Οξεία καρδιακή ανεπάρκεια
Ταξινόμηση και προγνωστικοί δείκτες

Βασιλική Μπιστόλα
Καρδιολόγος
Μονάδα Καρδιακής Ανεπάρκειας
Β’ Παν/κη Καρδιολογική Κλινική
ΠΓΝ Αττικό
Disclosures

• Honoraria: Novartis, Servier, Winmedica
Definition of acute heart failure

“Acute heart failure refers to rapid onset or worsening of symptoms and/or signs of heart failure”

ESC HF Guidelines 2016
Classification of acute heart failure

• By phenotype
• By hemodynamic profile
• By blood pressure
• By clinical profile
Clinical phenotypes of AHF

ESC Heart Failure Guidelines 2005

• Acute decompensated congestive heart failure
• Acute heart failure with hypertension
• Acute heart failure with pulmonary edema
• Cardiogenic shock/low output syndrome
• Severe cardiogenic shock
• High output failure
• Right sided acute heart failure
Definitions of AHF presentations

Table 1 (from ref 1) Classification of acute heart failure syndromes in the guidelines of the European society of cardiology based on clinical presentation

<table>
<thead>
<tr>
<th>Acute de novo or chronic decompensated HF</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Acute decompensated HF (de novo or as decompensation of chronic HF): signs and symptoms of acute HF that are mild and do not fulfill the criteria for cardiogenic shock, pulmonary edema, or hypertensive crisis.</td>
</tr>
<tr>
<td>- Hypertensive acute HF: signs and symptoms of HF are accompanied by high blood pressure and relatively preserved left ventricular function with a chest radiograph compatible with acute pulmonary edema.</td>
</tr>
<tr>
<td>- Pulmonary edema (verified by chest x-ray) accompanied by severe respiratory distress, with crackles over the lung and orthopnea, with O₂ saturation usually —90% on room air before treatment.</td>
</tr>
<tr>
<td>- Cardiogenic shock: cardiogenic shock is defined as evidence of tissue hypoperfusion induced by HF after correction of preload. There is no clear definition for hemodynamic parameters, but cardiogenic shock is usually characterized by reduced blood pressure (systolic blood pressure &lt;90 mm Hg or a drop of mean arterial pressure &gt;30 mm Hg) and/or low urine output (&lt;0.5 ml/kg/h), with a pulse rate &gt;60 beats/min with or without evidence of organ congestion. There is a continuum from low cardiac output syndrome to cardiogenic shock.</td>
</tr>
<tr>
<td>- High output failure is characterized by high cardiac output, usually with high heart rate (caused by arrhythmias, thyrotoxicosis, anemia, Paget disease, or iatrogenic or other mechanisms), with warm peripheries, pulmonary congestion, and sometime- low blood pressure, as in septic shock.</td>
</tr>
<tr>
<td>- Right HF is characterized by low-output syndrome with increased jugular venous pressure, increased liver size, and hypotension.</td>
</tr>
</tbody>
</table>
An introduction to acute heart failure syndromes: definition and classification

Gerasimos Filippatos · Faiez Zannad

Figure 3 Clinical classification of acute heart failure. Modified from Filippatos et al. Heart Fail Rev 2007
Congestion, Not Low Cardiac Output: Main Finding in Hospitalized Patients

SBP $> 140$ mmHg $^1$ 50%
SBP $90 - 140$ mmHg $^1$ 45%
SBP $< 90$ mmHg $^1$ 5%

PCWP (mm Hg) $^2$ 25 - 30

Cardiac Index $^2$ usually preserved

$^1$ Fonarow GC. Rev Cardiovasc Med. 2003; 4 (Suppl. 7): 21
$^2$ The VMAC Investigators. JAMA. 2002; 287: 1531
Congestion in Acute Heart Failure Syndromes: An Essential Target of Evaluation and Treatment

Mihai Gheorghiade, MD, a Gerasimos Filippatos, MD, b Leonardo De Luca, MD, c and John Burnett, MD d

- Hypertensive
  - Vascular type
  - De novo AHF
  - Pulmonary congestion
  - Fluid redistribution

