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Fractional Flow Reserve:
When, Why, and How

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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial Interest /arrangement or affiliation with the organization(s) listed below:

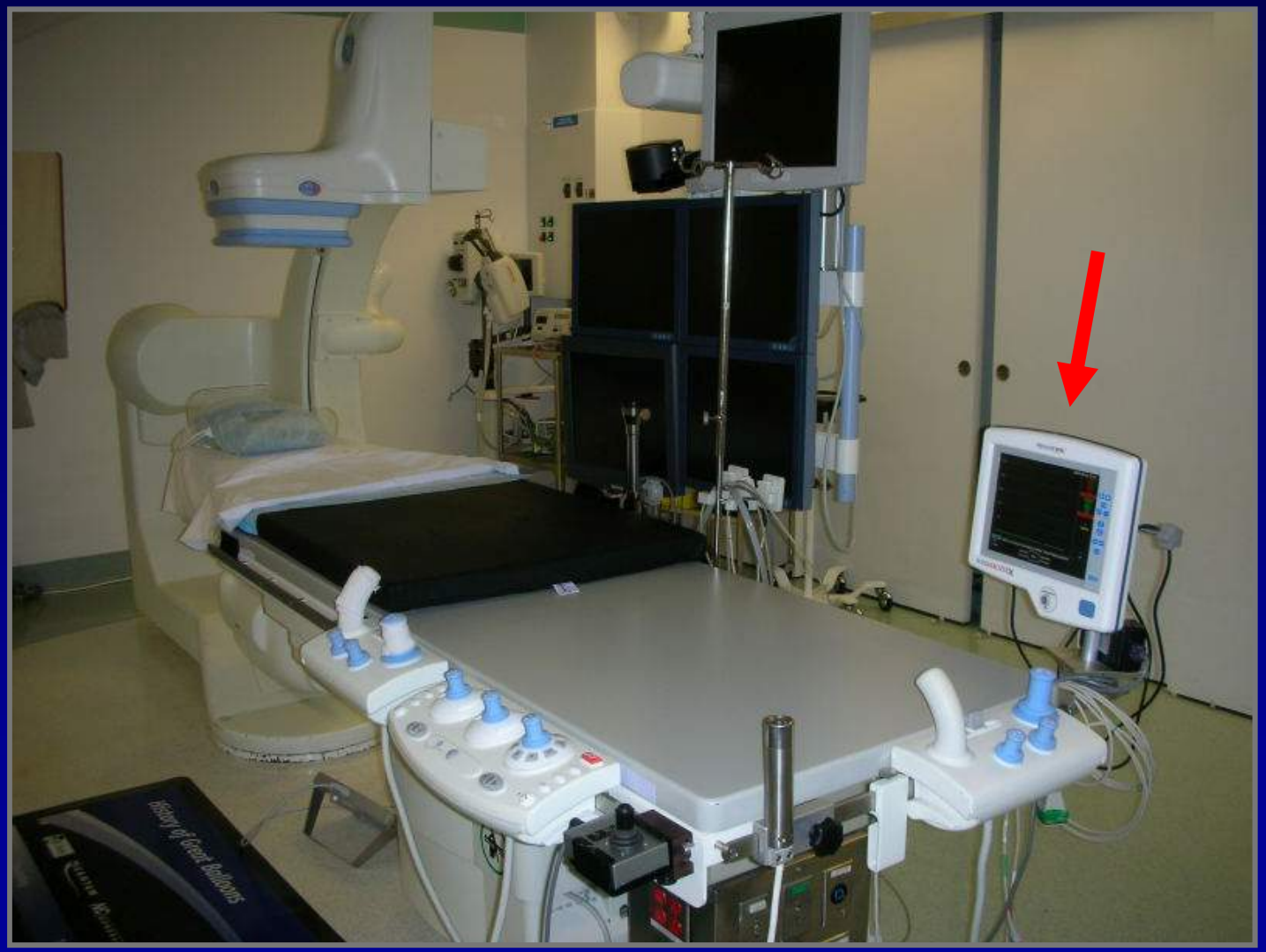
Affiliation/Financial Relationship	Company
Grant/ Research Support:	NIH R01 HL093475 (PI)
Consulting Fees/Honoraria:	
Major Stock Shareholder/Equity Interest:	
Royalty Income:	
Ownership/Founder:	
Salary:	
Intellectual Property Rights:	
Other Financial Benefit:	

How to Measure FFR

Incorporating Physiology

- Educating your assistants
  - Limitations of angiography
  - Benefits of physiology
  - Measure FFR in 10 consecutive cases
  - Obey FFR result
- Streamlining set-up
  - Identify point person
  - Post medication mixing and dosing instructions
  - Keep analyzer connected at all times

Incorporating Physiology



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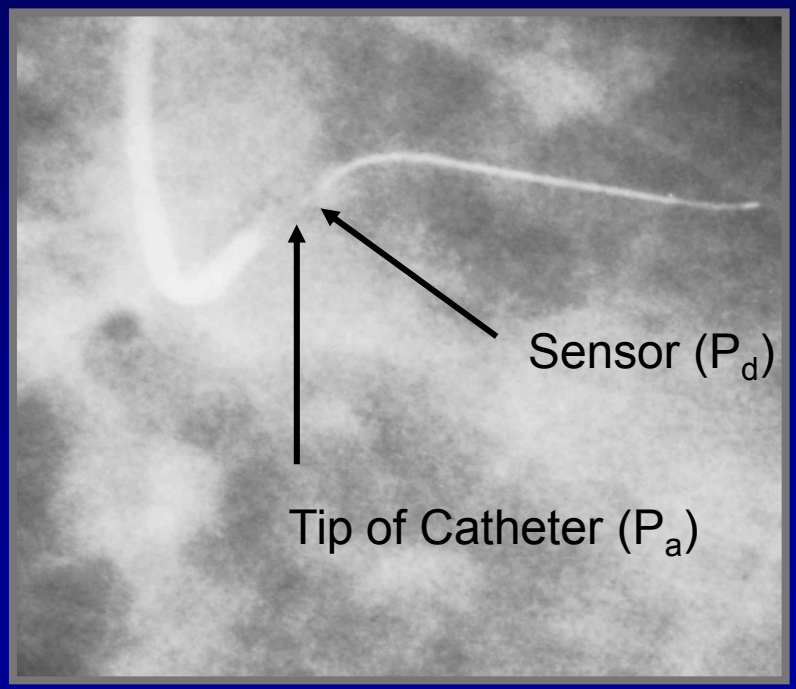
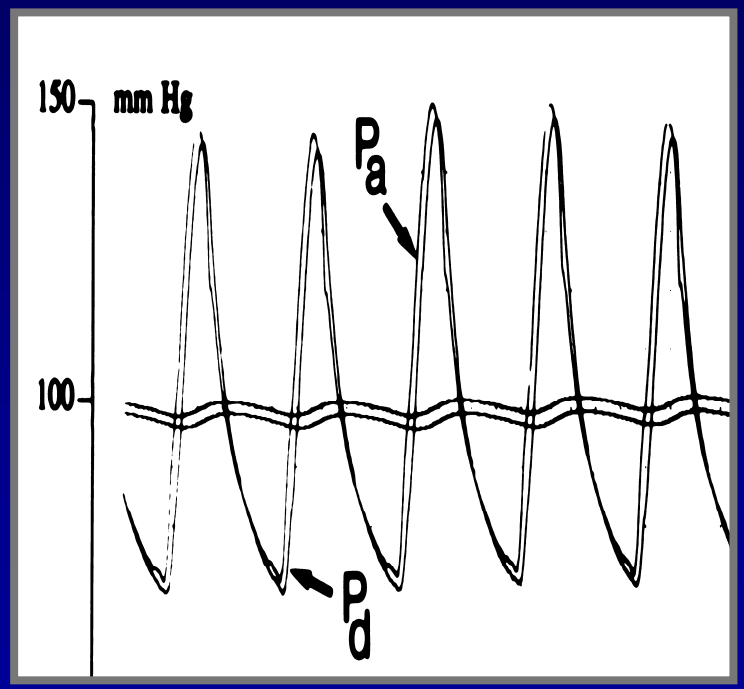
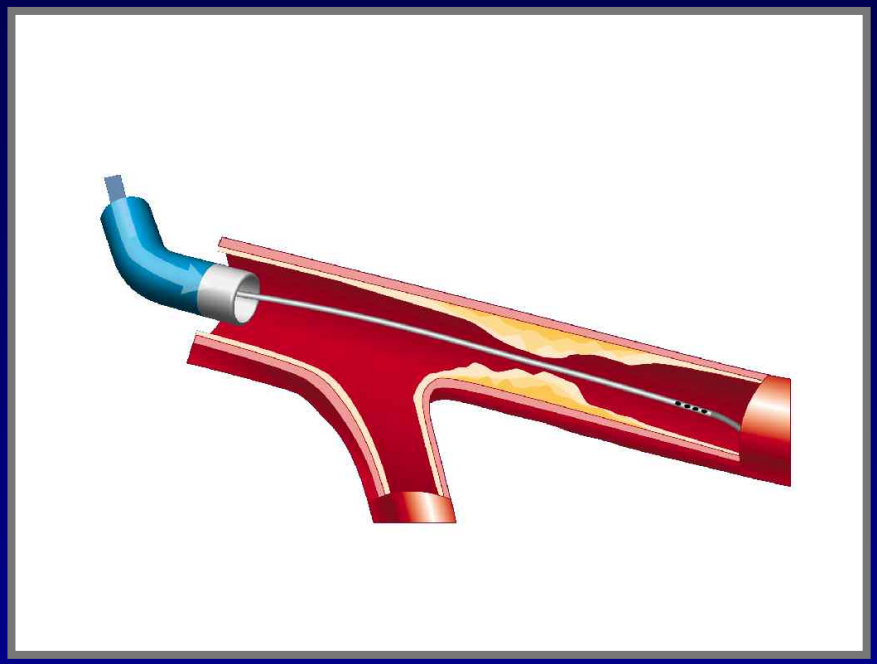
Performing FFR

