Coronary Physiology and Imaging Summit
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Physiologic Study and PCI

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Conflict of Interest

- No conflict of interest relevant to this talk

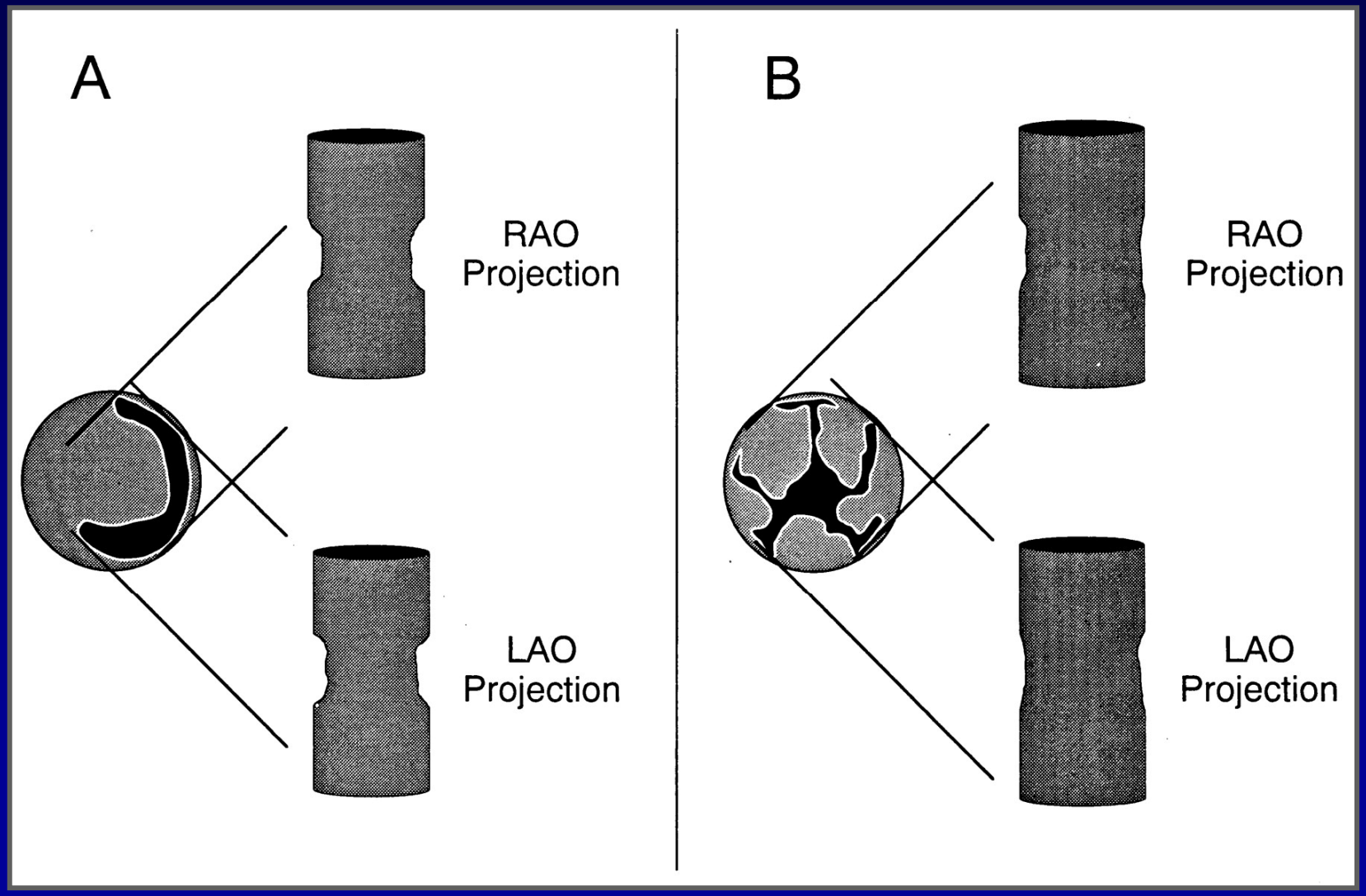
Why do we need physiology?

- Limitations of coronary angiography
- Limitations of noninvasive techniques
- Potential downside to indiscriminate DES use
- Cost issues

Why do we need invasive techniques?

- Limitations of coronary angiography
  - "Lumenogram"
  - Disconnect between angiography and physiology

Limitations of Angiography:



Topol and Nissen Circulation 1995;92:2333-42

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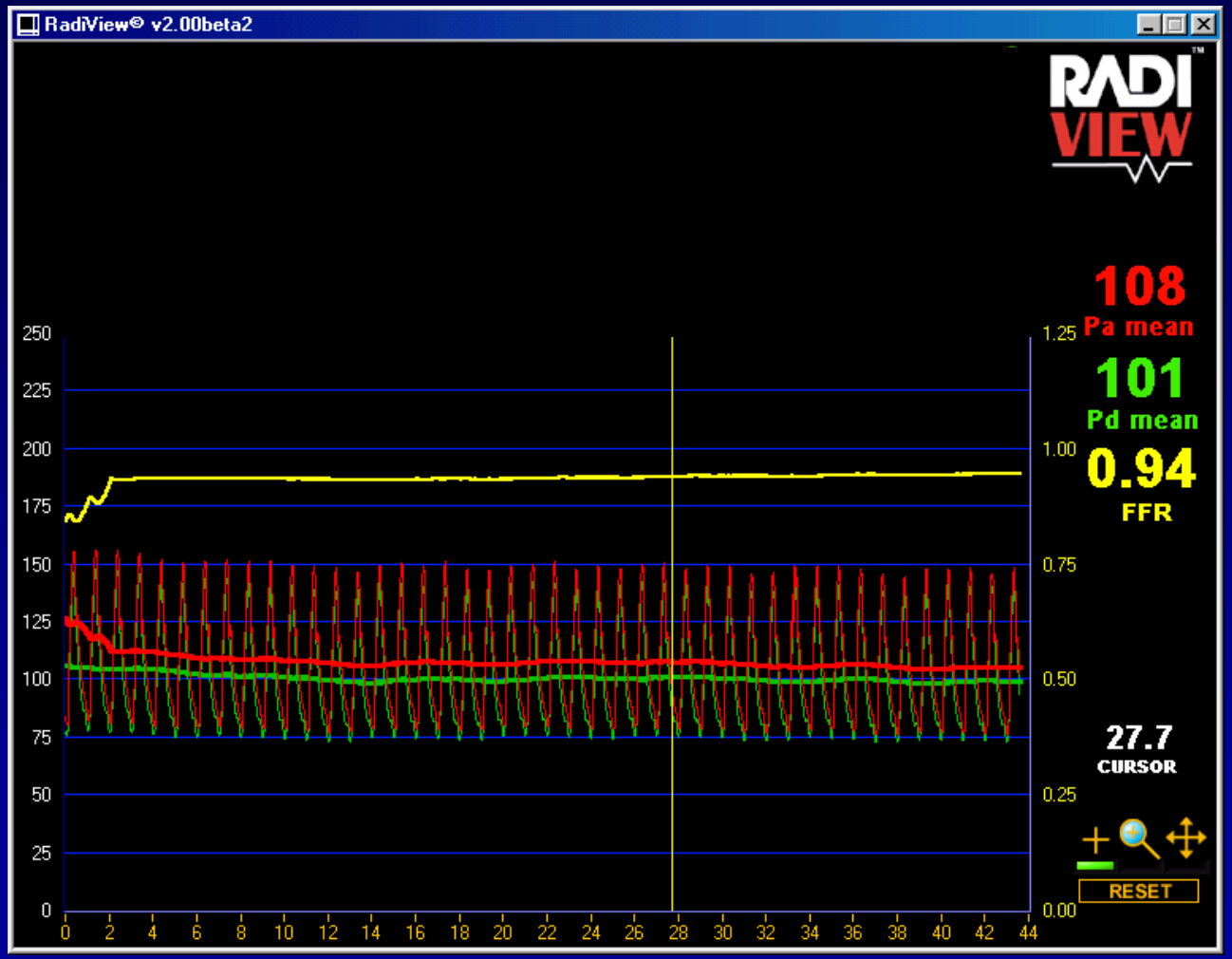
Disconnect between Angiography and Physiology



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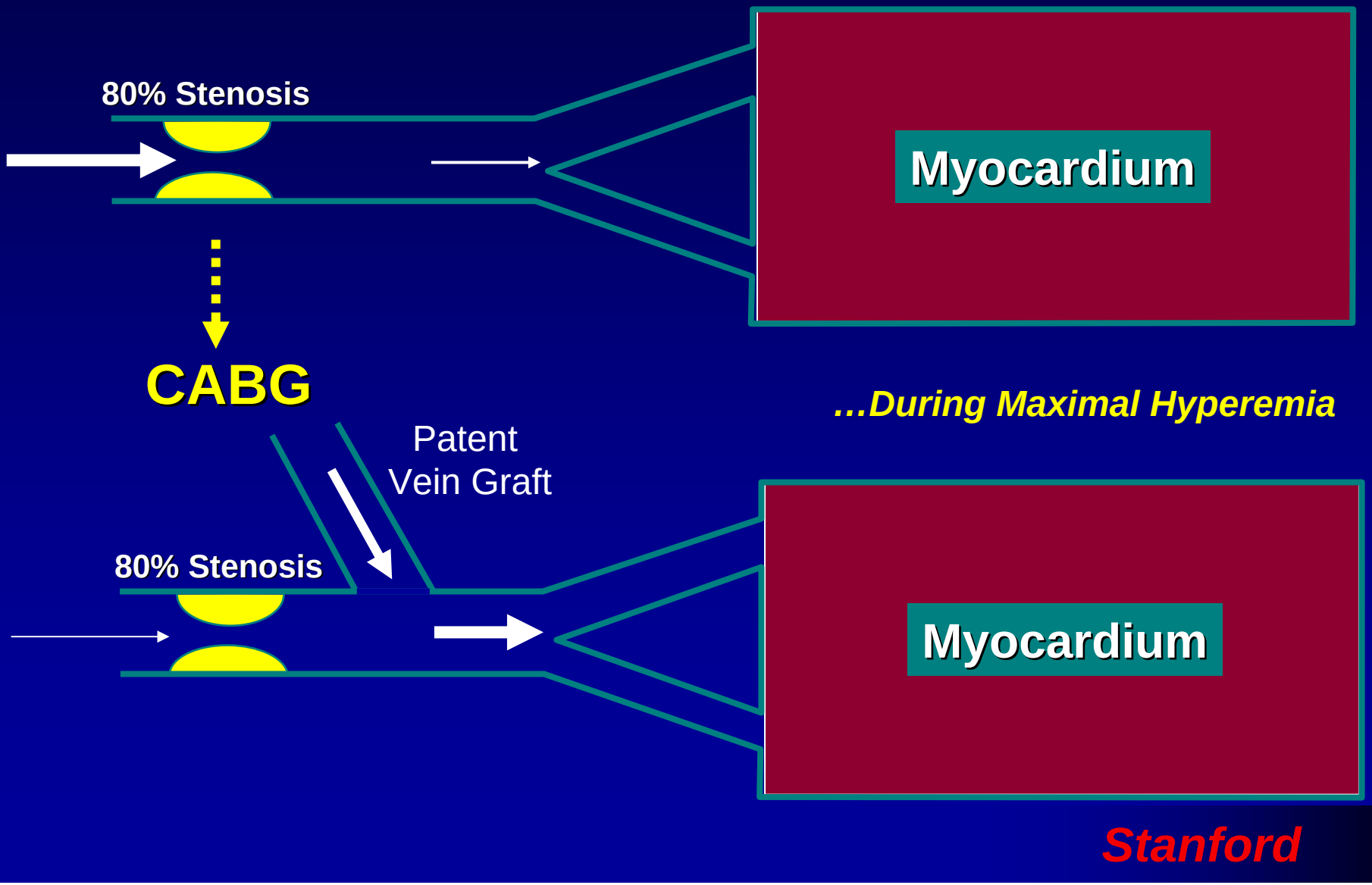
Disconnect between Angiography and Physiology



