

Que Mas que la Angiografía es Necesario para Optimizar mis Resultados?

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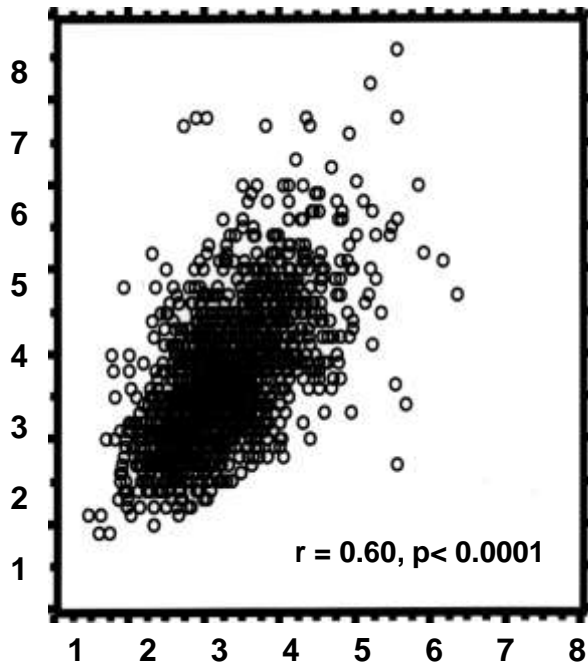
- 1. Angio is no longer the gold standard**
2. IVUS has been the best for severity analysis
3. FFR proven physiologically accurate and clinically useful
4. IVUS FFR correlations surprising
5. New paradigm: FFR for intervention or not. IVUS for prognosis

QCA inaccurate for Lesion Dimensions

WHC: Mintz et al 1996

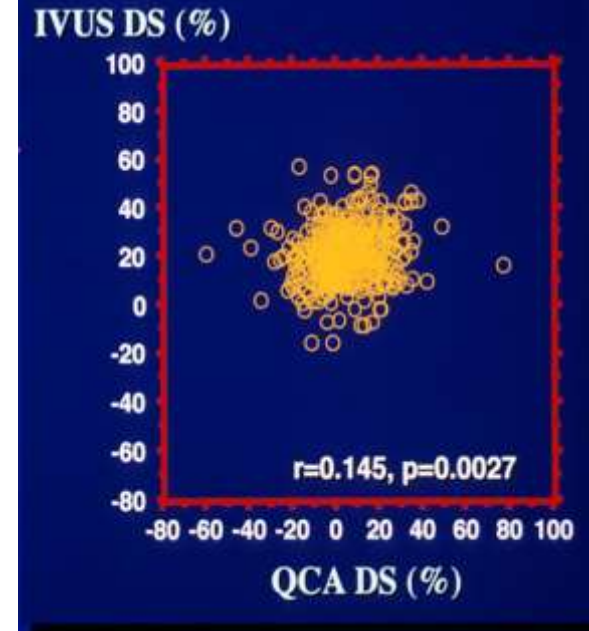
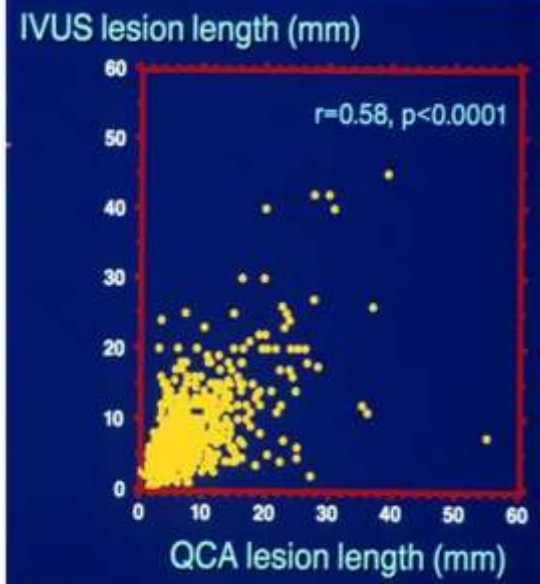
n = 2545 lesions

IVUS maximum reference lumen diameter (mm)



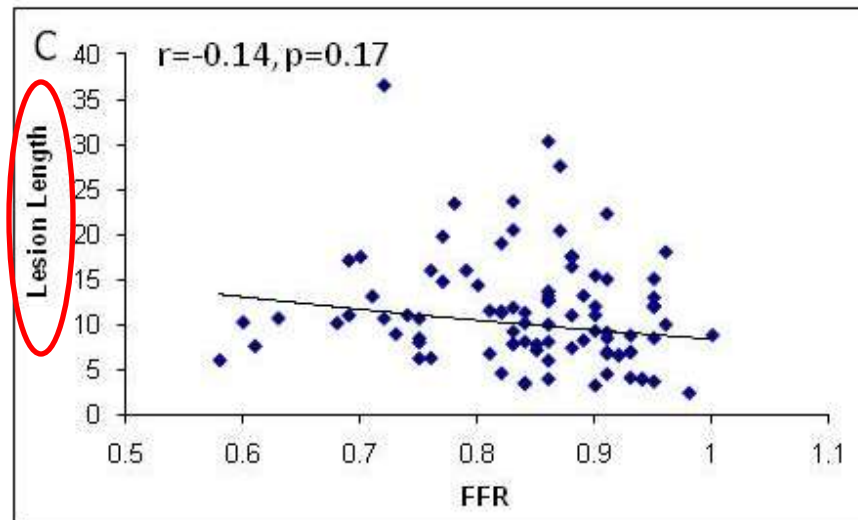
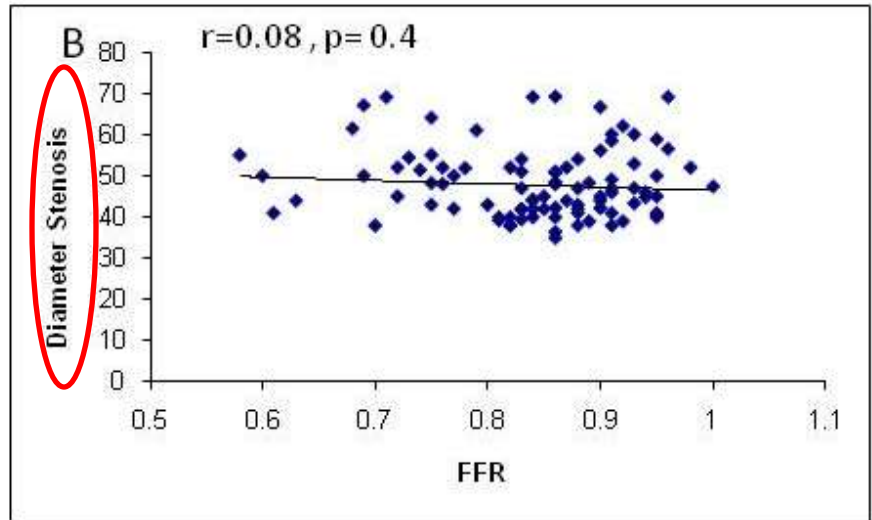
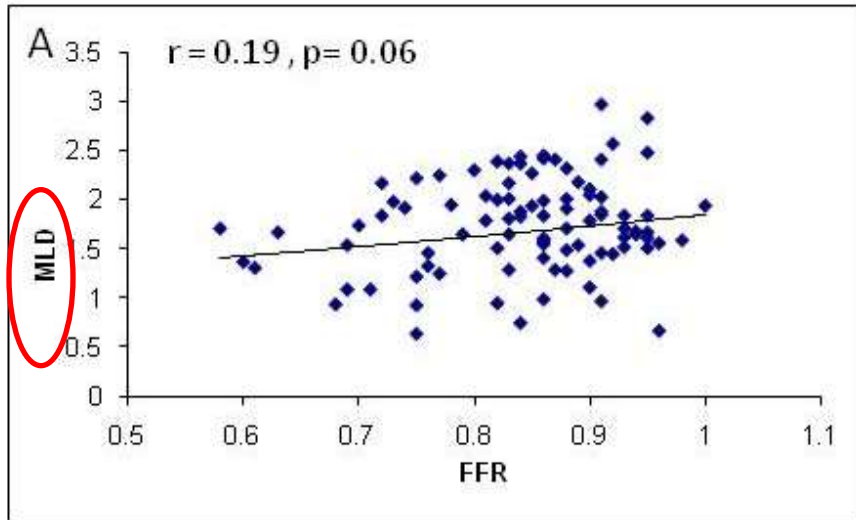
QCA reference diameter

n = 616 stents



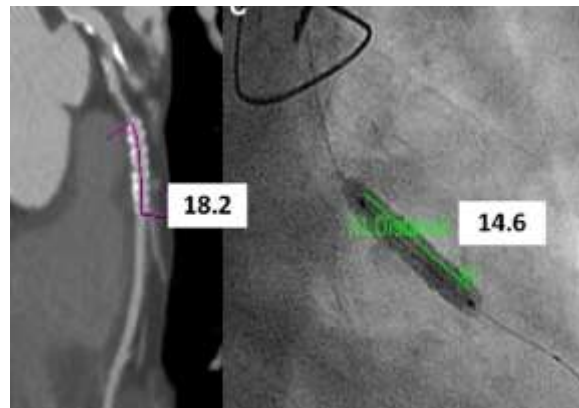
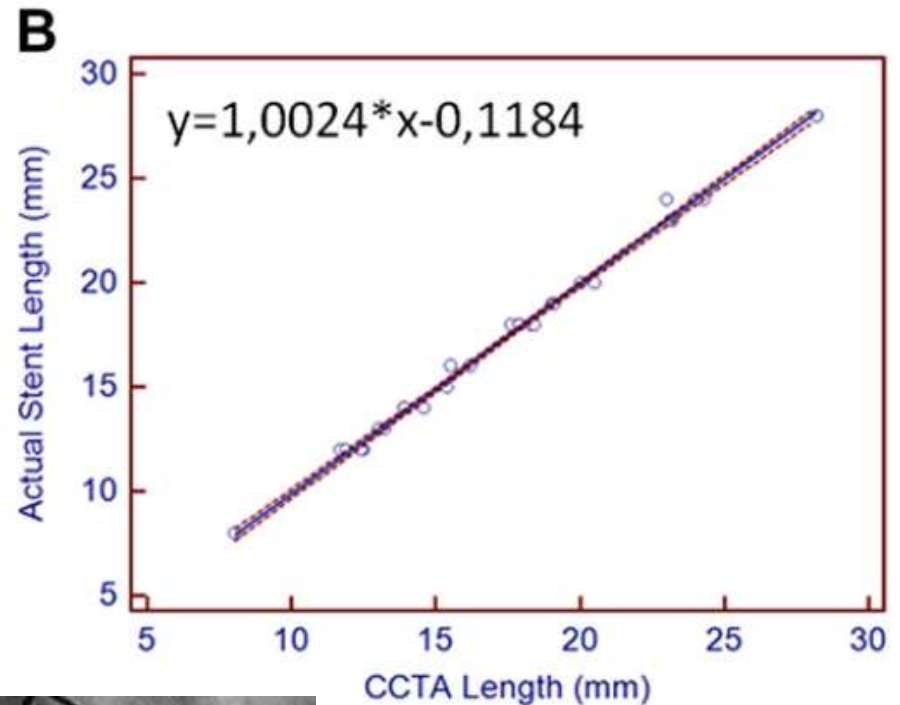
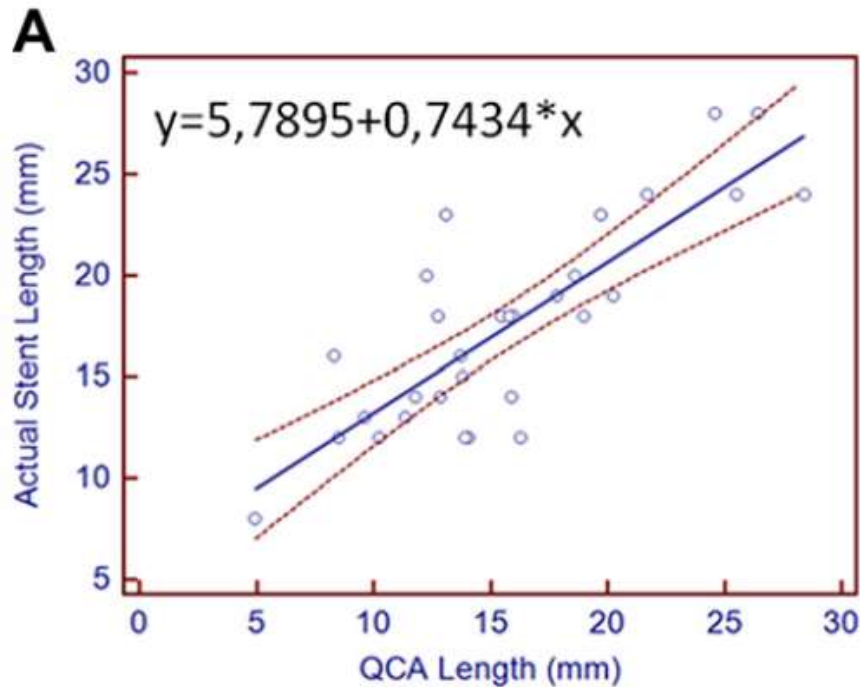
FFR vs QCA

