

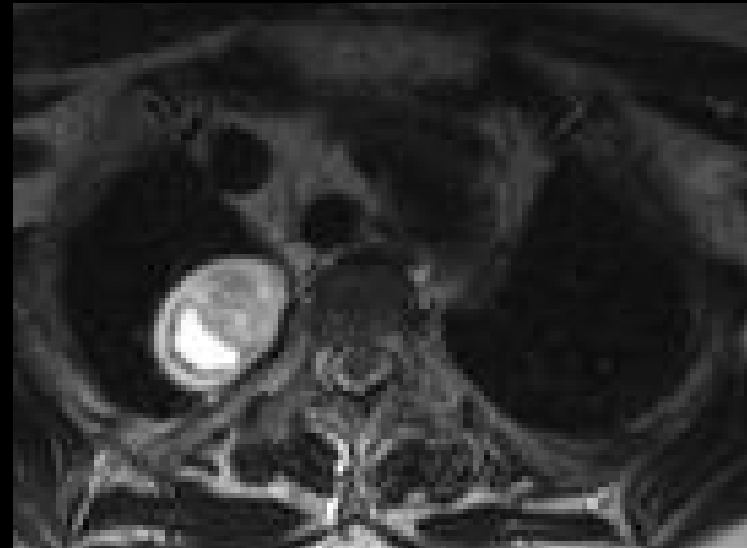
Feasibility of MDCT for Tissue Characterization of Myocardium

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The Catholic University of Korea

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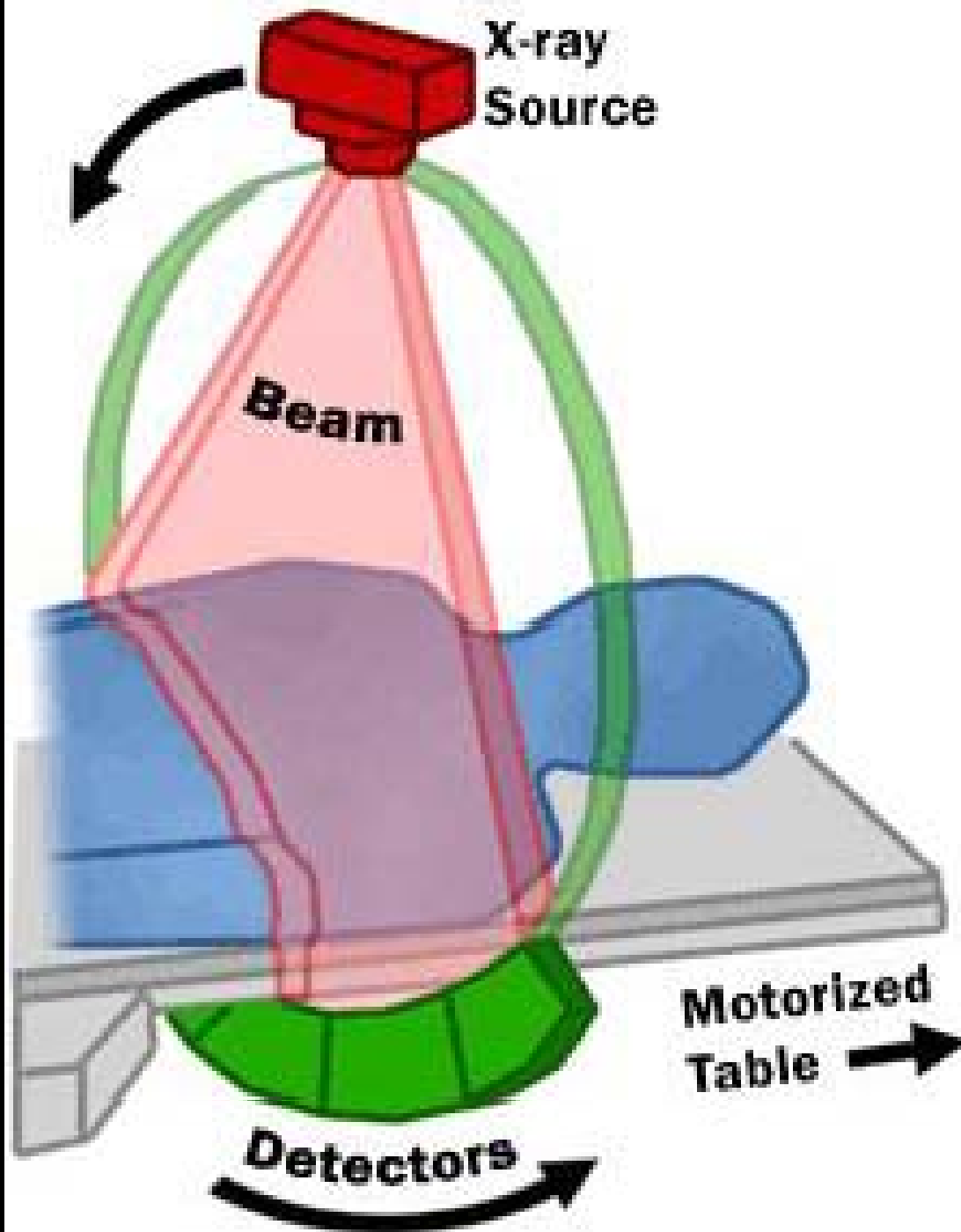
- Introduction
 - Basic CT physics for tissue characterization
 - Availability vs. Limitation
- Clinical Application
 - Fat
 - Calcification
 - Soft tissue
- Two-phase contrast enhanced CT for MI
- Conclusion

Introduction

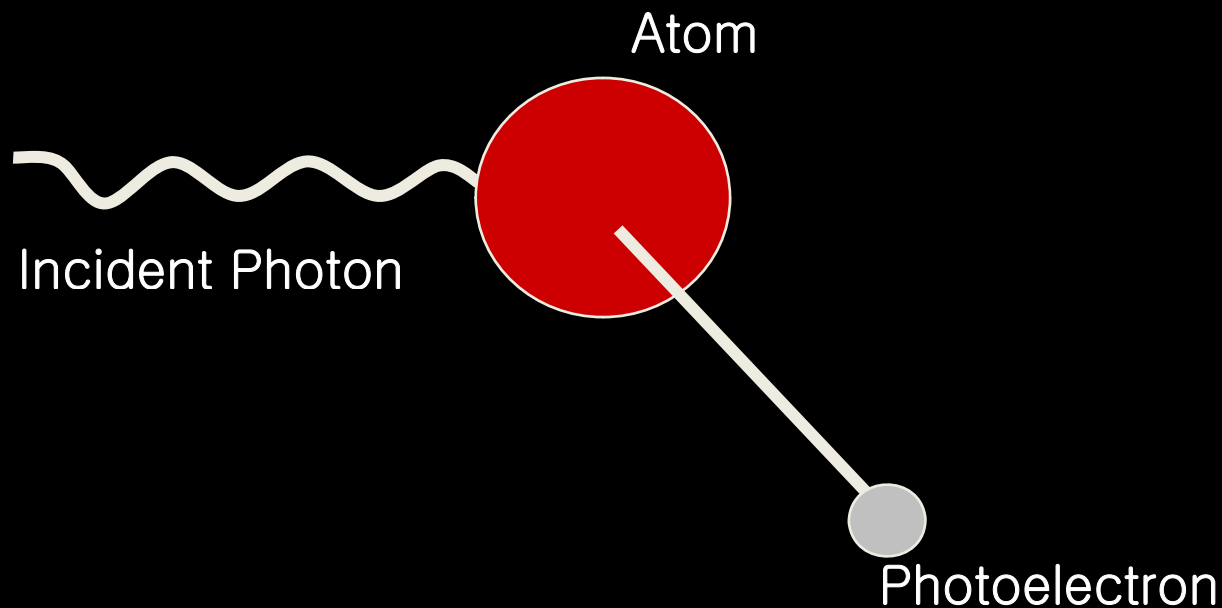


Tissue Characterization

- Contrast difference
- CT Contrast
 - Subject contrast
 - Display contrast

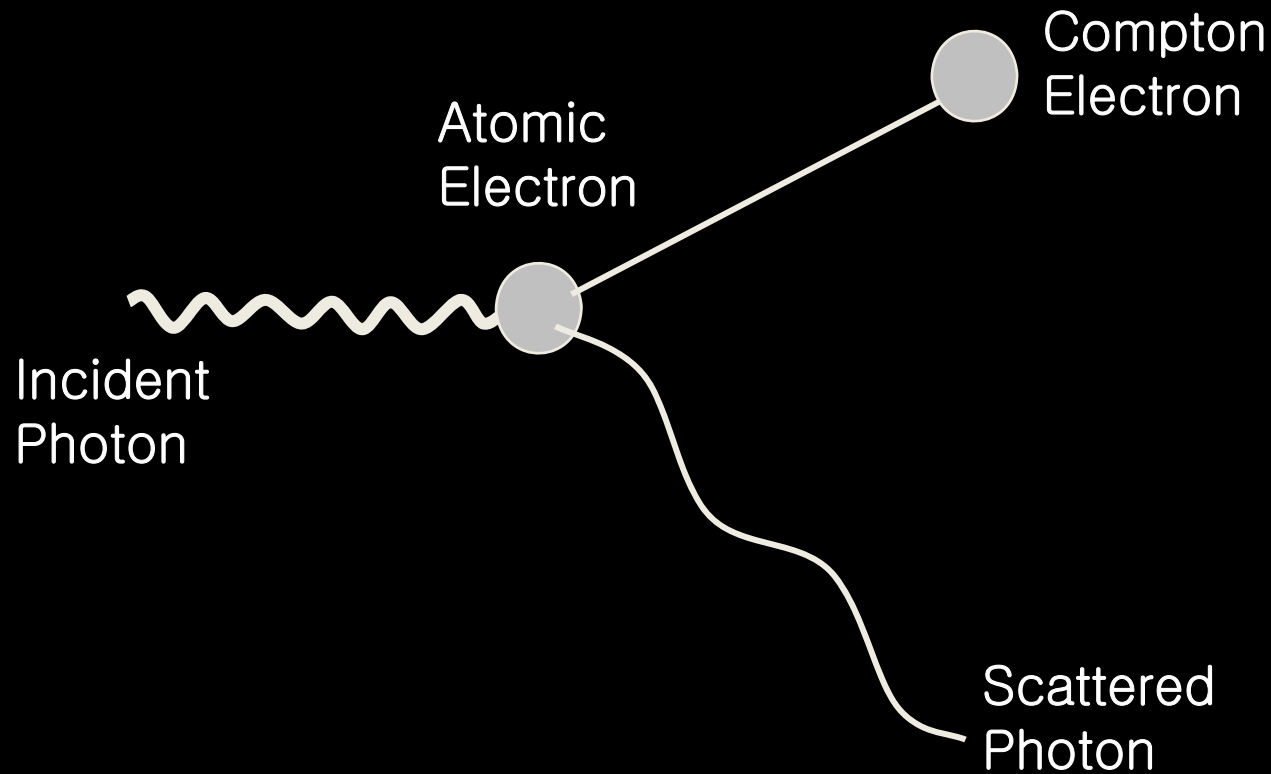


X-ray Interactions - Photoelectric Effect



Photoelectric effect results in total absorption of the X-ray photon and the emission of a bound electron

X-ray Interactions - Compton Scatter



Compton Scatter results in a free electron & a scattered (less energetic) photon

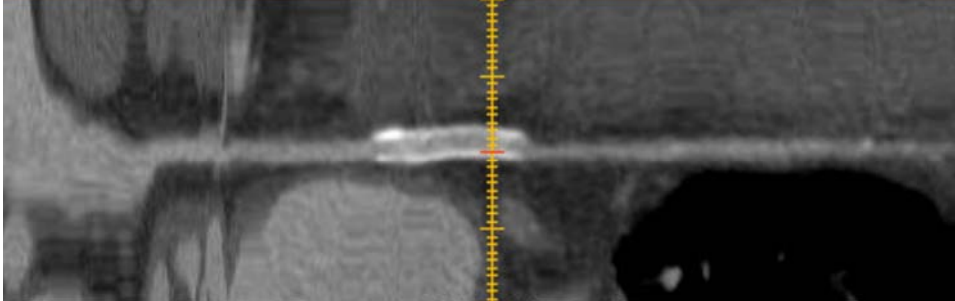
Subject Contrast

- Attenuation difference
 - Electron difference
 - Bone/ Air/ Fat/
Soft tissue (Water)



Display Contrast

- Attenuation difference (Hounsfield unit)
 - 4000 ~ +4000 (HU)
- Gray scale: 256
- Display level and width:
window width & level



Quantum mottle (Image noise)

- Statistical fluctuation
- 2-4HU difference: no significant clinical importance
- Motion artifact

Availability vs. Limitation

- Electron difference:
Air/ Fat/ Soft tissue/ Calcification
- Helpful points:
Morphologic character, Frequent site
- Limitation:
Low tissue resolution

Clinical Application

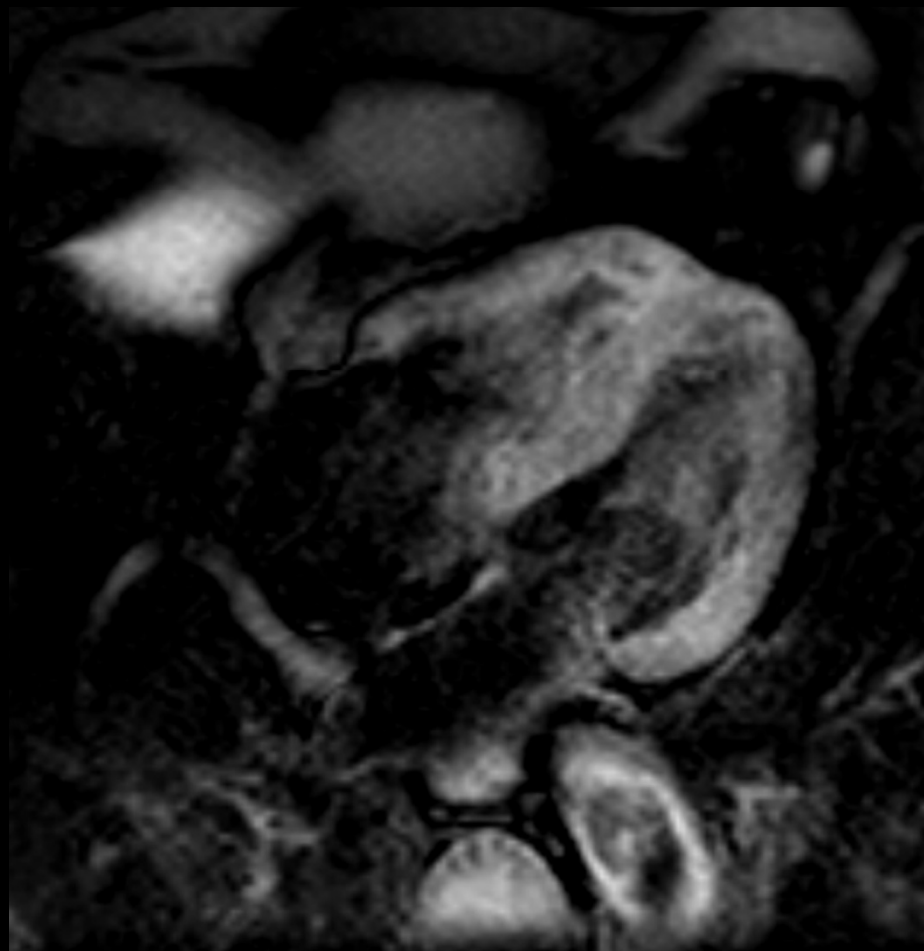
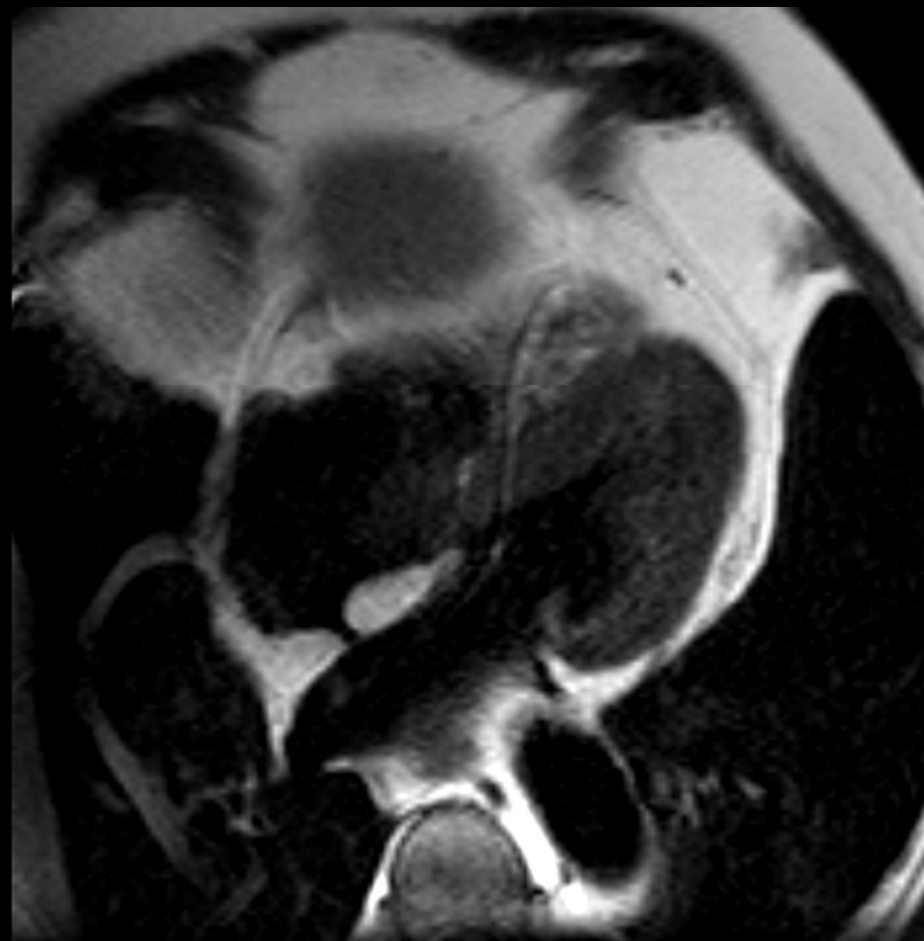
- Fat infiltrations
 - Lipomatous hypertrophy of interatrial septum
 - ARVD
 - Lipoma/ Liposarcoma
 - Incidental fat infiltration

Lipomatous Hypertrophy of Interatrial Septum

- Excess fat deposition of interatrial septum
- >2cm in thickness
- Spare fossa ovalis
- Dumbbell shape fat infiltration
- Associated epicardial and/or mediastinal fat.

