CMC Certification Review Course:  
Handout

Session #: 2  
Congestive Heart Failure Cardiomyopathy

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An AACN Critical Care Publication  
101 Columbia  
Aliso Viejo, CA 92656-1491

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CMC Review Course
Session 2:
Congestive Heart Failure Cardiomyopathy
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### Congestive Heart Failure

- **Definition**
  - Congestion in pulmonary or systemic circulation
  - Heart's inability to pump adequate amounts of blood
  - Most common admission criteria in the elderly
- **Etiology**
  - Myocardial infarction
  - Cardiomyopathy
  - Valvular heart disease
  - Volume overload
  - Cardiac depressants
  - Hyperthyroidism

### Right Ventricular Failure

- **Clinical Presentation**
  - Jugular venous distention (JVD)
  - Peripheral edema
  - Cyanosis
  - Congestive hepatomegaly
  - Ascites
  - Hepatojugular reflex

### Left Ventricular Failure

- **Clinical Presentation**
  - Pulmonary crackles
  - Tachypnea
  - S₂
  - Cardiac murmurs
  - Aortic stenosis
  - Aortic regurgitation
  - Mitral regurgitation
  - Paradoxical splitting of S₂
CHF: Diagnostics

- Lab
  - CBC
  - Blood urea nitrogen (BUN)
  - Creatinine
  - Liver enzymes
  - Thyroid stimulating hormone (TSH)
  - B-type natriuretic peptide (BNP)
- Imaging
  - Chest x-ray
  - 2-dimensional (2-D) echocardiography
  - Cardiac catheterization

BNP

- Substance secreted from the ventricles of the heart in response to changes in pressure that occur when heart failure develops and worsens
- Increases when HF symptoms worsen and decreases when HF is stable
- Quick, inexpensive test that enhances current diagnostic assessment tools
- Allows the correct diagnosis of HF
- Future research
  - Determine prognosis
  - Decisions regarding treatment

BNP: Interpretation

- < 100 picograms/milliliter (pg/mL) indicates no HF
- 100 – 300 pg/mL suggests HF is present
- > 300 – < 600 pg/mL indicates mild HF
- > 600 – < 900 pg/mL indicates moderate HF
- > 900 pg/mL indicates severe HF
CHF: Goals of Treatment

- Systolic Dysfunction
  - Diuretics
    - Furosemide
  - Aldosterone inhibitor
  - ACE inhibitor
  - Beta-blockers
  - Digitalis

- Direct vasodilating drugs
  - Hydralazine (Apresoline)
  - Isosorbide (Isordil)

- Indications
  - Unable to tolerate ACE inhibitor
  - ACE inhibitor not effective

- Anticoagulants
  - Indications
    - Atrial fibrillation
    - History of embolism

- Antidysrhythmic agents
  - Amiodarone
    - Modest effect in reducing mortality
    - Pulmonary toxicity
Diastolic Dysfunction: hypertension (H1N)
- Calcium channel blockers
- ACE inhibitors
- Beta-blockers
- Diuretics

Diastolic Dysfunction: aortic stenosis
- Diuretics
- No ACE inhibitors, nitrates, or digitalis (except in rate control)
- Aortic valve replacement

Diastolic Dysfunction: aortic and mitral regurgitation
- ACE inhibitors with diuretics
- Hydralazine with nitrates if ACE inhibitor is not tolerated
Diastolic Dysfunction: mitral stenosis
- Diuretics
- Beta-blocker, digitalis, and/or verapamil to control heart rate
- Repair or replace mitral valve
- Balloon valvuloplasty

CHF: Goals of Treatment

Practice Exam Questions

Question #1 - Answer
The patient’s BNP on admission is 625 pg/mL. This is consistent with:

A. No indication of CHF
B. Mild CHF
C. Moderate CHF. BNP levels < 100 pg/mL indicates no HF. BNP levels from 100 – 300 pg/mL indicates HF is present. Levels > 300 pg/mL indicates mild HF; levels > 600 pg/mL indicates moderate HF, while levels > 900 pg/mL indicates severe HF.
D. Severe CHF
Question #2 - Answer
The symptom of HF associated with worsening New York Heart Association (NYHA) functional class and a reliable indicator of hospitalization is:

A. Edema
B. Decreased appetite
C. Profound fatigue. Fatigue was present in patients before dyspnea. Most patients ignored the fatigue; however, it increased with worsening NYHA class.
D. Activity intolerance