WHC: Ben-Dor et al. EuroIntervention 2011



Angio vs CT for Stent Length

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

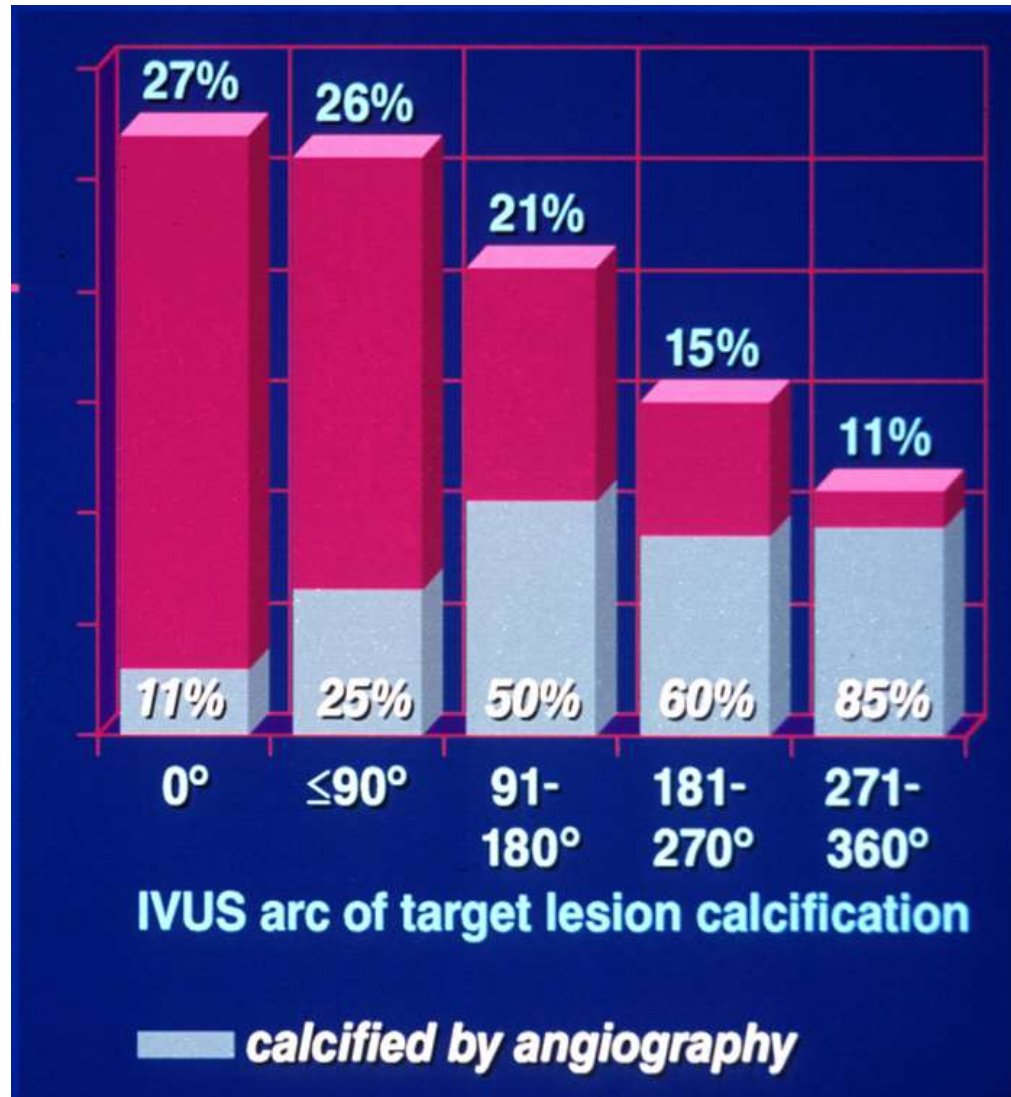


Angiography Frequently Misses Severe Calcification

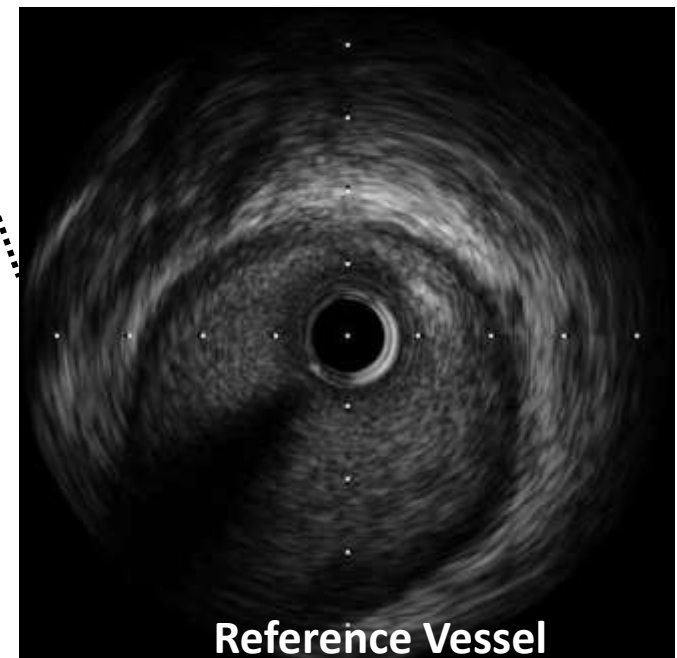
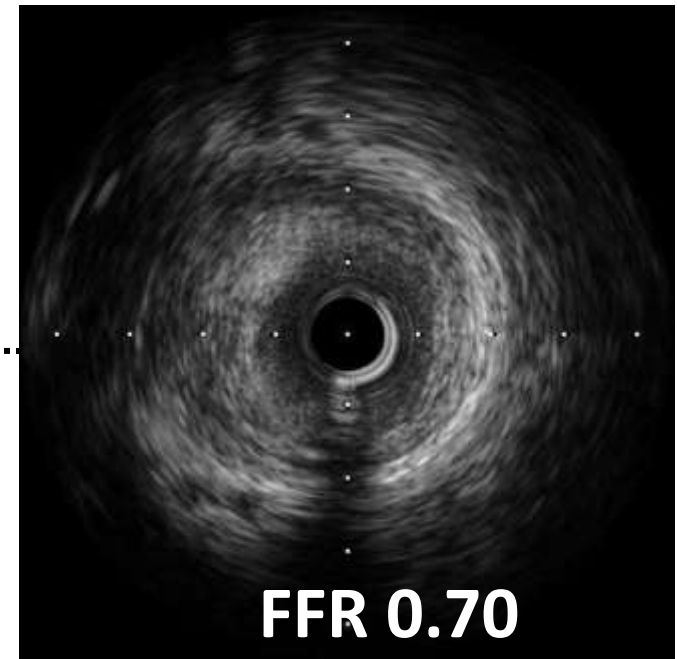
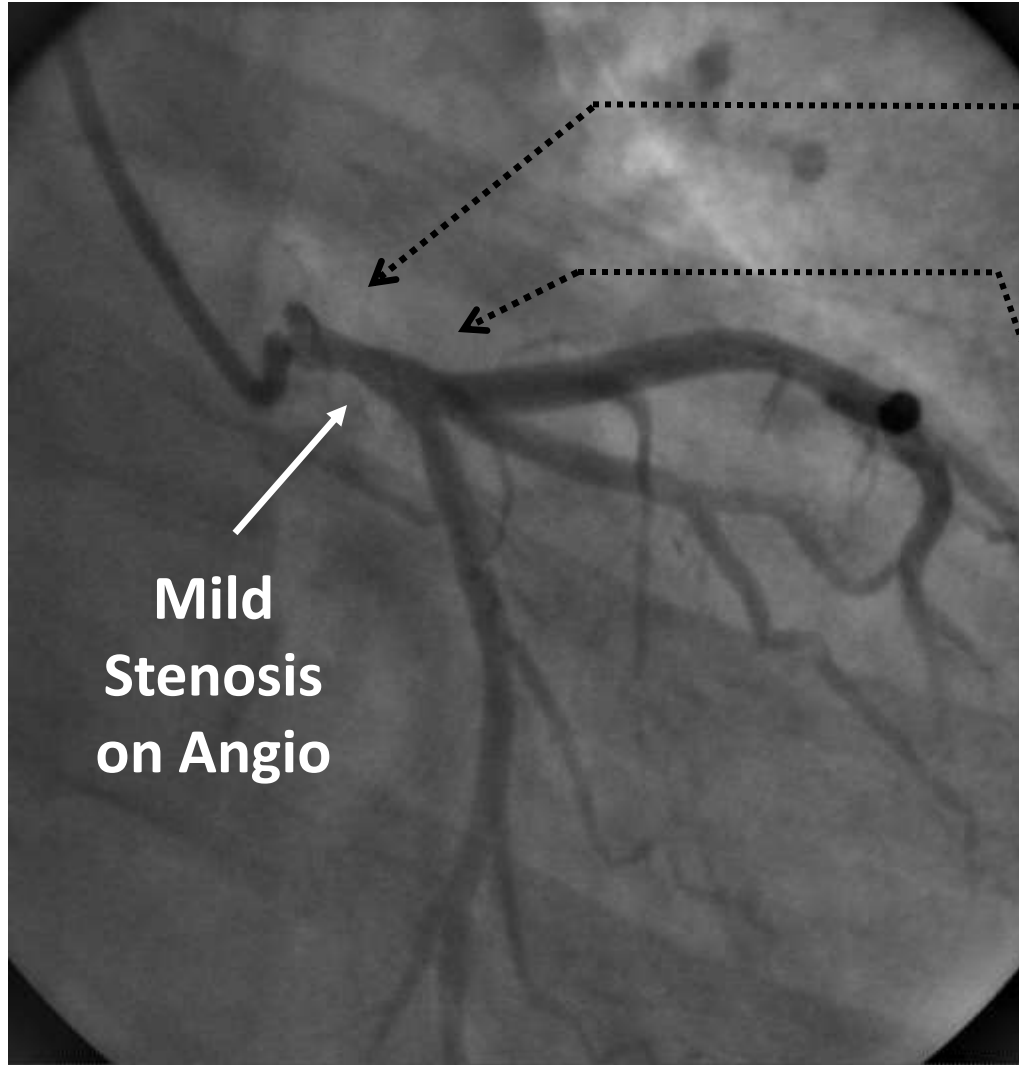
n=1155 lesions

Calcification
detected:

- 73% by IVUS
- 38% by QCA



Angio is most Inaccurate in LMCA

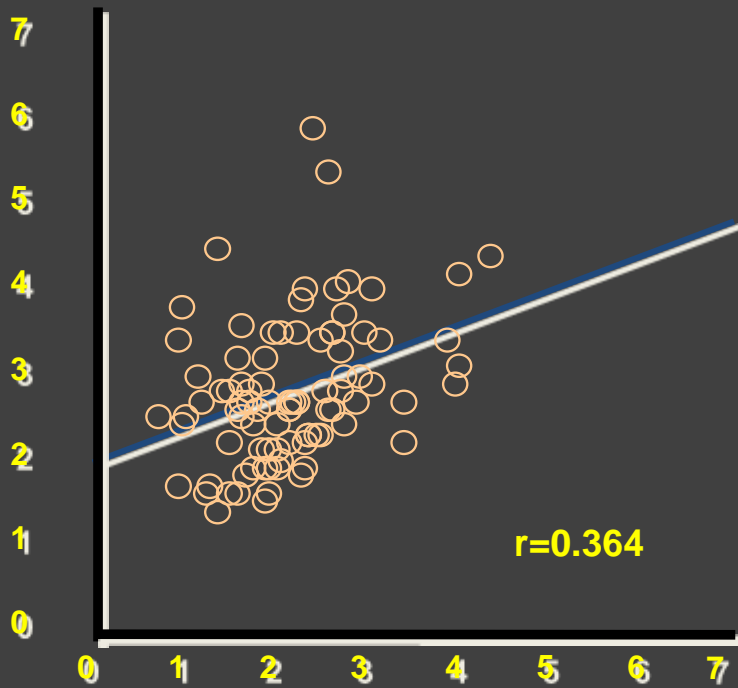


Angio vs IVUS in LMCA.

