Is HFpEF Transitional Form to HFrEF?

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Contents

- Subtle systolic dysfunction in HFpEF
- HFpEF progressing to HFrEF

Conventional concept of diastolic HF

- Increased resistance to LV diastolic filling

  aggravated by increased heart rate

- Presence of abnormal LV filling

- Preserved systolic function, commonly EF > 50%

How to Diagnose Diastolic Heart Failure. European Study Group on Diastolic Heart Failure. Eur Heart J. 1998;19:990–1003

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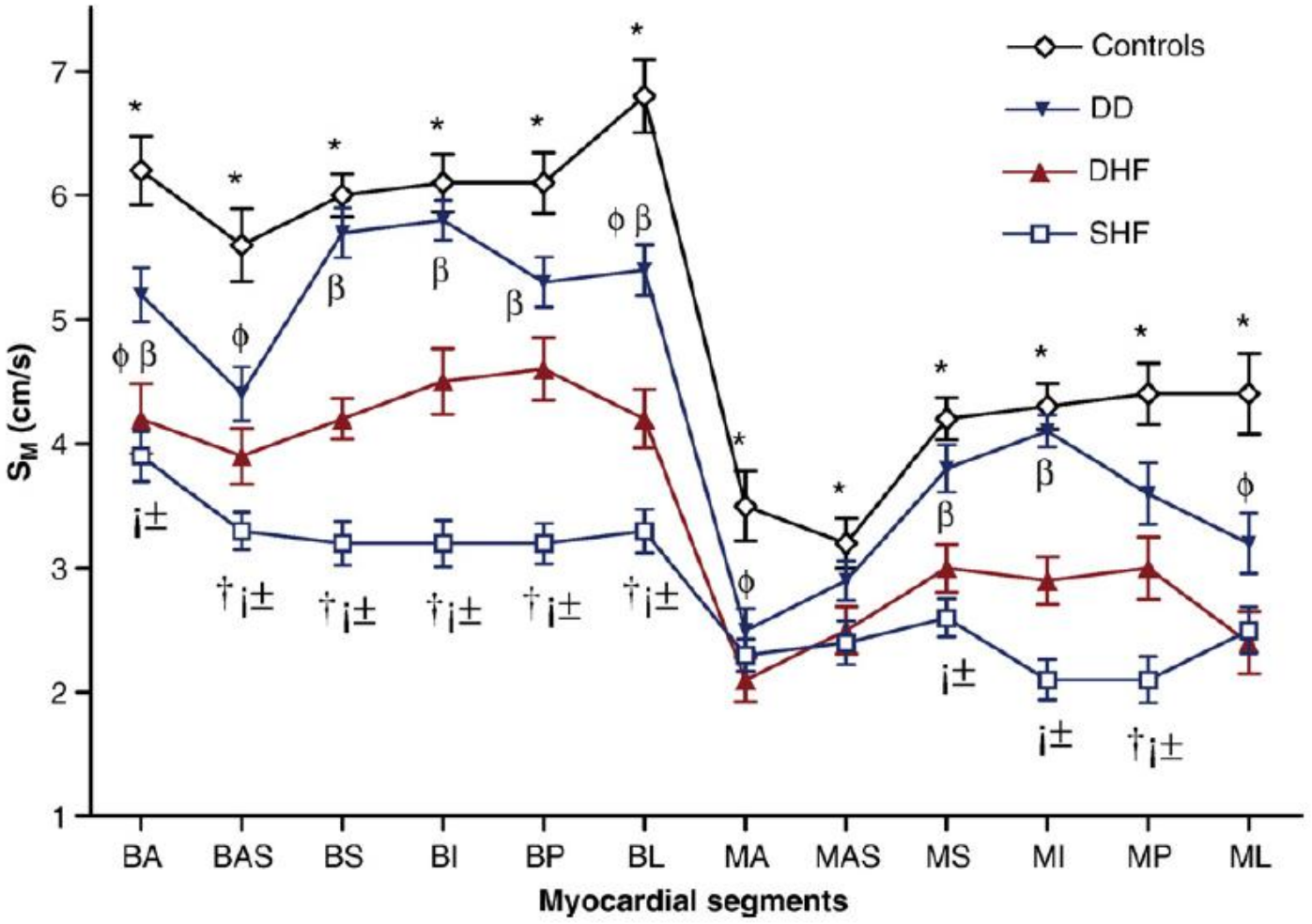
Regional peak systolic myocardial velocities in controls, isolated diastolic dysfunction, diastolic HF, & systolic HF



