

William Herring, M.D. © 2004

The Heart: Inside Out

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Intraluminal Lesions

Tumors and Thrombi

Cardiac Tumors

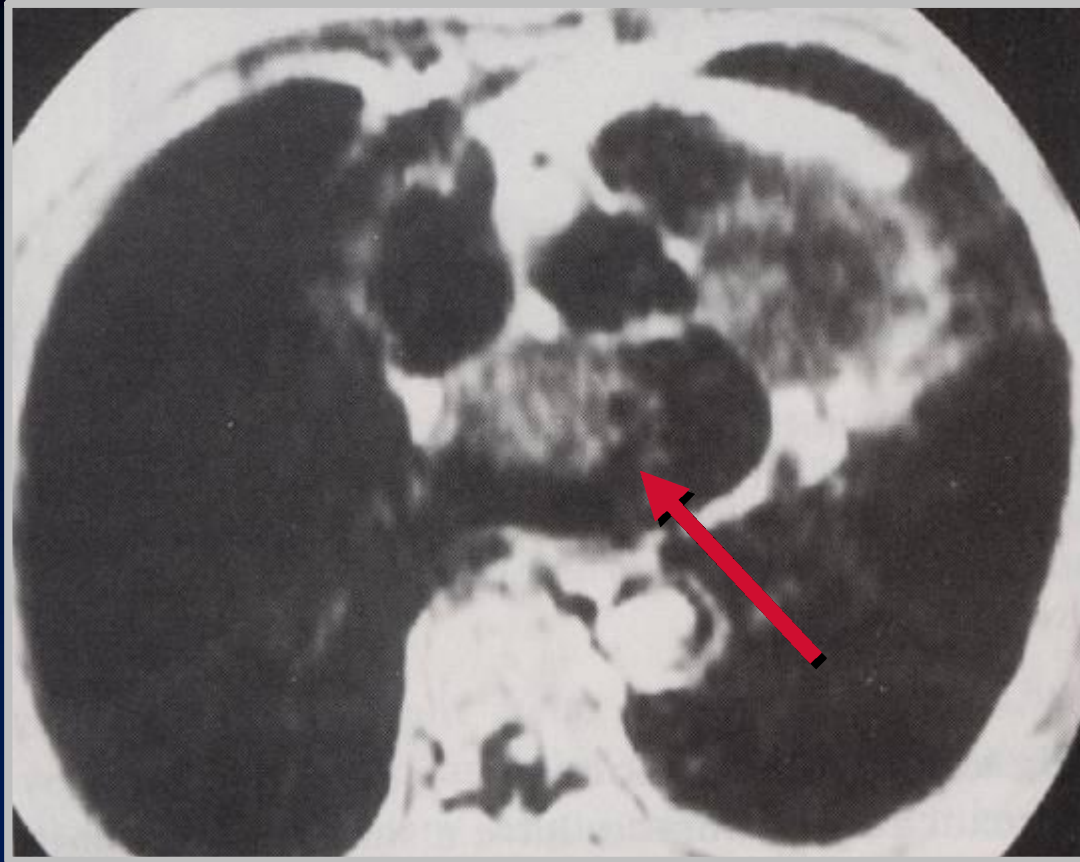
- Rare
- Metastatic tumors are 20x more common than primary
 - Melanoma, lymphoma, lung and breast most frequent
- Most mets involve the pericardium

Cardiac Tumors

- In children, most common tumor is rhabdomyoma
 - Tuberosus 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



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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

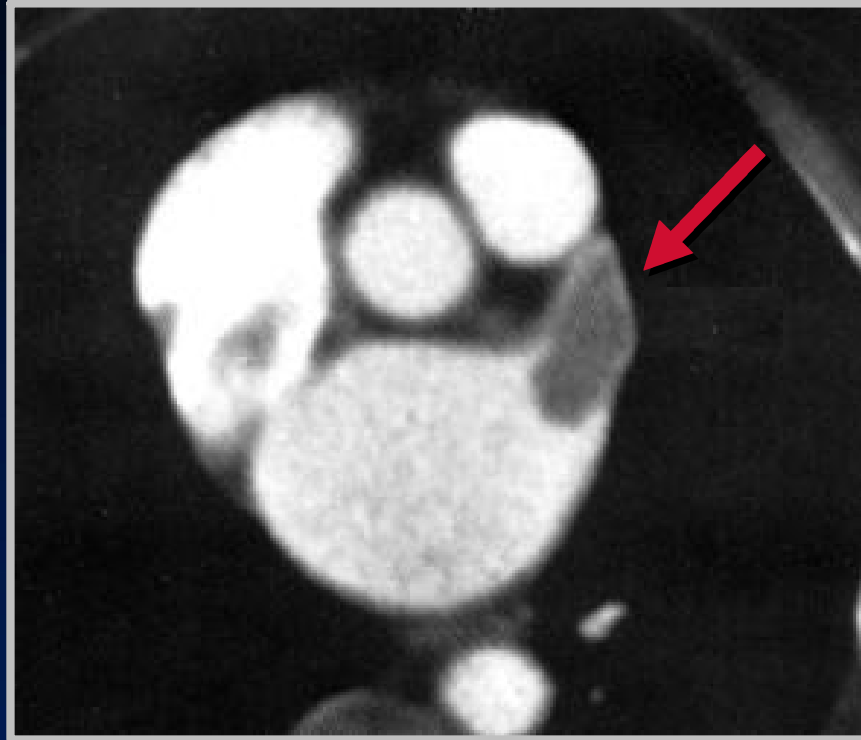
- **Occur on cardiac walls that are akinetic**
 - Usually at cardiac apex or along IV septum
- **Biggest pitfall**
 - May be confused with posterior papillary muscles
 - Look for thickened chordae



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



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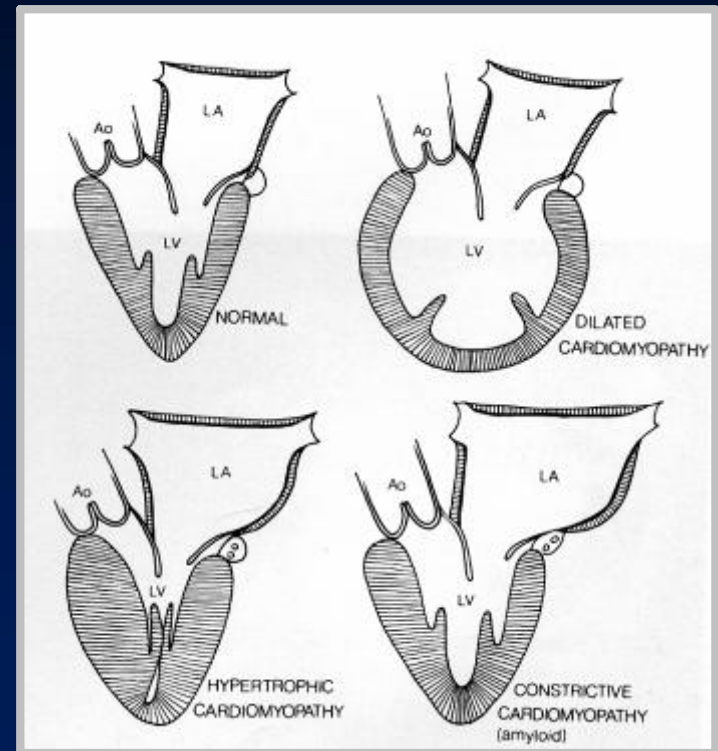
Thrombus in left atrial appendage

