
Gap Between Anatomy and Function: *Bifurcation Lesions*

William F. Fearon, MD

Associate Professor

Stanford University Medical Center



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:

St. Jude Medical

Consulting Fees/Honoraria:

Tryton Medical

Major Stock Shareholder/Equity Interest:

Royalty Income:

Ownership/Founder:

Salary:

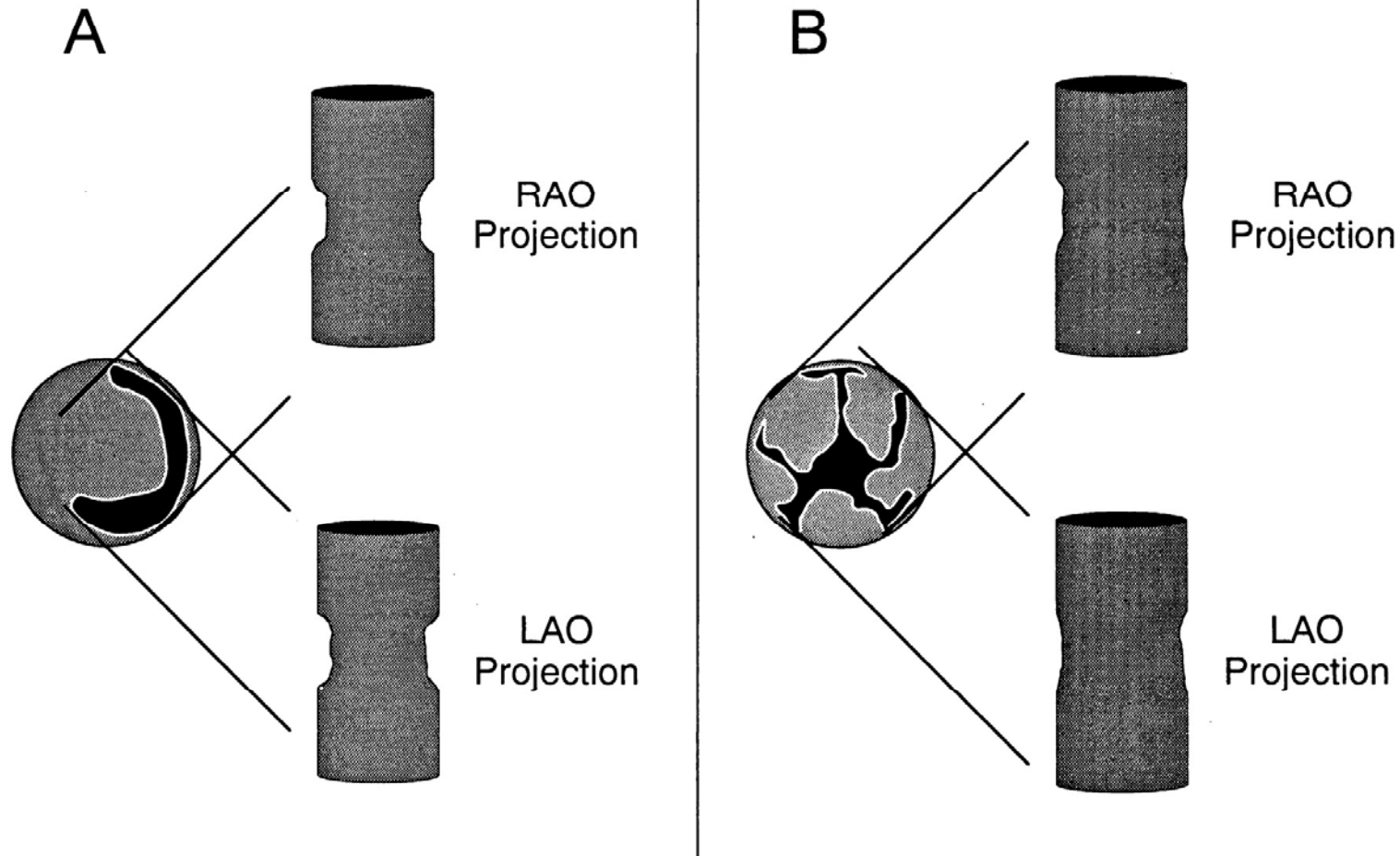
Intellectual Property Rights:

Other Financial Benefit (minor stock options):

