Kantonsspital St.Gallen

OSA and Cardiovascular Risk

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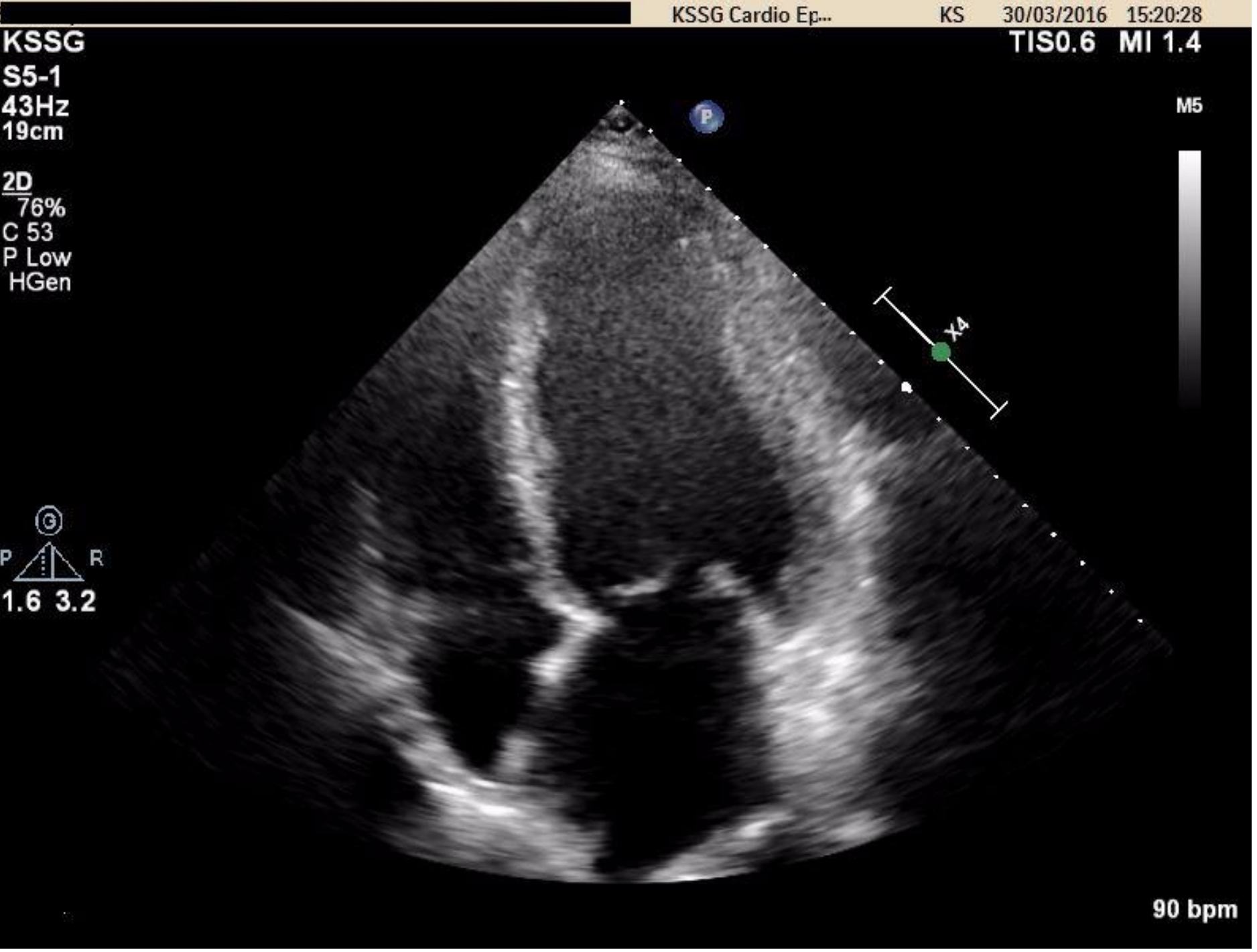
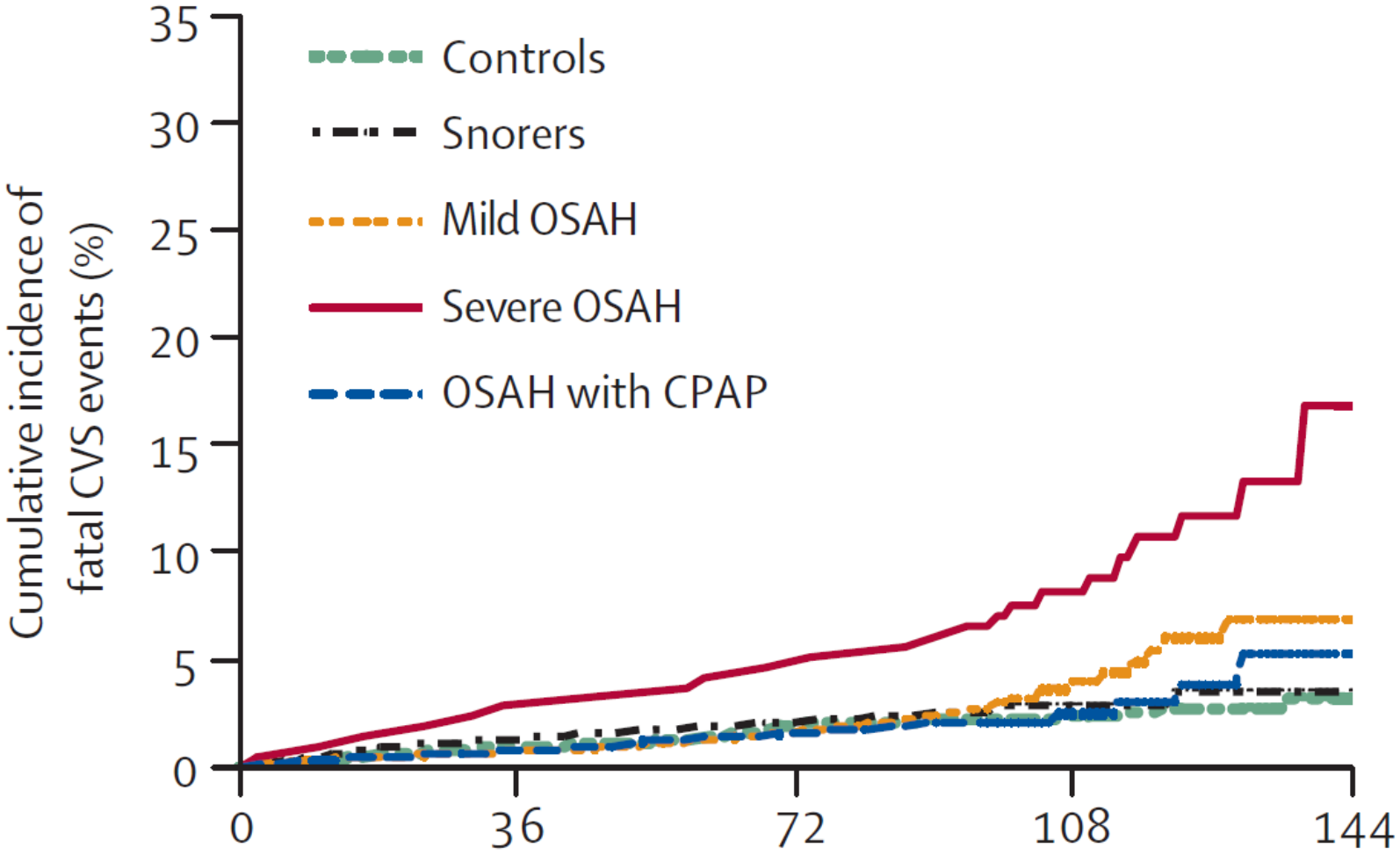

KSSG Cardio Ep...
KS
30/03/2016
15:20:28
KSSG
S5-1
43Hz
19cm
2D
76%
C 53
P Low
HGen
TIS0.6
MI 1.4
M5
X4
P
R
1.6 3.2
90 bpm

Why might OSA be relevant for HF?



Marin et al. Lancet 2005;365:1046-53

OSA and HF: lines of evidence

- Pathophysiological concept
- OSA and CV risk factors
- OSA and cardiac structure/function
- OSA and CAD and AF
- OSA and HFrEF
- Effects of CPAP

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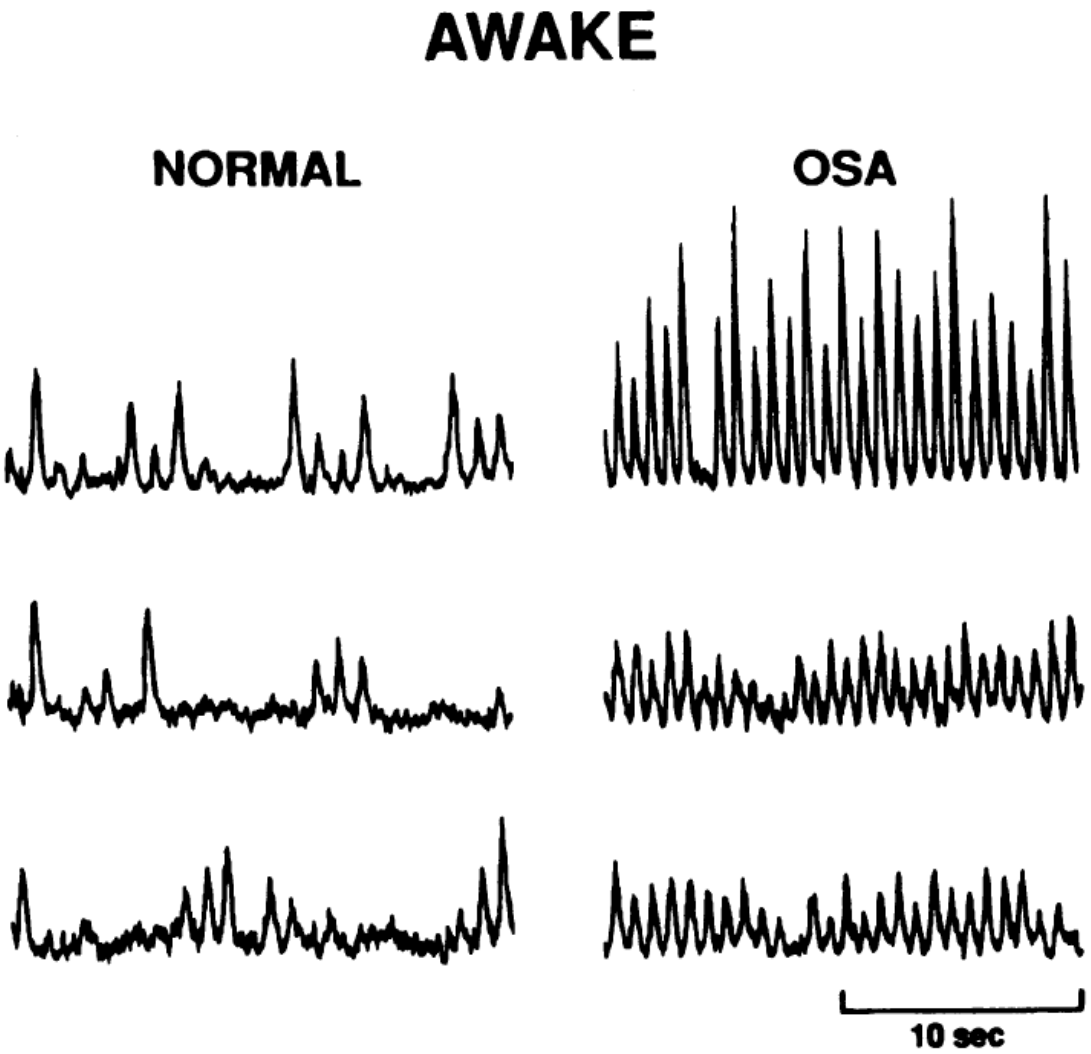
Mechanisms OSA-CV dysfunction

