Future Clinical Role of IMR or Microcirculation Study

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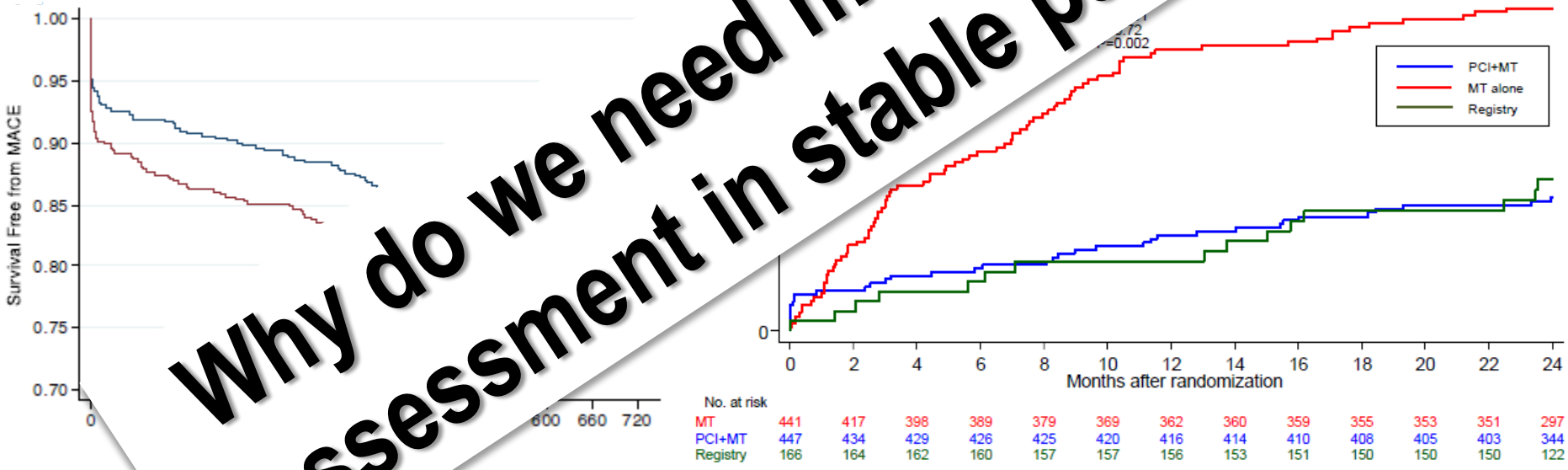
FFR-guided revascularization

- Better than Angio-guided PCI or Me

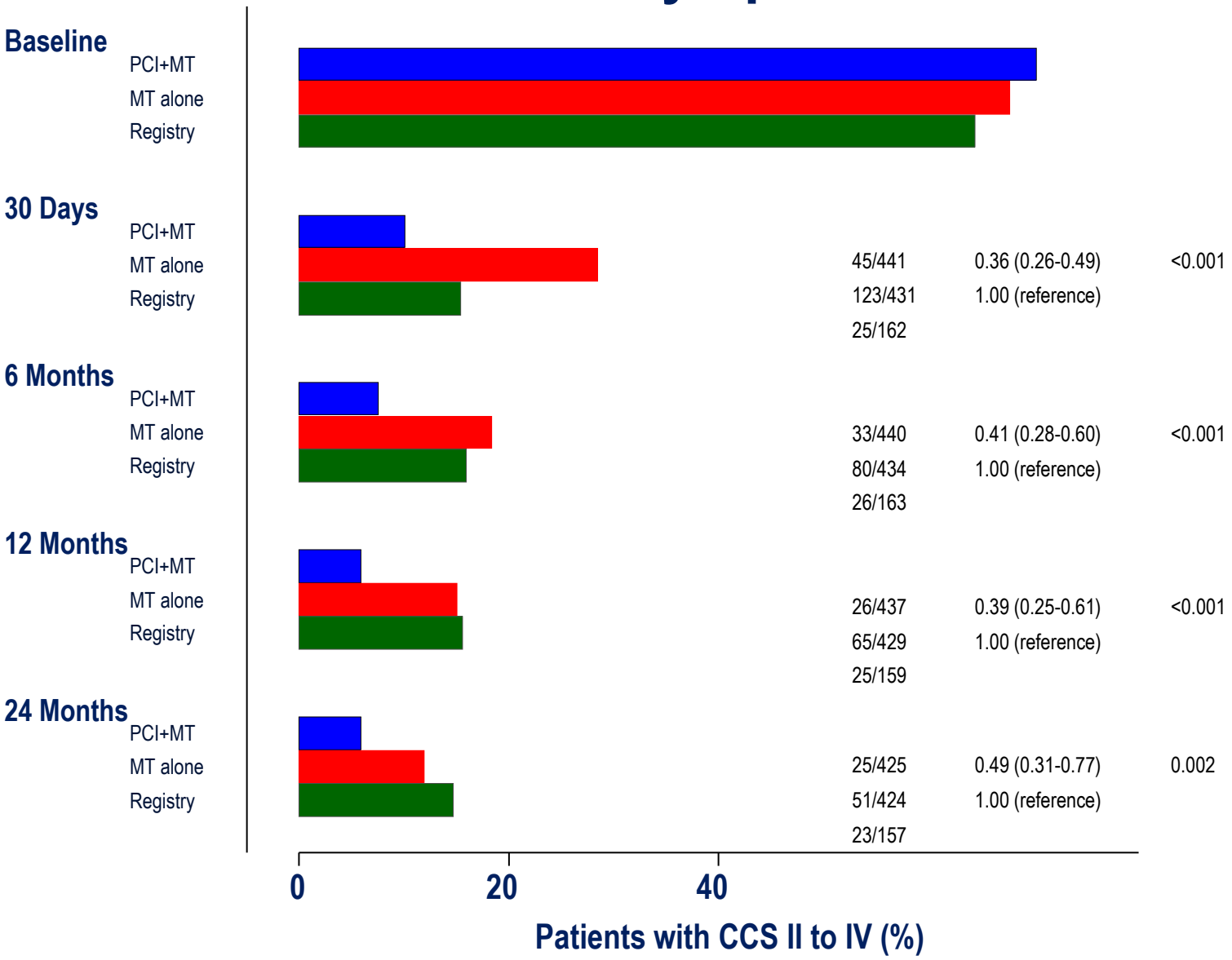
FAME 1

Why do we need microvascular assessment in stable patients?