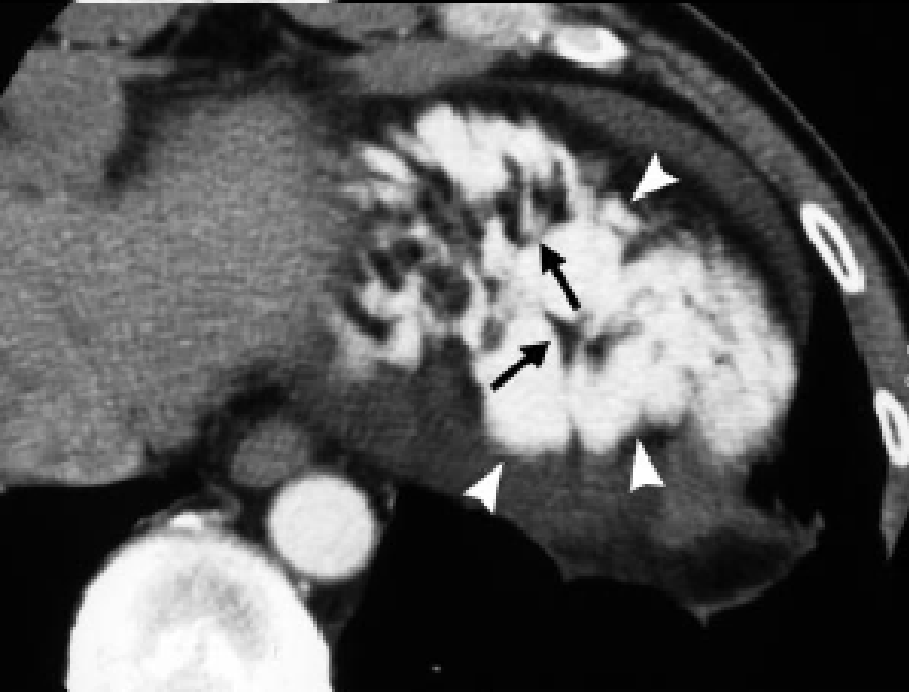


75/M



Arrhythmogenic Right Ventricular Dysplasia (ARVD)

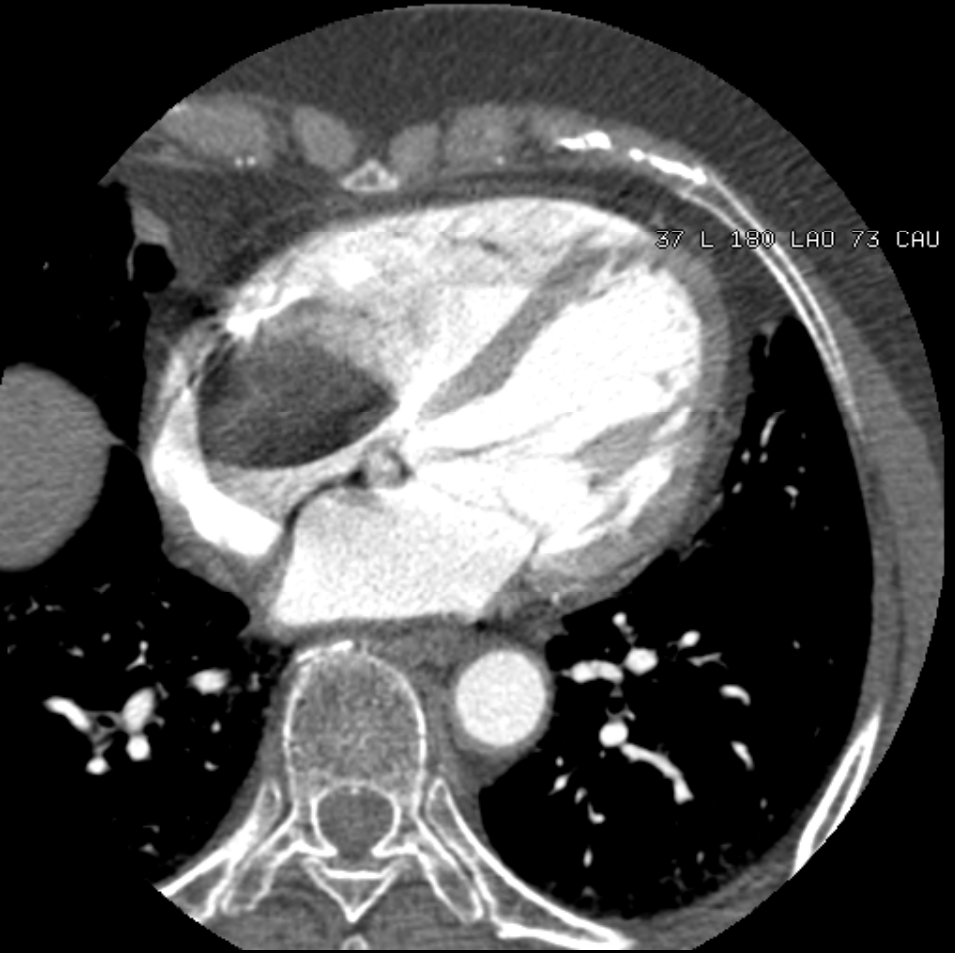
- CT findings
 - Right ventricle dilatation
 - Fatty tissue on right ventricle
 - Right ventricle bulging
- Young patients
- Clinical evidence



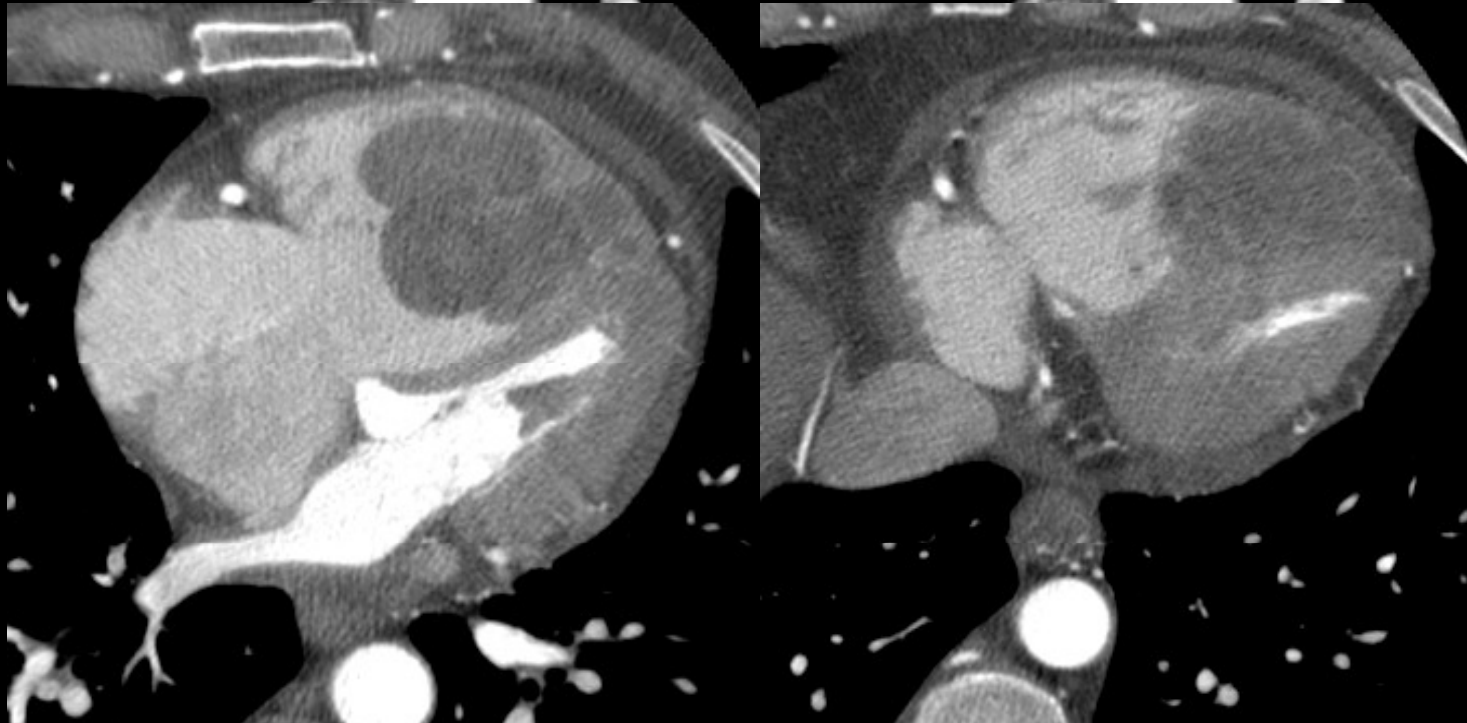
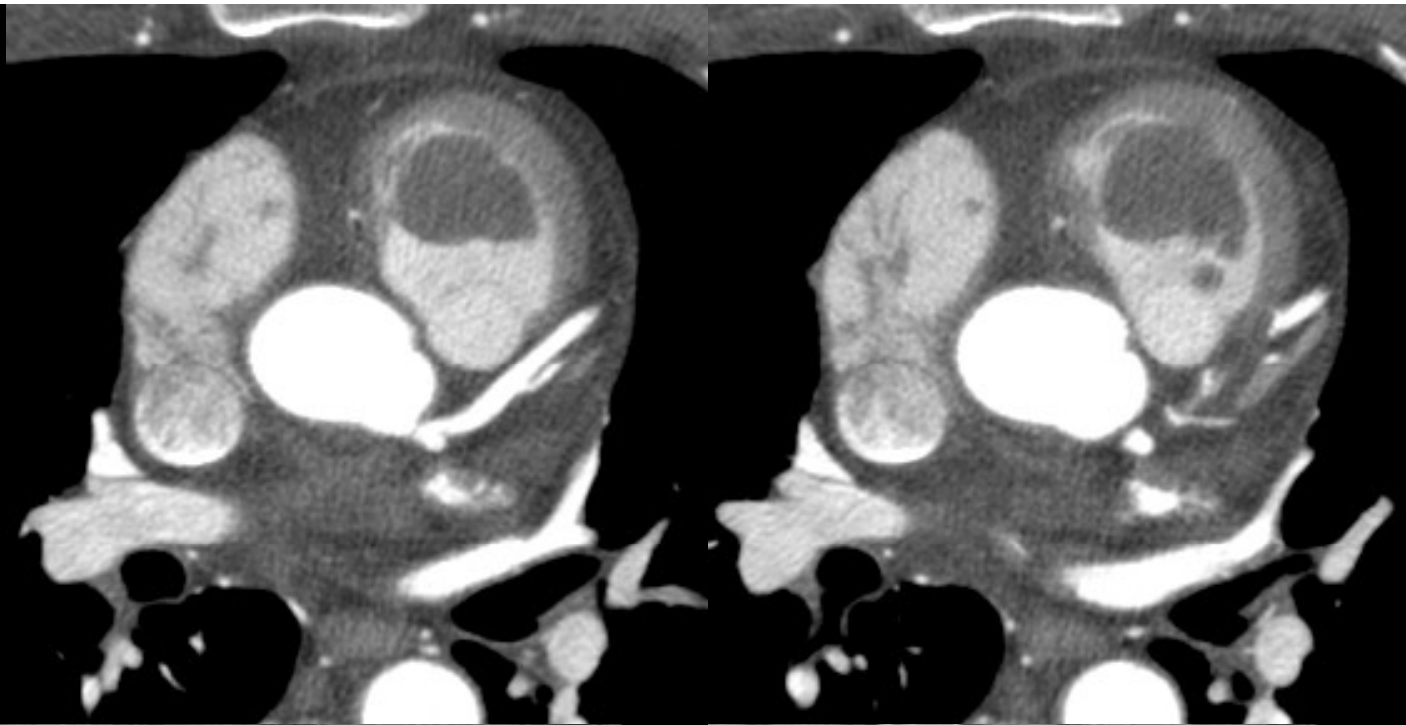
Lipoma/ Liposarcoma

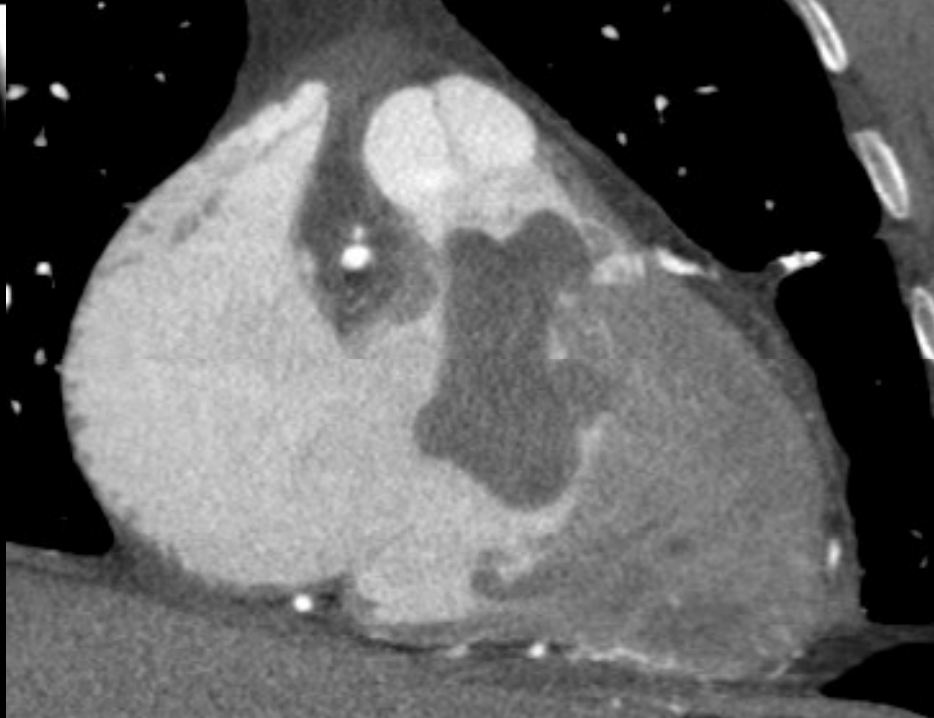
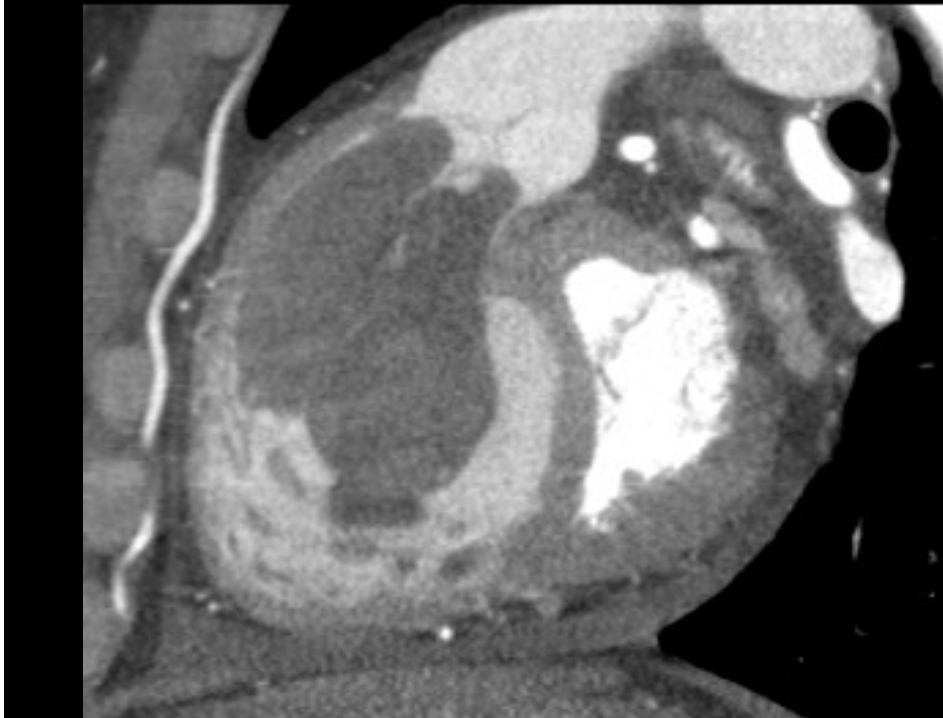
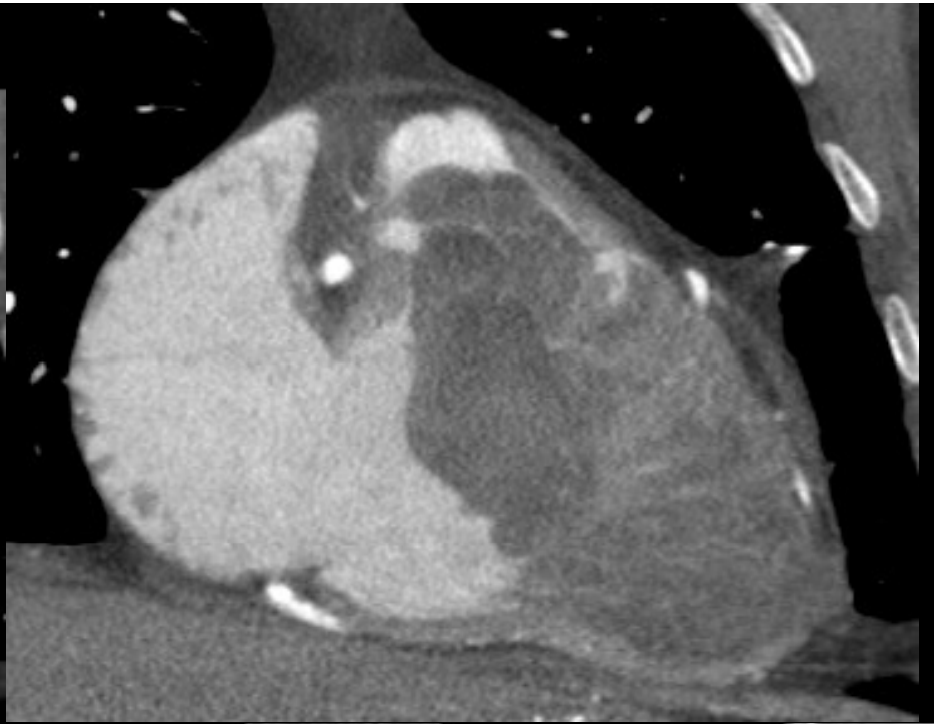
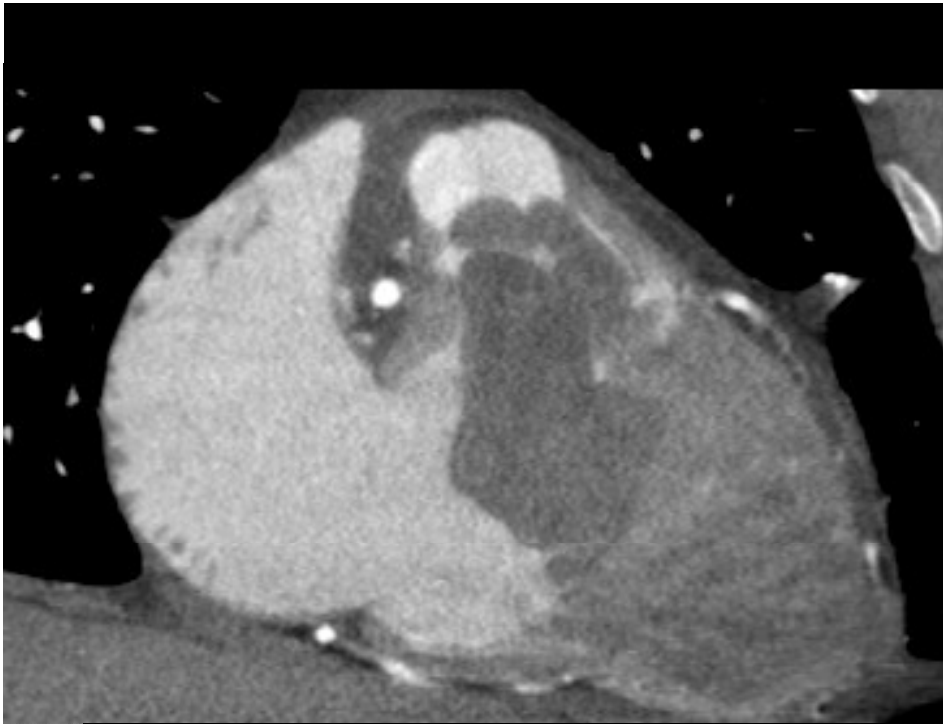
- Fatty mass
- Lipoma: encapsulated, smooth contour, homogeneous fat density
- Liposarcoma: irregular, multilobular morphology, Heterogeneous fat density

