Is coronary revascularization therapy effective in HFpEF?

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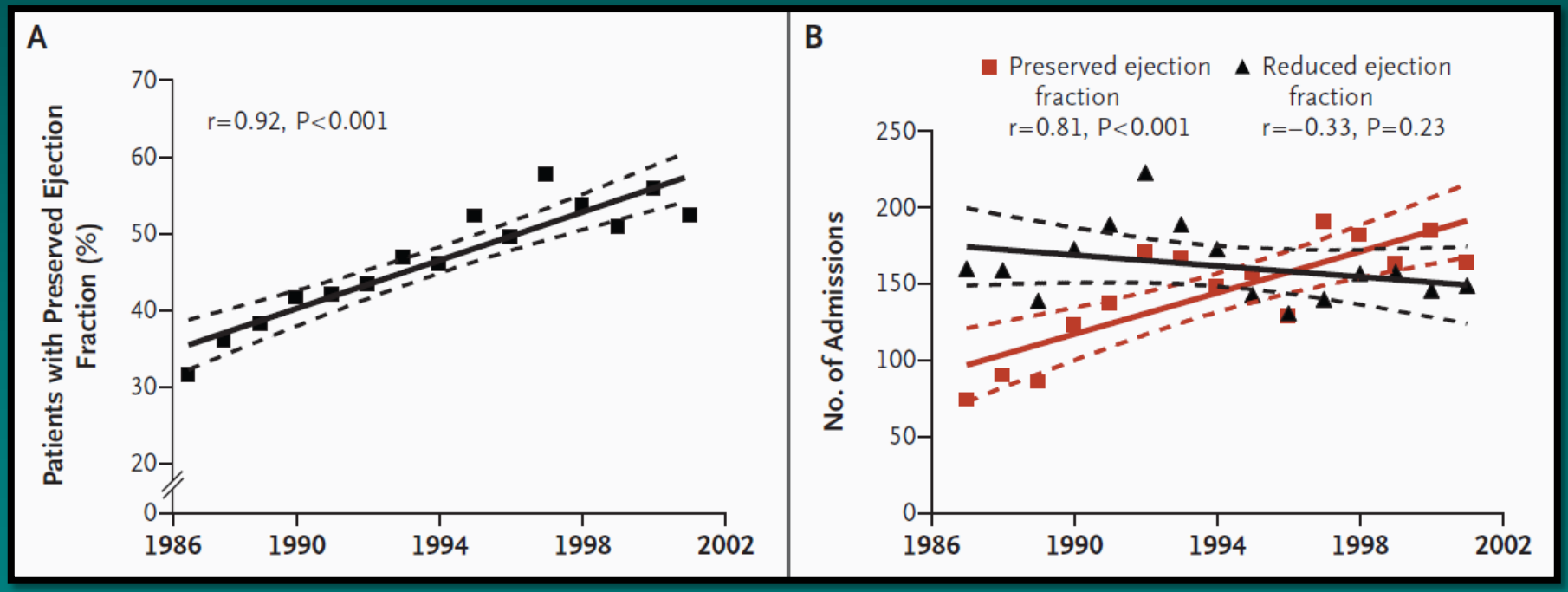
Disclosure

none

Trends in HFpEF prevalence

Community based study from Olmsted county, MN
From 1986 to 2002

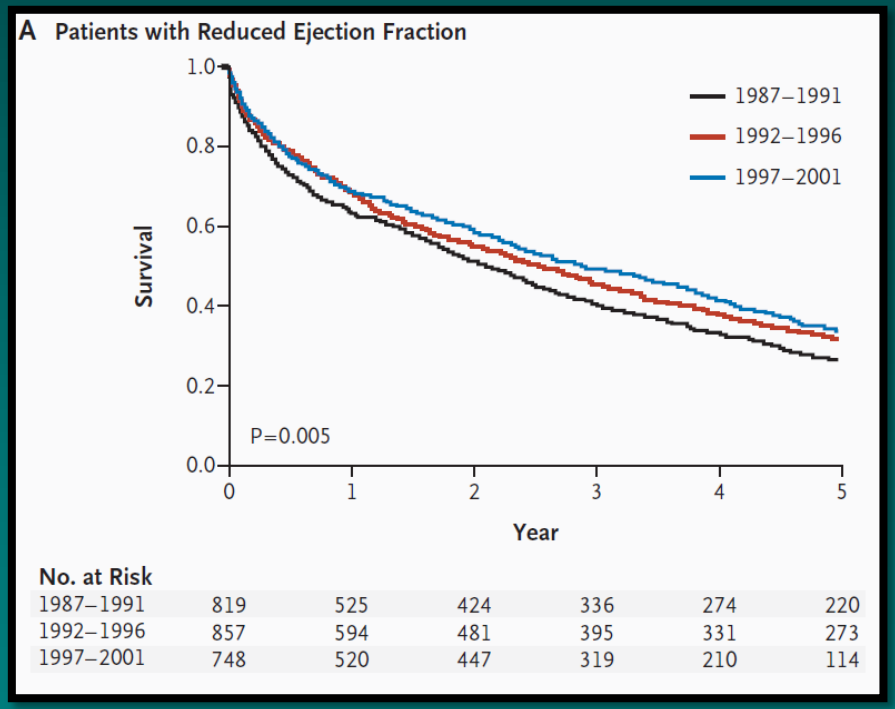
Increasing HFpEF compared to decreasing HFrEF



