The Heart: Inside Out
Intraluminal Lesions
Tumors and Thrombi
Cardiac Tumors

- Rare
- Metastatic tumors are 20x more common than primary
  - Melanoma, lymphoma, lung and breast most frequent
- Most mets involve the pericardium
Cardiac Tumors

- In children, most common tumor is rhabdomyoma
  - Tuberous sclerosis; multiple, IV septum
- In adults, most common benign tumor is myxoma
  - Angiosarcoma most common malignant
    ▲ Usually right-sided
Myxomas

- Most common 1° benign cardiac tumor
- Usually found in left atrium
- Arise from inter-atrial septum
- About 10% calcify
Myxoma in Left Atrium
Ventricular Thrombi

- In left ventricle
  - After MI
  - In a ventricular aneurysm
- Filling defects in opacified cardiac chamber
- May calcify
Ventricular Thrombi

- Occur on cardiac walls that are akinetic
  - Usually at cardiac apex or along IV septum
- Biggest pitfall
  - May be confused with posterior papillary muscles
  - Look for thickened chordae
Thrombus in Right Ventricle
Atrial Thrombi

- Commonly associated with LA enlargement
- Most frequent in mitral stenosis with atrial fibrillation
- Left atrial appendage a frequent site
Thrombus in left atrial appendage
Myocardium
Cardiomyopathy
Classification

- Dilated cardiomyopathy
- Restrictive cardiomyopathy
- Hypertrophic cardiomyopathy
- Arrhythmogenic right ventricular dysplasia
Dilated Cardiomyopathy
Dilated Cardiomyopathy

- Dilatation of both ventricular cavities
  - Increased cardiac mass
- Over 75% have mural thrombi
  - Most often LV>RV>RA>LA
- More than half of patients are alcoholics
<table>
<thead>
<tr>
<th>Dilated Cardiomyopathy Other Causes</th>
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<tbody>
<tr>
<td>* Idiopathic</td>
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<tr>
<td>* Coronary artery disease</td>
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<tr>
<td>* Myocarditis</td>
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<tr>
<td>* Lupus</td>
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<td>* Viral infection</td>
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Dilated Cardiomyopathy

Clinical

- Poor systolic ventricular function
  - Pooling in diastole leads to thrombogenesis
- Severe, intractable CHF is dominant symptom
  - Usual cause of death
Dilated Cardiomyopathy
Imaging Findings

- Cardiomegaly
  - Usually involves left ventricle
- CHF common
- Echo: poor global wall motion
  - Wall thickness usually thin
Dilated Cardiomyopathy
Dilated Cardiomyopathy

Cine MR images in the short axis plane show little change in size between end diastole and end systole
<table>
<thead>
<tr>
<th>Arrhythmogenic Right Ventricular Dysplasia</th>
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</thead>
<tbody>
<tr>
<td>- Rare cardiomyopathy</td>
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<tr>
<td>- Arrhythmias and sudden death</td>
</tr>
<tr>
<td>- Younger age group</td>
</tr>
<tr>
<td>- RV anterior free wall replaced by fat and fibrous tissue</td>
</tr>
<tr>
<td>- Thinning of ant wall; more fat than normal</td>
</tr>
<tr>
<td>- Dilated RV, aneurysms and tricuspid regurgitation</td>
</tr>
</tbody>
</table>
Arrhythmogenic Right Ventricular Dysplasia

Left-thickening and replacement of RV anterior wall by fatty tissue. Fat suppression (right) - loss of signal in RV anterior wall, confirming fatty nature of these changes.
Restrictive Cardiomyopathy
Restrictive Cardiomyopathy

General

- Least common
- Normal ventricular size
- Inability of the ventricles to fill properly
- Thick LV wall and dilated LA
Restrictive Cardiomyopathy

General

- Mural thrombi occasionally
- Resembles constrictive pericarditis
- Biopsy may be needed
Restrictive Cardiomyopathy
Causes

- Associated with extracellular infiltration
  - Amyloid
  - Sarcoid
  - Glycogen storage diseases
  - Mets
  - Radiation
Restrictive Cardiomyopathy