Question #3 - Answer
Your patient has been diagnosed with systolic HF. The medication that reduces morbidity and mortality by 50% is:

A. Spironilactone (Aldactone)
B. Metaprolol (Lopressor). Metaprolol and carvedilol have been found to reduce M&M by 50%. An ACE inhibitor reduces M&M by 10%. Spironilactone reduces M&M by an additional 10%. No reduction directly related to the use of a statin.
C. Lisinopril (Zestril, Prinivil)
D. Simvastatin (Zocor)

Question #4 - Answer
The definitive diagnostic indicator for systolic HF is:

A. BNP > 300 pg/mL
B. C-reactive protein
C. Wall motion abnormalities on echocardiogram
D. EF < 40%. EF is the factor that differentiates between diastolic and systolic failure. BNP is an indicator of the severity of the HF. C-reactive protein elevates in all inflammatory diseases, and wall motion changes are related to the etiology of the HF.
Cardiomyopathy

Anatomic and pathologic diagnosis
Muscle or electrical dysfunction
Heterogeneous group of diseases of the myocardium
Ventricular hypertrophy and dilatation

Classifications
- Primary
  - Genetic
  - Mixed
  - Acquired
- Secondary
  - Infiltrative
  - Toxic
  - Inflammatory
Dilated (Congestive) Cardiomyopathy (DCM)

- Clinical Manifestations
  - Highest incidence in middle age
  - African-American 2x more frequent than Caucasian
  - Men 3x more frequent than women
  - Symptoms may have gradual onset
  - Acute presentation
    - Misdiagnosed as viral upper respiratory infection in young adults
    - Uncommon to find specific myocardial disease on endomyocardial biopsy

Dilated Cardiomyopathy

- Clinical Presentation
  - Right and left HF
- Diagnosis
  - Chest x-ray
    - Cardiomegaly
    - Pulmonary congestion
  - ECG
    - Biventricular hypertrophy
    - AF
  - Echo
    - Diminished wall motion
    - Reduced EF
  - Chest x-ray
Dilated Cardiomyopathy

- Diagnosis
  - Cardiac catheterization
  - Elevated pulmonary artery occlusion pressure (PAOP) and pulmonary artery pressure (PAP)
  - CO and EF
  - Mitral valve abnormality

Dilated Cardiomyopathy

- DCM: Management
  - Manage CHF
    - Oxygen to achieve O₂ saturation 90%
    - ACE inhibitors
    - Vasodilators
    - Diuretics
    - Inotrope (digitalis)
DCM: Medications
- Beta-blocker (antagonist)
  - Carvedilol (Coreg)
  - Bisoprolol (Zebeta)
  - Metoprolol (Lopressor)
- Calcium channel blockers
  - Not first-line therapy

DCM: Treatments
- Antidysrhythmic
  - ICD
- Anticoagulant
  - Coumadin
  - AF
  - Stroke
  - Thrombus

DCM: Patient Management
- Immunosuppressant
- Dual chamber pacing
- Surgery
  - Mitral valve replacement (MVR)
  - Heart transplant
- Diet and physical exercise
- Decrease O₂ demand
  - Activity restriction
  - Sodium restrictions
  - Anxiolytics as needed

Cardiomyopathy
DCM: Managing Complications

- Dysrhythmias
  - AF
  - Ventricular
  - Systemic emboli

DCM: Manage Symptoms

- Cardiac transplantation
  - DCM is the most common indication for cardiac transplantation
  - Survival after transplant is:
    - 80% at 1 year
    - 70% at 5 years
  - LV reduction procedures
    - LV reshaping

Hypertrophic Cardiomyopathy (HCM): Introduction

- Idiopathic hypertrophic subaortic stenosis (IHSS)
- Hypertrophy of the heart muscle
- Rigid, noncompliant ventricle
  - Decreased preload and CO
- Outflow tract obstruction
  - Decreased coronary and cerebral blood flow
**HCM: Clinical Presentation**
- Chest pain
- Syncope
- Palpitations
- Exertional dyspnea
- Fatigue
- Murmurs

**HCM: Murmurs**
- Murmurs
  - Subaortic stenosis
  - Systolic ejection murmur loudest along left sternal border (LSB)
  - Increases with Valsalva maneuver
  - Decreases in squatting position
- Mitral regurgitation
  - Holosystolic blowing murmur
  - Loudest at apex
  - Radiates to axilla

