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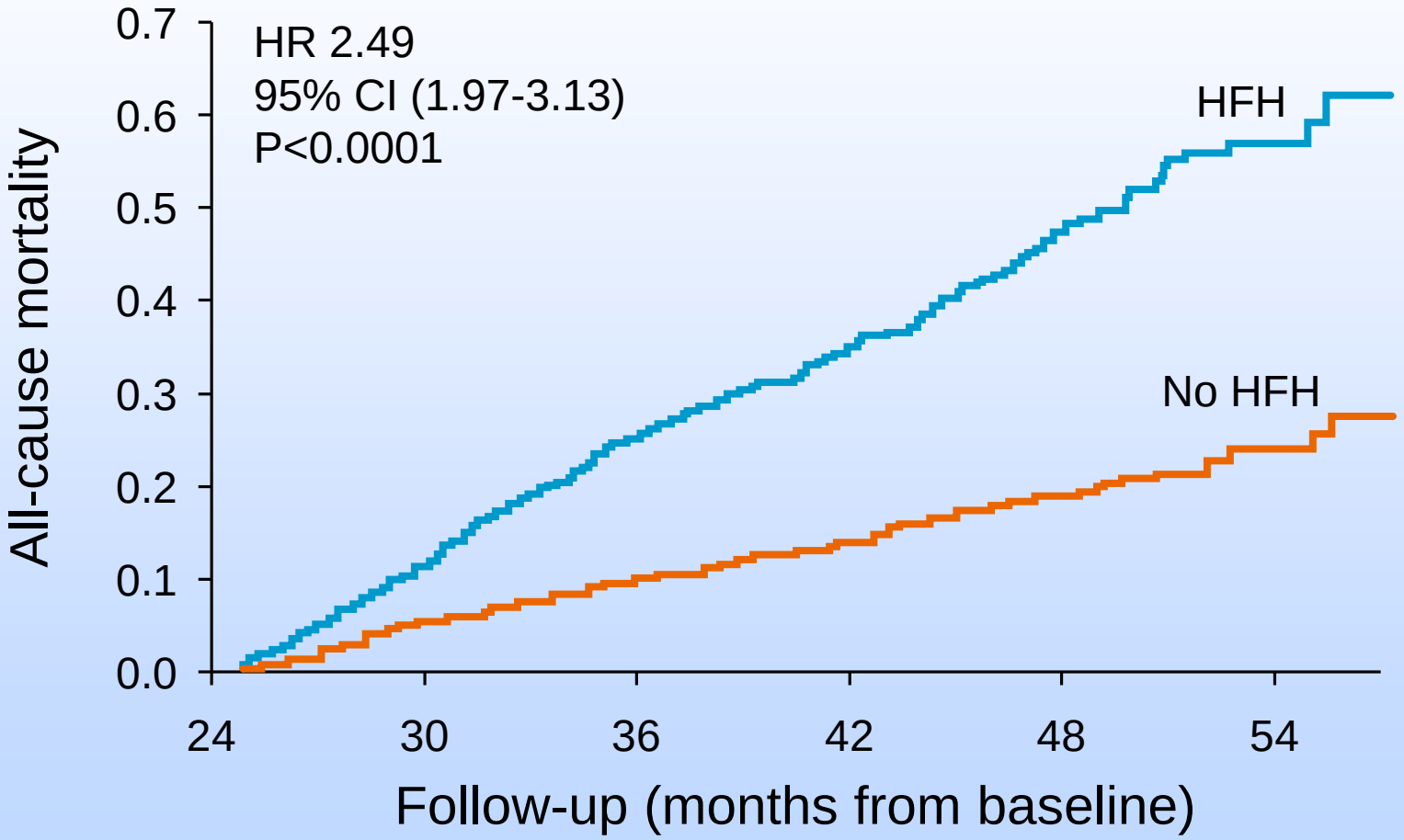
Acute Decompensated Heart Failure

