How About Integrated Use of Resting Pd/Pa and FFR?

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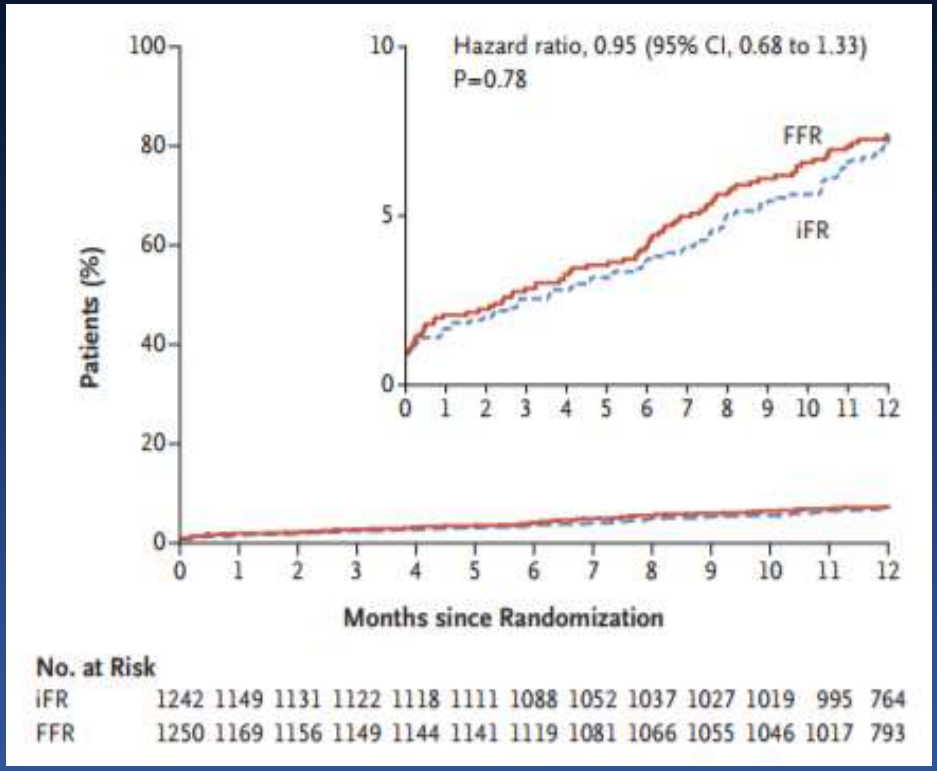
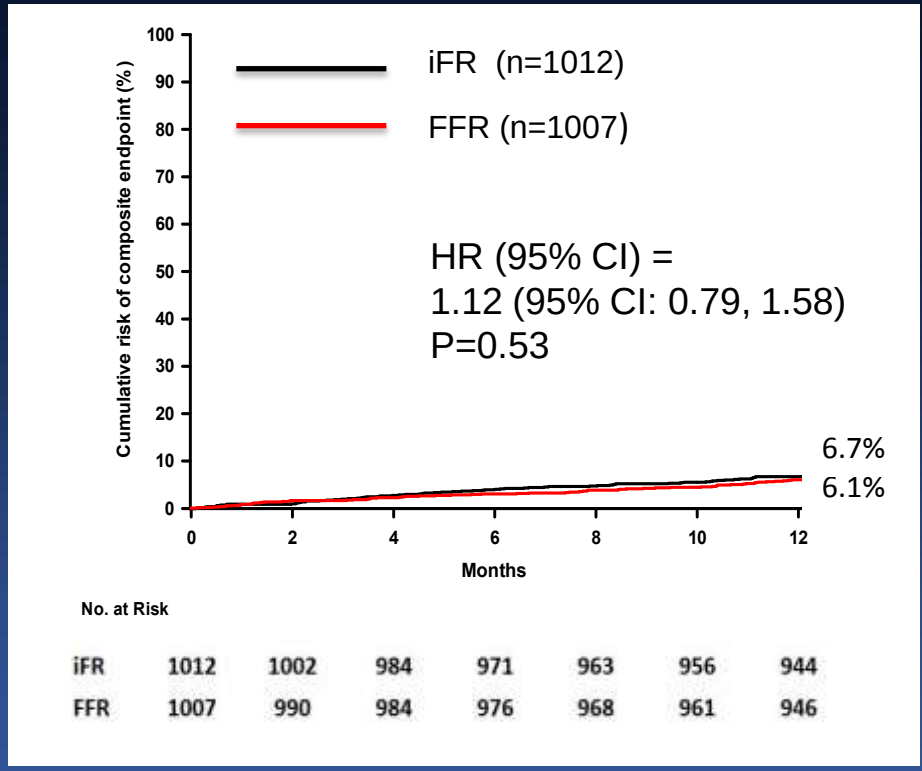
iFR is non-inferior to FFR

DEFINE-FLAIR



N Engl J Med. 2017 May 11;376(19):1824-1834

iFR-SWEDEHEART



N Engl J Med. 2017 May 11;376(19):1813-1823

Resting Pd/Pa and iFR: Similar (?)

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VOL. 70, NO. 17, 2017
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2017.09.049

ORIGINAL INVESTIGATIONS

Agreement of the Resting Distal to Aortic Coronary Pressure With the Instantaneous Wave-Free Ratio

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ABSTRACT

BACKGROUND Recently, 2 randomized controlled trials showed that the instantaneous wave-free ratio (iFR), a resting coronary physiological index, is noninferior to fractional flow reserve for guiding revascularization. The resting distal to aortic coronary pressure (P_d/P_a) measured at rest is another adenosine-free index widely available in the cardiac catheterization laboratory; however, little is known about the agreement of P_d/P_a using iFR as a reference standard.

OBJECTIVES The goal of this study was to investigate the agreement of P_d/P_a with iFR.

METHODS A total of 763 patients were prospectively enrolled from 12 institutions. iFR and P_d/P_a were measured under resting conditions. Using iFR ≤0.89 as a reference standard, the agreement of P_d/P_a and its best cutoff value were assessed.

RESULTS According to the independent core laboratory analysis, iFR and P_d/P_a were analyzable in 627 and 733 patients (82.2% vs. 96.1%; $p < 0.001$), respectively. The median iFR and P_d/P_a were 0.90 (interquartile range: 0.85 to 0.94) and 0.92 (interquartile range: 0.88 to 0.95), and the 2 indices were highly correlated ($R^2 = 0.93$; $p < 0.001$; iFR = 1.31 * P_d/P_a −0.31). According to the receiver-operating characteristic curve analysis, P_d/P_a showed excellent agreement (area under the curve: 0.98; 95% confidence interval: 0.97 to 0.99; $p < 0.001$) with a best cutoff value of P_d/P_a ≤0.91. The diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were 93.0%, 91.4%, 94.4%, 93.3%, and 92.7%, respectively. These results were similar in patients with acute coronary syndrome and stable angina.

CONCLUSIONS P_d/P_a was analyzable in a significantly higher number of patients than iFR. P_d/P_a showed excellent agreement with iFR, suggesting that it could be applied clinically in a similar fashion. (Can Contrast Injection Better

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VOL. 70, NO. 17, 2017
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2017.09.007

Similarity and Difference of Resting Distal to Aortic Coronary Pressure and Instantaneous Wave-Free Ratio

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ABSTRACT

BACKGROUND Instantaneous wave-free ratio (iFR) has been used in clinical practice to identify functionally significant stenosis and to guide treatment strategy. However, there are limited clinical data regarding another resting pressure-derived index, resting distal to aortic coronary pressure (Pd/Pa), and similarities and differences between resting Pd/Pa and iFR.