On TDI, **peak myocardial sustained systolic velocities (SM)** compared

Circulation. 2002; 105:1195-1201

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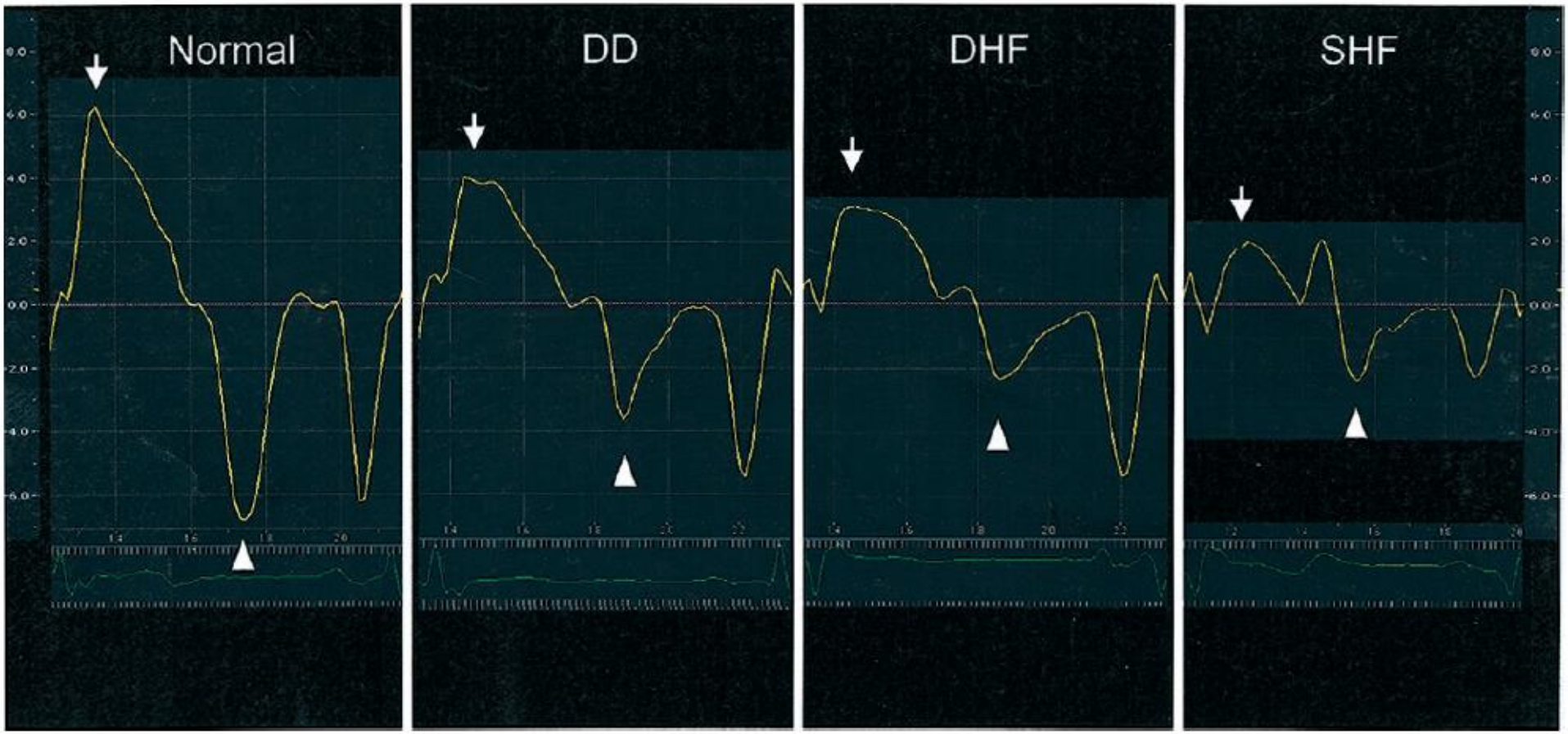
Representative TDI-derived myocardial velocity curves at LV basal septal segment



- Note progressive decrease in peak myocardial sustained **systolic velocities** (**arrows**) and early diastolic velocities (arrowheads) from DD to SHF

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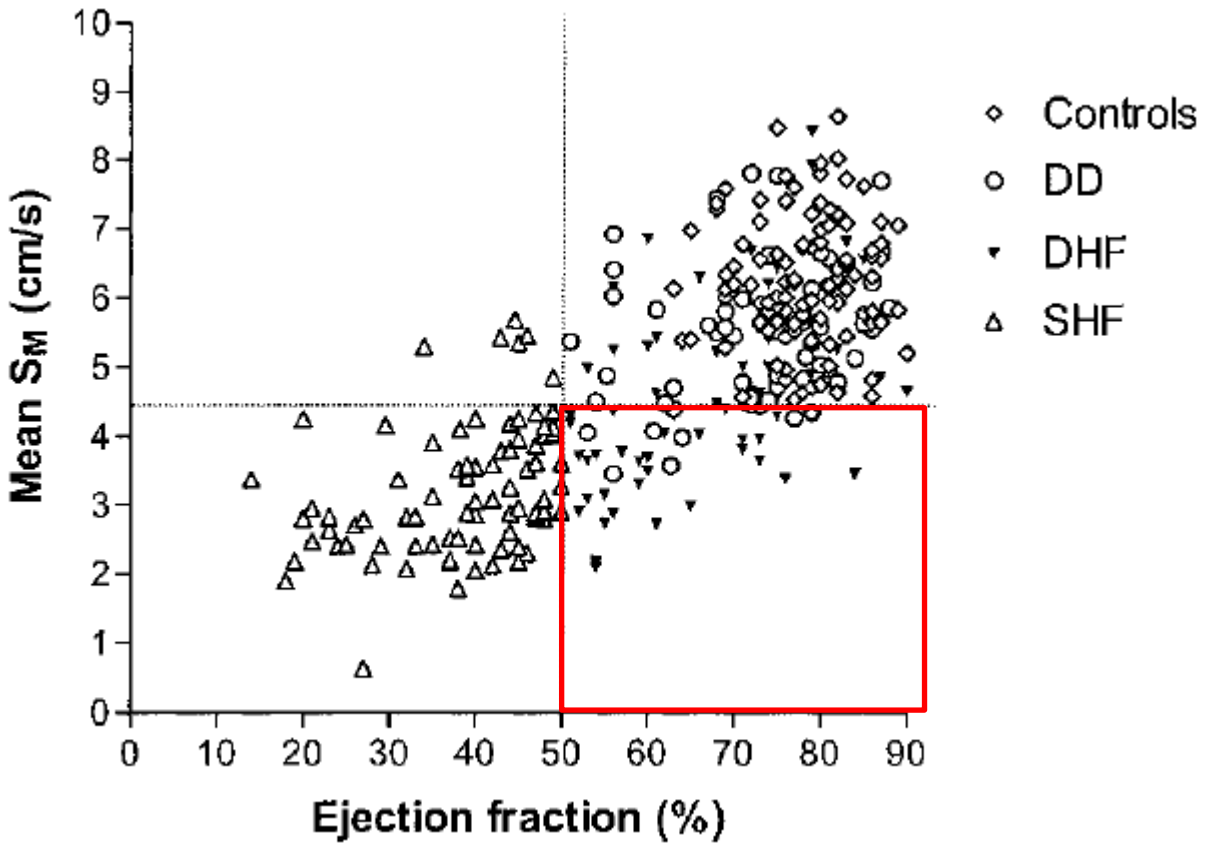
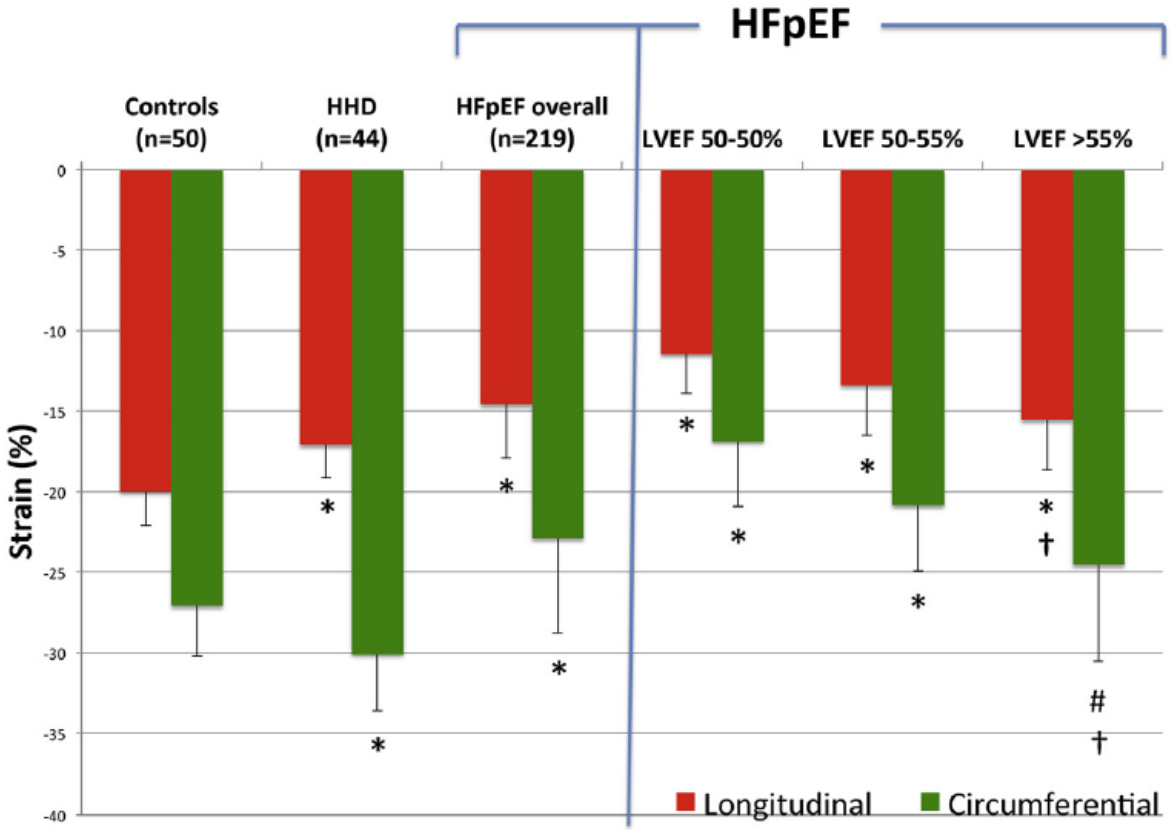
Scatterplot for mean SM and LV ejection fraction