Clinical and Hemodynamic Management

Sudhir S. Kushwaha, MD, FACC

Hospitalization for HF and Mortality



Ahmed A et al: JCF, 2008

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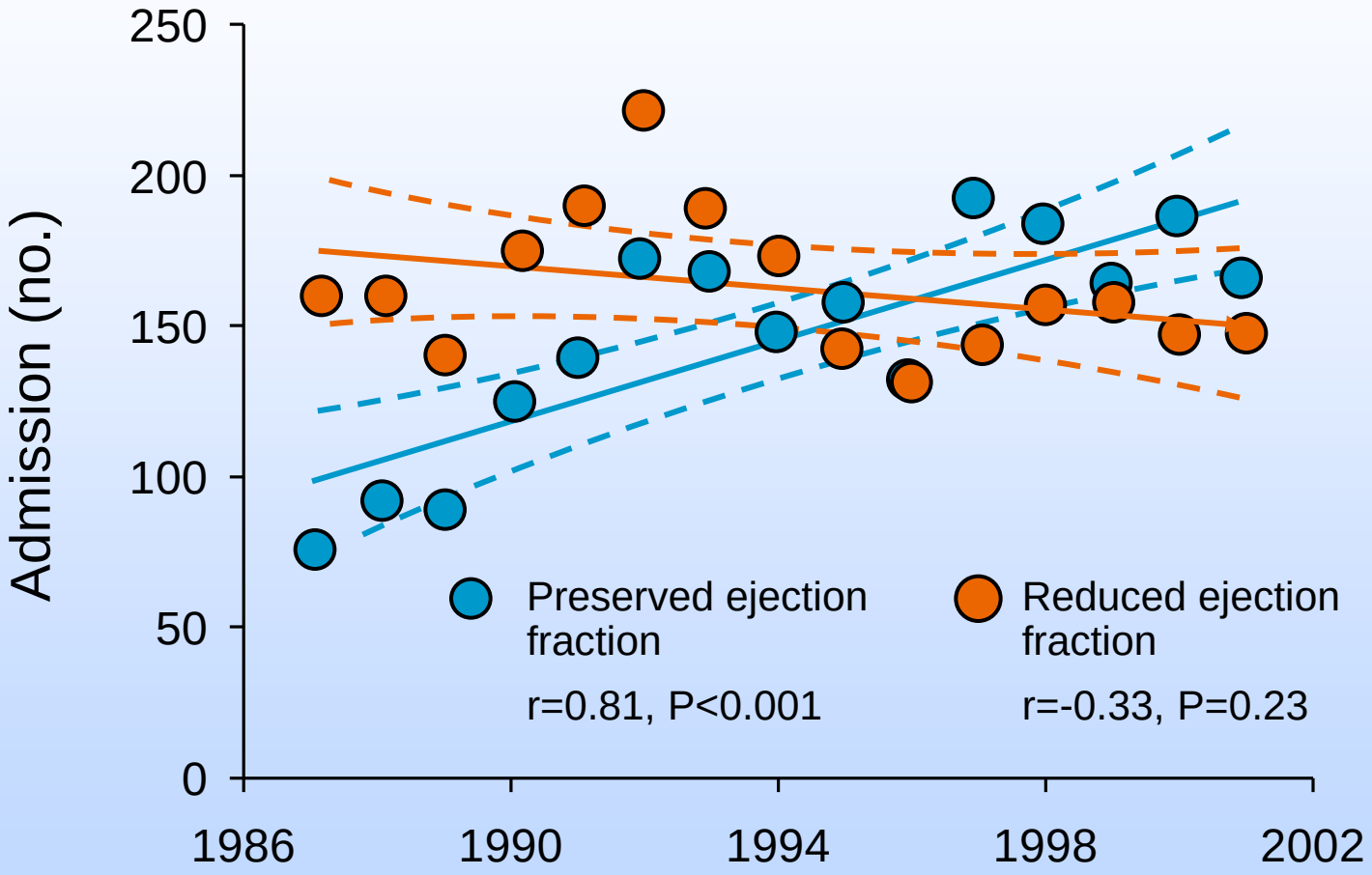
Trends in HF Admissions