- Cycles of **intermittent hypoxia and arousals**
  - Sympathetic nervous system activity↑
  - Oxidative stress↑
  - Systemic inflammation↑
- Sleep fragmentation, sleep deprivation
- intrathoracic pressure swings

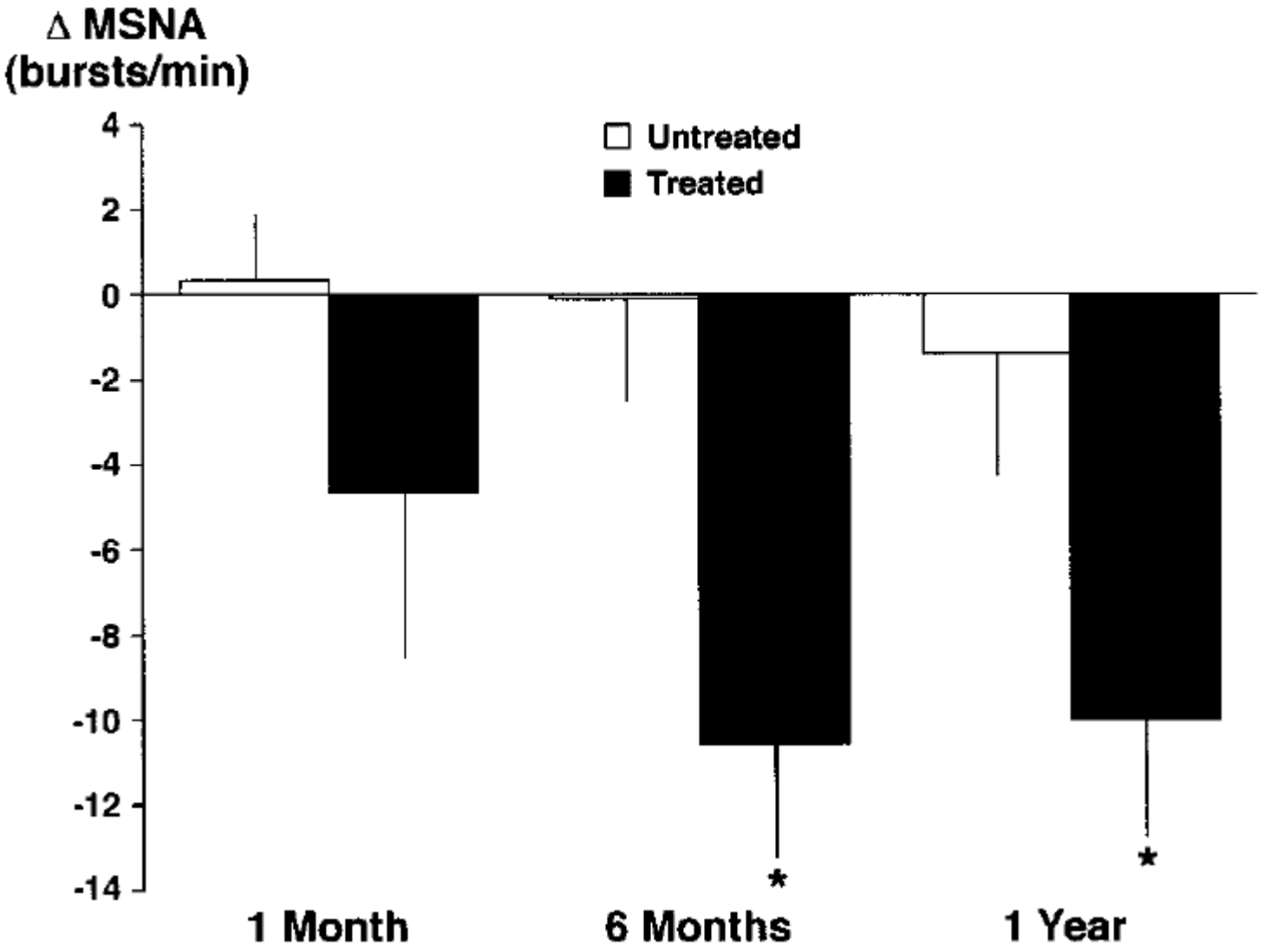
Levy P et al. Eur Respir Rev 2013;22:333-52

Muscle sympathetic nerve acticity in OSA



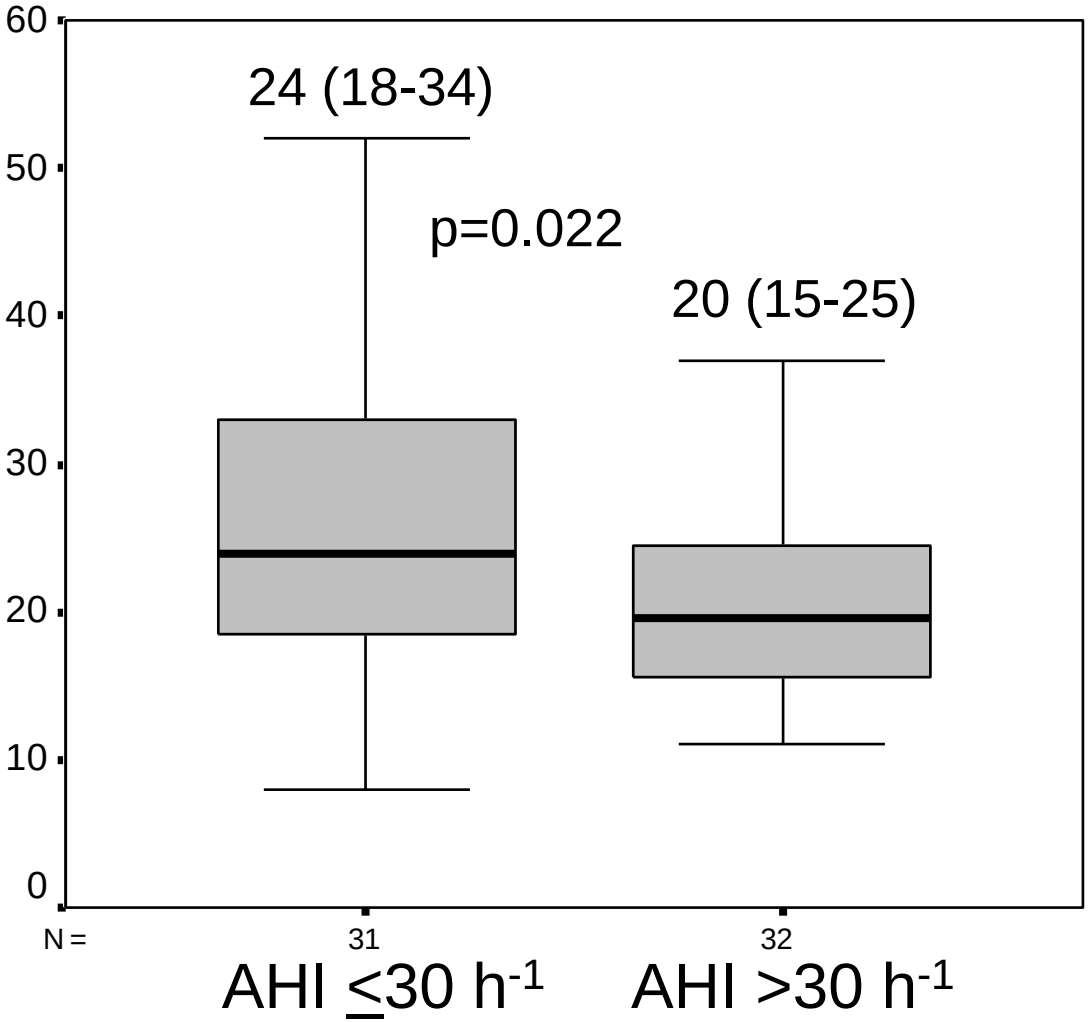
Somers et al. J Clin Invest 1995;96:1897-1904

Effect of CPAP on MSNA



Narkiewicz et al. Circulation 1999;100:2332-5

Heart rate recovery and OSA severity



Maeder MT et al. Sleep Med 2008;9:753-61

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OSA and hypertension

- **Association** well established, problem of «confounding factors» (obesity)
- **Prevalence↑:** AHI 15 h^{-1}: 1.8-fold risk of hypertension compared to AHI 0 h^{-1}
- **Incidence↑:** 1.42 for AHI 0-1-4.9 h^{-1}, 2.03 for AHI 5-14.9 h^{-1}, and 2.89 for AHI ≥15 h^{-1} versus AHI 0h^{-1}
- **CPAP:** established, but relatively small antihypertensive effect