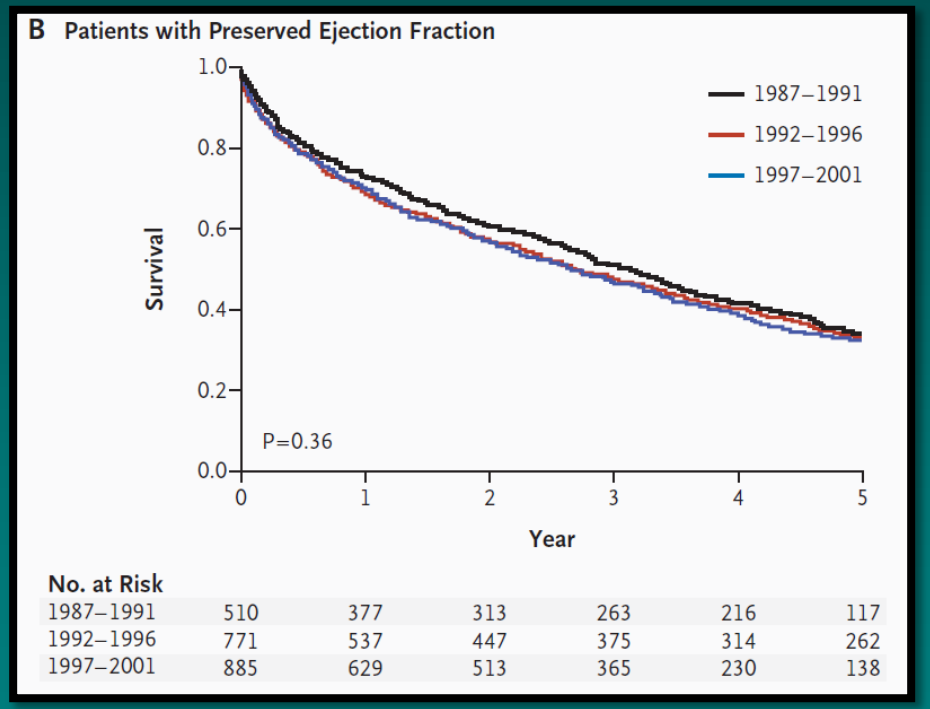
Owan et al NEJM 2006

Trends in HFpEF outcomes

Improving outcomes in HFrEF



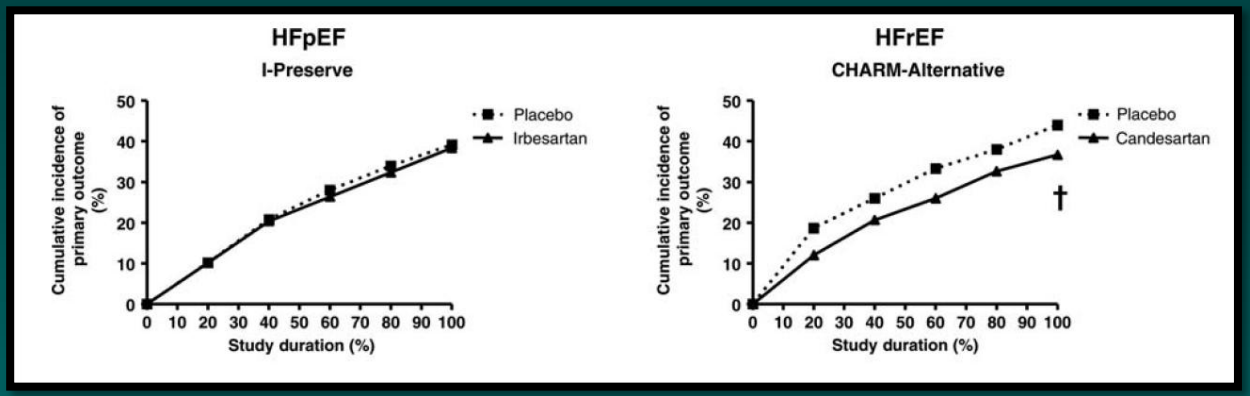
Unchanging outcomes in HFpEF



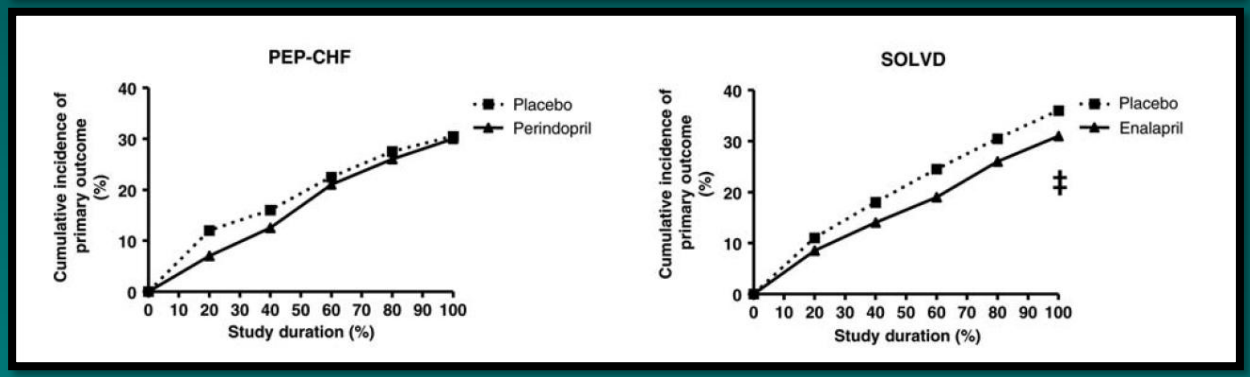
Owan et al NEJM 2006

Different treatment response to same class of drugs

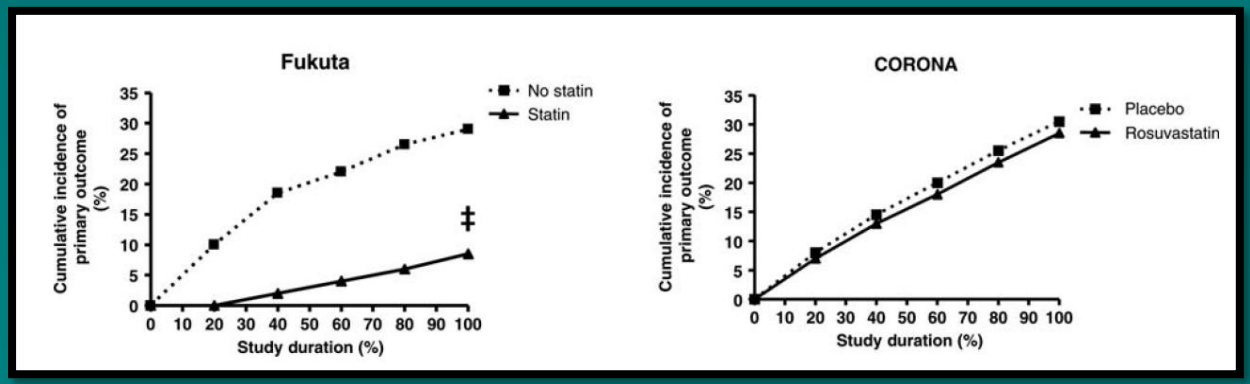
ARB



ACE inhibitor

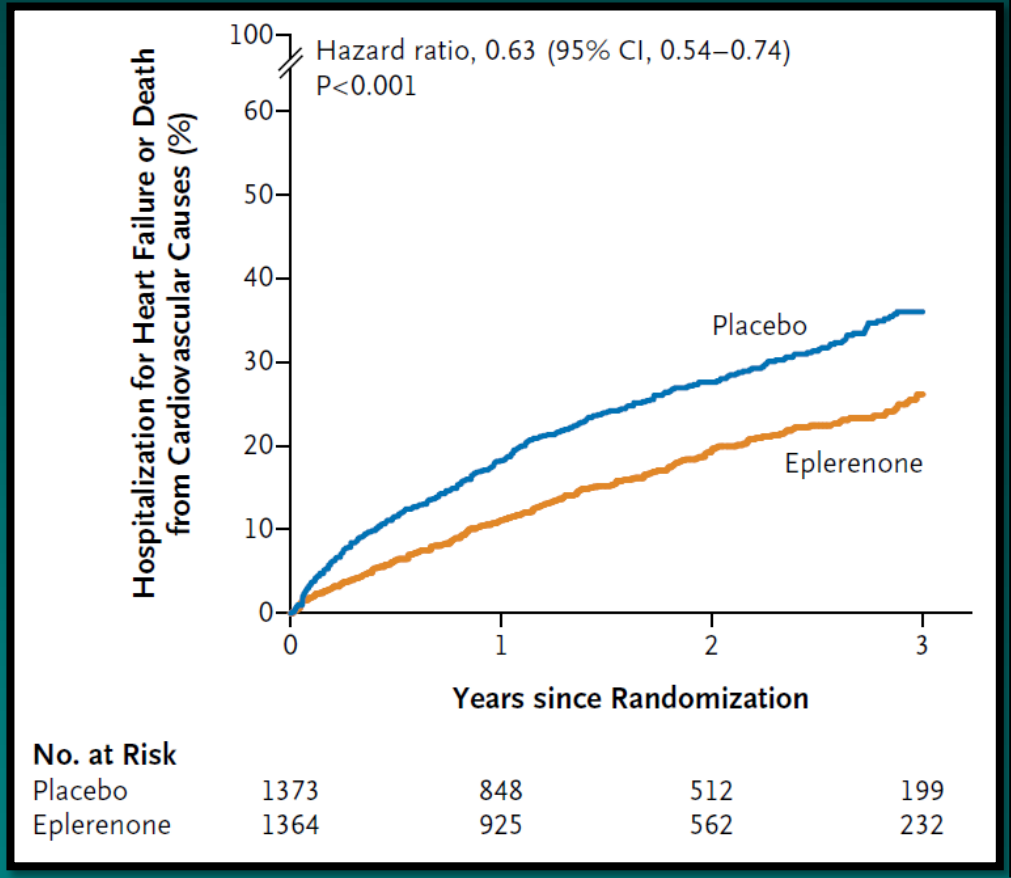


Statin

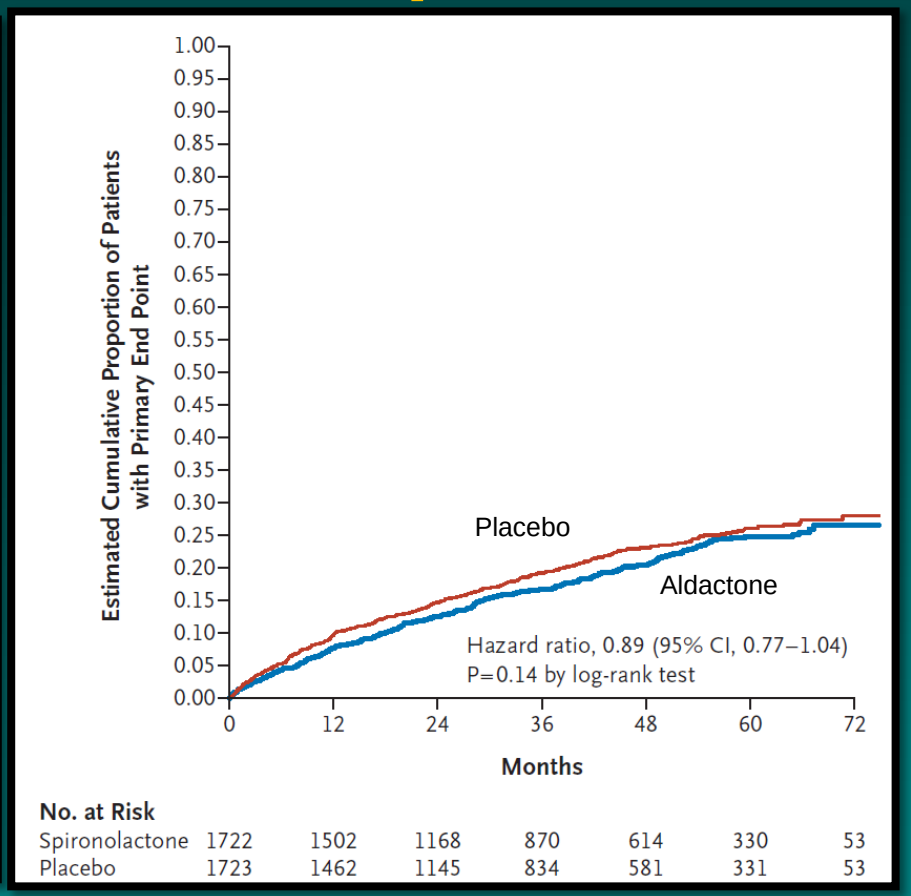


Different treatment response to aldosterone antagonist

HFrEF



HFpEF



EMPHASIS-HF

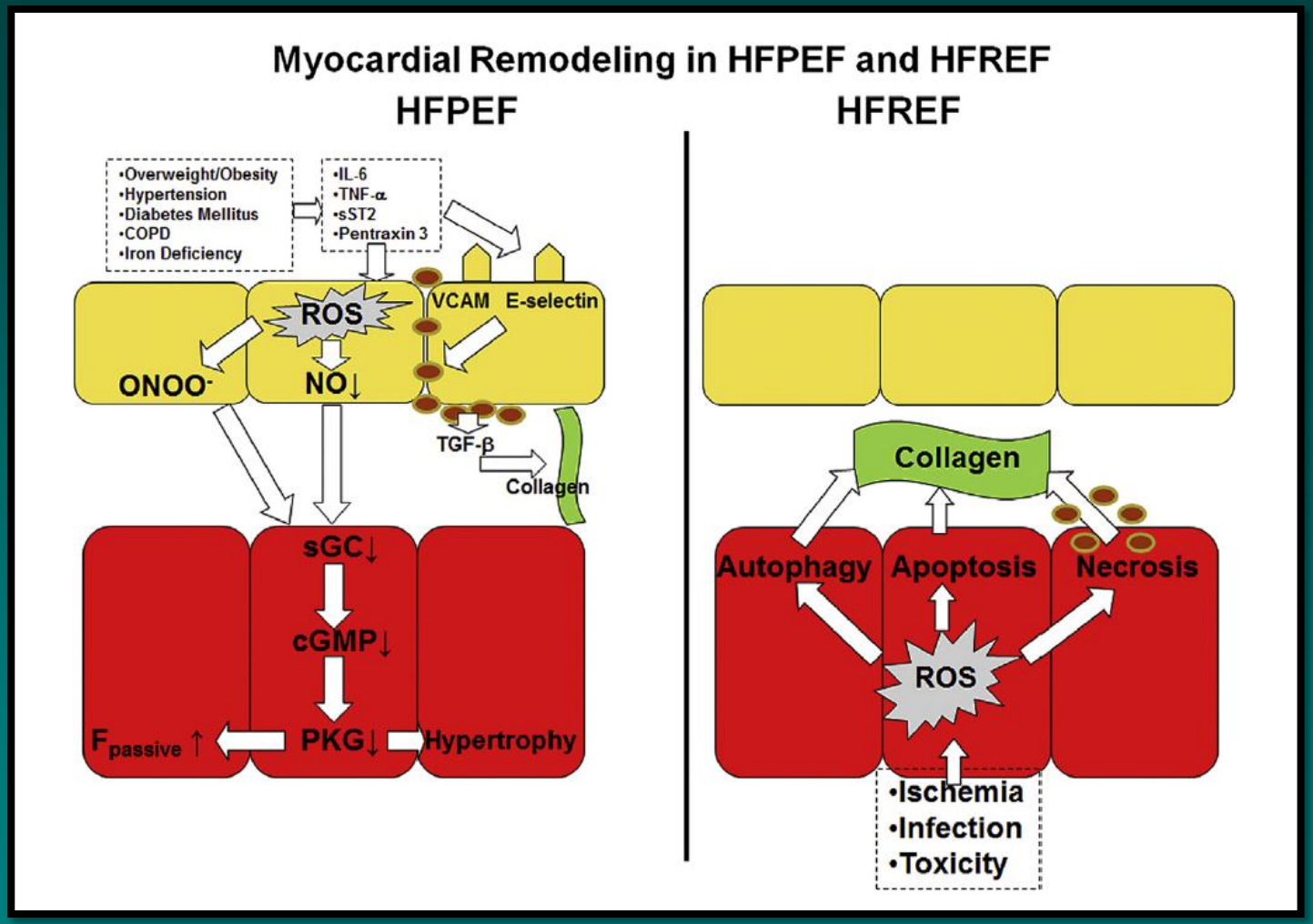
Faiez Zannad et al NEJM 2011

TOPCAT

Marc A. Pfeffer et al NEJM 2014

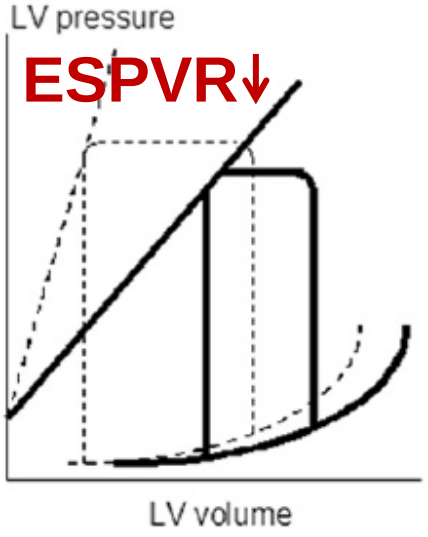
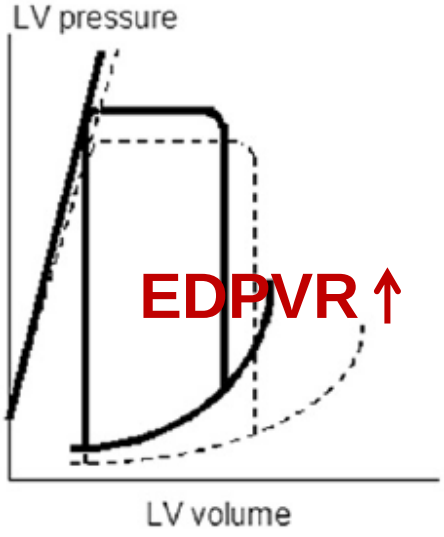
What makes it so different?

