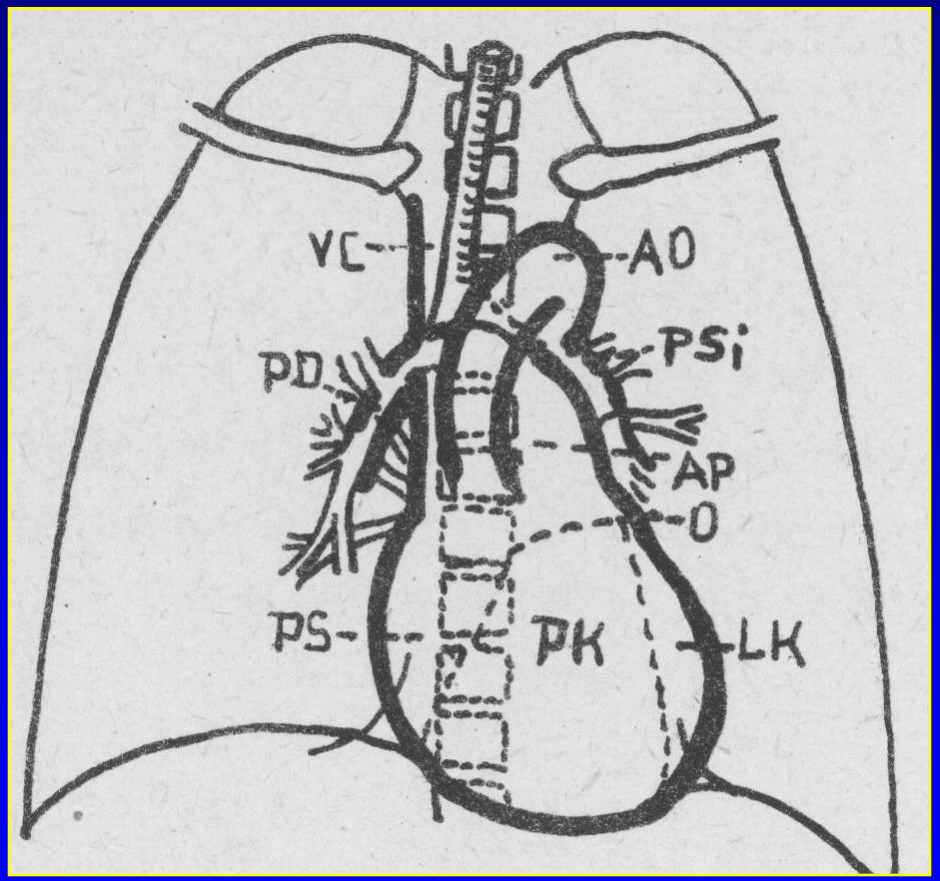
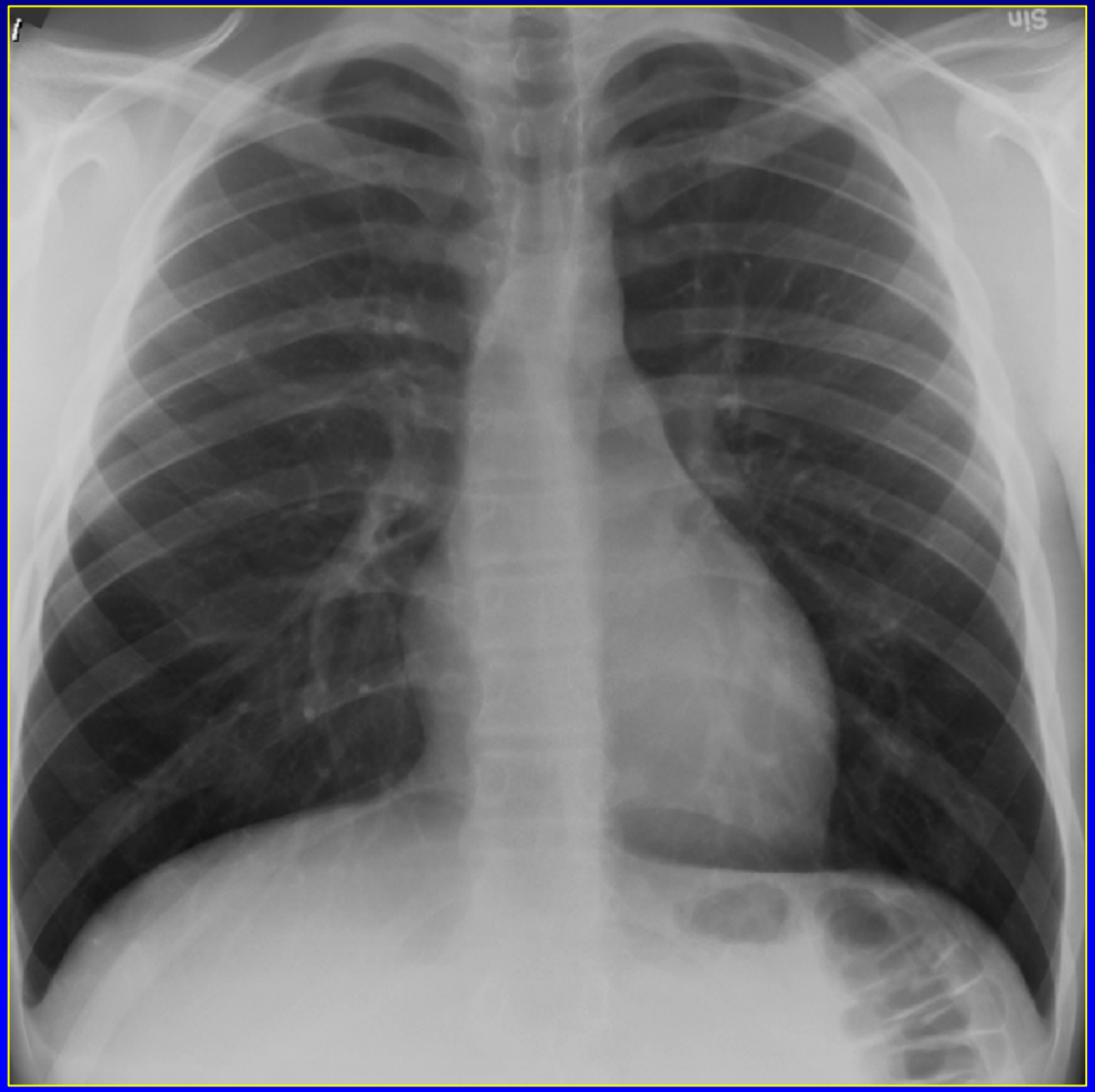
Cardiac Imaging

