

Heart Failure With Preserved Ejection Fraction

What You Need to Know

Rabeea Aboufakher, MD, FACC, FSCAI
Section Chief of Cardiology
Altru Health System
Grand Forks, ND

Clinical Vignette

A 79 year-old previously healthy woman was admitted to the hospital after a fall and hip fracture. She is admitted to the floor for possible surgical repair. She is being treated with NS at 150 cc/hr and pain control. Her history is significant only for hypertension.

Next morning her pain is improved but is now having dyspnea at rest and orthopnea. On exam there is crackles in the lower lungs and mild leg edema. CXR shows pulmonary congestion. ECG is normal except for LVH. Echo shows mild LVH and normal EF. BNP is 250.

Why is the etiology?

Clinical Vignette

An 85 year-old woman presents to the office with dyspnea on exertion. Her history is significant for diabetes, HTN and hyperlipidemia. She can only walk a short distance due to dyspnea which is a clear change over the last few weeks. No chest pain. Also feels tired.

On exam, her heart rate is 120 bpm and irregular. No murmurs or gallops. No crackles. Mild bilateral leg and ankle edema. JVD is noted. ECG shows AF. Echo shows normal EF.

What is the most important initial goal of therapy? What additional workup is needed here?

Objectives

- Definition and demographics
- Etiology and pathophysiology
- Diagnosis
- Treatment
- Prognosis

The Magnitude of HF

- The most common hospital discharge diagnosis in the elderly
- The prevalence is increasing due to the aging population and improvement in treating other cardiac diseases
- Major reason for hospital readmission within 30 days of discharge

Terminology of HF

- CHF is a complex clinical syndrome that can result from any cardiovascular disorder
- Systolic dysfunction is reduced EF (usually <40%) and can be symptomatic (systolic HF) or asymptomatic
- Diastolic dysfunction is related to impaired relaxation of the LV and can be symptomatic (diastolic HF) or asymptomatic
- Cardiomyopathy refers to a disease of the myocardium and can be primary or secondary and can cause systolic or diastolic dysfunction

HFpEF Definition

Clinical syndrome

- Symptoms and signs of HF
- Normal or near normal LVEF
- Evidence of diastolic dysfunction (elevated left ventricular filling pressures)

Demographics

- About 50% of HF patients have a normal or near-normal EF
- Increases with age
- More common in women (79% in one study)
- Asymptomatic diastolic dysfunction (on echo) is much more common than symptomatic disease

Demographics

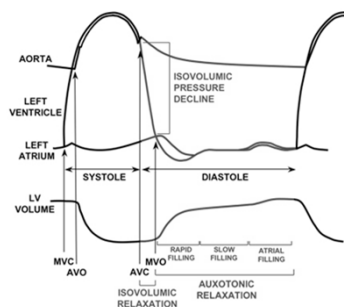
Compared to systolic HF patients

- More likely to be older, female, and hypertensive
- Less likely to have had a prior MI
- Lower in-hospital mortality (3% vs 4%) but similar ICU and hospital LOS

Etiology

- HTN with LVH (most common)
- Ischemic heart disease
- Hypertrophic cardiomyopathy
- Aortic stenosis
- Restrictive cardiomyopathies

Pathophysiology: Phases of Diastole



Pathophysiology

- Loss of normal LV diastolic relaxation (which is an active process) and distensibility impairs LV filling
- This results in increases in LVEDP, left atrial, and pulmonary venous pressures (also called LV filling pressures)
- This in turn causes pulmonary edema and increased right heart pressures
- More filling occurs later in diastole and more dependence on atrial filling results

Clinical Manifestations

- Asymptomatic disease is common
- Similar symptoms and signs to systolic HF especially reduced exercise capacity
- Similar neuro-humoral activation and diminished quality of life

Clinical Manifestations

- Poor tolerance of atrial fibrillation (due to the loss of atrial contraction)
- Poor tolerance of tachycardia (due to diastolic shortening)
- Sudden elevations of blood pressure may cause acute decompensation
- Ischemia can worsen diastolic dysfunction which may be responsible for anginal equivalent of dyspnea