**HCM: Diagnosis**
- Chest x-ray
  - Cardiomegaly
- ECG
  - LV hypertrophy
  - ST segment and T wave changes
  - Q waves in inferior and precordial leads
  - Atrial and ventricular dysrhythmias
- Echo
  - Narrow LV outflow tract
  - Thickened septum
  - Decreased LV chamber
HCM: Diagnosis
- Cardiac catheterization
  - Decreased LV compliance
  - Mitral regurgitation
  - Hyperdynamic systolic function
  - LV outflow obstruction

HCM: Management
- General
  - Fluid and sodium restriction
  - O₂ therapy
  - Rest and exercise restriction
  - Cardioversion for AF
  - Intra-aortic balloon pump (IABP)

HCM: Medications
- Beta-blockers
  - Decrease ventricular contractility
  - Increase ventricular volume and outflow
- Antimicrobials
  - Endocarditis prophylaxis
HCM: Medication Management

- Digitalis
  - Avoid
  - Worsens symptoms
- Diuretics
  - Cautious use

- Beta agonist
  - Worsens outflow gradient
- Beta – blocker
  - Improves diastolic filling
  - For angina, presyncope, dyspnea, and sudden death

HCM: Medication Management

- Calcium antagonist
  - Verapamil
    - Improves diastolic filling
  - Nifedipine (Adalat, Procardia)
    - Diminishes chest pain
- Antidysrhythmic
  - Amiodarone (Cordarone)
  - Sotalol (Betapace)
- Anticoagulant
  - For AF

HCM: Management

- DDD pacemaker
  - Reduces 25% of gradient
  - Improves exercise capacity
  - Worsens hemodynamic variables
- ICD
  - Helps prevent sudden death
- Septal ablation
- Surgical treatment
  - Myectomy
  - MVR
HCM: Complications
- Mural thrombus
- Pulmonary embolus
- Severe HF
- Sudden cardiac death

SCD: Risk Factors
- Young age (< 35)
- “Malignant” family history of SCD
- Aborted SCD
- Sustained VT or SVT
- Non-sustained VT on holter monitor
- AF

SCD: Risk Factors
- Dilated left ventricle
- NYHA Class III or IV
- Syncope
- Severe hypertrophy (LV > 3 cm)
- Abnormal blood pressure response to exercise
- Coronary artery disease
- Strenuous exercise or work
Hypertrophic Cardiomyopathy

- Genotype positive, phenotype negative
- Longitudinal follow-up
- No or mild symptoms
- No treatment
- Drug Therapy

HCM: Treatment Algorithm

- Hypertrophic Cardiomyopathy
- Heart Failure
  - Obstructive
  - Non-obstructive
    - Drug Therapy
    - Surgery
    - Pacemaker
  - Transplantation

- High clinical or genetic risk of death
  - Amiodarone Therapy
  - ICD
DCM vs. HCM

<table>
<thead>
<tr>
<th></th>
<th>Dilated Cardiomyopathy</th>
<th>Hypertrophic Cardiomyopathy</th>
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</thead>
<tbody>
<tr>
<td>LV Volume</td>
<td>Increased</td>
<td>Markedly Increased</td>
</tr>
<tr>
<td>End-diastolic</td>
<td></td>
<td>Decreased</td>
</tr>
<tr>
<td>LV mass</td>
<td>Increased</td>
<td>Markedly Increased</td>
</tr>
<tr>
<td>Mass/volume ratio</td>
<td>Decreased</td>
<td>Increased</td>
</tr>
<tr>
<td>Systolic function</td>
<td>Decreased</td>
<td>Normal or Increased</td>
</tr>
<tr>
<td>Myocardial Shortening</td>
<td>Decreased</td>
<td>Increased</td>
</tr>
<tr>
<td>Diastolic function</td>
<td>Decreased</td>
<td>Increased</td>
</tr>
<tr>
<td>Diastolic stiffness</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td>Myocardial stiffness</td>
<td>Increased</td>
<td>Increased</td>
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</tbody>
</table>

Restrictive Cardiomyopathy

- **Introduction**
  - Fibrous infiltration of heart
  - Heart becomes noncompliant
  - Decreased preload and contractility leads to decreased CO

- **Pathophysiology**
  - Wall of ventricle becomes stiff, but not thickened
  - Resists normal filling
  - Ventricular systolic pressure remains normal
  - Diastolic pressure elevates
  - CO decreases
Restrictive Cardiomyopathy: Clinical Presentation
- Chest pain
- Fatigue
- Weakness
- Dyspnea, orthopnea, paroxysmal nocturnal dyspnea (PND)
- Crackles
- Right-sided symptoms