Anatomy & imaging methods



Schema of heart silhouette in sagittal projection

Chest X-ray

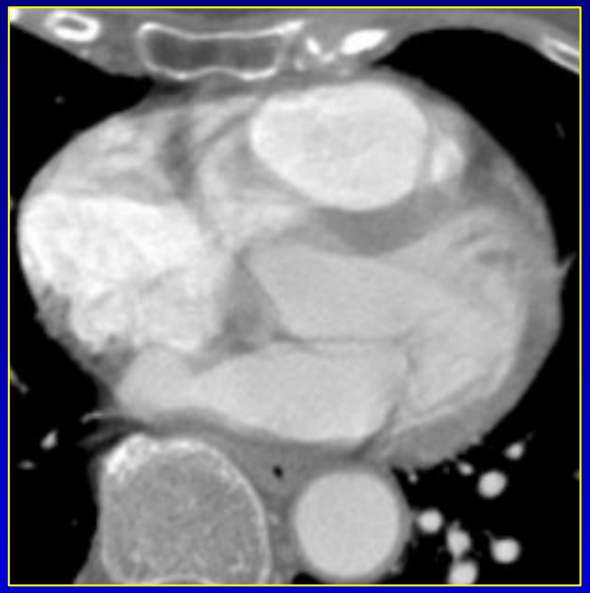


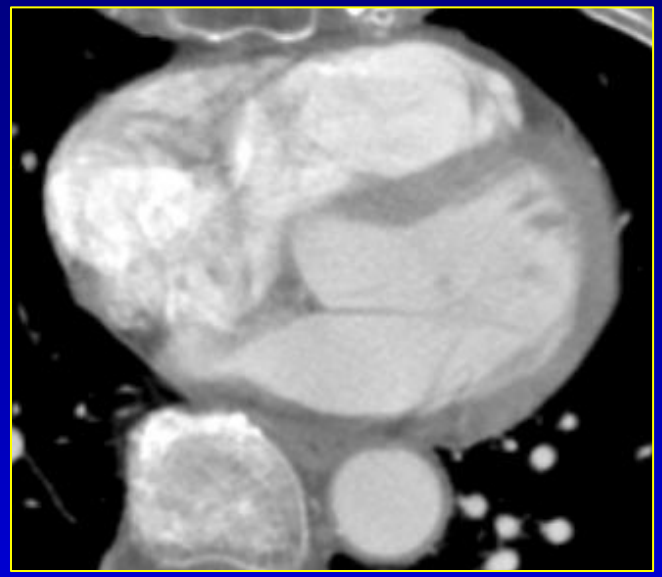
Chest X-ray

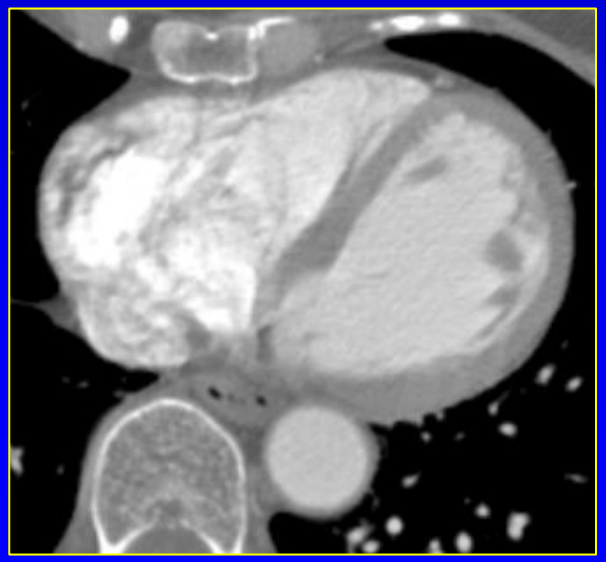
Chest X-ray

Chest X-ray

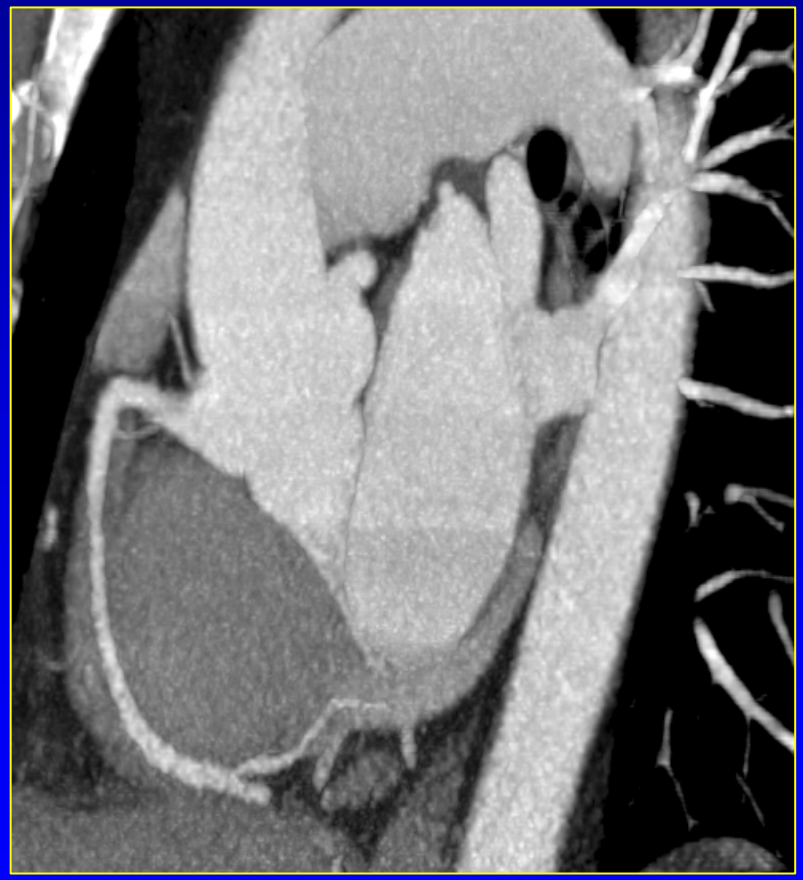
CT axial anatomy – MSCT

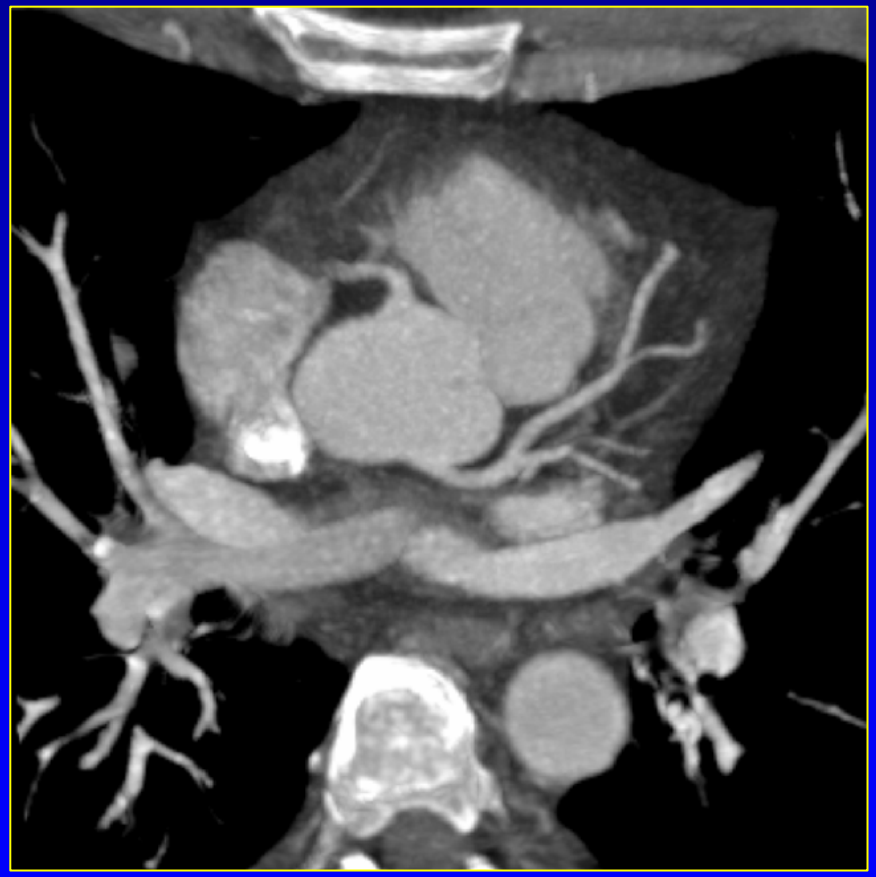




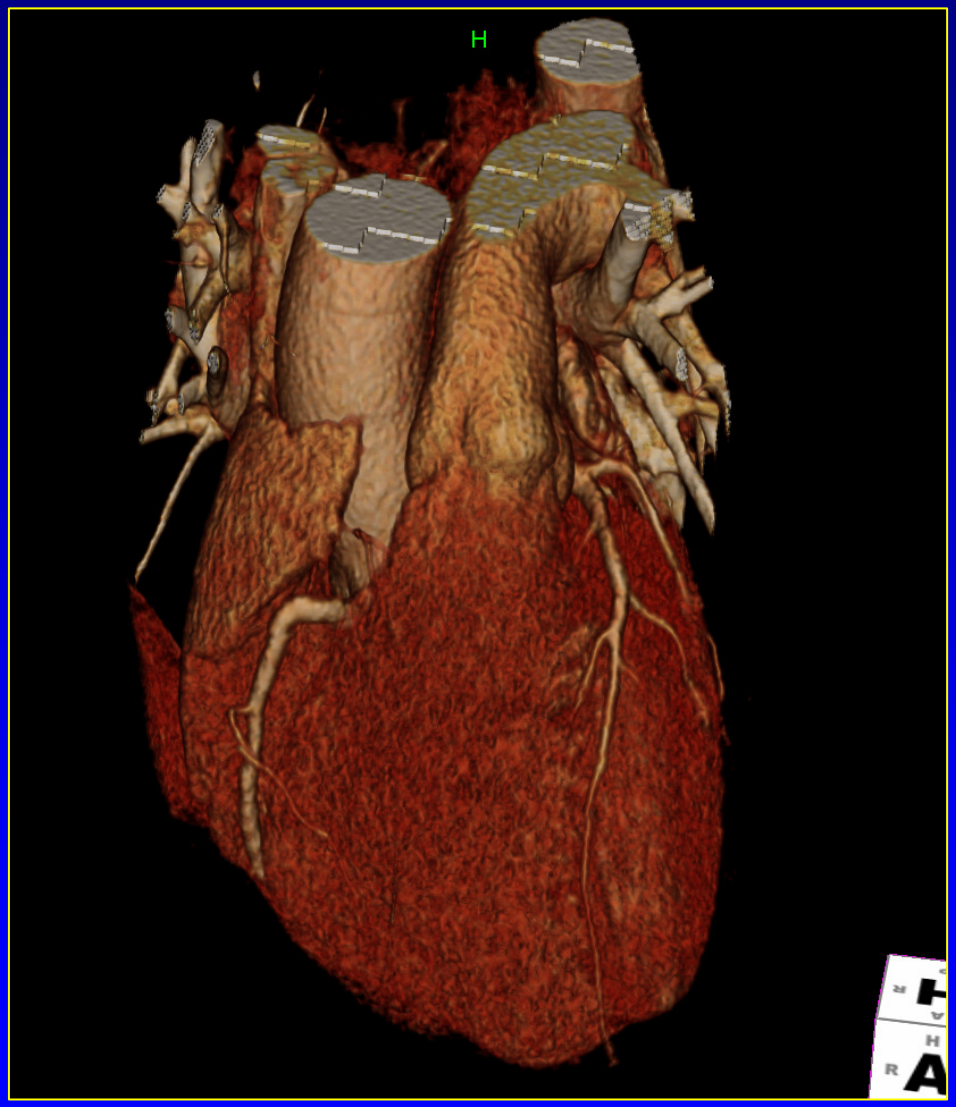


CT MIP and MPR reconstructions
Coronary arteries

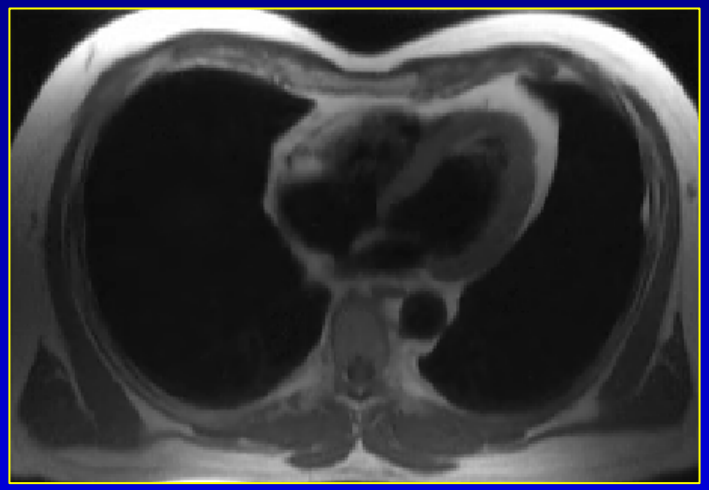


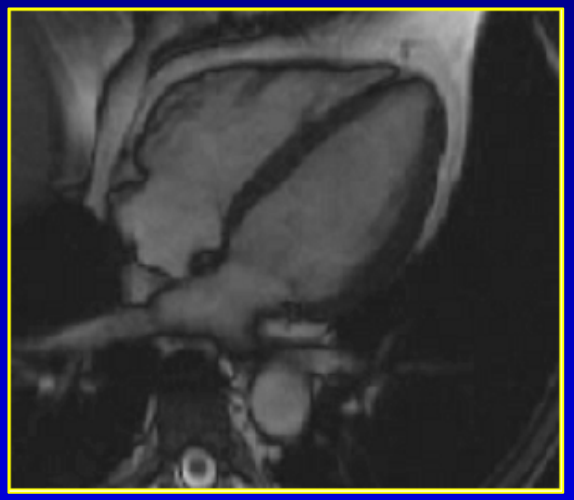


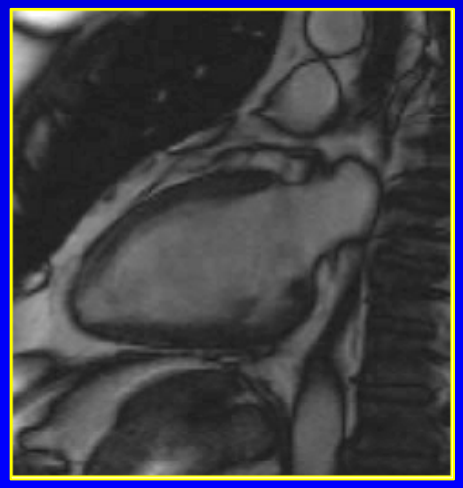
CT – VRT reconstruction

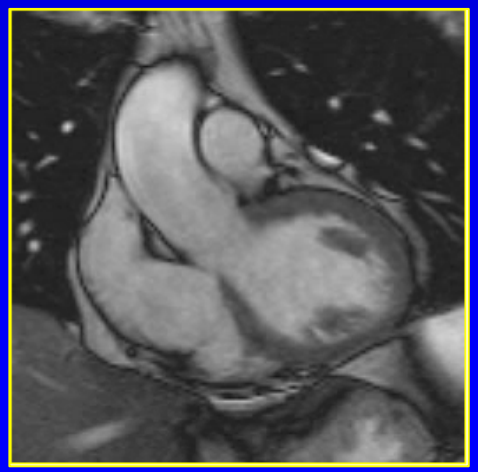


MR – different planes



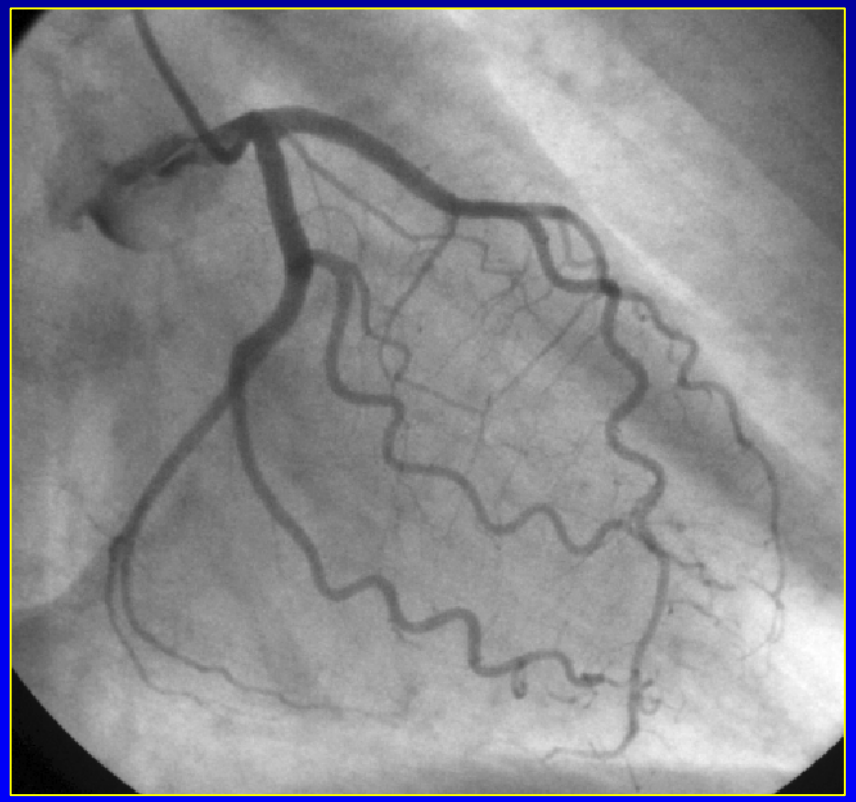