Differential Diagnosis

- Obesity
- Lung disease
- Deconditioning
- Other heart disease (valvular or pericardial)

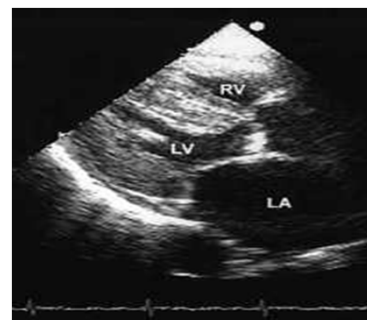
Diagnosis: Cardiac Catheterization

- May be useful to measure the LV filling pressures but is not routinely used
- More helpful if CAD is suspected based on non-invasive testing

Diagnosis: 2 D Echocardiography

- LVH
- Regional wall motion abnormality (ischemia)
- Amyloidosis and other cardiomyopathies
- Valvular disease
- Constrictive pericarditis
- LA size and volume (the Hg A1c of diastolic function)

Diagnosis: 2 D Echocardiography

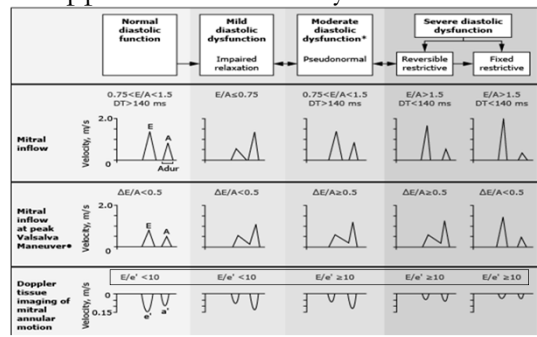


LVH in hypertrophic cardiomyopathy

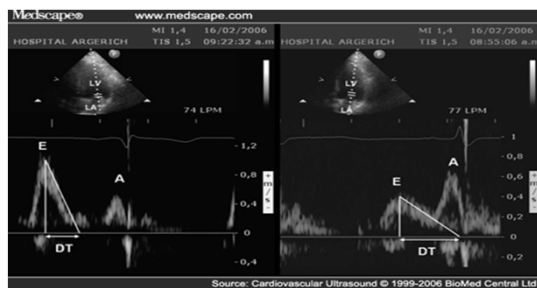
Diagnosis: Doppler Echocardiography

- The clinical gold standard to diagnose and grade diastolic function
- Mitral valve inflow velocities (E and A), the deceleration time (DT) and tissue Doppler mitral annular velocity (e') are most important
- E/e' ratio correlates well with the PCWP in most cases and is very useful clinically

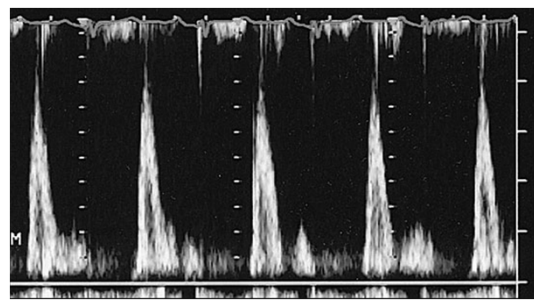
Doppler in Diastolic Dysfunction



Doppler in Diastolic Dysfunction



Doppler in Diastolic Dysfunction



Doppler in Diastolic Dysfunction

- Mild diastolic dysfunction is not usually associated with increased filling pressures and therefore is mostly asymptomatic
- Moderate and severe diastolic dysfunction are usually associated with elevated filling pressures and symptoms
- Diuretics are quite helpful in this situation even if no fluid overload on exam (improve exercise tolerance)

Diagnosis: BNP

- BNP is elevated in patients with HFpEF and can be used to help diagnosis and treatment
- Less elevated than systolic heart failure but cannot differentiate the two

