



HEART FAILURE: ANSWERS YOU NEVER GET TO QUESTIONS YOU ALWAYS ASK

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DISCLOSURES

NONE

DEFINITIONS

- HEART FAILURE

- A complex syndrome that results from any structural or functional impairment of ventricular filling or ejection of blood
- Irrespective of LVEF, most patients have both systolic and diastolic dysfunction
- Cardinal manifestations:
 - exercise intolerance due to dyspnea and fatigue
 - Fluid retention
- No longer called “congestive” heart failure
- Not synonymous with cardiomyopathy or LV dysfunction

DEFINITIONS

- ASYMPTOMATIC LEFT VENTRICULAR DYSFUNCTION
 - LVEF < 50% and NO history of signs and symptoms of heart failure

HEART FAILURE CLASSIFICATIONS

- American College of Cardiology / American Heart Association stages of HF
 - Emphasize the development and progression of disease
 - A: at high risk for HF but without structural heart disease or signs and symptoms of HF
 - B: structural heart disease present but NO past or present HF signs or symptoms present
 - C: structural heart disease present and current or prior HF signs symptoms present
 - D: Refractory HF requiring specialized interventions

HEART FAILURE CLASSIFICATIONS

- New York Heart Association functional class
 - Focuses on exercise capacity and the symptomatic status of the disease
 - NYHA I: no limitation of physical activity. Ordinary physical activity does not cause HF symptoms
 - NYHA II: Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in HF symptoms
 - NYHA III: Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes HF symptoms
 - NYHA IV: Unable to carry on any physical activity without HF symptoms or HF symptoms at rest

DEFINITIONS OF HF BASED ON EJECTION FRACTION (EF)

- Normal LV ejection fraction (HFrEF): $\geq 55\%$
- Heart Failure With Reduced EF: HF
Signs/symptoms + LVEF $\leq 40\%$
- Heart Failure with Preserved EF (HFpEF): HF
signs/symptoms + LVEF $\geq 50\%$
- Heart Failure with Preserved EF, Borderline: HF
Signs/symptoms + EF 41-49%
- Heart Failure with Preserved EF, Improved: HF
signs/symptoms with prior EF $\leq 40\%$, now $>40\%$

EPIDEMIOLOGY

- Prevalence: 5.8 million in US
- Incidence: > 650,000 new cases diagnosed annually in US
- 50% have HFrEF, 50% have HFpEF
 - HFrEF mortality: sudden death or pump failure
 - HFpEF mortality is more noncardiac
- Prognosis: mortality HFpEF = mortality HFrEF
- Expense: approximately \$37 billion/year

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HFrEF

QUESTIONS &

ANSWERS

QUESTION

- In a newly diagnosed HFrEF patient, what do I start first- ACEI or beta blocker?

ANSWER

- No evidence supporting superiority of one over the other
- CIBIS 3: ACEI versus bisoprolol as first agent. No difference which was started first.
- Most start with ACEI first, then add beta blocker 2 weeks later.
- Be patient specific: a fib with RVR or history of MI: start beta blocker first.
- Start both within a few weeks of each other and titrate up weekly to every other week.

QUESTION

- Does it matter which beta blocker I use for HFrEF patients?

ANSWER

- Not all beta blockers are equal.
- Only 3 are evidence based to improve mortality and are approved for HFrEF (carvedilol, bisoprolol, metoprolol succinate)
- All 3 beta blockers have similar efficacy for preventing mortality and morbidity
- Achieve the target dose (if possible) used in the trials, even in asymptomatic patients.

QUESTION

- Should I use hydralazine and nitrates? If, when? In whom?

ANSWER

- The combination should be used in HFrEF patients unable to tolerate ACEI and ARB due to drug intolerance, hyperkalemia, renal insufficiency, or hypotension.
- Use the combination in African American patients with HFrEF who remain NYHA III-IV despite optimal therapy with beta blocker and ACEI.

QUESTION

- What do I do with medications once the low EF improves?

ANSWER

- No data on whether it is safe to stop HF meds in a patient who has reversed remodeled.
- Anecdotal reports of some patients with reversible LV dysfunction having meds stopped and not redeveloping HF
- If the meds are stopped, follow closely for evidence of HF recurrence.
- There are no recommendations in the guidelines

QUESTION

- When do I add an aldosterone antagonist (eplerenone or spironolactone)?

ANSWER

- LVEF $\leq 35\%$ + NYHA III-IV + already on ACEI (or ARB) and beta blockers
- LVEF $\leq 35\%$ + NYHA II + already on ACEI (or ARB) and beta blocker + prior CV hospitalization or elevated BNP
- LVEF $\leq 40\%$ + Acute MI + either DM or symptoms/ signs HF

QUESTION

- When do I add digoxin?