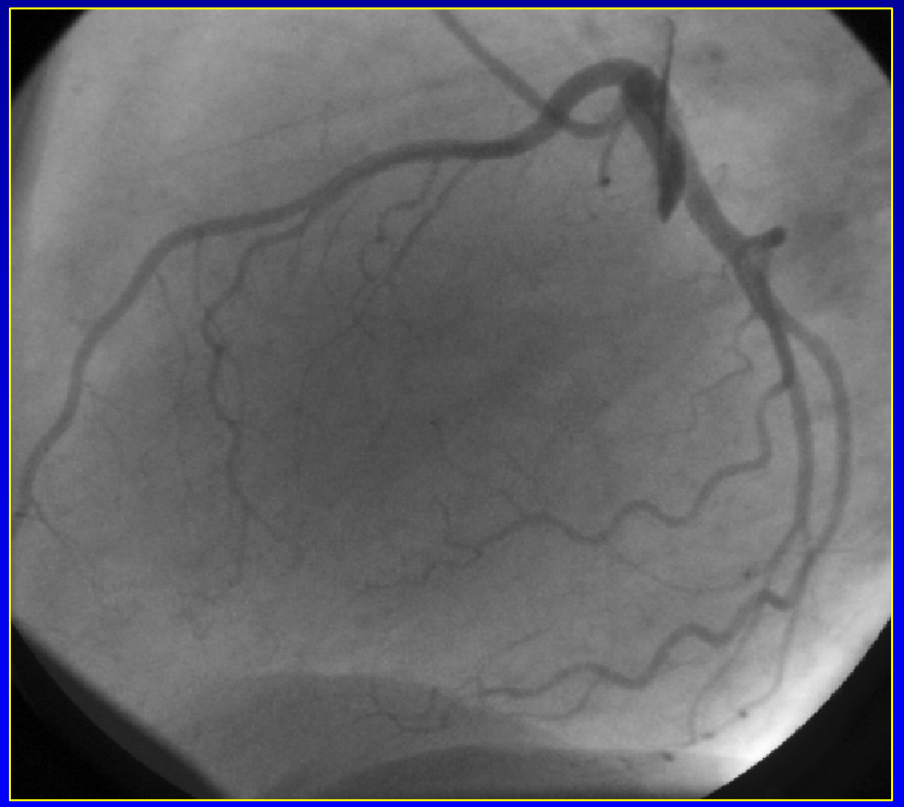




Coronarography

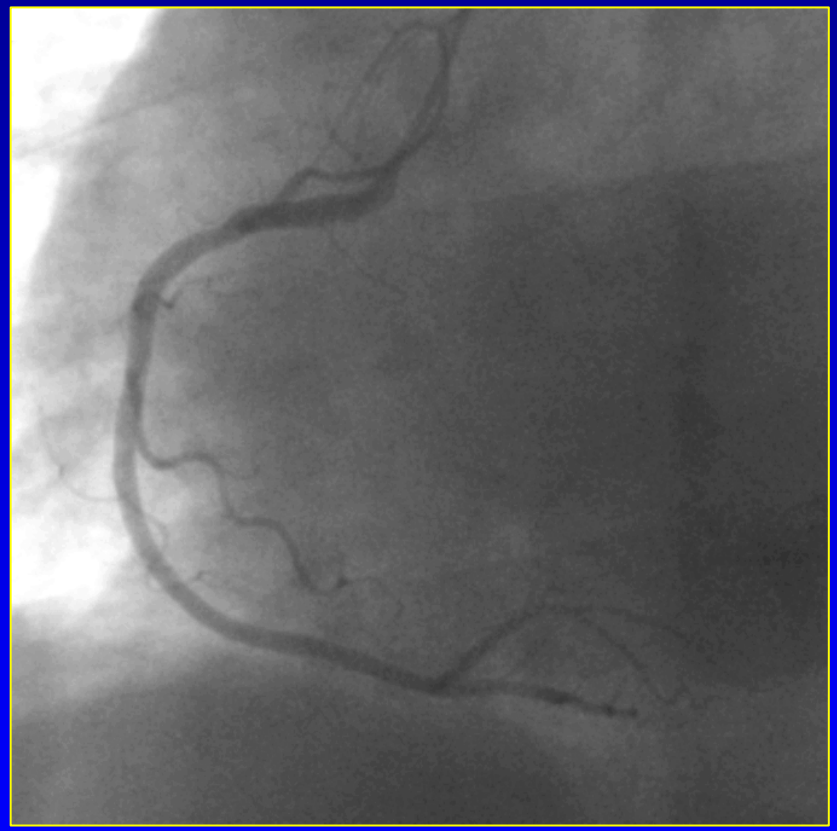
Left coronary artery

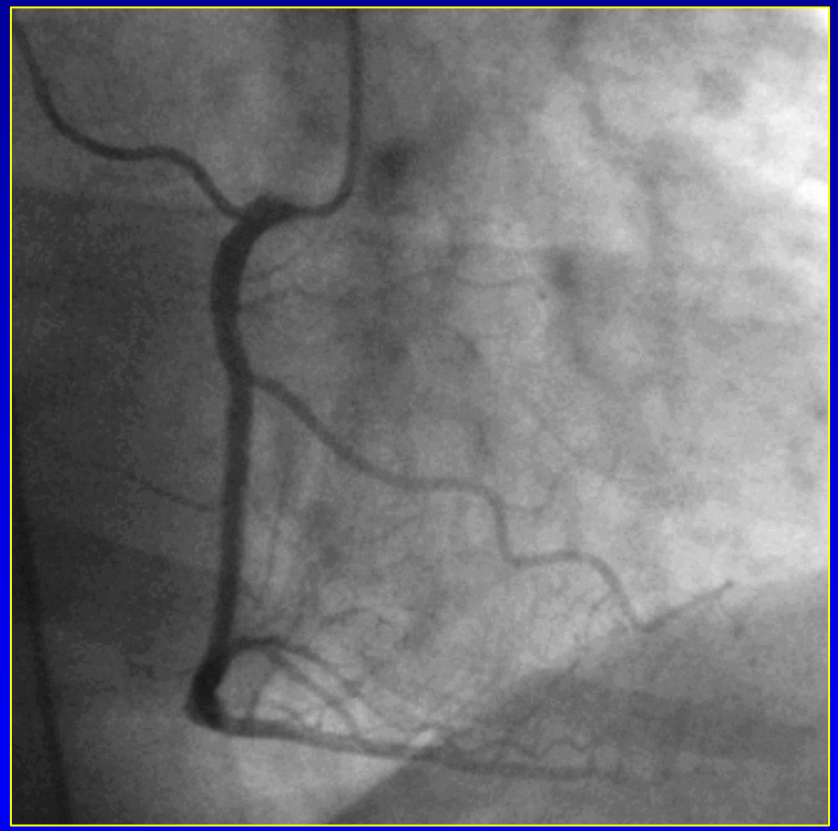




Coronarography

Right coronary artery

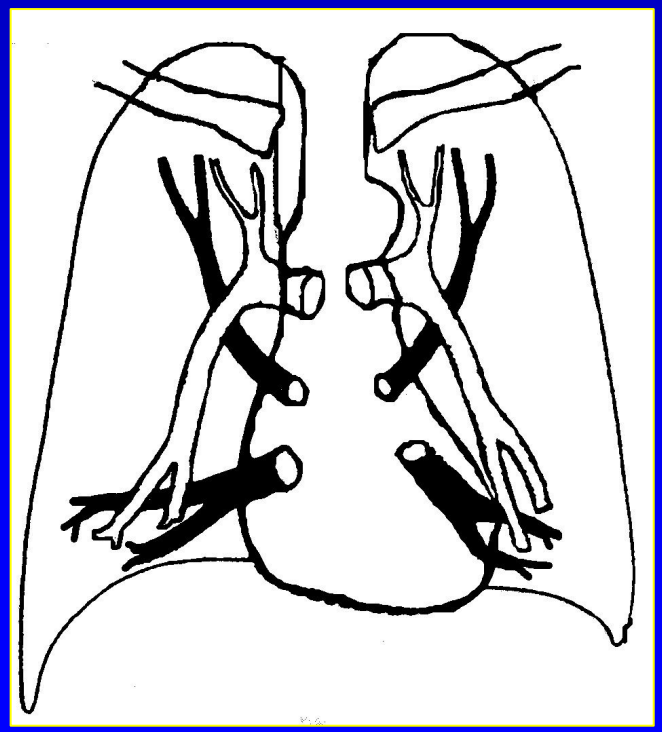


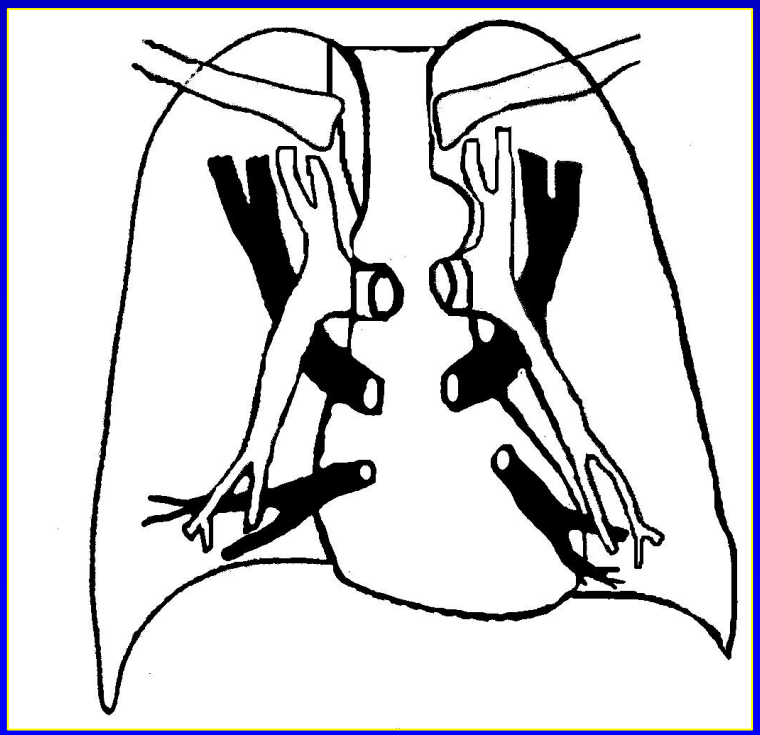


Pathologic findings: plain chest film

Lung vascular pattern

- **Normal**
  - Visible to 2/3 of lungs, the width of truncus intermedius a. pulm. to 14 mm
  - Craniocaudal Q quotient 0,8 A/B to 1,2 (till 1,4)
- **Widened**
  - Wide shadows visible to the periphery, craniocaudal index Q = 1
- **Poor**
  - Narrow shadows not visible to the periphery, narrow pulmonary artery, increased transparency