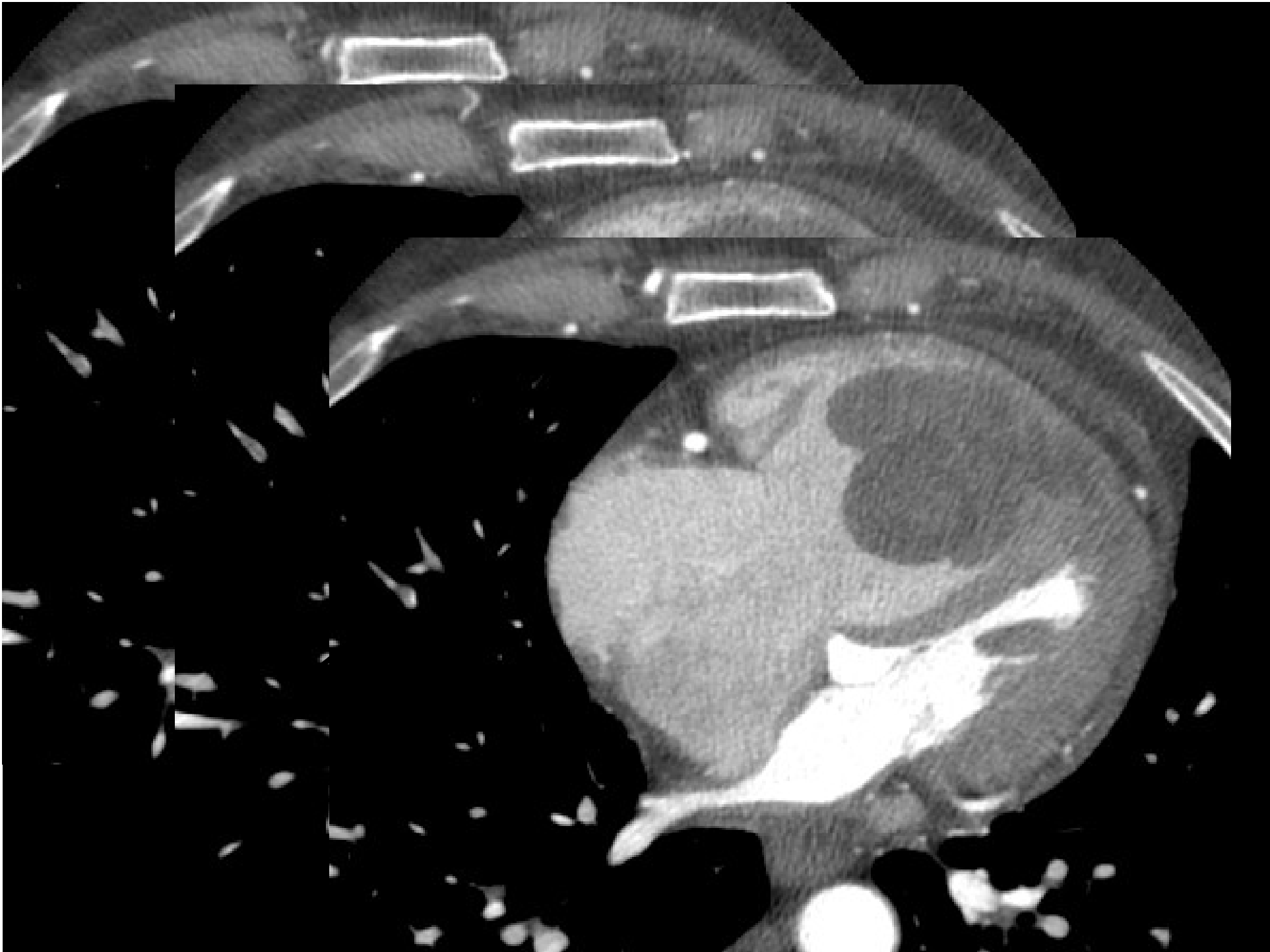
80/M



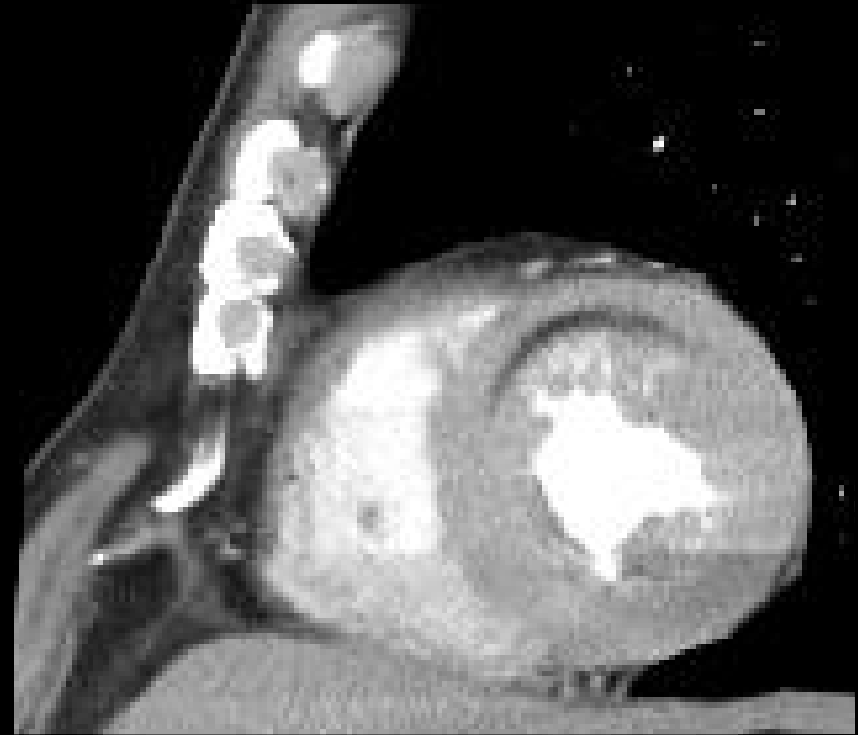








Incidentally Found Ventricular Fat Deposition



Left Ventricular Fat Deposition

- Chronic myocardial infarction
- Thin linear or curvilinear fat deposition
- Subendocardial deposition
- Left ventricular wall thinning and/or calcification
- Old age

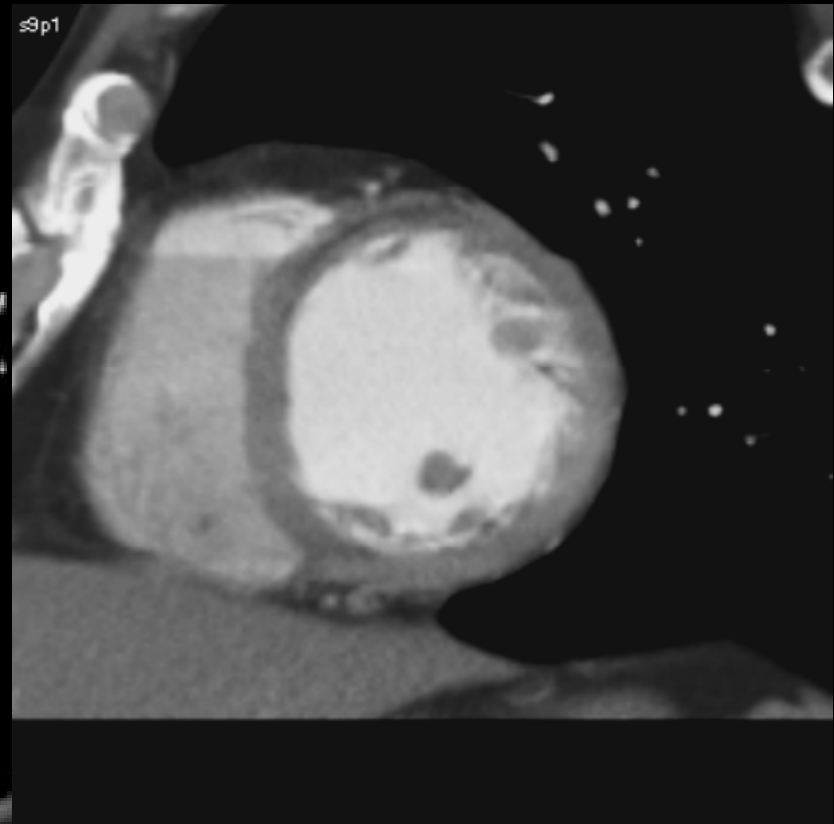
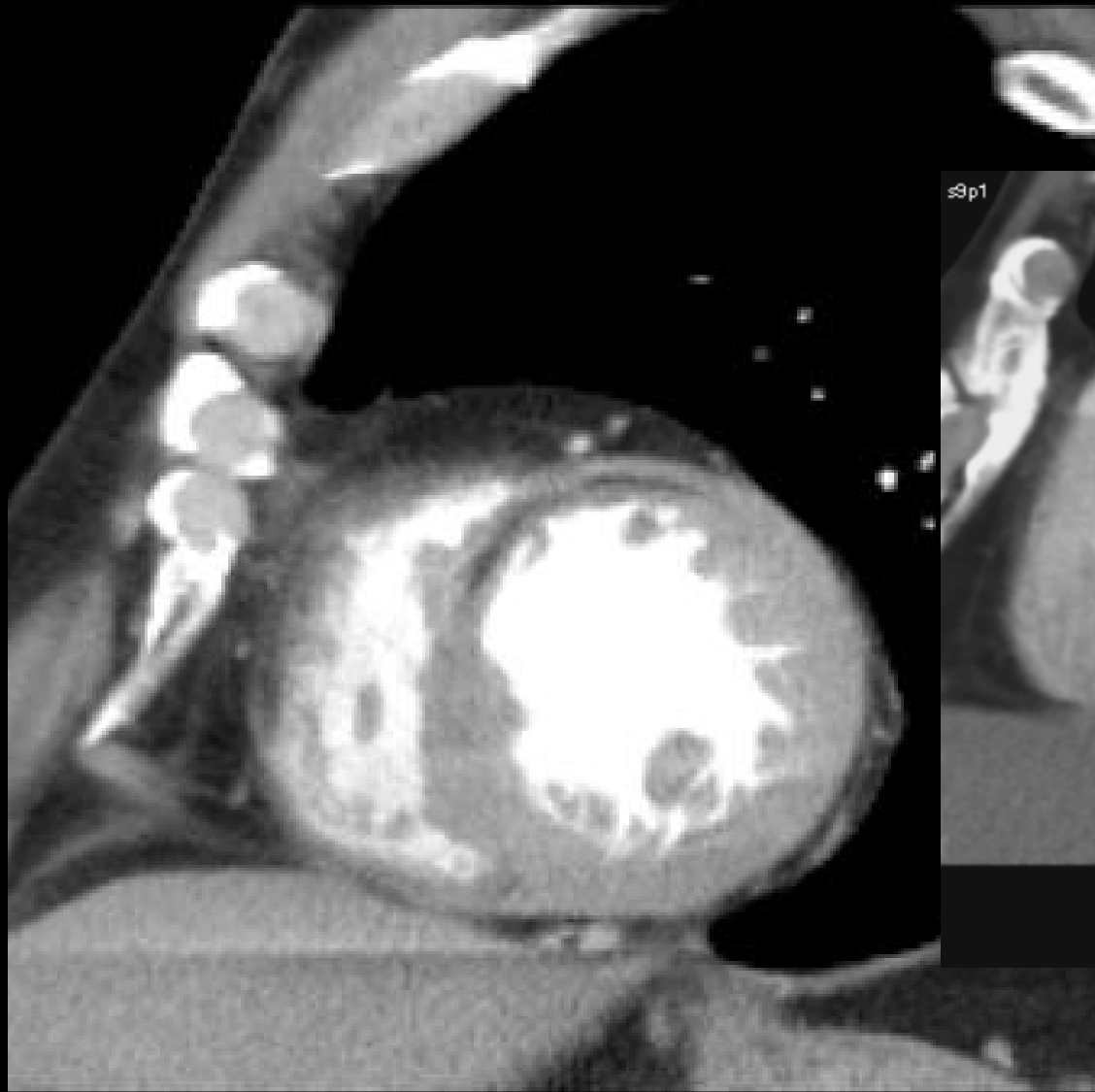
60/M