HeartFlow

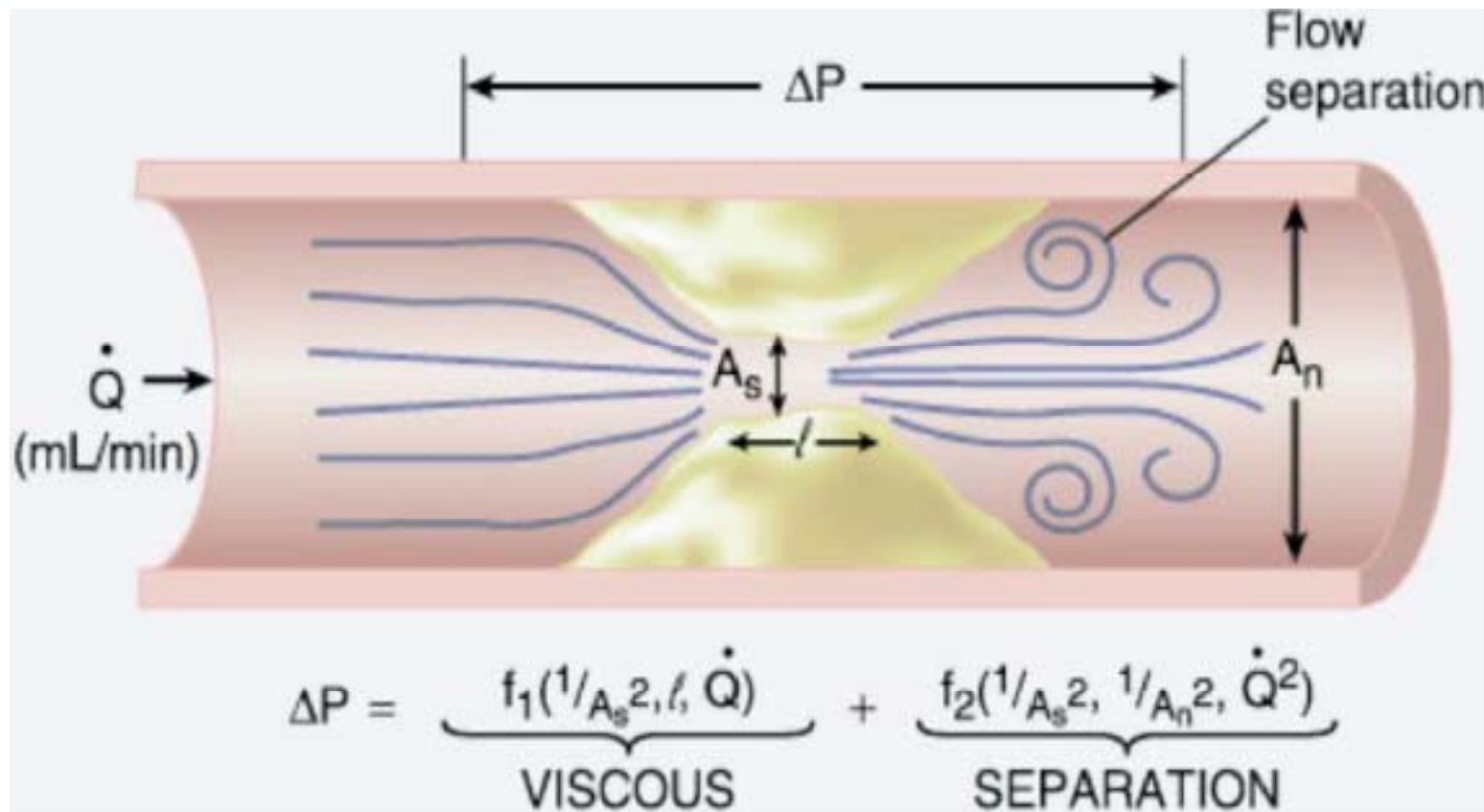


Limitation of Angiography

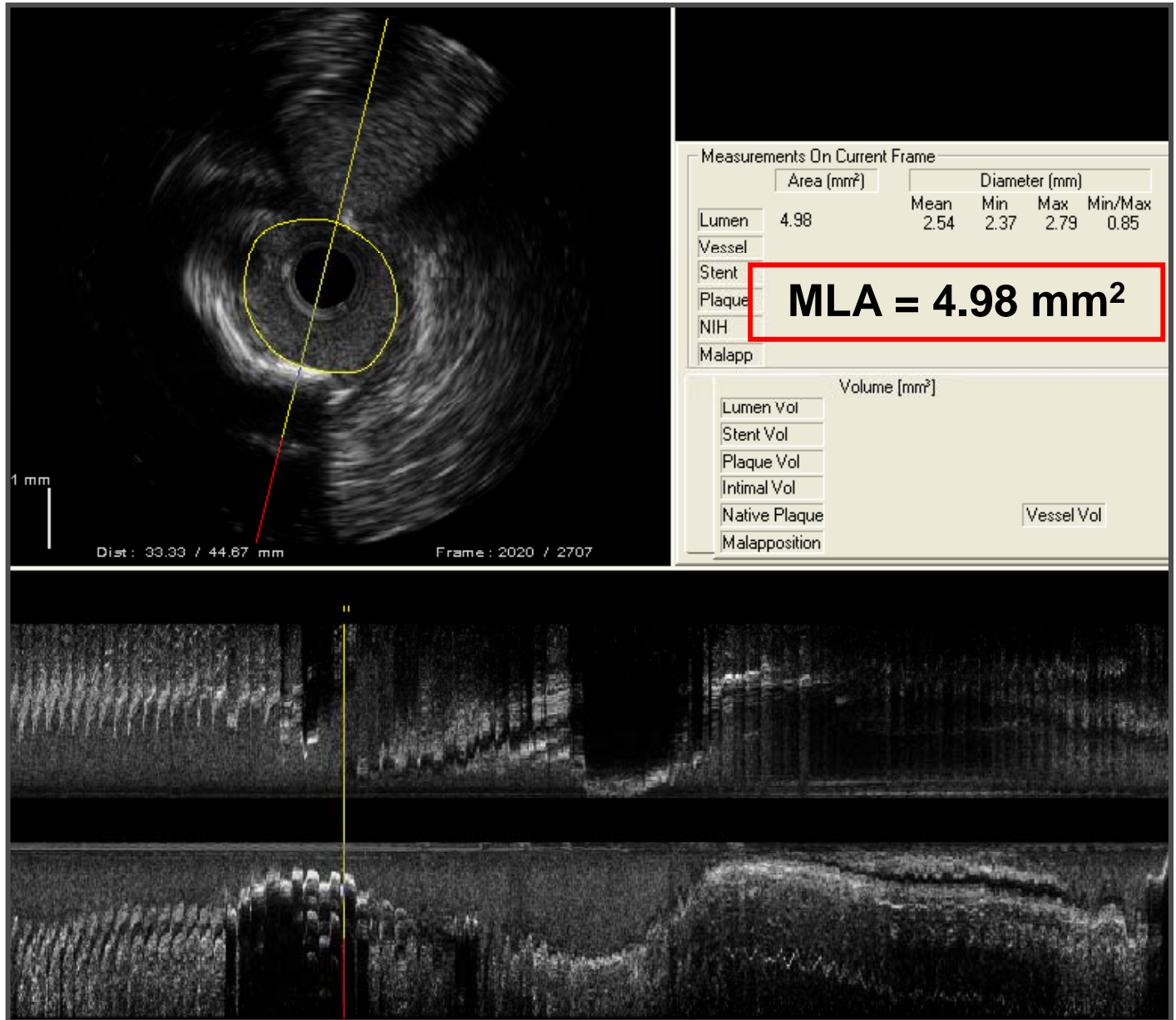


Ischemia-Producing Lesion

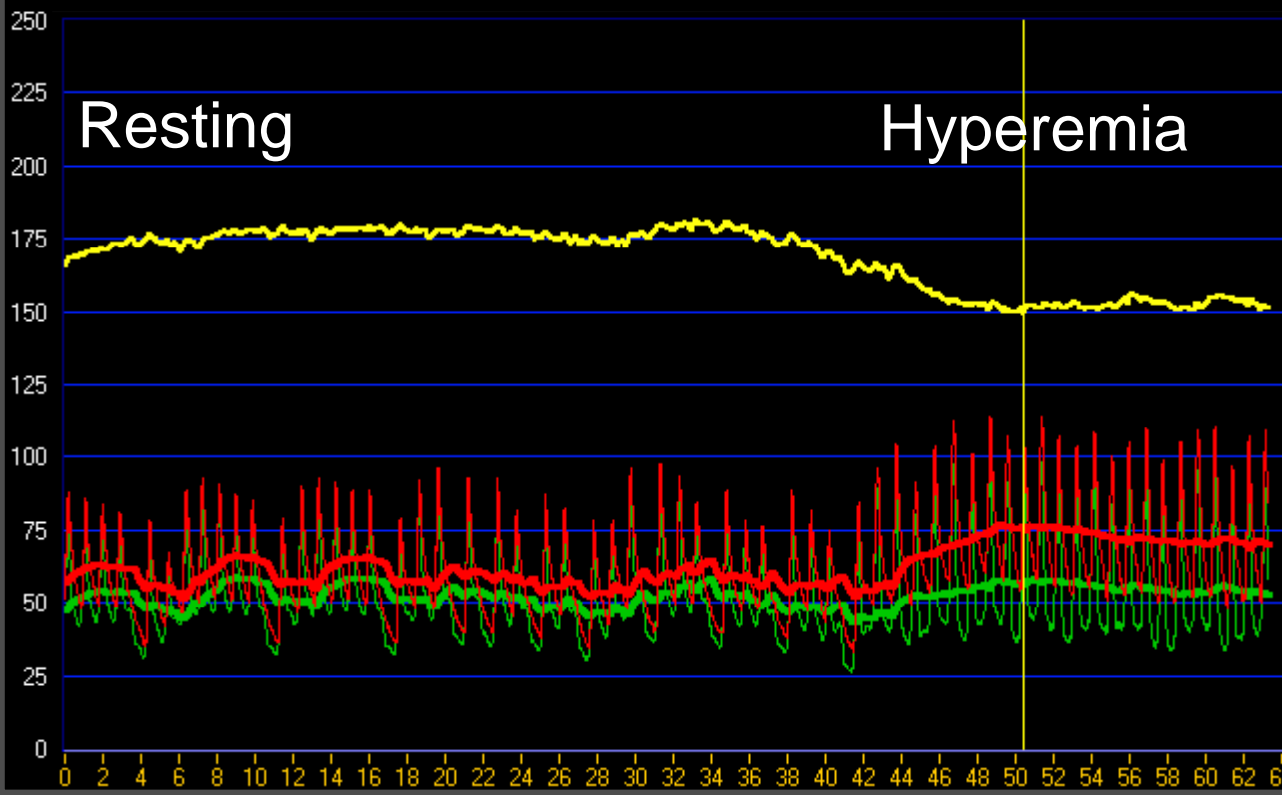
What causes a lesion to be functionally significant?