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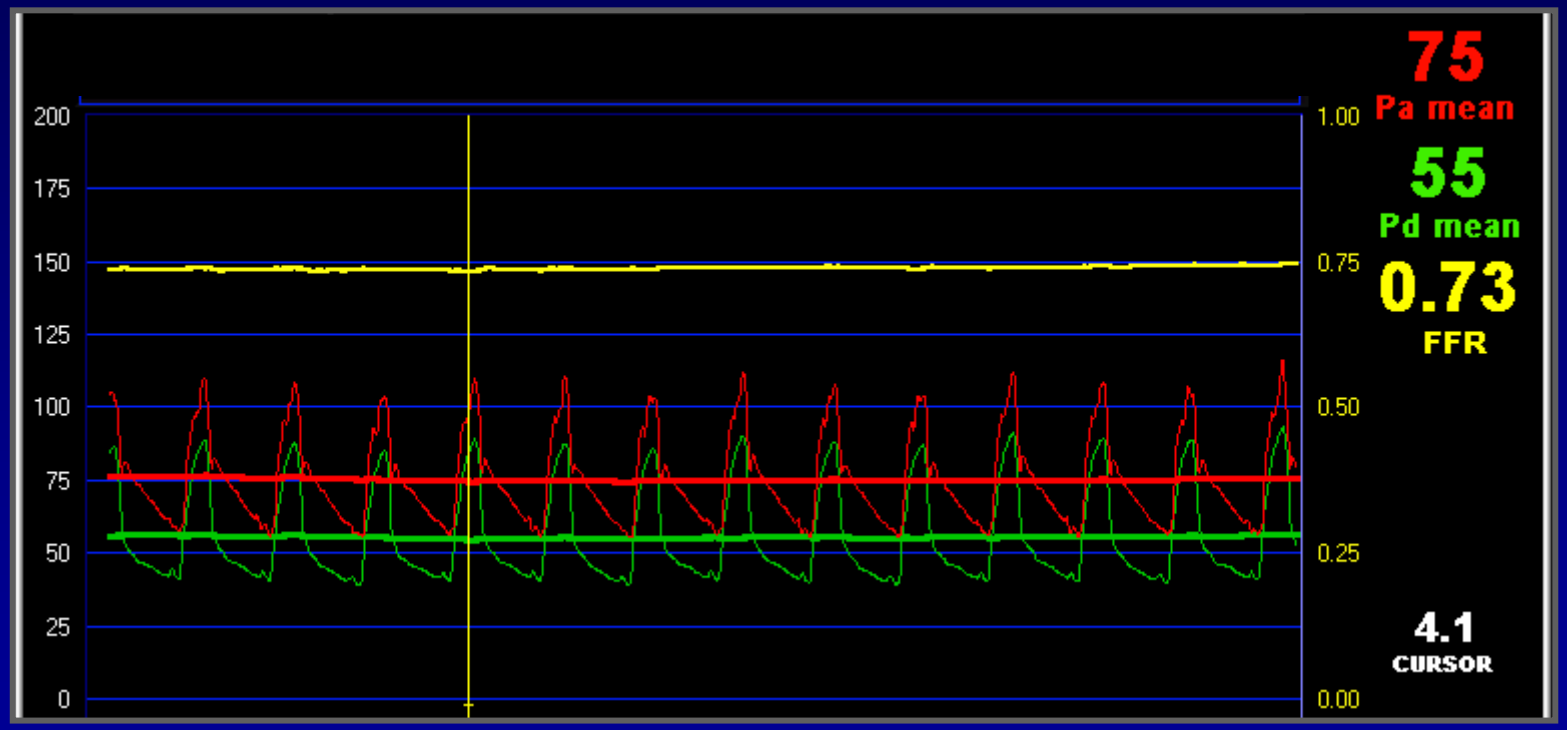
Disconnect between Angiography and Physiology



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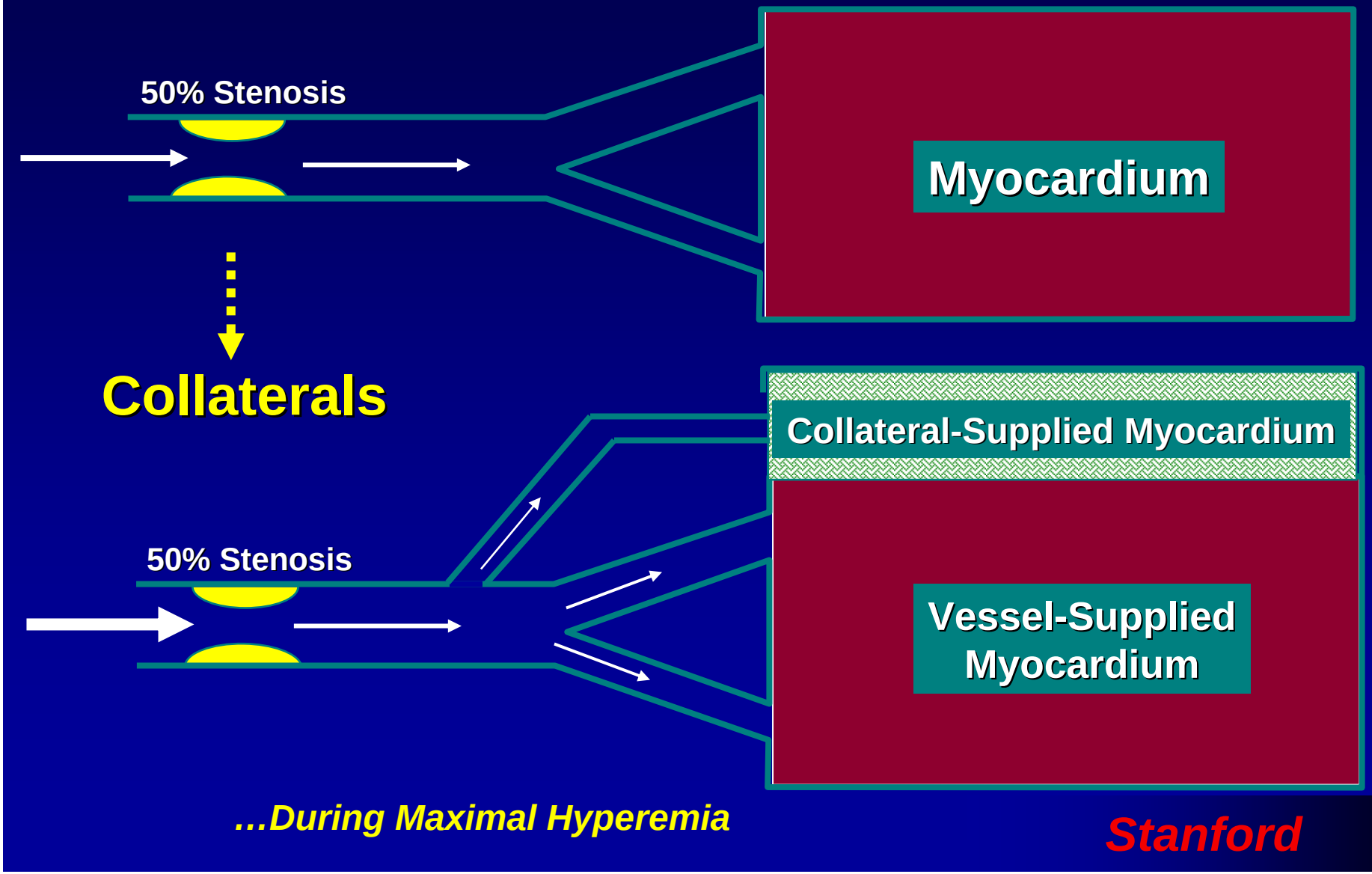
Disconnect between Angiography and Physiology



…During Maximal Hyperemia

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Why do we need physiology?

- Limitations of coronary angiography

- Limitations of noninvasive techniques
  - Often not performed
  - Can be inaccurate in multivessel disease
  - Generally “territory” specific, but not “vessel” specific
  - Can be “vessel” specific, but not “lesion” specific

Limitations of Noninvasive Imaging:

143 Patients with angiographically significant
3 vessel disease (> 70% diameter stenosis)

Thallium Scan Finding	% Patients
No Defect	18%
Single Vessel Pattern	36%
Two Vessel Pattern	36%
Three Vessel Pattern	10%

Lima et al. J Am Coll Cardiol 2003;42:63-70

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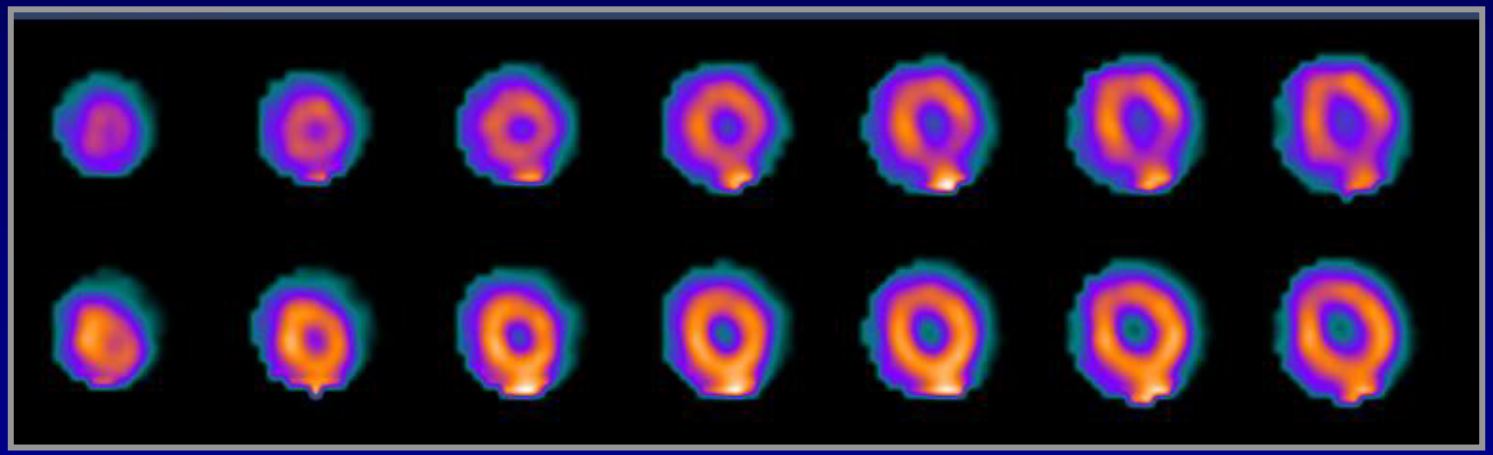
FFR-Guided PCI in MVD

- 74 year old woman with HTN, hyperlipidemia, diabetes and atrial fibrillation
- Admitted with ACS and ruled out
- Stress thallium revealed inferior and lateral reversible ischemia