Different myocardial remodeling

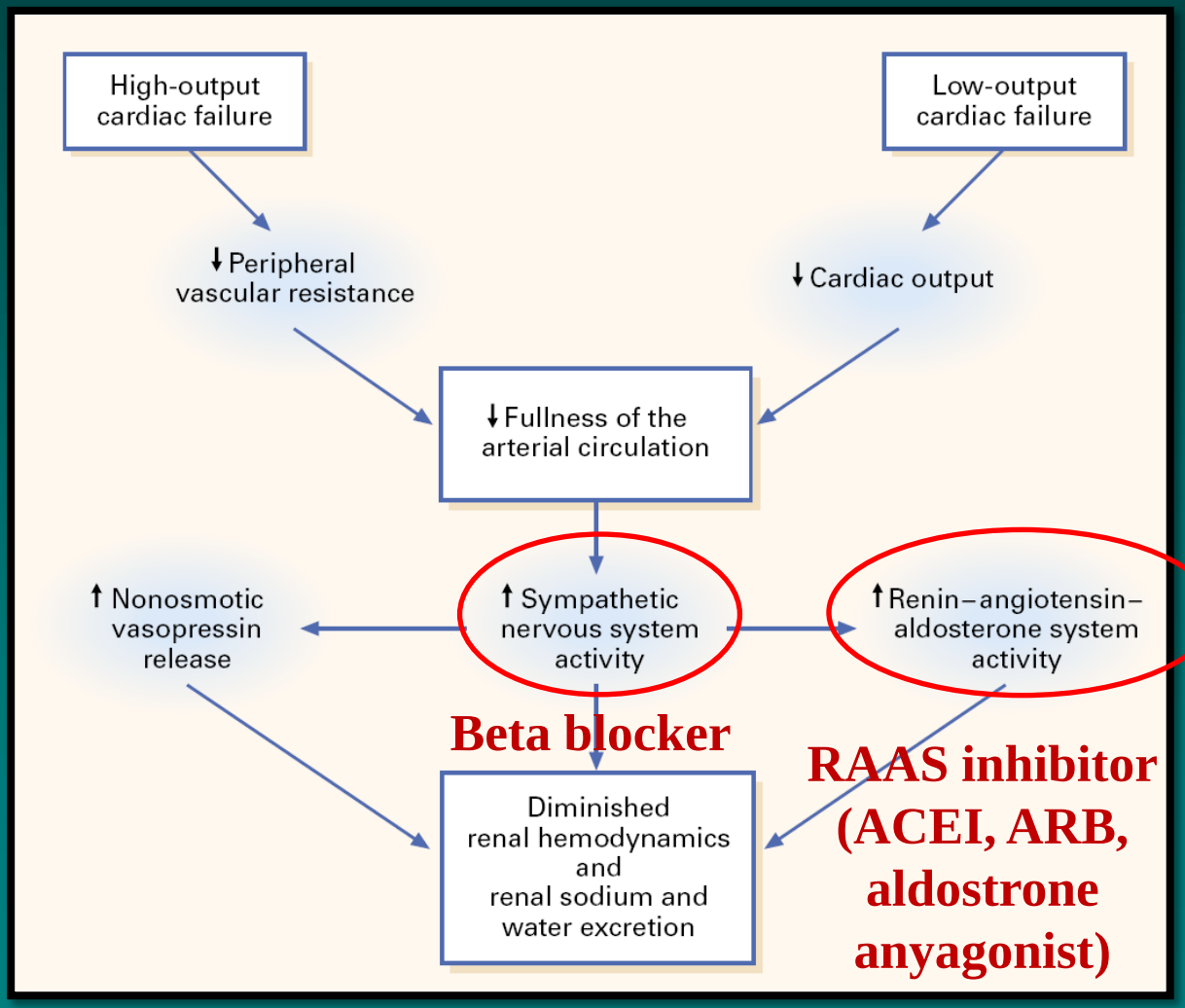


Walter J. Paulus et al JACC 2013

Different hemodynamic features

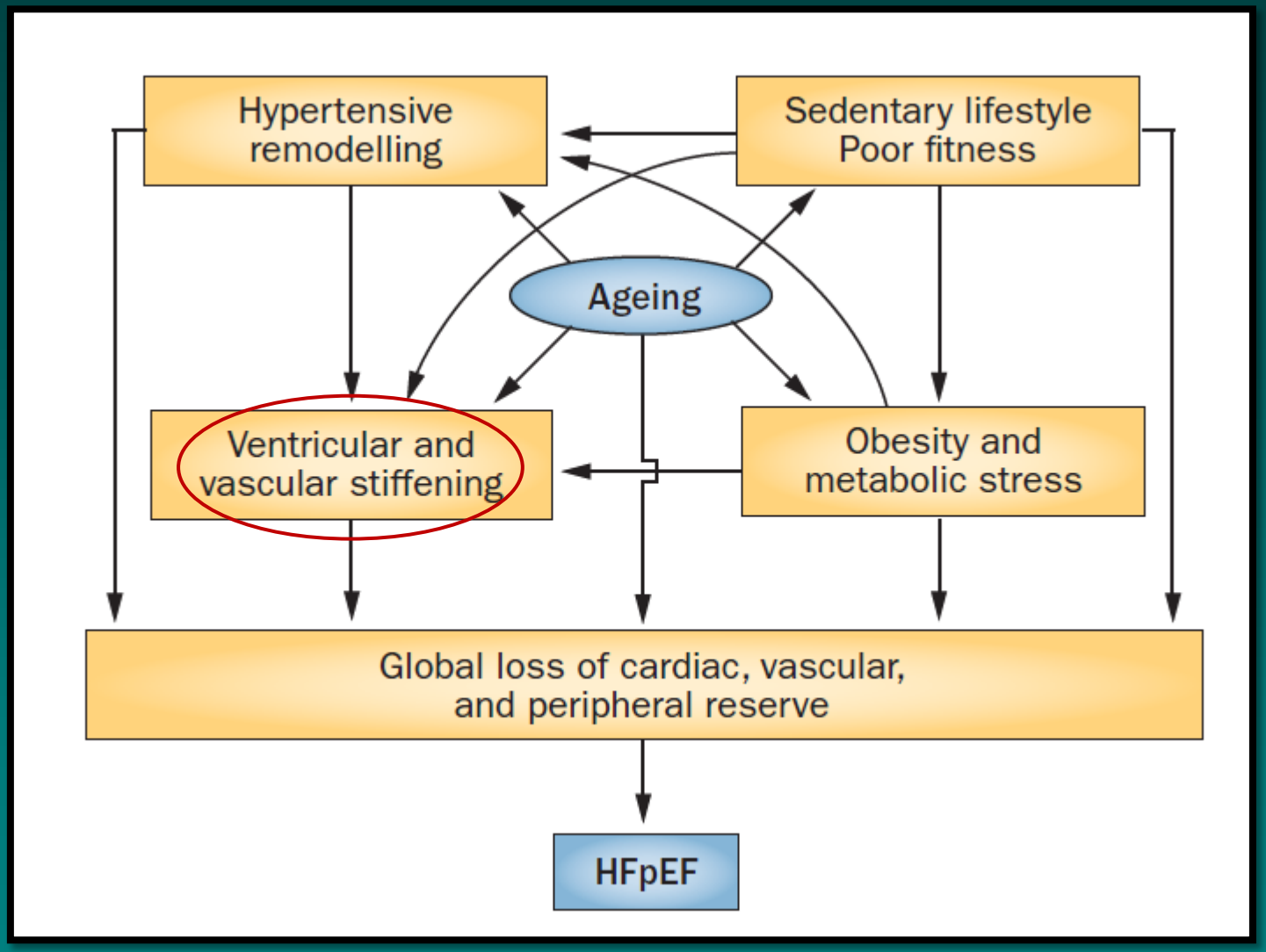
	HF with impaired LVEF	HFNEF
LV morphology		
Pressure-volume loop		
LVEDV	↑	normal
LV mass	eccentric LV hypertrophy	concentric LV hypertrophy or concentric LV remodeling
Left atrium	dilated	dilated
LVEF	↓	normal

