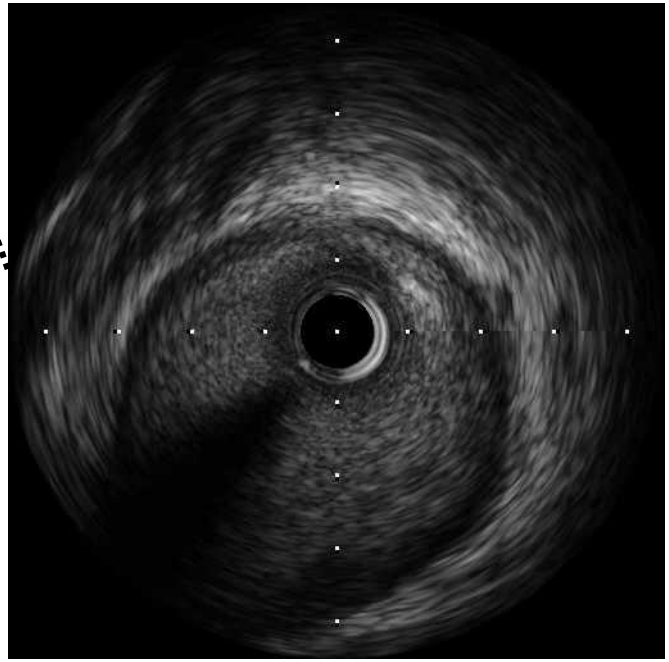
Olivier Muller. ESC 2011



Mild LM on Angio



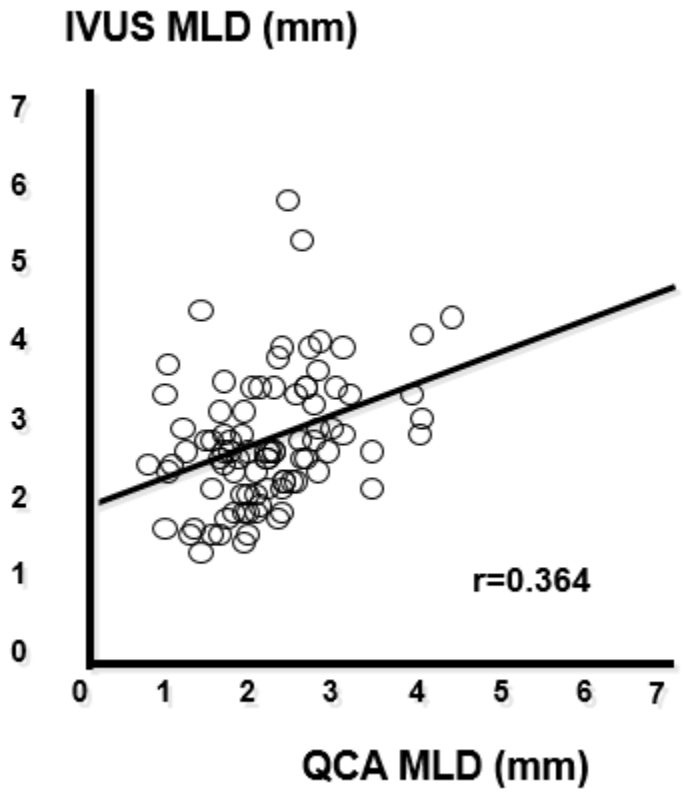


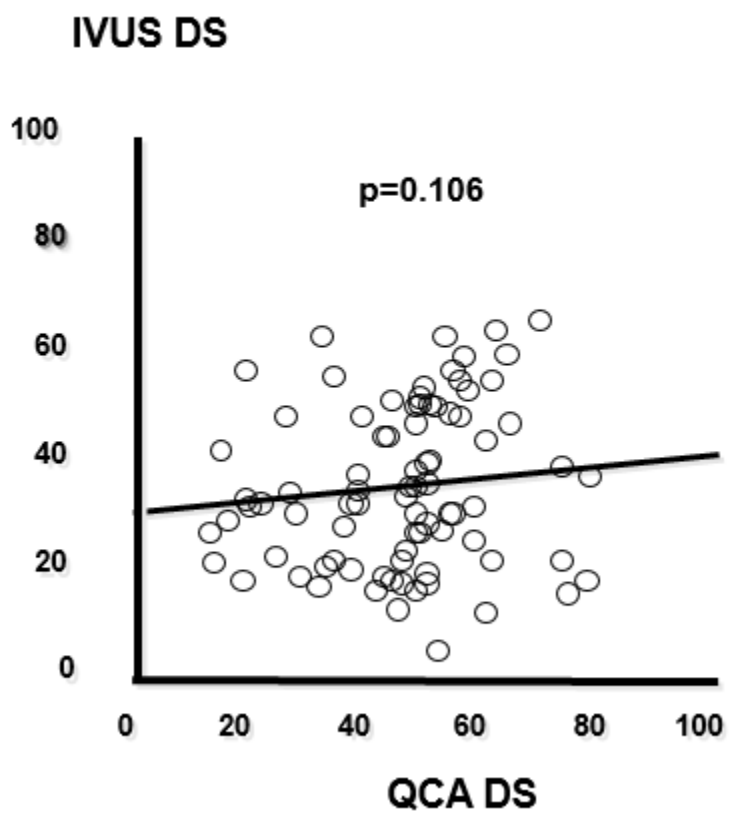


Angio vs IVUS in LMCA.