Nuclear Perfusion Scan

Stress

Rest



Inferolateral Ischemia

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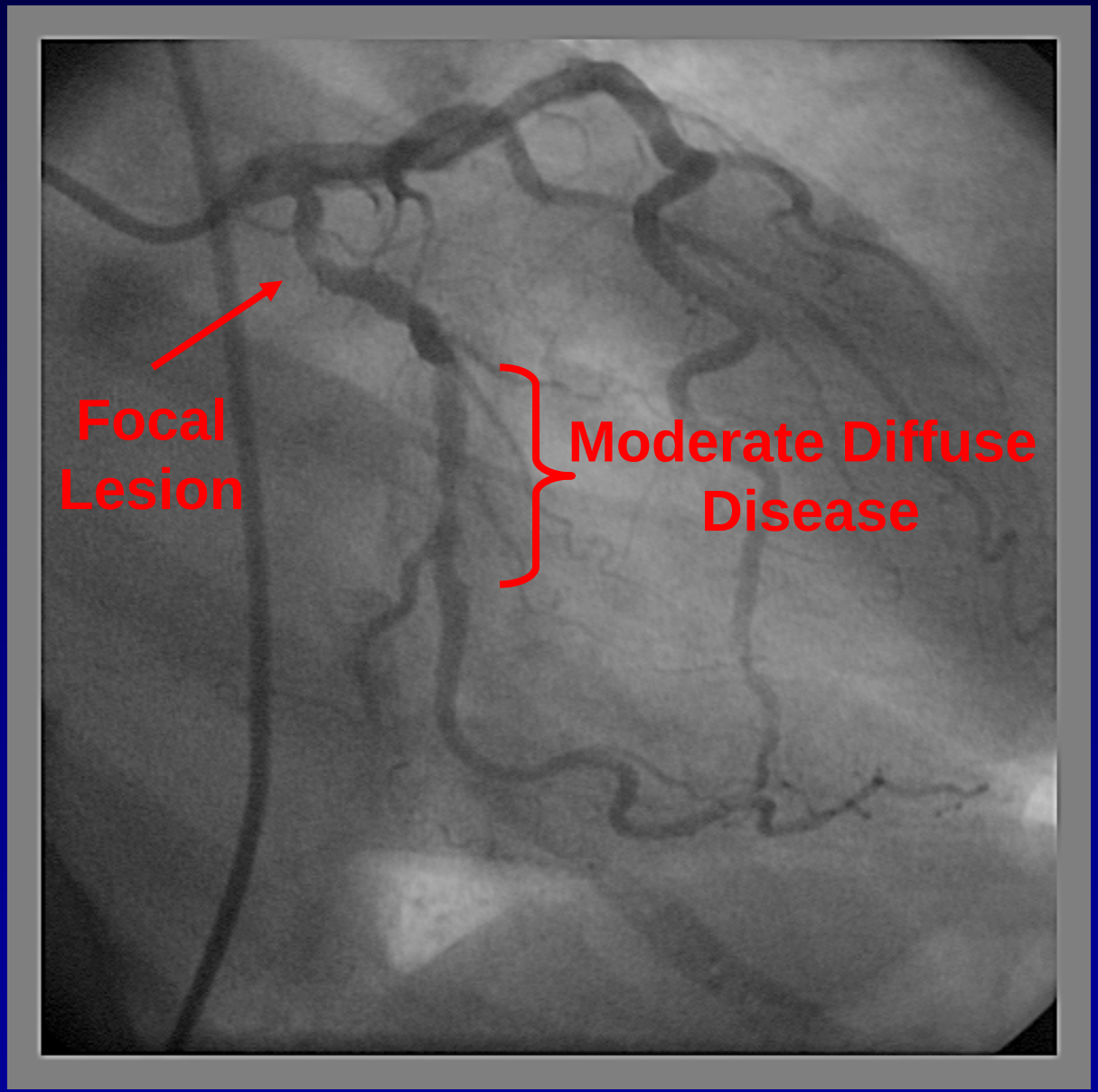

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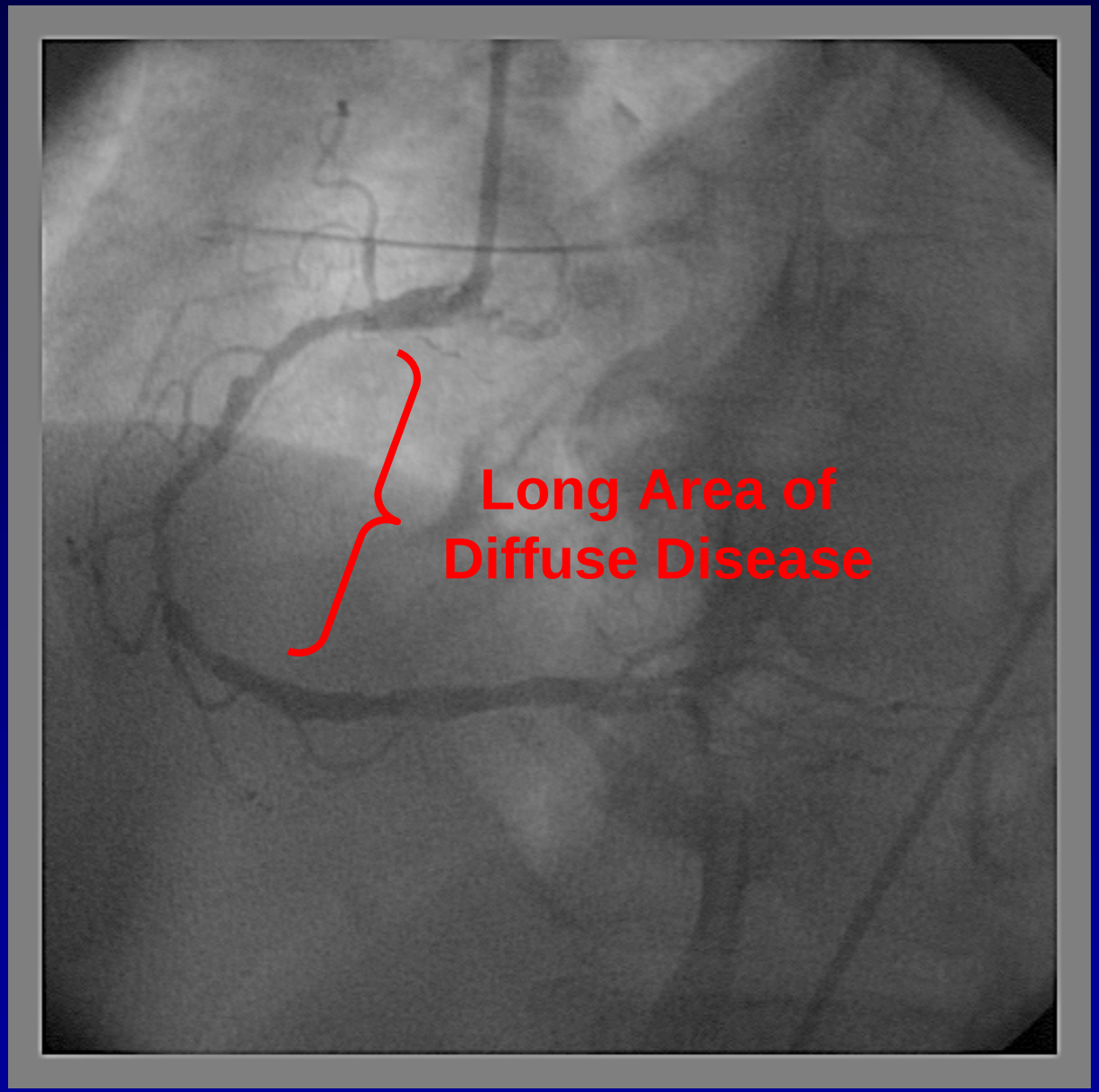
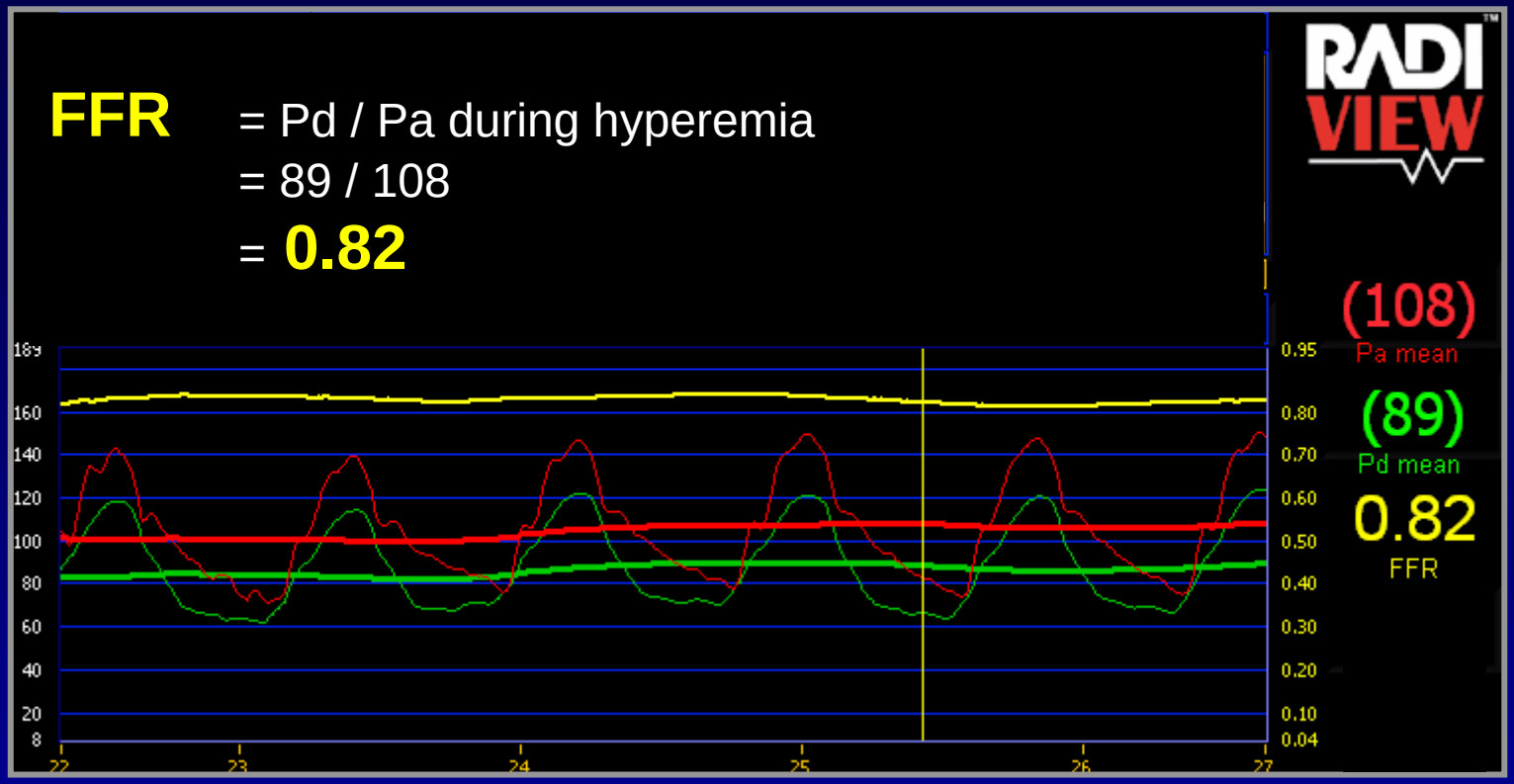