Young T et al. Arch Intern Med 1997;157:1746-52
Peppard PE et al. N Engl J Med 2000;342:1378-84.
Montesi SB et al. J Clin Sleep Med 2012;8:587-96

OSA and diabetes

- **Problem:** confounding factors (obesity)
- **Prevalence↑:** relative risk 2.3 for AHI 15 h^{-1} compared to AHI<5 h^{-1}
- **Incidence↑:** relative risk for diagnosis of diabetes within four years: 1.62 for AHI ≥15 h^{-1} compared to AHI <5h^{-1}
- **Prevention and treatment** of diabetes by CPAP: unknown

Reichmuth KJ et al. Am J Resp Crit Care Med 2005;172:1590-5
Botros N et al. Am J Med 2009;122:1122-7
West SD et al. Thorax 2007;62:969-74

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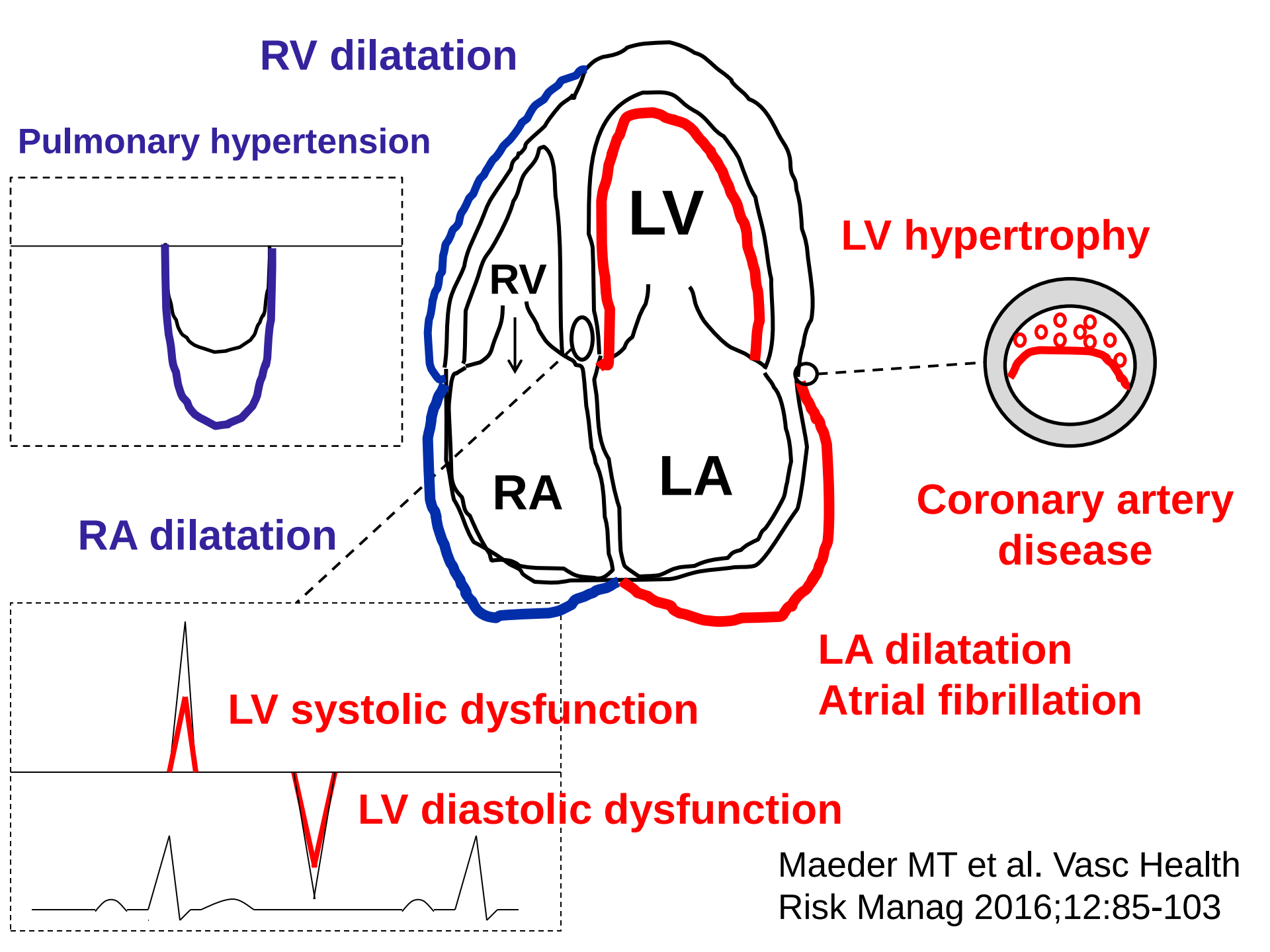
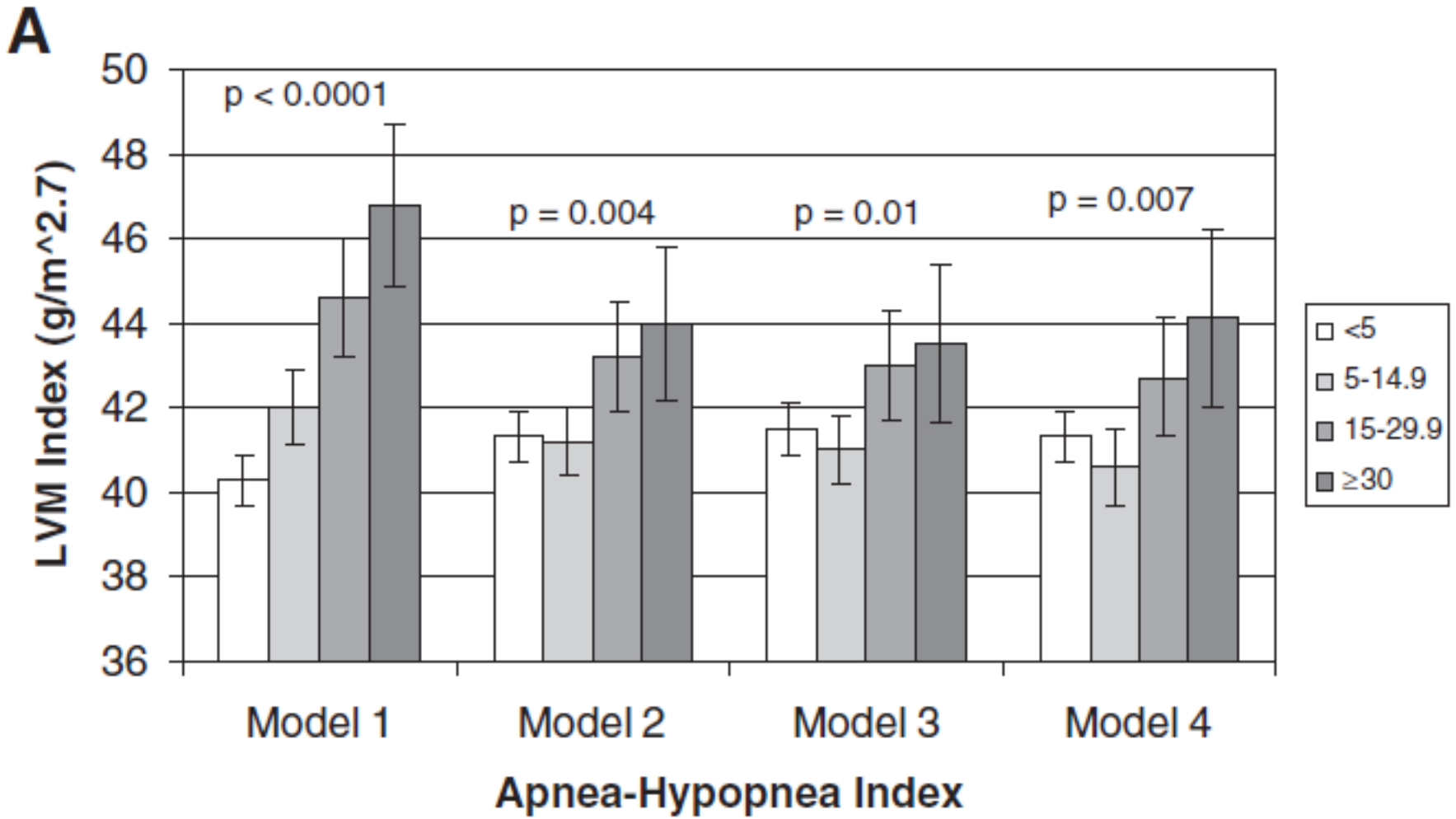


Maeder MT et al. Vasc Health Risk Manag 2016;12:85-103

OSA and cardiac structure and function

	Effect of OSA	Effect of CPAP
LV mass	↑	↓
Systolic LV function (s', strain)	↓	↑
Diastolic LV function (e')	↓	↑
LA size	↑	↓
Pulmonary pressure	↑	↓
RV size	↑	↓
RV function	↓	↑
RA size	↑	↓

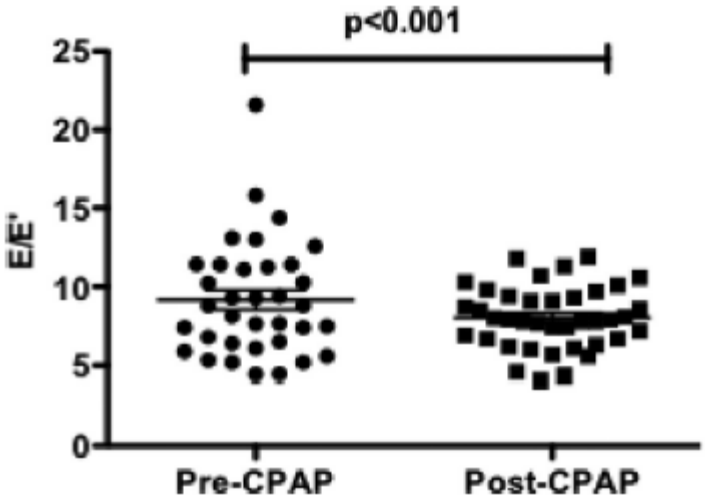
LV mass index and OSA severity (AHI)