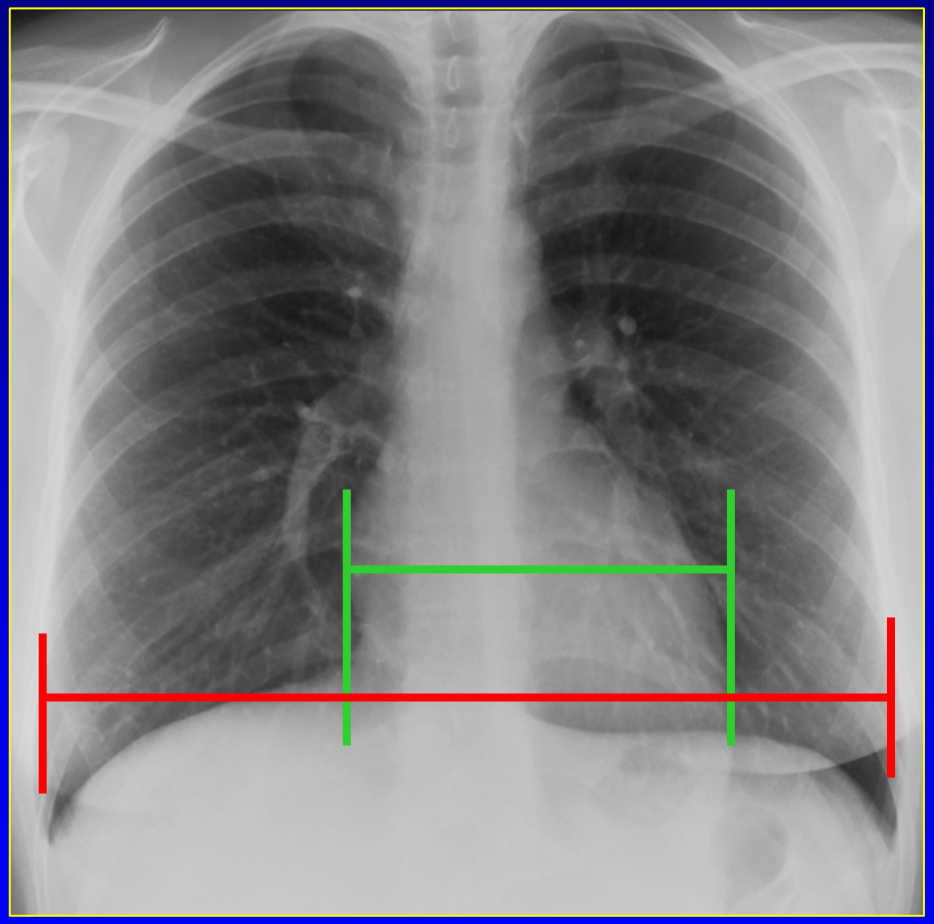


Cardiomegaly

- **Cardiomegaly vs. enlargement of the heart chambers**

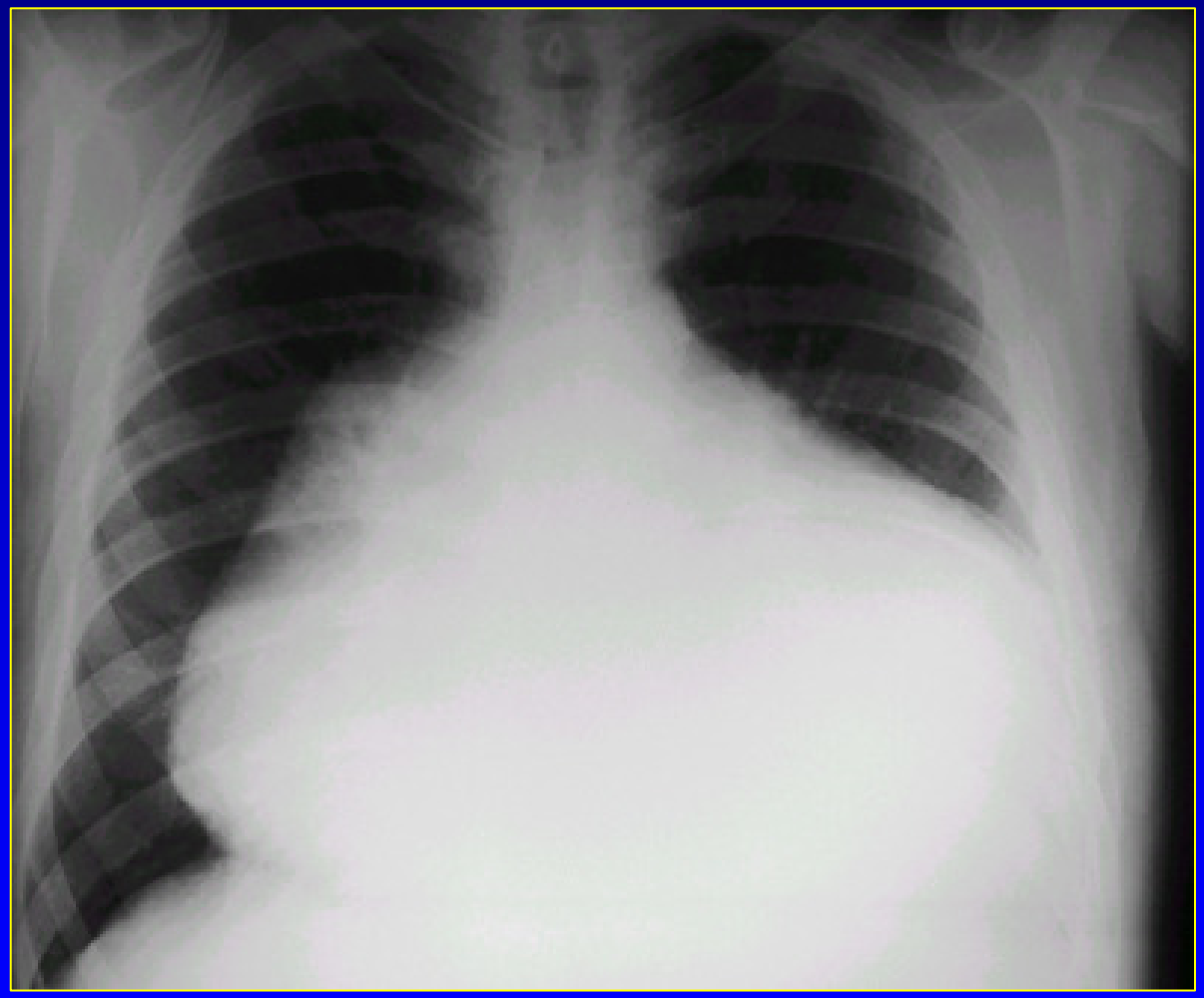
1) Valvular diseases
2) Pericardial effusion
3) Atrial septal defect
4) Eisenmenger syndrom
5) Cardiomyopathy
6) Ebstein malformation
7) Myocarditis

Cardiomegaly



Measurement of the Cardiothoracic ratio:
A / B < 0.5 is normal (< 0.6 in infants).

Cardiomegaly

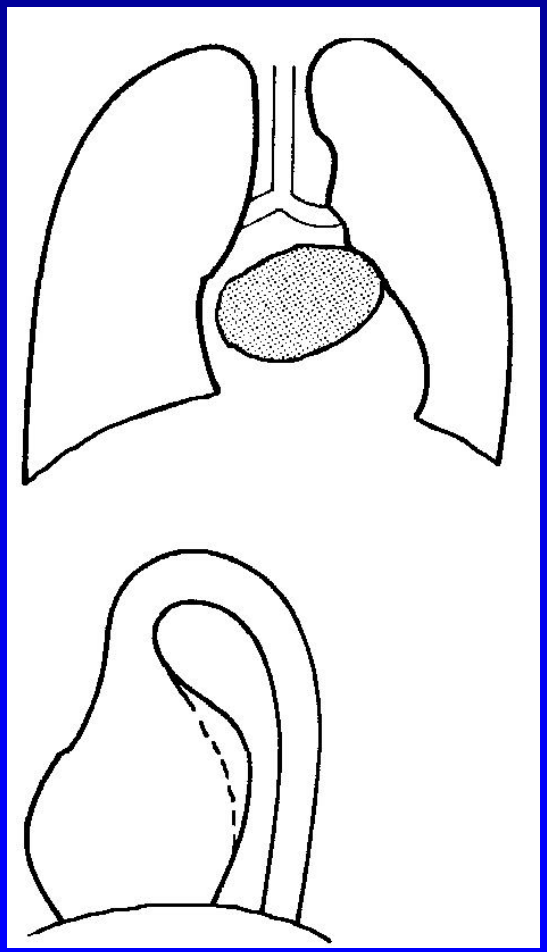


Pericardial effusion

Enlargement of the L atrium

- **preload -** mitral insufficency, atrial and ventricular septal defects, ductus arteriosus patens
- **afterload -** mitral stenosis
- **secondary in the left ventricle insufficiency**

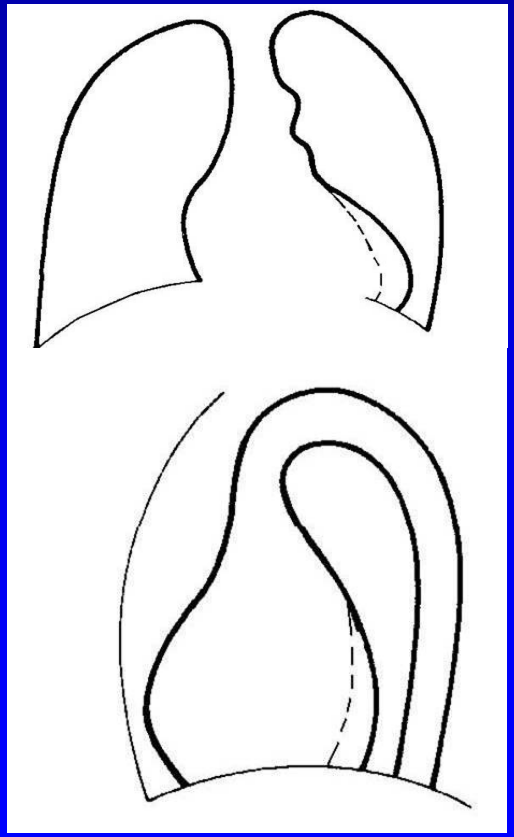
LA – dorsally



Enlargement of the L ventricle

- **myocardial disease –** ischemic heart disease, myocarditis, cardiomypathy
- **preaload -** aortic resp. mitral insuf., atrial septal defect, ductus arteriorus patens
- **afterload -** aortic stenosis,coarctation, systemic hypertension
- **enormous blood flow -** anemia, arterio-venous fistula

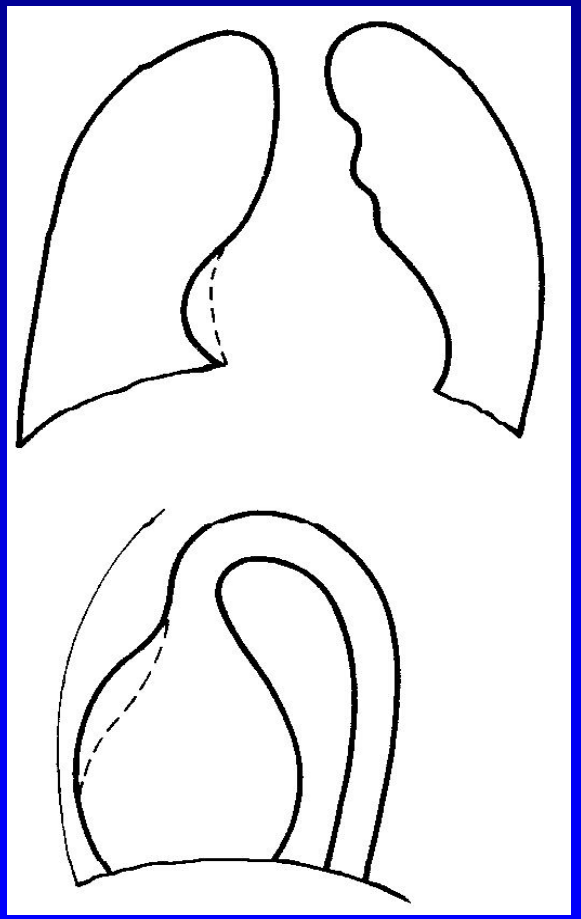
LV -apex to the left and laterally



Enlargement of the R atrium

- **Preload (volume) –**
  tricuspid insfuficency, atrial septal defect, ebstain anomaly
- **Afterload (pressure) –**
  pulmonary hypertension
- **Right ventricle insufficiency**

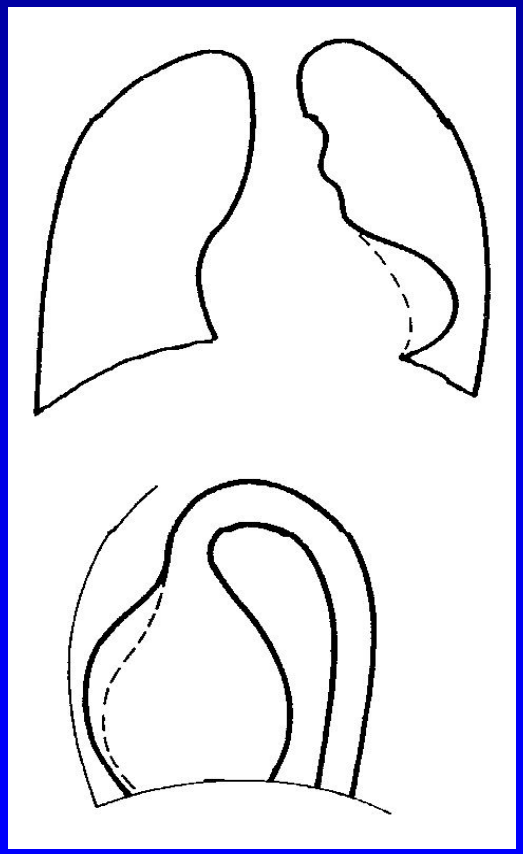
RA – right contour



Enlargement of the R ventricle

- **secondary in the left heart**
  = postcapillary pulmonary
- **hypertension** - left ventricle insufficiency, mitral disease
- **pulmonary hypertension** - PE, COPD, idiopathic
- **afterload** - pulmonary valvar stenosis
- **preload** - ASD, VSD

