Acute Heart Failure Management Update

JILL McEWEN, MD FRCPC

Clinical Professor & Director
Undergraduate Education Program
Department of Emergency Medicine
University of British Columbia
Vancouver, BC Canada
Past President, Canadian Association of Emergency Physicians

CAEP | ACMU

Disclosure

- I have no actual or potential conflict of interest in relation to this presentation

Objectives

- Discuss types of Acute Heart Failure syndromes and their relevance
- Outline current recommendations for the management of Acute Heart Failure (AHF)
- Touch on controversies in the management of AHF
- Discuss ‘decision rules’ for patient discharge from the ED

Is Heart Failure the Cinderella of cardiovascular diseases…?

“It begins with a chief complaint. It almost always ends with an admission. Somewhere in the middle, after the diagnosis is made, we treat patients like it’s 1974. Standard therapy hasn’t changed.”

Acute Heart Failure in the Emergency Department: Just a One Night Stand? Commentary.
Pang PS, Collins SP. Acad Emerg Med. March 2017, Vol. 24, No. 3 • www.aemj.org

Relevance of Acute Heart Failure

Common

- ~ 1% of patients > 65 have heart failure
- ~ 26 million people worldwide
- Aging population will increase prevalence

High Morbidity & Mortality

~ 50% 5-year mortality

~ 1 million ED visits/year in North America alone

Costly

~ $108 billion worldwide

~ $90 billion by 2030 in US

IF current admission practice continues

Emergency Department AHF Management Objectives

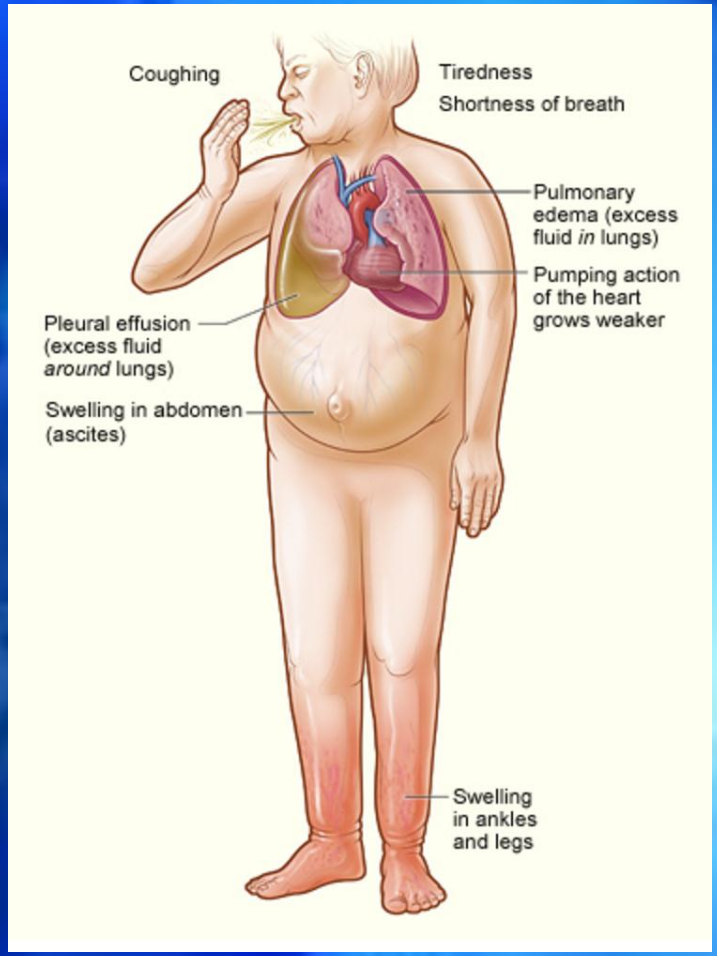
1) Diagnosis
   - Correctly identify AHF syndrome
2) Management
   - Treat symptoms and restore oxygenation
   - Address precipitating factors
3) Disposition
   - Determine patients who can safely be discharged vs high risk who will benefit from admission to an acute care hospital