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22

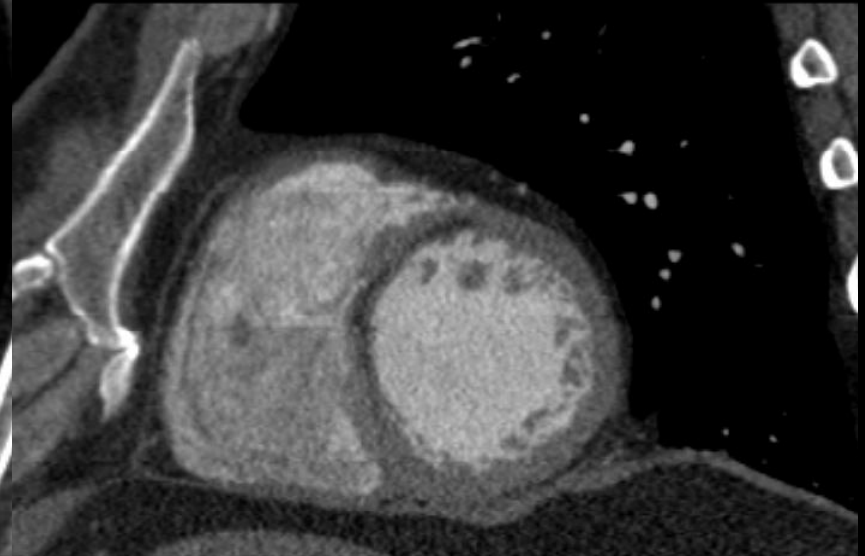
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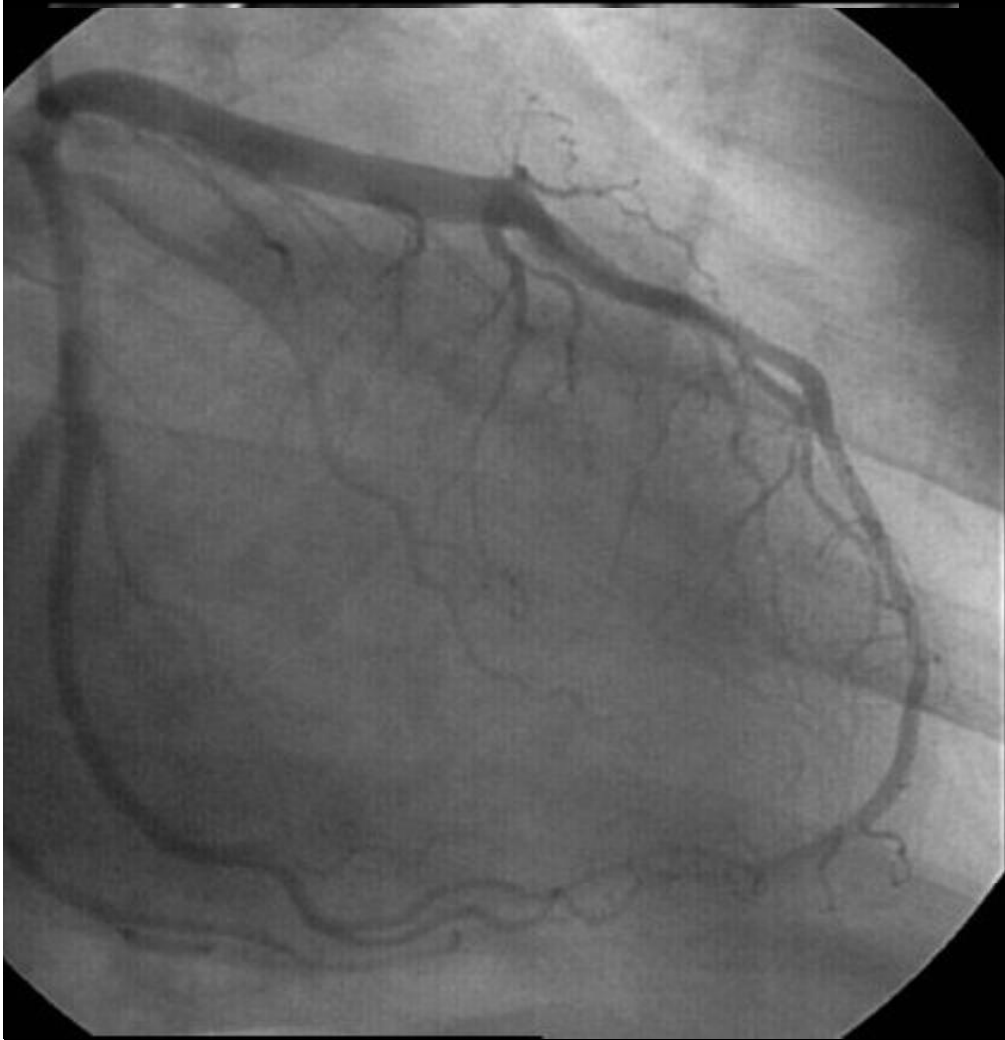
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on: 0.23



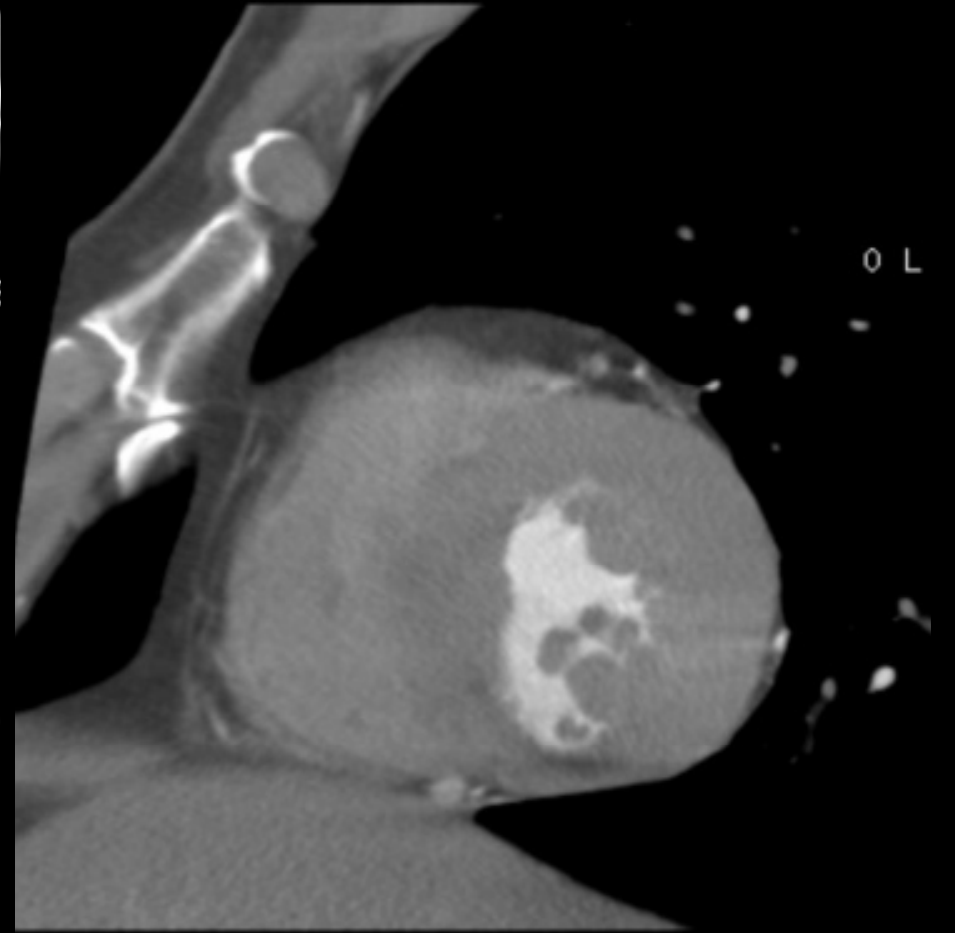
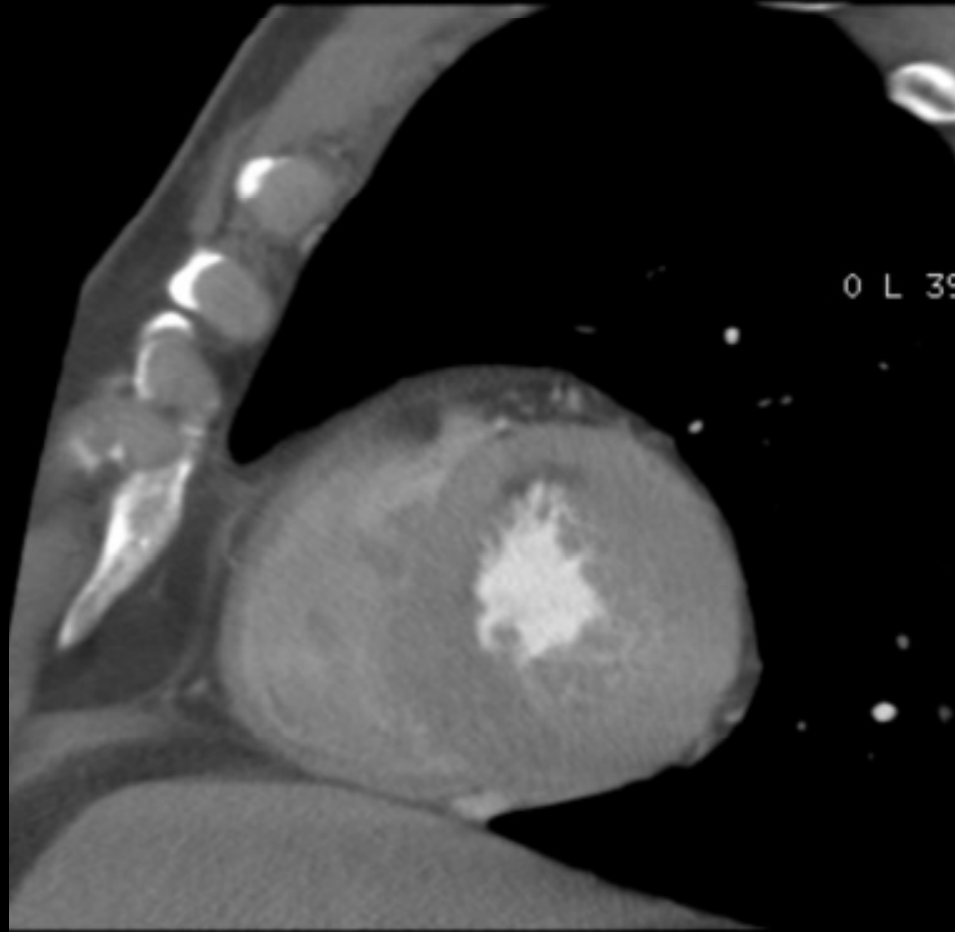


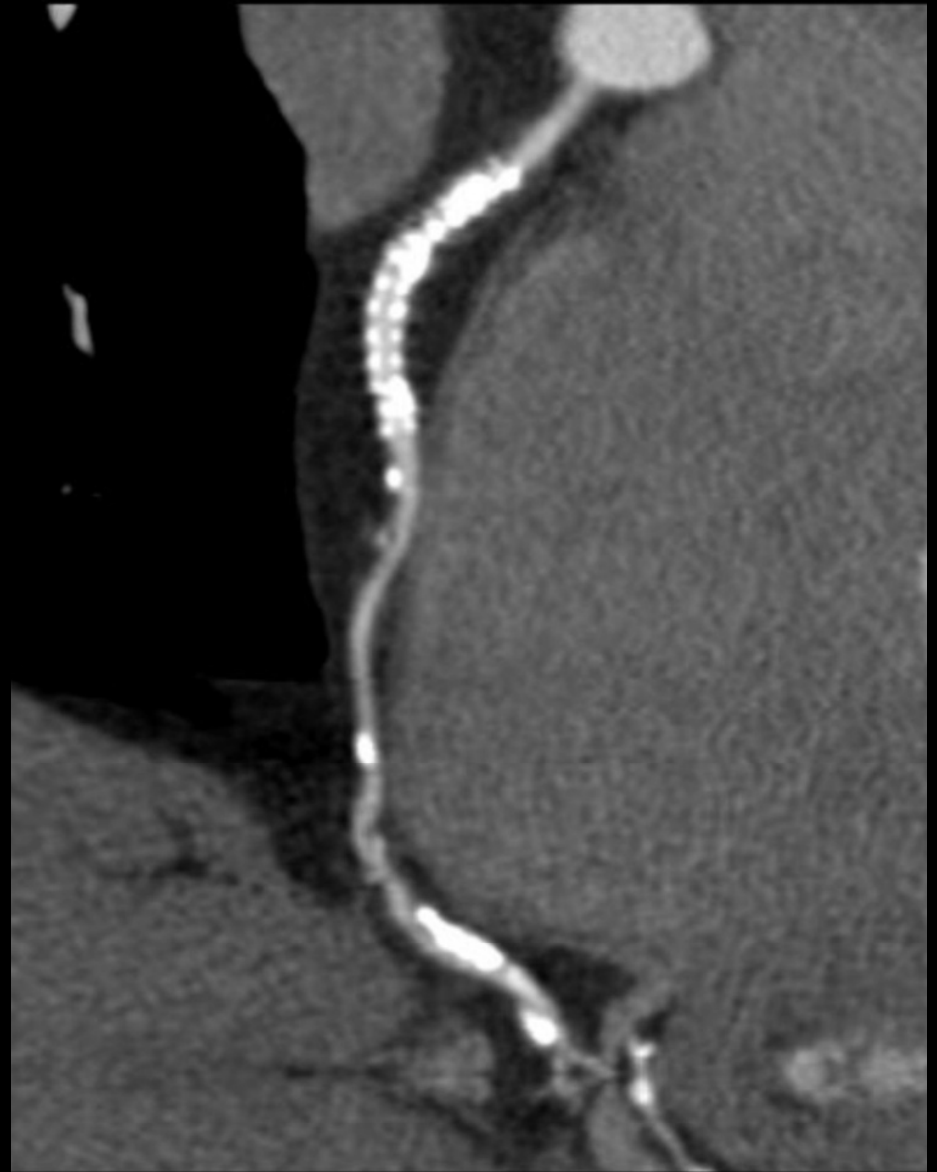
37/M





58/M

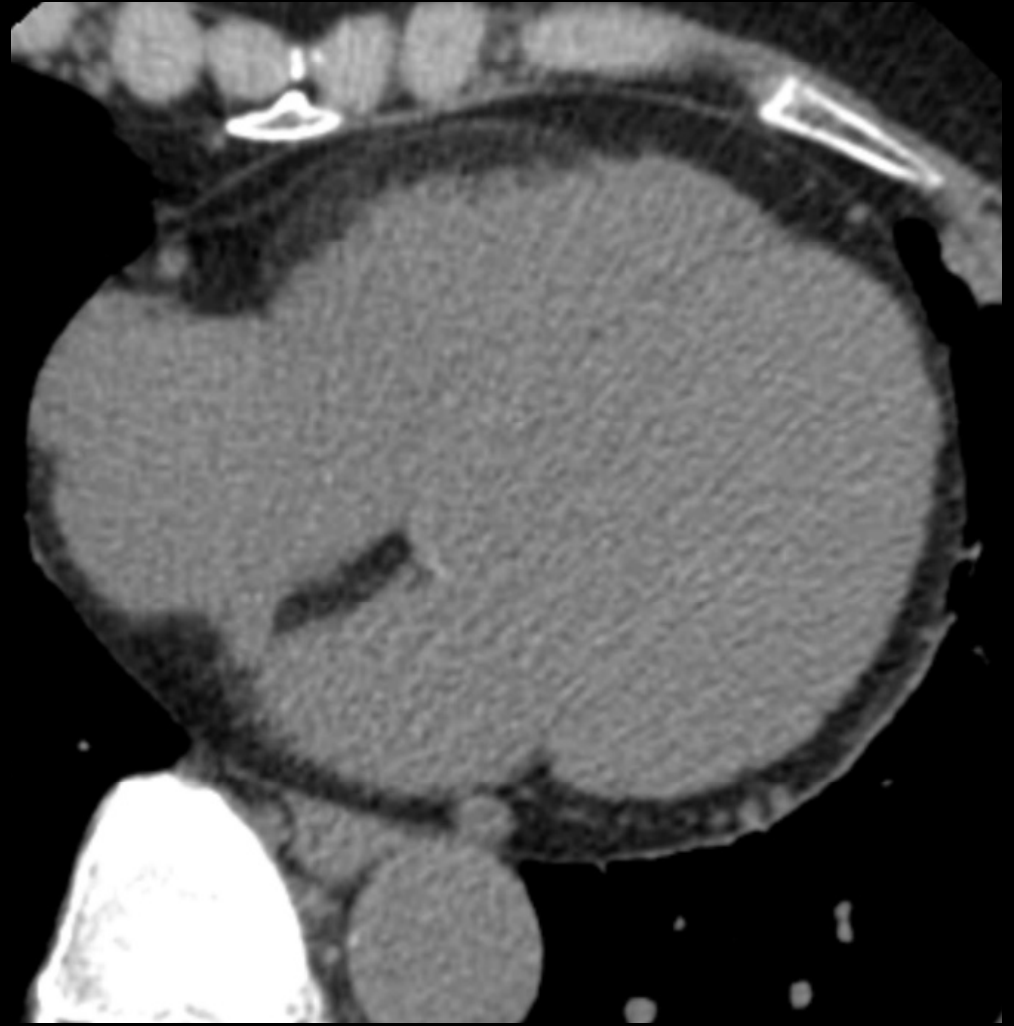




Right Ventricle Fat Deposition

- 17% of asymptomatic person
- Basal superior wall, middle superior an RV outflow tract
- Old age
- Degenerative change