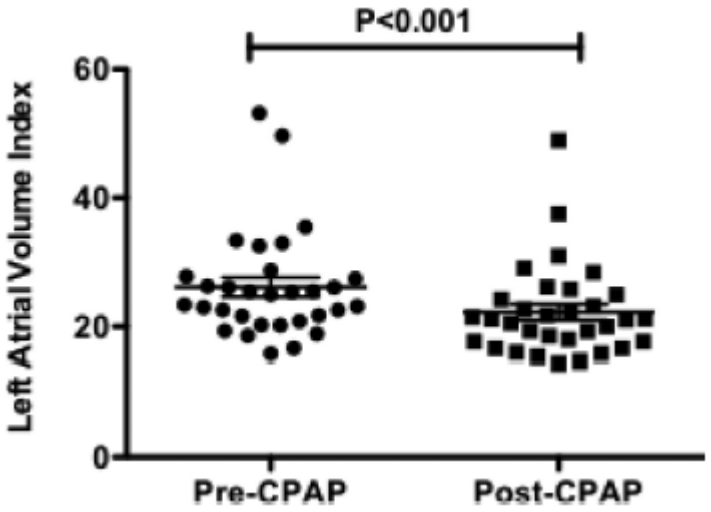


Chami HA et al. Circulation 2008;117:2599-2607

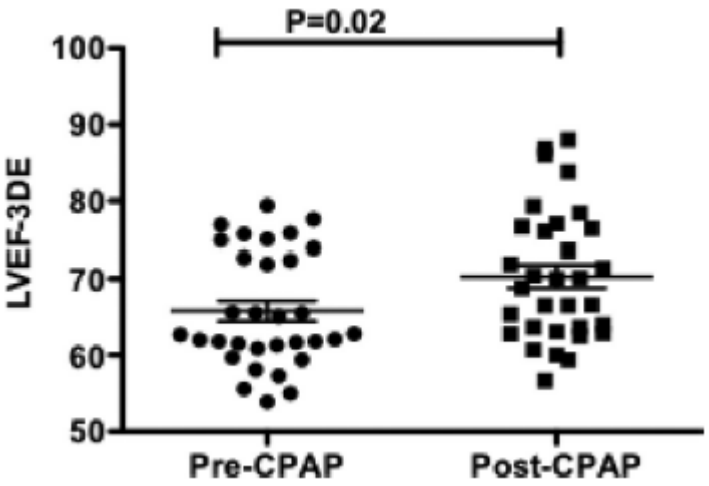
Effect of CPAP on LV function

LV diastolic function





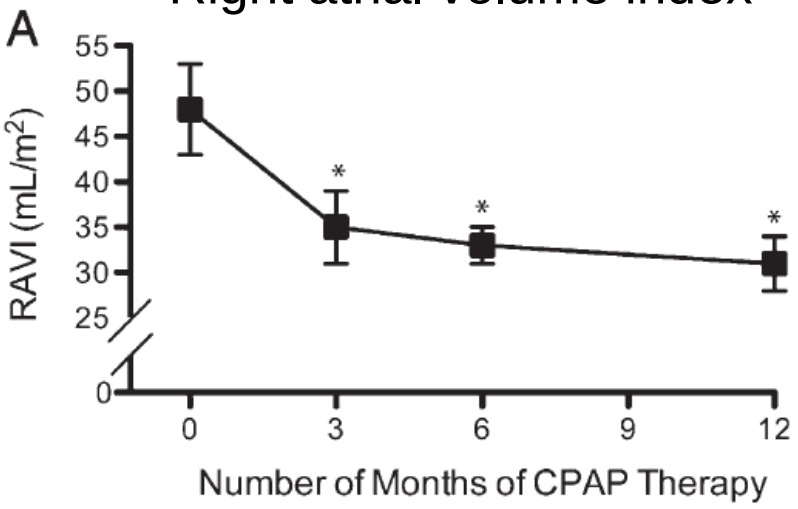
LV systolic function



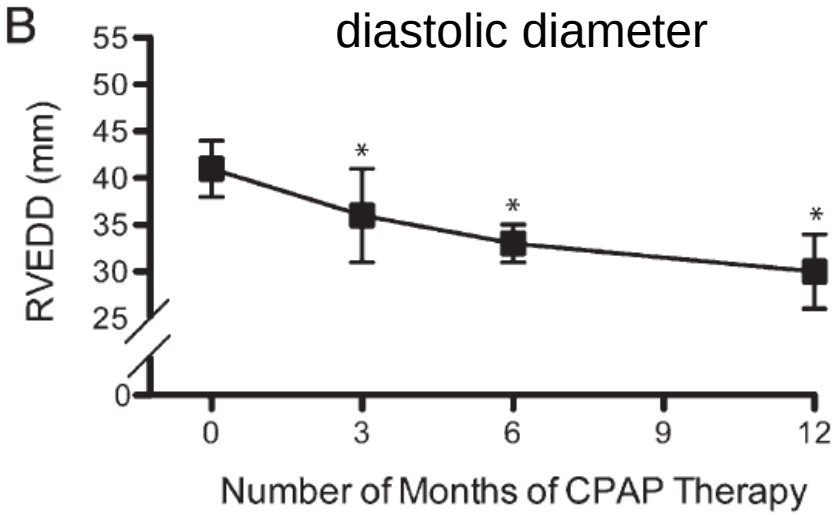
Butt M et al. Circ HF 2012;5:226-33

Effect of CPAP on the right heart

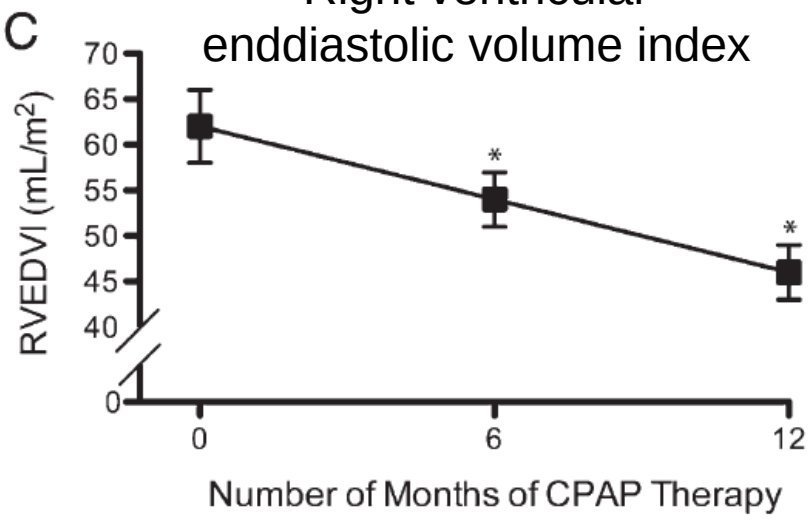
Right atrial volume index



Right ventricular enddiastolic diastolic diameter



Right ventricular enddiastolic volume index



Colish et al. Chest 2012;141:674-81

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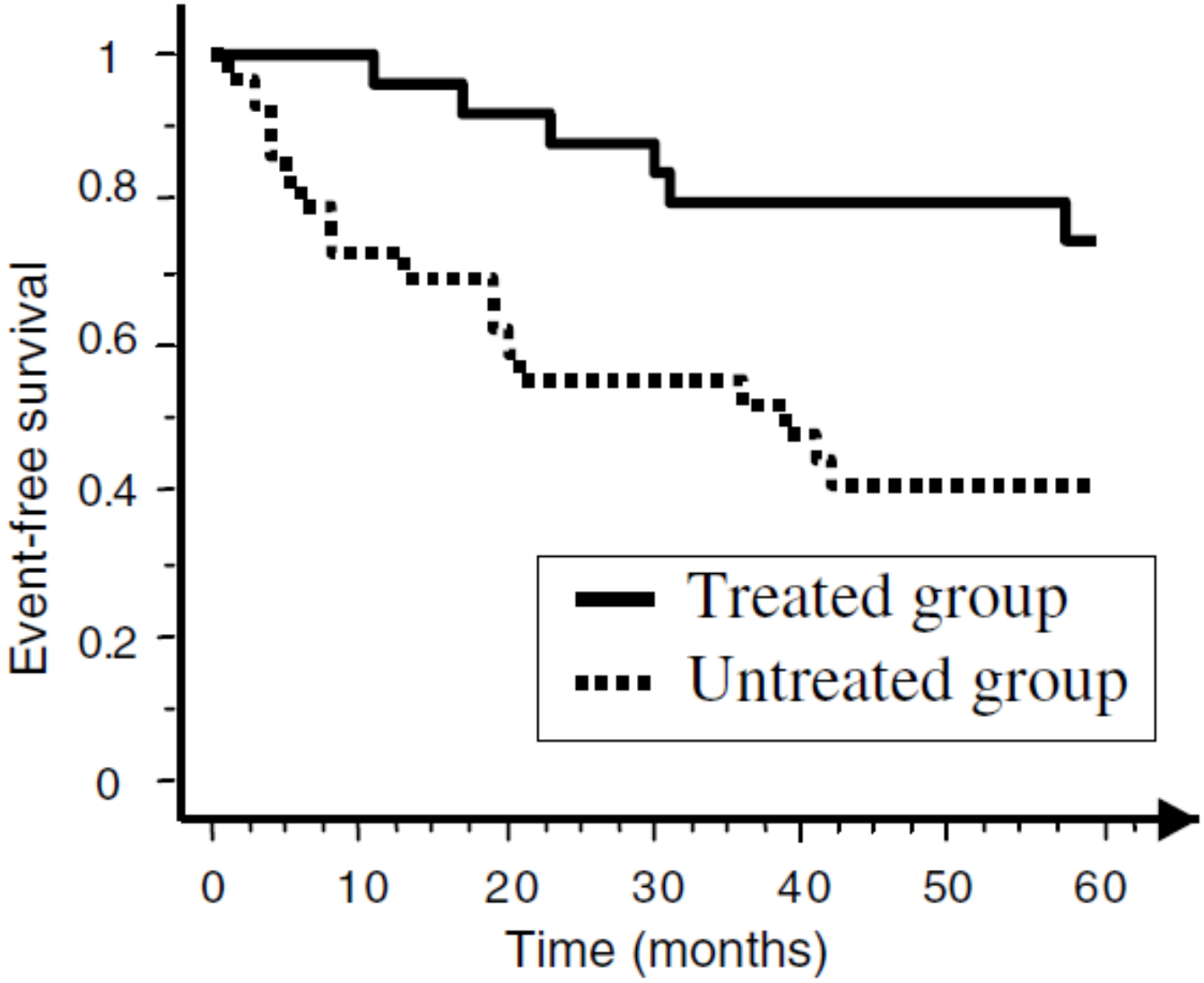
OSA and coronary artery disease