WHC: Abizaid et al JACC 1999;34:707-15

122 patients with LM disease



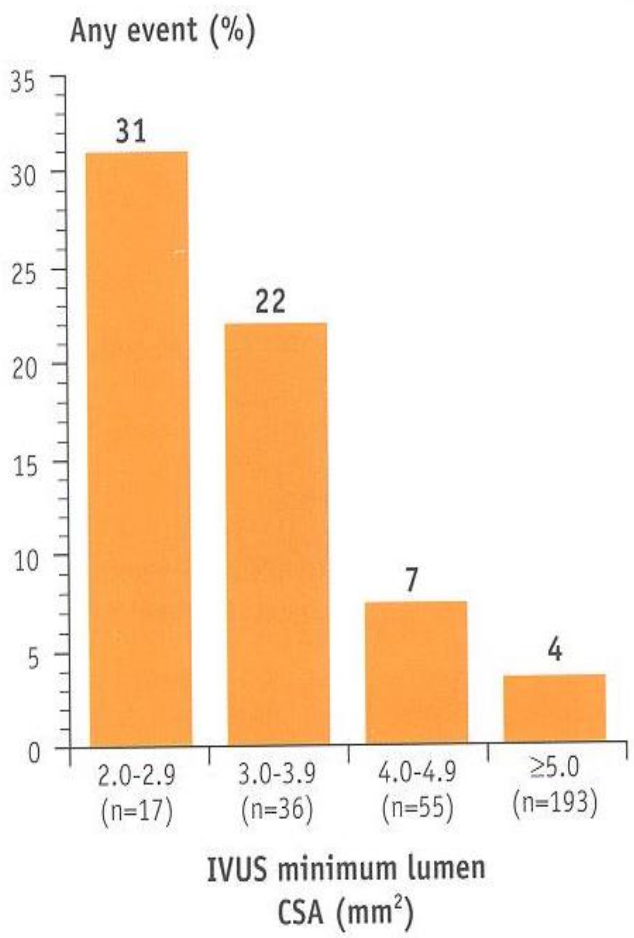


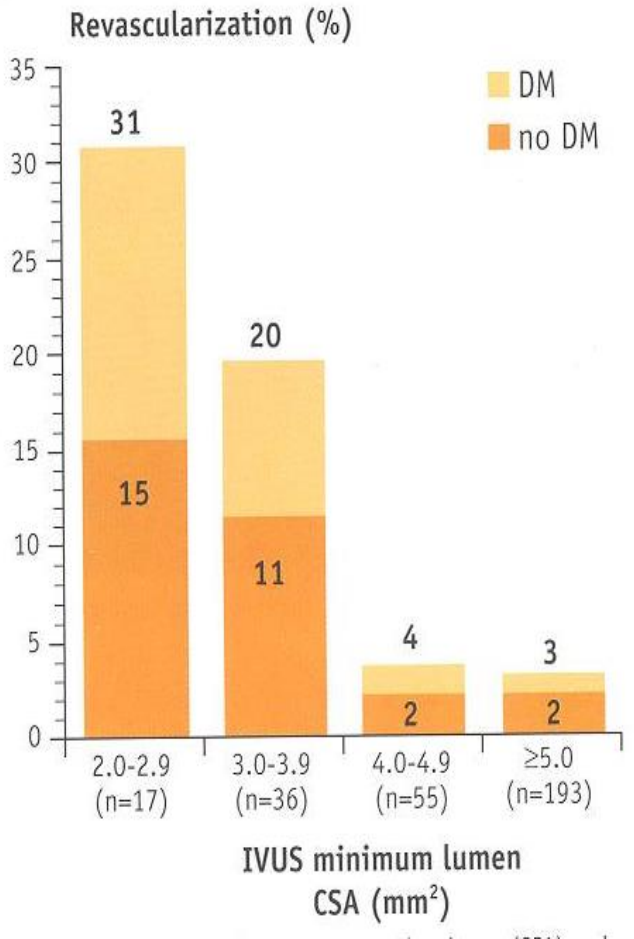
1. Angio is no longer the gold standard
2. **IVUS had been the best for:**
   a. **analysis of lesion severity**
   b. **for optimizing PCI results and improve outcome.**
3. FFR proven physiologically accurate and clinically useful
4. IVUS FR correlations surprising
5. New paradigm: FFR for inervention or not. IVUS for prognosis

IVUS final Lumen Area Determines Prognosis

WHC: Abizaid et al. Circ 1999; 100:256-261

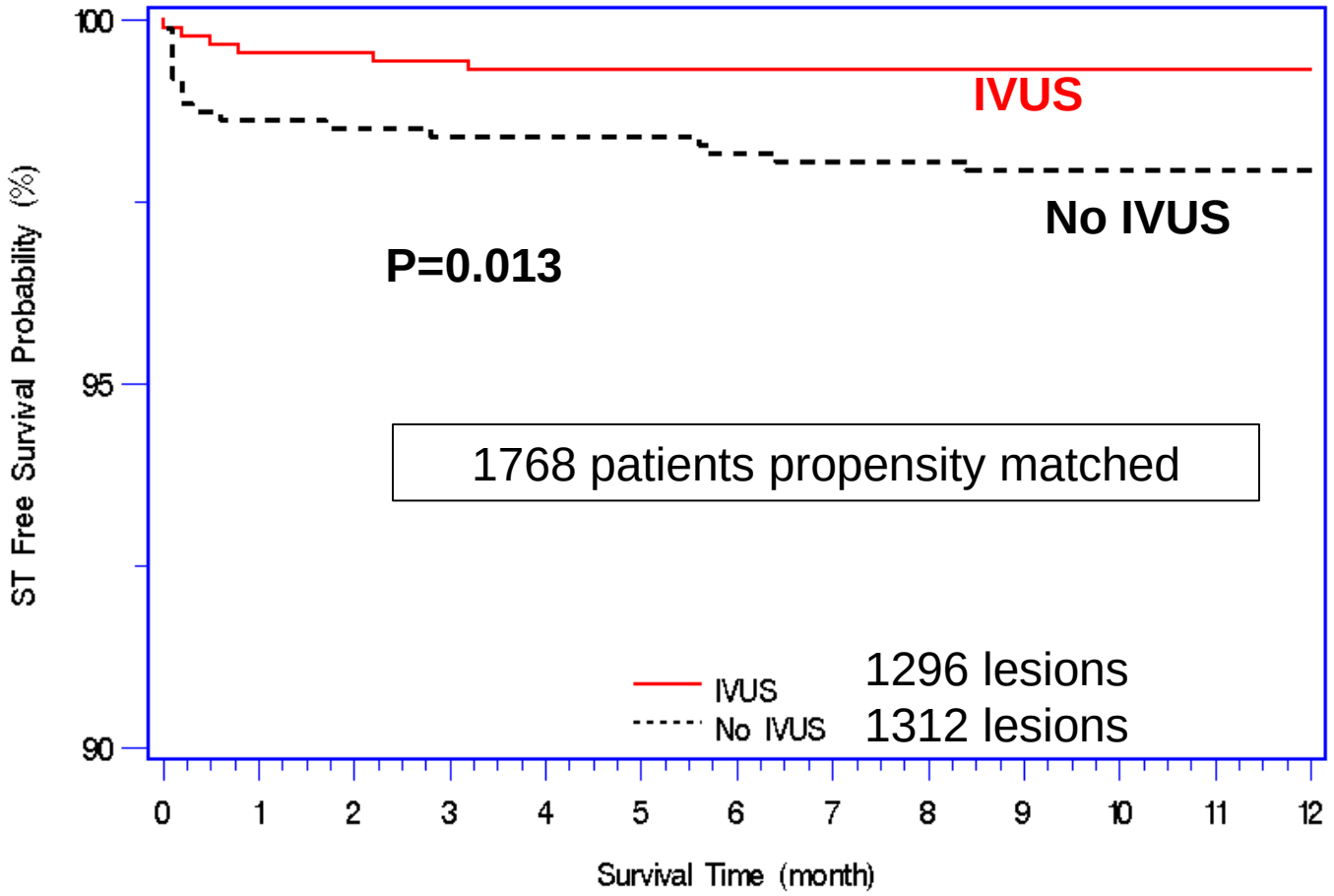
300 patients (357 lesions) <70% diameter stenosis.





Freedom from Stent Thrombosis.