Treatment

- Treatment is still empiric and mostly based on expert census due to paucity of trial data
- ACC/AHA guidelines
 - Control of systolic and diastolic blood pressure
 - Control of ventricular rate in AF
 - Control of pulmonary edema with diuretics
 - Coronary revascularization in CAD
 - Pneumococcal and influenza vaccination

Digoxin

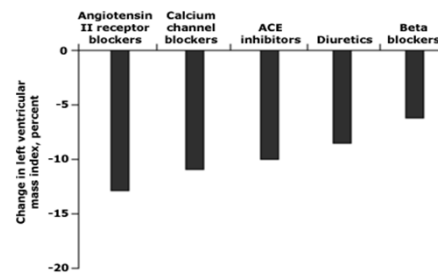
- Generally not used in HFpEF because contractility is intact
- One study showed no difference in all-cause or cardiac mortality or the rate of hospitalization

Ahmed A; Rich MW; Fleg JL; Zile MR; Young JB; Kitzman DW; Love TE; Aronow WS; Adams KF Jr; Gheorghade M. Circulation. 2006 Aug 1;114(5):397-403

Antihypertensive Therapy

- Lowering the systemic blood pressure was associated with reduced rate of HF in some large randomized hypertension treatment trials especially with diuretics (ALLHAT)
- LVH regression is an important goal since it may improve diastolic function
- Choice of therapy usually based on other patient factors especially co-morbidities

Regression of left ventricular hypertrophy in hypertension



Data from Klingbeil, AU, Schneider, M, Martus, P, et al, Am J Med 2003; 115:41

Atrial Fibrillation

- Cardioversion may be useful in patients with diastolic dysfunction
- Rate control is essential and beta blocker and CCBs are the usual first line treatments
- Digoxin only when rate cannot be controlled
- AV nodal ablation and pacemaker as last resort

Ischemia

- Ischemia can contribute to diastolic dysfunction and often precipitates HF
- Beta blockers and CCBs are preferred
- Nitrates may be used
- Revascularization with PCI or CABG

Beta Blockers

- Carvedilol was found in a small study to improve the E/A ratio but not other diastolic indices or filling pressures
- A large registry study failed to show any mortality benefit for beta blockers in HFpEF
- Beware bradycardia especially in the elderly

Calcium Channel Blockers

- CCBs, especially verapamil, were studied in small studies and showed improvement in diastolic function and symptoms of HF
- Long term effect and mortality reduction are unknown and more studies are needed

ACE-Is

- The PEP-CHF study (850 patients with HFpEF randomized to perindopril vs. placebo) showed
 - Reduction in all-cause mortality or HF hospitalization
 - The effect was almost entirely due to reduction in hospitalization
 - Significant improvement in functional class and six minute walk distance

ARBs

- No evidence that ARB therapy directly impacts morbidity or mortality in HFNEF
- The CHARM-preserved trial (candesartan) and the I-PRESERVE trial (irbesartan) were large randomized trials which showed no clear benefit in hard endpoints

Spirolactone

- A large NIH sponsored study (TOPCAT) evaluated the use of spironolactone in HFpEF:
 - No difference in mortality
 - Less CHF hospitalization but similar overall hospitalization
 - Double the rate of hyperkalemia
 - Subgroup analysis showed benefit for patients with elevated BNP

Other Treatments

- Low sodium diet
- Daily weight
- Exercise conditioning
- Implantable hemodynamic monitors

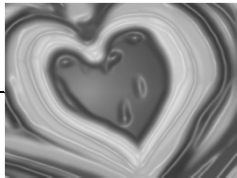
Prognosis

- Several studies suggested that even asymptomatic diastolic dysfunction was associated with increased risk of mortality and hospitalization for HF especially when moderate or severe

Take Home Message

- HFpEF is a major healthcare problem and PCPs are in the forefront
- History and physical combined with a good echo report are diagnostic in most cases
- BP control, rate control in tachycardia and AF, fluid management, and relief of ischemia are the main goals
- Prognosis may be as bad as systolic HF

Thank you for your attention



Questions??