Long Area of
Diffuse Disease

FFR of the RCA

FFR = Pd / Pa during hyperemia
= 89 / 108
= **0.82**



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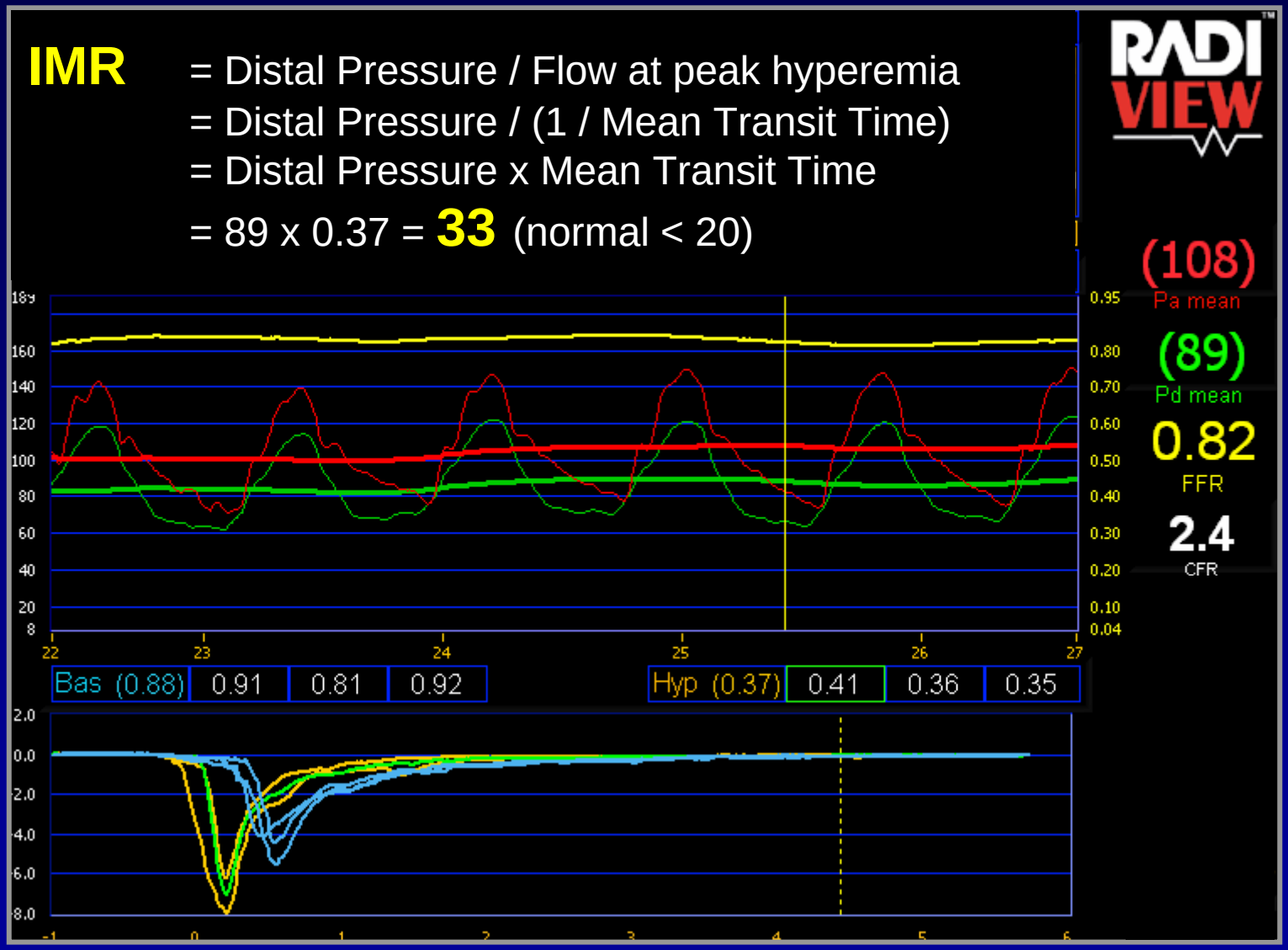
FFR/CFR/IMR of the RCA



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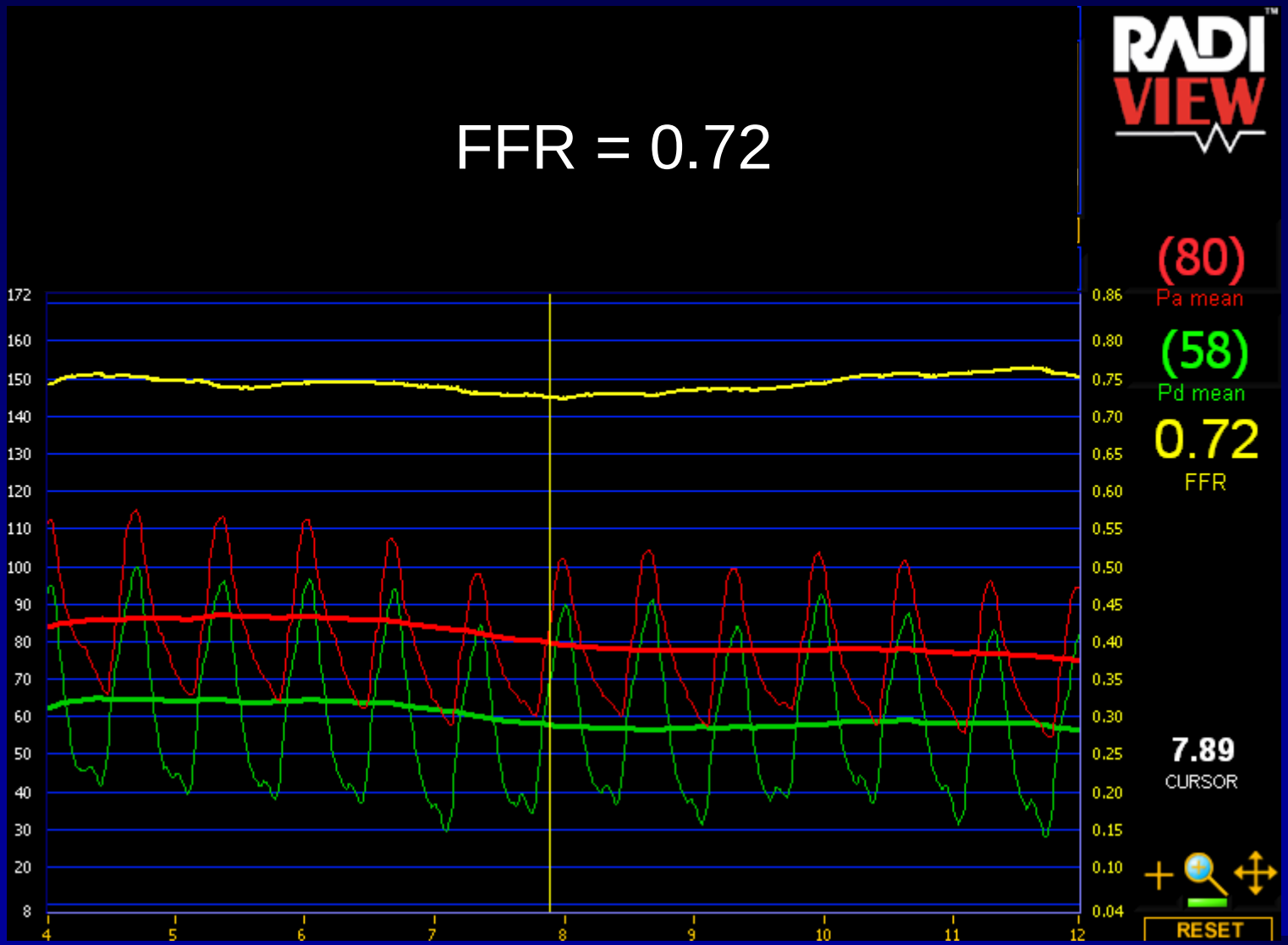
FFR Left Circumflex



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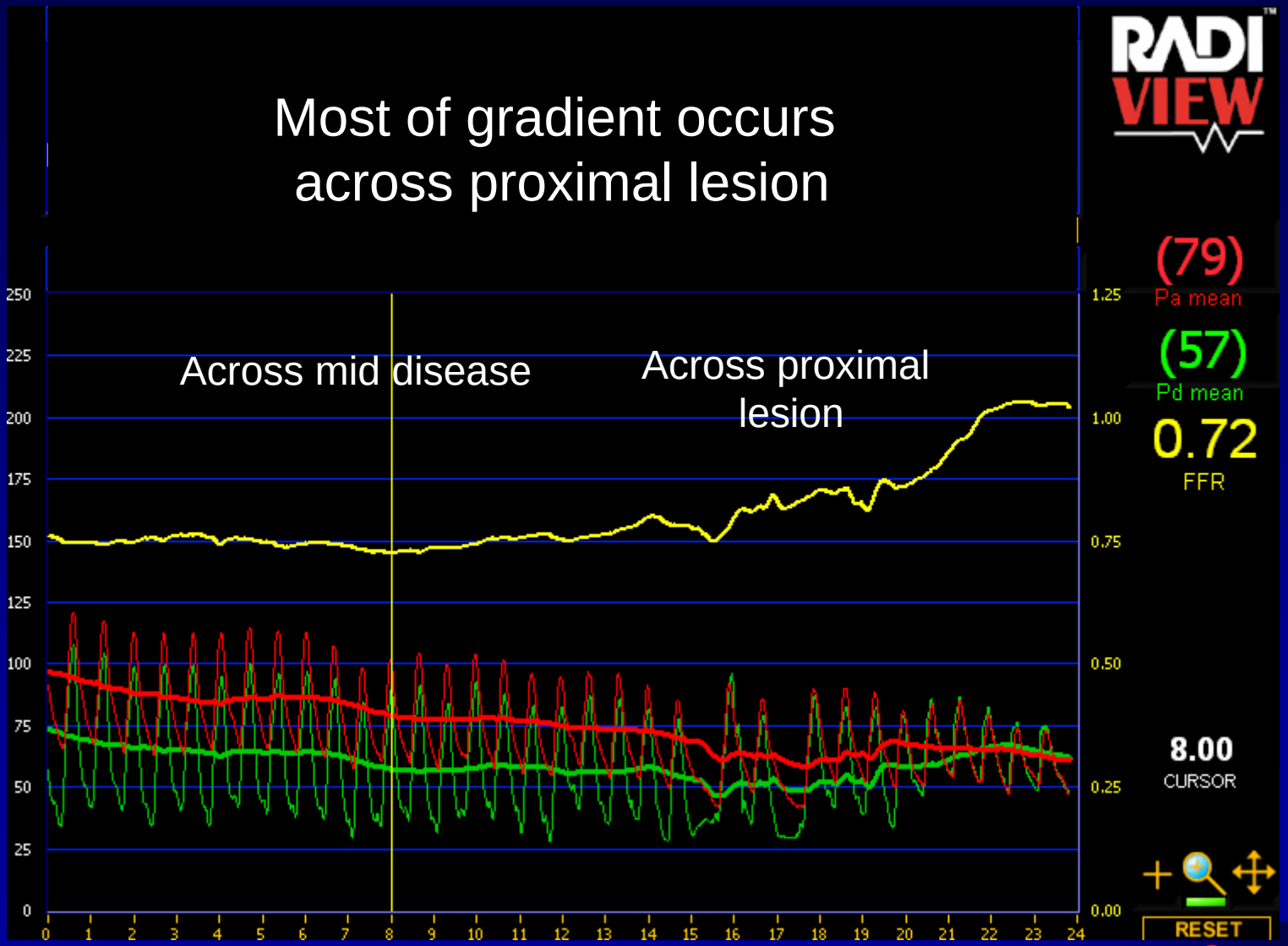
Pullback in Circumflex