Myocardium

Cardiomyopathy

Classification

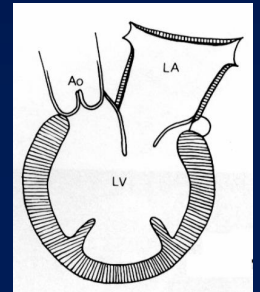
- Dilated cardiomyopathy
- Restrictive cardiomyopathy
- Hypertrophic cardiomyopathy
- Arrhythmogenic right ventricular dysplasia



Dilated Cardiomyopathy

Dilated Cardiomyopathy

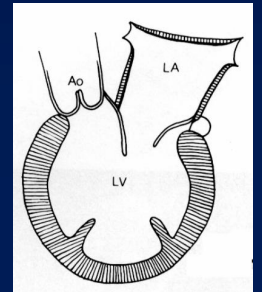
- Dilatation of both ventricular cavities
 - Increased cardiac mass
- Over 75% have mural thrombi
 - Most often LV>RV>RA>LA
- More than half of patients are alcoholics



Dilated Cardiomyopathy

Other Causes

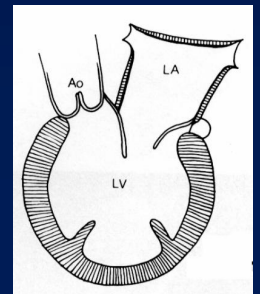
- Idiopathic
- Coronary artery disease
- Myocarditis
- Lupus
- Viral infection



Dilated Cardiomyopathy

Clinical

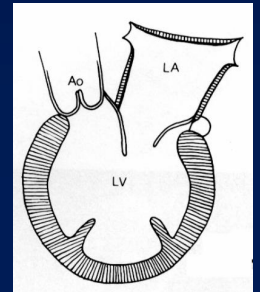
- **Poor systolic ventricular function**
 - Pooling in diastole leads to thrombogenesis
- **Severe, intractable CHF is dominant symptom**
 - Usual cause of death