Imaging Findings

- Little cardiomegaly
  - Walls are stiffened
- CHF common
- Echo: Normal-sized LV
  - Dilated left atrium
  - Pericardium not thickened
Restrictive cardiomyopathy

ECG-gated spin-echo image - enlargement of both atria and normal size of ventricles with thickened walls
Hypertrophic Cardiomyopathy (HCM)
Hypertrophic Cardiomyopathy

Idiopathic Hypertrophic Subaortic Stenosis

- Severe LV, and sometimes RV, hypertrophy
  - Thickened IV septum
- No ventricular enlargement
  - At least initially
- Divided into primary and secondary
- Further divided into those with and without LVOT obstruction
Hypertrophic Cardiomyopathy
Secondary, Non-obstructive

- Non-obstructive hypertrophic cardiomyopathy (HCM) is common
- Seen with high blood pressure
- Concentric and uniform thickening of LV wall
Hypertensive cardiovascular disease
Hypertrophic Cardiomyopathy
Primary

- Another cause of HCM is genetic
  - Autosomal dominant with variable penetrance
- Hypertrophy may be concentric or localized
  - Asymmetric septal hypertrophy (ASH)
    - IV septum is 1.5x thicker than posterior LV wall
  - Disproportionate upper septal thickening (DUST)
Hypertrophic Cardiomyopathy
Primary

- May appear from birth to old age
- Common cause of sudden cardiac death in patients < 40 yrs old
  - Most common cause of death amongst competitive athletes
- About 1/3 have LVOT obstruction
Hypertrophic Cardiomyopathy
Primary

- Unlike DC with hypokinesis, HCM is hyperkinetic
  - LV empties too completely
- Atria attempt to compensate and enlarge
  - Much larger atria than in DC
Hypertrophic Cardiomyopathy
Obstructive (HOCM)

- Hallmark: dynamic subvalvular aortic stenosis
- Anterior leaflet of mitral valve moves into LVOT on systole
  - Systolic Anterior Motion (SAM) of mitral valve
  - Occludes LVOT
Hypertrophic Cardiomyopathy
Obstructive (HOCM)

- Neither ASH nor SAM is specific for HOCM
  - E.g. ASH also seen in Pulmonic Stenosis
  - SAM also seen in Transposition of Great Vessels
Hypertrophic Cardiomyopathy
Imaging Findings

- Usually normal-sized heart
  - Left atrium may be enlarged 2° MR
- CHF not common
- Echo: LV hypertrophy
  - ASH
- Dynamic LVOT obstruction
  - SAM
Hypertrophic Cardiomyopathy

ECG-gated spin-echo image in coronal plane - severe symmetrical hypertrophy of LV
Asymmetric septal hypertrophy

Hypertrophic Cardiomyopathy

Thickened apex
Hypertrophic Cardiomyopathy

Mitral Regurgitation From SAM

Almost complete emptying of LV

Marked wall thickening

©Elliot-Cardiac Imaging

Hypertrophic Cardiomyopathy
<table>
<thead>
<tr>
<th></th>
<th>Dilated</th>
<th>Restrictive</th>
<th>Hypertrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LV Cavity Size</strong></td>
<td>Increased</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td><strong>Mitral Regurgitation</strong></td>
<td>Mild</td>
<td>Variable</td>
<td>HOCM: mild to severe</td>
</tr>
<tr>
<td><strong>Wall motion</strong></td>
<td>Global hypokinesis</td>
<td>Normal</td>
<td>Hyperkinetic</td>
</tr>
<tr>
<td><strong>Mural thrombi</strong></td>
<td>Frequent</td>
<td>Occasional</td>
<td>None</td>
</tr>
<tr>
<td><strong>Systolic Function</strong></td>
<td>Decreased</td>
<td>Normal</td>
<td>Increased</td>
</tr>
<tr>
<td><strong>Diastolic Function</strong></td>
<td>Normal</td>
<td>Decreased</td>
<td>Normal</td>
</tr>
<tr>
<td><strong>Ejection Fraction</strong></td>
<td>Decreased</td>
<td>Normal</td>
<td>Normal</td>
</tr>
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</table>
Endocarditis
Endocarditis

