

# Insuffisance cardiaque: Evaluation de la congestion et suivi biologique

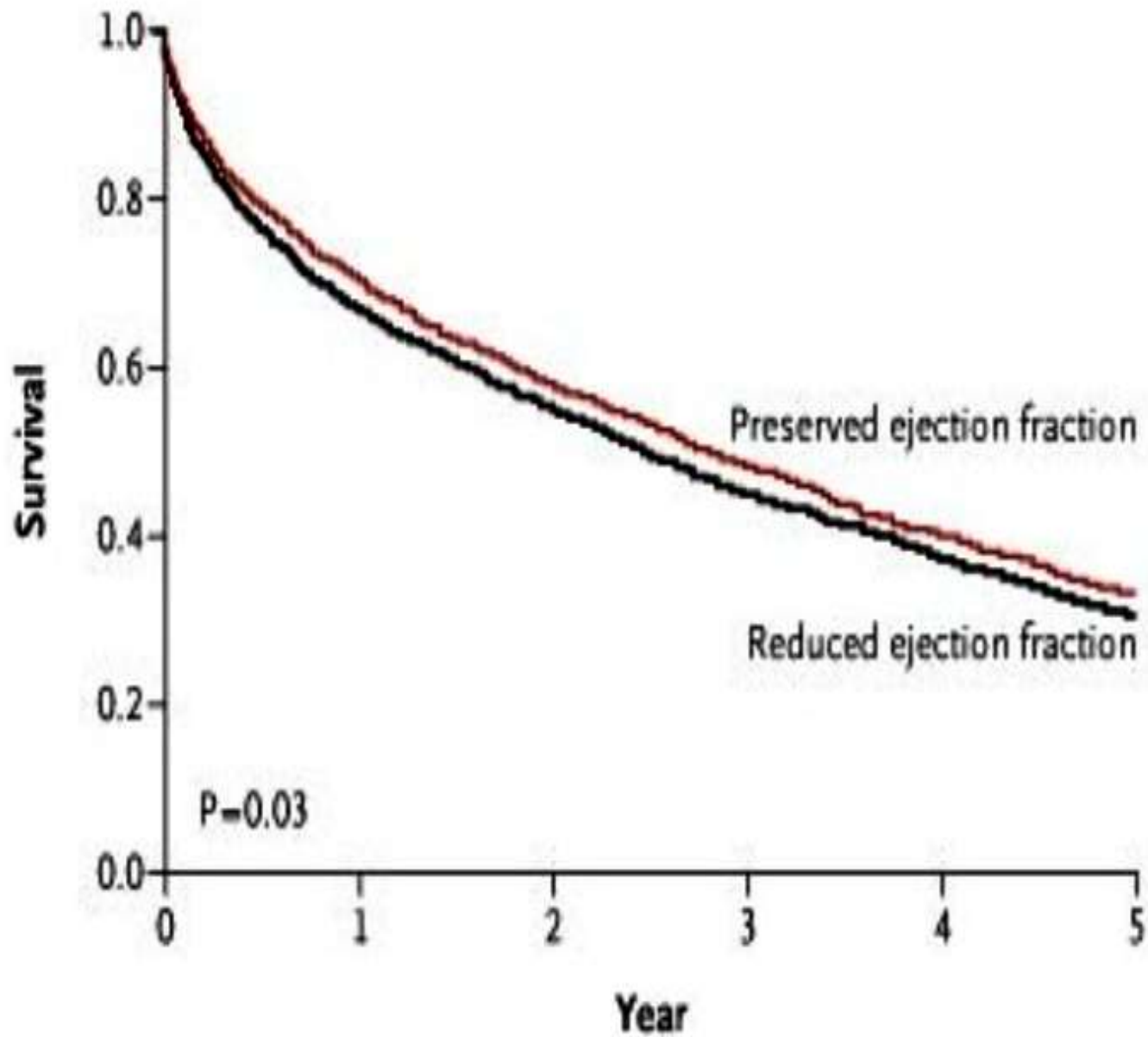
Mustapha El Hattoui  
CHU Mohammed VI  
Marrakech

# CONGESTION

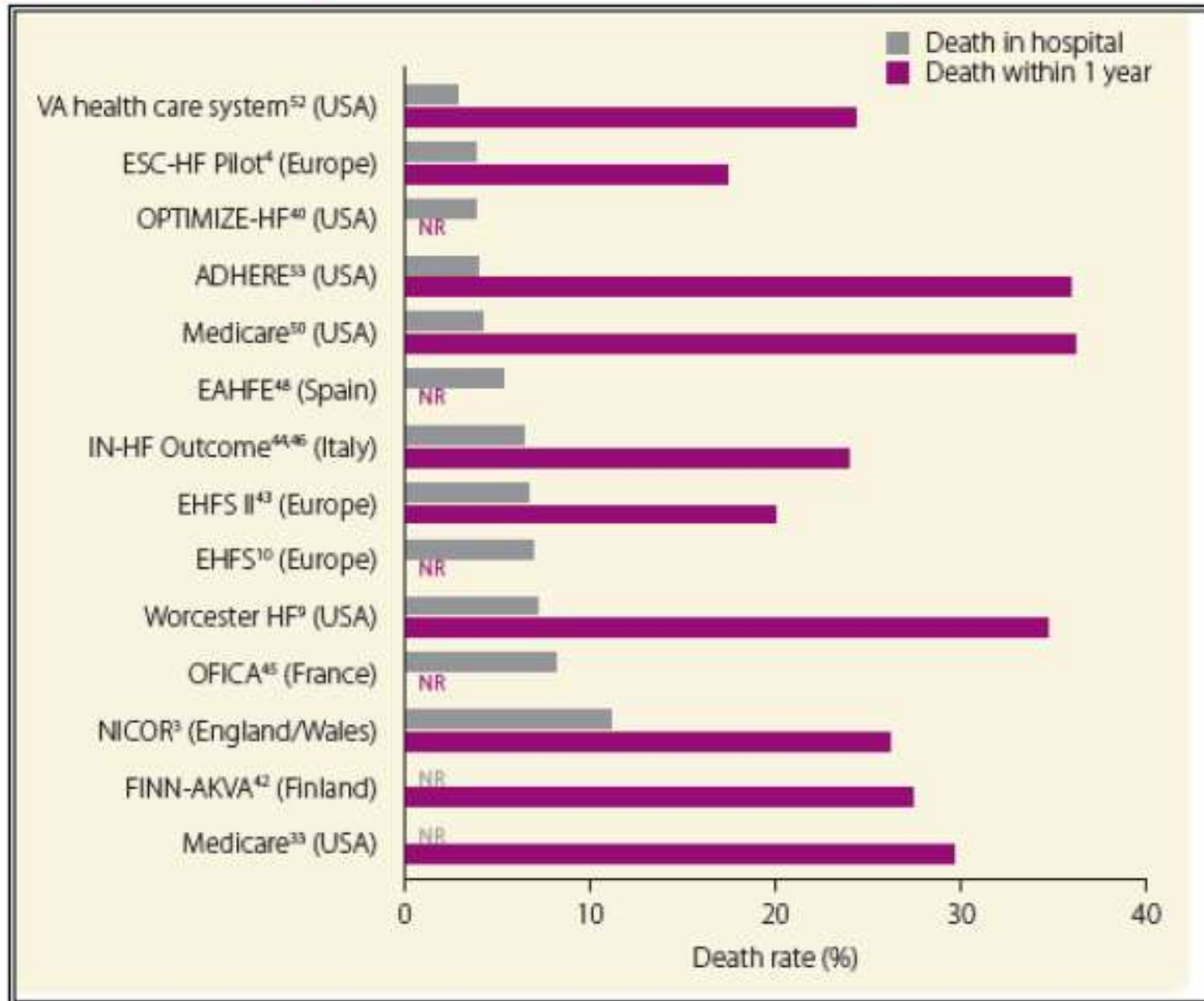
Quelle  
importance?


Comment  
évaluer?





# High in-hospital and annual death rates

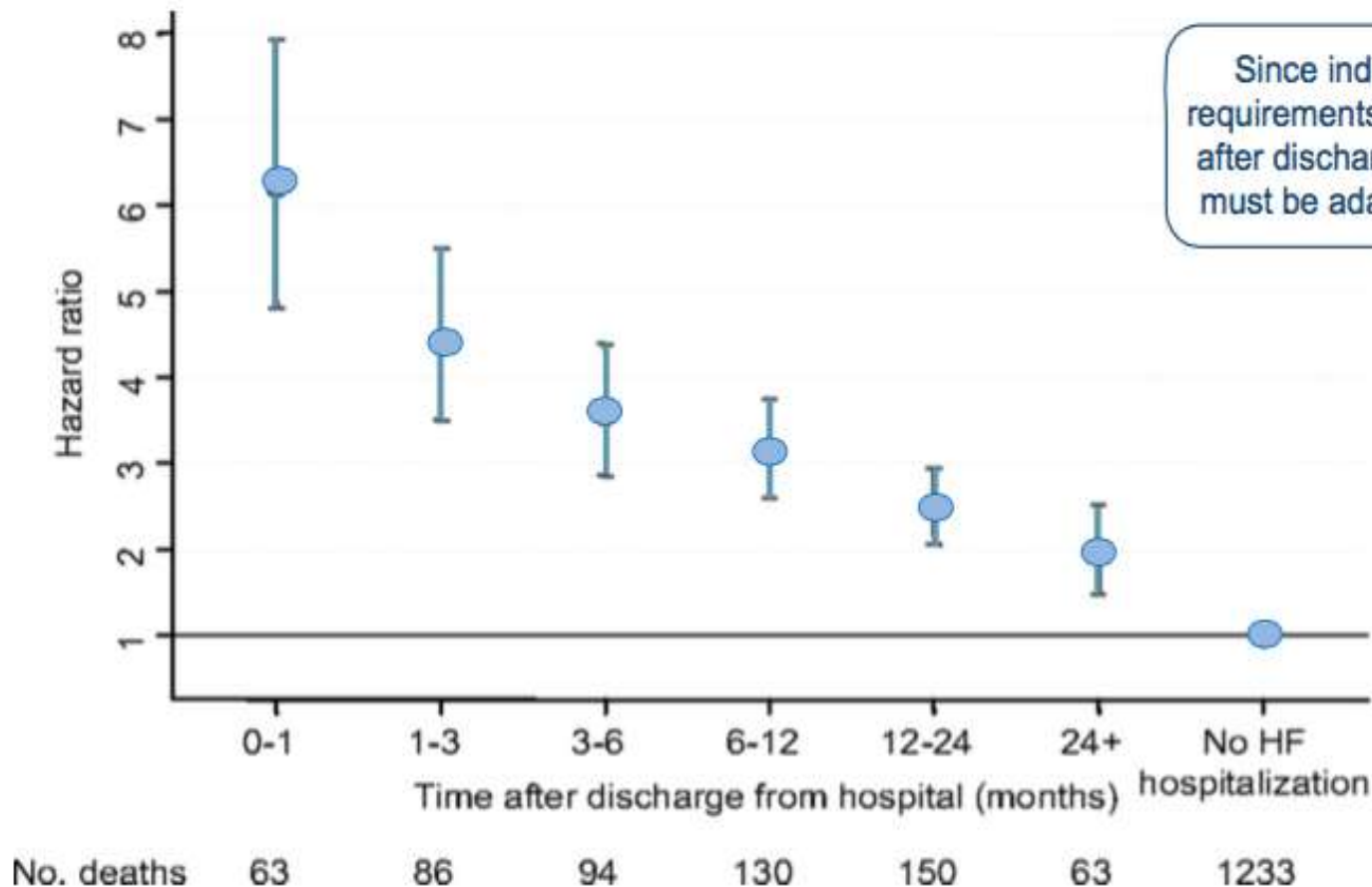


- ▶ Quel est le taux moyen de mortalité à 1 mois après décompensation cardiaque:
  - ▶ A. <1%
  - ▶ B. 10%
  - ▶ C. 25%
  - ▶ D. 40%
- 

# High hospital readmission rates

Study	Country/region	Rehospitalization rate (%)
Medicare <sup>49</sup>	USA	30-day 24.8
Medicare <sup>51</sup>	USA	30-day 26.9
VA health care system <sup>52</sup>	USA	30-day 22.5
ADHERE <sup>9</sup>	USA	30-day 22.1 1-year 65.8
Medicare <sup>50</sup>	USA	30-day 22.7 1-year 67.0
Medicare <sup>38</sup>	USA	6-9-month 60
EHFS I <sup>10</sup>	Europe	12-week 24.2
ESC-HF Pilot <sup>4</sup>	Europe	1-year <sup>a</sup> 43.9
EAHFE <sup>48</sup>	Spain	1-year 27.2
CCU <sup>47</sup>	Italy	6-month 38.1
IN-HF Outcome <sup>46</sup>	Italy	1-year 30.7

