ΔΙΑΣΤΟΛΙΚΗ ΚΑΡΔΙΑΚΗ ΑΝΕΠΑΡΚΕΙΑ

Μια παρεξηγημένη οντότητα

Μαρία Μπόνου
Διευθύντρια ΕΣΥ, ΓΝΑ Λαϊκό
Diastolic HF

DD: Diastolic Dysfunction

Pathophysiologic condition: impaired relaxation, ↓ LV compliance, ↑ LV filling pressures

DHF: Diastolic HF

Normal LVEF plus signs/symptoms of HF due to DD (excluding severe valve disease, constriction etc)

HFpEF: HF with preserved EF

Normal LVEF plus signs/symptoms of HF not only due to DD
Definition of HFpEF
2016 ESC Guidelines

1. Symptoms ± Signs

2. LVEF >50%

3. Elevated levels of natriuretic peptides
   \( BNP > 35 \text{ pg/mL and/or NT-proBNP} > 125 \text{ pg/mL} \)

4. At least one additional criterion:
   a. Relevant structural heart disease (LVH and/or LAE)
   b. Diastolic dysfunction
Characteristics of patients with HFpEF

- Older population
- Female predominant

Comorbidities

- Average: 4 Co-morbid Conditions
  - Hypertension
  - Atrial fibrillation
  - Coronary Artery Disease
HFpEF Comorbidities

- Rheumatoid Arthritis
- Renal Dysfunction
- Hypothyroidism
- Peptic ulcer disease
- Others

Non-Cardiac Co-morbidities of HFpEF

- Subclinical Pulmonary Dysfunction
- Obstructive Sleep Apnea
- COPD
- Obesity
- Hypoalbuminemia
- Anemia
- Hyponatremia
- Volume Related
Prevalence of HFpEF

1987-2001, 4596 pts with HF

Mortality is High in HFpEF and Similar to HFrEF

![Graph showing survival rates for preserved and reduced ejection fraction](chart.png)

- **EF ≥ 50%**
- **EF < 50%**

Echo plays a pivotal role in the diagnosis of diastolic dysfunction

Don’t miss a “non-HFpEF” cause of HFpEF

<table>
<thead>
<tr>
<th>Non-cardiac causes</th>
<th>Cardiac causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaemia</td>
<td>Hypertrophic cardiomyopathy</td>
</tr>
<tr>
<td></td>
<td>Infiltrative or restrictive cardiomyopathy</td>
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<tr>
<td></td>
<td>Constrictive pericarditis</td>
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<td></td>
<td>High output heart failure</td>
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<tr>
<td></td>
<td>Valvular heart disease</td>
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<tr>
<td></td>
<td>Coronary artery disease</td>
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<tr>
<td></td>
<td>Pulmonary embolism</td>
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<tr>
<td></td>
<td>Right ventricular myopathies</td>
</tr>
</tbody>
</table>
Diastolic dysfunction

Ventricular–Arterial (V–A) coupling

Chronotropic incompetence

Abnormal LV systolic function

Inadequate increase in heart rate and CO during exercise

Systolic Abnormalities in HFpEF

Diastolic and Systolic Dyssynchrony is common in HFpEF

Echo with TDI

Mitral regurgitation

Atrial fibrillation

Increased pulsatile loading on RV

Mitral relaxation

Increased LV stiffness

Elevated LV filling pressure

Elevated LAP

PA pressure

RV+ PA pressure

RV failure

↓ Cardiac output reserve

Exertional dyspnea and fatigue

Activity avoidance

Oedema, ascites and cachexia

Peripheral limitations

Hoeper et al. Eur Heart J 2017; 2869–73
**Echocardiographic Assessment of Diastolic Function**

**Assessment of LV Diastolic Function**

- **Transmitral pulsed-wave Doppler**
- **Mitral annular tissue Doppler**

**E/e’**: Marker of LV Filling Pressure

E/e’=27
Echocardiographic Assessment of Diastolic Function

<table>
<thead>
<tr>
<th>PEARLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal E’ for age</td>
</tr>
<tr>
<td>E DT normal</td>
</tr>
<tr>
<td>E/A &lt; 0.8</td>
</tr>
<tr>
<td>↓ e’ for age</td>
</tr>
<tr>
<td>E DT prolonged</td>
</tr>
<tr>
<td>E/A &gt; 0.8 (often &gt;1)</td>
</tr>
<tr>
<td>↓ e’ for age</td>
</tr>
<tr>
<td>Look for:</td>
</tr>
<tr>
<td>↑ E/e’ and/or</td>
</tr>
<tr>
<td>↑ LA size</td>
</tr>
<tr>
<td>E/A &gt; 1.5-2</td>
</tr>
<tr>
<td>E DT &lt; 140 ms</td>
</tr>
<tr>
<td>↓↓ e’ for age</td>
</tr>
<tr>
<td>↓ A wave and a’</td>
</tr>
</tbody>
</table>