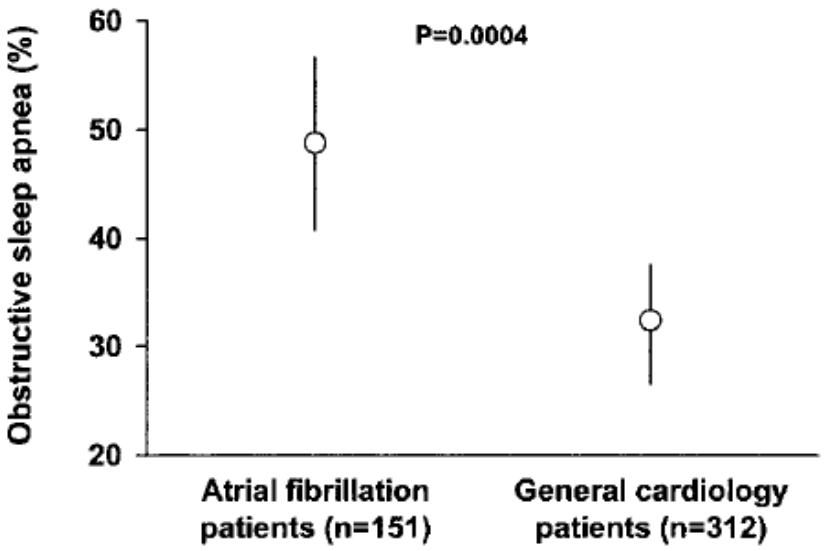


***P*<0.01**

Milleron et al. Eur Heart J 2004;25:728-34

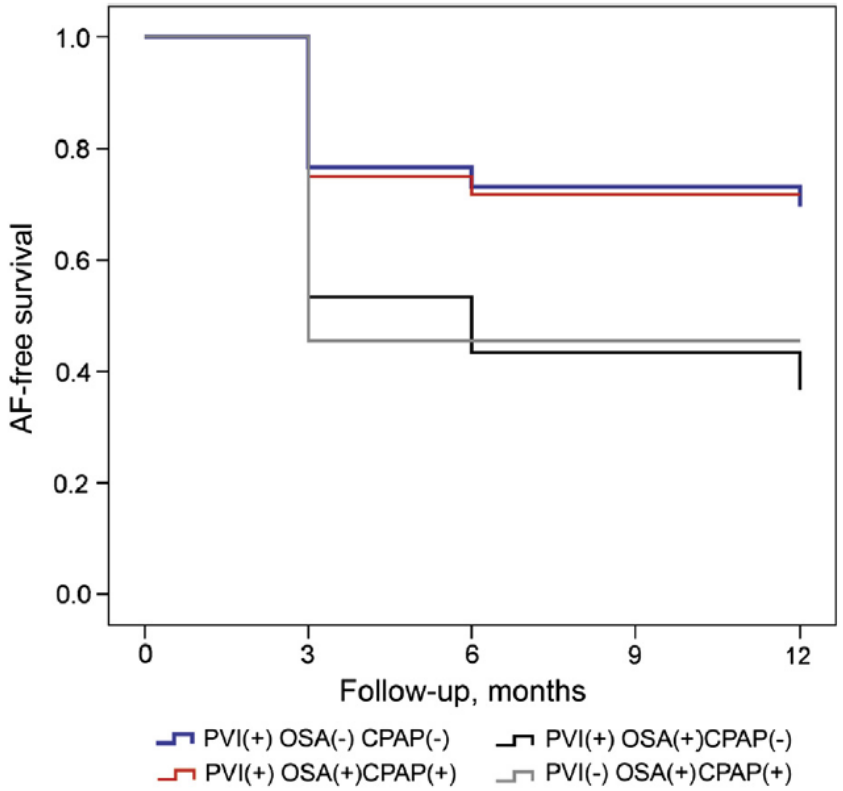
OSA and atrial fibrillation

Prevalence of AF in OSA↑



Gami AS et al. Circulation 2004;110:364-7

AF recurrence after PVI↓



Fein et al. J Am Coll Cardiol 2013;62:300-5

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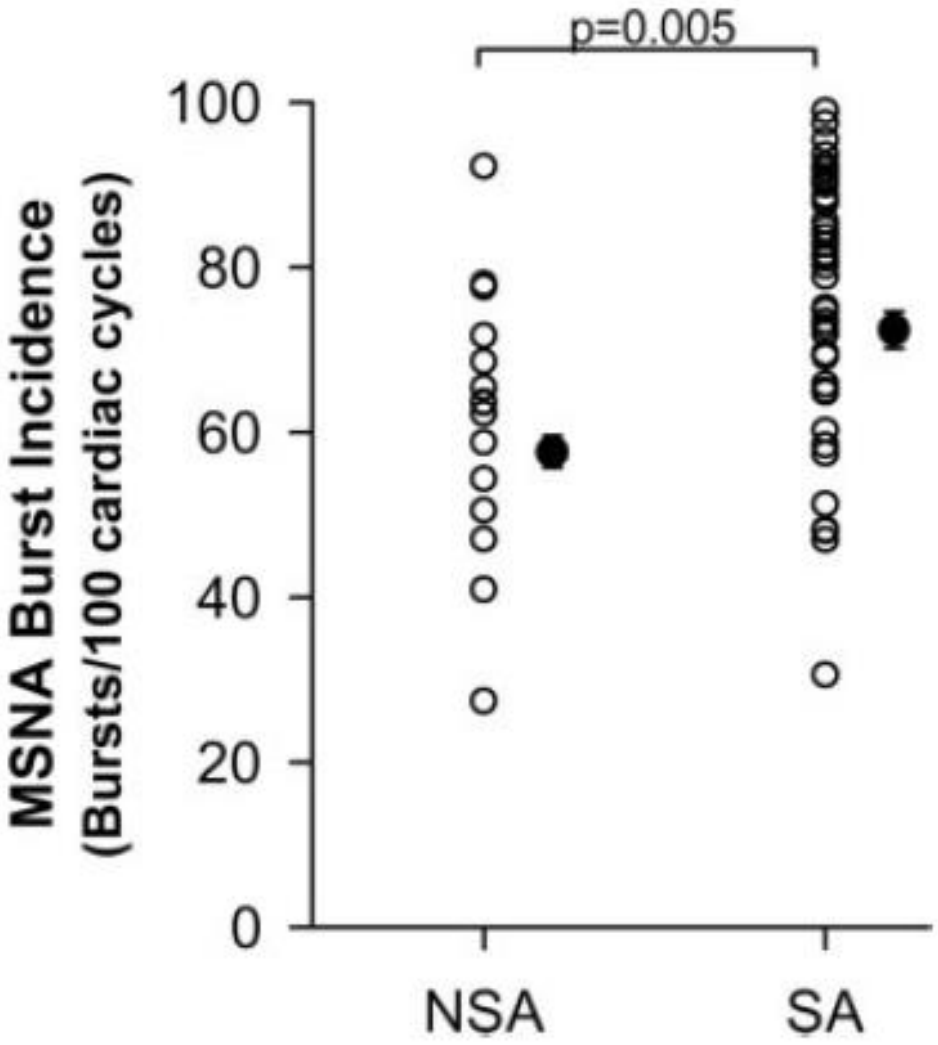
OSA and incidenct heart failure

	AHI (Events per Hour)				
	<5.0	5.0 to 14.9	15.0 to 29.9	≥30.0	P†
Men					
No. of subjects	829	644	282	172	
No. of heart failure events	44	46	25	26	
Covariates in model					
Age, race, BMI, smoking	1.00 (Referent)	0.96 (0.63, 1.46)	1.17 (0.71, 1.94)	1.61 (0.95, 2.71)	0.03
Plus total and HDL cholesterol, lipid-lowering medications, diabetes mellitus	1.00 (Referent)	0.90 (0.59, 1.38)	1.08 (0.65, 1.80)	1.59 (0.94, 2.69)	0.02
Plus SBP, DBP, use of antihypertensive medications	1.00 (Referent)	0.88 (0.57, 1.35)	1.13 (0.68, 1.89)	1.58 (0.93, 2.66)	0.02

Gottlieb DJ et al. Circulation 2010;122:352-60

MSNA in HFrEF with versus without OSA



60 patients with HFrEF (LVEF ≅22%); 43 patients with AHI ≥15/h, 17 patients with AHI <15/h