FFR = 0.75

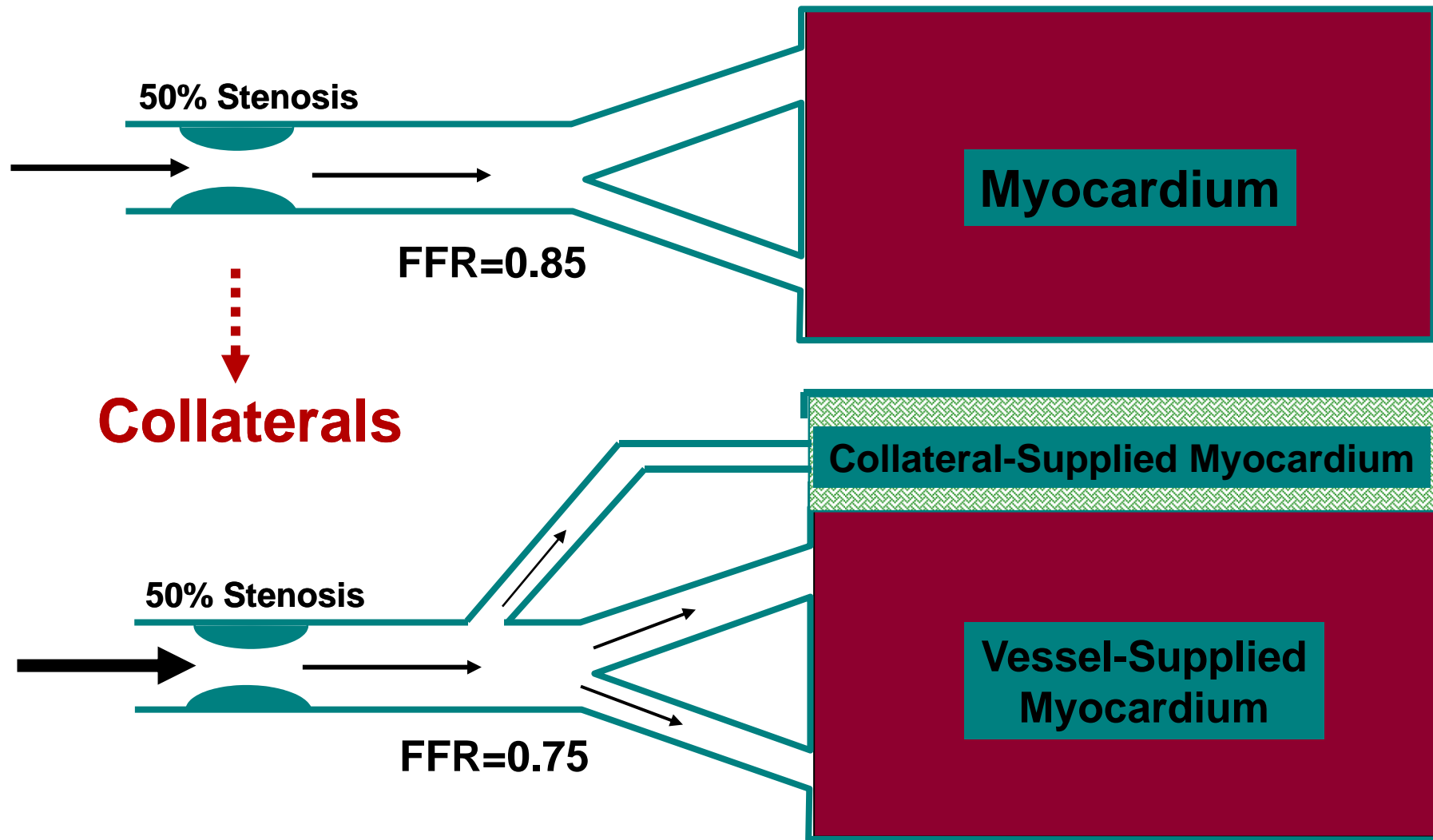


75
Pa mean
56
Pd mean
0.75
FFR

50.5
CURSOR

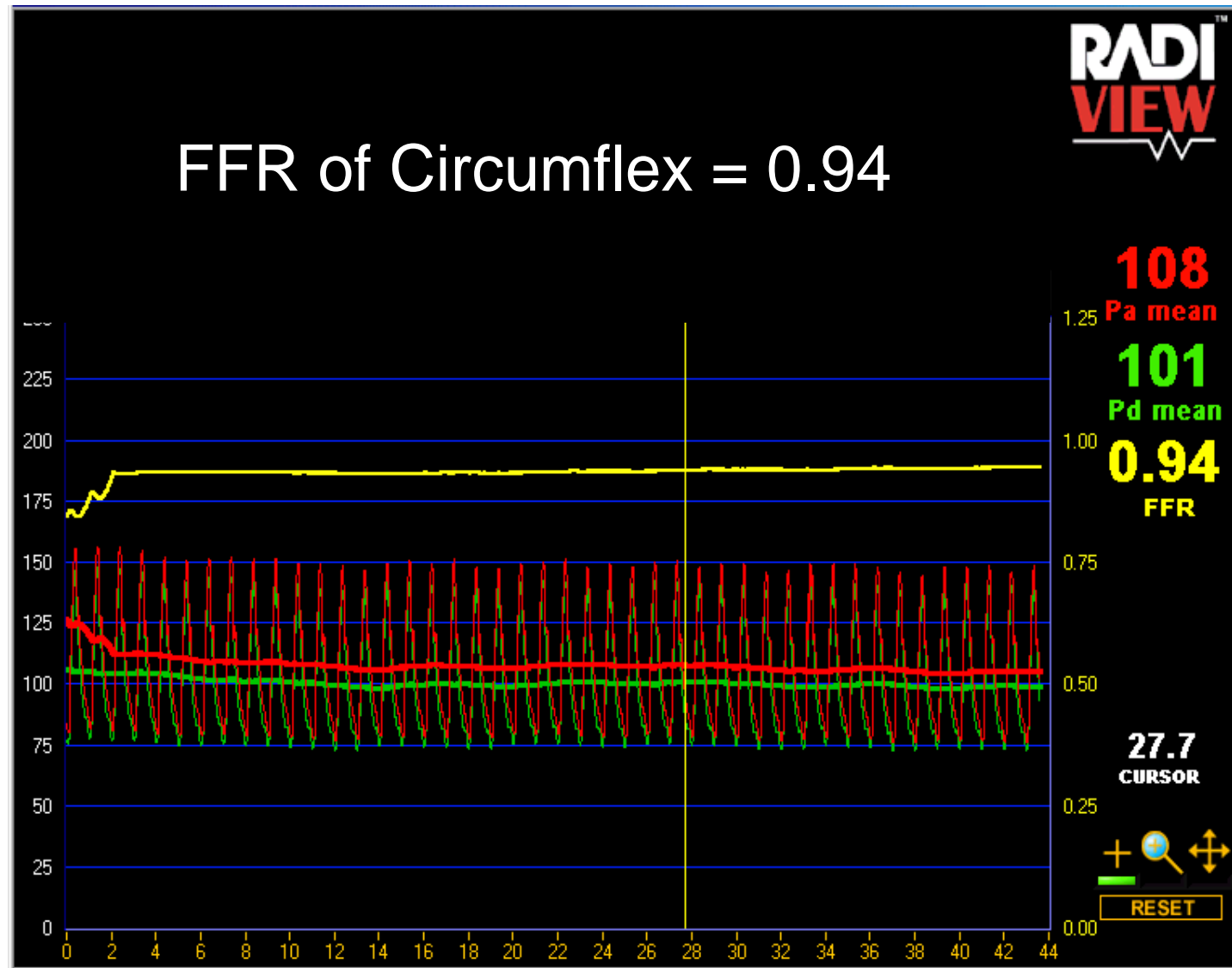


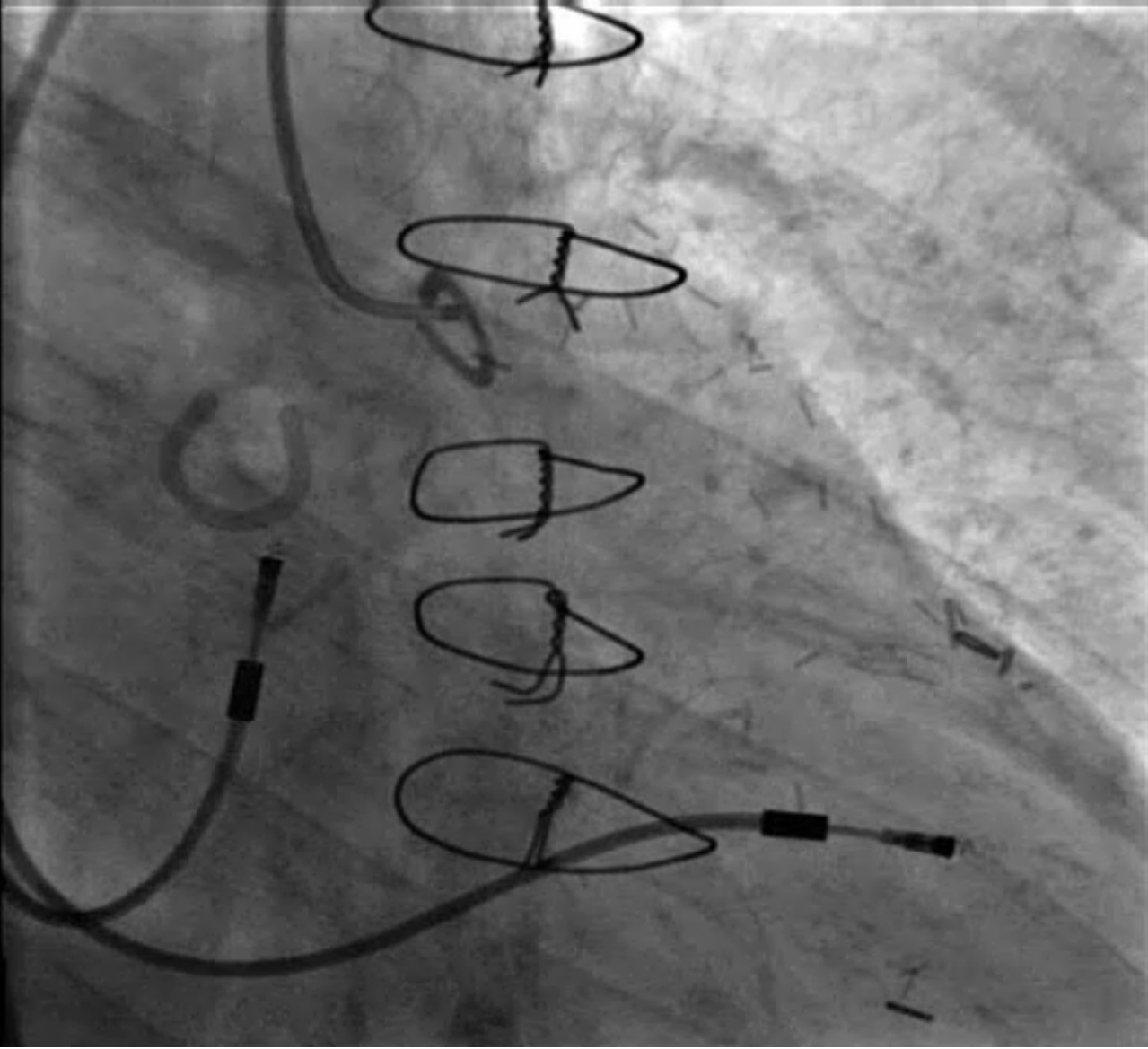
Disconnect between Anatomy and Physiology



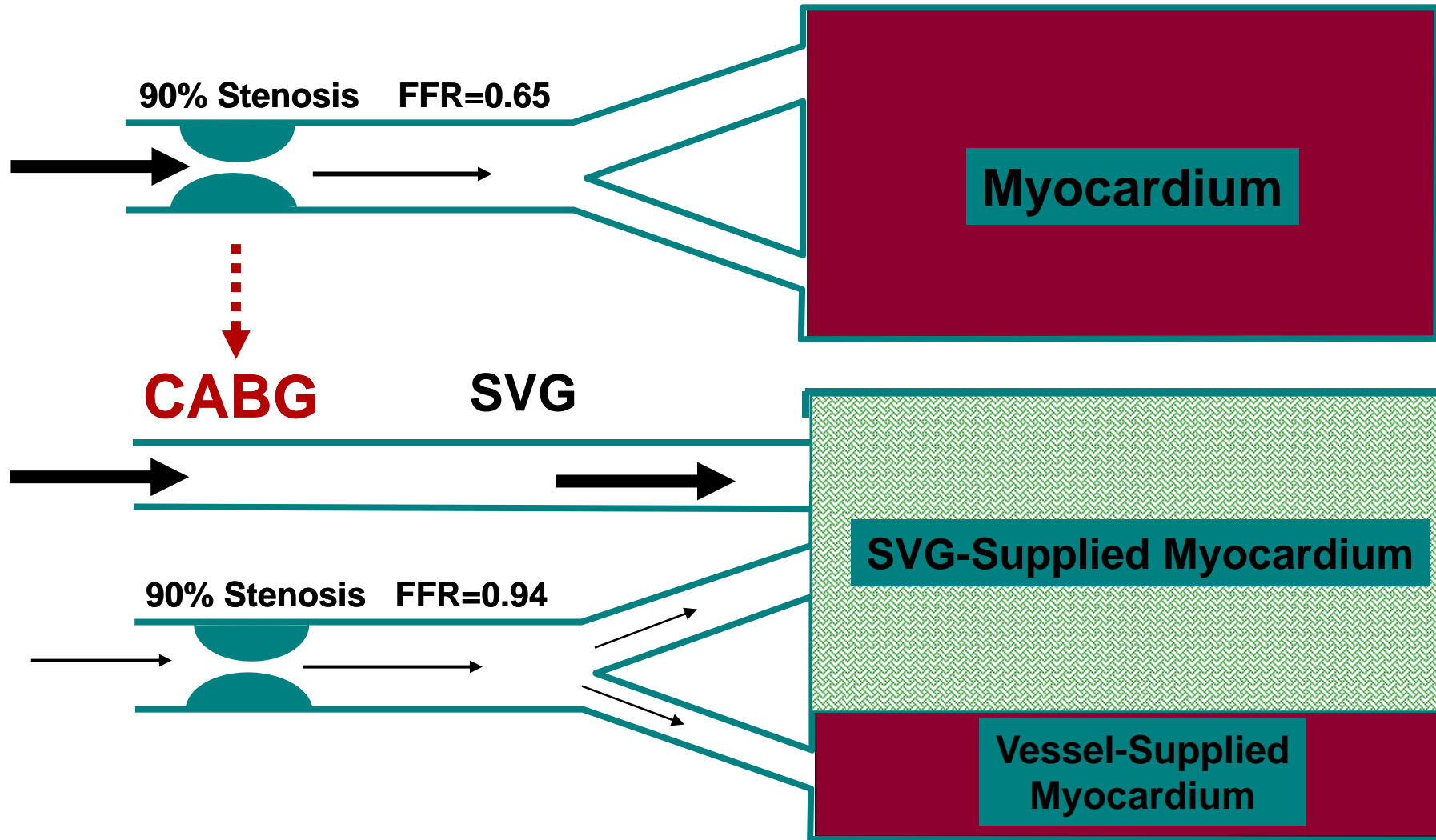


FFR of Circumflex = 0.94