1) Diagnosis

- Correctly identify AHF syndrome

Symptoms & Signs

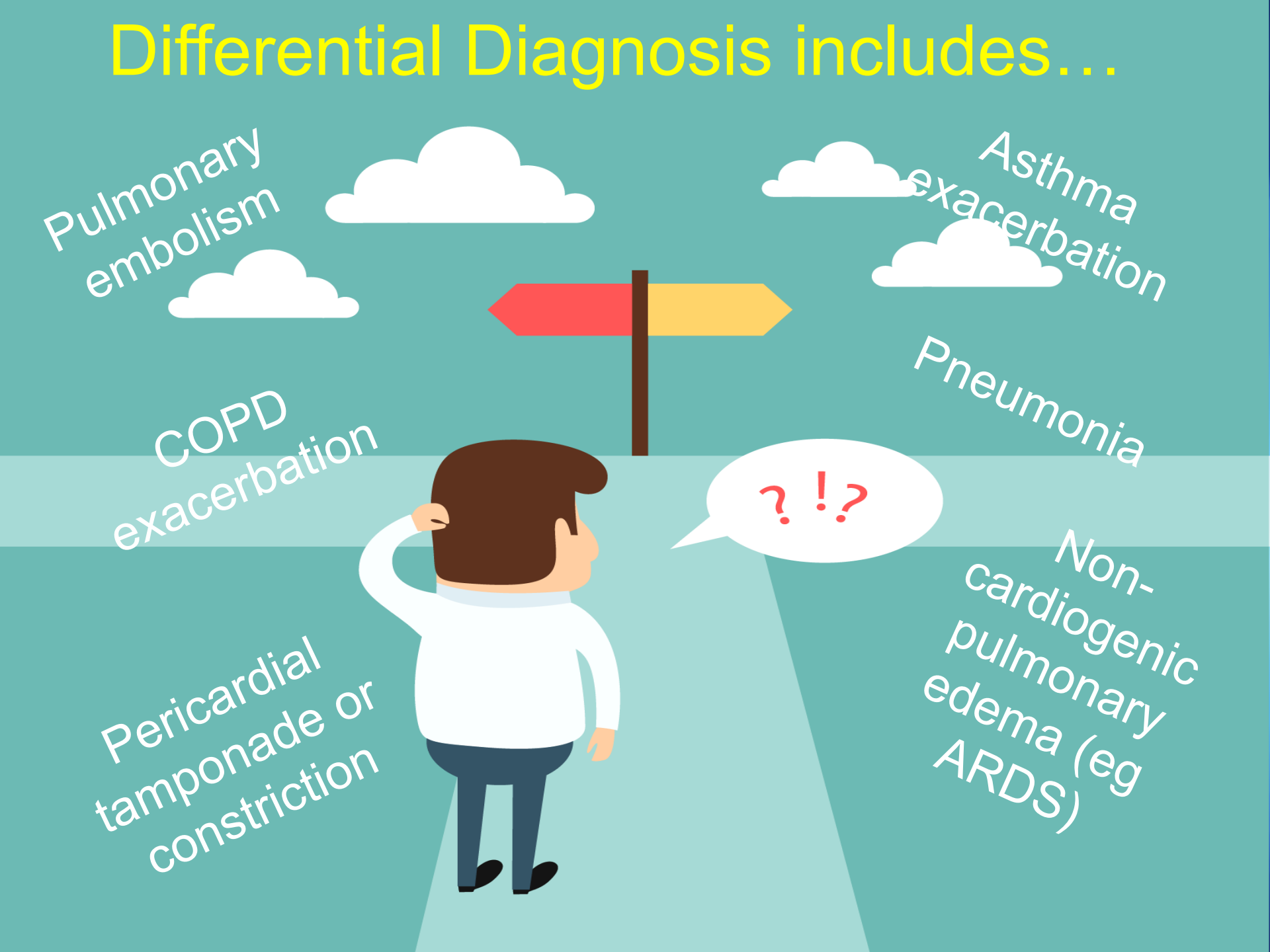
- Acute dyspnea
- Orthopnea, PND history
- Tachypnea
- Tachycardia
- Hypertension
- Crackles
- ~Wheezes
- ~S3
- Elevated JVP
- Peripheral edema



Diagnostic studies

- ECG – ischemia, rhythm, LVH
- Portable **CXR**
- CBC, troponin, electrolytes, BUN & creatinine
- +/- ABGs
- BNP or NT-proBNP (?helpful for discharge decisions, not ED diagnosis)
- Bedside echo if available to assess heart disease & performance

Differential Diagnosis includes…



Acute Heart Failure Syndromes

HFpEF: Heart Failure with preserved ejection fraction

- LVEF > 50%
- Typically normal LV volumes
- (diastolic HF)
- Treat contributing factors & comorbidities

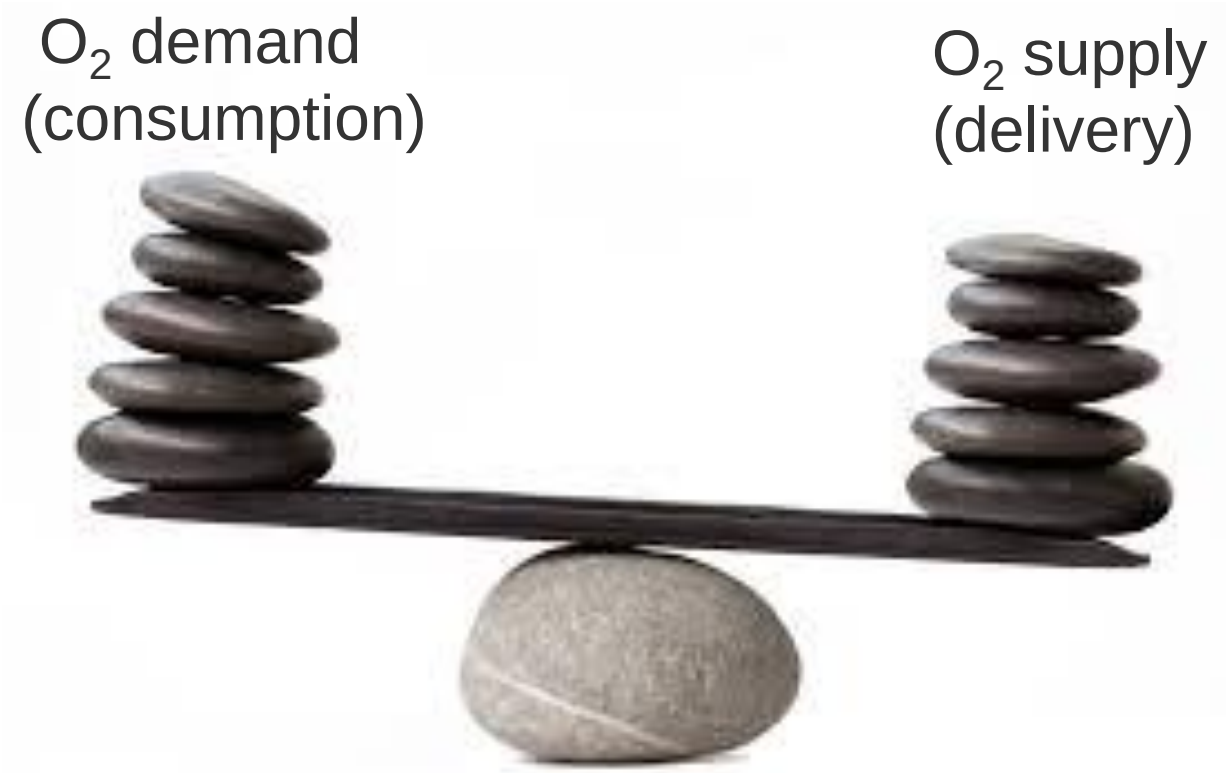
HFrEF: Heart Failure with reduced ejection fraction