Spaak J et al. Hypertension 2005;46:1327-32

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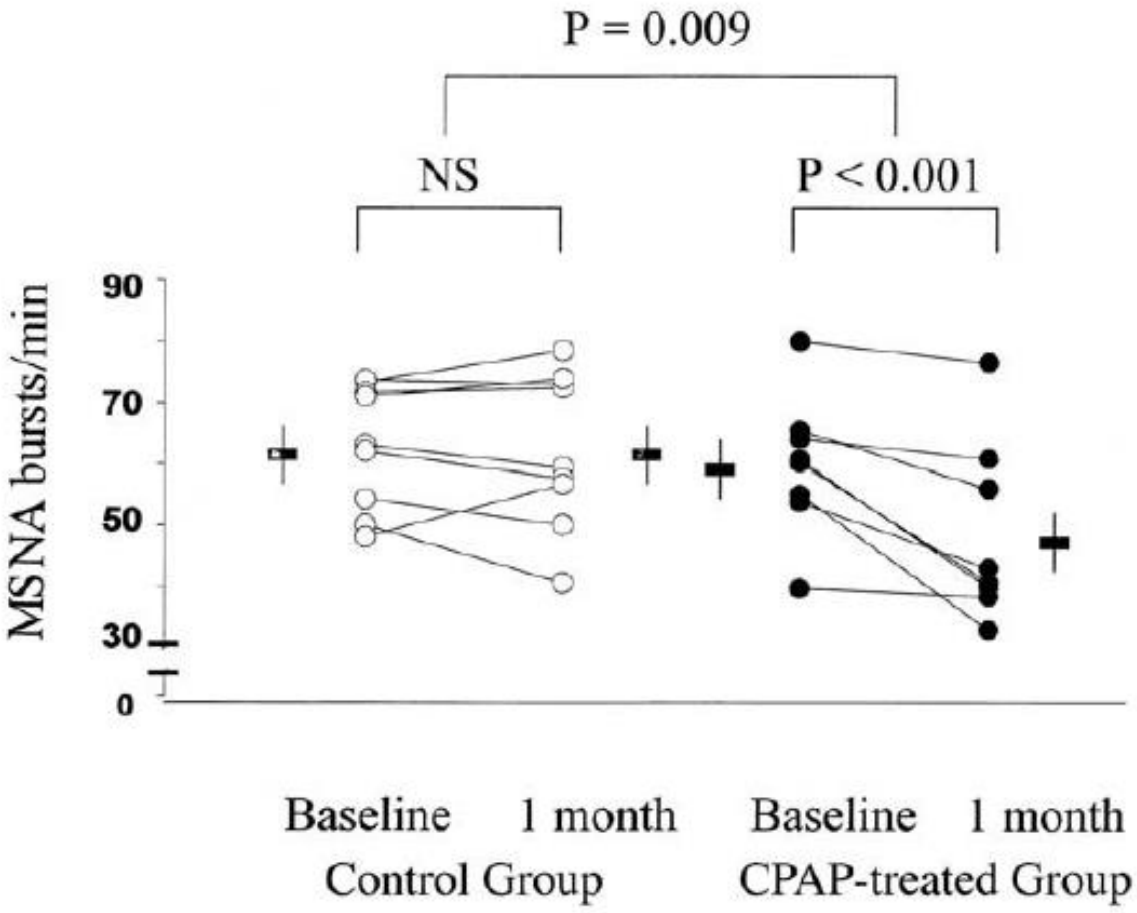
Effect of CPAP on MSNA in Patients with HFrEF and OSA

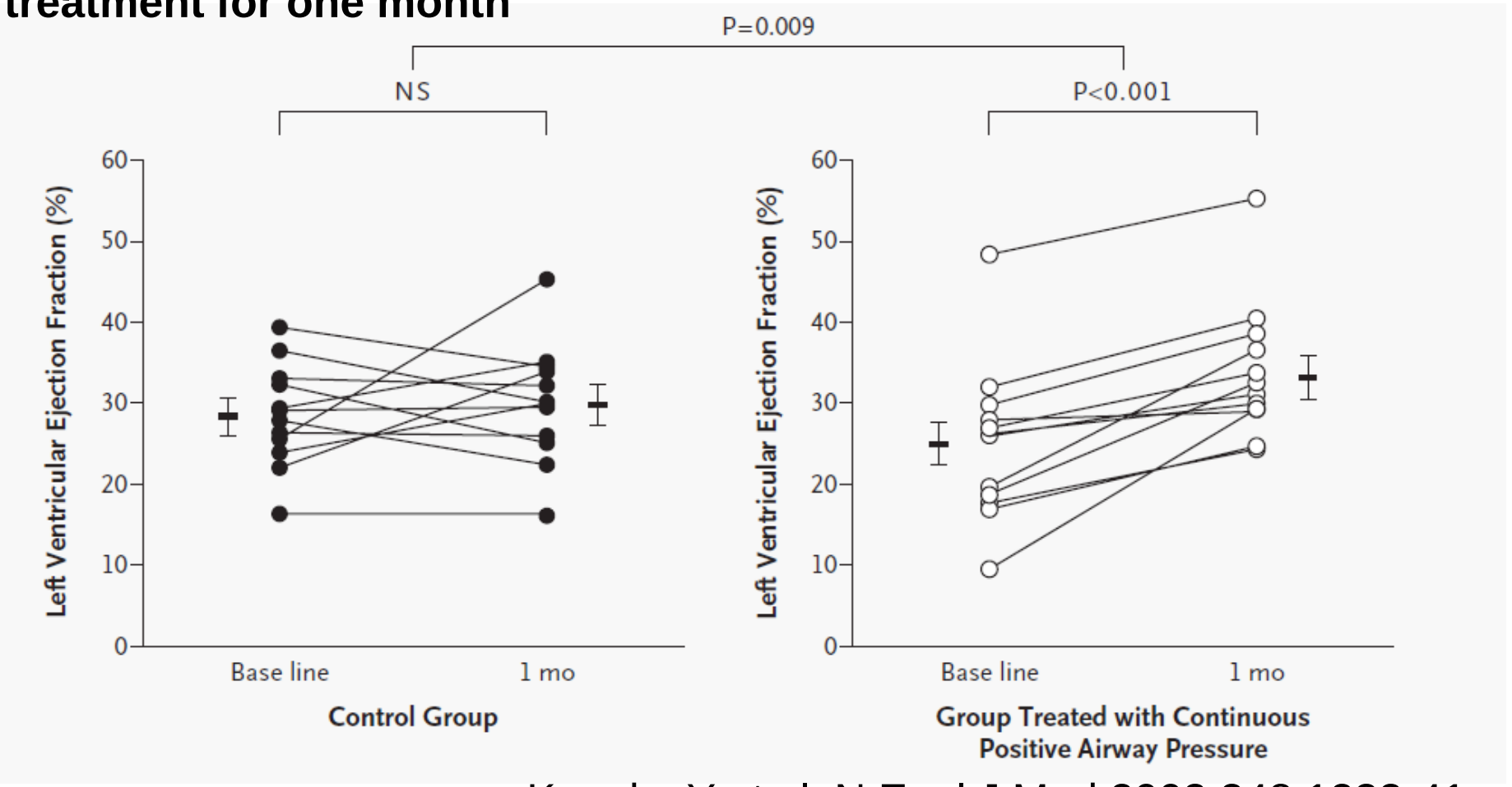


17 patients with HFrEF (LVEF <45%) and SDB (AHI >20/h, predominantly OSA), randomized to CPAP for one month (n=8) vs. no CPAP (n=8)

Usui K et al. J Am Coll Cardiol 2005;45:2008-11

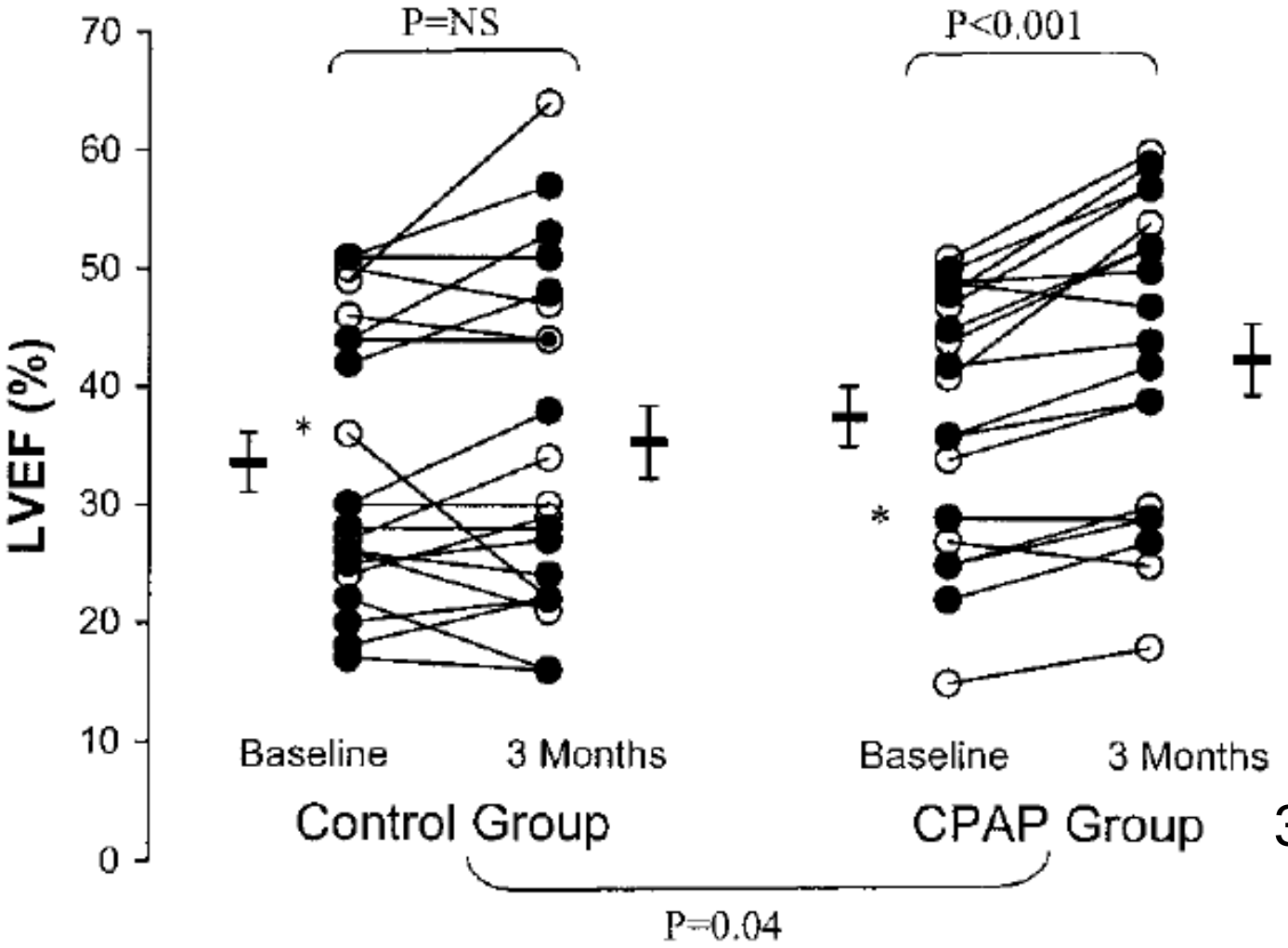
Effect of CPAP on LVEF in HFrEF and OSA

24 patients with HFrEF (LVEF <45%) and OSA (AHI ≅40/h), 55 years, predominantly men, BMI ≅32 kg/m^2, 100% on ACEI, 50% on BB, randomized to **CPAP + optimal medical treatment vs. optimal medical treatment for one month**