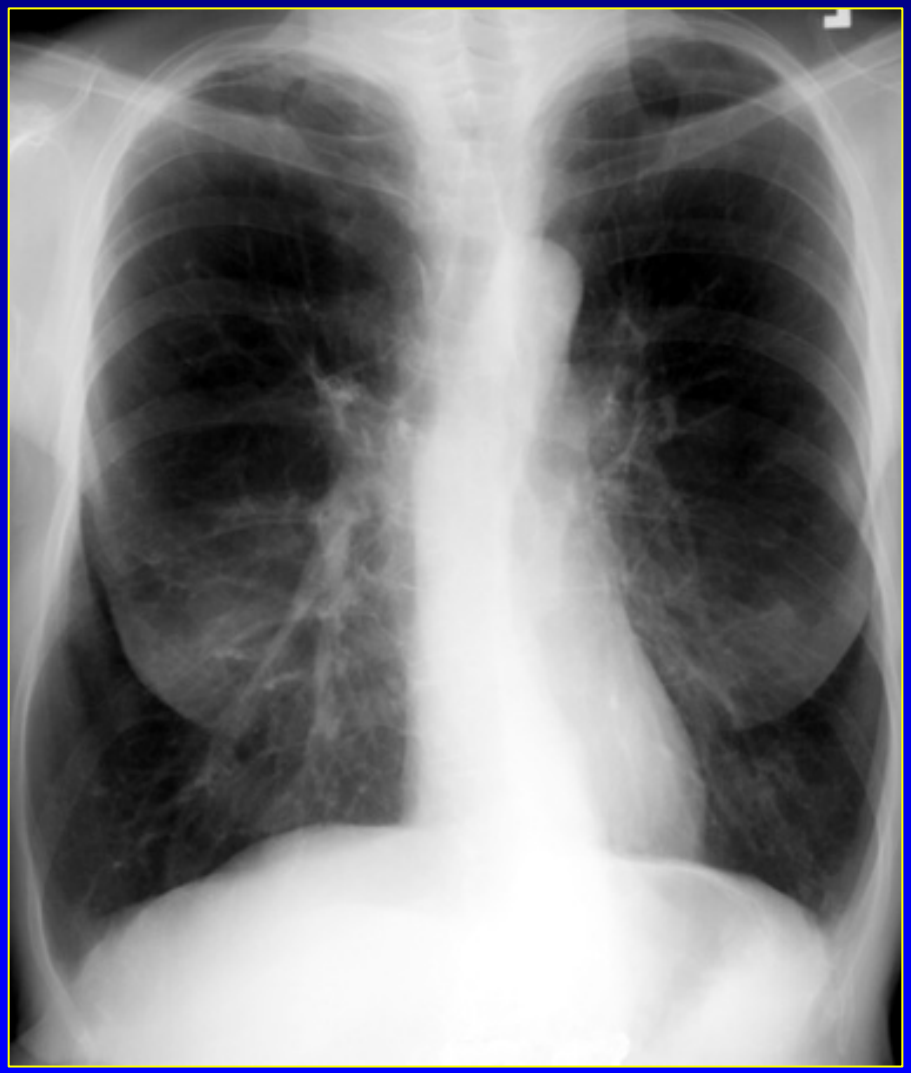
RV – cranial displacement of the apex



Small heart shadow

1) Lung emphysema
2) Dehydratation
3) Constrictive pericarditis

Small heart shadow



Lung emphysema:

- increased lung volumes
- flattened diaphragms
- wide separation of the ribs
- elongated narrow heart shadow
- pulmonary vessels appear to be diffusely decreased

Heart diseases

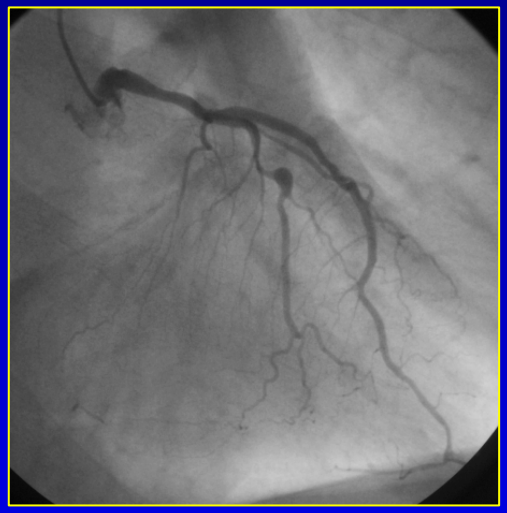
Heart diseases of adults

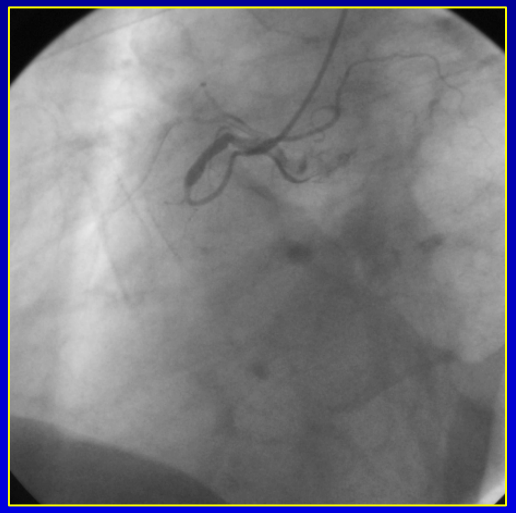
- **Ischemic heart disease**
  - X-ray (lung congestion, cardiomegaly, Kerley lines, pleural effusion)
  - AG (coronarography)
    - Atherosclerotic changes – stenosis, occlusion, thrombus
    - Percutaneous Transluminal Angioplasty
  - ECHO
  - CT
  - MR
  - Nuclear medicine