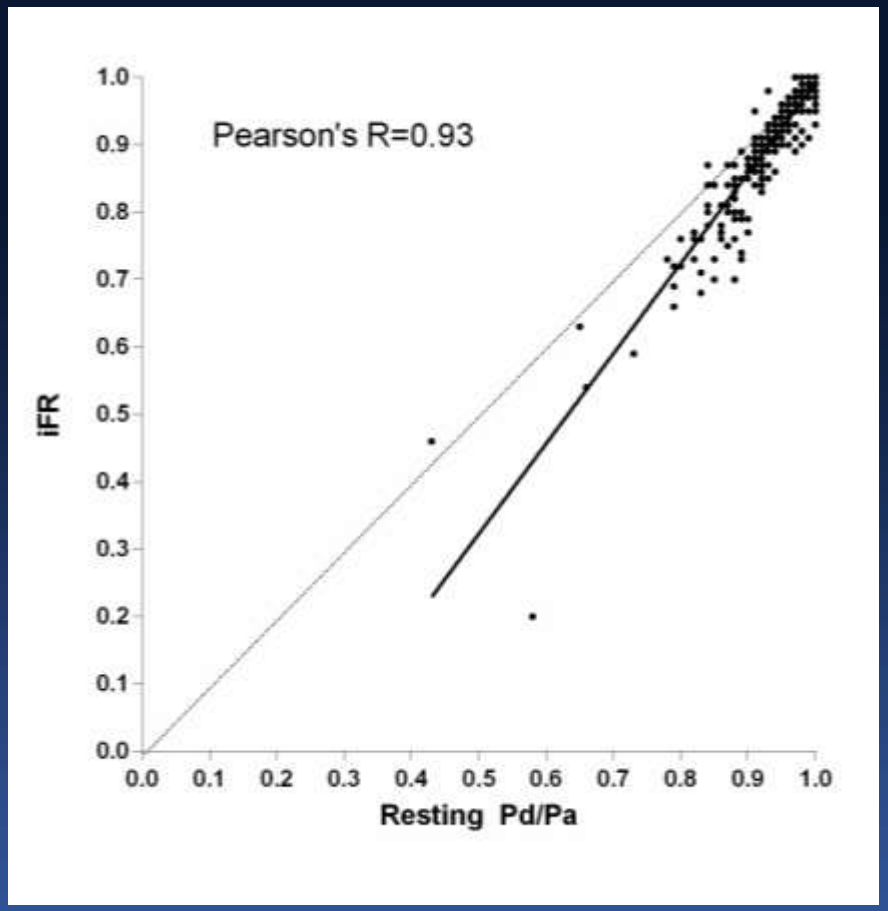
OBJECTIVES The authors investigated the changes in resting Pd/Pa and iFR according to anatomic and hemodynamic stenosis severity and their prognostic implications.

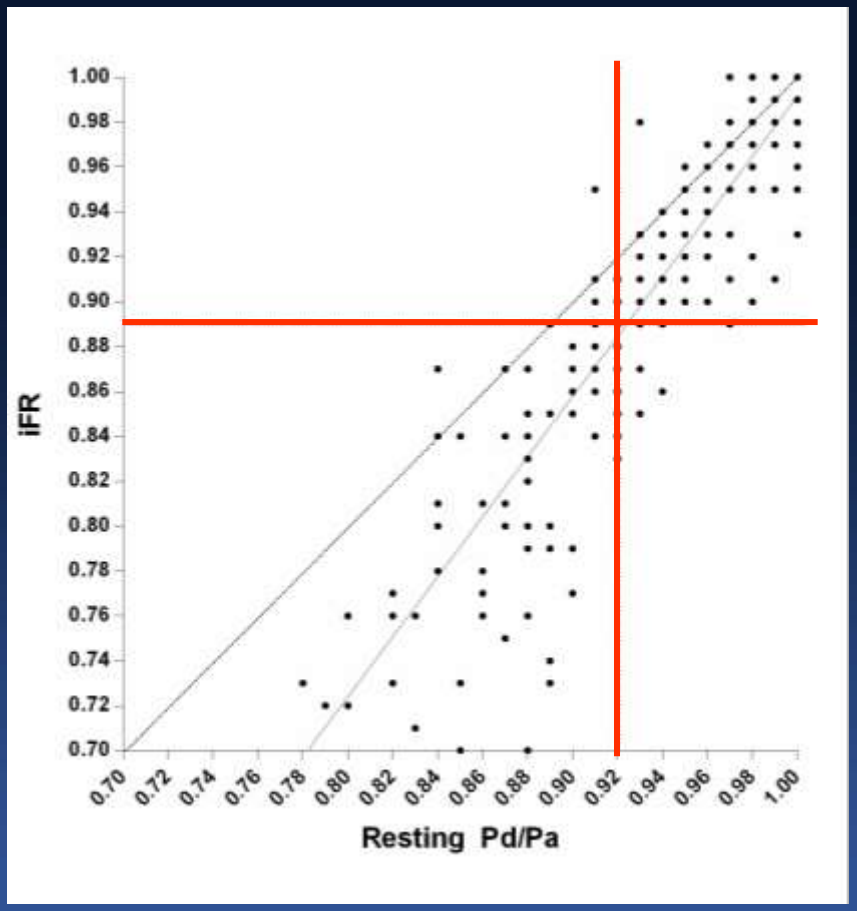
METHODS From the 3V FFR-FRIENDS (Clinical Implication of 3-vessel Fractional Flow Reserve) and the IRIS-FFR (Study of the Natural History of FFR Guided Percutaneous Coronary Intervention) studies, 1,024 vessels (n = 435) with available pre-intervention resting Pd/Pa and iFR were used to explore the changes in resting physiological indices according to percent diameter stenosis. Among 115 patients who underwent ^{13}N-ammonia positron emission tomography, the changes in those indices according to basal and hyperemic stenosis resistance and absolute hyperemic myocardial blood flow were compared. The association between physiological indices and the risk of 2-year major adverse cardiac events (MACE) (a composite of cardiac death, myocardial infarction, and ischemia-driven revascularization) were analyzed among 375 deferred patients.

RESULTS There was a significant linear correlation between resting Pd/Pa and iFR ($R = 0.970$; $p < 0.001$, iFR = 1.370 × resting Pd/Pa − 0.370). Both resting Pd/Pa and iFR changed significantly according to percent diameter stenosis, basal and hyperemic stenosis resistance, and hyperemic absolute myocardial blood flow (all p values <0.001). Percent difference of iFR according to the increase in anatomic and hemodynamic severity was higher than that of resting Pd/Pa. Both resting Pd/Pa and iFR showed a significant association with the risk of 2-year MACE (resting Pd/Pa hazard ratio [per 0.10 increase]: 0.480; 95% confidence interval: 0.250 to 0.923; $p = 0.027$; iFR hazard ratio [per 0.1 increase]: 0.586; 95% confidence interval: 0.373 to 0.919; $p = 0.020$) in deferred patients. However, the difference between the upper- and lower-bound estimated MACE rates according to the approximate measurement variability of each index was significantly higher with resting Pd/Pa compared with iFR (resting Pd/Pa 3.85 ± 4.00% and iFR 3.27 ± 3.39%; $p < 0.001$).

CONCLUSIONS Both resting Pd/Pa and iFR showed similar associations with anatomic and hemodynamic stenosis severity and the risk of MACE. However, iFR was more sensitive to the difference in stenosis severity and showed