General

- Triad: fever, murmur, septicemia

- Causes
  - Rheumatic fever
  - Infection
  - Non-bacterial thrombotic endocarditis
    - Libman-Sacks Endocarditis
    - Smaller vegetations than bacterial
Endocarditis
General

- Vegetations frequently produce regurgitation of affected valve
- Can embolize to lungs or aorta
  - Septic emboli in lungs
  - May produce mycotic aneurysm of aorta
Rheumatic Vegetations
Septic Emboli to Lungs
Pericardium
Pericarditis
Constrictive Pericarditis

- Thickening of pericardium impeding diastolic filling
- Thickened pericardium may calcify
  - 50% on chest x-rays
- Right-sided failure due to impeded RV filling
<table>
<thead>
<tr>
<th>Causes</th>
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<tbody>
<tr>
<td>Viral pericarditis (most common)</td>
</tr>
<tr>
<td>Tuberculous pericarditis</td>
</tr>
<tr>
<td>Uremic pericarditis</td>
</tr>
<tr>
<td>Post-cardiac surgery</td>
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</table>
Constrictive Pericarditis
Calcification

- About 50% with constrictive pericarditis calcify
  - Eggshell – viral and uremic
  - Shaggy, amorphous in AV grooves – TB
- Calcified pericardium doesn’t imply constriction
Constrictive Pericarditis
Eggshell calcification as seen in viral or uremic pericarditis
Constrictive Pericarditis
Thick calcification as seen in tuberculous pericarditis
Constrictive Pericarditis vs. Restrictive Cardiomyopathy

- May be impossible to distinguish two
- Both have abnormal filling of the heart
- CT best for calcified pericardium
  - If calcified, not restrictive cardiomyopathy
- Normal pericardium on both CT and MRI
  - Excludes constrictive pericarditis
## Constrictive Pericarditis vs. Restrictive Cardiomyopathy

<table>
<thead>
<tr>
<th></th>
<th>Constrictive Pericarditis</th>
<th>Restrictive Cardiomyopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heart size</strong></td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td><strong>Pericardial Calcification</strong></td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td><strong>Right Atrial Border</strong></td>
<td>Straight</td>
<td>Convex</td>
</tr>
<tr>
<td><strong>Right Atrial Wall Thickness</strong></td>
<td>Increased</td>
<td>Normal</td>
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</table>
Congenital Defect in the Pericardium
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Embryogenesis</td>
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</table>

- Premature atrophy of left duct of Cuvier (cardinal vein) leads to
- Failure of nourishment of left pleuro-pericardial membrane which leads to failure of pericardium to develop
### Congenital Pericardial Defect

#### General

- **Male:female ratio of 3:1**
- **May be detected at any age**
  - Most common in low 20’s
## Congenital Pericardial Defect Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foraminal defect on left side</td>
<td>35%</td>
</tr>
<tr>
<td>Complete absence of left side</td>
<td>35%</td>
</tr>
<tr>
<td>gives levoposition of heart</td>
<td></td>
</tr>
<tr>
<td>Diaphragmatic surface</td>
<td>17%</td>
</tr>
<tr>
<td>Total bilateral absence</td>
<td>9%</td>
</tr>
<tr>
<td>Right sided</td>
<td>4%</td>
</tr>
</tbody>
</table>
Congenital Pericardial Defect

Associations

- Bronchogenic cysts
- VSD, PDA, mitral stenosis
- Diaphragmatic hernia
- Sequestration
## Congenital Pericardial Defect

### Clinical

- Mostly asymptomatic
- May have:
  - Tachycardia
  - Palpitations
  - Right bundle block
  - Positional discomfort lying on left side
  - Chest pain
## Congenital Pericardial Defect
### X-ray Findings

- Focal bulge in area of main pulmonary artery
- Sharply marginated
- Lung may interpose between heart-left hemidiaphragm
- Increased distance between sternum and heart 2° absence of sternopericardial ligament
### Congenital Pericardial Defect

**X-ray Findings-Continued**

- Levoposition of heart
- Pneumopericardium following pneumothorax
Congenital Defect in the Pericardium
Congenital Pericardial Defect

Treatment

- Since herniation and strangulation of left atrial appendage or herniation of LA/LV may occur
- Foraminal defect requires surgery
The End

To start over from beginning, click here