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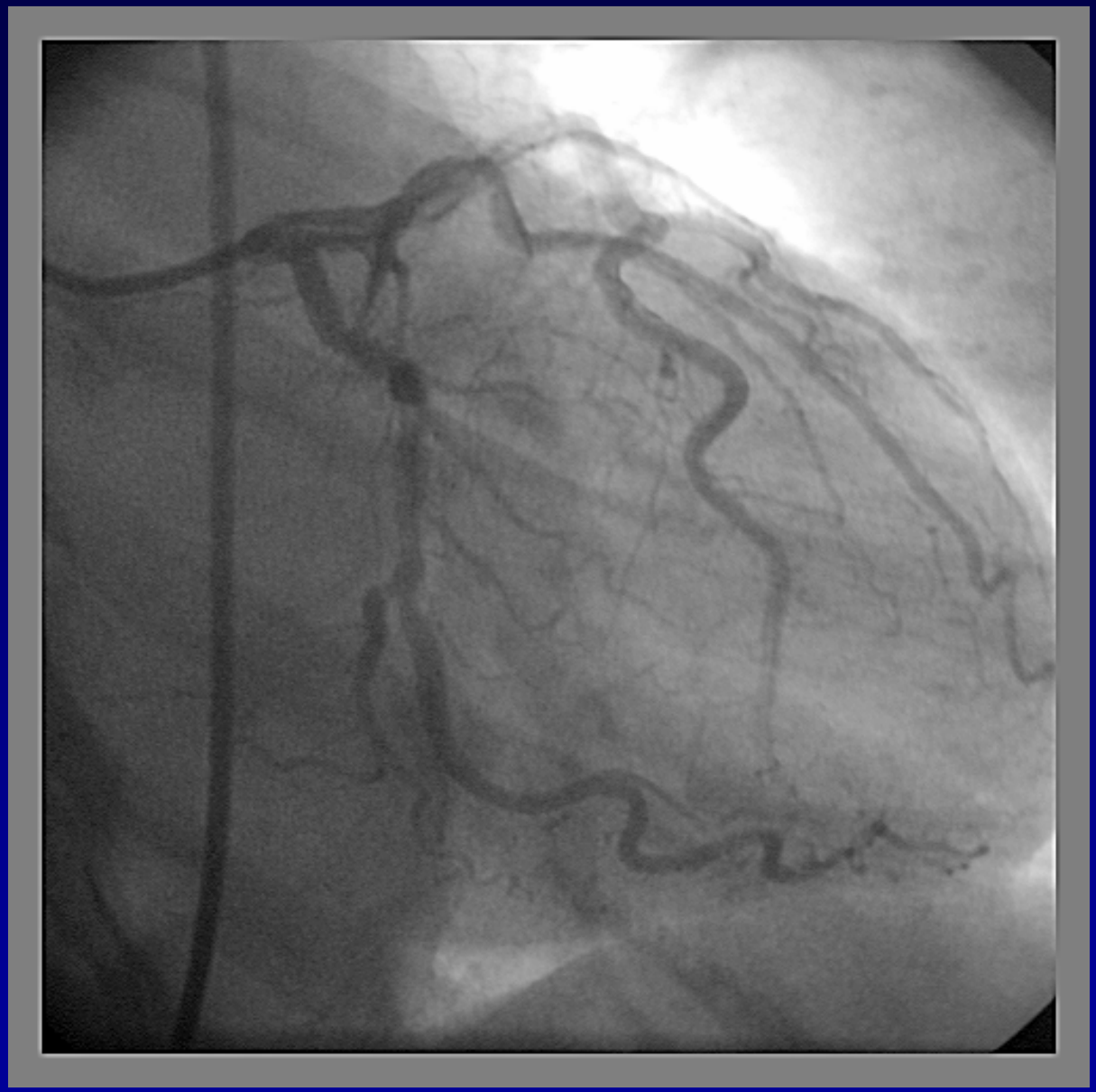

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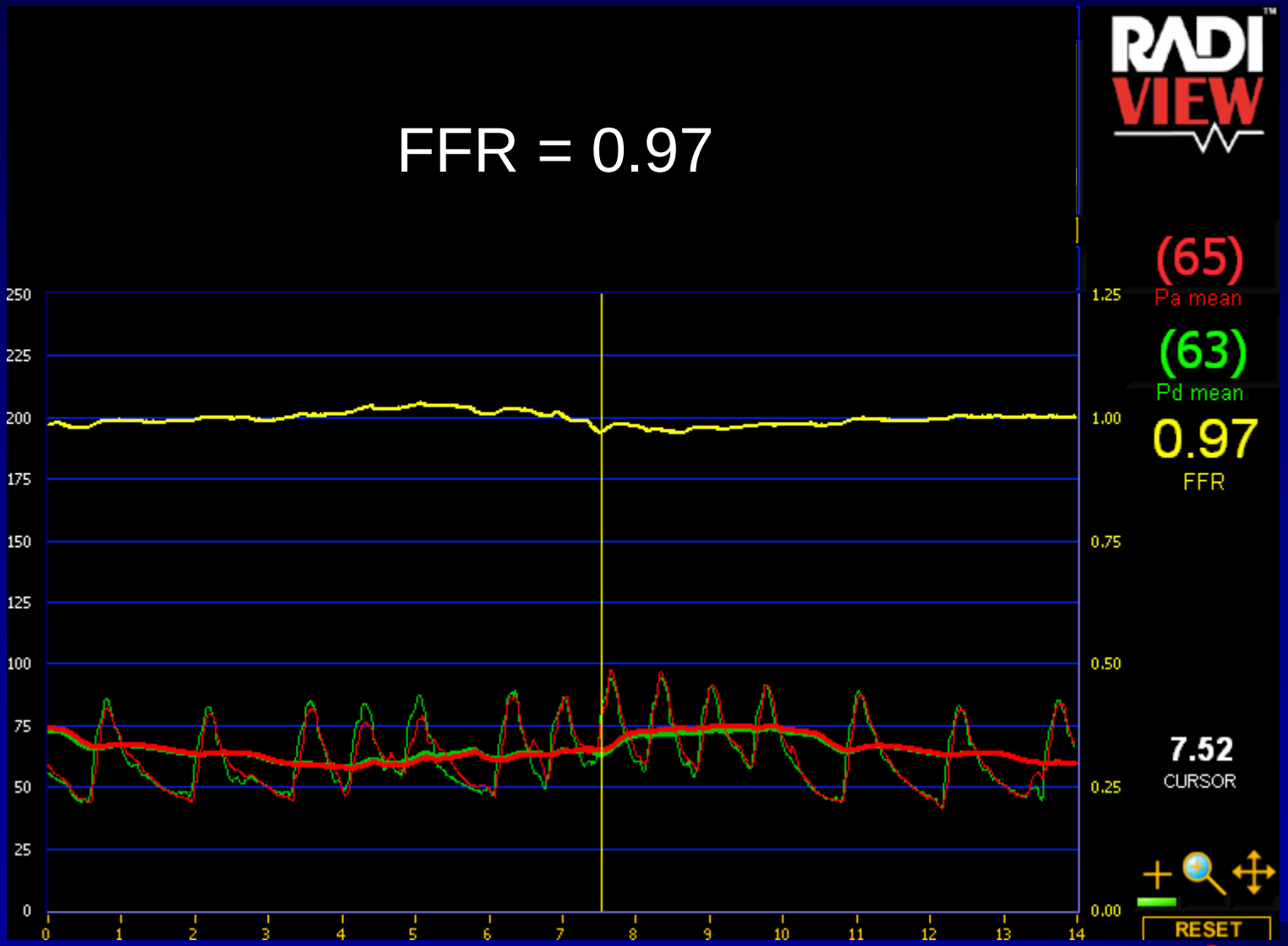
After "spot-stenting" proximal circumflex



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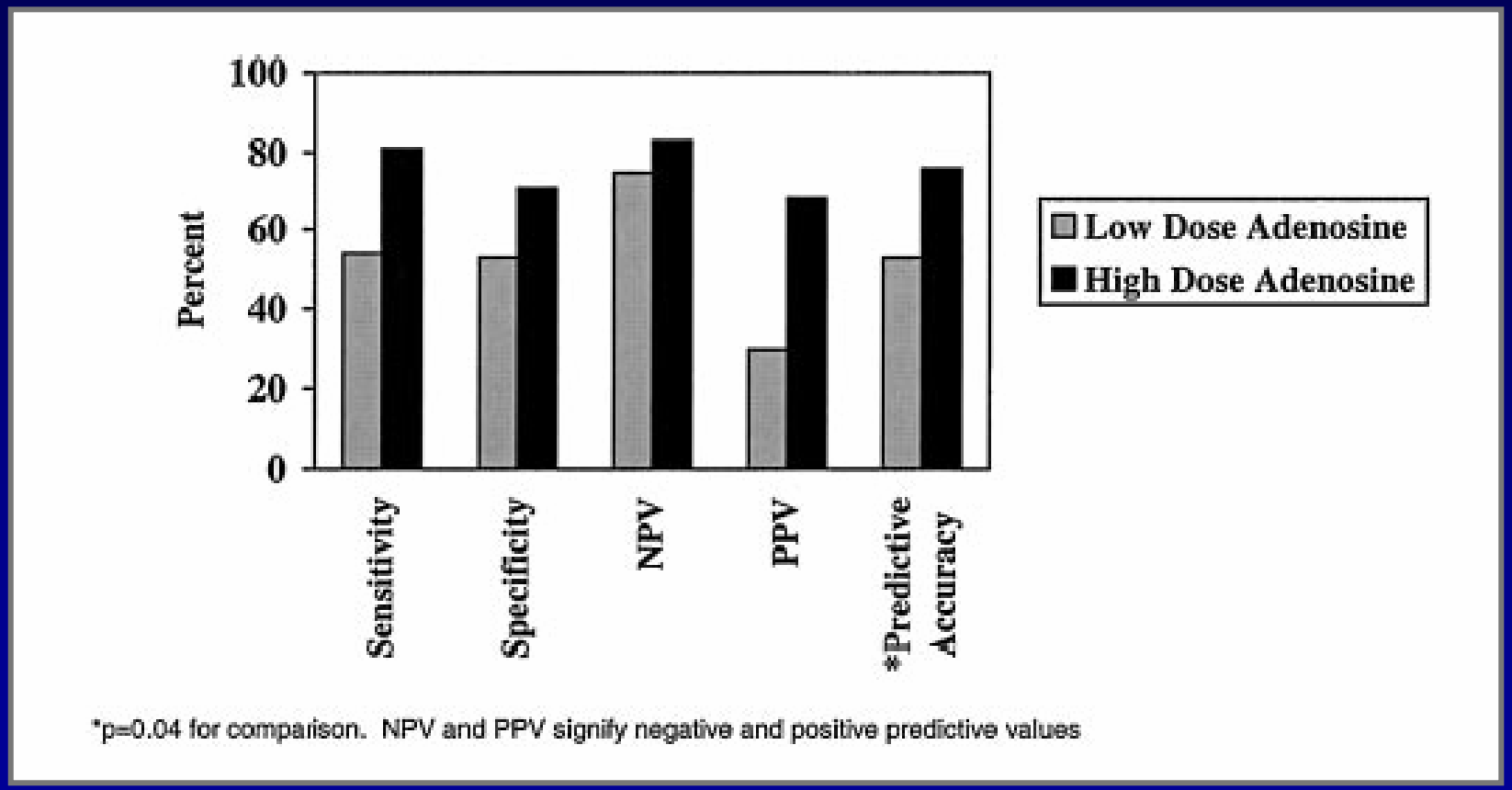
FFR after Stenting