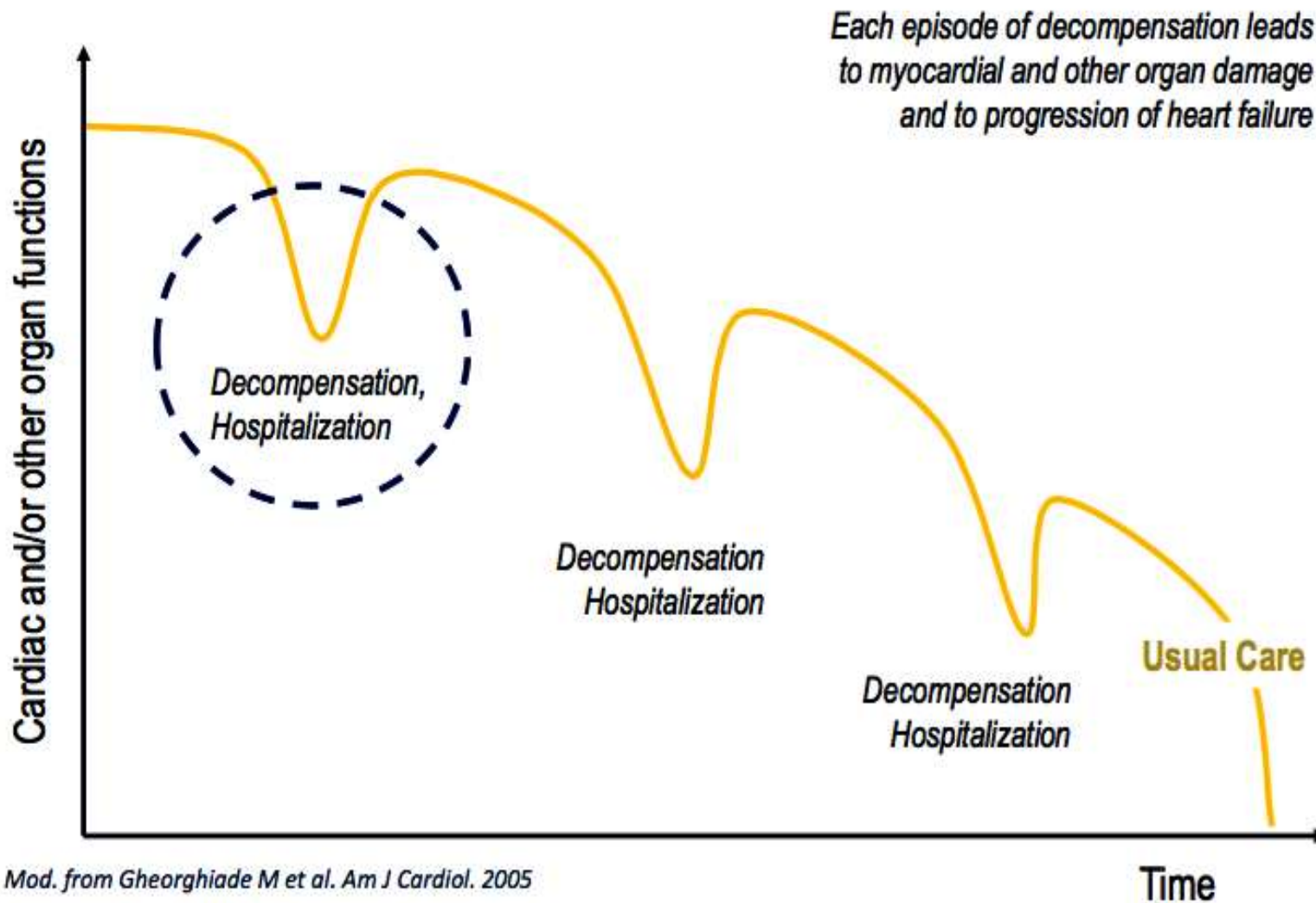
## Mortality risk according to time after discharge from hospital



Solomon SD, et al. *Circulation* 2007; 116:1482-7



# Disease progression in heart failure

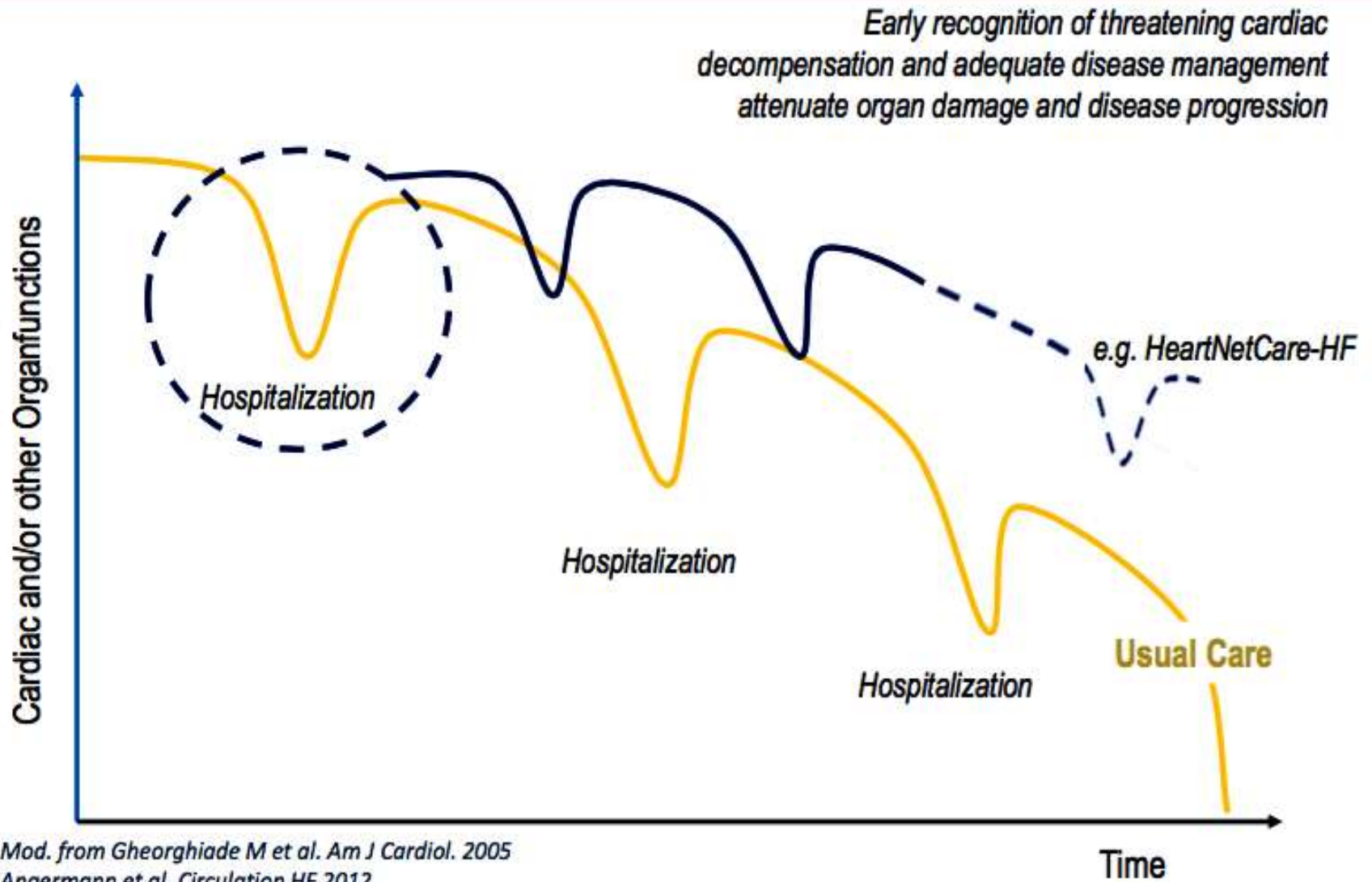


Mod. from Gheorghiade M et al. Am J Cardiol. 2005






# Attenuation of Disease Progression by Holistic (Telemedical) Heart Failure Care



Mod. from Gheorghiade M et al. Am J Cardiol. 2005  
Angermann et al. Circulation HF 2012



- ▶ La majorité des hospitalisations pour décompensation cardiaques sont:
    - A. Bas débit
    - B. Surcharge hydrosodée
    - C. Aggravation de la dyspnée
    - D. Prise de poids
- 

Over 90% of All Hospitalizations for Acutely  
Decompensated Heart Failure (ADHF) Are Due to  
Fluid Overload<sup>1</sup>

The Majority of These Patients Have Failed  
Treatment With Oral Diuretics<sup>2</sup>

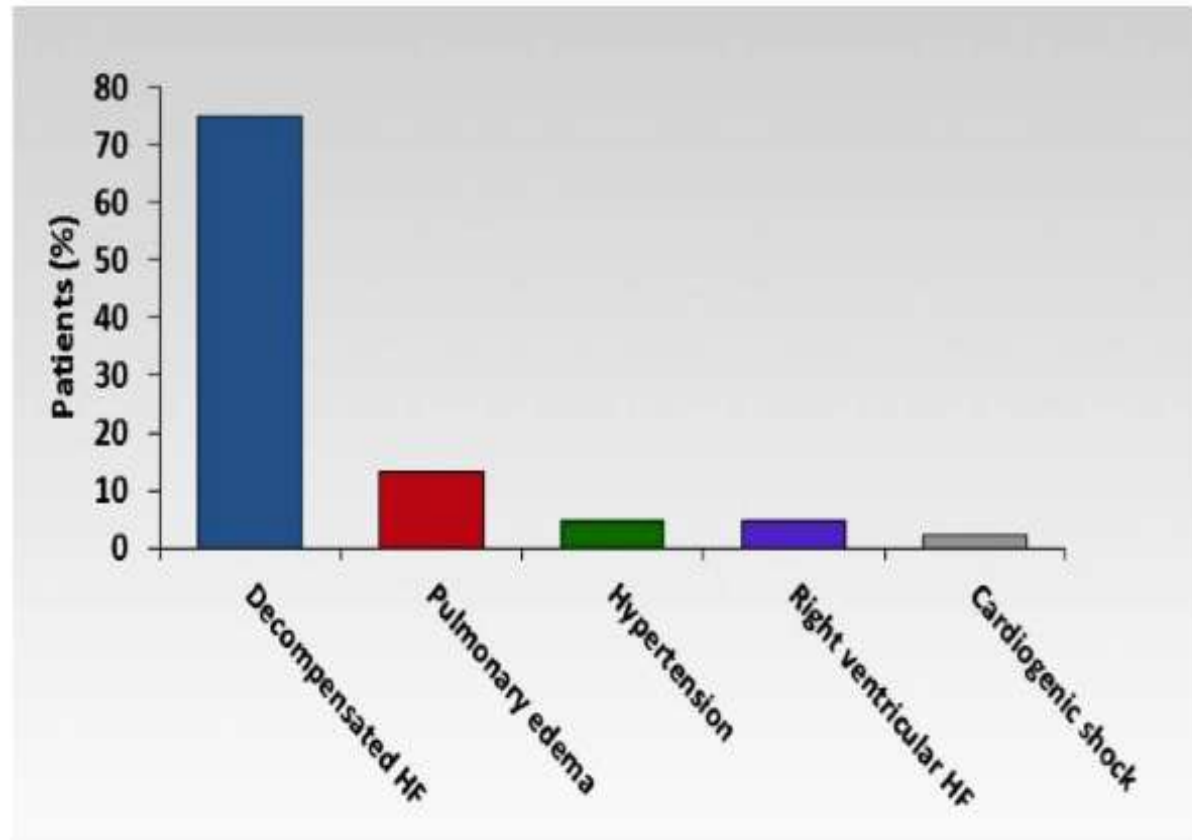
1. Aronson. ACC. 2010.