Heart diseases of adults

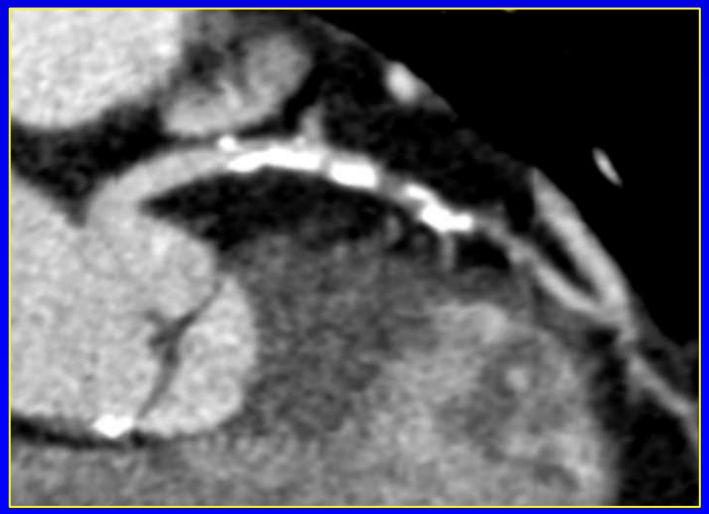
- **Ischemic heart disease**

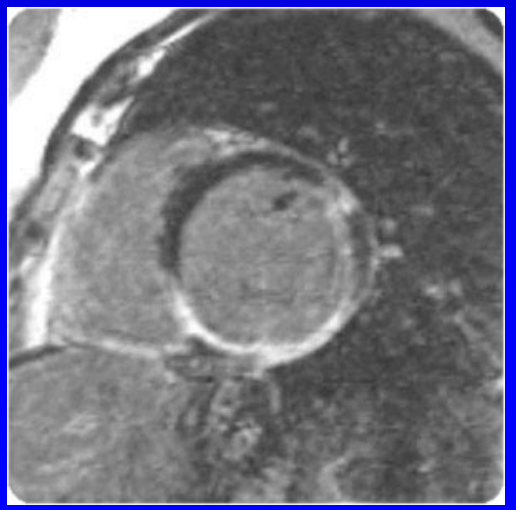
Coronary AG





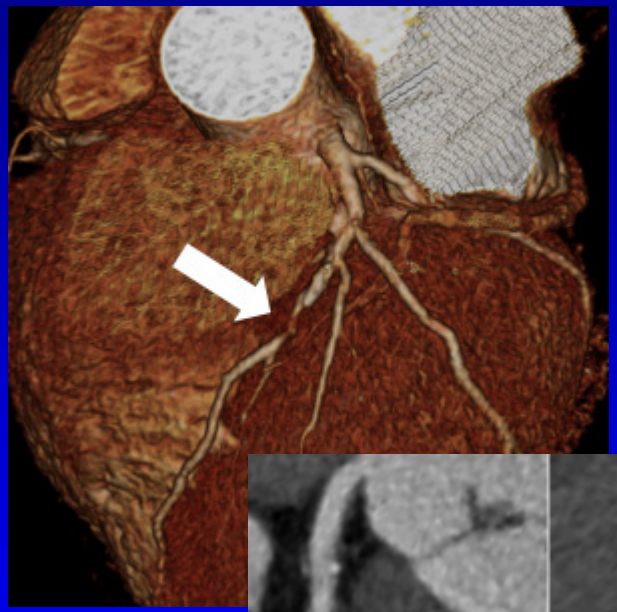
CT



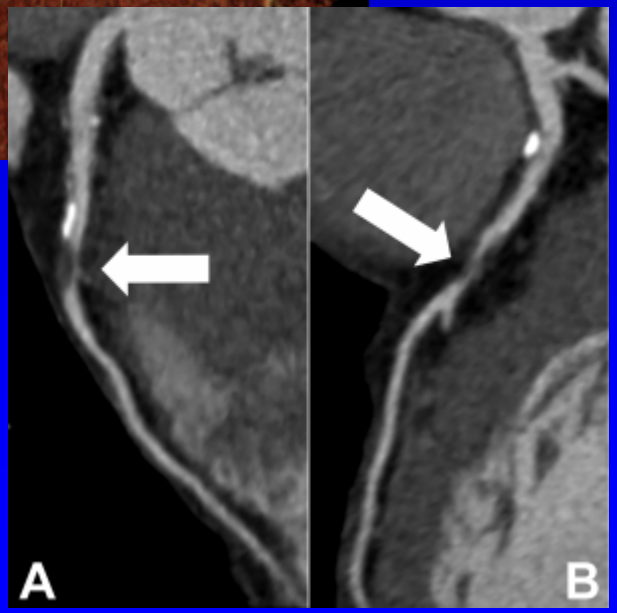


MR

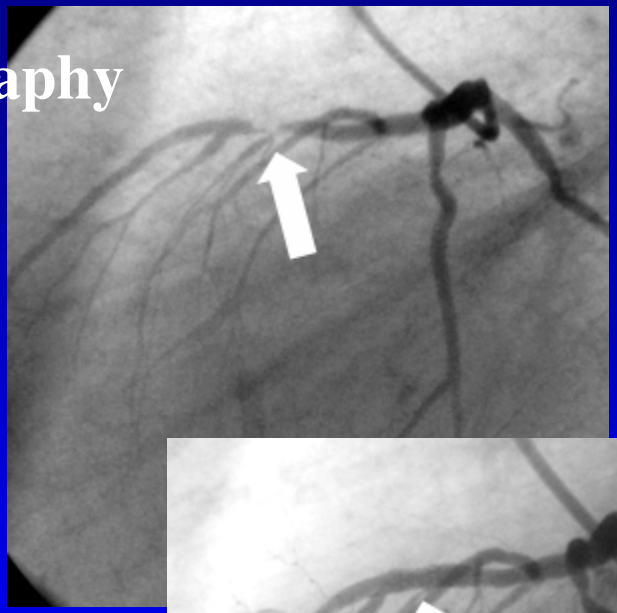
Stenosis of LAD

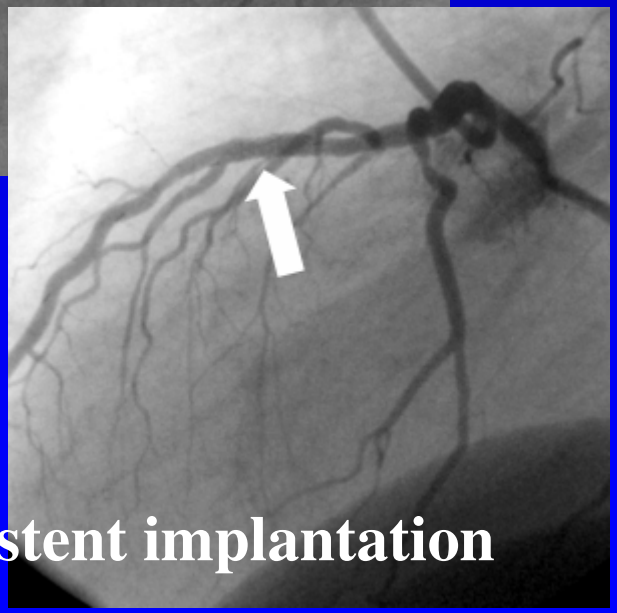


CT



Angiography





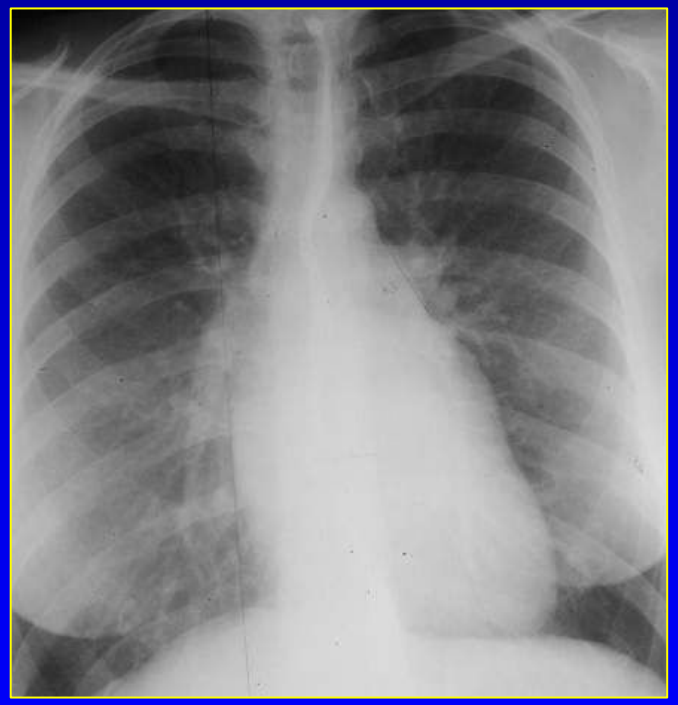
after stent implantation

Heart diseases of adults

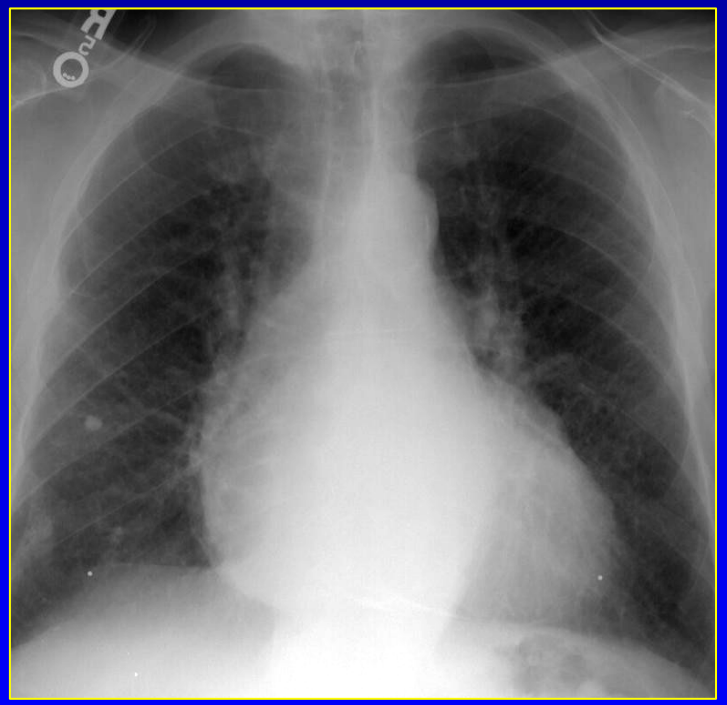
- **Valvular diseases – insufficiency, stenosis**
  - **X-ray**
    - **Indirect changes (enlargment of chambers, pulmonary vessels)**
  - **Echocardiography**
    - **Morfology, flow**
  - **CT**
    - **Morfology**
  - **MR**
    - **Morfology, flow**

Heart diseases of adults

- **Valvular diseases**



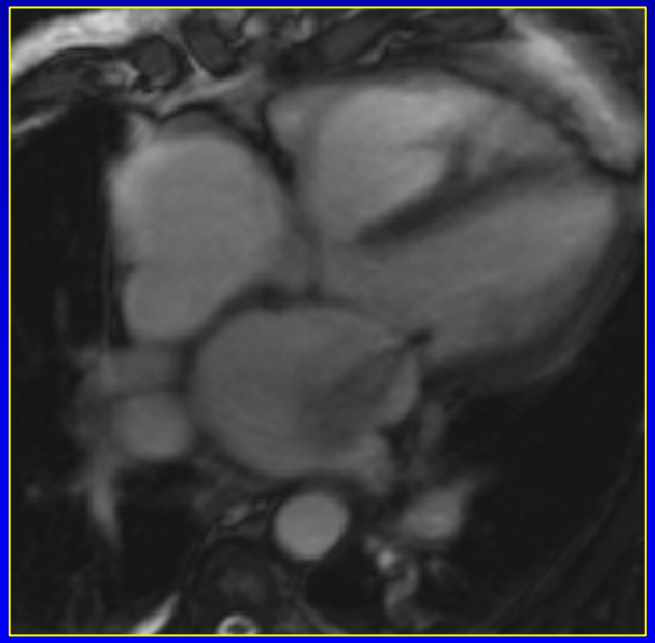
MRI: Mitral stenosis



MRI: Mitral regurg.

Heart diseases of adults

- **Valvular diseases**



MRI: Mitral regurg.

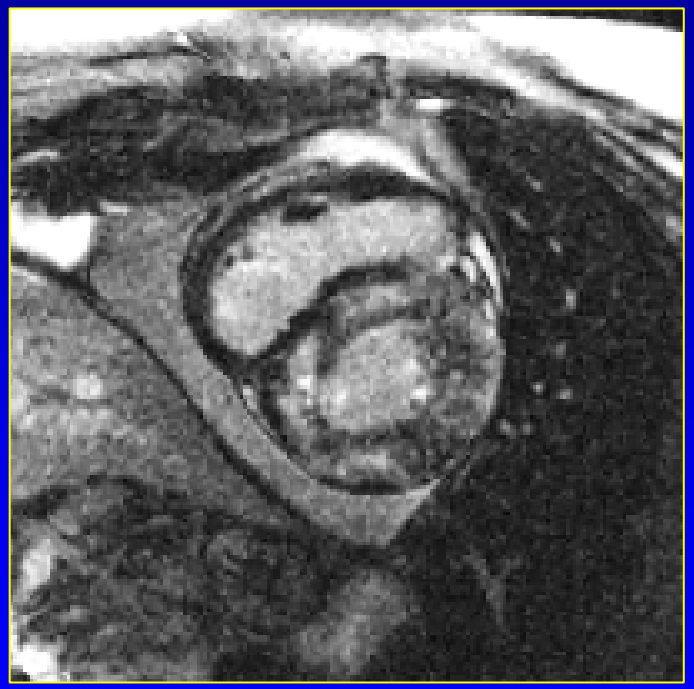
MRI: Aortic stenosis

Heart diseases of adults

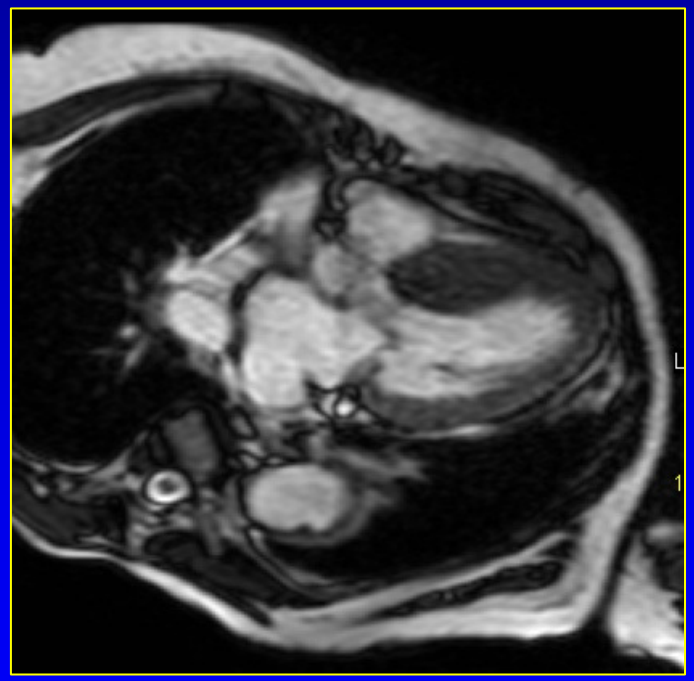
- **Myocardial diseases**
  - **Myocarditis, Cardiomypathy**
  - **(X-ray)**
  - **Echocardiography**
  - **CT**
  - **MR**

Heart diseases of adults

- **Myocardial diseases**



MRI: Myocarditis



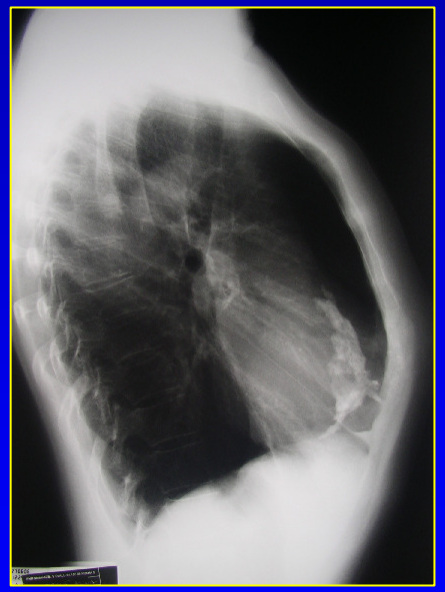
MRI: HOCM

Heart diseases of adults

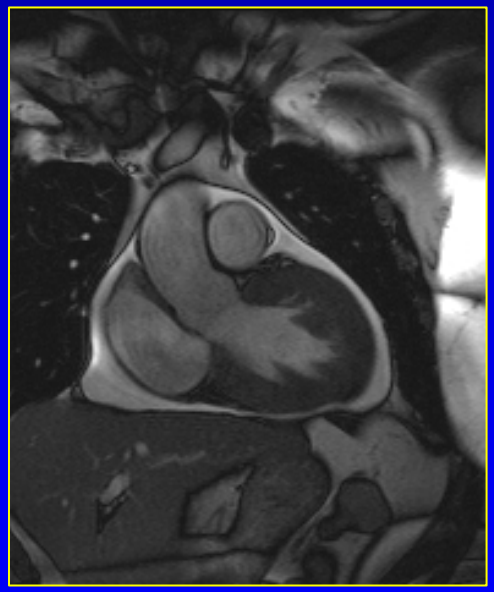
- **Pericardial diseases**
  - **Paricarditis acute, Constrictive pericarditis**
  - **with or without effusion**
  - **X-ray**
    - **Effusion** – widening of shadow, tent shape, change shape according to the position
    - **Constrictive p. - calcification**
  - **Echocardiography**
  - **CT**
  - **MR**

Heart diseases of adults

- **Pericardial diseases**



X-ray and CT: Pericardial constriction



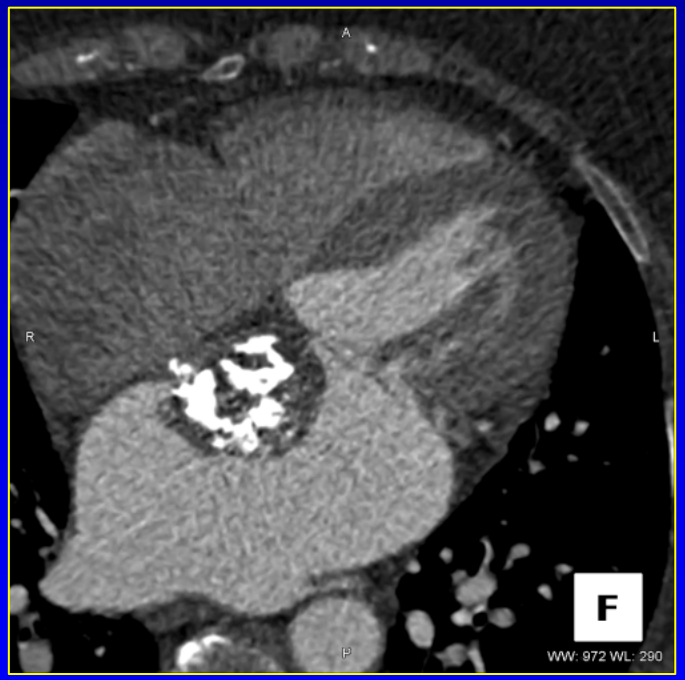
MR: Effusion

Heart diseases of adults

- **Tumors and pseudotumors**
  - **Localization: pericardial, myocardial, intracavital**
  - **Thrombus, myxoma, fibroma, angiosarcoma, rhabdomyosarcoma, vegetation (infective endocarditis), metastasis, pericardial cyst**