Decreased CO ↓
Evident neurohormonal activation in HFrEF



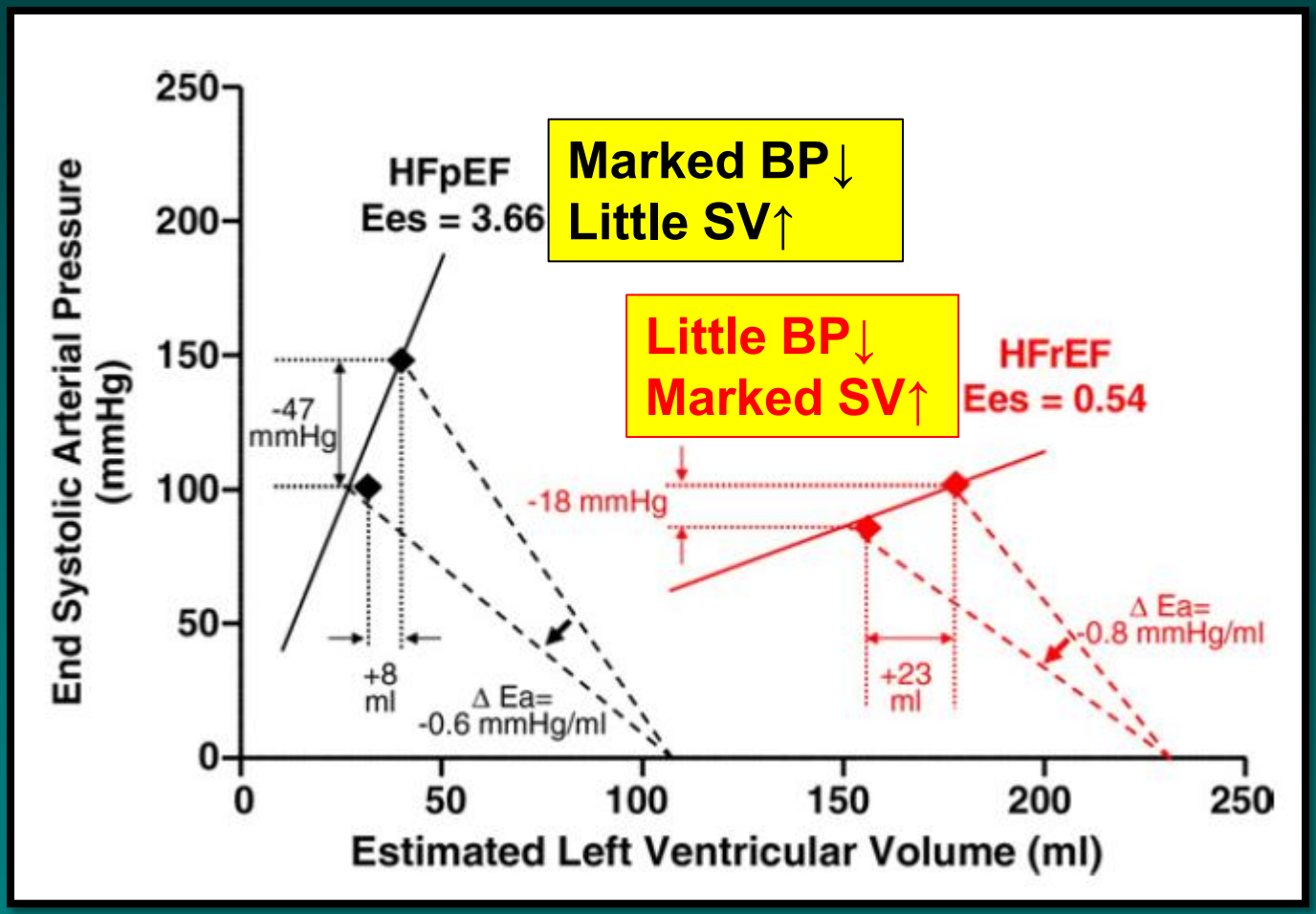
N Engl J Med. 1999;341:577-850

Preserved CO and not so evident neurohormonal activation in HFpEF



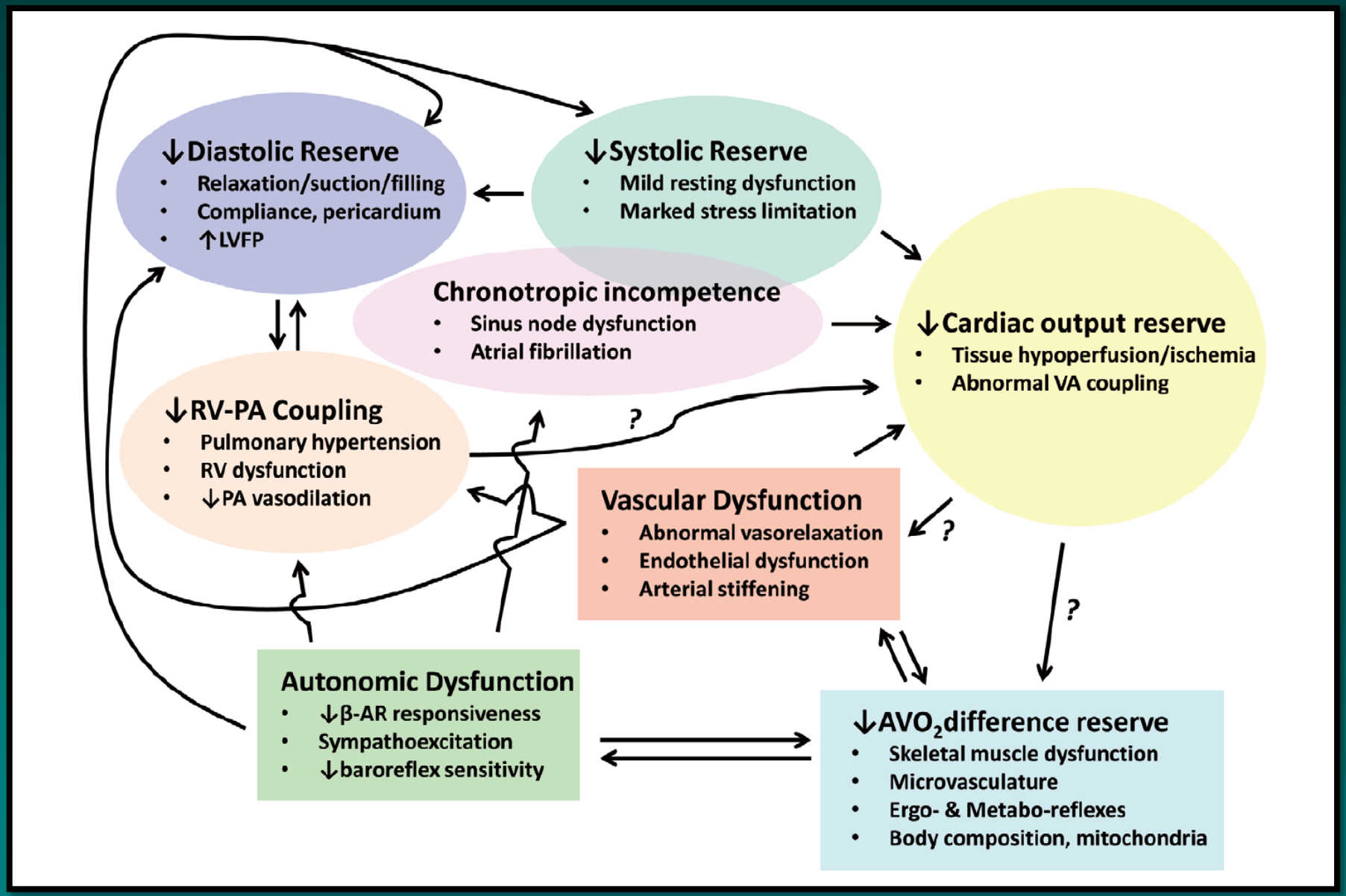
Borlaug Nat Rev Cardiol 2014

Different hemodynamic response to nitroprusside



Borlaug et al JACC 2012

Heterogeneous group of disease



Borlaug Circ J 2014

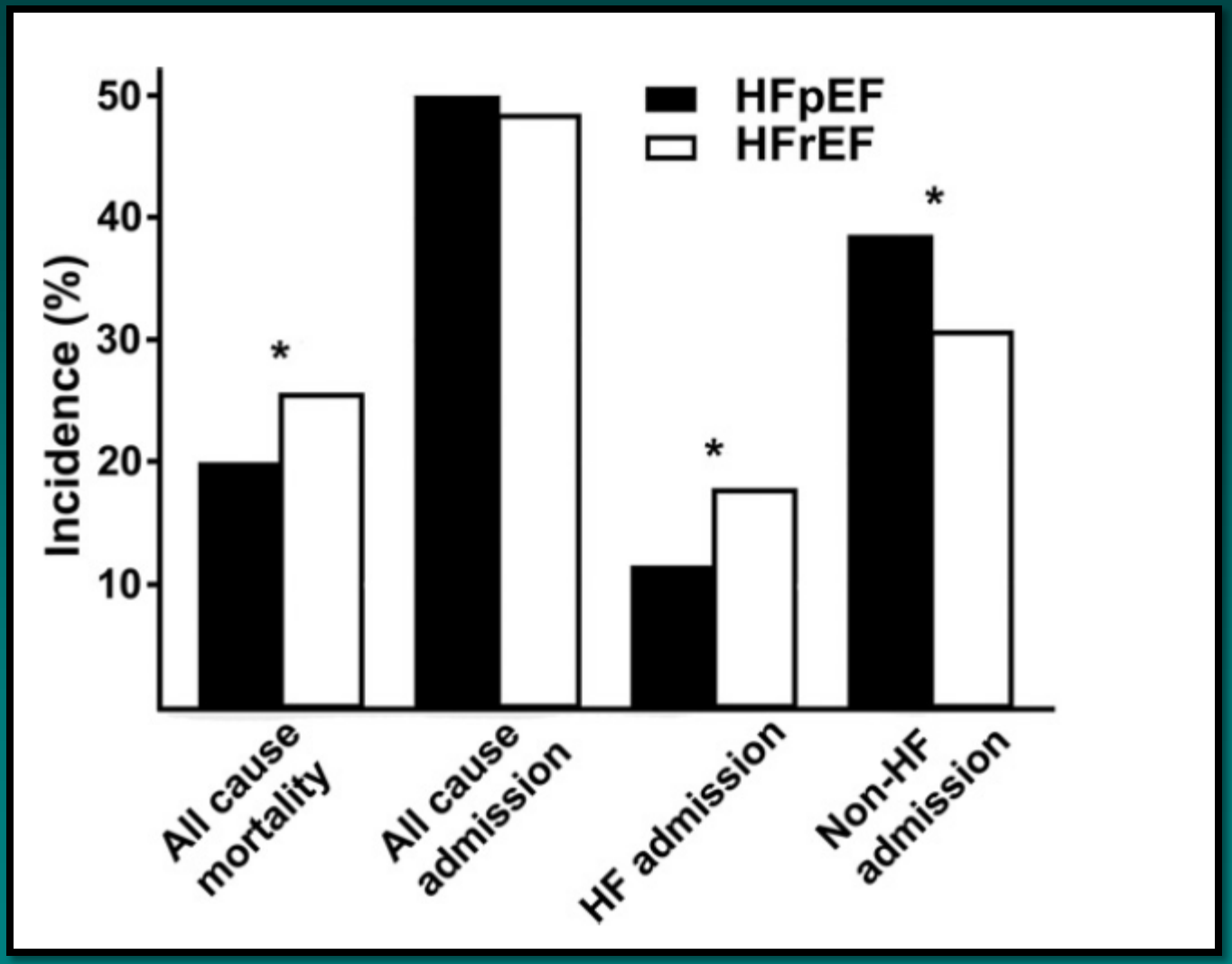
Many comorbidities in HFpEF

- Hypertension (55-77%)
- Obesity (BMI > 30 kg/m^2 , 40-51%)
- Chronic kidney disease (23-26%)
- COPD (33%)
- Anemia (33%)
- AF (32-41%)
- DM (32-45%)
- coronary artery disease (36%-53%)

N Engl J Med 2006;355:251-9

Sameer Atheret al JACC 2012

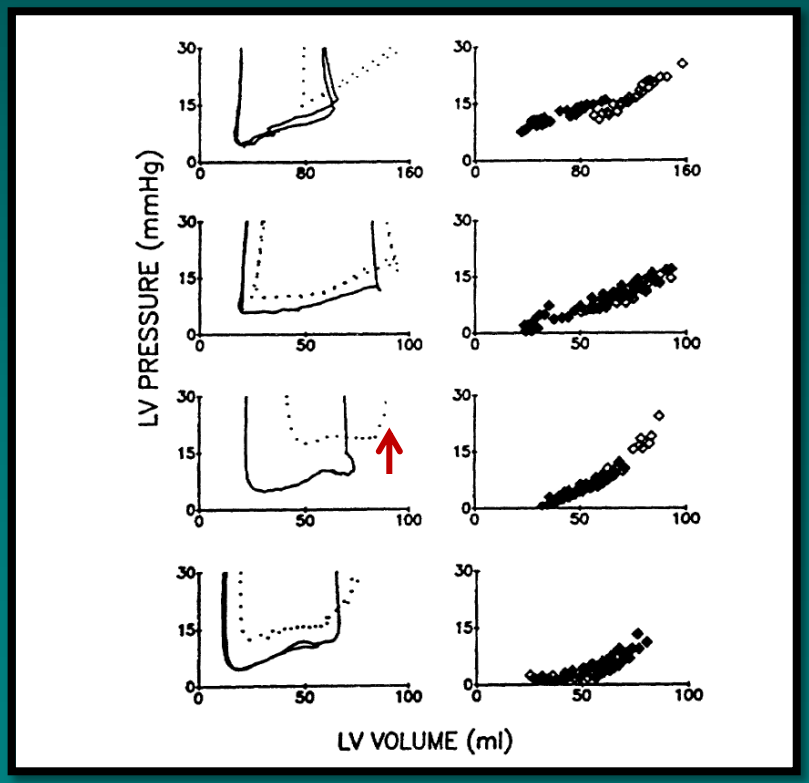
Treat now HFpEF by treating comorbodities!



Ather et al JACC 2013

How about CAD as key comorbidity?

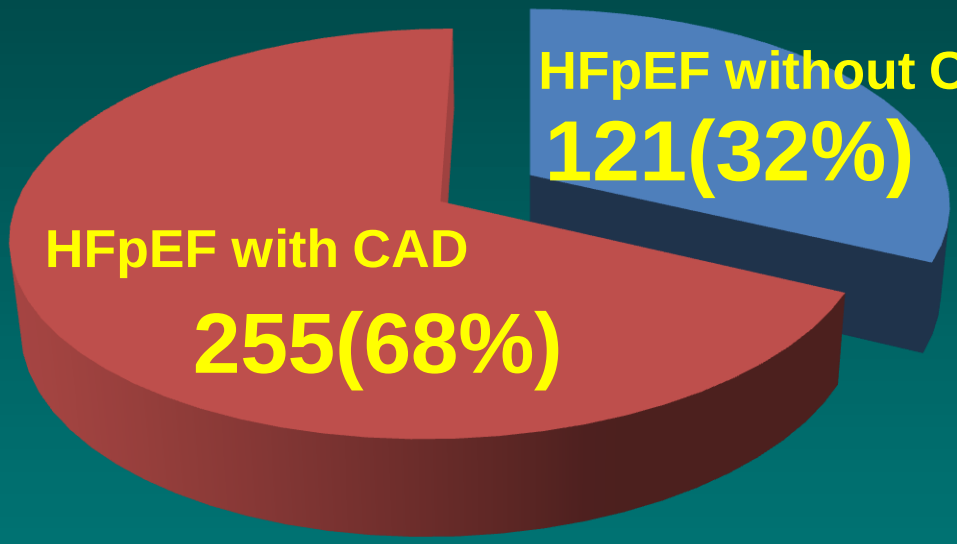
Known to cause diastolic dysfunction
Have common risk factors with HFpEF (aging, hypertension, DM etc)
Reversible and treatable



Influence of coronary occlusion on diastolic function

(KASS et al Circ 1990)