Owan TE et al: NEJM, 2006

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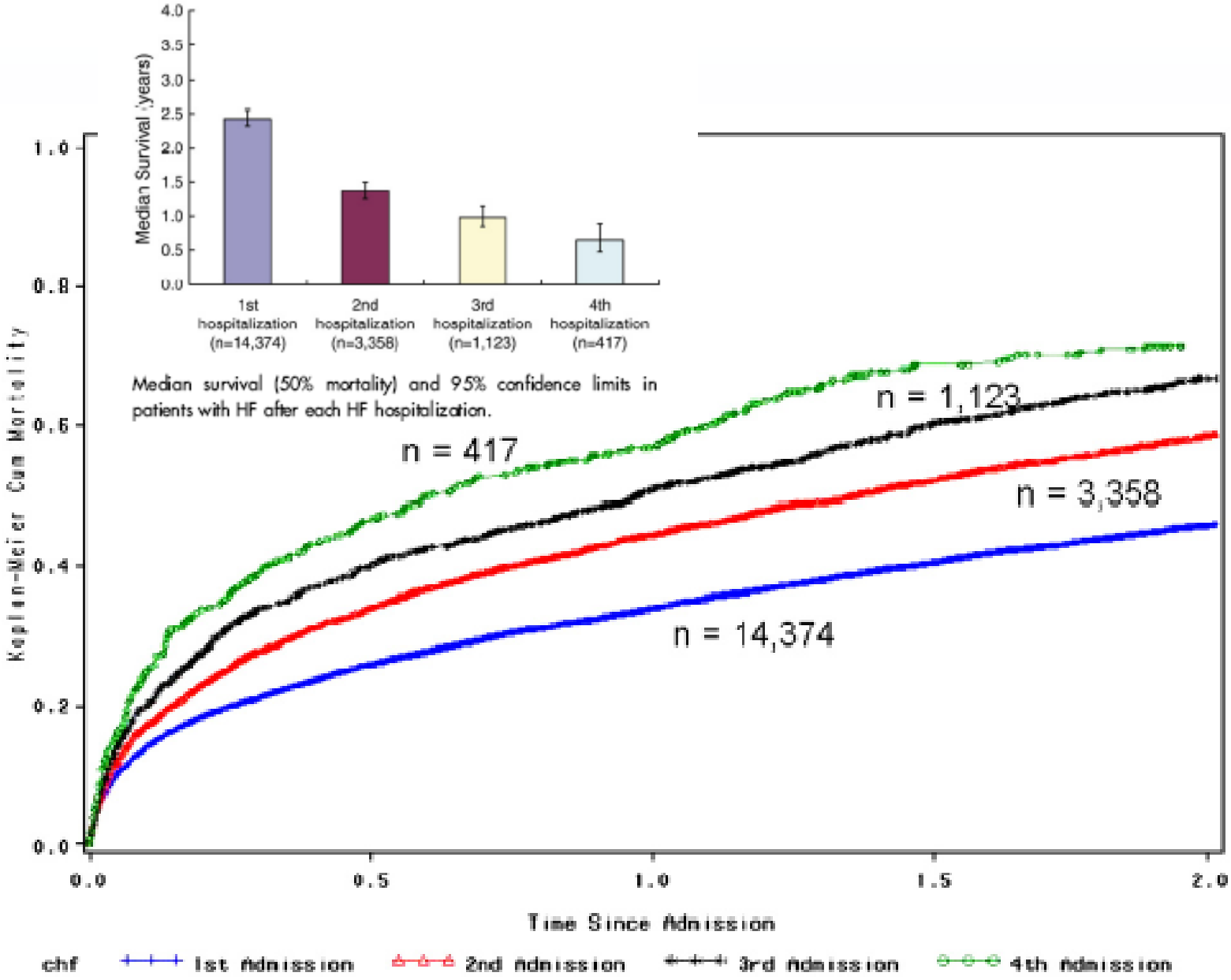

Kaplan-Meier cumulative mortality curve for all-cause mortality after each subsequent hospitalization for HF.