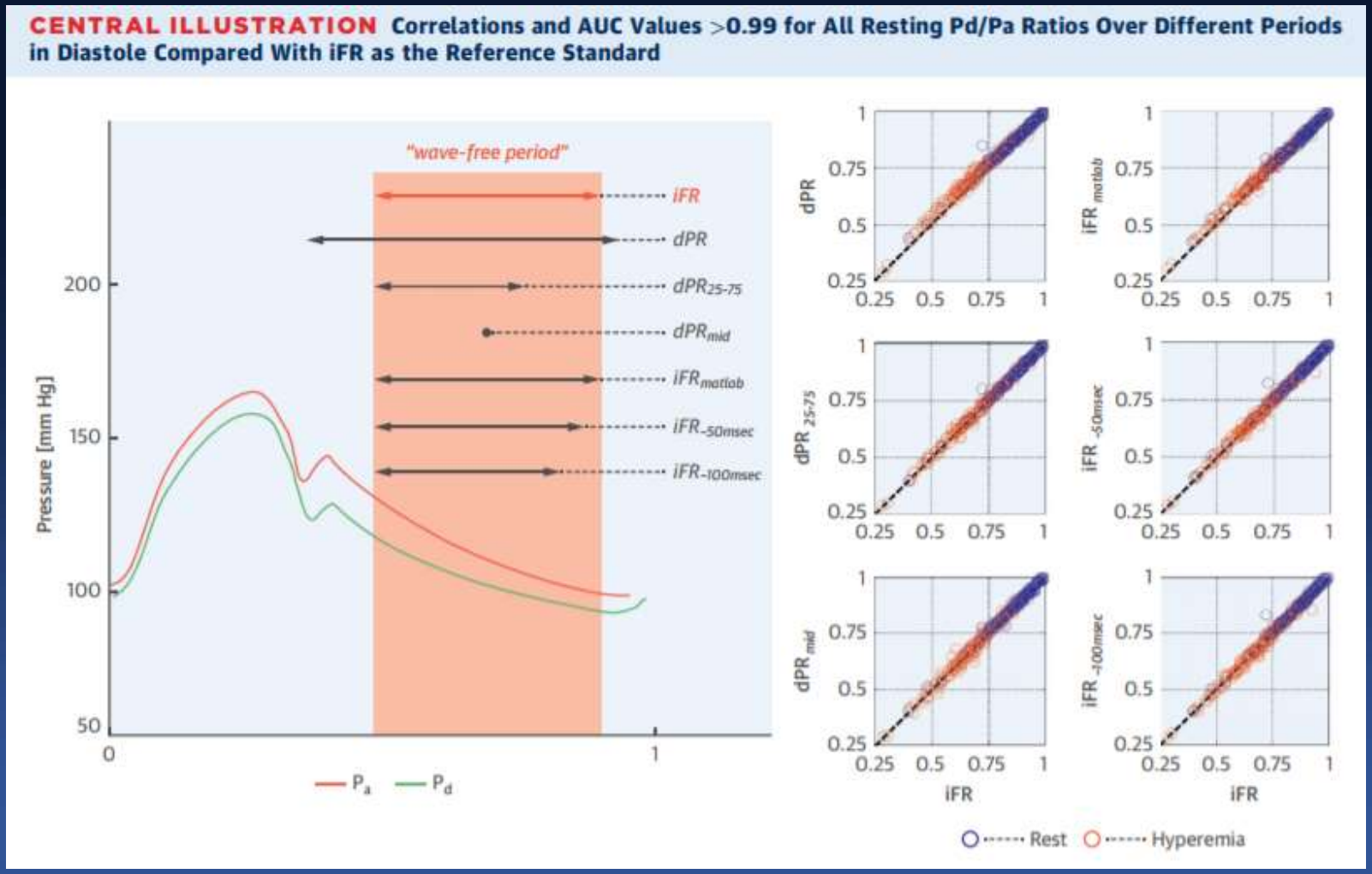
IRIS FFR Registry





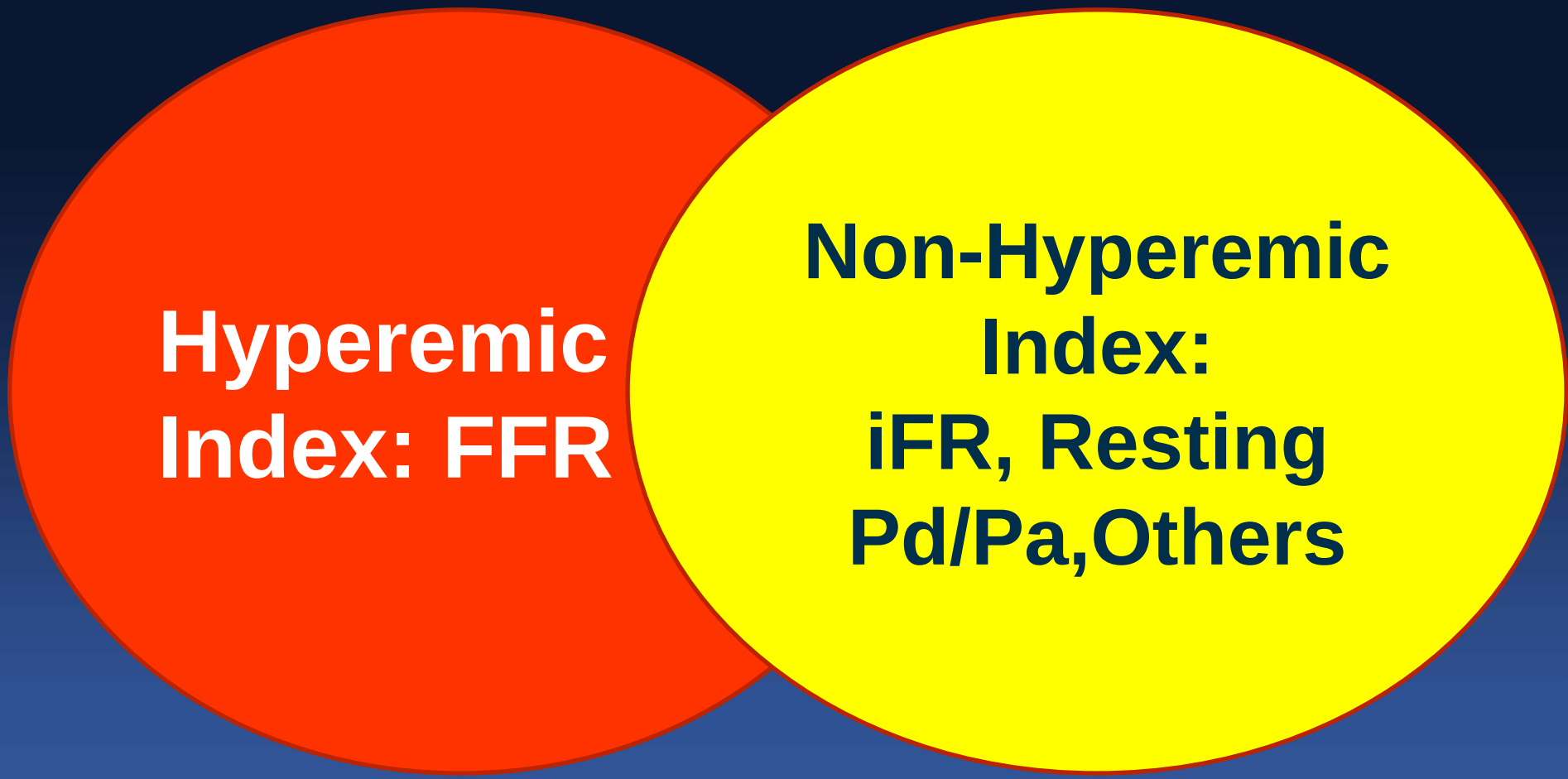
Concordant Rate of Resting Pd/Pa and iFR is ***94.1%***

Diastolic Resting Index: Are They All Equal?



Van't Veer M et al J Am Coll Cardiol. 2017 Dec 26;70(25):3088-3096

Integrated Use



Objective

- Based on the large prospective IRIS-FFR registry, we evaluated

1) Prognostic value of resting whole-cycle Pd/Pa against FFR
2) The integrated usefulness of resting index and FFR for predicting cardiac outcomes.

IRIS FFR Registry* (NCT01366404)

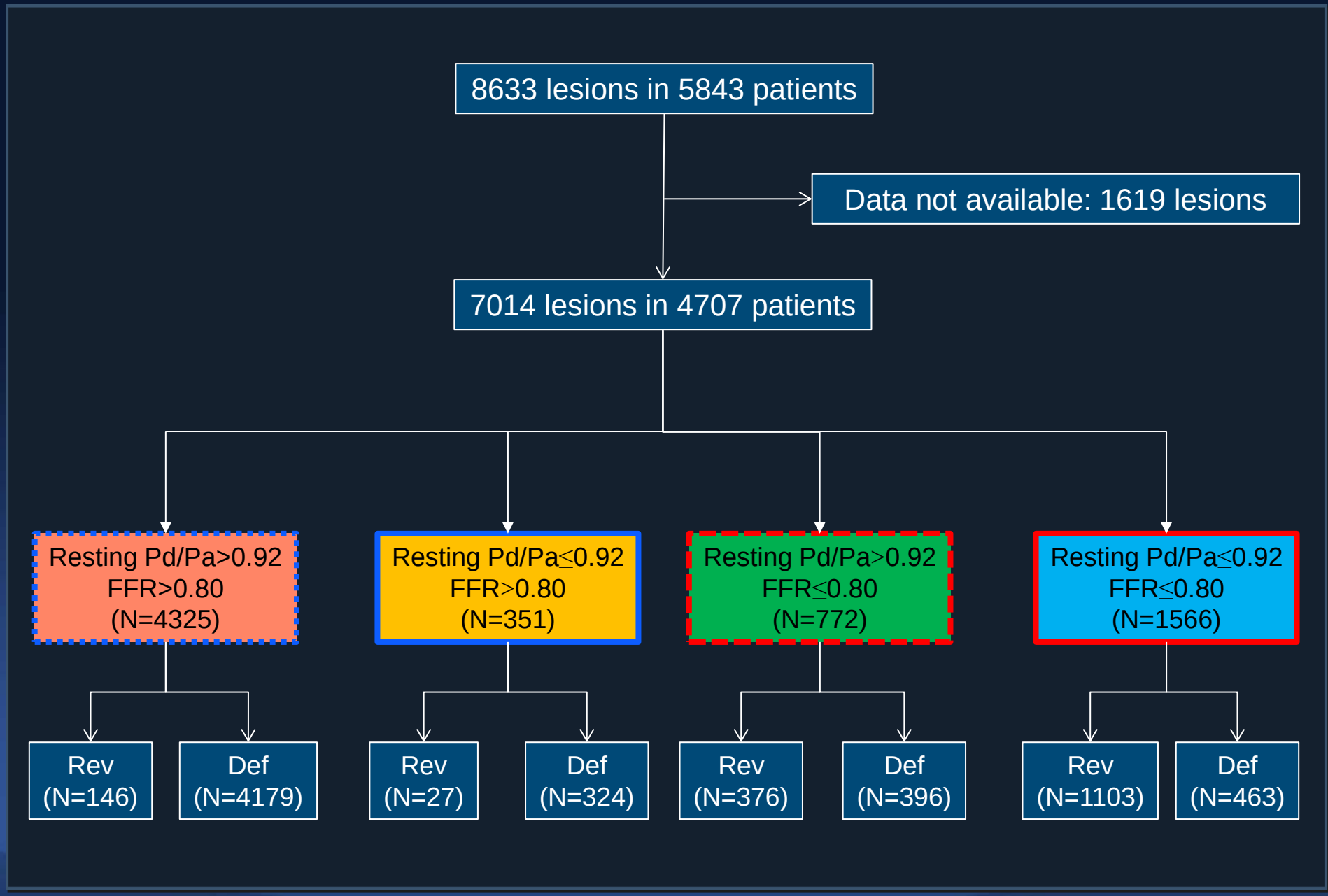
- A prospective multicenter study designed to investigate the natural history of coronary stenosis assessed by FFR
- A total of 30 heart centers in South Korea participated.
- The registry consecutively enrolled 5843 patients who underwent FFR measurement of at least one coronary lesion with minimal exclusion criteria between August 2009 and August 2015.
- All events were centrally adjudicated