1. IC NTG and IV heparin/bivalirudin
2. Equalize Pressures

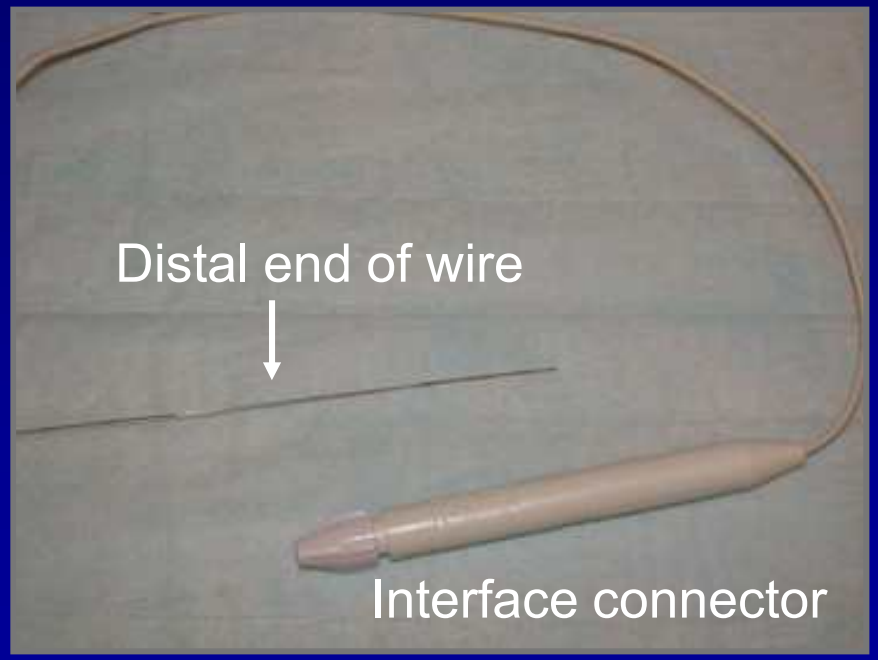




Potential Pitfalls



Wiring the Lesion

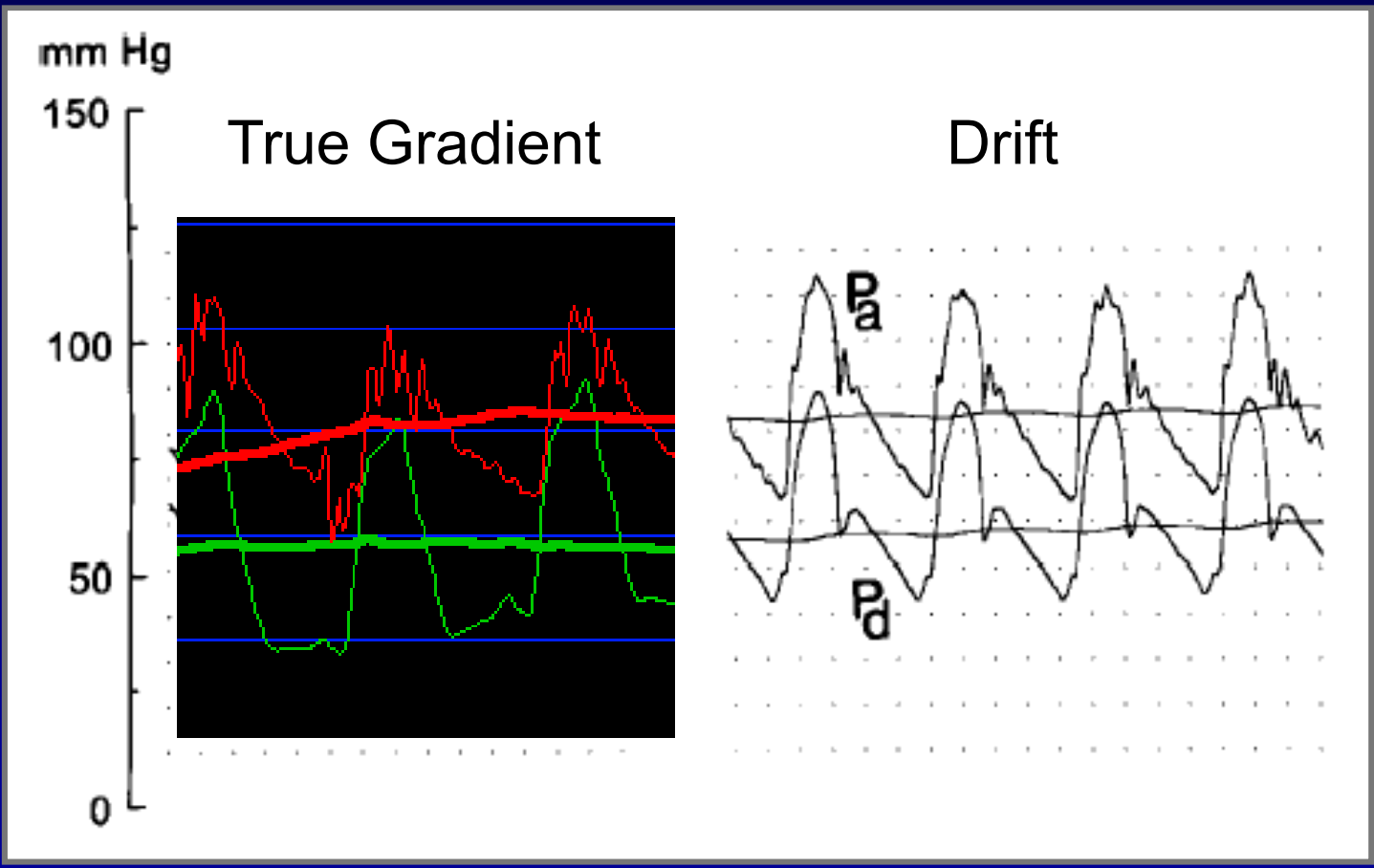


Consider disconnecting the wire from the interface connector

Can use exchange catheter to more safely position pressure wire

Potential Pitfalls

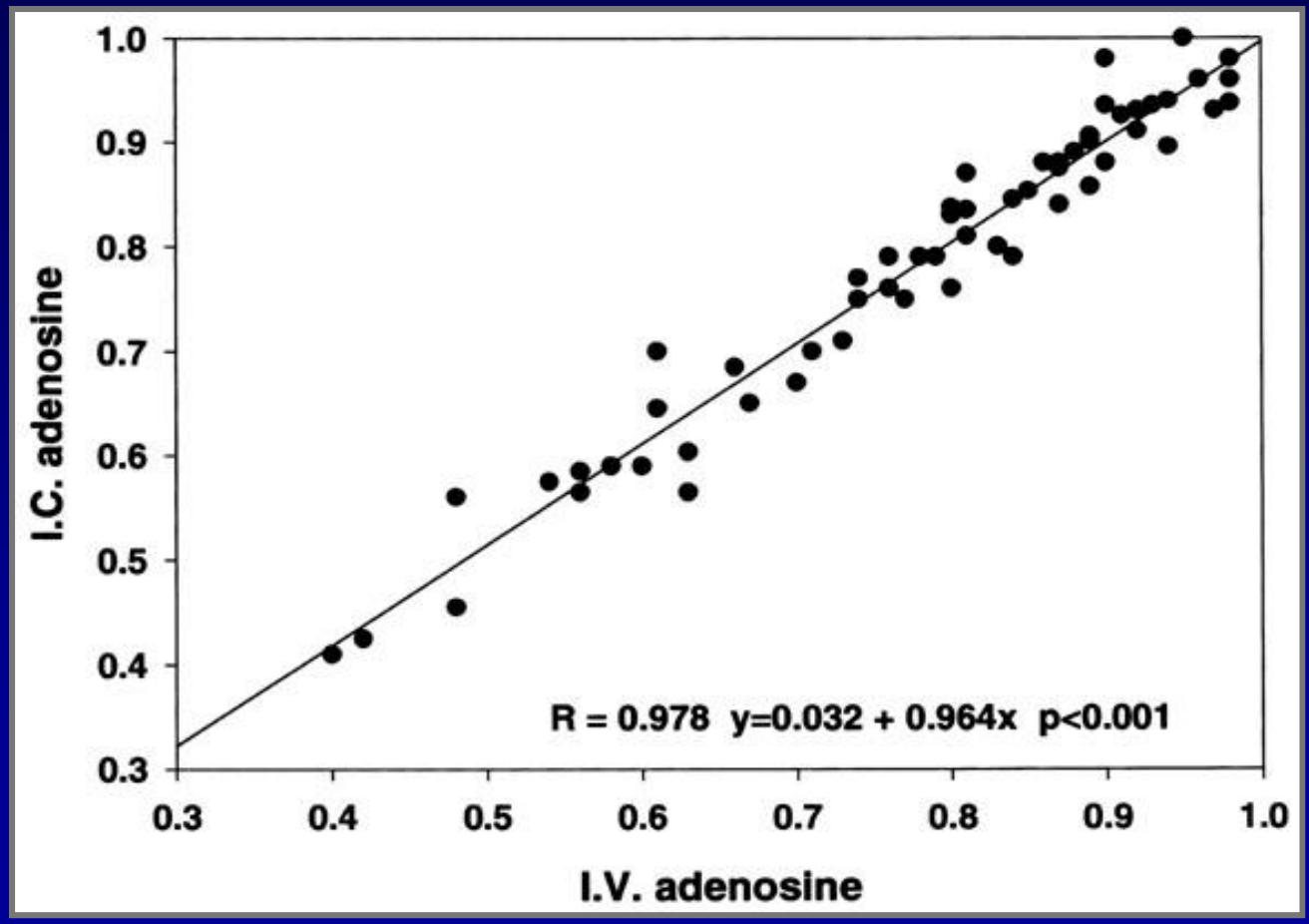