WHC: Roy et al. EHJ 2008;29:1851-7

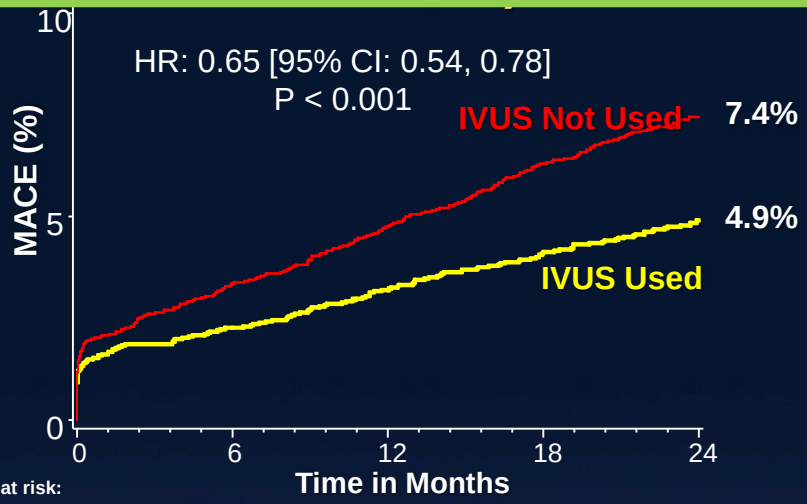


"No IVUS" was a significant predictor of cumulative ST at 12 months: HR 3.3, CI 1.25-10, p=0.01

ADAPT-DES Trial

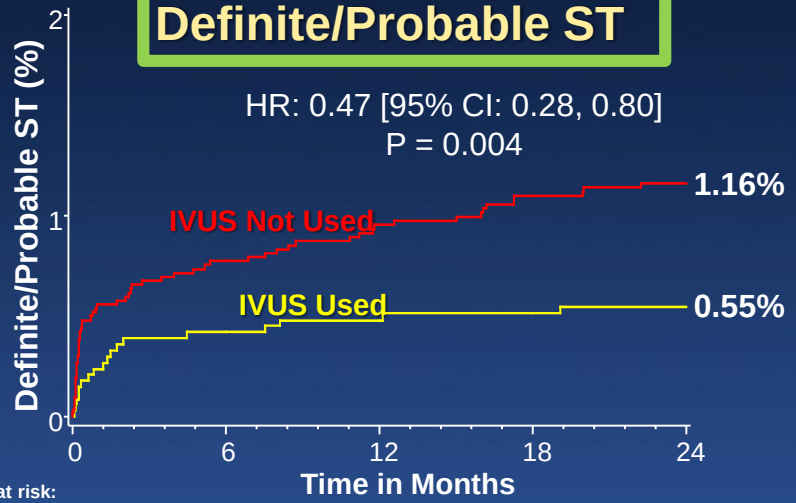
PCI with IVUS (3361 pts)
PCI without IVUS (5221 pts).

MACE (Definite/Probable ST, Cardiac Death, MI)



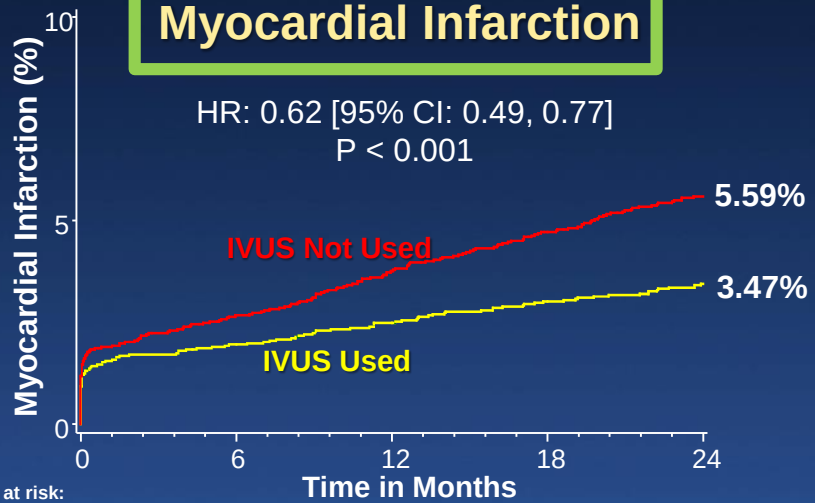
Number at risk:					
IVUS Used	3361	3206	3117	2988	1739
IVUS Not Used	5221	4912	4740	4537	2177

Definite/Probable ST



Number at risk:					
IVUS Used	3361	3260	3182	3065	1791
IVUS Not Used	5221	5019	4886	4713	2279

Myocardial Infarction



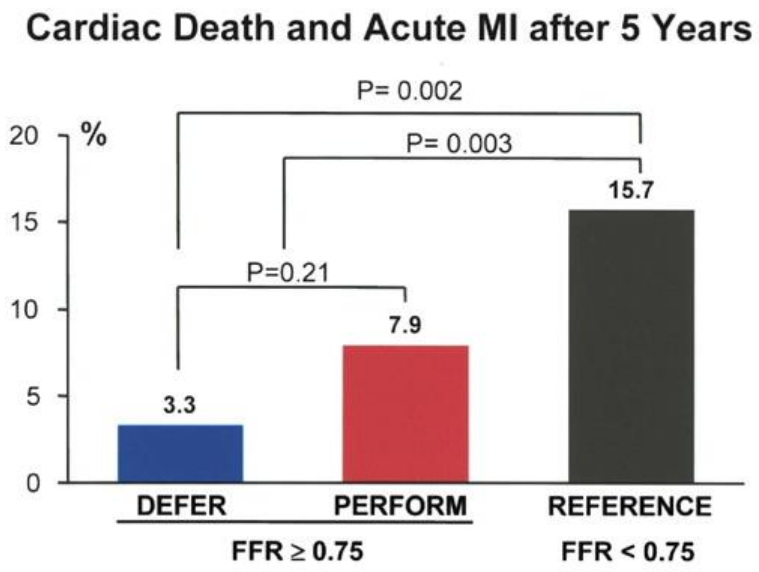
Number at risk:					
IVUS Used	3361	3209	3120	2991	1739
IVUS Not Used	5221	4916	4744	4541	2179

Maehara et al. JACC 2013;62:B21-22

1. Angio is no longer the gold standard
2. IVUS has been the best for severity analysis
3. **FFR is now the gold standard for physiologically and clinically significant lesion.**
4. IVUS FR correlations surprising
5. New paradigm: FFR for inervention or not. IVUS for prognosis

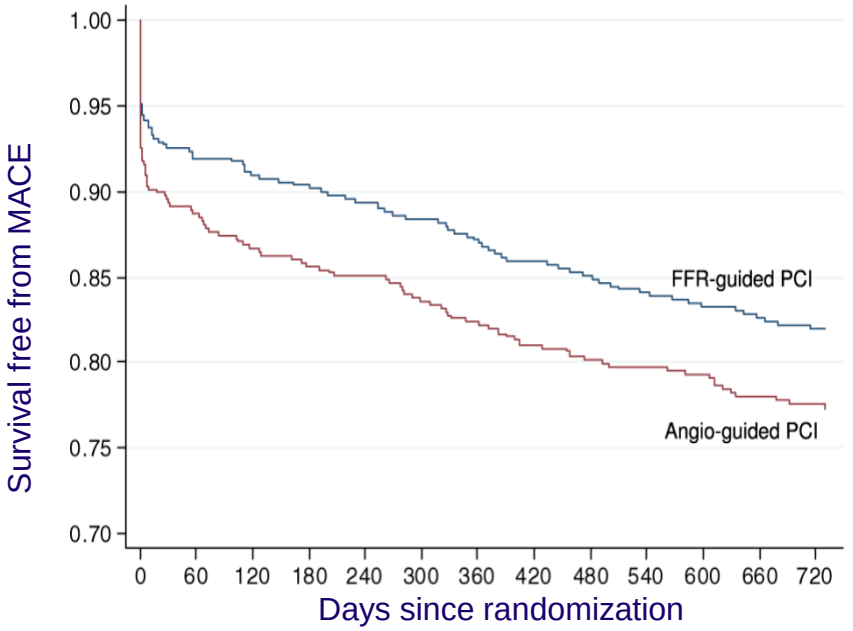
FFR Guidance Proven Clinically Superior than Angiographic Guidance.