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

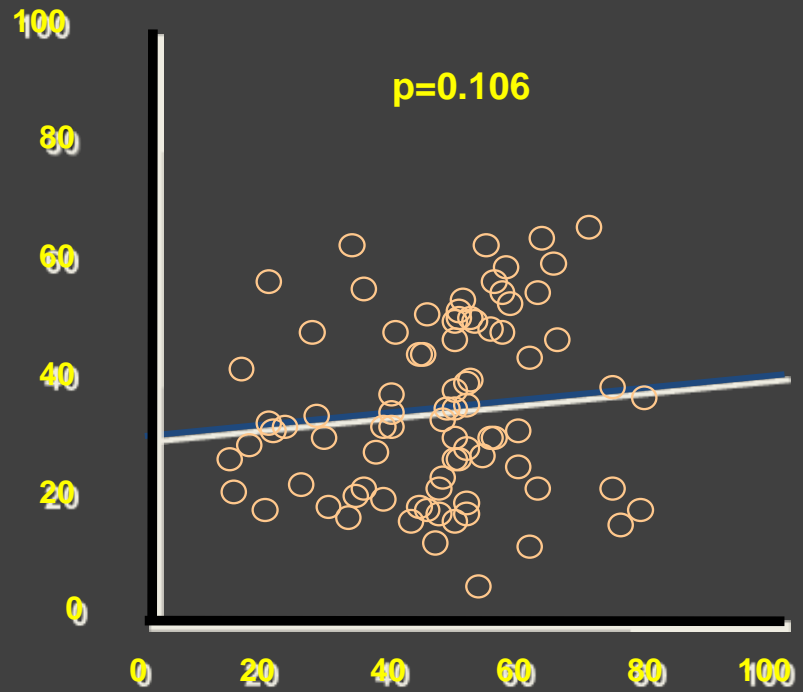
122 patients
with LM disease

IVUS MLD (mm)

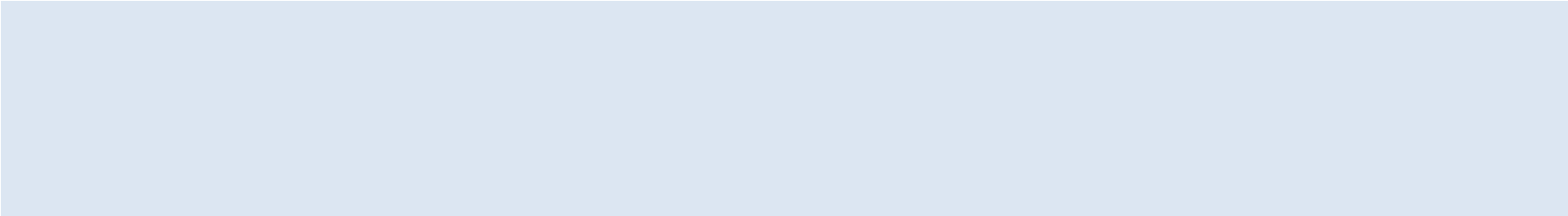


QCA MLD (mm)

IVUS DS



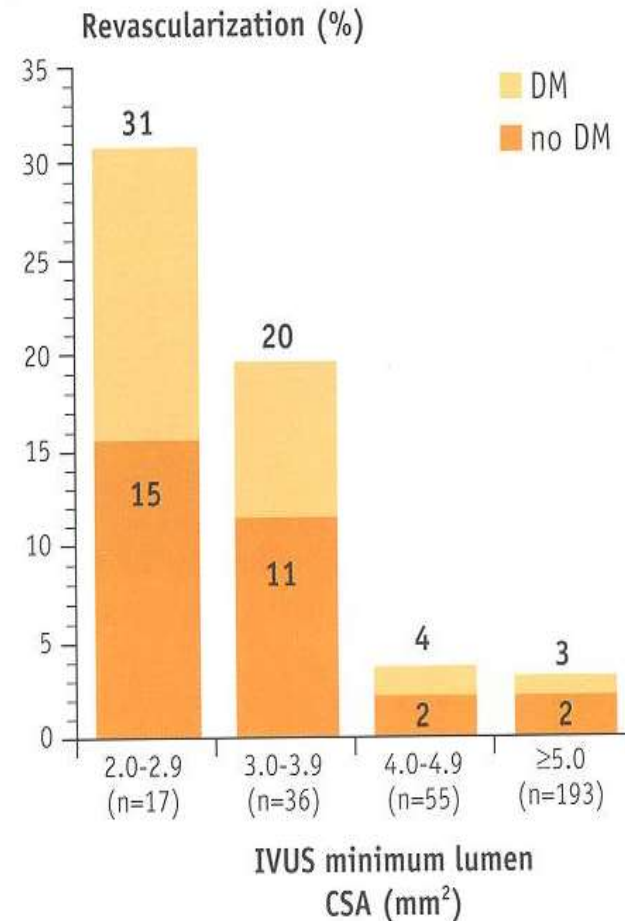
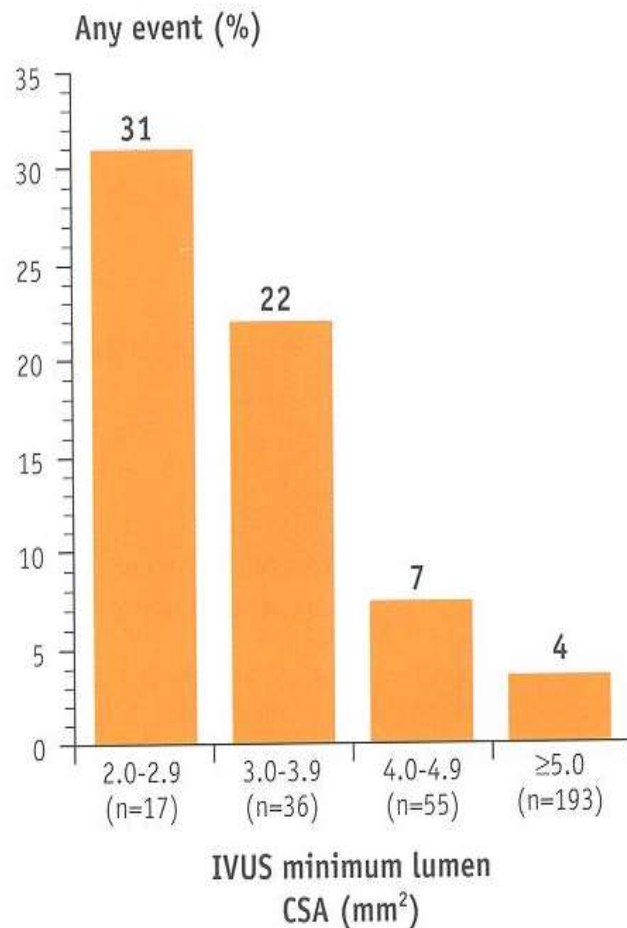
QCA DS

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

IVUS final Lumen Area Determines Prognosis

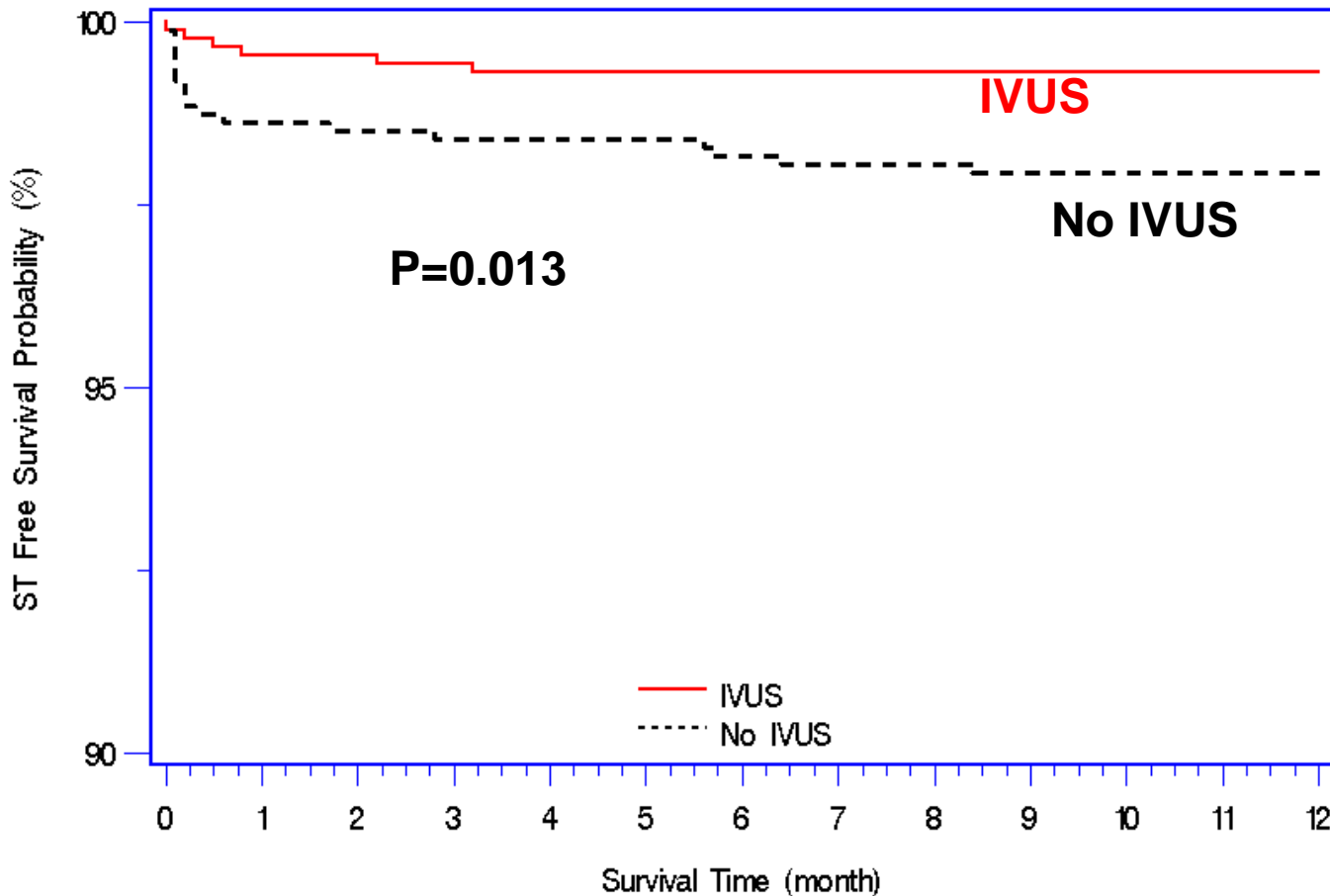
WHC: Abizaid et al. Circ 1999; 100:256-261

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



Freedom from Stent Thrombosis.