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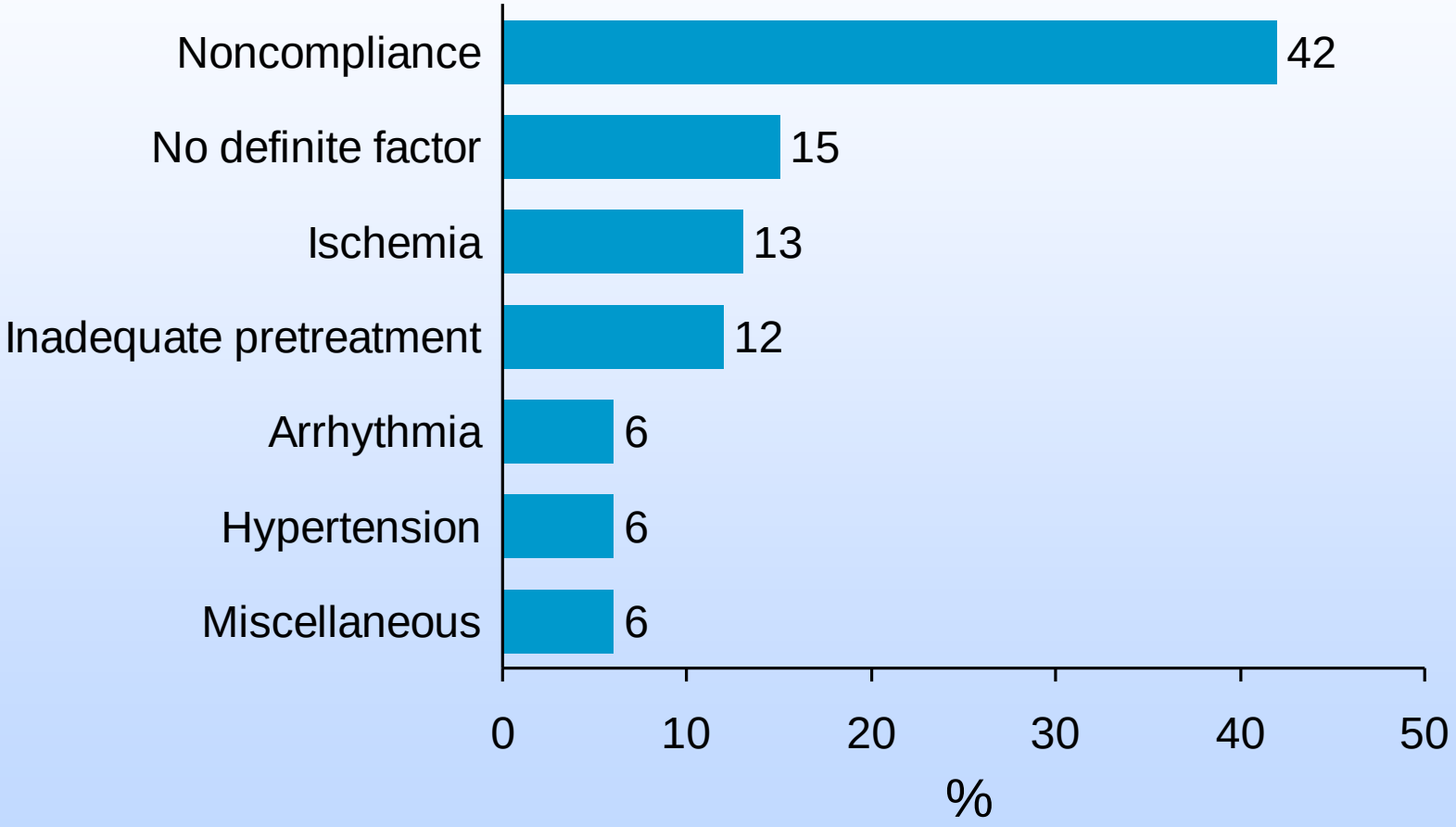
Setoguchi AHJ 2007