Pijls, et al. JACC 2010
De Bruyne et al. NEJM 2014

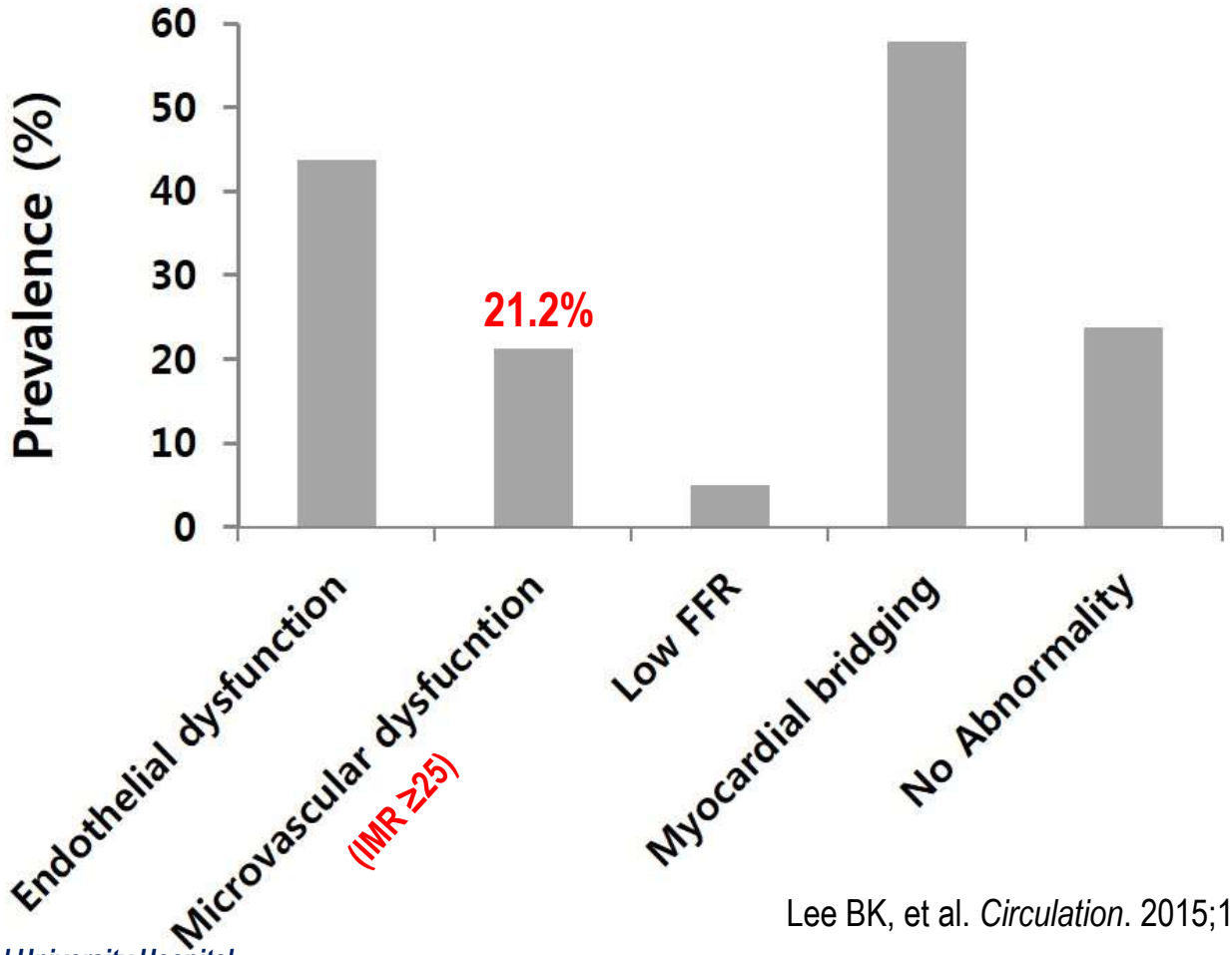
FAME 2 Symptoms



De Bruyne B, et al. N Engl J Med 2014

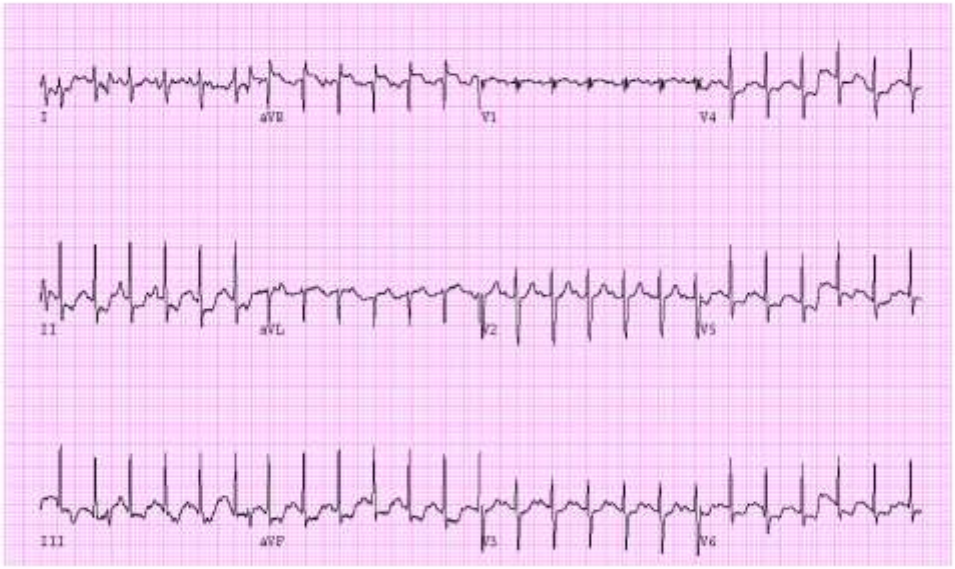
Invasive Evaluation of Patients With Angina in the Absence of Obstructive Coronary Artery Disease

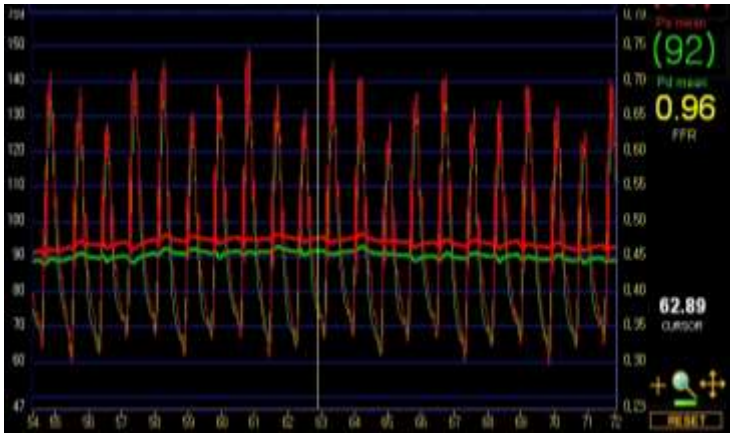
Bong-Ki Lee, MD, PhD; Hong-Seok Lim, MD, PhD; William F. Fearon, MD; Andy S. Yong, MBBS, PhD; Ryotaro Yamada, MD; Shigemitsu Tanaka, MD; David P. Lee, MD; Alan C. Yeung, MD; Jennifer A. Tremmel, MD, MS

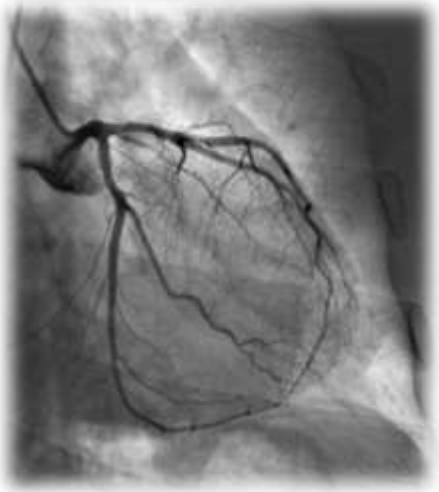


Lee BK, et al. *Circulation*. 2015;131:1054–1060

Stable angina, Exercise test +, but....