DEFER 5 years



Pijls JACC 2007;49:2105

FAME two years

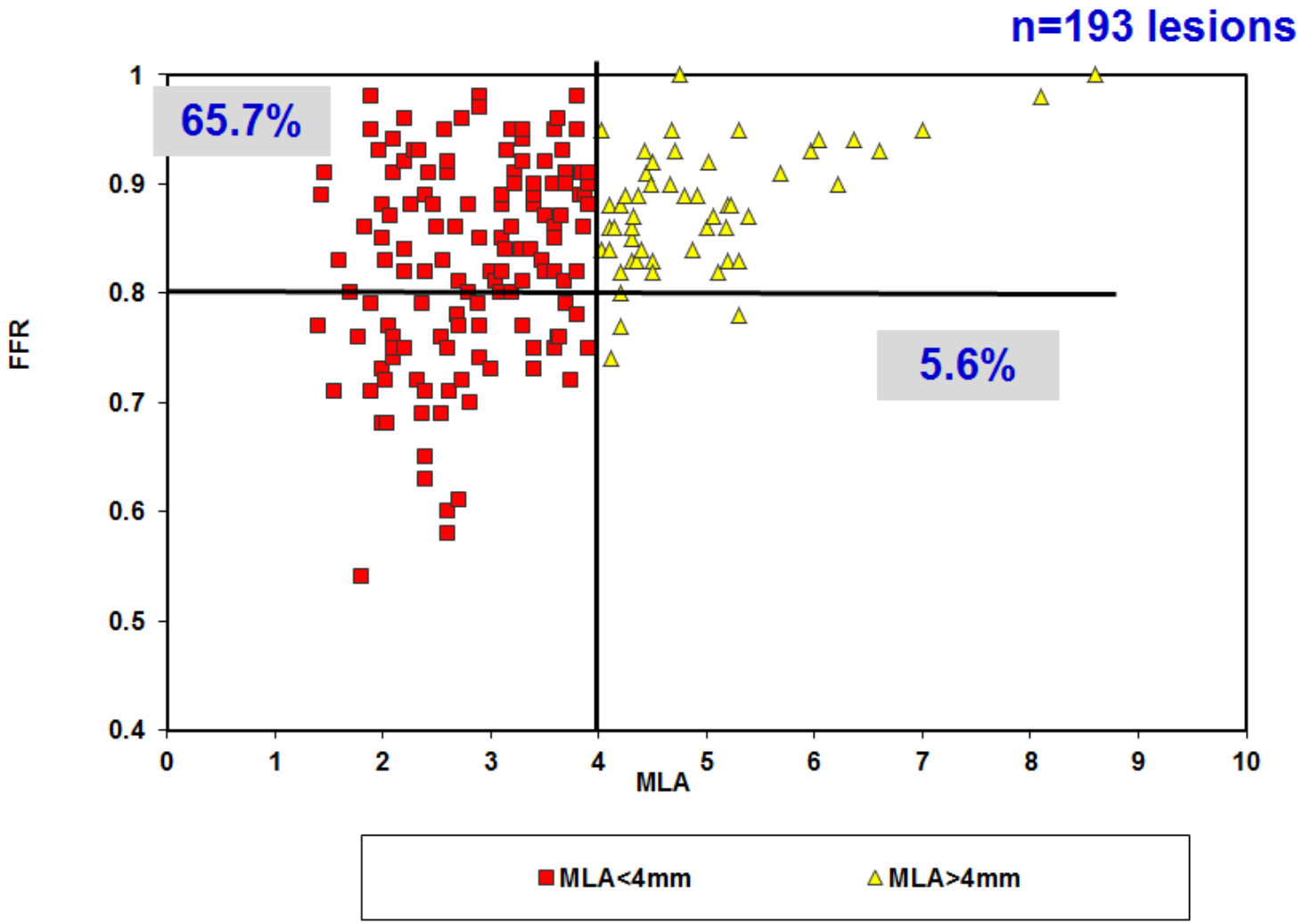


Pijls JACC 2010;56:177

1. Angio is no longer the gold standard
2. IVUS has been the best for severity analysis
3. FFR proven physiologically accurate and clinically useful
4. **IVUS FFR correlations surprising**
5. New paradigm: FFR for inervention or not. IVUS for prognosis

