Major Predictors of Mismatching between Anatomic and Functional Stenosis Severity

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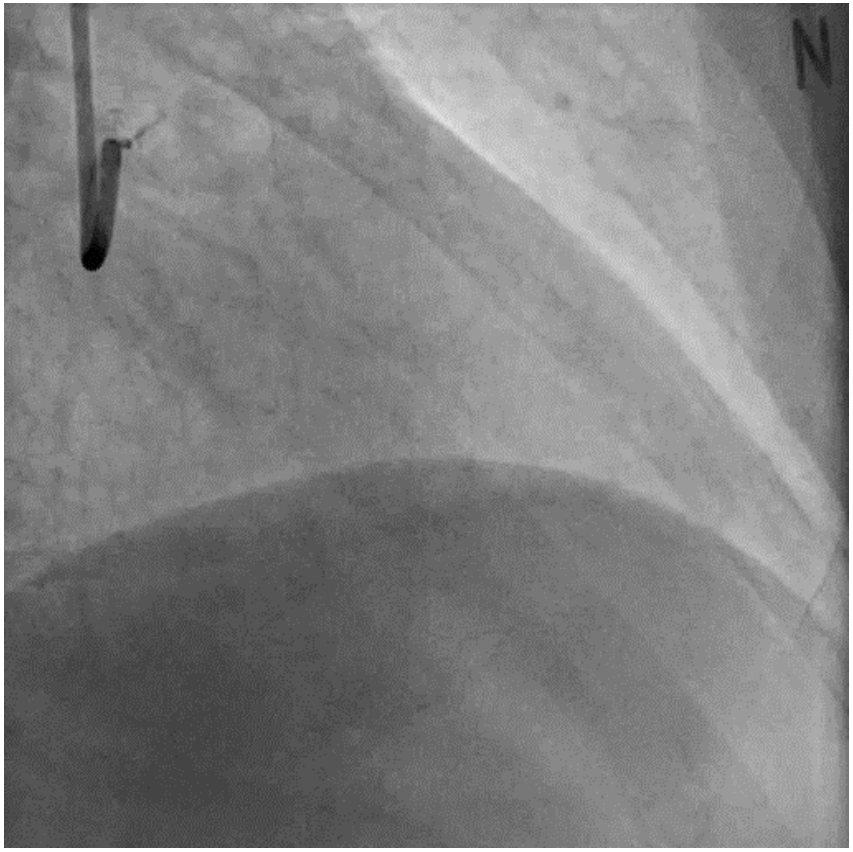
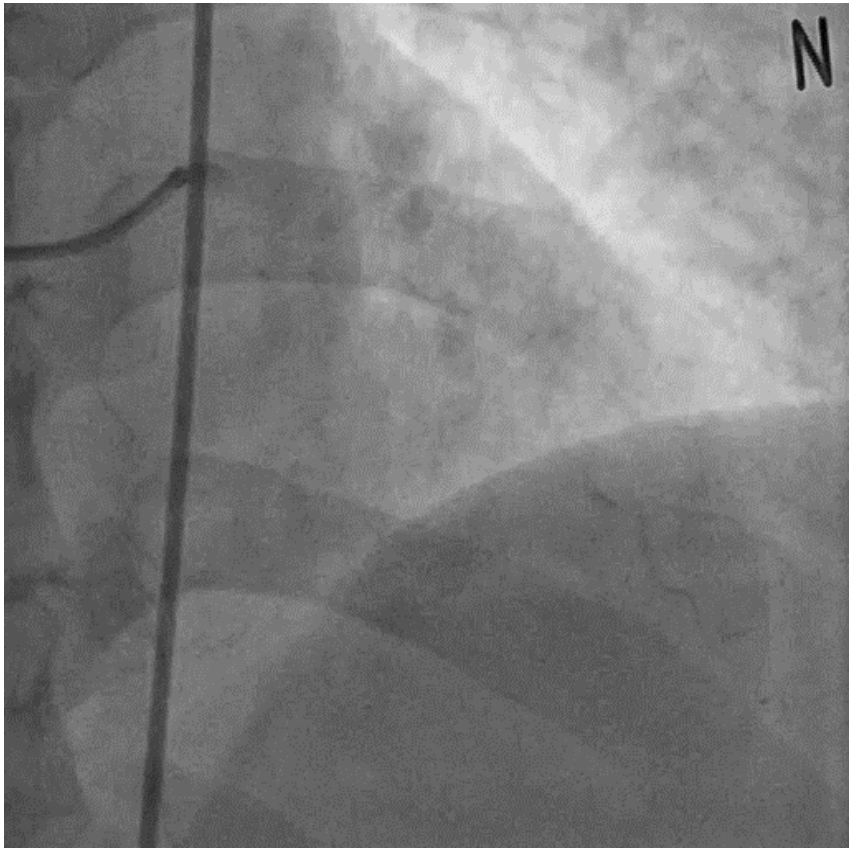
Case 1 윤 00 51/M, UA





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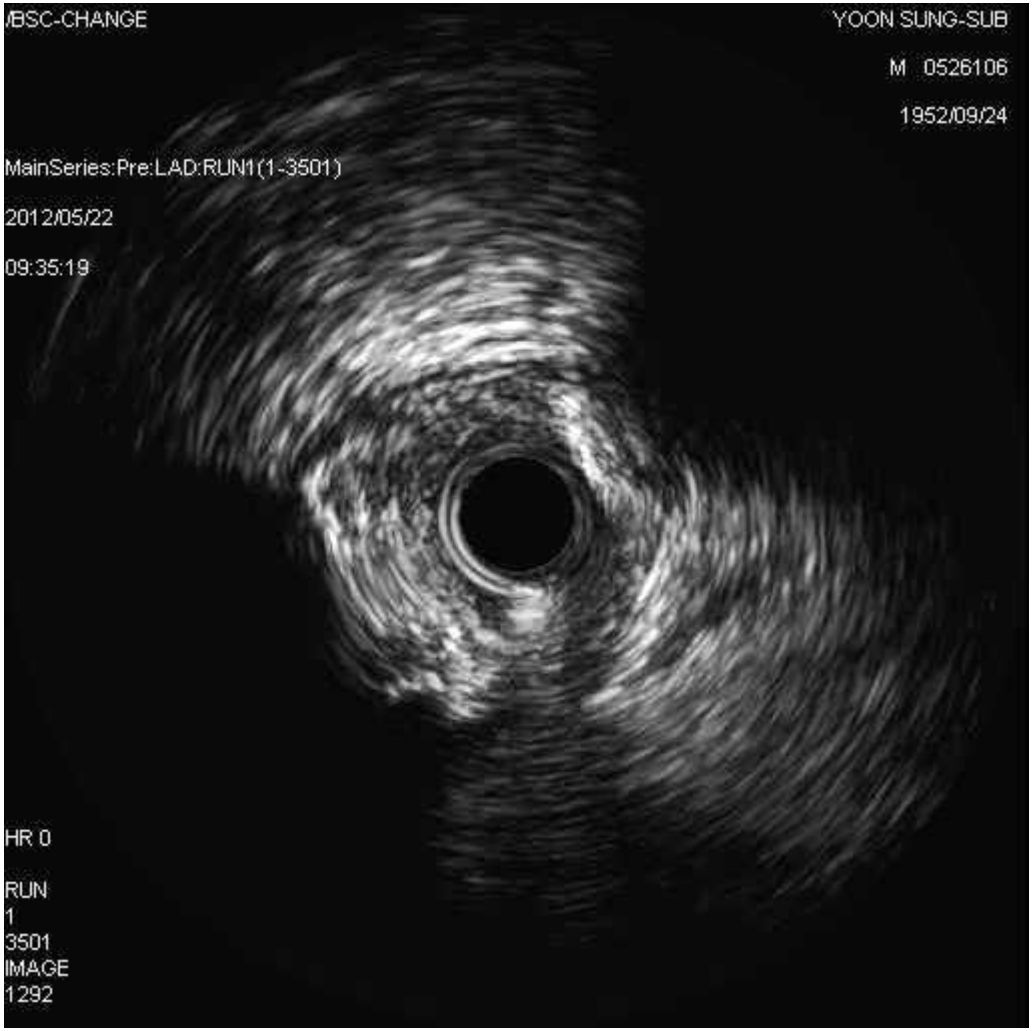
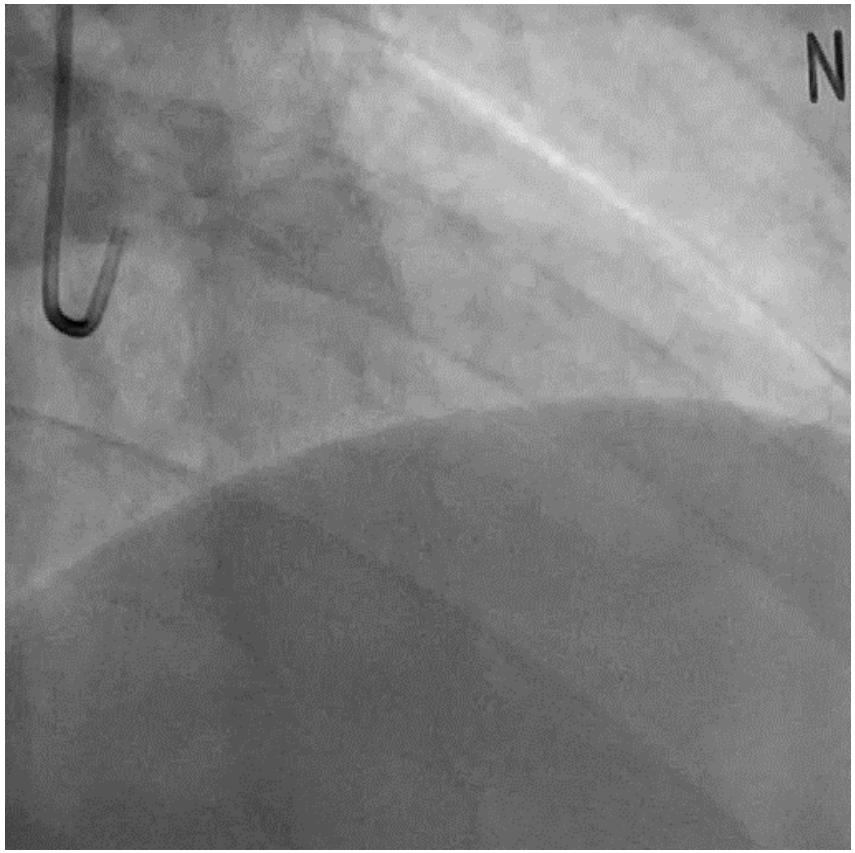