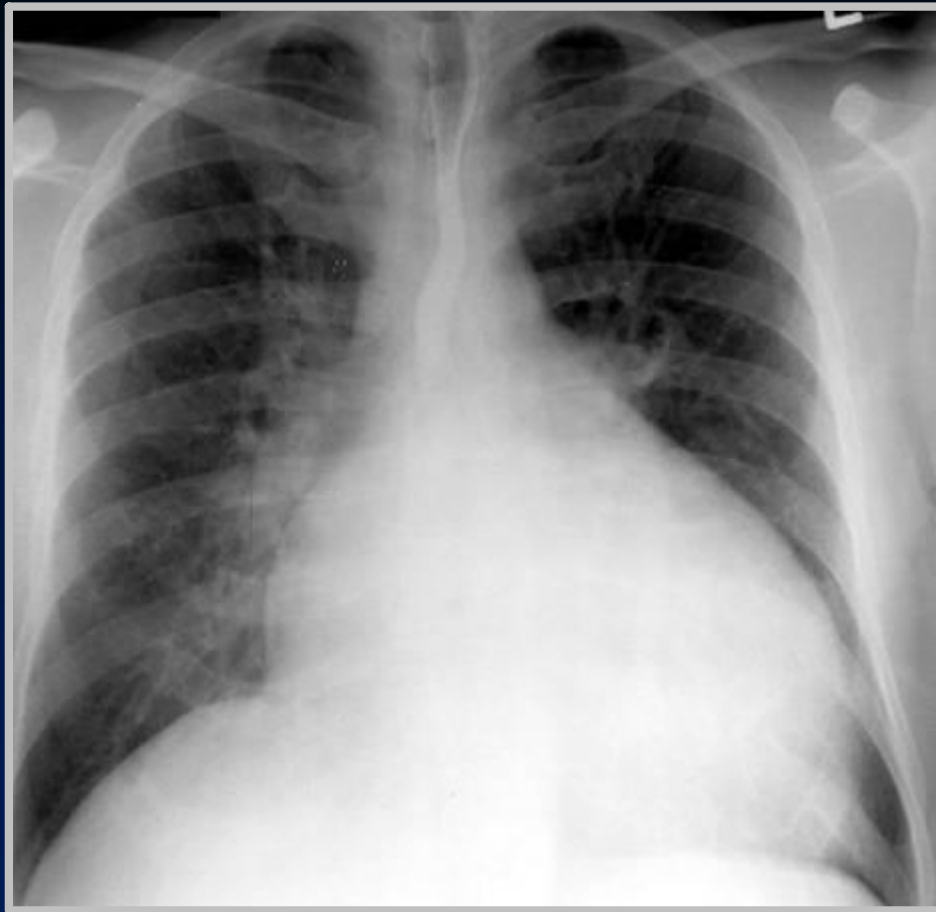


Dilated Cardiomyopathy

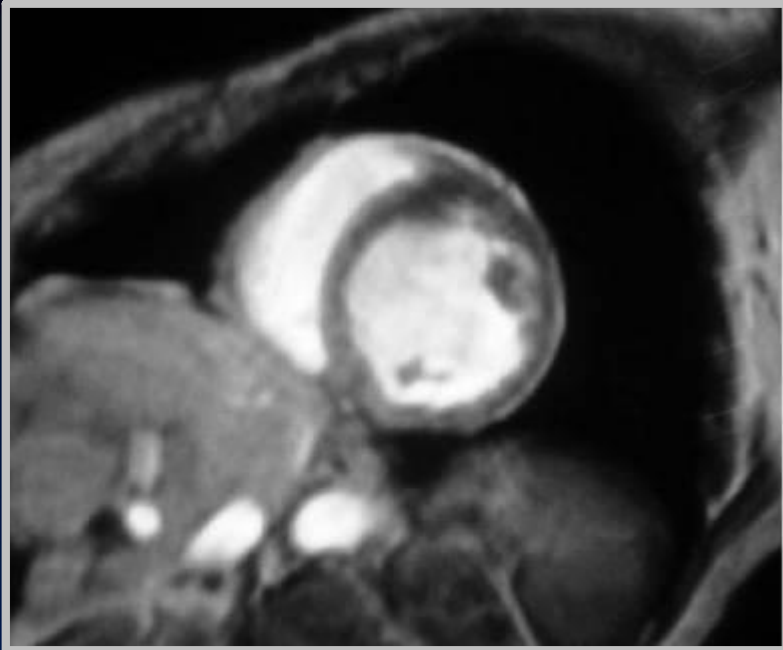
Imaging Findings

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

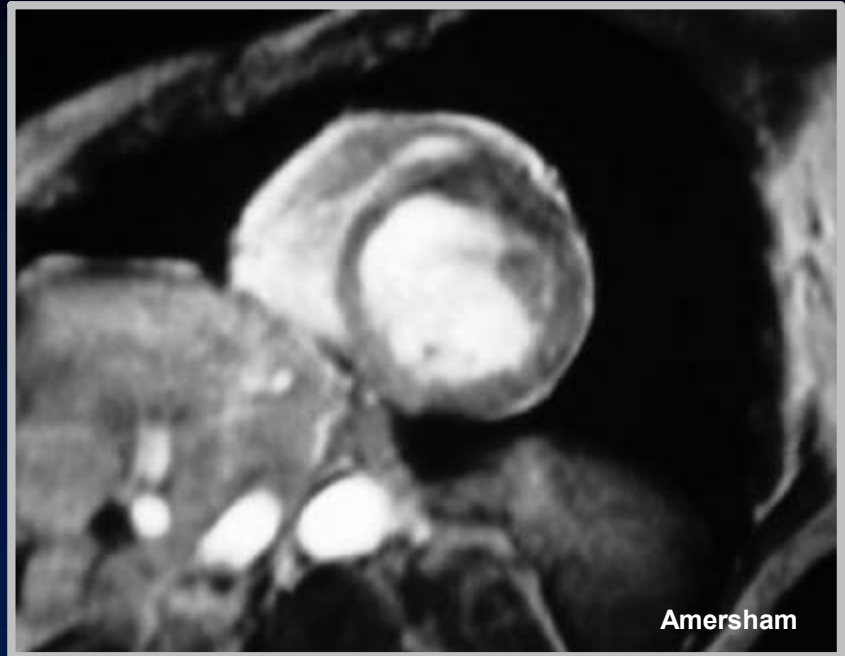




Dilated Cardiomyopathy



End systole



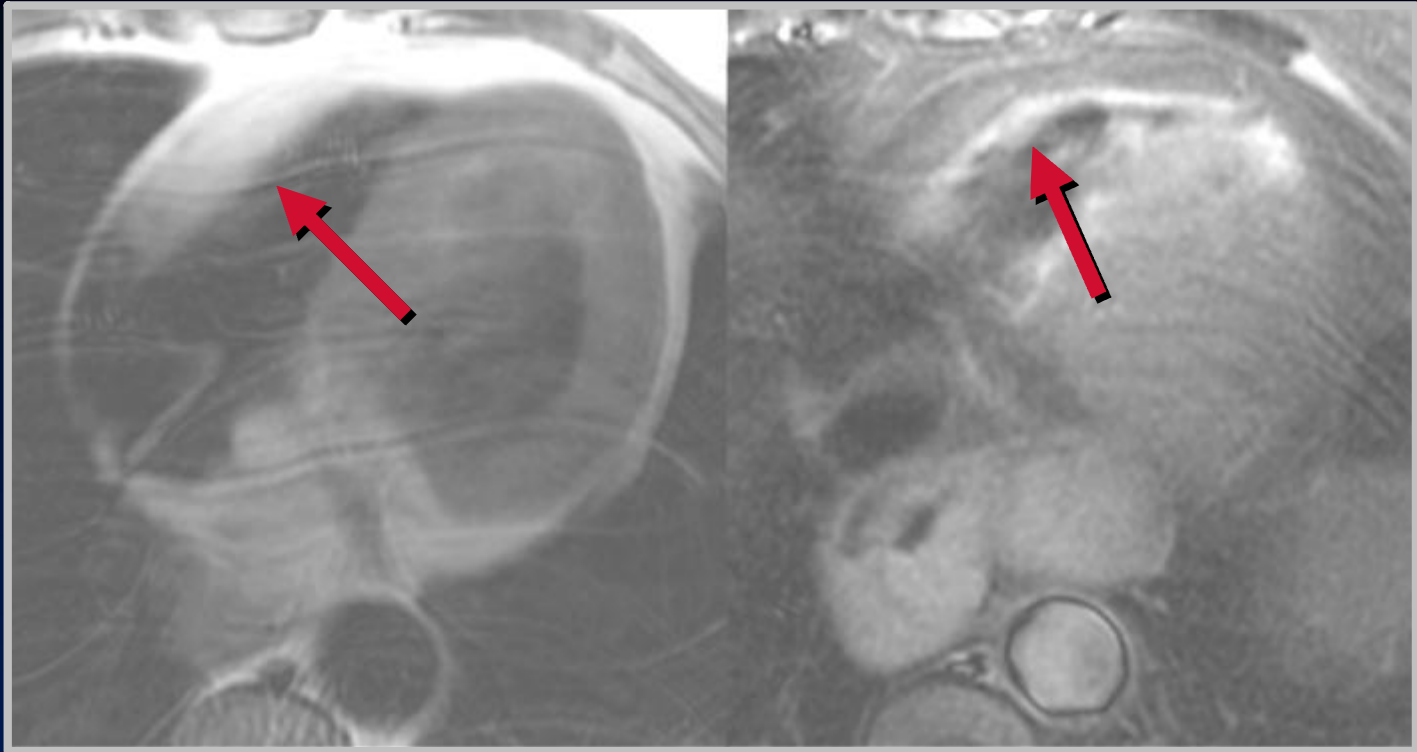
End diastole

Dilated Cardiomyopathy

Cine MR images in the short axis plane show little change in size between end diastole and end systole

Arrhythmogenic Right Ventricular Dysplasia

- Rare cardiomyopathy
- Arrhythmias and sudden death
 - Younger age group
- RV anterior free wall replaced by fat and fibrous tissue
 - Thinning of ant wall; more fat than normal
- Dilated RV, aneurysms and tricuspid regurgitation



Arrhythmogenic Right Ventricular Dysplasia

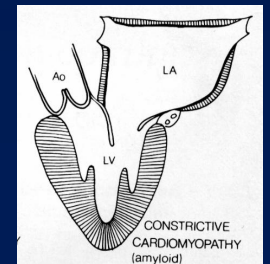
**Left-thickening and replacement of RV anterior wall by fatty tissue.
Fat suppression (right) - loss of signal in RV anterior wall, confirming
fatty nature of these changes**

Restrictive Cardiomyopathy

Restrictive Cardiomyopathy

General

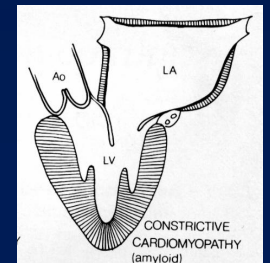
- Least common
- Normal ventricular size
- Inability of the ventricles to fill properly
- Thick LV wall and dilated LA