Stable angina, Exercise test +

IMR = Pd x Tmn = 93 x 0.42 = 39

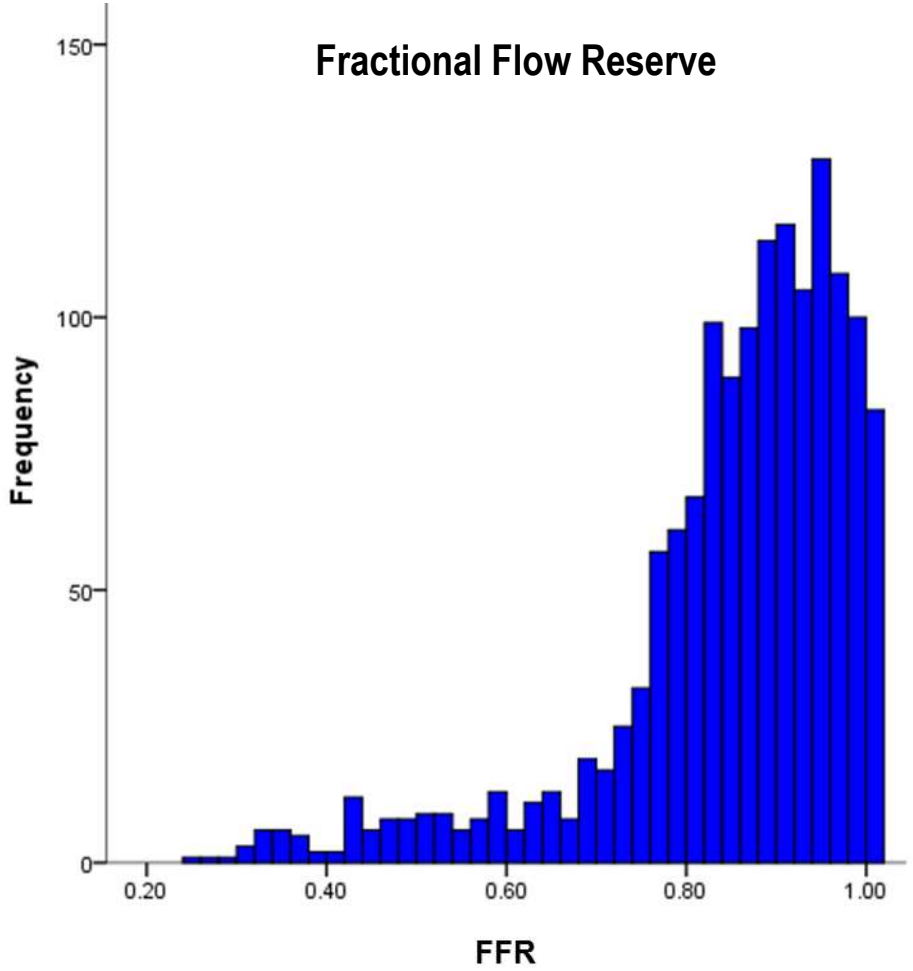
Microvascular disease

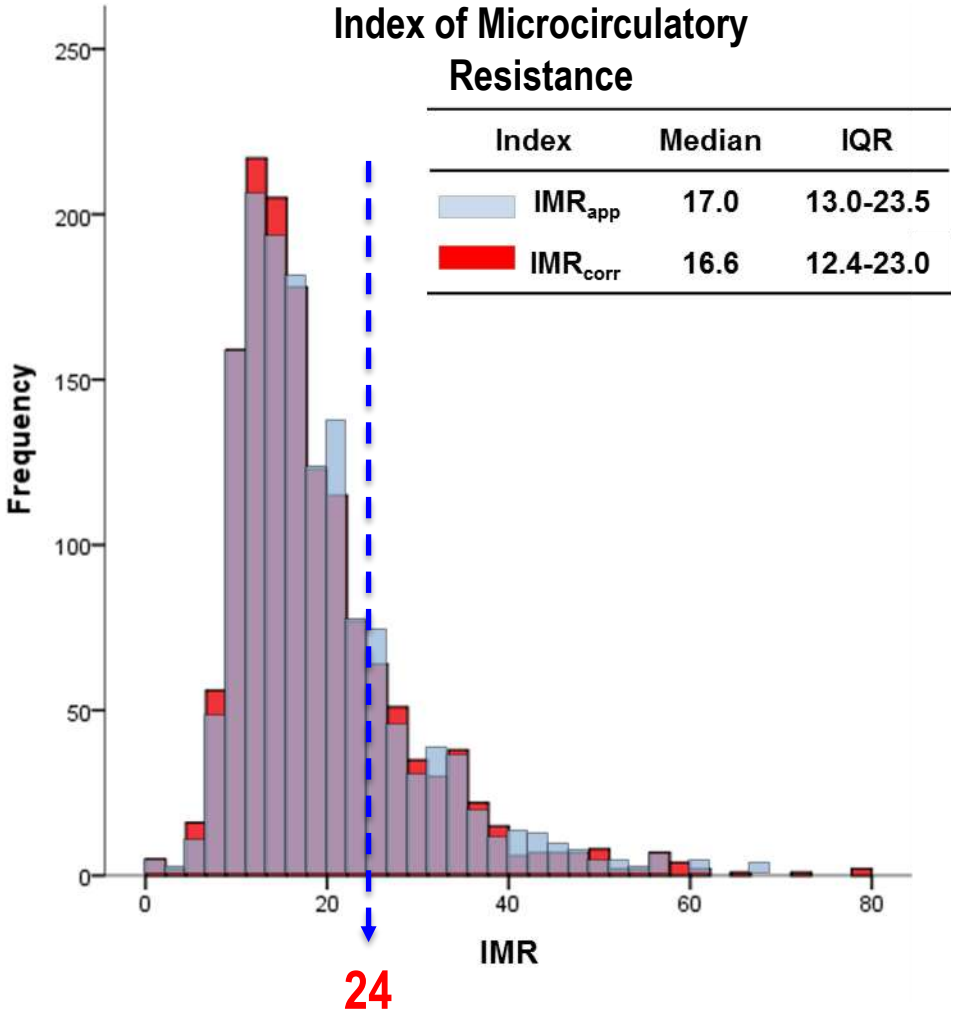
Questions on microvascular system in stable CAD

- Distribution of microvascular disease
- Interaction between macro- and microsystem
- Abnormal value of IMR in non-MI patients
- Relationship between CFR and IMR
- Mechanism of clinical events
- Prognostic implication of IMR/CFR
- ……

Distribution of FFR and IMR

International IMR registry (n=1,452)