- Increased LV volumes and reduced EF
- (systolic) HF
- Treat symptoms, slow/reverse decreased myocardial function, reduce mortality

Heart Failure…
Oxygen Delivery to Organs & Tissue

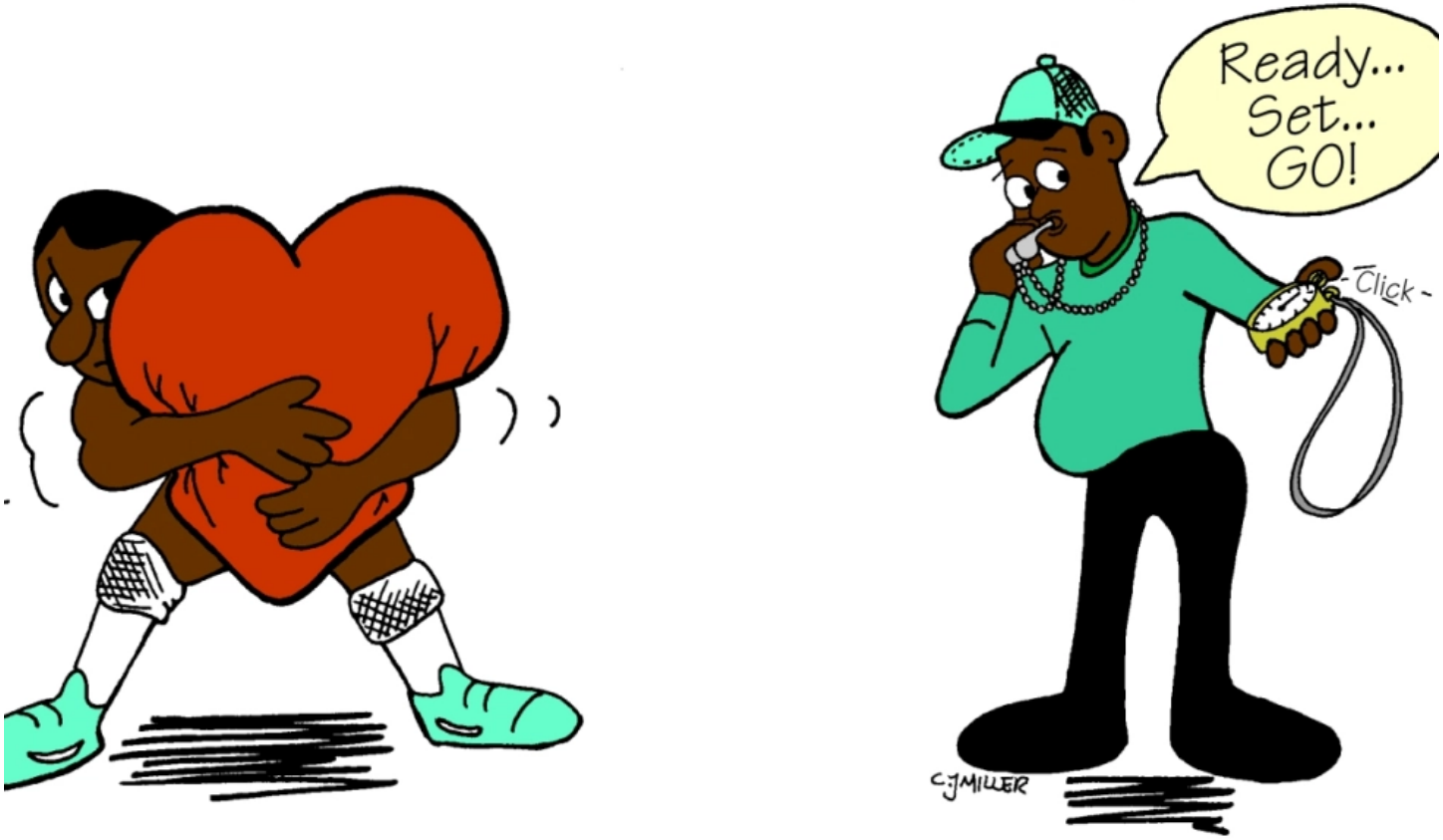
O_2 demand
(consumption)

O_2 supply
(delivery)