- Normotensive
  - Cardiac type
  - Decompensated chronic HF
  - Pulmonary and peripheral congestion
  - True volume overload
Arbitrary blood pressure cut-off in AHF

Heart Fail Rev (2007) 12:87–90
Italian Survey on AHF
Clinical Profiles According to ESC Guidelines

- Cardiogenic shock: 7.7% (n. 217)
- Hypertensive HF: 6.7% (n. 189) *
- Pulmonary edema: 44.3% (n. 1244)
- Acute decompensated HF: 41.3% (n. 1157)

SBP > 180,
- Cardiogenic shock: 7.7% (n. 217)
- Hypertensive HF: 11.1% (n. 311) **
- Pulmonary edema: 41.6% (n. 1168)
- Acute decompensated HF: 39.6% (n. 1111)

SBP > 160,

L. Tavazzi et al. Italian Survey on AHF
Hemodynamic classification of AHF

Developed in AMI patients

- Hemodynamic assessment (CI/ PWP)
- Clinical assessment (hypoperfusion/congestion)

![Diagram](image)

Modified from Forrester Am J Cardiol 1977;39:137
Clinical assessment of congestion and peripheral perfusion at rest

Nohria A, Stevenson LW. JACC 2003

<table>
<thead>
<tr>
<th>Adequate Perfusion</th>
<th>Congestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>A dry-warm (N=123)</td>
<td>B wet-warm (N=222)</td>
</tr>
<tr>
<td>L dry-cold (N=16)</td>
<td>C wet-cold (N=91)</td>
</tr>
</tbody>
</table>
### 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

#### CONGESTION (-)
- Pulmonary congestion
- Orthopnoea/paroxysmal nocturnal dyspnoea
- Peripheral (bilateral) oedema
- Jugular venous dilatation
- Congested hepatomegaly
- Gut congestion, ascites
- Hepatojugular reflux

#### HYPOPERFUSION (-)

<table>
<thead>
<tr>
<th>Warm-Dry</th>
<th>Warm-Wet</th>
</tr>
</thead>
</table>

#### HYPOPERFUSION (+)
- Cold sweated extremities
- Oliguria
- Mental confusion
- Dizziness
- Narrow pulse pressure

<table>
<thead>
<tr>
<th>Cold-Dry</th>
<th>Cold-Wet</th>
</tr>
</thead>
</table>

Hypoperfusion is not synonymous with hypotension, but often hypoperfusion is accompanied by hypotension.
Clinical phenotypes and outcome of patients hospitalized for acute heart failure: the ESC Heart Failure Long-Term Registry

Ovidiu Chioncel¹*, Alexandre Mebazaa², Veli-Pekka Harjola³, Andrew J. Coats⁴,

A

B

C

European Journal of Heart Failure (2017) 19, 1242–1254
Therapeutic algorithm of acute heart failure

ESC HF Guidelines 2016

PATIENT WITH ACUTE HEART FAILURE

Bedside assessment to identify haemodynamic profiles

PRESENCE OF CONGESTION?

YES
(95% of all AHF patients)

‘Wet’ patient

NO
(5% of all AHF patients)

‘Dry’ patient

ADEQUATE PERIPHERAL PERFUSION?

YES

‘Wet and Warm’ patient
(typically elevated or normal systolic blood pressure)

Vascular type – fluid redistribution Congestion predominates

Cardiac type – fluid accumulation Congestion predominates

• Vasodilator
• Diuretic

NO

‘Wet and Cold’ patient

Systolic blood pressure <90 mm Hg

• Inotropic agent
• Consider vasopressor in refractory cases
• Diuretic (when perfusion corrected)
• Consider mechanical circulatory support if no response to drugs