Case 2 김 00 51/M, UA



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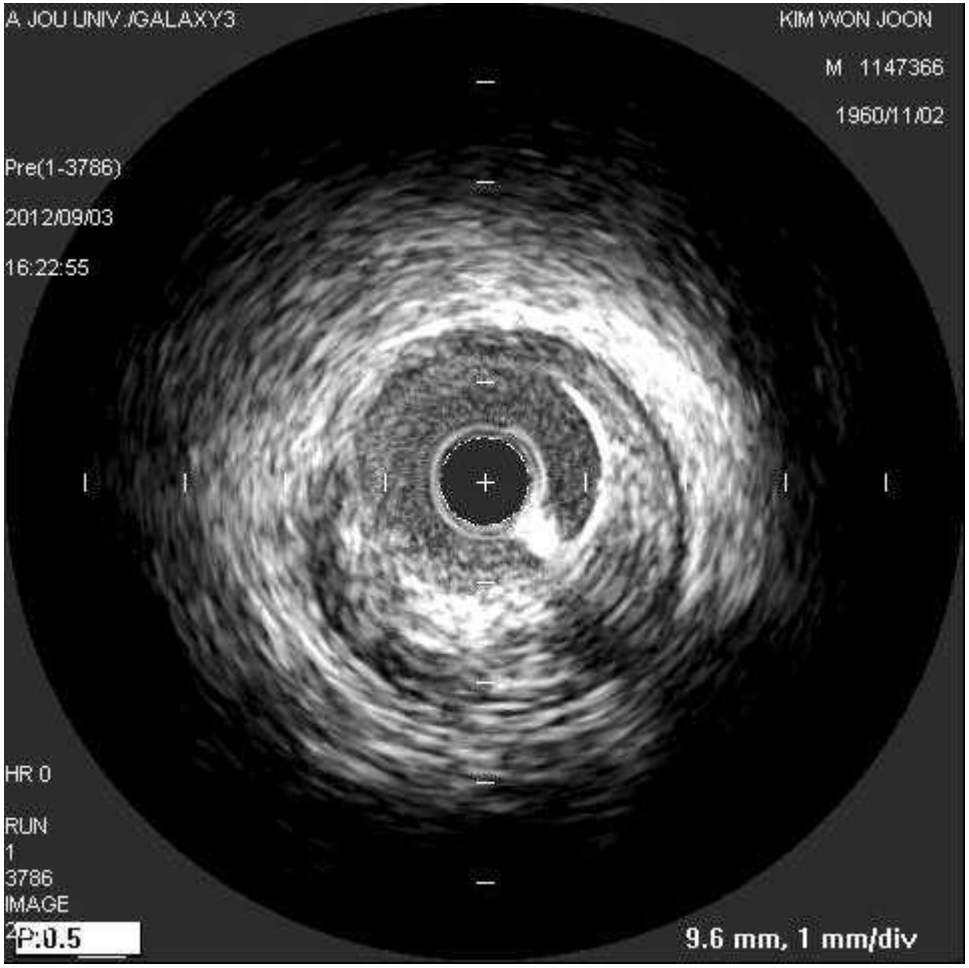


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Pa mean
(91)
Pd mean
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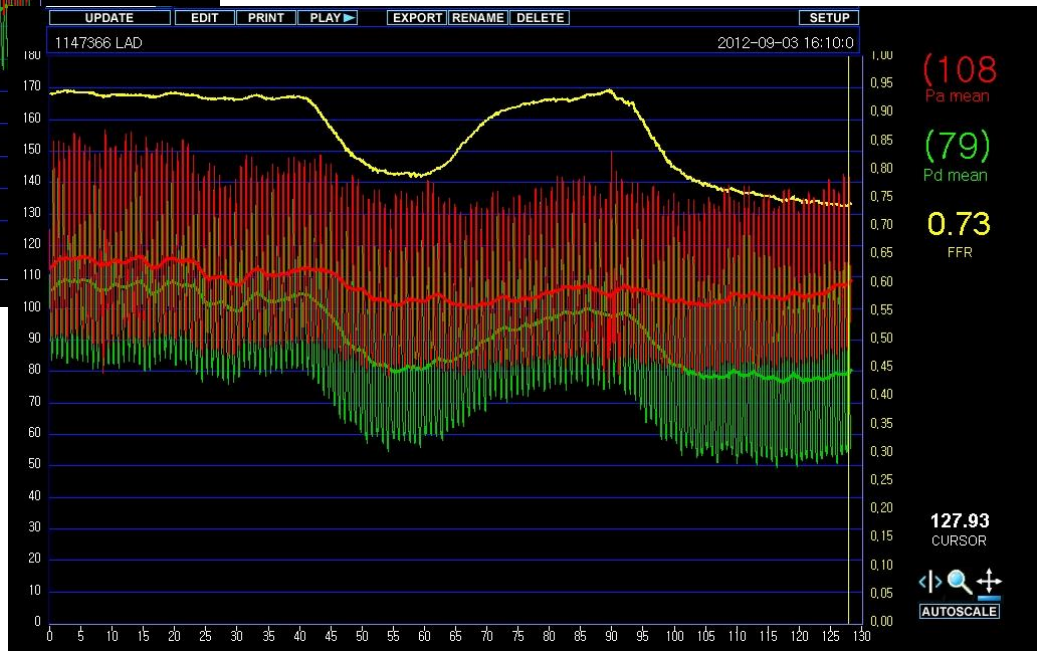
FFR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FFR
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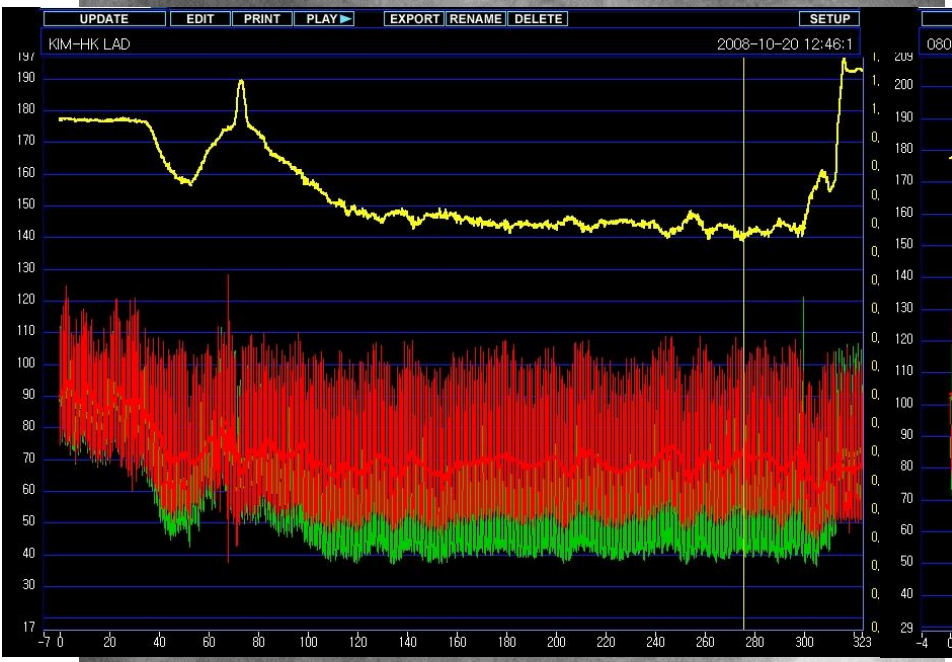
CURSOR
AUTOSCALE

