Making the Black Box of the Heart More Transparent!

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Disclosure

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Introduction

• Non-gated chest CT common imaging test
• Heart is included in its field of view
• New technology (high temporal and spatial resolution) decreases cardiac motion with increased detection of cardiac findings
• 268 chest CT reviewed for reportable cardiac findings by two radiologists

• 61% reportable cardiac findings - 22% not mentioned in radiology report

✓ Incidental cardiac findings are common but usually not reported
Introduction

- Heart often regarded as a “black-box” on chest CT

- Cardiovascular and pulmonary diseases may overlap in their presentation

- Cardiac/pericardial diseases may alter patient’s clinical course
Objectives

✓ Learn a stepwise approach to the examine the heart on CT chest

✓ Review clinically significant cardiac findings through cases

✓ Tips and Take Home Messages
Normal References

- RV myocardium < 4 mm
- Pericardium < 4 mm
- Pulmonary Artery < 29 mm
  - PA/Ao diameter ratio ≤ 1
Chambers

Right ventricular enlargement
- RV displaces inferiorly (below the level of the LV on axial)
- RV/LV ratio >1

- Left ventricular enlargement > 5.6 cm
  - Sens 78%, Spec 100%

- Left atrial enlargement > 4.5 cm
  - Sens 53%, Spec 94%

- Atria smaller than ventricles
  - Valvular or congenital disease

Stepwise Approach to Examine Heart

Left Sided Chambers, Mitral & Aortic Valves
Aorta
Case 1

- 56-year-old male with abdominal pain
- Rule out bowel ischemia
Case 1 - What is the most likely diagnosis?

1. Small bowel obstruction
2. Small bowel ischemia due to heart failure
3. Small bowel ischemia due to prior myocardial infarction
4. Small bowel ischemia due to SMA embolism from LV thrombus
Filling Defect Superior Mesenteric Artery

Non Enhancing Small Bowel Loops

LV Apical Aneurysm & Calcification
Intra-Cavitary thrombus (*)
Small Bowel Ischemia due to Superior Mesenteric Artery Embolism from LV thrombus

• In the presence of systemic embolism inspect the heart to look for sources of embolism

✓ Intracardiac thrombus should be reported and communicated to the referring physician

✓ Patients may need anticoagulation
Interventricular
Interatrial septa
Pulmonary Veins
Case 2

• 68-year-old man with heart failure
• Rule out PE
Case 2 - What is the most likely diagnosis?

1. Secundum ASD with PAPVR
2. Secundum ASD
3. Septum primum ASD
4. Unroofed coronary sinus
Dilated MPA (>29 mm)
Ao/MPA>1

RV/LV ratio> 1-
Dilated RV Contrast extends from RA to LA - ASD

Pulmonary vein drains into RA
Secundum ASD with associated partial anomalous pulmonary venous return

- Increased flow in right heart results in pulmonary hypertension
- Over time increased PA pressures may reverse shunt from L-R to R-L → Eisenmenger Syndrome
Dilated MPA (>29 mm) 
MPA/Ao ratio >1

**Pearls**

- Suspect a shunt in patients with unexplained PH, right heart dilatation and RV hypertrophy
  - ASD
  - PAPVR
  - Patent ductus arteriosus
- May present in adulthood and be missed on echocardiography
Case 3

• 67-year-old woman presents with facial numbness, chest, back and abdominal pain
Case 3 - What is the most likely diagnosis?

1. Massive PE
2. Massive PE and RV strain
3. Mesenteric ischemia and simultaneous PE
4. Paradoxical embolism
Multiple pulmonary emboli

Dilated RV (RV/LV>1)
Hypodensity in interatrial septum

Filling defect superior mesenteric artery
Asymmetric enhancement of kidneys
Transesophageal echocardiogram

- Large PFO with right to left shunt
- No intracardiac thrombus
- RV dilatation and dysfunction
- Pulmonary hypertension
  - SMA thrombus removed with surgical embolectomy
  - IVC filter implanted
Paradoxical Embolism

- Emboli from venous system reach arterial system through abnormal communication between cardiac chambers resulting in systemic embolism

Case 4 - 58-year-old man with renal cancer
Case 4 - What is the most likely diagnosis?

1. Hypertrophic cardiomyopathy
2. Cardiac metastasis
3. Cardiac angiosarcoma
4. Cardiac amyloidosis
Hypodense nodules within myocardium
Nodular contour of myocardium

Uniform thickness and contour
Homogeneous enhancement

Multiple enhancing nodules in myocardium
Cardiac Metastases

- Most common cardiac neoplasm
- Myocardium, epicardium, pericardium, intracavitary
- Multifocal masses
- CMR-Delayed enhancement
- Primaries: Lung, breast, melanoma, kidney, lymphoma and leukemia
Case 5 - 34-year-old woman with pneumonia, fever, hypotension

Rule out empyema
Case 5 - What is the most likely diagnosis?

1. Constrictive pericarditis
2. Acute pericarditis
3. Loculated pericardial effusion with suspected tamponade
4. Loculated pleural effusion
• Large loculated pericardial effusion (*)
• Compression and flattening of RA and RV free wall
• Concerning for Tamponade
Cardiac Tamponade

✓ Accumulation of fluid, gas or soft tissue resulting in elevation of intrapericardial pressure
✓ Intrapericardial pressure - no effective filling of ventricles ➔ decreased cardiac output ➔ cardiogenic shock
✓ Life threatening condition → pericardiocentesis
✓ Clinical diagnosis
CT Findings in Cardiac Tamponade

✓ Large effusion
✓ ↑SVC ≥ AAo diameter
✓ ↑IVC > 2 x adjacent Ao
✓ Reflux of contrast into azygous vein and IVC
✓ Periportal edema
✓ Bowing of IVS towards left
✓ Compression of cardiac chambers
✓ Flattened heart sign

Restrepo CS, et al. Imaging findings in cardiac tamponade with emphasis on CT. Radiographic 2007
CT Findings of Tamponade

- Large effusion
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Take Home Messages

• Incidental cardiac findings are common and usually not reported

• **Opportunity for radiologist to diagnose cardiac disease which may influence clinical decisions and management**

• Incidental findings may require further work up and diagnose other conditions
Thank you for your attention!

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