2. Adams et al. *Am Heart J.* 2005;149:209-216.

# Clinical presentation of AHF patients

## EORP- HF pilot survey

---

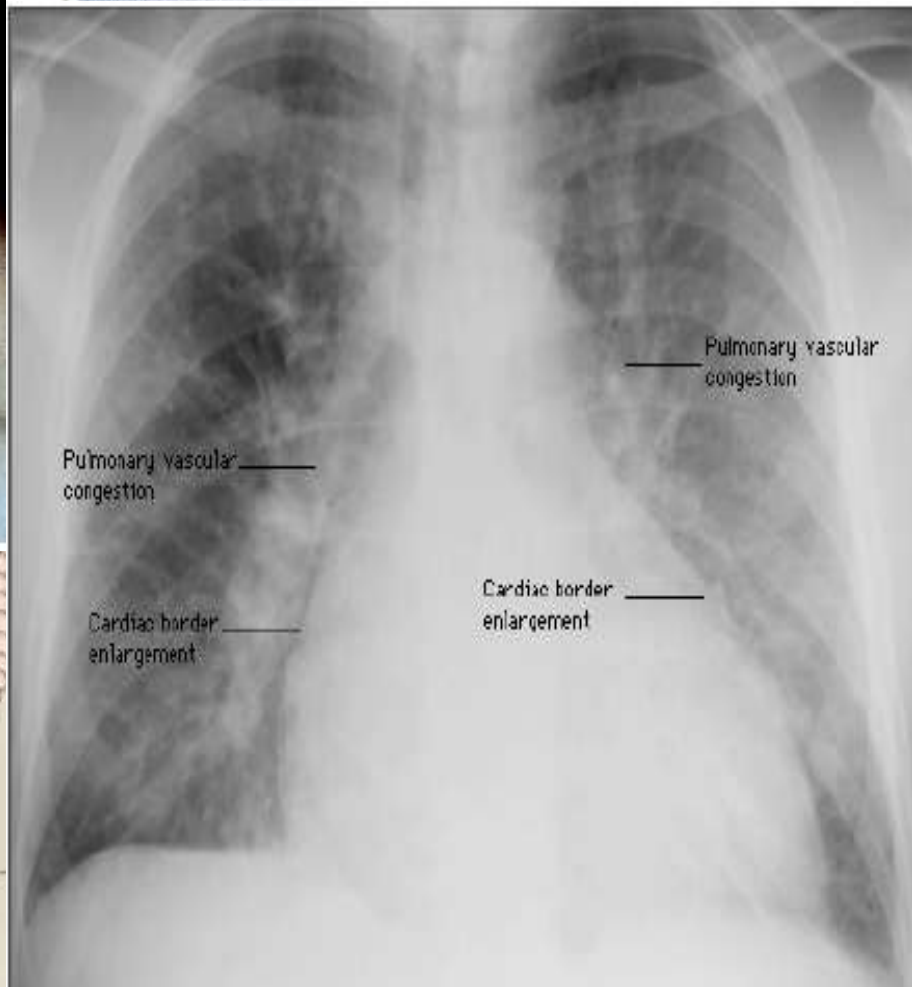




### Cerebral edema

- Impaired cognition
- Delirium

### Pulmonary edema



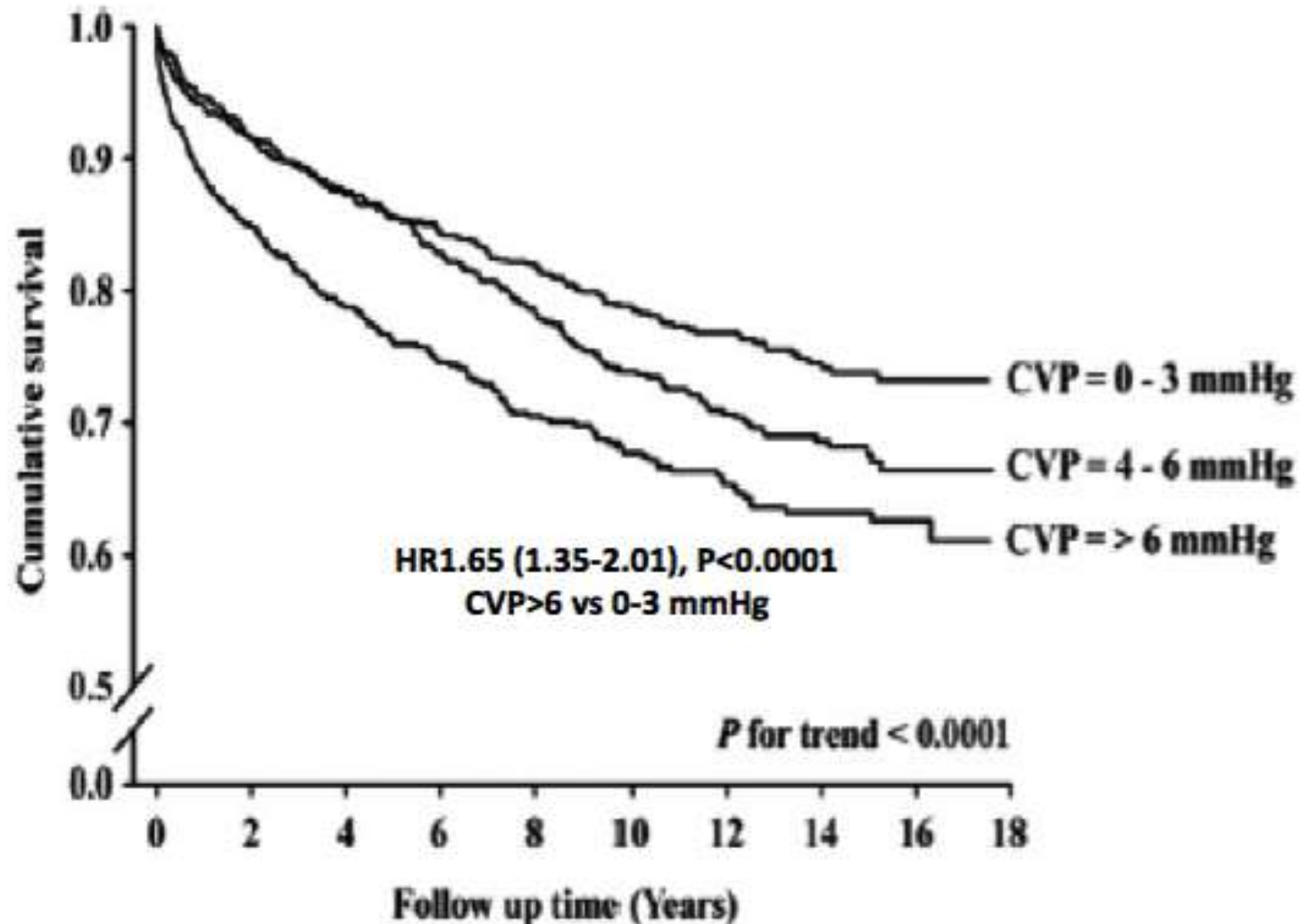
### Gut edema

- Malabsorption
- Ileus



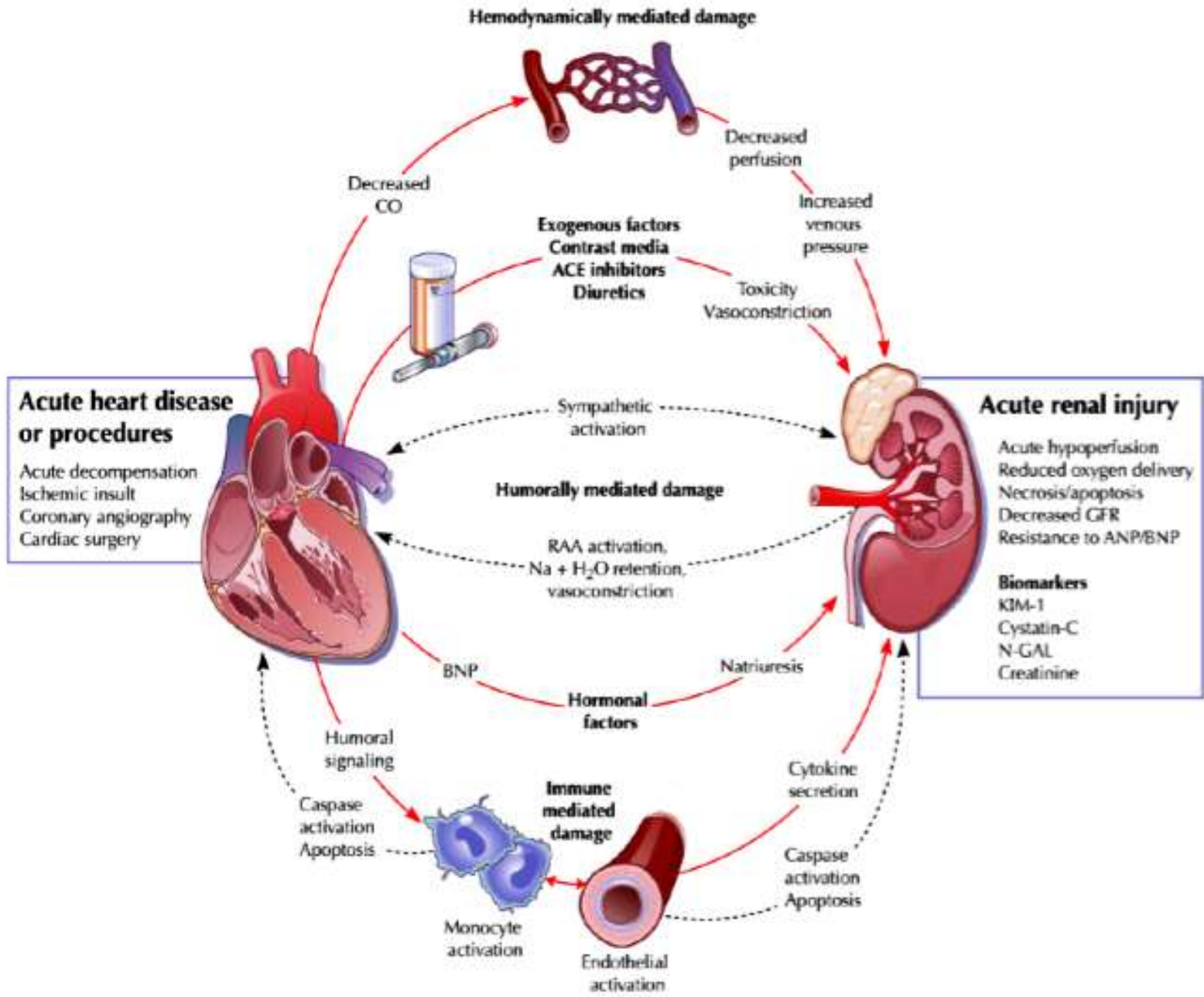
- Wound infection
- Pressure ulcer


# Increased Central Venous Pressure Is Associated Mortality





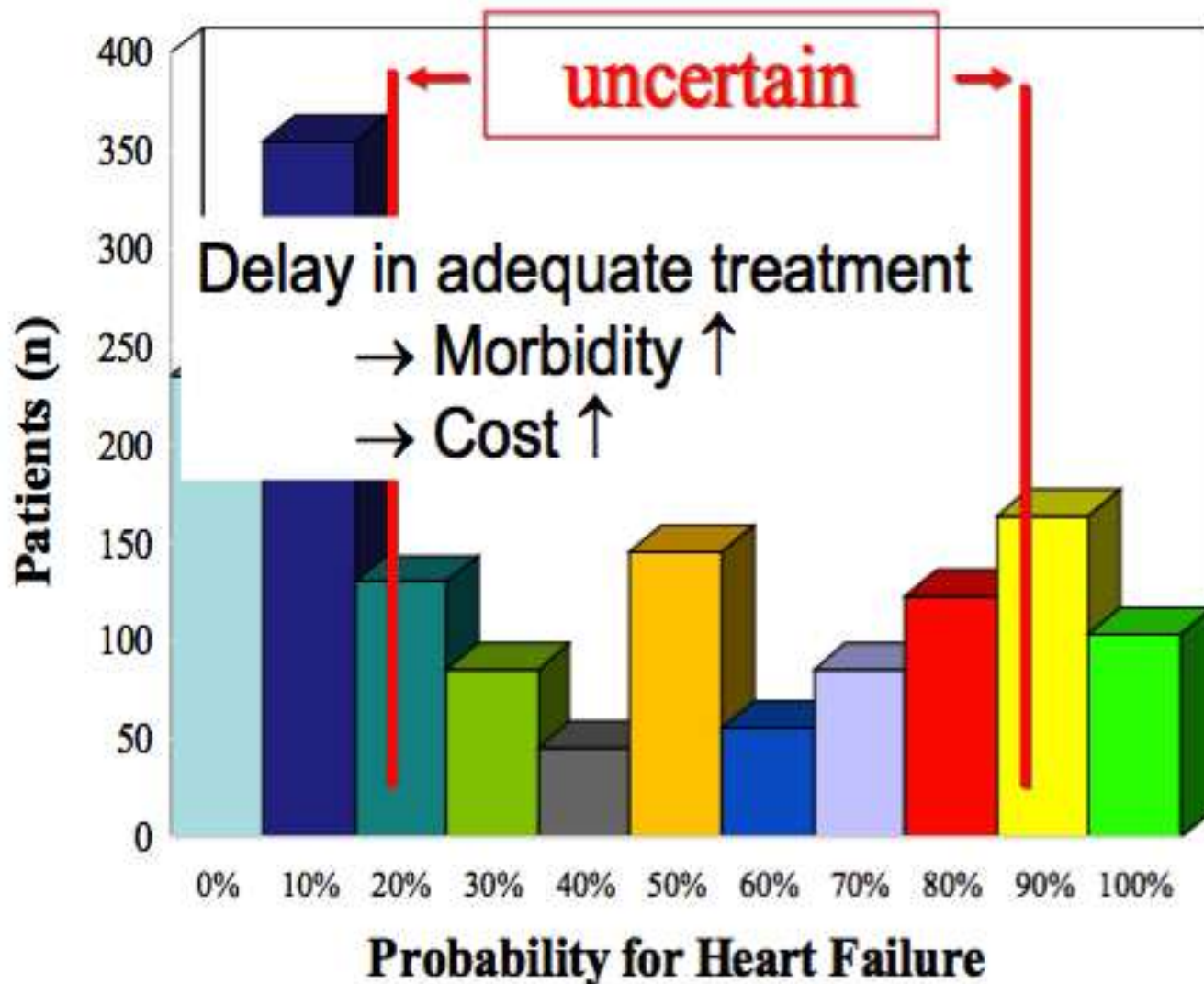
# Cardio-Renal Syndrome (Type 1)