71/F



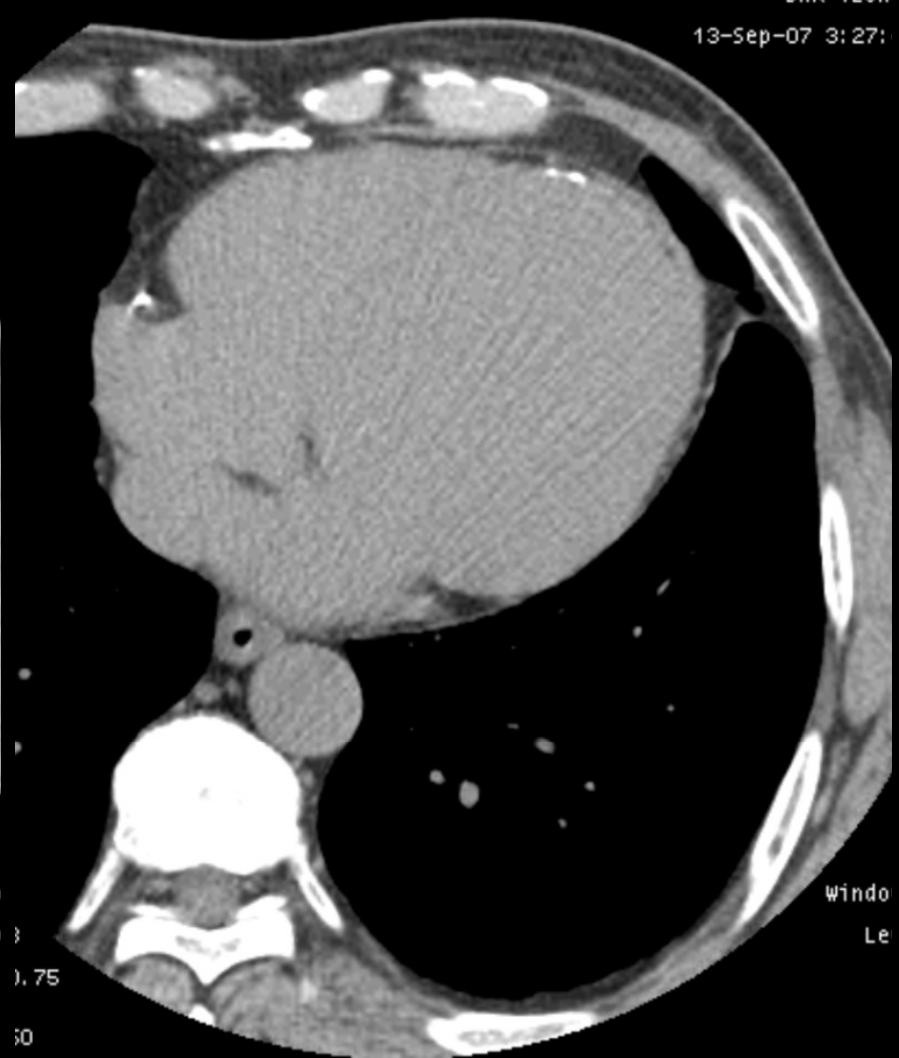
Clinical Application

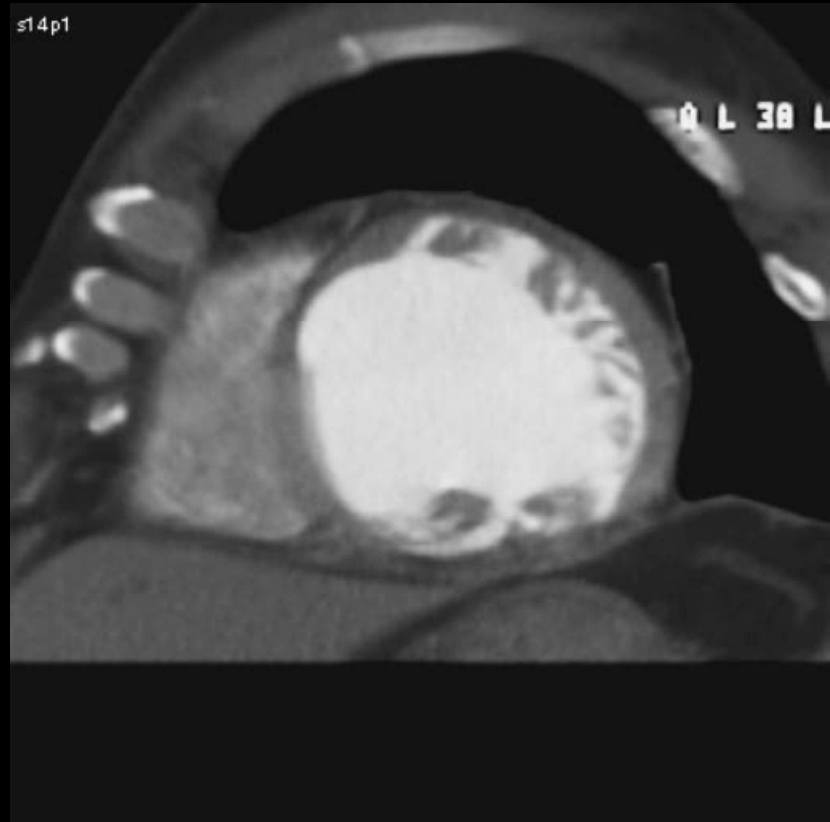
- Fat infiltration
- Calcification
 - Chronic myocardial infarction
 - Constrictive pericarditis
 - Thrombus
 - Myxoma
 - Fat necrosis

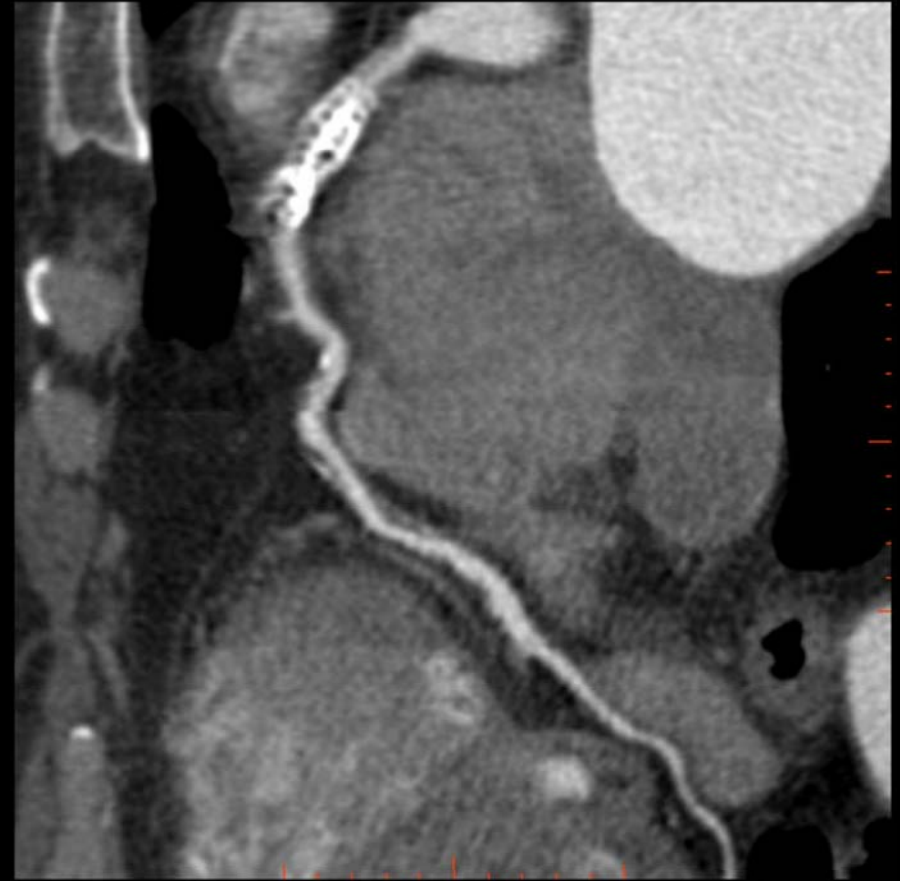
Chronic Myocardial Infarction

BAK YEO
13-Sep-07 3:27

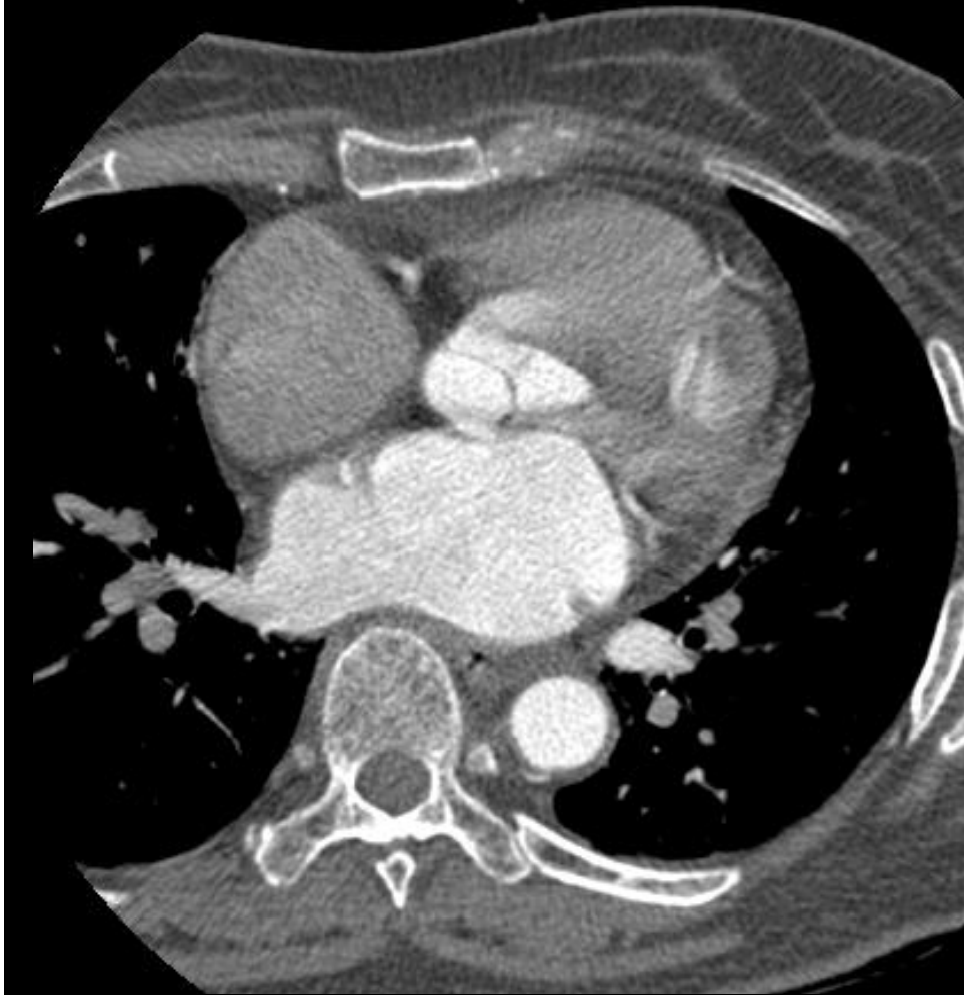
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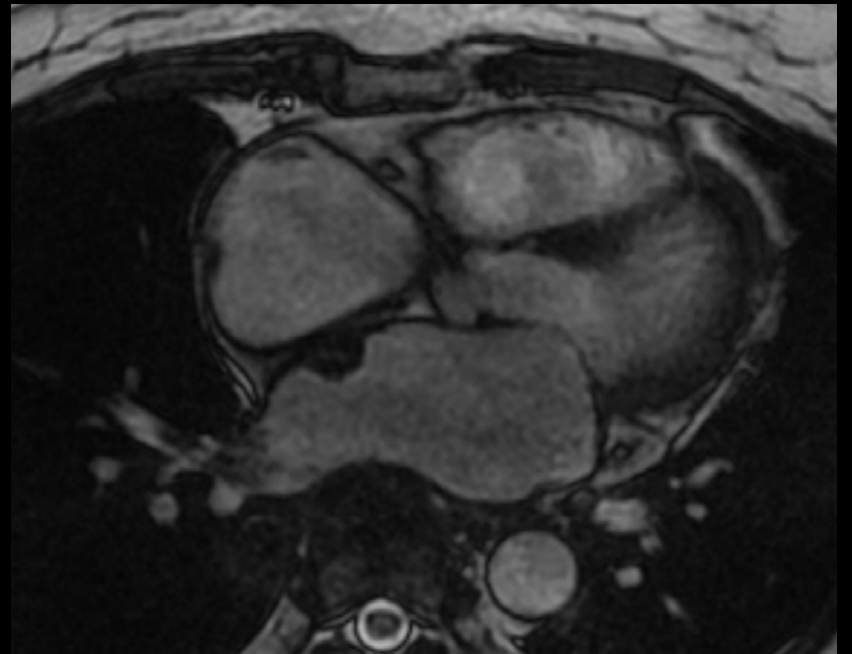
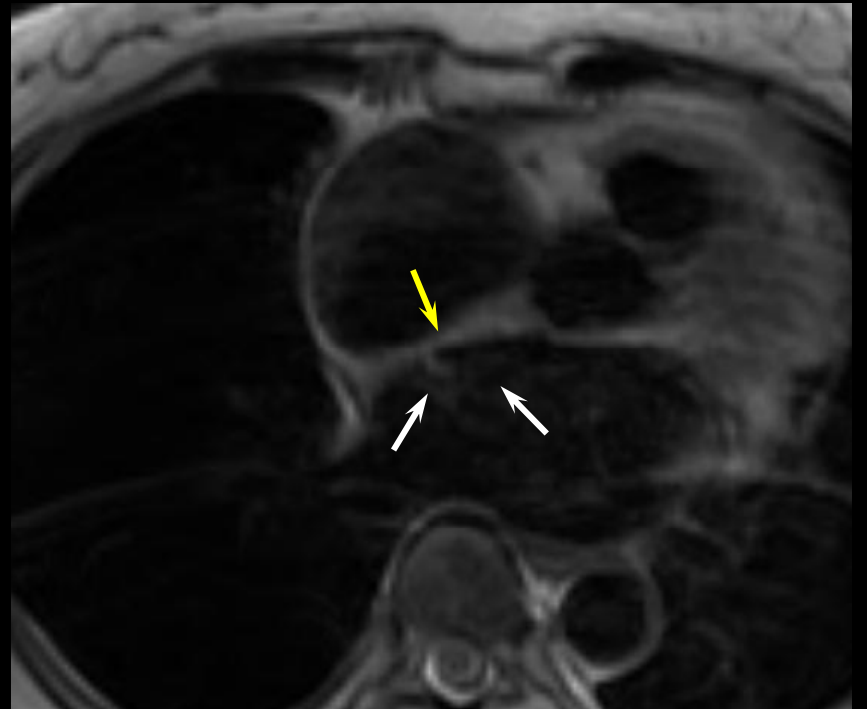
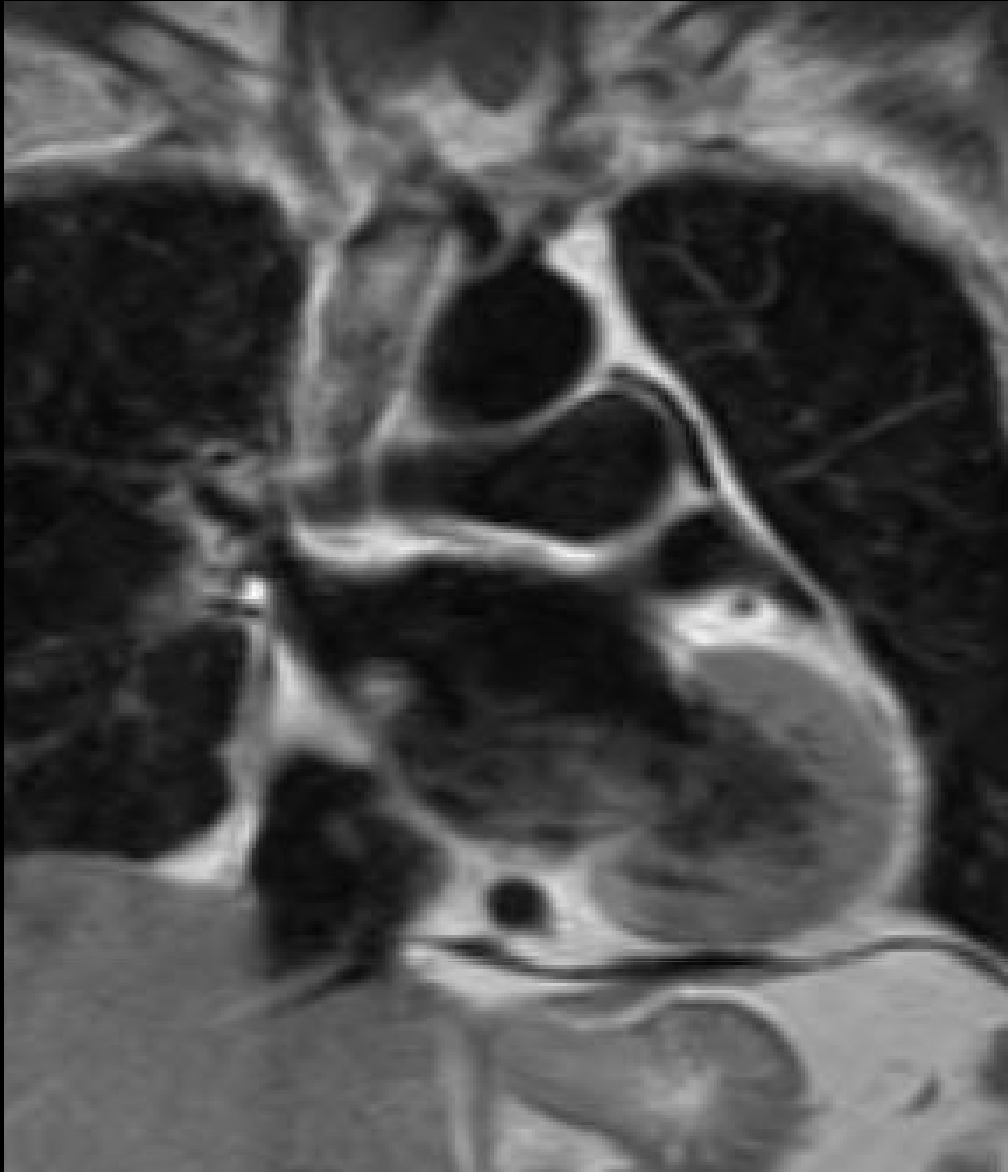