Kaneko Y et al. N Engl J Med 2003;348:1233-41

Effect of CPAP on LVEF in HFrEF and OSA

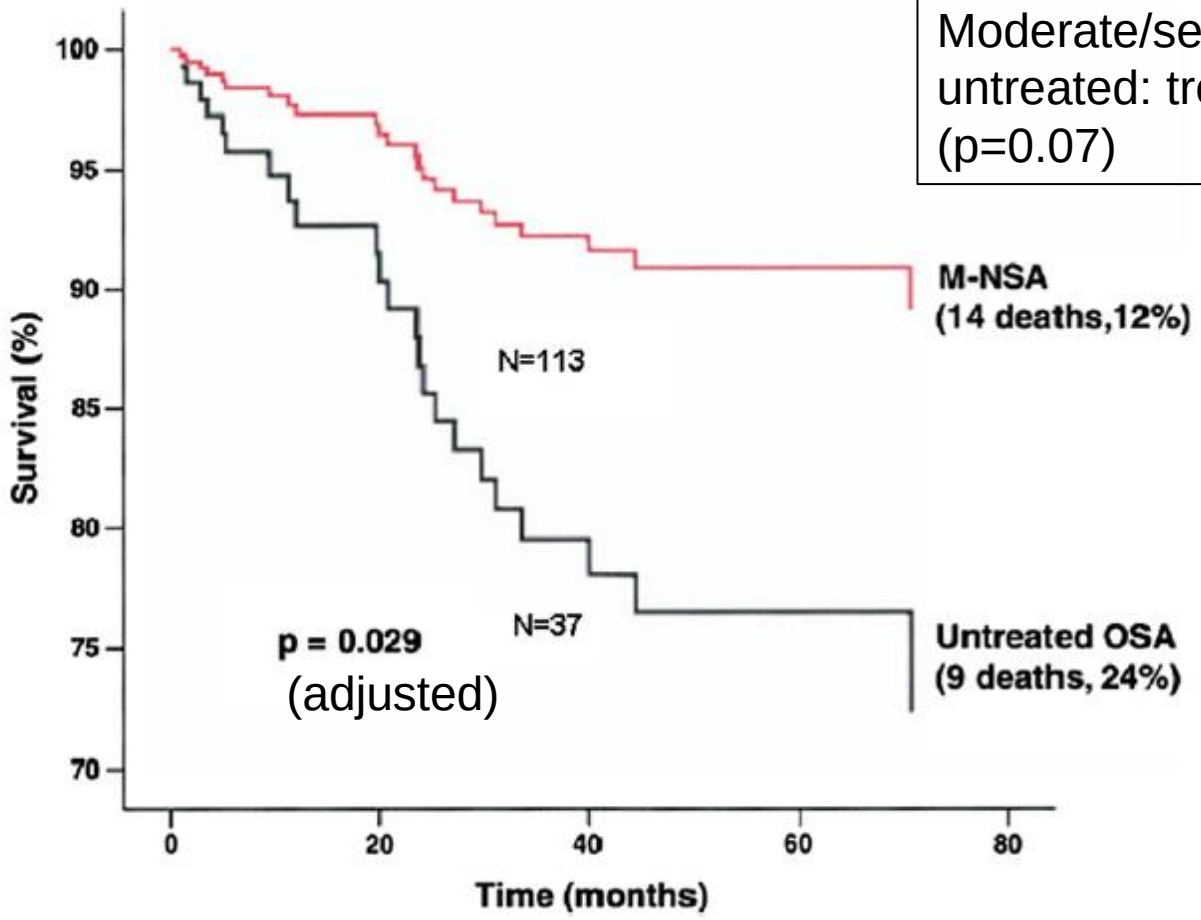


3 months

Mansfield DR et al. Am J Resp Crit Care Med 2004;169:361-6

164 patients with HFrEF (LVEF <45%), 80% on betablocker:
-No/mild OSA (AHI <15/h; n=113)
-Untreated moderate/severe OSA (AHI ≥15/h; n=37)
-CPAP-treated moderate/severe OSA (n=14)

Moderate/severe OSA: CPAP vs. untreated: trend in favour of CPAP (p=0.07)

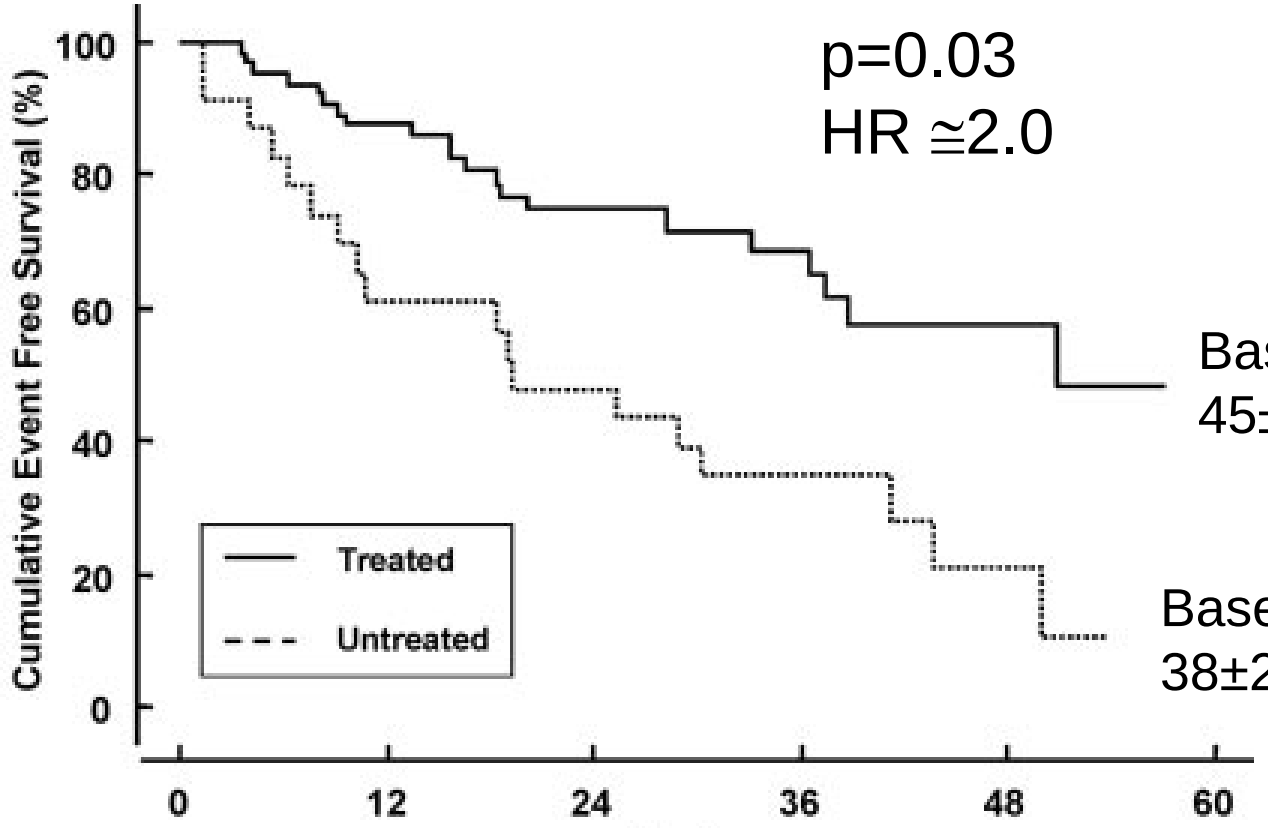


AHI 7±4/h

AHI 33±14

Wang H et al. J Am Coll Cardiol 2007;49:1625-31

88 patients with HFrEF (LVEF <50%) and AHI ≥15/h (predominantly OSA; 60% on betablocker): 65 with CPAP, 23 without CPAP