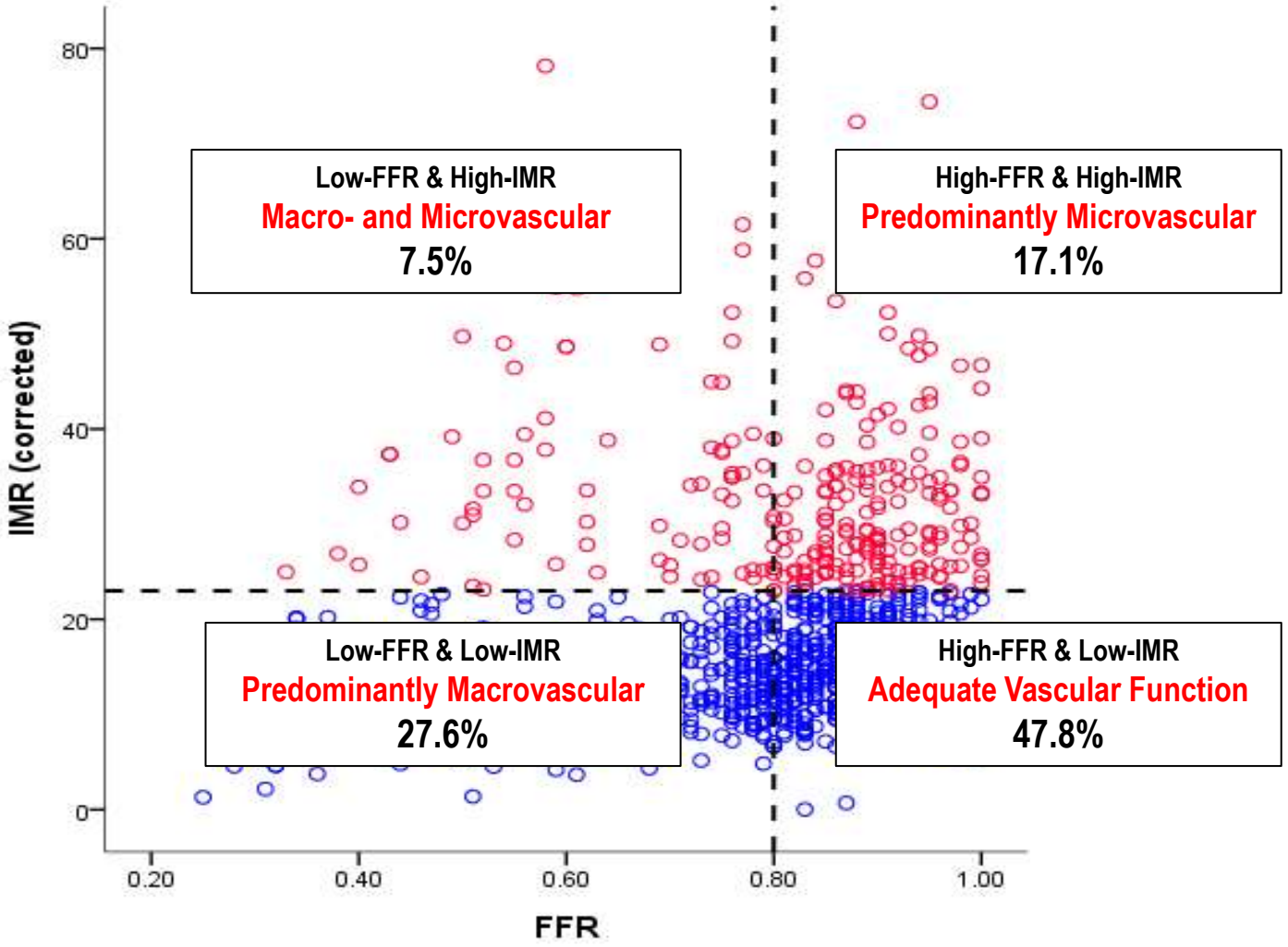




Lee JM, Koo BK, et al. Circ Cardiovasc Interv 2016

Macro vs Micro

International IMR registry (n=1,452)



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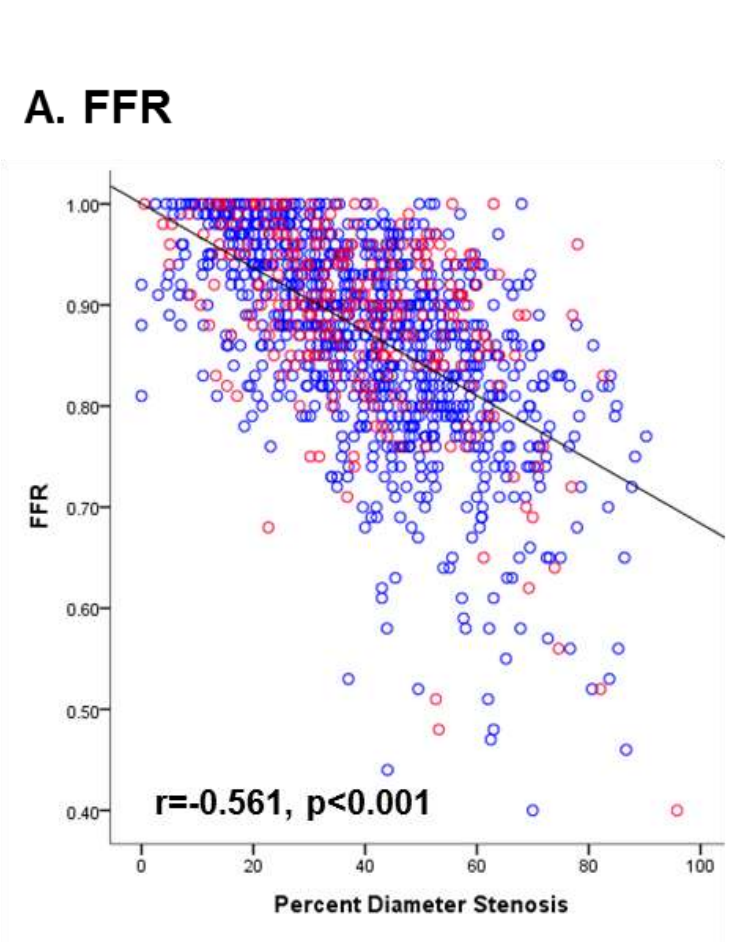
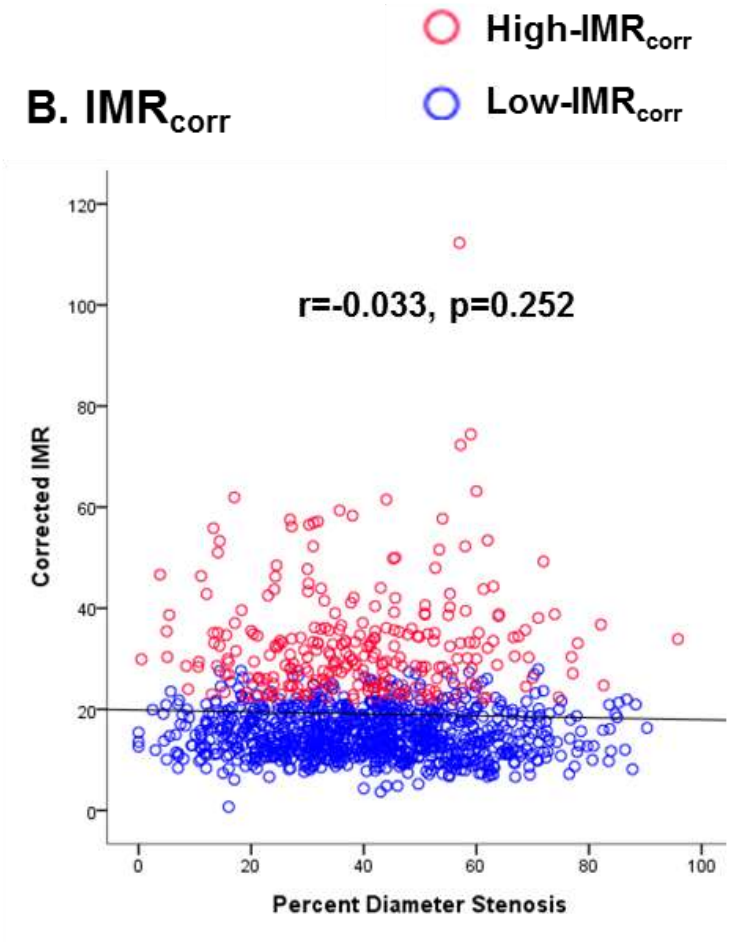
Angiographic severity vs. FFR/IMR