CAD is common in HFpEF patients

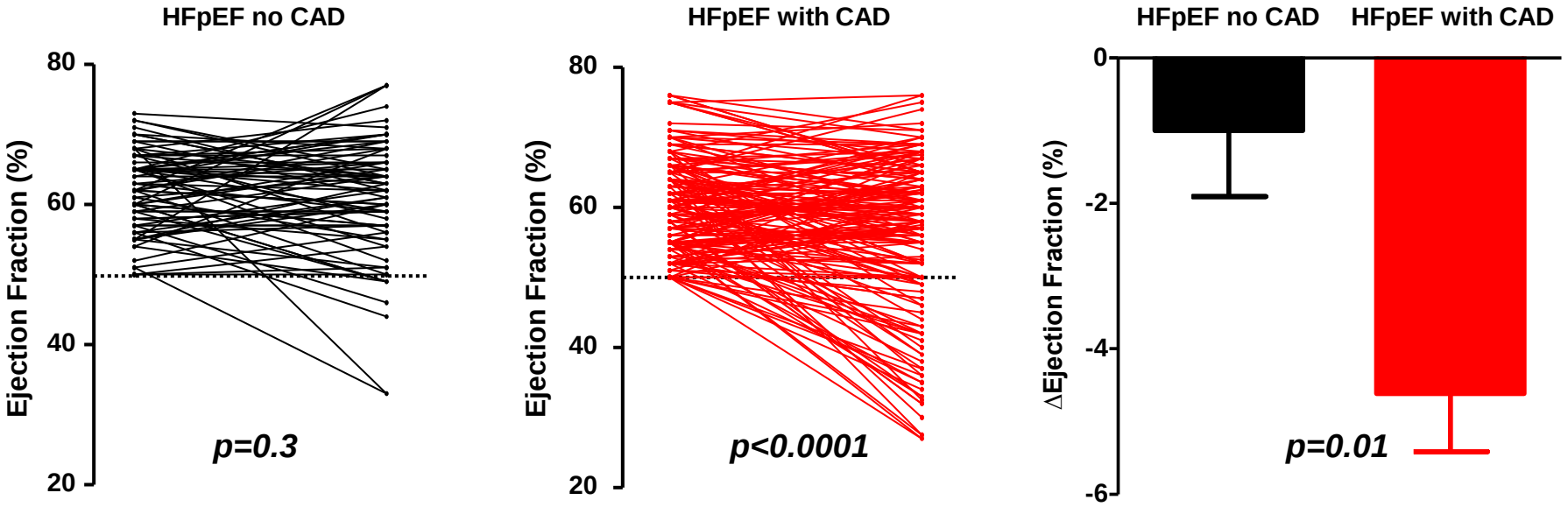


Coronary artery stenosis > 50% by CAG

Seok-Jae Hwang, Barry Borlaug JACC 2014

Impact of CAD on EF change in HFpEF

median follow-up of 1,314 days (IQR: 655 to 1,947 days)



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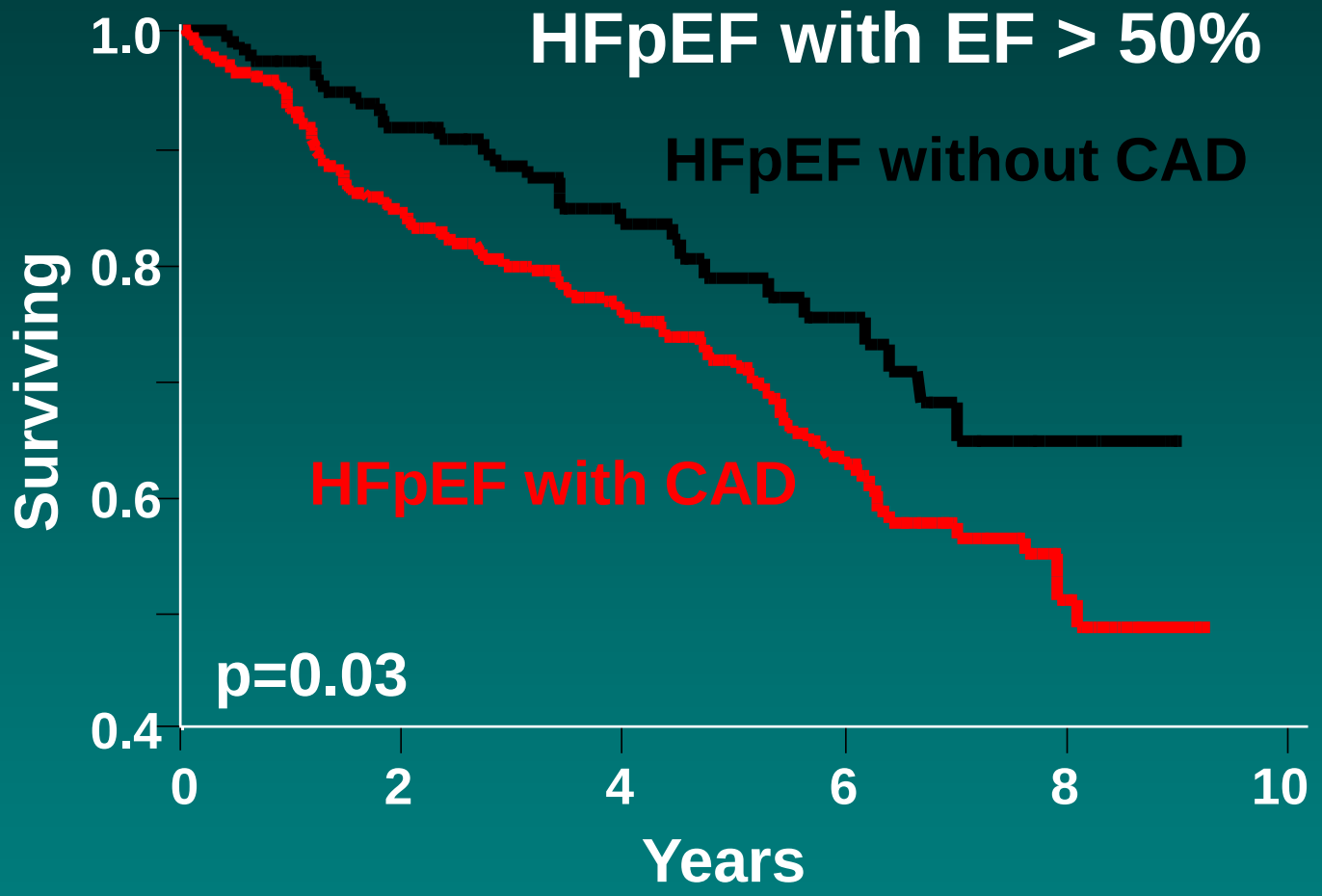
Impact of CAD on mortality in HFpEF pts



Number remaining					
CAD (-)	121	90	60	34	14
CAD (+)	255	193	129	83	23

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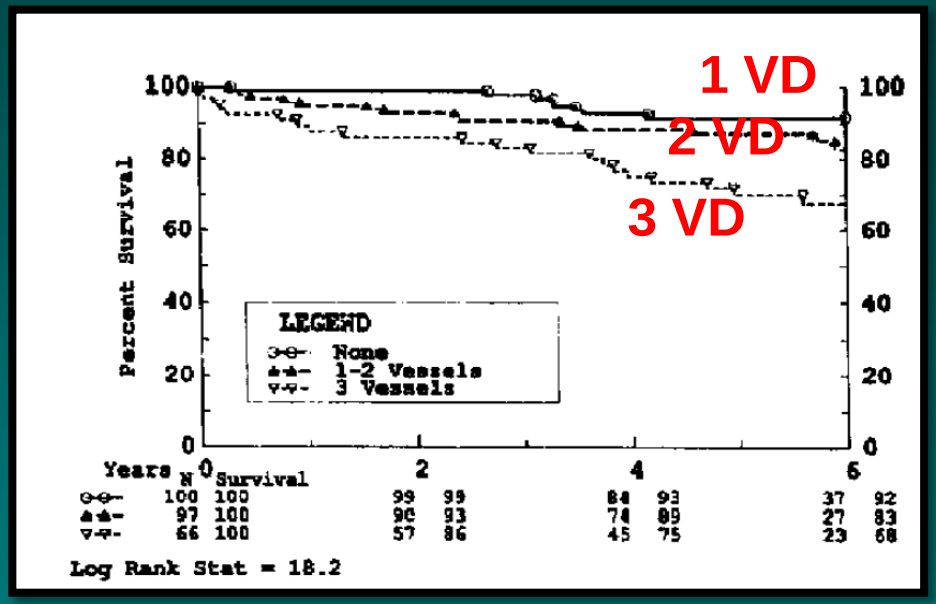
Impact of CAD severity on mortality

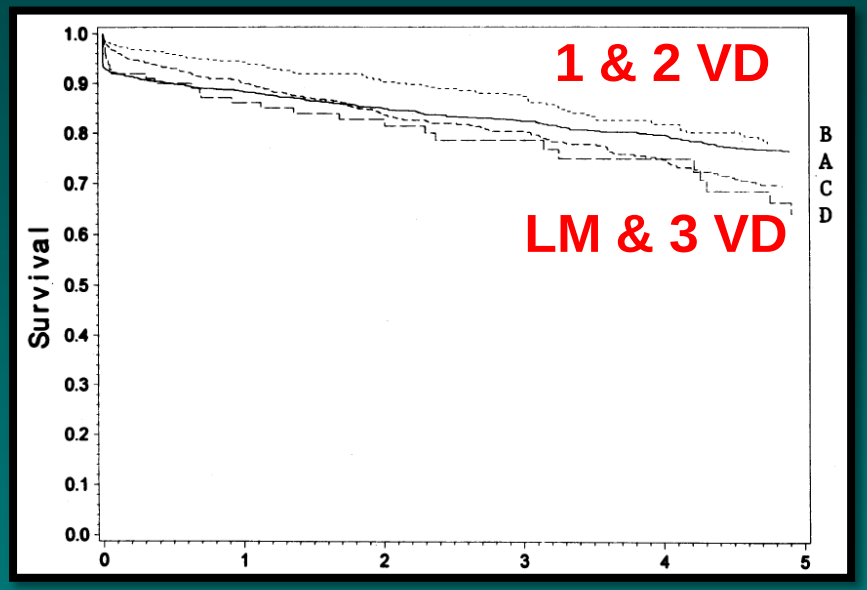
284 CABG pts, EF > 45%



CASS registry

(Kevin et al JACC 1991)

2498 pts with CAG, EF > 40%



Duke data bank

(Christopher et al AJC 2000)

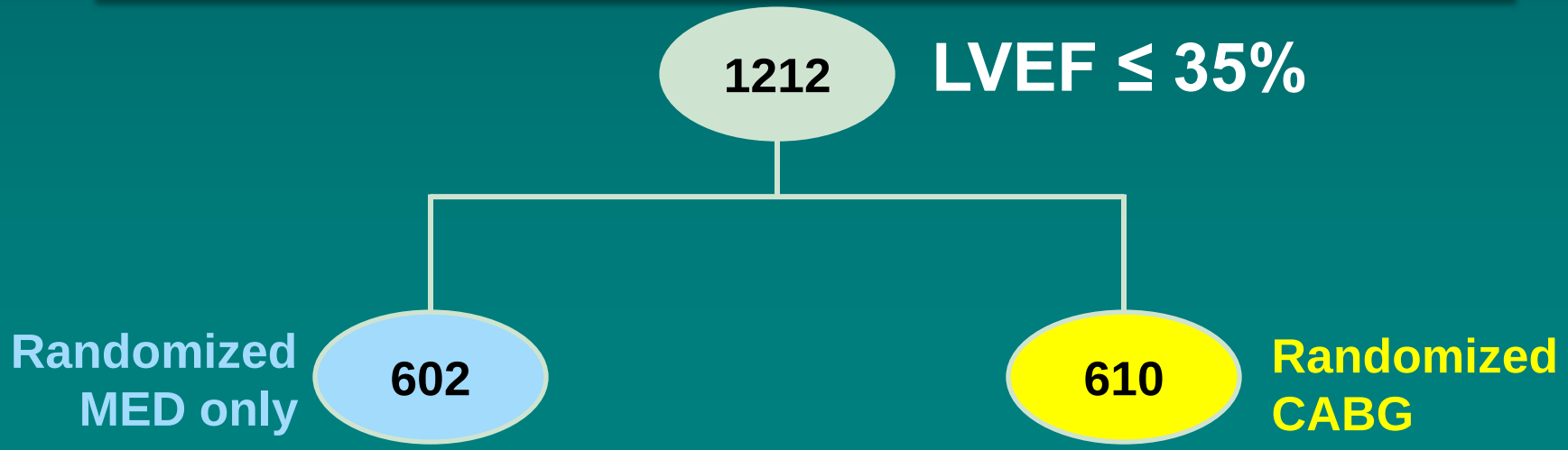
What would be the impact of coronary revascularization on outcomes in patients with HFpEF?