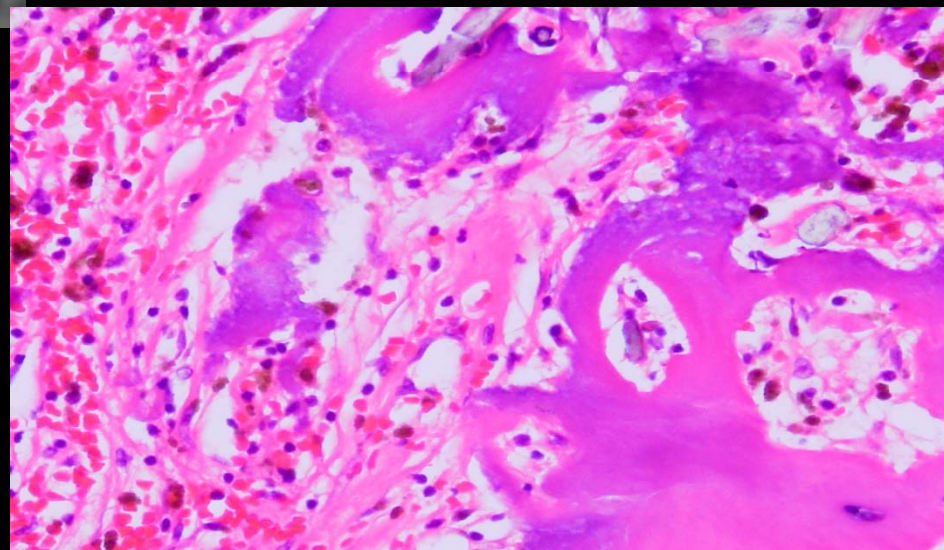
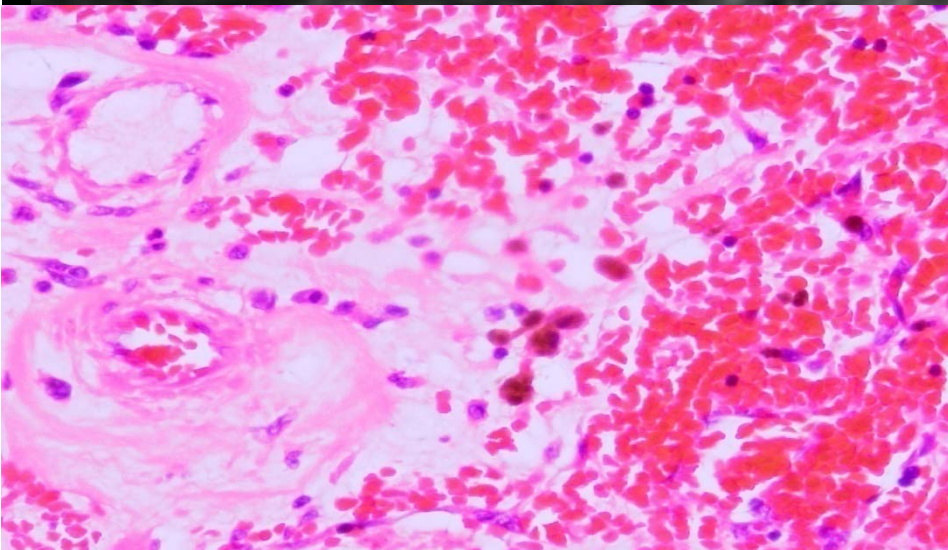




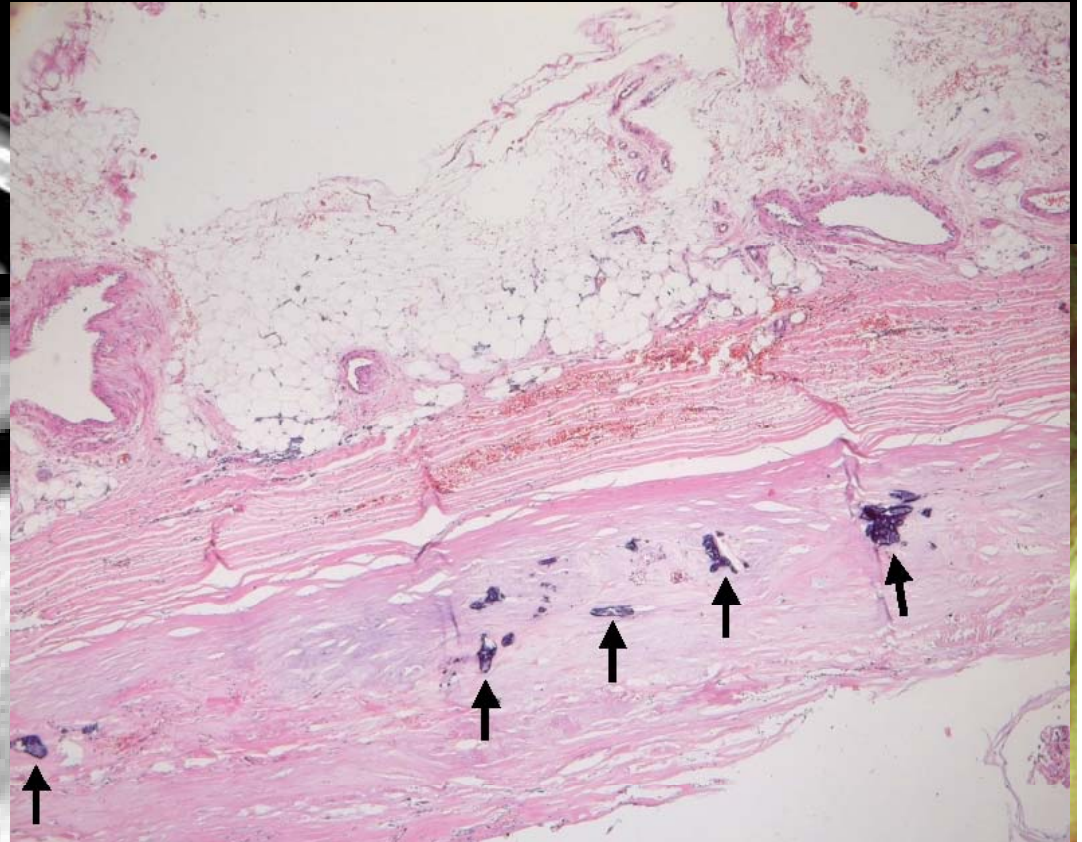
Thrombus







47/M



Clinical Application

- Fat infiltration
- Calcification
- Soft tissue attenuation
 - Tumor
 - Thrombus
 - Hypertrophic cardiomyopathy
 - Non-compaction

Cardiac Tumors

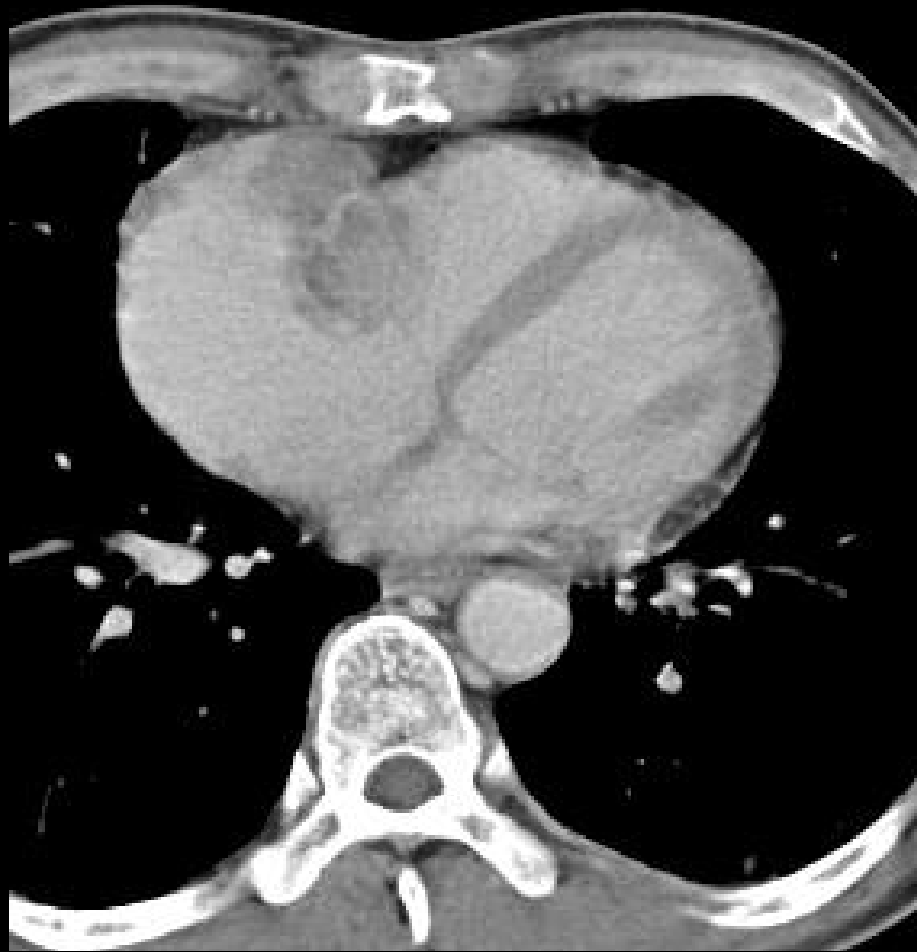
- Most of cardiac tumors except for lipoma or liposarcoma
- Benign cardiac tumors
 - Encapsulated smooth contour
 - Myxoma/ Fibroma/ Rhabdomyoma
- Malignant cardiac tumors
 - Irregular, lobulating contour
 - Metastasis/ Angiosarcoma/ Rhabdomyosarcoma/ Mesothelioma

52/F



51/M





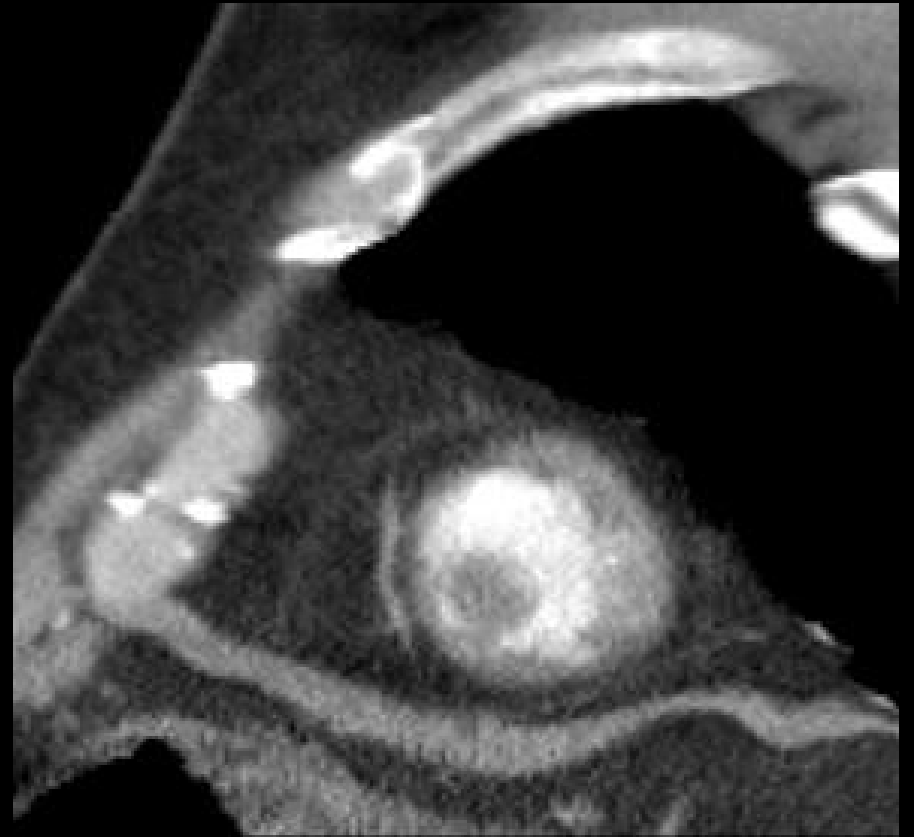
Thrombus

- Pseudotumor
- Poor enhancement
- Left atrium
- Predisposing factor: atrial fibrillation

59/M



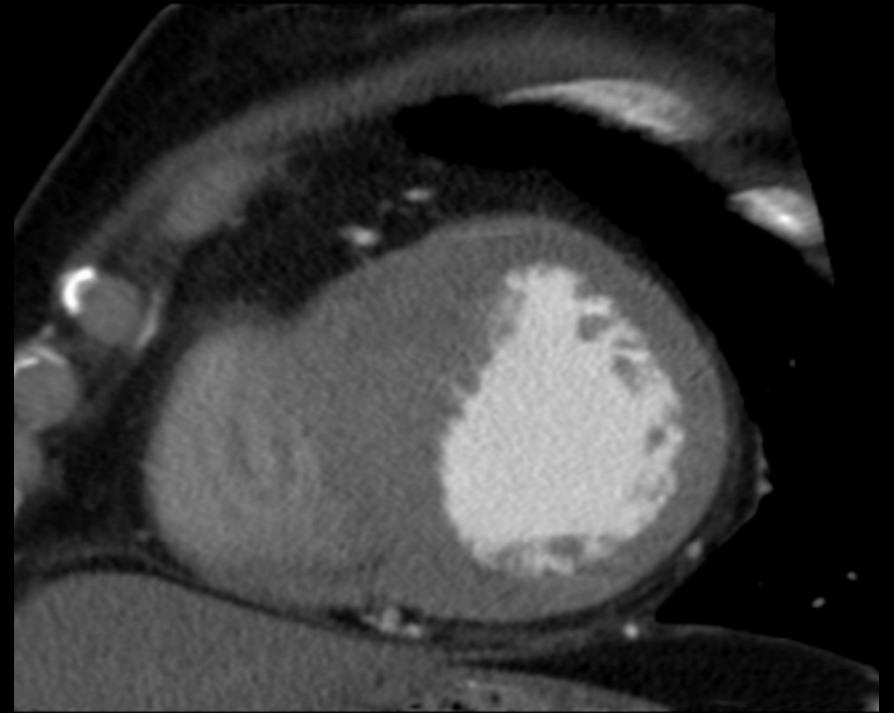
64/M



Hypertrophic Cardiomyopathy

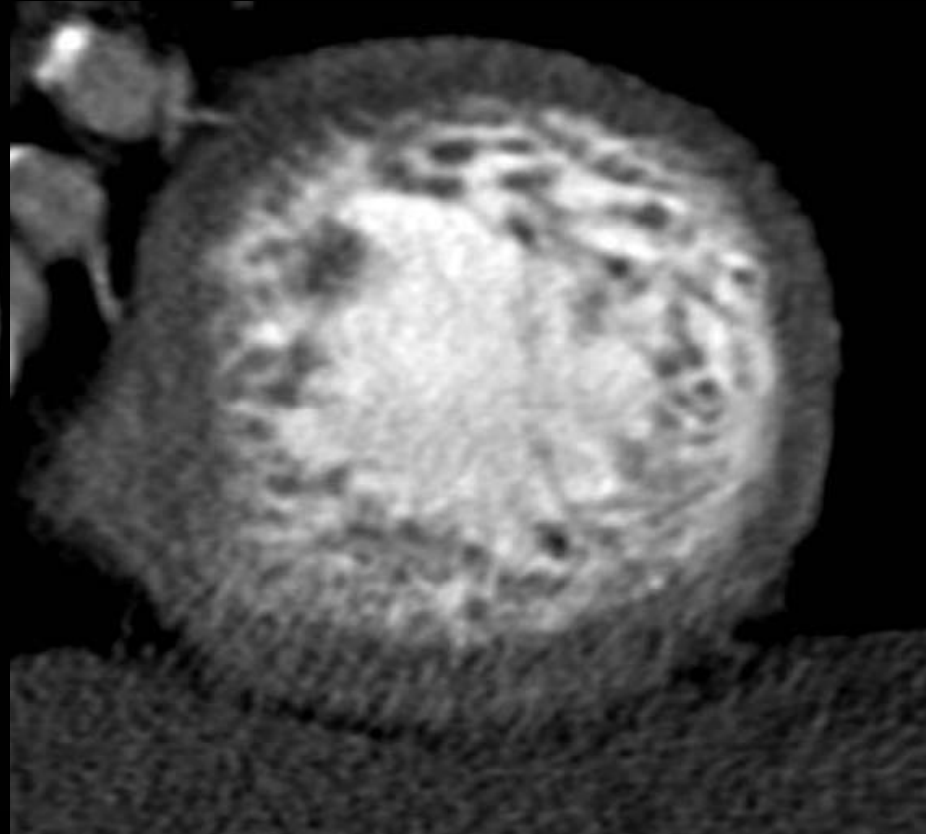
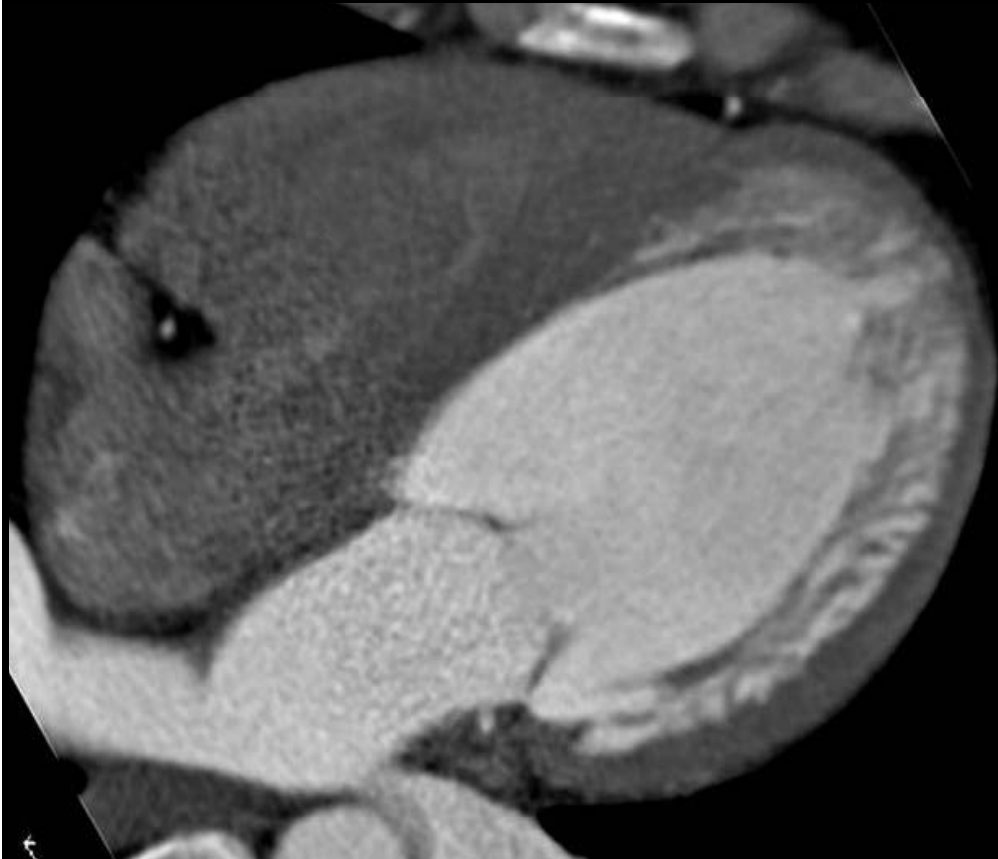
- Left ventricular outflow tract anomaly
- 0.2% of young adult
- Symmetric or Asymmetric thickening of septum or apex.