Case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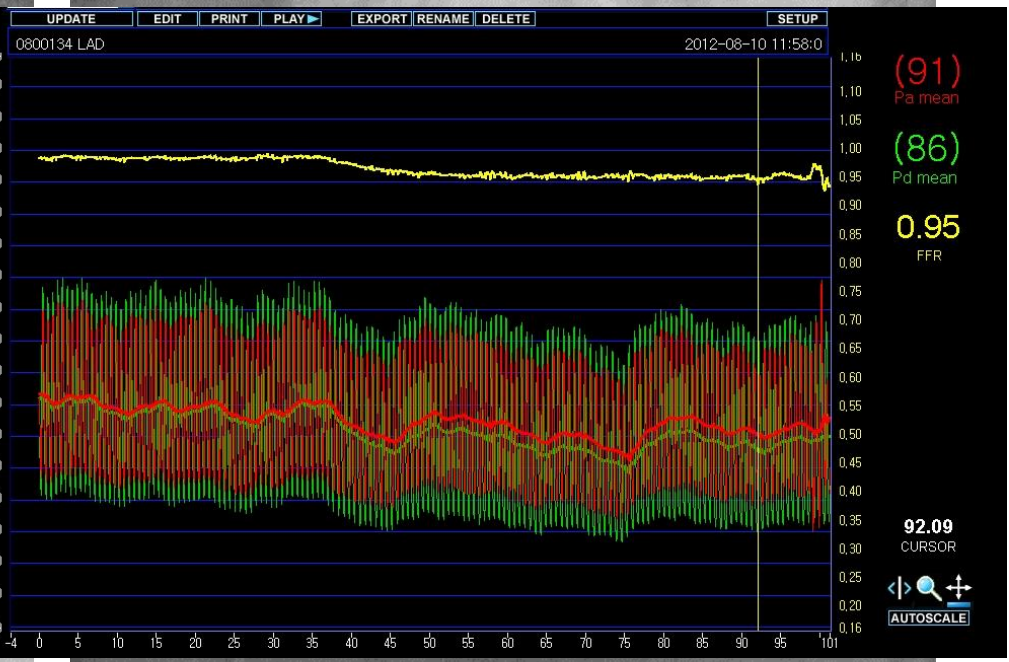
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Pd mean
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FFR
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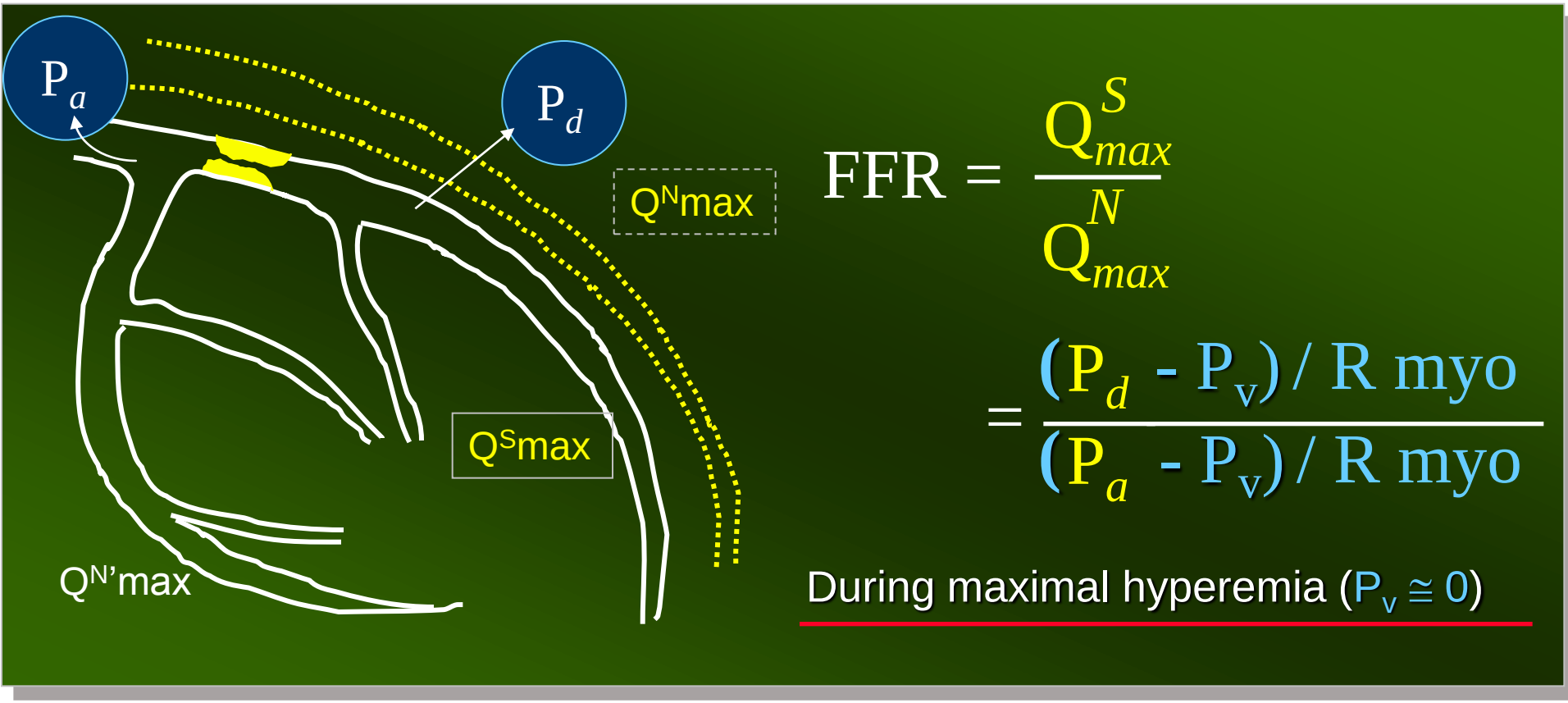
CURSOR
AUTOSCALE



FFR = the ratio of maximal myocardial flow in the stenotic territory to maximal myocardial flow in that same territory if the stenosis were absent

Blood Flow

$$Q = \frac{\pi (Pi - P_0)\, r^4}{8\eta l}$$

Q: flow volume

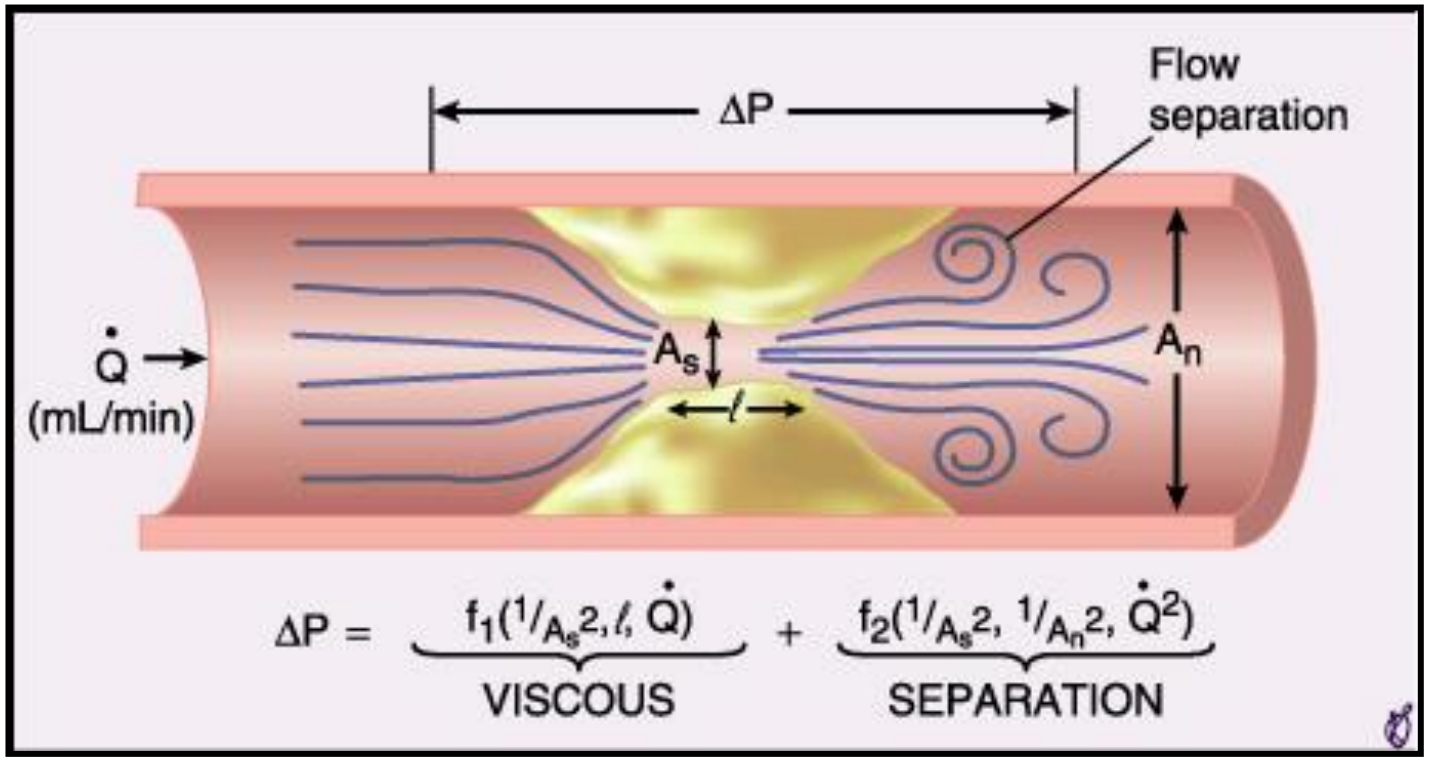
***Pi-P*$_0$(ΔP): inflow pressure –outflow pressure**