Disconnect between Anatomy and Physiology



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562.68-4401
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VA Palo Alto

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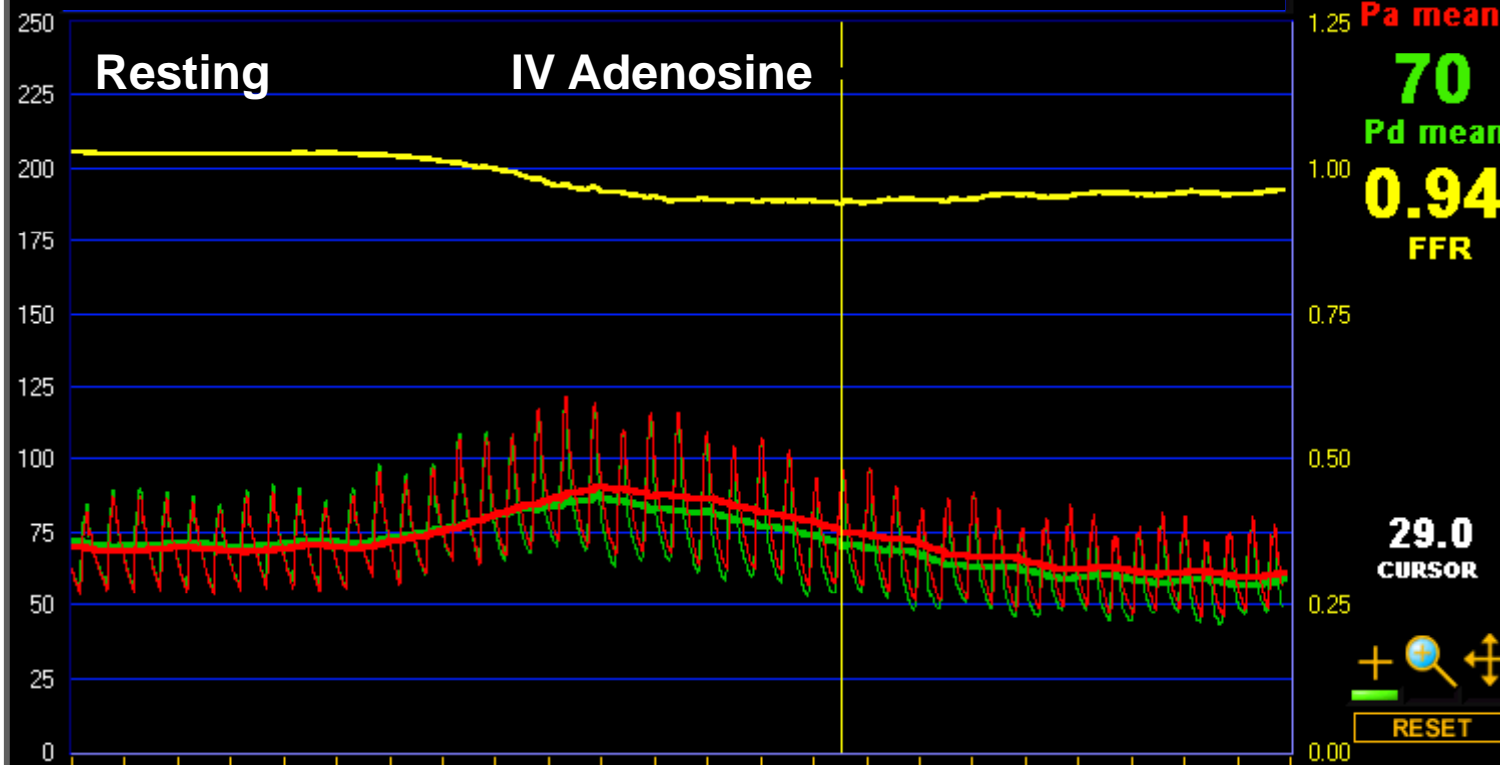