Recognizing Drift



Adapted from Pijls et al. Cathet Cardiovasc Intervent 2000;49:1-16

Inadequate Hyperemia

IC vs. IV Adenosine



Jeremias et al. Am Heart J 2000;140:651-657.

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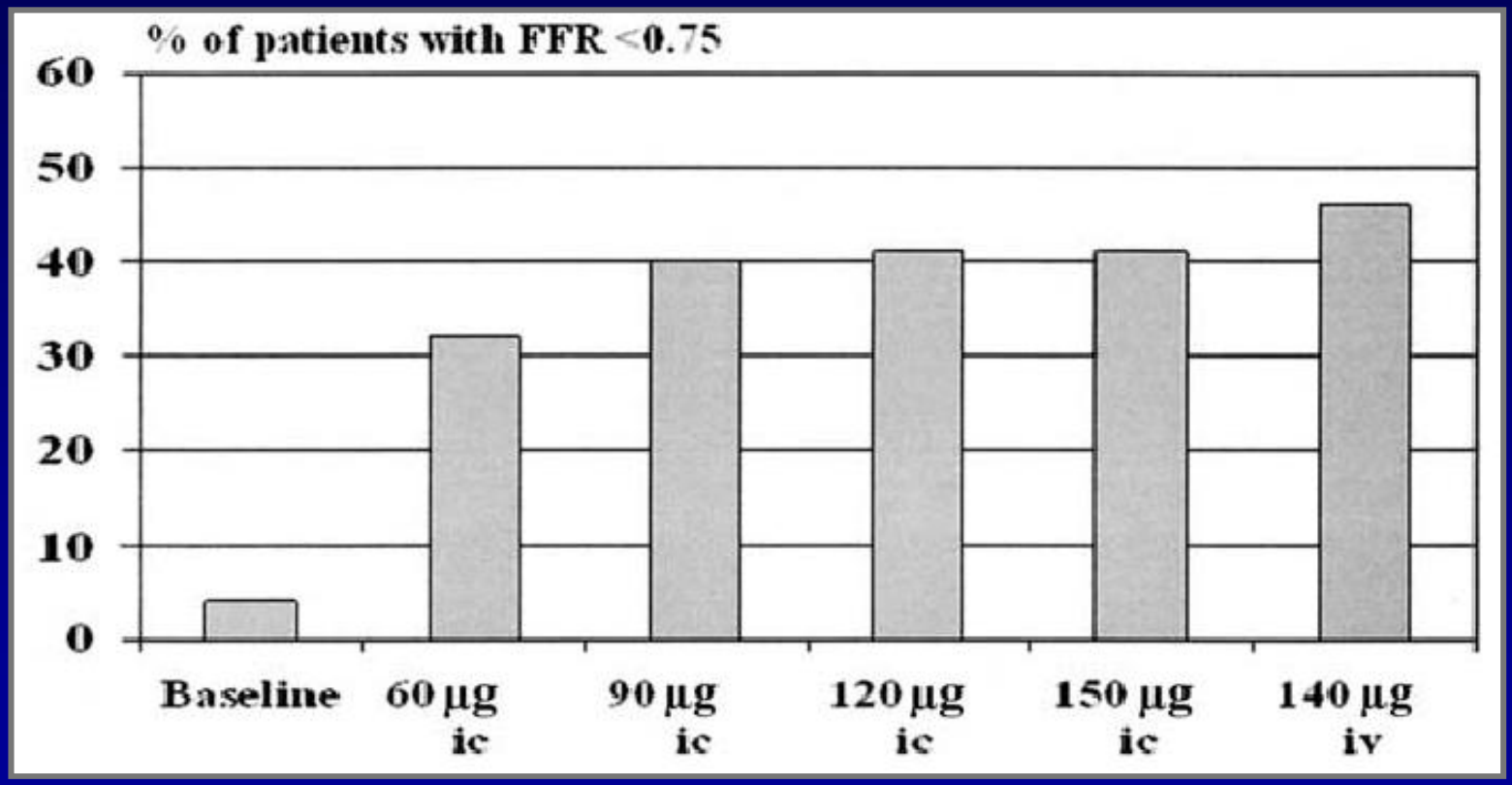
Inadequate Hyperemia

FFR measured in 50 patients with intermediate lesions



Casella et al. Am Heart J 2004;148:590-5.