***r*: radius of the vessel**

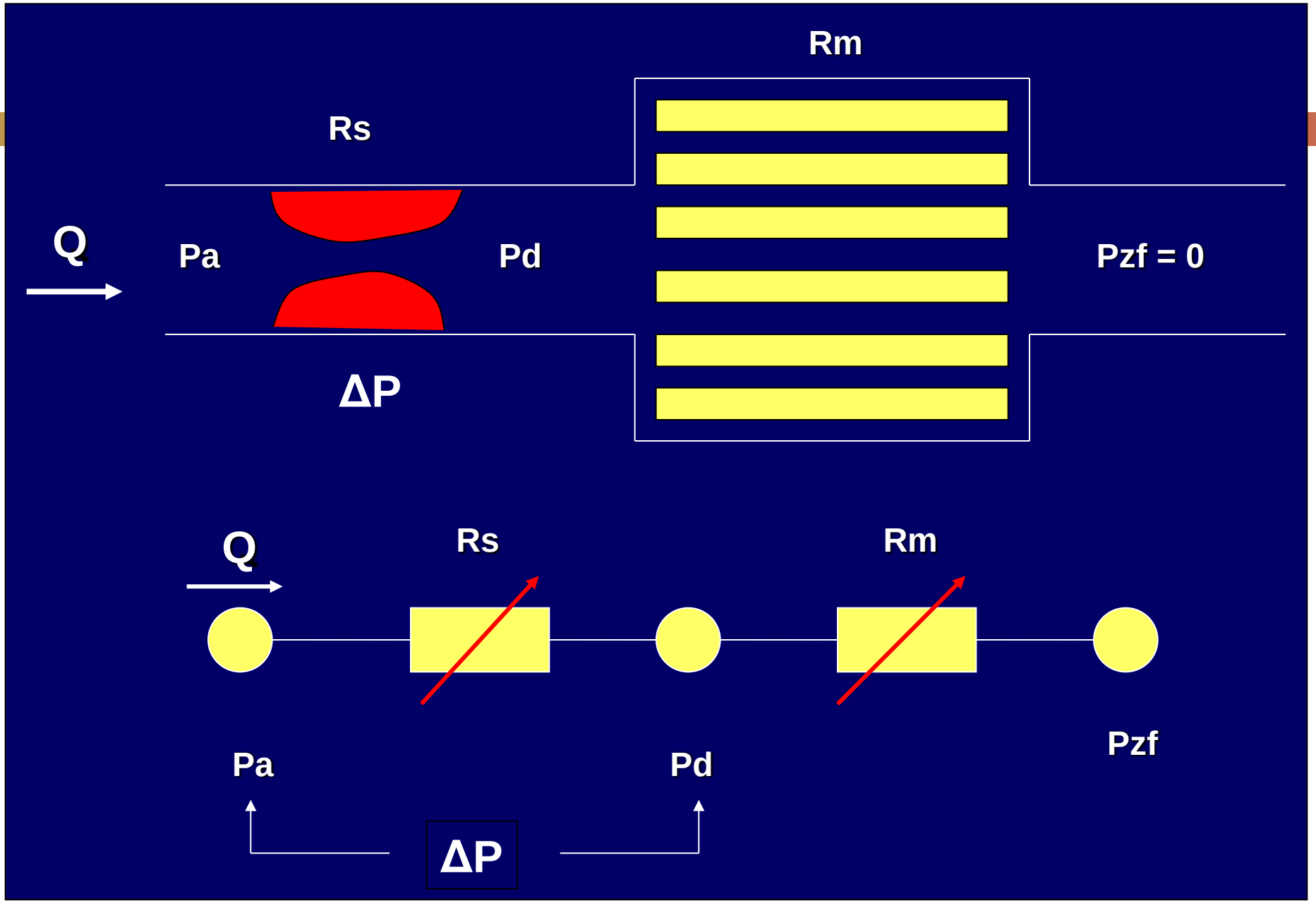
***l*: length of the lesion**

η : viscosity of the blood

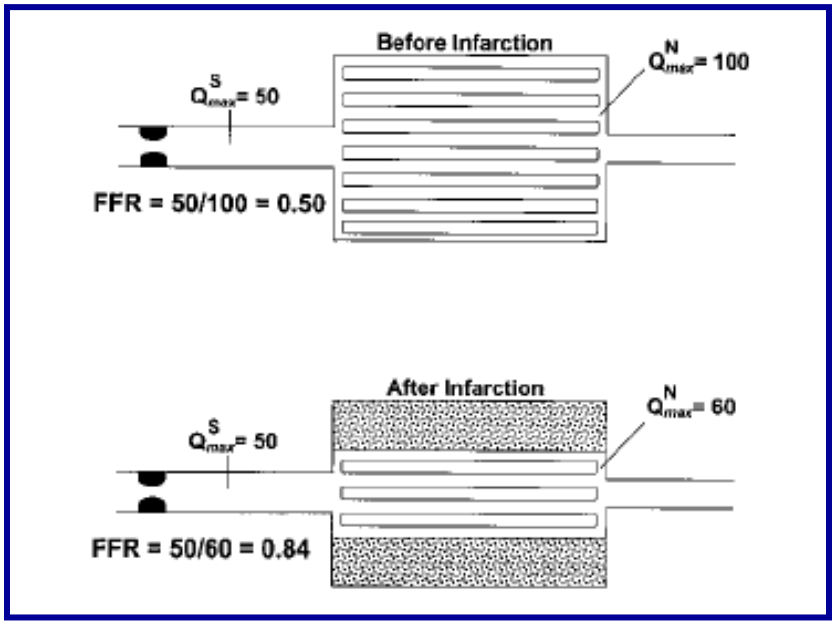
Diagrammatic illustration of the Bernoulli equation

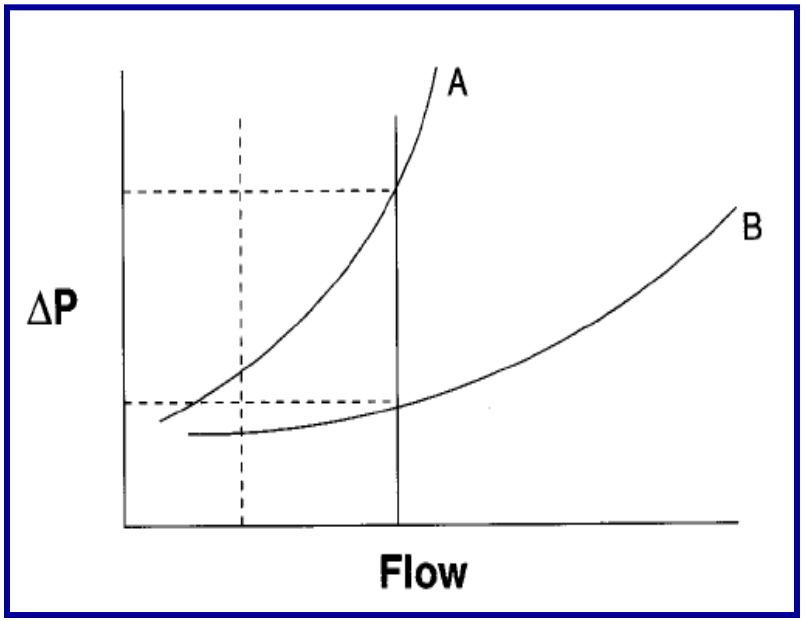


- $\Delta P = f_1 Q + f_2 Q^2$, $R = \Delta P / Q$
- ΔP=pressure gradient; A_s = area stenosis; A_n= area of the normal segment; L=stenosis length; Q = flow; f_1=viscous factor; f_2=separation factor.