Restrictive Cardiomyopathy

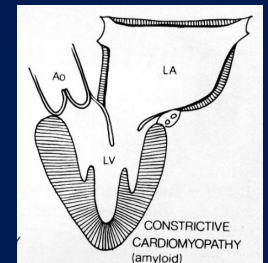
General

- Mural thrombi occasionally
- Resembles constrictive pericarditis
- Biopsy may be needed



Restrictive Cardiomyopathy Causes

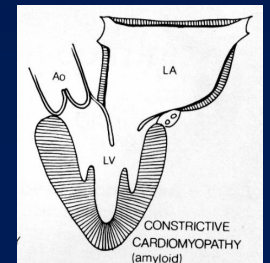
- Associated with extracellular infiltration
 - Amyloid
 - Sarcoid
 - Glycogen storage diseases
 - Mets
 - Radiation

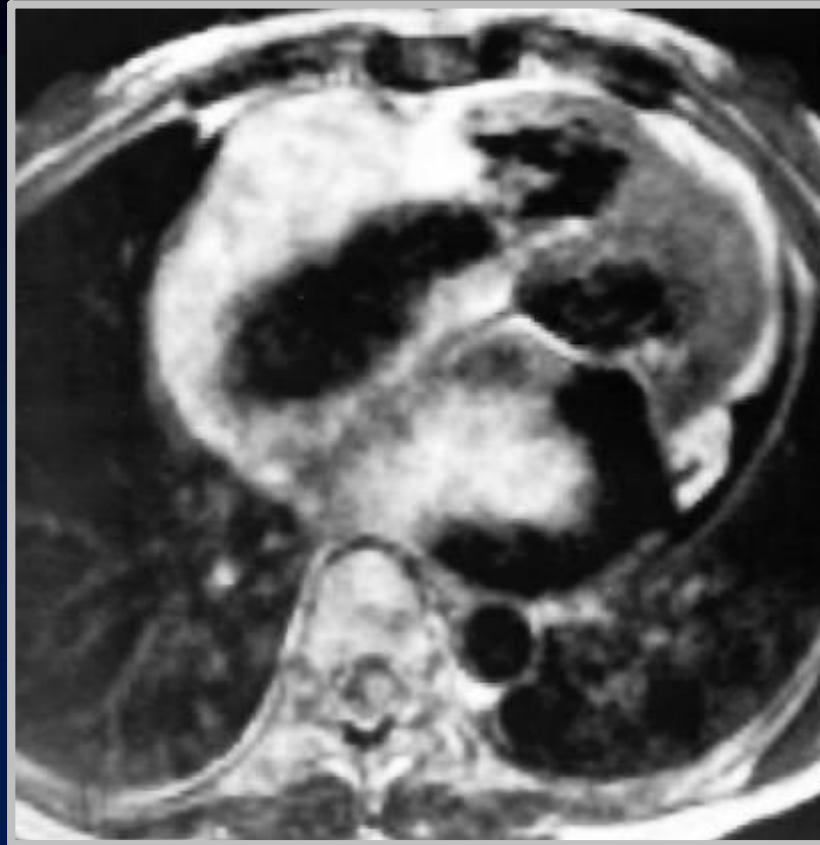


Restrictive Cardiomyopathy

Imaging Findings

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

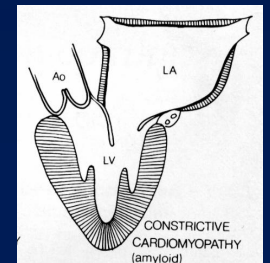




Amersham

Restrictive cardiomyopathy

ECG-gated spin-echo image - enlargement of both atria and normal size of ventricles with thickened walls

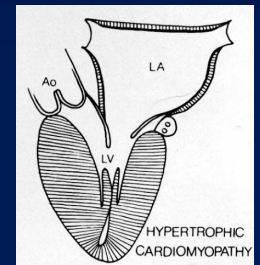


**Hypertrophic
Cardiomyopathy
(HCM)**

Hypertrophic Cardiomyopathy

Idiopathic Hypertrophic Subaortic Stenosis

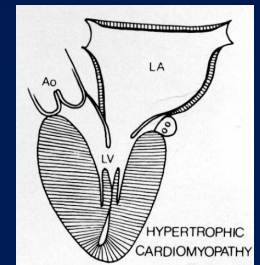
- Severe LV, and sometimes RV, hypertrophy
 - Thickened IV septum
- No ventricular enlargement
 - At least initially
- Divided into primary and secondary
- Further divided into those with and without LVOT obstruction