Anaerobic metabolism
… eventually organ failure

CARDIAC OUTPUT



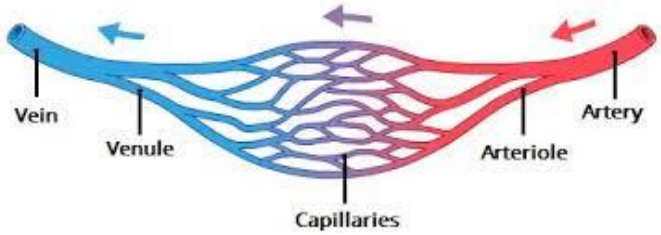
CO = HR X Stroke Volume

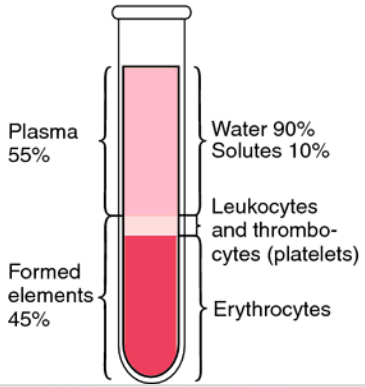
Cardiac Output = Heart Rate

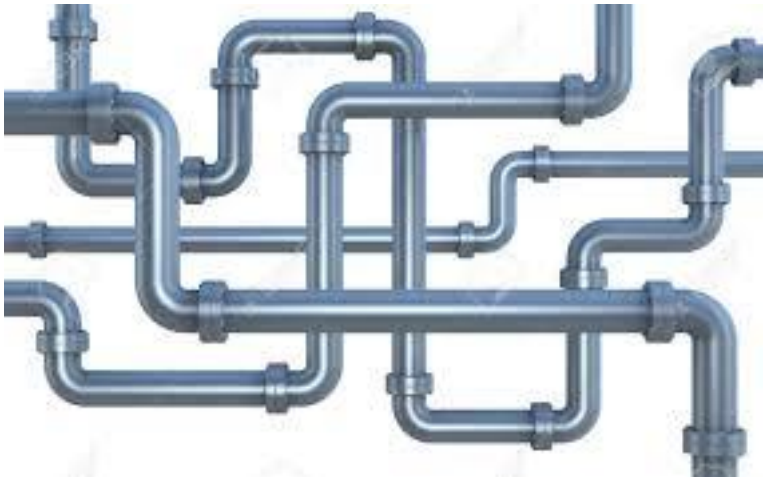
Stroke volume

- preload (tank)
- afterload (pipes)
- contractility (pump)