68/F



Non-compaction of Ventricle

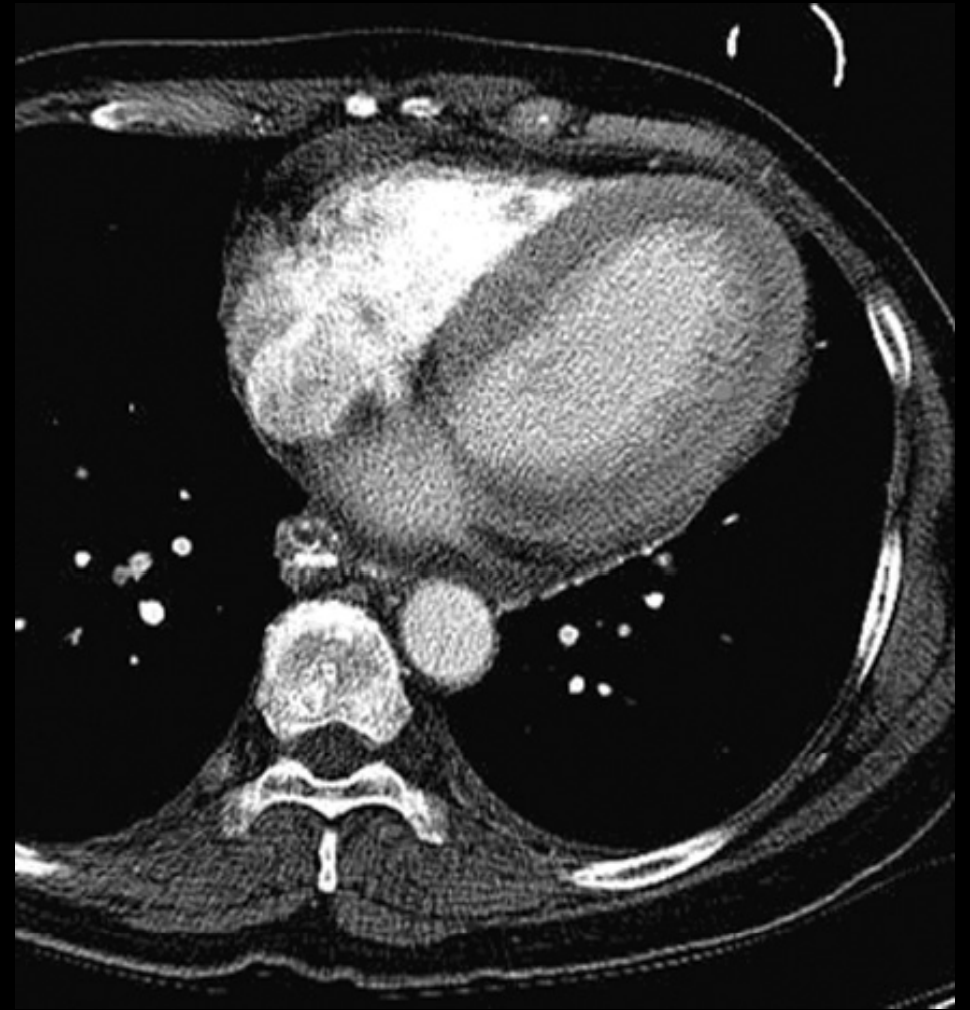
- Prominent trabeculation
- Deep intertrabecular recess



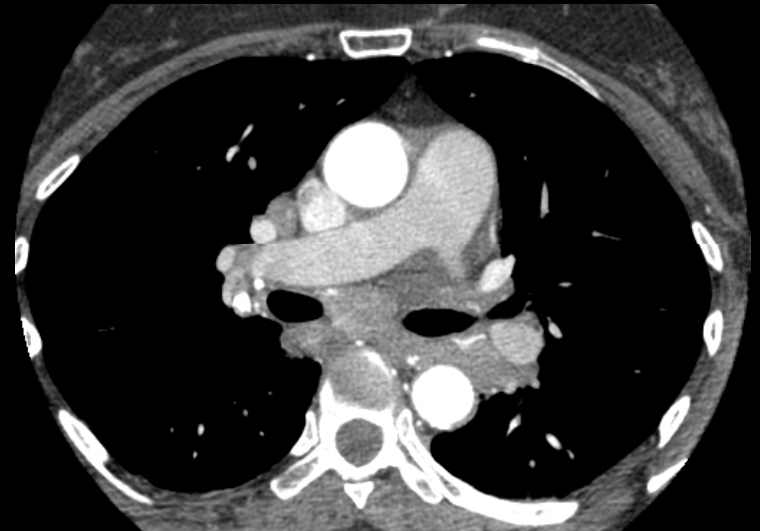
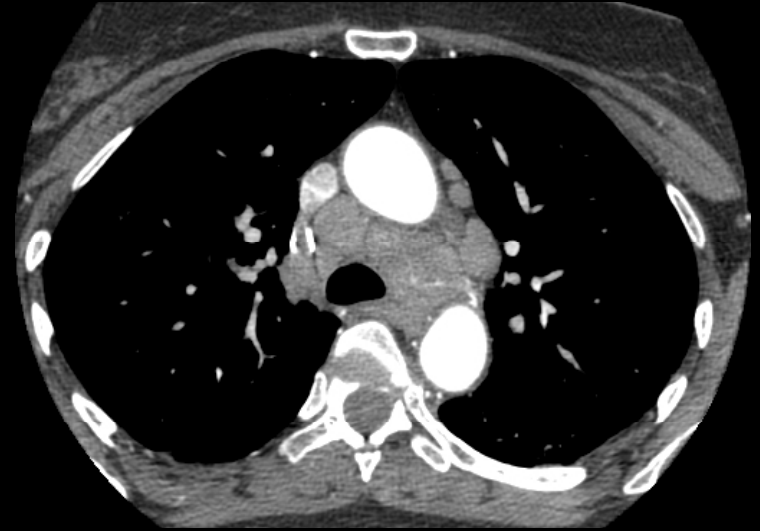
Ventricular involvement of Systemic disease

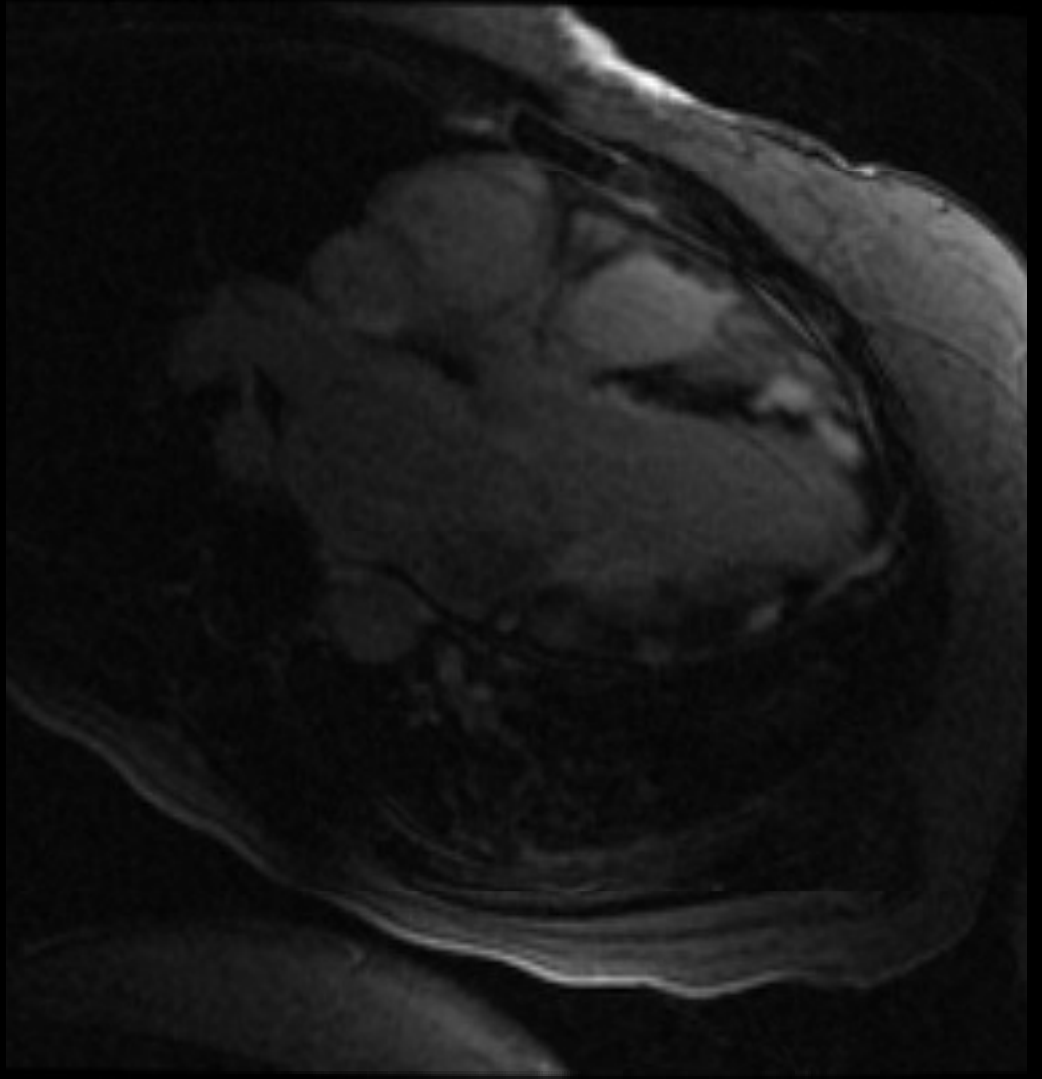
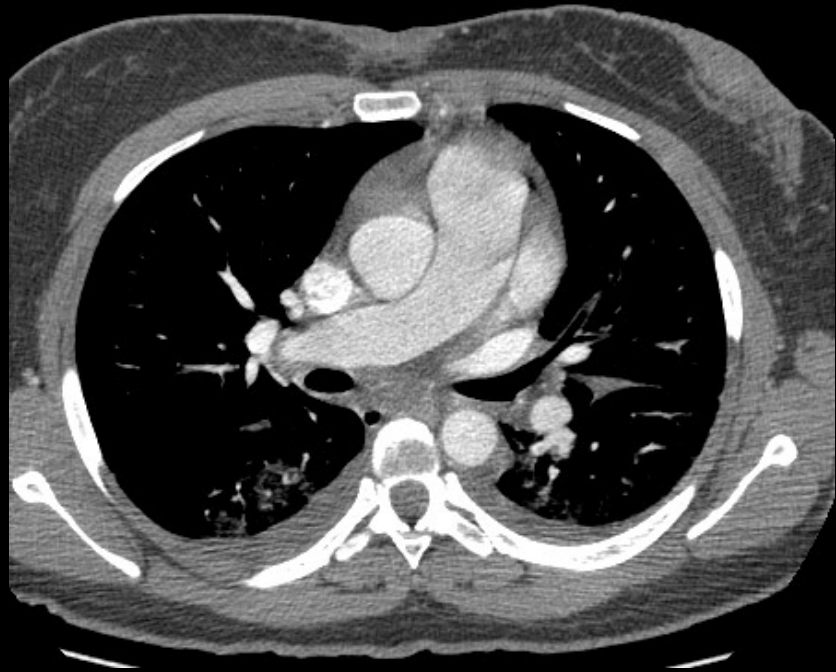
- Amyloidosis
- Sarcoidosis
- Hemochromatosis

54/F



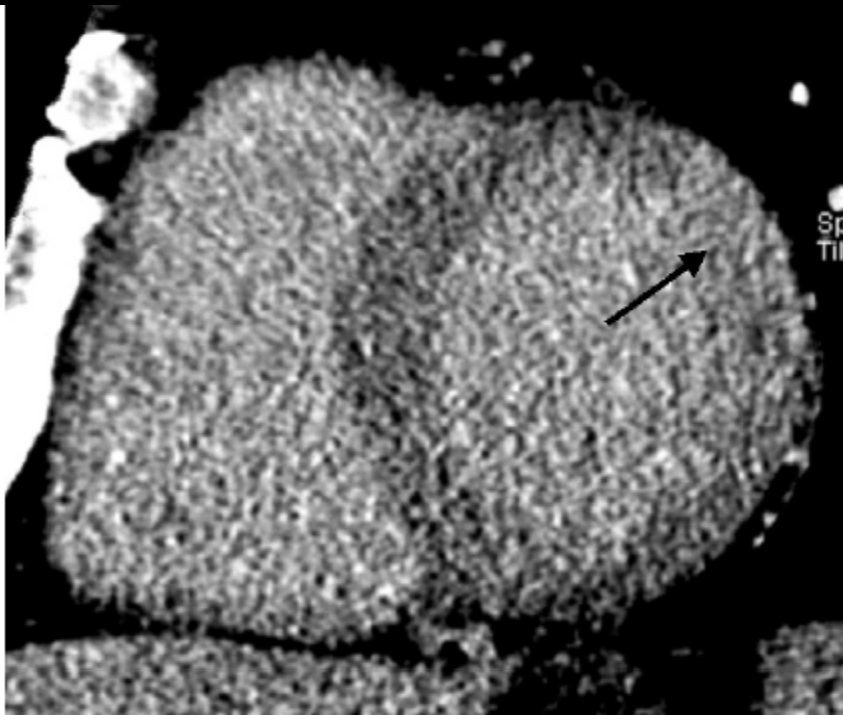
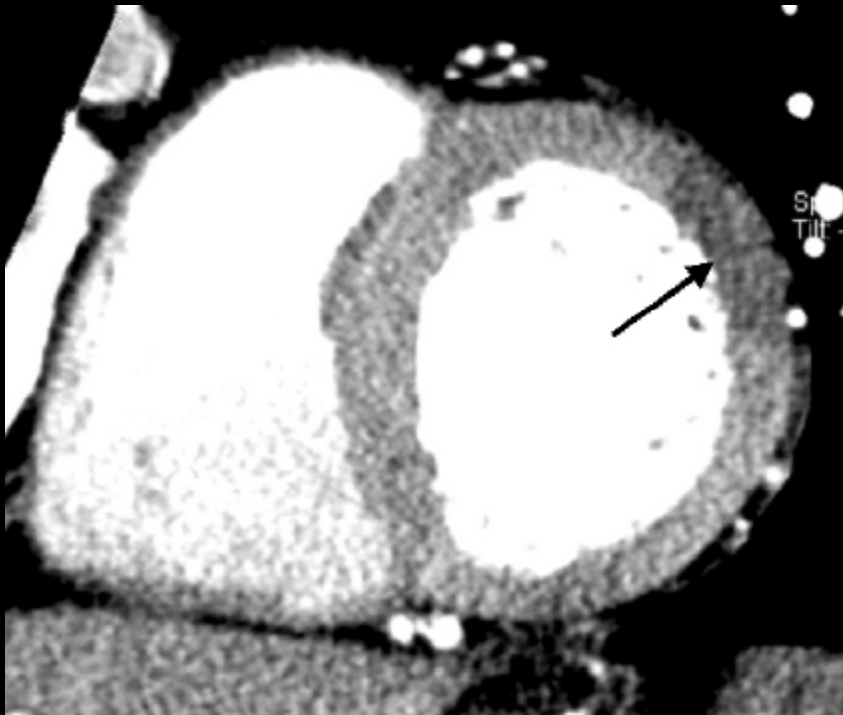
66/F