- Value of 2 SD from the mean SM in the control subjects (ie, 4.4 cm/s) was used as cutoff point for abnormality
- Significant correlation btw mean SM and LVEF ($r=0.73$, $P < 0.001$)
- 50% of patients with DHF and 1/7 DD had subnormal mean SM.

Impaired systolic function by strain imaging in HFpEF



- Substudy from PARAMOUNT study published in JACC 2014
- > 50% of HFpEF patients with an LVEF > 55% had reduced LS.
- Pts with IHD had worse LS & CS compared to HFpEF without IHD.
- Neither LS nor CS related to echo. measures of diastolic function (E' or E/E').

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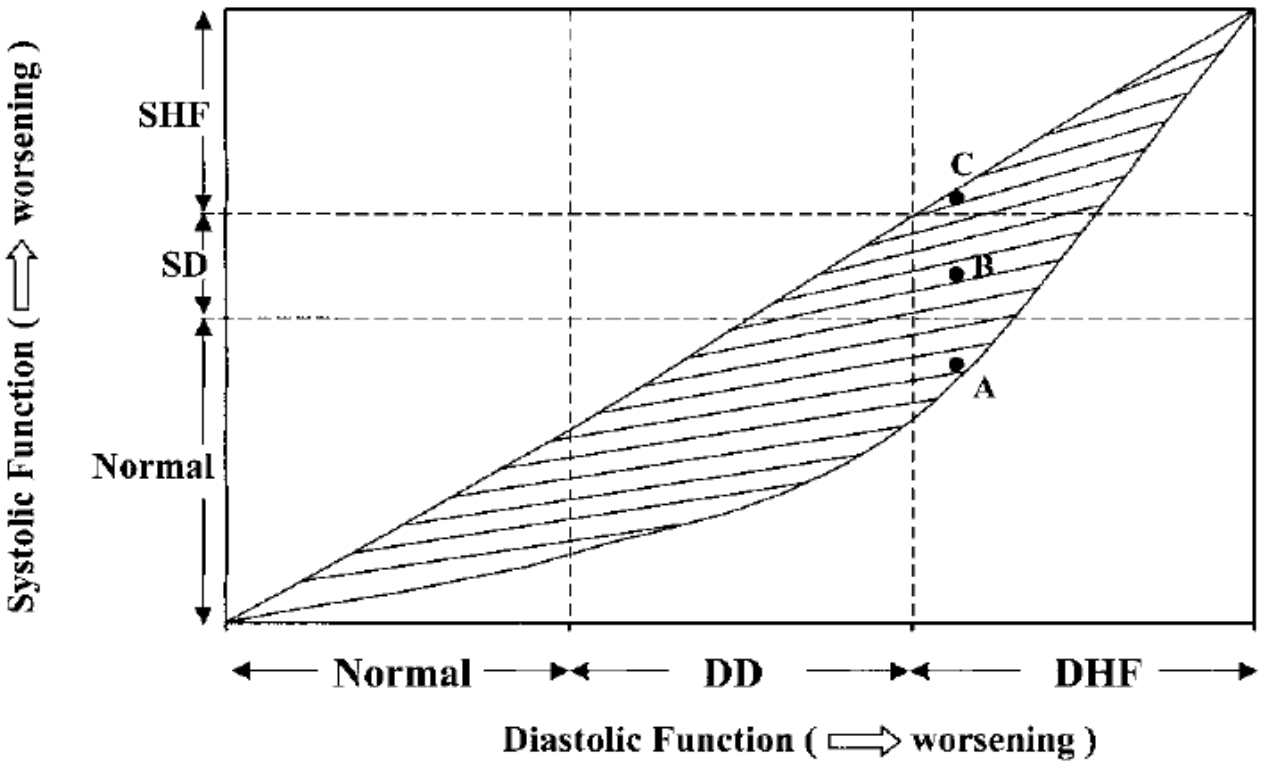
Concept of relation btw LV systolic & diastolic abnormalities