*Ahn JM, Park SJ et al. Circulation. 2017 Jun 6;135(23):2241-2251

Patient and Lesion Characteristics

Patient	N=4707
Age	63.4±9.8
Gender (Male)	72.0%
ACS	21.1%
Hypertension	36.4%
Diabetes	30.8%
Current smoking	23.7%
Hyperlipidemia	63.2%
Previous MI	6.3%
Previous PCI	19.6%
Family history	11.3%
Previous CHF	1.1%
Previous stroke	5.7%
PAD	2.7%

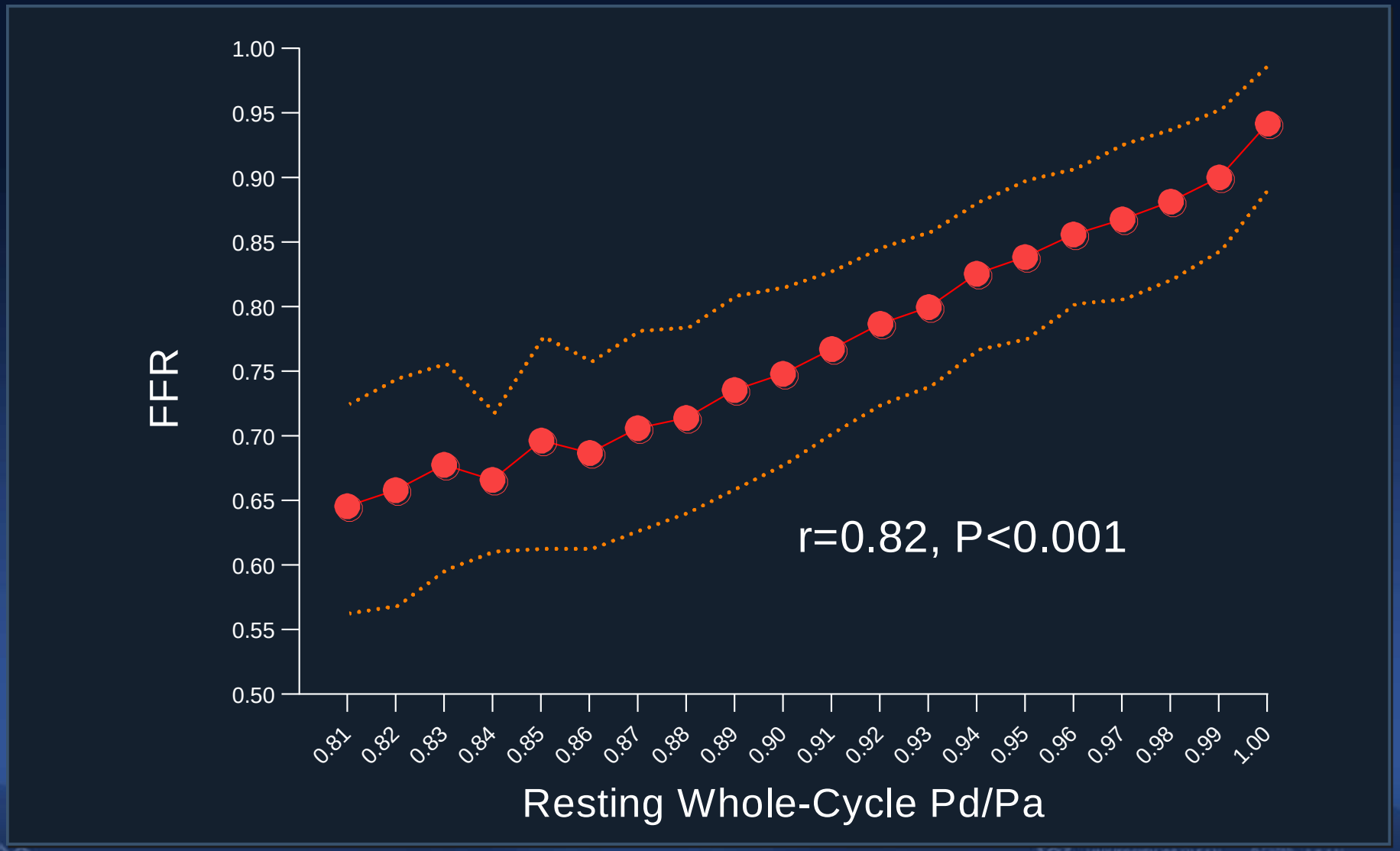
Lesion	N=7014
Revascularization	23.6%
Lesion territory	
Left main	4.3%
LAD	50.3%
RCA	24.1%
LCX	16.3%
Lesion location	
Proximal/Mid/Distal	45.3/31.8/22.9%
Diameter stenosis (%)	
≥70/50-69/30-49	20.2/45.9/33.6%
AHA/ACC B2C lesion	57.2%
Long lesion (>20mm)	43.4%
Calcified lesion	2.6%


8633 lesions in 5843 patients
Data not available: 1619 lesions
7014 lesions in 4707 patients
Resting Pd/Pa>0.92
FFR>0.80
(N=4325)
Resting Pd/Pa≤0.92
FFR>0.80
(N=351)
Resting Pd/Pa>0.92
FFR≤0.80
(N=772)
Resting Pd/Pa≤0.92
FFR≤0.80
(N=1566)
Rev
(N=146)
Def
(N=4179)
Rev
(N=27)
Def
(N=324)
Rev
(N=376)
Def
(N=396)
Rev
(N=1103)
Def
(N=463)

Contents

1) Relationship between Resting Pd/Pa and FFR
2) Revascularization Decision
3) Predicting Outcomes
4) Integrated Use of Resting Pd/Pa and FFR