- ▶ Pensez vous que les signes fiables de la décompensation peuvent être:
    - A. Le passage de la dyspnée st II à III
    - B. L'orthopnée
    - C. La prise de poids
    - D. La distention jugulaire
    - E. Les oedèmes des membres inférieurs
- 



# Acute Dyspnea: Difficult Diagnosis



# Clinical markers of congestion

## Diagnostic value

---

Sign or symptom	Sensitivity	Specificity	PPV	NPV
Dyspnoea on exertion	66	52	45	27
Orthopnoea	66	47	61	37

# Clinical markers of congestion

## Diagnostic value

---

Sign or symptom	Sensitivity	Specificity	PPV	NPV
Oedema	46	73	79	46
Resting JVD	70	79	85	62
S3	73	42	66	44

# Radiological markers of congestion

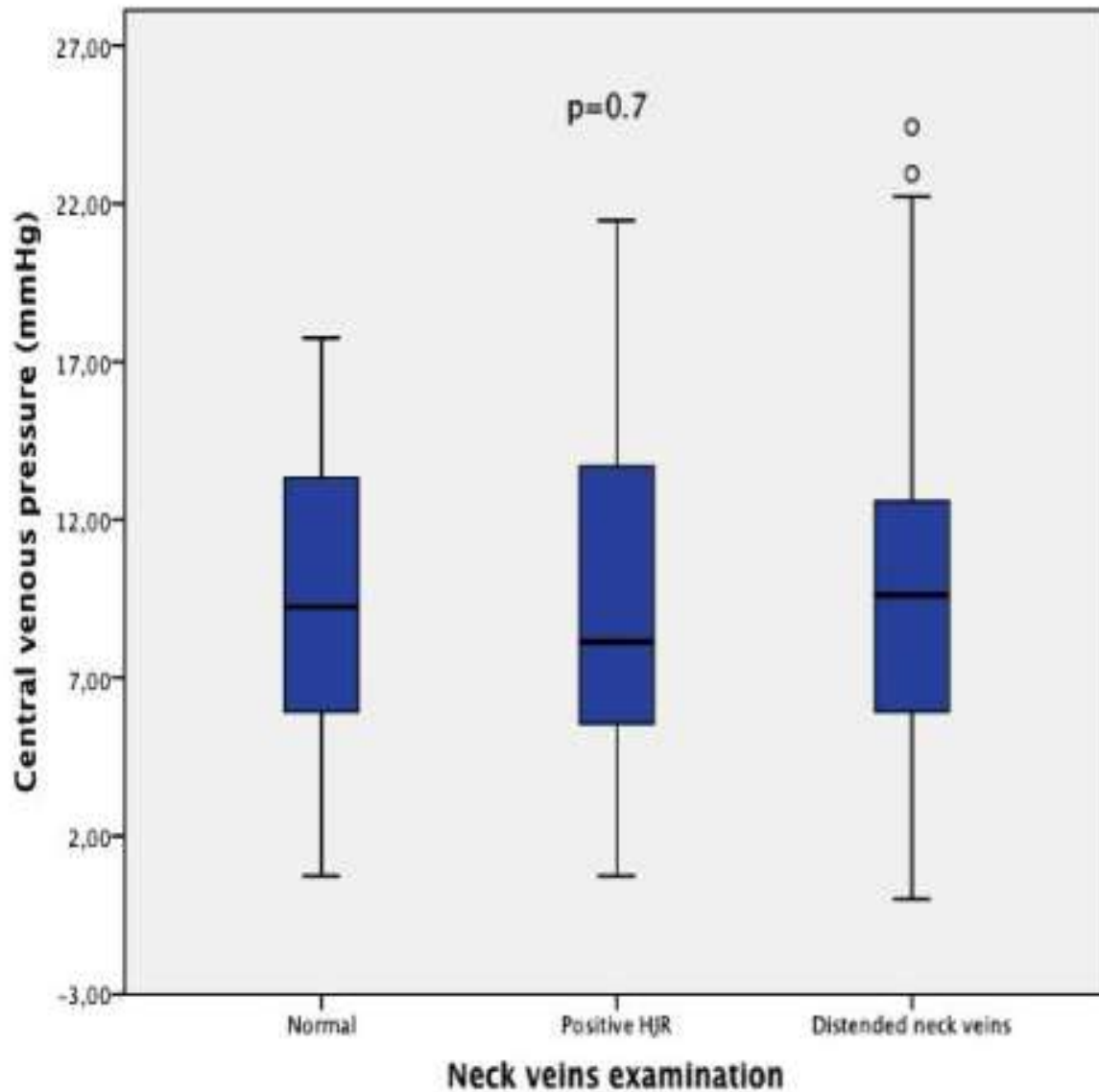
## Diagnostic value

---

Sign or symptom	Sensitivity	Specificity	PPV	NPV
Chest X-ray				
Cardiomegaly	97	10	61	—
Redistribution	60	68	75	52
Interstitial oedema	60	73	78	53
Pleural effusion	43	79	76	47

- ▶ Qu'est ce qui prédit le mieux une PVC élevée:
  - A. Distention veines jugulaires
  - B. Reflux hépatojugulaire

# BASEL V

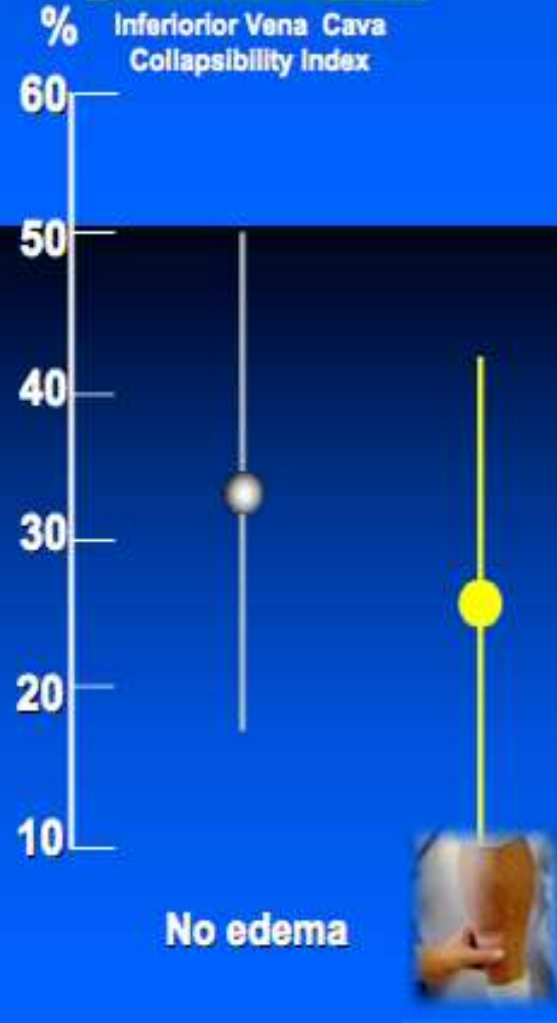
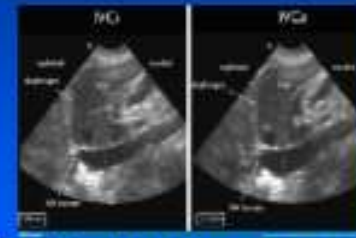
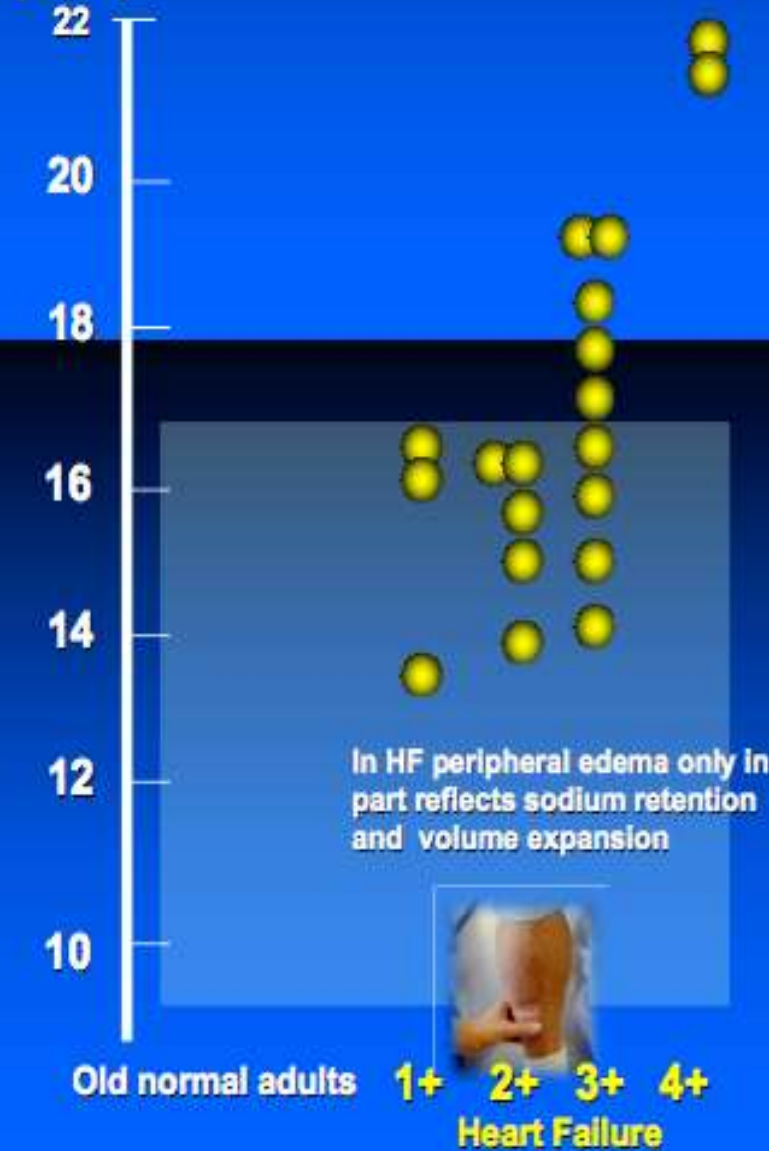


Warner GF et al., Total body sodium space in cardiac edema  
 Circulation 5:915, 1952

Agarwal R et al., On the importance of pedal edema in HD patients. Clin J Am Soc Nephrol 3: 153-158, 2008.