Restrictive Cardiomyopathy: Diagnosis
- Chest x-ray
  - Cardiomegaly
- ECG
  - Low QRS voltage
  - AV blocks
- Echo
  - Atrial enlargement
  - Enlarged ventricular outside dimension; small ventricular chamber

Restrictive Cardiomyopathy: Diagnosis
- Cardiac catheterization
  - Elevated left ventricular end-diastolic pressure (LVEDP)
  - Elevated right ventricular end-diastolic pressure (RVEDP)
  - Elevated right atrial pressure (RAP)
  - Elevated PAOP
Restrictive Cardiomyopathy: Management

- O₂
- Sodium restriction
- Maintain volume
- Septal myotomy
- Minimize therapies that increase outflow obstruction
  - ACE inhibitors
  - Vasodilators
  - Diuretics
  - Inotropes

Restrictive Cardiomyopathy: Complications

- Dysrhythmias
  - AV blocks
  - Systemic emboli
  - Consider transplantation

Amyloidosis

- Diuretics and vasodilator
  - Low dose
- Permanent pacemaker
- Anticoagulant
  - Even without atrial dysrhythmia
Amyloidosis: Management

- Digoxin (Lanoxin)
  - Increases dysrhythmia
- Nifedipine (Adalat, Procardia)
  - Exacerbates CHF
  - Enhances negative inotropic effect
- Autologous stem cell transplantation
- Heart transplantation

Constrictive Pericarditis vs. Restrictive Cardiomyopathy

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>Constrictive Pericarditis</th>
<th>Restrictive Cardiomyopathy</th>
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</thead>
<tbody>
<tr>
<td>History</td>
<td>Prior history of pericarditis or condition that causes pericardial disease</td>
<td>History of pericarditis or condition that causes pericardial disease</td>
</tr>
<tr>
<td>Physical examination</td>
<td>Ascites, S3 gallop, low-frequency murmur</td>
<td>No ascites, normal physical examination</td>
</tr>
<tr>
<td>Systemic examination</td>
<td>No edema, high-frequency sound</td>
<td>Edema, high-frequency sound</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Abnormal heart sounds, pericardial knock</td>
<td>No abnormal heart sounds</td>
</tr>
<tr>
<td>Prior chest x-ray</td>
<td>No pericardial calcification</td>
<td>Normal results of prior chest x-ray</td>
</tr>
</tbody>
</table>

Löffler Endocarditis

- Myocardial dysfunction
- Pericardial effusion
- Amyloidosis
- Hypertension
- Congestive heart failure
- Systemic lupus erythematosus
- Atherosclerosis
- Diabetes mellitus
- Rheumatoid arthritis
- Idiopathic
- Connective tissue disease
- Systemic inflammatory disease
- Parasitic infection
- Infiltration by cancer or tumor
Löffler Endocarditis

Symptoms
- Weight loss
- Fever
- Cough
- Rash
- CHF

Diagnosis
- ECG
- Atrial fibrillation + RBBB
- Echo & cardiac catheterization
- Probable mitral valve and tricuspid valve regurgitation

Complications
- Systemic emboli

Treatment
- Steroid
- Cytotoxic agents
- Hydroxyurea
- Symptom control

Symptom control
Practice Exam Questions

Question #1 - Answer
Your patient has been diagnosed with restrictive cardiomyopathy. An appropriate intervention would include administration of:

A. Volume. Preload must be maintained. Any medication that increases outflow tract obstruction will exacerbate symptoms. Avoid inotropes, dilators, and diuretics.
B. Dobutamine
C. Lasix
D. Nitrates

Question #2 - Answer
Patients with hypertrophic cardiomyopathy with high clinical or genetic risk of sudden death should receive:

A. Cardiac transplantation as soon as possible
B. Surgical manipulation of the septum
C. An implantable cardioverter-defibrillator. These patients are at high risk of ventricular fibrillation. Usually, drug therapy with amiodarone and the insertion of an ICD is the treatment of choice.
D. A beta-blocker to reduce workload
Dilated Cardiomyopathy is:

A. Found 3x more often in women than in men
B. Diagnosed from findings on endomyocardial biopsy
C. An acute onset of symptoms
D. Misdiagnosed as a viral URI in young adults.
DCM is found 3x more often in men, is not diagnosed by endomyocardial biopsy, and has a gradual onset of symptoms.