Heart diseases of adults

- Tumors and pseudotumors



CT: Myxoma of LA

MRI: Myxoma of LA

Congenital heart disease

Congenital heart disease

- **Cardiac defects**
  - Atrial septal defect
    - L→P shunt: cardiomegaly, RA, RV and PA enlargement, increased pulmonary vascularity
  - Ventricular septal defect
    - L→P shunt: cardiomegaly, LA enlargement, increased pulmonary vascularity
  - Tetralogy of Fallot
    - VSD, overriding of aorta, pulm. stenosis, RV hypertrophy
    - Coeur en sabot (wooden-shoe heart), pulmonary hypovascularity
  - Ebstain's anomaly
    - Displacement of tricuspid valve into the right ventricle, cardiomegaly - globular heart

Congenital heart diseases

- **Vascular abnormalities**
  - **Persistent ductus arteriosus**
    - **L→P shunt, PA, LA, LV and ascending aorta enlargement, increased pulmonary vascularity**
  - **Coarctation of the aorta**
    - **Figure 3 sign, CM, LV hypertrophy, costal indentation**
  - **Pulmonary stenosis**
    - **Poststenotic dilatation of the trunk and left main pulmonary artery, RV hypertrophy**
  - **Transposition of the great arteries**
    - **Ovoid heart configuration, narrow vascular pedicle, increased pulmonary vascularity**

Congenital heart diseases Diagnostic algorithm

- **ECHO (US)**

  Valves, pericardial fluid, intraluminal changes

- **X-ray**

  Heart size and configuration, size of the heart chambers, pulmonary vascularity, effusion

- **Angiography, Coronarography**

  size and shape of chambers, blood flow, coronary anomalies

- **MR**

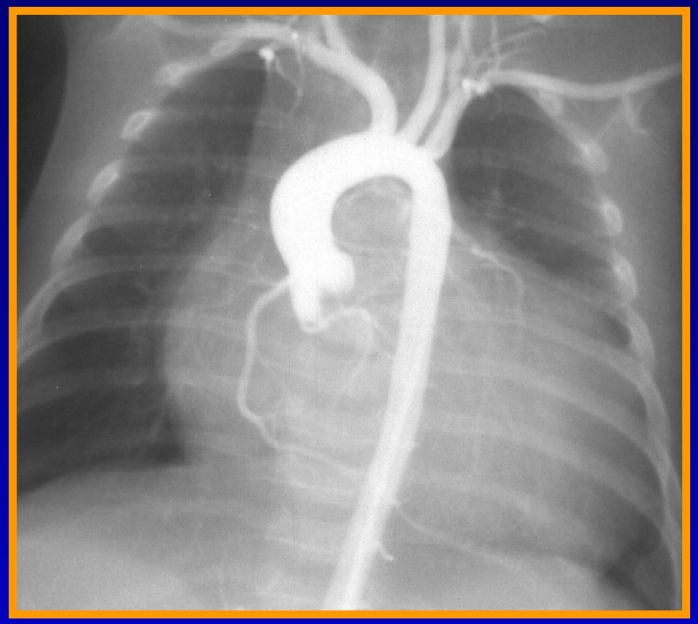
  Complex assessment of the intra- and extracardial findings, myocardial perfusion

ASD

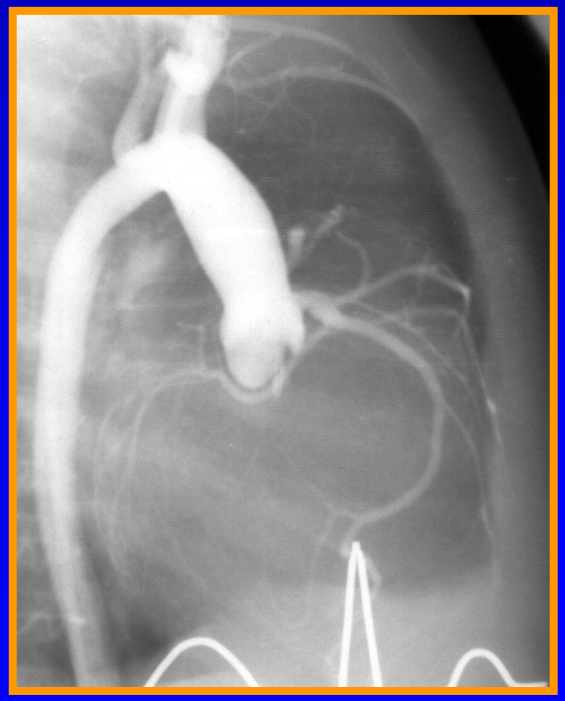
-cardiomegaly,
-right atrial prominence,
-upturned apex,
- increased pulmonary vascular markings

VSD

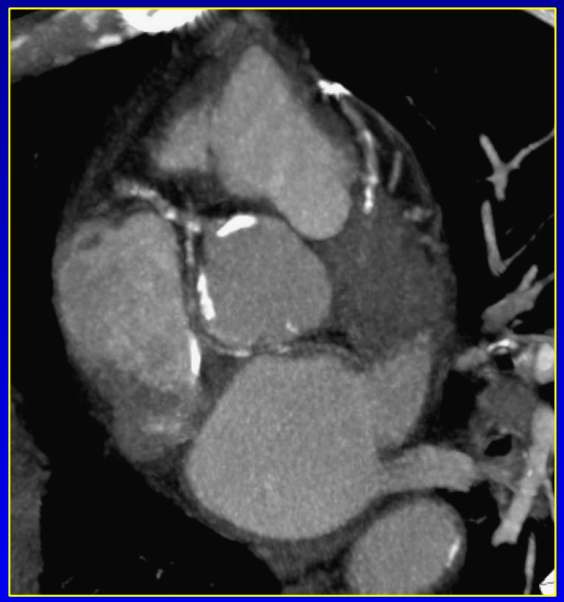
-normal cardiac size
-main pulmonary artery enlarged
-Peripheral vasculatur small



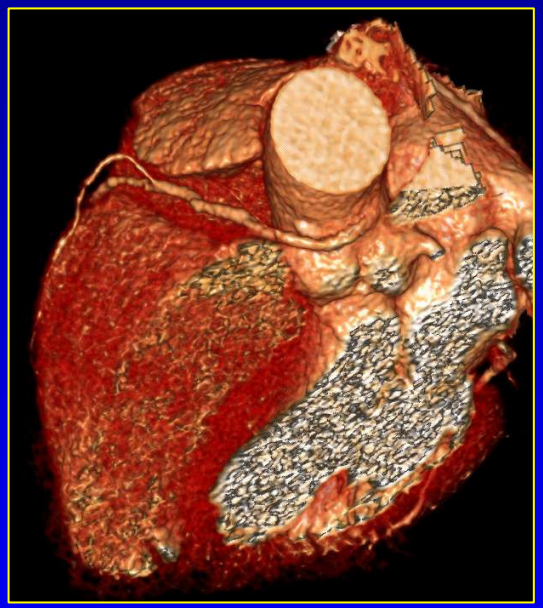
Anomaly origin of r. interventricularis ant. left coronary artery from lung artery