Causes of Decompensation in HF



Michalsen A et al: Heart, 1998

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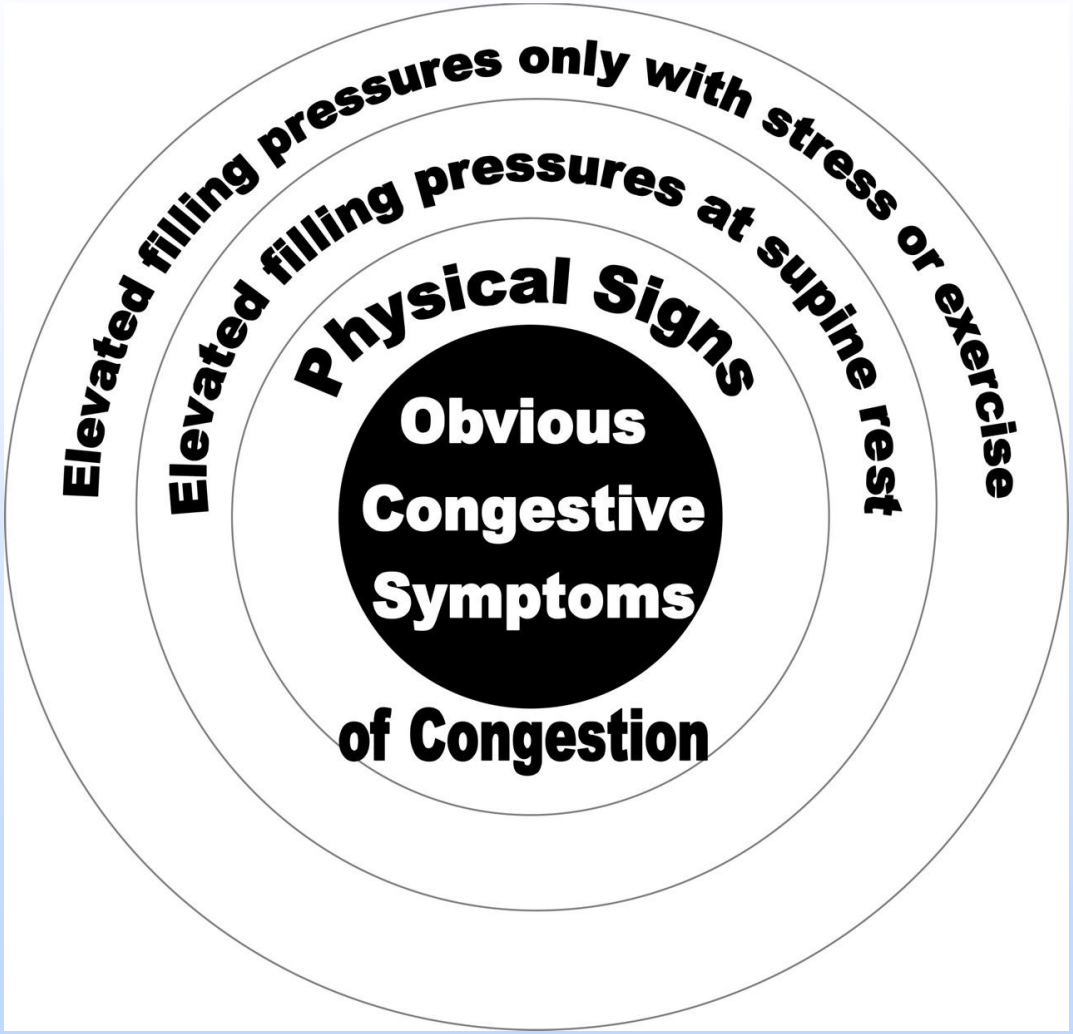
Potential targets for therapy



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Stevenson L W Circulation 2006;113:1020-1033

Recognize Decompensation in HF Patients

- Pulmonary rales may be absent
- Edema may be absent
- BNP levels may not always be elevated
- PND and orthopnea are reliable symptoms
- Weight gain
- JVP is a reliable sign

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When to Hospitalize?

- Persistent NYHA class IV symptoms
- Persistent volume overload
- Unexplained symptomatic hypotension
- Worsening renal failure
- Altered mentation
- Hemodynamically significant arrhythmias

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Goals of Treatment

- Reduce congestion
- Improve exercise tolerance
- Improve survival
- Prevent re-hospitalization

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Goals of Treatment

Assessed Clinically

Absence of orthopnea

No peripheral edema

No hepatomegaly/ascites

Jugular venous pressure <8 cm

Warm extremities

Systolic blood pressure ≥80 mm Hg

Measured Directly

Pulmonary capillary wedge pressure <15 mm Hg

Right atrial pressure <8 mm Hg

Systemic vascular resistance <1,200 dynes-sec-cm^{-5}

Systolic blood pressure ≥80 mm Hg

Stevenson LW: Eur J Heart Failure 1:251, 1999

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Treat Reversible Causes

- Anemia
- Hyper- or hypothyroidism
- Myocardial ischemia
- Tachyarrhythmias
- Sleep disorders
- Education
- Diet
- Minimize alcohol intake
- Optimize medical and device therapy

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Step 1: Clinical Assessment

Evidence of congestion		
	Orthopnea	Elevated JVP
	Increasing S3	Edema
	Ascites	Rales (uncommon)
	Abdominojugular reflux	

Low perfusion at rest?	Congestion at rest?	
	No	Yes
No	Warm & dry	Warm & wet
Yes	Cold & dry	Cold & wet

Evidence for low perfusion		
	Narrow pulse pressure	ACE-related hypotension
	Pulsus alternans	Declining serum sodium
	Cool extremities	Worsening renal function
	Mental confusion	

