Don’t forget about the CXR: Cardiovascular Chest Radiograph Findings

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Goals and Objectives

• To use the next few cases to emphasize CXR findings of cardiac disease that are still relevant in the age of MDCT and MR
• To illustrate these findings, using MDCT and MR

I have no financial disclosures

20-year-old man with inguinal lump
Aortic Coarctation

- Radiographic features:
  - Bilateral inferior rib notching in ribs 3-8
  - Aortic contour resembling the number “3”
  - Reverse “3” on a barium esophagram
  - Left ventricle enlargement
Aortic Coarctation

- Rib notching allows distinction from pseudocoarctation
  - Pseudo often more obvious on CXR
Aortic Coarctation

- Preductal: rib notching on the right
- Other causes of rib notching
  - Neurofibromatosis (bilateral)
  - Blalock-Taussig shunt (unilateral) (Subclavian artery to pulmonary artery)
  - Interrupted PA with collaterals (unilateral)

69-year-old woman with newly diagnosed pancreatic cancer

Scimitar Syndrome

- Spectrum of disease that shares:
  - Small right lung
  - Anomalous right pulmonary venous return to the inferior vena cava

Resembles a Turkish sword (Scimitar)
Scimitar Syndrome

- Symptoms depend on size of left-to-right shunt
- Other associated anomalies:
  - Septal defects
  - Anomalous feeding arteries (akin to sequestration)
  - Horseshoe lung
- The affected lung is hypoplastic but atelectasis and air-trapping are absent

24 year-old woman with increasing fatigue and dyspnea
Left Anomalous Pulmonary Venous Return

- Tubular opacity on frontal not seen on the lateral suggests a middle mediastinal process or mass
- Straight border suggests vascular
- Oblique nature is key

Anomalous Pulmonary Venous Return

- Sinus Venosus ASD
- Isolated Anomalous Return
- Scimitar
- Congenital lung and heart disease

60-year-old man with increasing shortness of breath
**Shunt Vascularity**

- Shunt vascularity = increased pulmonary vascularity from a left-to-right shunt
- Severity of shunt (shunt fraction or Qp:Qs) will determine whether shunt vascularity is seen on CXR

Net forward flow in PA = Qp

Net forward flow in Aorta = Qs

- Qp:Qs must be > 1.5-1.7 for changes to be appreciated on CXR
- Most common defect undiagnosed in adults is atrial septal defect
Eisenmenger syndrome

- Pulmonary arterial calcification is rare in idiopathic pulmonary hypertension and chronic pulmonary embolism.

- With marked PA enlargement, pulmonary calcification is likely from a cardiac shunt.
- Hemoptysis is commonly seen in Eisenmenger syndrome (Bronchials).
Eisenmenger syndrome

- Right Interlobar Artery >16mm [frontal]
- Left Descending Artery >17 mm [lateral]
Pulmonary Hypertension

- Main PA enlargement can be distinguished from LA appendage enlargement because it is above the left mainstem bronchus.
65 year-old woman with chest pain and cardiomegaly
Pericardial Effusion

- Sandwich or Oreo Cookie Sign

When cardiomegaly is encountered
- Look for single chamber enlargement
- Pulmonary venous hypertension

Chest radiographic signs
- Fat pad sign (sandwich or Oreo) [50%]
- Variable density sign [13%]
- Posterior bulge sign [80%]

Best: Time course, compare
**Pericardial Effusion**
- Best sign: Acute change in size

20-year-old woman with history of arrhythmia

**Mitral Disease**
- Isolated left atrial enlargement is a sign of mitral disease
  - If the LV is enlarged, think regurgitation
  - If not, think stenosis
Mitral Disease

- Radiographic findings of left atrial enlargement include:
  - Increased distance from right double density to left main bronchus (> 7cm)
  - Splaying of carina
  - Convex left heart border below left bronchus
  - Upward displaced left main bronchus
  - Posterior displacement of left main bronchus on the lateral

32-year-old man admission CXR

[Images of chest X-rays and MRIs showing cardiac structures]
**Ebsteins anomaly**
- Tricuspid regurgitation results in the largest RA
- Wall-to-wall heart

**Ebsteins anomaly**
- The ectopic leaflets of the tricuspid valve obstruct pulmonary flow
- Decreased pulmonary vascularity

**Ebsteins anomaly**
- The obstruction results in right-to-left flow in the ASD
- Cyanosis or positive bubble study
**Ebsteins anomaly**

• Results in a three-chambered right heart

85-year-old woman with shortness of breath

**Ebsteins anomaly**

• Findings of right heart enlargement
  • Increased length and convexity

85-year-old woman with shortness of breath
**Mitral Annulus Calcification (MAC)**

- Degenerative process of the fibrous support for the mitral valve
  - Seen more in elderly women
- Not indicative of valve dysfunction
  - Really hard to see mitral valve calcification on CXR
Calcific pericarditis

- Pericardial calcification may follow cardiac surgery, hemorrhage, radiation, uremia, and infection.
Calcific pericarditis

- Pericardial calcification favors the atrioventricular and interventricular grooves.