Circulation 2001;104:1917-1922

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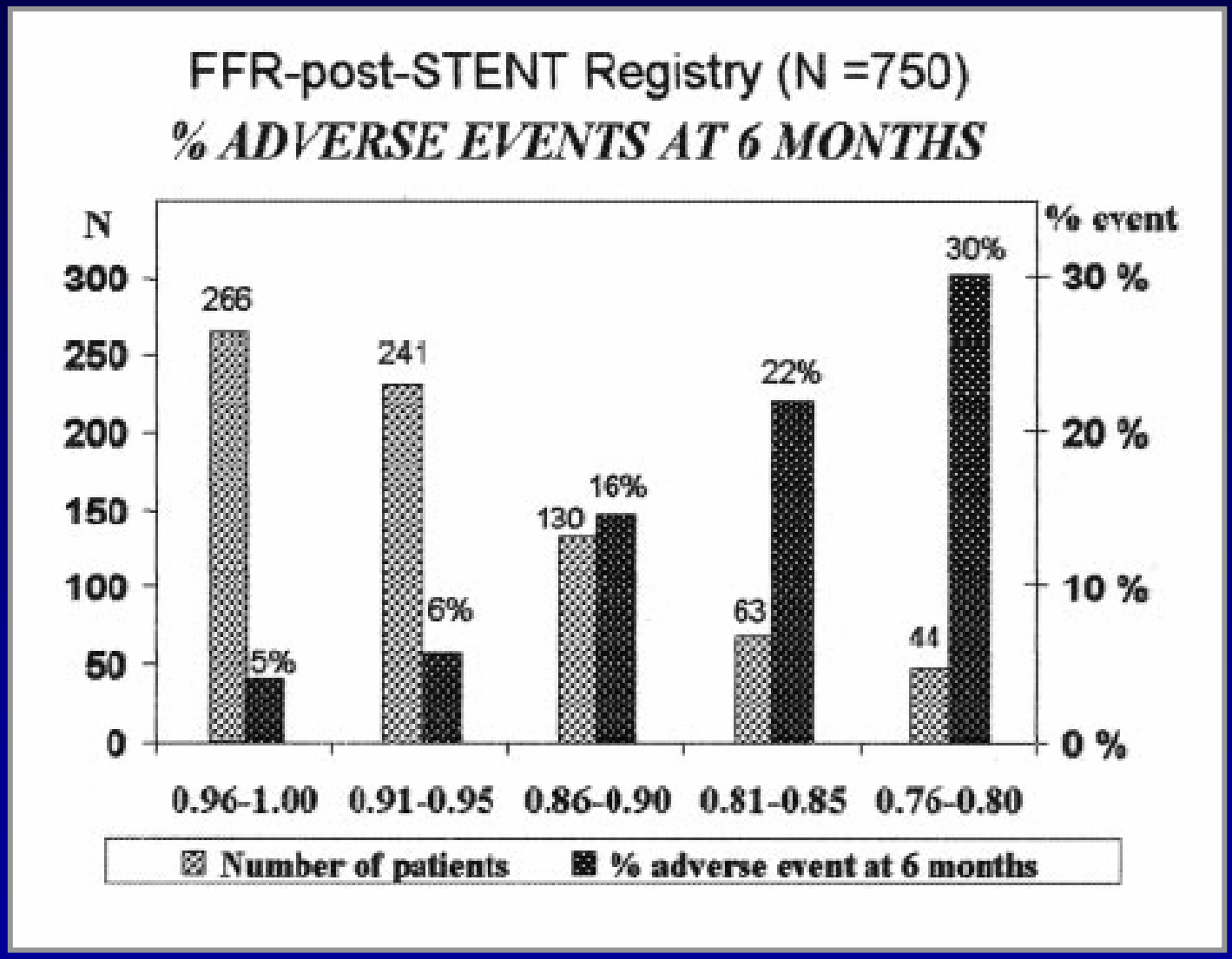
FFR after Stenting



Pijls et al., Circulation 2002;105:2950-2954

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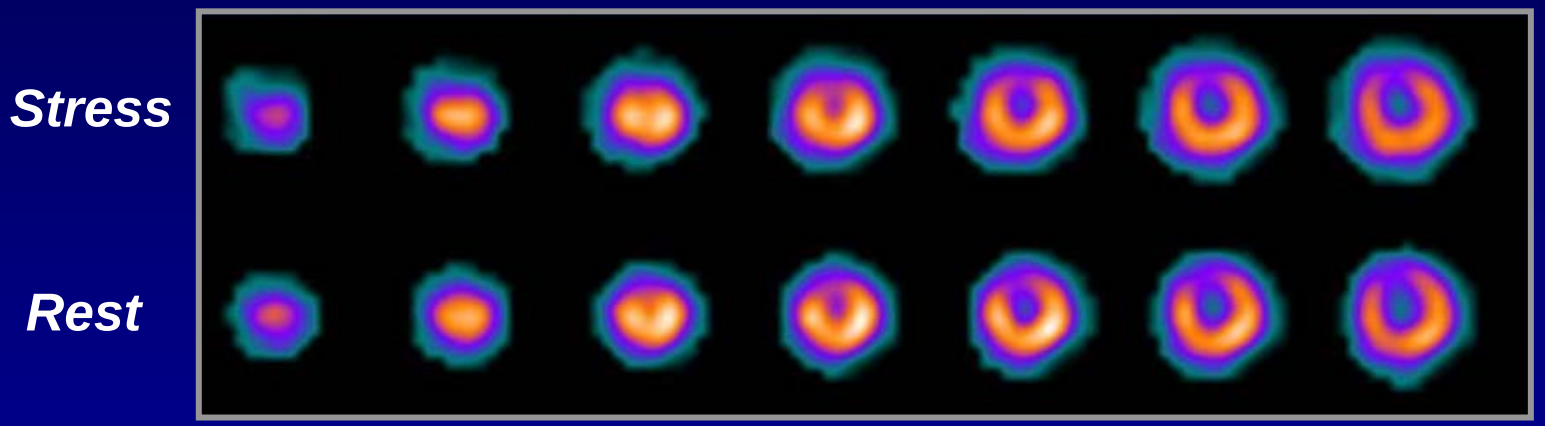
Follow-up Nuclear Perfusion Scan



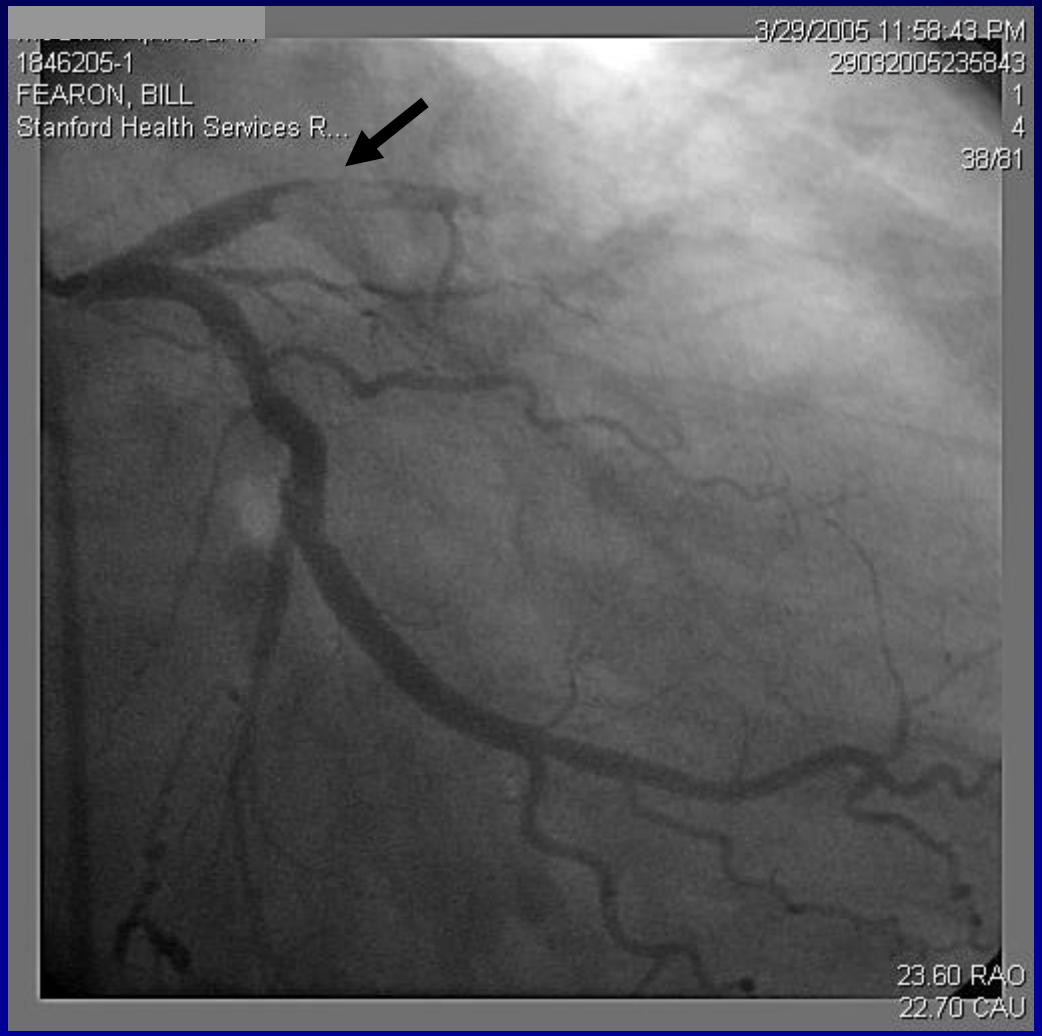
No more inferolateral ischemia

(fixed anterior defect secondary to breast attenuation)

Why do we need physiology?

- Limitations of coronary angiography
- Limitations of noninvasive techniques
- Potential downside to indiscriminate DES use

Late Thrombosis 15 Months after DES



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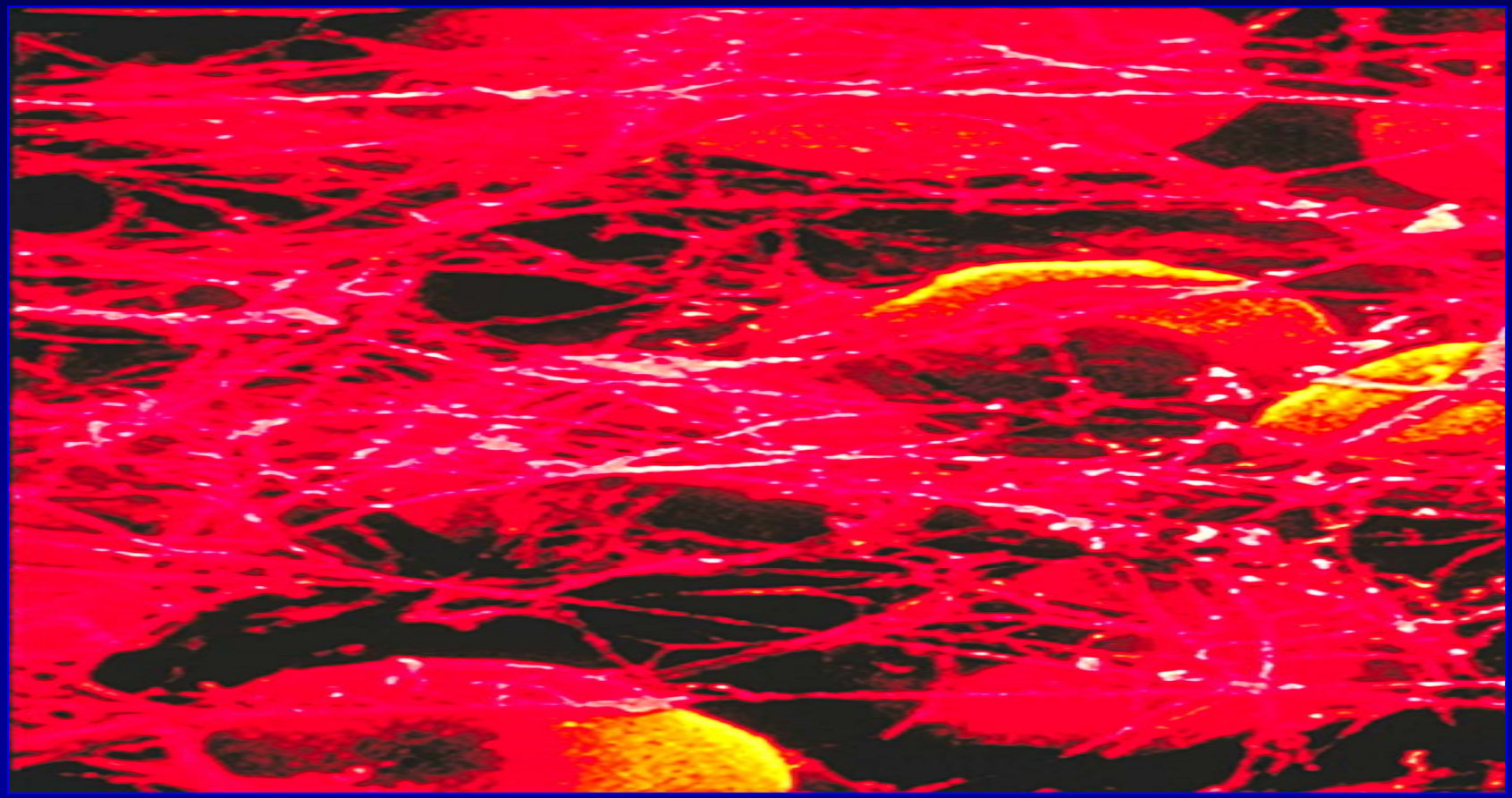
Drug-eluting stents: The “clot” thickens