# Total Na Space

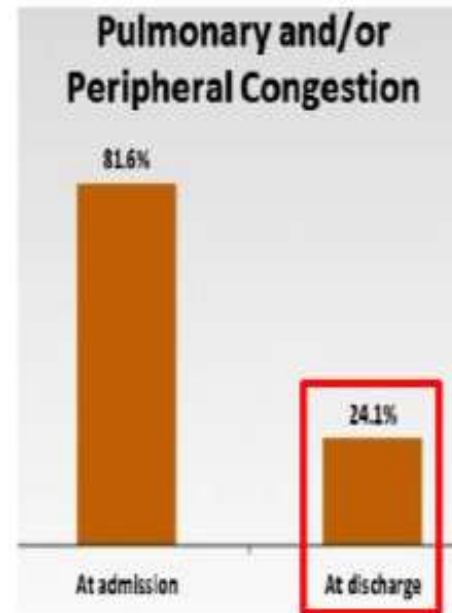
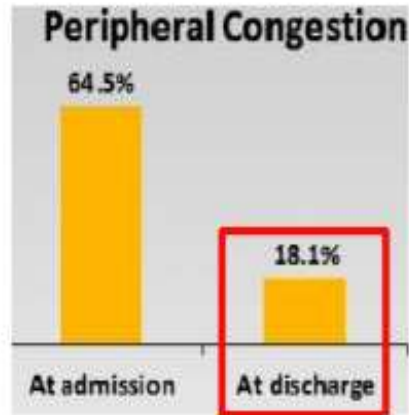
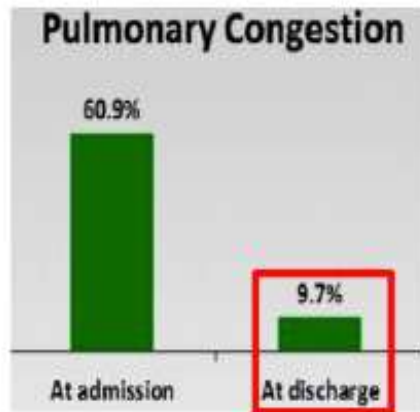
(L/m<sup>2</sup>)



# EORP- HF pilot survey

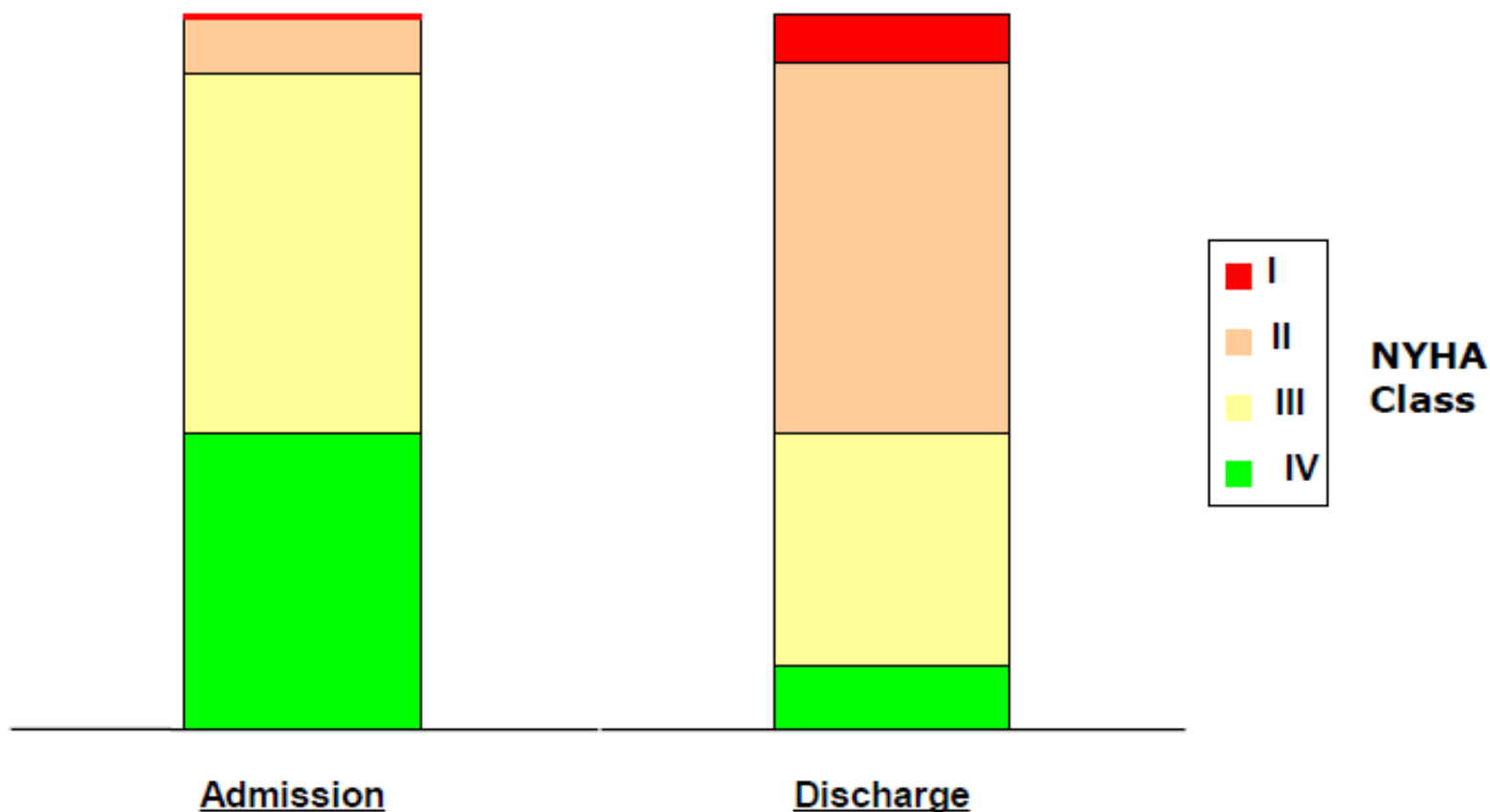
## Congestion at admission and discharge

---





Many patients remain symptomatic even at time of discharge from hospital



Prospective Outcomes Study in Heart Failure (POSH):  
300 patients admitted with decompensated HF to  
European centres, 2002/3

# Congestion

Gold standard objective measurement

---

Currently, the gold standard for evaluating haemodynamic congestion in HF patients is cardiac catheterization to measure RAP and PCWP

# Congestion

## Definition

---

### Hemodynamic congestion

- ↑ LVEDP
- No signs and symptoms of HF

### Clinical congestion

- ↑ LVEDP
- **Signs and symptoms of HF** (dyspnoea, rales, and oedema).

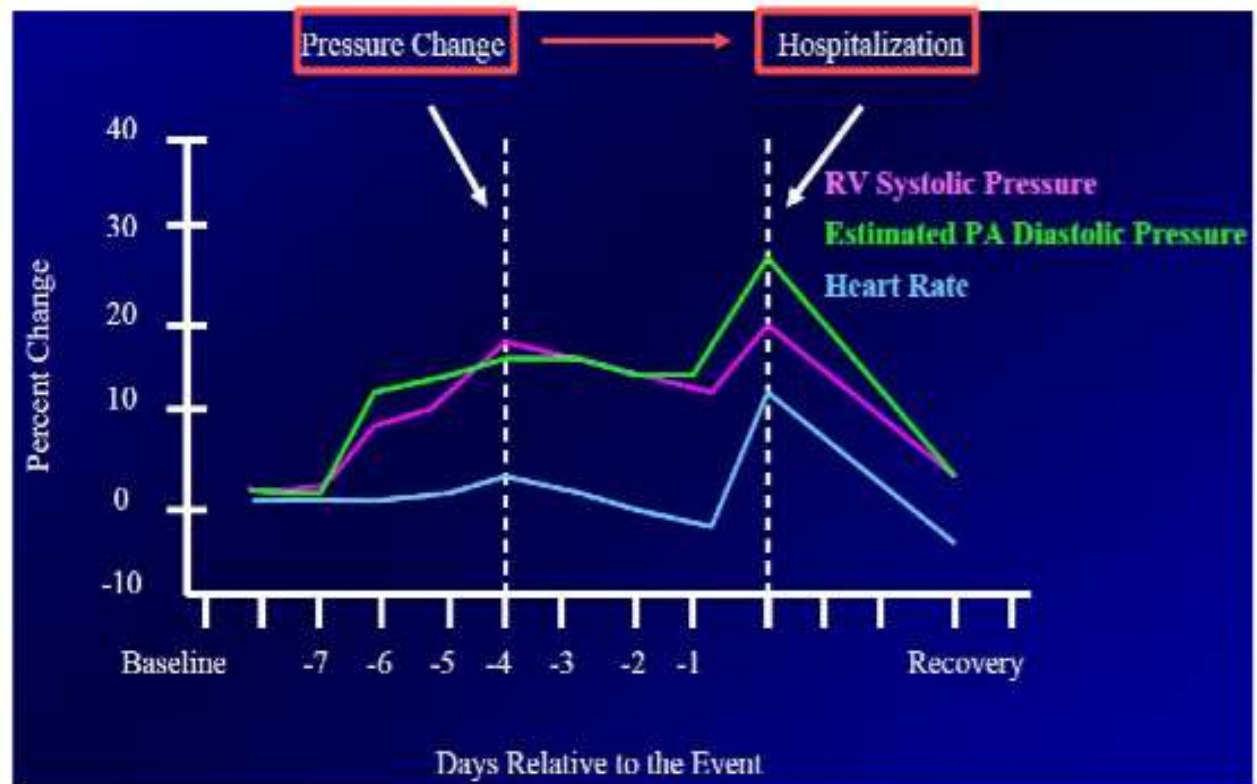
# Congestion

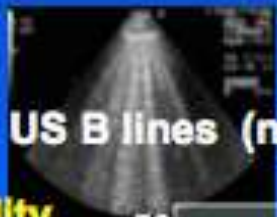
## Haemodynamics vs clinical manifestations

---

Often, haemodynamic congestion precedes clinical congestion by days or even weeks ....

## ... and precedes hospitalization

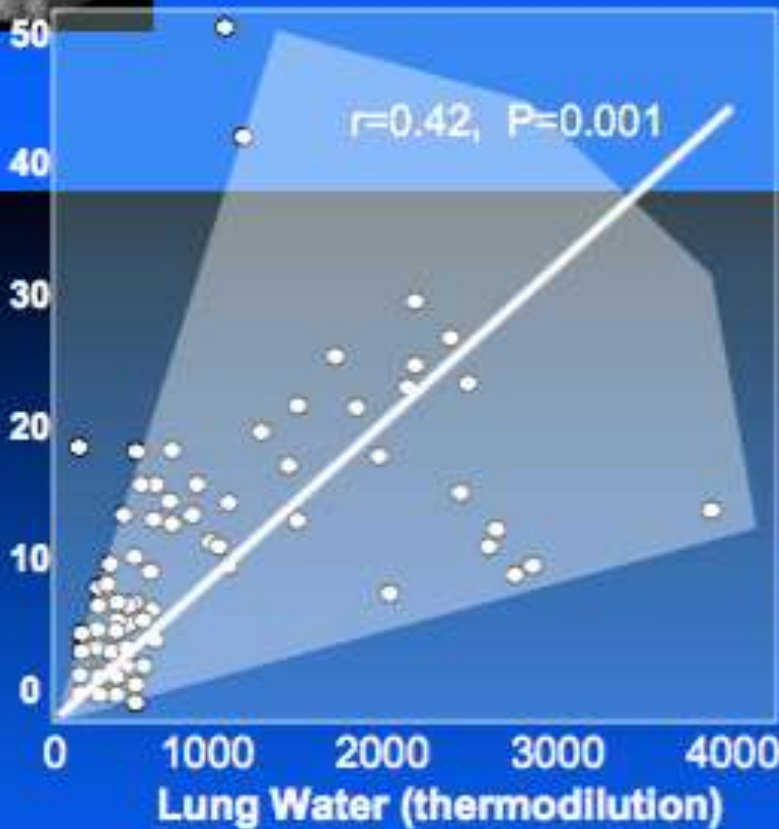




US B lines (n)

Agricola E et al., CHEST 127:1690, 2005  
Validation in patients with Heart Diseases

Reproducibility  
<5%



Reproducibility  
10%-15%

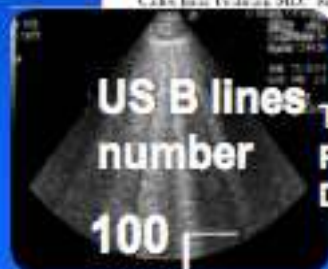
# Lung Ultrasound for the Evaluation of Pulmonary Congestion in Outpatients

JACC CV Img

2013;6:1141-51

A Comparison With Clinical Assessment, Natriuretic Peptides, and Echocardiography

