The Pericardium

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Pericardium: Anatomic Basics

- Fibrous anchors heart to mediastinum & chest wall
- Serous comprises visceral (“epicardium”) & parietal layers
- Extends to proximal ascending aorta, superior vena cava, pulmonary trunk
- Thickness 0.7-2 mm on thin section CT
- Marginated by epicardial & mediastinal fat

Superior Aortic Recess

- Pericardial sleeve encases ascending aorta (AA) & proximal arch
- Crosses anterior aspect of ascending aorta (AA) & main pulmonary artery (PA)
- Mimics aortic dissection, lymphadenopathy, bronchogenic cyst

Transverse Sinus

- Posterior to ascending aorta (AA) & main pulmonary artery (PA)
- Just above left atrium (LA)
- Communicates with superior aortic recess
- Mimics Type A aortic dissection

Left Pulmonic Recess

- Pericardial recess contiguous with venous adventitia
- Between main PA (PA) & left superior pulmonary vein (LSV)
- Communicates with transverse pericardial sinus

Oblique Sinus

- Posterior to left atrium (LA), partly anterior to esophagus
- Separated from transverse sinus by pericardial reflections
- Mimics bronchogenic cyst or esophageal lesion
**Pulmonary Venous Recess**
- Contiguous with venous adventitia
- Orifice of right inferior pulmonary vein (RPV) & left atrium (LA)
- Mimics bronchopulmonary lymph node or lung mass

**Congenital Absence of the Pericardium**
- Sharp indentation in PA window
- Abnormal left heart contour (LAA)
- Lucency above left hemidiaphragm due to cardiac levorotation

**Surgical Absence of the Pericardium**
- Congenital
- Right > Left cardiophrenic angle
- Thin mesothelial capsule
- No enhancement
- Homogeneous fluid density

**Pericardial Cyst**
- MR Imaging
  - T1-weighted SI = intermediate signal
  - Post-gadolinium = no enhancement
  - T2-weighted SI = uniform high signal

**Hemopericardium**
- Pericardial effusion >35-45 HU
- Rapid accumulation may lead to tamponade
- Scenarios
  - Status post cardiac surgery
  - Type A aortic dissection
  - Myocardial infarction
  - Ruptured coronary bypass graft
  - Coagulopathy
  - Trauma (stab wound, line puncture)
  - Neoplastic involvement
**Pericardial Tamponade**

- Collapse of RV, RA free wall during diastole
  - Tachycardia compensates for low stroke volume
- Beck’s triad
  - Hypotension, jugular venous distension, muffled heart sounds
- A clinical diagnosis, supported by imaging findings
- Often due to rapid accumulation of fluid in pericardial sac

**Type A aortic dissection with hemopericardium and tamponade.**

- Rapid filling of pericardial sac (no time for compensation)
- Inward bowing of anterior free wall of RA & RV
- Straightening or reversal of interventricular septum

**Pericarditis**

- A Clinical Diagnosis
  - Sharp chest pain, altered with change in position
  - Pericardial friction rub on auscultation
  - ST segment elevation on ECG
- Scenarios
  - Idiopathic (most common)
  - Infection (viral, bacterial, TB)
  - Post-viral (2-3 weeks later)
  - Autoimmune disease
  - Radiation
  - Myocarditis or post-MI
  - Renal failure (uremic)
  - Trauma

**Pericarditis**

- Inflammation of pericardial linings
  - Fibrin deposition on thickened visceral and parietal pericardium
  - Shaggy, yellow fibrinous exudate on gross inspection (‘bread & butter’)
- CT features
  - Smooth pericardial thickening
  - Enhancement of linings
  - Pericardial effusion

**Pericardial fluid analysis:**

- High white count
- No organisms
- Negative cultures

60 year old female 5 days s/p myocardial infarction due total occlusion left circumflex artery.
60 year old female 5 days s/p myocardial infarction due to total occlusion left circumflex artery.

- Posterolateral LV
- Papillary muscle

Myocardial hypoperfusion:

Post-MI Pericarditis (Dressler syndrome)
- Days/weeks after transmural infarct
- Pleuritic chest pain, pericardial rub, fever
- Inflammatory but STERILE pericarditis
- Pericardial effusion & enhancement
- (+/-) tamponade, loculation, pleural effusions, left lower consolidation

66 year old male with tuberculous pericarditis and contiguous abscess formation in the adjacent epigastrium.

Granulomatous inflammation in pericardium.

Pericarditis – Potential Sequelae
- Fibrosis
- Adhesion
- Calcification
- Constriction

Pericardial Constriction
- Reduced diastolic filling (symptomatic)
  - Constriction
    - Conical ventricles, paradoxical septal “bounce”, adherence, dilated atria
    - Venous congestion
      - large IVC, hepatic congestion, ascites
- Pericardial thickening >4mm (may be normal)
  - Delayed enhancement on MRI
- Pericardial calcification (up to 50% cases)
- Scenarios
  - Healed or chronic pericarditis
  - Prior cardiac surgery or infarct
  - Thoracic radiotherapy

40 year old male status post liver and kidney transplant with extensive pericardial calcification & constrictive physiology.
65 year old male asymptomatic, with no constrictive physiology.

The PRESENCE of pericardial calcification DOES NOT ensure the diagnosis of constriction, and the ABSENCE of calcification does not exclude it.

60 year old male with lung carcinoma, left lower lobe.

Dx: Metastatic Disease to the Pericardium

Metastatic Disease to the Pericardium

- Hematogenous, lymphatic, and contiguous routes
- Nodularity (tumor deposition), fibrinous exudates, hemorrhagic effusion
- Tamponade (15-30% of cases)
- Lung, breast, lymphoma, melanoma, renal, cardiac angiosarcoma

42 year old male with right atrial angiosarcoma.

Pericardium & Primary Malignancy

- Lipoma
- Hemangioma
- Lymphangioma
- Benign Teratoma
- Paraganglioma
- Mesothelioma
- Sarcoma

Dx: Pericardial Lipoma

- Complications rare
- Caval obstruction
- Dysrhythmias
Dx: Pericardial Lymphangioma

Pericardium: The Essentials

- Pericardial sinuses & recesses mimic pathology
  - Knowledge of normal anatomy, classic morphology & fluid density avoids misdiagnosis
- A pericardial cyst has diagnostic imaging features
  - Cardiophrenic angle location, thin non-enhancing mesothelial capsule, simple fluid content
- Pericarditis = clinical expression of mesothelial inflammation with fibrinous exudates
  - CT & MRI may demonstrate pericardial effusion with smooth pericardial thickening & rapid contrast enhancement

Pericardium: The Essentials

- Hemopericardium often accumulates rapidly, increasing the risk of tamponade
  - Pericardial effusion approaches soft tissue density (>35-45 HU)
  - Pericardial sac cannot accommodate enlarging effusions without adequate time to stretch & hypertrophy
- Pericardial constriction = impaired diastolic filling caused by non-compliant adherent pericardium
  - Conical ventricular deformity, dilated atria, pericardial thickening & paradoxical septal "bounce" are supportive imaging findings
  - Pericardial calcification may be present but is NOT diagnostic of constrictive physiology

Pericardium: The Essentials

- Metastatic disease to the pericardium
  - May produce nodular pericardial thickening & enhancement, adhesions, effusion (occasionally hemorrhagic) & even tamponade
  - Lung cancer is the most common primary
- Primary pericardial malignancy is rare
  - Lipoma, hemangioma, lymphangioma, benign teratoma, mesothelioma, sarcoma & schwannoma are reported