Potential Pitfalls

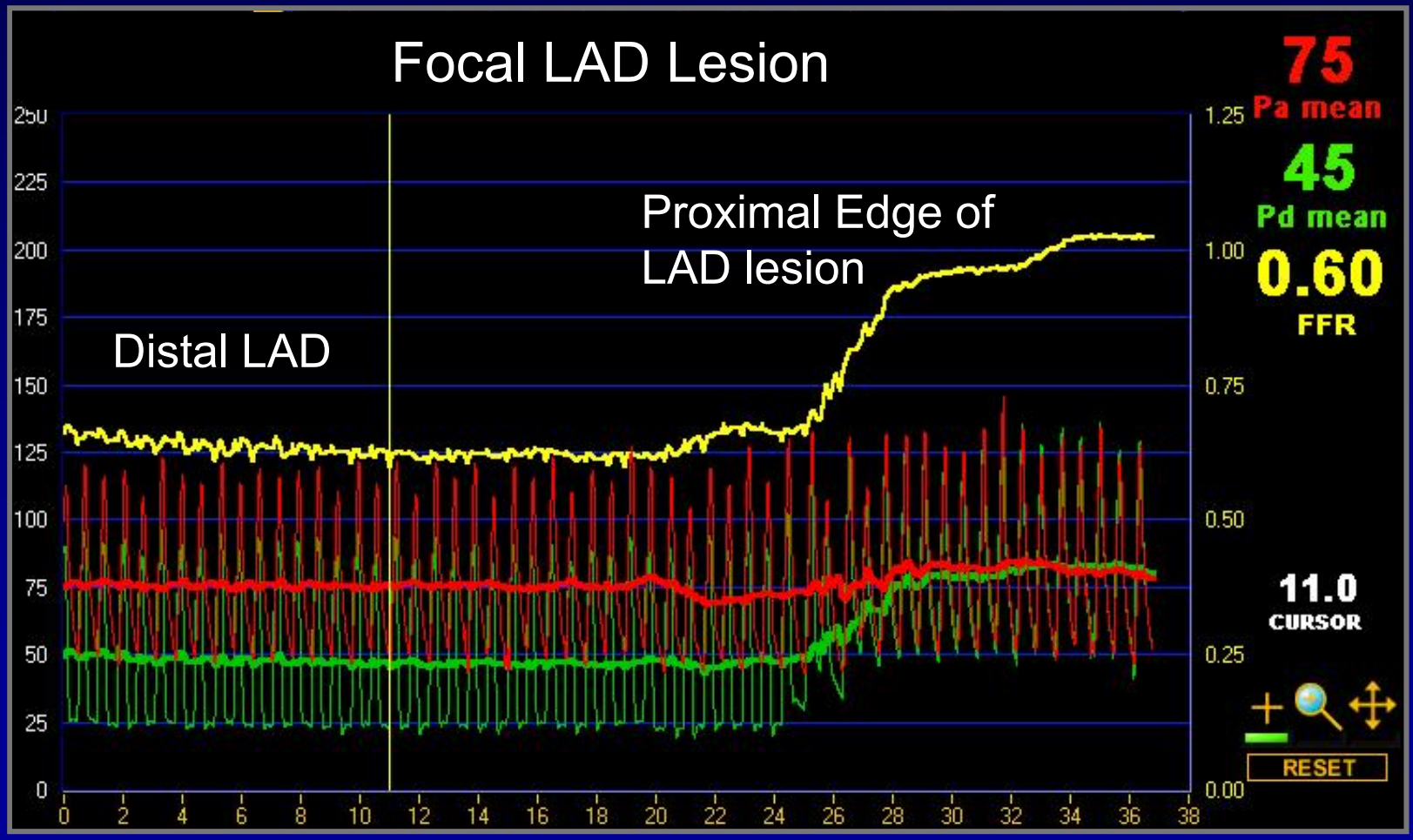
- Inadequate hyperemia
  - Intracoronary adenosine
    - Short-lasting peak effect (~5 seconds)
    - Don’t use a guiding catheter with sideholes
    - If one suspects inadequate hyperemia, then increase dose or use intravenous adenosine

Potential Pitfalls

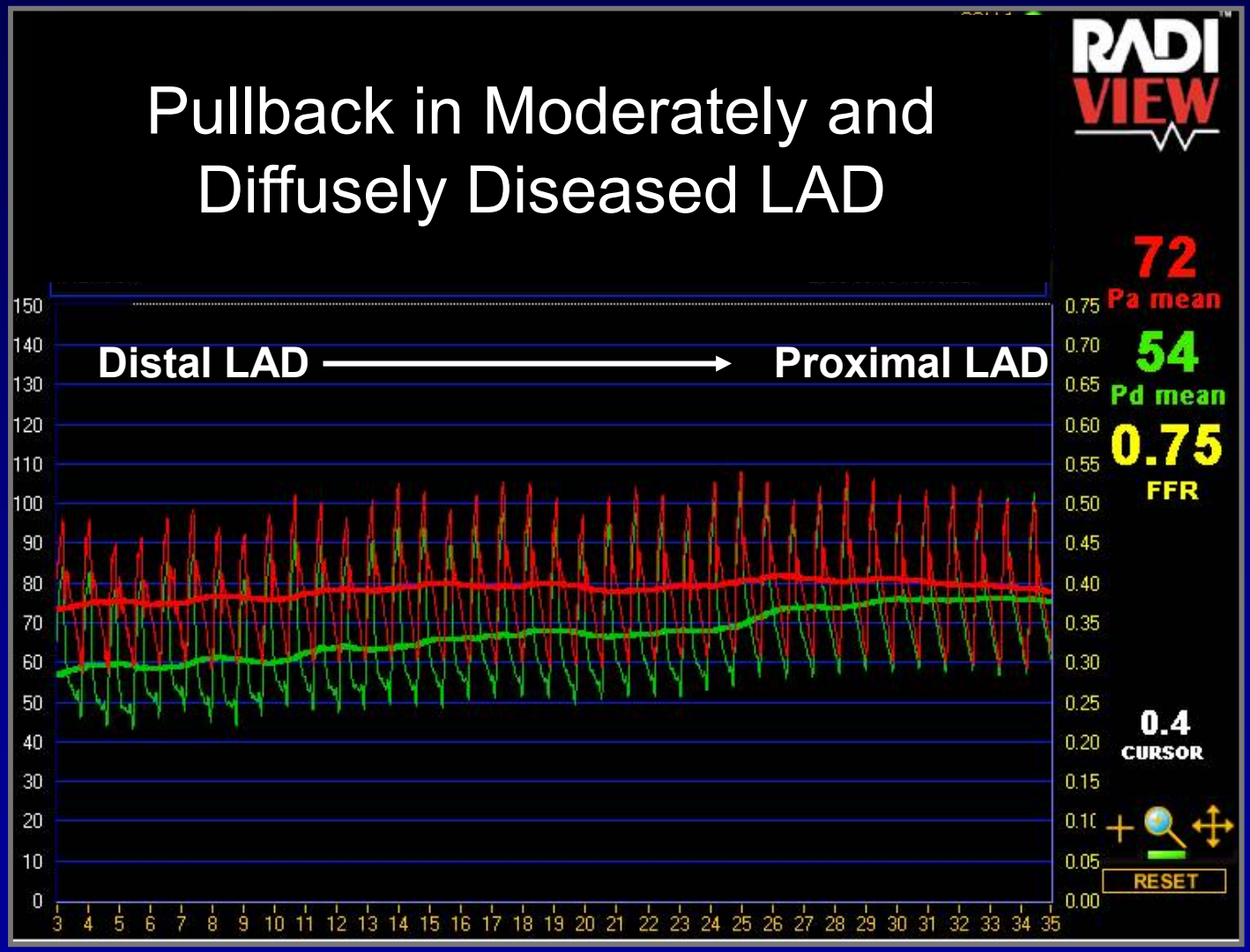
- Inadequate hyperemia
  - Intravenous adenosine
    - Should be administered via central vein
    - May require higher doses (>140 ug/kg/min) if given peripherally
    - If the patient doesn't develop symptoms and/or hemodynamic changes, the patient is likely not receiving IV adenosine