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

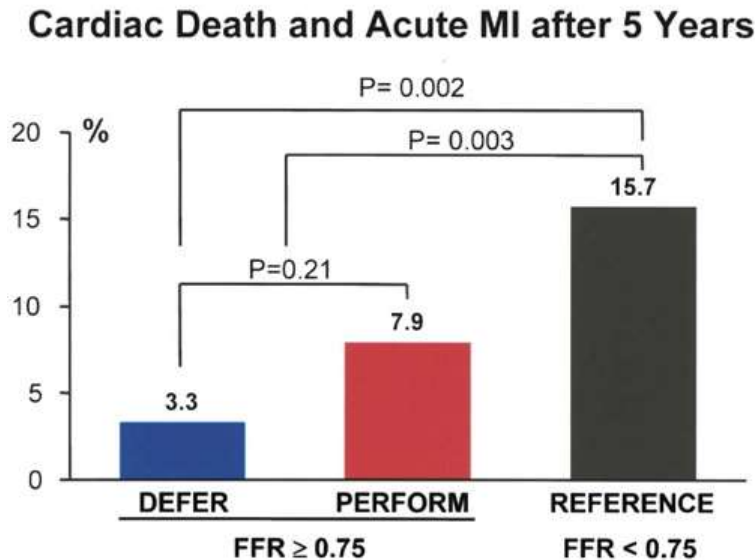


“No IVUS” was a significant predictor of cumulative ST at 12 months: HR 3.3, CI 1.25-10, p=0.01

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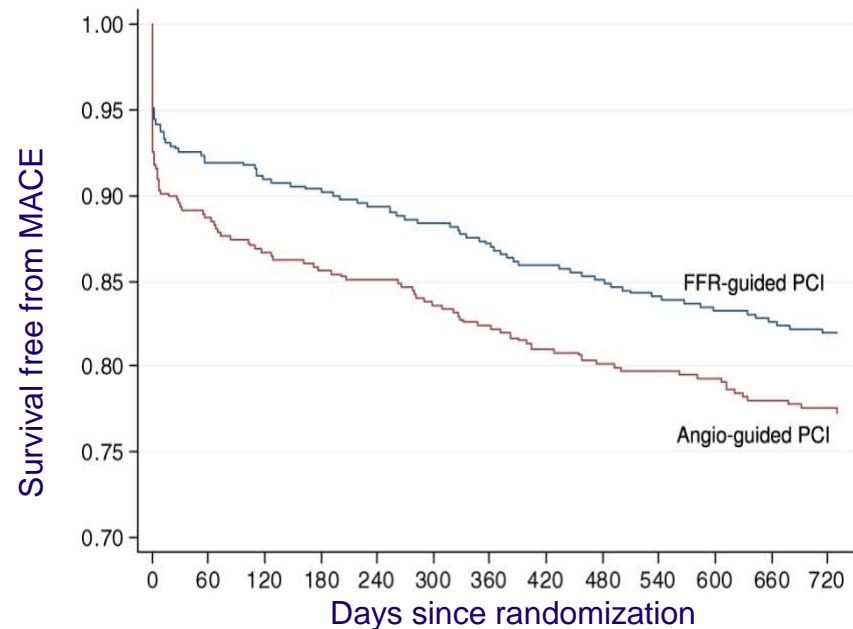
FFR Guidance Proven Clinically Superior than Angiographic Guidance.

DEFER 5 years



Pijls JACC 2007;49:2105

FAME two years



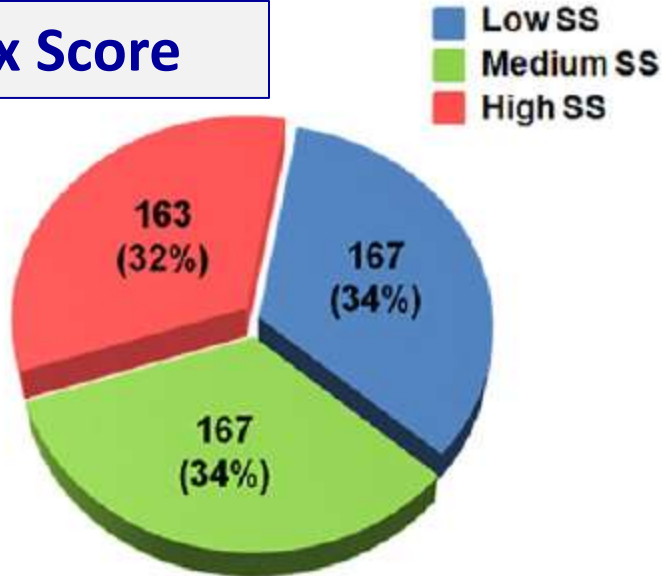
Pijls JACC 2010;56:177

Syntax Score vs. Functional SS.

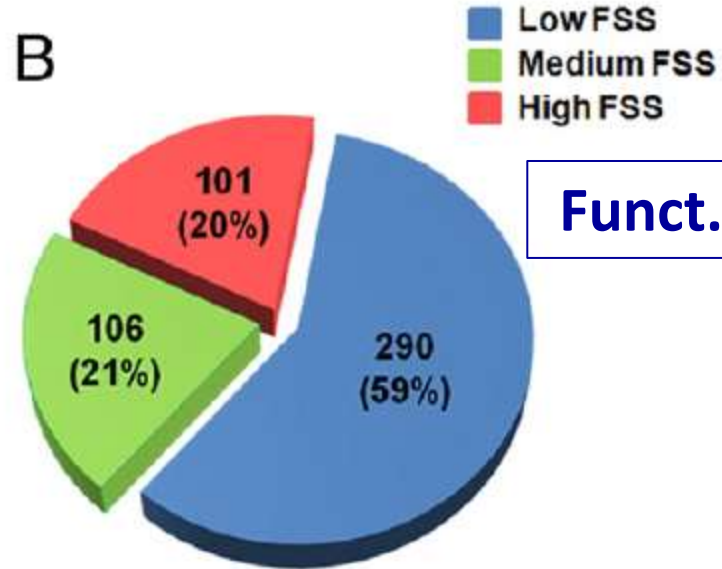
Nam et al. JACC 2011;58:1211-8



Syntax Score



B



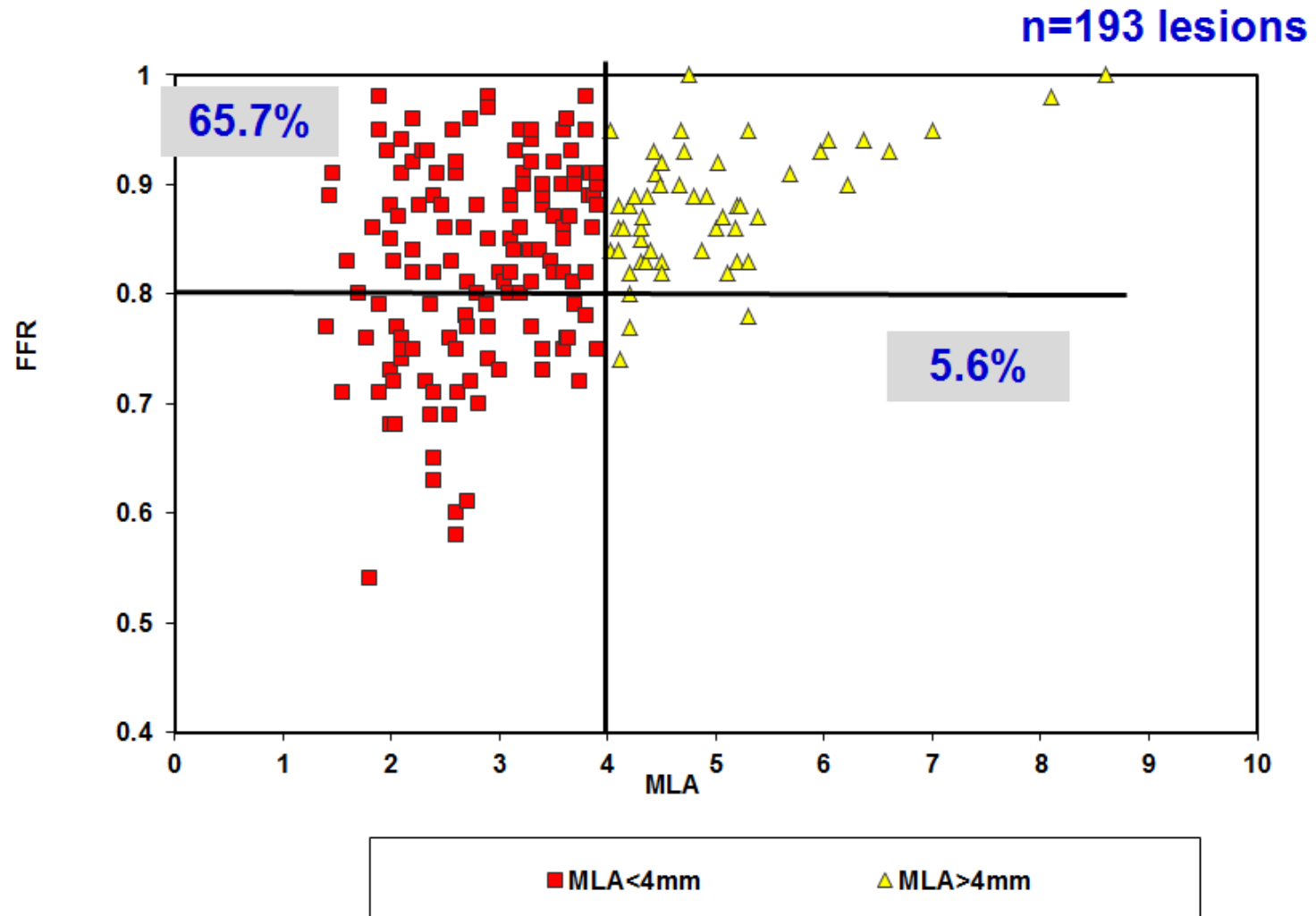
Funct. S Score

- 32% of patients moved from a higher-risk group to a lower-risk group :
- 38% of the highest SS tertile moved to the medium-lowest-risk FSS group
- 59% of the medium-risk SS tertile moved to the lowest-risk FSS group