0.80 RAO
32.80 CAU

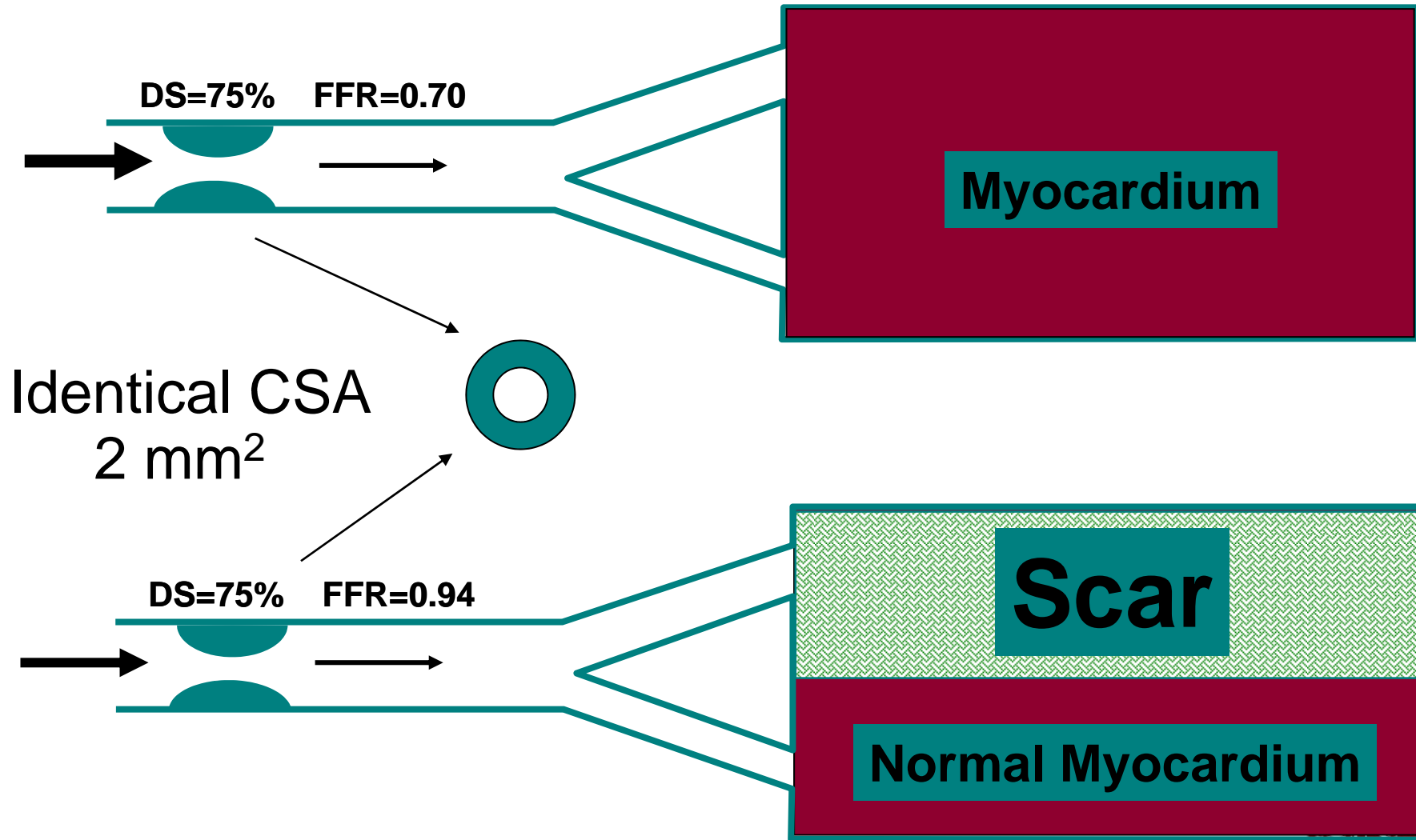


FFR of Left Circumflex

**RADI
VIEW**TM

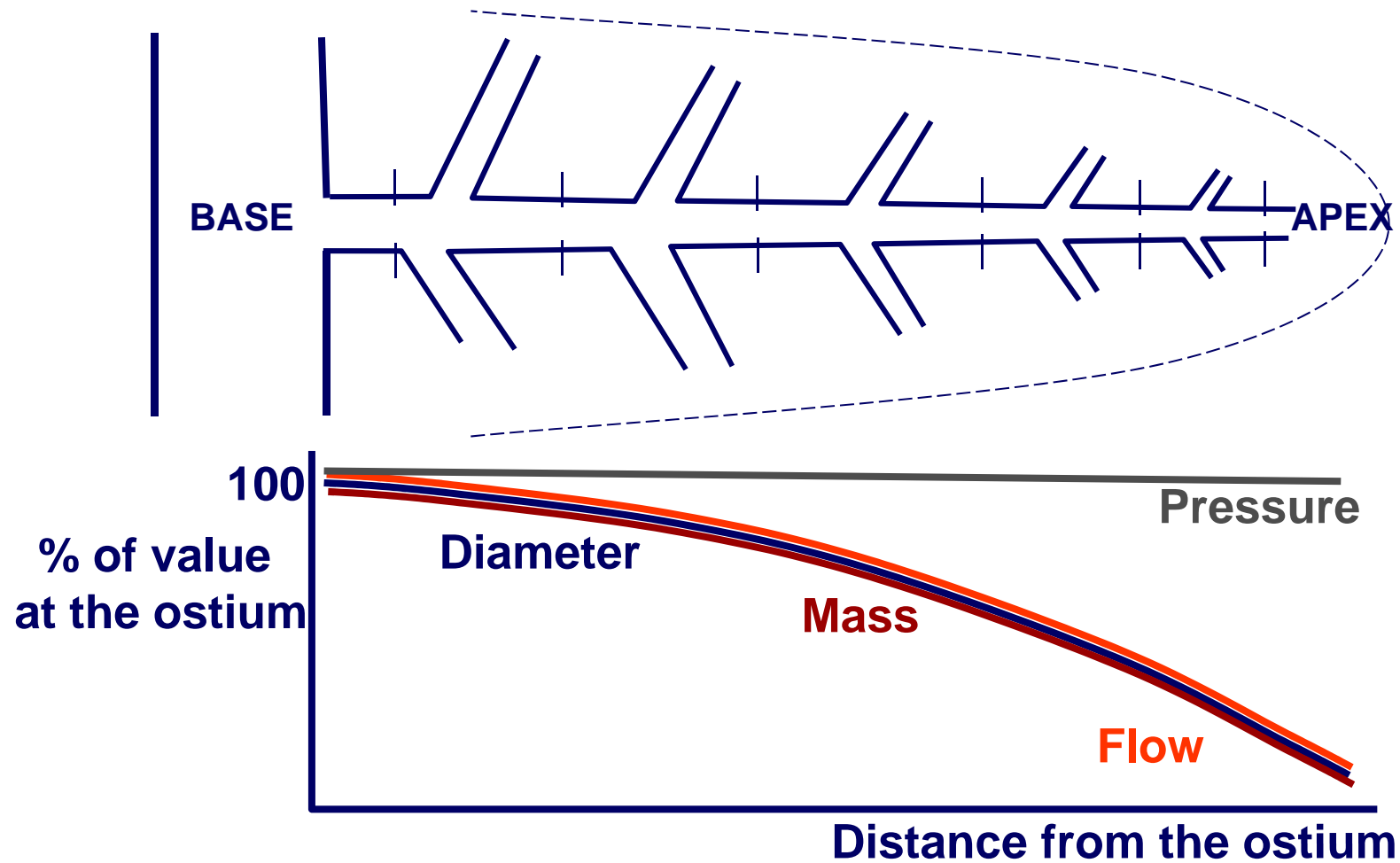


Disconnect between Anatomy and Physiology



Epicardial Coronary Pressure:

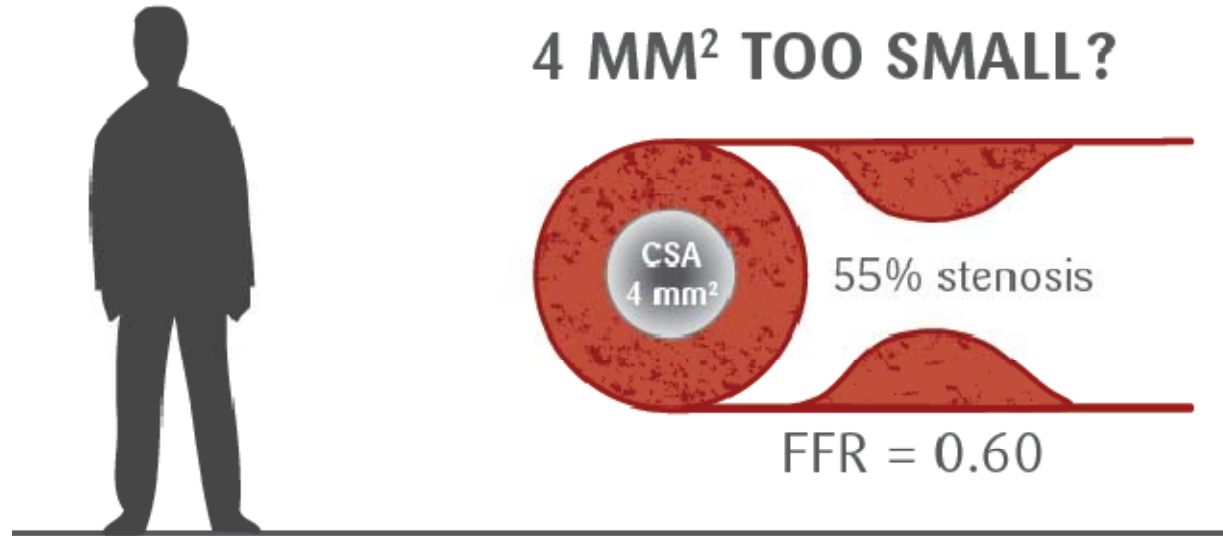
Pressure, Flow, Resistance and Vessel Size



Courtesy of Bernard De Bruyne



IVUS cutoff is affected by vessel size

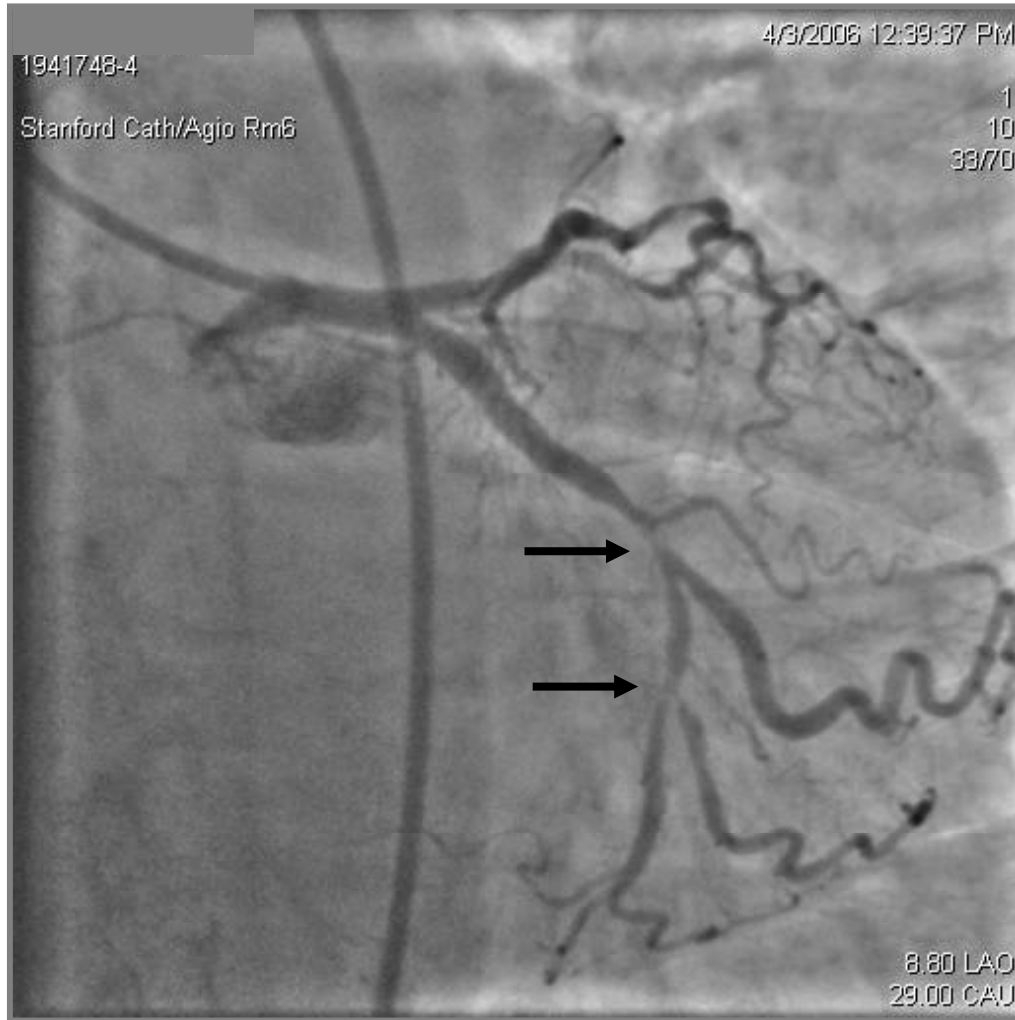


Why we need FFR for bifurcation lesions

- Angiographic evaluation is difficult due to vessel overlap, angulation, foreshortening, and stent strut artifact
- IVUS/OCT criteria for a significant sidebranch lesion are unknown and it is technically difficult to perform in some cases (particularly after stenting)
- The amount of myocardium supplied by a sidebranch is relatively small and highly variable