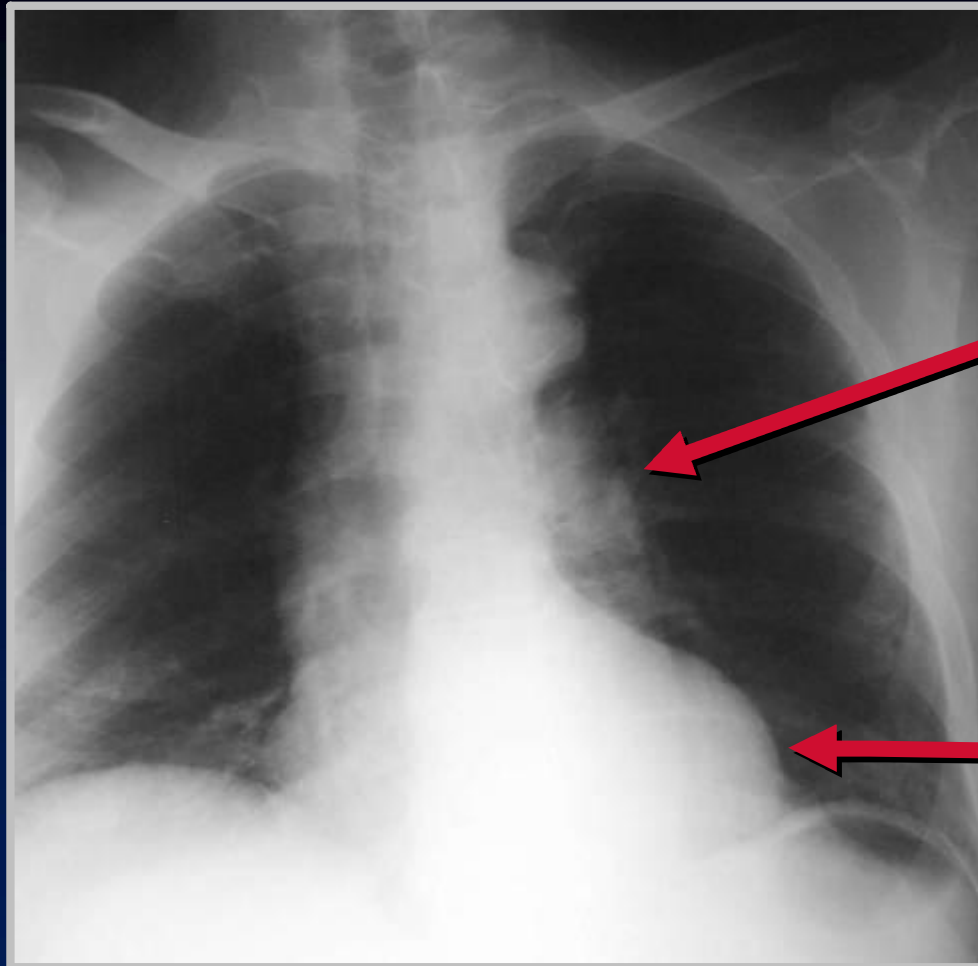


Hypertrophic Cardiomyopathy

Secondary, Non-obstructive

- Non-obstructive hypertrophic cardiomyopathy (HCM) is common
- Seen with high blood pressure
- Concentric and uniform thickening of LV wall

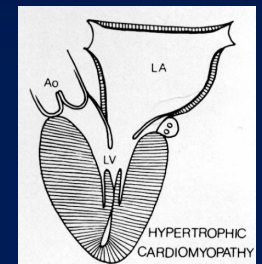




**Uncoiled
aorta**

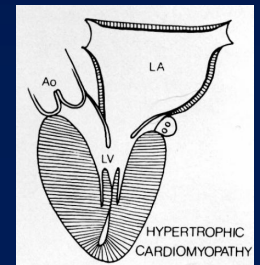
**Prominent
LV**

Hypertensive cardiovascular disease



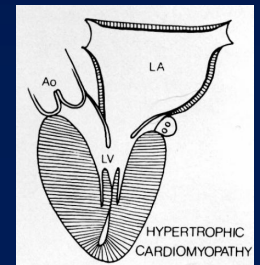
Hypertrophic Cardiomyopathy Primary

- 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)



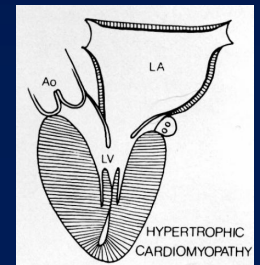
Hypertrophic Cardiomyopathy Primary

- 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



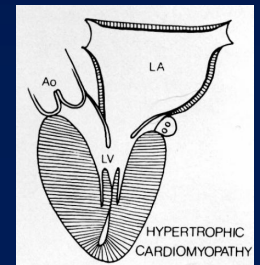
Hypertrophic Cardiomyopathy Primary

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



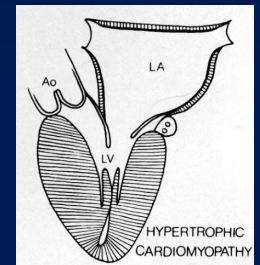
Hypertrophic Cardiomyopathy Obstructive (HOCM)

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



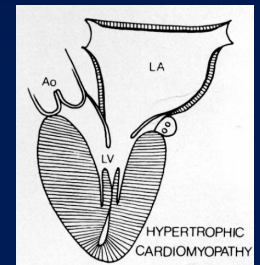
Hypertrophic Cardiomyopathy Obstructive (HOCM)

- **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

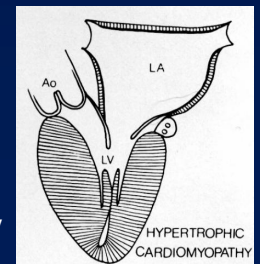
- Usually normal-sized heart
 - Left atrium may be enlarged 2° MR
- CHF not common
- Echo: LV hypertrophy
 - ASH
- Dynamic LVOT obstruction
 - SAM