CT

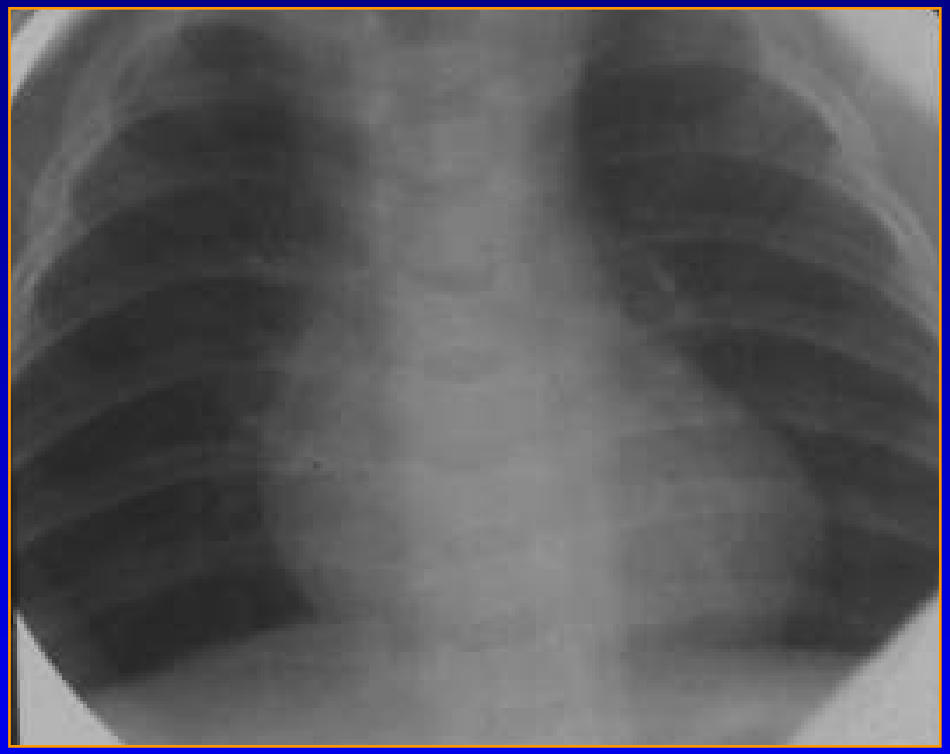


RCx from ACD



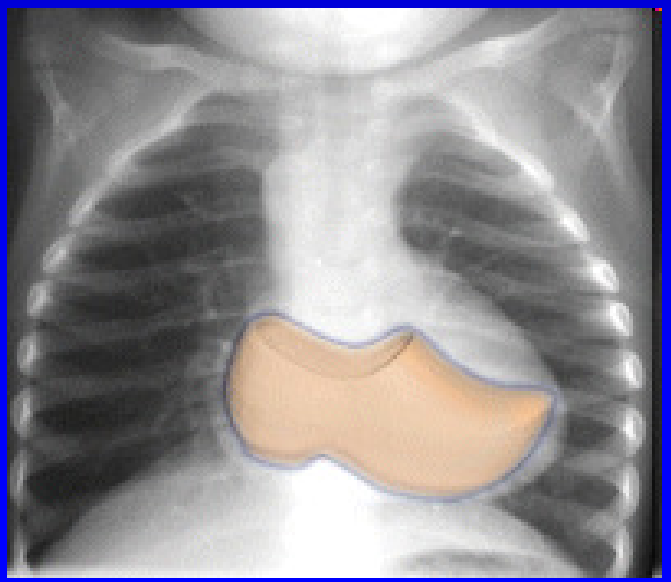
ACD from left sinus

Myocardial bridge



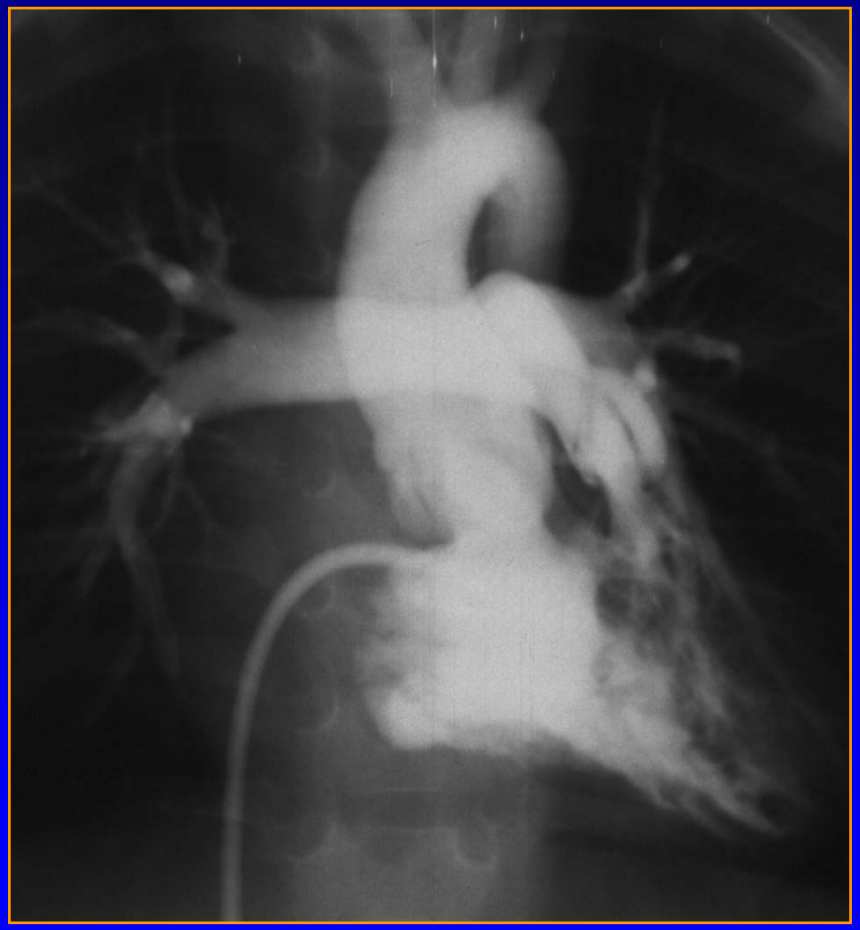
Fallot´s tetralogy

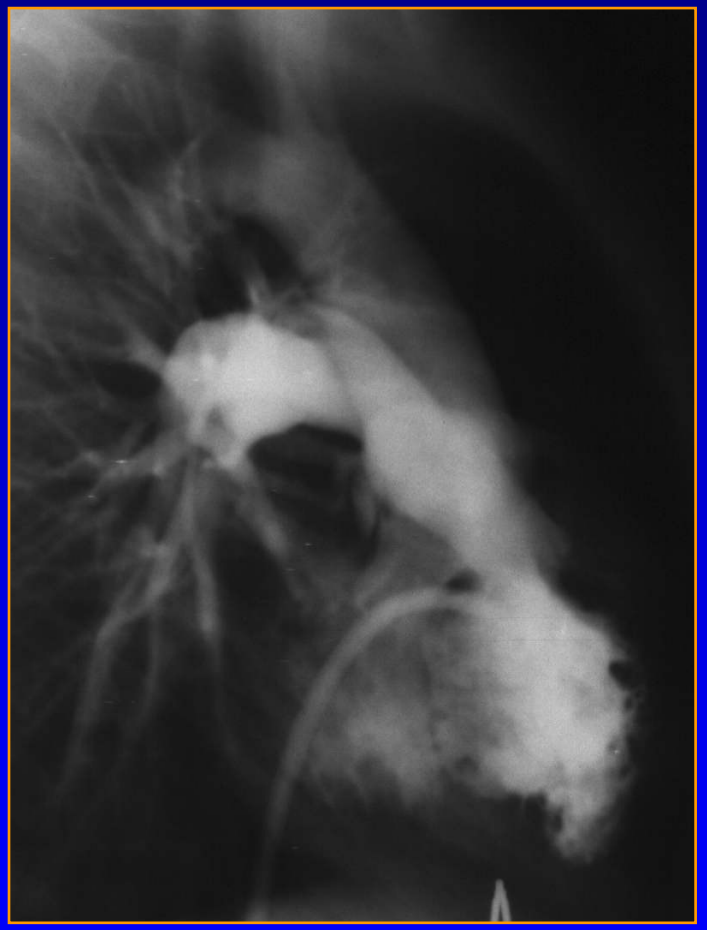
- Normal size heart
- Silhouette is normal or prominent RV
- Concavity of in the main pulm. artery
- Lifted apex
- Right aortic arch (25%)



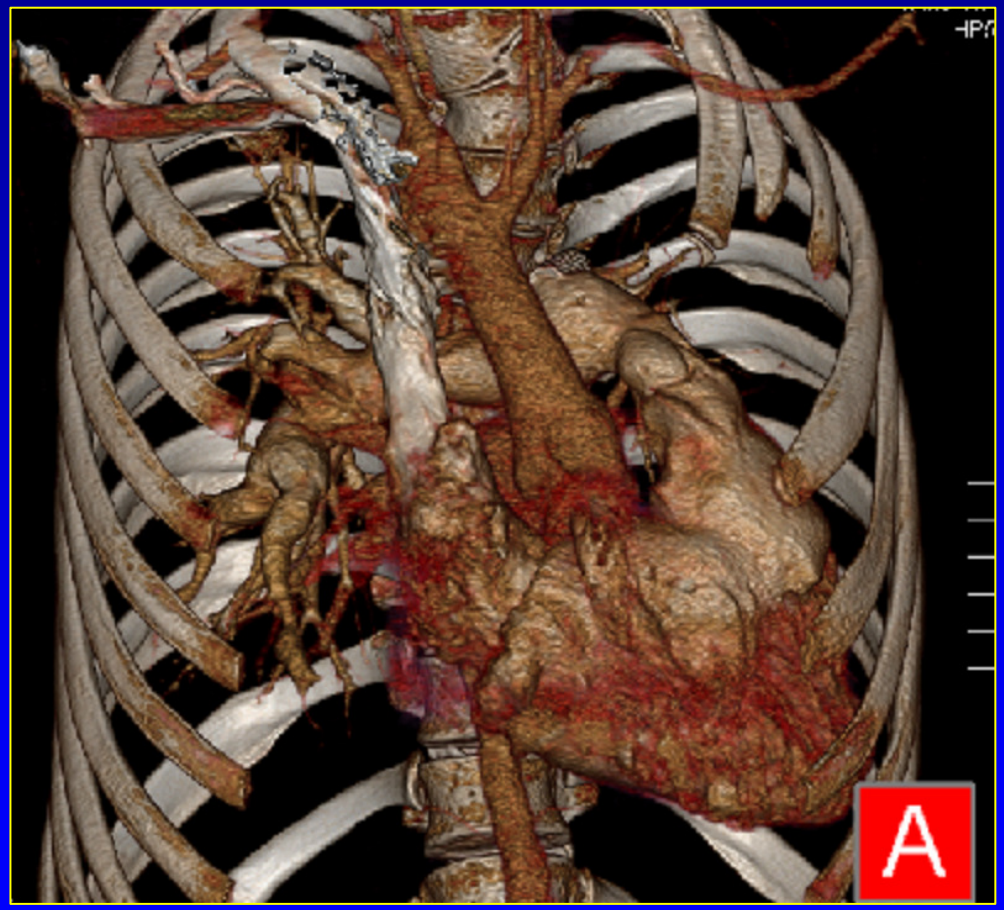
Coeur en Sabot Sign

Fallot´s tetralogy

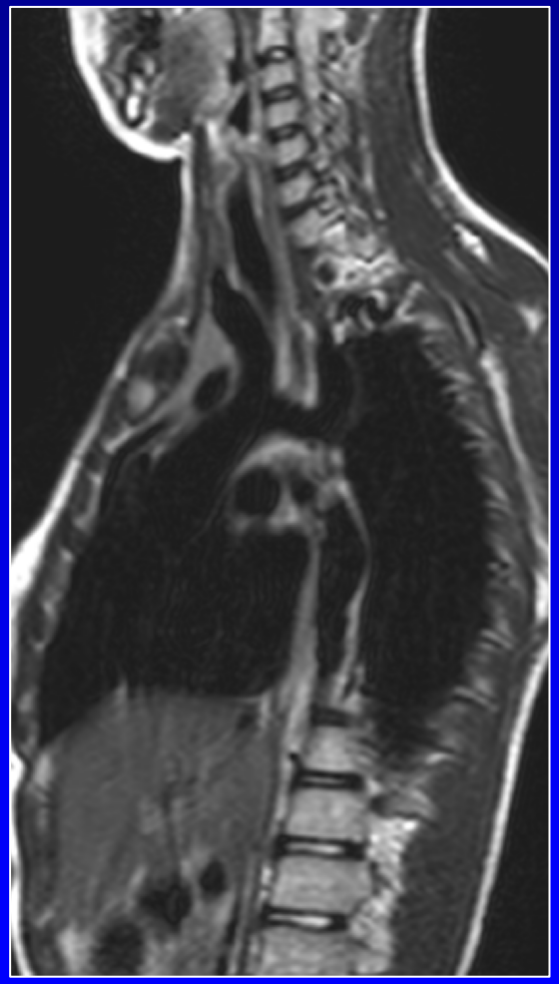


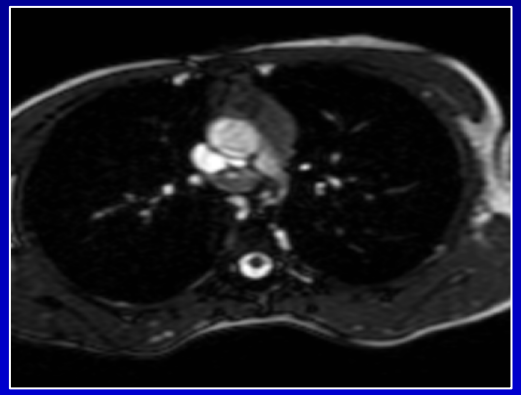


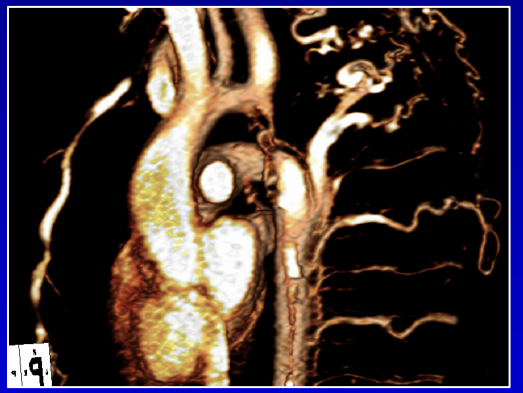
TOF, after correction



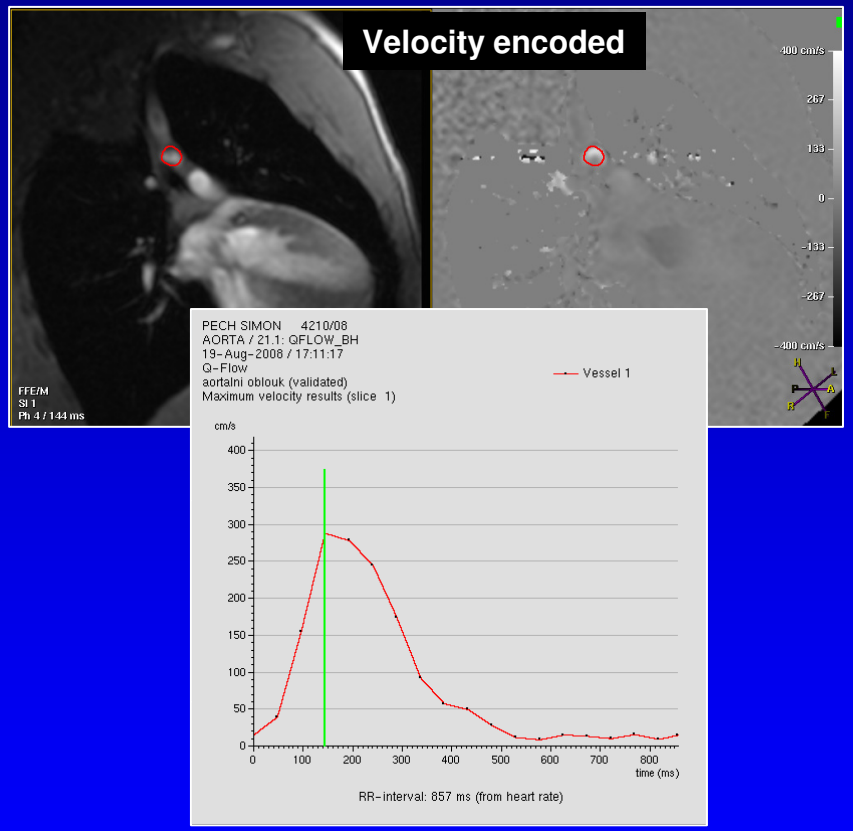
Severe coartation of aorta







Recoarctation



- Measuring of velocity
- Calculation pressure gradient