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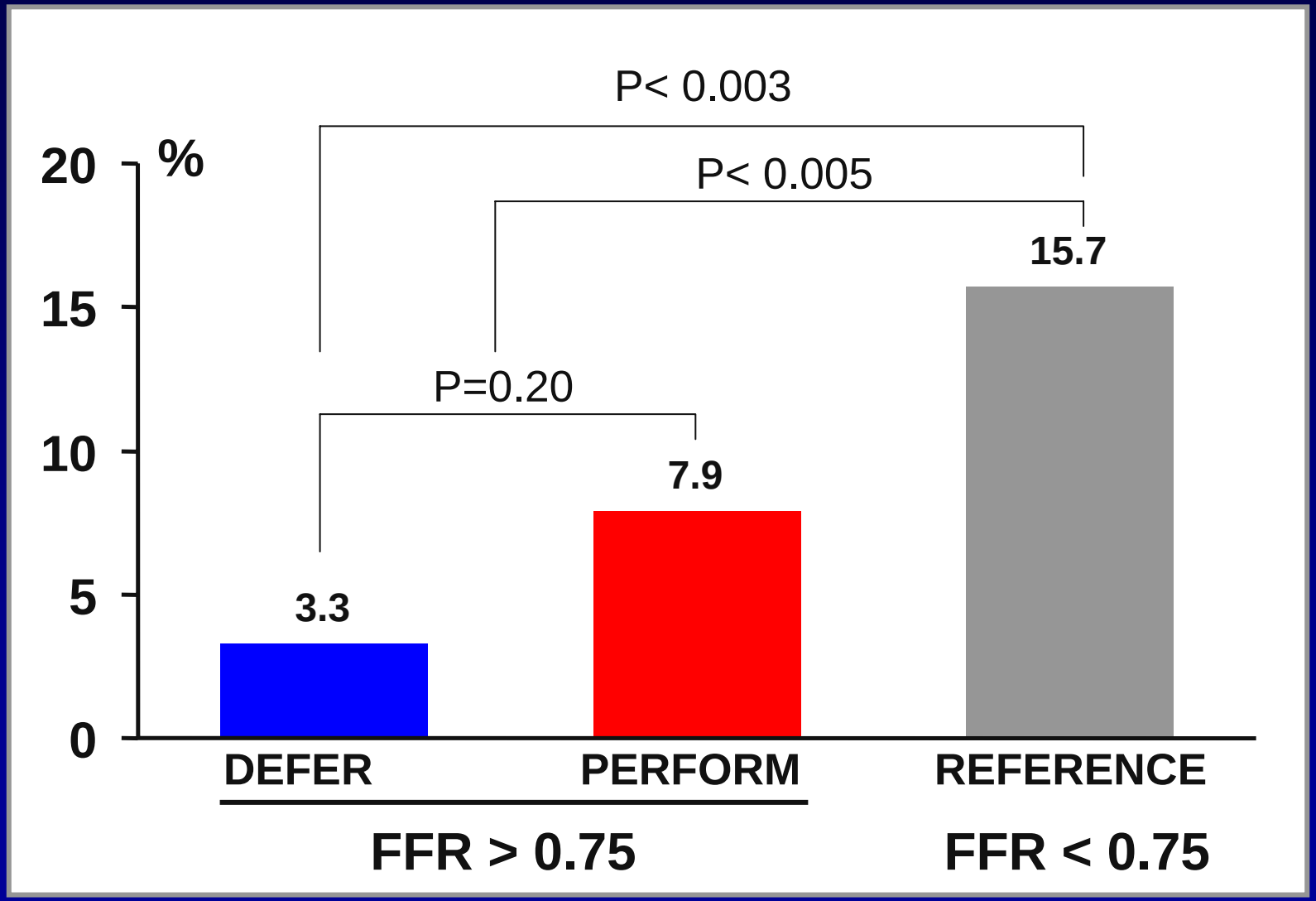
DEFER Study: 5 Year Death/MI



Pijls NHJ (Personal Communication)

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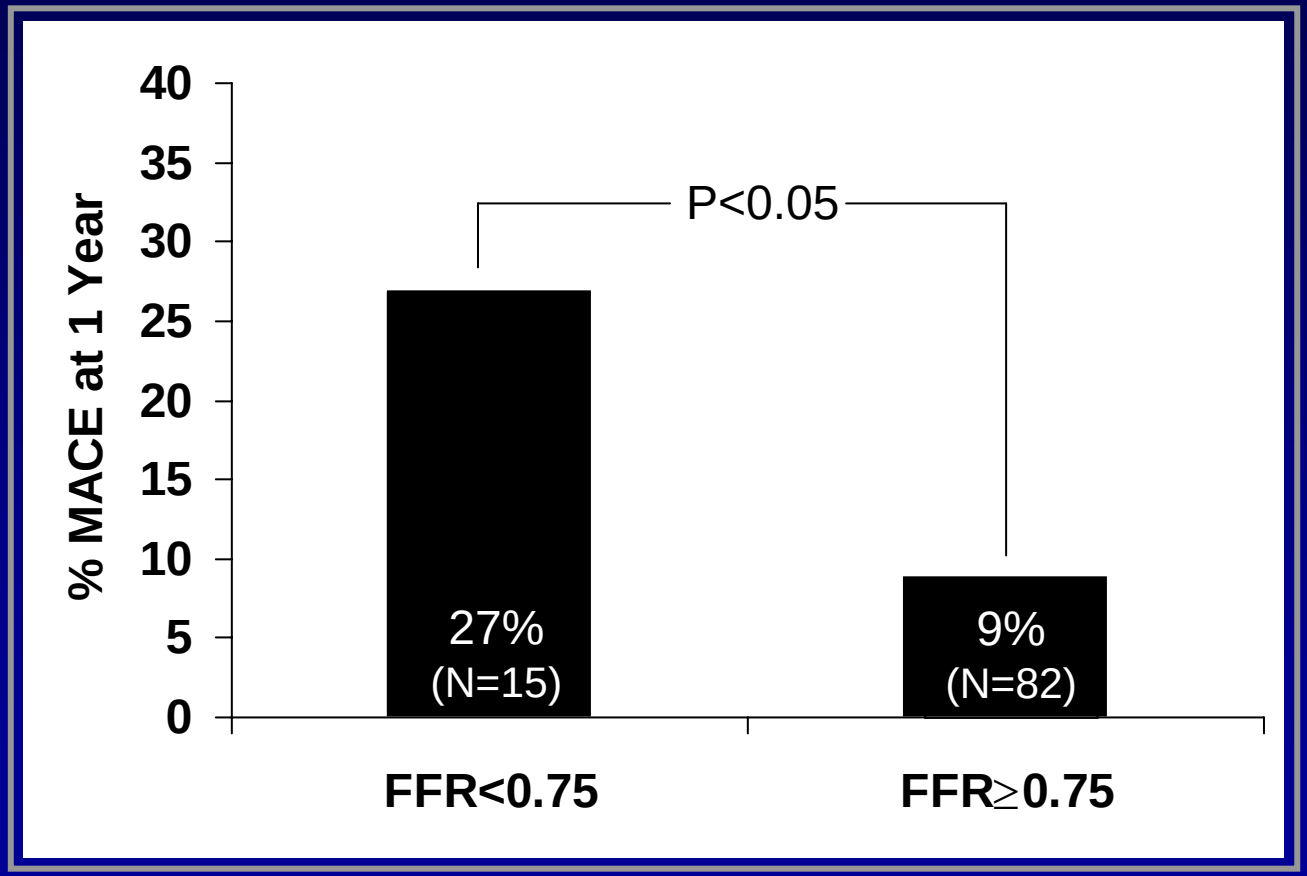
Danger of Deferring PCI if FFR < 0.75



Chamuleau et al. Am J Cardiol 2002;89:377-380

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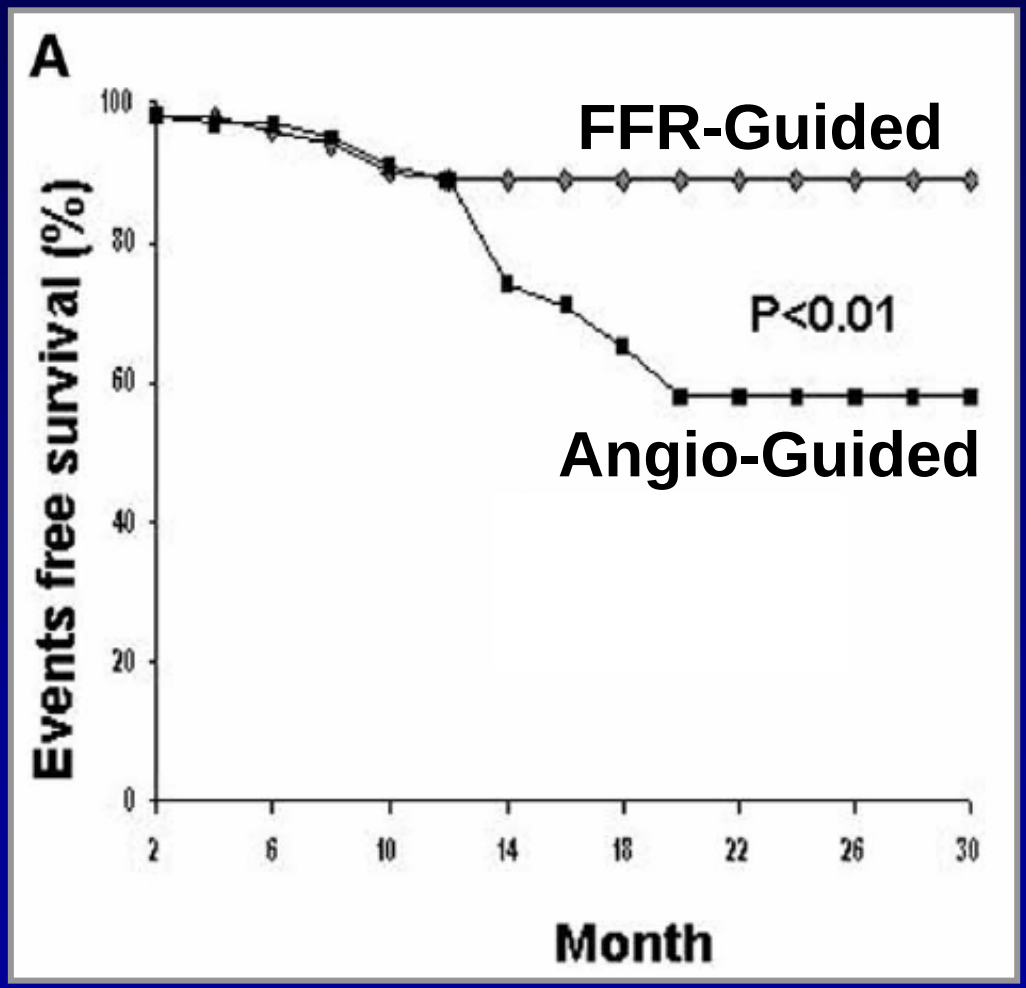
FFR-Guided PCI in MVD

137 Patients, Non-Randomized



Wongpraparut et al. Am J Cardiol 2005;96:877-884.