Mitter et al. JACC 2017;1451-64
Echocardiographic Assessment of Diastolic Function

Valsalva maneuver

Pulmonary Venous Flow

(Complicating factors: tachycardia, bradycardia, AV block, arrhythmia, MAC, mitral valve prosthesis, any mitral stenosis, ≥3+ MR)
### Special Scenarios for Assessing Diastolic Function and LV Filling Pressures

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Transmitral Pulse Wave Doppler</th>
<th>Mitral Annulus Tissue Doppler</th>
<th>Pearls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L AND L’ WAVES</strong></td>
<td><img src="image" alt="L and L’ Waves" /></td>
<td><img src="image" alt="mitral annulus tissue doppler" /></td>
<td>• Severe impaired relaxation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• high LA pressure</td>
</tr>
<tr>
<td><strong>ATRIAL FIBRILLATION</strong></td>
<td><img src="image" alt="atrial fibrillation" /></td>
<td><img src="image" alt="septal" /></td>
<td>• E/e’&gt;11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(septal e’)</td>
</tr>
<tr>
<td><strong>PULMONARY ARTERIAL HYPERTENSION</strong></td>
<td><img src="image" alt="pulmonary arterial hypertension" /></td>
<td><img src="image" alt="lateral" /></td>
<td>• E/a&lt;1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(LA underfilled)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Lateral e’ is preserved</td>
</tr>
<tr>
<td><strong>CONSTRUCTIVE PERICARDITIS</strong></td>
<td><img src="image" alt="constrictive pericarditis" /></td>
<td><img src="image" alt="septal" /></td>
<td>• Respiratory variation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Septal e’≥lateral e’</td>
</tr>
<tr>
<td><strong>MITRAL ANNULAR CALCIFICATION</strong></td>
<td><img src="image" alt="mitral annular calcification" /></td>
<td><img src="image" alt="septal" /></td>
<td>• Small ↑E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ↓ e’</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Falsely ↑E/e’</td>
</tr>
</tbody>
</table>
Algorithm for diagnosis of LV diastolic dysfunction

2016 ESC Guidelines

In patients with normal LV EF:

1. Average E/e' > 14
2. Septal e' velocity < 7 cm/s or Lateral e' velocity < 10 cm/s
3. TR velocity > 2.8 m/s
4. LA volume index > 34ml/m²

- <50% positive
  - Normal Diastolic function

- 50% positive
  - Indeterminate

- >50% positive
  - Diastolic Dysfunction

Diastolic Stress Testing

Heart Catheterization
PATIENT WITH SUSPECTED HFpEF

Assessment of HFpEF probability
1. Clinical History: > 60 yr of age
   Comorbidities
2. Physical examination
3. ECG

Natriuretic peptides
NT-proBNP ≥125 pg/mL, BNP ≥35 pg/mL

Cardiac echo: ejection fraction >50%

Are there complicating factors or is image quality poor?
(tachycardia, bradycardia, AV block, arrhythmia, MAC, MV prosthesis, any MS, ≥3+ MR)

Check for presence of diastolic dysfunction
Average E/e’ > 14
Septal e’ < 7 cm/s or Lateral e’ <10 cm/s
TR velocity > 2.8 m/s
LA volume index >34ml/m²

Grade diastolic dysfunction
Normal
E/A > 0.8
e’ normal for age
Normal LA volume

Grade I
E/A < 0.8
Reduced e’ for age
LAVI normal or ↑

Grade II
E/A > 0.8
Reduced e’ for age
↑ LAVI

Grade III
E/A > 1.5
Reduced e’ for age
↑ LAVI, DT < 140 ms

Assess for increased LV filling pressure (LVFP)
Likely normal
Septal E/e’ < 8
Lateral E/e’ < 8

Indeterminate
Septal E/e’ 8-15
Lateral E/e’ 8-12

Likely elevated
Septal E/e’ > 15
Lateral E/e’ > 12

Inconclusive results

Consider alternative causes

Perform alternative testing (i.e. invasive hemodynamic testing)

Diastolic Stress Testing

HEART CATHETERIZATION
“A one-size-fits-all approach is probably not the solution”.

Thank you