Correlation



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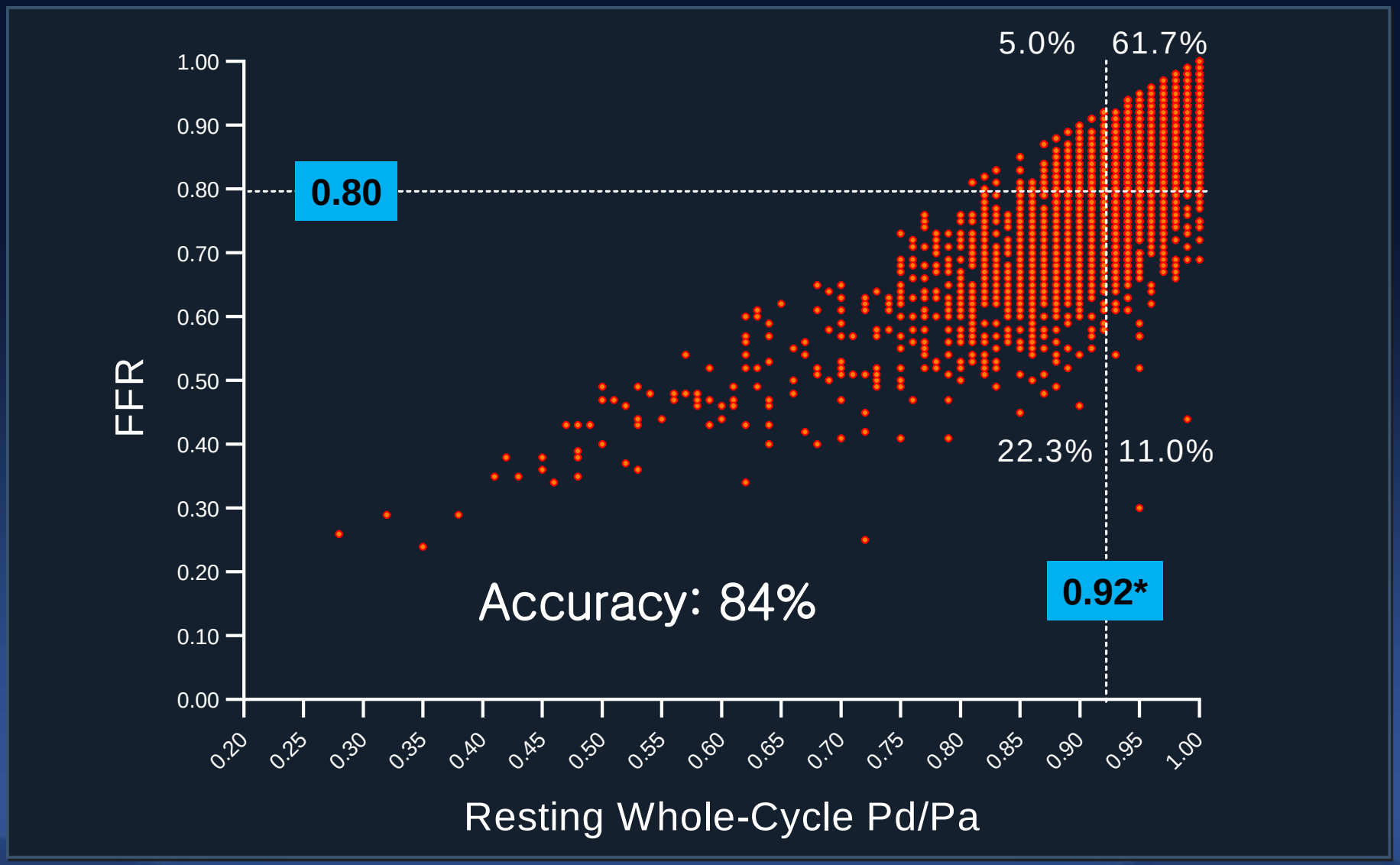
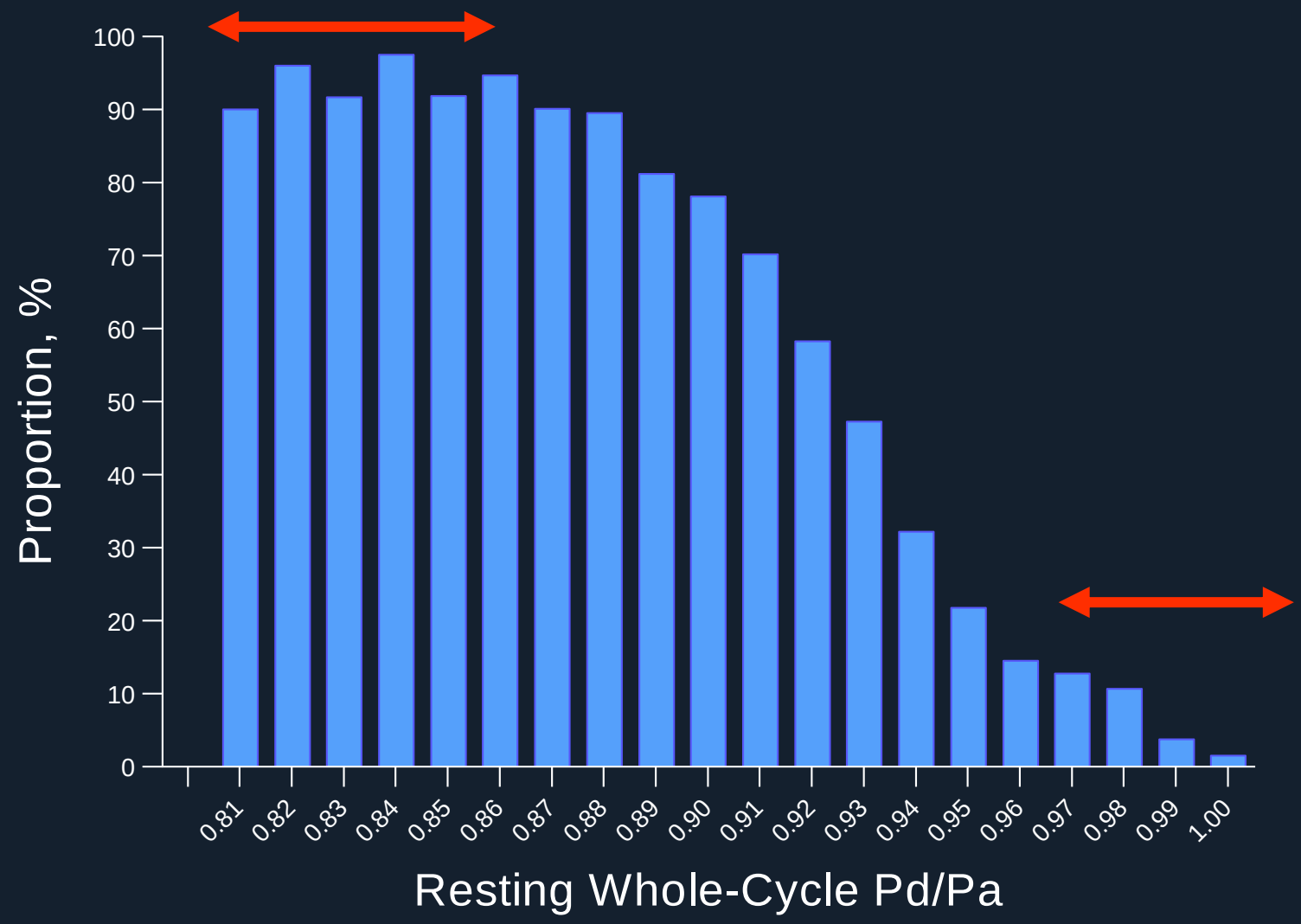
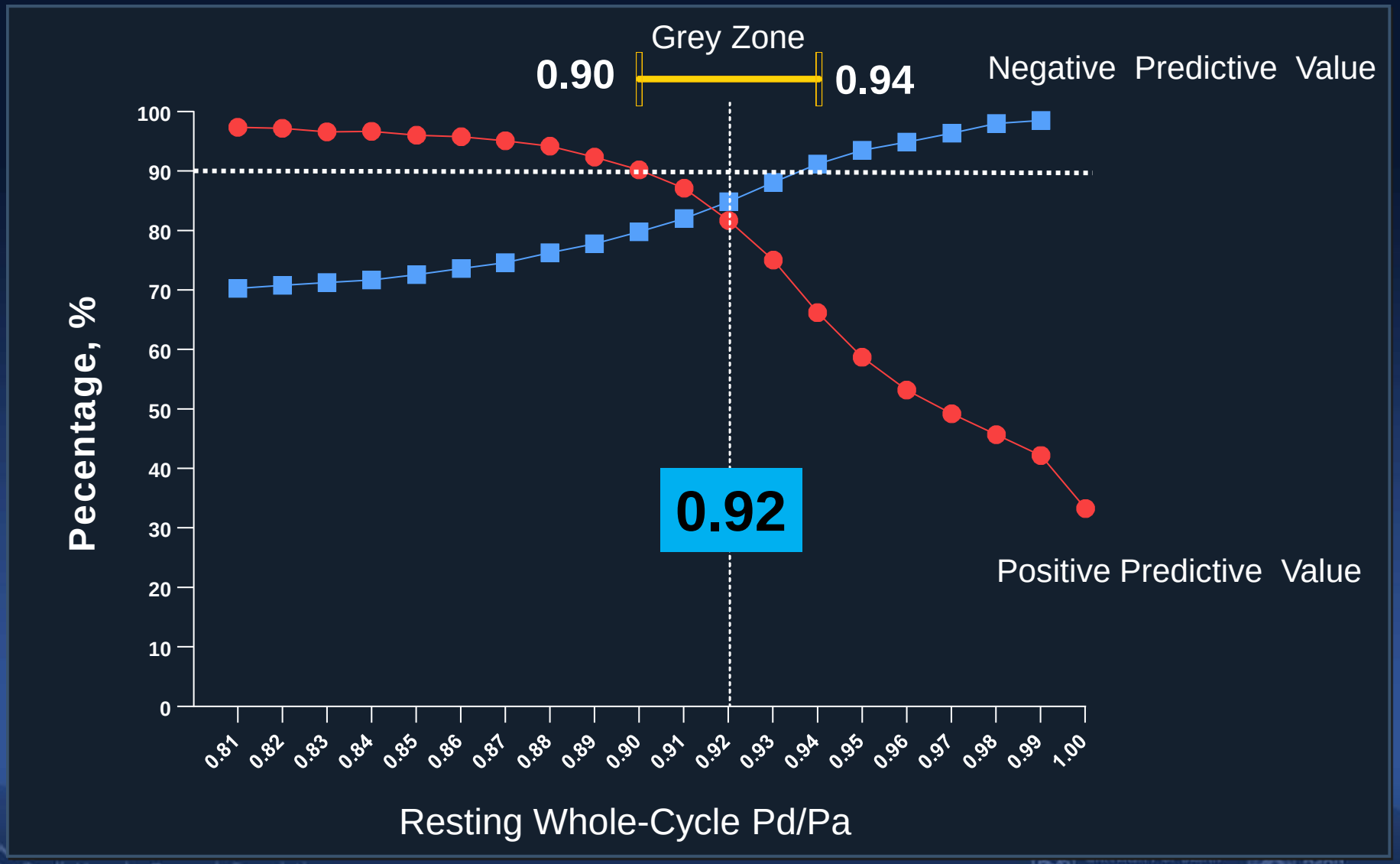