Calcific pericarditis can be constrictive.
- Diagnostic signs of constriction
  - Atrial enlargement
  - Evidence of venous congestion

Constrictive pericarditis does not need to be calcified!
Calcifications

Pulmonary VSD with PH
Mitral Annulus MAC
Pericardial
Left Ventricle Old Infarct
13-year-old girl with a reported mediastinal mass and hemoptysis

**Pulmonary Stenosis**

- Enlargement of the main and left pulmonary arteries is a sign of moderate to severe pulmonic valve stenosis.
Pulmonary Stenosis

- Because of its vascular nature, the abnormality may be difficult to see on lateral radiographs.

Pulmonary Stenosis

- Enlarged pulmonary artery above the left mainstem bronchus; enlarged atrial appendage below the bronchus
78-year-old woman with cough undergoing examination to exclude pneumonia.

**Enlarged Azygous Vein**

- Right paratracheal stripe widening:
  - Lymphadenopathy
  - Vascular anomaly
  - Foregut duplication cyst

- The size of an enlarged azygous vein can change depending on patient positioning.
Enlarged Azygous Vein

- Azygous continuation of an interrupted IVC (in isolation or with polysplenia)
- SVC occlusion
- Portal Hypertension
- Idiopathic

Enlarged Azygous Vein

23-year-old man shot in the groin. No injury to the chest.

Enlarged Azygous Vein

- On the lateral, enlarged azygous projects posterior to trachea; adenopathy projects anterior to trachea
Enlarged Azygous Vein

- On the lateral, enlarged azygous projects posterior to trachea; adenopathy projects anterior to trachea
54-year-old woman. Rule out pneumonia.
In a double aortic arch, right moiety is more cranial than left.
Dilated Ascending Aorta from BAV

- Apex of the curve is near level with carina (unlike LAA enlargement)

Dilated Ascending Aorta

- Unusual in atherosclerosis:
  - Bicuspid aortic valve (regardless of stenosis)
  - Tricuspid valve with stenosis
  - Marfans, Loeys-Dietz and other inherited fibrillin disorders
  - Conotruncal abnormalities such as tetralogy
33-year-old man presents for preoperative chest radiograph.
Post-Traumatic Pseudoaneurysm

- Classic location
- Inferior atherosclerosis
- Saccular Aneurysm:
  - Post-traumatic
  - Mycotic
  - PAU
Saccular outpouching at the isthmus

- Vector may help in distinguishing between post-traumatic PSA and ductus aneurysm

84-year-old woman with acute myocardial infarction and renal failure

Bypass aneurysm or pseudoaneurysm

- Should be considered when a mediastinal mass is encountered in a patient who has undergone bypass surgery.
Bypass aneurysm or pseudoaneurysm

- 3 most common locations of saphenous bypass aneurysms
  - Right-heart border
  - Left-heart border
  - Aorticopulmonary (AP) window

Bypass aneurysm or pseudoaneurysm

- A saphenous aneurysm usually seen years after surgery and can be fatal: rupture, embolism, ischemia

Bypass aneurysm or pseudoaneurysm

- Should be fusiform if atherosclerotic
- When saccular, be concerned about mycotic
Bypass aneurysm or pseudoaneurysm

52-year-old man with leukocytosis and fever 1 month after repair of Stanford type A aortic dissection

Sternal dehiscence

- The radiographic features usually precedes clinical suspicion by 3 days
Sternal dehiscence

- Sternal dehiscence frequently associated with mediastinitis.

The radiographic features
- Disruption of the sternal wires
- Wire migration
- Vertical gas-filled cleft >3 mm in diameter

Sternal dehiscence

- Sternal infection with mediastinitis occurs in as many as 2% of patients after sternotomy and may have a mortality as high as 14%.
The CXR remains an important screening tool in CV conditions.

- Acuity
- Focal vs Diffuse enlargement
- Localization of calcium (if present)
- Abnormalities of pulmonary vascularity