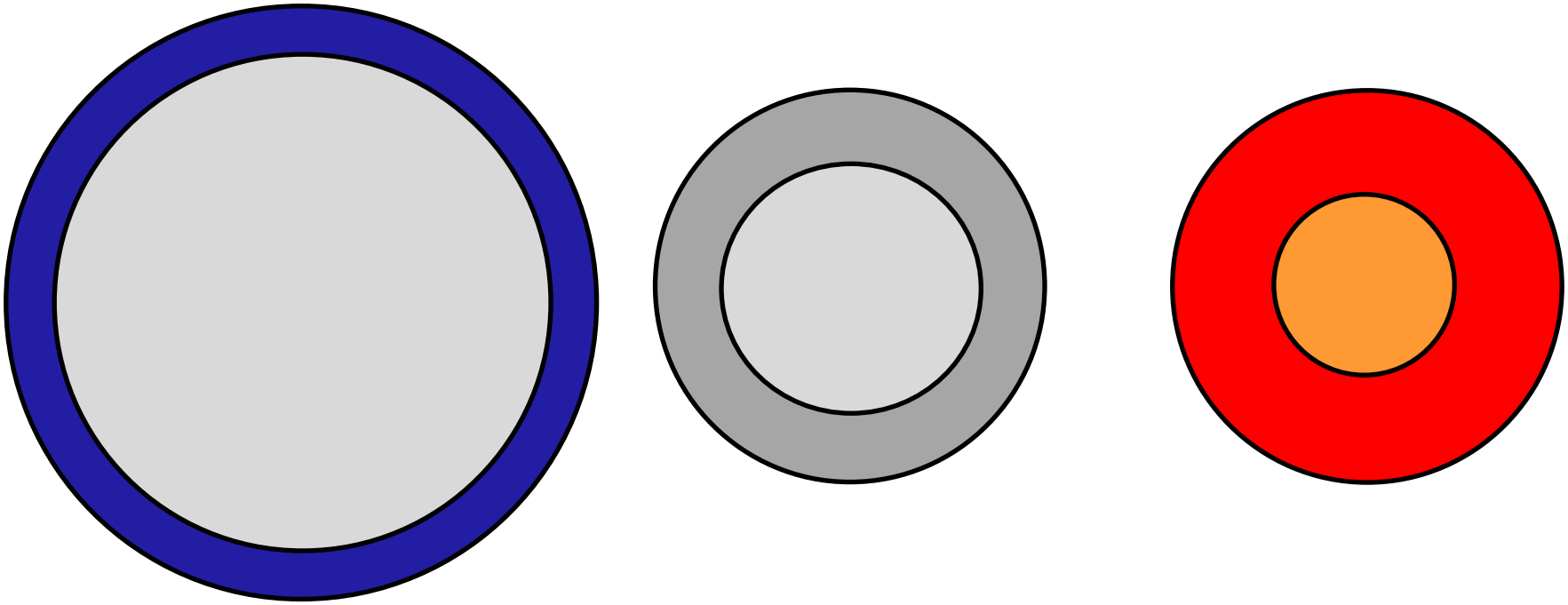


Numbers at Risk					
Treated	65	56	27	20	7
Untreated	23	14	11	6	2

Kasai T et al. Chest 2008;133:690-6

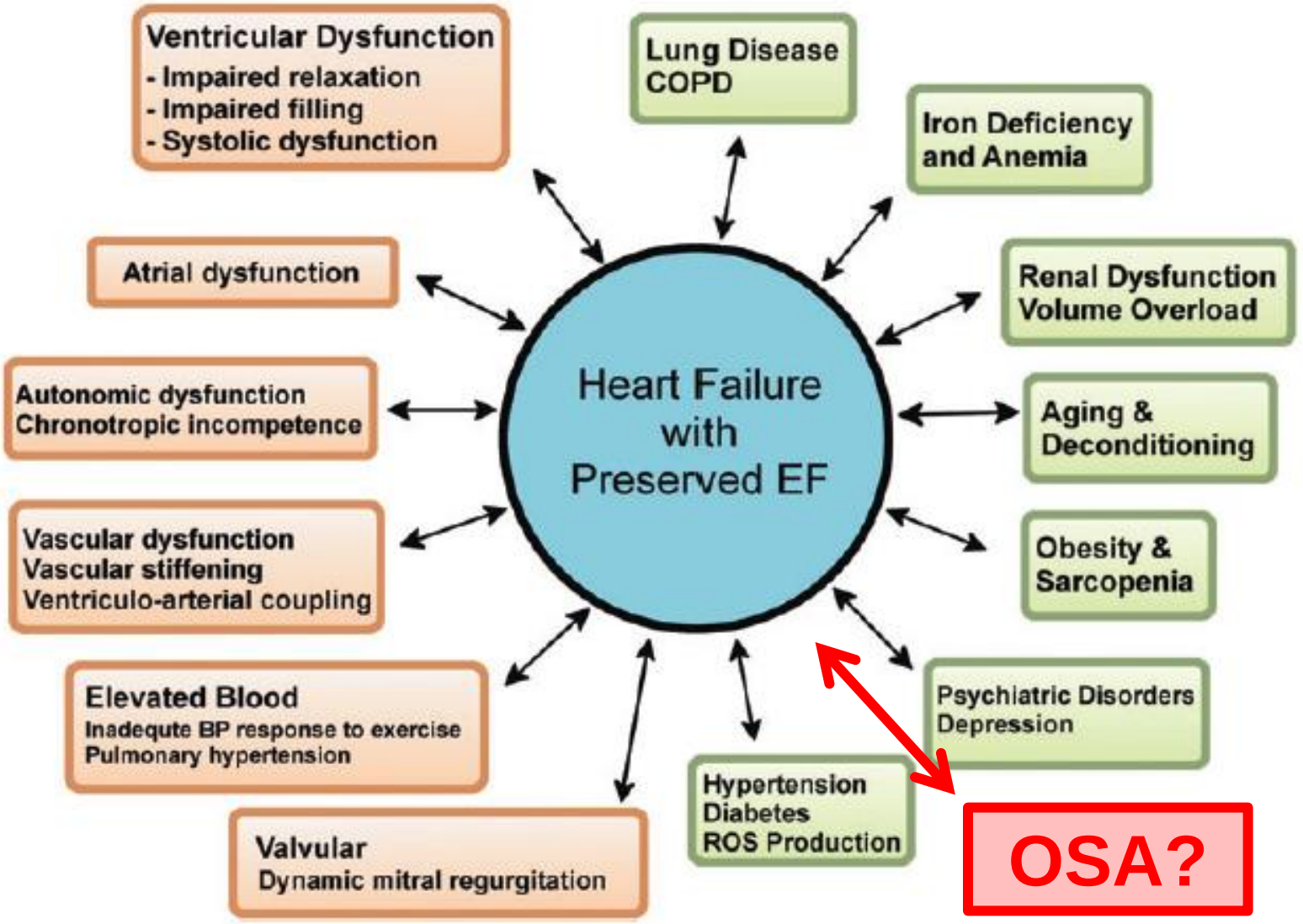
HFrEF

HFpEF

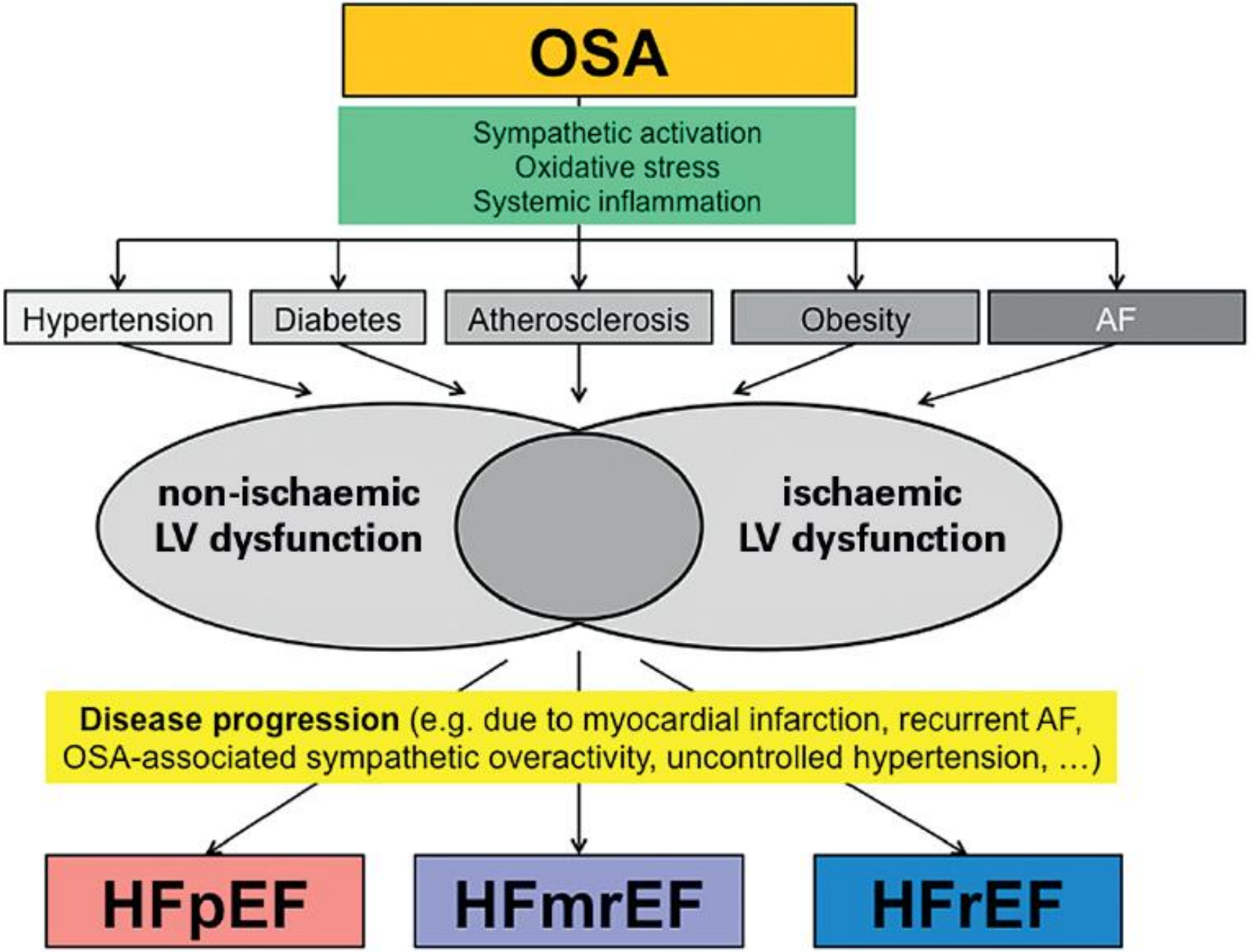


dilated	**Size**	Non-dilated
eccentric	**Remodeling**	concentric
↓↓↓	**Systolic function**	↓
↓ bis ↓↓↓	**Diastolic function**	↓ bis ↓↓↓

«phenotype diversity» in HFpEF



Senni M et al. Eur Heart J 2014;35:2797-815



Maeder MT et al. Cardiovasc Med 2017;20:9-16

Summary

- OSA associated with CV risk factors
- OSA associated with cardiac dysfunction and cardiac diseases associated with HF
- OSA associated with increased sympathatic acitivation in patient with and without HF
- CPAP therapy with beneficial effects on these features in patients with OSA without HF
- improvement in LVEF following CPAP in patients with HF and reduced LVEF (very small studies)
- no conclusive data on impact of CPAP therapy on outcomes in patients with HF and reduced LVEF
- OSA and HFpEF?