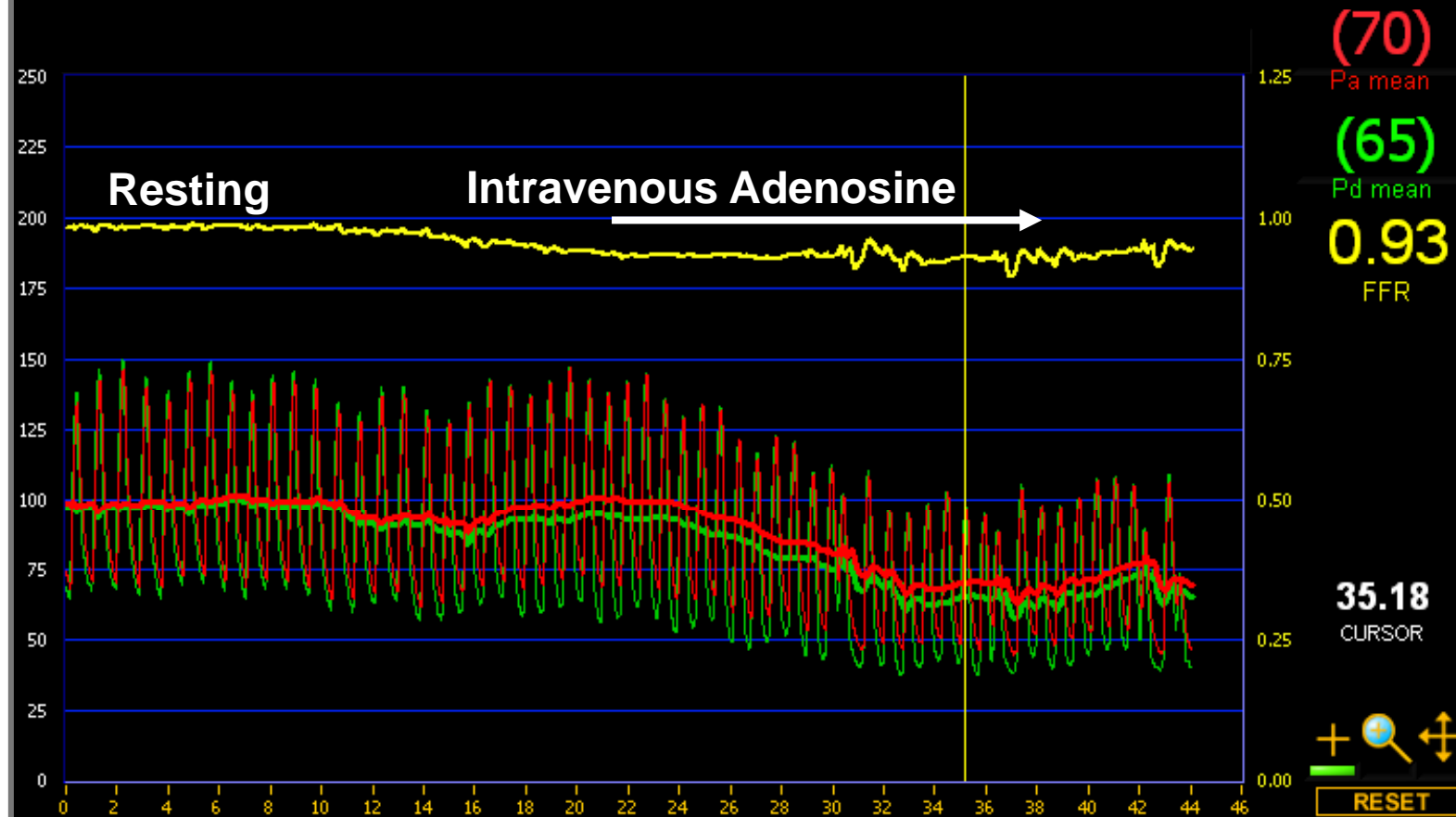
“Jailed” Side Branches



“Jailed” Side Branches

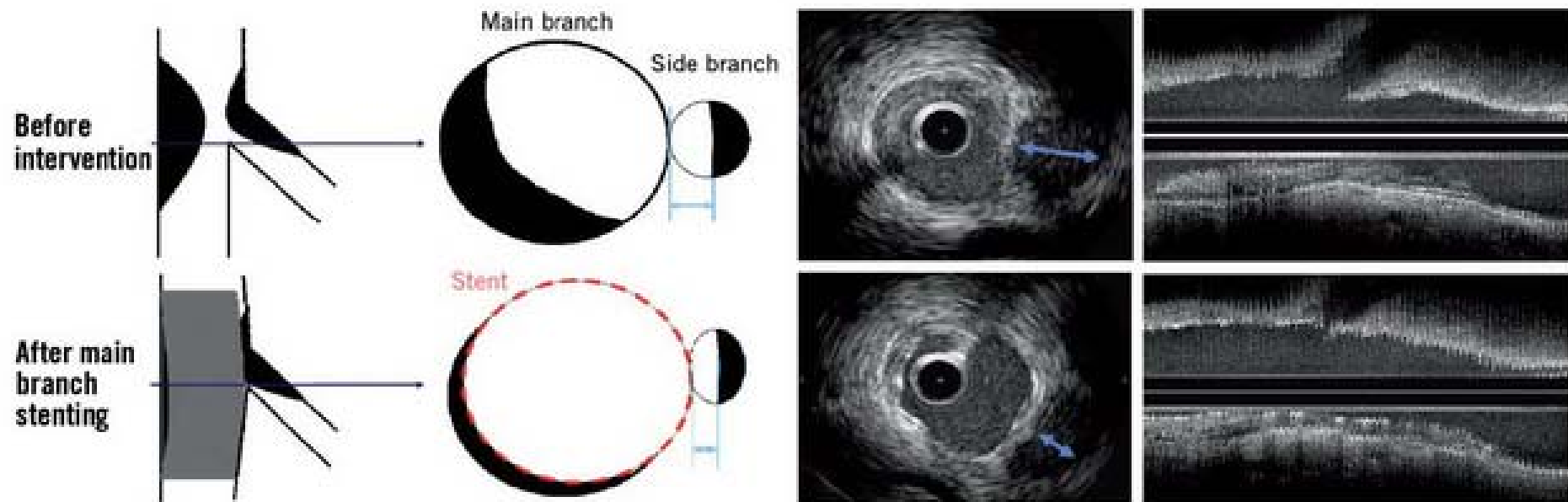


FFR of "Jailed" OM = 0.93



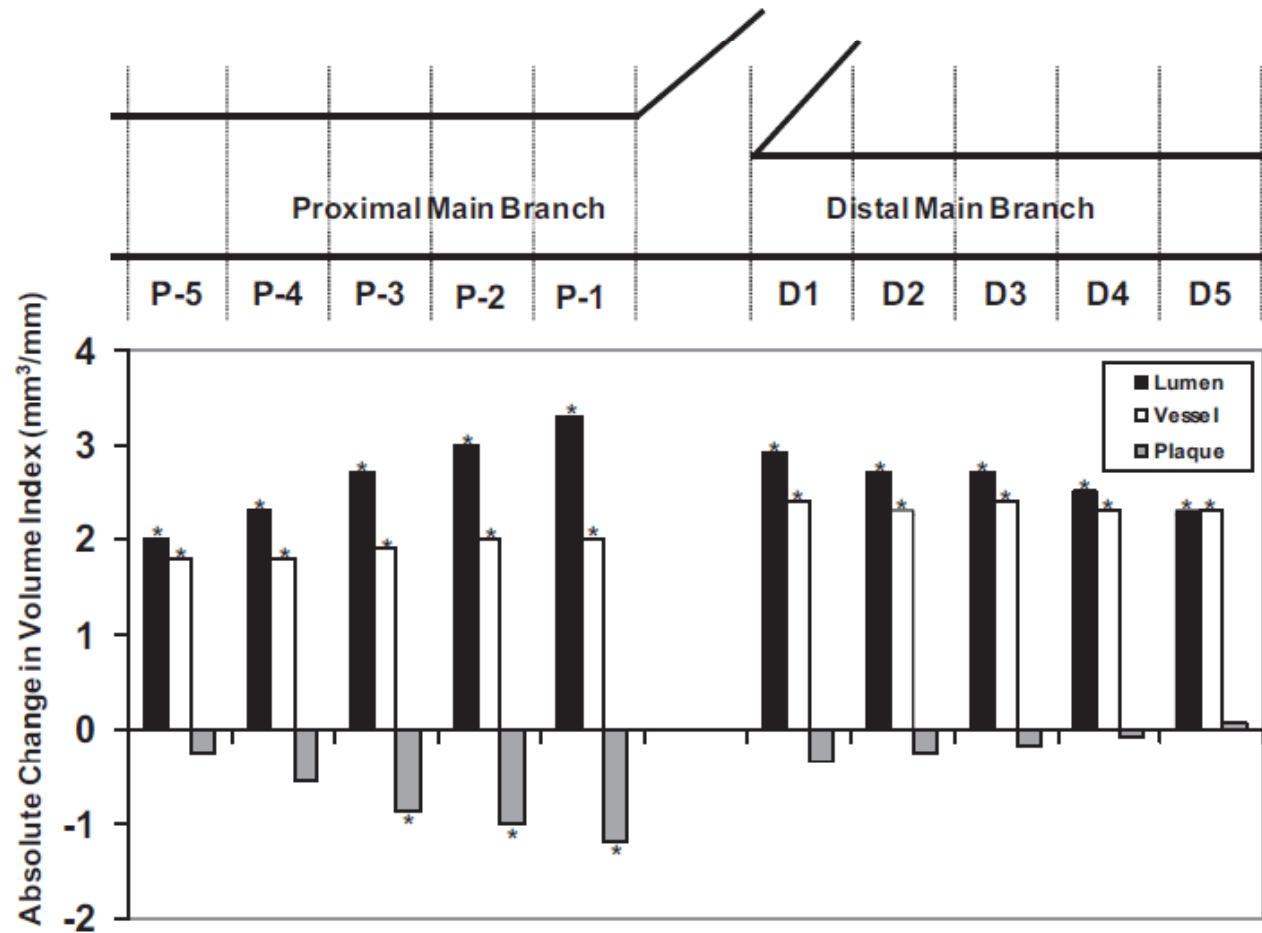
Mechanism of Side Branch “Jailing”

Carina Shifting and Plaque Shifting



Mechanism of Side Branch “Jailing”

Carina Shifting and Plaque Shifting



Can we predict which side branches will have an abnormal FFR after MB stenting?