Diagnostic labeling is dependent on the underlying cause, patient age, and **sensitivity of the diagnostic tools (shaded area).**

- Diastolic and systolic disease probably coexist, although the severity of these two elements may vary.
- **Patients with a milder systolic dysfunction or with a less sensitive diagnostic tool for detecting systolic dysfunction may be labeled as DHF (point A)**, whereas others may be labeled as DHF with coexisting systolic abnormalities (point B) or vice versa (point C).

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- Subtle systolic dysfunction in HFpEF
- **HFpEF progressing to HFrEF**

Progression of HFpEF to HFrEF- Natural history study

- HF admissions from the community in St. Vincent's University Hospital emergency department, Ireland
- Of 210 HF admissions, 56 had preserved systolic function (LVEF > 45%).
- 3 month F/U, 21% exhibited significant decline in LV systolic function with LVEF< 45%.

International Journal of Cardiology 2006;106:95-102

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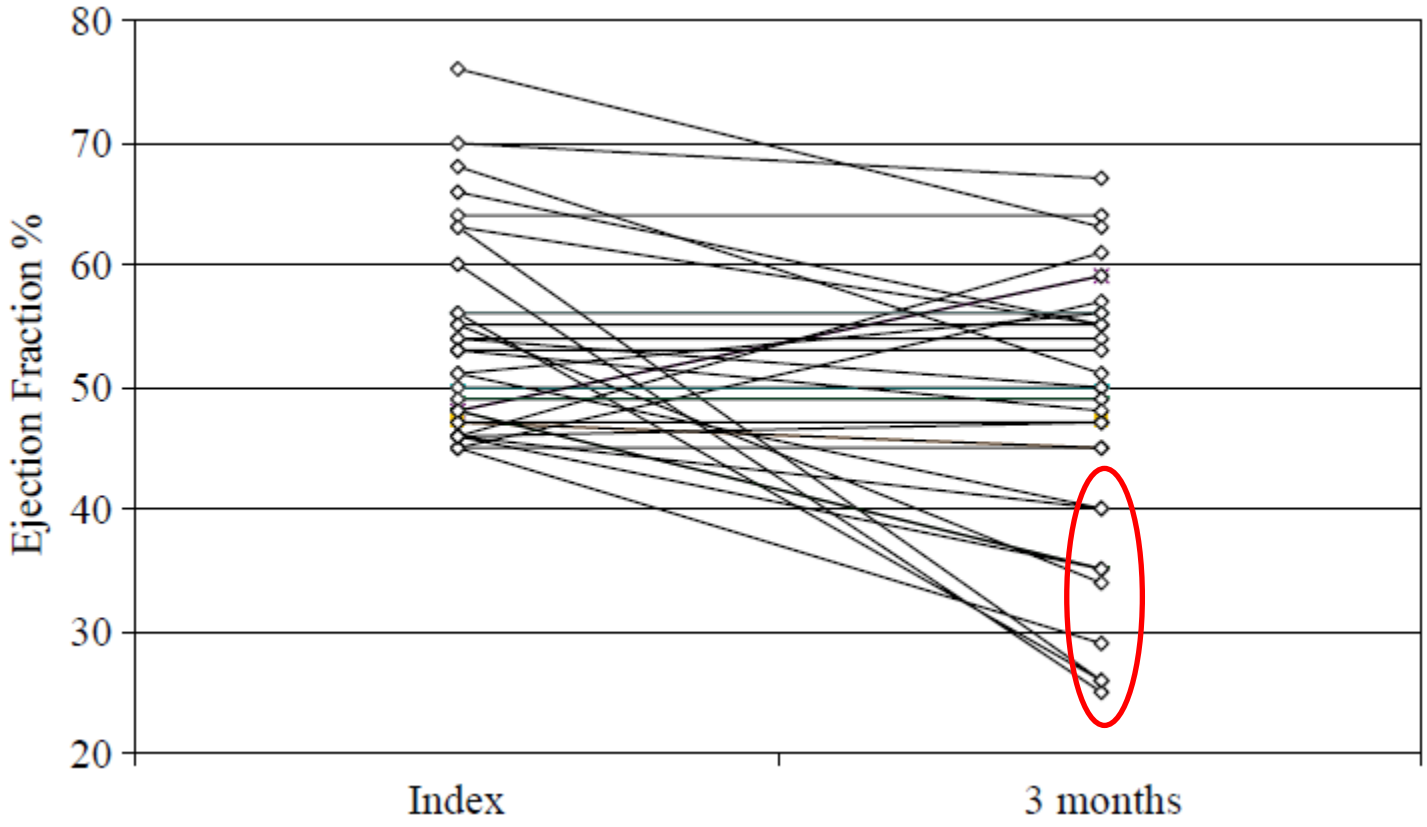
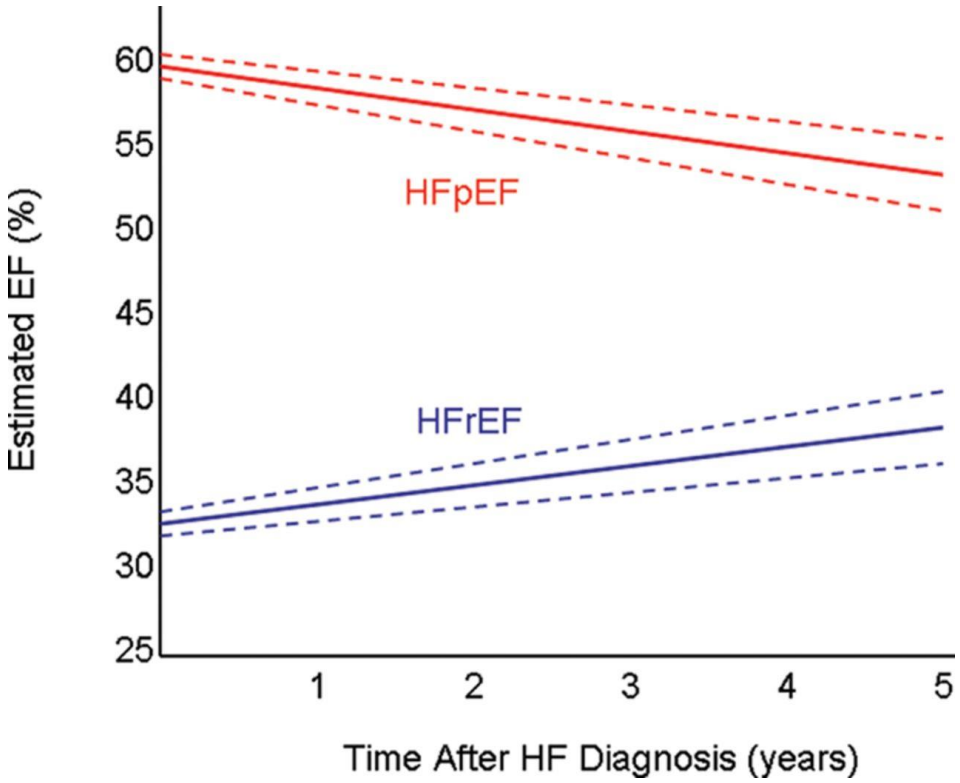
LVEF change over 3 months