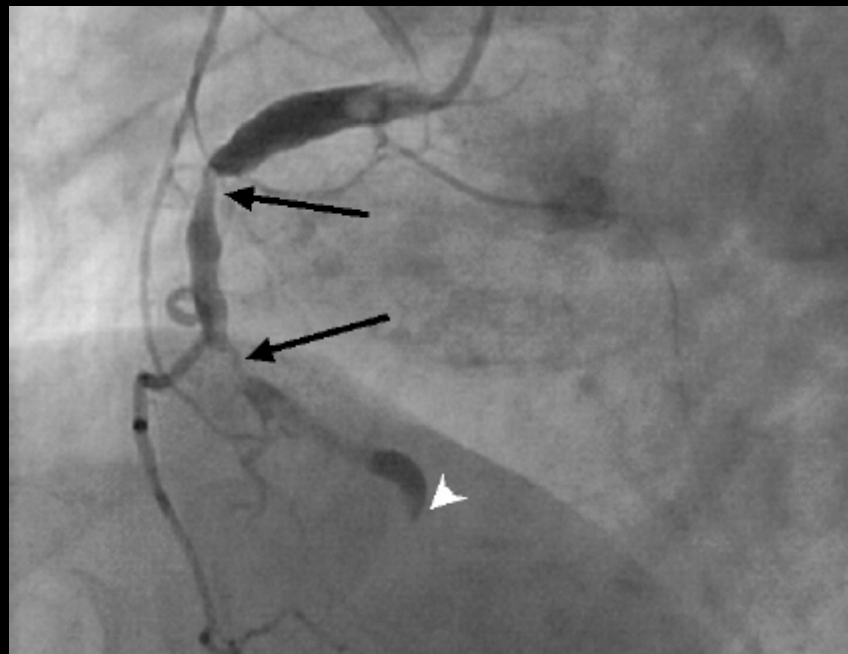
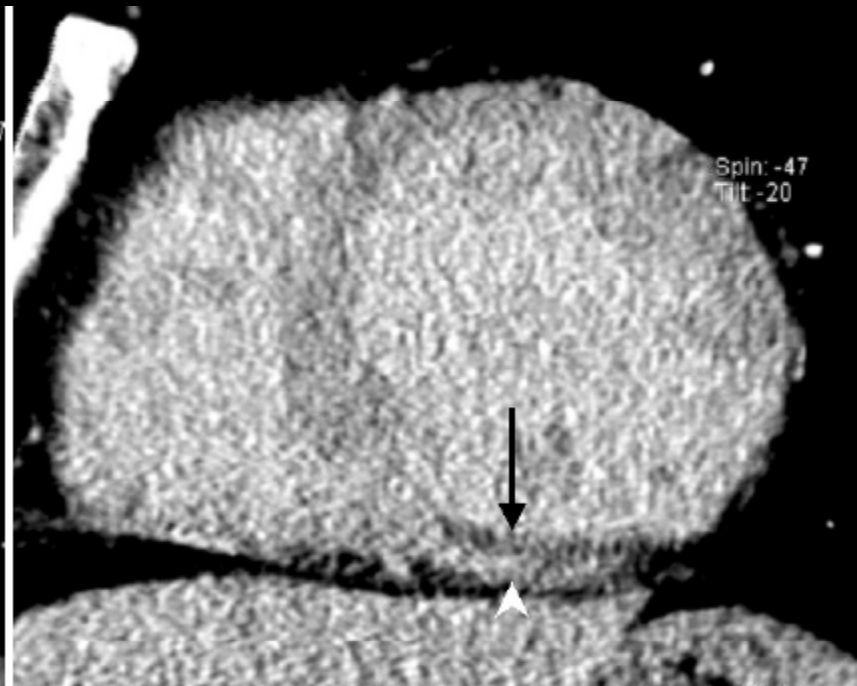
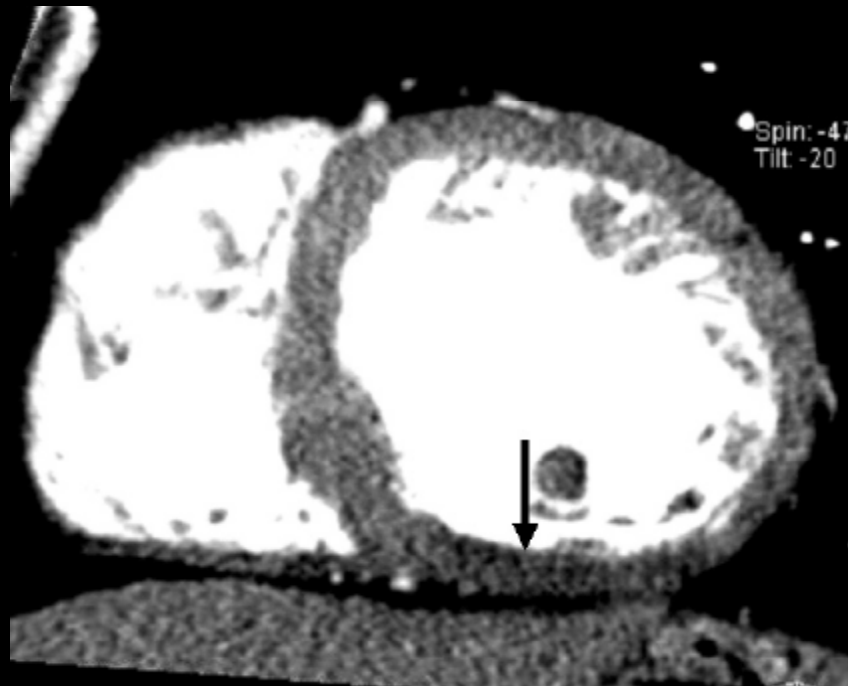




Two-phase contrast enhanced CT for myocardial infarction

- Acute MI
 - Early perfusion defect: decreased blood volume in vascular bed
 - Late enhancement: contrast leakage due to myocyte necrosis
 - Good correlation with pathologic result

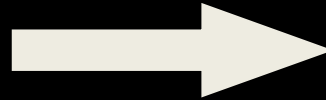
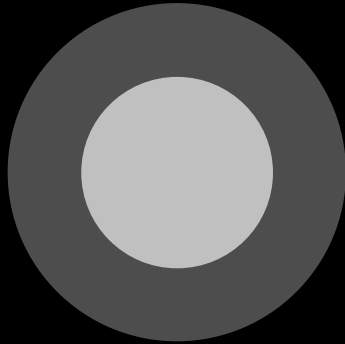




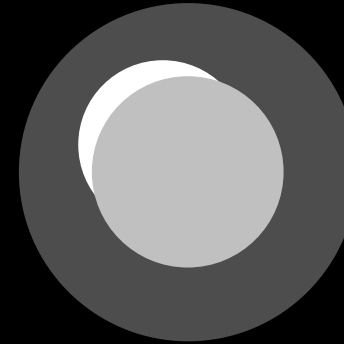
Early phase (45 see)

Late phase (7 min)

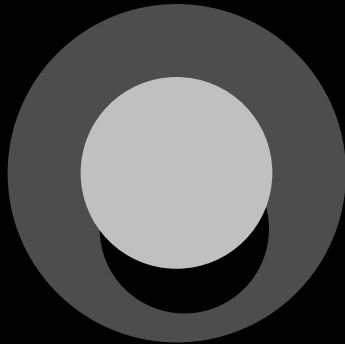
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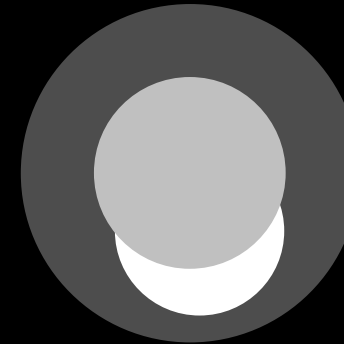
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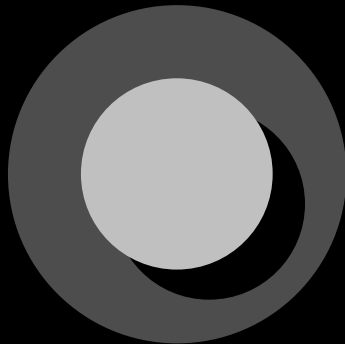
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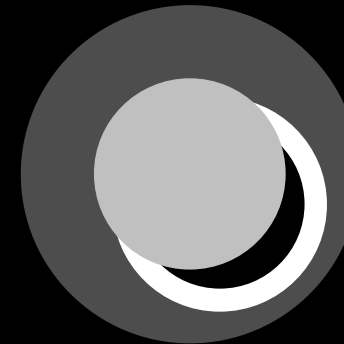
(ED+, LE+, RD-)



Group 3



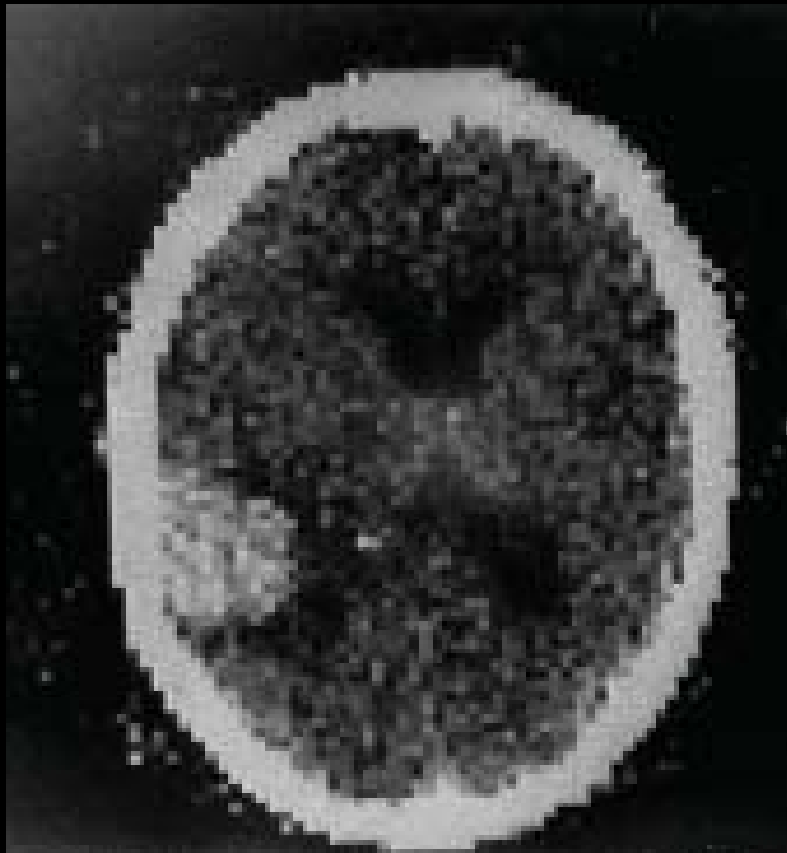
(ED+, LE+, RD+)



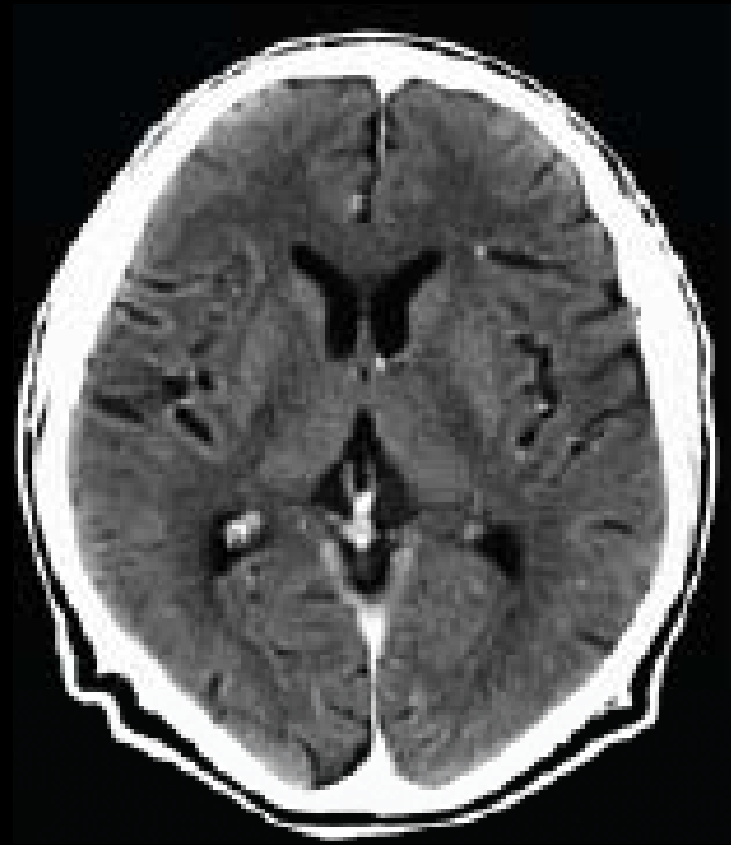
Prognosis in re-perfuse MI

- 2 groups
 - Delayed enhancement without residual defect
 - Delayed enhancement with residual defect : myocardial necrosis, more progression of ventricular thinning

Progress in Brain CT image Quality (1974-2000)

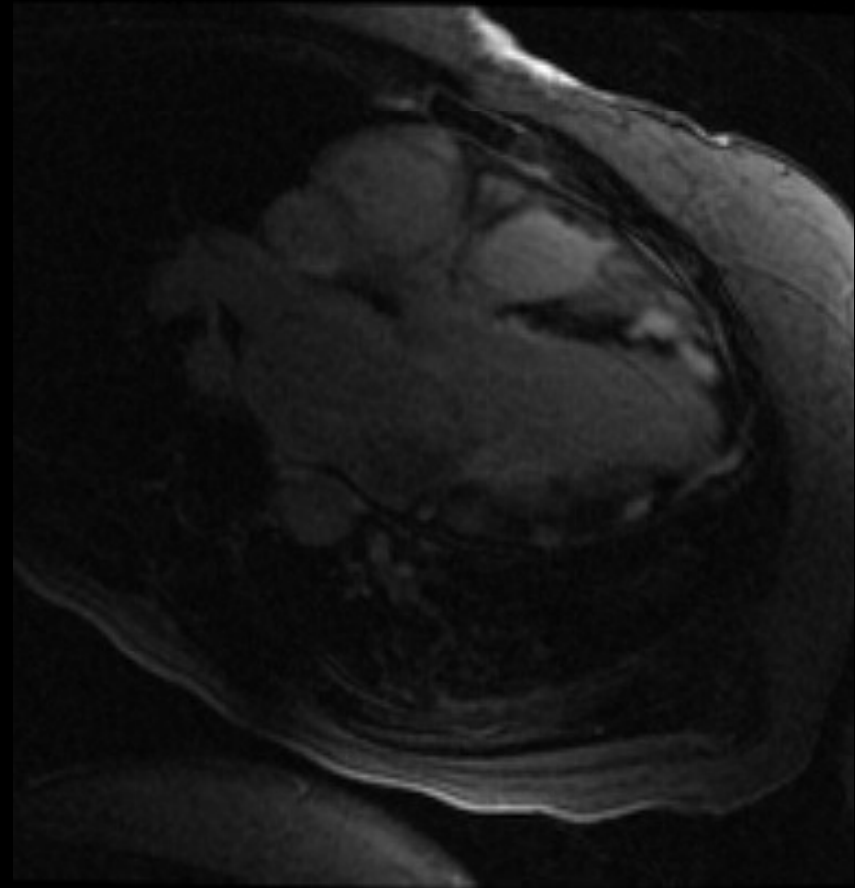
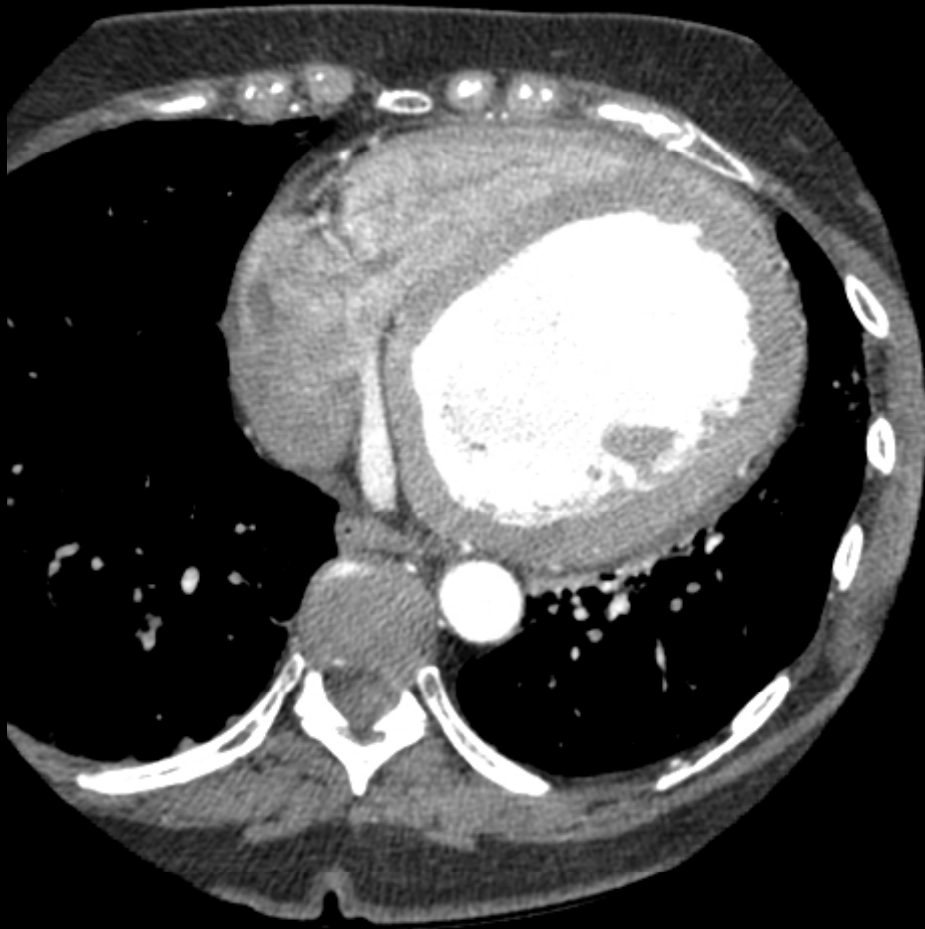


(1974)



(1996)

Expected progress in CT based myocardial image 2008-???



Conclusion

- Although tissue characterization of myocardium with MDCT is somewhat limited, knowledge of tissue characterization of myocardium would help to make the diagnosis of various myocardial disease depicted on coronary CT angiography.

Special Thanks to

- Bae Young Lee, St. Paul's Hospital
- Ho Jong Chun, Kangnam St. Mary's Hospital
- Horrim Kim, St. Vincent Hospital
- Ki Jun Kim, Our Lady of Mercy Hospital

감사합니다