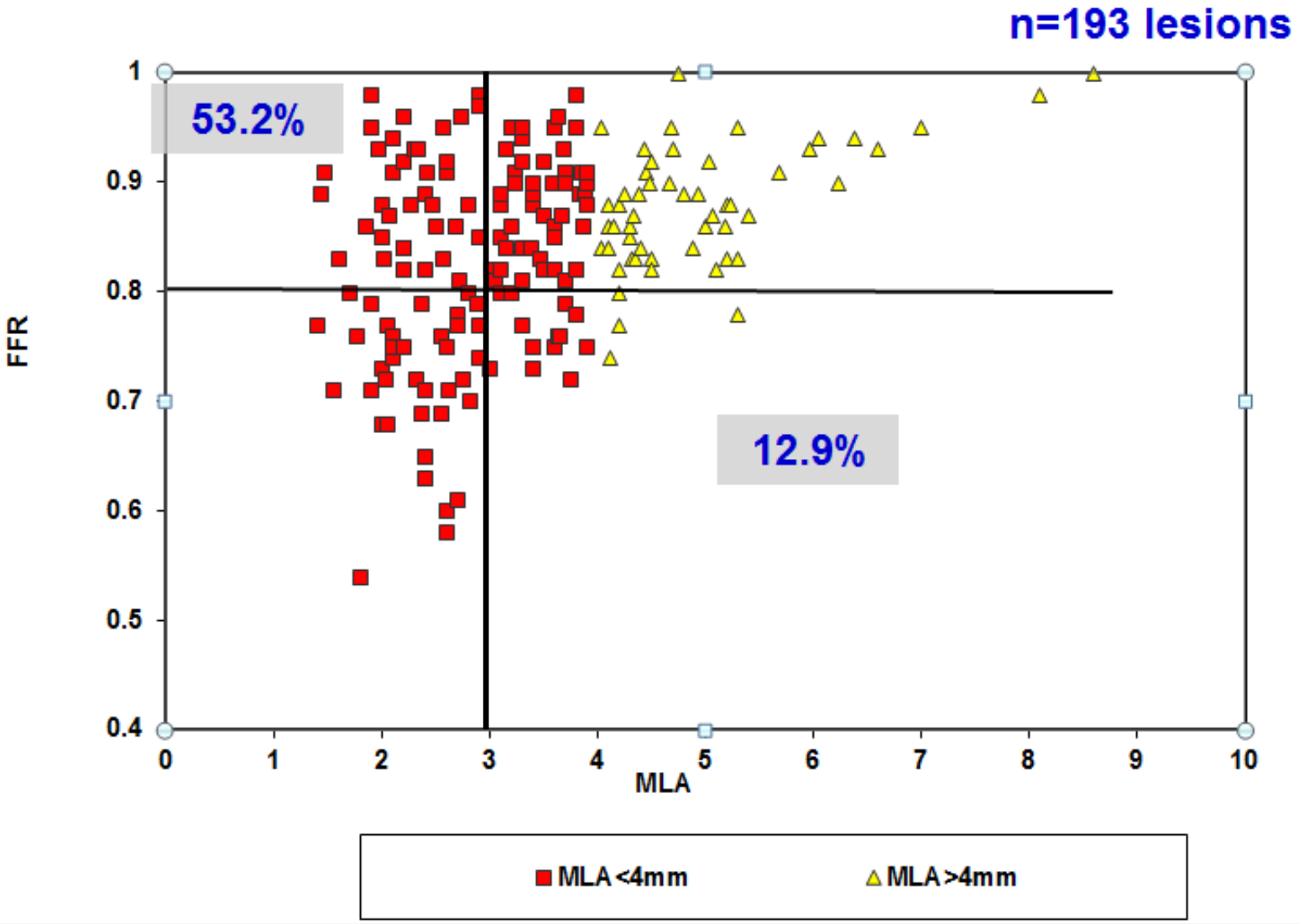
IVUS vs. FFR

WHC: Ben-Dor et al. Eurointervension 2011 7:225-33



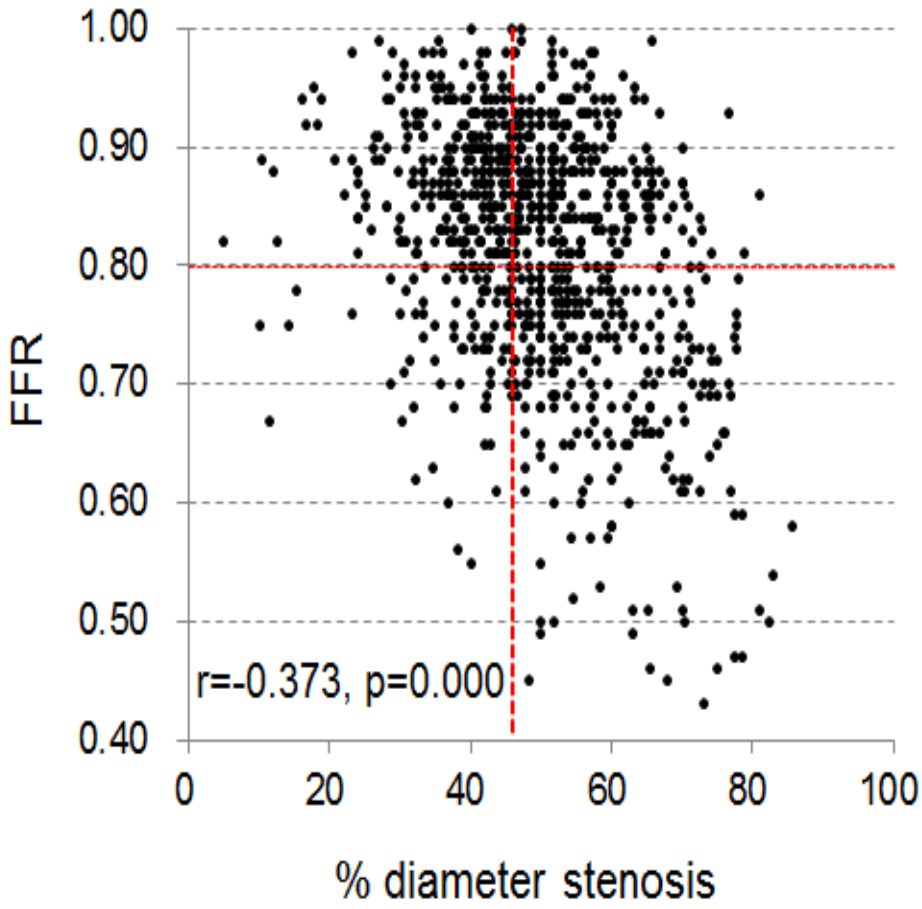
IVUS vs. FFR

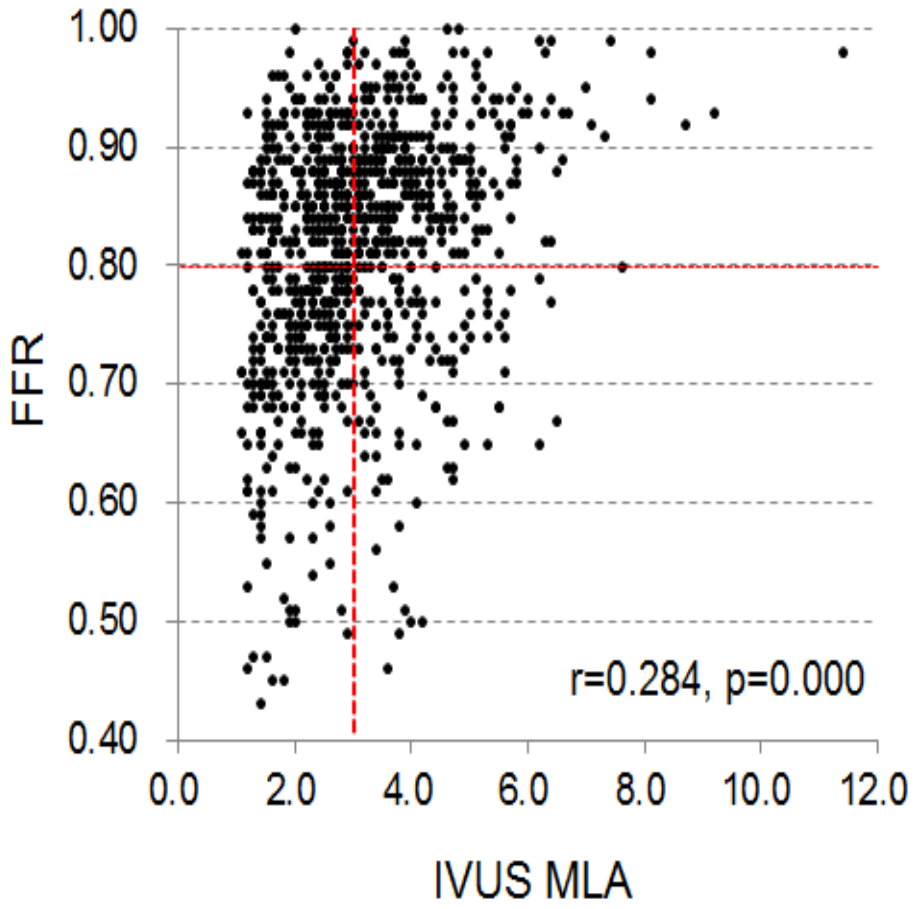
WHC: Ben-Dor et al. Eurointervension 2011 7:225-33