Oxygen Delivery – Pump System







Causes/precipitants of Heart Failure

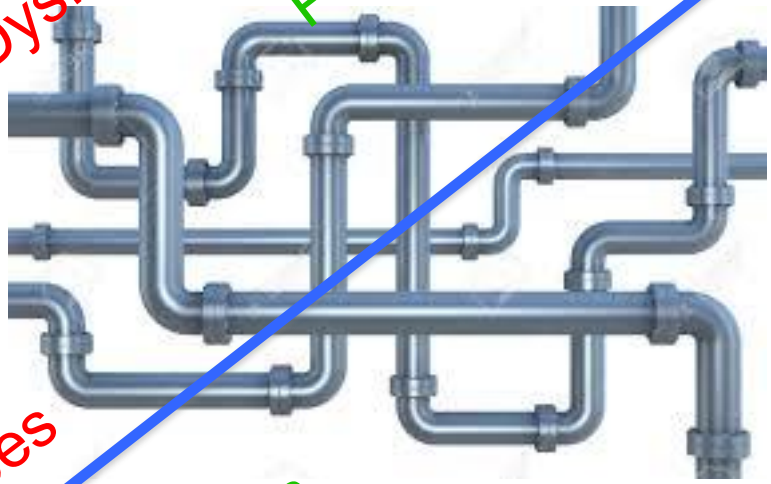
Acute Coronary Syndromes

Dysrhythmias

Myocardial Depression/ Dysfunction

Pulmonary embolism

Fluid/salt overload



Cardiomyopathy

Valvular dysfunction

Negative inotropes

Hypertension

Anemia

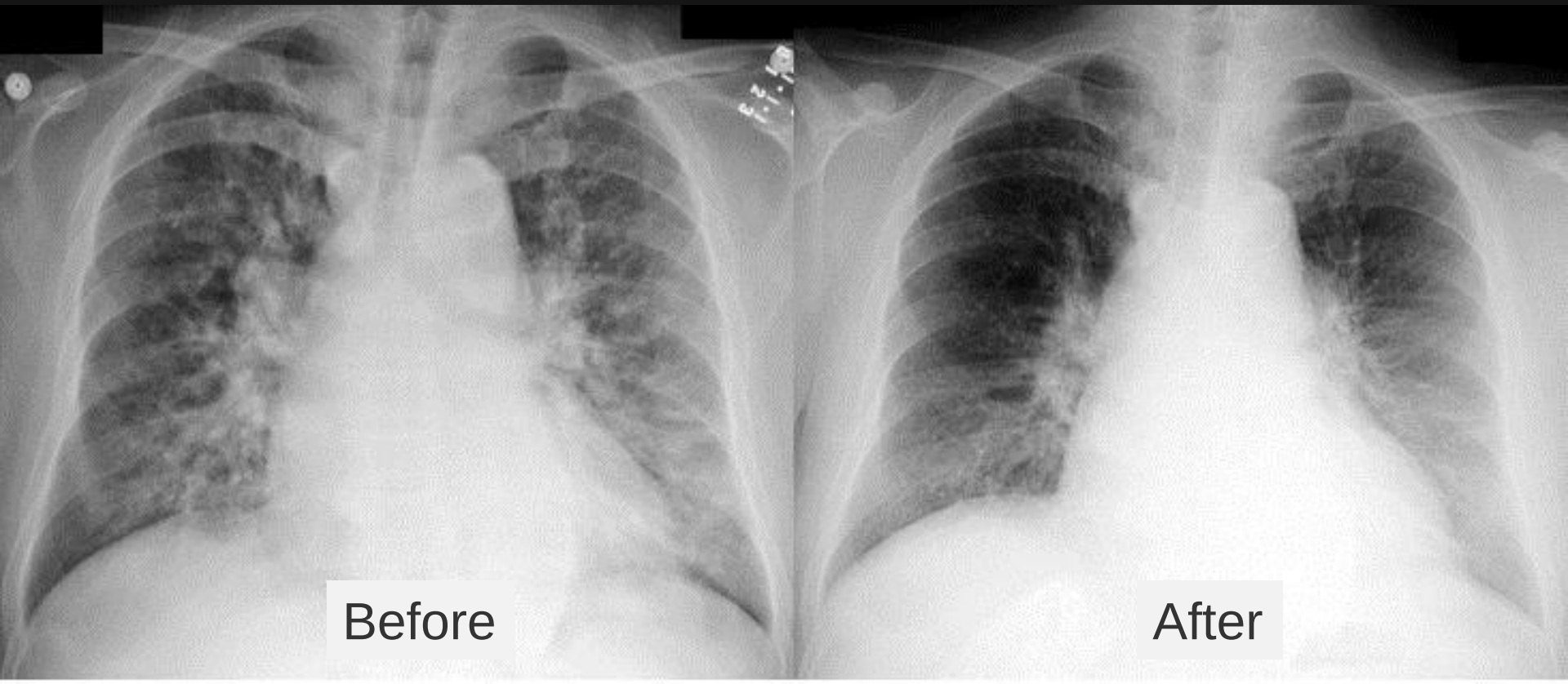
Distinguish

- Acute Heart Failure with Adequate Perfusion
  - Common
  - Easier to treat
- Acute Heart Failure with Decreased Perfusion = Shock

2) Objectives of Treatment

1) Decrease symptoms and signs of compensatory failure:
   - ✓Restore oxygenation
   - ✓Resolve dyspnea
   - ✓Resolve pulmonary edema
   - ✓Restore tissue perfusion

2) Treat/manage precipitating factors



Successful treatment of AHF: symptom resolution

Treatment of both types of Acute Heart Failure
(+/- adequate perfusion)

- **Optimize oxygenation**
- Increase O_2 sat to > 90%... stepwise as needed:
  1) O_2 by nasal cannula
  2) O_2 by mask, non-rebreather
  3) ***Non-invasive ventilation*: BiPAP**
  4) Endotracheal intubation

AHF with Adequate Perfusion

1) Sit patient upright
2) Vasodilators *(if hypertensive)
    - **Nitroglycerine**
        - 0.4 mg SL q 5 mins
        - 5 – 10 µg/min IV to start, then +increase
    - (nitroprusside, nesiritide)
3) Loop diuretics *(if volume overloaded)
    - Furosemide
    - 0.5 – 1 mg/kg IV, then double.

    (Bumetanide 0.5 – 2 mg IV

    Torsemide – 10-20 mg IV)

(Morphine sulfate 2-5 mg IV bolus)

AHF with Hypoperfusion*

1) Consider small crystalloid boluses (eg 250 ml normal saline)
2) Vasopressors (stepwise to achieve +MAP)
    - **Norepinephrine** (8 – 12 µg/min)
    - Dopamine (0.5 – 2 µg/kg/min)
    - Epinephrine (1 – 4 µg/min)
    - Dobutamine (0.5 – 1 µg/kg/min)

**Arterial line for accurate BP is helpful*

AHF with Hypoperfusion – Consider:

1) Dialysis
   - renal failure or volume overload refractory to diuretics
2) Blood transfusion
   - if anemia is significant factor
3) Rate/rhythm control
   - if rate/rhythm are major precipitants (carefully consider pros and cons)
4) Coronary revascularization
   - if STEMI

For refractory AHF syndromes, consider:

1) Extra Corporeal Membrane Oxygenation (hypoxia)

2) Intra-aortic balloon counterpulsation (shock)

1) Shekar K, Mullany DV, Thomson B, et al. Extracorporeal life support devices and strategies for management of acute cardiorespiratory failure in adult patients: a comprehensive review. Crit Care. 2014;18(3):219.
2) Mizuno M, Sato N, Kajimoto K, et al. Intra-aortic balloon counterpulsation for acute decompensated heart failure. Int J Cardiol. 2014;176(3):1444-1446.

3) Disposition?

- Hospitalize vs discharge
- Identify patients with low risk for serious adverse events who can be safely discharged
- Identify patients at high risk for adverse events who require admission
- Admission rates differ by country

ORIGINAL RESEARCH • RECHERCHE ORIGINALE

Comparison of management and outcomes of ED patients with acute decompensated heart failure between the Canadian and United States' settings

Anita Lai, MD*; Elliott Tenpenny, MD†; David Nestler, MD†; Erik Hess, MD†; Ian G. Stiell, MD*

- Canadian ED vs US ED
- Similar characteristics of patients
- US admission rate was 95.2% vs Canadian 50.6%
- outcomes were similar:
  - relapse to the ED, MI, 30 day mortality
- Findings question the need for routine admission of patients with CHF

Lai A et al. CJEM 2016; 18(2)81-89.

Studies leave knowledge gaps*

- Acute Decompensated Heart Failure National Registry (ADHERE)*
- 2013 American College of Cardiology Foundation & American Heart Association heart failure guidelines
- Diuretic Optimization Strategies Evaluation (DOSE)
- Trial of Intensified vs Standard Medical Therapy in the Elderly Patients with Congestive Heart Failure (OPTIMIZE-HF)
- The Rapid Emergency Department Heart Failure Outpatient Trial (REDHOT)
- Comparison of Medical, Pacing & Defibrillation Therapies in Heart Failure (COMPANION)

**Abdo, A. Hospital Management of Acute Decompensated Heart Failure. (Review). Am J Med Sci. 353(3):265-274, March 2017.*