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IVUS for prognosis

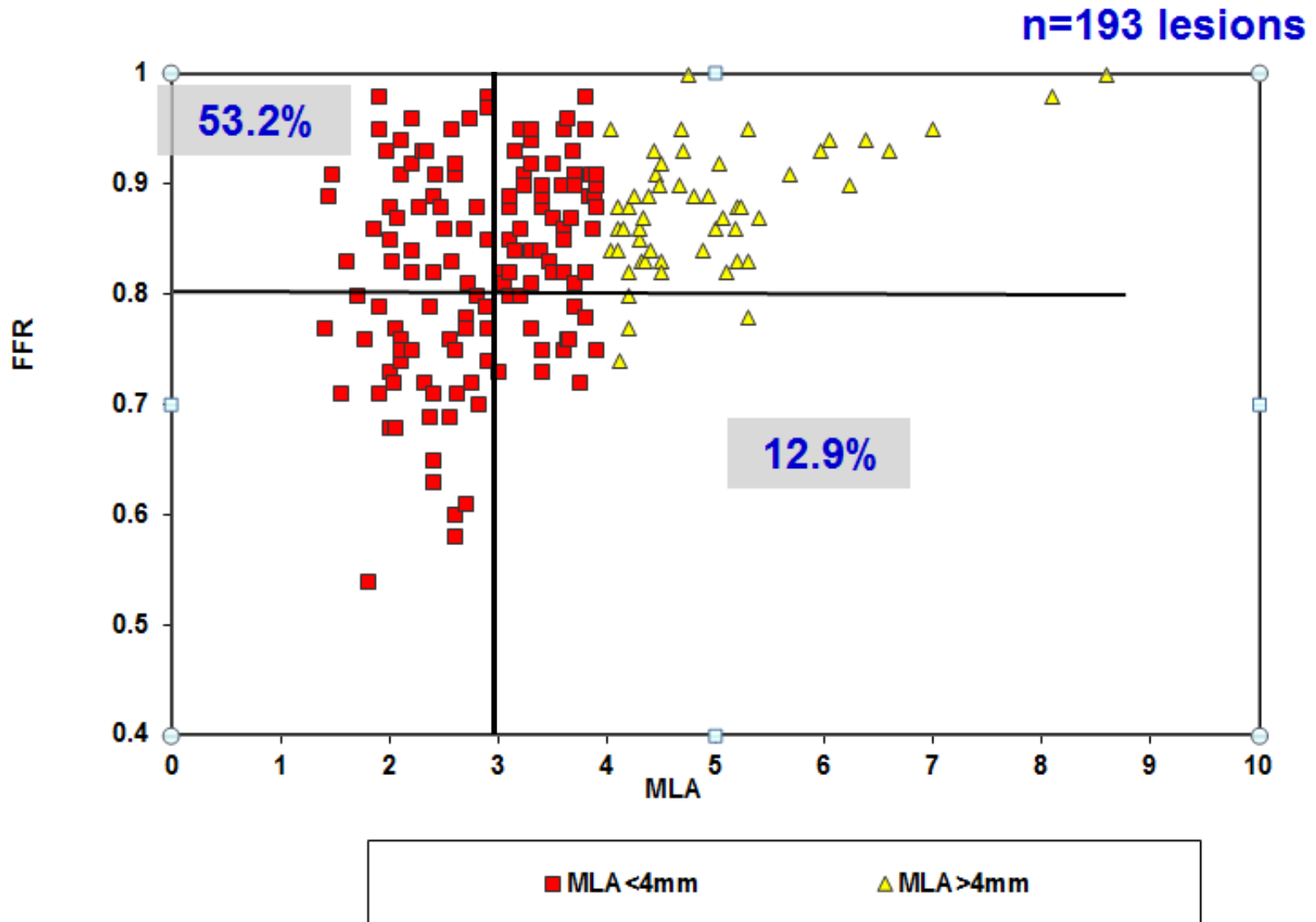
IVUS vs. FFR

WHC: Ben-Dor et al. Eurointervention 2011



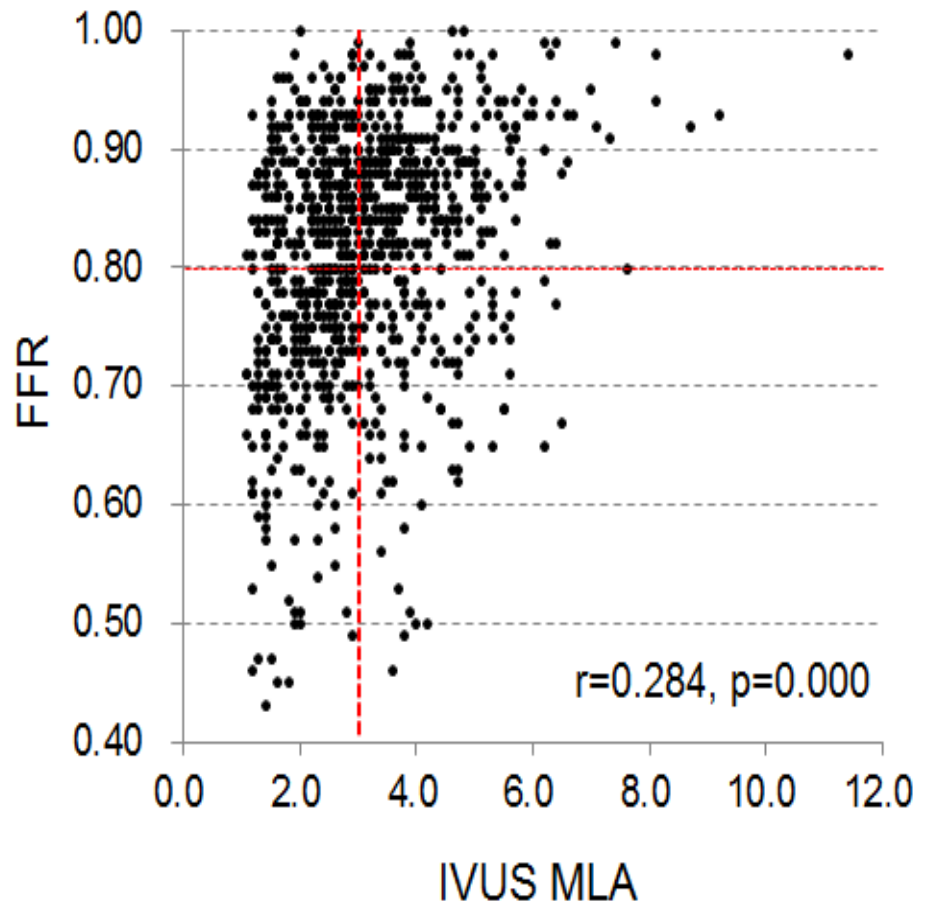
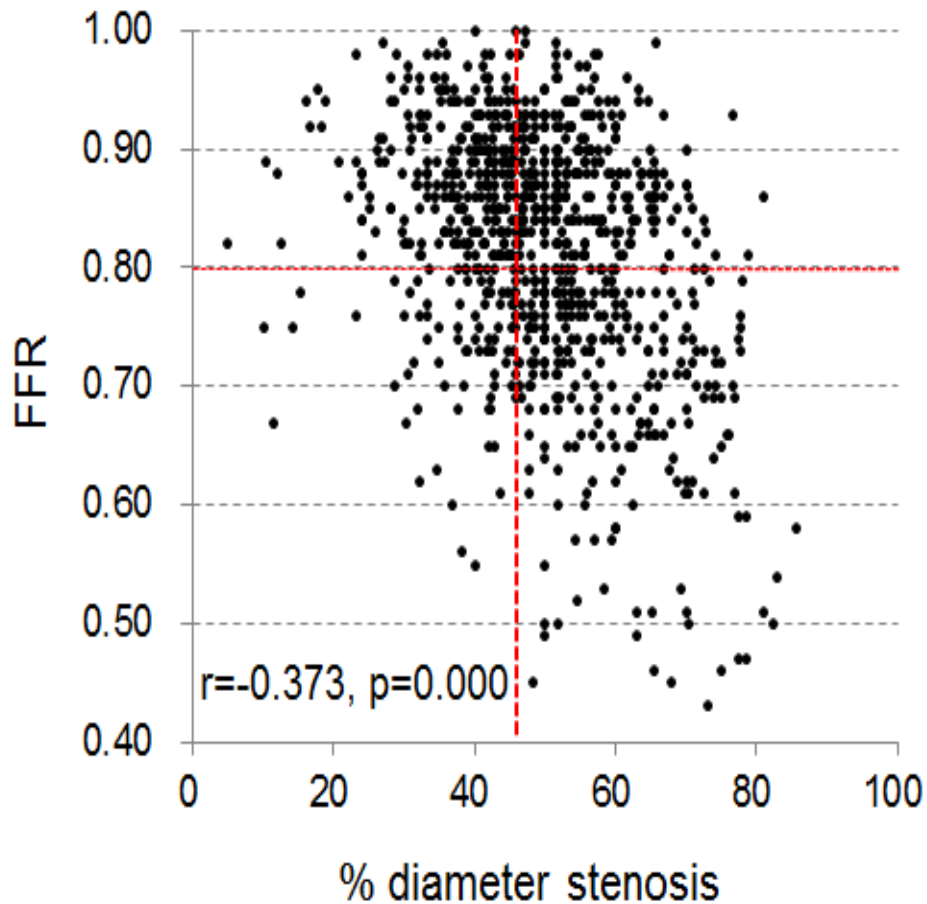
IVUS vs. FFR

WHC: Ben-Dor et al. Eurointervention In Press



881 Lesions with IVUS/FFR.

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

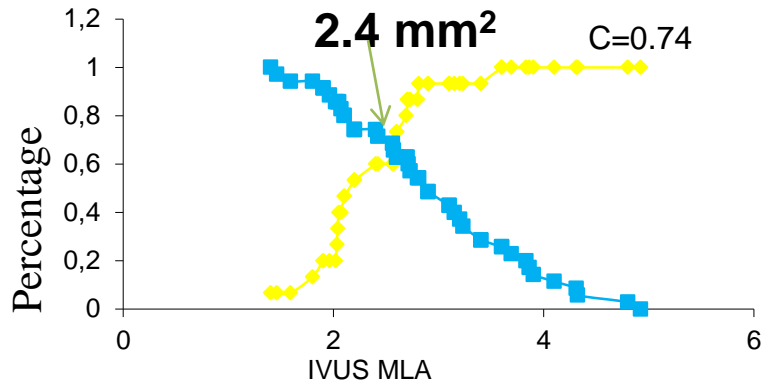


NO MORE 4 mm² at the WHC!

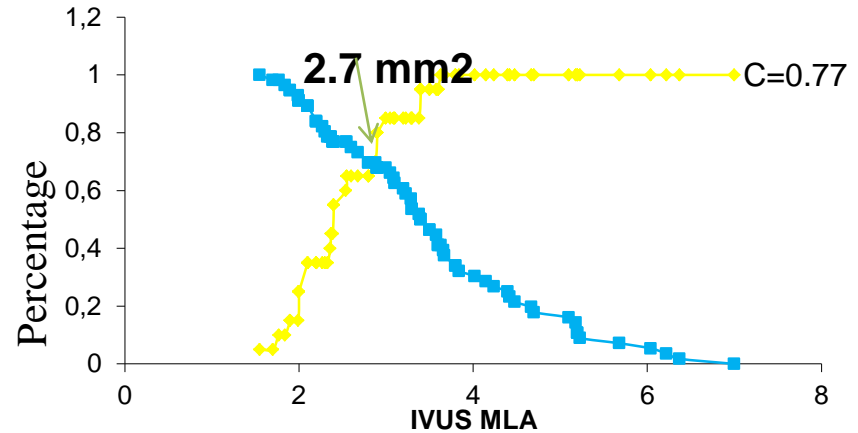
New IVUS MLAs since 2011.