Performing FFR

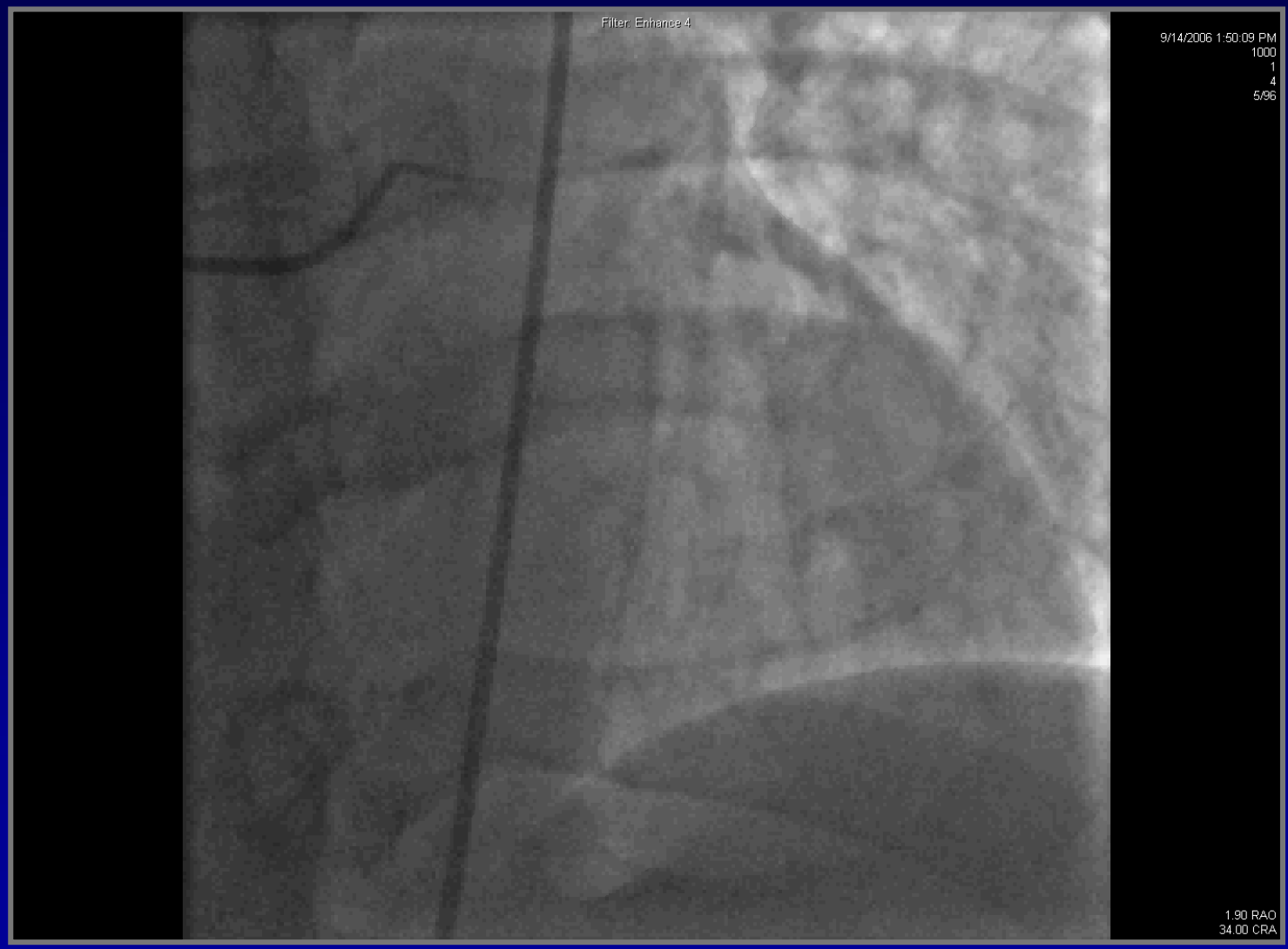
Pressure Pullback



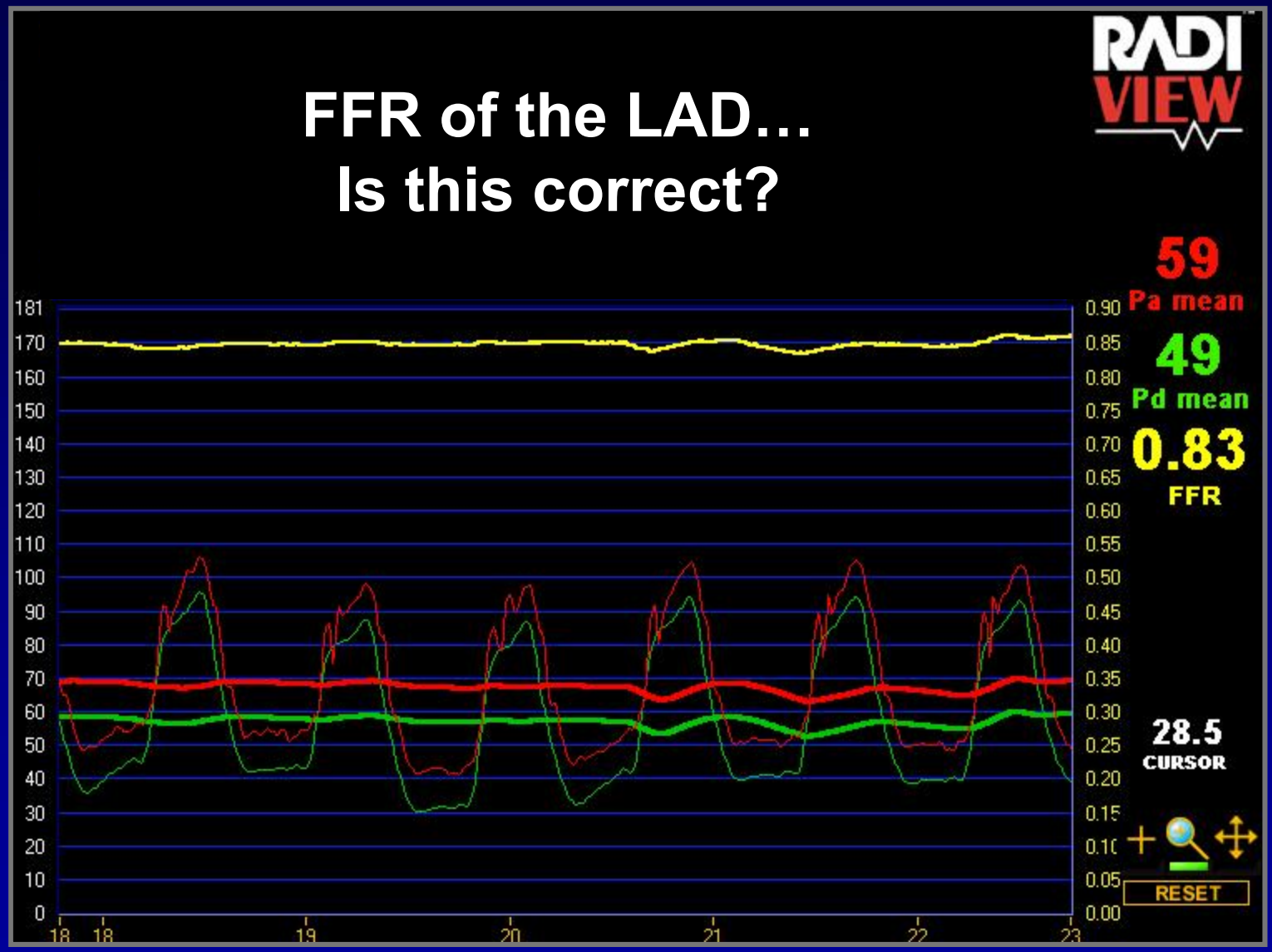
Performing FFR



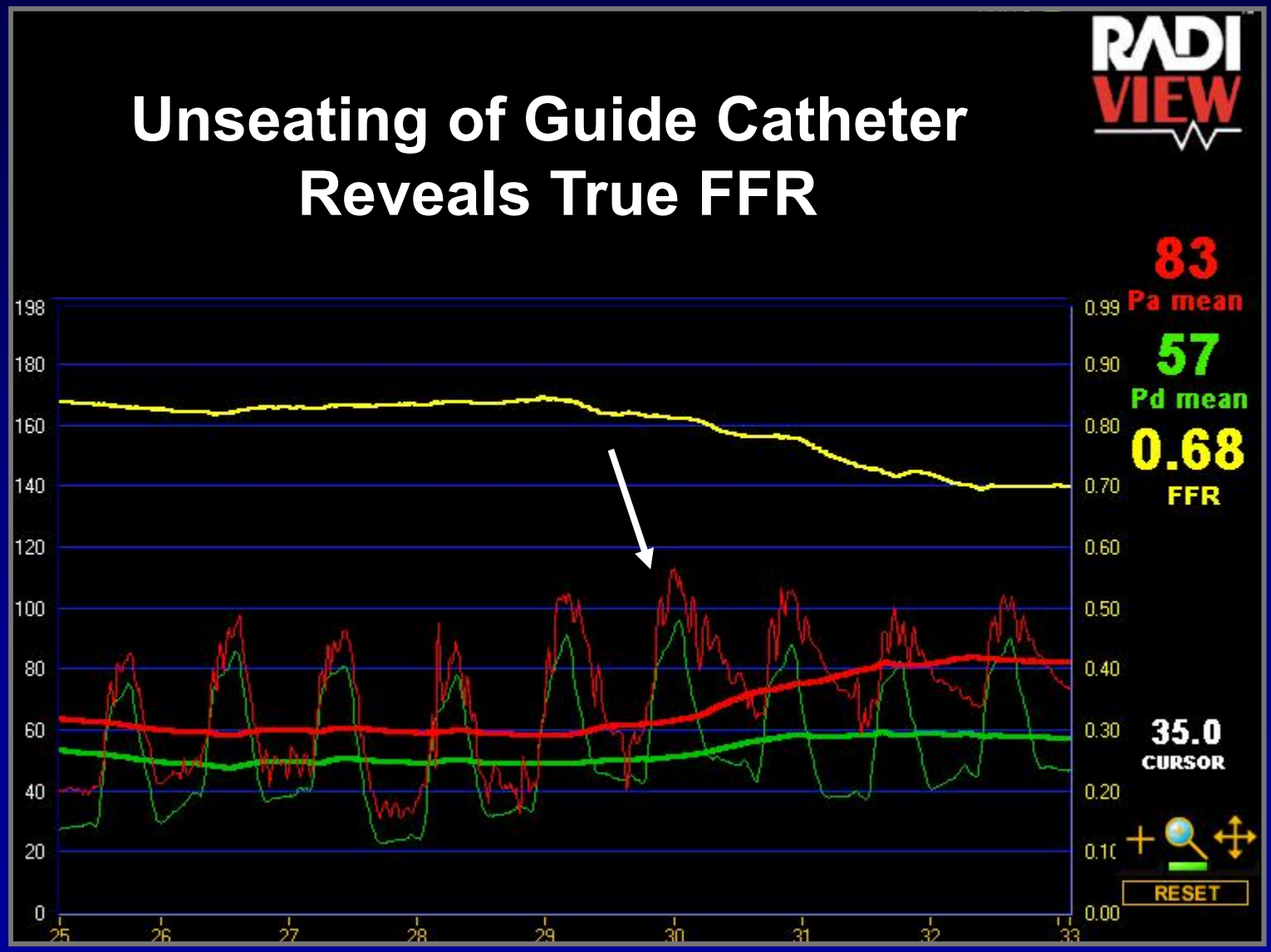
Catheter Issues



Catheter Issues