Lee JM, Koo BK, et al. Circ Cardiovasc Interv 2016

Macro vs Micro

International IMR registry (n=1,452)

Predictors for High-IMR and Low-FFR

High-IMR	Low-FFR			
		OR	95% CI	P value
	LAD	5.92	3.73-9.41	<0.001
	%DS ≥50%	5.84	3.98-8.56	<0.001
	Male	2.25	1.38-3.66	0.001
	Age	1.02	1.00-1.04	0.046

Lee JM, Koo BK, et al. Circ Cardiovasc Interv 2016

Questions on microvascular system in stable CAD

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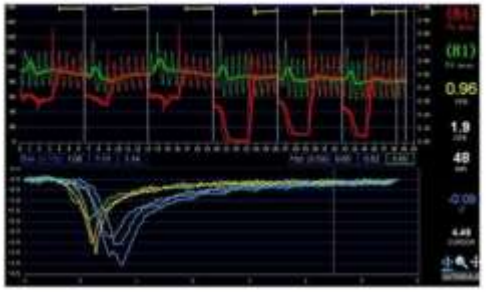
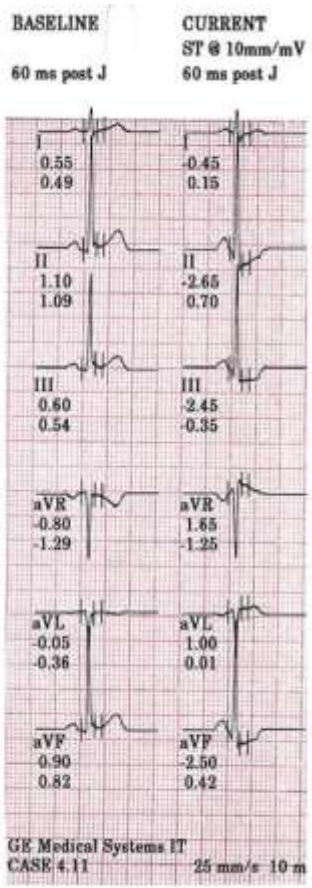
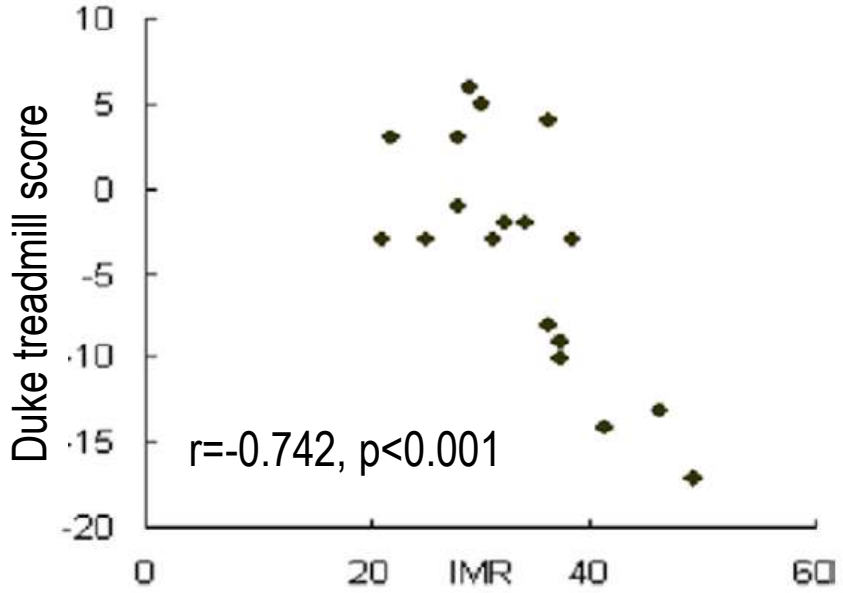
- **Prognostic implication of IMR/CFR**
- ……

IMR and Severity of ischemia

- 18 patients with syndrome X
- Mean CFR: 2.37±0.81
- Mean IMR 33.3±7.6







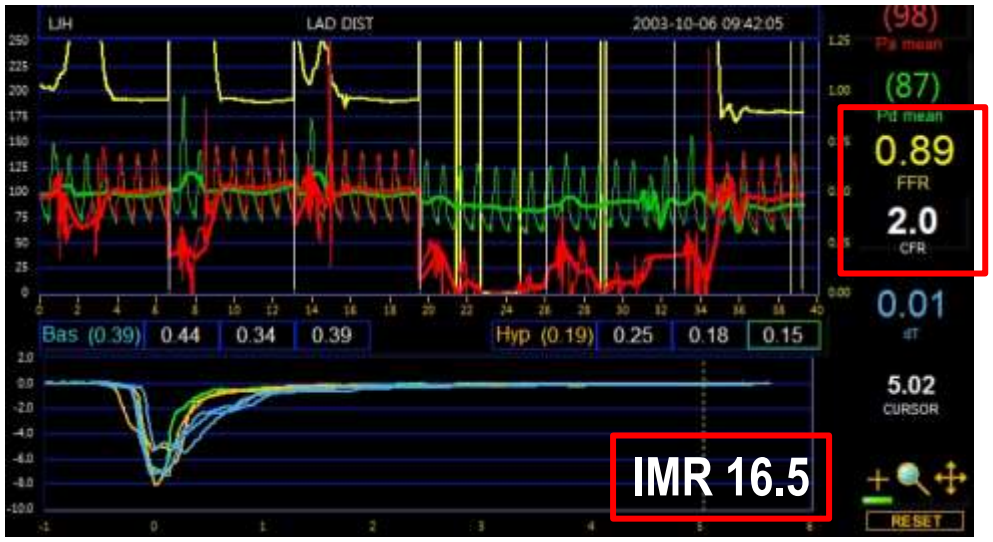
Luo C, et al. Circ Cardiovasc Interv 2014;7:43-48