‘Dry and warm’ Adequately perfused = Compensated

Adjust oral therapy

‘Dry and cold’ Hypoperfused, Hypovolemic

Consider fluid challenge Consider inotropic agent if still hypoperfused

NO
Clinical Outcomes in Patients Hospitalized with Heart Failure

All-cause mortality:
In hospital 3-7%
At 60 - 90 days 10 - 16%

Readmissions:
At 60 - 90 days 20 - 25%

*50% in pts. with SBP<120mmHg at admission

Fonarow GC. Rev Cardiovasc Med. 2003
Long-term prognosis in acute heart failure

All-cause death or HF hospitalization

EURObservational PILOT Research Programme

Maggioni, Fillipatos et al. Eur J Heart Fail;2013:15, 808–817
Prognostic factors in AHF

Clinical
- SBP
- HR
- Respiratory rate
- NYHA at discharge

Demographics
- Age

Cardiac function
- Left ventricular systolic dysfunction

Laboratory
- Blood urea nitrogen
- Serum creatinine
- Serum sodium
- Hemoglobin
- Potassium
- NT-proBNP (discharge, in-hospital reduction)
- Troponin
- Bilirubin

Comorbidities
- Cerebrovascular disease
- Dementia
- COPD
- Cirrhosis
- Active cancer

Therapies
- Metolazone before arrival
- CPR/mechanical ventilation during hospitalization
- Loop diuretic dose
- No BB
- 6-min walk distance at discharge
In hospital all-cause mortality according to the systolic BP at admission

Tavazzi L Eur Heart J 2006; 27: 1207-15
The Relation Between Admission Systolic Blood Pressure and Outcomes in Hospitalized Patients with Heart Failure: An OPTIMIZE-HF Analysis

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>≤119 (n=12,252)</th>
<th>120-139 (n=12,096)</th>
<th>140-161 (n=12,099)</th>
<th>≥161 (n=12,120)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean Age, y</strong></td>
<td>72.9 (14.0)</td>
<td>74.0 (13.5)</td>
<td>73.8 (13.6)</td>
<td>72.1 (14.6)</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td>43.4</td>
<td>49.1</td>
<td>45.2</td>
<td>48.7</td>
</tr>
<tr>
<td><strong>Mean EF (%)</strong></td>
<td>33.3 (17.4)</td>
<td>37.8 (17.6)</td>
<td>40.9 (17.1)</td>
<td>44.4 (16.5)</td>
</tr>
<tr>
<td><strong>Ischemic Etiology</strong></td>
<td>50.7</td>
<td>48.8</td>
<td>44.1</td>
<td>39.2</td>
</tr>
<tr>
<td><strong>HTN Etiology</strong></td>
<td>13.4</td>
<td>18.1</td>
<td>25.4</td>
<td>34.8</td>
</tr>
<tr>
<td><strong>Serum Cr&gt;2 (mg/dl)</strong></td>
<td>20.7</td>
<td>18.0</td>
<td>18.1</td>
<td>21.5</td>
</tr>
<tr>
<td><strong>Edema Admission</strong></td>
<td>63.9</td>
<td>65.1</td>
<td>65.6</td>
<td>63.9</td>
</tr>
<tr>
<td><strong>Edema DC</strong></td>
<td>30.1</td>
<td>27.1</td>
<td>27.0</td>
<td>23.8</td>
</tr>
<tr>
<td><strong>Total mortality in-hospital</strong></td>
<td>7.2</td>
<td>3.6</td>
<td>2.5</td>
<td>1.7</td>
</tr>
<tr>
<td><strong>Total mortality 60-90 days D/C</strong></td>
<td>14.0</td>
<td>8.4</td>
<td>6.0</td>
<td>5.4</td>
</tr>
<tr>
<td><strong>Readmission</strong></td>
<td>30.6</td>
<td>29.9</td>
<td>30.3</td>
<td>27.6</td>
</tr>
<tr>
<td><strong>Mean LOS, days</strong></td>
<td>6.5 (6.6)</td>
<td>5.7 (5.3)</td>
<td>5.4 (5.0)</td>
<td>5.1 (4.8)</td>
</tr>
</tbody>
</table>

Gheorghiade M et al. JAMA November 2006
Prediction of in-hospital mortality

33,000 Patients in ADHERE
Fonarow, Adams, Abraham et al.
Prognostic role of spot urinary sodium in AHF

Honda S, Int J Cardiol 2018
Adjusted OR 2.55 (95% CI, 2.24 to 2.89; P<0.001).