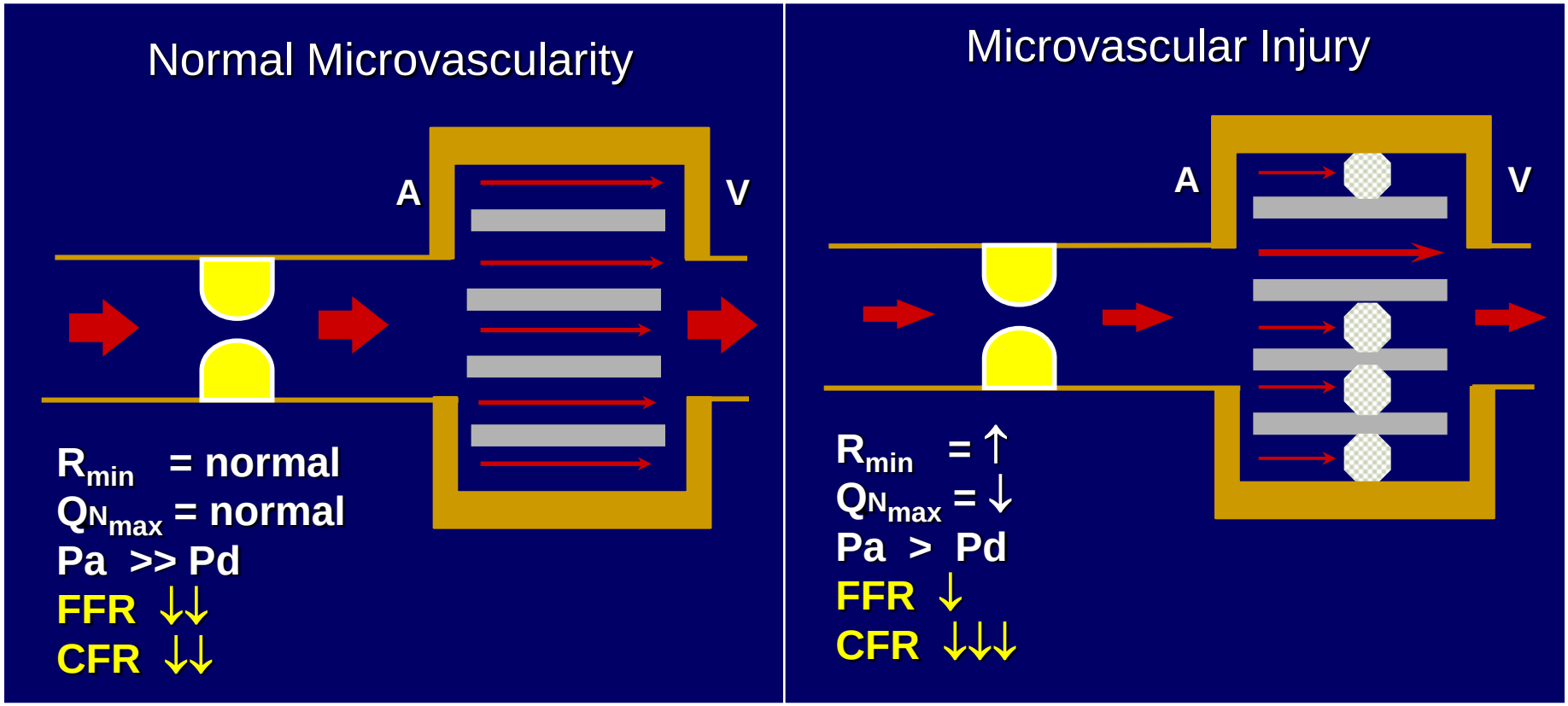

Rm
Rs
Q
Pa
Pd
Pzf = 0
ΔP
Q
Rs
Rm
Pzf
Pa
Pd
ΔP

Schematic of Coronary Stenosis and Its Dependent Myocardium before and after MI



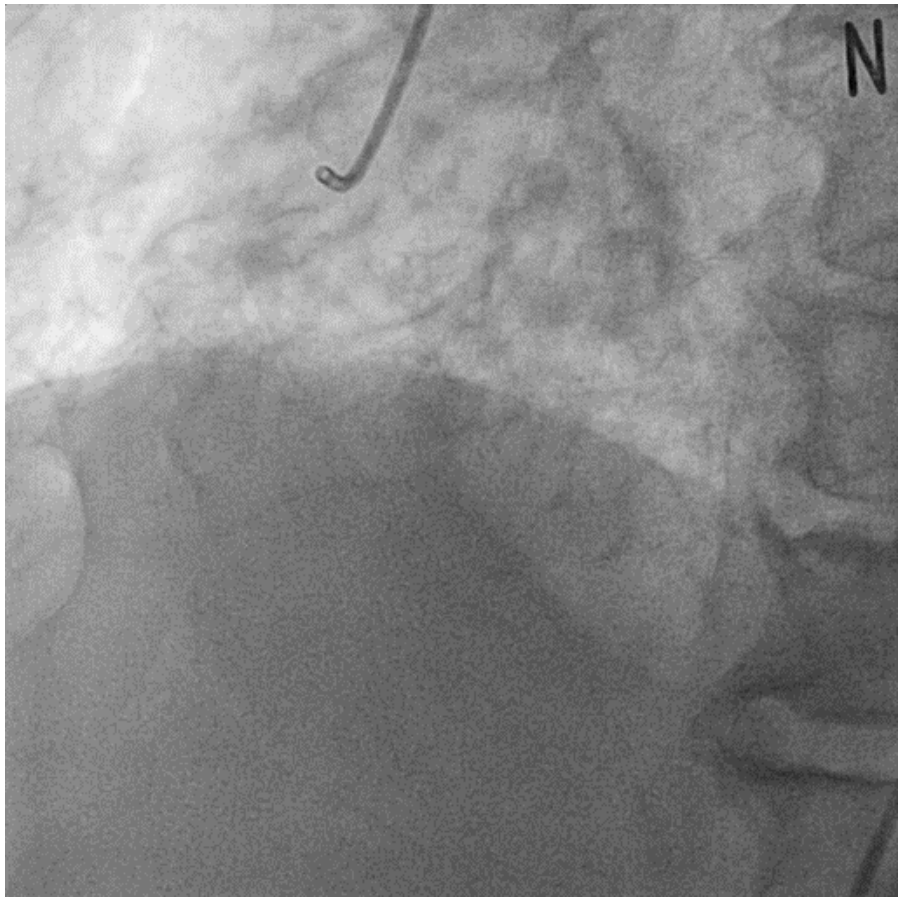


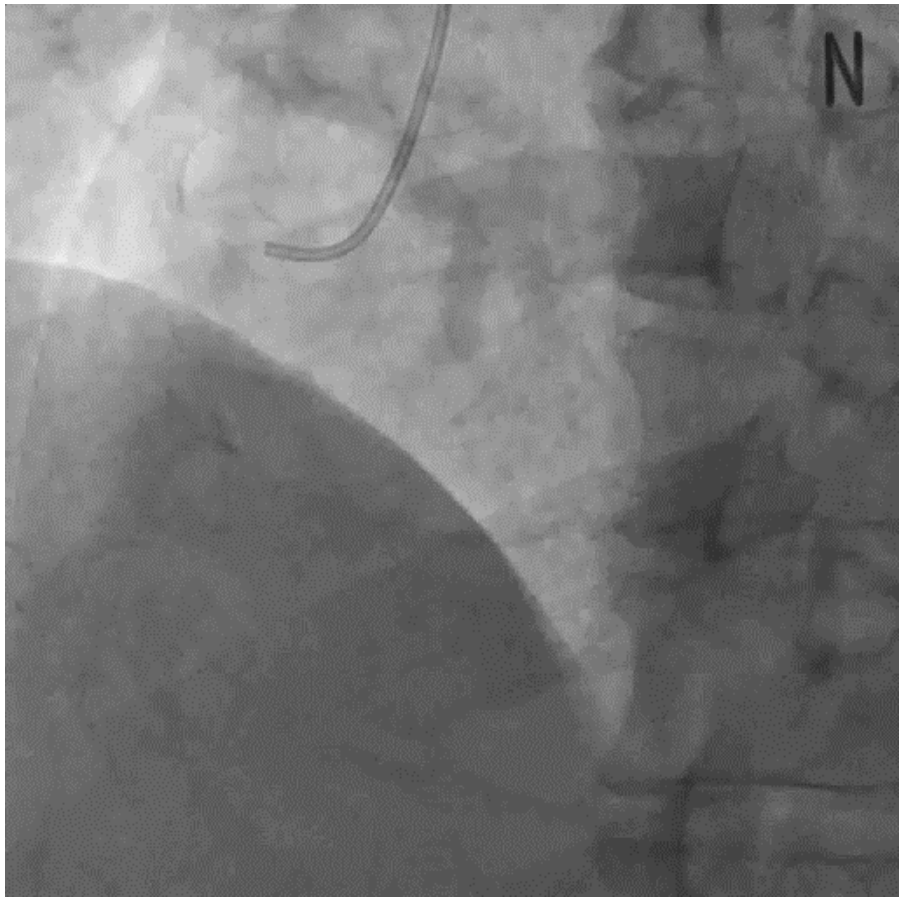
Effect of Microvascular Integrity and Myocardial Mass subtended by a Lesion



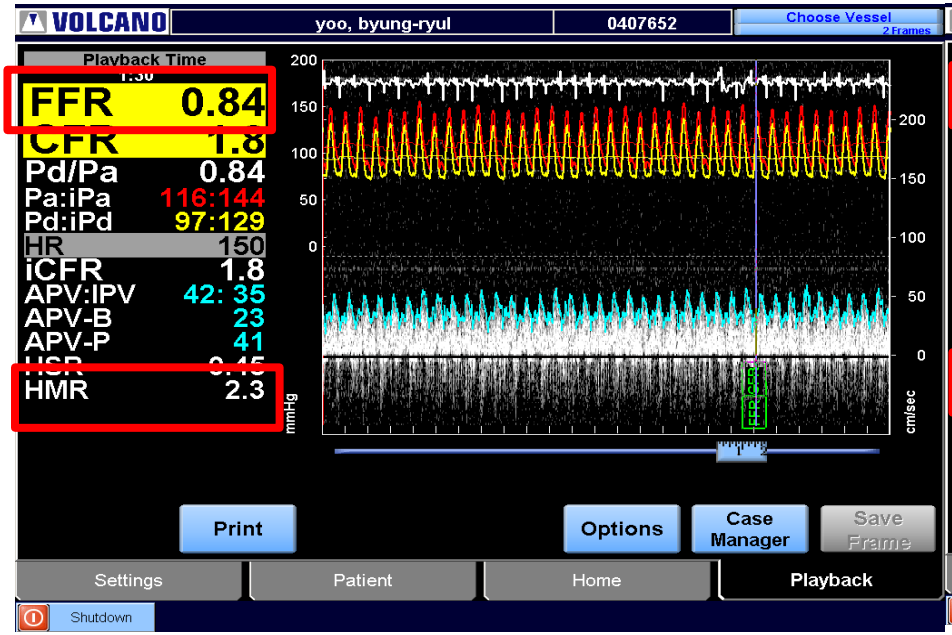
- Therefore, FFR may affected by hMVRI after PCI, which is represents microvascular integrities of the lesion distal segment.

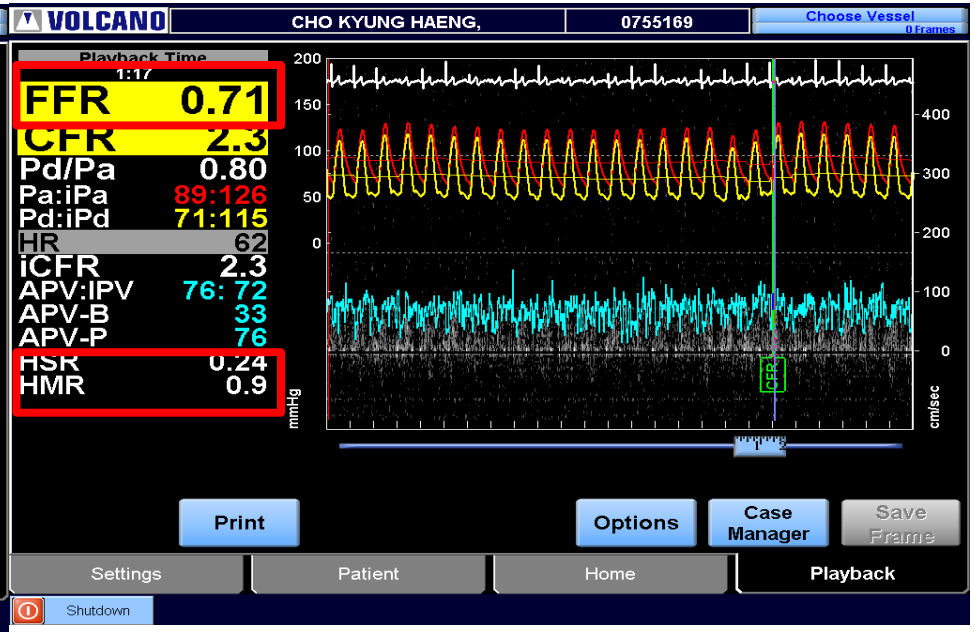
FFR really independent on microvascular function unlike CFR?