*The RESOLVE Study J Am Coll Cardiol. 2014 Apr 8;63(13):1253-1261
The VERIFY II Study Circ Cardiovasc Interv. 2016 Nov;9(11)

Proportion of FFR≤0.80



Positive/Negative Predictive Value

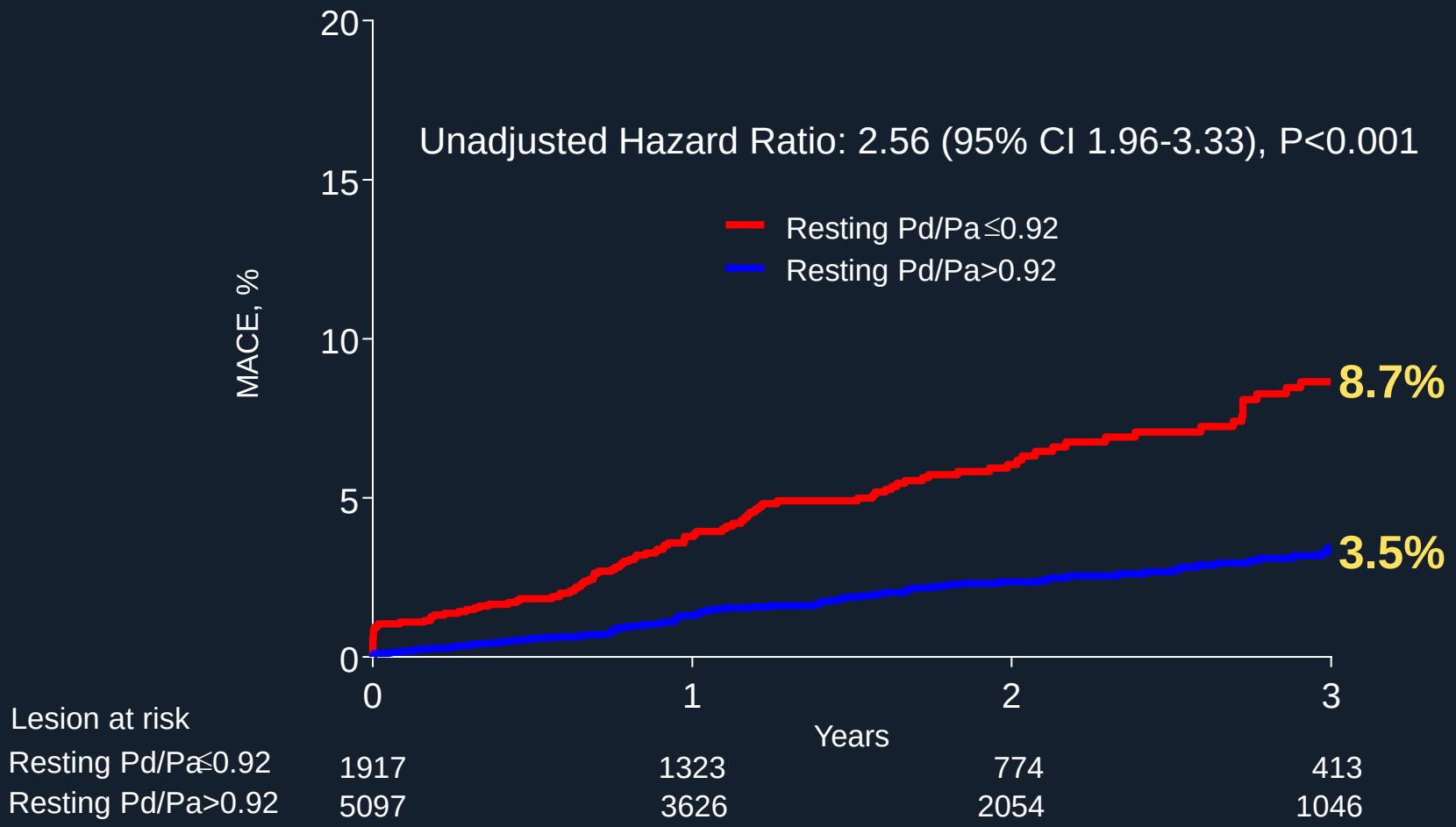


Summary (1)

- Overall concordance rate between resting Pd/Pa using cutoff 0.92 and FFR using cutoff 0.80 was 84%.
- Use of a hybrid resting Pd/Pa-FFR strategy, incorporating FFR measurement for only lesions within the resting Pd/Pa grey zone of 0.90-0.94 (in which positive and negative predictive value > 90%), would improve agreement rate with FFR upto 93.7%, with diagnosis achieved without the need for hyperemia in 73.1% patients.