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

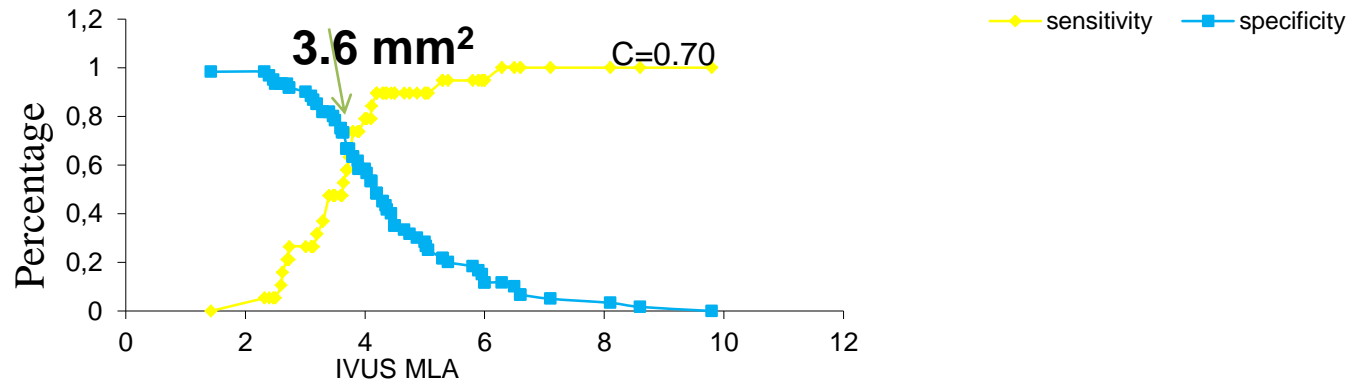
Reference vessel 2.5-3mm



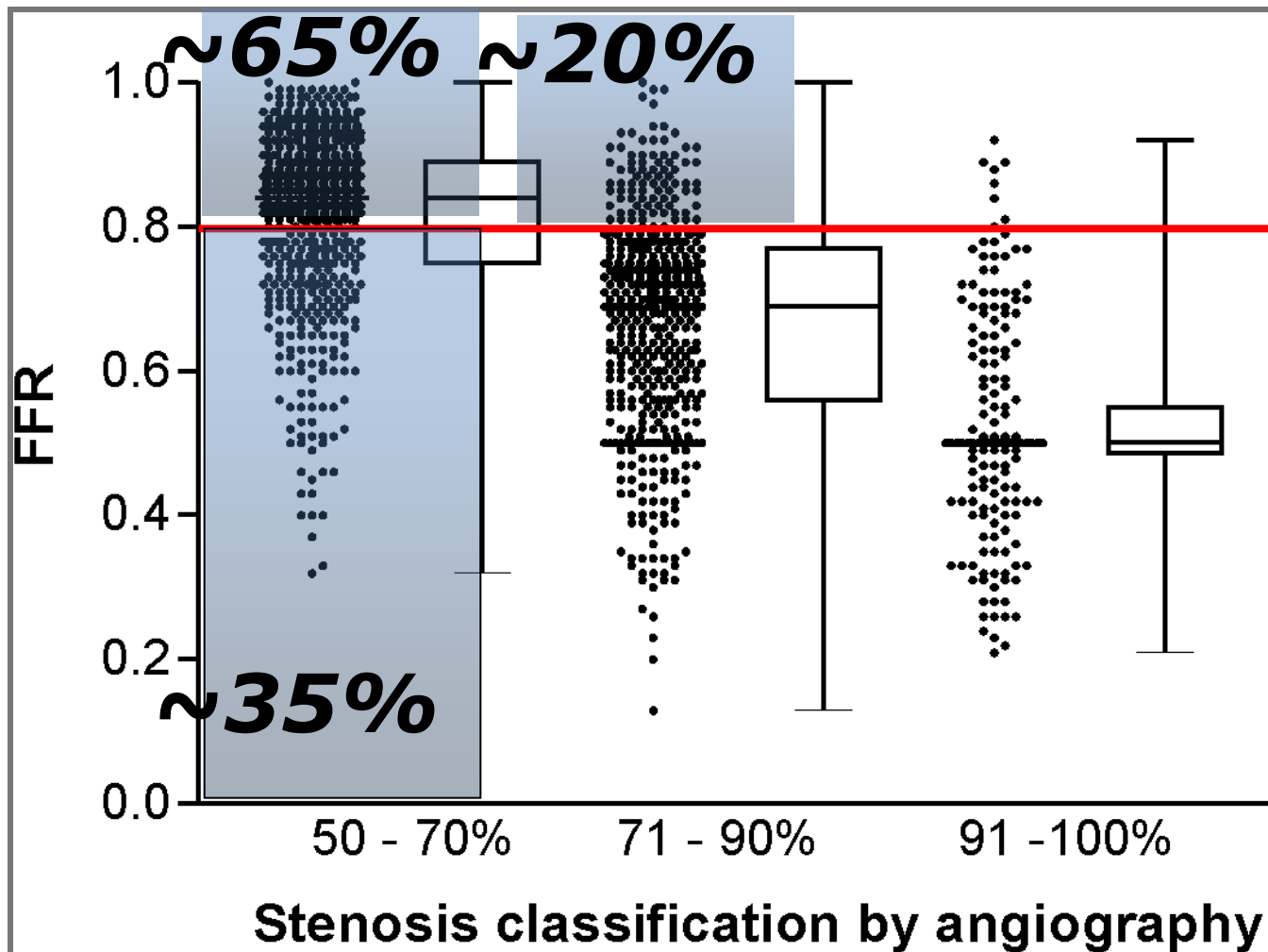
Reference vessel 3-3.5mm



Reference vessel >3.5mm



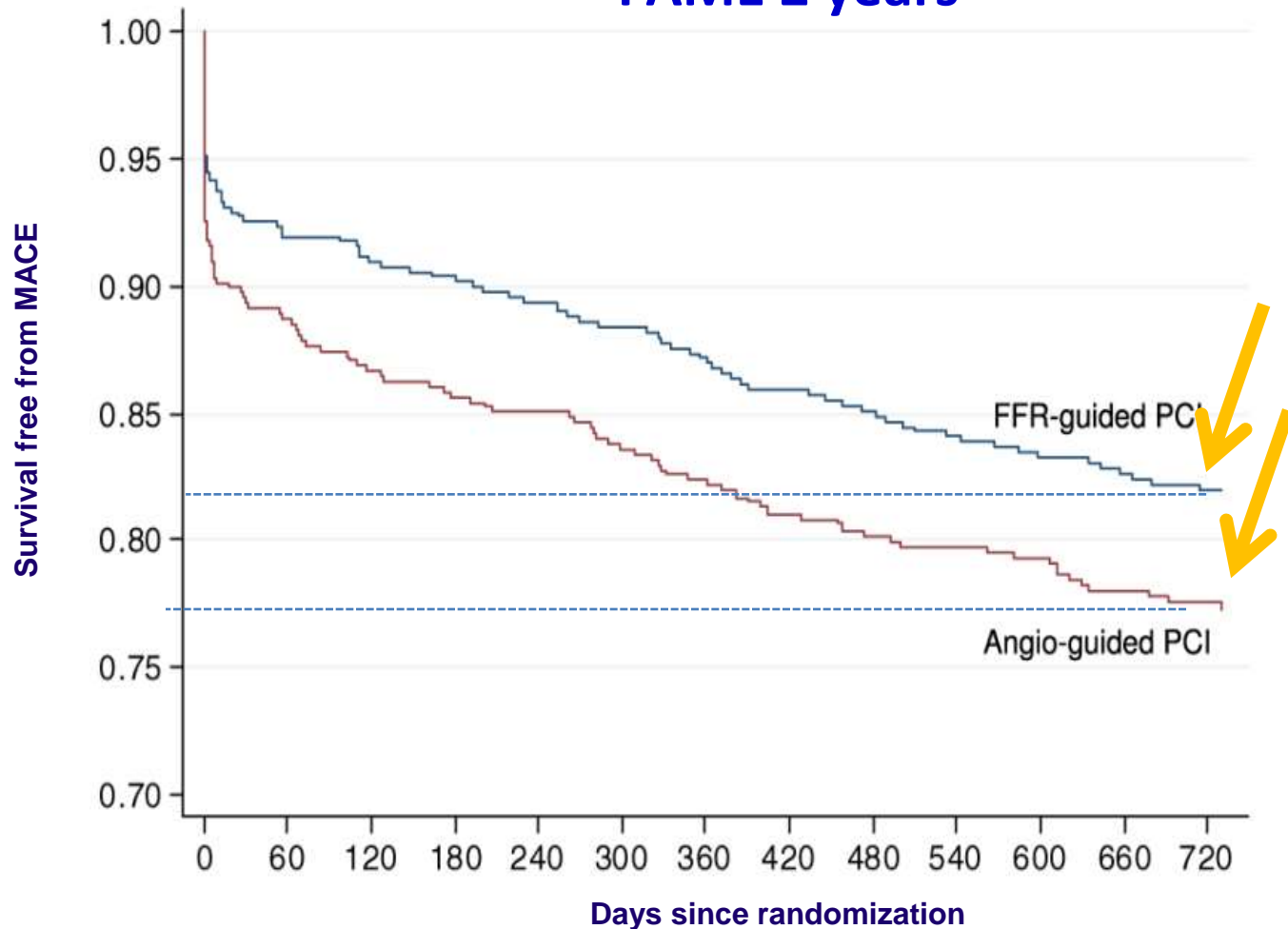
Which Lesions Need FFR?



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

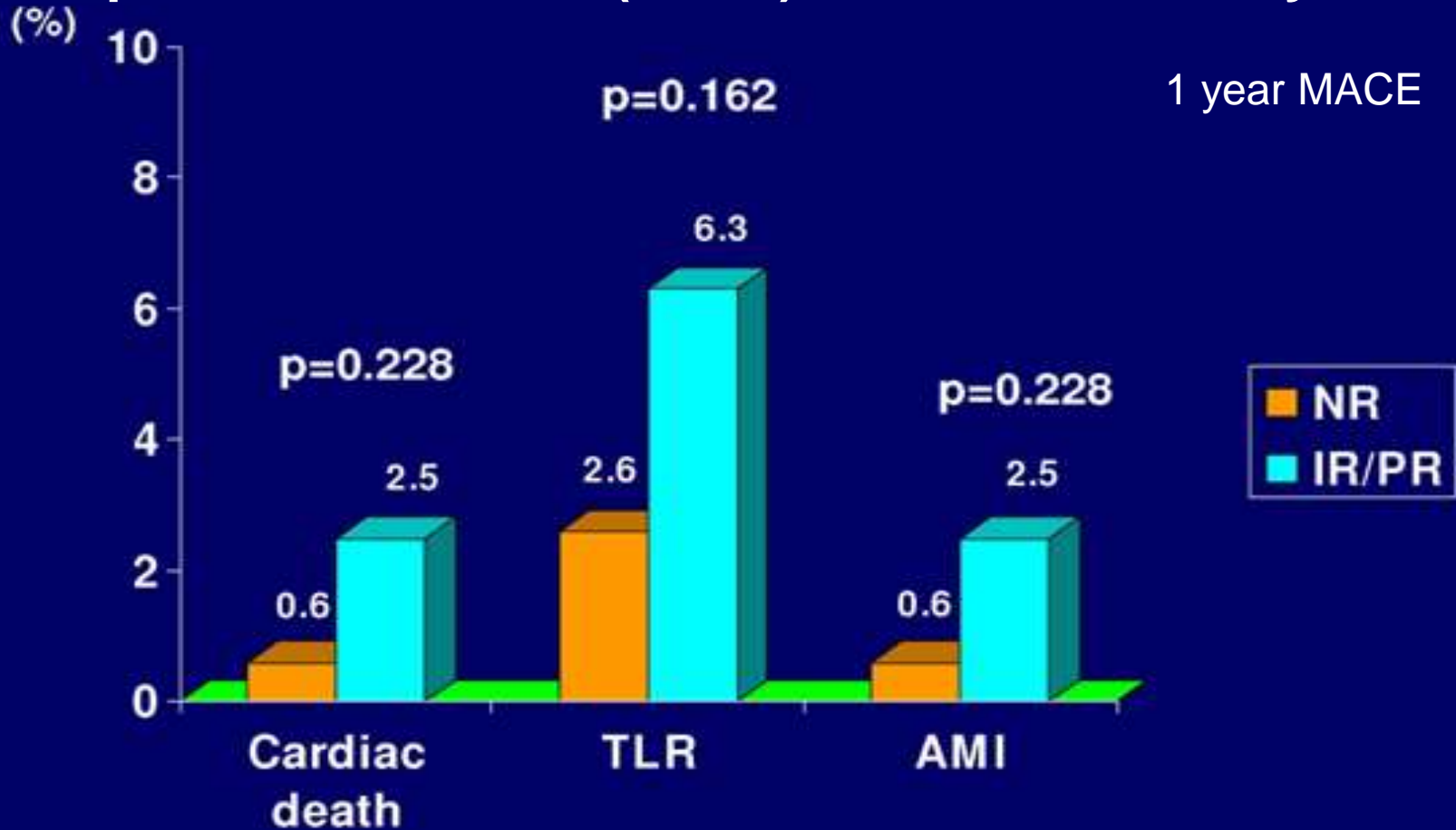
FAME 2 years



Plaque Positive Remodeling and Outcome.