- Progressors were more likely to be female and having lower BP on admission

Longitudinal changes in EF in HFpEF & HFrEF patients



- Community cohort of incident HF patients diagnosed from 1984–2009 in Olmsted County

Circ Heart Fail. 2012; 5(6): 720–726

- In HFpEF, EF decreased by 5.8% over 5 yrs ($p<0.001$) with greater declines in **older individuals and those with CAD**.
- Conversely, EF increased in HFrEF (average increase 6.9% over 5 yrs, $p<0.001$). Greater increases in women, younger patients, individuals without CAD, and those treated with evidence-based medications.

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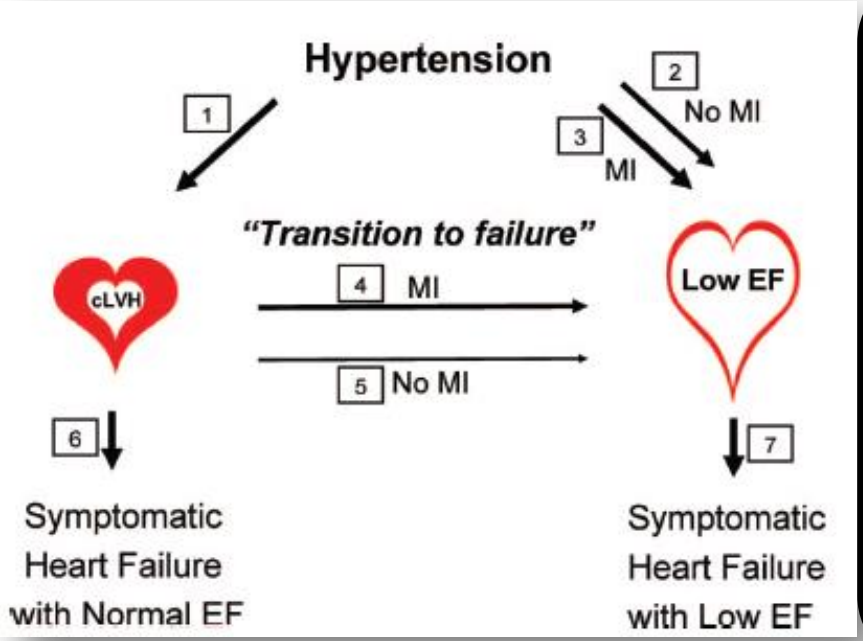
Patho-physiology of hypertensive HF



1 → common → 6 **(HFpEF)**

3 → common →

1→ commonly 4 → common →

2 → **some** →

1 → rarely ? → 5 ? → 7 →

7 (HFrEF)