ANSWER

- Digoxin can be beneficial in patients with HFrEF, unless contraindicated, to decrease hospitalizations for HF
 - Keep trough level between 0.5-0.9
- HFrEF + atrial fibrillation + rate not well controlled on optimal dose of beta blocker = addition of digoxin

QUESTION

- When do I anticoagulate a HF patient?

ANSWER

- HF + AF + 1 additional risk factor for cardioembolic stroke (hypertension, age $\geq$ 75, DM, prior CVA or TIA)
- HF + AF and NO additional risk factors
- Selection of anticoagulation agent (dabigatran, rivaroxaban, apixaban, warfarin) for AF should be individualized
- HF + prior thromboembolic event / cardioembolic source

QUESTION

- How do I treat asymptomatic LV dysfunction stage B (structural heart disease with no prior or current HF signs/symptoms)?

ANSWER

- If history of MI + $EF \leq 40\%$, use both ACEI (or ARB) and evidence based beta blocker
- If history of MI, use statins to prevent HF
- BP should be controlled to prevent symptomatic HF
- ACEI + beta blocker should be used in all patients with a reduced EF to prevent HF
- ICD is reasonable in patients with asymptomatic ischemic CM who are > 40 days post MI with $LVEF \leq 30\%$ + GDMT

QUESTION

- When do I use an ARB rather than an ACEI in HFrEf?

ANSWER

- ARBS may be used in patients with ACEI intolerance (defined as ACEI cough and possibly ACEI induced angioedema)
- ARBS may be used as first line therapy for HFrEF, especially for patients already taking ARBs for other indications
- ARBS may be added to ACEI in persistently symptomatic HFrEF patients in whom aldosterone antagonist is contraindicated

QUESTION

- Which ARBs demonstrated improved survival in Hfref?

ANSWER

- Candesartan (CHARM Alternative) 32 mg/day
- Valsartan (ValHeFT) 160 mg/day
- Losartan (HEAAL) 150 mg / day

QUESTION

- When is Cardiac Resynchronization Therapy (aka bivenricular pacemaker) indicated?

ANSWER

- LVEF $\leq$ 35% + AF + GDMT + Requires ventricular pacing or otherwise meets CRT criteria + AVN ablation or pharmacologic rate control will allow near 100% ventricular pacing with CRT
- LVEF $\leq$ 35% + GDMT + undergoing a new or replacement device implantation with anticipated requirement for $>$ 40% ventricular pacing

ANSWER

- LVEF $\leq$ 35% + sinus rhythm + LBBB + QRS $\geq$ 150 msec + NYHA II, III, or ambulatory IV already on GDMT
- LVEF $\leq$ 35% + sinus rhythm + non LBBB + QRS $\geq$ 150 msec + NYHA III/ambulatory IV already on GDMT
- LVEF $\leq$ 35% + sinus rhythm + LBBB + QRS 120-149 msec + NYHA II, III, ambulatory IV

QUESTION

- When is an ICD indicated for primary prevention of sudden cardiac death (SCD)?

ANSWER

- LVEF $\leq 35\%$ + > 40 days post MI + NYHA II –III on GDMT + reasonable expectation of meaningful survival for > 1 year
- LVEF $\leq 30\%$ + > 40 days post MI + NYHA I on GDMT + reasonable expectation of meaningful survival for > 1 year.
- Nonischemic CM $\leq 35\%$ + NYHA II-III on GDMT

**HEART FAILURE
WITH PRESERVED
EJECTION
FRACTION (HF_pEF)**



HFpEF: PATHOPHYSIOLOGY

- HFpEF structural changes are same as those of chronic hypertension
 - Increased vascular stiffening contributing to chronic pressure overload
 - Secondary concentric LV chamber remodeling
 - Left atrial enlargement due to elevated LV diastolic pressures

HFpEF PATHOPHYSIOLOGY: DIASTOLIC DYSFUNCTION

- Pathologic mechanism considered to produce HFpEF symptoms: diastolic dysfunction and nondiastolic mechanism.
- Characterization of diastolic dysfunction
 - Delayed LV relaxation and increased chamber stiffness
- Delayed relaxation and increased chamber stiffness lead to:
 - Impaired diastolic filling or the requirement of pathologically elevated filling pressure to achieve adequate preload
 - Chronic elevation of filling pressure -> LA remodelling

HFpEF PATHOPHYSIOLOGY: DIASTOLIC DYSFUNCTION

- Chronic elevation of LV filling pressures -
 >LA remodeling->atrial fib and/or
 pulmonary venous hypertension-
 >pulmonary hypertension ->right heart
 failure
 - Atrial fibrillation: loss of atrial “kick” and rapid
 ventricular rate decreases diastolic filling time
 while increasing myocardial O₂ demand

HFpEF PATHOPHYSIOLOGY: NONDIASTOLIC DYSFUNCTION

- While EF is normal, other measures of regional, chamber, and myocardial systolic function are impaired.
 - Systolic function is impaired during exercise
 - CO may not increase adequately during exercise
 - Reserve capacity with stress is impaired
- Chronotropic incompetence: unable to increase HR adequately during exercise
- Impaired vasodilation during exercise
- Ventricular-arterial stiffening-> labile BP