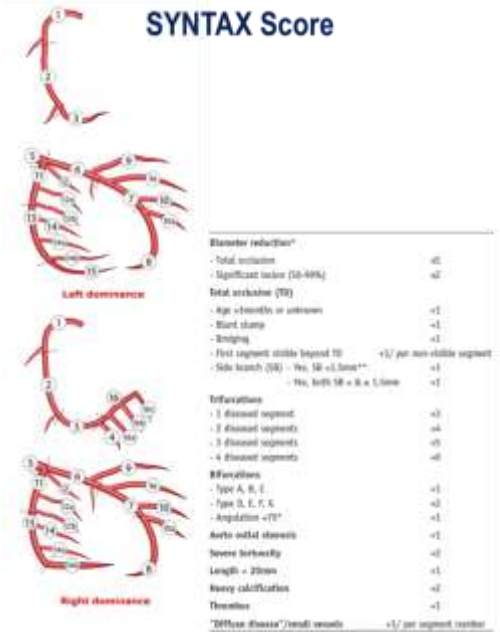
4 center CFR/IMR/FFR registry

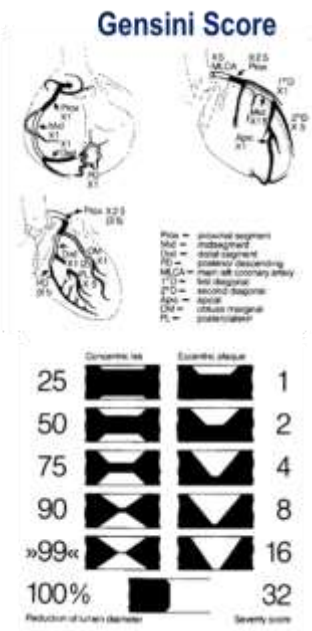
- 334 patients with 663 vessels from 4 centers in Korea (2009-2013)

  : Ulsan university hospital, Keimyung university Dongsan hospital, Inje university Ilsan Paik hospital, Seoul national university hospital

- Median follow-up duration: 658.0 (503.8-1139.3) days







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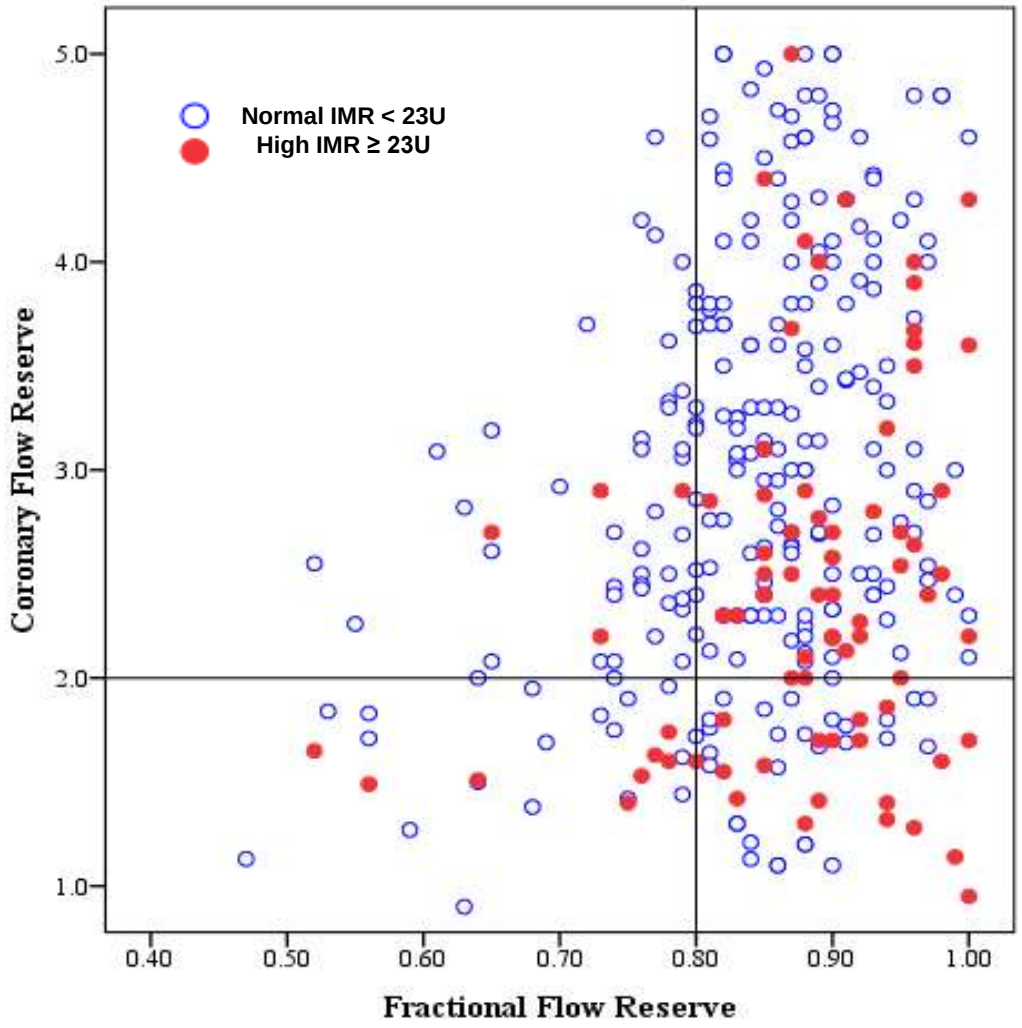
Distribution of patients according to FFR and CFR



- Angiographic % DS: 41.0±17.2%
- FFR 0.85±0.09
- CFR 2.81±1.02
- Median IMR 16.0U