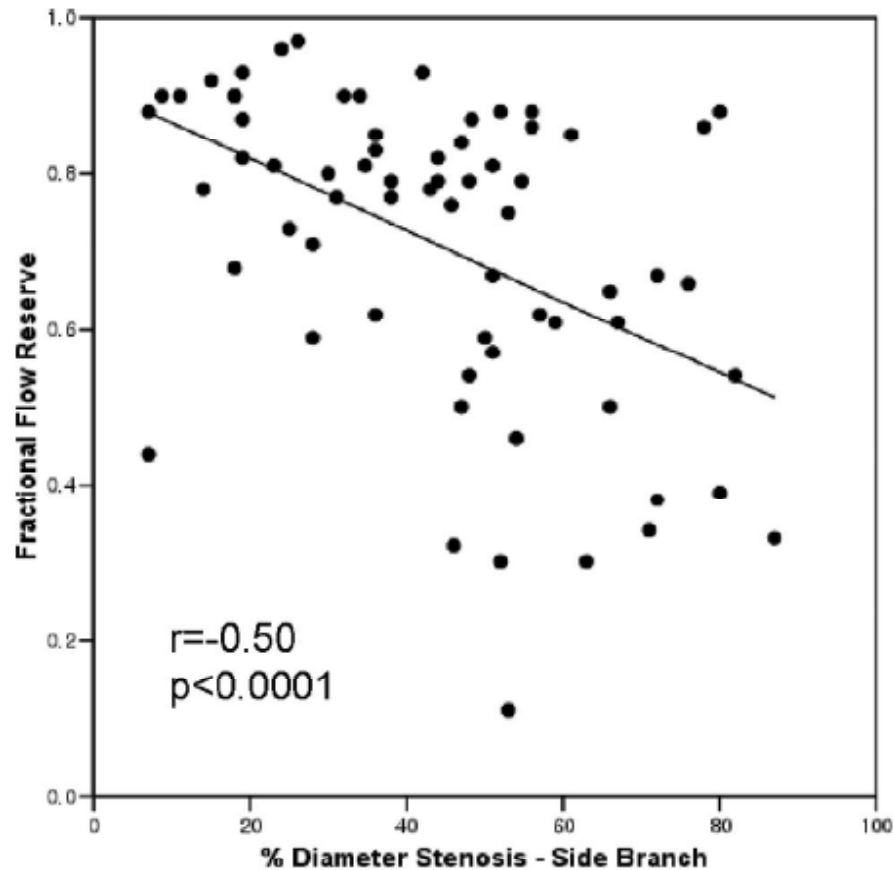
Pre-Intervention Angiographic Parameters

Angiographic Parameters	FFR<0.75 (N=28)	FFR≥0.75 (N=39)	P
Main branch			
Reference diameter, mm	3.0±0.6	3.0±0.4	1
Minimal lumen diameter, mm	1.0±0.4	1.2±0.4	0.15
% diameter stenosis	65±13	61±14	0.27
Side branch			
Reference diameter, mm	2.1±0.5	2.2±0.4	0.33
Minimal lumen diameter, mm	0.9±0.4	1.4±0.4	<0.001
% diameter stenosis	54±20	37±18	<0.001
Type B lesion	19 (56)	15 (44)	0.04
Bifurcation angle, degrees	44±19	46±11	0.62



Can we predict which side branches will have an abnormal FFR after MB stenting?

Correlation between Pre PCI Angiographic DS and Post PCI SB FFR



Koo, et al. Circ Cardiovasc Intervent 2010;3:113-9.



Can we predict which side branches will have an abnormal FFR after MB stenting?

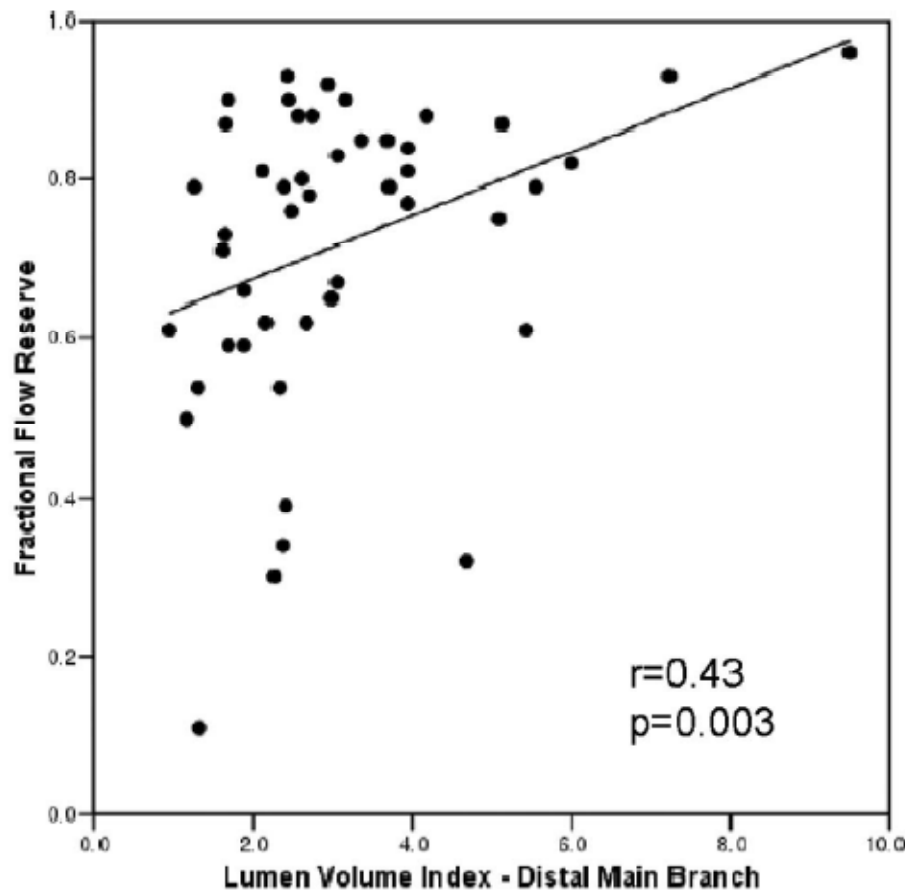
Pre-Intervention IVUS Parameters

IVUS parameters	FFR<0.75 (N=22)	FFR≥0.75 (N=30)	P
Proximal MB			
Lumen volume index, mm ³ /mm	2.6±1.1	3.4±1.5	0.08
Vessel volume index, mm ³ /mm	13.2±3.5	12.7±3.5	0.67
Plaque volume index, mm ³ /mm	10.6±3.1	9.4±3.1	0.21
Plaque burden, %	80±8	73±10	0.03
Distal MB			
Lumen volume index, mm ³ /mm	2.3±1.1	3.6±1.8	0.01
Vessel volume index, mm ³ /mm	8.3±2.0	9.4±2.7	0.14
Plaque volume index, mm ³ /mm	6.0±1.5	5.8±2.0	0.69
Plaque burden, %	73±10	61±12	0.002



Can we predict which side branches will have an abnormal FFR after MB stenting?

Correlation between Pre PCI MB IVUS and Post PCI SB FFR



Koo, et al. Circ Cardiovasc Intervent 2010;3:113-9.



Summary

- Anatomic evaluation alone is insufficient to determine the physiologic significance of a coronary lesion.
- The disconnect between anatomy and function is even more pronounced in the setting of bifurcation lesions.
- FFR helps to identify functionally significant bifurcation lesions.

