TYPES OF CONGESTIVE HEART FAILURE BY LEFT VENTRICULAR FUNCTION

Mitchell Karl, MD, FACC,MBA
Associate Professor of Medicine and
Director of Cardiology Teaching Rotations
Boca Regional Campus
Internal Medicine Residency Program
FAU/Schmidt School of Medicine

Congestive Heart Failure

- A condition where the heart is unable to pump sufficiently to maintain the blood flow needs of the body.

- Signs and symptoms include volume overload, in part caused by compensatory activation of the renin angiotensin system and also vasoconstriction and tachycardia mediated by increased adrenergic/sympathetic tone. These compensatory mechanisms ultimately worsen the expression of the disorder itself

- CHF is the most common cause of hospitalization in the Medicare recipient population.

Three Types of Congestive Heart Failure By Left Ventricular Ejection Fraction

- 1. Low/reduced ejection fraction CHF (Ejection fraction less then 40%)
- 2. Intermediate left ventricular function CHF (Ejection fraction 40% to 50%)
- 3. Preserved ejection fraction CHF
- (Ejection fraction greater then or equal to 50%)

Low Ejection Fraction CHF and Cardiomyopathy

- Cardiomyopathy is not synonymous with left ventricular dysfunction
- Cardiomyopathy is a primary disease of the heart muscle with or without systemic manifestations
- Thus, ischemic left ventricular dysfunction, valvular left ventricular dysfunction, congenital heart disease other then aplastic left ventricle and hypertensive left ventricular dysfunction are all not cardiomyopathies.

Low Ejection Fraction CHF and Cardiomyopathy

- After all of these non-cardiomyopathies are excluded, 35% of the remaining true cardiomyopathies are genetic
- Left ventricular dysfunction remains common in middle-aged and older people with 14% having left ventricular dysfunction
- Causes of true cardiomyopathies are many
- The prevalence of true dilated cardiomyopathy is approximately 1 in 5000

Major causes of dilated cardiomyopathy

Infectious diseases

- Viral
  - Adenovirus
  - Coxsackie virus
  - Cytomegalovirus
  - HIV
  - Influenza virus
  - Varicella
  - Hepatitis
  - Epstein-Barr
  - Echovirus
  - Parvovirus
  - Other
- Bacterial
  - Streptococci-rheumatic fever
  - Typhoid fever
  - Diphtheria
  - Brucellosis
  - Psitticosis
  - Mycobacteria
- Rickettsial
- Spirochetal
  - Leptospirosis
  - Syphillis
  - Lyme disease
- Fungal
  - Histoplasmosis
  - Cryptococcosis
- Parasitic
  - Toxoplasmosis
  - Trypanosomiasis (Chagas disease)
  - Shistosomiasis
  - Trichinosis

Medications

- Chemotherapeutic agents
  - Anthracyclines
  - Cyclophosphamide
  - Trastuzumab
- Antiretroviral drugs
  - Zidovudine
  - Didanosine
  - Zalcitabine
- Phenothiazines
- Chloroquine
- Clozapine

Toxins

- Ethanol
- Cocaine
- Amphetamines
- Cobalt
- Lead
- Lithium
- Mercury
- Carbon monoxide
- Beryllium
- Methysergide

Electrolyte and renal abnormalities

- Hypocalcemia
- Hypophosphatemia
- Uremia

Nutritional deficiencies

- Thiamine
- Selenium
- Carnitine
- Niacin (pellagra)

Inflammatory/autoimmune

- Systemic lupus erythematosis
- Dermatomyositis
- Scleroderma
- Rheumatoid arthritis
- Sarcoidosis
- Hypersensitivity myocarditis
- Other autoimmune myocarditis
- Giant cell arteritis
- Kawasaki disease

Endocrinologic disorders

- Thyroid hormone excess or deficiency
- Growth hormone excess or deficiency
- Diabetes mellitus
- Cushing's syndrome
- Pheochromocytoma or other catecholamine excess

Genetic with or without neuromuscular disease

- Familial (and sporadic) genetic cardiomyopathies
- Duchenne's muscular dystrophy
- Myotonic dystrophy
- Friedreich's ataxia
- Arrhythmogenic right ventricular cardiomyopathy

Miscellaneous

- Peripartum cardiomyopathy
- Tachycardia
- Heat stroke
- Hypothermia
- Sleep apnea
- Radiation
- *(Calcium overload)*

- Other cardiomyopathies in the classification of the 1995 World Health Interventional Society and Federation of Cardiology include:

- 1. Hypertrophic Cardiomyopathy
- 2. Restrictive Cardiomyopathy
- 3. Arrhythmogenic right Ventricular Cardiomyopathy
- 4. Unclassified Cardiomyopathies

CHF With Preserved LV Function

- Of those with congestive heart failure, 50% have preserved LV function
- These patients have a similar morbidity and mortality as those with reduced left ventricular function
- Predictive risk factors for CHF with a preserved ejection faction include a history of hypertension, atrial fibrillation, female sex, obesity and increased age

- (the predictors for CHF with reduced left ventricular function include prior myocardial infarction and left bundle branch block)

Pathophysiology of CHF with Preserved Left Ventricular Function

- Static stiffness is present sometimes
- Impaired diastolic relaxation is present all of the time
- Other common findings in CHF with preserved LV function include chronotropic incompetence and decreased vasodilatation.
- Thus, there is an inability to augment stroke volume in response to impaired vasodilatation and an inability to increase the heart rate
- Therefore, the cardiac output which is a product of those falls despite normal LV function
- Symptomatology is common mostly with exertion but can be at rest

Pathophysiology of CHF with Preserved Left Ventricular Function

- An elevated pulmonary artery systolic pressure of greater then 45mmHg has a 95% sensitivity and a 95% specifity for this disorder.
- The etiology may relate to a combination or isolated factors that include endothelial dysfunction, ischemia, a tendency toward hypertrophy, increased catecholamine, responsiveness, altered calcium transport, and interstitial deposition of abnormal amounts of collagen and/or elastin
- Of note, no clinical trials have yet supported a therapeutic benefit from any medications with regard to patient survival

Treatment Of CHF With Preserved LV Function

- 1. Diet
- 2. Exercise
- 3. Viagra
- 4. Diuretics

Treatment possibilities that have shown a benefit in reduced left ventricular function but not in patients with CHF with preserved LV function include:

- 1. ACE inhibitors and ARBs
- 2. Beta blockers
- 3. Digoxin
- 4. Left ventricular assist devices
- 5. Transplantation
- 6. Biventricular Pacing
- Note the benefit of Aldosterone inhibition with spironolactone and Aldactone remains unknown and is to be answered by an ongoing trial called the TOPCAT trial

CHF WITH INTERMEDIATE LEFT VENTRICULAR FUNCTION - EJECTION FRACTION IN THE 40% TO 50% RANGE

- These patients in general have eccentric left ventrical hypertrophy
- They have a shift in the Starling curve to the right with regard to pressure volume
- They are therefore similar to patients with reduced left ventricular function and congestive heart failure
- There is, however, no proven benefit or even any studies to evaluate the benefit of common congestive heart failure therapies in these patients

CHF WITH INTERMEDIATE LEFT VENTRICULAR FUNCTION - EJECTION FRACTION IN THE 40% TO 50% RANGE

- It is suggested by the commonalities with reduced left ventricular function that they may benefit from similar medications
- Their prognosis with regard to arrhythmia seems to be somewhat better and correlates with the actual left ventricular function
- Studies on these patients are hampered by the variable definition of intermediate left ventricular function