Raman et al. JACC 2010, Drazner et al. Circulation 2011

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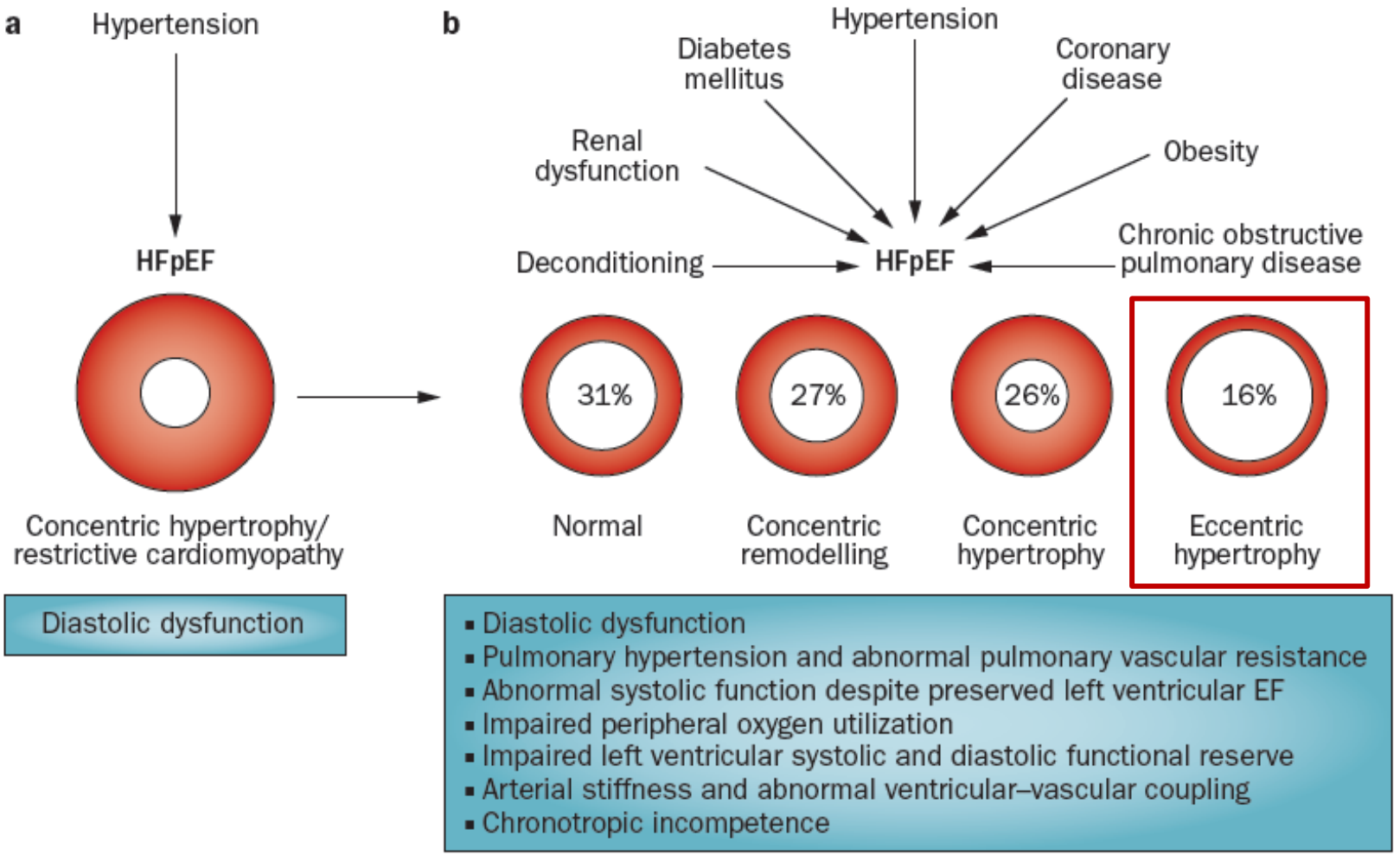
Hypertension induced heart failure



LV geometry and EF decrease over time

- 3042 participants in Cardiovascular Health Study followed-up for 4.9 ± 0.14 years
- The baseline LV geometry classified as normal (n = 1,856), concentric remodeling (n = 84), eccentric hypertrophy (n = 218), or concentric hypertrophy (n = 26)
  - eccentric hypertrophy defined as increased LVM due to increased LV volume with normal relative wall thickness
- % of participants developed a depressed LVEF at follow-up
  - Normal 6.7%
  - Concentric remodeling 8.3%
  - **Eccentric hypertrophy 16.5% (p < 0.001)**
  - Concentric hypertrophy 3.8% our groups was
- Eccentric hypertrophy associated with development of a depressed LVEF (relative risk 2.3; 95% CI 1.4 to 3.6)
  - but concentric remodeling (relative risk 1.2; 95% CI 0.4 to 3.5) and concentric hypertrophy (relative risk 0.8; 95% CI 0.1 to 6.3) did not.

J Am Coll Cardiol 2004;43:2207–15

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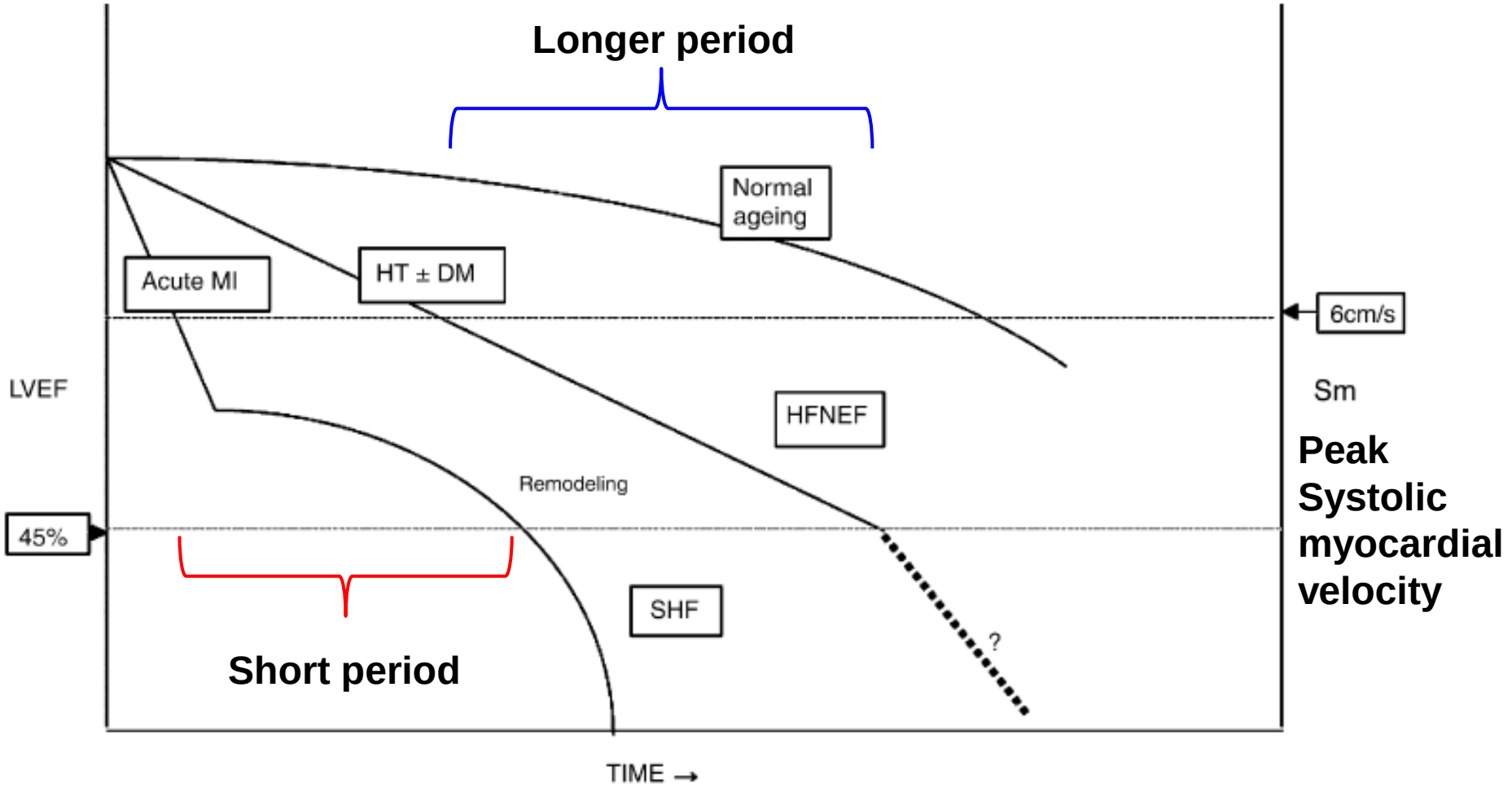
Time course of HFpEF progressing to HFrEF