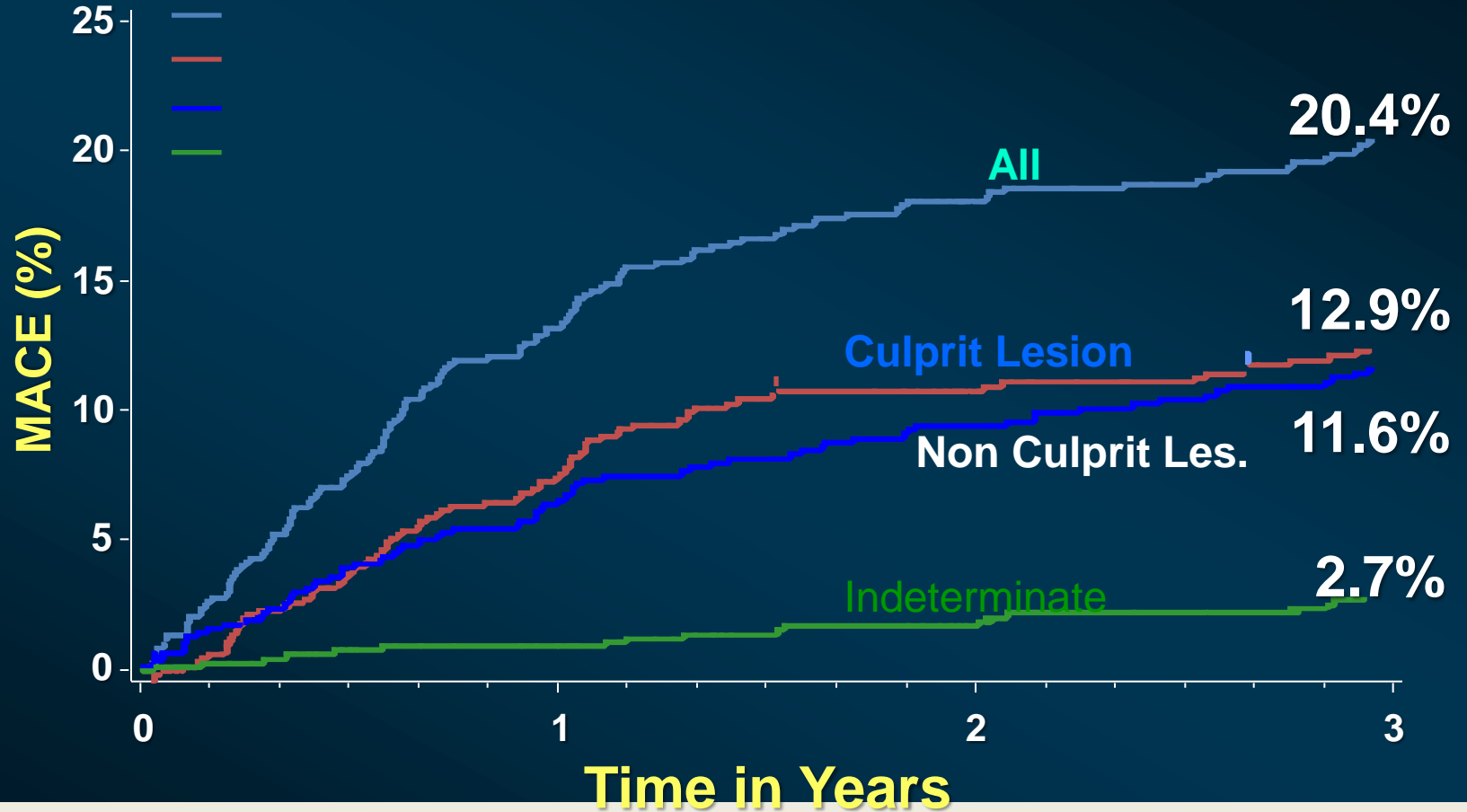
WHC: YJ Hong et al. JIC 2007;19:500-5

236 patients with mild (<50%) LMCA stenosis by QCA.



PROSPECT Trial

Stone et al. NEJM 2011;364:226-235



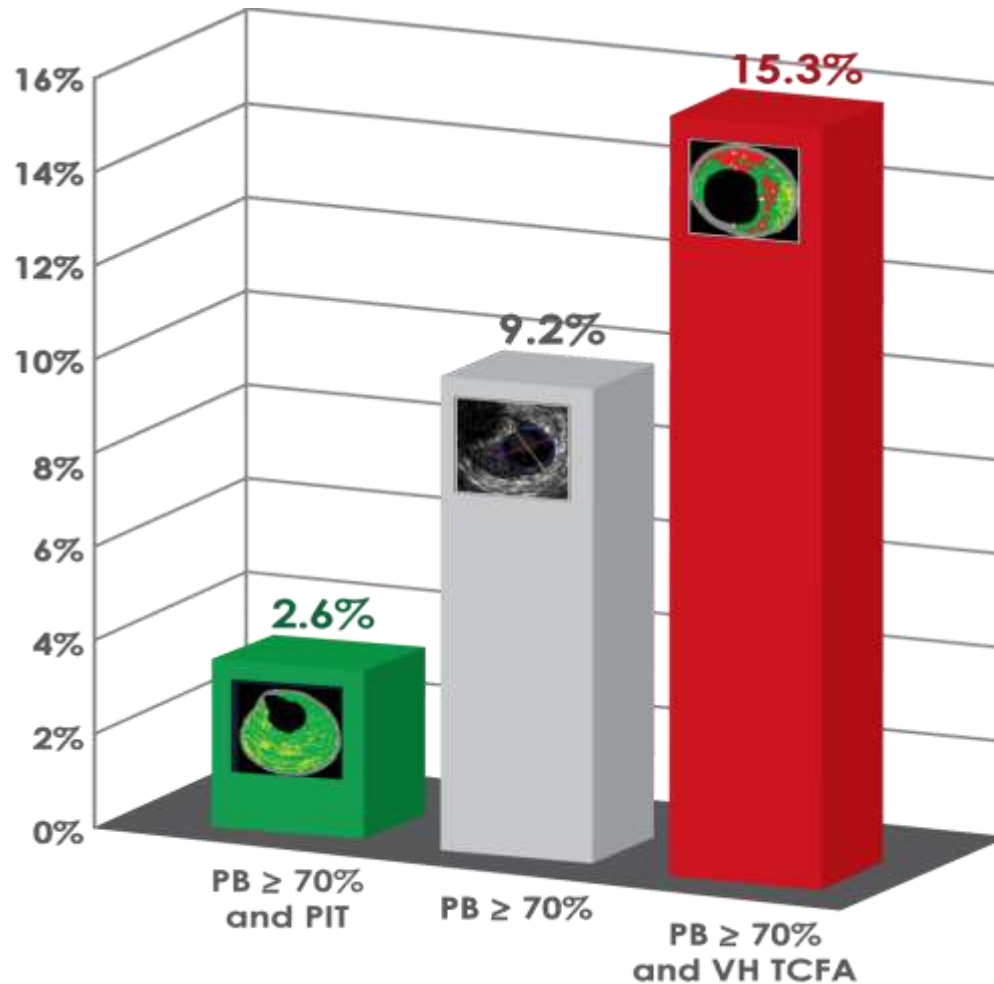
Number at risk

ALL	697	557	506	480
CL related	697	590	543	518
NCL related	697	595	553	521
Indeterminate	697	634	604	583

Plaque Characteristics Determine Outcome

Prospect Trial. Stone et al. NEJM 2011;364:226-235

**MACE
in non
Culprit
lesions**

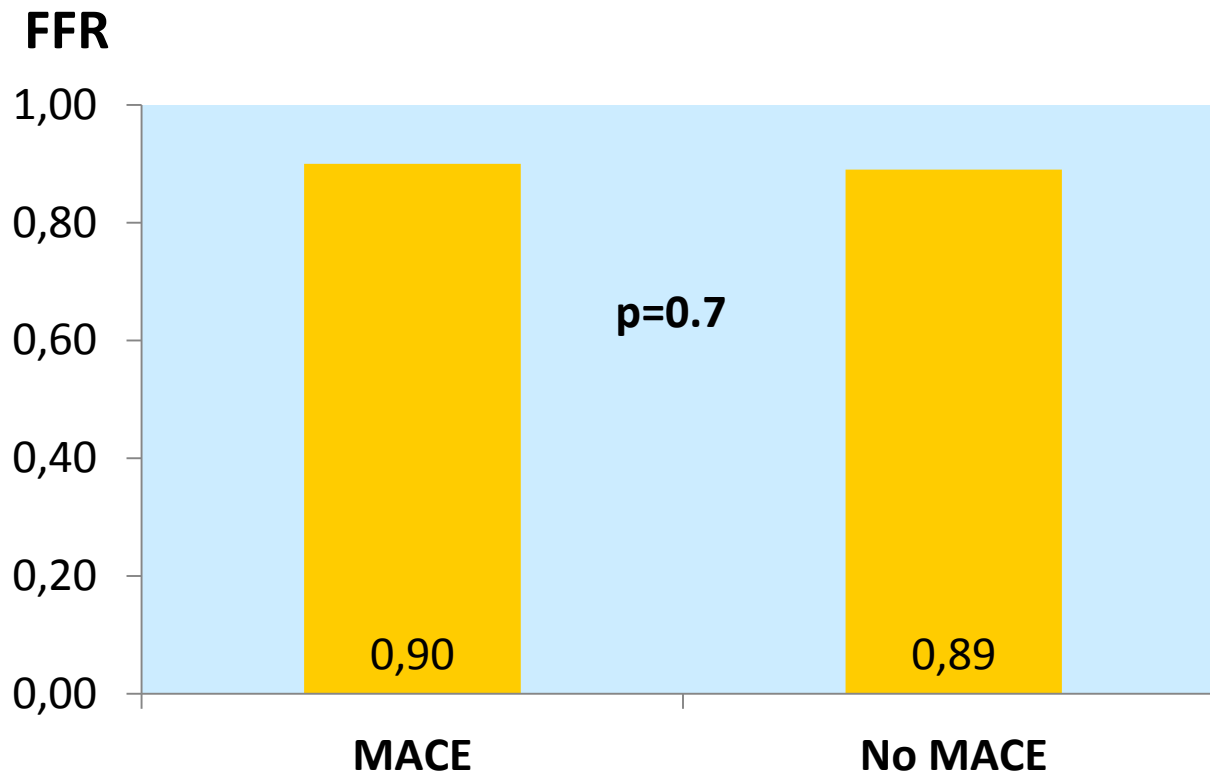


PIT= pathological intimal thickening

ATLANTA I

Voros et al. JACC Interv 2011; 4: 198 - 208.

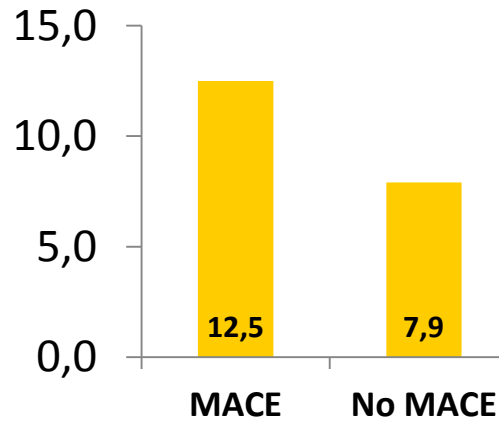
60 patients with FFR, VH, CT and Intermediate Lesions.
12 months follow up.