Figure 1. Mortality According to Number of Days in the Hospital and Troponin Status at Presentation.
P<0.001 by the log-rank test. Dashed lines show 95% confidence intervals.
Natriuretic peptides as prognostic markers in AHF

- Individual patient meta-analysis
- 7 prospective cohorts
- 1301 patients

Prognosis and Determinants of Survival in Patients Newly Hospitalized for Heart Failure: A Population-Based Study

38702 consecutive patients with first-time admissions for HF

<table>
<thead>
<tr>
<th>Regressor</th>
<th>No. (%)†</th>
<th>OR (95% CI)</th>
<th>P Value</th>
<th>OR (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>19766 (51.1)</td>
<td>0.95 (0.89-1.01)</td>
<td>.10</td>
<td>0.84 (0.80-0.88)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age group, y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-64</td>
<td>4940 (12.8)</td>
<td>1.19 (0.86-1.64)</td>
<td>.29</td>
<td>1.56 (1.29-1.90)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>65-74</td>
<td>10335 (26.7)</td>
<td>1.71 (1.26-2.31)</td>
<td>&lt;.001</td>
<td>2.18 (1.81-2.63)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>≥75</td>
<td>22397 (57.9)</td>
<td>3.55 (2.63-4.79)</td>
<td>&lt;.001</td>
<td>4.24 (3.53-5.09)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Comorbidity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignancy‡</td>
<td>1015 (2.6)</td>
<td>2.32 (1.99-2.70)</td>
<td>&lt;.001</td>
<td>2.89 (2.53-3.29)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Renal disease</td>
<td>2501 (6.5)</td>
<td>1.97 (1.77-2.19)</td>
<td>&lt;.001</td>
<td>2.35 (2.16-2.55)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Dementia</td>
<td>980 (2.5)</td>
<td>1.77 (1.52-2.07)</td>
<td>&lt;.001</td>
<td>1.85 (1.62-2.11)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>2111 (5.5)</td>
<td>1.57 (1.39-1.76)</td>
<td>&lt;.001</td>
<td>1.60 (1.46-1.76)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Rheumatologic disease</td>
<td>515 (1.3)</td>
<td>1.32 (1.01-1.71)</td>
<td>&lt;.04</td>
<td>1.47 (1.22-1.77)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Peripheral vascular disease</td>
<td>1711 (4.4)</td>
<td>1.17 (1.01-1.35)</td>
<td>&lt;.03</td>
<td>1.42 (1.28-1.57)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Previous myocardial infarction</td>
<td>5685 (14.7)</td>
<td>1.16 (1.07-1.27)</td>
<td>&lt;.001</td>
<td>1.12 (1.05-1.19)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Chronic pulmonary disease</td>
<td>7383 (19.1)</td>
<td>1.08 (1.00-1.17)</td>
<td>&lt;.056</td>
<td>1.13 (1.07-1.19)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diabetes with chronic complications§</td>
<td>670 (1.7)</td>
<td>1.14 (0.99-1.47)</td>
<td>&lt;.031</td>
<td>1.52 (1.29-1.80)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*OR indicates odds ratio; CI, confidence interval.
†Prevalence rates are given in parentheses.
‡Includes any malignancy, including leukemia and lymphoma.
§Excludes patients with diabetes without chronic complications.
Acute HF: persisting congestion at discharge and all-cause mortality during the follow-up

Pulmonary and/or Peripheral congestion

- At admission: 81.6%
- At discharge: 24.1%
- No: 11.3%
- Yes: 20.8%

EurObservational HF Registry ESC

National and Kapodistrian University of Athens

Attikon
Haemoconcentration, renal function, and post-discharge outcomes among patients hospitalized for heart failure with reduced ejection fraction: insights from the EVEREST trial

In-hospital haematocrit change (%)
Q 1 (n= 467): −17% to −2%
Q 2 (n= 375): −1% to 0%
Q 3 (n= 398): 1% to 2%
Q 4 (n= 444): 3% to 16%