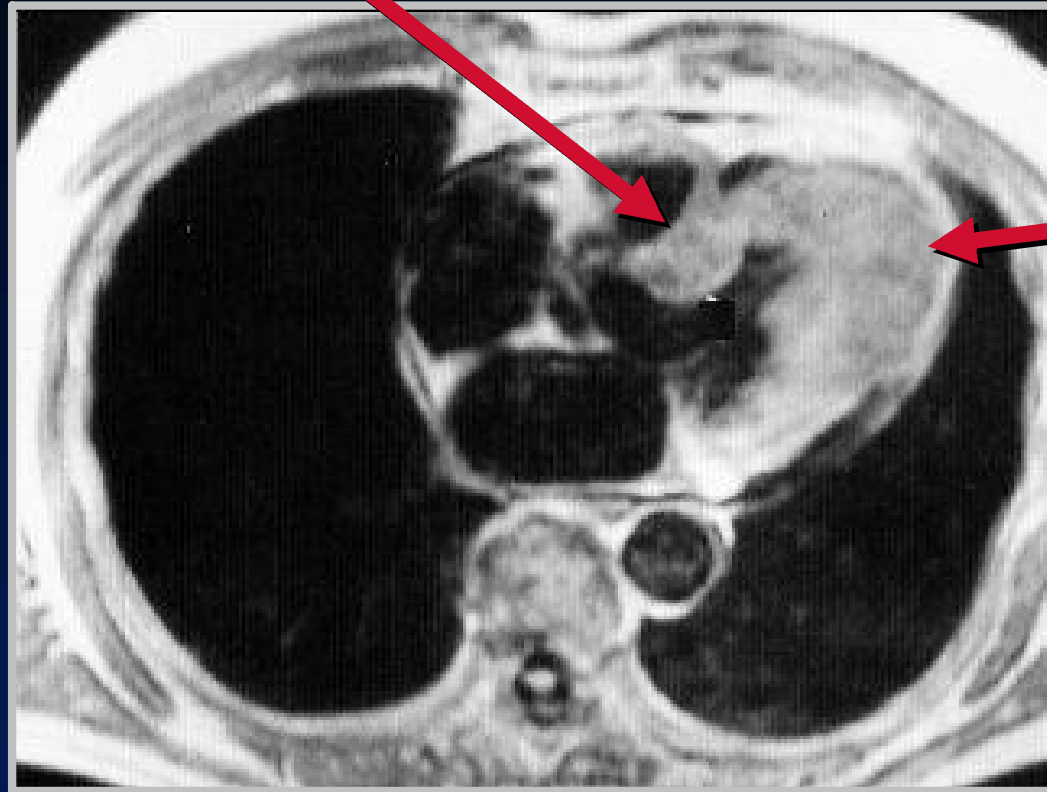


Hypertrophic Cardiomyopathy

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



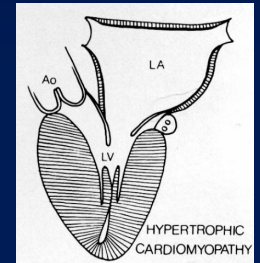
Asymmetric septal hypertrophy



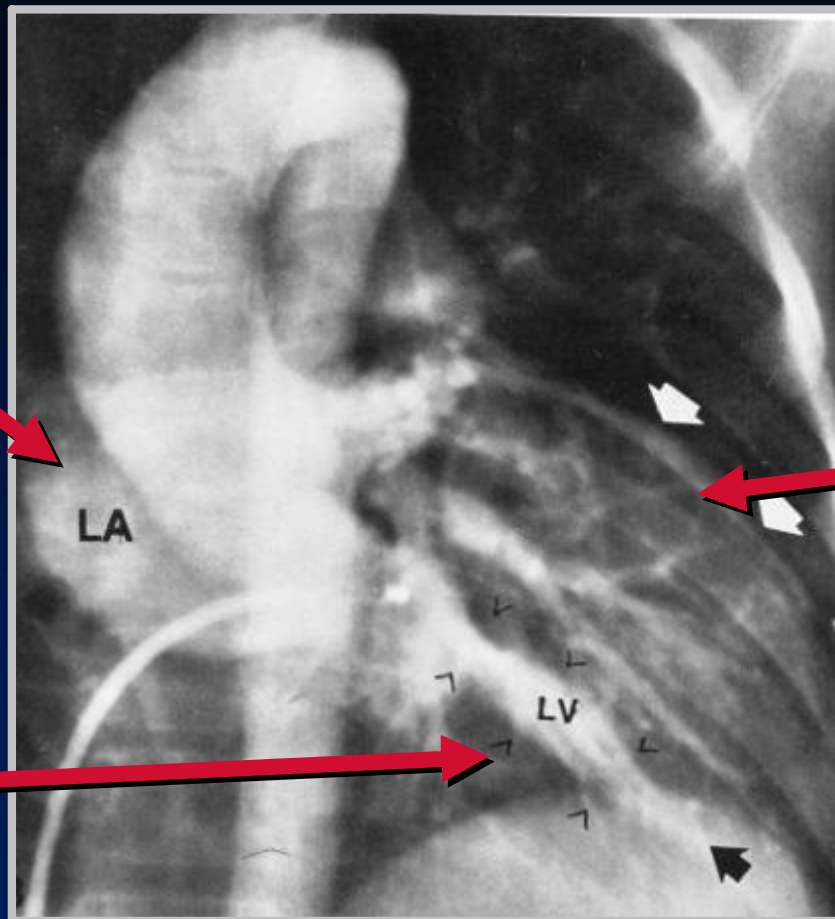
Thickened apex

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Hypertrophic Cardiomyopathy



**Mitral
Regurgitation
From SAM**

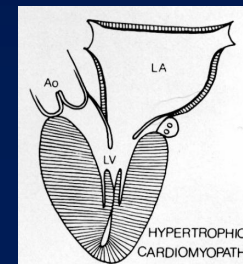


**Marked
wall
thickening**

**Almost
complete
emptying of
LV**

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Hypertrophic Cardiomyopathy



	Dilated	Restrictive	Hypertrophic
LV Cavity Size	Increased	Normal	Normal
Mitral Regurgitation	Mild	Variable	HOCM: mild to severe
Wall motion	Global hypokinesis	Normal	Hyperkinetic
Mural thrombi	Frequent	Occasional	None
Systolic Function	Decreased	Normal	Increased
Diastolic Function	Normal	Decreased	Normal
Ejection Fraction	Decreased	Normal	Normal

Endocarditis

Endocarditis

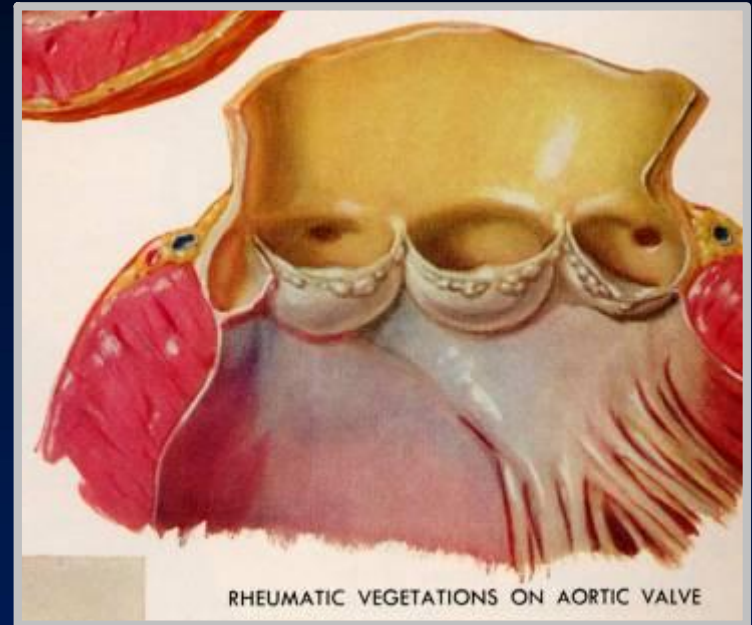
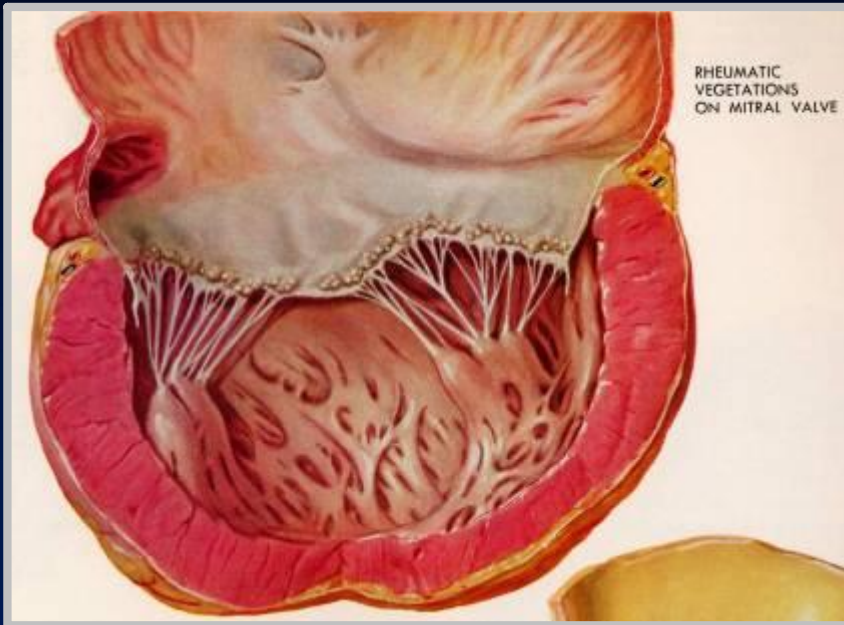
General

- **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**



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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