881 Lesions with IVUS/FFR.

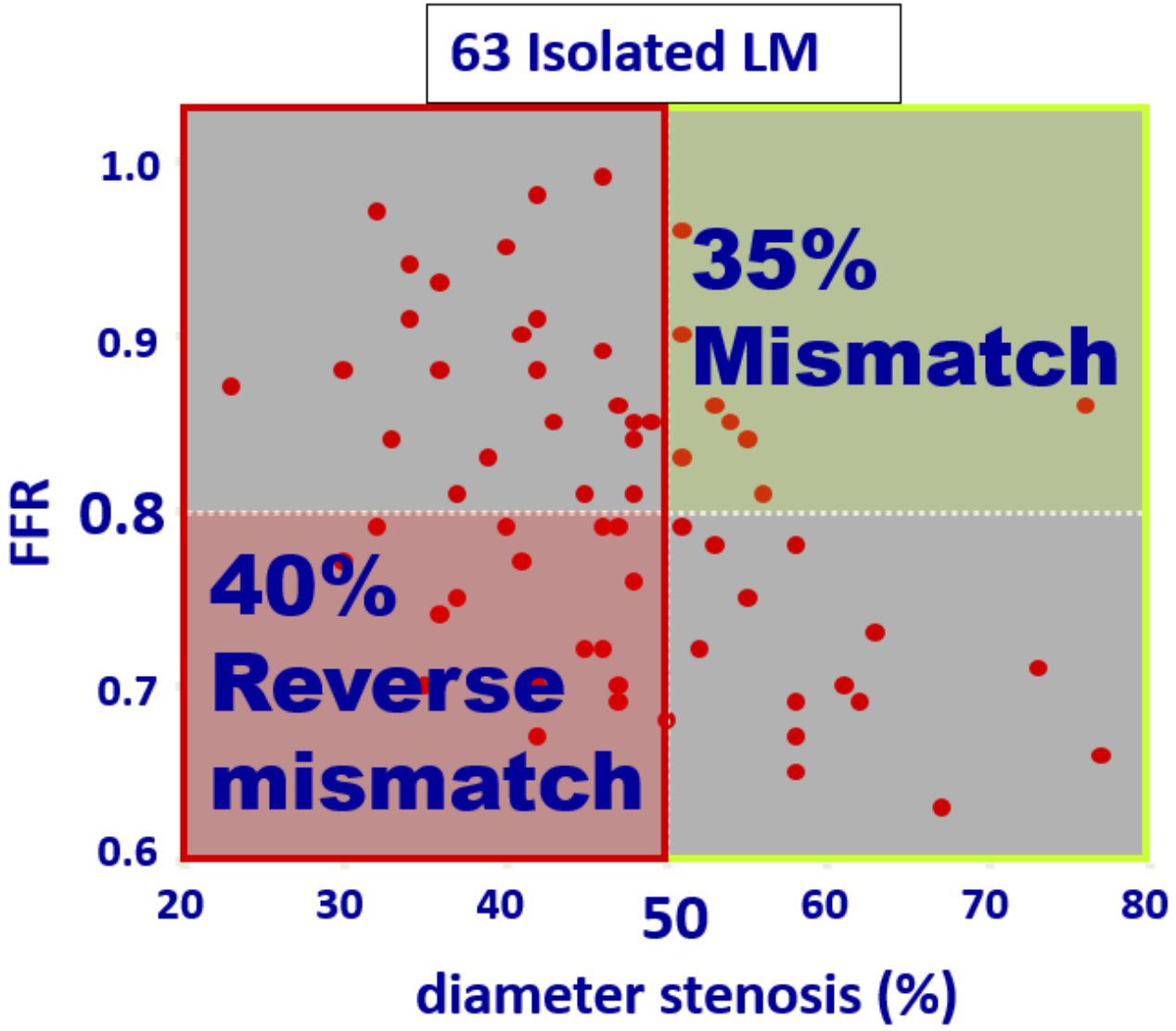
Han et al. EuroIntervention. 2012;8:N74.





QCA-FFR Discordance in LMCA.

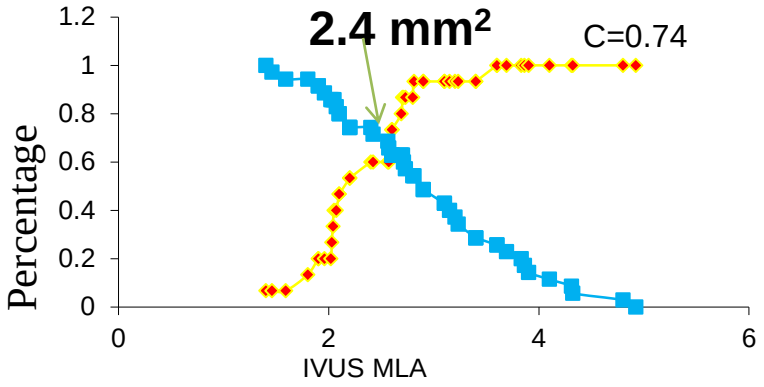
SJ Park et al. JACC Interv 2012;5:1029-35



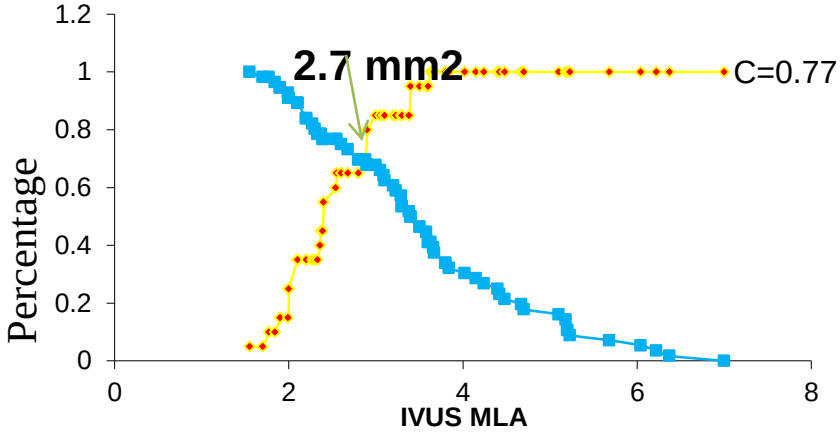
NO MORE 4 mm2 to decide Intervention. New IVUS MLAs since 2011.