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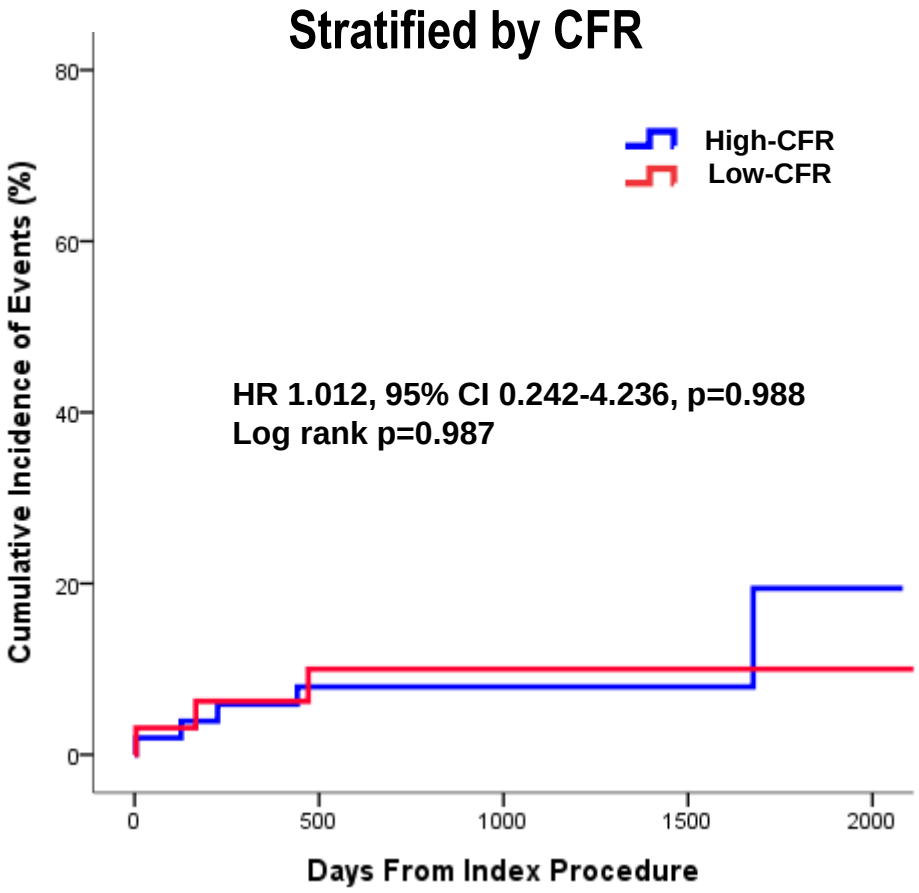
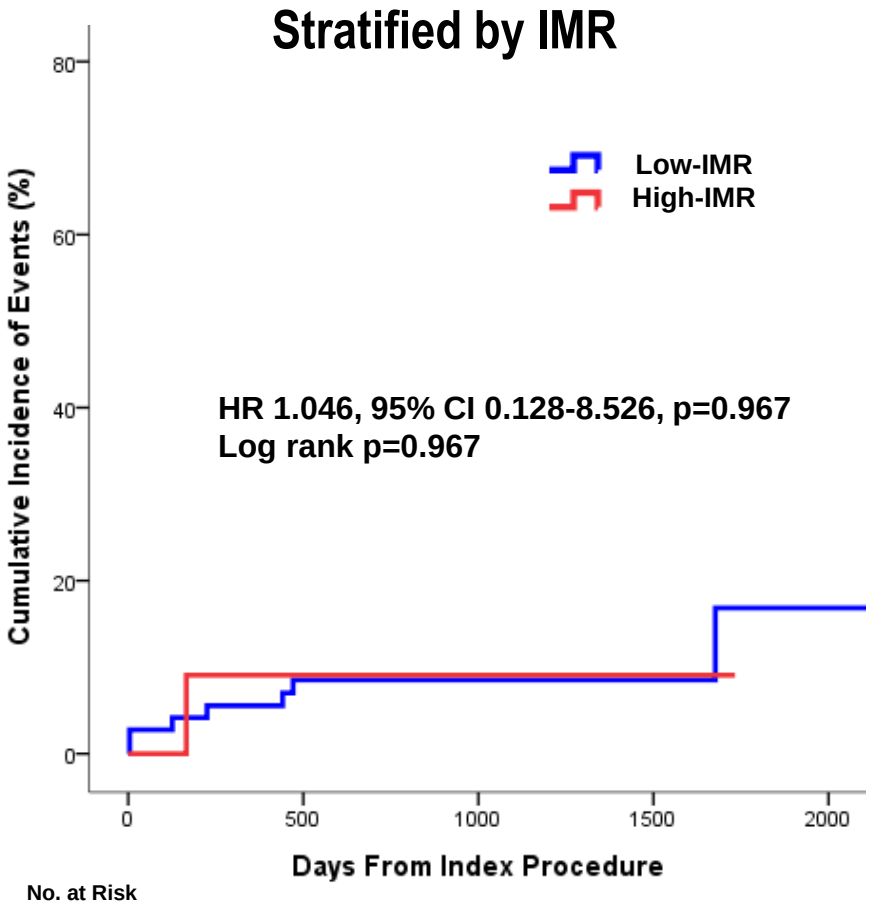
Clinical outcomes in patients with low FFR according to CFR/IMR





In patients with low FFR, clinical outcome is not influenced by CFR/IMR.

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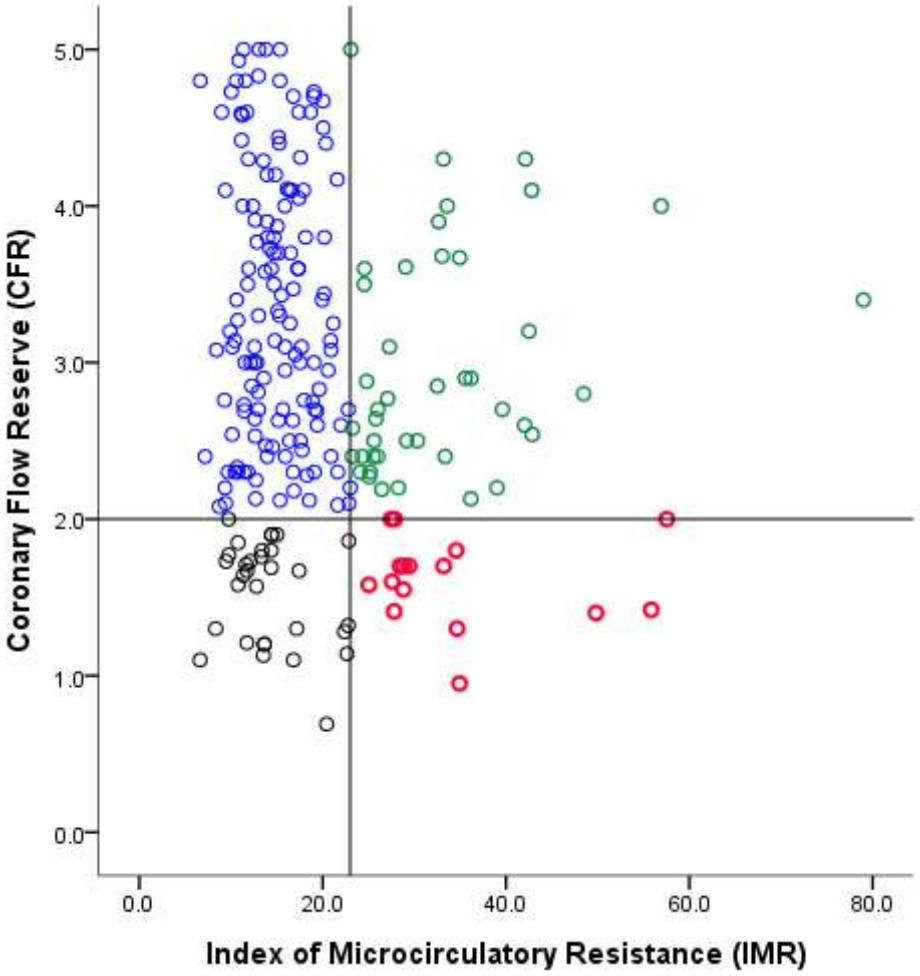
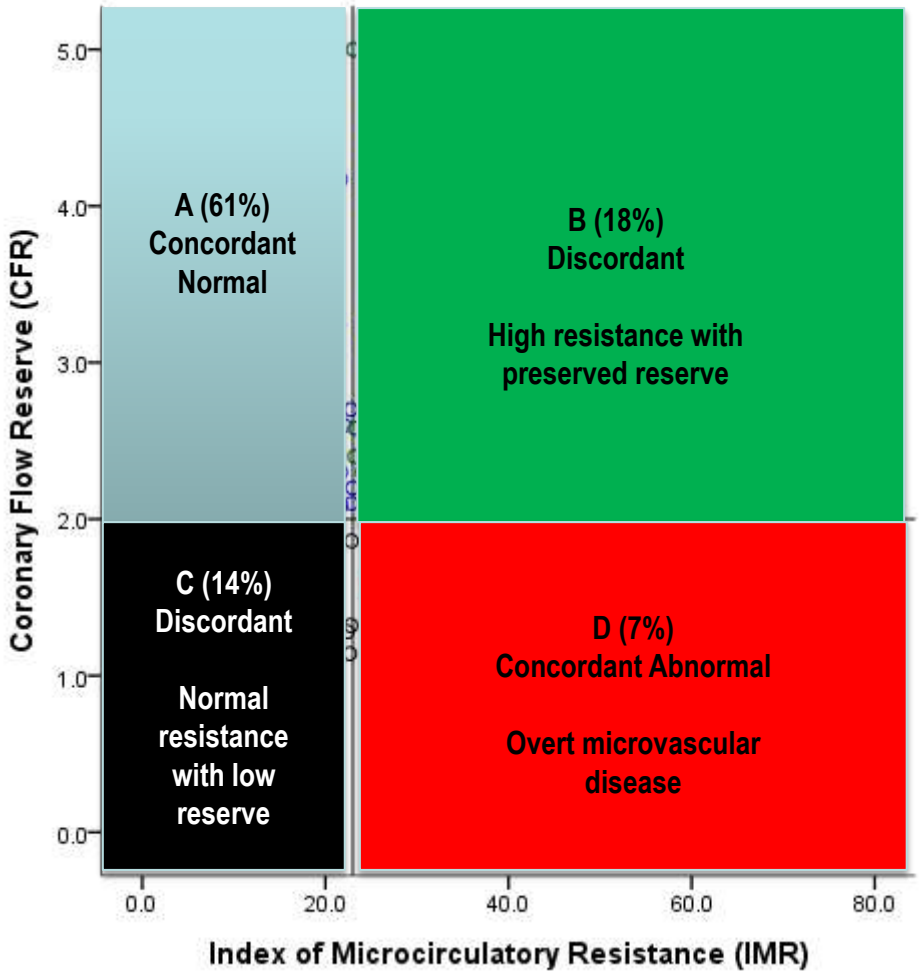
Distribution of High-FFR patients according to CFR and IMR