Constrictive Pericarditis

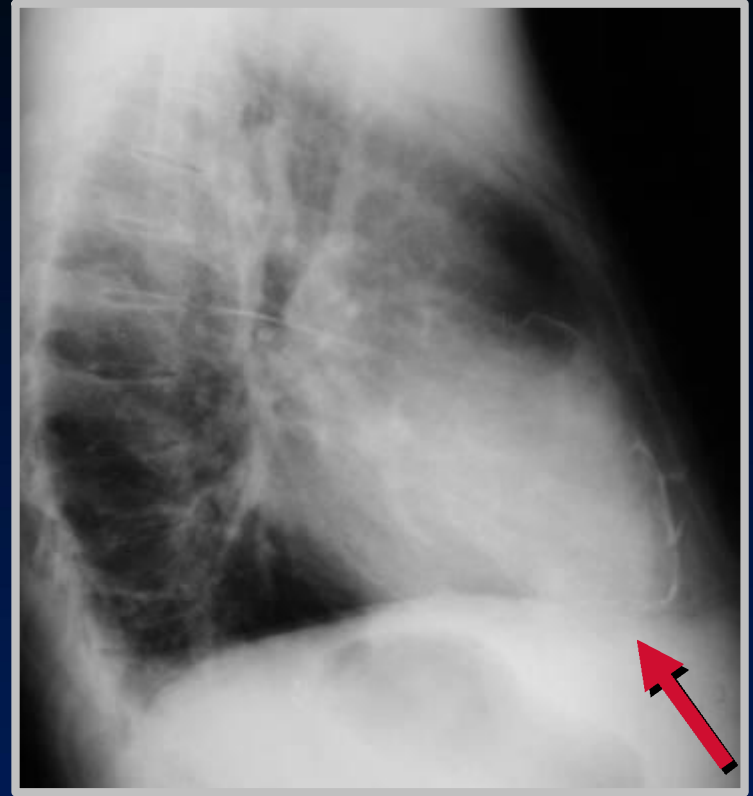
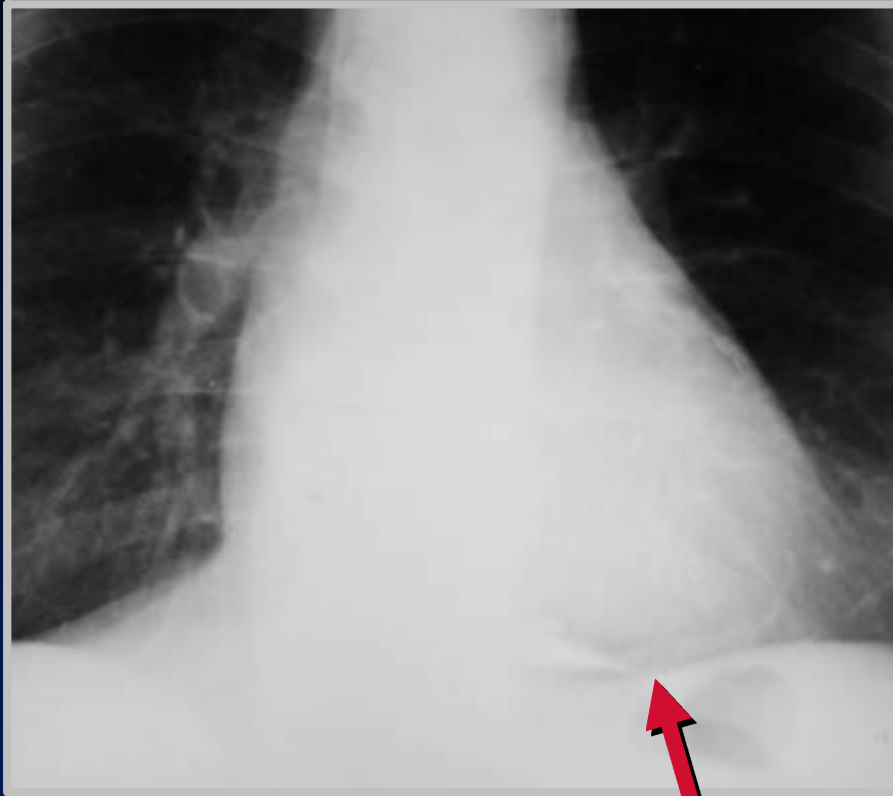
Causes

- **Viral pericarditis (most common)**
- **Tuberculous pericarditis**
- **Uremic pericarditis**
- **Post-cardiac surgery**

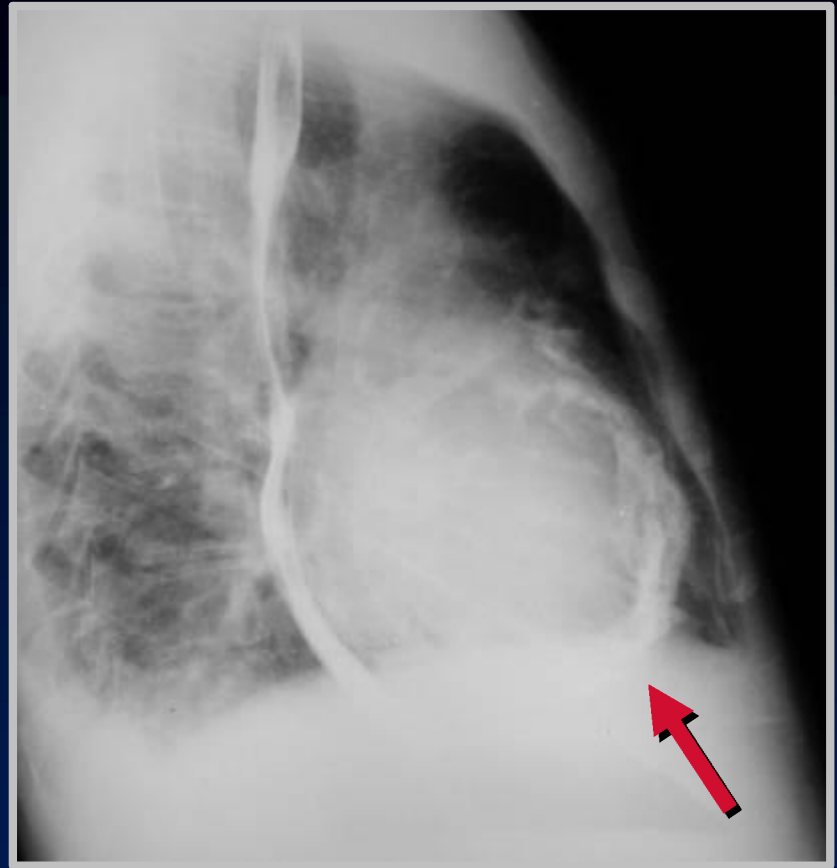
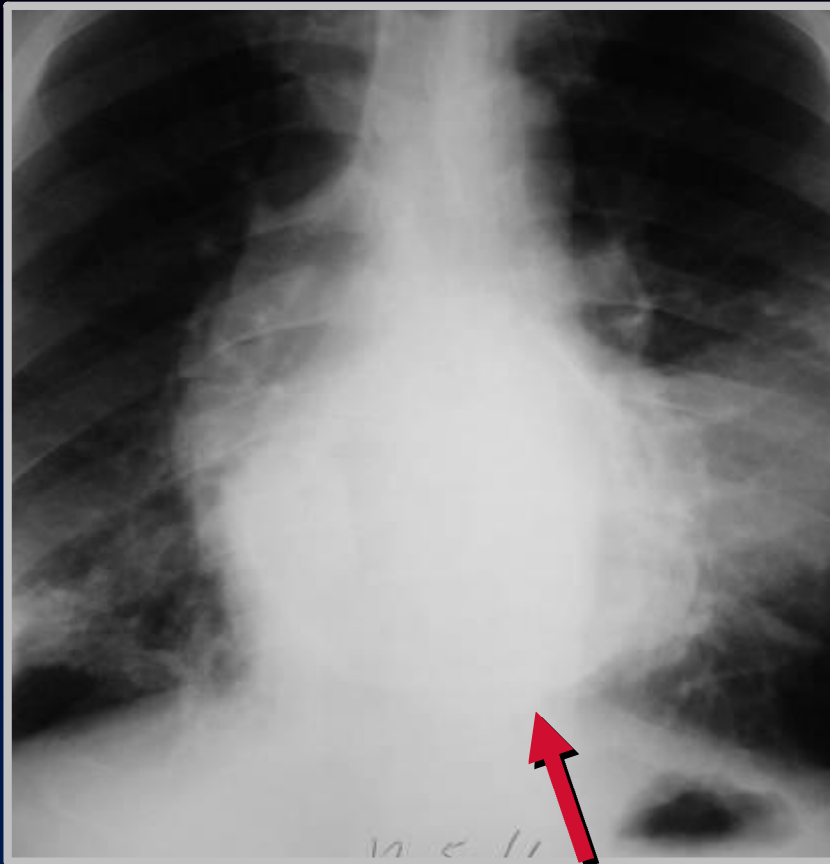
Constrictive Pericarditis