WHC: Ben-Dor et al. Eurointervension 2011 7:225-33

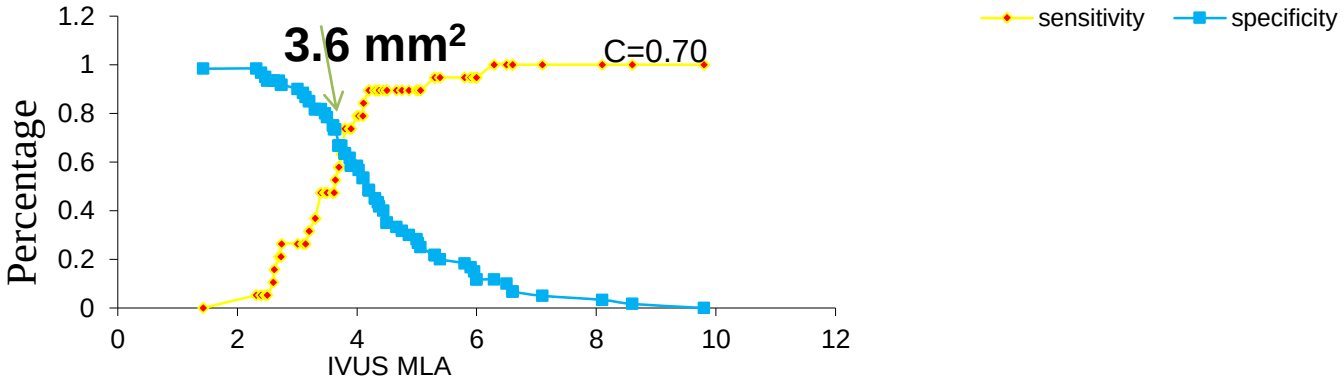
Reference vessel 2.5-3mm



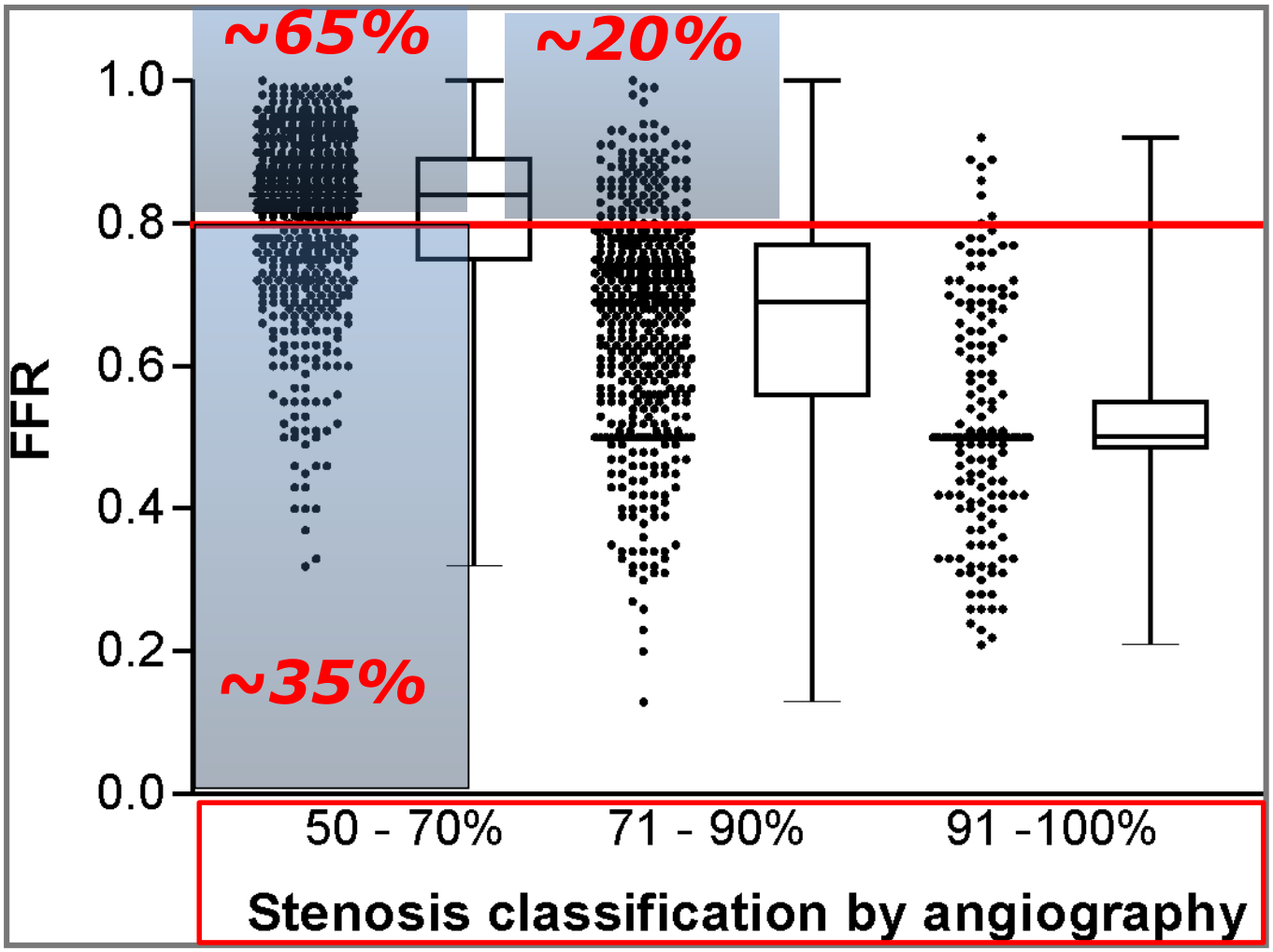
Reference vessel 3-3.5mm



Reference vessel >3.5mm



Physiologic Relevance of Angio Stenosis



P. Tonino et al JACC 2010

Summary

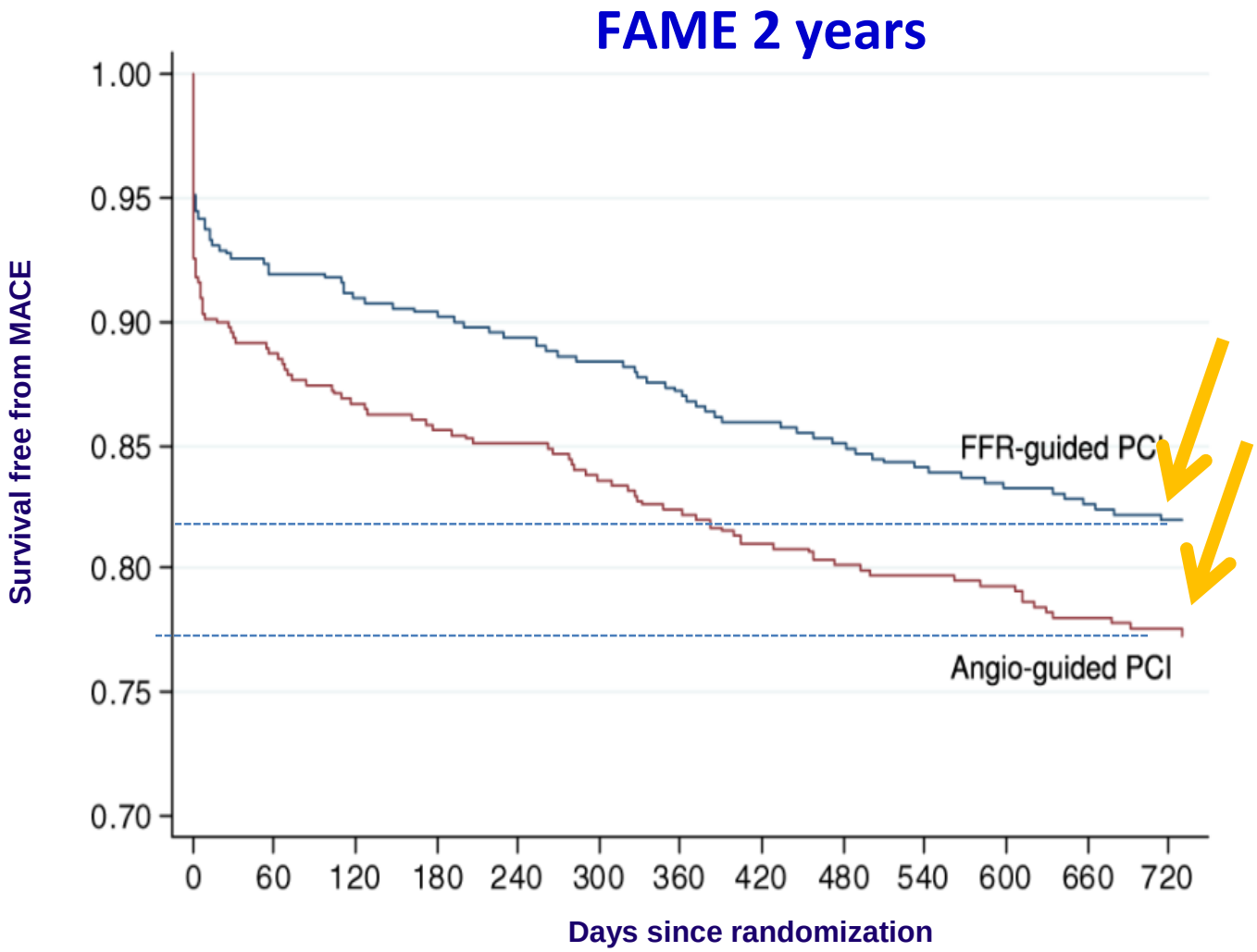
Intermediate lesions (50-80%) have better outcome with Optimal Medical Therapy than with Stents.

Value of Spot Stenting.

1. Angio is no longer the gold standard
2. IVUS has been the best for severity analysis
3. FFR proven physiologically accurate and clinically useful
4. IVUS FFR correlations surprising
5. **What happens to the patient with deferred intervention?**

Not all Patients are MACE Free

Pijls et al. JACC 2010;56:177



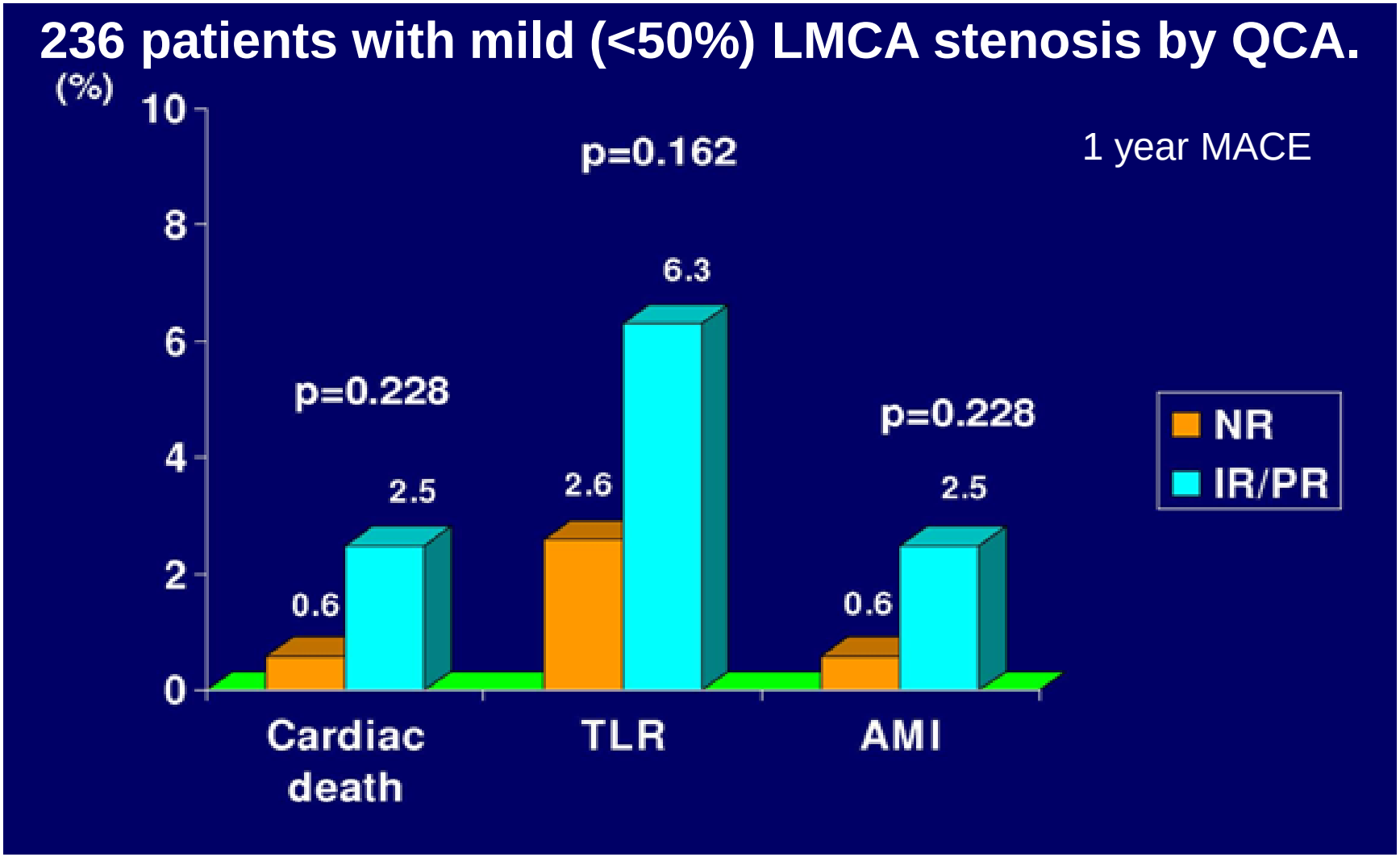
Plaque Morphology Helps Predict Prognosis

High risk plaque morphology is associated with worse outcome:

- positive remodeling/plaque burden
- thin-cap fibroatheroma
- inflammatory markers (CRP, PET scan).
- shear stress
- etc.

Plaque Positive Remodeling and Outcome.

WHC: YJ Hong et al. JIC 2007;19:500-5



Conclusions

1. In Stable CAD, non Invasive quantification of ischemia and severity of symptoms determines need for angiography.
2. Angiography (QCA) is no longer the Gold Standard to indicate revascularization, except for lesions >90%.
3. FFR is presently the optimal method to decide if intervention is needed in angiographic intermediate lesions (50-80%).
4. IVUS (OCT) contributes greatly to achieve optimal PCI and should be used in complex, high risk PCI.
5. Plaque imaging (IVUS, OCT, MSCT, MRI, NIR, PET, etc) can help predict outcome.

The end