Risk Stratification Research for ED Patients

TABLE 1 AHF ED Risk Stratification Models From Last 6 Years

First Author (Year) (Ref. #)	Setting	Predicted Outcome	Model Variables
Lee et al. (2012) (23)	Population-based ED cohort	7-day mortality	Creatinine, BP, O_2 saturation, troponin, home metolazone, EMS transport
Stiell et al. (2013) (32)	Convenience sample from ED	30-day mortality and 14-day adverse nonfatal events	History of stroke/TIA, history of intubation for respiratory distress, HR, O_2 saturation, ECG, urea, CO_2, troponins, NT-proBNP
Lassus et al. (2013) (33)	AHF patients presenting to ED or CCU	30-day and 1-yr mortality	CRP, NT-proBNP, BNP, MR-proANP, MR-proADM, sST2
Peacock et al. (2008) (34)	Consensus recommendations for hospital vs. observation unit vs. direct discharge	30-day mortality	Troponins, BUN, creatinine, serum sodium, SBP, ECG, BNP/NT-proBNP
Hsieh et al. (2008) (35) Validation of the AHF Index (2005) (36)	Retrospective cohort of patients hospitalized from ED and discharged with a diagnosis of HF	30-day mortality, adverse events, inpatient mortality	pH, HR, renal function, WBC, glucose, serum sodium

AHF = acute heart failure; BNP = b-type natriuretic peptide; BP = blood pressure; BUN = blood urea nitrogen; CCU = critical care unit; CRP = C-reactive protein; ECG = electrocardiography; ED = emergency department; EMS = emergency medical services; HF = heart failure; HR = heart rate; MR-proADM = mid-regional proadrenomedullin; MR-proANP = mid-regional proatrial natriuretic peptide; NT-proBNP = N-terminal prohormone of brain natriuretic peptide; SBP = systolic blood pressure; sST2 = somatostain receptor 2; TIA = transient ischemic event; WBC = white blood cell.

Need Validated Guidelines

Academic Emergency Medicine
Official Journal of the Society for Academic Emergency Medicine

ORIGINAL RESEARCH CONTRIBUTION

CME

A Risk Scoring System to Identify Emergency Department Patients With Heart Failure at High Risk for Serious Adverse Events

Ian G. Stiell, MD, MSc, Catherine M. Clement, RN, Robert J. Brison, MD, MPH, Brian H. Rowe, MD, MSc, Bjug Borgundvaag, MD, PhD, Shawn D. Aaron, MD, Eddy Lang, MD, Lisa A. Calder, MD, MSc, Jeffrey J. Perry, MD, MSc, Alan J. Forster, MD, MSc, and George A. Wells, PhD

Ottawa Heart Failure Risk Score (OHFRS)

- To determine whether a retrospectively-derived clinical prognostic algorithm can be used more broadly to assist with decision-making in the ED
- Convenience sample of 559 patients – 38% of patients were admitted
- Patients excluded if “too sick” to consider discharge
- SAE: death, intubation, admission to MU, relapse

Ottawa Heart Failure Risk Scale

Items	Points
1. History	
a) Stroke or TIA	1
b) Intubation for respiratory distress	2
2. Examination	
a) Heart rate on ED arrival ≥ 110	2
b) SaO_2 < 90% on arrival	1
c) Heart rate ≥ 110 during 3-minute walk test (or too ill to perform walk test)	1
3. Investigations	
a) ECG has acute ischemic changes	2
b) Urea ≥ 12 mmol/L	1
c) Serum CO_2 ≥ 35 mmol/L	2
d) Troponin I or T elevated to MI level	2
e) NT-proBNP ≥ 5,000 ng/L	1
Total Score (0 - 15):	____

Stiell et al. 2013. ACADEMIC EMERGENCY MEDICINE 2013; 20:17–26 Society for Academic Emergency Medicine

CME

Prospective and Explicit Clinical Validation of the Ottawa Heart Failure Risk Scale, With and Without Use of Quantitative NT-proBNP

Ian G. Stiell, MD, MSc, Jeffrey J. Perry, MD, MSc, Catherine M. Clement, RN, Robert J. Brison, MD, MPH, Brian H. Rowe, MD, MSc, Shawn D. Aaron, MD, Andrew D. McRae, MD, PhD, Bjug Borgundvaag, MD, PhD, Lisa A. Calder, MD, MSc, Alan J. Forster, MD, MSc, and George A. Wells, MSc, PhD

Items	Points
1. Initial Assessment	
a) History of stroke or TIA	(1) ___
b) History of intubation for respiratory distress	(2) ___
c) Heart rate on ED arrival ≥ 110	(2) ___
d) Room Air SaO_2 < 90% on EMS or ED arrival	(1) ___
2. Investigations	
a) ECG has acute ischemic changes	(2) ___
b) Urea ≥ 12 mmol/L	(1) ___
c) Serum CO_2 ≥ 35 mmol/L	(2) ___
d) Troponin I or T elevated to MI level	(2) ___
e) NT-ProBNP ≥ 5,000 ng/L	(1) ___
3. Walk test* after ED treatment	
a) SaO_2 < 90% on room air or usual O_2, or HR ≥ 110 during 3-minute walk test, or too ill to walk	(1) ___
Total Score (0 - 15):	____

Heart Failure Risk Categories for Serious Adverse Events within 14 days

Total Score	Risk	Category
0	2.8%	Low
1	5.1%	Medium
2	9.2%	Medium
3	15.9%	High
4	26.1%	High
5	39.8%	Very High
6	55.3%	Very High
7	69.8%	Very High
8	81.2%	Very High
9	89.0%	Very High

Figure 1. Ottawa Heart Failure Risk Scale (OHFRS) to identify ED patients with acute heart failure at high risk for serious adverse events. ECG = electrocardiogram; MI = myocardial infarction; OHFRS = Ottawa Heart Failure Risk Scale; TIA = transient ischemic attack.