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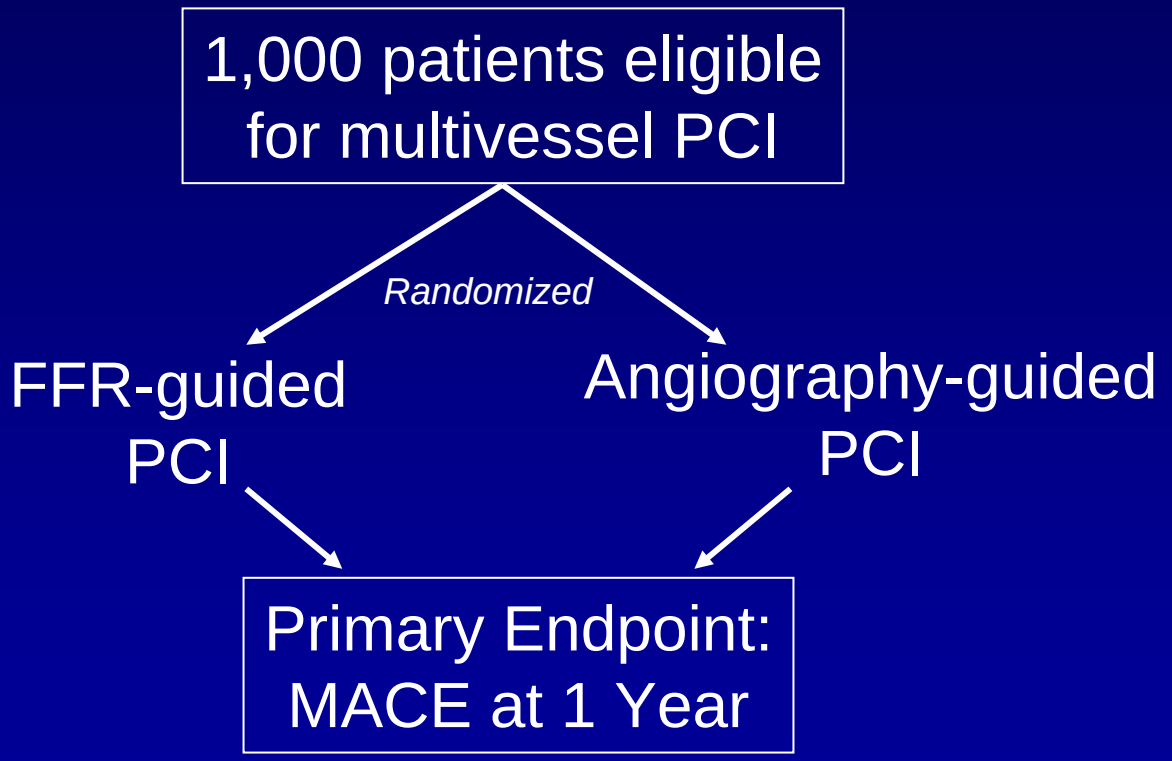
FFR vs. Angiography for Multivessel Evaluation (F.A.M.E. Study)

- Multicenter, international, randomized study including 10 European and 6 U.S. sites.
  - Co PIs: Nico Pijls (Europe) and Bill Fearon (U.S.)

- Compare an angiography-guided strategy to PCI with DES in MVD to an FFR-guided strategy

FFR vs. Angiography for Multivessel Evaluation (F.A.M.E. Study)



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Why do we need physiology?

- Limitations of coronary angiography
- Limitations of noninvasive techniques
- Potential downside to indiscriminate DES use
- Cost issues

FFR is Cost Effective

	Total Cost	QALYs*	Cost / QALY Gained
NUC Strategy	$13,190	14.7962	
FFR Strategy	$11,395	14.7940	
Difference	**$1,795**	**0.0022**	**$808,000**
STENT Strategy	$15,225	14.7761	
FFR Strategy	$11,395	14.7940	
Difference	**$3,830**	**- 0.0179**	**FFR Dominates**

Am Heart J 2003;145:882-887

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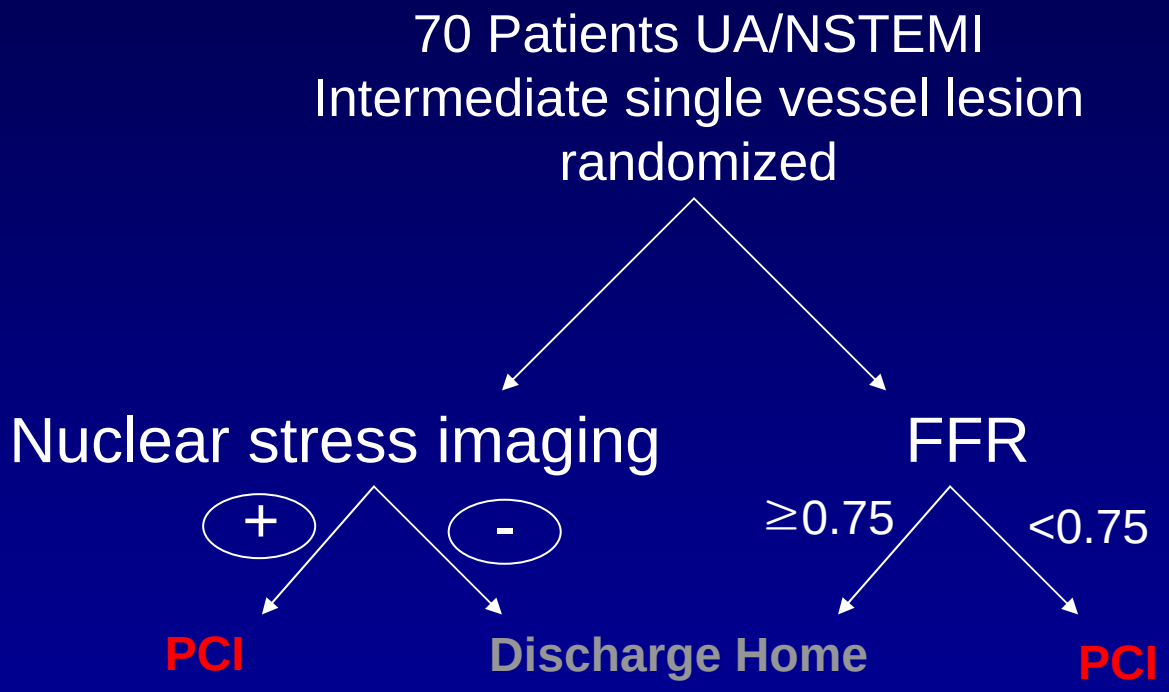
Cost Effectiveness of FFR: Clinical Validation



Endpoints: clinical outcome, duration/cost of hospitalization

Leesar et al. JACC 2003;41:1115-21

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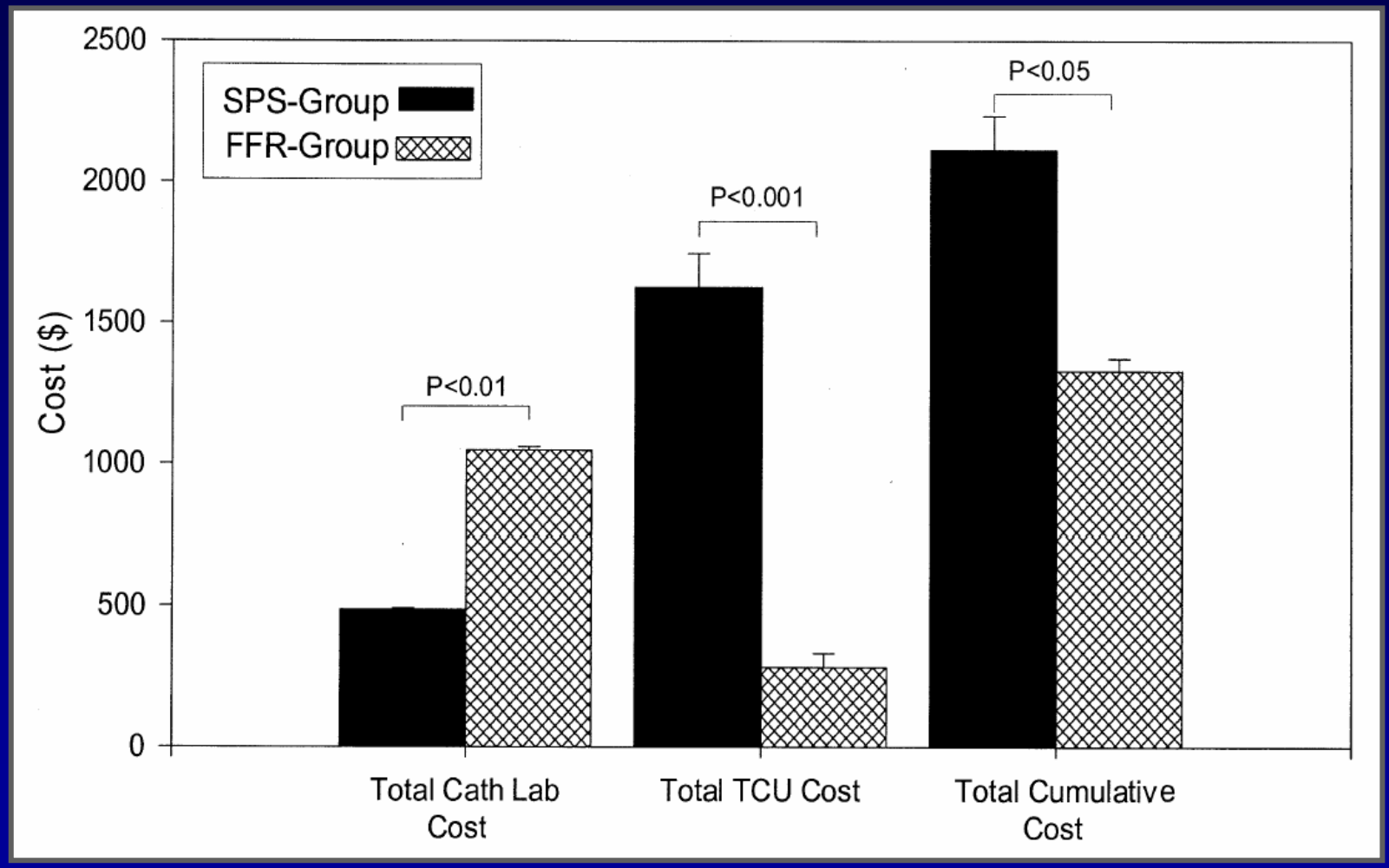
Cost-Effectiveness of FFR



Leesar et al. JACC 2003;41:1115-21

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FFR strategy resulted in similar outcomes

Table 3. Follow-Up and Clinical Events

	Group 1 (SPS) (n = 34)	Group 2 (FFR) (n = 34)
Average follow-up (months)	12.0 ± 0.8	14.0 ± 1.0
Death	0	0
Angina		
No angina (n)	17	24
CCS classification of angina (n)		
1–2	17	10
3–4 (admitted to the hospital)	6	5
Stress perfusion scintigraphy	4	4
Negative (n)	4	4
Cardiac catheterization	2	3
Results (no change)	2	2
Disease progression	0	1
MI	1	1
CABG including target vessel	1	2
PCI	0	0

Leesar et al. JACC 2003;41:1115-21

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Summary

- We need coronary physiology to help guide decision-making in the catheterization lab
  - Limitations of angiography
  - Limitations of noninvasive evaluation
  - Avoid indiscriminate DES use
  - Cost effective