Catheter Issues



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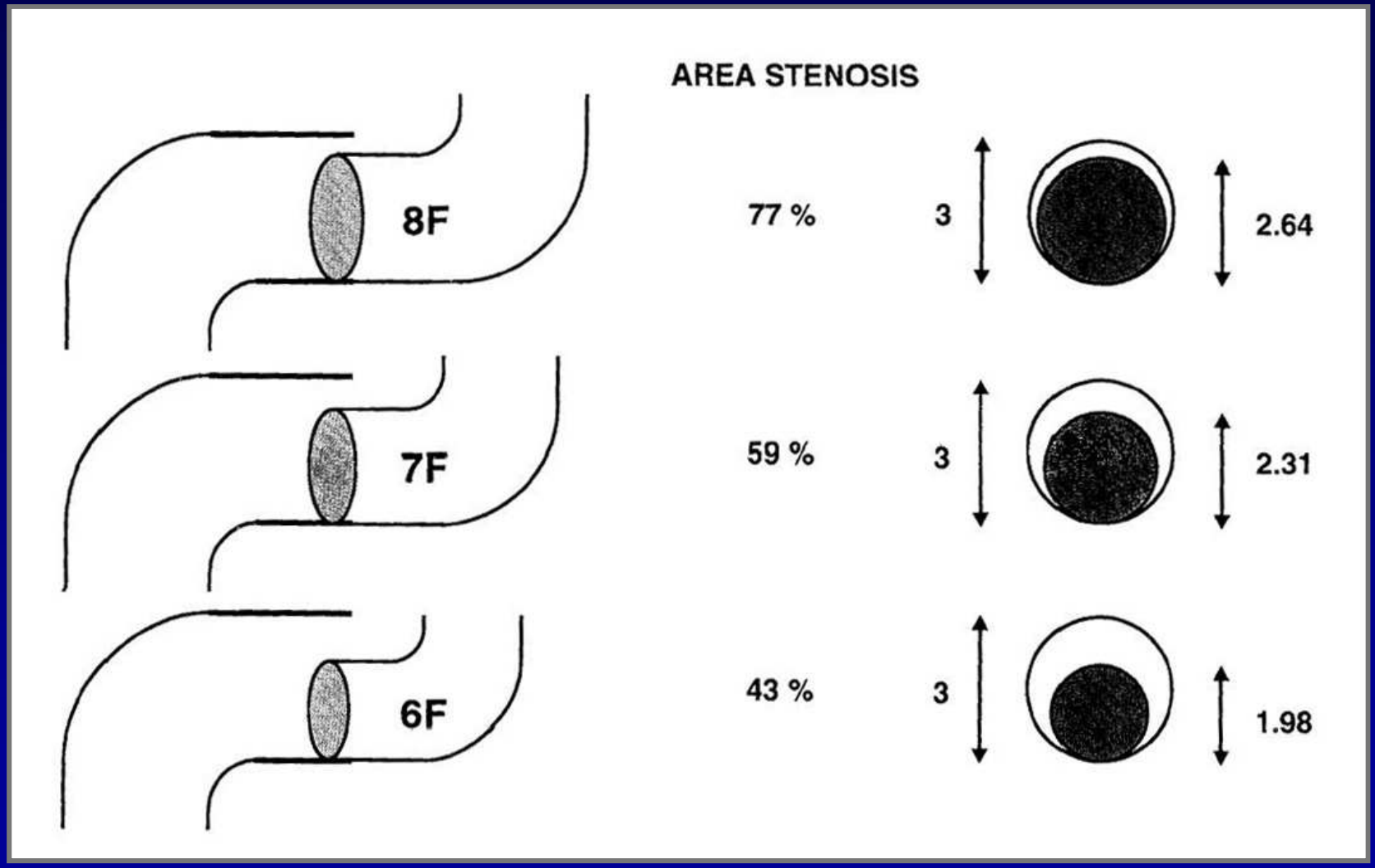
Impact of Catheter Size on Hyperemic Flow



De Bruyne et al. Cathet Cardiovasc Diagn 1994;33:145-152.

