

**SESSION III: MECHANISMS OF HUMAN DISEASE: LABORATORY SESSIONS**  
**CARDIOVASCULAR PATHOLOGY II**

November 12, 2008  
1:00 pm – 2:30 pm

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**GOAL:** Describe the basic morphologic and pathophysiologic changes in various conditions of the cardiovascular system.

**OBJECTIVES:**

1. Describe the morphologic characteristics of congestive heart failure.
2. Describe the morphologic characteristics of the different types of cardiomyopathy.
3. Describe the morphologic characteristics of tumors in the heart.

**CLINICAL CASE:**

**Case 1**

**A 72-year-old man presents with progressive dyspnea, fatigue and pitting edema of the lower extremities. He has a history of multiple episodes of chest pain resulting in hospitalizations. He was offered coronary artery bypass surgery in the past but declined stating that “my father died on the table during heart surgery and I don’t want that to happen to me”.**

**Physical Exam:**

**Jugular venous pulse is elevated.**

**On cardiac exam the apical impulse is in the 5th intercostal space, lateral to the left midclavicular line. S3 is heard at the apex. (he cannot lay flat during the exam because of dyspnea).**

**On lung auscultation there are bilateral crackles over 2/3 of the lower lung fields. There is dullness to percussion.**

**There is mild tender hepatomegaly.**

**His feet and legs are edematous.**

- a. Identify the organs: **Heart/Lung/Liver.**
- b. Describe the characteristic pathologic features in each organ.  
**Section of the heart reveals irregular fibrosis replacing myocardium. Section of the lung shows severe, chronic passive congestion. Vessels, including alveolar capillaries, are congested. Alveoli contain numerous hemosiderin laden macrophages. Section of the liver shows centri-lobular sinusoidal congestion. Hepatocytes around the central vein show degeneration and atrophy. Students should be able to describe changes in healing, from necrosis to granulation tissue to formation of scar.**

c. Correlate the clinical findings with the pathology.

**Clinical findings are due to congestive heart failure.**

**Dyspnea correlates with severe congestion.**

**Enlarged, sometimes tender, liver correlates with hepatic congestion.**

**Fatigue correlates with poor muscle perfusion.**

**Pitting edema correlates with elevated venous pressure.**

d. Diagnosis: **Healed Myocardial Infarction/Chronic Passive Congestion of the Lung and Liver (CHF).**

e. Does this patient have signs/symptoms of left sided heart failure, right sided heart failure, or biventricular heart failure?

– **Biventricular heart failure**

• **Left sided heart failure**

– **Pulmonary congestion**

– **Pulmonary edema**

• **Right sided heart failure**

– **Hepatic enlargement and congestion**

– **Peripheral edema**

– **Jugular venous distention – elevated systemic congestion**

## Case 2

**A 29-year-old male presents with exertional dyspnea. He has no history of joint pains, fever, previous heart disease, or previous lung disease.**

**Physical examination:**

**Lungs are clear to auscultation and normal to percussion. On cardiac exam a harsh crescendo-decrescendo systolic ejection murmur is heard best at the apex and lower left sternal border. S4 is present. The heart rhythm is irregular. There is no peripheral edema.**

**Despite physician recommendations against strenuous activity, one week later, he plays basketball, collapses and dies.**

a. Identify the organ: **Heart**

b. Describe the characteristic pathologic changes.

• **Grossly, the myocardium is thickened, especially the interventricular septum and left ventricular wall.**

• **On transverse section, the thickened septum impinges on the ventricle producing a “banana shaped” chamber.**

• **Microscopically, the muscle fibers are hypertrophied, disorganized and haphazard in arrangement, with fibrosis between the fibers.**

- c. Correlate the clinical findings with the pathology.  
**The hypertrophied wall is less compliant and less blood fills the ventricle. These changes cause decreased stroke volume and cardiac insufficiency leading to exertional dyspnea. Septal hypertrophy may lead to stenotic systolic murmur which radiates to the apex. Atrial fibrillation is common.**
- d. Diagnosis: **Hypertrophic cardiomyopathy**
- e. What is a common genetic defect that is associated with this disorder?  
**In about 50% of patients, hypertrophic cardiomyopathy is familial. Autosomal dominant transmission with variable expression.**
- Genetic defects comprise mutations of any one of four genes that encode proteins of the sarcomeres (cardiac contractile elements): Beta-myosin heavy chain, cardiac troponin T, Alpha-tropomyosin, or myosin binding protein C.**

### Case 3

A 43-year-old female presents after fainting while getting out of bed. She has no previous history of syncope. She has hyperlipidemia for which she has been taking medication for the past 15 years. On examination there is a cardiac murmur that develops with changes in the patient's position.

- a. Identify the organ: **Heart**
- b. Describe the characteristic pathologic changes.
- **Single globular neoplasm growing in atrium (usually left). May be pedunculated.**
  - **Microscopically, a mixture of cells is embedded in a loose connective tissue background. The cells include primitive mesenchyme, smooth muscle and inflammatory cells. Blood vessels are noted.**
- c. Correlate the clinical finding with the type and location of the pathologic lesion.  
**A pedunculated myxoma may have a "ball-valve" effect, creating turbulence of blood flow (murmur) when the patient is in one position versus another. The tumor impedes blood flow between the atrium and ventricle.**
- d. Diagnosis: **Atrial myxoma**

**Case 4 (no virtual microscopy slide)**

A 37-year-old woman presents with tiredness. She had gained weight in the past several months. Swelling in her legs and feet made it difficult to walk.

She had a complete physical examination two years ago which was unremarkable except for an abnormal Pap smear for which she had followed up with her gynecologist.

**Physical exam:**

On cardiac exam the apical impulse is in the 5th intercostal space, lateral to the left midclavicular line. S3 is heard at the apex. There is a II/VI holosystolic murmur at the apex which radiates to the axilla. On lung auscultation there are bilateral crackles over 2/3 of the lower lung fields. There is mild tender hepatomegaly. Her feet and legs having pitting edema.

- a. Identify the organ: **Heart**
- b. Describe the characteristic pathologic changes. **Grossly the heart is markedly enlarged and flabby. Usually all four chambers are dilated. Mural thrombi are frequent.**
- c. Correlate the clinical finding with the pathology. **The weakened myocardium fails to pump blood efficiently.**
- d. Diagnosis: **Dilated cardiomyopathy**
- e. What are possible etiologies of the cardiomyopathy?  
**Viral myocarditis, alcohol, peripartum cardiomyopathy, drugs (i.e., doxorubicin), familial, idiopathic**
- f. What is the likely etiology of the heart murmur in this patient?  
**Mitral regurgitation**
  - **Holosystolic murmur at the apex which radiates to the axilla**
  - **Left ventricular dilatation distorts the mitral valve annulus and tendinous cords leading to failure of the valve to close completely and regurgitation**