Heide Hans-Matthews, MD, MDR,<sup>1</sup> Luis Garcia, MD,<sup>2</sup>  
Roberto Talini-Saiz-Araujo, MD,<sup>3</sup> Marlon Melo-Jorge, MD,<sup>4</sup> Ulisses Magalhães Martins, MD,<sup>5</sup>  
Argemiro Marques, MD,<sup>6</sup> Cristina Wilton, MS,<sup>7</sup> Maria Aparecida Mattos, RN, PhD,<sup>8</sup>  
Celia Inês Pedreira, MD,<sup>9</sup> Renato Abdala, Kassab, G&L, MD, PhD,<sup>10</sup>  
Luis Carlos de Mattos, MD, PhD,<sup>11</sup> Diego Galvão de Lencastre, MD, PhD<sup>12</sup>



US B lines  
number

100

Target Population:  
Patients with Heart  
Disease

80

60

40

20

0

No cardiac  
decompensation

Decompensation

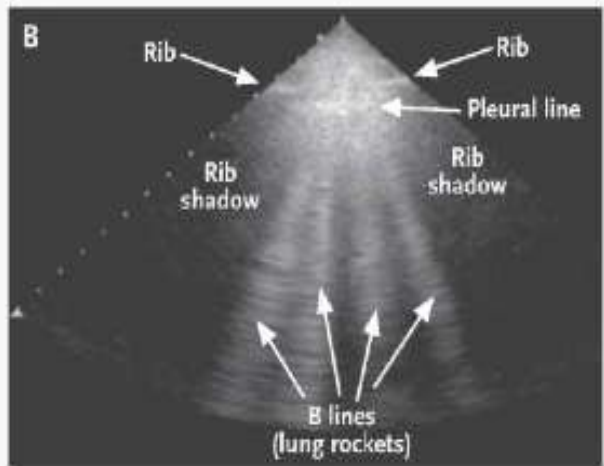
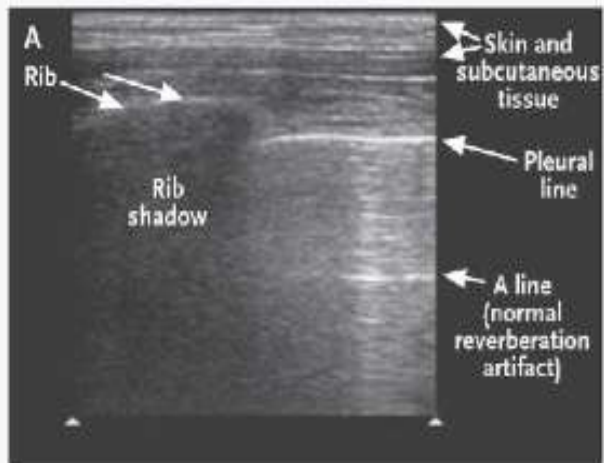
High discriminatory value  
for decompensated HF

Sensitivity 85%  
Specificity 83%  
Area under the ROC  
curve 0.89



# Lung ultrasonography

## Using a 2D-echo probe



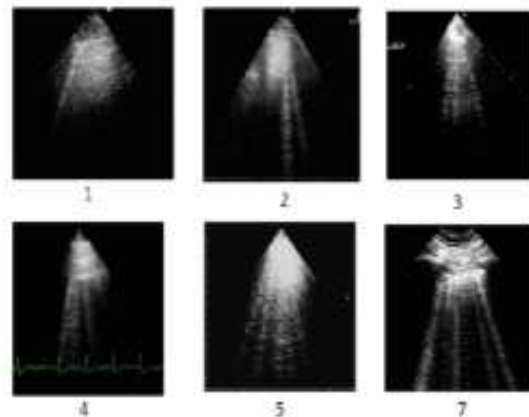
### B-lines: definition

Discrete laser-like vertical hyperechoic reverberation artifacts, that arise from the pleural line.



© Farnsworth/Corbis Images via Pleural and Lung Ultrasound

### How to count B-lines





# MANAGEMENT GUIDÉ PAR LES BIOMARQUEURS



# Concept of HF Monitoring

---

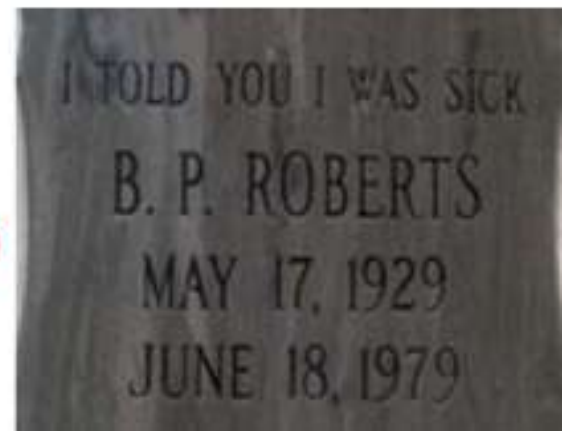
- Low BNP, low mortality/morbidity
- If BNP  $\downarrow$   $\longrightarrow$  risk of death/rehosp  $\downarrow$
- Aim: Maximal  $\downarrow$  of BNP (without arterial hypoperfusion = Crea $\uparrow$ )

Biomarker to assess **safety**  
(organ perfusion)

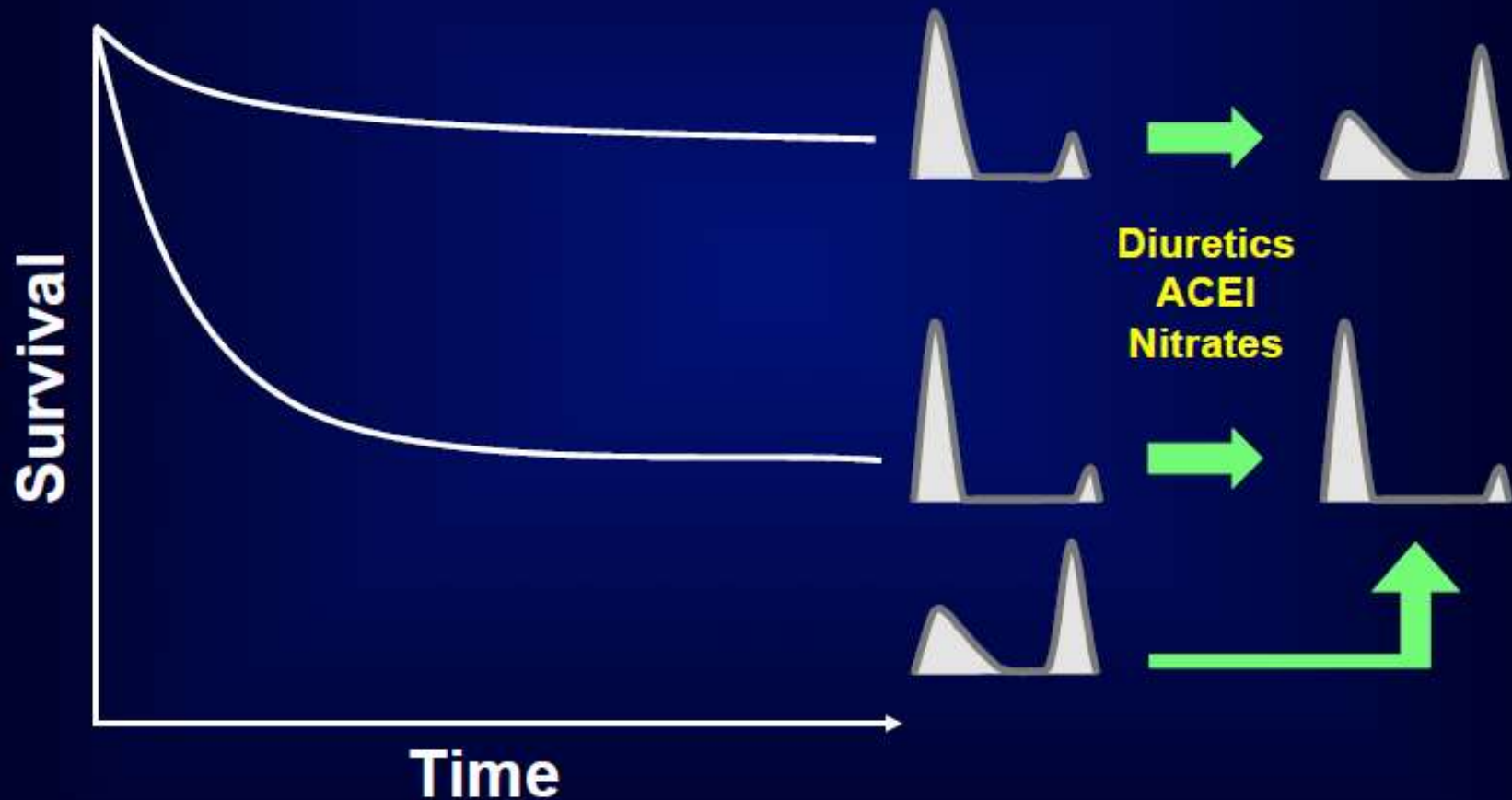
**Cardiac output**

Biomarker to assess **efficacy**  
(filling pressures)

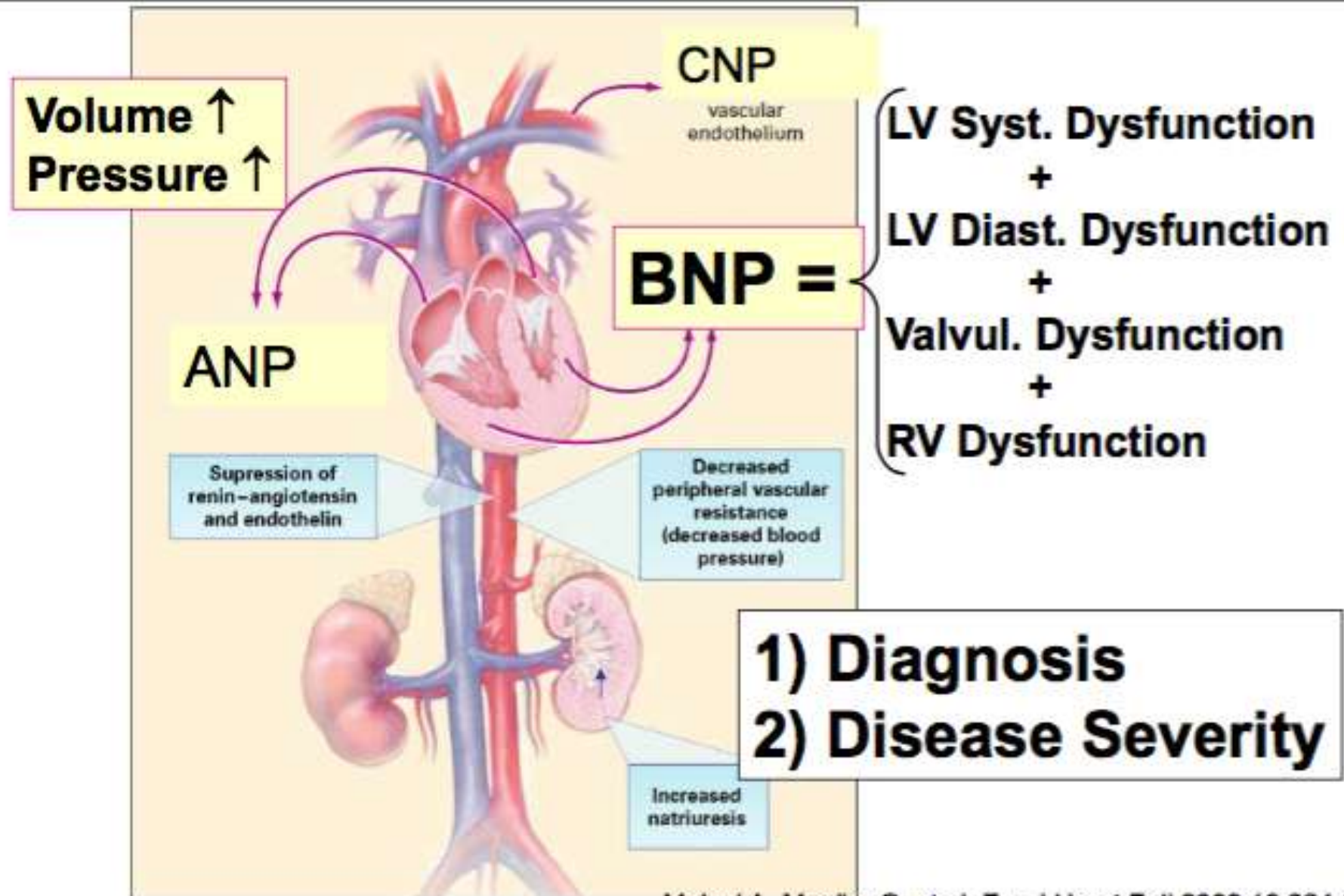
**PCWP**



# Mitral flow velocity changes after 6 months of optimized therapy provide important hemodynamic and prognostic information in pts with chronic HF