Progress in Cardiovascular Diseases. 2006: pp 196-206

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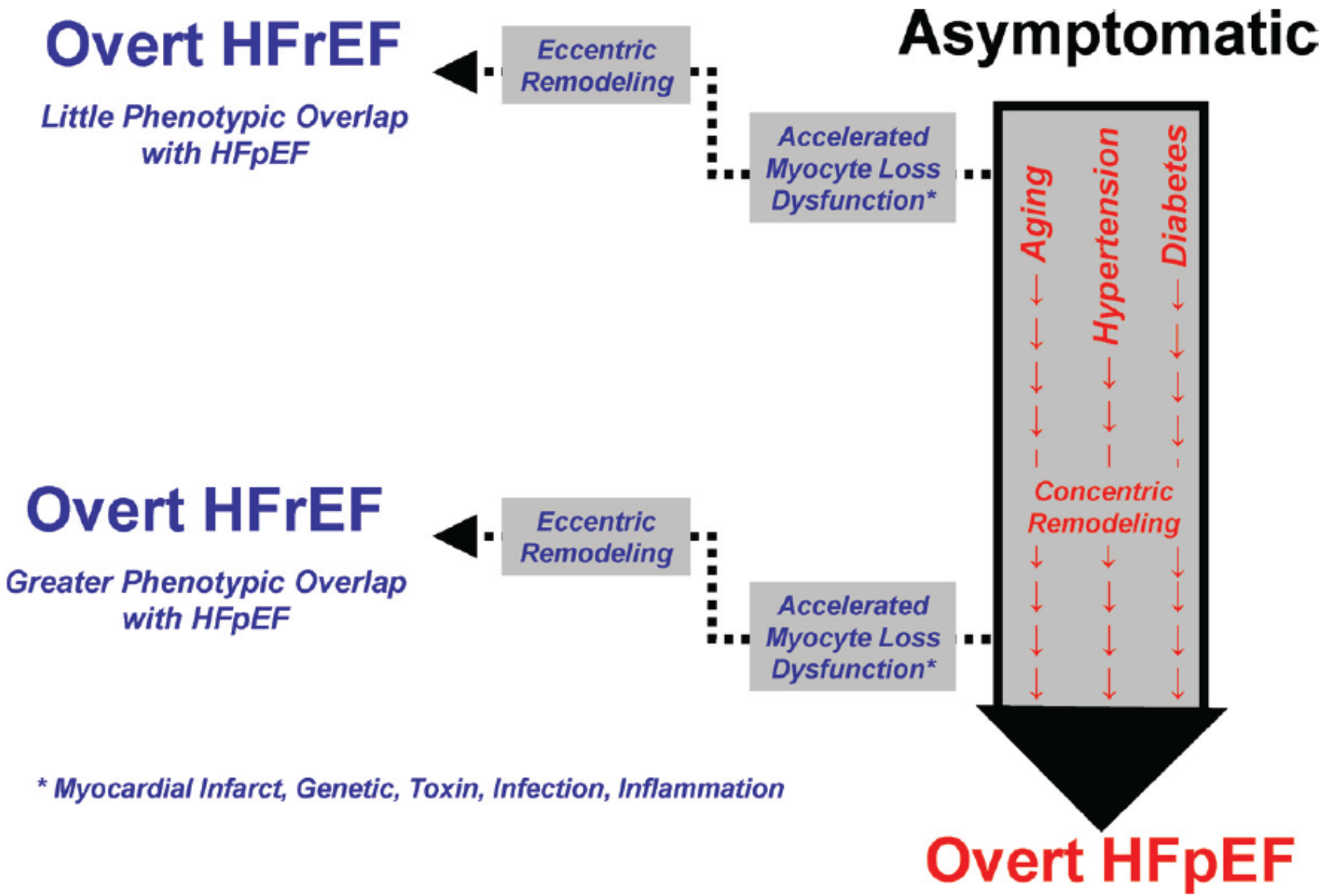
Temporal change of HFpEF to HFrEF