Nohria et al: JAMA, 2002

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“Warm and Wet”

- 50-60% of patients with acute HF
- IV diuretics are mainstay of therapy
- Optimize ACE-I and beta-blockers when euvolemia is achieved

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“Cold and Wet”

- 20% of patients
- IV diuretics
- IV vasodilators for normal-high BP
  - Nitroprusside
  - Nitroglycerin
  - Nesiritide
- IV inotropes for low BP
  - Dobutamine
  - Dopamine
  - Milrinone

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“Cold and Wet”

- Once euvolemia is achieved
  - Up-titrate oral vasodilator therapy and wean IV vasodilators
  - Optimize oral diuretics
- Consider PAC in selected cases

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“Cold and Dry”

- Less than 5% of patients
- Referral to an advanced heart failure or transplant center
- Frequently require PAC to determine volume status
- Inotrope therapy for palliation or a bridge to transplant or MCS

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What To Do with Beta-Blockers?

ELSEVIER

European Journal of Heart Failure 9 (2007) 901–909

The European Journal of Heart Failure

www.elsevier.com/locate/ejheart

Should beta-blocker therapy be reduced or withdrawn after an episode of decompensated heart failure? Results from COMET ☆

Marco Metra [a,*], Christian Torp-Pedersen [b], John G.F. Cleland [c], Andrea Di Lenarda [d], Michel Komajda [e], Willem J. Remme [f], Livio Dei Cas [a], Philip Spark [g], Karl Swedberg [h], Philip A. Poole-Wilson [i] for the COMET investigators [1]

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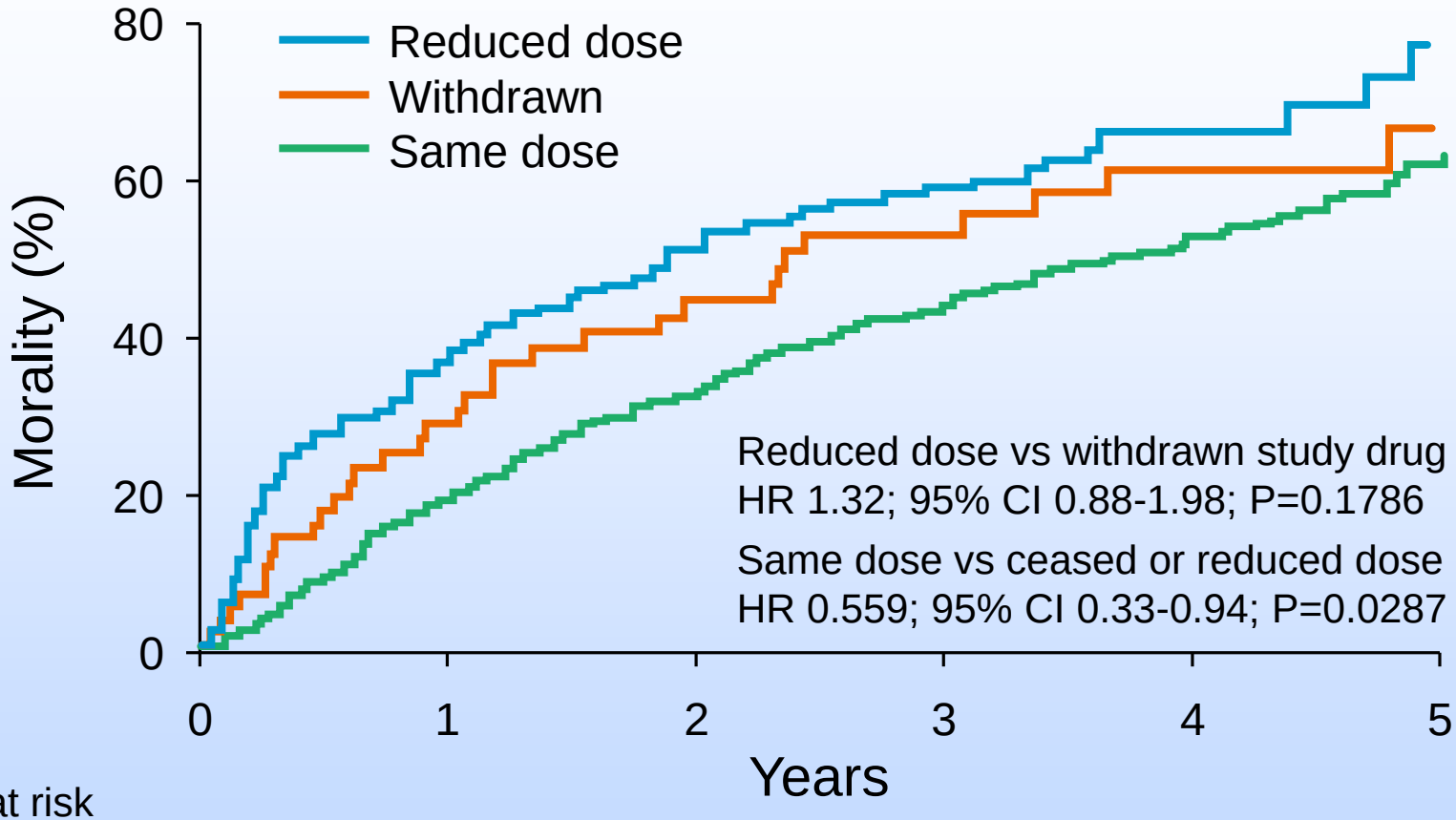
What to Do with Beta-Blockers?