Annals of Internal Medicine | ORIGINAL RESEARCH

Prediction of Heart Failure Mortality in Emergent Care

A Cohort Study

Douglas S. Lee, MD, PhD; Audra Stitt, MSc; Peter C. Austin, PhD; Therese A. Stukel, PhD; Michael J. Schull, MD, MSc; Alice Chong, BSc; Gary E. Newton, MD; Jacques S. Lee, MD, MSc; and Jack V. Tu, MD, PhD

- Population based random sample of 12,500 ED AHF patients – admitted & discharged
- 30% were discharged
- Multivariate analysis of 7 day mortality
- "EHMRG" Score

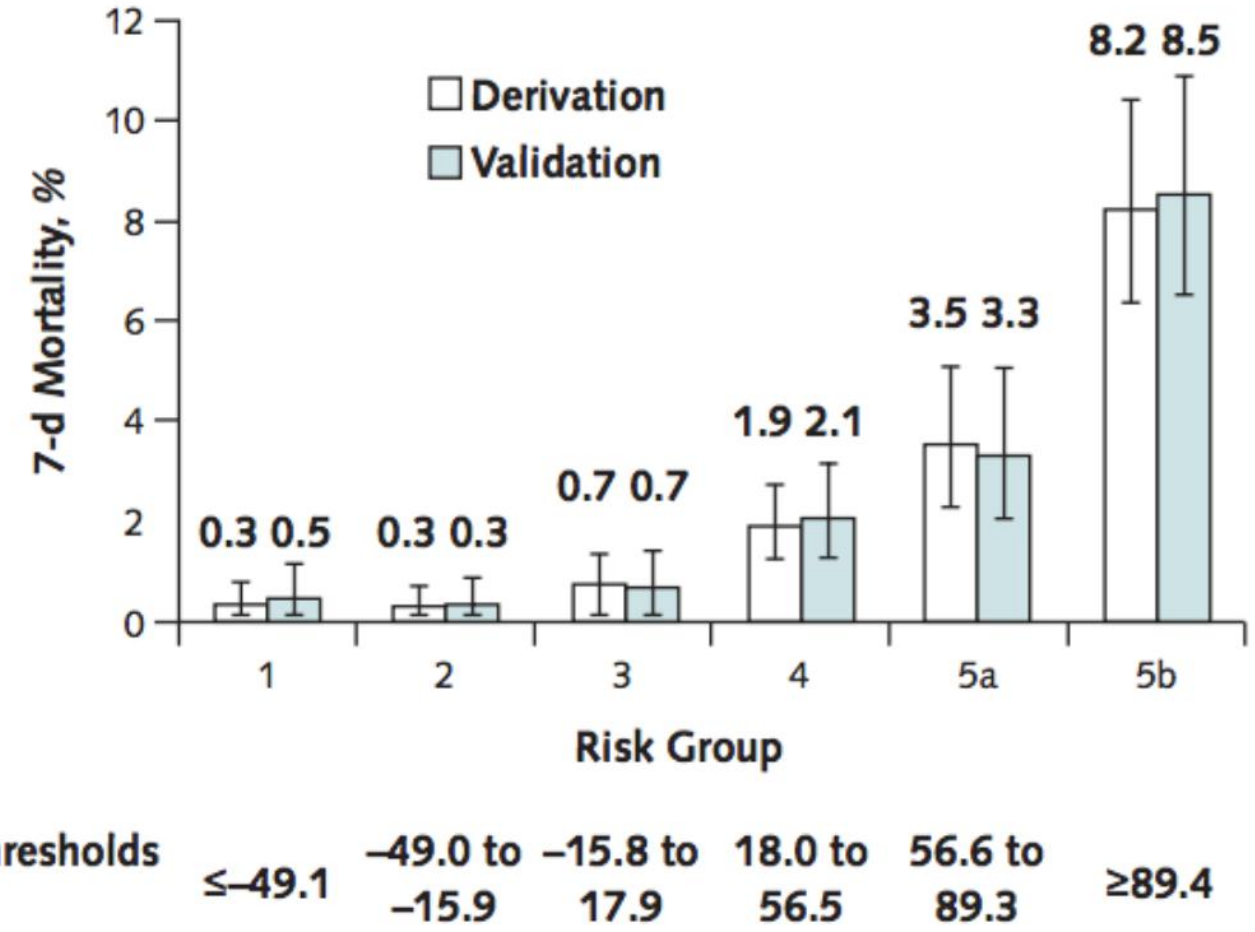
Ann Intern Med. 2012;156:767-775

Table 3. EHMRG 7-Day Mortality Risk Score

Variable	Units	Additive or Multiplicative Component
Age	y	2 × age
Transported by EMS	If "yes"	+60
SBP	mm Hg*	−1 × SBP
Heart rate	beats/min†	1 × heart rate
Oxygen saturation	%‡	−2 × oxygen saturation
Creatinine	mg/dL§	20 × creatinine
Potassium	4.0 to 4.5 mmol/L	0
	≥4.6 mmol/L	+30
	≤3.9 mmol/L	+5
Troponin	>ULN	+60
Active cancer	If "yes"	+45
Metolazone at home	If "yes"	+60
Adjustment factor‖		+12
Total		**EHMRG score¶**

EHMRG = Emergency Heart Failure Mortality Risk Grade; EMS = emergency medical services; SBP = systolic blood pressure; ULN = upper limit of normal.
* Initial/triage SBP, maximum of 160 mm Hg.
† Initial/triage heart rate, minimum of 80 beats/min and maximum of 120 beats/min.
‡ Lowest initial/triage oxygen saturation, maximum of 92%.
§ If creatinine concentration is in μmol/L, divide by 88.4 to convert to mg/dL.
‖ Adjustment factor of +12 added to allow for an approximate 0 median score.
¶ All variables are required to calculate the score; users are cautioned against estimating component values. The EHMRG is not for use in patients who are dialysis-dependent.