Greene S, Gheorghiade M, et al. EJHF 2014
Oral therapies at discharge and AHF prognosis

- 19980 AHF patients from the GREAT registry
- 90-day and 1-year all-cause mortality

Gayat E, Eur J Heart Fail 2018;20:345–354
## Prognostic scores in AHF

<table>
<thead>
<tr>
<th>Prognostic score</th>
<th>Reference</th>
<th>Derivation</th>
<th>Validation</th>
<th>Online calculator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-hospital prognosis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADHERE (Hospitalized)</td>
<td>21</td>
<td>Registry</td>
<td>Temporal</td>
<td></td>
</tr>
<tr>
<td>OPTIMIZE-HF Hospitalized (HFrEF/HFpEF)</td>
<td>28</td>
<td>Registry</td>
<td>External</td>
<td><a href="http://www.optimize-hf.org">http://www.optimize-hf.org</a></td>
</tr>
<tr>
<td><strong>Post-discharge prognosis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPTIMIZE-HF Hospitalized (HFrEF/HFpEF)</td>
<td>29</td>
<td>Registry</td>
<td>External</td>
<td>NA</td>
</tr>
<tr>
<td>ESCAPE Hospitalized (HFrEF)</td>
<td>30</td>
<td>RCT</td>
<td>Internal</td>
<td>NA</td>
</tr>
<tr>
<td>EHRMG (ED)</td>
<td>23</td>
<td>Community cohort</td>
<td>Temporal</td>
<td>NA</td>
</tr>
<tr>
<td>ELAN-HF Hospitalized (HFrEF/HFpEF)</td>
<td>31</td>
<td>Individual patient meta-analysis</td>
<td>External</td>
<td>NA</td>
</tr>
</tbody>
</table>

*Bistola V, Parissis J, Filippatos G. ESC Textbook of Cardiovascular Medicine, 3rd Ed. 2018*
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

Table 3. EHMRG 7-Day Mortality Risk Score

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Additive or Multiplicative Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>y</td>
<td>2 × age</td>
</tr>
<tr>
<td>Transported by EMS</td>
<td>if “yes”</td>
<td>+60</td>
</tr>
<tr>
<td>SBP</td>
<td>mm Hg*</td>
<td>-1 × SBP</td>
</tr>
<tr>
<td>Heart rate</td>
<td>beats/min†</td>
<td>1 × heart rate</td>
</tr>
<tr>
<td>Oxygen saturation</td>
<td>%‡</td>
<td>-2 × oxygen saturation</td>
</tr>
<tr>
<td>Creatinine</td>
<td>mg/dL§</td>
<td>20 × creatinine</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.0 to 4.5 mmol/L</td>
<td>0</td>
</tr>
<tr>
<td>≥4.6 mmol/L</td>
<td>+30</td>
<td></td>
</tr>
<tr>
<td>≤3.9 mmol/L</td>
<td>+5</td>
<td></td>
</tr>
<tr>
<td>Troponin</td>
<td>&gt;ULN</td>
<td>+60</td>
</tr>
<tr>
<td>Active cancer</td>
<td>if “yes”</td>
<td>+45</td>
</tr>
<tr>
<td>Metolazone at home</td>
<td>if “yes”</td>
<td>+60</td>
</tr>
<tr>
<td>Adjustment factor</td>
<td></td>
<td>+12</td>
</tr>
<tr>
<td>Total</td>
<td>EHMRG score</td>
<td></td>
</tr>
</tbody>
</table>

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

Population-based random sample of 12 591 patients presenting to the ED from 2004 to 2007 in 86 hospitals in Ontario, Canada

Annals of Internal Medicine 2012
Summary

• Acute heart failure is a heterogeneous syndrome with multiple manifestations
• Although several classifications have been proposed, the **clinical classification based on congestion/perfusion** appears to be adopted widely.
• Prognosis assessment is based on classical and evolving clinical/laboratory markers
• Prognostic tools **need to be validated** for early assessment even from the ED to improve management/outcomes