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

	Constrictive Pericarditis	Restrictive Cardiomyopathy
Heart size	Normal	Normal
Pericardial Calcification	Present	Absent
Right Atrial Border	Straight	Convex
Right Atrial Wall Thickness	Increased	Normal

Congenital Defect in the Pericardium

Congenital Pericardial Defect

Embryogenesis

- **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

- Foraminal defect on left side 35%
- Complete absence of left side 35%
gives levoposition of heart
- Diaphragmatic surface 17%
- Total bilateral absence 9%
- Right sided 4%

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

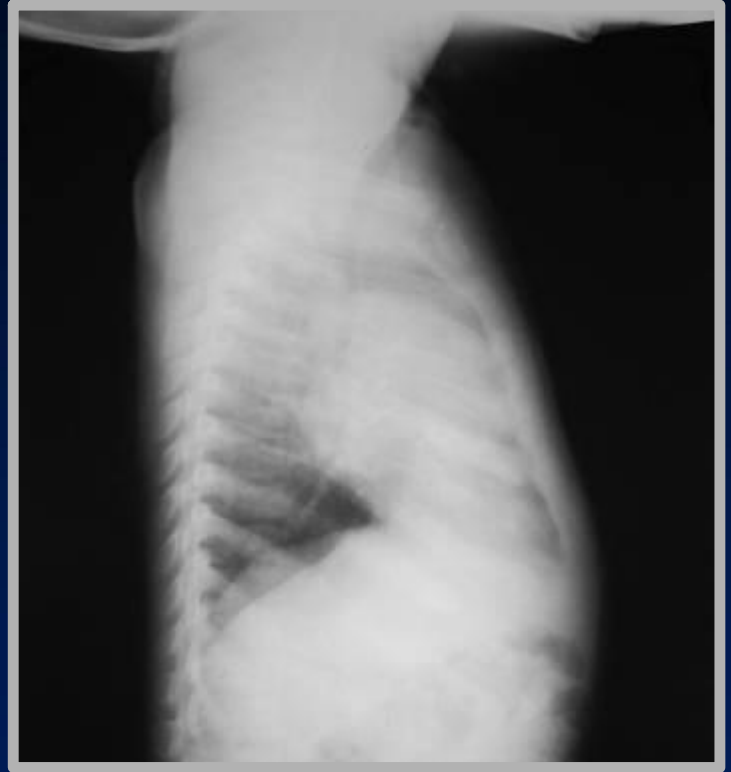
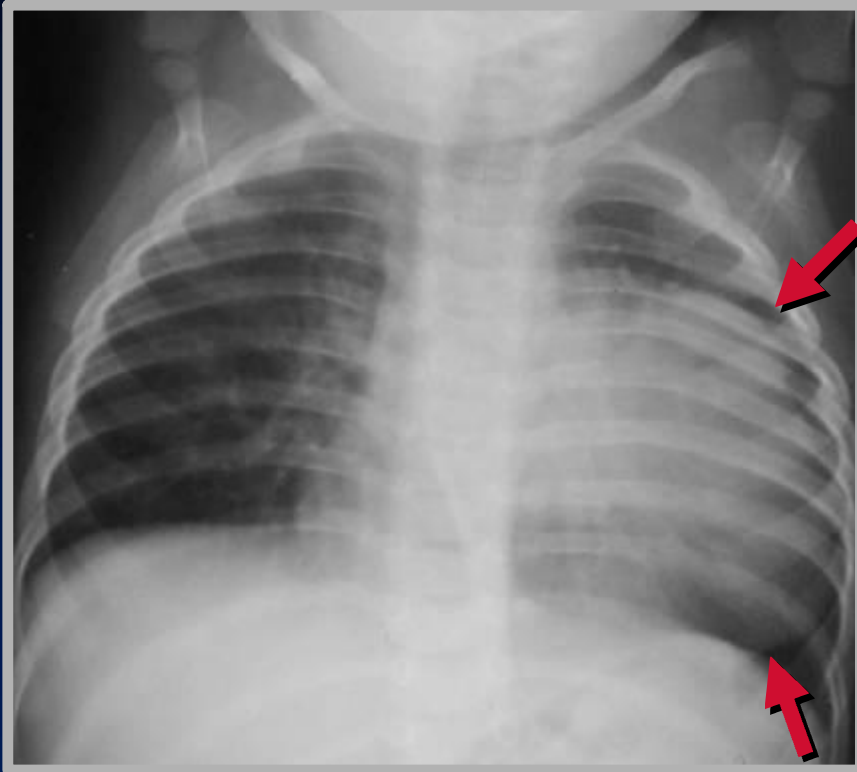
X-ray Findings

- **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](#)