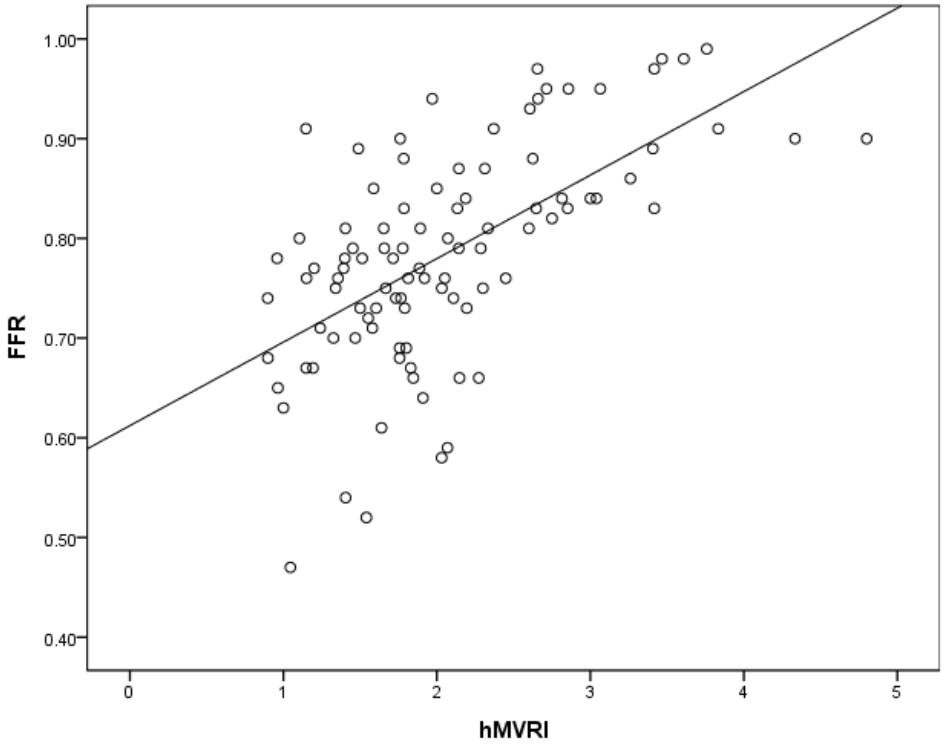


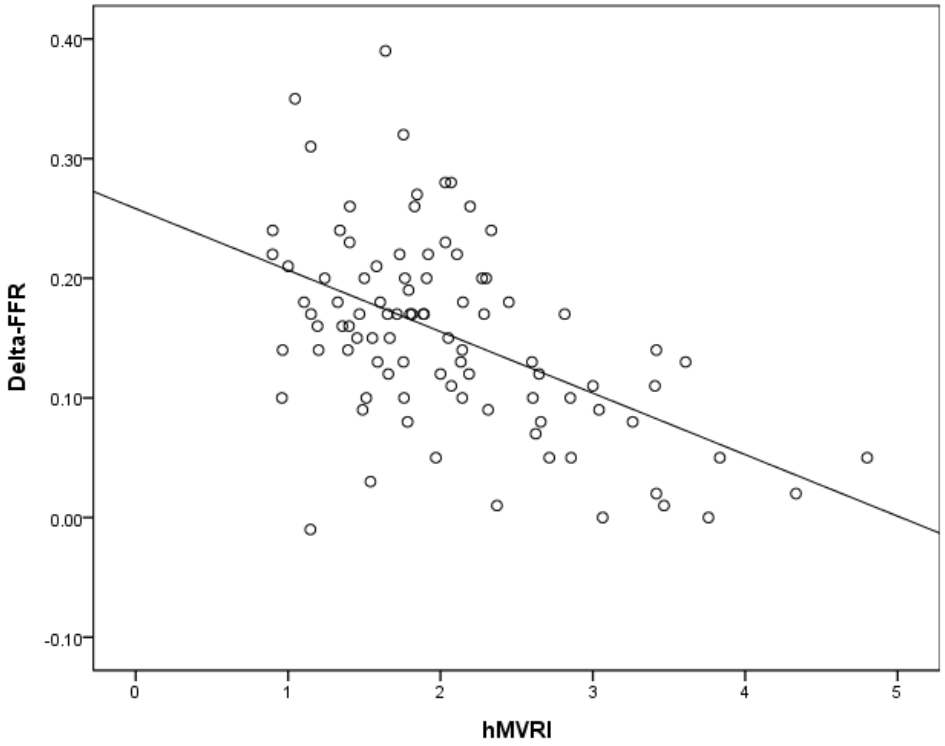
FFR really independent on microvascular function unlike CFR?