# NPs: Quantitative Marker of HF

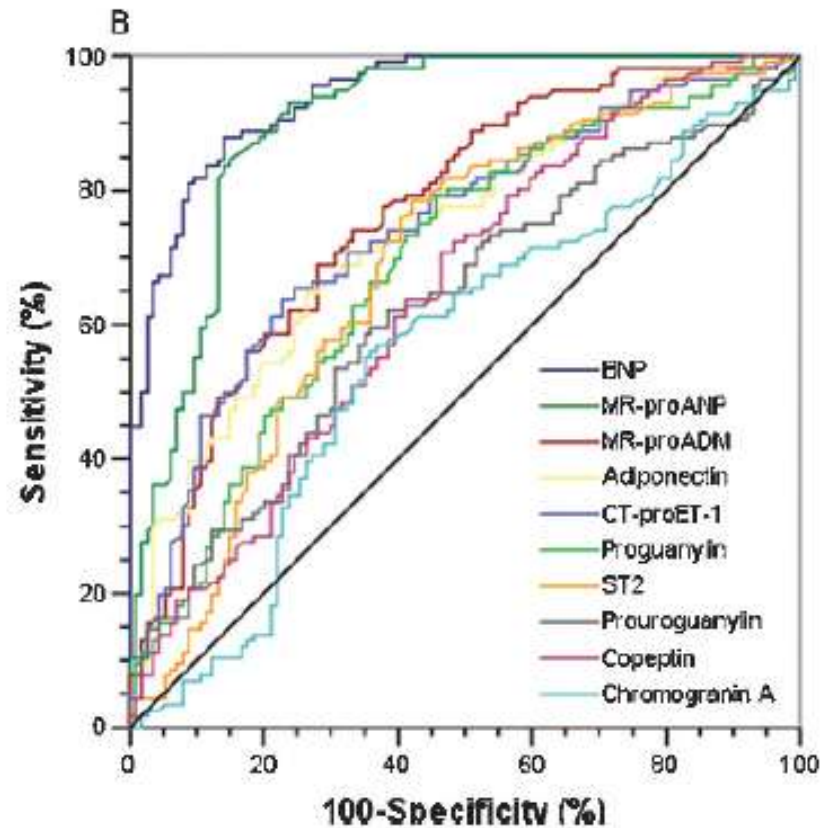


# Multiple Biomarkers for LV Dysfunction in AHF

251 consecutive ER-dyspnoea

BNP, MR-proANP, MRproADM, copeptin, CT-roET-1, ST2, adiponectin, chromogranin A, proguanylin and prouroguanylin.

BNP and MRproANP were the only independent diagnostic markers of HF.

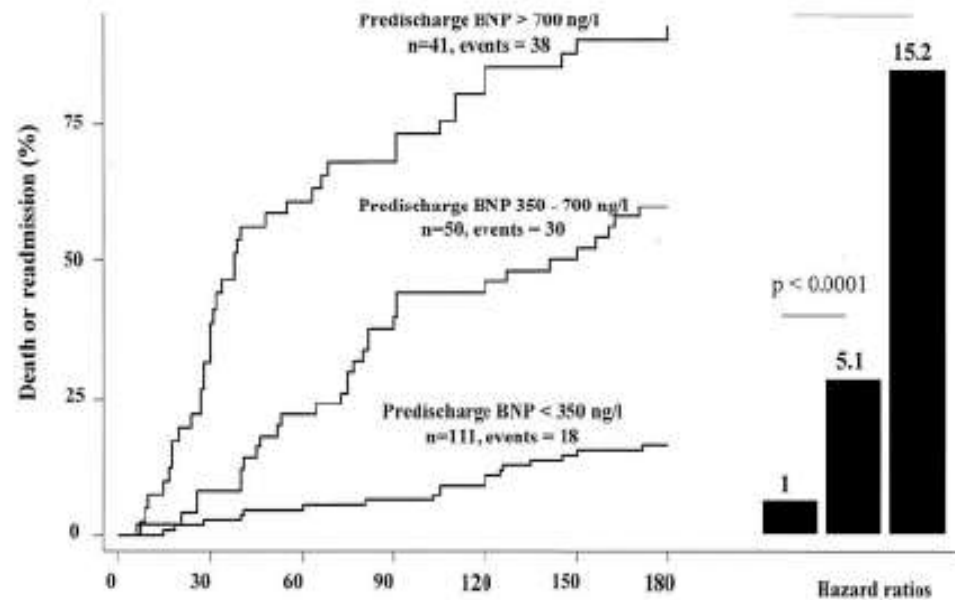


*Mueller et al Heart 2009;95:1508*

137 with HF

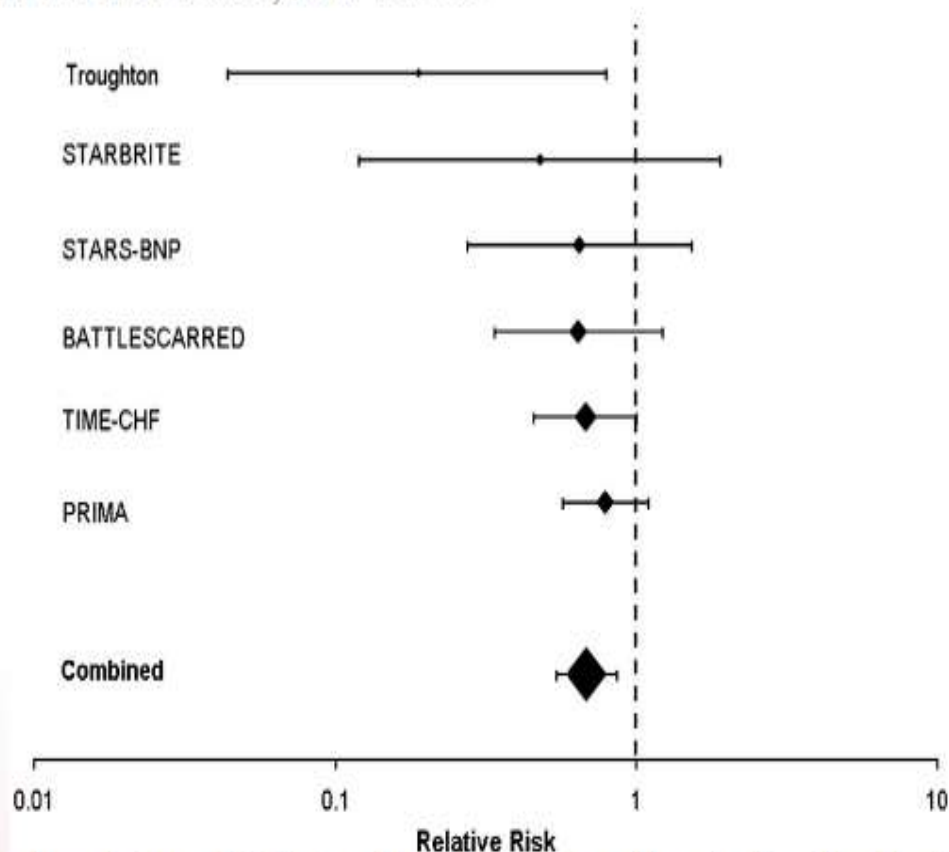
# BNP and Readmission for HF

- **Admissions for DHF-**
  - 105 derivation cohort
  - 97 validation cohort
- **Serial and predischARGE BNPs measured**
- **Pre-discharge BNP best predictor of readmission (AUC=0.85), only significant variable in multiple regression model, (HR=15.2 [8.5-27], p=0.0001)**
- **Patients greatest ↓ in BNP -better outcome cf those with a more modest reduction (HR=0.18 [0.07-0.48], p=0.001)**



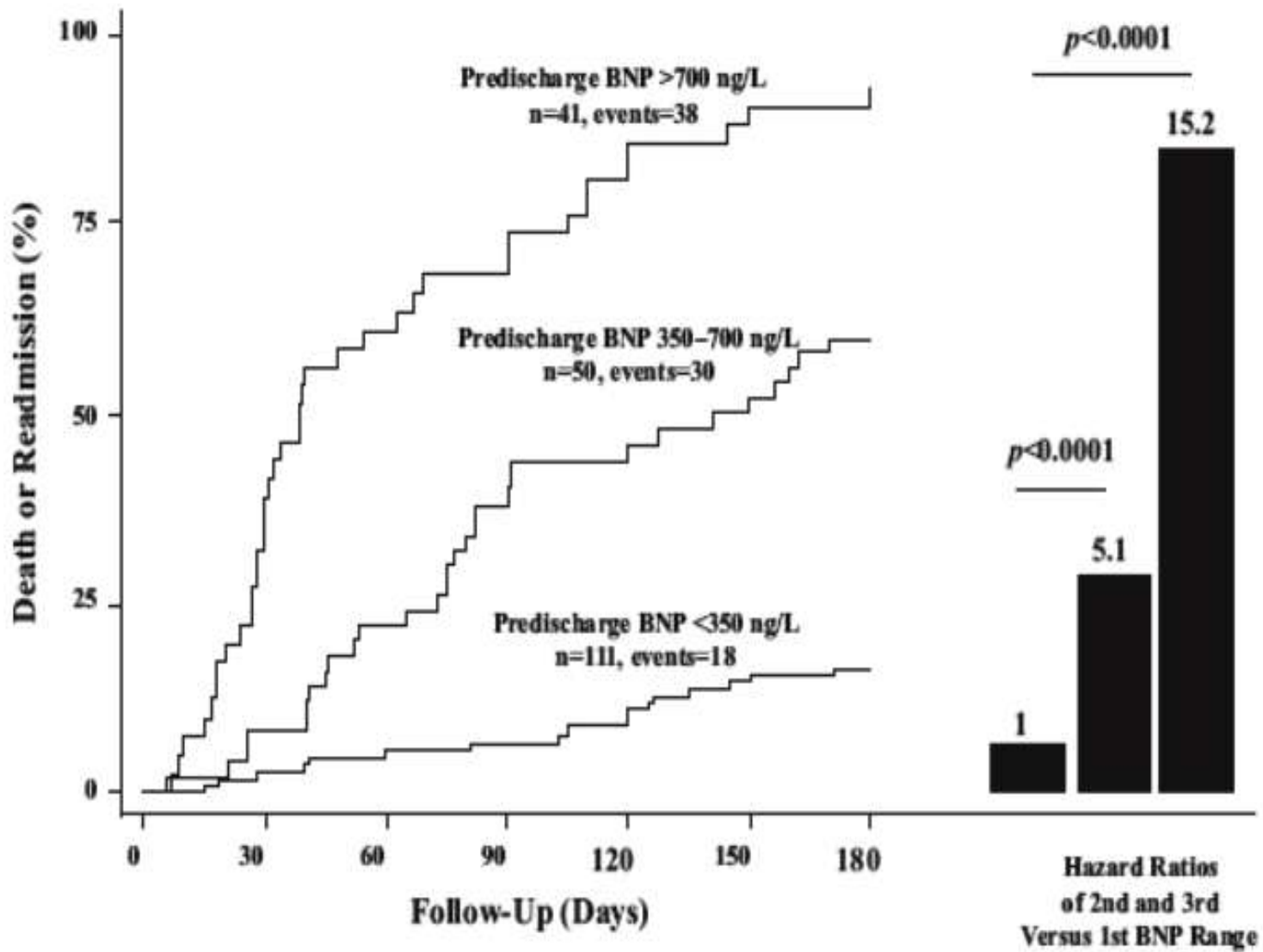
# Bio-marker guided therapy in CHF: A meta-analysis of randomized controlled trials

Felker GM et al. *Am Heart J* 2009;158:422-30



**6 studies randomizing 1627 patients met criteria for inclusion. Pooled analysis showed a significant mortality advantage for biomarker guided therapy (hazard ratio 0.69, 95% CI 0.55-0.86) compared to control.**