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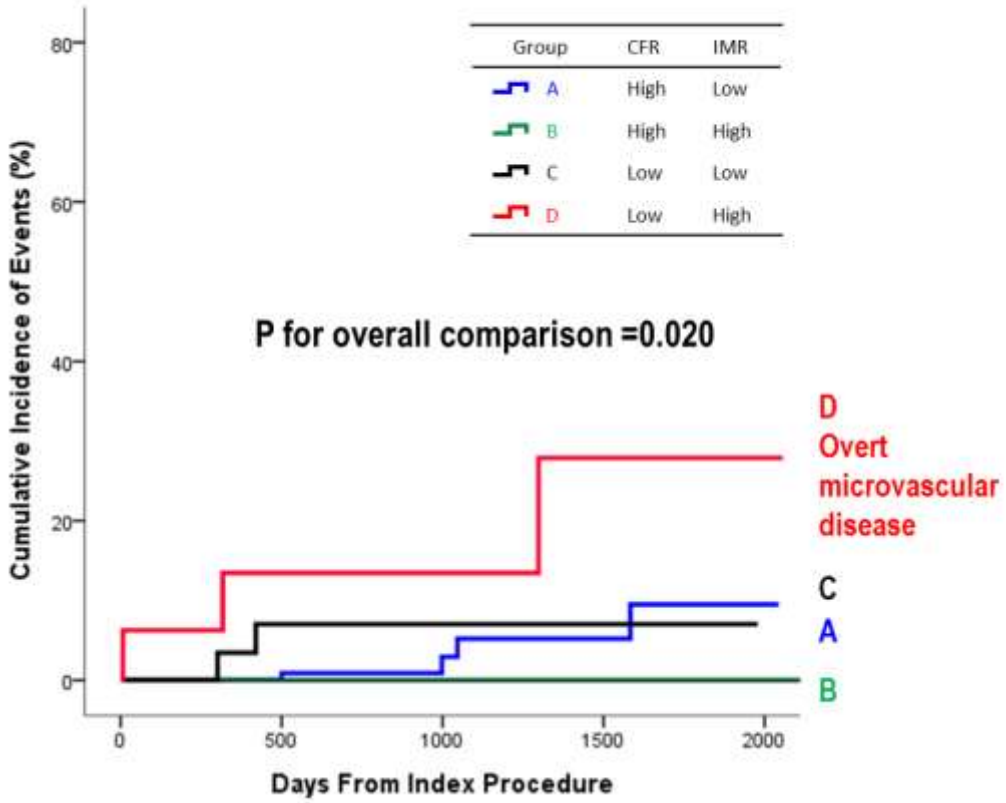
Can we discriminate?

	Group A (CFR>2 and IMR<23U)	Group B (CFR>2 and IMR≥23U)	Group C (CFR≤2 and IMR		p value
Age, years	**60.2 ± 9.9**	**63.9 ± 7.1**			**.017**
Male	90 (63.8%)	22 (52.4%)			
BMI, kg/m^2	24.3 ± 2.9	25.4 ±			
Hypertension	78 (55.3%)				.47
Diabetes mellitus	44 (31.2%)				0.784
Hypercholesterolemia	88			(43.8%)	0.434
Current smoker				2 (12.5%)	0.687
Family history				1 (6.3%)	0.548
Previous MI			0 (0.0%)	0 (0.0%)	0.541
Previ			9 (29.0%)	2 (12.5%)	0.263
		.6%)	14 (45.2%)	3 (18.8%)	0.163
Ge		11.3 (5.0-18.8)	20.5 (9.0-37.0)	9.3 (4.8-19.5)	0.114
Angiogr					
Reference	**.02 (2.95-3.09)**	**3.18 (3.03-3.34)§**	**2.91 (2.80-3.01)‡**	**3.12 (2.92-3.32)**	**0.017**
Diameter steno	36.8 (34.9-38.6)	36.4 (33.4-39.4)	38.7 (35.6-41.9)	33.2 (28.3-38.1)	0.343
Lesion length, mm	10.9 (10.1-11.8)	10.7 (9.4-12.4)	10.9 (9.4-12.4)	10.4 (8.6-12.2)	0.961

Only the invasive physiologic assessment can tell the difference!

Clinical outcomes according to CFR/IMR



	HR	95% CI	P
Model 1			
Multivessel disease	3.25	1.08-9.79	0.033
Diabetes mellitus	2.83	1.09-7.35	0.033
Model 2			
Overt microvascular	4.91	1.54-15.66	0.007
Multivessel disease	3.64	1.24-10.7	0.019
Diabetes mellitus	2.71	1.05-7.02	0.039

Improved discriminant function (Model2)

- Relative IDI: 0.467, p=0.037
- Category-free NRI: 0.648, p=0.007

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Take Home Message

- In stable CAD patients, macro- and micro-vascular diseases seem to be a different disease process with some overlap. When FFR is low (macro is significant), simply follow the rule.
- Among patients with high FFR, invasive physiologic assessment can provide additional information on coronary circulation and improve risk stratification.
- However, there still remain several unanswered questions related to microvascular system.

I am still hungry, still thirsty, but the time for me to be satisfied is only deferred, not taken away for ever.

- St. Augustine (354-430), from Expositions of the Psalms