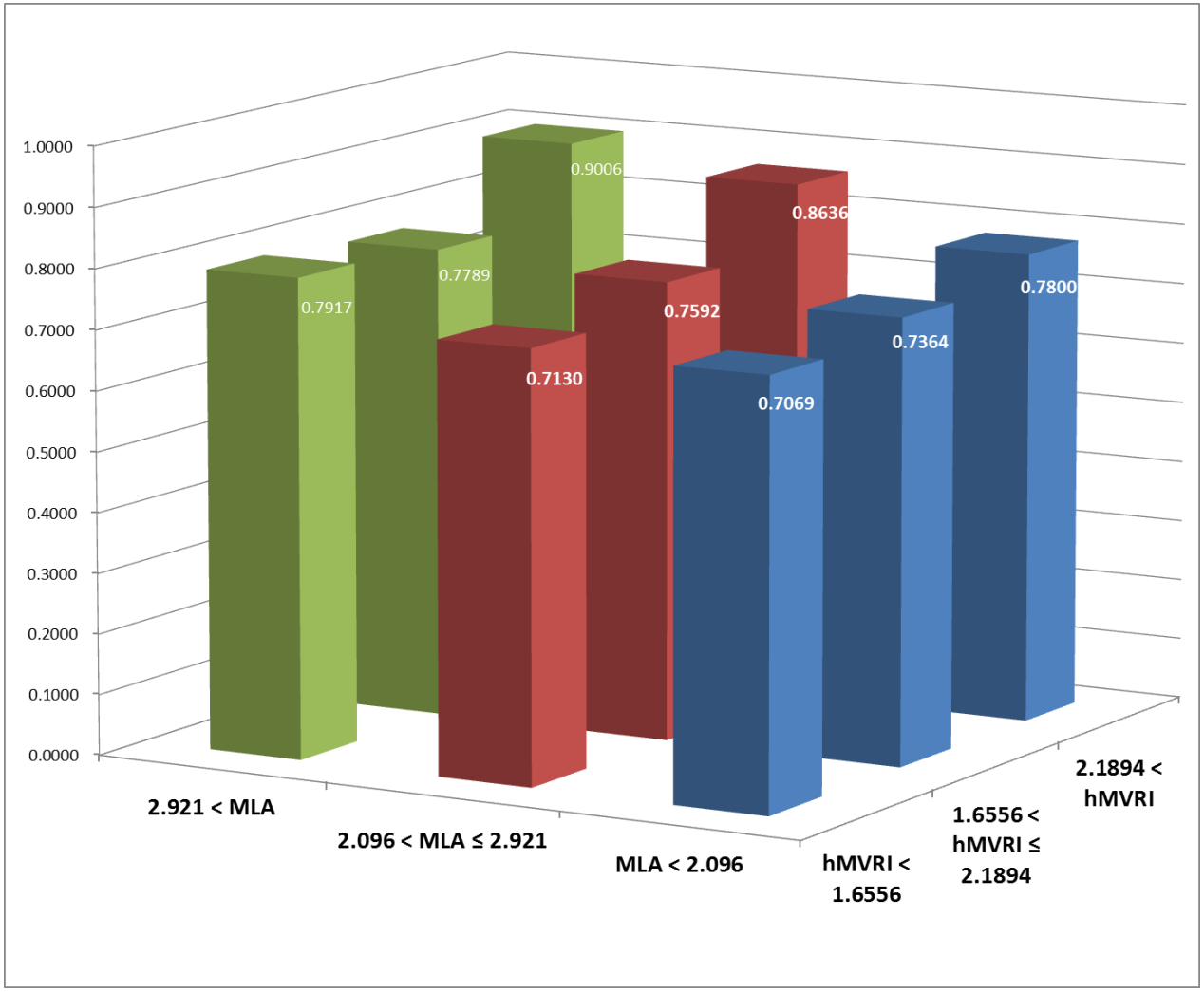


Correlations between FFR and microvascular function

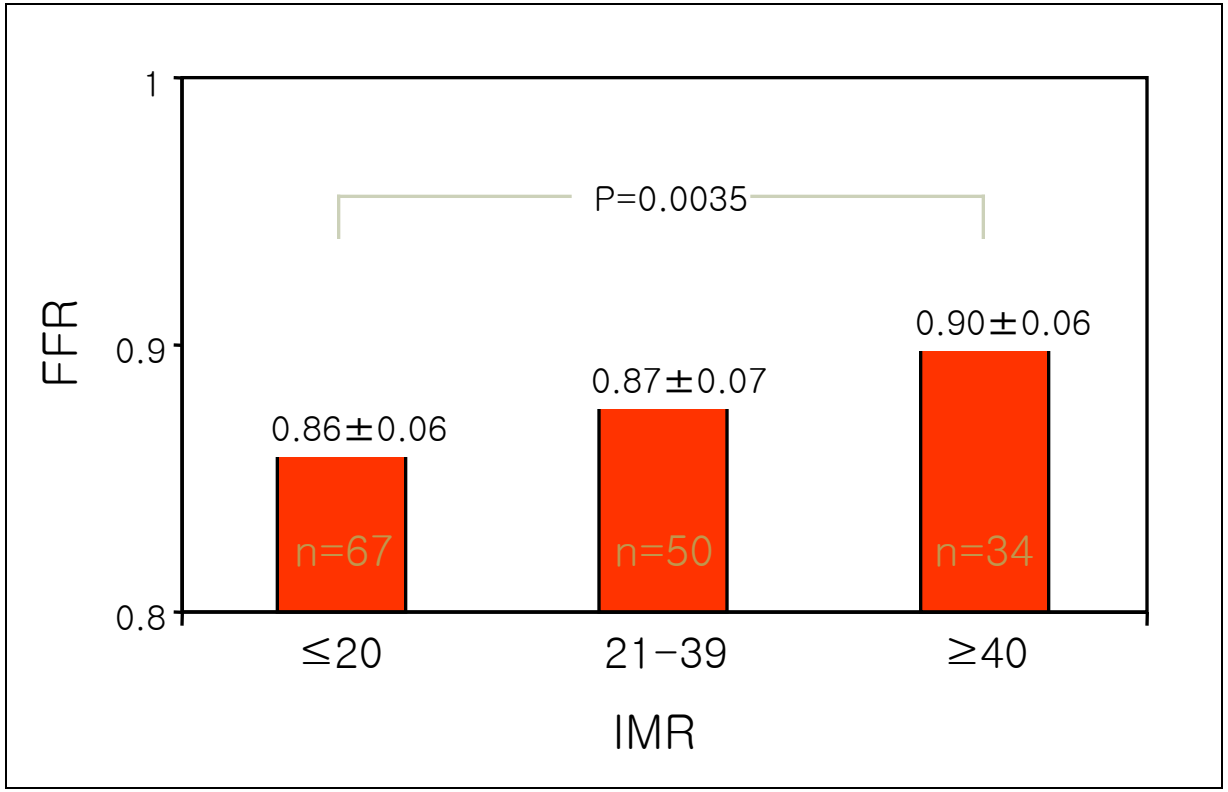




Correlations between FFR and microvascular function

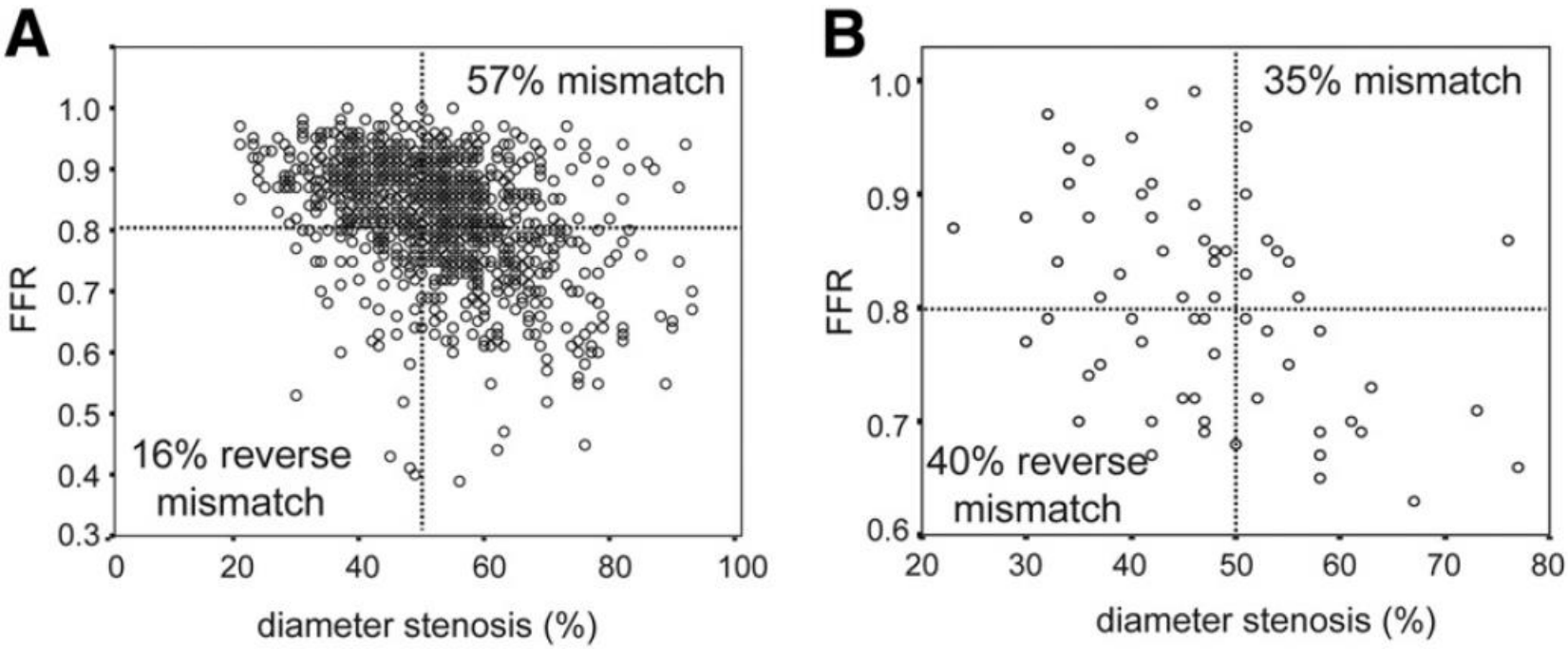


Example of Interplay between FFR and IMR



Hirohata et al. Am J Cardiol 2007; in press

Correlation Between Angiographic DS and FFR



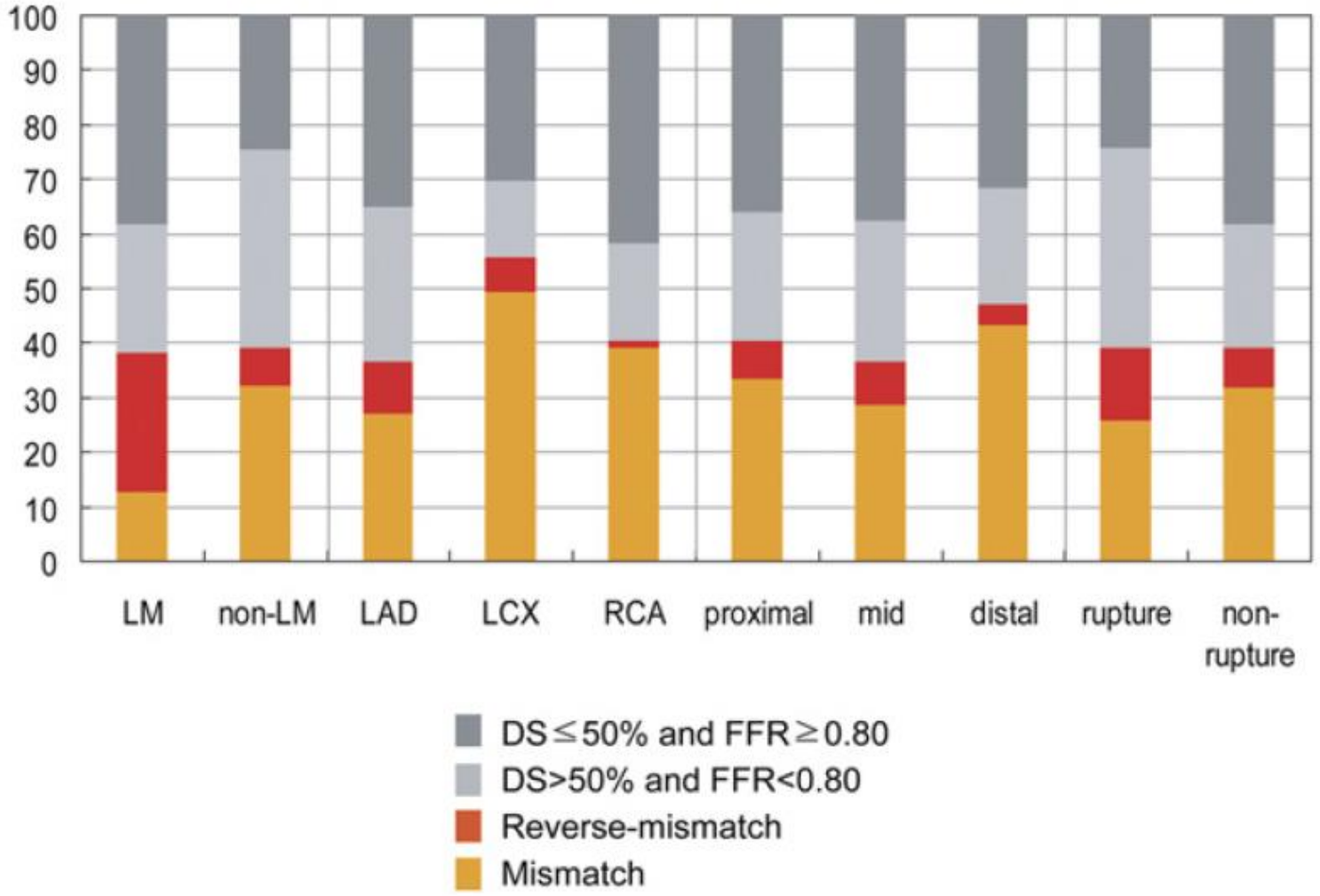
Predictors of Discrepancy

Table 4. Multivariable Analysis of Independent Factors Predicting "Mismatch" and "Reverse Mismatch" Between Angiographic DS and FFR in 1,066 Non-LMCA Lesions

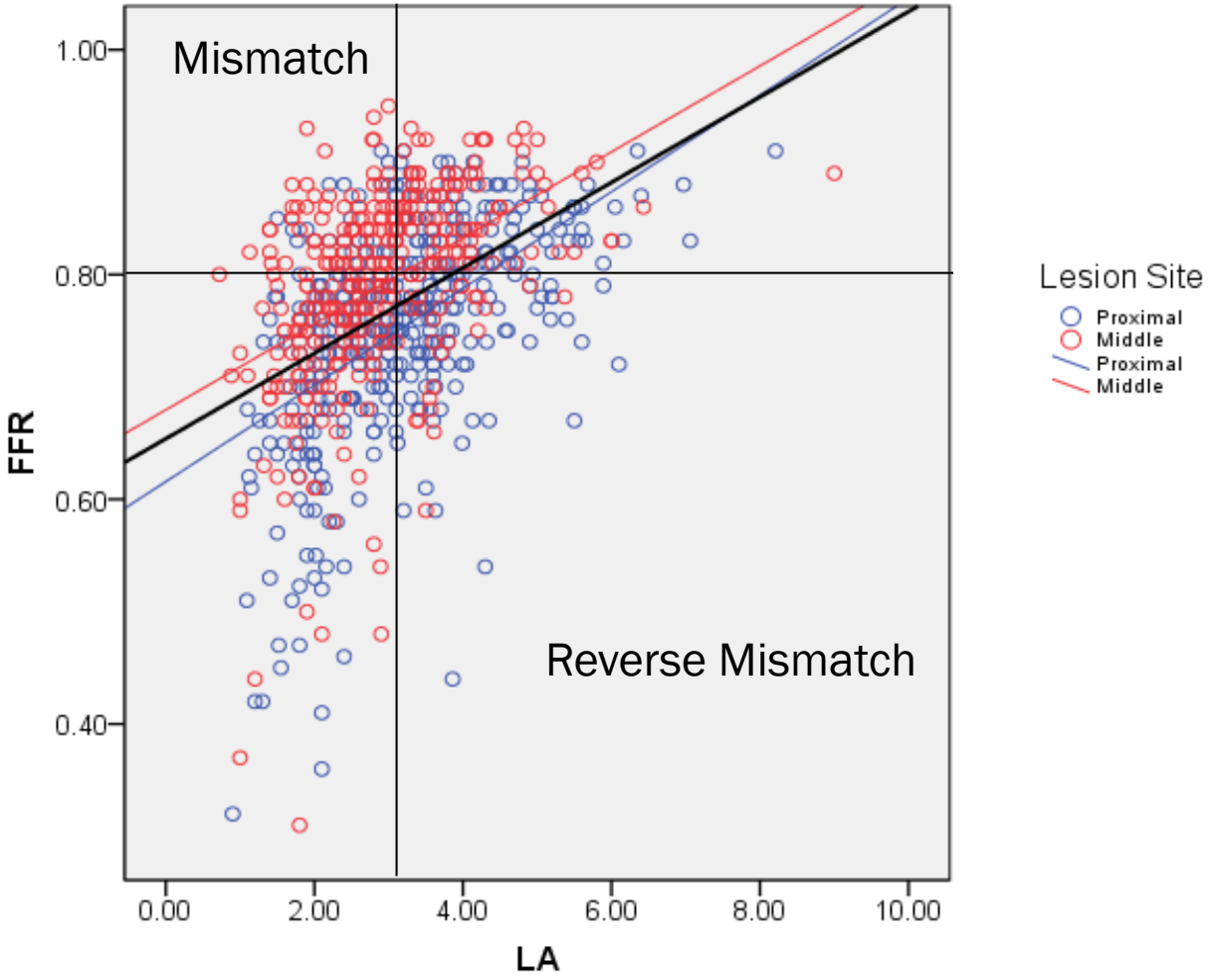
	Beta	SE	p Value	Adjusted Odds Ratio	95% Confidence Intervals
Predictors for "mismatch"*					
Age	0.040	0.012	<0.001	1.040	1.017–1.064
Female	0.430	0.250	0.085	1.537	0.942–2.508
LAD location	−1.094	0.227	<0.001	0.335	0.214–0.522
Plaque rupture	−0.956	0.334	0.004	0.385	0.200–0.740
Lesion length	−0.0335	0.008	<0.001	0.966	0.950–0.982
IVUS-MLA	0.687	0.189	0.001	1.989	1.371–2.886
Plaque burden	−0.050	0.014	<0.001	0.951	0.926–0.977
QCA-MLD	0.086	0.040	0.034	1.089	1.007–1.179
Predictors for "reverse mismatch"*					
Age	−0.044	0.015	0.003	0.957	0.929–0.985
LAD location	1.691	0.457	<0.001	5.427	2.216–13.29
Plaque rupture	1.150	0.452	0.011	3.159	1.301–7.667
IVUS-MLA	−1.064	0.203	<0.001	0.345	0.232–0.514
Plaque burden	0.032	0.014	0.027	1.032	1.003–1.061