Pt at risk						
Reduced	162	86	59	42	19	3
Ceased	61	38	26	17	12	3
Same dose	529	392	281	182	97	27

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What to Do with Beta-Blockers?

"Warm and Wet"

- Continue treatment, no change in dosage

"Cold and Wet"

- Decrease dose by 50% or hold until end-organ perfusion is achieved

"Warm and Dry"

- Initiate therapy as inpatient
- Shorter hospital stays, improved survival
- During follow-up more patients tend to be on the drug

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Diuretics

- Consider addition of a thiazide diuretic
- Continuous infusion of furosemide preceded by a loading dose may be superior to intermittent IV furosemide
- Maintenance diuretic dose is a significant predictor of mortality
- In the presence of volume overload renal function may improve with diuresis

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Have We Achieved Euvolemia?

- Monitor weights
  - Achieve dry weight
- Monitor renal function and electrolytes
  - Avoid nephrotoxicity
- Increasing creatinine may indicate
  - Hypotension
  - Over diuresis
  - RV failure
  - Low cardiac output

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The Cardiorenal Syndrome

- The presence of declining renal function usually accompanied with diuretic resistance in HF
- Declining renal function is more accurately measured by GFR rather than creatinine
- Causes are unknown
  - Diuretics
  - Systemic congestion
  - Low cardiac output less reliable

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Cardiorenal Syndrome: An Approach

- Evaluate renal structure and function
- Avoid hypotension
- Consider ultra-filtration and/or hemodialysis
- Abdominal paracentesis or thoracentesis as indicated
- Consider RHC

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When to Perform Right Heart Catheterization

"there is no established role for periodic invasive or noninvasive hemodynamic measurements in the management of HF, nevertheless it may assist in the determination of volume status and in distinguishing HF from other disorders that may cause circulatory instability"

ACC/AHA Guidelines, 2005

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When to Perform Right Heart Catheterization

"considered in patients in whom the response to initial therapy is inadequate, volume status and filling pressures are unclear, clinically significant hypotension is present, renal function is declining, or outpatient inotrope therapy is being considered"

HFSA Guidelines, 2006

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ESCAPE Trial – However

- PAC is not better than expert clinical assessment in affecting outcomes in advanced heart failure patients
- However
  - Identify patients who need inotrope therapy
  - Guide minimal effective dose of inotropes
  - Assess reversibility of renal dysfunction
  - Obtain “dry” weight of patient
  - Determine heart transplant or VAD candidacy

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Indications for Hemodynamic Measurement

- Short-term management of inotropes and pressors for cardiogenic shock
- Evaluation for transplant or LVAD
- Uncertain hemodynamic status
  - Pulmonary disease
  - ACS in HF
  - RV vs LV failure
  - Assessment of SVR
- Adjustment of therapy

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Inotrope Therapy

- 10% of patients with acute HF continue to receive inotrope therapy
- Hypotension may occur with milrinone, avoid a loading dose
- Milrinone and dobutamine are probably equivalent in efficacy
- Milrinone may be useful in patients treated with beta-blocker or with concomitant pulmonary hypertension but may be harmful in ischemic HF

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Use of Inotropes: Guidelines

Class IIB indication for stage D patients as palliative therapy or bridge to transplant