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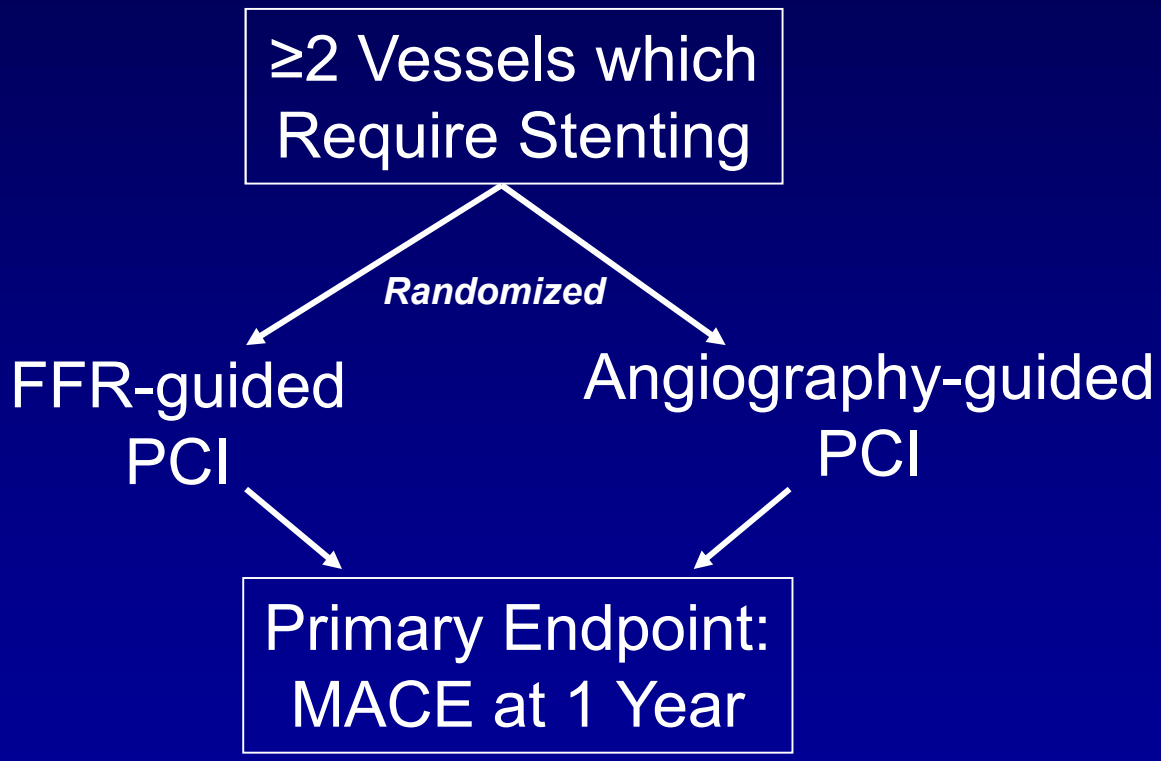
When and Why to Measure FFR

FFR vs. Angiography for Multivessel Evaluation (FAME Study)



New Engl J Med 2009;360:213-24

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Procedural Characteristics

	Angio-Guided n = 496	FFR-Guided n = 509	P Value
Indicated lesions / patient	2.7±0.9	2.8±1.0	0.34
Stents / patient	2.7 ± 1.2	1.9 ± 1.3	<0.001

Procedural Characteristics

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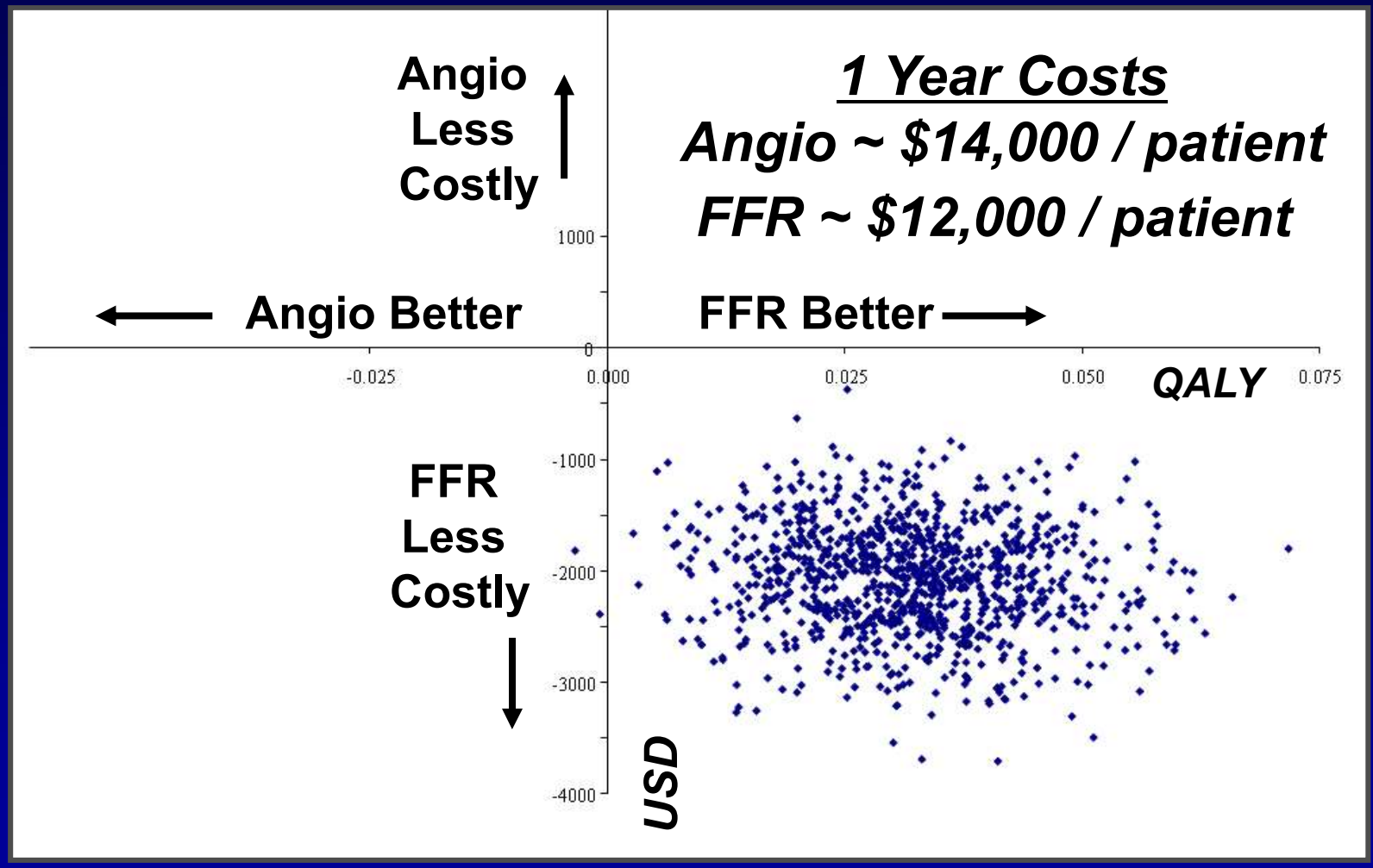
Indicated lesions / patient	2.7±0.9	2.8±1.0	0.34
Stents / patient	2.7 ± 1.2	1.9 ± 1.3	<0.001
Procedure time (min)	70 ± 44	71 ± 43	0.51
Contrast agent used (ml)	302 ± 127	272 ± 133	<0.001
Equipment cost (US $)	6007	5332	<0.001
Length of hospital stay (days)	3.7 ± 3.5	3.4 ± 3.3	0.05

Adverse Events at 1 Year

	Angio-Guided n = 496	FFR-Guided n = 509	P Value
Total no. of MACE	113	76	
Death	15 (3.0)	9 (1.8)	0.19
Myocardial Infarction	43 (8.7)	29 (5.7)	0.07
Small / peri-PCI (CK-MB 3-5xNl)	16	12	
Other infarctions (“late or large”)	27	17	
CABG or repeat PCI	47 (9.5)	33 (6.5)	0.08
Death or Myocardial Infarction	55 (11.1)	37 (7.3)	0.04
Death, MI, CABG, or re-PCI	**91 (18.3)**	**67 (13.2)**	**0.02**