Impact of coronary revascularization on outcomes in patients with HFrEF

The NEW ENGLAND JOURNAL of MEDICINE

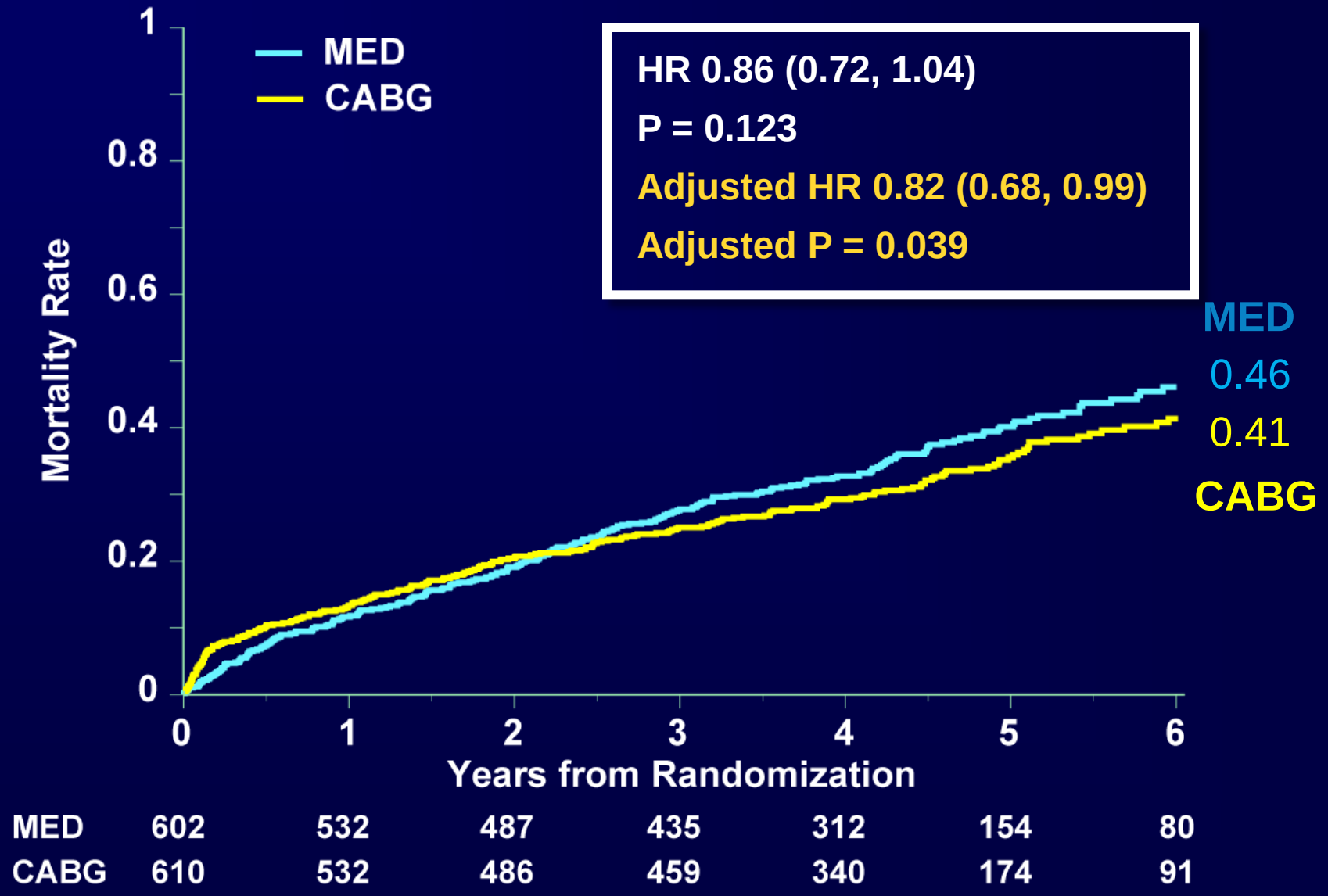
ORIGINAL ARTICLE

Coronary-Artery Bypass Surgery in Patients with Left Ventricular Dysfunction



Eric et al NEJM 2011

All-Cause Mortality — As Randomized



Impact of coronary revascularization on outcomes in patients with HFpEF

Short term impact of RVR on outcomes of HFpEF pts

OPTIMIZE HF registry

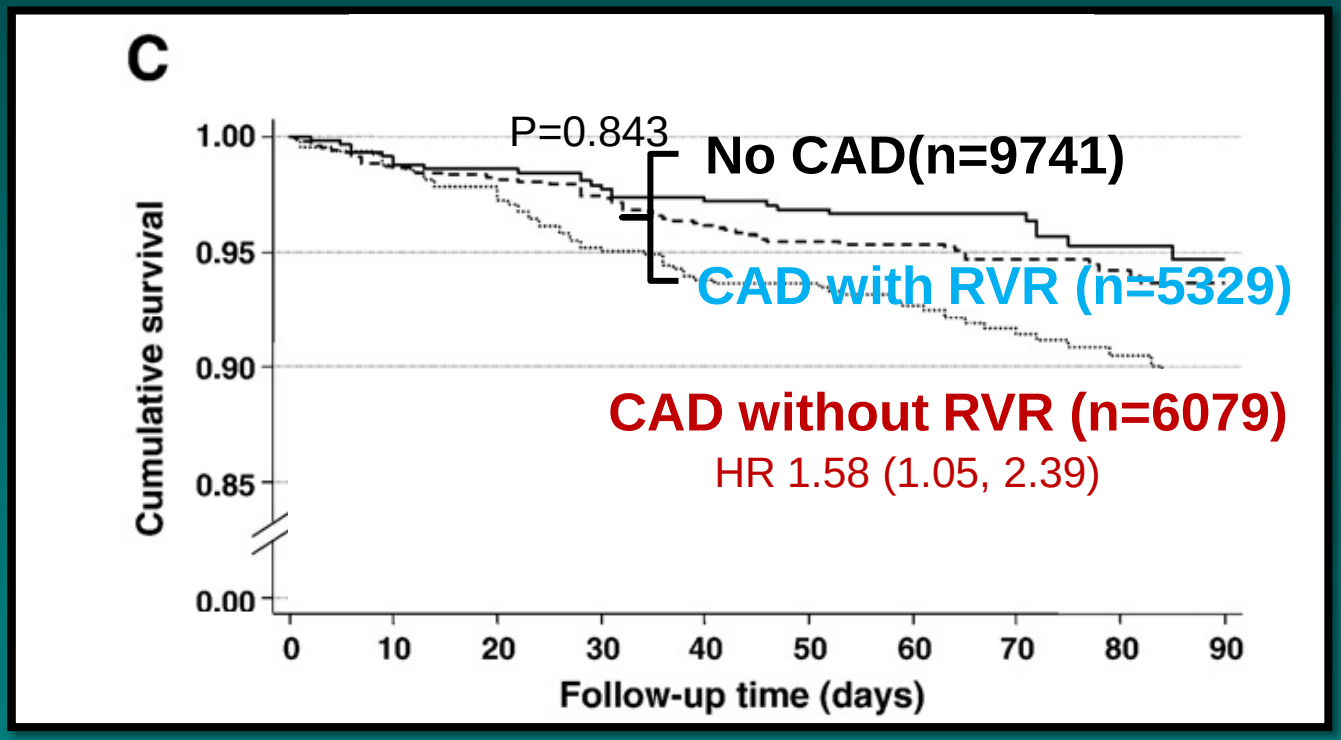
New-onset or worsening preexisting HF
48,612 consecutive patients
from 259 U.S. hospitals

Preserved EF > 40%
CAD identified by history
No lesion & procedural characteristics
Most RVR was before index HF admission
90 days FU in prespecified subgroup (10%)

J.S. Rossi et al European Journal of HF 2008

Short term impact of RVR on outcomes of HFpEF pts

OPTIMIZE HF registry



J.S. Rossi et al European Journal of HF 2008

Long term impact of RVR on outcomes of HFpEF pts

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Heart Failure

Implications of Coronary Artery Disease in Heart Failure With Preserved Ejection Fraction

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Rochester, Minnesota; Jinju, Republic of Korea; and Prague, Czech Republic

Retrospective study from Jan 2004 to Dec 2012
In Mayo clinic with primary Diagnosis of HF
With echocardiography and CAG

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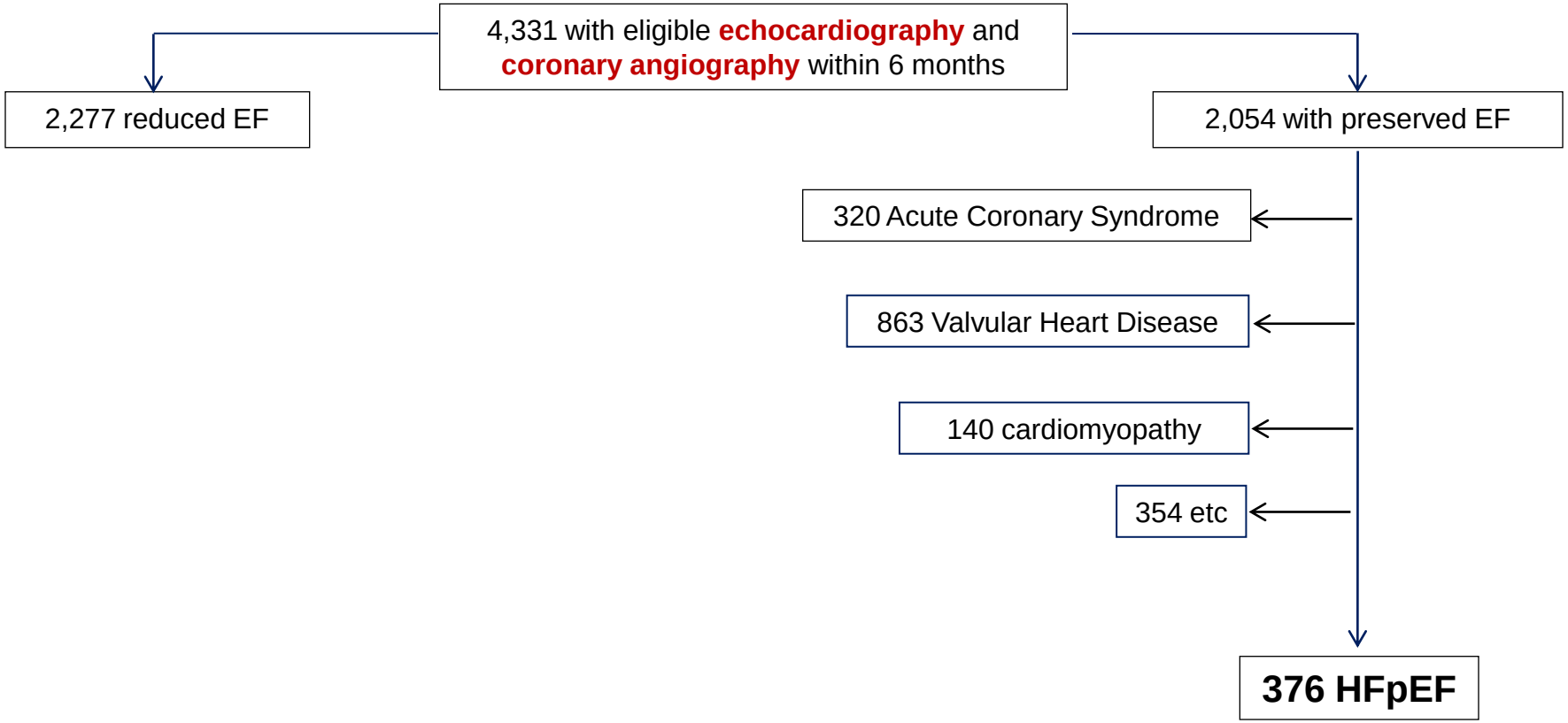
Rigorous phenotyping of HFpEF



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Patients grouping

376 HFpEF

(CAD > 50% stenosis in > 2mm)