HEART FAILURE WITH PRESERVED EJECTION FRACTION (HFpEF)

- Symptoms on presentation are exactly like HFrEF
- Exam findings on presentation are exactly like HFrEF (except perhaps for PMI)
 - Physical exam will not reveal the ejection fraction
- May present as acute pulmonary edema or gradually progressive volume overload
- Precipitators for HF decompensation are similar to HFrEF

NONINVASIVE MARKERS OF ELEVATED LV FILLING PRESSURES

- Physical Exam
 - JVD, AJR, S3 gallop, peripheral edema, ascites, hepatomegaly
- Chest radiography
 - Cardiomegaly, pulmonary venous hypertension or edema, pleural effusion, pulmonary artery enlargement
- Echocardiography
 - LA enlargement, elevated PA systolic pressure, IVC dilation and/or failure to collapse, pulmonary vein doppler c/w elevated LA pressure, restrictive filling pattern of mitral inflow velocity, high $E/E' > 15$
- Blood Work
 - Elevated BNP or NTproBNP

PRECIPITANTS OF ACUTE DECOMPENSATED HF (HFpEF or HFrEF)

- **M**yocardial ischemia or infarction
- **H**ypertension, **H**igh Output State, **H**ypoxia
- **E**ndocrine (e.g., thyroid disease)
- **A**rrhythmia, **A**nemia
- **R**eduction in Therapy, **R**enal Disease
- **T**oo much Na and fluid intake
- **S**econd Heart Disease (aortic dissection, SBE)
- **D**rugs, **D**epressants, **D**oc
- **I**nfection
- **E**mbolism (PE)

HFpEF DIAGNOSIS

- HFpEF is a probabilistic, clinical diagnosis
 - Central components of diagnosis:
 - Clinical symptoms compatible with HF
 - Exercise intolerance due to dyspnea, fatigue
 - Salt and water retention (congestion)
- +
- objective evidence of cardiac dysfunction
 - Resting or exercise-induced high filling pressures or low cardiac output

HFpEF DIAGNOSIS

- Relative to HFrEF, HFpEF patients have a higher incidence of:
 - Anemia, atrial fibrillation, hypertension, obesity
- If symptoms are significant with exercise but all resting studies are normal, refer for cardiac catheterization- it's the gold standard of dx
 - Resting hemodynamics may be normal
 - After exercise or saline infusion, filling pressures increase **significantly**

HFpEF: A DIAGNOSIS OF EXCLUSION

- Diseases Commonly Confused With HFpEF can be both cardiovascular and noncardiovascular
 - HFpEF is not diagnosed until these diseases have been excluded
- Myocardial ischemia causes acute diastolic dysfunction, and evaluation for CAD should be strongly considered
- Pulmonary disease may present with similar symptoms, and pulmonary function testing may help to rule in or exclude this entity

NONCARDIOVASCULAR DISEASES CONFUSED WITH HFpEF

- Pulmonary Disease
- Neuromuscular Disease
- Obesity
- Deconditioning
- Thyroid Disease
- Renal Artery Stenosis
- Anemia



CARDIOVASCULAR DISEASES CONFUSED WITH HFpEF

- Constrictive Pericarditis
- Coronary Artery Disease
- Hypertrophic Cardiomyopathy
- Infiltrative or Restrictive Cardiomyopathy
- Right Ventricular Myopathies
- Valvular Heart Disease
- Pulmonary Artery Hypertension
- Pulmonary Embolism
- High Output Heart Failure

HFpEF TREATMENT: 2013 ACCF/AHA GUIDELINES

- Systolic and diastolic BP should be controlled according to published clinical practice guidelines
- Diuretics should be used for relief of symptoms due to volume overload
- Coronary revascularization for patients with CAD in whom angina or demonstrable myocardial is present despite GDMT

HFpEF TREATMENT: 2013 ACCF.AHA GUIDELINES

- Management of AF according to published clinical practice guidelines to relieve symptoms
- Use of beta-blocking, ACEI, and ARBS for hypertension in HFpEF
- ARBs might be considered to decrease hospitalization in HFpEF
- Nutritional supplementation is NOT recommended in HFpEF

HFpEF TREATMENT SINCE 2013 ACCF/AHA GUIDELINES

- Aldosterone antagonist: TOPCAT trial results
 - N=3445
 - Average Follow up: 3.3 years
 - Patients Studies: HFpEF: LVEF > 45%
 - Agent: Spironolactone 30-45 mg/day versus placebo
 - Primary Endpoint: CV mortality, aborted cardiac arrest, or HF hospitalization
 - Result: Primary Endpoint NOT met. **HF hospitalizations significantly decreased**