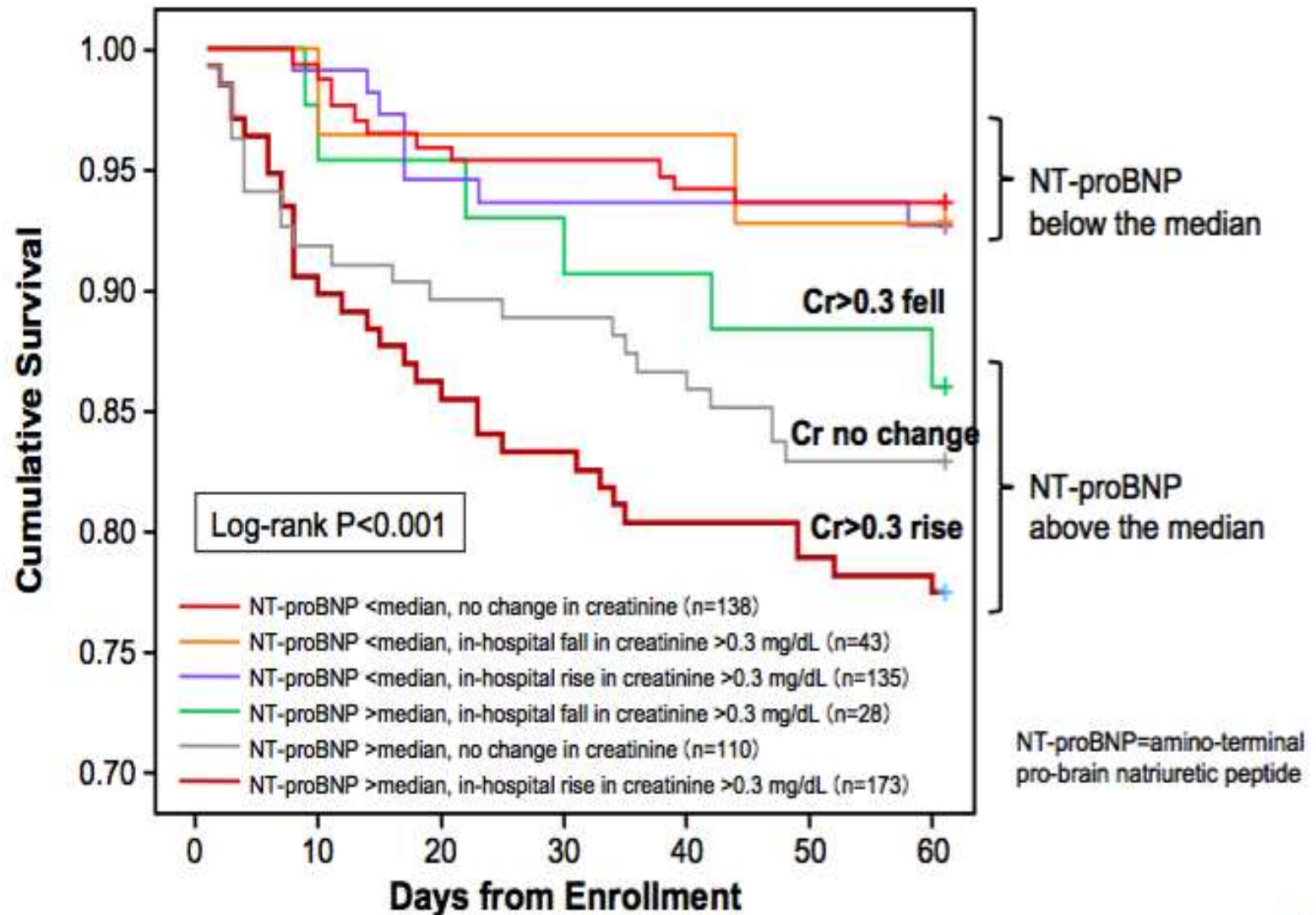
# BNP





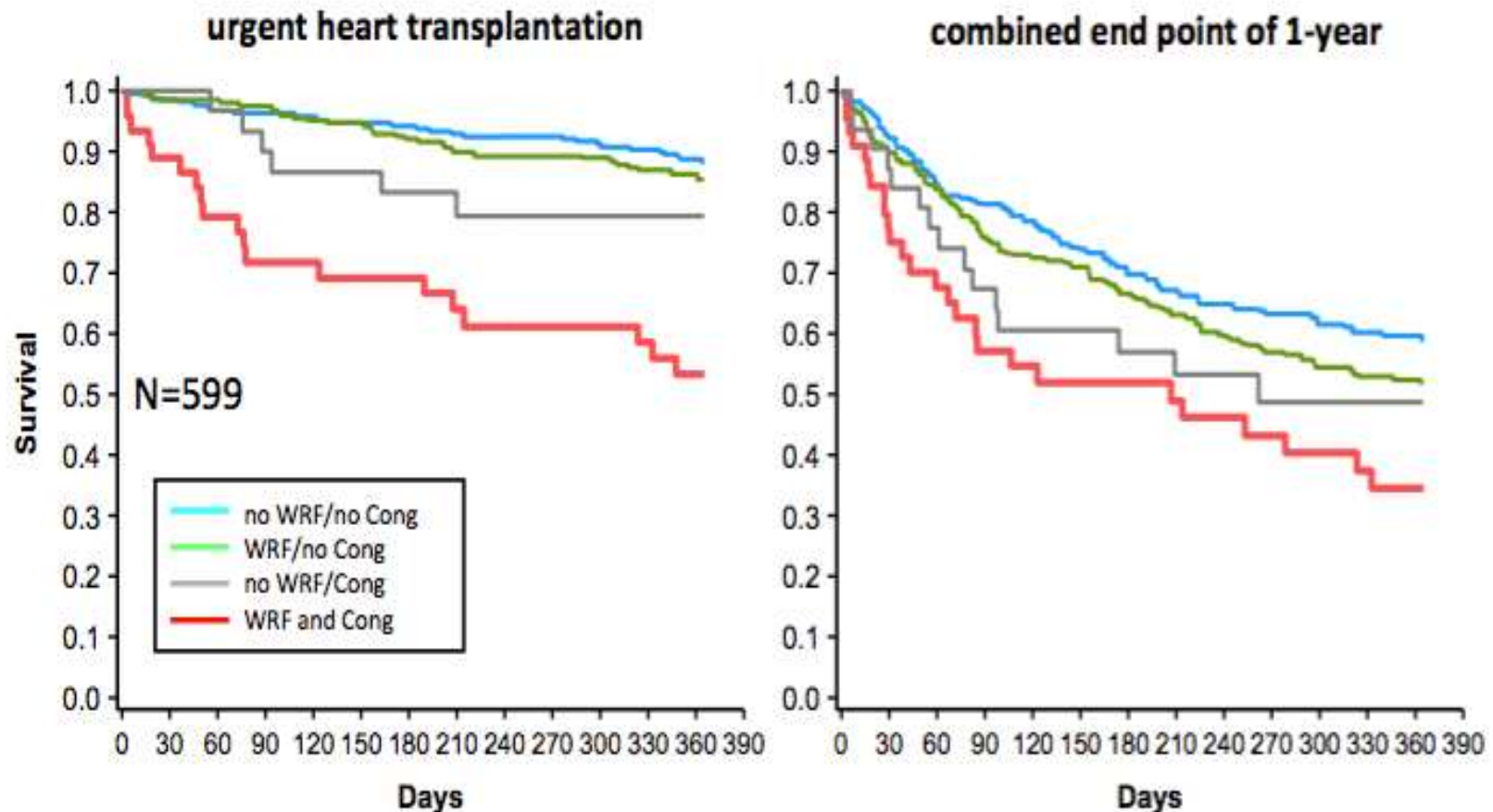
# Renal function impairment in acute phase worsens the prognosis of HF

van Kimmenade, R. R. et al.: *J. Am. Coll. Cardiol.*, 48(8), 1621-1627, 2006



# Combined effect of WRF and Congestion

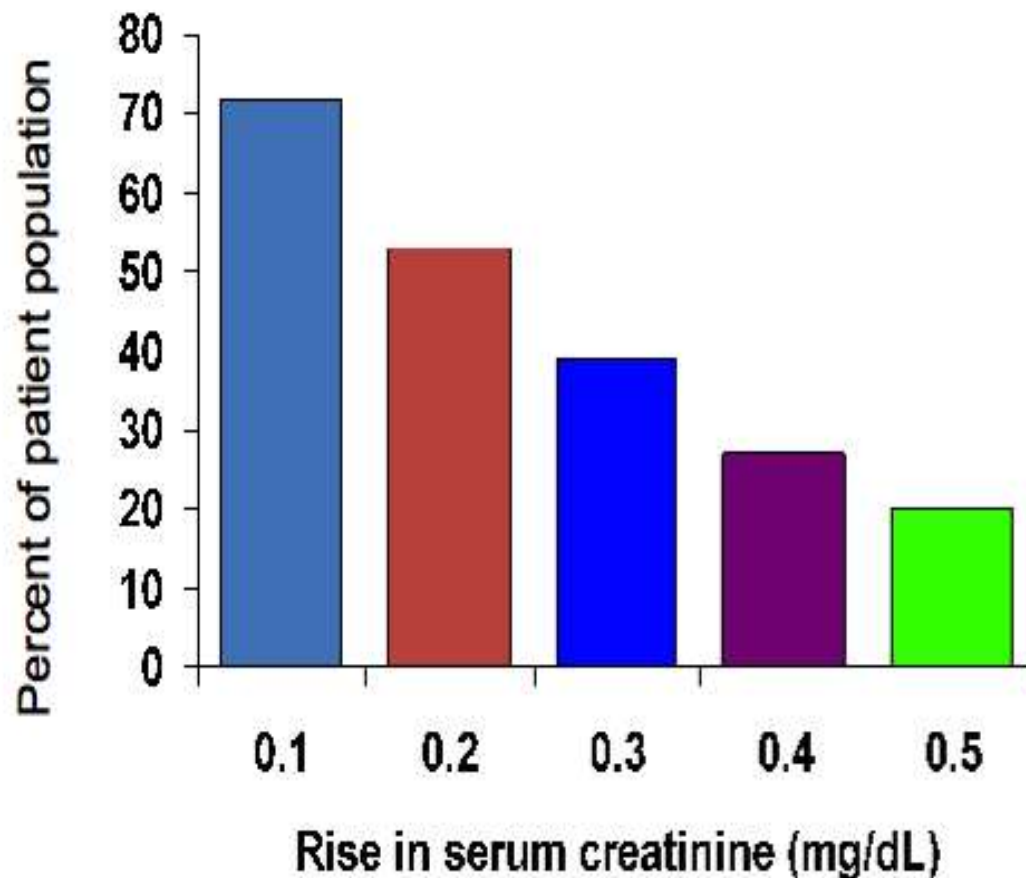
Metra et al.: *Circ Heart Fail.* 2012;5:54-62



Outcome for 1-year death or urgent heart transplantation (Tx) (**left**) and for the combined end point of 1-year death, urgent heart transplantation, or heart failure (HF) readmission (**right**) for the patients subdivided on the basis of the development of worsening renal function (WRF) and on the presence of signs of congestion (Cong) at discharge.

# WRF During Therapy of Decompensated HF

*Multicenter retrospective chart review  
of 1,002 pts*



Creatinine  $\uparrow \geq 0.3$  mg/dL associated with significantly higher hospital and post-discharge mortality, length of stay, readmission rate and cost.

# CONCLUSION

---


Congestion is the main reason for hospitalization for AHF.

It is a cause of severe symptoms

and a potent predictor of bad prognosis

# CONCLUSION

---

- No single non-invasive test accurately detects haemodynamic congestion.
  - Clinical evaluation and Chest X-ray have diagnostic limitations
  - No established algorithm for the assessment of congestion
- 

# Congestion

## proposed Pre-discharge ideal targets

---

- **Orthopnea:** be able to lie supine or with no more than one pillow with no breathlessness
- **Dyspnea:** walk for at least 6 min without undue breathlessness and complete at least 200 m
- 
- **Rales:** absent
- **JVP:** no increased JVP
- **Edema:** no more than trace edema
- **Weight:** be at 'target' or at least at lower body weight compared with admission
  
- **Natriuretic peptides:** lower than on admission
  - Patients with high NPs at discharge (NT-proBNP . 1500 pg/mL and BNP . 300 pg/mL) should be considered at high risk of death or re-admission

- ▶ The combination of NP levels together with symptoms, signs and weight gain assists in the assessment of clinical decompensation in HF.
  - ▶ NP-guided therapy may improve morbidity and/or mortality in chronic HF.
  - ▶ NP levels at discharge aid in risk stratification of the HF patient.
  - ▶ NP levels may be helpful to screen for asymptomatic left ventricular dysfunction in high-risk patients.
- 