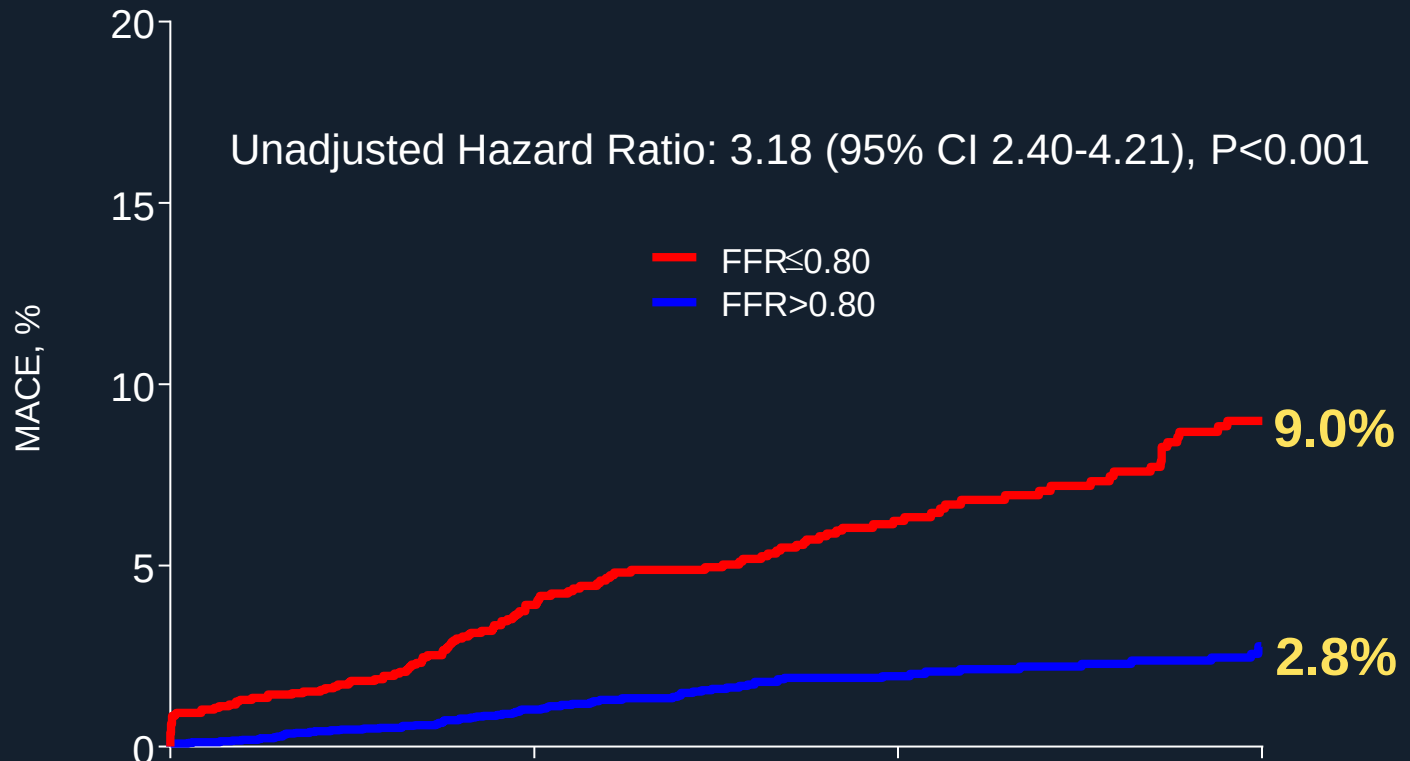
Resting Whole-Cycle Pd/Pa

Cardiac Death, MI, RR



FFR

Cardiac Death, MI, RR



Lesion at risk				
FFR≤0.80	2338	1606	947	528
FFR>0.80	4676	3343	1881	935

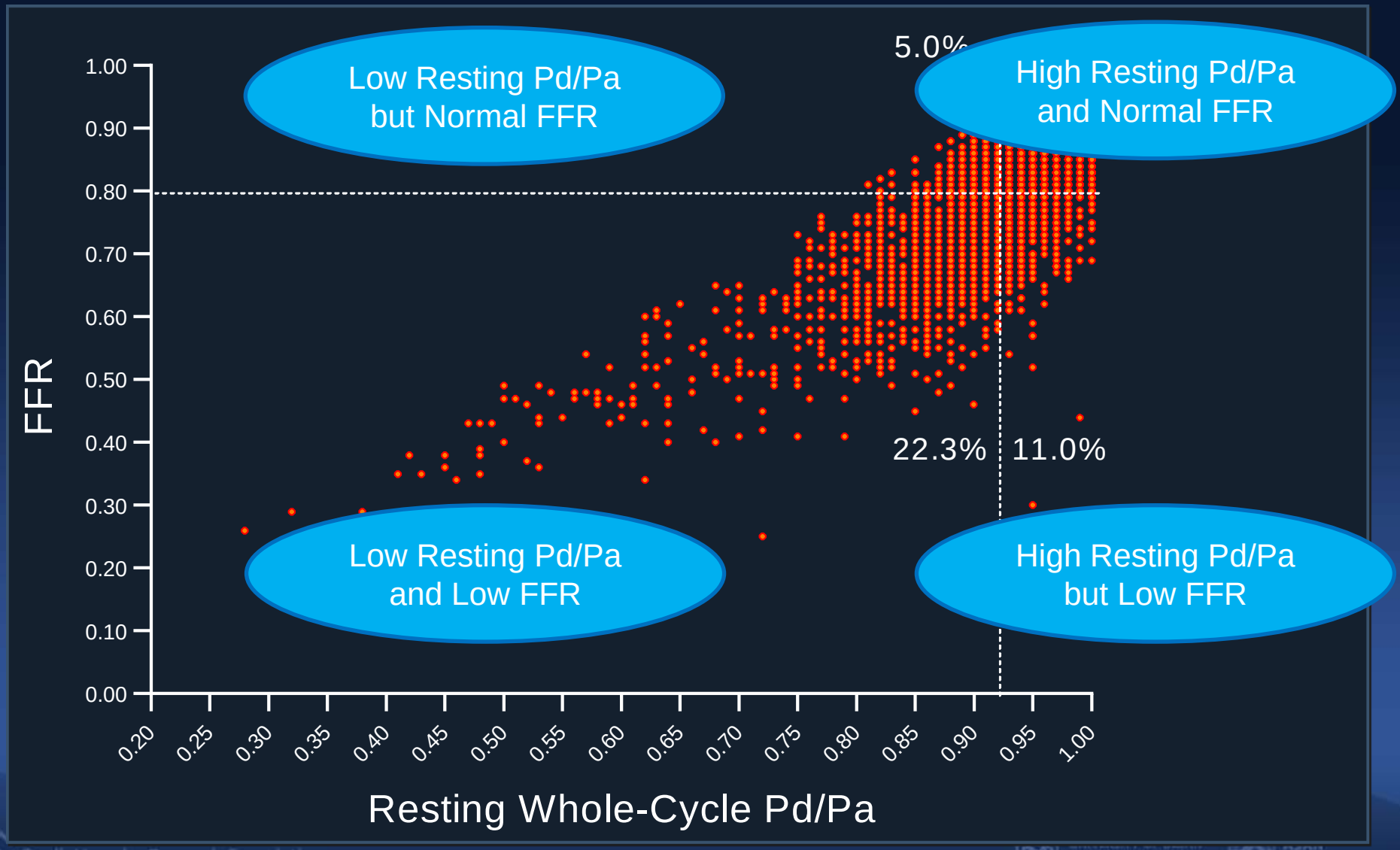
Independent and Integrated Predictive Value

	Independent Prognostic Value			Integrated Prognostic Value		
	Adjusted HR	95% CI	P value	Adjusted HR	95% CI	P value
As binary						
Overall						
Resting Pd/Pa≤0.92	1.66	1.19-2.32	0.003	1.22	0.84-1.79	0.29
FFR ≤0.80	2.10	1.47-2.99	<0.001	1.89	1.25-2.86	0.003
Deferral						
Resting Pd/Pa≤0.92	2.85	1.97-4.11	<0.001	1.92	1.25-2.95	0.003
FFR ≤0.80	2.94	2.02-4.28	<0.001	2.16	1.40-3.34	0.001
Revascularization						
Resting Pd/Pa≤0.92	1.10	0.69-1.76	0.68	0.96	0.56-1.63	0.87
FFR ≤0.80	1.82	0.76-4.40	0.18	1.87	0.69-5.09	0.22
As continuous by decrease of 0.01						
Overall						
Resting Pd/Pa	1.03	1.01-1.06	0.014	1.00	0.96-1.04	0.97
FFR	1.02	1.01-1.04	<0.001	1.02	1.01-1.04	0.013
Deferral						
Resting Pd/Pa	1.10	1.06-1.14	<0.001	1.03	0.98-1.09	0.23
FFR	1.06	1.04-1.08	<0.001	1.05	1.02-1.07	<0.001
Revascularization						
Resting Pd/Pa	1.01	0.97-1.04	0.76	1.00	0.95-1.06	0.90
FFR	1.00	0.98-1.02	0.76	1.00	0.97-1.03	0.91

Summary (2)

- Resting Pd/Pa had an independent prognostic value over clinical and angiographic factors. However, when adding both resting Pd/Pa and FFR in the same model, resting Pd/Pa did not remained as an independent predictor.
- Therefore, regarding the prediction of cardiac events, the induction of hyperemia would be prerequisite, unless hyperemic agent was contraindicated or was not easily available. In those circumstance, resting Pd/Pa could be used as an important prognostic index.