- Hypertensive heart failure (HT-HF)
  - LVH leads to ↓ systolic / diastolic function particularly in long axis.
  - Initial compensatory phase, ↑ radial contraction results in a normal EF
  - At later stages, LV volumes gradually increase (eccentric hypertrophy), slipping from HFpEF to more obvious HFrEF.
- In myocardial infarction
  - Remodeling resulting in ↑ ventricular volumes and ↓ EF occurred more rapidly.
  - HFpEF phase is shorter than HT-HF

Distinct pathophysiology of HFpEF and HFrEF



Circulation. 2011;123:2006-2014

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Prognostic value of EF change over time

	Unadjusted HR (95% CI) for 5% Decrease EF	P value	[a] Adjusted HR (95% CI) for 5% Decrease EF	P value
HFpEF	1.08 (1.04–1.12)	<0.001	1.07 (1.03–1.12)	<0.001
HFrEF	1.12 (1.08–1.16)	<0.001	1.12 (1.07–1.16)	<0.001

[a] Adjusted for age, sex, and Charlson comorbidity index

- In HFpEF, survival was better in Pts with less decline in EF over time
  - In HFrEF, survival was better in Pts with greater improvements in EF.
- **Among Pts with HFpEF, a decline in EF of 5% associated with a 7% increase in mortality**.
  - In Pts with HFrEF, a 5% increase in EF associated with a 12% reduction in mortality

Community cohort of incident HF patients diagnosed from 1984–2009 in Olmsted County. Circ Heart Fail. 2012; 5(6): 720–726

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Summary and Conclusion

- Regional and chamber-level systolic dysfunction common in HFpEF.
  - Systolic dysfunction becomes more apparent and limiting during the stress of exercise in HFpEF.
- Pts with a milder systolic dysfunction or with a less sensitive diagnostic tool detecting systolic dysfunction may be labeled as HFpEF.
- HFpEF can progress to HFrEF.
  - Overall, 39% of HFpEF Pts had an EF<50% at some point after diagnosis.
- Decreases in EF over time in HFpEF are associated with reduced survival.

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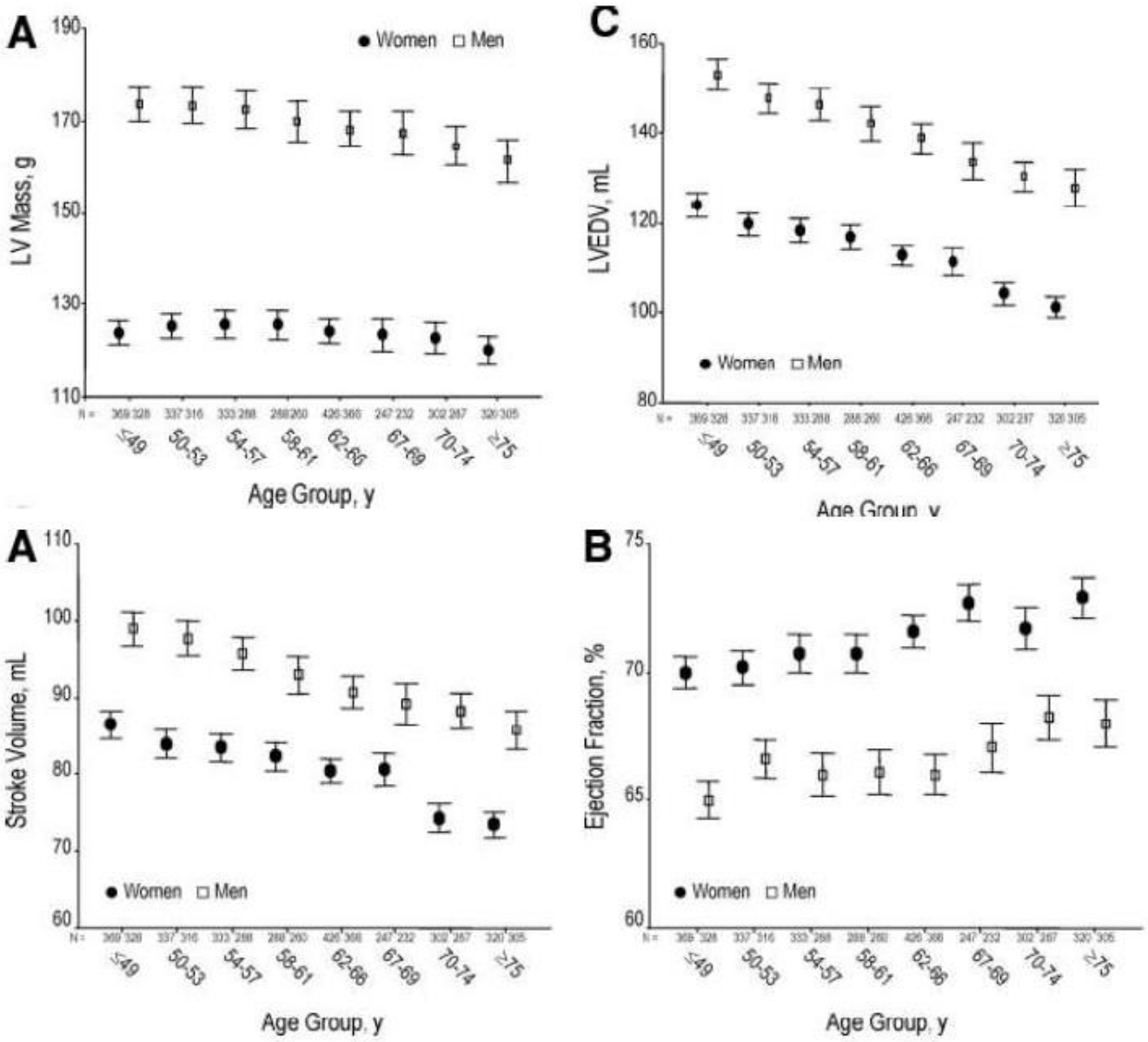
Thank you for your attention.

Is HFpEF an artifact of too low an EF cutoff in elderly women?



Cheng S et al Circ Cardiovasc Imaging 2009