1 Year Economic Evaluation

Bootstrap Simulation

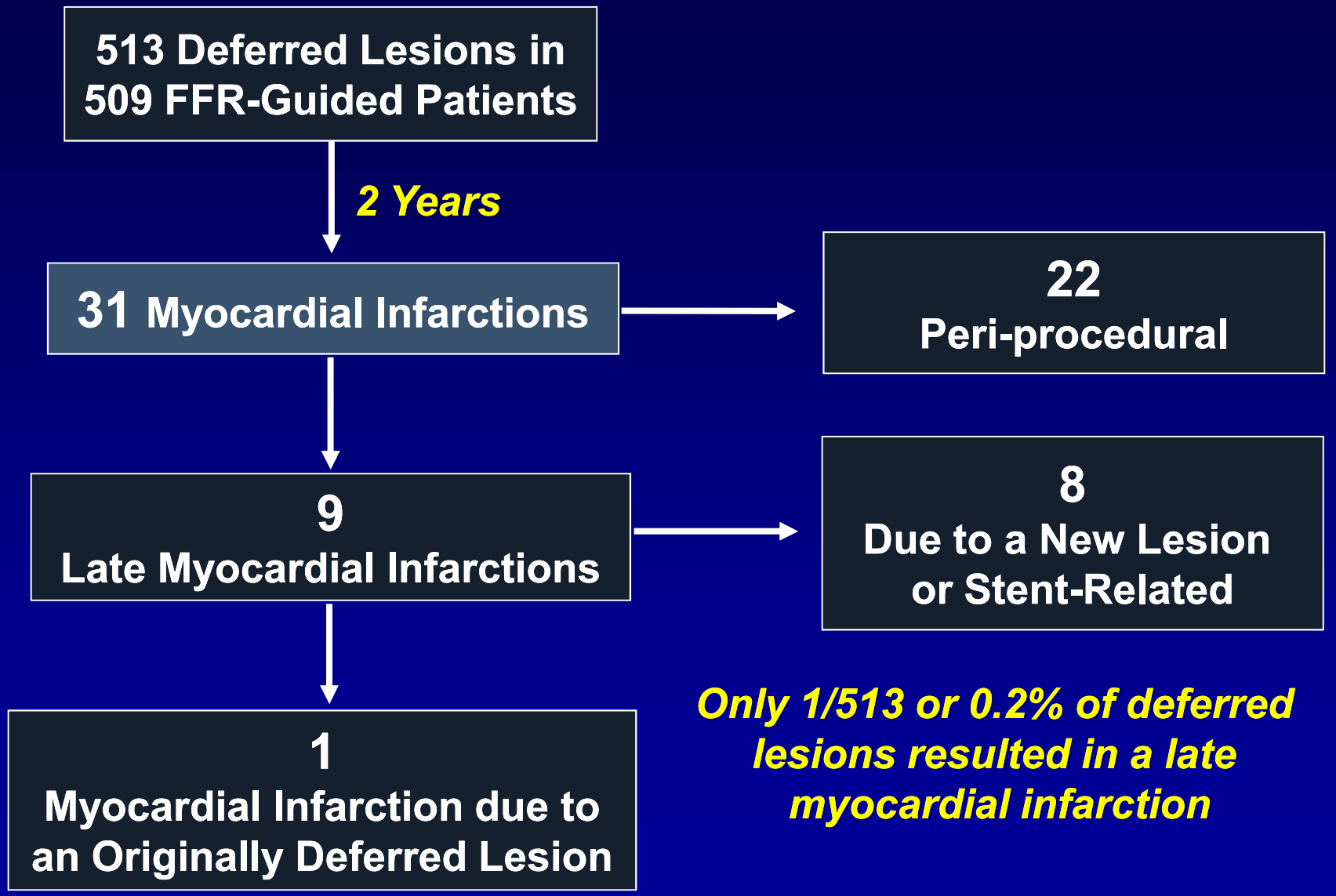


Adverse Events at 2 Years

	Angio-Guided n = 496	FFR-Guided n = 509	P Value
Total no. of MACE	139	105	
Individual Endpoints			
Death	19 (3.8)	13 (2.6)	0.25
Myocardial Infarction	48 (9.7)	31 (6.1)	0.03
CABG or repeat PCI	61 (12.3)	53 (10.4)	0.35
Composite Endpoints			
Death or Myocardial Infarction	63 (12.7)	43 (8.4)	0.03
Death, MI, CABG, or re-PCI	110 (22.2)	90 (17.7)	0.07

Late Breaking Trial, TCT 2009

2 Year Outcome of Deferred Lesions



Only 1/513 or 0.2% of deferred lesions resulted in a late myocardial infarction

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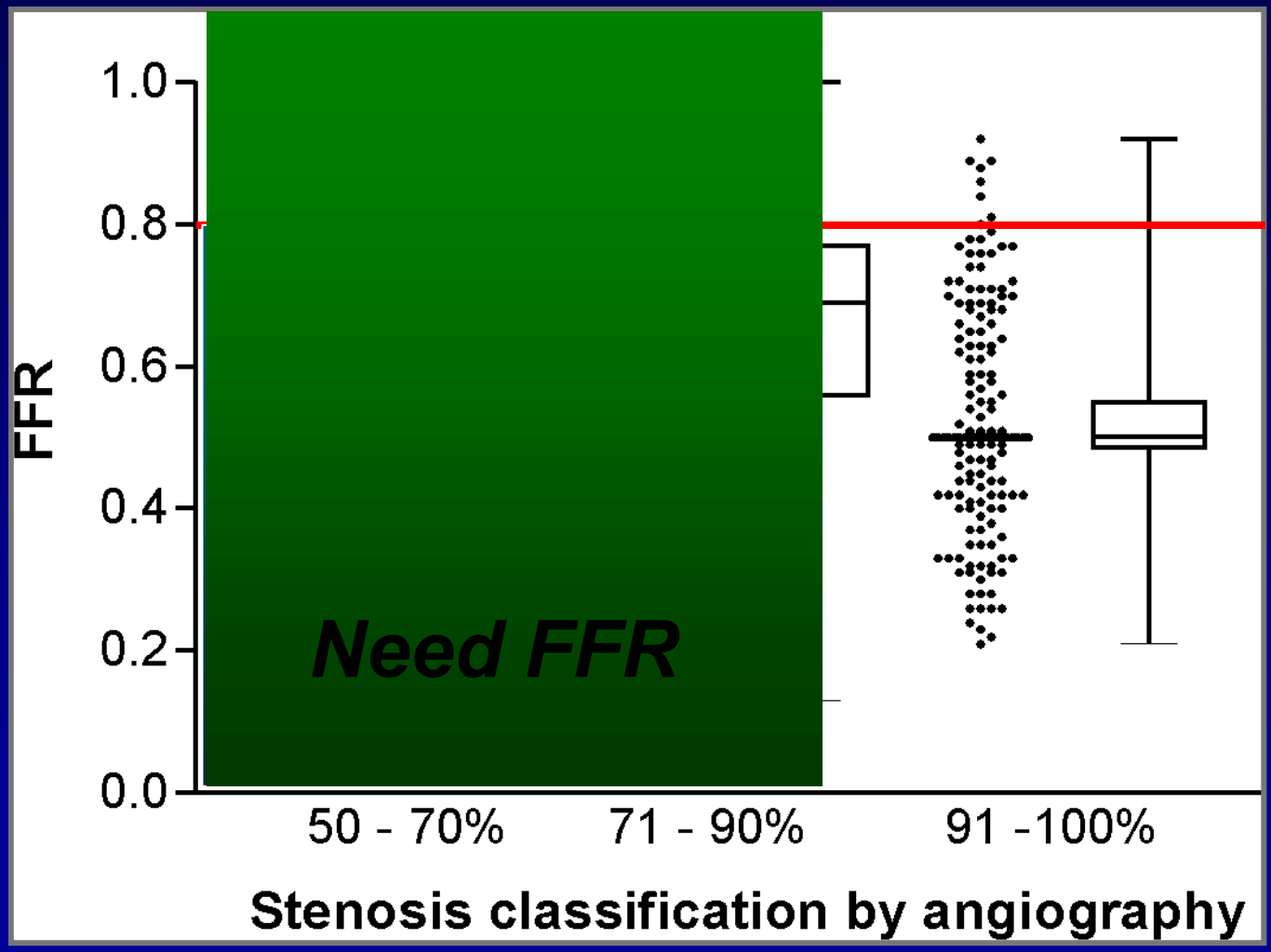
Anatomic vs. Functional CAD

Patients with angiographically 3VD (N=115), proportions per number of diseased vessels after assessment by FFR

Tonino et al., JACC 2010 (in press)

Which Lesions Need FFR?

1329 lesions in the FFR-guided arm



Tonino et al., JACC 2010 (in press)

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