ACC/AHA guidelines, 2005

Class IIA indication to relieve symptoms and improve end organ perfusion in low output patients who have hypotension or fail to respond to diuretic and vasodilator therapy

ESC guidelines, 2005

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Medicare Dobutamine Coverage

- Dyspnea at rest despite diuretics, ACE I, or vasodilator and digoxin
- CI <2.2 L/min/m^2 and/or PCWP >20 mm Hg on maximal medical management
- 20% increase in CI and/or 20% decrease in PCWP during inotrope infusion
- If dobutamine is continuously infused documented deterioration in clinical status when drug is tapered or discontinued

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Inotropes and Mortality

Randomized mortality trials of intravenous dobutamine therapy in patients with severe heart failure

Author	Dobutamine mortality	Control mortality
Leier et al	2/15	1/11
Dies et al	13/31	5/29
DICE study	5/19	3/19
Total	20/65	9/59
Percent	31%	15%

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Case Study

- 21-year-old female with new-onset nonischemic HF, presented with persistent dyspnea despite initial medical therapy of diuretics and ACE-I
- Started on beta-blockers but developed sustained, symptomatic hypotension without overt signs of congestion
- Started on dopamine and transferred to ICU for PAC placement

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Case Study

- Hemodynamics
  - RA 13, PA 43/23, PCWP 25, CI 2.4
- ACE-I and beta-blockers held
- Patient is significantly diuresed
- BP improves, dopamine discontinued
- Hemodynamics
  - RA 8, PA 35/22, PCWP 16, CI 1.7

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Case Study

- Due to preserved renal function, excellent urine output and no clinical signs of hypoperfusion dopamine was not restarted
- Patient was reinstated on ACE-I and beta-blockers
- Patient remains stable and was discharged home with improved functional status

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Lessons Learned

- Adverse reaction to beta-blocker in a setting of volume overload
- PAC clarified volume status, enabled diuresis and identified true dry weight
- Decrease in PCWP portends a good prognosis
- Allowed re-initiation of beta-blocker
- Cardiac output is not an important prognostic endpoint for neurohormonal blocking drugs

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Case Study

- 49-year-old male with IDC, stage D on IV milrinone listed for heart transplantation was admitted with dyspnea, hypotension and worsening renal insufficiency
- Felt to be “cool and wet” on clinical exam hence dobutamine was added and he was diuresed 7.3 kg within a week
- Renal function, BP improves, BNP was 120 pg/mL

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Case Study

- PAC placed to assess inotrope requirement
  - RA 8, PA 42/24, PCWP 28, CI 2.3
- Referred for LVAD implantation

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Lessons Learned

- Despite dramatic clinical improvement PAC determined persistently elevated PCWP, a poor prognostic indicator
- Cardiac output measurement demonstrated need for dual inotropes
- Supported decision to provide mechanical support

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Indications for MCS

- In the ADHF setting placement of a PAC is usually required
- Failure of medical therapy in relieving congestion and improving end-organ function
- Acceptable hemodynamic parameters are
  - RA $\geq$12, PCWP $\geq$20, CI $\leq$2 L/min/m^2

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Identify the High-Risk Patient

Low perfusion

- High admission BUN
- High serum creatinine
- Low systolic blood pressure
- Inotrope requirement

Persistent congestion

- Diuretic resistance

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MCS or Heart Transplant

- Heart transplantation remains a life saving procedure for selected patients with advanced heart failure
- MCS is a viable option as a bridge to transplant and as destination therapy
  - Heartmate I is FDA approved as BTT and DT
  - Heartmate II is FDA approved as BTT
  - Ongoing clinical trials

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"To-Do" List Prior to Hospital Discharge in CHF

- Discontinuation of inotropes 48 hr prior to discharge
- 24-hour stabilization with oral diuretics, electrolyte supplementation, and vasodilator drugs
- Patient and family education regarding diet and medications
- Follow-up visit with cardiologist in 7-10 days
- Telephone or visiting nurse contact within 3 days

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Summary

- ADHF is a major public health problem
- ADHF is seen in patients with both reduced and preserved left ventricular function
- Patients with ADHF are older, and have more renal insufficiency
- Therapy for ADHF is primarily symptom based but should be focused on
  - Initiation or optimization of medical and device therapy
  - Appropriate recognition of the high-risk patient to enable MCS or heart transplantation if indicated

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