Distribution



Predictors of Resting Pd/Pa and FFR Discordance

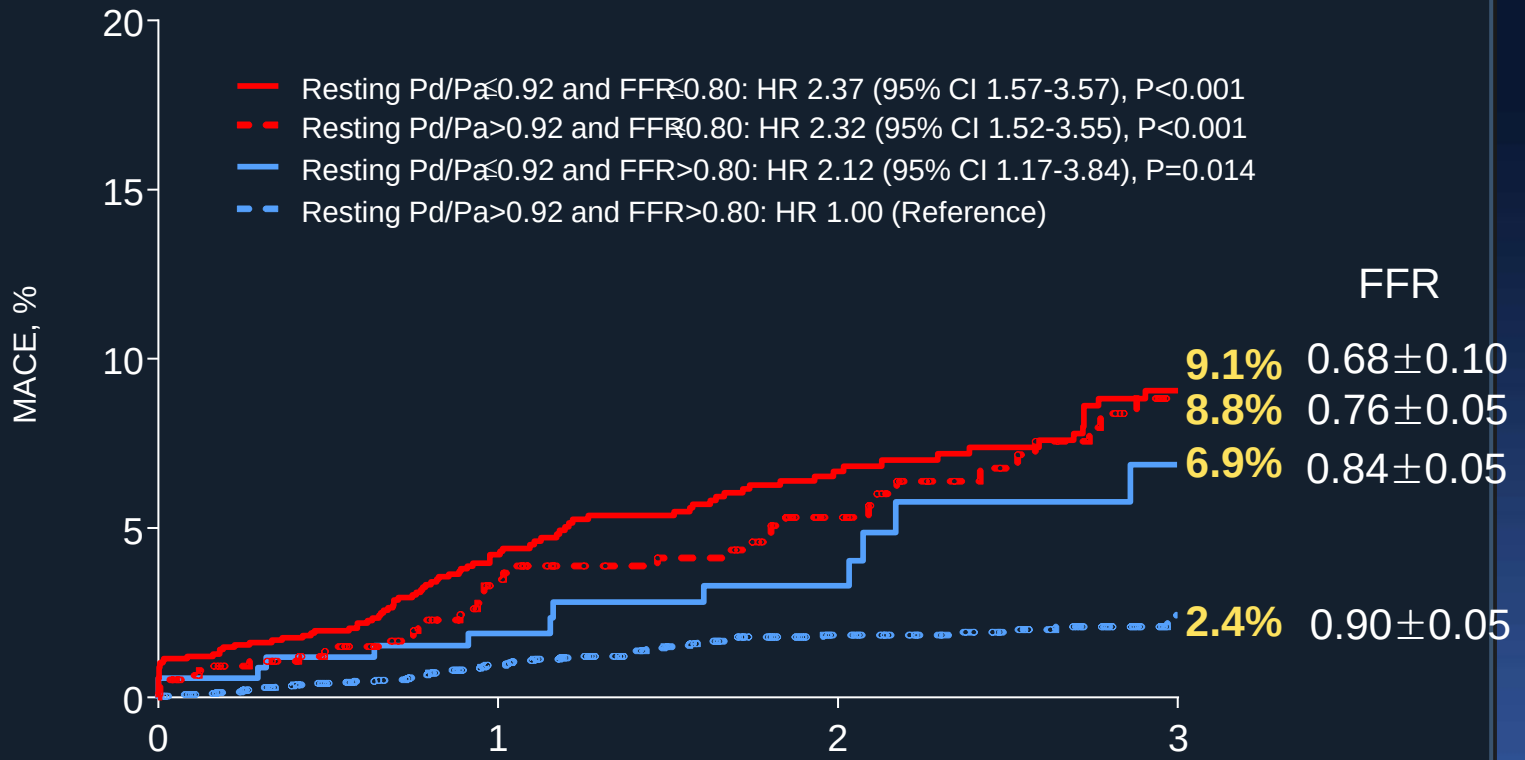
	Odds Ratio	95% CI	P Value
Resting Pd/Pa≤0.92 and FFR>0.80 Very Small Hyperemic Pressure Drop			
Age	1.02	1.01-1.03	0.004
Gender (Male)	0.74	0.59-0.94	0.012
Diabetes	1.50	1.19-1.89	0.001
Hyperlipidemia	0.72	0.57-0.91	0.005
Left main and LAD (vs. others)	4.38	3.28-5.85	<0.001
Proximal location (vs. mid to distal)	0.60	0.49-0.78	<0.001
Resting Pd/Pa>0.92 and FFR≤0.80 Very Big Hyperemic Pressure Drop			
Age	0.98	0.97-0.99	<0.001
Gender (Male)	1.79	1.45-2.22	<0.001
Diabetes	0.80	0.66-0.96	0.016
Family history	0.65	0.50-0.87	0.003
Chronic renal failure	0.32	0.14-0.75	0.008
Left main and LAD (vs. others)	1.36	1.14-1.62	0.001
Diameter stenosis (≥50%)	4.06	3.16-5.21	<0.001
AHA/ACC lesion B2C lesion	1.44	1.20-1.71	<0.001

Low CFR phenotype

Super normal CFR phenotype

Resting Pd/Pa and FFR

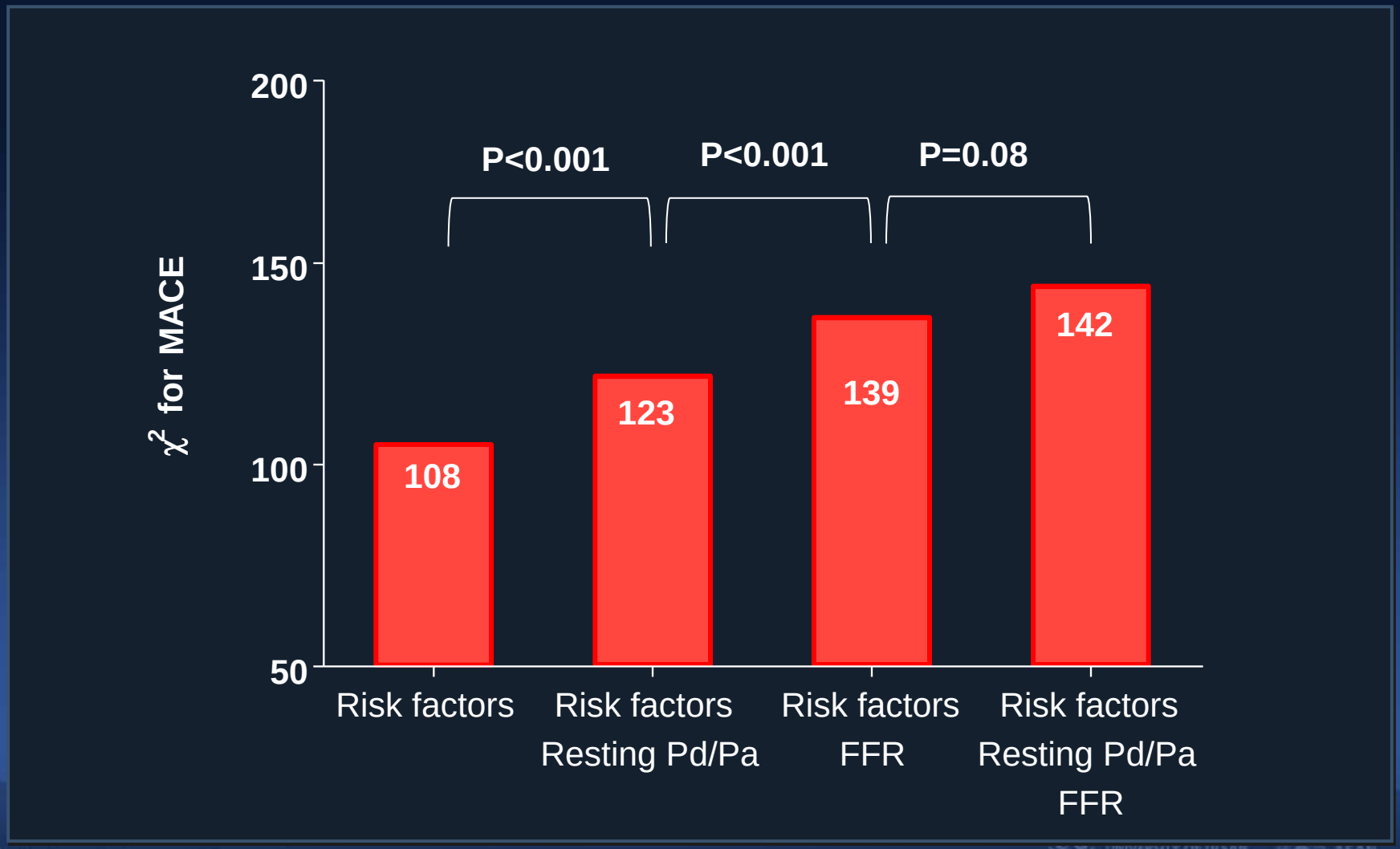
For Cardiac Death, MI, RR



Lesion at risk				
Pd/Pa ≤0.92 and FFR≤0.80	1566	1079	623	345
Pd/Pa>0.92 and FFR ≤0.80	772	527	324	183
Pd/Pa ≤0.92 and FFR>0.80	351	244	151	71
Pd/Pa>0.92 and FFR>0.80	4325	3099	1730	864

Incremental Predictive Value

For Cardiac Death, MI, RR



Summary (3)

- That integration of resting Pd/Pa and FFR identified unique clinical, physiologic, and prognostic phenotype of patients.
- Integrated approach using resting and hyperemic index showed better predictive performance for cardiac event than individual assessment.


서울아산병원
Thank you.