Figure 2. **Absolute 7-day mortality rates and 95% CIs, by EHMRG score.**



Error bars are 95% CIs. EHMRG = Emergency Heart Failure Mortality Risk Grade.

Annals of Internal Medicine | ORIGINAL RESEARCH

Prediction of Heart Failure Mortality in Emergent Care

A Cohort Study

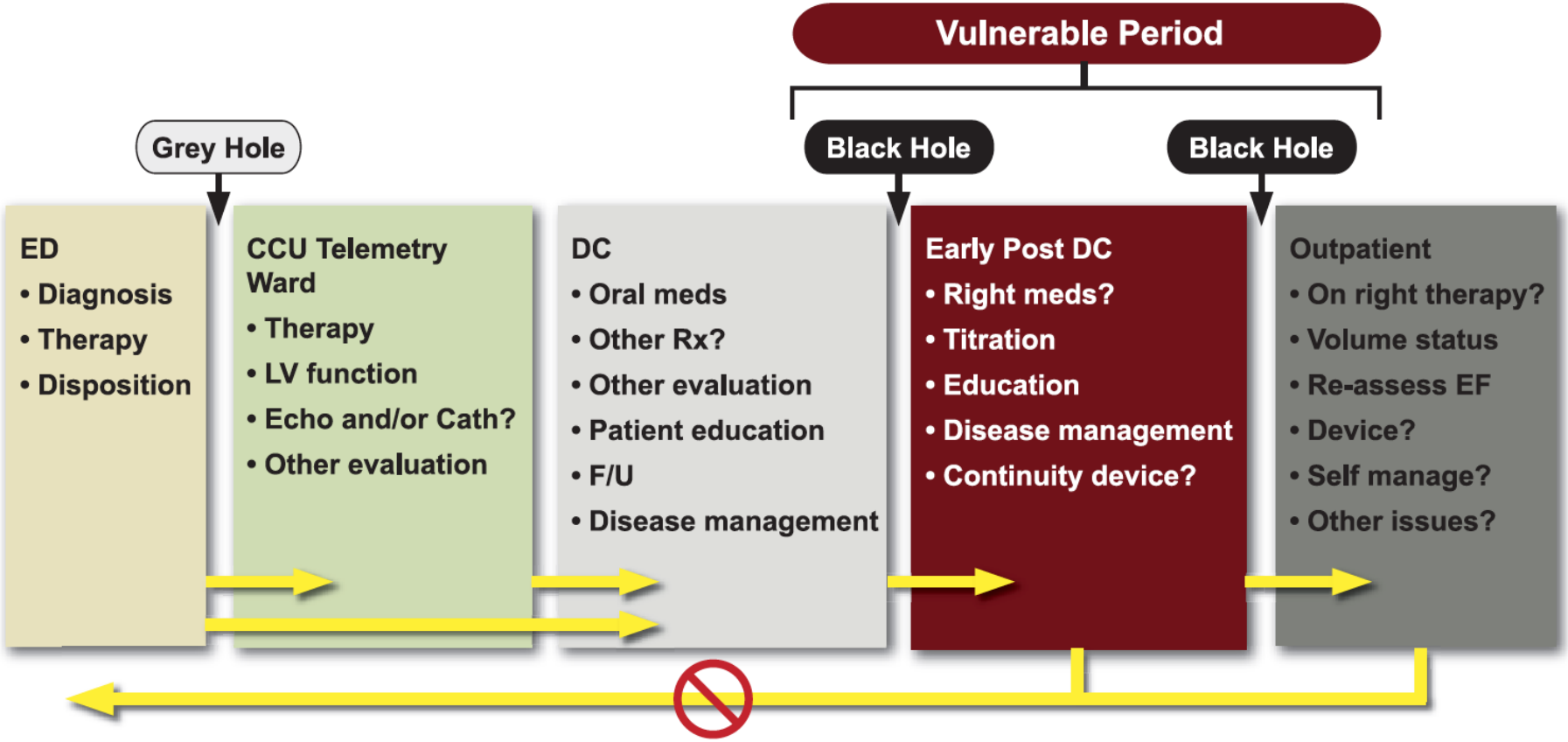
Douglas S. Lee, MD, PhD; Audra Stitt, MSc; Peter C. Austin, PhD; Therese A. Stukel, PhD; Michael J. Schull, MD, MSc; Alice Chong, BSc; Gary E. Newton, MD; Jacques S. Lee, MD, MSc; and Jack V. Tu, MD, PhD

ACUTE prospective validation study

- if predictive validity of the EHMRG and EHMRG30-ST can be demonstrated, they may be useful as adjuncts to clinical judgment in the acute care emergency environment.
  - ✓ EMHRG is a risk score derived to predict 7 day mortality in the ED setting &
  - ✓ EHMRG30-ST to predict 30 day mortality

Am Heart J 2016;181:60-5.)

Figure 1. The vulnerable period in the continuity of acute heart failure syndrome care



Adapted and reprinted with permission from Fonarow GC. Heart failure with preserved ejection fraction: disturbing trends. Rev Cardiovasc Med 2006;7:247-8.

- Short stay units?
- Same day treatment units?

In: Storrow AB. New Recommendations for Acute Heart Failure Treatment in the Emergency Department

Conclusions

- AHF syndromes are common
- Early diagnosis and treatment by EPs is critical
- The evidence supports:
  - Oxygenation by escalating interventions
  - Vasodilators unless low BP - Nitroglycerine
  - Non-Invasive ventilation – BiPAP
  - Diuretics in patients who are volume overloaded
  - Correction of precipitating factors
- High quality evidence for ED risk-stratification is needed to perfect tools to support decisions around patient disposition


Questions?
© JULIUSREQUE.COM