121 (32%)
no CAD

255 (68%)
CAD

(Complete RVR of all >50% stenoses)

153 (60%)
incomplete RVR

102 (40%)
complete RVR

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Lesional characteristics

	Incomplete revascularization (n=153)	Complete revascularization (n=102)	P value
CAD characteristics			
Extent of CAD			0.8
1 vessel disease	41 (27%)	27 (31%)	
2 vessel disease	57 (37%)	28 (32%)	
3 vessel disease	55 (36%)	32(37%)	
multivessel disease	112 (73%)	60 (69%)	0.6
average number of vessel disease	2.1±0.8	2.1±0.8	0.8
Syntax score	18±13	21±15	0.2
Syntax grade			0.24
Score < 22	100 (65%)	52 (60%)	
Score 22-32	31 (20%)	14 (16%)	
Score > 32	22 (14%)	21 (24%)	
Disease territory			
LM disease	20 (13%)	19 (22%)	0.1
LAD disease	100 (65%)	62 (71%)	0.4
Diagonal disease	46 (30%)	30 (35%)	0.8
LCX disease	100 (65%)	52 (60%)	0.4
RCA disease	104 (68%)	52 (60%)	0.2

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RVR characteristics

	Incomplete revascularization (n=153)	Complete revascularization (n=102)	P value
Method of revascularization			0.9
PCI	66 (64%)	64 (63%)	
CABG	37 (36%)	38 (37%)	
Numbers of vessel revascularized			0.42
1 vessel revascularized	46 (47%)	44 (43%)	
2 vessel revascularized	29 (29%)	28 (27%)	
3 vessel revascularized	17 (17%)	23 (22%)	
4 vessel revascularized	7 (7%)	7 (7%)	
multivessel revascularized	53 (54%)	58 (57%)	0.7
average number of vessel revascularized	1.8±1.0	1.9±1.0	0.5
Revascularized vessel			
LM	2 (2%)	4 (4%)	0.7
LAD	57 (58%)	62 (61%)	0.7
Diagonal branch	20 (20)	22 (22%)	0.9
LCX	53 (54%)	56 (55%)	0.9
RCA	51 (52%)	53 (52%)	1.0

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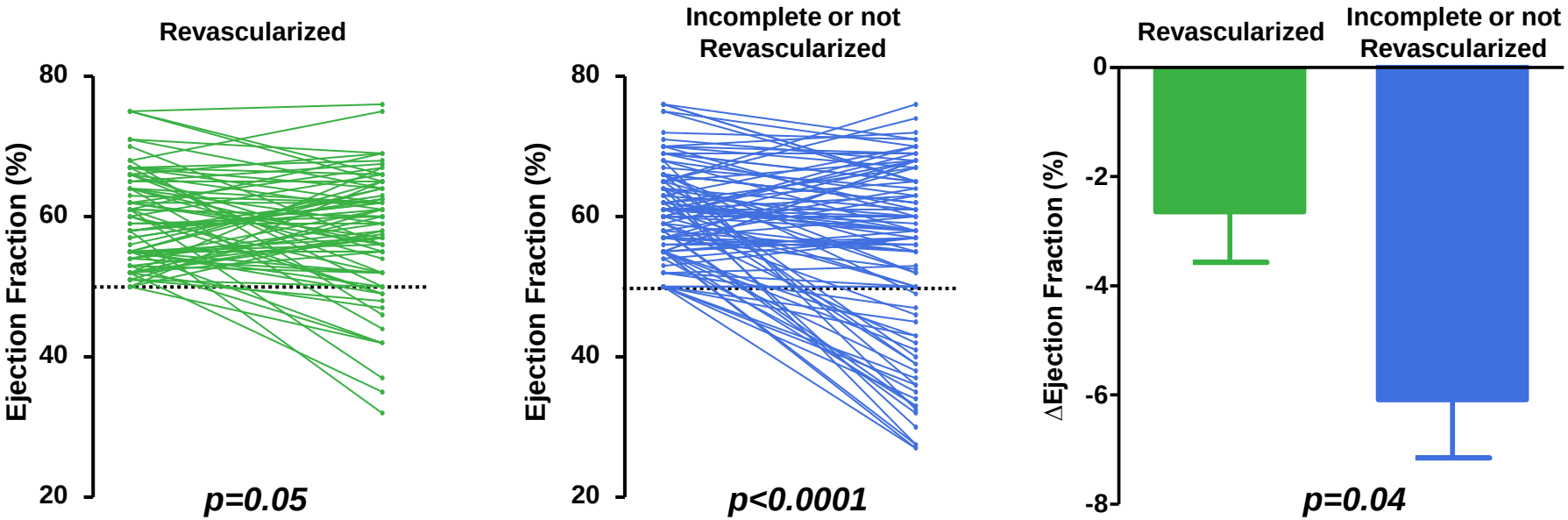
Impact of RVR on EF change in HFpEF

median follow-up of 1,219 days (IQR: 651 to 1,898 days)



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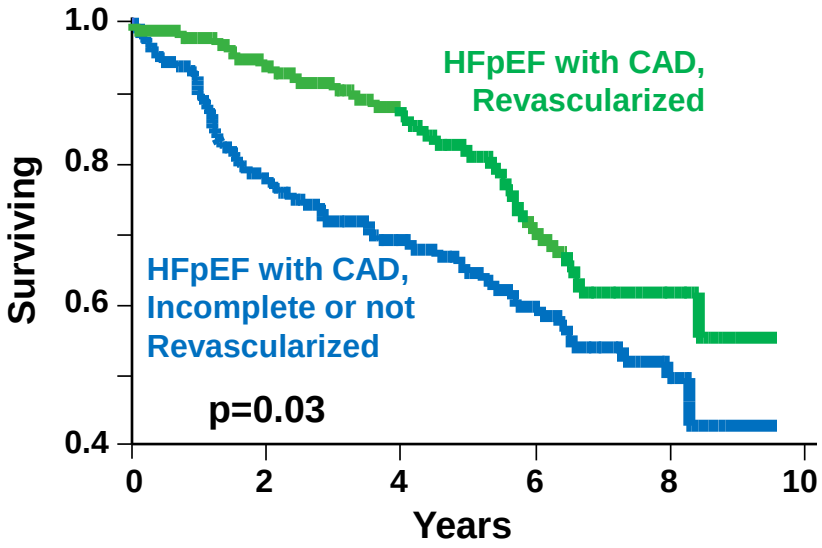
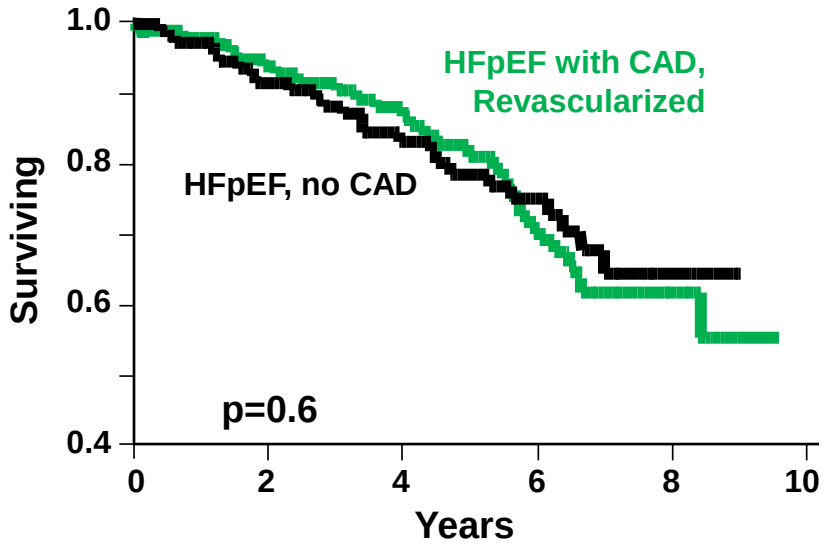
Impact of Revascularization on Survival in HFpEF pts With CAD

median follow-up of 1,478 days (IQR: 708 to 2,371 days)



Number remaining

Revasc (+)	101	85	63	37	11
Revasc (-)	154	108	68	47	13



Number remaining

Revasc (+)	101	85	63	37	11
CAD (-)	121	90	60	34	14

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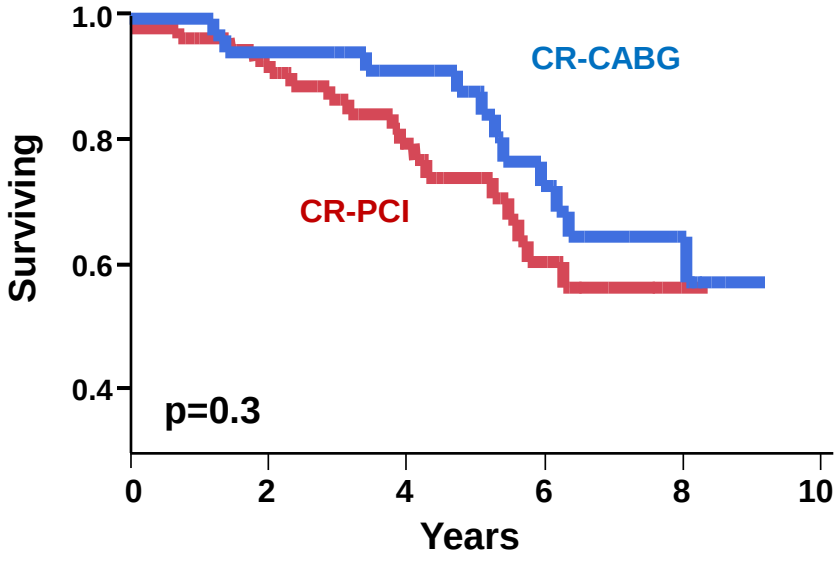
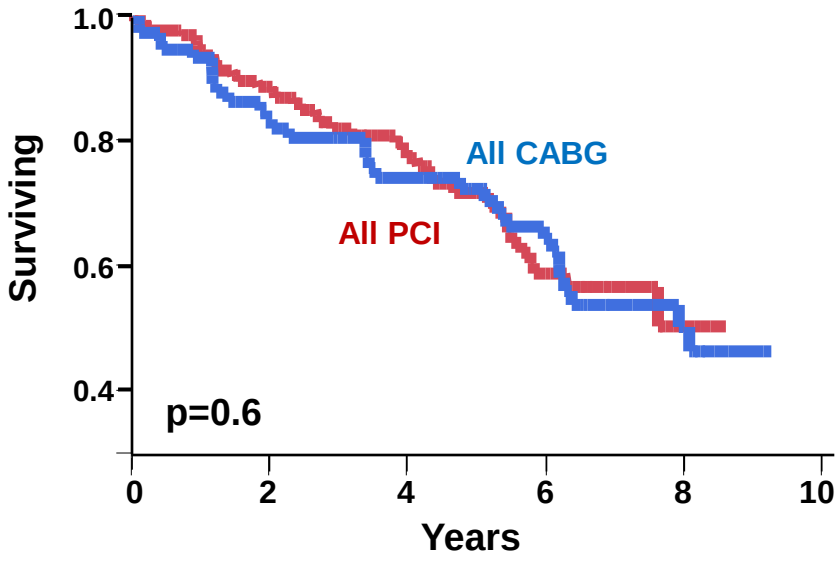
Modality of Revascularization dose not affect outcomes differently in HFpEF pts with CAD