Park SJ, et al. J Am Coll Cardiol Intv 2012;5:1029

Functional and angiographic mismatch according to lesion location

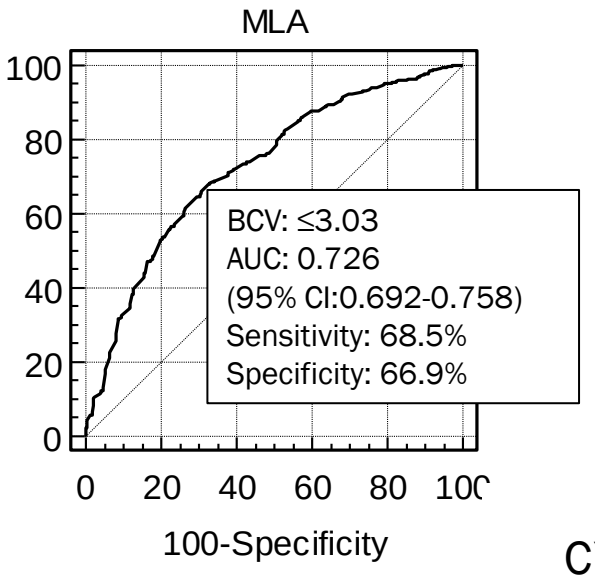


Functional and angiographic mismatch according to lesion location (pLAD vs. mLAD)

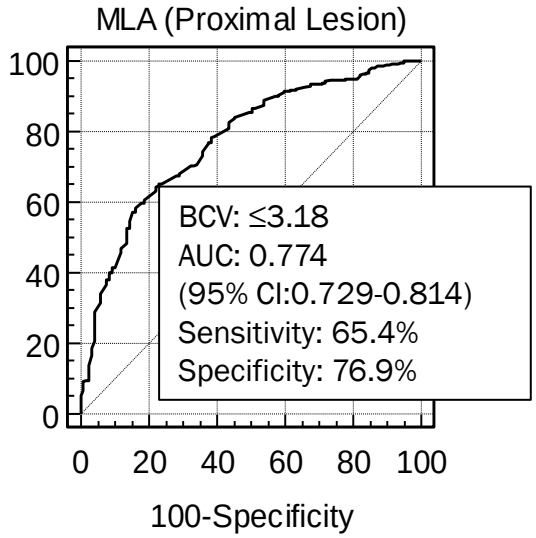


BCVs to predict FFR<0.80 according to lesion location

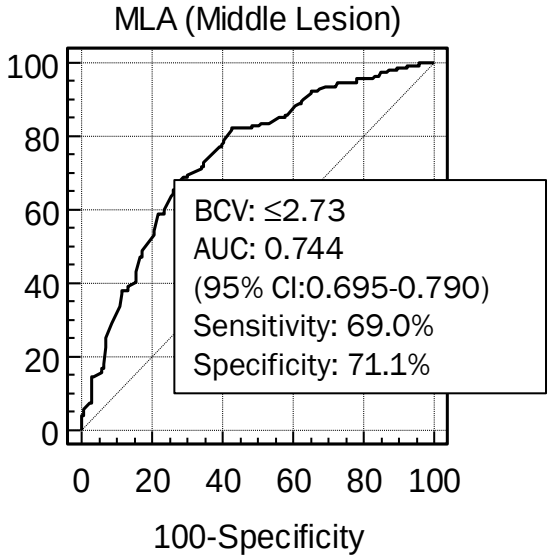
A)



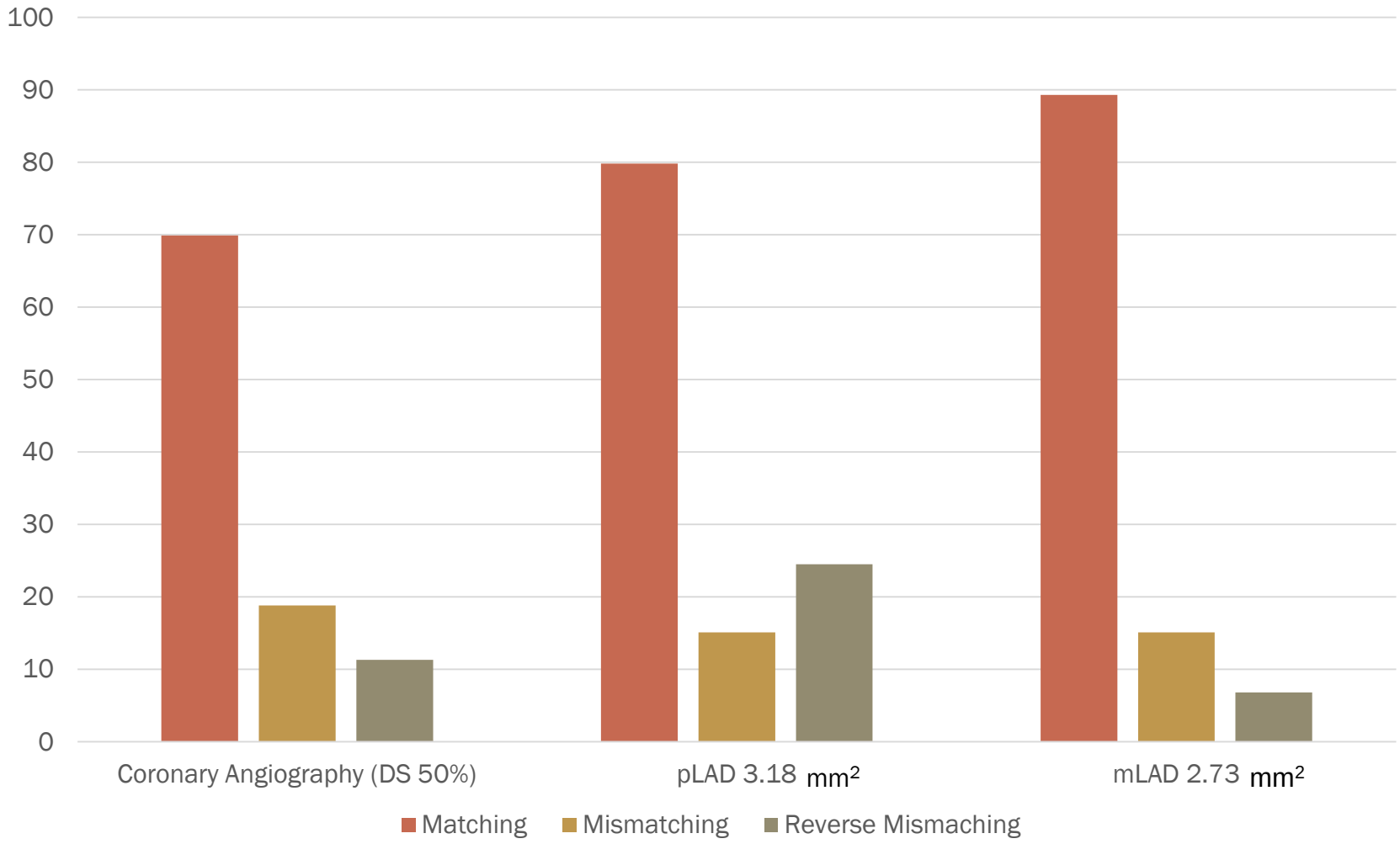
B)



C)



Discrepancies according to pLAD and mLAD



Predictors of Discrepancy

	Univariate P value	Multivariate Analysis			
		Odd Ratio	S.E	95% CI	p value
Reverse Mismatching					
Age	0.009	0.966	0.012	0.943-0.989	0.004
Multivessel	0.001	2.211	0.231	1.420-3.442	<0.001
Proximal Lesion	<0.001	3.489	0.258	2.104-5.784	<0.001
Lesion PB	<0.001	0.933	0.026	0.887-0.982	0.007
Mismatching					
Female	<0.001	3.154	0.287	1.798-5.533	<0.001
Middle Lesion	<0.001	3.221	0.295	1.808-5.739	<0.001
Lesion MLA	<0.001	0.378	0.328	0.199-0.720	0.003

Predictors of Discrepancy

	Odds ratio	95% CI	*p*-value
Predictor for "mismatch"			
Non-LAD lesion	2.444	1.620-3.686	<0.001
Predictors for "reverse mismatch"			
Race (Asian)	0.391	0.219-0.698	0.001
LAD lesion	2.677	1.709-4.191	<0.001
LVEF	0.977	0.957-0.997	0.023

CI: confidence interval; LAD: left anterior descending artery; LVEF: left ventricular ejection fraction

Cho YK, et al. Eurointervention 2015;11:163

Summary

- Anatomic-functional mismatches frequently encountered as high as 30-40%.
- The discrepancy patterns between anatomic stenosis and functional stenosis differed according to the lesion location and evaluation methods(Angiography or IVUS).
- The major determinant of FFR was closely associated with myocardial mass subtended by a stenotic lesion and microvascular dysfunction except epicardial stenosis severity.

Conclusions

- Major determinants to predict functional significance or discrepancy may be related with correlationships between epicardial stenosis and myocardial mass, microvascular dysfunction.
- FFR is a very physiologic parameter representing all conditions related myocardial ischemic status.