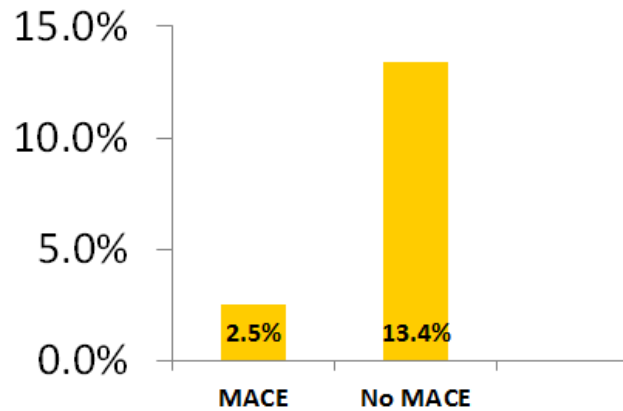
Plaque Characteristics and Outcome.

ATLANTA I. Voros et al. JACC Interv 2011; 4: 198 - 208.

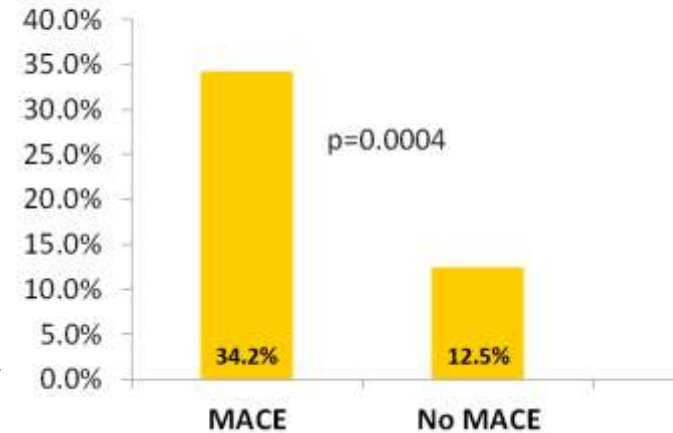
Plaque Volume



Dense Calcium %

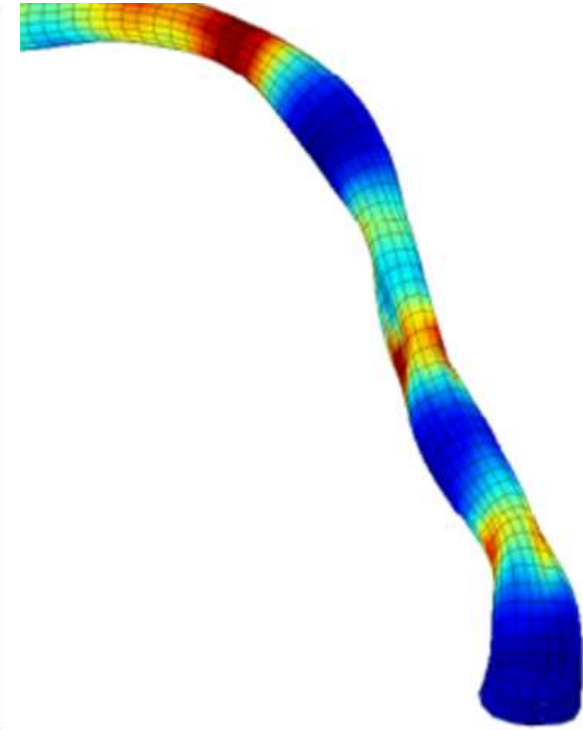
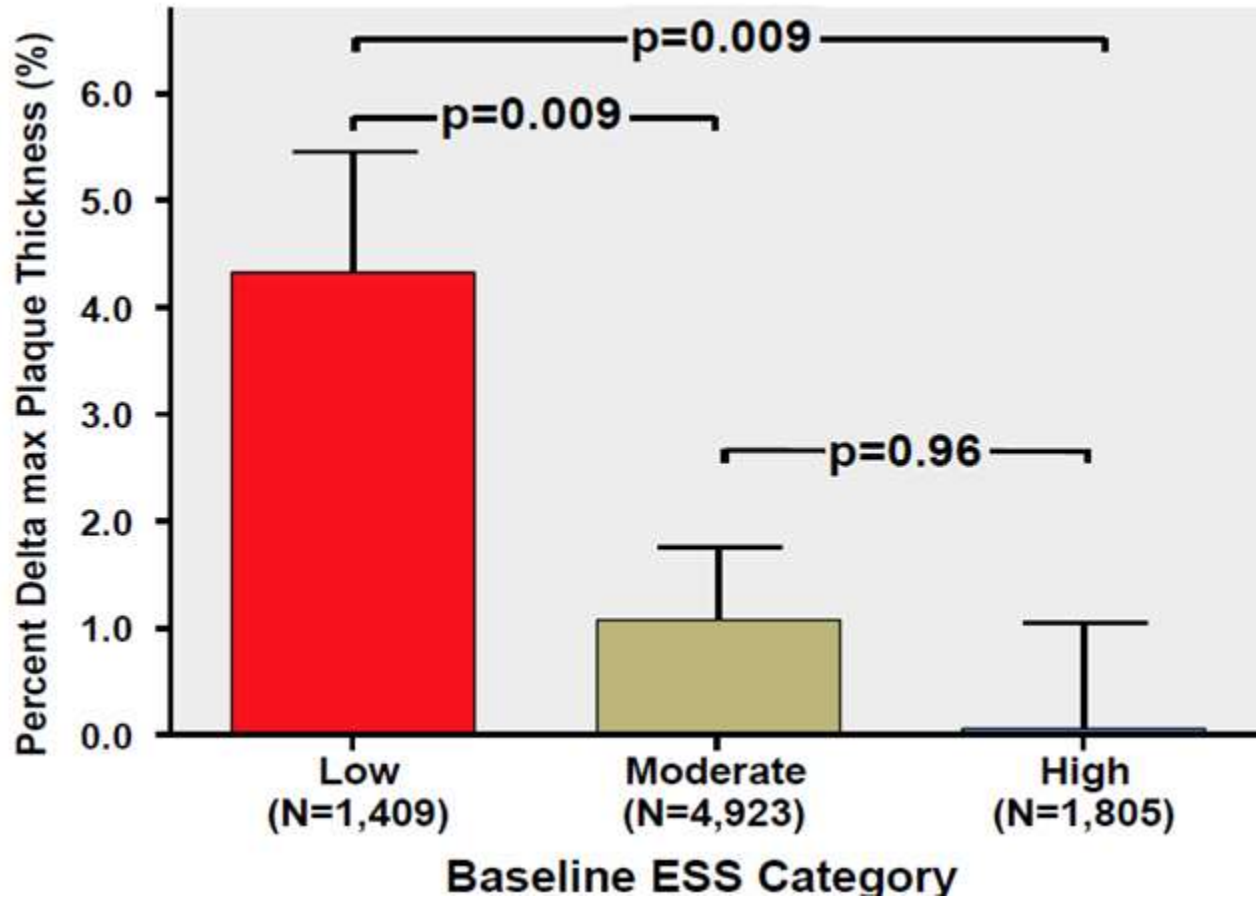


Fibro-Fatty %



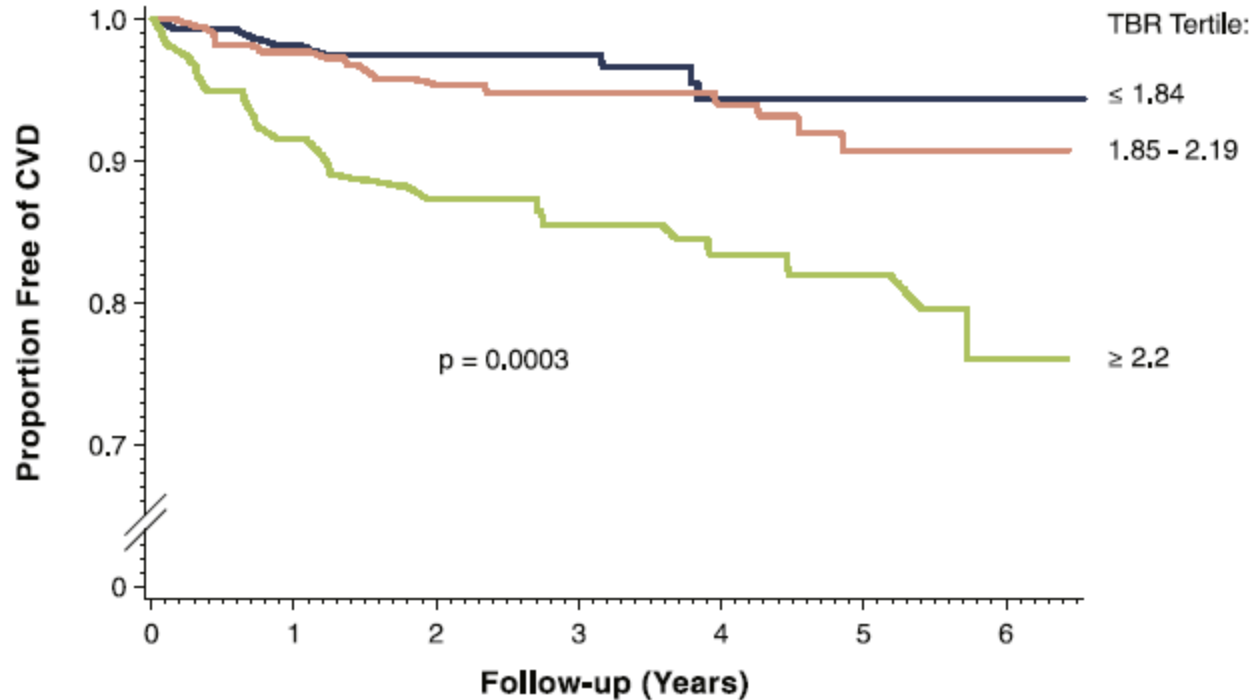
Endothelial Shear Stress and Outcome

Prediction Trial. Stone et al. Circ 2003;108:538



Arterial Inflammation by PET and CV Risk.

Figueroa et al. JACC Imaging 2013;6:1250-9



Number at Risk:

	0	1	2	3	4	5	6	<u>Adjusted HR:</u>
TBR Tertile 1:	167	160	149	120	75	36	10	1.0 (Referent)
TBR Tertile 2:	224	216	199	170	112	58	14	1.36 (0.55, 3.35)
TBR Tertile 3:	122	108	101	92	74	40	14	4.71 (1.98, 11.2)

TBR= target to background ratio of 18F-fluorodeoxyglucose uptake by PET

US PCI Procedures 2006-2012



Figure 1. PCI procedures in the United States, 2006-2012.

With permission from Boston Scientific, Source: Medical Device Industry Estimates, 2012. (Referred to by Gregg W. Stone, MD).

- **Angiography not enough to indicate intervention.**
- **Symptoms and NI data determine appropriateness.**
- **Physiological proof of ischemia producing lesion required.**
- **Institutional, payers, government monitoring.**

Conclusions

- 1. Non Invasive quantification of ischemia and severity of symptoms determines need for angiography.**
- 2. Angiography (QCA) is no longer the Gold Standard for lesion severity, except for lesions $<40\%$ or $>90\%$ diameter stenosis.**
- 3. FFR is presently the optimal method to decide if intervention is needed in intermediate lesions (50-80%).**
- 4. IVUS contributes greatly to achieve optimal PCI.**
- 5. Plaque characteristics on IC imaging (IVUS, OCT, MSCT, MRI, NIR, etc) can help predict outcome.**

The end