Number remaining					
CABG	38	36	31	20	10
PCI	64	50	33	18	2



Number remaining					
CABG	75	59	46	33	14
PCI	130	101	62	34	5

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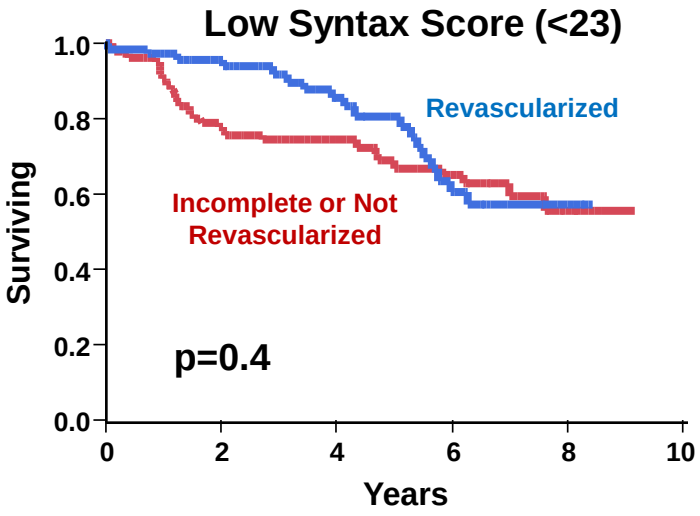
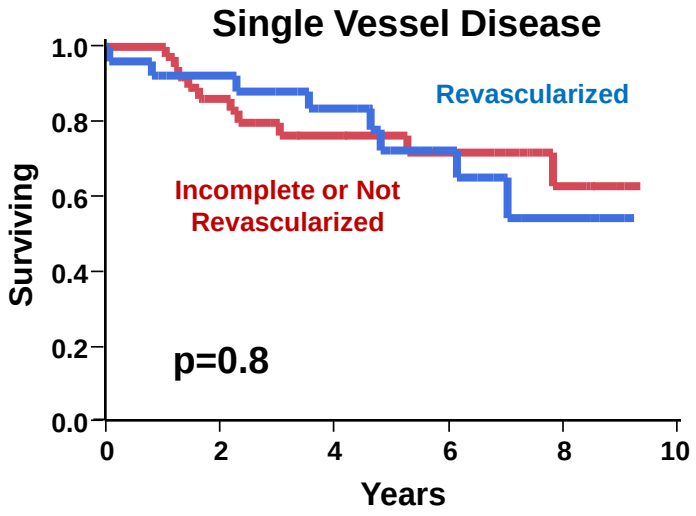


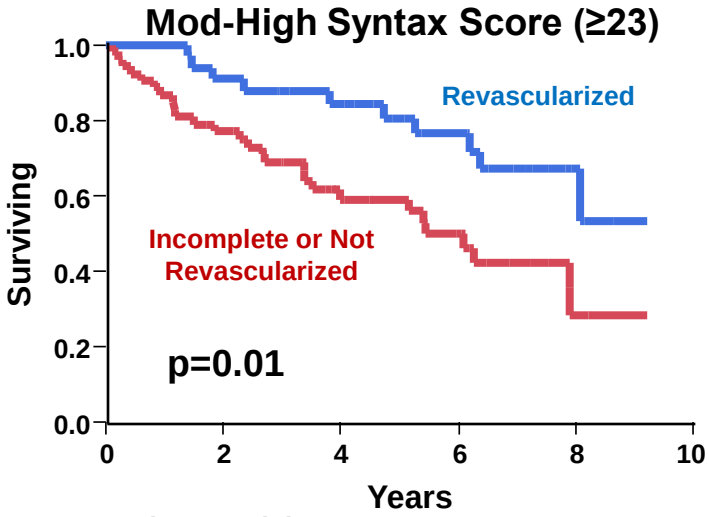
Number remaining

Revasc (+)	67	55	38	20	6
Revasc (-)	101	69	45	32	9



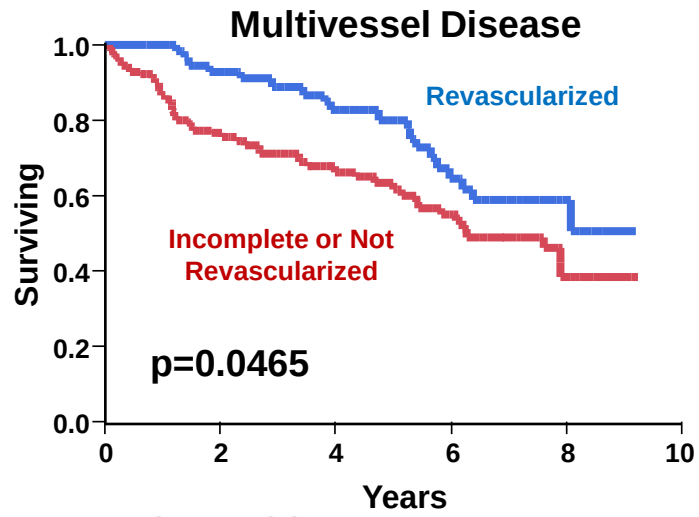
Number remaining

Revasc (+)	26	23	17	9	3
Revasc (-)	37	27	18	16	3



Number remaining

Revasc (+)	34	31	26	18	6
Revasc (-)	53	40	23	16	6



Number remaining

Revasc (+)	59	53	41	25	8
Revasc (-)	116	81	50	31	11

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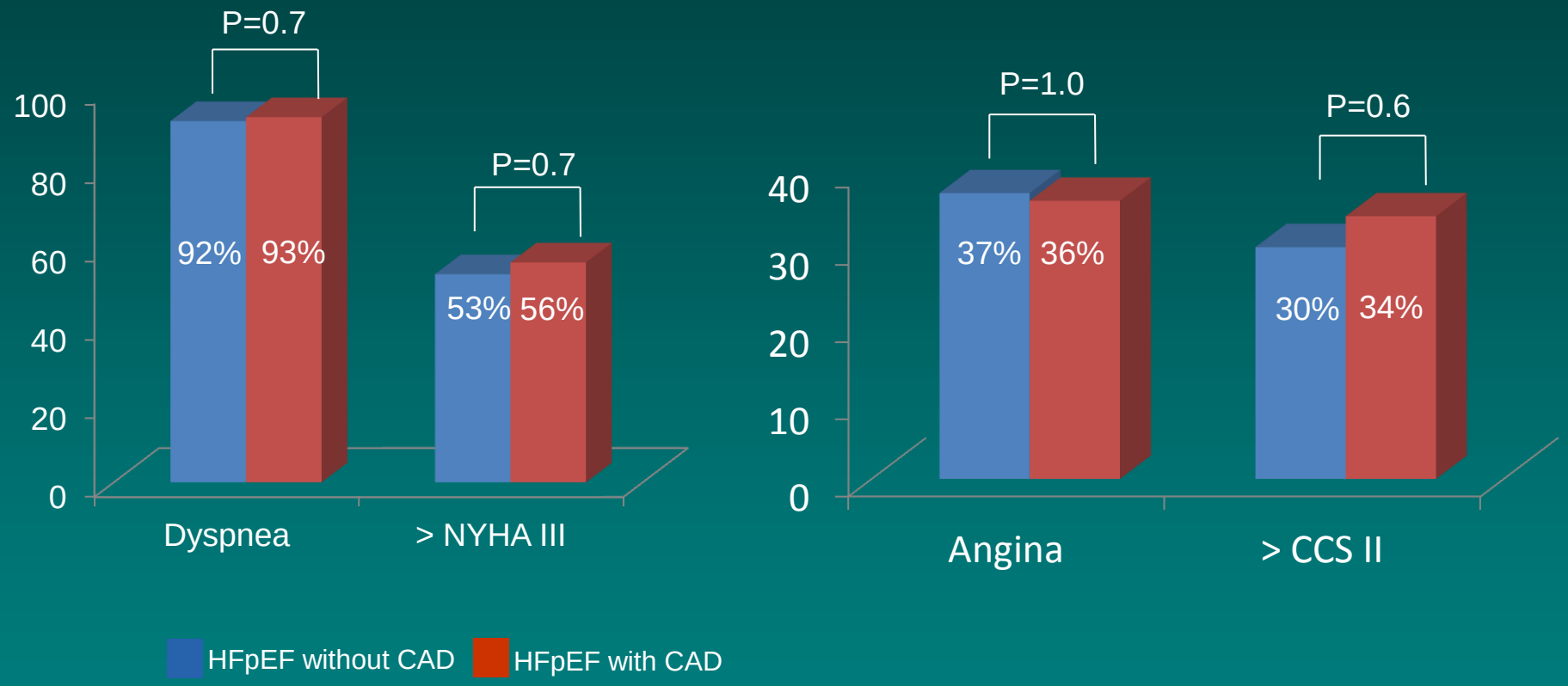
When and how can we evaluate CAD in HFpEF pts?

CLASS IIa

1. Coronary **revascularization** is reasonable in patients with HF and normal LVEF and coronary artery disease in whom **symptomatic or demonstrable myocardial ischemia** is judged to be having an adverse effect on cardiac function. (*Level of Evidence: C)*

From 2009 Focused Update for the Diagnosis & Management of HF

Chest pain and dyspnea dose not discriminate HFpEF from CAD



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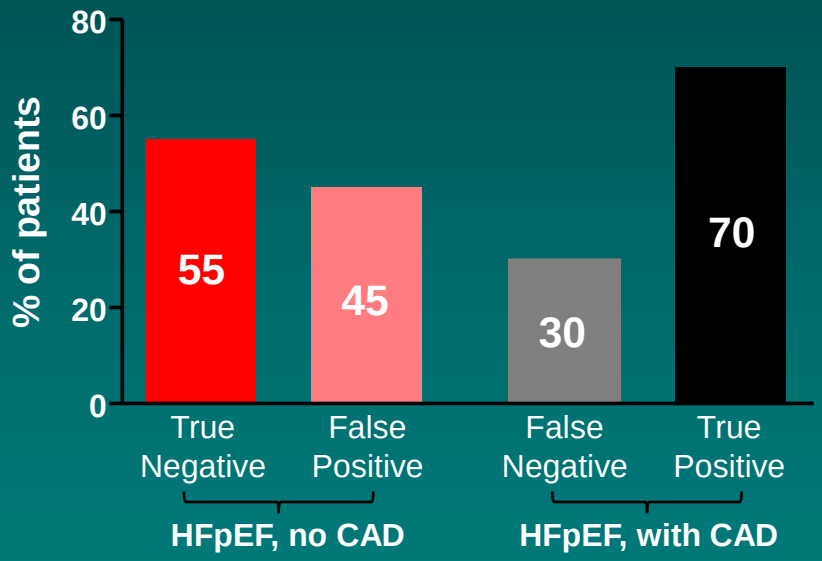
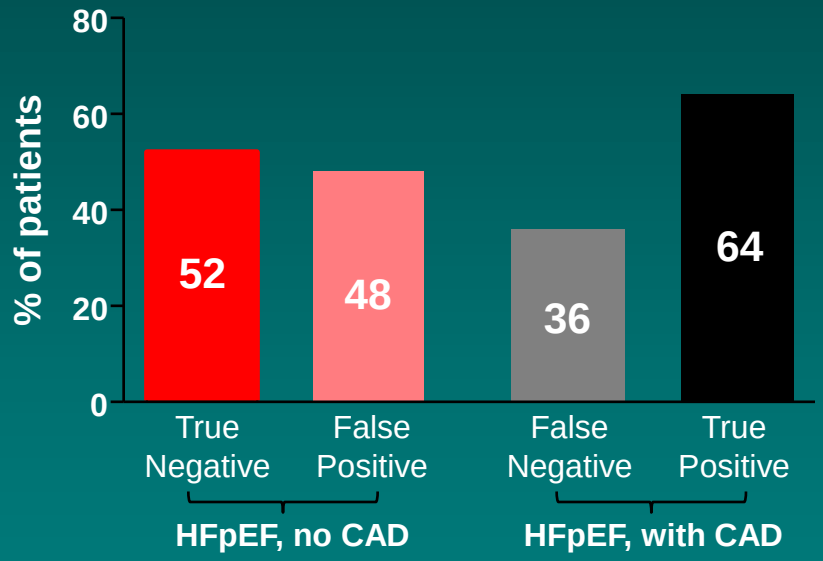
Stress tests poorly classify CAD

All Patients



Patients with angina



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Summary

1. CAD is common in HFpEF and is associated with worsening of EF and increased mortality in HFpEF patients.

2. Coronary revascularization was associated with improved outcomes of HFpEF patients with CAD, especially with more severe CAD burden.

3. CAD in HFpEF is hard to find out but should be thoroughly searched for.

4. CAD qualifies as key morbidity in HFpEF

Conclusion

Given the rarity of effective treatments for HFpEF, prospective trials are urgently needed to determine the optimal evaluation and management of CAD in HFpEF.

Thank You for Your Attention